IEA Experts' Group on R&D
Priority-Setting and Evaluation

Summary Report

The Transition to a Low-Carbon Economy: Socio-Economic Considerations

24-25 May 2011
Baden, Austria

International Energy Agency

Energy Technology Network

International Energy Agency

The International Energy Agency (IEA) is an autonomous body established in November 1974 within the framework of the Organisation of Economic Co-operation and Development (OECD) to implement an international energy programme. It carries out a comprehensive programme of energy co-operation among 28 of the OECD member countries.

The basic aims of the IEA are to:

- Maintain and improve systems for coping with oil supply disruptions.
- Promote rational energy policies in a global context through co-operative relations with non-member counties, industry, and international organisations.
- Co-operate in maintaining a permanent information system of the international oil market.
- Improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use.
- Assist in the integration of environmental and energy policies.

The IEA member countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, Germany, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. The European Commission also participates in the work of the IEA.

Experts' Group on R&D Priority-Setting and Evaluation

Research, development, and deployment of innovative technologies are crucial to meeting future energy challenges. The capacity of countries to apply sound tools in developing effective national research and development (R&D) strategies and programmes is becoming increasingly important. The IEA Experts' Group on R&D Priority-Setting and Evaluation (EGRD) was established by the IEA Committee on Energy Research and Technology (CERT) to promote development and refinement of analytical approaches to energy technology analysis, R&D priority setting, and assessment of benefits from R&D activities.

Senior experts engaged in national and international R&D efforts collaborate on topical issues through international workshops, information exchange, networking and outreach. Nineteen countries and the European Commission participate in the current programme of work. The results reported here are intended as input to and support of ongoing work of the CERT and, more generally, that of the IEA Secretariat.

For information specific to this workshop, including the presentations, see:
http://www.iea.org/newsroomandevents/workshops/workshop/name,30671,en.html

For more information on activities of the EGRD, see www.iea.org/about/experts.asp.

Acknowledgements

The IEA Experts' Group on R&D Priority-Setting and Evaluation (EGRD) would like to thank Sea Rotmann, Energy Efficiency and Conservation Authority (New Zealand), Carrie Pottinger, EGRD Secretariat, IEA, Rob Kool (NL Agency), EGRD chair and Herbert Greisberger, (ÖGUT), EGRD Vice-chair for authoring this report.

The EGRD would like to thank the speakers for their valuable presentations and the participants for their thoughtful contributions to the discussions during the workshop.

The EGRD is most appreciative of the Austrian Society for Environment and Technology (ÖGUT) and the Austrian Ministry for Transport, Innovation and Technology for hosting this workshop. Jasmine Bachmann (ÖGUT) and Irene Sudra (ÖGUT) provided administrative support.

Table of Contents

Executive Summary

The transition to a low-carbon economy is a major challenge for policy makers, research and development (R&D) planners, investors, businesses and individuals. It requires comprehensive policies at the local, regional and global level; R&D to refine technologies not quite at market stage; and investments to spur technologies that are ready for market deployment.

Critically, the transition requires public acceptance of these technologies. As a result, researchers must be able to translate the understanding of behavioural theory into practicable outcomes for policy makers and implementers. R&D planners must factor consumer uptake into technology R&D programmes and plans. Governments have to provide effective legal and regulatory frameworks, ensure public policy coherence across its mandates, build and maintain public acceptance and support the uptake of new technologies and practices.

As evidenced by the expert presentations from Asia, Europe and North America, successful implementation of climate-friendly policies have taken individuals' purchasing and energy-using behaviours into consideration. The questions addressed by participants were:

- What is the role of social science and how best can it feed into technology R&D programmes and policies? What is the realistic timeframe that would enable R&D programmes to synchronise with energy markets?
- Which social considerations (*e.g.* health, environmental, lifestyles) can be adequately addressed? Which methods (*e.g.* impact assessments, stakeholder consultations, target groups) are found to be the most effective in addressing them? At what point in the R&D planning process should they begin?
- Which legal and regulatory frameworks are the most conducive to the transition process? What is a manageable scope for these policy frameworks – local, regional or national – and what is the relationship between them?
- Which economic considerations (*e.g.* sectoral shifts, employment, energy markets, infrastructure or trade) are manageable and which financial instruments (*e.g*. taxes, subsidies, investment credits) are found to be the most effective?
- Which methodologies and tools provide the greatest insights for planners? Which data sets (quantitative or qualitative) or indicators are the most effective for socio-economic impact assessments?
- Which strategies integrate energy, economic, social and environmental issues? Which strategies integrate socio-economic impact assessments into energy plans?

Though answers to all these leading questions were not possible, several key messages of the proceedings emerged and are summarised below. [1]

Provide Information and Support Institutions

Generalised public information campaigns were found useful to raise awareness. A promising tool was found to be a virtual knowledge centre where theory, practice, case studies and experiences can be shared across various cultures and programmes. However, local public and private institutions were more effective in providing individuals with the tools and solutions applicable to their particular situations. Regional institutions were also found to be effective in treating issues common to neighbouring countries.

[1] The findings from this workshop will be further explored under a new project, 'Closing the Loop - Behaviour Change in Demand-side Management: from Theory to Practice' led by the Implementing Agreement for Co-operation on Technologies and Programmes for Demand-Side Management.

Implement Local Solutions to Global Problems

Climate change is an inherently global problem. Nevertheless, climate change policies and regulations are implemented at regional, national and, importantly at local levels. This leads to what has been termed the “climate pyramid” with some targets defined at global level; frameworks and polices and measures for implementation at (supra-, multi-) national level (*e.g.* EU framework directives with minimum requirements and clear national targets); and implementation and public participation at the local level. There is no one-size-fits-all strategy: policies and measure need to be tailored to local contexts. This workshop underlined the potential effectiveness of multi-national policies if technological and socio-economic knowledge is combined and applied.

Make Early and Frequent Consultations with Stakeholders a Priority

It is imperative that the public is included in decision-making, goal-setting and planning processes, and that social norms are created before major policies or programmes are implemented. Strategies that integrate a sense of ownership among a community of stakeholders have been shown to be effective.

Strengthen Socio-Economic Research

To increase the usefulness of socio-economic research to support the transition towards a low-carbon society, two approaches should be taken:

- Provide greater support for research and experimentation in behavioural and organisational change strategies to increase knowledge about socio-economic drivers and barriers.
- Socio-economic investigations should be incorporated into all R&D programmes, even basic research, to facilitate the dissemination and (mass-scale) market introduction of new technologies.

Even though socio-economic research related to demonstration projects is often not directly transferred to other regions and cultures, international exchange of R&D results is highly relevant. A solid basic knowledge of the main socio-economic drivers and barriers and behavioural models can be applied to local situations.

Integrate Ongoing Evaluations into Behavioural Research

For behavioural research programmes it is important to shift from approaches based solely on fulfilling the objectives to those that include evaluation of ongoing outcomes. Evaluations enable programme managers to extract the valuable lessons learned at every stage in the research process. The lessons from ongoing evaluations of socio-economic research programmes should be used to further improve technology deployment policies and programmes or to design new policies and programmes.

Share Best Practice

It was found that a variety of approaches are needed to influence habitual versus investment behaviour and that a problem-oriented rather than an instrument-oriented approach yields greater results. Cultural and community differences need to be understood and knowledge sharing encouraged.

Introduction

The International Energy Agency (IEA) Experts' Group on R&D Priority-Setting and Evaluation (EGRD) convened this workshop to gain an understanding of the socio-economic parameters, actors and impacts involved in the transition to a low-carbon society. Participants shared the mechanisms, methods and measures taken to achieving successful implementation. This event was designed for policy makers, energy planners, socio-economic researchers, R&D experts and energy technology experts. The results of the workshop are expected to inform national R&D policies and plans.

The transition to a low-carbon society is a multifaceted challenge in which the actors are inter-dependent and for whom the solutions have immediate (local) and long-term (global) benefits. For the transition to be a success, a variety of stakeholders representing socio-economic sectors will need to actively participate: policy makers, energy planners, the research community, academia, businesses and industry, and individuals.

Unfortunately socio-economic considerations are not consistently included in technology R&D programmes and plans, but this is changing. For new technologies, integrated consultation and planning can begin at inception. Universities are increasingly creating cross-departmental programmes where students from engineering, environment, design, architecture, economics and social science departments work together.

For existing technologies entering the market, coherent legal and regulatory frameworks that include socio-economic considerations are the keys to acceptance. Attempts by some policy makers have been successful, while others have not. Examining the conditions that led to success or failure can serve as lessons learned for R&D planners.

Investments and fiscal measures (*e.g.* progressive/regressive tax schemes) are also important. What is feasible? Who pays? Some instruments and policies have shown to be effective in implementing R&D from a socio-economic perspective, particularly consumers, industry and R&D agencies.

The topic was examined from four viewpoints: technology; policies and measures; integrated approaches; and the role of socio-economic research for R&D priority setting. Summaries and key messages from each session are highlighted in this report.

TECHNOLOGY

Moderator: Sea Rotmann, National Energy Research Institute, New Zealand

Social scientists recognise that humans are not rational economic actors. Instead, behaviour is driven by what some have termed as "predictable irrationality": overestimating or underestimating the risks and opportunities, habits, values, and surrounding social norms and environments. Understanding how we use energy is imperative for good policies, plans and programmes. Yet social science theory related to drivers of behaviour change and the effect on technology deployment are not sufficiently taken into consideration.

We need energy for the services that we derive from them (*e.g.* heating, lighting, mobility). As the primary fuel source basically goes unnoticed this often leads to wasteful and seemingly irrational consumer use behaviours. These behaviours also lead to failure to successfully implement energy efficiency and conservation programmes. These issues also extend to social acceptance of renewable energy projects. Some environmentally minded citizens abhor fossil fuels and nuclear energy, yet they also resist renewable developments due to their perceived or actual impacts on the (local) environment.

The focus of this session was to explore the lessons from case studies of energy behaviour and social acceptance of energy efficiency and renewable energy technologies.

Evaluation of European Energy Behavioural Change Programmes

Antoinet Smits, NL Agency, Netherlands

The Evaluation of Energy Behavioural Change Programmes (BEHAVE) project was created in 2008 to craft new guidelines for the development and implementation of behaviour change programmes; prepare a report on relevant theories for the development and implementation of behaviour change programmes; train policy makers and programme managers; and make an inventory of case studies from European countries.

