

The contribution of ICT to **energy efficiency**: local and regional initiatives

IMPLEMENTING ENERGY EFFICIENCY
INITIATIVES HARNESSING ICT

... **Executive summary**

March 2011

European Commission
Information Society and Media



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1 Introduction

This executive summary is intended for senior decision-makers in local and regional authorities. The summary presents highlights from — and is supported by — an extensive toolkit of resources for local and regional authorities regarding information and communication technologies (ICT) for energy efficiency. The toolkit is available electronically via a wiki-style website hosted within the collaborative platform at <http://www.ict4e2b.eu> and in a report publication.

The toolkit comprises:

- **practical guidance** in the form of 12 narratives or ‘walk throughs’ to enable local and regional authorities to explore how to advance energy efficiency initiatives;
- **specific examples (case studies)** of where local and regional authorities from across the European Union have implemented energy efficiency initiatives involving ICT. Some 23 case studies are presented, each one providing an in-depth description of how the initiative was developed, its successes and the lessons learnt so that other authorities can benefit from the experiences.

The toolkit focuses on energy efficiency and sustainability initiatives for topics that are likely to be relevant to most local and regional authorities in terms of their common areas of responsibility and their assets. The initiatives all utilise ICT in some way — with the ICT element varying depending on the situation. In particular the focus is upon:

- ICT infrastructure and equipment
- ICT-enabled buildings and construction
- ICT-enabled transport
- ICT-enabled carbon/energy management and reporting.

Why is this toolkit important?

Energy efficiency is a key element of Europe’s climate and energy package to meet the target of a 20 % reduction in energy demand by 2020. Energy efficiency is seen as one of the most cost-effective ways to reduce carbon emissions and improve security of energy supply.

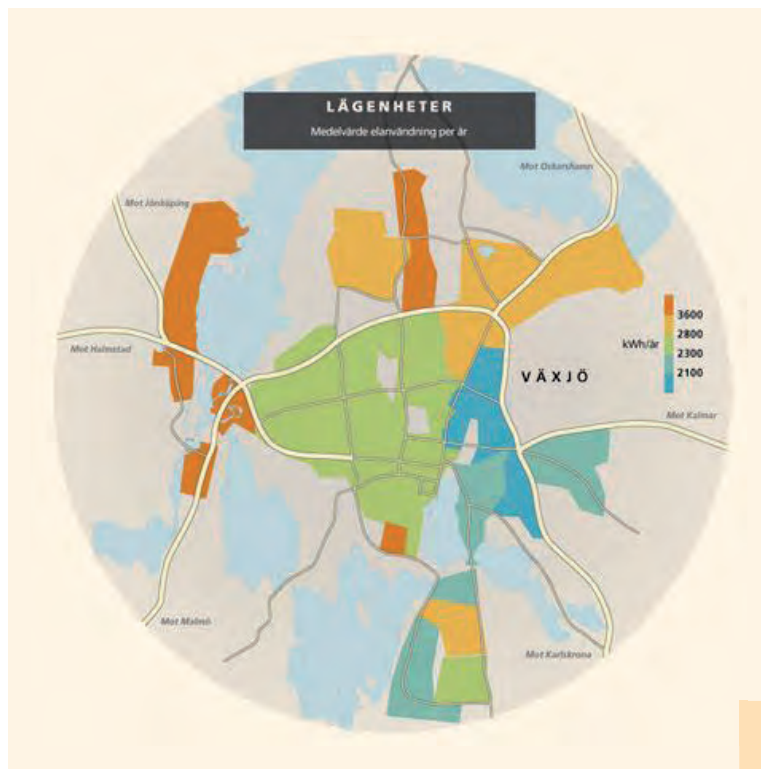
ICT has a crucial role to play in delivering energy efficiency and this was recognised by the European Commission in its recommendation of 9 October 2009 ‘on mobilising information and communication technologies to facilitate the transition to an energy-efficient, low-carbon economy’. ICT solutions are already delivering the unique transformation to a knowledge society and they can also help to achieve the energy and climate objectives involved in the transformation to a low-carbon society.

Much of the transformation to a low-carbon society needs to happen at the local and community levels — where the energy is actually consumed. Local and regional authorities (i.e. cities, municipalities and regions) have a critical role to play and can take a lead by setting up initiatives that build momentum and draw in other parties. To do this most effectively, authorities require the knowledge and tools concerning how ICT-based energy efficiency solutions work and where they have been successfully implemented. This is the role of this toolkit.

Due to the already pervasive nature and presence of ICT, in many cases energy efficiency is not the main objective pursued; however, understanding the add-

itional energy efficiency and sustainability benefits of using ICT will help to increase the uptake at the local and regional levels. It is also recognised that different parts of the EU have an uneven uptake of ICT solutions, particularly in relation to the use of ICT to deliver energy and carbon reduction. This can be attrib-

uted to national, regional and local economic, social and cultural circumstances, including the presence (or absence) of advanced ICT technology providers and supply chains. Thus, it is beneficial for authorities to learn from each other, in order to move faster and avoid unnecessary costs and mistakes.



Comparing electricity use across the city of Växjö, Sweden

Source: SAMS Project.

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Practical guidance for **authorities** on cross-cutting themes

Eight sections of practical guidance based on **cross-cutting themes** are presented in the toolkit. These themes are those likely to have relevance for authorities involved in taking forward a wide range of energy efficiency/ICT initiatives of different kinds and on different scales. The practical guidance covers:

- funding sources
- metrics/indicators
- user engagement
- leadership, governance and public–private partnerships
- appropriate use of technology
- planning energy efficiency to 2020 and beyond
- managing project risks
- procurement.

