



JESSICA

JOINT EUROPEAN SUPPORT FOR SUSTAINABLE INVESTMENT IN CITY AREAS

JESSICA for Smart and Sustainable Cities

HORIZONTAL STUDY

Final Report

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JESSICA for Smart and Sustainable Cities



Contributors:

Paula Hirst, Eppa Hummerstone, Stefan Webb, Ann-Kristin Karlsson, Anne-Sophie Blin,
Mike Duff, Michael Jordanou, Professor Mark Deakin

The contents of this report were delivered by Mazars LLP, Tower Bridge House, St Katherine's Way, London, E1W 1DD



Definitions and Abbreviations

City Authorities	Refers to the collective group of authorities that have administrative functions which govern a city. This can include 'city regions' or the 'territorial area of a city', and reflects the multi-layered governance within the geographical area, including but not limited to national government, regional government, and local government
Cloud Computing	Where data and software are accessed via the Internet (through the Cloud) which is hosted by a third party on their server, rather than via your own ICT hardware, software, and data servers.
CEB	Council of Europe Development Bank
Dark Fibre Network	A privately operated optical fibre network that is run directly by its operator over dark fibre leased or purchased from another supplier, rather than by purchasing bandwidth or leased line capacity
DG REGIO	Directorate General for Regional and Urban Policy of the EC
EC	European Commission
EE	Energy Efficiency
EIB	European Investment Bank
ERDF	European Regional Development Fund
EU	European Union
Feed-In Tariff	A Feed-In Tariff is a Government scheme which pays a property owner a fixed amount per unit of electricity generated, where the owner has installed electricity-generating technology from a renewable or low-carbon source
FEI	Financial Engineering Instrument
FI	Financial Instrument: Revised term for FEIs in the next programming period
FUA	A Functional Urban Area (FUA) can be described by its labour market basin and by the mobility patterns of commuters, and includes the wider urban system of nearby towns and villages that are highly economically and socially dependent on a major urban centre
HF	Holding Fund
ICT	Information and Communication Technology
Internet of Things	Refers to internet-enabled devices that can network and communicate with each other and with other web-enabled gadgets.

Investment Agreement	A legal contract between an urban project and a UDF defining the rights and obligations of the parties with respect to the UDF investment being made.
IPSUD	Integrated Plan for Sustainable Urban Development.
ITI	Integrated Territorial Investment. ITIs are proposed for the next programming period as tools to bundle funding from different thematic priorities of cohesion policy programmes into an integrated territorial strategy.
JESSICA	Joint European Support for Sustainable Investment in City Areas
MA	Managing Authority
Mega City	Usually defined as a city with a total population in excess of 10 million people.
MS	Member States of the European Union
National Co-financing	National resources (sometimes referred to as “match funding” or “National Contribution”) that can be either from the public or private sector, providing the share of OP Resources required to complement the contribution from the Structural Funds
OP	Operational Programmes are programming documents setting out expenditure priorities and development strategies, submitted by the Member States and adopted by the European Commission, covering the use of Commission Structural Funds and National Co-financing contributions during the 2007-2013 programming period in the context of the applicable National Strategic Reference Framework
OP Resources	ERDF resources and national co-financing are together known as OP Resources
PPP	Public Private Partnership
Programming Period	Budgetary period of European Funds. Current period is 2007-2013, next is 2014-2020
RE	Renewable Energy
SF	Structural Funds
ROI	Return on Investment
Smart Grids	A type of electricity grid which attempts to predict and intelligently respond to the behaviour and actions of all electric power users connected to it in order to efficiently deliver reliable, economic, and sustainable electricity services

Smart Appliances	A product, such as a fridge or washing machine, that is able to communicate with a smart grid and be programmed to turn off or on in response to price or other signal from the grid
Smart City Infrastructure	The key building blocks of a smart city, from its energy supply, to its buildings, to its transport infrastructure, to its ICT network
Smart Citizen	Citizen who is skilled, through training and education, and enabled, through technology, to participate in the economy, environment and democracy of a smart city
Smart Sensors	A sensor embedded in any surface or product which is able to capture data and communicate it to other ICT devices
System of Systems	Linking individual systems into a joint system of systems allowing them to operate together in tandem
UDF	Urban Development Fund
UDP	Urban Development Project
Web 2.0	Web applications which facilitate information sharing, participation and collaboration by the user in a virtual community. Applications include social networking sites amongst others.

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1. Executive Summary

A sustainable city¹ is one which develops in a manner which meets the needs of the future without compromising the ability of future generations to meet their own needs². Increasingly cities are seeking to become 'smarter' in how they are managed and developed in order to become more sustainable. A smart and sustainable city invests in human and social capital, manages resources wisely, has citizens which participate in city governance, and has traditional and modern infrastructure which supports economic growth to create high quality of life for its inhabitants³. Increasingly cities wishing to become smarter are looking to integrate recent efforts to introduce smart ICT-enabled, communicative and networked features of a city's infrastructure, services and citizens, and use the environment created by this 'system of systems' to manage growth and sustain development⁴. Such ICT innovations and the recent growth of 'networked', 'intelligent' and 'smart' computers, sensors and technologies could provide the enabler for smarter and more sustainable cities, through smarter electricity grids, smarter transport and mobility solutions, smarter city planning, smarter public service delivery, smarter buildings, and smarter citizens, supporting economic development, social inclusion, and environmental improvements and responsibility.

The [Europe 2020 Strategy](#) for smart, sustainable and inclusive growth⁵ sets out Europe's priorities for Smart Growth, Sustainable Growth, Inclusive Growth and Economic Governance, with objectives and targets in relation to employment, R&D / innovation, climate change / energy, education, and poverty / social exclusion. To stimulate a move towards smarter and more sustainable cities in support of the Europe 2020 strategy, the European Union has promoted a combination of policy initiatives, networks, research, frameworks, and funding programmes including:

[European Technology Platform for Electricity Networks of the Future](#)⁶, [European Network of Living Labs](#)⁷, [Interreg IVB North Sea Region Smart Cities](#)⁸, [EXPGOV](#)⁹, [IntelCities](#), [European Smart Cities Project](#)¹⁰, [European Initiative on Smart Cities](#)¹¹, [Smart Cities Project](#)¹², [Smart Cities and Communities](#)¹³

¹ For definition of what is meant by a city in this study, see chapter 4.

² The Brundtland Commission Report defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' *Our Common Future* (1987), Oxford: Oxford University Press

³ This working definition of smart and sustainable cities as 'growth orientated, environmentally responsible and socially cohesive territories', is drawn from the following sources: Giffinger, R., Haundmaier, G. and Kramar, H. (2010): The role of rankings in growing city competition, *Urban Research & Practice*, vol. 3, (3), 299-312; Deakin, M. (2010) SCRAN's development of a transnational comparator for the standardisation of e-government services, in Reddick, C. *Comparative e-Government*, Springer press, Berlin; Caragliu, A., Del Bo, C and Nijkamp, P. (2011) Smart Cities in Europe, *Journal of Urban Technology*, vol. 18, (2): 65-82. As a composite definition, it incorporates the key components of previous research undertaken on the subject and aligns their specific territorial dimensions with a recent statement made by the EC on the 'City of Tomorrow', available at: http://ec.europa.eu/regional_policy/conferences/citiesoftomorrow/index_en.cfm.

⁴ The Brundtland Commission Report defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' *Our Common Future* (1987), Oxford: Oxford University Press

⁵ http://ec.europa.eu/europe2020/index_en.htm

⁶ <http://www.smartgrids.eu/>

⁷ <http://www.openlivinglabs.eu/news/enoll-strategic-project-involvement>

⁸ <http://www.smartcities.info/>

⁹ <http://is.jrc.ec.europa.eu/pages/EAP/EXPGOV.html>

¹⁰ <http://www.smart-cities.eu/index2.html>

¹¹ <http://setis.ec.europa.eu/about-setis/technology-roadmap/european-initiative-on-smart-cities>

The role of Cohesion Policy in implementing the Europe 2020 strategy and especially in the area of ‘smart growth’ is underlined in a number of documents, including two Communications from the European Commission (EC) in 2010 and 2011. These texts highlight the necessity for all policymakers in European Member States (MS) to act “without delay to invest more of the resources still available from the European Regional Development Fund (ERDF) in the present programming period on smart growth”.

The proposals of the European Commission for Cohesion Policy for 2014-2020 consider cities as engines of the European economy being catalysts for creativity and innovation but also places where persistent problems such as unemployment, segregation and poverty can be severe. The proposals further state that ERDF should “support sustainable urban development through integrated strategies that tackle the economic, environmental, climate and social challenges of urban areas”.¹⁴ The role of cities in the achievement of EU2020 objectives is emphasised in proposing that a minimum of 5% of ERDF resources in each Member State should be invested in integrated actions for sustainable urban development, implemented through for example, the “Integrated Territorial Investment” tool, with the possibility of management and implementation of those resources delegated to cities. In addition, in order to foster new and innovative solutions, innovative urban actions have been proposed as part of the future cohesion policy package.

JESSICA - Joint European Support for Sustainable Investment in City Areas, is a policy initiative of the European Commission (EC) developed jointly with the European Investment Bank (EIB) and in collaboration with the Council of Europe Development Bank (CEB). JESSICA aims to support sustainable urban development and regeneration through financial instruments, which combine European Structural Fund resources (most frequently ERDF) with other public and private sources of finance to create revolving investment funds such as Urban Development Funds (UDFs) to invest PPPs and other projects included in Integrated Plans for Sustainable Urban Development (IPSUD).

This study seeks to understand the potential for JESSICA financial instruments to support smarter and more sustainable cities to help deliver EU 2020 objectives. Commencing in September 2011, the study included desktop research and stakeholder interviews to understand more about how smart city initiatives arise and evolve, and how projects are procured and financed, to better understand the potential role JESSICA could play. Four cities were studied in depth as case studies: Malmö, Barcelona, Manchester and Amsterdam. The study also included a workshop in December 2011 with industry and policy makers, and a European conference to explore the business models for smart and sustainable city projects in March 2012.

This study has highlighted how smart city projects can provide the potential to advance the progression towards all three Europe 2020 objectives – smart, sustainable and inclusive growth - through the creation of more sustainable cities. The study identifies five key categories of projects

¹² <http://www.smartcities.info/aim>

¹³ http://ec.europa.eu/energy/technology/initiatives/smart_cities_en.htm

¹⁴ http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/urban_en.pdf

which can assist in creating smarter and more sustainable cities, as shown below, and can be embedded in investment strategies pursued by Urban Development Funds:

<p><i>Digital infrastructure projects for urban areas</i></p> <p>The provision of new ICT infrastructure and high speed broadband through fibre optic cables, wireless, and/or networked information systems.</p>	<p><i>City wide data projects</i></p> <p>Data collection, storage, and analysis at a city wide level, potentially through the 'Cloud', which can enhance a city's ability to plan for both current and future services and city development, through the ability to model and analyse data, such as traffic, environmental, demographic or land use.</p>	
<p><i>Smart urban transport and urban mobility</i></p> <ul style="list-style-type: none"> • Cycle hire schemes • Real time bus timetable information • Electric vehicle charging infrastructure, car pools, and batteries • Congestion charging • Intelligent transport systems 	<p><i>Area-based and renewable energy/energy efficiency projects for urban areas</i></p> <ul style="list-style-type: none"> • Combined heat and power • Renewables • Sensors to monitor traffic, pollution, emissions • Street lighting • Waste collection systems • Smart grids 	<p><i>Smart and sustainable buildings in urban areas</i></p> <ul style="list-style-type: none"> • Smart meters • Building management systems • Energy efficiency measures: Insulation, low energy lighting, efficient boilers • Building integrated renewables • Electric vehicle charging points • Smart appliances • Motion detectors • Automatic weather forecasting

Smart and sustainable city projects tend to arise following substantial discussion between city authorities and industry as part of city wide smart city initiatives. These in turn tend to evolve from, and support city wide strategic or spatial planning strategies and documents (often IPSUDs) which include sustainability objectives and targets, as in Malmö and Amsterdam, and/or city wide energy plans as in Malmö and Barcelona, and/or ICT initiatives as in Manchester.

City authorities play a key role in creating smart and sustainable city initiatives, and in attracting industry players to develop ideas for potential projects, and to act as partners. Whilst several technology companies have developed smart city initiatives of their own; e.g. **IBM Smarter Planet**¹⁵, **Cisco Smart+Connected Communities**¹⁶, **GE Ecomagination**¹⁷, **Siemens Infrastructure**

¹⁵http://www.ibm.com/smarterplanet/uk/en/index.html?cmp=100KX&ct=100KX09A&cr=oooh_sp&cm=P&csr=neioutuk_agenda-q42010&ccy=GB&cd=2010-11-02

¹⁶ <http://www.smartconnectedcommunities.org/index.jspa>

¹⁷ <http://www.smartconnectedcommunities.org/index.jspa>

and Cities¹⁸, all industry players interviewed cited strong city leadership as key to their involvement. In city initiatives, authorities and their partners consider how new technologies can be applied to support city projects. From the discussions at a city wide level, cities develop a programme of several smart city projects for implementation.

Such projects, highlighted in the table above, involve both public and private sector actors to develop and test the technology and to deliver on the sustainable outcomes sought by the city authorities. They often involve public private partnerships and formal agreements between the various parties to protect the intellectual property of the technology provider and to share the risk associated with the project. They also tend to be relatively high risk due to the uncertainty attached to future financial returns, and have long payback periods. Projects of this nature therefore struggle to access traditional commercial financing on the capital markets. As a result most smart and sustainable projects identified in the study have tended to be pilots, financed by public sector investment, and/or research and development programmes of the private companies involved, frequently supplemented with the financial support of one or more of the European initiatives noted above in the form of grants. Such pilots tend to be small scale in nature to test the technology, and to understand the social, economic, environmental, and financial returns on investment more clearly, as often such returns are associated with behavioural change which is difficult to understand and accurately predict in advance. Given the early stage in the development of these pilots, outcomes are currently largely unknown. Despite this, it is envisaged that such projects have strong potential to assist cities become both smarter and more sustainable in support of Europe 2020 goals. In order to achieve meaningful impact, such projects will need to happen in more European cities, and become larger in scale. This suggests that alternative financing solutions are needed.

Given the focus of JESSICA UDFs in supporting the achievement of sustainable urban development in pursuit of both financial, and of broader social, economic, and environmental returns, such funds present a potential alternative source of financing for smart and sustainable urban development projects. Through combining European Structural Fund resources with private sector investment, UDFs can reduce the risk associated with smart and sustainable city projects for co-investors. Their long term investment horizons also may allow projects to proceed which would otherwise fail to attract commercial investment due to the long payback periods. As JESSICA UDFs are also explicitly designed to support public private partnerships, then they are ideally suited towards supporting smart and sustainable city projects involving multiple parties. UDF support could be at a project level, but also across an investment portfolio, through investment strategies which incentive smarter projects, where such an approach can support the delivery of more sustainable outcomes.

Looking to the next programming period, it is likely that Managing Authorities will be able to allocate funds to financial instruments from a much broader range of policy areas within their Operational Programmes. This may increase the potential for such instruments to support smarter and more sustainable cities. It is also anticipated that through the proposed Integrated Territorial Investment (ITI) tool there will be an opportunity to bundle funding from different priorities of one or several programmes under European Cohesion Policy, into one strategy that could be managed directly by a city/urban authority.

¹⁸ <http://www.siemens.com/entry/infrastructure-cities/cc/en/index.htm>

To assist Managing Authorities in understanding the potential to support smarter and more sustainable cities using JESSICA, and a broader set of financial instruments in the next programming period, technical assistance to support project development was felt to be useful, as well as being able to access a databank of information regarding existing projects. In particular, understanding the business case for different types of projects was felt important to assist in the understanding and development of new projects. This suggests the need for further research as the current pilots evolve and develop to capture knowledge and share learning.

2. Introduction

Europe 2020 sets out Europe's strategy for smart, sustainable, and inclusive growth, where Europe's economy is based on knowledge and innovation, is more resource efficient, greener and economically competitive, and where there is high employment, social, and territorial cohesion¹⁹. The role of Cohesion Policy in implementing the Europe 2020 strategy and especially in the area of 'smart growth' is underlined in a number of documents, including two Communications from the European Commission (EC) in 2010²⁰ and 2011²¹. These texts highlight the necessity for all policymakers in European Member States (MS) to act "without delay to invest more of the resources still available from the European Regional Development Fund (ERDF) in the present programming period on smart growth", by concentrating investment in actions supporting climate, energy and environmental issues.

Under the Joint European Support for Sustainable Investment in City Areas (JESSICA) initiative, Managing Authorities (MAs) in Member States (MS) are offered the possibility to invest some of their Structural Fund (SF) allocations in financial instruments (revolving funds), aiming to enhance the efficiency and productivity of capital deployed in urban areas and achieve this by investing in sustainable urban development projects. Effective management of urban assets is pursued through the integrated approach to investment by Urban Development Funds (UDFs). These UDFs invest in Public-Private Partnerships (PPPs) and other projects included in integrated plans for sustainable urban development (IPSUD).

In light of this search for greater efficiencies and higher productivity, it is considered helpful to better understand the contribution JESSICA instruments can provide to achieving EU policy objectives related to 'smart' growth and 'smart' cities. The focus should be on solutions that are smart, i.e. based on selecting appropriate technology and cost-effective options, and lead to sustainable outcomes, i.e. contribute to the social, environmental and economic development associated with Europe's 2020 objectives. To this end, within the framework of a grant awarded by the European Commission, the European Investment Bank (EIB) appointed Mazars, and its partners WSP and Jones Lang La Salle, and academic partner Edinburgh Napier University to undertake a study into this area. This study also aims to elaborate on the practical role of UDFs and cities as catalysts for smart growth, linked to the use of SF resources in the current programming period.

This final report has been developed primarily through desktop research and interviews with key players in the smart city arena, and in selected case studies, and has been informed by a stakeholder seminar and public conference. The report commences with background context regarding JESSICA, followed by an overview of smart cities including key initiatives in this area. Given the plethora of organisations which can be involved in shaping the external policy environment, influencing the market, as well as delivering solutions, designing, building, and financing Smart and Sustainable City development, the next section focuses on details of smart city initiatives in four European cities which are considered as 'best practice' case studies: Malmö, Amsterdam,

¹⁹ COM (2010) 2020 - Commission from the Commission 'Europe 2020 'A strategy for smart, sustainable, and inclusive growth' Brussels, 3.3.2010

²⁰ COM(2010) 553 final – Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: **Regional Policy contributing to smart growth in EUROPE 2020**

²¹ COM(2011) 17 final – Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: **Regional Policy contributing to sustainable growth in EUROPE 2020**

Barcelona, and Manchester. Organisational and financing issues regarding smart and sustainable project implementation are then outlined, before considering how JESSICA can assist in the delivery of smart city initiatives and projects. Throughout the document are some examples of the types of 'smart and sustainable' city projects and initiatives underway, as well as key issues and questions for consideration.

Chapters 2-8 of this report formed a 'Background Paper' for a Smart and Sustainable City seminar hosted by the EIB on the 6th December 2011 in Luxembourg. The Paper provided an overview of the type of projects that could be considered as smart and sustainable urban development projects, and the financing and organisational issues associated with their implementation. The key questions explored during the seminar are contained in Appendix F. Key points of the discussion at the seminar are contained in Appendix G of this report. The Background Paper and these two Appendices formed a 'Phase One' Report, which was used to inform a 'JESSICA and Smart and Sustainable Cities' Conference held in the city of Malmö on 29th March 2012.

A summary of the Conference is provided in Appendix H of this report. The findings from this Conference, which focussed on increasing understanding of the business case for smart and sustainable city investments, formed the final part of the study. The Conference was open to City Authorities, Managing Authorities (MA), Urban Development Fund managers, private companies, and others interested in how JESSICA financial instruments could support smart city initiatives and projects.

Overall conclusions and recommendations are contained within Chapter 9 and 10.

Smart City Building Blocks

There are already a number of JESSICA operations which encourage investments in projects which can assist in cities becoming smarter. The main components of these are as follows –

- Energy Efficiency in Housing and Public Buildings
- Combined Heating and Power in Public Buildings and Housing Developments
- Small scale renewable energy sources (PV, biomass, wind turbines)
- District heating and cooling
- Waste to Energy Plants
- Low carbon public transport infrastructure

3. Joint European Support for Sustainable Investment in City Areas (JESSICA)

JESSICA - Joint European Support for Sustainable Investment in City Areas, is a policy initiative of the European Commission (EC) developed jointly with the European Investment Bank (EIB) and in collaboration with the Council of Europe Development Bank (CEB). JESSICA aims to support sustainable urban development and regeneration through financial instruments.

Under procedures applicable in the 2007-2013 programming period, Managing Authorities (MAs) in the Member States (MS) are offered the possibility to invest some of their Structural Funds (SF) allocations in financial instruments (revolving funds) supporting urban development and so recycle financial resources in order to enhance and accelerate investments in Europe's urban areas. These financial instruments are Urban Development Funds (UDFs) investing in Public Private Partnerships (PPPs) and other projects included in integrated plans for sustainable urban development (IPSUD).

Alternatively, Managing Authorities can decide to channel funds to UDFs using Holding Funds (HFs) which are set up to invest in several UDFs. This is not compulsory, but does offer the advantage of enabling Managing Authorities (MA) to delegate some of the tasks required to implement JESSICA to expert professionals.

JESSICA responds to the call for sustainable urban development by addressing a perceived shortage of investment dedicated to integrated urban renewal and regeneration projects and aims to provide MAs with new ways to implement SF Operational Programmes by:

- ensuring long-term durable support to urban transformation processes through the revolving character of the SF's contributions to JESSICA financial instruments;
- contributing financial and managerial expertise from specialist institutions such as the EIB, the CEB, other IFIs and financial institutions;
- leveraging additional resources for PPPs and other urban projects in the regions of the EU; and
- creating stronger incentives for successful implementation by final beneficiaries.

London Green Fund

The London Green Fund is a £100 million (€113million) fund for investment in schemes that will cut London's carbon emissions. It is a fund of funds utilising EU Structural Funds resources through the JESSICA mechanism and is managed by the EIB. This 'Holding Fund' has so far invested in two Urban Development Funds (UDFs), one supporting waste projects, the other energy efficiency projects.

The two UDFs will primarily finance, via equity or equity-type investments, the construction or expansion of:

- Waste to energy facilities;
- Value added re-use, recycling or reprocessing facilities; or
- Other facilities displacing fossil fuel such as 'waste to fuel';
- The adaptation or refurbishment of existing public buildings to make them more sustainable; and
- Energy efficiency improvements to existing social housing.

JESSICA, which is the result of the partnership established between the Commission, EIB and Council of Europe Development Bank (CEB), can also act as a powerful catalyst for the establishment of the partnerships between Member States, regions, cities, EIB, CEB, other banks, investors, and others that will be required to address the problems which urban areas are confronted with now and in the future.

JESSICA UDF investment should be structured so that along with financial returns adequate to ensure that the resources employed can operate as revolving funds (i.e. following repayment of initial project investments, UDFs are able to reinvest funds in other projects at a later stage), adequate socio-economic impacts are also taken into account and achieved through project implementation. In this way, JESSICA is expected to build up a lasting funding legacy of EU and national public money, to be reinvested over the long term to support sustainable urban transformation.