All research projects, analyses of case studies and development of guidelines for programme owners and managers were based on collaboration. The theory of planned behaviour, *i.e.* rational energy use based on external factors, was discarded for new models of "habitual behaviour" that are based on integrated approaches.

The project reviewed 100 behaviour change programmes which were aimed at a direct effect on energy-related behaviour; to affect behavioural determinants and motivational, facilitating or reinforcing factors. Based on the type of intervention, *e.g.* awareness campaigns, education, design, community approaches, and financial instruments, 41 programmes were studied in detail. The guidelines for managers were designed by experts in each country and translated into the relevant language.

Key findings from the analysis of behaviour change programmes are:

- *There is still a long way to go before programmes are designed to deliver successful, ongoing behaviour change.* This was found to be due to the lack of proper social science theory or scientific research methods; no ex ante analysis or evaluation of programmes; no truly multi-disciplinary approach that included all relevant stakeholders; and a lack of knowledge sharing and synergy.

- *Different approaches are needed to influence habitual versus investment behaviour; that a problem-oriented rather than an instrument-oriented approach is needed and that cultural differences need to be better understood and more knowledge sharing encouraged*. The most promising vehicle is thought to be the development of a virtual knowledge centre where theory, practice, case studies and experiences can be shared across various cultures and programmes.

- *Bottom-up approaches involving trusted local community members and non-governmental organisations are regarded as being more effective in changing social norms than top-down approaches led by national energy agencies, particularly top-down approaches that do not include ongoing evaluation.* Greater collaboration between local actors is recommended.

- *Best practice can be transferred between cultural and country contexts*, *to reduce the likelihood of "re-inventing the wheel" and to gain from shared experiences.* Examples cited include France (energy efficient light bulbs), Finland (individual energy advice) and the United states (car/van pooling organised by employers).

- *Only 5% of a household's energy budget is spent on energy investments and purchases: the rest is spent on daily energy consumption.* Therefore investments in new technologies such as renewables, energy efficiency improvements and retrofits would require additional financial efforts than is currently the case.

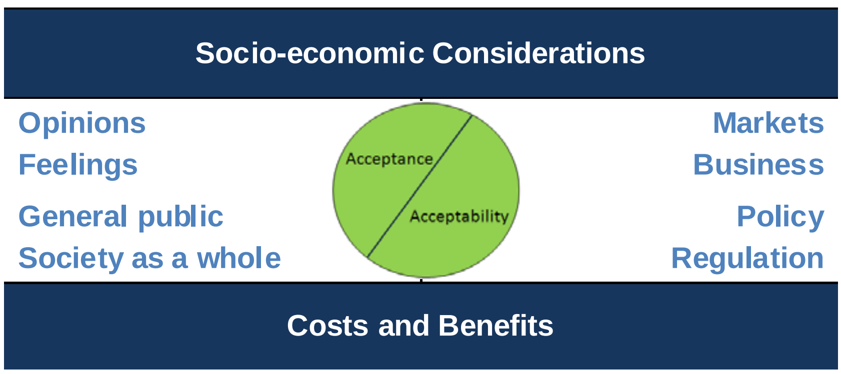
- *The minimum time needed to see long-lasting behaviour change is estimated to be at least a generation.*

Socio-Economic Considerations for Technology Development

Sebastian Elbe, SprintConsult, National Representative (Germany), Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects, Bioenergy Implementing Agreement[2]

The aims of the study "Socio-Economic Drivers in Implementing Bioenergy Projects" of the Bioenergy Implementing Agreement are to highlight the socio-economic drivers in implementing bioenergy projects and establishing markets; synthesise and transfer of information and critical knowledge; increase bioenergy deployment; and provide guidance to policy makers (Figure 1). The study attempts to answer the following key questions: Who develops the technology and for whom? Is it effective? What are the barriers?

Figure 1: Social Acceptance and Acceptability



[2] Implementing Agreement for a Programme of Research, Development and Demonstration on Bioenergy.

Source: Adapted from SprintConsult.

The study, ongoing since 2000, has derived the following key messages:

- *All stages of the technology development process should be cross-disciplinary (including social science) and include the end-user perspective from the outset*. This includes educating engineers as well as technology development, assessing acceptability and implementation.

- *Information and R&D results alone do not convince people to use a technology: users are influenced by other users.* The R&D results must be more than reports and "guidelineification".[3] Implementation of the results (the outcome) must be the real aim and not the final reports or guidelines (the output).

- *It is imperative that the public is included in decision-making, goal-setting and planning processes, and that social norms are created before major policies or programmes are implemented.* National goals and formal agreements may not be in line with investments, technological development and individual acceptance. For example, the goal of reaching 1 million electric vehicles on the road by 2020 helps a country reach CO_2 reduction targets in the transport sector but requires significant investment by the automobile manufacturers as well as individual consumers.

- *It is important to conduct economic and social cost-benefit analysis in order to build the link between single investment and regional benefits*. For example, a three-year competition was carried out between 25 German regions to create bioenergy networks, contribute to regional added value, reduce CO_2 emissions and improve the uptake of bioenergy. As a result, a farmers' bioenergy network was created which illustrates that collaboration is effective and does not necessarily need guidelines (which farmers generally do not need).

- *One size does not fit all.* In some cases, non-acceptance was also due to information from groups with vested interests (*e.g.* automobile manufacturers' reluctance to invest in biogas vehicles). In another, despite subsidies, feed-in tariffs and a high level of bioenergy exports, public acceptance of bioenergy plants in some German communities was found to be difficult due to perceived risks.

- *Evaluation is important, especially to ascertain if the guidelines and reports are implemented*. It was noted that socio-economic research is now included in federal government central knowledge sharing.

Social Acceptance of Wind Energy Projects: Winning Hearts and Minds

Stefanie Huber and Robert Hobarty, ENCO Energie-Consulting, Programme Managers, Task 28: Social Acceptance of Wind Energy Projects, Wind Implementing Agreement[4]

The 2011 state-of-the-art report, "Social Acceptance of Wind Energy" of the Wind Implementing Agreement is a cross-country, inter-disciplinary examination of 150 projects in ten OECD countries. It aims to answer the questions: What do we know about social acceptance? What do we need to know? Which areas require more research or implementation effort?

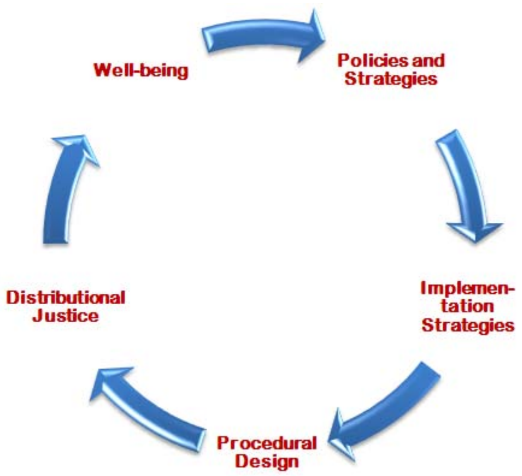
---

[3] This term was used in the presentation by Sebastian Elbe to represent the overuse of guidelines which are often too long and complex, and are seldom read.
[4] Implementing Agreement for Co-operation in the Research, Development and Deployment of Wind Energy Systems.

The elements of successful framework for social acceptance of wind energy developments were found to include the following criteria:

- Policies and strategies: national frameworks, incentive programmes, spatial planning and local implementation policy.
- Implementation strategies: visualisation, social marketing/communication, checklists and guidelines, practical application of scientific results.
- Procedural design: regulatory requirements, fair and transparent processes, role of public engagement and provisions for cultural history and local context.
- Planning.
- Distributional justice: ownership models, regional welfare and creation of win-win conditions.
- Well-being or standard of living: quality of life, health effects and valuation of ecosystems.

Figure 2: Elements of Social Acceptance



Source: Adapted from ENCO Energie-Consulting AG.

Based on this framework, the following key messages emerged, illustrated by the experience from the countries participating in the study:

- *Policies and Strategies*: An overarching framework with policies that facilitate local implementation can help to mitigate opposition. In Denmark, introduction of a range of measures helped to implement national targets: local options for share purchases, green schemes, funds to support early stage development and compensation for loss of property values.

- *Implementation Strategies*: Local and regional authorities need knowledge on how to deal with wind energy and its impacts. In Ireland, a series of regional wind energy good practice workshops were held to provide information on framework conditions and support the sharing of experiences.

- *Planning*: Wind energy projects require new planning and decision-making processes. In the Netherlands, this was the result of collaboration among a series of parties and their ability to involve other relevant regional and local actors. Independent process facilitators were also successful in influencing networks. Examples include wind turbines used as a tourism opportunity or planting forests to reduce visual impact.

- *Procedural Design*: Stakeholder networks are an important means to enhance social acceptance and understanding. In the United States, informed, influential citizens are given an opportunity to showcase the advantages of wind power at public community forums. In Switzerland, ongoing communication with environmental organisations is based on mutual respect, helping to define what is acceptable (and what is not) and ensuring discussions based on facts.

- *Distributional Justice*: Local residents often bear a disproportionate share of the impact of wind energy installations and benefits for the host communities can have varying characteristics. Local acceptance was improved in a Japanese community when citizens felt there was greater distributional justice, *i.e.* that people nationwide were also involved. By writing their names on the turbine, locals could take ownership and feel they were contributing to the collective good. The Social Innovation Community Project offered investors an opportunity for corporate social responsibility while creating employment and investing in the community. In Germany, 70% of the business tax related to wind developments remains in the host communities. In Ireland, the funds are distributed to individuals and invested in community projects to support sport and cultural activities.

- *Well-being/standard of living*: The real — or perceived — risks of effects on well-being and standard of living of local citizens must be taken into consideration. In the United States, a wind development project faced extreme opposition for fear of loss of real estate values. An ex-post evaluation found that property prices within five miles from the wind development did not change and in one case were actually higher four years after construction.

Session Summary

Sea Rotmann, Moderator

It is difficult for policy makers, engineers and energy providers to understand the complex drivers of energy use. Unfortunately there is no single social science model for explaining the causes and effects of human behaviour. There is, however, agreement in social science approaches that emotional responses need to be addressed in order to achieve technology uptake.

An individuals' initial excitement over a new technology does not necessarily translate to long-term behaviour change. The minimum time needed to see long-lasting behaviour change is estimated to be at least a generation.

Only 5% of a household's energy budget is spent on energy investments and purchases: the rest is spent on daily energy consumption. Therefore investments in new technologies such as renewables, energy efficiency improvements and retrofits require additional, individual financial efforts.

