

# Green Digital Action Framework

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## 1 Preamble

This document is deliverable D2.2 of the NiCE (Networking intelligent Cities for Energy Efficiency) project and as such describes the second iteration of the Green Digital Action Framework (also referred as the Action Framework). It aims to provide a shared conceptual reference for deriving concrete action from the Green Digital Charter. The final version of the Action Framework will be produced in June 2013 and will incorporate further guidance on approaches for implementation. The word “charter” has been removed from the title to provide a more universal and transferable framework for Green Digital action, thus embracing also non-signatory cities.

## 2 Executive Summary

The Green Digital Action Framework is a result of work undertaken on the NiCE project to develop a replicable framework that can be used by cities to help their implementation of the Green Digital Charter including the reduction of a city's carbon footprint using digital technology. This structure can also be used more broadly to guide a city's use of digital media to become greener and to make their ICT infrastructure itself more environmentally friendly.

The framework can be visualised as a three dimensional matrix, as shown in Figure1 below:

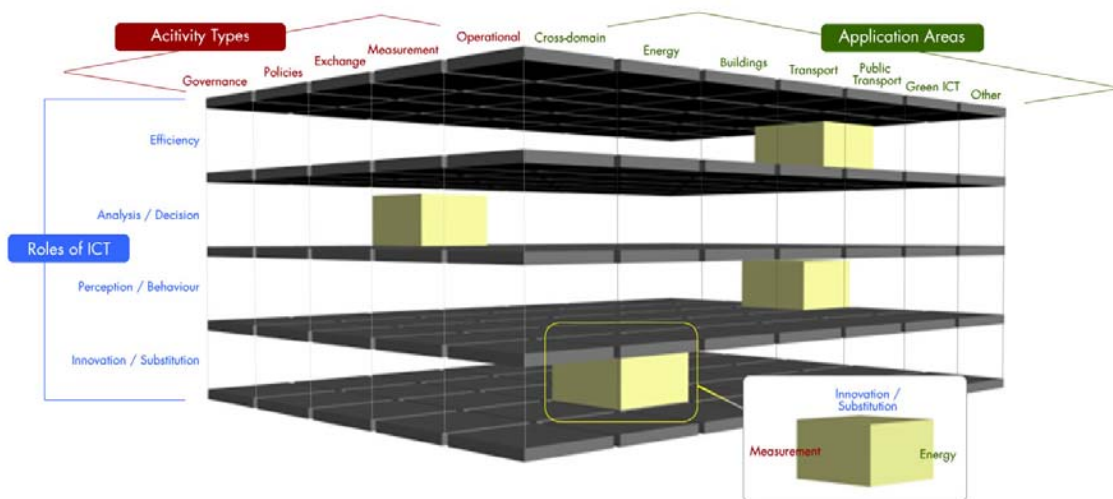


Figure 1 - Green Digital Action Framework: a three dimensional matrix

The three dimensions represent:

1. the application areas for a city;
2. the type of activity they might undertake;
3. the role that ICT can play in impacting a city's carbon footprint.

The three dimensions help analyse and plan city-based ICT activities in different domains. The type of ICT activity and its role is applied to a variety of areas from energy to buildings to transport to ICT itself.

This simple framework provides a powerful tool to help cities from across Europe and beyond:

- understand and identify where action is required;
- assess local progress in terms of Green Digital activity (including the implementation of the Charter);
- share information between each other.

The Action Framework also provides a replicable reference structure that will enable the GDC toolkit to be presented in a consistent way and be accessible by cities via a consistent set of terms arranged in the three Charter dimensions. It also provides a method for connecting green digital activity to the Covenant of Mayors planning structure by matching common terminology.

This framework provides a powerful tool to help cities categorise their own activities in such a way that they can share information between each other. Furthermore, it helps a city identify where action is required and to understand its progress in terms of green digital activity, including the implementation of the Green Digital Charter.

The Action Framework thus provides a means to guide cities on their “green digital journey” and in the context of the Charter, answering the question “We signed the Charter on Friday - so what do we do on Monday?”. Guidance on how to approach and design such journeys will be completed for the final version of the framework, including examples based on work with the NiCE Reference Cities Group.

### 3 Rationale for green digital activities in cities

Cities today face the unprecedented challenge of achieving economic, social and environmental sustainability, under conditions of increasing time and resource constraints. The cost of achieving carbon stabilisation at sustainable levels is predicted to be around 1% of global GDP<sup>1</sup> (gross domestic product) and cities will have to be major contributors to this effort, if carbon reduction targets are to be reached. With cities becoming the home to nearly 5 billion people by 2020, the future of national and regional economies will depend on the ability of cities to tackle the cause and effect of global climate change. Along with the demands of an increasing population, cities will have to be innovative in finding new ways of tackling carbon emissions that will contribute to local economies while also ensuring social cohesion. Furthermore, carbon emissions provide an internationally recognized and comparable metric to assess city progress on reducing pollution and negative environmental impacts more widely.

