

Scenarios for the integration of renewables in a European cities network

P.H. Webber

Leicester Energy Agency (Leicester City Council),
Leicester Energy Efficiency Centre
2-4 Market Place South, Leicester LE1 5HB UK,
webbp900@leicester.gov.uk

D. Lack

Leicester Energy Agency (Leicester City Council),
Don.Lack@energy-advice.co.uk

M. Pardo

Leicester Energy Agency (Leicester City Council)
pardm001@leicester.gov.uk

Keywords

awareness, demonstration project, dissemination, electric battery management system, enabling action, local, overcoming barriers, partnerships, renewable energy, scenarios, workshop

Abstract

Leicester City Council has a target to reduce by 50% Leicester's carbon dioxide emissions from 1990 levels by 2025, and for 20% of the city's energy requirements to be provided by renewable energy sources by 2020. It has been working to implement renewable energy and energy efficiency measures in Leicester. As part of this work, barriers to the uptake of energy efficiency and renewable energy have been considered. For example, the Leicester Energy Agency has recently participated in the European Commission supported SIREN project, co-ordinated by Innova (Italy) with other partners in Italy, Portugal, and the Netherlands, which has looked at non-technical obstacles associated with the dissemination of new and renewable energy-related research and development projects at the local level in Europe.

The SIREN project has included the selection of a number of new and renewable energy-related research and development projects, with the potential impact of the results of these projects for Leicester and the other partner cities being explored. Four possible future scenarios have been considered for individual energy projects. The partner cities have used the 'European Awareness Scenario Workshop' approach involving workshops with representatives of local groups (technical experts, residents, local decision makers/politicians and businesses). The workshops have included discussion of obstacles facing the uptake of new and renew-

able energy project results, such as meeting the initial cost of new technologies, and insufficient awareness and information. Possible actions to overcome the barriers to new and renewable energy, including financing schemes and public participation have been identified.

Introduction

There is significant potential for renewable energy and energy efficiency, but an important limitation for the technologies is the presence of non-technical barriers to their uptake. It has been considered that there has been a lack of suitable techniques to involve local actors in decision making on the utilisation of renewable energy. The SIREN project (Scenarios for the Integration of Renewables in a European Cities Network) was established against this background. Details are given below on the process followed during the project, with an example given of the experience in Leicester. Results from the project are reviewed and discussed and the use of the results to improve energy efficiency is considered.

The SIREN project looked at obstacles associated with the dissemination of new and renewable energy related research and development projects at the local level in Europe. It received European Commission funding and involved partners in Italy, the Netherlands, Portugal and the United Kingdom. The project was co-ordinated by INNOVA (Italy), with the project's partners being AEA (Italy), AMERLIS (Portugal), NOVEM (Netherlands), Leicester Energy Agency, University of Lisbon (Portugal), Dialogic (Netherlands), and Ecoazioni (Italy).

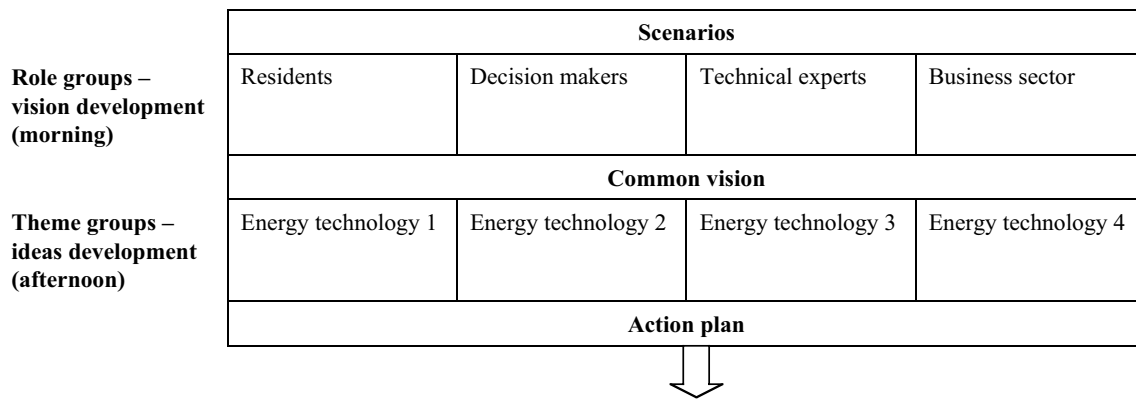


Figure 1. The workshop structure (Bilderbeek 2002).