Since JESSICA was launched in 2007, as at 30 March 2012, a total amount of around EUR1.94bn has already been committed to JESSICA operations across 11 Member States (Bulgaria, Czech Republic, Estonia, Germany, Greece, Italy, Lithuania, Poland, Portugal, Spain and the United Kingdom) with around 37 UDFs already in operation. By July 2012, investment agreements are in place with Urban Development Projects (UDPs) in Estonia, Germany, Lithuania, Poland, Portugal, Spain and the UK. A number of JESSICA UDFs have been established to invest in Energy Efficiency (EE) and Renewable Energy (RE) projects as a means of creating sustainable urban development; other UDFs are more focused on urban renewal and regeneration.

This report considers how adding a 'smart' dimension to JESSICA investments presents the opportunity to increase how UDPs can contribute to EU2020 goals.

Issues and Questions

How can UDFs investment better support the smart dimensions of sustainable urban development projects?

What sort of smart and sustainable projects might be appropriate for JESSICA investments?

4. What are Smart and Sustainable Cities?

The EU Report Cities of Tomorrow²² explores the available definitions of “city”, positing that this might “refer to two different realities: the *de jure* city – the administrative city – and the *de facto* city – the larger socio-economic agglomeration. It is this *de facto* city which is the kind of territory this study is describing, with regards to smart and sustainable city initiatives. Cities of Tomorrow would label such a geography as a Functional Urban Area (FUA), i.e. an urban area described by more than its physical form and urban density, to include nearby towns and villages which are economically and socially dependent on the urban centre in question.

It is within these kinds of geography, that constellations of city authorities and private actors, working at multiple scales, are increasingly attempting to integrate the recent efforts to introduce smart ICT-enabled, communicative and networked features of a city’s infrastructure, services and citizens, and use this ‘system of systems’ to manage the urban environment better to achieve growth and sustainable development. The desired outcome of such efforts is to produce “smart” and “sustainable” cities.

The concept of smart and sustainable cities is relatively new, and definitions contained within academic literature are currently evolving to reflect the on-going development of ideas and practice. One of the most recent texts defines smart and sustainable cities as “settlements where investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance”²³

Cities which are considered to be sustainable are those which have strong economic growth, are socially inclusive in their growth, and are environmentally responsible (i.e. have a positive or at least minimal adverse impact on the environment). The most widely accepted definition of sustainable development is the quoted definition in the Brundtland Commission report of 1987²⁴ which defines sustainable development as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’. Increasingly, discussions of urban sustainability are referring to the integration of these different facets of sustainability as a target outcome. The EU’s Cities of Tomorrow report, for example, among others, sets out a vision for the “European City of Tomorrow, in which all dimensions of sustainable urban development are taken into account in an integrated way”²⁵. The Leipzig Charter on Sustainable European Cities describes an ideal approach to urban development work in which “the spatial, sectoral and temporal aspects of key areas of urban policy are co-ordinated”²⁶. The connection between this kind of target outcome and modern ICT developments should not be lost: the increasing ability to handle larger and more disparate pieces of data, allows those actors working on the sustainable improvement of the city to integrate information across disciplines; demonstrating the connection between that which is more sustainable, and that which is “smarter”.

²² Cities of Tomorrow, page 1,

http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/citiesoftomorrow/citiesoftomorrow_final.pdf

²³ Caragliu, A., Del Bo, C and Nijkamp, P. (2011) Smart Cities in Europe, *Journal of Urban Technology*, vol. 18, (2): 65-82.

²⁴ *Our Common Future* (1987), Oxford: Oxford University Press

²⁵ Cities of Tomorrow, page 10,

http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/citiesoftomorrow/citiesoftomorrow_final.pdf

²⁶ Leipzig Charter on Sustainable European Cities, 2007, page 2

What might a smart and sustainable city look like?

...city residents, businesses, and visitors use their smart phones and other smart devices to access data, information and services wherever they are. City authorities and other public service agencies are able to connect directly with residents and businesses to inform public service delivery and allow for increased efficiency, targeting, and reduced costs, and contribute to citizen engagement in issues that affect their quality of life...

...city transport authorities predict the demand for public transport and anticipate road traffic, people work at home and remotely, reducing city congestion and easing the flow of traffic, and allowing the provision of up to the second travel and routing information to people on foot, cycling, using public transport and electric vehicles...

...sensors within your energy efficient home allow you to remotely manage your energy use, with automated systems automatically switching your electric vehicle to charge when electricity is in lowest demand, and providing renewable energy back into the grid as its generated...

... all powered by advances in technology, allowing cities to operate 'smarter', and providing opportunities for economic growth and development, reduction in carbon emissions, and socially inclusive cities.

4.1 What are the drivers for Smart and Sustainable Cities?

For the first time in history, more than 50% of the world's population now live in cities; in the EU this is in excess of 70% (Eurostat, July 2011) and is an ever growing trend. By 2050, the population of the European Union is expected to have grown to over 500,000,000 (Eurostat, October 2011), putting increasing pressure on city infrastructure, the delivery of public services, energy demand and supply networks, and quality of life within urban areas.

Such urbanisation trends, alongside demographic and cultural shifts, ICT innovations, as well as environmental, and financial pressures, mean that new models of city development are being considered which are 'smarter' and more sustainable.

Drivers and trends influencing a move towards smarter and more sustainable cities include:

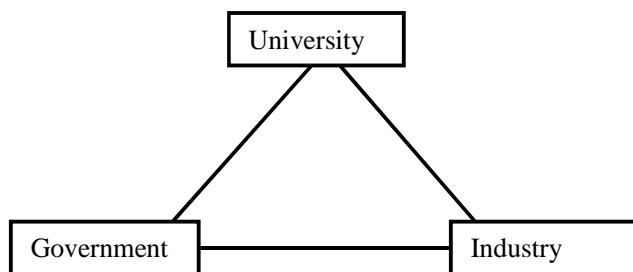
- the increasing size and density of cities creates complex service delivery challenges for city authorities and increased demand on ageing city infrastructure
- the creation of new markets for goods and services which tackle the challenges and exploit the opportunities of city-scale development
- increases in renewable energy generation and more efficient new and existing energy infrastructure, homes and appliances
- the persistence of inequality and deprivation within and between European cities
- increased exploitation of smart technologies by businesses delivering personalised services to customers whenever and wherever they are needed, means that people are increasingly demanding the same of public services
- EU commitments to reduce carbon emissions (from 1990 levels) by 80% by 2050.

The recent growth of “networked”, ‘intelligent’ and ‘smart’ computers, sensors and technologies potentially provide the tools to respond to these drivers. Networked ICT innovations (web 2.0, Internet of Things, smart phones etc.) and intelligent infrastructures (smart grids, smart appliances, smart sensors etc.) offer the potential for greater productivity to be extracted from existing and new infrastructure, products and services, as well as offering economic growth opportunities through innovation, new business opportunities, and new market creation.

For cities to be smart, enhanced ICT technologies need to form part of a city strategy, and be capable of improving public service delivery (Smart Government). Smart cities also require users to understand potential applications of ICT by becoming ‘smart citizens’, to maximise the contribution to productivity, economic growth, carbon emission reduction, and to ensure that the benefits are experienced across a city’s diverse inhabitants.

Such ‘smart government’ and ‘smart citizens’ can enable smart technologies, goods and services to support economic growth. However, for cities to realise the maximum potential benefits, there is a need for information, knowledge, education and training. City departments also need to work together to understand and realise the benefits that ICT innovations can bring.

Research into smart cities shows that cities are smarter where government, industry, and universities work together²⁷.



Such ‘triple helix’ models present opportunities for learning and knowledge generation, key to a city being

²⁷ Deakin, M. (2010) SCRAN’s development of a Trans-National Comparator for the Standardisation of eE-Government Services, in Reddick, C. ed. *Comparative E-government: An Examination of E-Government Across Countries*, Springer Press, Berlin.

Smart City Eco-System

While the core components of a Smart City often relate to physical infrastructure, the value from a ‘smart’ approach comes from not only joining up systems (e.g. ensuring that renewable energy is supplied to energy efficient homes, with smart enabled products) but also ensuring that people are trained in the skills that are required to deliver new systems (be it PV cells or municipal WiFi) as well as operate them so as to extract maximum value (the most sustainable home, with the smartest features and appliances will save little energy if the user does not know how to use the energy saving features).

Similarly at the city level, Smart and Sustainable growth will only be possible by the fusing of knowledge between businesses (small and large), government (local and national) and universities.

'smart'²⁸. Smarter cities can be measured against different axes and different performance measures in relation to outcomes²⁹. All the case studies selected and detailed in this paper have universities, industry, and government working in tandem.

The intelligent use of ICT to solve the challenges facing cities does not only relate to growing cities. While urbanisation trends continue and are pervasive over most of Europe, there are also a substantial number of cities experiencing population decline, and declined levels of economic activity. Creating sustainable solutions to such 'shrinking cities' is a key policy and investment challenge for city authorities. In these instances, intelligent use of ICT, data, and analytics can enable city authorities to plan the redevelopment of their cities in a manner which seeks to balance economic growth, with social inclusion, and environmental improvement³⁰.

There are also strong business and commercial drivers for the move towards smarter cities. Increasingly cities are marketing themselves and competing with others to attract top businesses and their employees by promoting their sustainable and smart attributes. Businesses will increasingly expect smarter, leaner and greener city infrastructure. Smart consumers are demanding more responsive and personalised products and services from all businesses (public and private), requiring organisations to invest in Smart R&D to maintain competitiveness and profitability.

With carbon pricing increasingly an important consideration in business planning, it is also a commercial imperative for organisations to become more resource and carbon efficient. This is driving the growth in smart grids, appliances and applications as governments legislate for, and consumers and businesses demand, more resource efficient products and services. In particular, the building retrofit agenda is one being pushed globally, as some 80% of existing buildings will still be in use in 2050.³¹ With buildings being responsible for 40% of our carbon emissions³², smartening these buildings is

²⁸ Deakin, M. and Leydensdorff, L. (2011) The triple helix of smart cities: a neo-evolutionary perspective, *Journal of Urban Technology*, vol. 18, (2): 53-63.

²⁹ Lombardi, P., Del Bo, C., Calaghiu, A., Deakin, M. and Nijkamp, P. (2011) An Advanced Triple-Helix Network Model for Smart Cities Performance in Ercoskun, O. ed. *Green and Ecological Technologies for Urban Planning*, ICI Publisher, Hershey.

³⁰ Deakin, M. (2011) The embedded intelligence of smart cities, *International Journal of Intelligent Buildings*, vol.3, (2): 189-197.

³¹ <http://www.goodarchitecture.co.uk/environment/refurbish.php>

What makes a Smart City? Europe Rankings

The European Smart Cities project ranks cities on six categories and a number of indicators, including -

Smart Economy

- Innovative Spirit
- Entrepreneurship

Smart Mobility

- Accessibility
- Availability of ICT Infrastructure

Smart Environment

- Sustainable Resource Management
- Pollution

Smart People

- Qualification Level
- Creativity

Smart Living

- Health conditions
- Cultural facilities

Smart Governance

- Participation in decision making
- Transparency

Source: <http://www.smart-cities.eu>

a central challenge in meeting climate change targets, and a significant business opportunity.

The market for business to deliver Smart City solutions to Government will be driven (especially under the current economic circumstances) to do more with less, in particular by using its existing infrastructure more efficiently. Governments and city authorities will need to work together to create a smart business infrastructure and environment so as to nurture more productive smart citizens and attract smart businesses and entrepreneurs.

The need to bring together a range of data sets capable of providing up-to-date and real-time information on a city's infrastructure, will require new types of planning, financial and business consultancy. Increasingly data will have a value in itself; as an example 'pachube.com' is an online company that specialises in global data capture and information processing, with a focus on enabling online tools and applications to be developed from such analysis.

Issues and Questions

- The drivers for smart cities are multifaceted, and not all smart city drivers relate to sustainability issues. What types of smart city projects can contribute to sustainable outcomes?

Sunderland City Council Cloud Platform

Sunderland City Council recently revealed plans to install a city-wide cloud computing platform in partnership with IBM. The new service will be used both by the council and local businesses.

IBM will plan, design, provide, and implement the new infrastructure, which will be the first of its kind in Europe, and is based upon IBM Cloud solutions already implemented in China and USA.

The Sunderland Cloud will help stimulate economic growth, by enabling businesses to expand their IT capabilities and improve collaboration with minimal investment.

In terms of Council services, the Cloud will support online self-service, fraud detection, and process optimisation.

The initial investment of £5.7m will lead to annual operational cost savings of £1.4m, thus paying for itself within 5 years.

Source:

www.sunderland.gov.uk

³² www.carbontrust.co.uk

4.2 What types of projects and initiatives can contribute to creating smart and sustainable cities?

Smarter public service planning and delivery

Computer simulation, modelling and visualisation tools will be central to interpreting and understanding the mass of data generated by the Smart City, allowing the relevant public authority to coordinate their services and interact with its residents and businesses. In particular, smartphone applications are already central to the Smart City, with many cities already testing applications to allow citizens to report littering, anti-social behaviour etc. via cameras on their phones, with the relevant city authority sending back a message when the problem is resolved. GE, for example, are developing games linked to smart meters which enable children to drive energy saving behaviour by competing with friends and neighbours.³³

Integrated into and supporting this infrastructure is a parallel ICT infrastructure of increasing numbers of sensors picking up data to be stored on servers. The data is accessed by city authorities, the energy provider, businesses, and residents increasingly via the 'Cloud' which enables all parties to concurrently analyse and share data. Increasingly people will want to consume data wherever they are, and whole-city WiFi will become all the more important in supporting the Smart City and 'Smart Citizen'.

The design and development of such applications to support sustainable behaviours and smarter business development is a growing industry and will be a key sector for many creative cities.

Smart citizens

Cities will also have to play a role in developing 'Smart Citizens'. With increasing concerns about privacy, government will have to demonstrate the safety and security of data sharing and the potential benefits that can accrue. Similarly, as the growth of data increases choices and potentially supports more efficient markets, information will have to be presented in increasingly innovative ways to ensure that people are clear about the choices on offer.

It is estimated that the choices that individuals make about their lives and behaviours is a significant contributory factor in levels of carbon emission. Developing sustainable behaviours in people, from smart policies which 'nudge' people towards more sustainable living, to online applications and tools which support smart citizens, in the classroom, at home and on the move, are central to the smart and sustainable functioning of a city. This will range from behavioural initiatives that promote the importance and benefits of energy saving measures and the need to separate waste, to skills programmes that train people in housing energy efficiency refurbishment, micro renewables and smart meter installations.

Smart citizens are also important to ensure that the benefits of a 'smarter city' are experienced across a city's diverse inhabitants, and those who work, study, and visit a city. Education, training, and targeted support may be needed to enable those who do not have the existing skills, knowledge, or access to ICT to ensure that the intended positive outcomes of smart city initiatives are realised and distributed equitably.

³³ <http://challenge.ecomagination.com/home/EnergyWiz---Your-mobile-social-energy-mo>

Smarter transport and mobility

A smart city transport infrastructure aims to optimise those journeys that take place within a city and minimise their carbon impact. Real-time city transport planning and coordination of buses, trains and traffic lights, complemented by live travel information sent to people's smartphones, supports a seamless passenger experience and minimises disruption. City-wide cycle hire schemes (and associated cycle lanes) reduce traffic, can reduce pressure on public transport and improve health. With the EU Transport White Paper envisaging that all cities are free of conventionally fuelled vehicles by 2050, a network of electric vehicle charging points will need to be delivered across cities.

A significant proportion of traffic in any modern city is made up of vans and trucks delivering to the hundreds of different stores. Smart logistics projects make use of rail and water freight to deliver goods to the city, which are then consolidated and dispatched using cycle or electric vehicle.

Smart Grids

Key to creating a step change in the sustainability of cities is 'smarter grids'.

One of the biggest challenges for cities is its energy infrastructure. In addition to needing to revolutionise the way we produce and distribute energy so as to meet climate change targets, the pressures of growing city populations increases energy demand, and the need for greater resilience from national electricity grids.

Smart grids seek to manage peak energy demand to reduce the need to build more capacity through new power stations. Smart grids also incorporate distributed and micro renewable energy (solar PV, combined heat and power, wind turbines etc.) thereby supporting the transition to a lower carbon energy mix.

Smart grids require communication between users and suppliers of electricity meaning that energy transmission infrastructure (substations, gas pipes etc.) need to be improved to allow data to be captured and transmitted. Smart grids also require smart appliances and smart citizens using those appliances to allow for automated systems to regulate energy demand. This becomes increasingly important as cities make the transition to electric vehicles which will create significant increases in demands on the electricity network.

Paris Autolib

The Autolib system is intended to build on the success of the Velib bicycle-rental service, similar to that operating in many European cities.

A two-month pilot project will allow motorists to hire the Electric Vehicle Bluecar for 30 minutes at a cost of four to eight euros.

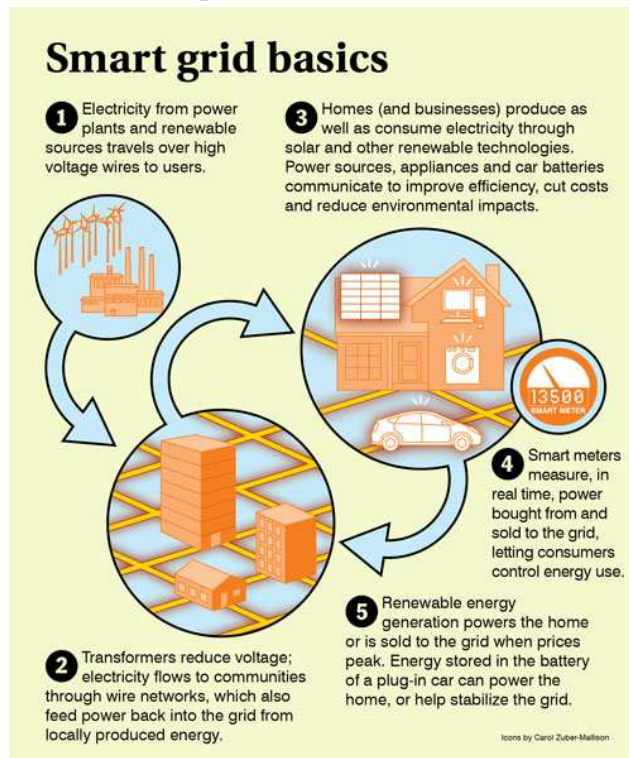
Membership of the Autolib scheme will cost from 10 euros a day up to 144 euros a year. Like the Velib cycle-hire scheme, Autolib's pricing structure encourages people to rent vehicles only for short journeys.

At first, 66 of the four-seater vehicles will be available for hire at 33 charging stations.

The Mayor of Paris Bertrand Delanoë intends to expand to 3,000 vehicles and more than 1,000 stations by the end of 2011.

Source:

<http://www.bbc.co.uk/news/world-europe-15134136>



Source: <http://www.edf.org>

Smarter buildings

An equally important challenge is the refurbishment of our existing building stock, which currently contributes 40% of our carbon emissions.³⁴ The carbon and productivity savings of a smarter electricity grid will be lost if they are not accompanied by measures to make new and existing buildings more energy efficient. Such measures in homes include insulation, modernisation of boilers and windows but can also extend to water saving devices, smart meters and home energy management systems. Smart meters which measure and present your energy use in cash terms, and smart appliances which 'talk' to the grid and turn on when energy is cheapest, are two critical components of building energy efficiency. A host of other products and systems are available to reduce energy use in buildings, commercial, public and government buildings in particular can benefit from low energy lights, combined heating, cooling and ventilation systems, and building energy management systems.

Similarly, pressures on water supplies in cities means that water efficiency is key component of a smart city, with

³⁴ <http://www.carbontrust.co.uk/emerging-technologies/current-focus-areas/buildings/pages/buildings.aspx>

Better Buildings Partnership: Smart Buildings

The Better Buildings Partnership (BBP) is an exclusive collaboration of London's leading commercial property owners, supported by the Mayor of London.

The aim is to develop solutions to improve the sustainability of London's existing commercial building stock and achieve substantial CO2 savings in support of the Mayor's target of 60 per cent by 2025.

Projects include the retrofit of the iconic One Canada Square in Canary Wharf, with measures including replacement lighting resulting in 47% less energy use for lighting, cutting CO2 emissions since the work started by 803 tonnes.

BBP has also supported new approaches to fit-out of new build developments at 201 Bishopsgate and The Broadgate Tower, which achieved 97% of fit-out waste re-used or recycled and 1,693 tonnes of waste diverted from landfill.

innovation required at city infrastructure level, so as to prevent the need for expensive and energy-hungry desalination plants.

Smarter waste reduction, reuse, and recycling

Dealing with waste in a Smart City will require, at a basic level, the facilities to collect, sort and recycle household and business waste. However, more innovative approaches include investing in a city-wide pipeline system (Envac) for disposing of and sorting waste, as has been delivered in Hammarby Sjödstad in Sweden. 'Closed-loop' recycling systems, such as at the Sustainable Industries Park in East London, take plastic waste and, after treatment, are able to make plastic out of it again.

There are also an increasing number of 'up-cycling' projects that take waste streams and turn them into more valuable products (a good example are Freitag bags, made from truck tarps, used car safety belts and used inner tubing of bicycle tires). Businesses of this kind can be supported by the development of hub facilities where similar businesses can share costs and innovate together.

Another component of smart waste infrastructure is waste to energy plants, which allow city authorities to cut costs on transporting waste outside of their borders, while being able to generate energy and heat to supply to the city. As well as the waste to energy plant itself, such plants require a supporting infrastructure for the collection and separation of waste streams.

Smarter city planning

Collaborative data platforms can provide city planners and developers information on a wide range of city information to assist with smarter planning. Real time information on traffic, land use, building typologies, demographic data, socioeconomic data, environmental data, infrastructure systems, and flood risk zones present new opportunities for much more intelligent spatial planning of city growth and infrastructure.

This is increasingly important in the context of sustainable urban development, which is increasingly resulting in mixed use neighbourhoods. The Leipzig Charter on Sustainable European Cities from 2007 (among other documents), defines this as the "strategy of mixing housing, employment, education, supply and recreation use in urban neighbourhoods". As neighbourhoods are mixed more in terms of their content, they become more complex, and as complexity increases, the kinds of data platforms referred to above become more and more useful to those charged with managing these areas from a planning point of view.

The process of making city planning "smarter", is an illustration of how technological advances can support and enhance existing management, policy and development processes, like urban planning, rather than replace or supplant them. Technology is not to be understood as a solution in its own right, but as a tool to achieve outcomes which current strategies are targeting.