Information and Communications Technology (ICT) companies have an important part to play in this process. For example by using smart technologies in areas such as electricity grids, transport, logistics, buildings and industrial motors it has been shown that ICT could potentially save as much as 15% of global emissions by 2020<sup>2</sup>. ICT also promises to assist in bringing about behavioural change e.g. by making information about energy use more accessible and visible in homes, offices and public spaces of a city. Investment in ICT solutions to environmental problems promises to invigorate digital industries and to empower ever more connected and mobile citizens to participate in making their cities sustainable places to live in.

At the same time, ICTs are large consumers of energy themselves. In using ICT to achieve sustainability agendas, cities will also need to address the question of how to reduce their ICT footprint, both by using the technologies that they have in place more effectively, and investing in low energy solutions for the future.

Due to the rapid development of ICT and its inherent complexity, individuals and organisations are continuously struggling to gain a better overall understanding of how ICT is shaping and shaped by their city. Established policy domains and action fields such as e-government, economic development or mobility therefore often fragment local practices. While strategies and projects focused on the environmental agenda are increasingly drawing on ICT, it is not done explicitly. Data is collected and analysed, mapped and visualized, but very few cities in Europe actually have a strategy which explicitly incorporates both a commitment to using ICT to its full potential to address environmental challenges ('ICT for green') and to reducing the impact of ICT itself on climate change ('green ICT').

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<sup>1</sup> Stern Review: The Economics of Climate Change

<sup>2</sup> Smart 2020 Report, The Climate Group

Signing the Green Digital Charter allows for both political commitment and a step-by-step process for cities to use ICT to address climate change issues, as well as improve their resource management, cooperate with other cities and stimulate their economies and citizens' wellbeing.

### ***3.1 ICT and the Green Agenda***

The wide spectrum of the potential for ICT to address environmental challenges is a relatively new acknowledgement in cities, but also for society as a whole. While ICT has been an integral part of many city processes for a long time already, recognition of, and support for, its *transformative* function is a key objective of the Green Digital Charter. Apparently, the specific value of ICT lies not in the technology itself but in the services it provides to achieve green goals.

This implies a full acknowledgement of the following qualities and roles of ICT:

#### **ICT is affecting all scopes of emissions for a city<sup>3</sup>**

Three scopes of urban emissions can be distinguished:

1. **Scope 1 emissions:** All direct emission sources from activities taking place within the community's geopolitical boundary. For most cities, this scope is not relevant in terms of ICT.
2. **Scope 2 emissions:** Energy-related indirect emissions that result as a consequence of consumption of grid-supplied electricity, heating and/or cooling, within the community's geopolitical boundary. Scope 2 relates primarily to the use phase of ICT as a major energy consumer. The reduction of energy consumption by ICT itself will support a city's commitments on reducing carbon emissions as well as generating cost efficiencies. Furthermore, since ICT supports all other sectors, steps taken to reduce energy used in hosting centres and by ICT equipment will reduce emissions across the city.
3. **Scope 3 emissions:** All other indirect emissions that occur as a result of activities within the community's geopolitical boundary. It therefore provides a route to embodied carbon and a total lifecycle footprint.

For most cities, ICT is used to measure all three scopes. However in scope 1, no emissions are directly created by the use of ICT itself. Scope 2 does relate primarily to the use of ICT and scope 3 provides a route to embodied carbon and a total footprint of ICT usage.

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<sup>3</sup> Global Protocol for community-scale GHG Emissions (GPC) (2012)  
<http://c40citieslive.squarespace.com/storage/GPC%20Report.pdf>



The calculation of both the negative and positive effects of ICT remains a complex challenge whether done top down or bottom up. NiCE is tracking developments around international standards such as those produced by the United Nations agency for information and communication technologies (International Telecommunication Union, ITU). An additional challenge is the measurement of rebound and substitution effects which are currently regarded as too difficult to measure.

### **ICT enables efficiency improvements**

Integrating ICT applications into conventional systems and practices can help optimise processes and operations in terms of energy, time and costs. Multiple efficiency gains can thus be delivered e.g. by implementing smart lighting systems, intelligent facades or traffic management schemes.