The aim of the SIREN project was to help to overcome the non-technical barriers to the effective dissemination of energy-related research and development projects in different European areas. The project intended to raise public awareness of European new and renewable energy related research and development projects by:

- creating a network of European cities using a consensus building process involving politicians, experts, residents, and businesses and analysing the impact of a selection of research and development projects at the local level, and
- helping with a policy formulation process promoting the dissemination of the new and renewable energy research and development projects, and their testing and integration.

SIREN methodology

The project, which began in February 2001 and lasted eighteen months, involved a number of stages:

1. Definition of a group of research and development projects and a preliminary analysis of selected technologies/projects

This included the selection of a number of European new and renewable energy related research and development projects. It was intended that the results of these projects would be supported, promoted and further integrated in the energy systems of the partner cities, Lisbon (Portugal), Deventer (Netherlands), Spoleto (Italy), and Leicester (UK).

The SIREN partners have focused on a range of technologies. In the project as a whole, thirteen technologies covering three main areas were considered by the partner towns, with the majority being concerned with solar energy and a few projects concerned with transport and biomass energy.

2. Scenario development

A description of a common methodology for the project in all the cities has been developed (DIALOGIC et al 2001), which is based on a participatory approach using workshops and also a future scenarios approach.

A reference scenario was developed for each city, which included the collection of a range of information (including renewable energy aspects) related to the individual cities, and consideration of the relevant individuals and groups to be involved in a Scenario Workshop.

The project has used the 'European Awareness Scenario Workshop' approach. The European Awareness Scenario Workshop (EASW) was originally developed in the early 1990s as a method of increasing the involvement of residents in Europe in work towards achieving more sustainable cities. The EASW method has been used in over 70 cities and has dealt with topics such as urban sustainable development, urban mobility, and urban regeneration.

Special features of the European Awareness Scenario Workshop are that it brings together participants from different sectors and, by following a structured approach, enables interaction between people from the different groups, and it helps in developing future visions and ideas for action towards local sustainable development.

3. Application of the SIREN methodology

This included the development of four possible future scenarios for individual energy projects/technologies for each city.

The use of the EASW approach in the SIREN project has involved organising a one day workshop for about 25-30 people with representatives of different local groups (technology experts, local Council officers, residents and businesses) in each of the partner cities (see Figure 1). The workshops have considered the development of a future vision, the identification of barriers and factors for success for new and renewable energy projects/technologies, and have included the preparation of a brief action plan.

4. European qualification/Final seminar

Following the Scenario Workshops, a final seminar has been held when the project partners met to consider the results of the Workshops.

5. Dissemination and follow up

The local media (for example press and radio) have provided publicity for the project, and a website for the project has been set up to assist with disseminating the project (at <http://www.tech-road.com/siren>).

Applying the SIREN methodology in Leicester

Leicester is a city in the East Midlands of the UK, with a population of about 294 000, and covering an area of about 7 337 ha. Leicester City Council has developed an Energy

Action Plan, and produced a city-wide energy strategy in 1994 (Leicester City Council 1994) which considered both energy supply and demand. The Council has targets to reduce energy consumption in the city by 50% of 1990 levels by 2025, and for 20% of Leicester’s energy requirements to be obtained from renewable energy sources by 2020. Recently Leicester has been preparing its Climate Change Strategy (Leicester Environment Partnership and Leicester Partnership 2002) which considers the impact of climate change in addition to measures to reduce greenhouse gas emissions. The City Council has been working to implement renewable energy and energy efficiency measures in Leicester, and has been interested in barriers to their uptake.

Details of the experience in Leicester in applying the SIREN approach are given below.