It is also important to conduct economic and social cost-benefit analysis in order to build the link between a single investment and regional benefits. Local and regional authorities need knowledge of how to deal with wind energy and its impacts.

National goals, for example, CO_2 reduction, must be matched with framework policies, well-designed implementation strategies, procedural design and distributional justice in order to achieve acceptance of the citizens living near technology installations. However, bottom-up approaches involving trusted local community members and non-governmental organisations are regarded as being more effective in changing social norms than top-down approaches led by national energy agencies, particularly those that do not include ongoing evaluation.

Environmental protection groups can be supportive of renewable energy per se yet oppose implementation at a local level. Other groups with vested interests can pressure citizens not to approve local developments. Each situation must be examined individually, taking concerns and criticisms seriously. Identifying and creating win-win situations are important factors for success.

Cultural and community differences need to be understood and knowledge sharing encouraged. Local workshops; community meetings led by influential civic members; stakeholder networks; guidelines; and virtual knowledge centres were cited as effective examples of enabling consumers to make informed decisions. But they must be tailored to individual needs: detailed, lengthy guidelines may be useful for engineers or technicians but not for consumers.

Much remains to be done before programmes are designed to deliver successful, ongoing behaviour change. All stages of the technology development process should be cross-disciplinary (including social science) and include the end-user perspective from the beginning. This includes educating engineers as well as technology development, assessing acceptability and implementation. Without programme evaluation outcomes and lessons learned are not known, leading to duplication of efforts.

POLICIES AND MEASURES

Moderator: Sea Rotmann, National Energy Research Institute (New Zealand)
[Standing in for Herbert Greisberger, OGUT (Austria]

To be successful, policies and measures to advance the transition to a low-carbon economy need to broaden beyond technologic and economic aspects to adequately consider the influence of social and behavioural factors. They need to reflect a more complex understanding of the many factors that shape or drive social and individual behaviours. Strategies must actively involve the people, industries, businesses, organisations and institutions that demand and consume energy. Approaches that integrate and apply social and behavioural insights can accelerate the transition.

There is a need for more research to develop better understanding of social and behavioural initiatives to contribute to more efficient and sustainable energy use. Policy makers and economists should develop and use enhanced models and frameworks that recognise and incorporate social and behavioural aspects to complement and extend the usual techno-economic models as a means to understand, explain and project demand patterns. Energy policies and programmes should employ a portfolio of measures that recognise the social and behavioural dynamics of energy demand and consumption.

The focus of this session was to explore the lessons from experiences at community, sectoral and national levels.

ProjectZero - Lessons Learned in Overcoming Barriers

Christian Eriksen, Project Manager, ProjectZero

ProjectZero is the name of a holistic, socio-economic vision for Sönderborg Island, Denmark. The goal is to transform the local economy and to reduce CO_2 emissions to zero by 2029. Three main plans of action are expected to reduce CO_2 emissions by 25% by 2015:

- Lowering consumption by energy efficiency gains is estimated to reduce energy consumption by 40% compared with 2007 through building retrofits and residential ground-source heat pumps.
- Favourable market conditions to expand renewable energy sources including biogas from farming, geothermal heat, wind, solar heating, and photovoltaics.
- Investments in infrastructure including district heating and cooling networks, electricity transmission and distribution, and an electric car pilot project.

ProjectZero also aims to transform the economy through creation of green jobs. ProjectZero programmes are financed with a small seed fund from the national government and a grant from the region, with the majority of funding from a public-private partnership established between local stakeholders including government, energy providers, large industries, businesses, and technical experts.

Best practice, technical competencies and research are integrated into the programme. Research entities included the Nordic Research Adaptation Research; the Initiative for Science, Society and Policy of the Technical University of Denmark and the Low-Carbon Cities Initiative of the World Wildlife Fund.

At the outset, an ambitious master plan was drafted and agreed by all stakeholders in the public-private partnership. As the programme advanced, challenges and barriers emerged. Solutions were found on a case-by-case basis (Figure 3).

Figure 3: Barriers to Implementation of ProjectZero Programmes

Source: Adapted from ENCO Energie-Consulting AG.

Project/Technology	Policy/ Planning	Economic	Consumer Adoption	Other
Electrical cars				
Biogas plants				
Wind turbines				
District heating from low-carbon sources				
Ground-source heat pumps in rural areas				
Retrofits for private homes				

Key:
Fully addressed.
Partially addressed.

Source: Zero Master plan[5]

Electric vehicles reduce emissions from transport and help to balance electricity supply and demand. However, consumers expressed concerns with costs and reliability. The solution was a pilot project that involved providing electric vehicles to eight families to drive and then share their experiences in the community.

Biogas plants create methane emissions. In addition, the feed-in tariff cannot sustain biogas from waste only and are not high enough to incentivise biogas.

Wind turbine installations in Denmark on the whole show that it is profitable with a return on investment in approximately eight years. As Sönderborg is a small island, turbines could potentially have a significant impact on land use, tourism and wildlife. ProjectZero worked to present evidence to the community and invited participation in the planning process. Community members were also given the opportunity to buy shares in the turbines. (Approximately 20% of wind turbines in Denmark are owned by community members).

Despite that district heating is the cheapest, low-carbon way to provide consumers heat, Project Zero managers faced consumer resistance to district heating development. This was complicated by the variety of fuel sources used and consumer-owned companies.

The ZEROfamilies programme involved educating 100 families on more efficient use of energy through group courses and workshops. At the end of the one-year pilot programme, ZEROfamilies had on average reduced their electricity consumption by 30% and water consumption by 50%. The ZEROfamilies became community ambassadors for saving energy.

Deployment of ground-source heat pumps in rural areas faced opposition due to a history of poor product quality in the 1980s, high initial investment and lack of a regulatory framework. The solutions included: integrating ground-source heat pumps into urban planning; a fast-track municipal approval process: government subsidy of EUR 2 700 if the heat pump replaced an oil

5 www.uk.brightgreenbusiness.com/lib/file.aspx?fileID=607

boiler; a massive local information campaign and road shows. As a result, the local market for ground-source heat pumps installations more than tripled, with 40% of oil boilers replaced and another 30% underway.

The ZEROhousing retrofit programme involved 19 000 households. Barriers included the significant initial investment, lack of contractor competencies, the financial crisis and consumer reticence due to lack of trust in the contractors. The solutions included: stricter municipal building codes for commercial and residential buildings; special loans; free energy advisor visits; and a massive information campaign. Municipal buildings were the first to be retrofitted, setting an example for the community.

As a result, businesses and citizens took the challenge: 50% of contractors were trained as energy advisors; more than 65% of households audited chose to make the retrofits; and new jobs were created in construction, banking, energy consultancies and related areas. The Danish national information campaign, “Good Energy”, cites the best practice from the ZEROhousing programme, encouraging other communities to follow the example.

The key messages from the ProjectZero can be summarised as:

- *Policy and regulatory frameworks pave the way.* For biogas and wind turbine installations, a regulatory framework is necessary, particularly for installations requiring upgrades or expansion of infrastructure such as district heating and cooling, biogas and wind turbines. Better frameworks are needed for public-private partnerships, regulations on privately owned renewable energy installations and further incentives for energy efficiency in industry and households.

- *Ambitious, realistic plans must be combined with in-process adjustments.* An ambitious master plan is needed to set the framework and reach agreement on goals. Short-term results are needed keeping in mind the long-term goals. As technology, people and policies change over time, the programmes and projects may have to be re-adjusted. Barriers and unforeseen challenges arise as projects advance. Managers must be able to choose the best solution among the many ideas proposed.

- *Project design should include data provisions to monitor progress.* Data on energy consumption is a key indicator of progress, but in this case most of the data were either sensitive (prices of energy providers) or confidential (consumers). Close co-operation with local energy companies enabled collecting sensitive company data. For consumer data, contracts with volunteer consumers were established.

- *Research is needed to highlight issues, but programmes must be practical and understood.* Sociologists, psychologists and technical expertise are needed. But research and advice must be translated into common-sense information and practical programmes that can be implemented.

- *Multi-stakeholder financing ensures balanced interests and benefits.* The public-private partnership between local stakeholders ensured balanced representation of local interests. Community members had the option to become shareholders where possible. New green jobs were created in construction, banking, energy consultancies and related areas. One of the project partners now has a 90% turnover from climate-related products and technologies.

- *Achieve early and ongoing stakeholder acceptance.* Early commitment from municipal government, businesses and large industries is critical. It is important that community members of all sectors, roles and ages actively participate and integrate the programme into their daily lives. Links to national regulators and experts are also needed.

- *Maintain the commitment to leadership and communication.* When faced with barriers to public acceptance, programme leaders did not hesitate to implement targeted information campaigns. Information campaigns were effective in addressing the barriers to acceptance except when combined with other factors, *i.e.* feed-in tariffs for biogas and complex markets for district heating and cooling.

Policies and Measures for Organisational Change and Behaviour Models in Industry in the Netherlands[6]

Rob Kool, NL Agency, Netherlands

Since the early 1990s the Netherlands has employed voluntary covenants, known as long-term agreements (LTAs) with various sectors – industry, services, transport and agriculture – to stimulate energy efficiency improvements and to contribute to national goals to promote economic growth, ensure security of energy supply and to reduce greenhouse-gas emissions. LTAs have proved to be an important and effective policy tool to affect organisational change.

The aim is to achieve policy objectives in a collaborative approach rather than by direct regulation. It looks for win-win options. Since gaining efficiency improvements is more than technical measures and also involves behaviour and innovation, there is a need to foster co-operation and involvement with industry. The first band of LTAs (1992 – 2000) sought to accelerate efficiency improvements beyond the existing trends without the imposition of new regulations. Government and industry – through sector associations – negotiated and agreed upon goals and jointly moved forward to achieve them. Industry has freedom of choice as to how to reach the goals, yet there is considerable focus on results. LTAs are established on a voluntary basis, but failure to meet the agreed targets may lead to repercussions for the industry sectors involved.

A key characteristic of LTAs is that an industry trade association and its members commit to a quantified target for energy efficiency improvement by a specific year based on an Energy Efficiency Plan. Monitoring, evaluation, reporting and updating of the Plan are required. The LTA scheme in the Netherlands offered industry easier access to environmental permits and served as a mechanism to recycle the Green Tax. The government offers support with development of the Energy Efficiency Plan through the implementing organisation Agentscap NL (NL Agency) in addition to a variety of other support mechanisms.