Issues and Questions

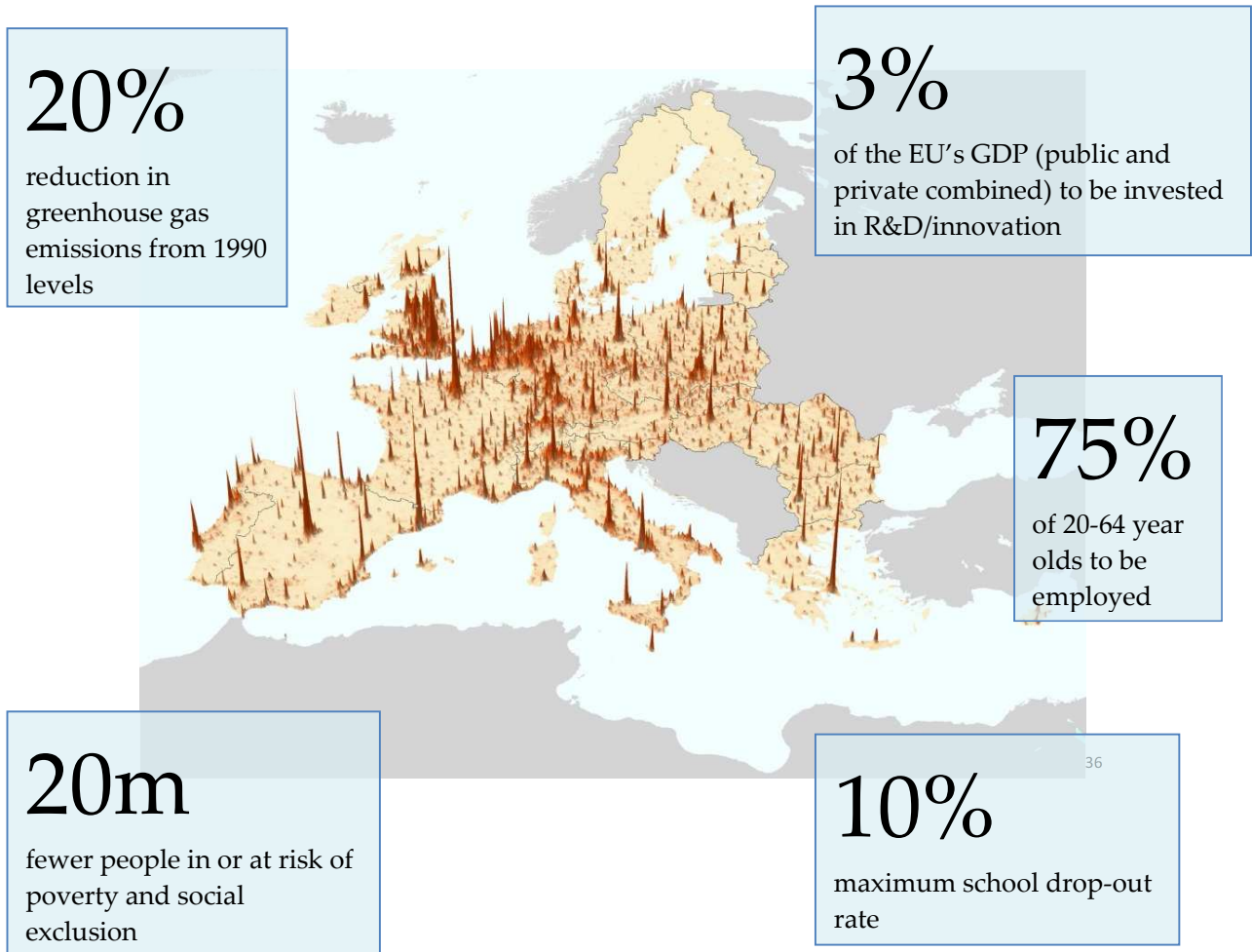
- Who are the key players in developing and delivering smart city initiatives?
- How do projects get initiated, organised, financed and implemented?
- How important is education and training in cities becoming smarter?

- Given recent technological innovations and advances, to what extent are opportunities being missed to take advantage of these to enhance public service delivery, improve city competitiveness, and increase the sustainability of cities? How could this be addressed?
- How can JESSICA financial instruments best support the delivery of smart city projects?

5. Smart and Sustainable City Initiatives

5.1 Europe 2020 Strategy

The Europe 2020 Strategy for smart, sustainable and inclusive growth³⁵ is built on European priorities of Smart Growth, Sustainable Growth, Inclusive Growth and Economic Governance. While each of these components looks to improve the overall economic, social and environmental wellbeing of the EU, in rural as well as urban areas, in agriculture as well as in the manufacturing, construction and service sectors, the smart cities agenda has the potential to provide a catalyst to all components of the Strategy.



The table overleaf lists key EU initiatives relating to the Europe 2020 targets, and how these initiatives may contribute to creating smarter and more sustainable cities in Europe.

³⁵ http://ec.europa.eu/europe2020/index_en.htm

³⁶ Cartography: European Commission, DG Regional Policy. The spikes in the image depict areas of population density: urban areas and cities.

Europe 2020 Target	Europe 2020 Flagship Initiatives	Smart and Sustainable Cities Contribution
<p>R&D / innovation</p> <p>3% of the EU's GDP (public and private combined) to be invested in R&D/innovation.</p>	<p>Digital Era for Europe, has seven goals:</p> <ul style="list-style-type: none"> • A new Single Market for online services to deliver the benefits of the digital era • Improve ICT standard-setting and interoperability • Enhance trust and security • Increase Europeans' access to fast and ultra-fast internet • Boost cutting-edge research and innovation in ICT • Empower all Europeans with digital skills and accessible online services. <p>Unleash the potential of ICT to benefit society.</p> <p>Industrial policy for the globalisation era has ten key actions including:</p> <ul style="list-style-type: none"> • European transport, energy and communication infrastructure and services will be upgraded to serve industry more efficiently, taking better account of today's changing competitive environment • Sector-specific innovation performance will be addressed through actions in sectors such as advanced manufacturing technologies, construction, bio-fuels and road and rail transport, particularly in view of improving resource efficiency • The challenges of energy-intensive industries will be addressed through actions to improve framework conditions and support innovation 	<p>The smart cities agenda can be used to focus businesses and public authorities on the opportunity to extract more value from their existing infrastructure and capital, via research and innovation.</p> <p>Creating new products and services that generate more efficient growth to address social and environmental challenges.</p>
<p>Climate change / energy</p> <p>Greenhouse gas emissions 20% (or</p>	<p>Resource Efficient Europe, has a number of key components:</p> <ul style="list-style-type: none"> • Outline what the EU needs to do to create a low-carbon economy by 2050, cutting greenhouse gas emissions by 80-95% • Analyse how the EU can create an energy system by 2050 which is low- 	<p>Creating smarter grids, powered by more renewable energy, with smart technologies supporting and rewarding people for energy saving behaviour, can do more to reduce energy use and tackle climate change than any</p>

<p>even 30%, if the conditions are right) lower than 1990, 20% of energy from renewables, 20% increase in energy efficiency.</p>	<p>carbon, resource-efficient, secure and competitive</p> <ul style="list-style-type: none"> • Present a vision for a low-carbon, resource-efficient, secure and competitive transport system by 2050 that removes all obstacles to the internal market for transport, promotes clean technologies and modernises transport networks • Define medium and long-term objectives and means for achieving them with the main aim to decouple economic growth from resource use and its environmental impact. 	<p>one of these initiatives alone.</p>
<p>Employment 75% of the 20-64 year-olds to be employed.</p>	<p>A new agenda for jobs and skills, has four key components:</p> <ul style="list-style-type: none"> • Making labour markets function better through further reform • Equipping people with the right skills for employment, including creating an 'EU skills panorama' to help people better see which skills are most needed now and in the future. • Improving job quality and working conditions • Creating jobs. 	<p>Smart city developments will create a range of new jobs across all industries, due to the demand for new products and services (Siemens expects EUR 40 billion of green revenue by 2014 and IBM's smarter planet solutions revenues are growing faster than the rest of their business).³⁷ Smart cities make the best use of scarce resources, making them more productive and competitive.</p>
<p>Education Reducing school drop-out rates below 10%, at least 40% of 30-34-year-olds</p>	<p>Youth on the Move is a comprehensive package of policy initiatives on education and employment for young people in Europe, which aims to improve young people's education and employability, to reduce high youth unemployment and to increase the youth-employment rate by:</p> <ul style="list-style-type: none"> • Making education and training more relevant to young people's needs • Encouraging more of them to take advantage of EU grants to study or 	<p>New methods of teaching and training, in the home, at school and at the workplace, will make education a more compelling proposition and encourage people to learn, study and update their skills.</p>

³⁷ <http://www.greenchallenge.info/MediaDetails/WhatIsTheBigDealAboutSmartCities.htm>

<p>completing third level education.</p>	<p>train in another country</p> <ul style="list-style-type: none"> • Encouraging EU countries to take measures simplifying the transition from education to work. 	
<p>Poverty / social exclusion</p> <p>At least 20 million fewer people in or at risk of poverty and social exclusion.</p>	<p><u>European Platform Against Poverty:</u></p> <ul style="list-style-type: none"> • Improved access to work, social security, essential services (healthcare, housing, etc.) and education • Better use of EU funds to support social inclusion and combat discrimination • Social innovation to find smart solutions in post-crisis Europe, especially in terms of more effective and efficient social support • New partnerships between the public and the private sector. 	<p>Digital society – far from creating atomised individuals, smart cities can use virtual networks to create and reinforce social networks, inclusion and cohesion</p> <p>Giving people more access to better information about how to access public services and be a smarter consumer protects them from poverty and help them plot a path to success.</p> <p>The smart and energy efficient refurbishment of existing homes can significantly cut energy bills and reduce fuel poverty.</p>

5.2 EU Initiatives

The EU have launched a number of initiatives and funding streams that aim to support one or more elements of creating smarter and more sustainable cities. These cover a diverse range of technical, administrative and social responses to supporting smarter cities and have been influenced by, and themselves seek to influence a large number of actors (public, private, academic and community) central to researching, designing and delivering the initiatives. There has been a significant focus on a number of networks that bring together, fund and stimulate the various communities of interest in different parts of the Smart and Sustainable City agenda.

Smart Citizens and Smart Government

The [European Network of Living Labs](#)³⁸ (ENOLL) brings together a range of strategically important projects across the EU which aim to research and design innovative system-wide solutions to smart cities. This includes the:

- **Smart Metropolitan Areas Realised Through Innovation & People (SMARTiP)**³⁹ project that focuses on the challenge of transforming public services by empowering ‘smart citizens’ who are able to use and co-produce innovative Internet-enabled services within emerging ‘smart’ cities. The project will deliver a range of technical pilots to stimulate citizen engagement in generating content and applications for smart products and services, as well as being more informed and involved users of the developing Internet-enabled services in ‘smart’ cities. The pilot projects cover three thematic areas: smart engagement, smart environments, and smart mobility, reinforcing that the benefits of smart projects can be both physical or environmental, but also social and economic. The pilot projects include:
 - a new “e-participation” service launched by Cologne city council to support the involvement of citizens by means of the internet in a way that is effective, transparent, and activity orientated.
 - the enhancement of the Bologna Smart Mobility system, including setting up a multichannel internet service for citizens and officers providing information updated in real time on mobility in the city.
 - Smart Environments in Manchester, deploying prototypes to enable citizens to collect environmental data about their city through the use of wearable technologies, passive sensors (e.g. on bicycles and cars), interactive sensors on streets, buildings and in green spaces and through other sensing devices.
- **European Platform for Intelligent Cities (EPIC)**⁴⁰ will help to accelerate the uptake of new citizen-generated services across Europe by combining business expertise with the practical, first-hand knowledge of the European Network of Living Labs to guide cities through the routes, decisions and steps they need to undertake to improve service delivery and achieve the benefits of ‘smart’ working. The project suggests that the use of cloud computing provides economies of scale and networks effects that help enable

³⁸ <http://www.openlivinglabs.eu/news/enoll-strategic-project-involvement>

³⁹ <http://www.smart-ip.eu/>

⁴⁰ http://ec.europa.eu/information_society/activities/livinglabs/docs/epic_v6_pub.pdf

innovate synergies between technology and service providers, city administrators, small and medium sized enterprises and end users. EPIC uses the IBM Smart City Test and Development Cloud to help implement the flexible and cost-efficient, cloud based development and testing environment. The cloud based platform will be developed to aid city services, using innovative future internet technologies such as 3D-geolocation for mobile devices, mobile sensors, and augmented reality to create truly smart, cost effective web applications. The outcomes of the project will be:

- a tested prototype for a pan-European web service delivery platform
 - a range of e-Government web services extending to the private sector and citizens, ensuring distributed socio-economic benefit to the city dwellers
 - a deployment roadmap that shows how a smart city can transition to web based service and cloud computing
- **Networked Smart Peripheral Cities for Sustainable Lifestyles (PERIPHÈRIA)**⁴¹ takes the learning from elsewhere in the living labs and looks to apply them to the real world geographies of the neighbourhood, street, square, park, museum and city hall. In effect PERIPHERIA explore and test the real world impact of smart cities solutions as developed in the lecture hall, lab and pilot projects. For example, there is a pilot project in Athens to develop the Smart Square Arena as the space for public debate and decision-making on key eco-policy issues facing the municipal government. The pilot will explore different ways that Smart Citizens can actively contribute to the conception and implementation of eco-policies with scenarios based on Future Internet mobile. The full list of projects is available at:
http://ec.europa.eu/information_society/activities/livinglabs/docs/periphèria_pub.pdf

[EXPGOV](#)⁴² looks to understand the new ICT-enabled governance models at the city level and looks at how ICT drives changes in the governance processes of cities. In particular it aims to understand how it can positively change organisational and administrative procedures, stakeholder involvement and decision making.

The [Interreg IVB North Sea Region Smart Cities](#)⁴³ project has created a network of government and academic leaders aiming to deliver transformational e-Government strategies for public service delivery and e-enabled public services. The project aims to develop replicable approaches by combining existing solutions developed by the partners and co-designing new customer services, wireless applications and strategies for take-up.

In a similar manner, [IntelCities](#) (Intelligent Cities) is a research and technological development project to pool advanced knowledge and experience of electronic government, planning systems and citizen participation from across Europe.

⁴¹ <http://www.periphèria.eu/>

⁴² <http://is.jrc.ec.europa.eu/pages/EAP/EXPGOV.html>

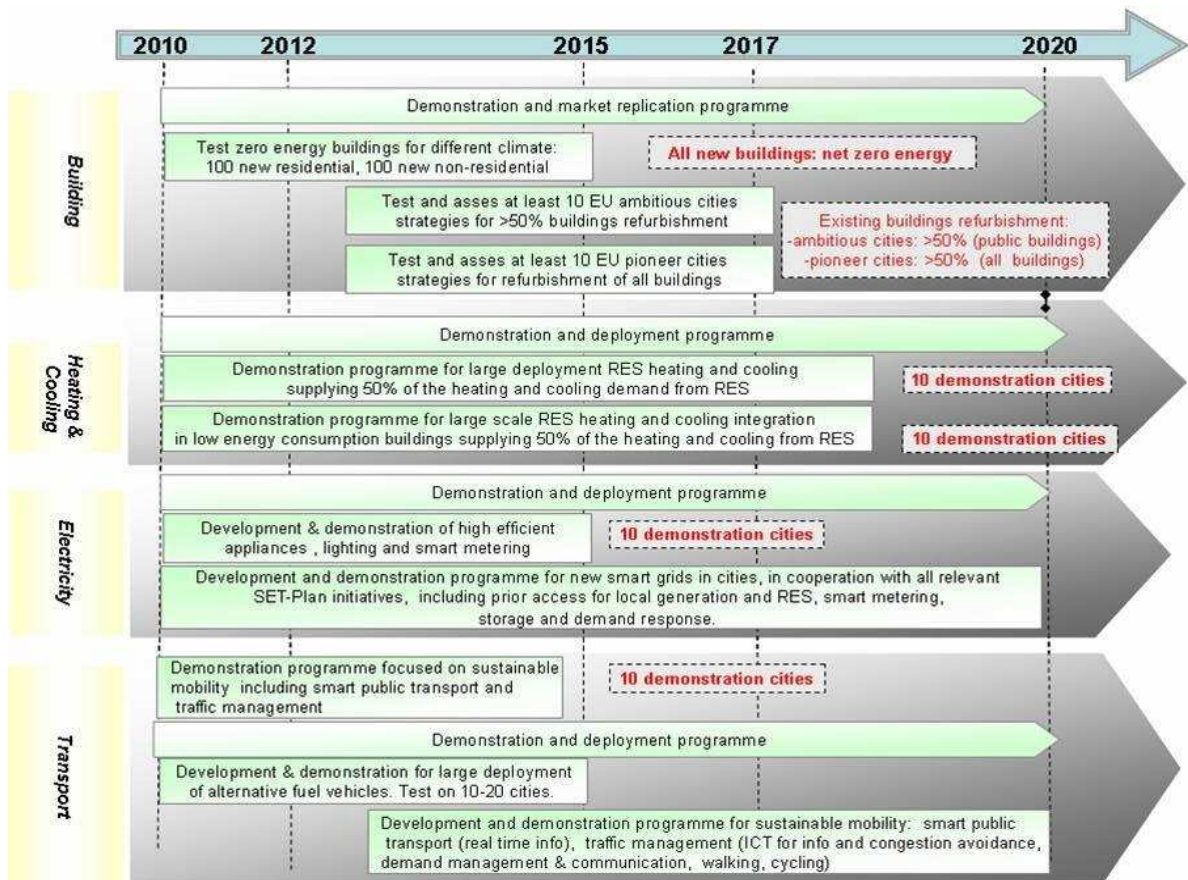
⁴³ <http://www.smartcities.info/>

Smart Cities

The [European Smart Cities Project](#)⁴⁴ looks to rank 70 small medium and large cities over 74 indicators under the categories of Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living and Smart Governance.

A similar collaborative project across the North Sea Region of the EU is the [Smart Cities Project](#)⁴⁵ which aims to create an innovation network between governments and academic partners to promote the take up of best practice in the field of e-services.

[European Initiative on Smart Cities](#)⁴⁶ – This project looks to provide a roadmap (outline below) and collaborative framework for those cities and regions wishing by 2020 to progress towards a 40% reduction of greenhouse gas emissions, through increased take up of energy efficient and low carbon technologies. It will do so by spreading best practice in sustainable energy concepts at the local level, with a focus on buildings, energy networks and transport, by supporting the delivery of solutions at scale.



⁴⁴ <http://www.smart-cities.eu/index2.html>

⁴⁵ <http://www.smartcities.info/aim>

⁴⁶ <http://setis.ec.europa.eu/about-setis/technology-roadmap/european-initiative-on-smart-cities>

One of the most recent initiatives is the recently announced [Smart Cities and Communities](#)⁴⁷ Initiative. In its first call for proposals, Smart Cities and Communities is looking to spend €40m on a range of collaborative projects that bring together academics, governments and industry across a range of energy-focused themes including strategic sustainable planning at the city level, large scale systems for urban area heating and/or cooling, and partnerships to deliver near zero energy refurbishment of buildings. .

Finally, Green and Connected Cities is a group of private and public bodies from cities, businesses, experts, researchers, associations and institutions in Europe that was initiated by the Association of Information and Communication for Sustainable Development. The initiative aims to combine information technology and sustainable development to respond to the social and environmental challenges facing cities.

The objectives of the initiative are to:⁴⁸

- *Imagine and develop with the ICT new local ecosystems that are innovative and carbon effective*
- *Create venues and places for networking and connected innovative activities*
- *Work on free and sustainable mobility*
- *Focus on the issue of work to home transport*

The first operational project is Ecocentres 2.0, which sets out to introduce new features and urban locations in cities for sharing and providing training in e-business.

Smart Energy and Climate Change

The [European Technology Platform for Electricity Networks of the Future](#)⁴⁹ (Smart Grids ETP) began its work in 2005 and its aim is to formulate and promote a vision for the development of European electricity networks looking towards 2020 and beyond. Its broad objectives are to build and maintain a shared vision and maintain a high level overview of developments, opportunities and threats across the sector.

As such the Smart Grids ETP can be seen as the strategic coordinating forum, sitting above the [Smart Energy Networks](#)⁵⁰, an R&D programme that focuses on the two core components of a sustainable pan-European energy infrastructure, gas and electricity, with a focus on three research themes:

- **Development of inter-active distribution energy networks:** How should the grid function in an age where energy is created in homes, streets and communities not only in power stations, and where it is possible for consumers to demand real time pricing and suppliers can understand consumer demands in real time.
- **Pan-European energy networks:** How to create a single grid to support the proper functioning of an internal electricity and gas market, increase security of supply and balance the loads between member states.
- **Cross cutting issues and technologies:** In many cases the solutions to the above issues will require lateral technical and non-technical solutions.

⁴⁷ http://ec.europa.eu/energy/technology/initiatives/smart_cities_en.htm

⁴⁸ <http://www.greenandconnectedcities.eu/en-1/the-cluster-green-connected-cities/what-do-we-do-exactly/>

⁴⁹ <http://www.smartgrids.eu/>

⁵⁰ http://cordis.europa.eu/fp7/energy/about-smart_en.html

The European Institute of Technology (EIT) has created a three **Knowledge Innovation Communities** (KIC's), including the KIC InnoEnergy⁵¹ that aim to generate innovative products, services and businesses across the all aspects of the future energy infrastructure, including clean coal, energy from chemical fuels, renewable energy and sustainable nuclear. The Climate KIC⁵² recognises that Climate-change mitigation and adaptation present not only a formidable societal challenge; they also offer huge innovation and business opportunities. The Climate KIC mission is to creating promising new collaborations, attract and develop future climate entrepreneurs and building platforms to connect and support the wider climate entrepreneurship community.

Smart Regions

The Smart Specialisation Platform was established by the European Commission through the Joint Research Centre⁵³ to assist Europe's regions exploit their full potential and become competitive on a global scale. 'Smart specialisation' is defined as promoting *"efficient, effective and synergetic use of public investments and supports countries and regions in strengthening their innovation capacity, while focusing scarce human and financial resources in a few globally competitive areas in order to boost economic growth and prosperity."*⁵⁴

The Smart Specialisation Platform provides guidance, analysis, practical technical support, and research on smart specialisation, in addition to training on how to develop smart specialisation strategies.

5.3 Global Initiatives

OECD

The Organisation for Economic Cooperation and Development (OECD) has a mission to promote policies that will improve the economic and social well-being of people around the world. The OECD works with governments to understand what drives economic, social and environmental change. In September 2010, OECD published the document 'Greener and Smarter – ICTs, the Environment and Climate Change' which looked at the potential of smart ICT-based applications to improve the environment and tackle climate change as part of the wider OECD Green Growth Strategy.⁵⁵ The main points concluded in the study are that:

- ICTs are a key enabler of "green growth" in all sectors of the economy
- "greener and smarter" ICTS offer the prospect of better environmental performance than previous generations (direct impacts) and innovations which also create economic and social improvements (as indirect benefits)
- Direct environmental impacts of ICTs are considerable in areas such as energy use, materials throughput and end-of-life treatment

⁵¹ <http://www.kic-innoenergy.com/>

⁵² <http://www.climate-kic.org/about/>

⁵³ The European Commission's in-house science service.