DEFINITION OF PROJECTS/TECHNOLOGIES TO BE CONSIDERED IN LEICESTER

A review was carried out of information on the potential of renewable energy in Leicester to help in selecting the technologies to consider in the project. It was considered that the largest potential for renewable energies in the city of Leicester was for utilising solar energy. For example, opportunities include photovoltaics and solar thermal energy in retrofit and new build in the domestic sector, solar thermal in the business sector, and the use of passive solar techniques (such as light pipes). There is the potential for energy from waste, for example combined heat and power (CHP) using biomass (or paper pellets) with district heating. Also, the City Council is interested in possible new initiatives to expand the use of district heating in Leicester. Other energy technologies that could be relevant to Leicester include alternatively/cleaner-fuelled vehicles (and methods of improving transport sustainability) and cleaner energy generating systems, for example fuel cells. There is considered to be ‘little or no potential resource’ for wind power or landfill gas, and a ‘low potential resource’ for biomass in the form of wet agricultural wastes or forestry residues or hydropower in the City of Leicester (Land Use Consultants and IT Power 2001). (Although there is some resource outside the city in the East Midlands region.) The new and renewable energy projects that were selected to focus on in the SIREN project in Leicester were:

- Solar rental scheme

Leicester City Council has been implementing a novel scheme to assist in overcoming the barrier of the initial cost faced by householders in implementing solar water heating technology. The scheme helps local residents to install solar water heating systems in their properties. The solar rental scheme gives residents the opportunity to rent a solar water heating system with the rental charge related to the financial savings resulting from the heat that is used from the solar water heating system.

- Biomass energy plant

It was intended that a short-term outcome from the SIREN project would be the implementation of a biomass energy project in Leicester. The possibility of using biomass to con-

tribute to heating requirements in a community heating scheme in Leicester has been under investigation.

- Lead acid batteries

A new battery technology was considered, as the Leicester Energy Agency has an electrically powered vehicle which will need replacement batteries in future.

- Light pipe – passive solar lighting

Leicester City Council has been implementing some new passive solar lighting technology in schools. Light pipes, a form of skylight that channels sunlight through a specially designed tube, are being used to direct sunlight to areas in buildings where additional lighting would otherwise be needed. This can improve internal lighting conditions and reduce energy consumption required for artificial lighting.

- Ashton Green

There have been plans in Leicester for a new sustainable housing development, known as Ashton Green. This sustainable housing development was also considered as one of the projects to include in the workshop. Ashton Green could utilise biomass, solar water heaters and passive solar lighting and the workshop discussion related to these projects was relevant to Ashton Green.

SCENARIO DEVELOPMENT AND APPLICATION OF THE SIREN METHODOLOGY

Initially a reference scenario was developed for Leicester, considering the baseline position in the city. Also, four possible future scenarios for the introduction of new and renewable energy were developed to aid in the discussion in the scenario workshop. For Leicester, scenarios in each quadrant of Figure 2 were prepared.

The vertical dimension of the scenario framework is the ‘intervention dimension’, while the horizontal dimension is the ‘scale dimension’ (looking at the scale at which renewable energy will be produced and used) (Bilderbeek 2002). The four scenarios that have been developed describe four different visions of what the city might be like (for example, in 2010) given certain policy decisions. The scenarios consider the role of local authorities/public bodies, and market conditions and the role of individual actions and the scale of

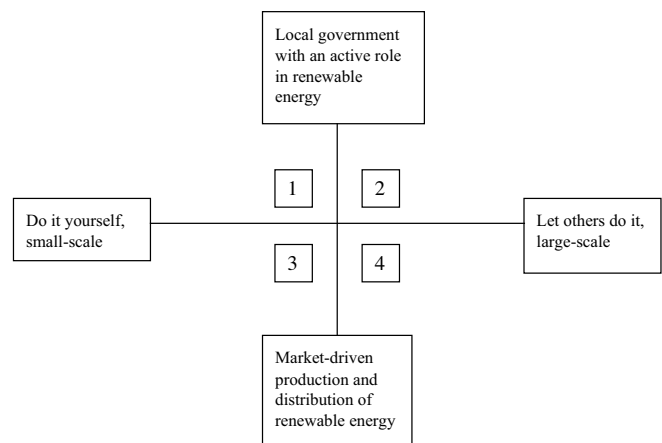


Figure 2. Scenario framework.

application of the renewable energy. The scenarios considered in Leicester are described below.