Funding sources

Many energy efficiency initiatives generate significant cost as well as energy/carbon savings. However, the savings may only be realised after many years and ICT-enabled solutions can involve significant upfront capital/installation costs. There are a wide range of national and European funding sources available for supporting investment in energy-efficient facilities and processes. In particular cohesion policy funds (Structural and Cohesion Funds) have included energy as a priority for the period 2007–13, in particular renewables and energy efficiency actions. In the EU as a whole, the planned support for energy activities for the period 2007–13 is approximately EUR 11 billion, or 3 % of the total funding. A further EUR 13 billion is allocated to ICT applications and services for the same period.

For local authorities that want to hand over the risk of implementing initiatives, there are an increasing number of innovative measures including energy service companies (ESCOs) and energy performance contracting which can help achieve energy efficiency improvements as well as cost savings at relatively low levels of risk to the authority. It can be expected that over time there will be an emergence of practical market-based instruments which will further increase opportunities to implement energy efficiency technologies with or without an ICT component.

Top five recommendations for authorities

- In the majority of cases, introducing energy efficiency measures at the local and regional levels involves additional capital and revenue funding, a hurdle that needs to be overcome by local authorities which tend to be constrained by their budget resources. It is essential to examine the funding arrangements for energy efficiency initiatives at the outset.
- There are a wide range of European and national sources of funding available, most importantly amongst them the European Structural Funds. Approximately EUR 24 billion is allocated to the fields of energy and/or ICT for the period 2007–13. The support in these fields includes grants, loans, loan guarantees and technical assistance.
- Be aware that many initiatives, apart from the smallest scale examples, will require a combined approach to funding, i.e. tapping into multiple sources.

- Consider what will happen when the funding for the implementation and initial period of operation is finished. Seek to put in place appropriate transitional arrangements so that, if appropriate, an initiative can become financially sustainable in the medium to longer term.
- Consider opportunities to transfer the financial and equipment performance risks to other parties using ESCOs and other forms of energy performance contracting. ESCOs can be useful partners to local and regional authorities — and some authorities have set up ESCOs themselves in order to accelerate the achievement of energy efficiency targets.

Metrics/indicators

Energy efficiency and sustainability initiatives have a wide range of potential outcomes in energy, cost and other terms. The use of practical metrics and indicators and supporting methodologies is critical to the effective management of these projects. Local and regional authorities are often involved in monitoring energy and CO₂ at various levels across their own assets and the wider community for various purposes (e.g. local greenhouse gas emissions inventories). At a project level the adoption of metrics/indicators and methodologies that align with such frameworks can be beneficial. Alternatively there are numerous examples of the metrics/indicators used by other authorities implementing similar initiatives across Europe, enabling the benchmarking of performance if the same metrics are chosen.

In terms of the energy and CO₂ impact of ICT equipment and infrastructure, although a finalised, fully developed, authenticated and validated methodology does not yet exist, it looks likely that it will become a reality within the next few years. A harmonised approach to this development of energy/CO₂ metrics for ICT equipment and infrastructure is advocated by the European Commission — see the recommendation of 9 October 2009 on **mobilising information and communications technologies to facilitate the transition to an energy-efficient, low-carbon economy**.

The existence of a methodology for measuring the energy/CO₂ of ICT equipment and infrastructure will be extremely important for the ICT sector, and in turn for authorities that are using ICT-based solutions, because it will enable the development of much more robust carbon calculations of the impact of ICT. The industry will be able to model potential applications and also evaluate, or re-evaluate, existing ones. It is known that the intelligent use of ICT can deliver very significant carbon reductions across the wider economy, but the actual impact of ICT is not yet known with any certainty. These methodologies will provide that certainty, or at least go a long way towards it.

Top five recommendations for authorities

- Put in place metrics/indicators at an early stage of developing your energy efficiency initiatives. That way you will achieve greater clarity in terms of investment and forward planning to help ensure that ICT-enabled low-carbon technologies are applied appropriately.
- To gain a broad perspective regarding the impacts of an initiative, consider selecting metrics that measure different aspects. For example select some that measure outcomes (e.g. actual energy saved as a result of the intervention) as well as others that measure inputs (e.g. expenditure or the number of partner organisations involved) and outputs (e.g. number of buildings treated with retrofit measures).
- Select metrics that cover areas such as energy/carbon consumption/saving (e.g. by energy source, per sector, per user and over different timescales), cost effectiveness and changes in user attitudes and behaviour.
- Pay attention to the practical considerations associated with establishing suitable metrics/indicators. These include the lag time between implementing an initiative and achieving the full energy savings, the measurement of supporting aspects (e.g. the roll-out of training) and qualitative as well as quantitative approaches.
- Make use of and consider linking the metrics to existing tools and methodologies such as local greenhouse gas emission inventories (e.g. Guidance for Covenant of Mayors signatory cities) and the bottom-up calculation approaches developed for the energy end use efficiency and energy services directive (see the EMEES project).