The first generation of LTAs focused on process efficiency within a company. Evaluations showed that management levels in participating companies increased attention to energy flows, became more aware of opportunities for energy savings and consequently accelerated the exploitation of that potential. The next generation, LTA2 (2001 – 2012), expanded the focus to an integrated life-cycle approach.

Companies participating in LTA2 were given the opportunity to formulate their own targets, in line with government preference to make companies more responsible for their own energy efficiency behaviour. Each company taking part in LTA2 developed a plan of action to improve energy efficiency. These individual plans form the basis for setting targets at the sub-sectoral level, which

[6] Based on the findings from the study: Rob Kool and Ruud Jonkers, (2010), *Improving Energy Efficiency in Industry in Time: A Search for Suitable Instruments*, UNESCO, Energy Bulletin. Available at: www.kooltiel.nl/Pagina%27s/Pub/Improving%20Industry%20Energy%20Efficiency%20In%20Time.pdf

are at least equal to the weighted sum of the targets of the member companies. Each company is screened and needs to comply with the ALARA principle (energy consumption should be As Low as Reasonably Achievable) in order to discourage the formulation of weak targets. These ALARA materials lists can be used to influence technology R&D and the design of incentives for innovation. Companies are obligated to introduce: all suitable process efficiency measures with a payback period of five years or less; and an energy management system in line with ISO 14001 within two years of signing the covenant.

The LTA2 assigns an important role to provincial and municipal authorities, as the competent authorities for the Environmental Management Act. These authorities deal with the energy consumption of companies within their boundaries through licensing and enforcement procedures. Energy efficiency requirements are imposed when environmental licenses are granted. To get or keep a license, businesses have to produce environmental reports. Participation in a LTA fulfils the energy requirement of those reports as the analyses and monitoring aspect are part of the LTA approach. Many municipal authorities pursue an active climate policy, which is also directed at local businesses, for example by promoting the development of sustainable industrial estates or the use of renewable energy. The LTA2 makes it easy to call companies to account for these possibilities.

In 2008, the private sector companies and sector associations that participated in earlier LTA programmes signed the LTA3 covenant for the period 2001 – 2020. It sets an overall goal of 30% energy efficiency improvement in the period 2005 – 2020.Trade branches will produce sector roadmaps aimed at long-term innovation for energy efficiency. An important new element in LTA3 is an approach that analyses energy use in the whole product chain. As such, it looks beyond the situation in single companies. Co-operation and thorough analyses lead to improvements that benefit the whole chain.

The government supports the private sector with an intertwined set of policy instruments in four groups:

- Legal – environmental legislation; covenant with government; ESCO framework.
- Economic – tax reductions; innovation incentives.
- Structural - strong support by a national agency to reduce the administrative burden and secure confidentiality; ISSO 50001energy management.
- Communication – annual reporting; capacity building; networking; success stories by peers.

As the LTA had become a long-standing and appreciated approach, the design of the LTA3 was a careful process in which the Ministry of Economic Affairs, SenterNovem (predecessor of the NL Agency) and representatives of industry negotiated the goals and the contributions of all parties involved in detail.

Selecting the right measures to achieve efficiency goals can be complicated. The use of models such as the Precede – Proceed Model can be useful to discuss instruments to be used (Figure 4). According to the model, the focus is on the decision makers to ensure momentum for lasting change in behaviour and action for energy efficiency improvements. An often used reasoning is that if industry is aware of the necessity to save energy, governments can simply force measures by either legislation or a cap-and-trade system. This line of thinking ignores elements in the model. The fact that companies are aware of the necessity of energy efficiency is not enough. They need the tools and support structure to act. When equipped with both instruments and awareness, the change they will perform is maximised. In phase three, the right instruments have to be in place. In the case of LTAs, this requires a mix of instruments.

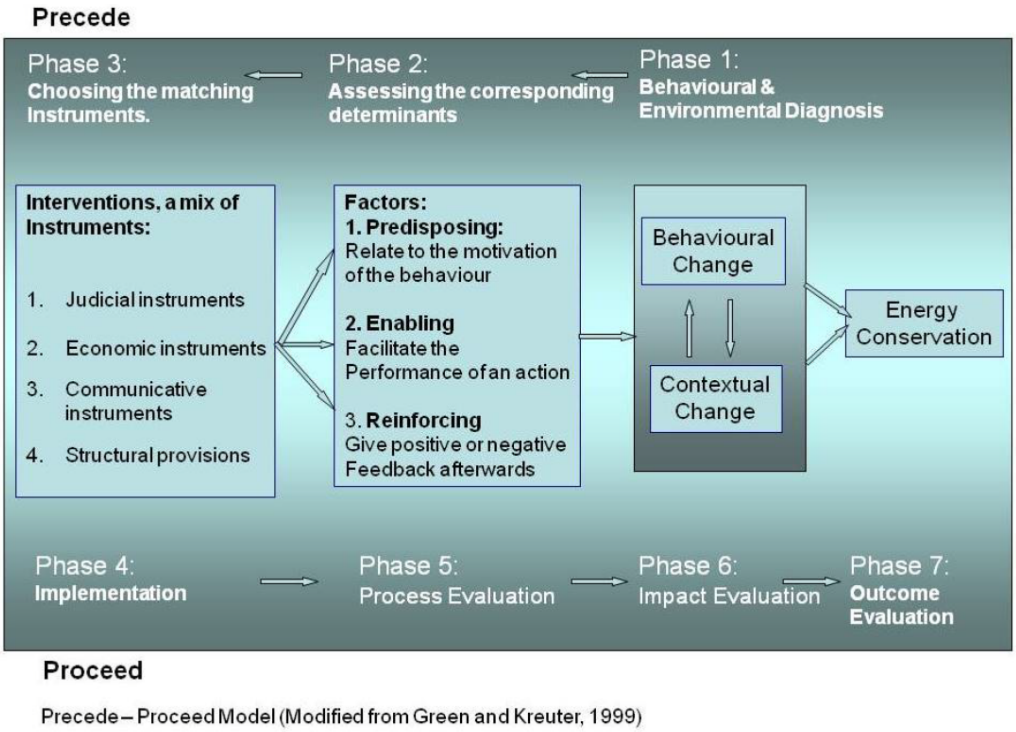
In order to promote energy efficiency beyond their borders, the Netherlands has and is still participating in a number of projects that introduce long-term agreements in other countries. The

Netherlands participates in a number of bilateral projects such as the Integrated Approach for Knowledge Transfer of LTA in central and eastern Europe, and bilateral efforts with Bulgaria, Romania and Turkey. As well it participates in the EU funded projects BESS, ExBESS and LTA Uptake.

BESS - Benchmarking and energy management schemes in small and medium-sized enterprises (SMEs) (2005 – 2007).The primary objective of BESS was to develop and promote the widespread application of benchmarking and energy management in order to improve energy efficiency in industrial SMEs.

ExBESS - Expanding BESS, which started in 2007, looks at the content of the LTA concept. An important goal is to improve the web-based tools. It also expands the number of industrial branches and countries involved compared to the BESS project. It aims to test LTA instruments in textile, dairy, bakery, meat processing, food, beverage and laundry industries. The tools, which are fully web-based and multi-language, were developed to support target groups of LTAs when implementing energy management and efficiency measures.

Figure 4: The Precede – Proceed Model



Source: Modified from Green & Kreuter, 1999.

LTA Uptake - Whereas the ExBESS project develops and adapts the LTA content, the LTA Uptake initiative structures the process of getting to an agreement. The project mainly aims at developing materials to set up LTAs in languages other than Dutch. The LTA Uptake Toolkit, which is web-based, publically assessable and fully operational, was endorsed together with the Ex-BESS toolkit in 2009.

Some key messages from the Netherlands experience with long-term agreements include:

- *Collaborative governance approaches can deliver energy efficiency gains to underpin the transition to a low carbon society.* In the Netherlands, public-private partnerships between government and industry have been successful and are on-going to implement technical advances, management practices and organisational changes with both a near-term focus and a long-term perspective which can influence social and technology R&D.

- *Research and practice increasingly focus on the role of more participative approaches to change energy use, which communicate the various co-benefits of energy efficient behaviour using existing social networks.* For example, the industry associations in the Netherlands: find political agreement on using covenants to make efforts towards achieving individual enterprise as well as national and local objectives; negotiate the agreement; encourage firms to engage; share valuable experiences through existing networks; consolidate performance indicators to protect confidentiality; co-ordinate knowledge management activities. Negotiated agreements and stakeholder networks provide a necessary basis for capacity building and standard setting in the various industry sectors.

- *Policy instruments need to be tested and adapted based on thorough analysis, monitoring, reassessment and enforcement.* Monitoring and reporting and the use of models dealing with social consideration analyses informed the evolution of the industry LTAs through three phases over almost two decades in the Netherlands.

- *Ensure stakeholder commitment and effective organisational structure.* Before starting an LTA the real interest and willingness of governments to invest time and money should be analysed in as impact evaluation in the Netherlands shows that LTAs work, but may take 12 to 18 months to implement. Limiting the administrative burden to parties involved is a key factor. A ministry that negotiates the LTA with industry may be too slow or industry is too impatient. In a number of countries the LTA also stays completely in the political domain as long as ministries are actively involved in all of the steps of the process. Experience in the Netherlands shows that a national implementing agency simplifies the process considerably and can be a crucial factor between success and failure.

- *If government provides an effective framework, industry can deliver mutually beneficial outcomes.* In the covenant scheme in the Netherlands, participating companies decide for themselves how the energy efficiency obligations are to be met and the sequencing. Having flexibility on options to comply with a given target makes it likely that least-cost solutions are chosen. The government provides the participating companies and sectors with support and assistance, *e.g.* technical assistance, information and training services, and financial incentives. Thus, not only the result of the energy efficiency measures is cost effective, but also the process of getting there.

- *More flexible than legislation.* Negotiated agreements with industry may be easier and quicker to upgrade than legislation allowing them to follow technological evolution and market changes and provide a way to address the information asymmetry between public authorities and firms about energy efficiency options and their costs.

- *Tailor-made approaches fit best.* The bundling of various measures that address the same target groups in industry is a key condition for the successful implementation of energy efficiency policies and reinforces mutual learning processes.

- *Covenants have over the years proven to be useful and successful instruments.* They enable companies to balance environmental and economic constraints and choose the most profitable solutions and timing while doing so. In the Netherlands, LTAs are not only appreciated for the financial benefits delivered by energy efficiency, but also for the influence on innovation and over-all production improvement. Consequently, industry advocates for LTAs as instrument and accepts obligations to make efficiency improvements with a payback period of up to five years.