Scenario 1: Local government with an active role in renewable energy. Small-scale application of renewable energy technologies / 'do-it-yourself'

The local government sets energy policies and is pro-active in promoting local applications of new and renewable energy technology.

The focus is on the promotion and implementation of small-scale renewable energy projects. These could be carried out by individuals or community groups, for example the installation of solar water heaters (e.g. using the solar rental scheme).

The local government raises awareness of available grants, discounts and financial support available for renewable energy schemes. It provides information and advice to support the implementation of renewable energy projects by local residents. Local government establishes new/renewable energy schemes (e.g. solar water heating, passive solar lighting, small-scale biomass) in its own properties, and introduces new transport technologies (e.g. innovative electric batteries) in its vehicles, which demonstrate the technology. Also it promotes opportunities to purchase electricity from renewable energy sources (green tariffs).

Local government uses information and communication technology (ICT) to provide information (for example case studies) and raise awareness of new/renewable energy technologies.

Scenario 2: Local government with an active role in renewable energy. Large-scale application of renewable energy technologies / 'let others do it'

The local government sets energy policies and is pro-active in promoting local applications of new and renewable energy technology (such as solar water heaters, passive solar lighting, small-scale biomass and innovative electric batteries).

The focus is on the identification of, and work towards, the implementation of large-scale renewable energy projects (for example the incorporation of renewable energy features in new building development, such as the planned Ashton Green development).

The local government prepares planning guidance on implementing renewable energy and provides information to developers. It promotes opportunities to purchase electricity from renewable energy sources and the opportunity for businesses to obtain a reduction in the Climate Change Levy if they obtain electricity from renewable energy sources.

Local government uses ICT to provide information and raise awareness of new/renewable energy technologies.

Scenario 3: Market-driven renewable energy production. Small-scale application of renewable energy technologies / 'do-it-yourself'

The local government does not actively promote local applications of new and renewable energy technologies. The implementation of renewable energy is left to the market, and private sector businesses.

The focus is on small-scale renewable energy projects at the local level, carried out by individuals or community groups for example. Renewable energy projects are established if individual residents, public organisations, or businesses request them. Local government does not develop or promote financial incentives for installing renewable energy technologies. Individual energy consumers select whether or not to purchase electricity from renewable energy sources without the local government providing information or advice.

Commercial renewable energy developers identify and promote opportunities for the small-scale application of renewable energy (for example solar water heaters, passive solar lighting, small-scale biomass and innovative electric batteries). They use ICT to advertise their renewable energy services.

Scenario 4: Market-driven renewable energy production. Large-scale application of renewable energy technologies / 'let others do it'

The local government does not actively promote local applications of new and renewable energy technologies. The implementation of renewable energy is left to the market, and private sector businesses.

The focus is on the identification and implementation of large-scale renewable energy projects by the private sector. Businesses can reduce their costs from the Climate Change Levy by purchasing electricity from renewable energy sources.

Commercial renewable energy developers identify and promote opportunities for the large-scale application of renewable energy (for example solar water heaters, passive solar lighting, small-scale biomass and innovative electric batteries). They use ICT to advertise their renewable energy services.

WORKSHOP

As in the other cities, a workshop was held in Leicester based on the European Awareness Scenario Workshop approach, focussing on new/renewable energy at the local level. In the first part of the workshop groups of residents, business representatives, local decision makers/local government officers, and renewable energy experts considered the advantages and disadvantages of the four renewable energy scenarios for Leicester and prepared their own preferred renewable energy scenario/vision.

In the second stage of the workshop, groups were formed for each of the renewable energies being considered; biomass renewable energy, solar water heater rental scheme, passive solar lighting, and innovative electric batteries, with each group producing ideas to contribute to their preferred renewable energy scenario.

Leicester already has an established energy strategy considering renewable energy and energy efficiency, and in the Leicester workshop emphasis was given to considering the barriers facing the technologies, and actions to further implement the technologies. For cities that are in the process of preparing a strategy for the implementation of renewable energy and would like to obtain some consensus from relevant local actors emphasis could be given to establishing a 'common ground' vision of the future in the workshop

assisting in identifying important policy options. Although there may have been some variation in emphasis given in individual workshops the common methodology was followed in each city, which allowed a comparison of results.