⁵⁴ <http://ipts.jrc.ec.europa.eu/activities/research-and-innovation/s3platform.cfm>

⁵⁵ <http://www.oecd.org/dataoecd/27/12/45983022.pdf>

- Innovative ICT applications enable sustainable production and consumption across the entire economy
- Information and communication are pivotal for system-wide mitigation of environmental impacts and adaptation to inevitable changes in the environment
- Measurement of the environmental impacts of “green and smart” ICTs remains an important issue to address.

The OECD is also a partner in the Green Growth Knowledge Platform.

World Bank

The World Bank does not currently have an initiative referred to as ‘smart cities’, however it has launched the Eco²cities initiative to help cities in developing countries achieve greater ecological and economic sustainability.⁵⁶ The program provides a framework for cities to work towards their sustainability targets. The program is defined by four principles: a city based approach, an expanded platform for collaborative design and decision making, a one system approach, and an investment framework that values sustainability and resiliency. The intention is for the World Bank to collaborate with cities, the private sector, academia, and development agencies, provide technical assistance, and where necessary to provide access to funding for climate change. The Eco²cities initiative has on-going operations in Ho Chi Minh City and Haiphong in Vietnam, Quezon, Mandaluyong, and Makati in Philippines, and Jakarta, Surabaya, Makassar and Palembang in Indonesia.

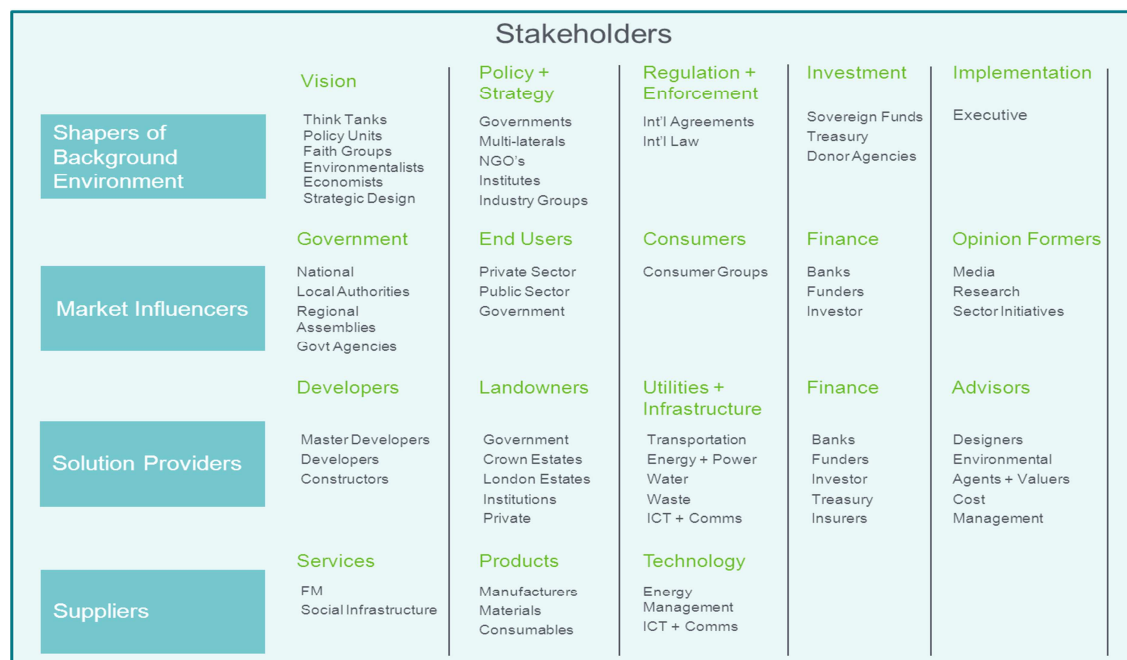
⁵⁶<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/0,,contentMDK:22643153~pagePK:148956~piPK:216618~theSitePK:337178,00.html>

5.4 What are the main Industry Smart City initiatives?

There a number of international companies who are actively promoting the potential of smart cities to transform how we live and work. The companies whose ‘smart city’ initiatives and technologies, which are profiled here as examples, are mainly involved at the ‘system of systems’ level (linking individual systems into joint system of systems allowing them to operate together in tandem) and can be seen as providing the ICT infrastructure, data platforms, analytics, applications, products and tools for use within a Smart City. An overview of these company initiatives is provided over the following pages.

While these companies in particular are heavily involved in promoting the benefits of smart cities and see the development of smart cities as a core commercial business driver, there are many other businesses in the market providing smart city related ICT services and products.

Companies providing ICT related services and products are also only one of the many stakeholders involved in the policy and delivery of Smart Cities shown below:

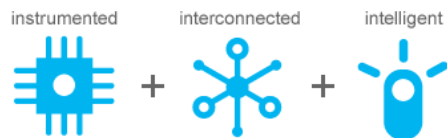


This report is concerned with how UDFs can support the delivery of smart *and* sustainable urban development. In addition, the relationship is bi-directional in that the study seeks to show both how smart city projects can be supported by UDF investment but also how smart city concepts (such as support for appropriate ICT-mediated urban experience) can be embedded into JESSICA instruments to make them more effective. Who the key players are for such smart and sustainable city initiatives and projects, and how they interact is analysed through the four case studies considered in this report, and in the Organisational and Financing chapter.

The **IBM Smarter Planet**⁵⁷ initiative emphasises the importance of capturing, analysing and utilising data as part of what they call the Decade of Smart. Their conception of the smarter planet focuses on all ‘things’ being instrumented (by means of sensor or micro-computer), connected and communicating (via the internet) with other things in intelligent ways.

IBM sees these sensors, computers and data having application in the Smarter City. They ultimately see these innovations driving customer experience and enabling more efficient public services. The particular goods (computer, servers and sensors) and services (ICT, financial and consultancy) that IBM provides allow businesses and in particular city authorities to design, plan and implement better services.

**By smarter, we mean the world
is becoming:**



An example of one of the projects that IBM has been involved in is the Smarter Cities Challenge. This is a competitive grant program awarding \$50 million worth of IBM expertise over three years to 100 cities around the globe to drive efficiencies and improve prosperity. In 2010, the city of Glasgow was the first city in the UK to win a grant from IBM as part of the initiative. The city hopes to use the grant to develop low carbon energy technologies, efficient homes, the provision of affordable heat and the creation of sustainable communities.⁵⁸

IBM offer a range of smart energy solutions, including the IBM Intelligent Utility Network Solution to help manage energy network supply and demand, smart metering systems, and a smart grid maturity model to track the results of smart grid initiatives.⁵⁹

Reducing traffic congestion and air pollution in the city of Stockholm

Stockholm held a democratic election to decide whether to implement a new ‘smart’ road tolling scheme. The city voted to implement a scheme that was powered by an IBM system which allowed a network of cameras all over the city to take photos of vehicles and map their precise journey. This allowed the city government to charge people accurately for the journey they took at the particular time they took it.

A smart traffic system helped the city of Stockholm cut gridlock by 20%, reduce emissions by 12% and increase the use of public transportation dramatically

⁵⁷http://www.ibm.com/smarterplanet/uk/en/index.html?cmp=100KX&ct=100KX09A&cr=oooh_sp&cm=P&csr=neioutuk_agenda-q42010&ccy=GB&cd=2010-11-02

⁵⁸ <http://www-03.ibm.com/press/uk/en/pressrelease/33994.wss>

⁵⁹ http://www.ibm.com/smarterplanet/us/en/smart_grid/nextsteps/index.html

The **Cisco Smart+Connected Communities**⁶⁰ initiative provides the ICT infrastructure and service delivery platforms to support smarter working, in new and existing cities. Cisco services focus on transforming the customer experience and providing the systems for collaboration across public, private and community agencies. Cisco provide the supporting ICT infrastructure for Smart Grids, the data centres to hold, manage and processes the masses of data generated in the Smart City and provide local technical solutions to Smart Buildings and Smart Workplaces.



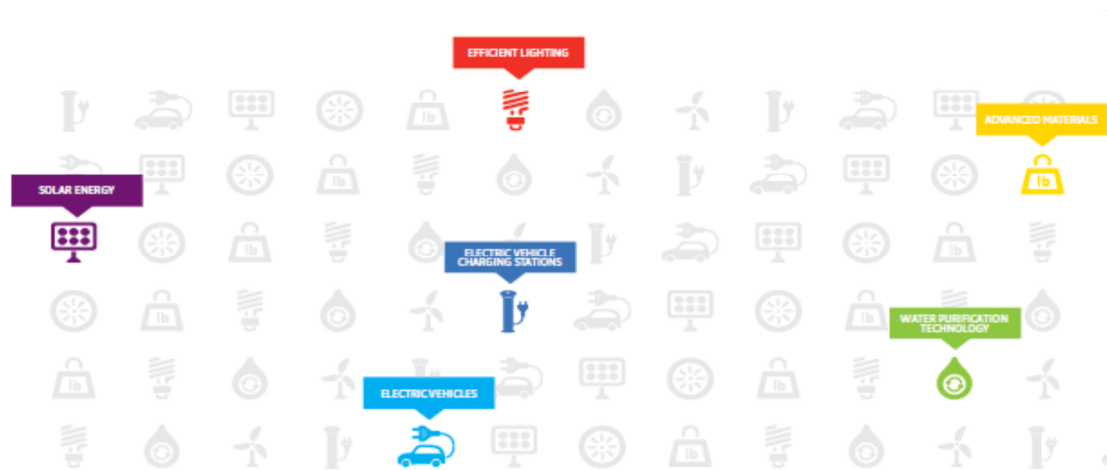
Cisco Smart+Connected Communities Solutions

‘The Home Experience’ allowing citizens to remotely manage their homes’ energy performance and security, remotely engage with your doctor and attend lessons and receive lectures from your living room. ‘The Office Experience’ similarly aims to provide you with your business critical information and data wherever you are, supports local authorities to allow officials to share and manage information between business units, and supports remote and tele-working.

⁶⁰ <http://www.smartconnectedcommunities.org/index.jspa>

The **GE Ecomagination**⁶¹ brand captures a variety of smart and sustainable innovation across its product and service range. Ecomagination is GE's business strategy to create new value for customers, investors and society by helping to solve energy, efficiency and water challenges. The initiative is overtly focused on sustainable and environmental goals, which in part reflects GE's role in providing the connections and appliances which will deliver renewable energy generation, and enable energy savings.

GE's product and service range includes the products to generate, store and distribute energy (in particular renewable energy), products and systems for buildings which minimise energy use, and the green and efficient vehicles and systems required to deliver smart public transport. GE also has a financing arm 'GE Capital' which provides financing for Smart city projects GE is involved with. One example of a project that GE participates in is the Solar4Schools scheme in the UK, which is profiled in the Organisation and Financing chapter.



Simple Energy: How Gamification Might Just Save the World

How Simple Energy works is that someone invites you to join an energy consumption challenge through Facebook or email. The platform establishes a baseline to compare energy consumption according to the size of your living space, location and climate.

Households are ranked on their energy consumption (or more specifically, ranked on their energy savings) against others in their group. Real prizes drive and in particular the competitive behaviour of children, drive significant energy savings.

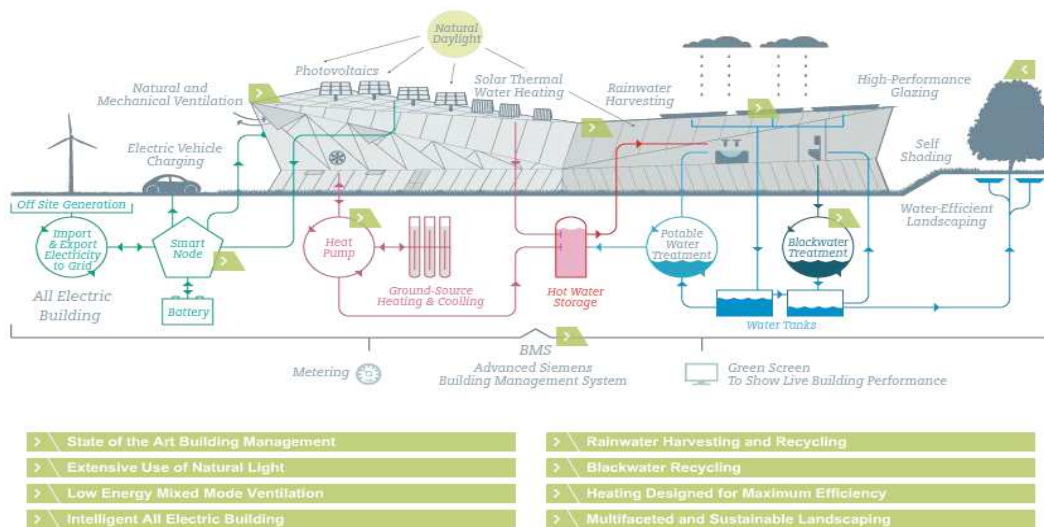
⁶¹ <http://www.smartconnectedcommunities.org/index.jspa>

Siemens Infrastructure and Cities⁶² division looks at supporting sustainable solutions for the Smart City, and will be launching the Siemens Crystal (Urban Sustainability Centre)⁶³ in London in 2012 to showcase the products and innovations of Siemens and their partners. Siemens also maintains the Green City Index⁶⁴ which looks at the performance of cities against a number of sustainability and wellbeing indicators.

Siemens offer products and services to support smart buildings, energy and water supply, traffic, safety and healthcare, including household appliances, building management sensors and systems, road and rail, traffic and logistics tools, as well as power distribution and smart grid technologies.

As an example of one of the initiatives Siemens is involved in, Siemens Energy joined forces with Viridity Energy, an American energy service provide, to offer power supply companies and network operators the technology required to implement virtual power plants. Virtual power involves the interconnection of a number of small power plants to be run by a central control system, resulting in more efficient and economical networks.

While Viridity offers their VPower system to forecast and optimise demand resources, Siemens provide their decentralised energy management system (DEMS). DEMS allows distributed generating plants to be networked into a smart grid using state-of-the-art information and communication technology.



Siemens have also developed Meter-to-Bill (M2B) which optimizes processes and information streams and integrates all relevant data within one innovative, single, comprehensive solution that enables better services and creates new business models. Furthermore, M2B improves management information while at the same time reducing costs through optimized and harmonized processes.⁶⁵

⁶² <http://www.siemens.com/entry/infrastructure-cities/cc/en/index.htm>

⁶³ http://www.thecrystal.org/_html/

⁶⁴ <http://www.siemens.com/entry/cc/en/greencityindex.htm>

⁶⁵ https://www.cee.siemens.com/web/austria/de/lostfound/it-solutions/news/Documents/Energy_SiemensM2B_PDF_e.pdf

6. Case Studies

Manchester, Barcelona, Amsterdam and Malmö all pioneers of smart and sustainable cities and centres of not only the innovation that underlie smart cities, but creativity which supports their sustainable development. Key to this are the institutional structures, technological innovation systems and cultures they have sought to create as the defining features of smart and sustainable cities, where universities, industry and government collaborate with one another.^{66 67} Their smart city initiatives are ICT-based, digital, orientated around the web and the notion of the future internet, and provide examples of where technical innovation has been embedded into city operations to such an extent that these cities are leading the way in demonstrating how cities can meet Europe's 2020 agenda on smart, sustainable, and inclusive growth.

Each city offers the opportunity to explore the technological innovation systems that enable a city to be smart in how it develops and enhances its services by electronic means, which can improve the efficiency and effectiveness of cities, stimulate innovation, aid economic competitiveness and social cohesion. Through the use of technology, these cities are enabling their economic, social, and environmental goals to be met, all of which are key to sustainable development. All four cities are using technology to reduce the carbon intensity of their economies and meet stricter environmental standards.

Each of the cities has developed ICT-related infrastructures to support sustainable and inclusive growth objectives, across social, economic, and environmental dimensions. They have supplemented this with the provision of inclusive public sector services provided via electronic means, over the web and through web-based services. Developments in technology, data capture, and knowledge of use and application have become the 'embedded intelligence' of smart cities, which provides a rich platform to allow cities to plan and deliver services which can consider:

- Life events of individuals including their safety and security, the quality of the built environment, provision of health, education, transport and mobility, energy, water and drainage services;
- The integrated and living nature of cities where access to urban services, promotion of public transport and other green forms of personal mobility, energy supply, energy consumption, energy-saving and carbon emission reduction measures, the smart metering of energy consumption, promotion of micro-renewable energy supplies, recycling of waste products to generate bio-fuels, introduction of distributed heating systems, establishment of water conservation measures, all interrelate and interact to create the conditions for sustainable community development;
- The integration of "quality of life" measures into sustainable urban development planning, as social, economic, and environmental data interrelate to allow for more intelligent and sophisticated development.

⁶⁶ Allwinkle, S. and Cruickshank, P. (2011) Creating smarter cities, *Journal of Urban Technology*, vol. 18, (2): 1-16.....

⁶⁷ Deakin, M. and Al Wear, H. (2011) The transition from intelligent to smart cities, *International Journal of Intelligent Buildings*, vol. 3, (2)

These cities act as leading examples where the adoption of smart, sustainable and inclusive agendas by universities and industry are acting as the main drivers of the knowledge economy and information society, and where the operation of smart governance strategies by city authorities provide the means to regulate the environmental sustainability of economic development activities.

The smart and sustainable city initiatives and projects for each of the four cities are profiled on the following pages. Each case study commences with a brief summary of the city and an overview of the key players involved in promoting smart city initiatives. Relevant strategies and/or targets for the delivery of smart and of sustainability objectives are mentioned. Smart city and related sustainability initiatives of the city are outlined, and specific urban development projects which combine smart and sustainable objectives in support of city strategies are described. Combined the case studies seek to give an overview of the key players involved in developing smart and sustainable city strategies, initiatives, and projects, to assist in understanding how smart and sustainable urban development projects evolve, are organised, and are financed. These issues are summarised in the Organisation and Financing chapter. Such issues are of key relevance to understanding how investments made by JESSICA financial instruments can support such projects, and thus how UDFs can make smart investments. This is explored in more detail in the JESSICA and Smart and Sustainable Cities chapter.

Low Carbon Economic Area

Manchester City Region was designated the UK's first Low Carbon Economic Area for the Built Environment in 2009

LCEAs were introduced by the Government to accelerate low carbon economic activity in areas where Britain's existing geographic and industrial assets give a locality clear strengths.

The Manchester LCEA for the Built Environment involves a 5 year programme which will:

- Address carbon abatement through deployment of existing technologies and accelerated investment in science, technology and innovation to bring new products to the market
- Raise employment and productivity levels by investing in the provision of appropriate low carbon high and low level skills
- Increase investment in Manchester and the UK in low carbon industries and their supply chains

Source:

http://neweconomymanchester.com/stories/1368-low_carbon_economic_area

6.1 Manchester

INTRODUCTION

The city of Manchester is leading the way in the research and development of new information and communication technologies (ICTs) for the purpose of enabling sustainable economic growth. Key players, organisations, and smart city initiatives underway in Manchester are included in Appendix A.

SMART AND SUSTAINABLE CITY PROJECTS

Digital Environment Home Energy Management System (DEHEMS)

With support from the City Council, Manchester is one of 5 'Living Labs' across Europe, which form part of the DEHEMS project.⁶⁸ The project looks at how technology can improve domestic energy efficiency. Participating households in the city are provided with intelligent electronic system infrastructure that provides real-time energy information, feedback on energy consumption, comparison of household energy consumption, and energy saving tips and alerts. Users provide feedback which will be used to develop understanding of the user behaviour context of such technology deployment. The project research indicated that people were keen to monitor consumption and save energy for a variety of reasons. Enabling households to view information about their usage and to make direct comparisons with other users helped to educate people on which appliances use the most energy, and the impact that altering their behaviour had on energy consumption. The result of the project was a change in consumption patterns amongst the household users, with an average saving of 26.03% in electricity consumption.⁶⁹

Eastserve

Manchester City Council formed an urban regeneration company called New East Manchester (NEM). This public-private partnership was formed operating on a not-for-profit basis with the purpose of establishing an online community network "Eastserve"⁷⁰. Eastserve was set up to connect

⁶⁸ The project received funding from the European Commission's Seventh Framework Programme 2007-2013

⁶⁹ http://www.dehems.eu/cms/wp-content/uploads/2010/06/D8.6_-Dehems_Deliverable.pdf

⁷⁰ The Eastserve project has used funding from a number of sources, including the Government scheme Wired Up Communities, the North West Development Agency, and the European Regional Development Fund.

Greater Manchester Strategy

The Greater Manchester Strategy was published in August 2009 with the vision:

"By 2020, the Manchester city region will have pioneered a new model for sustainable economic growth based around a more connected, talented and greener city region where the prosperity secured is enjoyed by the many and not the few."

The Strategy sets objectives for a Low Carbon Economy, encompassing the following elements:

- Internationally renowned research and consultancy excellence to help raise the profile of Manchester's low carbon leadership
- Investments in new skills and expertise for a low carbon economy
- Application of sustainability principles to procurement, transport, spatial planning and retrofitting of commercial and housing property

Source:

http://www.agma.gov.uk/agma/greater_manchester_strategy/index.html

residents of East Manchester to the internet and a community website. The scheme provided ICT training, subsidised computers, internet access to local households, and community information resources and services. The aim of this project was to:⁷¹

- Build the local community capacity by improving residents' ICT skills and by encouraging involvement in service provision
- Improve the area's economy by raising skills levels and increasing awareness of job opportunities and training
- Tackle crime and fear of crime and improving community safety through a confidential link with the police
- Address the lack of accessible amenities such as shops, sport and leisure facilities, health and community services, by providing web links to them

Surveys conducted on local residents in East Manchester revealed the following changes since the scheme began:

- An increase in broadband access from 2% to 25% in 4 years
- An increase in PC ownership from 19% to 52% in 4 years

Furthermore, the project received a high take up of online services such as an anonymous crime reporting service, and an interactive job database. Following the introductory ICT training that took place, 62% of respondents went on to further training, and 44% of these achieved a recognised qualification.

SHINE

Stockport Homes launched the SHINE project in 2011, setting out to install solar photovoltaics across 1,200 of its properties. As part of the scheme, Stockport Homes implemented a comprehensive behavioural change strategy for its customers. The strategy includes educating tenants on the most effective use of the new systems to ensure that the technology is used correctly.

The project has been set up in partnership with Procure Plus, a social housing procurement consortium, as an independent advisor. Procure Plus have used their purchasing and framework models to secure significant cost savings on materials and contractors, averaging a unit price saving of 50%.

The project supports the local economy and job market through the use of local businesses such as contractors to install the units. Furthermore, the project engages ex-offenders from the community to undertake training and employment through the SHINE scheme to install and maintain the solar panels.

The project uses capital investment of up to £9.5million⁷², initially financed via public borrowing agreements. The borrowing costs will be met through the revenue income streams provided by the

⁷¹ <http://www.idea.gov.uk/idk/core/page.do?pageId=8027678&aspect=full>

⁷² <http://democracy.stockport.gov.uk/documents/s721/Report.pdf>

UK Feed-in-Tariffs. Further detail of the proposed financial model for the scheme is provided in the Stockport Council Executive Meeting Report.⁷³

Corridor Manchester

Corridor Manchester is a partnership bringing together Manchester City Council, the University of Manchester, Manchester Metropolitan University, and the Central Manchester University Hospitals NHS Foundation Trust. The partnership, based on a 243 hectare area known as ‘the Corridor’ is focussed on driving economic growth and investment in the knowledge economy for the benefit of Manchester city. The board also has representatives from both public and private sector organisations.