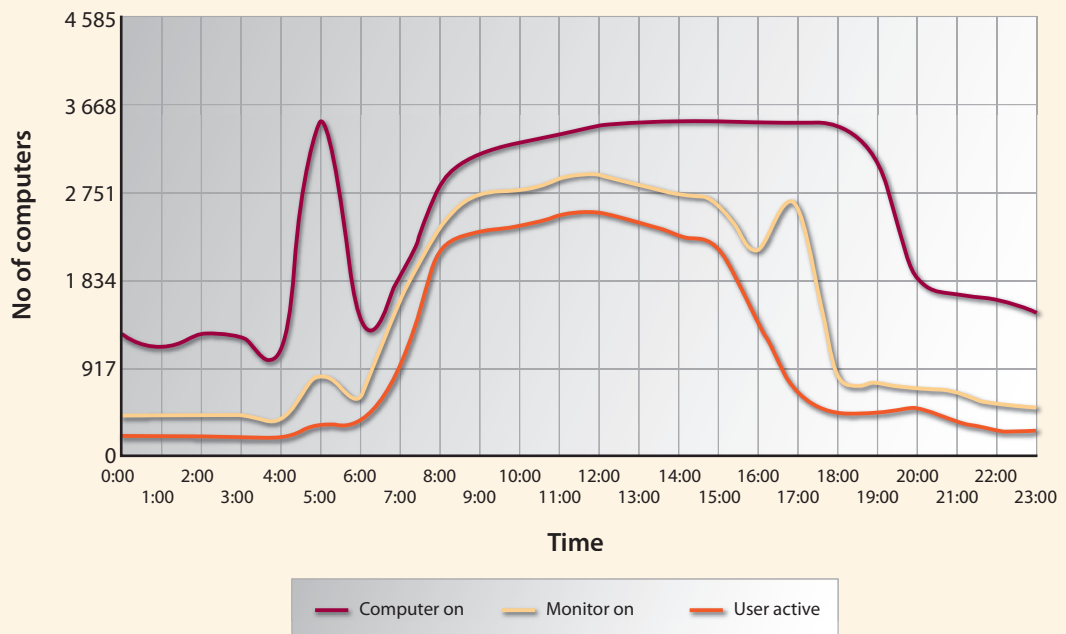
User engagement

Close user engagement and effective collaboration with project partners throughout the whole life cycle of energy efficiency measures are essential to achieving energy efficiency results. Understanding the 'human factor' is essential in designing and implementing energy efficiency initiatives. Only by enthusing individuals to change their attitudes and behaviour and enabling them to use new technologies appropriately can positive environmental results be achieved.

Top five recommendations for authorities

- Involve the operators and users of the technology as early as possible. The sooner users are involved the

Computer usage in a department of Helsinki City Council after the energy-saving settings have been enabled



Source: City of Helsinki.

more likely you are to gain acceptance, and the more likely you will be to understand and meet their specific needs, requirements and concerns.

- Set up different types of training and awareness raising to address the needs of different groups. The energy efficiency benefits of new ICT solutions will only be realised if they are used effectively and this can require detailed training for the primary operators of the new equipment. Training activities should be complemented by more general awareness-raising initiatives for other participants.
- Consider the best way to present information to communicate it most effectively to users. For example, the use of graphical illustrations, or interactive online tools which allow a comparison of the energy consumption impacts of different types of behaviour of technology, can be effective ways of generating interest.
- Consider enrolling a group of facilitators or ‘champions’ to carry the message to the grass roots level. Champions can help to embed a sense of ownership and enthusiasm for an initiative across different groups.
- Put in place appropriate monitoring arrangements for projects and include the monitoring of qualitative aspects such as user acceptance and comfort. This approach should help to explain the reasons for successes/failures and changes in performance.

Leadership, governance and public–private partnerships

Based on the experience of local and regional authorities across Europe, it is clear that strong leadership plays a central role in the success of energy efficiency initiatives. Effective leadership is required over the long term to help to address obstacles that will inevitably arise during the project implementation cycle.

Energy efficiency initiatives involving ICT solutions are often multifaceted and therefore need to involve a wide range of funders, promoters, users and other stakeholders. The governance models for planning and coordinating the initiatives need to provide a coherent leadership and management structure to reflect these aspects. It can also be advantageous and cost-effective to collaborate and form partnerships with other municipalities/regions when implementing ICT and energy efficiency initiatives.

Top five recommendations for authorities

- Secure the support of senior leaders in your local/regional authority by aligning the initiative to current

priorities. General statements of endorsement can be helpful but ultimately more active senior support will be more effective.

- Develop and promote a clear vision that will inspire others to play their role in making the initiative work. Translate this vision into effective and practical plans for the team delivering the initiative to follow.
- Organise governance structures (e.g. steering committees, advisory roles, working groups) to align with the initiative's vision and to tie it in to the policy agenda at different levels.
- Establish effective communication channels and use them on an ongoing basis. There may be a wide range of partners to be brought in initially and to be kept engaged and committed throughout the life of the initiative, even once the initial burst of enthusiasm has subsided.
- Generate strong evidence of success to help to persuade doubtful supporters/stakeholders. Monitoring and evaluation can provide feedback loops that reinforce the message and build momentum.

Appropriate use of technology

ICT-based energy efficiency projects do not have to be complex to be effective. In many cases, simple solutions seem to work best. The case studies have shown that this is especially true on occasions where the authorities are constrained by costs, where there are a large number of expected users or when there might be a need to link it with other technologies or scale the technology up at a later stage.