### **ICT supports data collection, analysis and decision making**

A key challenge for every city is identifying, interpreting and acting on relevant and current data. ICT is therefore an absolutely critical tool for data collection, analysis, and visualization of data for action on climate change, drawing on a wide range of data sources. This provides a more substantive basis for informed and timely decision making at individual and organisational level.

### **ICT cuts across domains and territories**

ICT is a powerful means through which various green related activities can be linked and compared. Since ICT is used in the delivery of all services, it cuts across any given set of policy domains or action fields. Figure 2 below shows one example of how ICT is indeed cross-cutting the sectors in which the Covenant of Mayors' Sustainable Energy Action Plans (SEAPs) are categorized in. It equally works across territorial boundaries (municipalities etc.) - a crucial quality for addressing urban challenges at agglomeration scale.

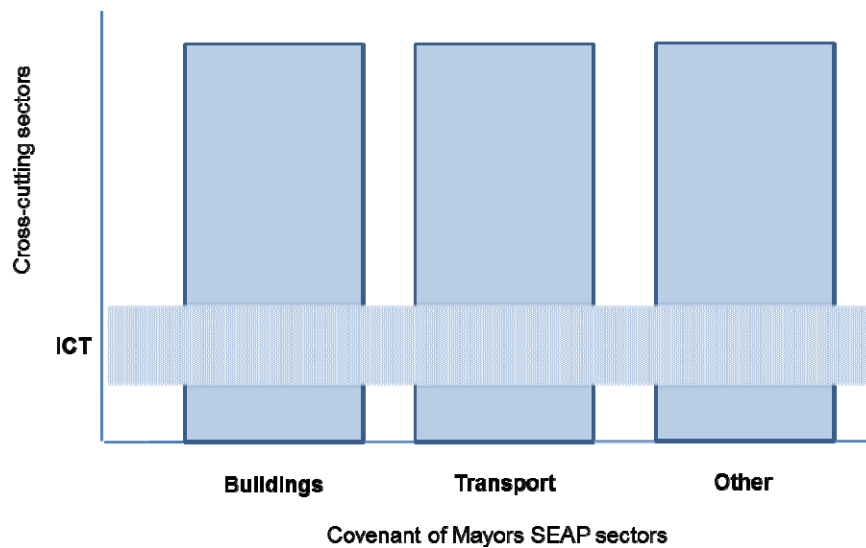


Figure 2 - ICT cuts across the Covenant of Mayors sectors

### ICT changes perceptions and behaviour

Major social changes over the past decade were stimulated by ICT, most notably by the Internet itself. ICT is already being mobilized to change perceptions and behaviour in relation to climate change activity e.g. through mapping carbon emissions or assessing individual mobility. This is explicitly recognized in Green Digital Charter<sup>4</sup>.

### ICT enables innovation and substitution

The use of advanced ICT solutions and applications (sensor nets, wireless broadband, Web2.0, etc.) can also enable the emergence of entirely new systems and practices, and thus the replacement of conventional ones - as illustrated e. g. by the adoption of teleworking schemes or city logistics.

<sup>4</sup> See Green Digital Charter text: <http://www.greendigitalcharter.eu/greendigitalcharter/download>

## 4 Framing green digital action

This section describes the conceptual framework developed by NiCE for cities to identify and assess green digital activity. It has arisen from an analysis of the commitments in the Charter, European policy, city initiatives and activity, as well as direct feedback from the NiCE Reference Cities Group.

In particular, the Action Framework aims to enable cities to:

- Understand and scope green digital activities;
- Identify requirements and activity gaps;
- Categorise and share good practice;
- Categorise and share action tools;
- Provide a shared reference for Charter signatories;
- Assess progress on Charter commitments;
- Connect Green Digital Charter to Covenant of Mayors activities.

### 4.1 *The three dimensions of green digital action*

The Action Framework identifies three dimensions of green digital development that together open up a particular 'space for action'. It provides a shared reference for cities to map their activities, recognise gaps and exchange experiences. This approach is supportive not only of the Charter, but also of wider city activities in terms of carbon footprint reduction.

The three dimensions are:

1. **Applications Areas:** five key policy domains in which actions for green digital development should be implemented by priority are highlighted: **energy, buildings, transport, public lighting and green ICT** – In addition, also green digital actions that cut across these domains, as well as contributions in other domains (e.g. waste, industrial processes) are essential.
2. **Activity Types:** five basic kinds of activity should be combined to trigger the innovation dynamics in terms of green digital development, namely **governance, policy, exchange, monitoring and operational activities**. Covering and coordinating these different activity types is a fundamental requirement for, and thus guides local action.
3. **Roles of ICT:** four kinds of contributions of ICT are identified that can be made within each activity type and policy domain. ICT can be used to simply enhance efficiencies, but it may also foster **data analysis and decision making**, modify **perceptions and behaviour**, or enable **innovation and transformation** of processes or lifestyles.