Public Perceptions of Low-Carbon Energy Policy and Technology: Recommendations for Policy Makers and R&D planners[7]

Paul Upham, Finnish Environment Institute and University of Manchester, United Kingdom

Transitioning to a low-carbon economy entails many challenges. Decarbonising energy systems while ensuring sustainable, affordable supply has major ramifications for the public, who will be asked to change patterns of demand and accept new energy infrastructure and technologies. Understanding public attitudes to these changes, and the ways in which energy and technologies are themselves understood and used, is vital. A synthesis of selected academic and non-academic literature relevant to public perceptions of low-carbon energy policy and technology based on the preliminary results of a study undertaken for the Energy Programme of the Research Councils of the United Kingdom was highlighted.

Attitude theory from psychology dominates studies of public perceptions of energy and engagement in energy research. Attitudes are considered to have three main dimensions: knowledge, relating to the intellect and cognition; affect, relating to emotion and feeling; and behavioural intentions. Attitudes can change and are influenced by a range of factors, often ambivalent or uncertain. But attitudes so not predict behaviour, for example such as turning off unnecessary lights or supporting new energy infrastructure.

In a sociological practices approach, attitudes are considered secondary in terms of explaining behaviour whereas habits and routines are seen as primary factors. The practices approach reverses the assumed causality: attitudes follow from behaviour, not the other way around, and the social and technological environment strongly influences what behaviour is possible.

This emphasis on the way in which people are embedded in and influenced by their environments is also prominent in socio-technical transition research and Science and Technology Studies. The role of the public in theoretical explanations of how the transition to new energy systems may take place has arguably been under-explored. While technology, research and risk governance have generally been restricted to experts and policy makers, there are good reasons for involving the lay public as all societal actors are involved in the transition to a low-carbon energy system. It is legitimate to perceive energy technologies in a variety of ways: opinion divergence is not necessarily a sign of ignorance or misunderstanding, but may be based on different values, lack of trust or other factors.

The concept of NIMBYism is problematic and overlooks the way individuals form strong attachments to place and how symbolic attributes of certain locations can form part of an individual's identity. Threatened place identity/attachment, rather than irrationality or ignorance, is often at the root of place-protective opposition to energy facilities.

A significant literature review of public perception of low-carbon energy policy and technologies studies in the United Kingdom showed that attitudes are erratic, particularly when doing a systematic review based on different energy technologies. Summary findings on energy attitudes include:

[7] Based on preliminary results of the study, "Public attitudes, Understanding and Engagement in Relation to Low-carbon Energy: a Selective Review of Academic and Non-academic Literature", January 2011, Energy Programme, Research Councils of the United Kingdom.

- Most of the UK public are aware that climate change and energy security are serious problems and that substantial changes to energy systems are needed. The majority much prefer a renewable energy future, but will reluctantly accept a role for nuclear and possibly for carbon capture and storage.

- Most people are willing to make modest reductions in energy consumption, but few seem willing to make large reductions in energy consumption.

- The public expect government, industry and other nations to act, but do not see convincing evidence of they are making substantial changes and this perceived inaction may be bolstering a reluctance to make what are perceived as sacrifices.

- Early dialogue is universally recommended to minimise siting objections, but is not always practised.

- Awareness-raising events cannot satisfy the deliberative, dialogue-based aspects of engagement. The public has a right to be involved in shaping their world.

- Energy attitudes are affected by non-energy factors: trust in institutions, political leanings, world views and lifestyle aspirations.

- Undesirable energy-related attitudes are unlikely to change without associated change in the socio-economic, political or other aspects of the wider environment that help to maintain these attitudes.

The synthesis review for the United Kingdom highlighted that the national energy programme research is well placed to bring the public into decision-making processes about the strategic direction which energy research should take in order to meet societal needs and aspirations, including the relative importance of behavioural versus technological types of research to ensure a low-carbon energy future as well as to prioritise particular energy technologies and infrastructures to be the focus of research and development funding. At an operational level the energy programme can also educate the public about publically funded technological and social innovations, and to learn from the public about how these innovations may (or may not) be taken up and used in diverse ways.

It is counterproductive to wait to engage the public in strategic R&D decision making until the deployment stage. Researchers and programme developers need to consider: which technological or social innovations are likely to most affect the public, *i.e.* number of people or particular risks; which innovations are likely to be particularly socially contentious for financial, cultural, or other reasons; where innovations are in the RD&D chain. Engagement will increase mutual understanding, but may not resolve controversy.

With respect to the potential functions of public engagement to disseminate information and educate the public, and to involve the public in strategic decision making, the study provides suggestions for the UK energy R&D community which are also applicable to other countries. These include:

- *Since much energy consumption is inconspicuous and habitual/routine, information campaigns to change energy habits will likely have only small effects.* However, two-way information exchange, whereby the public not only learns about energy research developments, but also provides answers about the social robustness of technologies and innovations, can provide significant benefits.

- *Effective public engagement to raise public awareness about technological or social research outputs must consider: which groups may benefit most from education*. This includes, for example*,* those most likely to be affected or interested; how best to communicate with each group using appropriate communication methods; where researchers may benefit from public engagement, *e.g.* in gaining feedback on results and debating their implications; and to explore potential public reaction, uptake and/or use of novel technologies or social/behavioural innovations.

- *It is equally important to understand energy attitudes and practices in the context of daily lives as it is to address research gaps related to specific energy technologies.*

- *Policy and RD&D need to make it easy and routine for people to use not only lower carbon intensity fuels but also to use less energy in absolute terms, which is not easy in a consumerist paradigm.*

- *No energy technologies or policies receive unequivocal public support or opposition.* Public support is generally higher for renewable energy than for fossil fuels or nuclear energy; and for energy efficiency than for energy conservation. However, support or opposition is often contingent on the particulars of the proposed development, technology or policy, on concomitant proposed changes and measures, as well as how engagement has been conducted or attitudes measured.

- *Public involvement in the strategic direction and conduct of energy research can help legitimise socially relevant and publically funded research*. It may be useful to increase acceptance from the public of potentially controversial areas of research; and it may improve the quality of decision making by expanding the range of perspectives and types of knowledge involved.

Session Summary

Sea Rotmann, Moderator

The most effective examples of successful, long-term implementation of socio-economic understanding underpinning the technology transfer to a low-carbon society are the collaborative governance models, as practiced by Scandinavian countries since the 1970s and by the Netherlands, via LTAs, since the 1990s. It overrides short-term political interests and is a cross-partisan agreement to concentrate on some long-term issues of major national and international importance. There may need to be a cultural predisposition to work this way. Even China and Turkey have managed to successfully implement some collaborative governance principles, as has New Zealand on freshwater issues.

Energy and infrastructure issues, as well as R&D take much longer time-scales (often 50-100 years) than political cycles. It is difficult to make these 50-100 year decisions on infrastructure when the system is set up to be focussed on the short term.

A mix of interventions is needed. That mix is dependent on the various cultural and individual attitudes and behaviours. Normative modelling or back-casting is a very successful way of planning and implementing policies and projects; the precede - proceed model used in the Netherlands is a good example. Policy choices are based on belief, not on fact and it is one of the realities that need to be incorporated into policy and intervention design. It is not just people, who are not entirely rational, but governments and policy makers as well.

Why implement energy efficiency policies? In the Netherlands, it makes sense for industry and the many co-benefits that are realised. A New Zealand Energy *Cultures* study found that by far the biggest driver for energy purchasing and using behaviours in households was “being smart and being capable”. Tradition, family history and convenience were also extremely important, even if it compromised comfort.

Two of the biggest drivers found to make energy efficiency and energy management programmes happen in industry and SMEs are leadership buy-in and an effective energy manager or “champion” motivating the implementation. *Nudge* (Thaler and Sunstein, 2008) has a great policy-making “silver bullet” theory but smart policy design and an understanding of the various needs, drivers and barriers of the end-user are absolutely imperative.

Up-scaling and knowledge sharing is extremely important in the international context. We need to share and learn as much as possible and keep adding to case studies. The complexity of this issue is enormous so the understanding can only be improved by in-depth studies and examples.

Research needs to be put into the equation of government and industry-driven interventions. Very important and good examples come from the Netherlands experience that government LTA negotiators understand industry language and issues. In New Zealand, the Labour government was voted out over energy-efficient light bulb standards because the opposition and media successfully called them a “nanny state”. As soon as major issues like the recession and climate change arise, everyone looks to the government to make all the decisions, but generally, heavy government regulation is not seen as politically viable.

It is very important that to shift the idea that the government needs to fix everything to taking personal responsibility over own energy use and wasteful behaviours. Trust is very important and cannot be mentioned enough as a lot of seemingly “irrational” behaviours or actions are based on inherent distrust in developers, politicians, policy makers and/or industry. The public needs to be brought into systemic thinking. However, that is very difficult as society seems to have become more dumbed-down and removed from centralised decision making.

It is very important that public consultation is shown to be taken seriously, otherwise it underpins the distrust. Evaluation is yet again shown to be hugely important. The Netherlands example is shows how on-going, continual improvements and energy savings provides the evidence needed to continue the programme and even convince industry to lobby for it.

Humans are emotionally incapable of understanding complex, long-term consequences as will be forced for example by climate change. We are much more capable of evaluating short-term benefits and risks which usually outweigh our fear of the unknown and overly complex. Climate change response has really suffered from this inherent, human short-sightedness and may become increasingly difficult to address with current behavioural models.

One solution is to translate knowledge and best practice into different cultural and situational contexts, *i.e.* geography, climate, politics, tradition, infrastructure and capital investments. We need to see it as a moral obligation, particularly by rich nations that had most of the benefits from resource extraction and use, to share learning and support each other into the transition to a low-carbon economy and society.

Integrated Approaches

Moderator: Rob Kool, NL Agency, Netherlands

Understanding the energy system and its relationship with society, the economy and the environment is a complex multi-faceted challenge. It is only through an integrated approach based on cross-sectoral collaboration by governments, the private sector, institutions and civil society that we can achieve the necessary conversion to a low-carbon economy. Incremental measures are not enough.

There is no single recipe to follow to drive the transition to a low-carbon economy. There is a diverse array of possible approaches depending on the context, but integration is essential and it requires policies with a medium- and long-term perspective. Governance also involves co-ordination of simultaneous policy actions and consideration of possible interactions with policies that have other objectives.