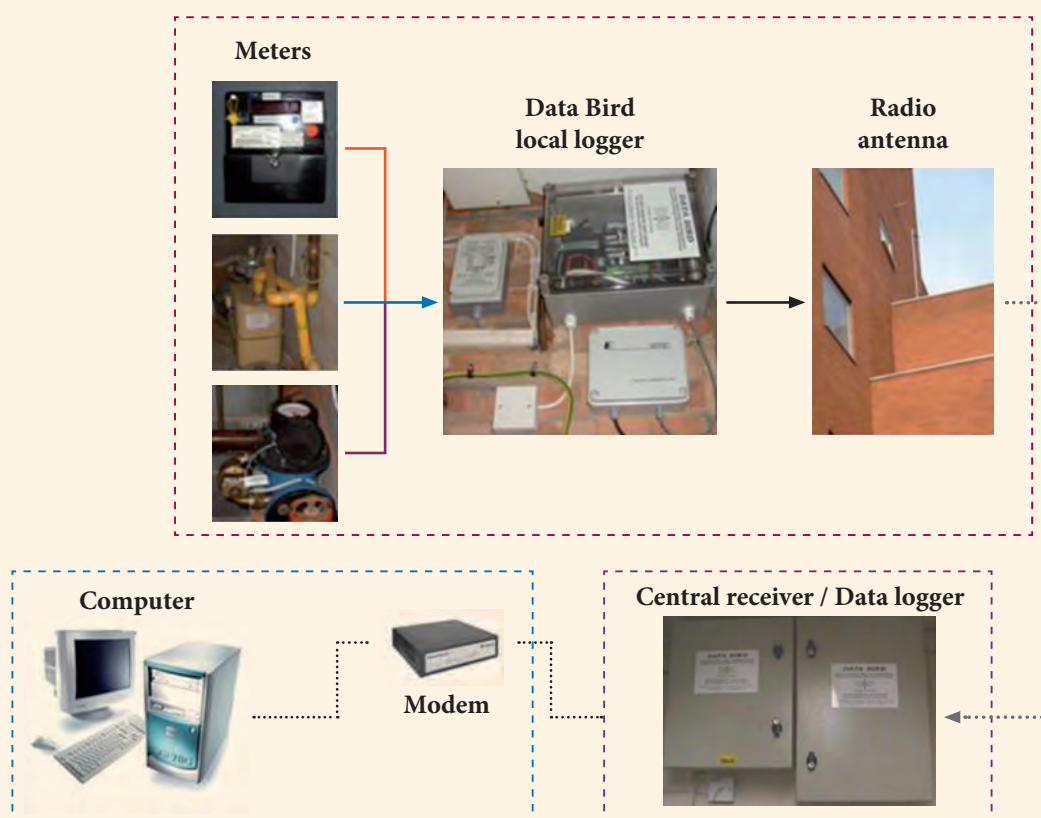
The starting point of any project should be the identification of the problem and what type of solution is required. The evaluation of different options should focus on the fitness for purpose. Aspects that can define what is fit for purpose can include the interoperability of the technology, and the extent to which it is multi-use by nature or how a particular solution might generate wider economic benefits which are prioritised by the authority.

Considering the 'human factor' in deciding on a technology is also important as it impacts on the way in which the technology is used. Training, awareness raising or adopting technologies which are accessible to all by design are strategies which can be used to ensure that the technology selected is in line with the skills and capabilities of the intended users. Various case studies have shown that testing and gradual implementation are important for successful ICT-based energy efficiency initiatives. Piloting not only allows any final technical difficulties to be spotted without causing large-scale disruption but it can also be useful for obtaining buy-in from users or other stakeholders.

Top five recommendations for authorities

- Always start a project by identifying what the problem is and outlining why and how the technology is going to help to address the energy efficiency issue or problem. It is important to create a solid case for investment prior to committing any resources.
- Do not get blinded by complex technologies with wide-ranging functionality. Consider simpler technologies which may be part of the general ICT package already used in local and regional authorities. This is especially useful if the authority is constrained by costs or faced by a large number of expected users or when there might be a need to link it with other technologies or scale the technology up at a later stage.
- When considering fitness for purpose, take into account interoperability and the extent to which the technology can be applied to multiple purposes or whether a particular option provides wider economic benefits which are important for the authority.
- The 'human factor' of any technology should be considered in both selecting technologies and also in implementing ICT projects. Where the skills of the users are not in line with the technology, training or awareness-raising should be used. When accessibility to users of all abilities is a concern, the authority should consider adopting ICT solutions which are recognised to be e-accessible.
- Test and roll out new technologies gradually. This can be especially useful when buy-in from users or stakeholders is required for the implementation to run smoothly.

Intelligent metering in local authority buildings in Leicester



Source: Leicester Energy Agency.

Planning energy efficiency to 2020 and beyond

Local and regional authorities may be able to identify some suitable energy efficiency and sustainability initiatives on an intuitive and ad hoc basis. However, without some strategic planning supported by information on the main areas of energy consumption/ CO_2 emission sources, there is a real danger that the initiatives selected are not the most appropriate or cost-effective. Ultimately this will hamper progress towards long-term goals.

The scope and planning time frames for energy efficiency will vary between cities and municipalities of different scales that will be working within different budgets and other constraints. Nevertheless, sharing experiences as well as processes/tools can help authorities to avoid common pitfalls. The sustainable energy action plan guidebook provides a useful framework for authorities looking to develop a successful plan.

SUSTAINABLE ENERGY ACTION PLANS WITHIN THE COVENANT OF MAYORS INITIATIVE

Many European towns, cities and regions have voluntarily committed to reducing their CO_2 emissions beyond the EU-wide 20 % target by signing up to the Covenant of Mayors. The Covenant of Mayors commitment is achieved through the implementation of sustainable energy action plans (SEAPs).

As defined in the publication 'How to develop a Sustainable Energy Action Plan — Guidebook', a SEAP:

is a key document that shows how the Covenant signatory will reach its commitment by 2020. It uses the results of the baseline emission inventory to identify the best fields of action and opportunities for reaching the local authority's CO_2 reduction target. It defines concrete reduction measures, together with time frames and assigned responsibilities, which translate the long-term strategy into action.

Top five recommendations for authorities

- Take a long-term approach and learn to devise projects as a complementary and coherent group to be delivered in a logical sequence. This includes the implementation of ICT-enabled and other energy efficiency projects.
- Build support from stakeholders and seek to secure a long-term political commitment. Be aware that conflicting stakeholders' interests deserve special attention.
- Put in place the appropriate financial and other resources. Ensure proper management arrangements are in place during implementation and make sure that your staff has adequate skills, and if necessary offer training.
- Do a proper CO₂ emissions inventory as this is vital to understanding where actions and initiatives are most needed. Establish CO₂ monitoring and reporting mechanisms with appropriate ICT to enable them.
- Actively search for and take advantage of case studies, experiences and lessons learnt from implementing energy efficiency plans in other cities.