This space is thus made up of boxes containing specific green digital actions, defined by the three dimensions (e.g. Energy/Measurement/Innovation). Starting from single practices in any of these boxes, cities can thus use the framework to expand activity types in a given domain, transfer and broaden activities towards other domains, or gradually explore new roles of ICT.

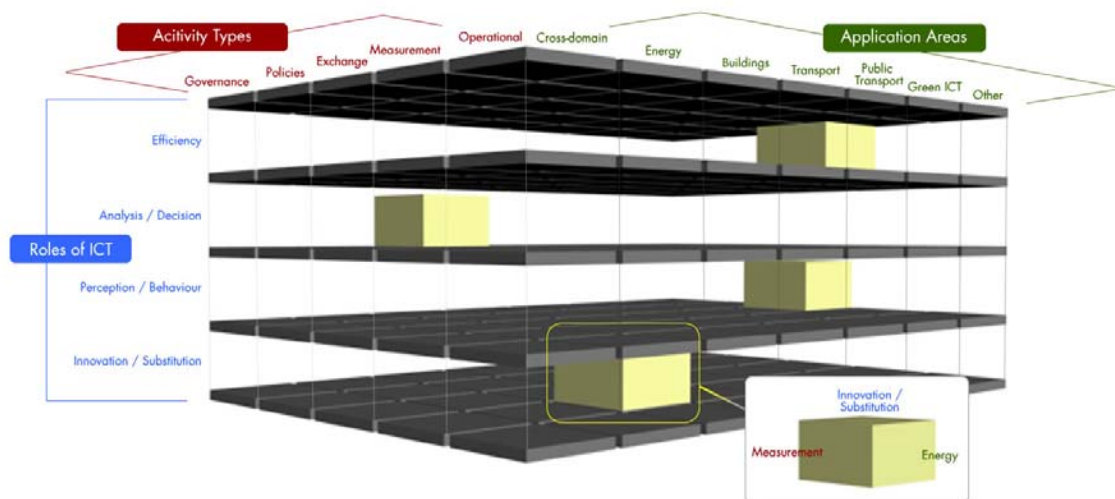


Figure 3 - the three dimensions of green digital action

## 4.2 Application areas

This dimension highlights the key policy domains in which actions for green digital development should be implemented including energy, buildings, transport, public lighting and green ICT. In addition, it includes green digital actions that cut across domains as well as contributions from other domains.

Area	Description	Example Subcategories	Description
Cross-domain	Green digital actions across two or more domains		E.g. a city strategy that states green digital development as a main priority; extensions of digital infrastructures and services to enable low carbon activities; decision support tools for household or enterprise location; ...
Energy	Green digital actions in the energy domain	Electricity production	E.g. adoption of standards for collection, collation and analysis of emission and energy data across the city administration; implementation of smart energy grids; advanced

			<i>planning tools to support greater use of renewable energy sources and micro generation; ...</i>
		Electricity distribution	<i>E.g. territorial cooperation for the extension of electricity infrastructures, implementation of smart energy grids to support the integration of renewable energy sources and micro generation into electricity grids.</i>
Buildings	<i>Green digital actions in the buildings domain</i>	Municipal buildings, facilities	<i>E.g. application of common standards for new buildings and retro-fitting existing buildings; implementation of smart meters in city council, schools and, libraries; ...</i>
		Tertiary(non-municipal) buildings, facilities	<i>E.g. creation of open innovation platforms for integrating renewable energy sources into building structures; implementation of advanced energy management systems in offices or museums; ...</i>
		Residential buildings	<i>E.g. citizen involvement or test-bed projects for smart homes; implementation of demand side management systems in residential buildings; ...</i>
		Industries (excluding industries involved in ETS)	<i>E.g. strategic concept for improving the energy efficiency of lighting systems; implementation of intelligent lighting systems in production and storage buildings; ...</i>
Transport	<i>Green digital actions in the transport domain</i>	Soft modes	<i>E.g. trip planners or on-trip services for cycling or walking (non-motorised transport); public bicycle rental systems; ...</i>
		Public transport	<i>E.g. real-time passenger information services; smart card systems for ticketing and services; bus priority schemes; ...</i>
		Motorised private	<i>E.g. parking management systems; car sharing schemes; usage-based road pricing; ...</i>
		Demand management	<i>E.g. mixed-land-use and urban design simulations; car-pooling and lift sharing schemes; teleworking and teleconferencing; ...</i>
		Logistics / freight	<i>E.g. freight transport guidance systems; green logistics and hubs; ...</i>
Public lighting	<i>Green digital actions in the</i>		<i>E.g. territorial cooperation for smart lighting systems; implementation of</i>