Non technical barriers to the introduction of new and renewable energy technologies and actions that could be taken to support them are discussed below.

DISCUSSION OF RESULTS OF THE WORKSHOP IN LEICESTER

A key barrier that was identified by the workshop participants is the high initial cost of new technologies and renewable energy technologies and the issue of finding finance to invest in the projects. This complements previous local studies which have identified funding (LUC and IT Power 2001) and the long payback period for renewable energy (Lack et al 2001) as being barriers to the implementation of renewables. A similar barrier is also faced in the introduction of energy efficiency measures as shown by a previous survey of businesses in Leicester carried out by De Montfort University and University of East Anglia which identified cost as a barrier preventing a business from investing (or further investing) in energy efficiency measures.

Possible actions, considered in the workshop, that could address the financial barrier of new and renewable energy technology mainly concerned funding being made available to assist individuals and organisations with the initial investment (for example start up funding, tax incentives). As costs reduce, with moves from small to larger scale production, such incentives would become less necessary. In Leicester, the Energy Agency runs a scheme which provides grants to assist with reducing the financial barrier to energy efficiency and renewable energy measures in small and medium sized businesses.

The workshop discussions identified barriers relating to insufficient awareness of renewable energy technologies (for example by the media, the general public, and local government), a lack of availability of relevant information and a lack of guidance, and the perceived cost/difficulty a potential user would face in using renewable energy. It is considered that similar barriers are faced by energy efficiency technologies, with the business survey mentioned above revealing that a major reason given by businesses for not investing more in energy efficiency measures as being a lack of information.

From comments in the workshop, the potential role for local government in providing the support (raising awareness and providing information) for others to introduce renewable energy technologies was highlighted. The role of demonstration schemes for renewable energy was considered. Such demonstrations or case study examples of best practice, when adequately publicised, can show the successful implementation of the technology, help to increase the relevance of the technology to the potential end user and reduce perceived difficulties that people might have concerning using renewable energy.

Workshop participants highlighted that a difficulty faced by renewable energy technologies is that the price of conventional energy is lower than the energy price for many renewable energy technologies. This difficulty has been lessened to some degree recently with the introduction of

the Climate Change Levy in the UK, where energy obtained from new renewable energy sources is exempt from the Levy which is applied to energy use in the non-domestic sector. Also, the cost of energy from different renewable energy sources has been decreasing as they have developed, although this is still a barrier to their uptake.

Obtaining planning permission is an obstacle that affects some renewable energy projects. For example, some wind energy projects have encountered concerns over visual impact, noise or proximity to airfields. Work has been carried out that has the potential to reduce these planning-related difficulties such as the production of regional renewable energy studies (e.g. LUC and IT Power 2001) and the production of guidance on energy efficiency and renewable energy for developers (e.g. Leicester City Council 2002).

The workshop discussion considered specific barriers facing the selected renewable energy technologies. For example, barriers facing Leicester's solar water heater rental scheme were highlighted. These included insufficient communication between relevant local organisations, a lack of good quality training, inadequate demand from the public and a low level of awareness, and that the time of installation of solar water heaters is not linked closely enough to the most appropriate time for the work to be carried out, such as when other building measures are needed. Following the workshop it has been possible for practical actions to be considered to assist with the uptake of the scheme.

Other barriers mentioned in the workshop included insufficient connection being made between the use of renewable energy and the contribution to minimising greenhouse gas emissions associated with climate change. With the ever developing climate change agenda there are clear opportunities to emphasise the contribution that renewable energy, and energy efficiency, can make in addressing greenhouse gas emissions targets. Commitments by local, regional and national governments and businesses, to achieving emissions targets have the potential to assist the uptake of new energy technologies.

The importance of involving residents in introducing new technologies was recognised in the workshop. While the process of involving residents can take a period of time it assists in the appropriate introduction of the technologies at the local level. The role of the local community in introducing renewable energy technologies is being successfully supported in the UK through the recently established Community Renewables Initiative, which has coordinators on a regional basis providing advice and information and referring enquirers to appropriate expert support.