Corridor Manchester has published a Strategic Vision to 2020⁷⁴, that globally and locally, people will recognise the Corridor as a place that is original, creative and smart, and where knowledge is put to work. The vision is articulated across five themes: sense of place, transport, environment and infrastructure, research and innovation, and employment, business, and skills.

Overall, Corridor Manchester will oversee capital investment in the area of approximately £2.5billion. The investment will be used to secure major improvements, including:

- new digital infrastructure, such as the innovative i-tree project, which involves the creation of a living laboratory to investigate the contribution of green cover to climate change resilience and adaptation.⁷⁵
- investment in public transport to provide a more efficient system, increase accessibility, improve air quality and support green travel planning measures in the city such as:
 - pilot green roofs scheme
 - geothermal project
 - pilot digitalisation scheme
 - implementation of Employment, Enterprise and Skills Plan

The revenue costs of Corridor Manchester will be met with the scheme’s partners with an agreed combination of cash and in-kind contributions. The capital funding will vary by project, but will be drawn from funding sources, private investment, and public funding from Northwest Regional Development Agency.

MediaCityUK

Media City is a new mixed-use complex, involving the redevelopment of a brownfield site in the Salford Quays area of Manchester.⁷⁶ The scheme is owned by the Peel Group, one of the leading infrastructure, real estate and investment enterprises in the UK.

⁷³ <http://democracy.stockport.gov.uk/documents/s721/Report.pdf>

⁷⁴ http://www.corridormanchester.com/_filestore/corridormanchester/cm-strategic-vision-2020-pdf/original/CM_strategic_vision_2020.pdf

⁷⁵ http://www.sed.manchester.ac.uk/architecture/research/ecocities/projects/associatedprojects/associated_projects_%20itree.pdf

⁷⁶ Funding has been provided from various sources. Public sector support has come from the Northwest Regional Development Agency (NRDA), Central Salford Regeneration Company, and Salford City Council. The European Regional Development Fund committed £4.2 million to the project, while the NRDA invested over £30million in the physical development of MediaCityUK.

The development is the first scheme in the world to become a BREEAM approved sustainable community.⁷⁷ Examples of sustainable design at the site include:

- Gas-powered tri-generation energy plant using water from the Manchester Ship Canal, which is twice as efficient as conventional grid electricity, reducing CO₂ emissions
- An advanced communications network consisting of over 20 million metres of fibre optic cable capable of delivering fast internet speeds
- A new metrolink station, high-frequency bus service, and improved footpaths and cycleways to Manchester city centre, with other improvements including the recently installed 300 cycle parking stands

Low Carbon Housing Retrofit Strategy

Greater Manchester proposes to launch a Low Carbon Housing Retrofit Strategy, which is currently in draft status. The Strategy sets out the plan for a wide-scale retrofit of 1.2 million homes with heat, energy, and water saving improvements, with the intention of achieving carbon reductions of 55% by 2022. The focus on retrofitting homes stems from the fact that in Manchester household energy use accounts for 36% of CO₂ emissions.

The Strategy acknowledges that there is limited public sector funding available, therefore it states that a combination of funding, subsidy, and private finance to reduce upfront capital costs will be needed. The form of private sector finance sought will be debt or equity finance for micro-generation and building fabric improvements. Sources of funding such as ECO and ERDF, and subsidy such as the UK feed-in-tariff and the UK Renewable Heat Incentive will also play an important role to attract and underwrite private finance for domestic retrofit.

The Strategy sets out three broad categories of investment that could be attracted in order to finance domestic retrofit:⁷⁸

- *Public borrowing agreements and bank debt: Lending on a project finance basis, alongside funding from ECO and ERDF*
- *Community and mutual finance: Community equity or local bond issues to finance community renewable installations and whole house retrofits*
- *Institutional investment: Investment by pension funds and commercial investors once the risks and returns are better understood.*

SMARTER

SMARTER is a project delivered by New Economy in support of the city's status as a Low Carbon Economic Area.⁷⁹ ⁸⁰

The project involved providing energy monitors to 100 businesses and 400 Housing Association homes between 2010 and 2011. The project looked to analyse behaviour patterns, and hoped to

⁷⁷ <http://www.mediacityuk.co.uk/#>

⁷⁸ <http://www.envirolink.co.uk/wp-content/uploads/2011/10/GM-Low-Carbon-Housing-Retrofit-Strategy-discussion-draft.pdf>

⁷⁹ SMARTER is financed by the Carbon Challenge Fund and the Carbon Innovation Fund.

⁸⁰ ne.stardotserver.co.uk/downloads/650-NE-095-10-SMARTER-II-doc

make savings of 8% in cost and carbon emissions. In 2010 an application was made to expand the project as 'SMARTER 2', delivering in total 1500 installations across the northwest. The application was accepted, providing £500,000 of ERDF funding to support the total project cost of £1m.

The second phase of SMARTER aims to review different smart meters on the market and identify the most appropriate technology to use when rolling out the scheme. Ultimately, this project aims to identify any challenges in terms of support and equipment, and to understand the behavioural change benefits associated with smart metering to support the longer term goal of wider roll out. A financial model was prepared based on tendered figures obtained for the Phase 1 equipment.

Greater Manchester Climate Change Strategy

Manchester was designated a national Low Carbon Economic Area in 2009, and has since set ambitious goals for its future. The Greater Manchester Climate Change Strategy for 2011-2020 states four objectives as follows:¹

- We will make a rapid transition to a low carbon economy;
- Our collective carbon emissions will have been reduced by 48% on 1990 levels;
- We will be prepared for and actively adapting to a rapidly changing climate;
and
- 'Carbon literacy' will have become embedded into the culture of our organisations, lifestyles and behaviours.

6.2 Barcelona

INTRODUCTION

The city of Barcelona has witnessed significant economic development and growth in recent years, with increasing focus on how to do this in a socially, economically, and environmentally sustainable manner. Since the Barcelona 1992 Olympic and Paralympic Games, the city has attracted investment and development and prospered through its transformation. Creation of new infrastructure to support the growth and redevelopment has been essential; however the city has looked beyond the short term and adopted measures to allow for on-going sustainable growth.

Most notably, Barcelona has adopted ICT and mobility solutions to support its growth. The City Council has placed particular focus on the use of ICT to transform the business processes of public administration, by developing a new concept of a municipal portal which aims to use the internet as its main channel of communication with citizens and businesses. The extension of the municipal WiFi Network has been designed to allow permanent broadband throughout the city streets to connect a wide range of services, including sensors, parking meters, public lighting control, access control bollards, information panels, surveillance cameras, and municipal fleet connection. The driving forces of smarter development have been the appearance of new technology, knowledge and innovation.

Barcelona has participated in a number of smart city initiatives, and progressed pilot schemes in new areas such as smart metering, to become a city at the forefront of smart and sustainable regeneration.

Barcelona won an award in 2007 sponsored by ManagEnergy⁸¹, for their commitment to sustainable energy solutions. The city ranks among the Western world's cities with the lowest CO₂ emissions per capita.

Key players and smart city initiatives within Barcelona are contained within Appendix A.

⁸¹ www.managenergy.net

Barcelona Energy, Climate Change and Atmospheric Quality Plan 2011-2020

Barcelona is updating their Energy Improvement Plan to provide a new programme up to 2020.

The main goals of the plan include reducing energy consumption by 9%, reducing CO₂ emissions by 16%, and improving the quality of air. The strategic plan sets out 108 measures to achieve these targets. The plan includes plans to gain financial support for the restoration and renovation of buildings to integrate energy efficiency criteria.

In 2010, the EIB, Caixa Catalunya, and la Caixa agreed to finance projects included in the plan, with a total investment of EUR 500m. The EIB set up two credit lines to be managed by the banks, who also contribute funding, to partly finance small and medium scale solar power and energy efficiency projects.

Source:

<http://www.barcelonaenergia.cat/eng/operations/pmeh.htm>

<http://www.eib.org/projects/press/2010/2010-059-espana-el-bei-aporta-250-millones-de-euros-al-programa-de-energia-y-cambio-climatico-de-la-diputacion-de-barcelona.htm>

SMART AND SUSTAINABLE URBAN DEVELOPMENT PROJECTS

Bicing –Smart Bicycle Scheme

Bicing is the community bicycle system in Barcelona, set up in 2007. The scheme is managed by the city council and Clear Channel. Over 400 stations across the city provide over 6,000 bicycles to rent, located at regular intervals and at transport interchanges.

The system uses a smart technology system with contactless cards which are swiped at services stations to unlock the bikes. The system is able to recognise bikes when they are returned to the stations. The aim of the system is to encourage sustainable travel within the city and thus reduce CO₂ emissions from transport. The technology system integrates the bike fleet software with a web page which allows users to browse where the bikes are stored, and the availability of free bicycle parking spaces. Users may also view information on their history of use, including the total time they have used the service. The Bicing portal has proven to be popular with over 30,000 users in its first two months, hence the integration of ICT is helping to attract people to use this form of sustainable transport.

The scheme is largely financed through on-street parking charges for motorists. This is supplemented with income from the telephone number that users are required to call for customer services and the rental costs when users exceed 30 minutes of hire.

Solar Powered Bus Stop Information Systems

IED Barcelona (the International school of design, fashion, visual arts and communication in Barcelona), Capmar SL and EMT (The Metropolitan Transport Body) worked together to produce a solar powered bus stop information system for implementation in Barcelona.⁸² The bus stop provides information on the bus network with digital information on real-time bus information, updated every 30 seconds to help inform public transport users. The bus stop provides data through a GPRS connection powered by solar energy. The digital screens have been designed to use minimal levels of power to enhance the energy saving process. Using solar power also reduces the energy bills to the transport authority.

⁸² The project has benefitted from investment of €550,000 from EMT

Barcelona ICT Projects

Barcelona is fast becoming known as a digital city, with a growing ICT sector placing it as one of the European regions with the highest percentages of population in high technology. Important ICT projects in the city include:

- Telefonica R&D Centre
- Innovation Centre Barcelona Media
- ICT Technology Centre
- ICT House
- MediaICT Space (22@Barcelona)
- Barcelona Centre of Virtual Reality
- Foundation i2Cat
- LaSalle Innovation Park
- UPC North Campus
- Barcelone Supercomputing Centre
- Barcelona Nord Technology Park

Source:

<http://www.slideshare.net/barcelonabusiness/ict-information-and-communications-technologies-in-barcelona-and-catalonia/download>

The project placed an order in 2009 for 100 bus stops for delivery in the metropolitan area.⁸³ Ultimately the intention is to replace 2,000 existing bus stops with the new solar powered model.⁸⁴



Source: <http://www.ecofriend.com>

Solar Thermal Ordinance

The Solar Thermal Ordinance was approved by Barcelona City Council in 1999 and came into effect one year later in 2000. The Ordinance requires all new buildings, renovated buildings, or buildings changing their usage plans (both private and public) to generate 60% of their hot water requirements from solar energy.

Since its implementation in 2000, the number of solar panels in Barcelona has increased by 1,780%, effectively saving 32,076 MWh/year from hot water energy consumption. The equivalent CO₂ savings achieved are in the region of 5,640 tonnes per year.

⁸³ www.iedbarcelona.es

⁸⁴ <http://www.advisolar.com/attachments/article/241/Promotion%20of%20Solar%20Energy.pdf>

22@Barcelona Innovation District

22@Barcelona is a regeneration project involving 200 hectares of land in the Poblenou area of the city. A municipal society was set up in 2000 by Barcelona City Council as a separate company to promote and manage the project.⁸⁵

The purpose of the project was economic, urban, and social renewal over a 20-25 year period, and has since transformed a previous industrial area into a new urban development comprising green space, businesses, retail units, and new homes. In total in the ten years since it began, the regeneration has seen the set up of approximately 4,500 companies creating over 55,000 new jobs. There are more than 1500 companies in 22@ which didn't exist previously.



The district promotes innovation and collaboration between research centres, universities, and commercial businesses, setting a model for economic development which the city council now intends to implement elsewhere in the region. The area consists of masterplanned areas, and aims to act as a demonstration project to test new means of service delivery.

The project has piloted a number of smart technology initiatives including on-street electric vehicle charging points, a dark fibre network, bluetooth sensors for traffic measurement, parking sensors, pollution sensors, centralised climate control system, a selective pneumatic waste collection system, a new power grid, and public lighting sensors. The area is also home to a LivingLab and ICT & Media Research Centre. More than 69% of the companies that have located in the 22@Barcelona district are related to media, ICT, MedTech, energy or design.

22@ is a lab where ICT is the backbone which can help deliver services such as waste collection, water, energy. ICT has been embedded in the concept of 22@, using this sector to promote competitiveness among companies based in the district, and to establish the district as a European reference point in the ICT sector. ICT projects underway in the area include the MediaTIC building, 22@Interface building, ICT technology centre, 22@Living Lab, mobile infrastructure, and shared services. The main companies involved are ICT companies, utilities, and transport/mobility companies.

Investment in the infrastructure totals over €180million.⁸⁶ Investment was provided both by the Barcelona City Council but also through contributions from real estate developers on the premise that the investments would raise the value of the real estate subsequently. Utility companies also invested in infrastructure development. The dark fibre network is rented to mobile telecommunication providers thus generating revenue for the City. Most of the infrastructure was financed from private sources such as through planning gains negotiated by the city authorities in relation to approvals awarded for development. Individual projects within 22@ are often financed by venture capital, although loans and grant funding are also used.

⁸⁵ <http://www.22barcelona.com/content/blogcategory/33/403/lang,en/>

⁸⁶ http://www.22barcelona.com/documentacio/22bcn_1T2010_eng.pdf

6.3 Amsterdam

INTRODUCTION

The city of Amsterdam is a leader in the implementation of projects and initiatives to drive sustainable economic growth.

The Municipality of Amsterdam has developed 'New Amsterdam Climate' to provide a formal framework to support the transition to a city with reduced carbon emissions. New Amsterdam Climate sets out the city's vision to reduce CO₂ emissions by 40% in 2025 compared to 1990 levels.

The city has adopted a collaborative approach to help deliver the 2025 goals. A scheme known as Amsterdam Smart City has been established, uniting the city's residents, businesses, and local authorities to help deliver the ambitious goal of moving towards a more sustainable future.

Projects taking place in the city range from smart grids, solar energy, wind farms, smart mobility, electric vehicles, smart street lighting, and distributed energy management systems. The city promotes itself as a Knowledge Capital and digital gateway, with a strong focus on ICT.

Amsterdam Innovation Motor created an ICT cluster to facilitate the growth of projects focusing on flexible working, health, and eGovernment, and to attract and retain innovation talent in the city. Over 60,000 people are now employed in the ICT sector in Amsterdam.

Amsterdam has established two revolving funds, one for Innovation – Amsterdam Innovation Fund, and one for sustainability – Amsterdam Sustainability Fund, which help to fund smart and sustainable projects in the city. The city has been awarded the European City Star Award 2011 for its exemplary work in demonstrating how cities can make successful efforts to use energy sustainably, and was ranked 5th in the Siemens European Green City Index.

SMART AND SUSTAINABLE URBAN DEVELOPMENT PROJECTS

Amsterdam Smart City Projects

A range of projects have been set up covering sustainable living, sustainable working, sustainable mobility, and sustainable public space. Projects include the use of technologies such as distributed generation, energy advice, energy displays, energy storage, smart meters, smart lighting,

Amsterdam Smart City

The Amsterdam Smart City initiative includes the following projects:

Sustainable Living

- Neighbourly living in Geuzenveld
- West Orange
- Emanagement Haarlem
- Onze Energie
- Smart Challenge

Sustainable Working

- ITO Tower
- Monumental Buildings
- Decentral Generation: Fuel Cell Technology
- Zuidas Solar Challenge
- Online Monitoring Municipal Buildings

Sustainable Mobility

- Ship to grid
- Moet je Watt

Sustainable Public Space

- Klimaatstraat
- Smart Schools Contest
- ZonSpot
- Swimming Pools

Source:

http://issuu.com/amsterdamsmartcity/docs/smart_stories

electric vehicles, EV charge points, electric waste collection, and sustainable logistics (i.e. low-carbon delivery and supply processes).

Each project involves collaboration between different companies. For example, 500 households in Amsterdam tested energy feedback displays connected to smart meters in the 'West Orange' project initiated by Nuon, IBM and Cisco. The displays were supplied by Home Automation Europe. The project aimed to analyse behaviour and how consumption reduced as a result of the smart meter installation. Further similar projects followed as a result.

Another project tested is 'Onze Energie', an initiative to collectively finance seven wind turbines. The collective financing approach was intended to overcome the high investment costs that exist for consumers wishing to generate their own energy. The scheme enables groups of energy consumers to invest together towards the cost of setting up and operating wind turbines. Large commercial operators make up the remainder of the investment costs.

Amsterdam Harbour is investing €2.5million in a project to install 73 ship to grid electricity points for barge vessels and river cruisers. Ship to grid electricity is more sustainable and generates fewer CO₂ emissions and provides a significant improvement compared with the existing diesel generators. The ICT infrastructure was developed by Utiliq, which enables the skippers to activate the power points by telephone or internet.

The energy savings on average were 13.2%. However, these were highest in Public Space projects which totalled 22.6% savings. In total the projects achieved a saving of 12,102 tons of CO₂ per year. It is estimated that scaling up the projects could realistically result in savings of 170,945 tons of CO₂ per year, though they have the potential to achieve savings of over 1 million tons per year.

Amsterdam Zuidas

Zuidas is a major new development zone in Amsterdam, and will ultimately be a new urban centre devoted to international commerce and knowledge development, home to 25,000 permanent residents, 80,000 employees and 30,000 students. The aim of Zuidas is to be one of the ten most sustainable urban centres in Europe, through creation of a clean and pleasant human environment.

Zuidas was designated by central government as one of its New Key Projects in 1997. The entire project is a Public Private Partnership, with the Dutch Ministry of Finance and the Municipality of Amsterdam each having a 20% stake, and the remaining 60% allocated between other private companies.

Facts about Zuidas include:⁸⁷

- *When complete there will be 10,000 bicycle spaces within a few metres of Station Zuid*
- *Amsterdam Bright City, located in Zuidas, is a joint initiative of ABN AMRO Bank and VU University, intended to bring academic talent and the private sector together.*
- *The renovation and construction of the Vivaldi Offices I and II resulted in a saving of over 70% in the energy requirement for lighting. The project won the European Commission's 'Green Light' award as a result.*

⁸⁷ <http://www.zuidas.nl/en/thema/sustainability>

- *The Gershwin development will include only energy-efficient homes with an Energy Performance Coefficient (EPC) some 10-20% lower than the standard legislative requirement of 0.8.*

District Heating and Cooling

Amsterdam has been investing in the growth and innovation of district heating and cooling. The system makes use of the residual heat from power plants in and around the city to supply heat to homes, and additionally make use of cold temperatures captured in winter to use for district cooling. Both schemes help to save energy and reduce CO₂ emissions. Innovation to develop the technology for the system has allowed major expansion. The Municipality of Amsterdam and Nuon have been collaborating to facilitate the expansion of the district heating system.

Developments that have enabled improvements include reorganisation to form a public private partnership, the exploitation of sustainable energy source (e.g. waste heat from biogas plant), and technical improvements to the network. District heating can save 50-80% of energy and CO₂ emissions, while district cooling saves approximately 75% in energy and CO₂ emissions.⁸⁸

It is considered that the public private partnership approach between the City and the utility company offers many advantages, and the joint investment has reduced the financial risks for both parties. Typically the financing of district heating projects involves losses at the beginning and high investment costs. Any increase in consumer numbers requires further investment, though profits are made as the project progresses. A mature project can generate constant cash flow to be used to finance other projects. Investment of approximately 7,000 Euros is required per property. The two district cooling projects underway in Amsterdam required an investment of approximately 40million Euros each. Nuon are working on financial improvements of these two projects before expansion of the scheme.

⁸⁸ http://www.districtenergyaward.org/download/awards2011/Expansion_Netherlands_Amsterdam_2011.pdf

6.4 Malmö

INTRODUCTION

The City of Malmö has a long tradition of working to advance sustainable development. The interest, engagement, and leadership from the top has been the most important factor for the city of Malmö to be well known internationally in this area. The cooperation with external partners such as energy companies, building developers, estate owners and other companies in the cleantech sector has also been a key factor for success. The city also has a strong focus on using green technology to aid development, having signed up to the Green Digital Charter to encourage more effective integration of ICT with energy efficiency measures.

A key factor of success for the city has been the identification of contribution, loans or other financial support for sustainable development projects. Public private partnerships are of particular importance. Malmö would not have come this far without the strong cooperation and involvement of different stakeholders. Private companies, developers, utility companies, the University and other key actors are engaged and cooperate in the different projects.

In addition to specific sustainable urban development projects which seek to make strategic use of ICT to enable the city to be 'smarter', the City of Malmö also has developed its online services, such as Sara, an interactive online help website, which answers citizen questions 24 hours a day.⁸⁹ It is also involved with PERIPHERIA, as part of a Living Lab project, as a pilot which aims to deliver future internet platforms and services for the promotion of sustainable lifestyles.

SMART AND SUSTAINABLE CITY PROJECTS

Western Harbour

The Western Harbour project in Malmö is an ecological development in the south of the city on a former dockyard area which has been evolving over the last two decades. The development will ultimately be mixed use, with commercial, residential, education and retail establishments. The aim is for the project to be an international example of best practice in environmental adaptation of a dense urban area.



Source: www.malmo.se

The City of Malmö initiated the development scheme which started with B001 – City of Tomorrow including housing, offices shops and services on the site of a previous industrial park. B001 was the first large demonstration area for sustainable urban development, and following dialogue between developers and the owners of the estate, a contract was entered into by all parties, which included

⁸⁹ <http://www.edemocracy-forum.com/2009/09/malmo.html>

aims and objectives in relation to energy efficient buildings, smart energy installations and renewable energy.

The development featured:

- Vacuum waste system and waste to biogas plant
- Renewable energy systems
- Energy efficient/passive houses. These were modelled using ICT to demonstrate how different efficiency measures could affect the energy performance of the house.
- Biodiversity
- Smart meters
- Electric vehicles

Each individual project within the development was led by the relevant companies including building developers (Skanska, NCC, PEAB etc), the utility company (E.ON).⁹⁰ Many of the projects did not have a reasonable payback period (and sometimes did not have any repayment at all).

Fullriggaren is a new sustainable district in the Western Harbour, which received grants from the Swedish Delegation for Sustainable Cities to enable it to pilot and provide examples of sustainability initiatives including:

- Passive and low energy houses
- Renewable energy
- Carpools
- Automatic food waste disposal systems
- Greenwalls and green roofs
- Certification of green buildings

The Western Harbour is also set to include eight smart energy villas, commissioned by E.ON. These will incorporate smart technology solutions to reduce energy use and allow for generation of electricity and hot water. Integrated electric and biogas vehicles, and all waste heat and household waste will be recycled. Residents will be able to monitor all electricity, heating, and water consumption.