Managing project risks

Implementing new energy efficiency and sustainability projects entails introducing change, and therefore inevitably involves taking some risks to deal with uncertainties and unforeseen issues. Many risks may be unlikely to occur and/or would have minor consequences for the project and the authority implementing it. However some risks may be more likely and, if they did arise, would have more serious implications, for example in terms of incurring financial costs, impacts on health and safety or negative publicity/political fallout. Equally there may be beneficial opportunities that arise from a project that can be captured if the project team are open to identifying and handling risks and uncertainties.

There are various tools and methods available that can be adopted by local and regional authorities to manage the risks associated with new energy efficiency and sustainability projects involving ICT. When risks are managed well, authorities will benefit in terms of:

- the ability to identify, prioritise and handle the common areas of uncertainty and project risks;
- achieving the most effective use of financial and other resources;
- generating and maintaining confidence amongst project partners and funding bodies.

Top five recommendations for authorities

- Be aware of the common risks that can affect the successful implementation of energy efficiency projects involving ICT and that these risks are likely to increase in line with the scale and complexity of the initiative. Direct risks to such projects include: delays; the failure or shortcomings of technologies; and situations where the intended benefits of the initiative are not realised.
- Be aware also of risks that might be associated with the broader context for energy efficiency/sustainability initiatives such as misalignment of partners' expectations and changes to people, institutions or policy goals.
- Make use of tools to help the project team to manage the most significant risks. For example, prepare and periodically update a 'risk register' (also known as a risk log) to list all of the identified risks and actions to be taken to control them.
- Put in place an appropriate approach for risk management right at the outset of a new project. That way the approach can be tailored for the scale, nature and environment of the particular initiative and a proportional level of time and resources can be allocated to be spent on risk management.
- Address project risk assessment and management throughout the project cycle of planning and implementing an energy efficiency initiative. Seek to embed risk management so that project teams naturally consider the risks and opportunities for an initiative.

Procurement

Local and regional authorities are urged to lead by example, particularly given that public sector spending accounts for a significant share of the EU's GDP. Green public procurement is an effective way to demonstrate a public authority's commitment to environmental protection and sustainable consumption and production and, if utilised effectively, can provide numerous environmental and economic incentives.

In cases where local or regional authorities require the contracting of services or purchasing supplies of goods/equipment involving or utilising ICT, the integration of sustainability requirements in the public procurement process (including the pre-procurement phase) can certainly prove indispensable for achieving reductions in energy consumption, and hence enable more climate-friendly solutions.

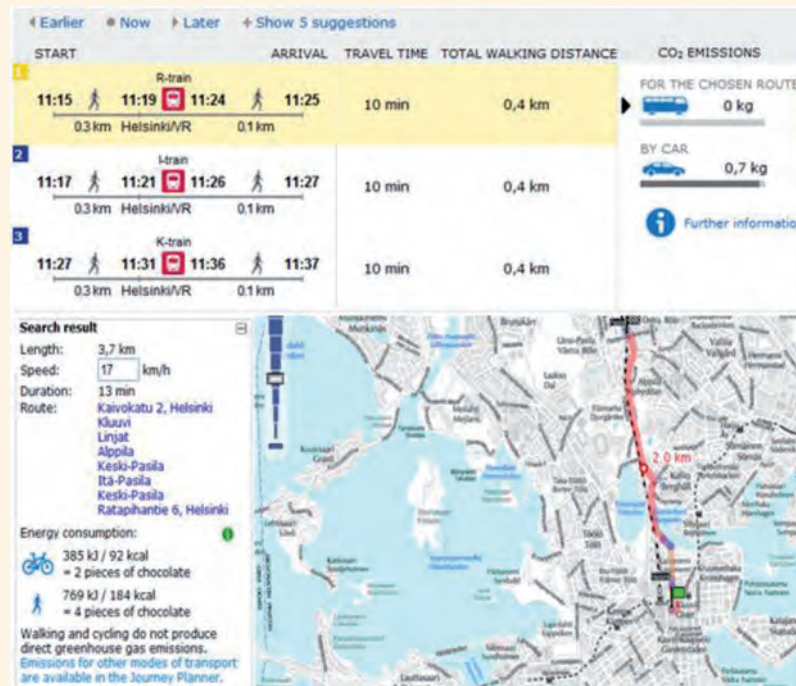
A number of mechanisms are available to support local and regional authorities in their sustainable procurement

practices, both technically and financially. These mechanisms have been developed by organisations working at the supranational, national, regional or local levels of government, and are geared towards the operative and policy frameworks which local and regional authorities function within.

Top five recommendations for authorities

- Cooperation between different departments and public authorities (local and/or regional) is imperative when it comes to green public procurement involving ICT.
- Smaller public authorities may find substantial benefits in working together with other public authorities in joint or collaborative procurement arrangements.
- The greatest benefits for energy efficiency through public procurement can be achieved by planning and organising the tendering and pre-tendering process effectively.
- Consider the use of performance-based specifications in tendering documents. Performance-based specifications provide the mechanism to embed quantifiable outcomes in terms of energy saving levels and more generally can encourage sustainable innovation, such as those involving ICT.
- Sound out the market. Solutions using or involving some form of ICT application are more and more wide-ranging and are likely to apply to different areas, including services. Sounding out the market in the preparatory (and pre-tender) phase, and actively consulting potential suppliers for the best available solutions on the market in terms of low-carbon technologies/solutions, can lead to superior end solutions.

A user-friendly journey planner and carbon calculator for Helsinki, Finland



Source: Reittiopas, <http://www.reittiopas.fi>

3

Practical guidance

on **specific types** of project

Four sections of practical guidance for **specific initiatives and measures** are presented in the toolkit.