	<i>public lighting domain</i>		<i>sensor-based lighting systems; ...</i>
Green ICT	<i>Green digital actions in the green ICT domain</i>		<i>E.g. procurement rules or service level agreements to minimise the carbon footprint of ICT infrastructures digital services; use of renewable energy sources to power ICT; ...</i>
Other domains	<i>Green digital actions in other domains</i>	Industrial processes	<i>E.g. collaboration with industry to support green digital processes; implementation of smart manufacturing systems; ...</i>
		Waste	<i>E.g. service level agreements for sharing information electronically to avoid using paper resources; implementation of intelligent recycling systems; ...</i>
		Land use	<i>E.g. advanced planning and policy simulation software; use of Geographical Information Systems (GIS) or the Urban Atlas initiative to provide ecomaps; ...</i>

### 4.3 Activity types

This dimension specifies five different kinds of activity that should be combined and coordinated to enable green digital development: governance, policy, exchange, monitoring and operational activities.

Activity Type	Description	Example Subcategories
Governance	<i>Activities that enable the partnership and stakeholder structures and workings that facilitate green digital activity.</i>	Stakeholder involvement
		Territorial cooperation
		Partnerships
		Commitments
Policy	<i>Activities that provide guidance and orientation, set a framework for action and drive innovation for green digital development</i>	Strategy
		Roadmap
		Rules/regulation

		Procurement of goods and services
		Open innovation
		Broadband
Exchange	<i>Activities that facilitate knowledge transfers among stakeholders in Europe for green digital development</i>	EUROCITIES
		Green Digital Charter
		European Network of Living Labs (ENoLL)
Monitoring	<i>Activities that enable measurement, assessment and comparison of green digital developments</i>	Good practice benchmarks
		Measurement standards
		Data collection & analysis
Operational	<i>Activities that implement green digital technologies and practices on the ground</i>	Test-bed projects
		Living labs
		Large-scale pilots
		Other implemented solutions
		Planning and management
		Services and engagement

#### 4.4 Roles of ICT

This dimension specifies the kind of contribution that ICT can make within each activity type and policy domain.

Role of ICT	Description
Efficiency	<i>Use of ICT for improvements of conventional systems, processes, operations, etc. for energy efficiency and carbon emission reduction</i>
Analysis / decision making	<i>Use of ICT for data collection, analysis and interpretation for decision support within/across organisations for energy efficiency and carbon emission reduction</i>

Perception / behaviour	<i>Use of ICT for data visualisation and interpretation addressing individuals and households for energy efficiency and carbon emission reduction</i>
Innovation / substitution	<i>Use of ICT for design and/or support of new systems and processes or replacement of conventional ones for energy efficiency and carbon emission reduction</i>

## 4.5 Examples

For example:

An innovative measurement method applied in the energy sector can be categorised as follows:

*Application Area: Energy*  
*Activity Type: Innovation*  
*Role of ICT: Measurement*

The analysis of forms of data exchange applicable across multiple domains can be categorised as follows:

*Application Area: Cross-domain*  
*Activity Type: Analysis*  
*Role of ICT: Exchange*

Concrete examples from Reference Cities Group:

In Linköping, they have recently rolled out a broadband solution across the city. This solution resulted in less travel for work, resulting in lower carbon emissions. This process can be categorised as follows:

*Application Area: Green ICT*  
*Activity Type: Operational*  
*Role of ICT: Efficiency*

In Manchester they have recently started a pilot to measure the local levels of pollution in the city using air monitoring devices. This process can be categorised as follows:

*Application area: Other - Waste (including air pollution)*  
*Activity Type: Innovation*  
*Role of ICT: Measurement*



## 5 The green digital approach

The green digital approach will be developed as a narrative for using the framework and included in the final version of the framework in 2013. Each city will have its own start point and its own journey but the framework will provide a reference to help answer the following questions.

### *5.1 Where to start*

- Identify green digital activities
- Establish baseline
- Exchange and learn

### *5.2 How to organise*

- Create responsibility
- Broaden dialogue
- Develop vision
- Devise strategy and roadmap
- Provide enabling framework
- Foster practical experience
- Monitor activities

### *5.3 Key barriers and drivers*

- Awareness and knowledge
- Costs & benefits
- Politics
- Institutions
- Technologies