Hyllie

Hyllie is a new sustainable district in the city of Malmö which will eventually provide 8,000 homes along with employment and supporting facilities. One of the project aims is for it to be supported completely by renewable energy by 2020 and for the energy to be used locally through an advanced IT solution called DEMS (decentralised energy management system) developed by Siemens and demand response control system (smart grid) in conjunction with E.ON.

The development is planned to include projects such as the use of renewable energy systems, food waste collection for biogas, CHP energy production, small scale power generation from solar thermal systems, energy efficient buildings, smart grid applications, and electric vehicles.

⁹⁰ Projects were financed through a combination of European and national funds, as well as investments from the companies themselves.

The smart grid solution for Hyllie aims to balance production and consumption, and regulate demand so that energy is used when supply is plentiful (e.g. when the sun is shining or wind blows). Consumers play a key role through understanding energy use and adjusting behaviour accordingly.

For the smart grid, EON and Siemens are developing and testing the system. An application to the Swedish Energy Agency has been made to part fund the project. Match funding will come from E.ON and other private sources.

Ekostaden (Eco City) Augustenborg

Ekostaden (Eco City) Augustenborg is a program designed to make the residential area of Augustenborg a more sustainable neighbourhood, in terms of its social, economic, and environmental qualities. The redevelopment is one of Sweden's largest urban sustainability projects, financed by the government's Local Investment Programme along with the City of Malmö and MKB Housing as partners.

Initiatives that form part of the project include individual smart meters for energy consumption, solar panel installation, wind power plant, restructuring of the road network, new electric powered trains, a car pool for residents, recycling systems for waste and food waste and energy efficient buildings.

Further projects at the site include the Future Laundry Room, a new facility with energy efficient washing machines, smart technology and improvements to the operation of standard laundry facilities to enhance its appeal. Another project at the site is the Green House, which includes climate smart solutions, buildings where local residents can grow their own produce, and an advice service on green living.

Sustainable Rosengård

Sustainable Rosengård is a project to transform the Rosengård area into a more socially, economically and environmentally sustainable district. The intention of the project is to create new social arenas for meetings and activities, new job opportunities, and better infrastructure linking Rosengård with Malmö.⁹¹ The scheme was initiated by individuals in a shared equity housing scheme, BRF Hilda. Hilda is in the Rosengård area, and the company is one of the largest housing cooperatives in Malmö.

The housing estate of Hilda was in desperate need of redevelopment and investment to become energy efficient and climate friendly through sustainable technical solutions. Some of the solutions used at Hilda include:⁹²

- individual water meters
- a new ventilation system which cuts electricity and heating costs by a third
- efficient heating system

⁹¹ <http://www.malmo.se/Medborgare/Miljo--hallbarhet/Miljoarbetet-i-Malmo-stad/Miljoprojekt/Hallbar-stadsutveckling/Hallbara-Rosengard/Sustainable-Rosengard.html>

⁹² http://www.hsb.se/malmo/hilda/sustainable-hilda-_english-version/replumbing-and-bathroom-renovation-

- renewal of all radiators to provide thermostat controlled radiators which will lower energy consumption
- rainwater recycling to flush toilets
- food waste to biogas facilities
- solar panels on tower block roofs

The energy savings predicted to result from the redevelopment are significant enough that the cost of managing the housing co-operative will remain unchanged over the next ten years. The climate friendly energy solutions are estimated to reduce CO₂ emissions by 350 tonnes per year⁹³.

When the work started at Hilda, the housing cooperative had negotiated loans of 240million Swedish kroner. The cooperative then applied for co-financing through the EU's LIFE programme and from the Delegation of Sustainable Cities. The City of Malmö assisted Hilda with the financing applications.

Climate Centre Sege park

Sege Park is Sweden's new centre for renewable energy, where future energy solutions are developed. The park is home to solar thermal installations for heating, and photovoltaic installations for electricity production. The facility has been designed to exploit Malmö's natural resources of wind and sun, and is home to Sweden's largest solar panel establishment. The area Sege Park is an old hospital area aiming to become a sustainable neighbourhood. Sege Park includes photovoltaics, Stirling powered solar plant, wind power, street lights powered on solar energy, and local heating production.

The land at Sege Park is owned by the City of Malmö, and was developed by the Department of Internal Service.⁹⁴

⁹³ http://www.hsb.se/malmo/hilda/sustainable-hilda_-_english-version/climate-friendly-visions-embodied-in-hilda-?select=1.134040

⁹⁴ <http://www.bbcs.dk/media/previous%20events/Sege%20park.pdf>

7. Organisation and Financing

Introduction

This chapter considers how smart and sustainable city initiatives and projects are initiated, evolve, procured, delivered, and financed. The information within this section derives from interviews conducted with key players involved in the smart city initiatives in the selected case study cities, as well as those involved in smart city initiatives across Europe. A list of organisations consulted in the course of the research is attached in Appendix B.

Understanding more about the organisation and financing of smart and sustainable city initiatives can help cities to appreciate the practicalities of smart and sustainable urban project development and delivery. In addition, such understanding is important when considering the potential role of JESSICA in Smart and Sustainable Cities, and particularly where UDFs may be able to invest in smart city initiatives and projects, or be smarter in their investment strategies, which is the subject of the next chapter.

Why are cities involved?

While motivations differ from city to city, case study and industry interviews suggest that the main drivers for advancing smart and sustainable city initiatives are as follows:

- Meeting sustainability objectives and targets, especially with regards to reducing carbon emissions;
- Increasing decentralisation of energy supply;
- Security and affordability of energy;
- Reducing the cost of public service delivery, especially in the current economic climate; and
- Digital inclusion – i.e. enabling broad based socially inclusive access to wireless and digital services.

Reducing carbon emissions plays a key role in area based smart and sustainable urban development projects, most notably in Amsterdam and Malmö, whereas access to ICT is more prominent in city wide initiatives, especially in Manchester and Barcelona. Industry representatives note

Low Carbon Networks Fund

Ofgem established the Low Carbon Networks (LCN) Fund in 2010 in the UK. The fund provides up to £500million over five years to encourage electricity network companies to test and anticipate how the networks will need to change for a low carbon future.

The LCN will part finance projects which apply for assistance. The projects are assessed by the degree to which the solution being trialled:

- accelerates the development of a low carbon energy sector
- has a direct impact on the operation of the distribution network
- has potential to deliver net benefits to existing and/or future customers
- generates new knowledge that can be shared amongst all network operators.

Projects underway include trialling smart meters, implementing new energy tariffs, and trials of new ways to dynamically control voltage on the electricity network.

that Nordic countries have a strong culture of sustainable living and are leading the way in searching for ICT solutions to improve the sustainability of their cities. The strong emphasis on reducing carbon emissions as a key driver for smart city initiatives may also be attributed to the focus of this study on smart *and sustainable* city projects, in that for many, sustainability is often viewed currently as being synonymous with carbon emission reduction, rather than perhaps the broader definition of sustainable development encompassing economic, social, and environmental development. While carbon emission reduction is clearly important for city authorities in particular, other smart city initiatives mentioned in chapter 3.2, such as smarter public service planning and delivery, also feature in city planning, in order to reach more extensively the social, economic and environmental goals of the city, which in the interviews undertaken received less emphasis.

In terms of broader drivers, perhaps unsurprisingly, city authorities put greater emphasis in projects supporting economic growth and job creation as well as issues of public access to ICT, whereas industry representatives emphasised efforts to ensure energy security, supply, and decentralisation.

How initiatives start

Case study and industry interviews demonstrate the key role that city authorities, and in particular City Councils, play in initiating smart and sustainable city initiatives. Smart city initiatives tend to evolve from, and support, city wide strategic or spatial planning strategies and documents (which in general could be considered compliant with the criteria for Integrated Plans for Sustainable Urban Development in JESSICA operations) which include sustainability objectives and targets, as in Malmö and Amsterdam, and/or city wide energy plans as in Malmö and Barcelona, and/or ICT objectives, as in Manchester.

In support of such strategies, individual local government authorities, or partnerships of public authorities governing a broader city regions may establish or support initiatives to advance smart and/or sustainable objectives, such as the Manchester Digital Development Agency, or the Amsterdam Innovation Motor, or participate in European networks or initiatives, such as ENoLL. Authorities develop relationships with a range of possible private partners to generate ideas on what could be achieved and how, and/or stimulate interest from developers and/or technology and utility providers and suppliers to support their smart and sustainable city initiatives.

Technology and energy companies are keen to participate in such partnerships, workshops, or discussion forums to understand more about the cities objectives and aspirations, help develop and inform strategy and project development, increase Authorities' understanding of their services and products, and assist cities in identifying solutions to the challenges they wish to tackle. Such partnerships generally require staff and funding to coordinate, develop ideas, and identify pilot projects. Each organisation tends to contribute their own time and expertise in support of these discussions.

Companies seek out cities to work with according to strength of existing relationships, and alignment of objectives (e.g. on sustainability between the city and corporate strategies). Whether there is an existing smart city initiative can also influence the decision to get involved, as it means that there is existing knowledge and momentum, and cities will need partners in order to meet their targets, e.g. as in Manchester.

Companies are also keen to get involved where there is an opportunity to bring a new product or service to market, and open up a dialogue to access and inform future business. One company representative noted that as the energy industry is changing significantly for energy companies to change relationship between themselves and their clients from one supplier to one of advisor, those in the energy industry need to have good relationships with those who are influencing changes in the energy system.

Industry representatives interviewed state that critical to their involvement is political commitment and leadership from the main administrative body for a city, and where there is a Mayor of a city, this was frequently cited as key to initiatives arising.

Pilot projects

Initial stages of activity in cities tends to focus on research, which is either funded by ERDF grants, European research programme funding or where there is a more formal partnership between the City Authorities and supplier, by the provision of in-kind support from technology companies and suppliers.

Testing new technologies through pilots forms a key initial step, and such pilots form the dominant focus of activity within the case study cities, and others involved in smart and sustainable urban development projects. This is illustrated through the examples below and comments made from case study stakeholders:

Amsterdam

Amsterdam's smart city initiative started through the identification of a list of 20 pilot projects in different areas of the city. Most smart meter projects have thus far been pilots, with no large rollout programme yet in progress, although it is hoped that this could happen in the future.

Barcelona

Smart city initiatives within Barcelona provide the opportunity for companies to pilot and test their services, allowing for knowledge creation gained from learning through project delivery.

Malmö

In Malmö, the Western Harbour and Hyllie are being used as a means to demonstrate the feasibility of using new technologies in development. Other projects also aim to demonstrate the use of new techniques and technologies to create smart and sustainable urban development. The City of Malmö has worked closely with E.ON on several of these projects which provide an opportunity to share knowledge and learning to look at future projects and city wide applications. The development at Western Harbour resulted in the Environmental Building Programme. This governs sustainable urban development for projects where the City of Malmö or Lund Municipality is the land owner, and is an internet based platform for constructive and strategic collaboration between municipalities, construction companies and others.

Manchester

Manchester's Digital Environment Home Energy Management System (DEHEMS) and SMARTER project both seek to demonstrate energy savings achievable through the use of technology. The second phase of SMARTER seeks to identify challenges and behavioural change issues to support the longer term goal of a wider roll out of smart meters.

Collaboration, Partnering, Procurement, and Public Private Partnerships: Relationships between Industry and City Authorities on projects

To assist other cities in understanding how to develop and implement smart and sustainable urban development projects, one of the questions posed to case study cities was how projects and pilots arise, and whether these are initiated by the City Authorities or by industry players. Information was also sought regarding procurement and contractual arrangements for smart and sustainable city projects. A summary of the information obtained for each city is provided below.

Barcelona

In Barcelona, the Mayor has a high level of commitment to the smart city agenda, as do the various different Deputy Mayors and administrators. The City Government wants to attract new private sector partners to improve the delivery of services. Usually the City Government initiates [a new project or] an initiative, and then the City Government generally approaches the private sector to see who wants to collaborate. Both the public and private sector agree on what they each offer, and then they select the best way to collaborate.

There is not necessarily a typical model of collaboration: public private partnership in some cases, in other cases a form of partnership arises that enables the private sector to test pre-commercial ideas such as sensors and hardware to inform future development. Through such partnerships, Barcelona is trying to foster new models of innovation. Sometimes the City Government has little presence, and seeks to take advantage of the initiative without having to contribute. Other times, the City Government sets up a partnership that delivers revenue for both the private company, and the public sector (through an Empresa Mixta company).

Examples of partnerships in Barcelona noted include with Cisco to manage information in the city, with Telefonica to deploy tools for new services and new applications of data, and with Albertis as a local telecoms provider. The partnership with Cisco is an Empresa Mixta. This is important to allow for issues concerning intellectual property.

Amsterdam

The Municipality of Amsterdam has a specialist unit on climate change and energy reduction, where 5-6 people specifically look at making Amsterdam more sustainable. They initiated contact with Liander which owns the electricity network to discuss the desire to be a major leading sustainable city and what was needed to achieve energy reduction. Most departments of the Municipality of Amsterdam are involved to some degree in smart cities. The Municipality of Amsterdam tends to initiate projects, and the first step is generally to find partners when they have new ideas. Different projects can require different partners, e.g. in transport or energy, developers and/or housing associations.

In Amsterdam, the City Authority works closely with Amsterdam Innovation Motor, and the utilities company Nuon and Liander in particular as their main partners. However, some 30-40 SMEs also partly own the innovative technology and solutions applied as part of Amsterdam Smart City. Smart city projects are often undertaken as public private partnerships supported by Government programmes.

Energy projects tend to be more traditional procurement, with a client/supplier relationship. For the e-mobility project, there is client-supplier relationship between the Municipality and Nuon who won a tendering process for this project.

Malmö

In Malmö, the involvement of the City Authority has been crucial for many projects to start. The strong and committed management of the City Authority to moving towards a smarter city was considered by the stakeholders interviewed as being important. The Authority usually initiates the projects, bringing other parties to the table. Other initiatives are suggested by developers or the utility companies.

The City of Malmö works with E.ON, Siemens, developers, and housing associations on a range of different projects. Development agreements are signed for some projects. In Hyllie, the City of Malmö, E.ON and developers work together in a collaborative model, which has created opportunities to link projects together across the city and share knowledge and learning for future projects. A climate contract between the City Authority, VA-Syd, and E.ON which sets the vision and goal for Hyllie was signed which assists in achieving cooperation around a common objective. E.ON and Siemens subsequently signed a collaboration agreement to work together.

Manchester

In Manchester, the establishment of New Economy, and two small initiatives – one on low carbon, and one on building retrofit, started to provoke interest from technology companies. In Manchester it is often the technology provider that takes the lead on initiatives as they see gaps in the market, although the public sector still plays a facilitation and enabling role to establish frameworks, and they often own some of the assets.

Manchester New Economy works together with utility companies and British Telecom and other private companies in partnership. To date though procurement has been relatively minimal. Manchester Digital Development Agency is keen to see city wide fast broadband but the issue at the moment is who pays. To make this happen, they envisage the need for a Special Purpose Vehicle (SPV) to be established to bring together the different parties necessary for it to succeed. In theory this should be possible as it has been done elsewhere and there is a business case and ROI, but where the investment comes from is the question that needs to be resolved first.

Given the relatively embryonic and pilot stage of most smart and sustainable urban development projects, then there is no existing 'blueprint' for how such projects are procured and delivered. One of the only examples of a planned city-wide scale smart project is Masdar, further details of which are provided in Appendix C. Whilst Masdar is the United Arab Emirates and is a brand new city, and therefore limited parallels can be drawn with how to deliver smart and sustainable cities in Europe, several interviewees mentioned it as important, as it is through new cities that one is able to test and develop technologies and learning, which can be applied to existing cities, although adaptations may be required.

However, interviews suggested a number of different models which include JVs, SPVs, and other forms of collaboration and partnerships involving the City Authorities, developers, technology and/utility companies. Energy Performance Contracting is an emerging financial model for energy efficiency and renewable energy projects, but is not yet widespread in Europe (although this is very common in the US). Where EPC is conducted in the UK, the technology company will be contracted by or work in a JV with the utilities company.

The issue of procurement was one which arose in several conversations. Due to the pilot stage of most projects and concern over the retention of intellectual property, industry players in particular expressed a preference to enter into partnership and/or collaboration agreements, or more formal Joint Ventures, rather than to tender for services or to supply products through open competition. Several commented that this allowed the company to be able to contribute to the development of the project and its business case and increase its potential overall value to the city, as opposed to solely providing predefined or specified products or services chosen on the basis of lowest cost. One City Authority also mentioned that pilots with sole suppliers provided them with an opportunity to gain innovative thinking on how they could improve or change the delivery of services, in a way which they wouldn't have thought beforehand. When a service is well developed enough to move into broader roll out, however, it is likely that procurement strategies will change.

Financing of smart and sustainable urban development projects

Understanding how smart and sustainable urban development projects are financed is one of the key objectives of the study, to help inform whether and how JESSICA investments can support such projects. Information regarding the financing of specific projects is difficult to obtain for reasons of commercial confidentiality. However, interview responses suggest that:

- Involvement in city wide initiatives where various players come together to discuss possible pilot projects, and city wide strategies, are generally funded by contributions from each party, which are generally in the form of time and expertise.
- Where projects are led and financed by developers, they seek to raise finance through corporate or project finance.

Solar4Schools

Solar4Schools was set up in 2008 to introduce solar power to schools across the UK.

The project is run by a partnership between Solarcentury, GE Capital, and Triodos Bank, who aim to make photovoltaic (PV) installations more affordable for education establishments.

GE Capital offer a financial package to schools allowing them to save up to £840 a year on electricity bills, and generate income of £3,000 a year without the full upfront cost of buying solar. The school have to pay back the equipment cost over 15 years using income from the solar feed-in-tariffs.

The financial model for the scheme can be viewed online:

<http://www.solar4schools.co.uk/background/Lease-funding-model-for-schools>

The results of the scheme are that typically each school saves 2 tonnes of carbon per year, and over a 25 year period can make a profit of £25,000.

To date there have been 260 solar installations in schools across the UK.

Private companies also look to EU, National Government, City Authorities to assist in financing projects, in addition to their own resources, depending on the project. The EU's Seventh Framework Programme (FP7) funding was mentioned frequently by those interviewed as a source of funding in this area.

- Some pilot projects are financed through sponsorship from the technology supplier to pilot and test new technologies; however, for larger scale projects or rollout, then companies are looking for commercial returns from these projects. Technology companies tend to have their own internal financing divisions.

Issues highlighted by those interviewed regarding the financing of projects within the case study cities are provided below:

Barcelona

In Barcelona, the European Union almost always provides funding for projects. While the Spanish government has some funding and loans available, there is a shortage of financing for the development of science and technology parks, and for the construction of new buildings.

Amsterdam

In Amsterdam, ERDF has assisted in funding smart city projects. ERDF funded the first 'West Orange' smart metering project, and various European funding streams and grants support the various smart city projects, as well as the City Authority's own financing. There are investments from partner organisations through public private partnerships for larger projects, and contributions from smaller companies for smaller projects. Investment from industry is needed for projects to materialise.

The Municipality of Amsterdam originally had some shares in Nuon, which they sold a few years ago and invested some of the monies into two revolving funds, one for Innovation – Amsterdam Innovation Fund, and one for sustainability – Amsterdam Sustainability Fund, each of which received EUR60mil.

Amsterdam is keen to investigate new and smarter ways to fund projects. Moving forward, there is a desire to have more private investment to match public sector funding and move away from a grant funding approach towards

Bristol

In March 2011, Bristol City Council published a 'Smart City Bristol' report which was commissioned and funded by the Department of Energy and Climate Change. The work was undertaken to establish how smart city technologies could contribute towards Bristol's carbon reduction objectives, and outline recommendations that will contribute to further emission reductions and provide city-wide economic benefits.

As part of the report a best practice review was undertaken. The research suggested that currently there is no commercially realisable, self sustaining business model to sustain projects beyond small scale deployment. It stated that key sources of funding are the European Commission, UK funding agencies, economic stimulus packages, and corporate investment.

The research considered the possibilities of implementing smart grid, smart transport, and smart data projects. It found that smart grids can potentially make £20m pa in energy savings. For Bristol, although smart grid installation costs could not be estimated, it was stated that following a PV installation cost of £180m, annual feed-in tariff revenue and savings would be in excess of £20m. Similarly, smart transport measures were expected to generate energy savings equating to £69m pa. As an example of a scheme, a wireless electronic parking permit system in part of New York saved \$8m against upfront investment of \$50k

Source:

<http://www.slideshare.net/Bristolcc/bristol-smart-city-report-7579696>

repayable investments. It was noted that there often needs to be some public financial support to projects for the private sector to become involved.

The city of Amsterdam's experience is that so far projects have yet to generate revenue as they are only 2 years in, although from the original financial models, they are anticipating revenue to be generated, however the time taken for revenue generation is long.

Malmö

In Malmö, most of the new developments have been part financed through various EU and national grants, Vinnova, Delegation for Sustainable Cities as well as investment from developers and utility companies themselves. Many of the demonstration projects have long payback periods. Access to external funding is particularly important for innovations, and demonstration projects. Where the City Authority is also the land or property developer, then the Authority invests its own funds in energy efficient systems and smart automation and control systems.

Manchester

In Manchester, revenue generation is a key factor to generate ROI; however, so far very few projects generate revenue. Therefore the private sector relies heavily on the public sector to bridge the gap in funding. Those projects which most likely generate revenue are ones which reduce carbon emissions or are residential retrofit projects. Projects are typically funded by a combination of public and private sector finance. A smart metering project had 50% funding from ERDF. Public sector support is needed in particular where social outcomes are sought. Of those projects which do generate revenue, while some smart energy projects may have payback periods of around 5 years, smart grid projects may only have payback periods of 20 to 25 years. As such finance for such projects is very difficult to obtain.

Manchester City Council's Investment Strategy is increasingly focused on how to blend city funding with funding from other sources to move away from grants, and towards more repayable investments.

All interviewees have expressed the availability of finance as being problematic for smart city projects. Smart and sustainable urban development projects, and small scale smart energy efficiency and renewable energy projects face particular financing difficulties due to high upfront capital costs and payback periods longer than traditional commercial lending terms or investment horizons. Smart meter and grid initiatives can experience difficulties due to the different incentives of the various actors involved, benefits and costs being attributable to different parties, together with a lack of clarity on the potential savings. Such complexity and difficulty in capturing savings, means that the introduction of smart grids, or smart features, is often engineered out during the design stage.

An issue raised is that it is much easier to find finance for new development rather than retrofitting of existing areas. Retrofitting projects are expensive, and often difficult to raise financing for. Housing associations in particular can find it difficult to access bank loans, especially in areas of high unemployment.

Key success factors in smart and sustainable city projects are also considered to be education, awareness raising, and training initiatives to encourage appropriate use of technology and enable

sustainable outcomes to be met. Behavioural change is felt by many to be integral to the success of such projects and to achieving cost and/or energy savings to generate revenue on projects. An example of a programme in Amsterdam which aims to combine employment and energy saving objectives is the Step2Save⁹⁵ programme. Unemployed people are trained as energy saving advisors, who go door to door to talk about energy saving possibilities. This has strong social, environmental and economic drivers, but the business case is hard to make for a private company to finance alone.