These are most relevant to authorities considering implementing the specific type of initiative/project. They provide detailed information on the implementation/operational issues that are specific to that type of project. The practical guidance covers:

- the role of municipal energy agencies
- urban road user charging
- green municipal data centres
- audit and simulation in buildings.

Whilst these types of initiative are relatively common amongst local and regional authorities across Europe, it must be emphasised that there are many tens or even hundreds of other types of initiative that utilise ICT to achieve energy efficiency and sustainability outcomes.

The role of municipal energy agencies

Energy agencies can play an important role in promoting energy efficiency at the local and regional levels. Energy agencies are involved in a wide range of activities, with benefits for public authorities, businesses, professionals and citizens. They generally support the introduction of good energy management practices, advocate the concept of sustainability, provide information and guidance

on energy-saving technologies and practices and offer a number of services based on the specific local energy needs.

The number of energy agencies has expanded steadily since the 1980s/1990s and today there are some 400 energy agencies operating within the EU. Energy agencies can take various forms but in whatever shape they are set up, their core focus is the promotion of energy efficiency in all spheres of public and private activities. This makes them a champion of energy efficiency activities across the board, helping to provide a positive undercurrent for the introduction of any specific initiative.

Top five recommendations for authorities

- Consider establishing an energy agency to catalyse action on energy efficiency and renewable energy. Energy agencies can be involved in a wide range of activities, with benefits for public authorities, businesses, professionals and citizens. In various cities and regions they have been found to be critical to the success of energy efficiency initiatives.
- If considering establishing an energy agency, be aware that there are different organisational models for them. For example agencies can be embedded in host organisations such as in a particular local or regional authority. Alternatively they can be independent local agencies with or without significant additional private sector support.
- Call upon energy agencies, where they exist, as they provide an excellent resource of knowledge and expertise. They employ people with detailed expertise in the

technical and organisational issues arising from introducing energy efficiency initiatives.

- For ICT-based initiatives in particular, working with energy agencies can have a positive impact as they can advise on appropriate technologies and likely obstacles to be encountered in introducing them.
- Make use of the opportunities to learn from elsewhere. Energy agencies tend to be well networked with other organisations — including other energy agencies — at the national and international levels. This enables them to bring in relevant knowledge and expertise for specific initiatives and wider strategies and policies.

Urban road user charging

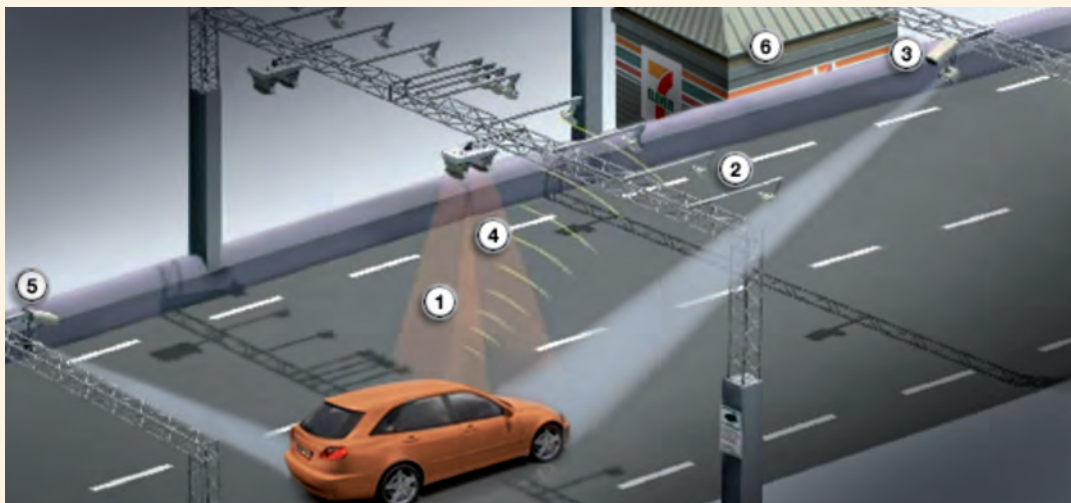
Technology-enabled urban road user charging is one of a range of responses to address the negative consequences of increased traffic levels in Europe's towns and cities. For authorities considering this solution, an integrated approach is advocated to identify and consider the transport problems so that a coherent package of travel demand management measures can be introduced.

Whilst there have been a relatively limited number of urban road user charging schemes implemented in European cities, much has been learnt from the successful solutions as well as from schemes that were partially developed but not implemented due to a lack of acceptance or funding support. The small number that have been implemented have all generally been considered to be successful in meeting their policy objectives, and many have achieved significant benefits in terms of traffic reduction, CO₂ reduction and revenue generation.

Top five recommendations for authorities

- Do not consider urban road user charging in isolation. It will be most effective as part of an integrated approach to managing travel demand and the provision of transport infrastructure and services in pursuit of various policy goals.
- Consider how best to use different technologies within any scheme. The three main types of technology are: automatic number plate recognition (ANPR)/virtual licences; dedicated short-range communication (DSRC); and global navigation satellite systems/cellular networks (GNSS/CN). These are probably best considered as complementary rather than competing technologies as they can play different roles in a single scheme.
- Bear in mind that achieving acceptance of urban road user charging schemes is fundamental to their success. The issues surrounding acceptance amongst different stakeholder groups including businesses, residents and politicians are potentially complex and require serious attention in planning a scheme.
- Develop a monitoring programme so that the scheme's performance against its policy objectives can be evaluated. This involves defining where and when the data are to be collected and determining the spatial coverage based on the design of the scheme and its anticipated impacts.
- Seek to learn lessons from other cities and towns that have successfully implemented, or have tried to implement, their own schemes such as Stockholm and London. However, it is also important to appreciate the local physical and socioeconomic context when seeking to transfer scheme designs.

Stockholm congestion charging scheme — how the charging points worked in the initial scheme



Source: IBM.