The focus of this session was to explore case examples of a research network, urban planning and energy efficiency, and integrating sustainable technologies in communities.

Low-Carbon Society Research in Asia

Kyoko Miwa, Institute for Global Environmental Studies, Japan

The International Research Network for Low-Carbon Societies (LCS-RNet), established in 2009, provides a platform for dialogue between policy and research to share the scientific knowledge needed and to support timely policy implementation linked directly with research to accelerate the transition to a low-carbon future, and to facilitate research exchange between countries. Sixteen institutions from France, Germany, India, Italy, Korea, Japan and United Kingdom participate. LCS-RNet also facilitates the interaction between researchers and various stakeholders, and delivers their findings to policy makers to assist science-based policy making in transitioning to low-carbon societies.

Key messages from the LCS-RNet 2nd Annual Meeting in 2010 include: inter-linkages among society's components must be understood; technologies and R&D alone cannot attain a low-carbon society; and both the implications and limitations of modelling must be correctly understood. Back-casting model exercises can show optimised pathways towards low-carbon societies. Further R&D into such methods is needed.

The risks of moving towards high-carbon intensive pathways are critically important in emerging economies since infrastructure developments, such as major transportation systems and power plants, are characterised by lifetimes ranging from decades to centuries. Moreover, avoiding carbon intensive lock-in will be achieved by mobilising the best available low-carbon options and improve their cost-efficiency and social attractiveness.

Early support for low-carbon options would help to avoid lock-in. This support needs to pay due attention to the timing of interventions from R&D through to market deployment. Local specificities, the level of maturity of technologies, and social acceptance (including the availability of adequate human resources) also need be taken into account. Delaying investment will transfer the costs to future generations and add to the costs associated with adapting to climate change.

National level packages that set the framework for the low-carbon transition are essential. However, these must be reinforced by policies and measures that are country and sector specific. Tailored policy packages need to take account of both variations *between* countries deriving from cultural attitudes towards the use of resources, and variations *within* countries that reflect local specificities and diverse market, cultural and social conditions. For example, in Asia being less dependent on material and processed goods may be considered a noble attitude thus creating a very different cultural norm when compared to consumerist attitudes in other societies. These values in Asia can accommodate top-down policy approaches. Korea is a good example.

The LCS-RNet is engaged in activities in a number of Asian countries. These include information sharing for policy makers and researchers to strengthen science-based policy making and capacity-building opportunities for researchers in developing countries, as has taken place in Cambodia, Thailand and Malaysia among others. There is also a focus on information, tools and methods to develop scenarios to leapfrog to low-carbon systems. This includes: developing narratives for low-carbon scenarios; quantifying future outlooks; and developing robust roadmaps to guide the development of policy packages.

Lessons from the low-carbon research in Asia include:

Inventories can provide a strong basis for a scientific approach.

- Countries that develop reliable inventories could be in a good position to attract clean development mechanism projects.
- Lack of reliable activity data is a barrier for developing low-carbon society scenarios.
- Co-operation between researchers and policy makers is urgently required for research agenda setting.

Co-ordination is a key in many ways such as between policy and research communities and inter-ministerial co-ordination.

Both adaptation and mitigation are important.

- Adaptation is given a priority in most developing Asian countries. For the effective use of limited resources, co-ordination of adaptation and mitigation policies is necessary.
- In urban areas, co-control of air pollution and greenhouse-gas emissions is called for. Pollution control measures can be a good entry point to mitigate greenhouse-gas emissions.

Sub-national level initiatives are important.

- Traditional values are very powerful tools to promote a low-carbon society.
- For energy supply, promoting off-grid systems using biofuels can improve access to electricity.
- Localisation of transferred technology is necessary.
- Since agriculture, forests and natural resources are target areas for mitigation, the knowledge of local people for adaptation and natural resource management are important in designing mitigation.

The key messages from LCS-RNet initiatives in Asia can be summarised as:

- *Policy signals from central governments, supported by local initiatives, are becoming more visible in Asia.*
- *The time is now to avoid carbon-intensive lock-in and enable low-carbon technology and practice to leapfrog in Asia.*
- *There is no one-size-fits-all: modelling, policies and measures need to be tailored to local contexts.*
- *Data and methods for inventorying greenhouse-gas emissions, particularly from cities, are needed.*
- *Working towards the transition is a two-way street: low-carbon research should inform policy, experiences with policies should inform research.*

- *Innovative governance with the institutional co-ordination (horizontal and vertical) must be strengthened.*

Energy Efficient Communities - Case Studies and Strategic Guidance for Urban Decision Makers

Olivier Pol, Austrian Institute of Technology, Annex 51: Implementing Agreement for a Programme of Energy Conservation in Buildings and Community Systems[8]

The work of the Annex 51 Energy Efficient Communities: Case Studies and Strategic Guidance for Urban Decision Makers covers the design of long-term energy conservation and greenhouse-gas mitigation strategies and their continuous optimisation at the community or neighbourhood level. It aims to enable communities to set up sustainable and secure urban energy structures and identify the specific actions necessary to reach economic efficiency and greenhouse-gas reduction targets. It employs an integrated and multi-disciplinary approach as a basis for providing tools, guidelines, recommendations, best-practice examples and background material for designers and decision makers. It also aims to transfer these experiences to other communities and enable them to establish their own local strategy to reach their desired sustainability goals.

While a high level of energy performance can be achieved in the building sector, the actual building energy performance depends on the local energy system configuration and performance. Urban parameters such as the functional mix of buildings and the availability of heat sources and sinks affect the overall energy performance of buildings. Decisions at community level, for example on transportation systems and infrastructure, have long-lasting impacts on the energy balance of cities. Urban energy planning must address issues at a strategic level such as targeted building renovation initiatives as well as at an operational level such as for district energy supply systems. Cities are generally committed to energy and environmental targets. Both new neighbourhood development projects and urban regeneration projects provide opportunities to include energy criteria in planning and to implement integrated energy systems.

Challenges for urban energy planning lie in the highly complex nature of the effects that need to be considered and the large variations within the building sector. There is a very complex decision-making, planning and implementation process involved, *e.g.* which questions are to be answered by whom and when; how to deal with divergent economic interest of stakeholders. The long-term nature of urban planning and complex monitoring framework also bring significant challenges, such as the large number of actors involved. Energy system boundaries are different to geographic boundaries which can complicate the designation of key performance indicators.

Nineteen case studies for energy efficient communities in Austria, Canada, Denmark, France, Germany, Japan, Sweden, Switzerland and the Netherlands were assessed. A special emphasis was put on planning aspects of energy efficiency measures involving technical energy modelling approaches as well as policies enabling the implementation of urban development projects. To facilitate the international comparison a descriptive framework was established for their evaluation and comparison.

Process mapping using CONCERTO was an important tool.[9] So was identifying the key mechanisms in the planning and implementation processes. These include consultation and joint

---

[8] Implementing Agreement on Energy Conservation in Buildings and Community Systems, www.iea.org/techno/iaresults.asp?id_ia=12

[9] CONCERTO is a European Commission initiative within the European Research Framework Programme which aims to demonstrate that the optimisation of the building sector of whole communities is more efficient and cheaper than optimisation of buildings individually.

decisions in the agreement phase; creation of urban development companies for new neighbourhoods; requirement setting; establishing public – private partnerships; tendering processes for energy service companies or other energy system builders and operators; internal and external training and information dissemination.

Various approaches ranging from government driven to front-runner models are employed to drive and steer the planning and implementation processes. Each has advantages and drawbacks. The solution is to find the right balance between different approaches that is appropriate for the type of project and the objectives sought.

As a common characteristic the approaches integrate a number of local stakeholders and employ multiple policy instruments in the transition from planning to implementation. Consequently they pursue a number of objectives reflecting the diversity of the involved actors and policy levels. The objectives were expressed in a range of economic, environmental, urban and energy-related targets.

Lessons learned and main findings from the case studies highlighted the importance of the role of actors and the continuous processes necessary from initial planning to implementation. The early integration of all relevant actors in the planning process is a key aspect for success and helps to take account of the complexity of economic issues at community level. Also the setting of targets and standards in early stages is deemed important. An integrated approach is fundamental as opposed to a supply-side technology solution. The whole energy system needs to be considered when planning community systems including the incorporation of social research in order to understand and meet community needs. Successful approaches to design and implement optimised neighbourhood energy concepts are presented in *Guidelines and Case Studies for Energy Efficient Communities*.[10]

Key messages for planning and implementing energy efficient communities include:

- *Define key performance indicators for communities and set up a monitoring framework.*
- *Understand planning and implementation processes for community projects and their implications for urban energy planning.*
- *Understand the complexity of economic issues at community level.*
- *Employ a tailored mix of policy instruments.*

Holistic Optimisation Leading to Integration of Sustainable Technologies in Communities

Aideen O'Hora, Sustainable Energy Authority Ireland

Ireland's Sustainable Energy Communities (SECs) Programme aims to stimulate a national move towards sustainable energy practice through demonstration of best practice in six communities by 2015, which in turn will inform and build capacity through the Sustainable Energy Community Network. The programme acts as a catalyst on the ground to help stimulate a national move towards sustainable energy practice, and a platform for wider debate and strategic influence at national and European levels.

The SEC approach is based on the principles of structured energy management, which drives continual improvement and an integrated approach to achieve more than the sum of the parts. The

[10] www.annex51.org

development of an sustainable energy community requires a holistic approach where public and private actors make a collective commitment and work towards achieving agreed targets. The development of an SEC is about a five-year process. The model begins by establishing a clearly defined geographic area called the Sustainable Energy Zone, which sets sustainable energy targets that are measured and monitored and creates a focal point for partners, projects and proposals to integrate in a structured way. This allows new technologies and techniques to be tried and tested in an incubator or living laboratory environment. SECs involve everyone in the community, across all sectors, working together to enhance sustainability by being as energy efficient as possible, using renewable energy where feasible and developing indigenous energy supplies. The Sustainable Energy Authority of Ireland (SEAI) partners with communities and provides them with strategic guidance, as well as technical and project management support.

The community of Dundalk was established as Ireland's pilot SEC in 2007. Work to date has involved the installation of energy efficient technologies in a wide range of buildings as well as implementing energy efficient behavioural change. It has employed a variety of measures including an adaptation of the long-term agreement concept from the Netherlands. In the Dundalk sustainable energy zone, the Xerox and Heinz companies saved EUR 2 million per year in energy costs via a work placement scheme.