Other comments related to the pilot nature of projects, as many smart and sustainable urban development projects are currently being piloted or trialled in smaller areas, this means they do not necessarily reach required thresholds for profitability that is potentially achievable in larger scale projects. Similarly pilot projects may require high levels of initial investment to trial and test new technologies which wouldn't necessarily be the case in larger scale rollouts.

Financing for project development was also noted as being difficult to access. Funding is likewise needed to help develop the smart city initiatives that in turn identify smart city projects.

European funding

Some particular comments were made in interviews in relation to European funding:

- European funding is considered to be complex and difficult to understand and access.
- European funding seems to require comprehensive business plans and studies before it can be applied /approved, yet such business plans/studies require financing that is difficult to obtain.
- A lot of available European funding is suitable only for pilot and/or R and D, rather than wide scale delivery or roll out.
- Due to IP considerations and commerciality considerations, the need for open book accounting can be considered as a barrier to accessing European funding.

This chapter has sought to outline how smart and sustainable city initiatives and urban development projects arise, are procured, and financed. The pilot nature of projects, long payback periods, risks associated with future revenue, and collaboration between public and private sectors makes such projects ideally suited to financing by JESSICA investments. The next chapter sets out a list of potential project typologies which might be relevant for financing by JESSICA investments, and provides some thoughts on how JESSICA could help support smart and sustainable projects being developed and implemented.

⁹⁵ <http://www.nuon.com/csr/Energy-sustainability/energy-saving/>

8. JESSICA and Smart and Sustainable Cities

Given the financing issues associated with funding smart and sustainable urban development projects, JESSICA Urban Development Funds can potentially play a key role in increasing the number of smart and sustainable city projects being developed and implemented, as well as being 'smarter' in their investment strategies.

8.1. Eligibility Considerations

UDFs are “funds investing in public-private partnerships and other projects included in an integrated plan for sustainable urban development.”⁹⁶ UDFs combine allocations from EU Structural Funds Operational Programmes (which include both Structural Funds and national co-financing) with investment from other sources, and invest by means of equity, loans and guarantees. Projects which receive investment which is partly financed by Structural Funds need to comply with the relevant national and European legislation⁹⁷

Rules on the eligibility of project expenditure, using JESSICA, are the same as those on the use of Structural Funds as a whole, and therefore need to take account of any specific national constraints. Apart from specific non-eligible items listed in the Regulations, JESSICA may allow for more flexible management of projects, respecting at the same time eligibility rules, provided always that the projects being supported form part of an IPSUD⁹⁸. Ineligible expenditure components might, for example, be included as part of a larger, multi-sector urban project, provided sufficient additional funding is attracted from other private or public sources to finance these ineligible components.

JESSICA investments could be targeted specifically at projects such as:

- Urban infrastructure, including transport, water/waste water, energy, etc.
- Heritage or cultural sites, for tourism or other sustainable uses
- Redevelopment of brownfield sites, including site clearance and decontamination.
- Office space for SMEs, IT and/or R&D sectors
- University buildings, including medical, biotech and other specialised facilities
- Energy efficiency improvements.

JESSICA operations will have to comply with applicable EU and national legislation like for instance public procurement legislation, state aid rules, environmental legislation, etc. Relevant European regulations and guidance of relevance to JESSICA are included in Appendix D.

Projects suitable for JESSICA investments should therefore:

- Form part of an Integrated Plan for Sustainable Urban Development (IPSUD)⁹⁹

⁹⁶ Article 44 of Council Regulation (EC) No 1083/2006 of 11 July 2006,

⁹⁷ See in particular EC Regulations 1083/2006 and 1080/2006) and Article 7 of EC Regulation 1080/2006.

⁹⁸ IPSUDs usually take the form of City spatial plans, and/or strategies for urban development and/or investment, which are in place in most European cities. Any sustainable urban development projects financed by Structural Funds from 2007 are required to form part of an IPSUD, not just those funded by UDFs. Notably, such IPSUD compliant plans have already been in place where smart city developments have been examined as part of this study.

⁹⁹ Except where funds or other incentive schemes invest exclusively in projects for energy efficiency and use of renewable energy in buildings, including in existing housing, it is not obligatory to include them in integrated plans for sustainable urban development. Revised Guidance Note on Financial Engineering Instruments under Article 44 of Council Regulation (EC) Nr 1083/2006, 08/02/2012

- Be (at least partly) eligible to receive Structural Funds under the applicable Operational Programme
- Normally involve collaboration or partnership between public and private entities
- Generate sufficient return to repay at least the original investment sum¹⁰⁰,
- Support the achievement of economic, social, or environmental goals
- Support the Investment Strategy of the UDF¹⁰¹

8.2. Potential Project Types

The types of smart and sustainable projects which focus on urban areas and cities which could potentially be supported by JESSICA investments are illustrated in the table below:

<p><i>Digital infrastructure projects for urban areas</i></p> <p>The provision of new ICT infrastructure and high speed broadband through fibre optic cables, wireless, and/or networked information systems.</p>	<p><i>City wide data projects</i></p> <p>Data collection, storage, and analysis at a city wide level, potentially through the 'Cloud', which can enhance a city's ability to plan for both current and future services and city development, through the ability to model and analyse data, such as traffic, environmental, demographic or land use.</p>	
<p><i>Smart urban transport and urban mobility</i></p> <ul style="list-style-type: none"> • Cycle hire schemes • Real time bus timetable information • Electric vehicle charging infrastructure, car pools, and batteries • Congestion charging • Intelligent transport systems 	<p><i>Area-based and renewable energy/energy efficiency projects for urban areas</i></p> <ul style="list-style-type: none"> • Combined heat and power • Renewables • Sensors to monitor traffic, pollution, emissions, • Street lighting • Waste collection systems • Smart grids 	<p><i>Smart and sustainable buildings in urban areas</i></p> <ul style="list-style-type: none"> • Smart meters • Building management systems • Energy efficiency measures: Insulation, low energy lighting, efficient boilers • Building integrated renewables • Electric vehicle charging points • Smart appliances • Motion detectors • Automatic weather forecasting

¹⁰⁰ Or more precisely, enable the counterpart of an investment agreement between a UDF and a project implementing entity to service a loan, pay guarantee fees, or otherwise repay investors

¹⁰¹ UDF Investment Strategies align with the relevant Operational Programme priorities from which the Structural Funds are allocated.

Such projects are often already included in transport or energy strategies for a city, as part of a broader city IPSUD, which often take the form of city strategic or spatial plans. As this programming period is relatively well advanced, there may well be greater opportunities for MA to invest in these types of projects in the next programming period, by setting them out in their future Operational Programmes. Within this programming period, projects will need to be in line with existing Operational Programme priorities and meet UDF investment criteria, which differ between countries and UDFs.

The table in Appendix E illustrates in some detail four different UDFs currently in operation and for each of them the types of potential smart and sustainable city projects which might be suitable for JESSICA investments. This is based on an analysis of publicly available information, and project types put forward are only intended to provide examples of the type of projects that could potentially be funded. Project applicants should consult the UDF manager for further information on exact eligibility requirements.

These four UDFs cover different types of urban projects through different financial instruments..

8.3. Urban Development Funds

Smart city initiatives seek to ‘combine’ individual projects to achieve city wide objectives, and therefore while the afore-mentioned project typologies represent the most common identified, they can also be combined in a specific project, and indeed ‘trailblazer’ pilots seek to do this. Many of those interviewed noted that due to the early ‘pilot’ stage of many smart city projects, these are often area based (rather than city wide) projects, until they are delivered and proven effective models developed and are able to be ‘rolled out’ more widely. As a result many companies tend to work on a project by project basis, with sustainability outcomes being achieved through a sum of the parts, rather than necessarily because individual projects are being integrated together across a city as a whole. The longer term objective is often that such developments can be ‘linked’ together in the future, but as cities have existing infrastructure, until areas come up for redevelopment, then new ‘smart’ infrastructure can be difficult to install. This is of relevance for JESSICA UDFs which through their investment strategies seek to achieve a range of social economic and environmental objectives through their portfolio of investments, rather than solely achieving individual objectives on a project by project basis. On a practical level, this may mean that UDF investment strategies could seek to encourage smarter elements across a project portfolio, rather than having one ‘smart’ project. That said, the value of individual pilots to demonstrate feasibility and success of certain technologies was also highlighted by many interviewed.

The success of JESSICA investments is likely to be judged on the basis that the investments are used to achieve outcomes and drive innovative processes rather than specific technologies. Therefore, the tools that UDF managers use to support integrated smart and sustainable urban development projects should be “light touch” as opposed to prescriptive to avoid discouraging applicants. Rather than imposing criteria and project specification around the use of ICT, it is recommended that project development work supports the development of projects in a way which can meet investment outcome criteria (e.g. employment, access to services, carbon emission reductions) through using ICT in an integrated manner in the project. The most important element of the application process is to ensure that applicants demonstrate that the results of the projects are outcome based rather than input based so that the efficacy of the project or intervention can be assessed subsequently. As an example, if the funds wanted to target projects specifically aimed at incorporating new technologies/ICT in energy retrofitting projects, then the fund managers should ensure in the application process that an asset efficiency review has been already undertaken and that the implementation of smart technologies will actually be suitable and effective.

Several of those interviewed emphasised the importance of specifying outcomes in advance for smart city projects, so one can evaluate their success later on. This could be through existing rating systems such as BREEAM or LEED¹⁰² where relevant, or through those in development such as the Sustainable Certification of Urban Areas programme in Sweden.

¹⁰² BREEAM - BRE Environmental Assessment Method (BREEAM) is a voluntary measurement rating for green buildings that was established in the UK by the Building Research Establishment (BRE)

LEED (Leadership in Energy and Environmental Design) is administered by the US Green Building Council as a standard for developing high performance sustainable buildings

Rest of the North West Evergreen Fund

Manchester forms part of the geographical area covered by the NW England Operational Programme. The EIB manages a JESSICA Holding Fund in the NW which is investing in two UDFs, one of which covers Merseyside, and the other the 'Rest of the North West' including the Greater Manchester area. The Rest of the NW fund, otherwise known as the Evergreen fund has recently received State Aid approval from the European Commission. The Evergreen fund initially contains funding from the ERDF Operational Programme priorities related to the redevelopment of specific sites and regeneration activities. The aspiration is for this to be supplemented by funding from other sources including institutional investors such as pension funds to create a sustainable replenishable investment fund for Greater Manchester and surrounding areas. Projects are anticipated to be provided with loan financing, which are then expected to be repaid upon sale of the asset within a 2-3 year period. The 'second round' of funding has been highlighted as an opportunity to fund 'digital and creative' projects.

The NW Operational Programme includes cross cutting themes in relation to sustainability, which means that the investments from the Evergreen Fund need to be in alignment with the NW Sustainable Buildings Policy. This states inter alia that new build commercial buildings must achieve a BREEAM Excellent rating and that commercial refurbishments achieve a BREEAM Very Good rating. To receive Operational Programme resources, any new construction projects must also ensure that sufficient ducting is provided from the building to relevant access points to allow for future broadband access. While the integration of ICT into regeneration projects is not explicitly mentioned, where this could contribute to a building achieving the necessary BREEAM rating, this could assist in making projects funded by the Evergreen Fund smarter as well as contributing to the sustainability of the city.

JESSICA is also designed to help finance projects which are considered as too risky to be funded by commercial sources alone. A good approach to risk management is to acknowledge that some projects will not work and that this is a key part of innovating. Therefore, the diversification, the size, and number of projects in a UDF's portfolio are important (i.e. not only having many small sums investments or only a few major projects).

It is also essential that, where smart technologies are incorporated in the projects, the fund managers ensure that the use of these technologies is actually going to drive behavioural change and have strong socio-economic and financial returns on investment. Some new technologies that have not been sufficiently tested could lead to poor returns on investment and therefore put the overall investment at risk for all investment partners. This needs to be taken into account in the investment risk management policy. For instance, for photovoltaic related technologies, if Feed in Tariffs are reduced by government, the profitability of the project could be at risk. UDF managers should always look to refer to technical cost benefit analysis and expertise to assess the risks associated with specific technologies.

8.4 Potential challenges in investing in smart cities

There are potentially a number of issues associated with the use of JESSICA investments for smart and sustainable city projects. These are set out below.

- Some of those interviewed expressed a view that where one provider or supplier has a monopoly, then this can act as a blocker for innovation. Alternatively, others suggested that single suppliers can create opportunities for learning, innovation, and long term investments. Some felt that the legitimacy of alliances between City Governments and the private sector were being questioned.
- European and national procurement legislation requires transparency and competition, which can be cost intensive and risky for global companies who wish to protect their intellectual property. How public and private companies can enter into agreements with one another given the legal framework is a key issue.
- Smart grid projects involve substantial collaboration between different entities. Without an 'initiator', then projects are unlikely to emerge.
- Some City Authorities expressed a lack of experience in establishing projects to generate revenue, and in the use of loans or guarantees, as they are much more familiar with grants. Some also expressed a lack of experience and skills of City Authorities in smart technologies and bringing new products to market. This is often combined with a lack of funding to procure specialist advisors to support. Cities may also not have 'smart city' strategies to guide their approach.
- Smart grid solutions need to create value. There need to be incentives for the utility company, the user, and the property owner. Often these are not always aligned, where there is no individual metering, or where owners and occupiers are not the same, or where there is no medium term commitment to use one supplier. Where the owners and building occupiers are the same, smart buildings and smart grids become easier, whereas tenanted residential buildings in private ownership are more difficult. Different countries value energy efficiency measures differently. In some Nordic countries this can add value to a building or development, in others it may make no difference to a formal valuation, and therefore this acts as a disincentive to invest.
- ICT itself now accounts for 6% of carbon emissions.
- The investment strategy of the UDF must be in alignment with the priorities of the Operational Programme that the ERDF funds allocated to a UDF derive from. Smart and sustainable urban development projects are therefore more likely to be funded where they are drawn from OP priorities which incorporate ICT and/or sustainability considerations.

Some of those interviewed expressed some reservations about the potential for UDF investments specifically including:

- The degree of preparatory work needed to apply for EU funding can be considerable and needs to be financed in addition to the preparatory work needed to bring a new technology project to market
- Requirements and restrictions on what can/cannot be funded were felt to often be prohibitive.

However, access to public financial support can boost projects, giving people the courage to take slightly bigger risks than they would otherwise take, and allow smart technologies to be integrated into projects. JESSICA investments can support the development of new technologies and new smart and sustainable urban development projects through its long term investment approach, and through their ability to ‘de-risk’ investments for other private sector co-investors.

Once a new technology or approach has been tested through pilots, its use can be ‘rolled out’ beyond the initial pilot area, enabling greater opportunity to achieve broader sustainability goals.

9. Conclusions

With over two thirds of Europe's population now living in urban areas, a focus on cities to help stimulate sustainable economic growth is an ever increasing priority for European member states and the European Union. Recent developments in technology provide opportunities to allow cities to grow and develop in a smarter and more sustainable way; using fewer resources, using existing resources more intelligently, and enabling a more inclusive approach to development and economic growth facilitating economic convergence between European regions. Taking advantage of technology to improve the planning and functionality of traditional infrastructure, deliver new infrastructure, and support urban development and regeneration facilitates the creation of smarter and more sustainable cities.

Smart city projects could help to contribute to the achievement of Europe 2020 goals. The proposals of the European Commission for Cohesion Policy for 2014-2020 consider cities as engines of the European economy being catalysts for creativity and innovation, but also places where persistent problems such as unemployment, segregation and poverty can be severe. The proposals further state that ERDF should "support sustainable urban development through integrated strategies that tackle the economic, environmental, climate and social challenges of urban areas".¹⁰³ The role of cities in the achievement of EU2020 objectives is emphasised in proposing that a minimum of 5% of ERDF resources in each Member State should be invested in integrated actions for sustainable urban development, for example implemented through the "Integrated Territorial Investment" tool, with the possibility of delegating management and implementation of those resources to cities. In addition, the future cohesion policy legislative package includes a proposal for innovative urban actions, supported by ERDF.

The smart city initiatives and projects identified through the background research for this study suggest that Europe's R&D/innovation goals could be progressed as smarter cities promote innovation and support the growth of knowledge-based economies and/or the fostering of a digital Europe. Energy and climate change goals can be advanced as technology is used to help facilitate reduced resource use and the carbon intensity of cities. Employment objectives could be advanced through enhanced levels of economic activity in urban areas as a result of new technology use, or new technology investment enabling smarter and more efficient working, as well as through the creation of new enterprises or employment in companies providing smart city solutions. Contributing to education and poverty/social exclusion targets could be realised through digital inclusion projects seeking to create enhanced access to, and the use of existing and new technologies bridging the 'digital divide' that exists in many cities, as well as increasing opportunities for citizen participation around the development of non-digital social and physical infrastructure projects. Using smart technology as part of upgrades to existing buildings in poorer areas can stimulate regeneration, reduce social exclusion, and stimulate a positive cycle of investment, as well as reducing energy use helping to reduce energy bills for occupants.

¹⁰³ http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/urban_en.pdf

Initiatives and projects profiled in this study seek to use 'smart' technology to advance sustainable development. These projects aim to create specific economic, social, and/or environmental benefits to the city concerned. Such multifaceted outcomes are not, however, automatically guaranteed by projects which focus solely on technology use or investment alone, without explicit consideration of the broader impacts, as argued in the recent Cities of Tomorrow report, and raised by a number of those interviewed in this study. This study has highlighted that where projects are designed in an integrated and intelligent way where sustainable outcomes are an explicit part of the project design, smart city projects do provide the potential to advance the progression towards all three Europe 2020 objectives – smart, sustainable and inclusive growth - through the creation of more sustainable cities.

The study suggested that current smart and sustainable city initiatives and projects could be categorised into the following five areas, which can be embedded in investment strategies pursued by Urban Development Funds:

- Digital infrastructure for urban areas
- City-wide data
- Smart urban transport and urban mobility
- Area-based renewable energy and energy efficiency for urban areas
- Smart and sustainable buildings in urban areas

The research also showed that such smart and sustainable city projects are not widespread across Europe. A few cities, such as those featured in this study are taking proactive steps to move towards being smarter and more sustainable cities, through developing relevant initiatives and projects. These initiatives and projects have derived from strong leadership within one or more of the various public authorities governing a city or city region, working in partnership with technology providers to develop pilot projects for their cities. As such projects tend to involve innovative and developing technology, the research undertaken suggests that such projects often require formal agreements and public private partnerships to protect the intellectual property of the technology provider. This has required cities and suppliers to think differently about how to procure such projects, and to move beyond traditional purchaser-supplier relationships.

Based on the desktop research, interviews, seminar discussions, and the conference undertaken for this study, it is also evident that the relatively high risk nature of smart city projects, due to the uncertainty associated with the financial returns, the cutting-edge nature of the technology, and the long time horizons with which they may be realised; combined with the frequent need for upfront capital investment, means that such projects have struggled to access traditional commercial financing through the capital markets. Designing smart and sustainable city projects which seek to deliver socioeconomic and/or environmental returns alongside pure financial returns may also not receive appropriate incentivisation from traditional lenders or investors.

As a result the initiatives and projects covered in this study have often been financed by public sector investment, and research and development programmes of companies themselves, frequently supplemented by European grant funding from various sources. These findings led to the focus of the conference undertaken as part of this study being on exploring the business case for smart and sustainable city projects, and whether JESSICA UDFs might be able to play a role in

supporting such projects. The conference confirmed that due to the early stage in the majority of existing initiatives and projects, there is no 'blueprint' for how to develop a smarter city; that outcomes of projects developed to date are often not yet known; and reiterated the challenges in accessing commercial financing in support of such projects. The research and the conference underpinned the need for innovative financing solutions to help stimulate investment in these areas, and suggested that the JESSICA initiative had a key role to play.

JESSICA Urban Development Funds support the achievement of economic, social, and/or environmental goals alongside financial returns, and they are therefore well placed to support smart and sustainable city projects. In combining European Structural Funds with private sector investment, UDFs provide the potential to reduce the risk associated with smart and sustainable city projects for co-investors. The long term investment horizon provided by UDFs could also assist in enabling projects to proceed, which may not be otherwise be financed; notably those where the payback period exceeds that which traditional lenders or investors are prepared to accept. UDFs are also explicitly designed to help facilitate financing of sustainable urban development projects involving public and private actors, which this study has demonstrated is a prerequisite for successful smart and sustainable city projects emerging.

UDFs can therefore potentially contribute to creating smarter and more sustainable cities in Europe through both financing individual smart and sustainable city projects, and by adopting investment strategies which encourage and incentivise 'smarter' sustainable urban development projects to come forward, where the 'smart' can act to deliver more sustainable outcomes.

10. Recommendations

Based on the background research, seminar, and conference undertaken for this study, a number of recommendations are presented below to support Europe's cities becoming smarter and more sustainable, together with how the JESSICA initiative might be able to support such efforts:

- a) City authorities need to exhibit strong leadership to act as a catalyst to bring together a range of public and private actors to create strategies, ideas, and individual projects
- b) Given the multifaceted nature of smart and sustainable city projects, public and private stakeholders should work together collaboratively to develop solutions to the challenges facing the city
- c) 'Out of the box' thinking may be required by all parties to develop appropriate procurement and project delivery vehicles which allow for the piloting and testing of new technology, whilst ensuring accountability and delivery against public policy objectives
- d) As technology is new and evolving, pilot projects may be needed to help establish the business case for projects and 'proof of concept' ahead of broader rollout
- e) Pilot projects should seek to test both financial return on investment and social, economic, and environmental returns on investment if they are to be appropriate for JESSICA investment and contribute to both smarter and more sustainable cities
- f) Education and training should be incorporated as part of project delivery where outcomes are dependent upon behavioural change, or projects involve communities which are unfamiliar with such technology
- g) Projects should have defined objectives and clear metrics to allow for measurement and reporting of financial and broader returns, to help inform future project design, and understand the outcomes associated with different types of initiatives and investment
- h) The business case for smart city initiatives which seek to use technology to enable carbon emission reduction appears to be more developed and hitherto has had greater emphasis than projects which seek to achieve economic and social outcomes. An increased focus on developing pilot projects and understanding the business case for projects which focus on socioeconomic outcomes could help to address the sustainability of cities threatened by inequality and deprivation
- i) Managing Authorities with existing Holding Funds or UDFs with uncommitted funds within this programming period could seek to establish additional UDFs focused on smart and sustainable city projects where there is alignment with the relevant OP priority. Given the timescales associated with bringing together the necessary partners and project development for such projects, such an option may be more appropriate in cities where existing initiatives are underway, and/or where project sponsors of pilot projects are seeking to take forward similar projects in other parts of the city, or look at broader rollout of an existing proved concept
- j) Managing Authorities should consider the potential for their OPs and Financial Instruments in the next programming period to support smart and sustainable cities, including such objectives within Ex-Ante Assessments and Evaluation Studies

- k) Given the multifaceted nature of smart and sustainable city projects, this may mean considering allocating funds to HF and UDFs from a broader range of OP priorities than has been traditionally considered in the current programming period
- l) If establishing UDFs in support of smart and sustainable cities, MAs should consider both the financing of individual smart and sustainable city projects, and how the UDF investment strategy could support creating smarter and more sustainable cities through its investment priorities and project appraisal criteria as a whole
- m) UDF investment strategies should ensure that project appraisal and selection criteria assesses the outcomes of any 'smart city' projects in an integrated way rather than solely the use of technology per se, so as to ensure that the investment will help to create sustainable urban development
- n) Managing Authorities could consider how the use of ITIs might support city strategies for smart and sustainable city development in the next programming period.