Green municipal data centres

Data centres are complex, energy-intensive environments. Because of the range of technologies involved, a one-size-fits-all approach may not be the best route to efficiency. At a strategic level, there are three key factors that will help optimise the energy efficiency of a data centre. They are forward planning, active energy management and a holistic approach.

Careful planning is critical at the build stage or when refreshing hardware or refitting the facility, and this planning has to accommodate changes in workload in the future. The return on investment (ROI) and the whole life cost/total cost of ownership must be taken into account

Active energy management is essential for the whole time the facility is in use. Good energy management will also help identify when servers should be refreshed to reduce total cost of ownership and when their lives should be extended. Automatic systems can monitor, benchmark, adjust and optimise energy flows through the buildings, particularly for cooling the hardware.

A holistic approach is critical. The data centre facility and the IT contained within it are intimately connected. Moreover, the data centre is only one part of the IT infrastructure and decisions about IT services provided for citizens will have an impact on the data centre infrastructure, and vice versa.

Fortunately there are many tools to help local authorities understand, measure and optimise the efficiency of their data centre operations.

Top five recommendations for authorities

- Review and rationalise your data — don't keep stuff you don't need. Don't store data on spinning disks that could be archived passively; de-duplicate your data and separate any mission-critical data so that they can be treated appropriately.
- Do your sums! Check performance of existing equipment compared to performance of new equipment to see how long the ROI on cost of refresh will be and whether it is better to sweat assets longer or to invest in new, more efficient hardware.
- Review the latest technologies and approaches such as server consolidation, virtualisation and grid computing. Find out whether a service approach would avoid the need for up-front investment.
- Ensure that energy use by the physical data centre infrastructure is minimised. For most authorities existing facilities will need upgrading and refitting. Many energy management technologies can be implemented at very low cost. For guidance always refer to the EU code of best practice for data centres and remember that most of it boils down to fluid dynamics.

New data centre building with modular units



Source: Cappgemini.

- Identify non-technical barriers and issues that may have to be addressed, such as contractual constraints, legislative obligations and legacy contracts. Most system integrators specialise in handling these complex problems so they may not be as hard to overcome as they seem.

Audit and simulation in buildings

Energy efficiency measures for public buildings (including local authority offices, schools or hospitals) can be most effective when implemented as part of a systematic process involving audits and ongoing management, supported by ICT-based monitoring and simulation tools. Authorities adopting such measures can achieve added benefits by demonstrating the potential for energy efficiency to other organisations and businesses locally.

Many of the energy efficiency solutions for buildings outlined in this toolkit have large potential for replication and scaling up. Although a 5 % energy reduction may not seem very high, due to the large number of households participating in the municipal smart metering programme (30 000 homes), as much as 450 MWh/year of electricity was saved in Växjö, Sweden.

Energy saving in buildings is not necessarily a matter of personal limitations and troubles. It can also be fun! The EnergiKollen website of Växjö is a great way of giving feedback about people's energy consumption and altering their behaviour. People can enter competitions and compare their performance with others.

Almost all of the case studies had a component of training and confirmed that a large portion of energy saving can be achieved by changing human behaviour. In Częstochowa, Poland, the administrators of 170 public buildings participated in training programmes between 2004 and 2009. After the training, the reduction in energy and water use was clearly measurable. This change in behaviour was facilitated by the ease with which monitoring data could be read and interpreted.

Top five recommendations for authorities

- Consider whether ICT-enabled building audit and energy management should be a high-priority initiative for your authority. Generally speaking this can be one of the most cost-effective ways for authorities to save carbon and energy with a relatively fast payback period.

- Bear in mind that relatively simple tools using standard software packages can play an important role in supporting building energy management as well as more sophisticated software.

- Seek to scale up once building energy audit and simulation processes are run effectively in one place. The extent of public buildings and housing mean that there should be opportunities to replicate successes and achieve economies of scale.

- Technology alone will not change behaviour — user/consumer engagement is critical if real change is to be achieved. Building/facility managers and the building occupiers are both key parties and will have different needs in terms of communication and support.

- Alongside the direct energy savings from building energy audit and management initiatives, seek to maximise other benefits for building users and your authority. This includes, for example, helping to change attitudes about energy efficiency generally.

Building renovations based on the results of energy audits in Valmeira, Latvia.



Source: Kaidi Tīngas.

4 Case study examples from across Europe

Except when dealing with the most innovative of ICT-enabled solutions, the chances are that for most kinds of energy efficiency initiative another city, municipality or region will have some experiences of implementing something similar. Case studies provide a useful way to share knowledge on the lessons learnt, barriers encountered and successes.

This toolkit contains 23 practical examples (case studies) of energy efficiency initiatives involving ICT from local and regional authorities across Europe (see the table below). The authorities and other stakeholders involved in implementing the initiatives have been directly involved in providing information for each case study so that detailed insights can be shared.

Case studies provided in the toolkit

Case study	Case study location
Energy savings through ICT-enabled building automation system and energy monitoring system — Aalst General Hospital	Aalst, Belgium
Awareness raising through smart metering	Amaroussion, Greece
Amsterdam Smart City	Amsterdam, the Netherlands
Political climate ambition triggers green ICT	Berlin, Germany
Pilot project to demonstrate the indirect effects of reconstructing prefabricated residential buildings to increase energy efficiency	Budapest, Hungary
Virtualising data centres	Copenhagen, Denmark
The Ecooffices building energy challenge	Cote d'Azur, France
Infomobility tools for fleet management	Craiova, Romania
Energy optimisation of public buildings in Austria and Czech Republic	Czech Republic and Austria
Energy and environmental management in public buildings	Częstochowa, Poland
Optimisation of waste collection routes	Daventry, UK
Mobility credits	Genoa, Italy
Centralised sleep mode for computers in Helsinki City Council's network	Helsinki, Finland
Julia 2030 project	Helsinki, Finland
Energy savings from intelligent metering and behavioural change	Leicester, UK
Sustainable schools	Málaga, Spain
ICT-supported centralised energy management system for municipal buildings	Maribor, Slovenia
The Euro Green IT Innovation Centre	Mons, Belgium
A shared energy advice service for Rennes and its surrounding districts	Rennes, France
Congestion charging	Stockholm, Sweden
Improving energy efficiency in public buildings	Tipperary, Ireland
Demand side management	Valmiera, Latvia
Demand side management for energy efficiency in buildings — SAMS	Växjö, Sweden

Source: SQW project team.