Dundalk's efforts have led to savings of more than 5 000 tonnes of CO_2 per year which will increase as more projects are delivered. Organisations have saved costs in excess of EUR 1.5 million since Dundalk 2020 began. These savings are sustained as organisations involved have embedded the principles of structured energy management systems. Local authorities in Dundalk were the first such authority in Ireland to implement structured energy management. Since 2008, work undertaken by a dedicated energy team has saved in excess of EUR 500 000 from annual energy costs. Some 160 residents of a housing estate spearheaded the "Householders, Be Your Own Energy Manager" programme, resulting in typical annual savings of EUR 250 per household.

Holistic Optimisation Leading to Integration of Sustainable Technologies in Communities (HOLISTIC) is a group of work packages within Dundalk 2020 that have been grouped and presented to the European Commission for financial support under the CONCERTO initiative. For this project Dundalk joined together with Neuchâtel (Switzerland) and Mödling (Austria) so that all three communities can work together and learn from each other.

HOLISTIC aims to show other communities across Europe how to use different energy technologies and techniques in an intelligent and integrated way. In Dundalk the main focus is on the technologies and behavioural changes that deliver the most efficient use of energy. The project also involves research programmes such as the innovative use of renewable technologies, as well as research on the development of sustainable transport initiatives.

Some lessons emerging from the Dundalk pilot SEC include:

- *To achieve structured energy management entails: commit – identify – plan – take action – review and that requires a balance of people, skills, organisational and technical collaboration.*
- *Effective communication is a significant challenge. Communicating learning between various stakeholders is essential.*
- *Risk taking is encouraged: failures teach.*
- *Leadership and champions are keys to success.*
- *Approaches can be replicated and adapted into different cultural context as in the long-term agreement model. International collaboration and experience sharing are valuable.*
- *A community-based approach allows all public, private and community organisations to share resources, expertise, ideas and knowledge.*

Session Summary

Rob Kool, Moderator

There is not one option to succeed on the path to a low-carbon economy; there needs to be a mix of interventions, both top-down and bottom-up. Combining the perfect mix is not easy. We need to design it as best as we can and to keep it simple for planners and politicians. The Dutch use the “knock-on effect” method of trying to adapt successful programmes as widely as possible.

The example in Dundalk which has adapted the LTA covenant model from the Netherlands and other countries’ examples are heartening. Back-casting from an ambitious target, good planning, collaboration and communication have also been shown to be very successful in Project Zero. CONCERTO is looking at community boundaries to see if they can be defined well enough to be modelled, which is a more theoretical approach and very important for top-down planning.

The Asian example of leapfrogging to avoid energy intensity lock-in is something we should all aspire to, particularly the cultural avoidance of over-materialism. It is extremely important to learn about and take due consideration of different cultures, and historical and traditional contexts.

Overall there is enough evidence that a cross-cutting approach that combines technological and socio-economic research and demonstration provides good feedstock for evidenced-based policy making. Up-scaling from local, regional and sometimes national level to multinational and even global level remains the biggest challenge.

The Role of Socio-Economic Research for R&D Priority Setting

Moderator: Robert Marlay, Department of Energy, United States

Synthesis Discussion

A transition to a low-carbon economy is a task of enormous scale, the challenges are daunting and the time is short. So far, measures to encourage the adoption of low-carbon technologies and increase energy efficiency have focused primarily on technologic and economic barriers while relatively little attention has been given to the influence of social and behavioural factors.

Barriers are not always technical or financial. They can be cultural, for example how people think about their environment. Therefore, policy planning and technology R&D from inception to diffusion would do well to include the social sciences as they are the experts in the human dimension of technological and societal change.

The transition to a low-carbon economy clearly requires accelerating energy innovation and technology adoption. RD&D will have a key role in bringing down capital costs as technologies move down the learning curve, thereby contributing to the inception and realisation of innovative low-carbon technologies. However, simply making energy efficiency and low-carbon options available and economically attractive is unlikely to bring about the degree and rate of change that is needed. To be successful they must actively involve the businesses, communities and institutions that consume energy. People-centred approaches that integrate and apply social and behavioural insights can provide the means to accelerate the transition to a low-carbon economy. Additional research is needed to identify the behaviours that can most readily be influenced by policy measures and interventions to improve energy efficiency and practices, and the uptake of low-carbon technologies.

This workshop considered a set of overarching questions to guide the presentations and discussions. To pull the threads together, the final session assigned a sub-set of the questions to three groups for discussion and synthesis to inform the primary recommendations as summarised below.

Group 1

- What is the role of social science and how best can it feed into technology R&D programmes and policies?

Without a doubt, it is very important to involve end-users and to understand their needs and motivations at the applied R&D stage. Nevertheless there is a strong case that even basic research should consider end-user needs and uptake issues early on. This can inform research questions and priority setting. Social science should be included in technology R&D from the start and multi-disciplinary interchanges facilitated. Capability building is important.

Successful programmes should be inter-disciplinary, based on trust and a mutual language of understanding and respect for different approaches, opinions and objectives. Evaluation is absolutely fundamental to prove effectiveness and achieve further funding.

It is unlikely that the “nudge principle” adheres - not to compel anyone to do anything, but to encourage people to make decisions that will make people better off. In order to automate or set a successful default process, it needs to be designed with a solid understanding of end-user needs.

There is a difference between social acceptance and acceptability. Social acceptance puts the onus on the community or the end-user, not the developer. Social acceptability puts the onus on the developer to ensure that projects are not developed without being acceptable to the wider public.

- What is the realistic timeframe that would enable R&D programmes to synchronise with energy markets?

The timeframe should be from the design phase and it should permeate through the whole RD&D process.

- Which other social considerations (*e.g.* health, environment, lifestyles) can be adequately addressed?

Good examples are programmes and subsidies to improve building insulation that improve energy efficiency and reduce greenhouse-gas emissions. They also deliver co-benefits including more comfort, better health, and employment opportunities.

- Which methods (*e.g.* impact assessments, stakeholder consultations and target groups) are found to be the most effective in addressing them and at what point in the R&D planning process should they begin?

Inter-disciplinary, mixed methodologies, stakeholder consultation and focus groups are important as are living labs and life-cycle analyses that take into account the soft benefits. Controlled experiments are most important as is the sharing of international best practice. Such methods should be an important part of the R&D planning process from the very beginning.

Group 2

- Which legal and regulatory frameworks are the most conducive to the transition process? What is a manageable scope for these policy frameworks - local, regional or national - and what is the relationship between them?

Effective and transparent legal and regulatory frameworks are needed at national and local levels. Local levels should ensure minimum requirements for public participation - it is important that people are heard and their concerns considered. At the supra-national level, such as the European Union framework directives, a degree of freedom is needed as targets are established but must be translated into national responses.

- Which economic considerations (*e.g.* sectoral shifts, employment, energy markets, infrastructure or trade) are manageable and which financial instruments (*e.g.* taxes, subsidies, investment credits) are found to be the most effective?

Financial and economic instruments are good if they are continuous, transitional and accountable; the less expensive the instruments, the better. Taxes, subsidies, grants and loans can all be successful depending on purpose, design and delivery. For example, taxing carbon can be effective, but in some cases has yet to prove effective. Subsidies for R&D are more important than taxes. Public – private partnerships can be both good and bad. Feed-in tariffs for low-carbon power technologies are effective, but usually very costly. Compensation for damage and increased job creation also should be important drivers.

Group 3

- Which methodologies and tools provide the greatest insights for planners?

A wide variety of methods and approaches are available. It is generally possible to choose among them the best suited for the objectives at hand, the issues to be considered, categories of stakeholders, geographic range, etc. Transporting one method to another situation in the same country may be easier than using a method developed and tested in another country, so "indigenous" methods may have merits with respect to "imported" ones, but this is not a fixed rule.

Experiences cannot necessarily be transferred seamlessly across countries, sectors or technologies since aspects are often unique and subject to national circumstances. However, certain lessons may be transferred to other national contexts, such as successful and unsuccessful responses to particular circumstances. A country seeking to improve the effectiveness of RD&D policies and programmes in the transition to a low-carbon economy can learn valuable lessons via the examination of what has worked and what has not in other disciplines and other countries. This can save time and costly experimenting.

- Which data sets (quantitative or qualitative) or indicators are the most effective for socio-economic impact assessments?

A large amount of data is available, generally more related to technologies than for social indicators. The problem may often not be the existence of data, but rather the choice of data sets, and their validation and elaboration.

Relevant data are not always readily available. This applies to technology data which may be protected by proprietary rights. It also is the case for some social indicator data such as market surveys that reflect consumer preferences and are often commercially protected knowledge.

- Which strategies integrate energy, economic, social and environmental issues? Which strategies integrate socio-economic impact assessments into energy plans?

Traditionally forecasting has been employed to assess which policies and measures in a strategy would be most effective to achieve desired objectives. As demonstrated in several examples presented at the workshop, back-casting models can be used to show optimised pathways towards low-carbon strategies. When developing plans to achieve reduction targets the use of back-casting methods in which the necessary policies for achieving a target are considered through working backwards from the target can be effective.

One advantage of this approach is that it starts from the identification of a desired situation, and therefore requires the development of a consistent situation that is considered desirable by the planners, which implies it should be desirable or at least acceptable by the main stakeholders. That may not be trivial, and in any case it would not be productive to develop a strategy of how to reach a target which is not broadly supported.

There is no one-size-fits-all strategy: policies and measure need to be tailored to local contexts. As illustrated in the case of two different arrival points, with similar objectives in terms of sustainability, but with very different characteristics: one based on high urbanisation and specialised area designations; the other of a more distributed type with integrated mixed use in all areas. The evolution of the energy system will differ significantly in the two cases, and the modelling is simplified if one chooses *a priori* the main characters of the target situation. It is important to make these visions clear and understandable, so that stakeholders can develop an informed opinion.

Once the objectives have been identified, the next step is to identify ways and means to reach them, both by technological means and by socio-economic approaches. The two categories are equally important and should always be developed together. One way to look at this task is to identify barriers and ways of breaching them. Many of these barriers are often not even recognised and therefore are not taken into account in the models. Barriers may be economic, financial, information, capacity building, technological, organisational and institutional. There is no simple and universal solution, but many studies on their nature and methods to overcome them are available.

An example of the influence of behaviour on energy consumption is the rebound effect. This is where the effects of certain measures to reduce energy consumption are less effective than theoretically expected as the lower cost of an energy service can be offset by the elasticity of demand for that service (lower cost brings higher consumption).