The role of local partnerships and creating the conditions for the partnerships to develop were identified as important in increasing the uptake of new renewable energy technologies. Such partnerships could involve, for example, agencies, local government, businesses, residents, and the media. In Leicester, as in other local areas, different organisations that work in related fields (for example, are interested in renewable energy or energy efficiency) can work jointly on projects using skills from each organisation to increase the uptake of the renewable energy technologies.

The potential for regulations to help with the introduction of new technology was noted. The latest edition of the Building Regulations has raised energy efficiency standards

in building work. In future, the standards have the potential to incorporate renewable energy technologies and of including even higher energy efficiency standards.

In Leicester, as in the other cities, the workshop participants have agreed on actions to help bridge the gap between new technologies and the consumer. In Leicester, workshop participants agreed on the implementation of innovative electric battery technology, and a biomass energy plant is to be implemented for district heating purposes.

Discussion of the SIREN results

As well as addressing renewable energy the results of the project have also been of relevance to energy efficiency and the increased introduction of energy efficiency technologies in different sectors.

The SIREN workshop successfully raises local awareness and helps in creating a network linking local authority representatives, representatives from the business community and other local stakeholders and citizens. The success of the SIREN project has shown the potential role of community participation in supporting renewable energy use and improving energy efficiency at the local level.

From local knowledge and the results of the workshop a range of non-technical barriers to the uptake of renewable energy were highlighted, as listed in Table 1.

In the workshops, actions that could be taken to overcome the barriers to new and renewable energy have been consid-

ered. The workshops have allowed agreement to be reached on actions, and related policy measures between the partners to be identified, such as financing schemes, market-related activities, and more public participation, awareness and education, the establishment of demonstration sites, and higher regulation standards (e.g. Horta 2002).

An important non-technical barrier to be addressed that has been identified in several of the participating cities has been that of meeting the high initial cost of renewables. In Spoleto, it has been considered that, in order to overcome economic obstacles, actions include carrying out a cost-benefit analysis of potential projects and the preparation of building-related regulations with tax incentives for the use of renewable energy (Spoleto 2002). The establishment of Green Investment Funds to be used to finance environmental projects, by banks working with local authorities, has been suggested as a way of reducing the initial financial barrier for renewable energy projects in Lisbon. Also, it was considered that the financial barrier could be addressed by the provision of increased support for developing third party financing (AMERLIS 2002). Similar actions could be relevant to support the introduction of energy efficiency technologies.

Activities to address market-related barriers were considered by different cities as ways of supporting the introduction of new energy technologies. For example, potential actions to influence market behaviour were identified in Deventer. It was considered that there could be a possibility

Table 1. Non technical barriers to the integration of renewable energies identified in partner cities.

(AMERLIS 2002; Horta 2002; NOVEM 2002; Spoleto 2002).

Deventer, The Netherlands	Spoleto, Italy	Lisbon, Portugal
Separation of investment and revenues from renewable energy	Economic and market barriers- high initial investment costs, renewables considered to be a risky investment, need to compete with low costs of conventional energy, lack of a realistic analysis of costs/benefits	Financial aspects- high initial investment costs, need for new financing schemes, lack of availability of third party financing, perceived low financial credibility of project promoters
Required financial liquidities for renewable energy projects	Environmental barriers- visual and noise impact of renewables	Market Structures- insufficient control mechanisms to ensure quality of installations of renewables projects, guarantee of energy results approach rare
Real compared to intended performance of installed renewable energy	Political and legislative barriers- absence of clear long term strategy, insufficient enforcement of energy legislation, lack of environmental taxation to support renewables	Energy policies and regulations- role of administrative authorities – lack of construction regulations on renewable energy, less favourable treatment of renewables compared to conventional energy
Knowledge and information about renewable energy	Infrastructural barriers- need to ensure a similar standard of energy supply from renewables as from conventional energy	Low public awareness of renewables and lack of education on renewable energy and energy efficiency issues
Drawing up and implementing spatial plans	Information barriers- lack of awareness in industrial, financial, commercial and public sectors of opportunities for renewables, lack of national agency to promote renewables, existing information on renewables is limited	
Licensing, enforcement of law and regulation		
Energy is not an argument		
Benchmarking is absent		

for the local authority to negotiate with the private sector on the energy performance of new buildings, and it might be possible to develop a benchmark for office buildings (Horta 2002). In Lisbon, the potential for the development of the energy services concept and its contribution to overcoming non-technical barriers was recognised. For example, end users could purchase energy from renewable energy generation sources instead of investing in establishing the renewable energy projects themselves, with a third party owning, operating and maintaining the renewable energy installation. Also, it was considered that a list of installers working to a good standard could be drawn up, which could lead to an improved quality of installation of solar thermal collectors and help to increase the confidence of users in the technology (AMERLIS 2002). (This could also be applicable to other renewable energy and energy efficiency technologies).