The website homepage for the Amsterdam Smart City initiative



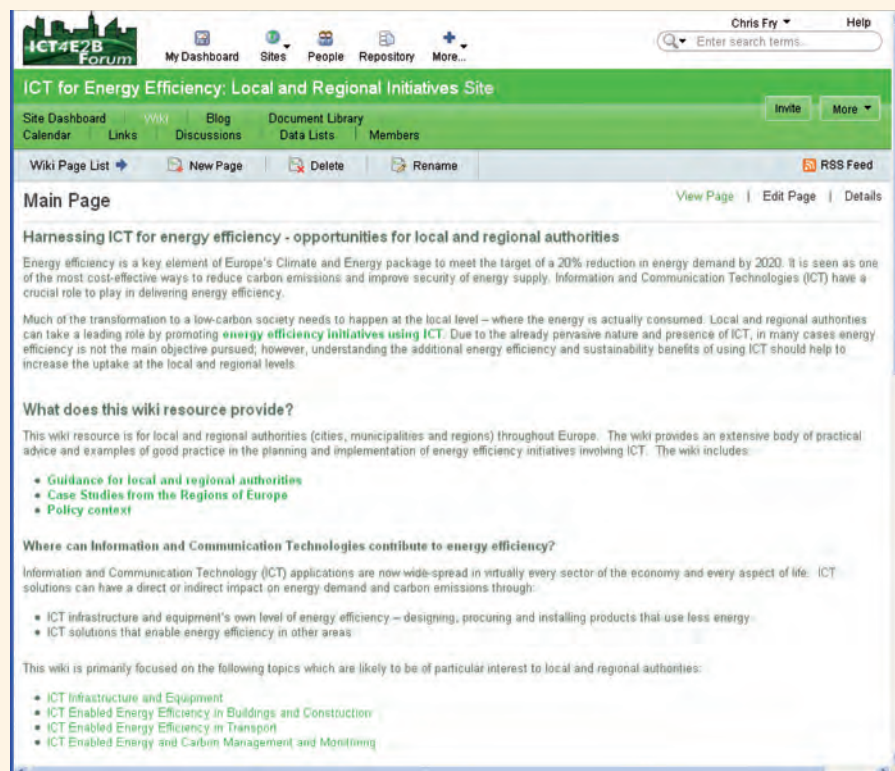
Source: <http://www.amsterdamsmartcity.com/#/en>

5 Using the wiki-style resource

The toolkit from this project is available electronically via a wiki-style website hosted within the collaborative platform (<http://www.ict4e2b.eu>). The platform is the home of the ICT4E2B Forum that brings together ICT and buildings stakeholders to identify needs, challenges and opportunities in further research and integration of ICT systems for energy efficiency in buildings.

Within the collaborative platform there is a site dedicated to the topic of 'ICT for Energy Efficiency: Local and Regional Initiatives'. The full toolkit is available to view and download from within that site.

The main page for the wiki-style resource hosted within the ict4e2b collaborative platform



Source: <http://www.ict4e2b.eu>

6

What to do next

Concluding remarks

ICT has great potential to assist in the delivery of a wide range of energy efficiency and sustainability initiatives in a myriad of ways. There are a growing number of practical examples of successes at local and regional levels and these examples vary widely in terms of:

- the types of situations that authorities are addressing including ICT equipment and infrastructure, buildings and construction, transport or other areas of energy monitoring;
- scale — from projects in a single building to city-wide initiatives;
- the complexity and type of ICT being used;
- the status from research through piloting/trialling to full scale roll-out.

ICT is generally part of a solution, not the total solution. Supporting people and helping to achieve behavioural change is widely recognised as being important in many successful energy efficiency projects.

Recommended next steps

The opportunities for harnessing ICT for energy efficiency are constantly improving. It is therefore beneficial for local and regional authorities to share information and learn from each other. This knowledge-sharing can be enabled through regular contact with sustainability and energy efficiency teams in neighbouring cities, municipalities and regions.

Sharing knowledge between authorities across the EU can also be facilitated, for example via the online toolkit from this project (available via <http://www.ict4e2b.eu>). The toolkit provides lessons from specific examples (case studies) and a wealth of other guidance to support authorities in accelerating the planning and implementation of energy efficiency projects involving ICT.

The toolkit can help authorities to:

- identify ways of getting started with new energy efficiency projects including the most cost-effective initiatives where support and funding is most likely to be easily achievable;
- start to take a more strategic approach to energy efficiency planning and implementation towards a range of policy goals over the longer term;
- identify and overcome potential barriers associated with the practical implementation of ICT-enabled energy efficiency projects on the ground;
- consider different models of collaboration with industry to deliver sustainability and economic development goals (e.g. public-private partnerships, eco-innovation centres/clusters);
- identify existing networks that can support activities (e.g. networks associated with municipal energy agencies, Green Digital Charter/Eurocities, Covenant of Mayors, Smart Cities);
- provide access to practical advice and a community of practitioners through which experiences can be shared (<http://www.ict4e2b.eu>).

European Commission

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INITIATIVES HARNESSING ICT

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