As demonstrated in a number of presentations, pilot projects are very important. They help to identify obstacles and solutions, to establish benchmarks and to clearly show the significance of various energy choices to stakeholders and the general public.

Strategies that integrate a sense of ownership among a community of stakeholders were shown to be effective in case examples from wind power developments in Japan and Switzerland. Actions can be taken such as active and early engagement of the stakeholders, proactive planning and evaluation of how the benefit sharing mechanisms are locally distributed. A proper consideration of the wide range of issues may provide significant insights to a more evidence-based decision-making process on energy developments. More precise knowledge may help planners, developers and authorities learn from past experiences and find mechanisms to improve citizen engagement with strategies to move towards a low-carbon economy.

Recommendations

Four primary recommendations were formulated:

- Funding and support for research and experimentation in behaviour change strategies should be increased so as to expand the base of reliable knowledge regarding the most effective approaches to achieve behaviour-based energy savings.

- Current schemes for programme implementation and energy savings attribution should be adjusted to incorporate mechanisms that facilitate the recognition of energy savings from behaviour change strategies.

- Existing measurement and accountability practices should be adjusted to allow programme managers more flexibility to incorporate behaviour change strategies and apply qualitative measures of customer satisfaction.

- The scope of understanding regarding the purview of utility regulators should be viewed more broadly so as to enable greater investment in a broader range of cost-effective programmes – particularly behaviour change strategies – and to encourage more social scientists to join the staff at all levels.

APPENDIX A: WORKSHOP AGENDA

FINAL AGENDA

24 May
Haus der Kunst, Kaiser Franz Ring 7
Baden, Austria

Welcome: Mayor, City of Baden

9:30	**Opening Remarks from the EGRD Chair**	**Rob Kool, Director, International Sustainable Development, NL Agency, Netherlands**
1	**TECHNOLOGIES**	
Moderator: Sea Rotmann, National Energy Research Institute, New Zealand		
10:00	**Evaluation of European Energy Behavioural Change Programmes**	Antoinet Smits, NL Agency, Netherlands
10:30	**Break**	
10:45	**Socio-Economic Drivers in Implementing Bioenergy Projects**	Sebastian Elbe, National Task Leader, Bioenergy Implementing Agreement
11:15	**Social Acceptance of Wind**	Stefanie Huber, Project Manager, ENCO Energy, Switzerland
12:15	**Key Findings**	**Moderator**
12:45	**Lunch**	
2	**POLICIES AND MEASURES**	
Moderator: Herbert Greisberger, Austrian Society for Environment and Technology		
14:00	**ProjectZero: Lessons Learned in Overcoming Barriers**	Christian Eriksen, Project Manager, ProjectZero
14:30	**Policies and Measures for Organisational Change and Behaviour**	Rob Kool, NL Agency
15:00	**Public Perceptions of Low-Carbon Energy Policy and Technology: Recommendations for Policy Makers and R&D Planners**	Paul Upham, Finnish Environment Institute and Centre for Integrated Energy Research, University of Leeds
15:30	**Break**	
15:45	**Discussion and key findings**	**Moderator**
17:00	**Close Day 1**	

25 May

Haus der Kunst, Kaiser Franz Ring 7

Baden, Austria **3** **INTEGRATED APPROACHES**

Moderator: Rob Kool, NL Agency, Netherlands

9:00	**Low-Carbon Society Research in the Asia-Pacific Region**	Kyoko Miwa, Institute for Global Environment Strategies, Japan
9:30	**Energy Efficient Communities: Case Studies and Strategic Guidance for Urban Decision Makers**	Olivier Pol, Energy Department, Austrian Institute of Technology
10:00	**Holistic Optimisation Leading to Integration of Sustainable Technologies in Communities**	Aideen O'Hora, Project Manager, Sustainable Energy Authority of Ireland
10:30	**Break**	
10:45	**Discussion and key findings**	Moderator
12:00	**Lunch**	

4 **THE ROLE OF SOCIO-ECONOMIC RESEARCH for R&D PRIORITY-SETTING**

Moderator: Robert Marlay, U.S. Department of Energy

14:00 **Open Discussion**

Key questions:

- *What is the role of social science and how best can it feed into technology R&D programmes and policies? What is the realistic timeframe that would enable R&D programmes to synchronise with energy markets?*
- *Which social considerations (e.g. health, environmental, lifestyles) can be adequately addressed? Which methods (e.g. impact assessments, stakeholder consultations, and target groups) are found to be the most effective in addressing them? At what point in the R&D planning process should they begin?*
- *Which legal and regulatory frameworks are the most conducive to the transition process? What is a manageable scope for these policy frameworks – local, regional or national – and what is the relationship between them?*
- *Which economic considerations (e.g. sectoral shifts, employment, energy markets, infrastructure, or trade) are manageable and which financial instruments (e.g. taxes, subsidies, and investment credits) are found to be the most effective?*
- *Which methodologies and tools provide the greatest insights for planners? Which data sets (quantitative or qualitative) or indicators are the most effective for socio-economic impact assessments?*
- *Which strategies integrate energy, economic, social and environmental issues? Which strategies integrate socio-economic impact assessments into energy plans?*

16:00	**Final Remarks**	Rob Kool, Chair, EGRD
16:30	**Meeting close**	

APPENDIX B: SPEAKERS

Speakers

Antoinet Smits, NL Agency, Netherlands

Sebastian Elbe, SprintConsult, National Representative (Germany), Task 29: Socio-Economic Drivers in Implementing Bioenergy Projects, Bioenergy Implementing Agreement

Stefanie Huber, ENCO Energie-Consulting, Programme Managers, Task 28: Social Acceptance of Wind Energy Projects, Wind Implementing Agreement

Christian Eriksen, Project Manager, ProjectZero

Rob Kool, NL Agency, Netherlands

Paul Upham, Finnish Environment Institute and University of Manchester, United Kingdom
Kyoko Miwa, Institute for Global Environmental Studies, Japan

Olivier Pol, Austrian Institute of Technology, Annex 51: Implementing Agreement for a Programme of Energy Conservation in Buildings and Community Systems

Aideen O’Hora, Sustainable Energy Authority Ireland

Moderators

Sea Rotmann, National Energy Research Institute, New Zealand

Rob Kool, NL Agency, Netherlands

Robert Marlay, Department of Energy, United States

APPENDIX C: WORKSHOP PARTICIPANTS

Herbert GREISBERGER	Austrian Society for Environment and Technology	Austria
Andreas LINDNER	Austrian Energy Agency	Austria
Olivier POL	Austrian Institute for Technology	Austria
Anders LUNNAN	ESM Program	Austria
Ludwig VANDERMAELEN	Federal Ministry for the Economy	Belgium
Birte HOLST JORGENSEN	Risoe DTU National Laboratory for Sustainable Energy	Denmark
Fre MAES	DG Environment - Climate Change Service	Belgium
Christian ERIKSEN	ProjectZero	Denmark
Eva HEISKANEN	Helsinki School of Economics	Finland
Christoph JESSEN	Forschungszentrum Jülich GmbH	Germany
Sebastien ELBE	Sprint Consult	Germany
Aideen O'HORA	Sustainable Energy Authority Ireland	Ireland
Ugo FARINELLI	Italian Association of Energy Economists	Italy
Oscar AMERIGHI	ENEA	Italy
Makato AKAI	National Inst. Adv. Industrial Science and Technology	Japan
Kyoko MIWA	Institute for Global Environment Strategies	Japan
Philip CARUANA	Malta Resources Authority	Malta
Rob KOOL	NL Agency	Netherlands
Albert JANSEN	NL Agency	Netherlands
Antoinet SMITS	NL Agency	Netherlands
Sea ROTMANN	Energy Efficiency and Conservation Authority	New Zealand
Grete COLDEVIN	Nordic Energy Research	Norway
Miroslava SMITKOVA	Slovak University of Technology	Slovak Republic
Luisa CABEZA	University of Llerida	Spain
Gunter SIDDIQI	Swiss Federal Office of Energy	Switzerland
Gundula HUBNER	ENCO AG	Switzerland
Paul UPHAM	Manchester Institute of Innovation Research	United Kingdom
Robert MARLEY	United States Department of Energy	United States
Lin LUO	European Commission Joint Research Centre	European Commission

APPENDIX D: SOCIO-ECONOMIC IMPACTS OF THE TRANSITION TO A CLEAN-CARBON SOCIETY

Rationale

The transition to a clean carbon society is a multifaceted challenge in which the actors are inter-dependent and for whom the solutions have immediate (local) and long-term (global) benefits. However, for the transition to be a success, each stakeholder group (policy makers, energy planners, the research community, businesses and industry, and individuals) will have their part to play.

But how can such wide-ranging challenges be addressed effectively and in an integrated manner? A coherent legal and regulatory framework between the sectors affected is a first key element. Regular and active consultations between energy, economic, social and environmental planners will also be required to create integrated strategies and plans.

Facilitating investments in low-carbon technology research, development and deployment by businesses and industry necessitates fiscal incentives. Engaging with relevant stakeholders early in the process as well as providing unbiased information is also vital.

Scope

This event will focus on gaining understanding of the socio-economic parameters, actors and impacts involved in the transition to a low-carbon society. Participants are invited to share the mechanisms, methods and measures taken to achieving successful implementation.

Questions to be addressed by experts include:

- *Which legal and regulatory frameworks are the most conducive to the transition process? What is a manageable scope for these policy frameworks – local, regional or national – and what is the relationship between them?*
- *Which strategies integrate energy, economic, social and environmental issues? Which strategies integrate socio-economic impact assessments into energy plans?*
- *Which economic considerations (e.g. sectoral shifts, employment, energy markets, infrastructure, or trade) are manageable and which financial instruments (e.g. taxes, subsidies, and investment credits) are found to be the most effective?*
- *What is the role of ongoing technology R&D and how best can it feed into programmes and policies? What is the realistic timeframe that enables R&D results to synchronise with energy markets?*
- *Which methodologies and tools provide the greatest insights for planners? Which data sets (quantitative or qualitative) or indicators are the most effective for socio-economic impact assessments?*

- *Which social considerations (e.g. health, environmental, lifestyles) can be adequately addressed? Which methods (e.g. impact assessments, stakeholder consultations, and target groups) are found to be the most effective in addressing them? At what point in the planning process should they begin?*

Target Audience

This event was designed for policy makers, energy planners, socio-economic researchers, R&D experts and energy technology experts.