Also, the potential for raising awareness and increasing the availability of relevant education on renewable energy have been factors commonly identified among different cities. For example, in Deventer it was considered necessary to influence public behaviour. In order to achieve this, it was thought that the local municipality, being a respected source of information, could take actions such as listing municipal projects in the context of Local Agenda 21, and that it could undertake demonstration projects, and provide information and education (Horta 2002). In Spoleto, raising student awareness of renewable energy has been highlighted as a means of supporting the implementation of renewable energy (Spoleto 2002). It is thought that students could be made more energy aware through the inclusion of energy aspects in teaching plans, and through a demonstration project at a local school. It has been considered to be important to enhance community confidence with the technologies, for example by promoting the technologies through campaigns, awards, meetings and pilot projects. In Spoleto (Spoleto 2002) it was thought that efforts to increase public participation, for example through meetings related to Agenda 21 on energy, would reduce barriers to the uptake of new renewable energy technologies. Also, the need to increase people's knowledge of new energy technologies through the provision of training on new energy technologies has been identified. In Lisbon (AMERLIS 2002) the role of the availability of education on renewable energy and energy efficiency has been recognised. Also, an opportunity for local authorities to promote renewable energies by assisting in improving communication between the financial sector and project developers has been noticed.

The establishment of demonstration projects by local authorities has been highlighted in a number of cities as a way of overcoming barriers to the introduction of new and renewable energy technologies (which could also be relevant to energy efficiency technologies). For example the role for local authorities in carrying out demonstration schemes has been identified in Lisbon (AMERLIS 2002), and Leicester. Also, in Deventer a further action for the municipality to help address barriers was identified as the provision of a test-site for sustainable renewable energy enterprises, which could help with the economic viability of renewable energy businesses (Horta 2002).

As in Leicester, the potential role of higher standards in regulations in overcoming barriers to renewable energy (and energy efficiency) has been noted. The role of new regulations and law enforcement have been identified in Deventer (Horta 2002). It was considered that barriers to new and renewable energy can be addressed by the enforcement of regulations and the incorporation of new requirements in spatial plans (considering the application of renewable energy). Also, in Lisbon (AMERLIS 2002), the role of regulation and standards was identified. It was considered that initially good practice rules for the use of renewable energy could be established which could become construction regulations for the local authority later.

The role of local government has been identified in Leicester and other cities. For example, in Spoleto the need to improve local government tools has been recognised, including the implementation of a local government energy plan (Spoleto 2002).

USE OF RESULTS TO IMPROVE ENERGY EFFICIENCY

While the focus of the project has been on renewable energy technologies actions have been identified that also relate directly to improving energy efficiency, which shows the opportunity to support the uptake of energy efficiency while addressing barriers facing the uptake of renewable energy technology.

The SIREN project complements Leicester's work to consider the barriers facing the implementation of its energy strategy and its work towards its carbon dioxide emissions reduction target, concerning the implementation of renewable energy and energy efficiency measures in the city. Many of the barriers to the uptake of renewable energies in Leicester that were identified are similar to those considered to be limiting the uptake of energy efficiency technologies. Leicester has been addressing these barriers in a number of ways including raising awareness, providing information, undertaking and publicising demonstration projects, and investigating various financing methods.

Use of SIREN approach for implementing energy efficiency

There is significant potential for the SIREN methodological approach to be applied in other cities or local areas, considering not only renewable energy technologies but also, or alternatively, energy efficiency technologies. In addition to raising awareness of the technologies, barriers facing the introduction of specific energy efficiency technologies and ideas to help to apply the technologies can be identified. The methodology should be considered by businesses or research organisations that have a new energy efficiency technology or result from an energy research and development project, which they would like to be taken up more widely. The SIREN approach would offer an opportunity for the technology result to be disseminated to potential users. Also, the approach is of interest to local governments who are interested in consulting locally in an attempt to develop some consensus on the introduction of new energy efficiency technologies locally. The approach is also relevant to organisations interested in exploring future scenarios for energy and energy efficiency locally (Vulcano 2002).

Conclusions

In Leicester the project has been effective in supporting the implementation of specific new and renewable energy technologies. For example through the SIREN scenario workshop a means of fine tuning the performance of the Agency's electrically powered 'bus' using a battery management system has been identified and implemented, and investigation has been underway into the use of biomass from local wood in a community heating scheme in the city.

While the workshop groups in Leicester encountered some challenges in the discussion sessions the workshop enabled barriers and success factors for new and renewable energy technologies in Leicester to be discussed by the public and local actors in the new and renewable energy field. The workshop has been a useful networking opportunity for the participants, and the workshop has raised awareness of renewable energy and related issues for participants.

Similarly in the participating towns in Italy, Portugal and The Netherlands barriers and success factors for the increased introduction of new and renewable energies locally have been identified, and agreements have been reached on actions to assist with their introduction. This has shown that a number of areas of action are possible. These include, for example, (Furlani 2002; Horta 2002) increasing public awareness and involvement, developing new supportive financing schemes, establishing a supportive policy statement by local government, and setting up higher standards/more demanding regulations.

The approach adopted in this project could be applied specifically for energy efficiency technologies in other local areas, exploring obstacles facing their uptake and strategies to assist with their introduction.

References

- AMERLIS, 2002, SiREN Task 4.2 – Agreement on socio-economic parameters. AMERLIS contribution. May 2002.
- Bilderbeek, R., 2002, Scenarios: designing, shaping the future. SiREN 2002 Renewables for Urban Sustainable Development, Brussels, June 21st 2002 (<http://www.tech-road.com/siren>).
- DIALOGIC, Universidade Nova de Lisboa, and Ecoazioni, 2001, Towards Local Renewable Energy Scenarios. Methodological aspects of the SiREN project. Deliverable 2.1.
- Furlani, A., 2002, SiREN: a new paradigm for policy formulation. SiREN 2002 Renewables for Urban Sustainable Development, Brussels, June 21st 2002 (<http://www.tech-road.com/siren>).
- Horta, P., 2002, SiREN support: overcome local barriers and enable actions. SiREN 2002 Renewables for Urban Sustainable Development, Brussels, June 21st 2002 (<http://www.tech-road.com/siren>).
- Lack, D., Holmes, R., Munson, G. 2001, Case studies of renewable energy developments with local authority involvement, ETSU/Department of Trade and Industry, UK.
- Land Use Consultants and IT Power, 2001, Viewpoints on sustainable energy in the East Midlands: A study of cur-

- rent energy projects and future prospects. Final Report, Land Use Consultants, London.
- Leicester City Council, 1994, The Leicester Energy Strategy. Leicester City Council, Leicester.
- Leicester City Council, 2002, Supplementary Planning Guidance. Energy efficiency and renewable energy in new developments. City-wide guidance, Leicester City Council, Leicester.
- Leicester Environment Partnership and Leicester Partnership, 2002, City of Leicester. Climate Change Strategy. Consultation Summary. Leicester City Council, Leicester.
- Spoletto, 2002, Del. 4.1 Socio economic parameters for RES community acceptance (Spoletto – Italy).
- Vulcano, 2002, SiREN: a methodology for promoting RES. SiREN 2002 Renewables for Urban Sustainable Development, Brussels, June 21st 2002 (<http://www.tech-road.com/siren>).

Acknowledgements

The authors would like to acknowledge support from the European Commission 5th Framework programme (contract no. ENG1-CT2000-80331) for the SIREN project, and the coordination of the project by INNOVA (Italy). Also they acknowledge the assistance of Dialogic (The Netherlands), and the other partners in the project, AEA (Perugia, Italy), AMERLIS (Lisbon, Portugal), NOVEM (The Netherlands), University of Lisbon (Portugal), and ECOAZIONI (Italy), and staff at the Energy Agency who helped with organising and running the Leicester renewable energy workshop, and the workshop participants.