To help stimulate a move towards smarter and more sustainable cities in Europe more broadly, many commented during the course of the study that whilst addressing the financing challenge was important, broader action was needed. Such actions could help move from the current small number of pilot projects to much broader city scale roll out across Europe, which would be needed if such initiatives are to help meaningfully support the achievement of Europe 2020 goals.

Those who have developed pilots felt that substantial project development work was needed to create a project which was 'investable', where the potential revenue or savings needed to provide financial return of investment was clearly established. A need for technical assistance was frequently highlighted to support project developers directly, and to Managing Authorities, and City Authorities to help understand how projects may need to be configured to stimulate private sector investment, and innovation in project design. This suggests a need for a technical assistance service to be funded to operate alongside the UDF. Broader education and awareness raising work may also be needed to stimulate interest in project development in this area, and awareness of the possibilities that JESSICA UDFs or future UDF-type vehicles may provide to resolve financing challenges.

While the business case for such projects remains in development, due to the early and pilot stage of most existing projects, many suggested that it would be useful to capture information about how existing and pilot smart city projects, to assist in more smart and sustainable city projects being initiated. Such information should include the process of project development and realisation in some detail through detailed in-depth project specific research, as well as research to capture the financial, social, economic, and environmental benefits of projects currently in progress. Such demonstration of the business case for different project typologies through the use of case studies, and open access to data from different European cities, may help to stimulate increased market and public sector action through increasing understanding and awareness of what might be feasible.

Appendix A: Case study information

Manchester

KEY PLAYERS AND ORGANISATIONS

Manchester City Council / Manchester Digital Development Agency

Manchester City Council is behind the drive for economic regeneration and social inclusion in the city, having sought involvement in a wide range of projects and initiatives focused on smart and sustainable cities.

Within the Regeneration division of the city council sits Manchester Digital Development Agency (MDDA) which was formed in 2003, aimed at supporting the regeneration of the city through technology focused projects. MDDA has played a key role in forging Manchester's role as a Smart City through involvement in schemes such as Manchester Living Lab.

MDDA is responsible for the development and implementation of the Digital Strategy for the Manchester city region. The Manchester Digital Strategy presents the idea of a 'digital masterplan' for the city, the main aim of which is to provide accessible and affordable broadband services across the region.

MDDA are also involved in a number of projects, including the PEPESec and DEHEMS projects detailed below, with the aim of demonstrating how technology can be used to increase energy efficiency.

Association of Greater Manchester Authorities

The Association of Greater Manchester Authorities (AGMA) represents the ten authorities in Greater Manchester, including Manchester City Council. The AGMA approved the Greater Manchester Strategy in 2009 which set out the strategic direction for the region up until 2020. The focus of the Strategy aims for long term sustainable economic growth through the creation of a more connected, talented, and greener city region. One of the key strategic priorities is to achieve a rapid transformation to a low carbon economy. In order to implement the Strategy, seven strategic commissions were set up, one of which is New Economy.

New Economy

New Economy is one of the commissions set up by AGMA, and was set up with the purpose of creating economic growth and prosperity for Manchester by:

- Developing economic intelligence.
- Helping to create jobs and improve skills.
- Saving money and increasing efficiencies.
- Increasing investment and enterprise.
- Playing its part in reducing carbon emissions.

New Economy's primary objectives are to:¹⁰⁴

"guide the development and implementation of innovation across Greater Manchester, to continue to promote Manchester as a knowledge city and to increase the rate of innovation and knowledge based activity to drive Manchester forward as a global innovation hub."

New Economy works closely with MDDA, local authorities, and industry partners to meet these objectives.

Since the Manchester City Region was designated as the UK's first Low Carbon Economic Area for the Built Environment in 2009, New Economy have been designing a five year programme of work which is intended to add £650million to the economy, support 34,000 jobs, and save six million tonnes of carbon. The Low Carbon Economic Area Joint Delivery Plan sets out the programme for achieving the ambitious results. The programme itself will not be financed by a specific allocation of Government funds, and instead aims to develop the market through public and private investment.

New Economy commissioned the 'Manchester Independent Economic Review' which involved an Independent Review panel consisting of economists and business leaders, to provide:¹⁰⁵

- *A shared evidence base which can be used to underpin policy choices regarding future priorities for strategic investment and to bridge some of the persistent gulfs in understanding what exist in the Manchester City Region (and in other City Regions), about how regional economies grow.*
- *An accessible and updateable evidence base at a more detailed level than has previously been achieved in order to support policymakers.*
- *A shared view of the future development of the City Region's economy including the longer-term drivers of change and factors facilitating responses to future external changes and shocks.*

The Review was funded by the Manchester Innovation Investment Fund, along with financing from the Association of Greater Manchester Authorities. The Manchester Innovation Investment Fund is managed by New Economy, and is a £7m strategic partnership between the Northwest Regional Development Agency, National Endowment for Science, Technology and the Arts, and Manchester City Council. The Fund is targeted at:¹⁰⁶

"Strengthening and developing the innovation ecosystem, supporting feasibility studies into innovative ways of working, developing projects and promoting major interventions against a thematic background."

The Fund provides grants to projects in the city focusing on five themes to drive city-wide innovation. The themes are Understanding Innovation, Inspiring Innovation, Embedding Innovation, Ideas to Investment, and Communities of Innovators.

¹⁰⁴ <http://neweconomymanchester.com/>

¹⁰⁵ <http://www.manchester-review.org.uk/>

¹⁰⁶ http://neweconomymanchester.com/stories/1018-manchester_innovation_investment_fund

Manchester: Knowledge Capital

Manchester: Knowledge Capital (MKC) is a not-for-profit company with partners including Manchester City Council, and other government, business, and education establishments in the city. MKC is funded by its members and by public sector grants for specific projects.¹⁰⁷

MKC works by bringing together partners to input ideas, knowledge and energy in developing the strategic intelligence of the city. MKC co-ordinate a range of projects including 'Manchester: Integrating Medicine and Innovative Technology', 'Innovate with Confidence', 'Manchester Fab Lab', and 'Manchester Science City'.

'Manchester Is My Planet' is a partnership within Manchester: Knowledge Capital, aimed at helping shape a low-carbon energy future for Greater Manchester. The Manchester is My Planet programme has focused on delivering two projects co-funded by the European Union: Partnership Energy Planning and Changing Behaviour.

MKC worked with IBM on a project to help design Return on Investment (ROI) tools that showed the connection between investments and outcomes from programmes designed to promote innovation, employment, and prosperity. The ROI systems developed by IBM with the assistance of MKC is intended to enable organisations to get a more thorough measure of how they are succeeding in efforts to build a smarter city.¹⁰⁸ An online webinar with representatives from MKC and IBM discussing Smart Cities is available here:

<http://microsites.streamuk.com/smart-cities-webinar/register/default.aspx>

SMART CITY INITIATIVES

IntelCities

Manchester is leading the Intelligent Cities initiative, a research and technological development project to pool advanced knowledge and experience of electronic government, planning systems and citizen participation from across Europe. In total, 18 European cities and 20 ICT companies, and 36 research groups are involved. The project is part of the budget coming from the EU's Information Society Technologies programme.¹⁰⁹

PEPESEC – Partnership Energy Planning as a tool for realising European Sustainable Energy Communities

Manchester Digital Development Agency as part of Manchester City Council (lead partner), and Manchester Knowledge Capital are both partners in the PEPESEC project, along with 11 other partners in 6 European countries. The project, now finished, ran for a period of 30 months, finishing in June 2010. The project developed best practice energy planning methodologies, including 3 energy plans in the Manchester region. The project promoted the economic, social and

¹⁰⁷ <http://www.manchesterknowledge.com/home>

¹⁰⁸ http://www-935.ibm.com/services/uk/bcs/pdf/Manchester_Knowledge_Capital_case_study.pdf

¹⁰⁹ <http://intelcities.itigr/intelcities>

environmental benefits of developing a low-carbon economy and shaping a sustainable energy community.¹¹⁰

ENoLL (European Network of Living Labs)

As set out previously, the ENoLL initiative participates in EU funded projects including SMARTiP and EPIC, both of which use Manchester as a 'Living Lab'. The Manchester Living Lab is also used for wider research projects, as set out below:

- SMARTiP (Smart Metropolitan Areas Realised Through Innovation & People)

Manchester City Council and the University of Manchester are partners in the SMARTiP project, which is focused on the 'smart citizen' element of smart cities. Manchester is one of five test-bed cities used as a case study.

The objective is:¹¹¹

"To enhance the ability of cities to grow and sustain a 'smart city' ecosystem which can support new opportunities emerging for a dynamic co-production process resulting in more inclusive, high-quality and efficient public services which can then be made replicable and scalable for cross-border deployment on a larger scale."

The Smart Environments tracking pilot in Manchester involves the deployment of prototypes to enable citizens to collect environmental data through the use of wearable technologies, passive sensors (e.g. on bicycles and cars), interactive sensors on streets, buildings and in green spaces. This project started one year ago and is therefore still in its early stages. Information on the project deliverables progress has not yet been published.

As part of the SMARTiP project a one-day event was held in Manchester to bring together local stakeholders to discuss their views and aspirations for a smarter future in the city. Interviews from the day, with representatives from organisations including Manchester Digital Development Agency and Manchester Knowledge Capital, can be found here:

<http://www.smart-ip.eu/2011/08/manchester-smart-city/>

- EPIC

The European Platform for Intelligent Cities (EPIC) is building upon the Smart Environment Application work undertaken as part of the DEHEMS project (outlined below) to provide a new service that can be used across Europe. Manchester City Council is working on this European Union funded project, which is ultimately aimed at helping cities achieve carbon reduction targets using cloud services. Manchester Living Lab acts as a pilot for the project.¹¹²

¹¹⁰ <http://www.pesesec.eu/>

¹¹¹ <http://www.manchesterdda.com/smartip/>

¹¹² <http://www.epic-cities.eu/>

Barcelona

KEY PLAYERS AND ORGANISATIONS

Barcelona City Council

Barcelona City Council has played a lead role in the emergence of Barcelona as a Smart City. The Council has placed particular focus on the use of ICT to transform the business processes of public administration, by developing a new concept of a municipal portal which aims to use the internet as its main channel of communication with citizens and businesses. The extension of the municipal WiFi Network has been designed to allow permanent broadband throughout the city streets to connect a wide range of services, including sensors, parking meters, public lighting control, access control bollards, information panels, surveillance cameras, and municipal fleet connection. The work of Barcelona City Council has been developed in different stages using grants, funds, and collaborations with different public and private entities.

Association of the Strategic Metropolitan Plan of Barcelona (PEMB)

The PEMB is a private non-profit organisation which brings together the 36 municipalities of the Metropolitan Area of Barcelona (AMB). The PEMB also includes economic and social bodies, educational institutions, and governing bodies of metropolitan transport and environment.

The PEMB was set up for the purpose of identifying and supporting strategies for the economic and social development of Barcelona.

The Strategic Metropolitan Plan for Barcelona - Vision 2020, approved in 2010, sets out a proposal for Barcelona to become one of the most attractive and influential cities for global innovative talent, with a high-quality model of integration and social cohesion. The Strategy places a strong emphasis on the need for greater public-private participation in delivery of shared objectives. Challenges and recommendations regarding sustainability within the Strategy include:¹¹³

- *Creation of a sustainability district (ecobarri) in the AMB as a benchmark for the new Barcelona*
- *Energy: intelligent networks, urban cold and heat networks, realistic exploitation of renewable energy*
- *Mobility (electric vehicle, group transportation systems), re-conceptualising of the traffic network*
- *Reduction of installed energy demand in new buildings*
- *Recovery and reuse system for treated waters*
- *Certification and recognition of sustainability initiatives: green schools, biomarkets, responsible energy consumption, etc*

¹¹³ <http://www.pemb.cat/wp-content/uploads/2011/07/PEMB-2020-angles-WEB.pdf>

SMART CITY INITIATIVES

Barcelona Digital Technology Centre

Barcelona Digital Technology Centre (BDigital) is an organisation set up to facilitate technology transfer between universities and enterprises. Barcelona Digital is made up of members from public and private sector companies, including Barcelona City Council, IBM, Microsoft, and the Catalanian Government.

BDigital's mission is to: *"Promote the growth of ICT sector and business transformation to the new digital society through research and development of new products and services intensive in knowledge and high added value, to improve the competitiveness of the Catalan economy."*¹¹⁴

The centre specialises in four sectors, one of which is Research, Development and Innovation in Mobile services, Smart cities and Energy Management. The main objective of the Mobility and Energy R&D&I group is:¹¹⁵

"The development of ICT tools that contribute to solving existing challenges in today's and future cities, with an emphasis at improving the quality of life of people living, working or visiting there."

Projects carried out by the Energy and Mobility group include 'Lab-Test ICT Applications for Energy Management' – a theoretical and practical project that aims to study the degree of technological advancement in relation to Information and Communication Technologies for home and commercial energy management solutions, and 'SmartOffice' – the construction of a technological environment based on the deployment of a sensors wireless network that measures environmental factors of space such as temperature, light and humidity, and can also monitor office energy wastage.

Smart+Connected Communities

Smart+Connected Communities is an initiative driven by Cisco, which provides political leaders, urban planners, developers, academic institutions and system integrators with an online community for engaging and collaborating on the development of future sustainable cities.

As part of this initiative, Cisco has collaborated with the Barcelona City Council by initiating a strategic pilot program in support of the city's 2020 vision. The Cisco Urban Platform Reference Architecture includes *"a persuasive physical network infrastructure throughout the streets and public spaces of Barcelona to which devices such as sensors, information access points and mobile can be connected easily and with a high degree of security."*¹¹⁶

Through this program, the aims are to reduce the capital costs of telecommunications and operating costs by up to 30%. The collaboration with Barcelona was launched in February 2011, and as such is in its early stages of implementation.

Smart SSP

SMART SSP – innovation through sustainable procurement, is a three year European initiative aimed at promoting the introduction of new, innovative low carbon emission technologies and

¹¹⁴ <http://www.bdigital.org/en/Pages/Home.aspx>

¹¹⁵ <http://www.bdigital.org/en/rdi/Pages/RDiMobility.aspx>

¹¹⁶ <http://cisco-news.tmcnet.com/cisco/articles/147639-cisco-supports-barcelonas-2020-vision.htm>

integrated solutions onto the European market. The project encourages early engagement between public authority procurers and suppliers and developers of new innovative products and services. The project is supported by the Intelligent Energy Europe funding programme. Smart SSP is a multi-partner initiative which involves experts from organisations across Europe.

Barcelona City Council has applied the SMART SSP approach in the tendering of installation, operation, and management of electric vehicle charging stations in the city. The SMART SPP methodology helped to identify the most innovative and energy efficient solution on the market.

LIVE Barcelona – Logistics for the Implementation of the Electric Vehicle

LIVE Barcelona is a public-private sector platform set up by Barcelona City Council in partnership with the Catalan Government, the Ministry of Industry, and industry companies SEAT, ENDESA, and SIEMENS for the purpose of promoting and supporting the development of electric mobility in the city.

The objectives of the LIVE project are:¹¹⁷

- *To promote demonstrative projects in electric mobility.*
- *To facilitate the tools to promote research (R+D+i) and related industry.*
- *Support for the creation of local consortia, in state and European projects, for technology and knowledge transfer.*
- *Organisation and hosting of events to promote electric mobility in Barcelona.*
- *To promote the deployment of recharging networks and public and private fleets.*
- *Creation of the first office for technical and public information in Europe for the deployment of electromobility.*

¹¹⁷ <http://www.pemb.cat/en/?projecte=live-barcelona-logistics-for-the-implementation-of-the-electric-vehicle>

Amsterdam

KEY PLAYERS AND ORGANISATIONS

Municipality of Amsterdam

The Municipality of Amsterdam has taken a proactive approach to exploring new initiatives and setting ambitious targets to make the city a frontrunner in smart and sustainable development.

The Municipality of Amsterdam has developed an 'Energy Strategy 2040', which recognises that good energy and climate policy is sensible economic and social policy. The Strategy sets out the challenges and plans for Buildings, Clean Transport, Port and Industry, and Sustainable Energy.

The Municipality of Amsterdam also set up New Amsterdam Climate. New Amsterdam Climate is made up of residents, businesses, and institutions, and provides a platform for knowledge sharing and collaboration on the subject of energy savings. New Amsterdam Climate restricts its activities to prevention measures to meet the goal of greatly reducing CO₂ emissions and limiting global warming.

The Municipality of Amsterdam itself has carried out a number of projects to set a good example in carbon reduction. In an attempt to become climate neutral by 2015, improvements have been made to municipal buildings, public lighting, and municipal transport facilities to make the most use of sustainable energy.

Amsterdam Innovation Motor

The Amsterdam Innovation Motor (AIM) was established in 2004 as an initiative of the Amsterdam Knowledge Network to help stimulate innovation in the Amsterdam Metropolitan Area. The work of AIM includes supporting entrepreneurs to create innovations in housing, finance and networking, seeking smart ICT applications, and uniting businesses with research institutions, and supporting sustainable businesses. AIM has been instrumental in the setup of Amsterdam Smart City. AIM was established by 10 partners including the Municipality of Amsterdam, ING and the University of Amsterdam.

Liander

Liander is an electricity grid manager in Amsterdam. Liander is part of Alliander who is responsible for energy distribution across large parts of the Netherlands. Alliander seeks collaboration with other network companies in an effort to enhance the efficiency of grid management in the Netherlands.

Liander has initiated several projects in the development of smart meters both in terms of research and practical implementation. Liander is a joint partner in the Amsterdam Smart City initiative.

SMART CITY INITIATIVES

Amsterdam Living Lab

Amsterdam Living Lab was established in 2008 for the purpose of facilitating user interaction in the process of product design. Amsterdam Living Lab is sponsored by the Municipality of Amsterdam, the Ministry of Economic Affairs, the Province of Noord-Holland, and Stadsregio Amsterdam. Amsterdam Innovation Motor is one of the project partners, along with Novay

(national ICT research centre), the University of Amsterdam, and Waag Society (a company developing technology for social innovation).

Amsterdam Living Lab is part of the European Network of Living Labs (ENoLL) and is used to support a number of projects including Amsterdam Smart City.

Amsterdam Smart City

Amsterdam Smart City is an initiative launched by the grid operator Liander and the Amsterdam Innovation Motor whereby fifteen projects will be implemented within a two year period, focusing on working, living, mobility and public space. According to SustainableCitiesCollective, the program will:

“involve energy saving systems in households, including a new “smart grid” platform, household solar panels and wind turbines, as well as power hook-ups for electric cars, making its already carbon conscious infrastructure more eco-friendly.”¹¹⁸

The project team has been enhanced by the collaboration with TNO (an independent research institute), who are on board to record and share the knowledge gained through the initiative. The overarching aim of the initiative is to reduce CO₂ emissions.

The initiative recognises public private partnerships as being crucial for the realisation of the city’s climate ambitions. The program has therefore been structured as a foundation to help facilitate public private partnerships. The foundation is 50% funded by AIM and 50% by Liander.¹¹⁹ There is an interactive website with further detail of the scheme projects, some of which are set out below: <http://www.amsterdamsmartcity.com/#/en>

¹¹⁸ <http://sustainablecitiescollective.com/thedirt/8726/amsterdam%E2%80%99s-smart-city-program>

¹¹⁹ <http://www.top-expo.cz/domain/top-expo/files/tee/tee-2011/prednasky/prednasky%202022den/2-3%20stahlavsky%20roman%20-%20amsterdam%20smart%20city%20project.pdf>

Malmö

KEY PLAYERS AND ORGANISATIONS

City of Malmö

Over several years the City of Malmö has initiated several pilot projects in the area of sustainable development and has been a driving force as a partner in all of the projects mentioned below. Core programmes/strategies for Malmö include:

- Environmental programme for the City of Malmö 2009-2020
- Malmö's Agenda 21
- Environmental and climate policy for environmental management in Malmö
- Business plan and budget for environmental management 2011
- The conservation plan/ biodiversity plan of the city of Malmö
- The comprehensive plan for the city of Malmö
- Transport strategy of the city of Malmö
- Green plan of the city of Malmö
- Energy strategy of the city of Malmö

The Environmental Programme for the City of Malmö 2009-2020 is a key overarching framework setting out the city's ambition to be a leading eco-city. The programme identifies four main environmental objectives for the target year 2020. These are:¹²⁰

- *By 2020, the City of Malmö will be climate neutral and by 2030 the whole municipality will run on 100% renewable energy*
- *In 2020 Malmö will be a flourishing and leading knowledge, demonstration, and development centre for sustainable development. Those who live and work in Malmö will enjoy a city environment with clean air and low noise levels*
- *Malmö's natural resources, in the form of land, sea, limestone, freshwater and biological diversity, are valuable assets which will be protected and used sustainably in 2020.*
- *In 2020, resource usage will be characterised by sustainability and long-term thinking. It will be easy for residents, industry and the municipality itself to make sustainable choices when it comes to commodities, services, travel, and waste management.*

Malmö has a range of projects, from sustainable development of new urban areas, regeneration of existing urban areas, and discreet projects involving implementation of electric vehicles, solar technology, biogas transport, district heating, and food waste conversion.

¹²⁰ <http://www.malmo.se/download/18.6301369612700a2db9180006235/Environmental-Programme-for-the-City-of-Malmo-2009-2020.pdf>

SMART CITY INITIATIVES

PERIPHÈRIA – Networked Smart Peripheral Cities for Sustainable Lifestyles

PERIPHÈRIA is a 30 month initiative funded by the European Commission under the CIP ICT PSP Programme. PERIPHÈRIA aims to deliver Future Internet platforms and services to the promotion of sustainable lifestyles through the use of Living Labs as a research tool. Malmö participated in the scheme as a pilot project with a focus on the Smart Neighbourhood Arena. The experiments in Malmö involved new technologies for user participation in urban planning. The outcomes of the project activities have not yet been reported.

EUROCITIES – Green Digital Charter

Malmö is part of the EUROCITIES initiative, a network of major European cities designed to provide a platform for knowledge sharing, and to develop innovative solutions, ultimately working towards a vision of a sustainable future.

In 2009 EUROCITIES launched the Green Digital Charter, signed by the City of Malmö. The Green Digital Charter outlines the contribution of public authorities in developing low carbon, energy efficient behaviour.

By signing up to the Charter, the city agrees to:¹²¹

- *Create an intercity partnership on ICT & Energy Efficiency to work through to the end of 2011;*
- *Deploy five large-scale ICT pilots per city addressing the above areas before 2015; and*
- *Decrease ICT direct carbon footprint per city by 30% by 2020.*

PEPESEC – Partnership Energy Planning as a tool for realising European Sustainable Energy Communities

The City of Malmö is a partner in the PEPESEC project. The project, now finished, ran for a period of 30 months, finishing in June 2010. The project developed best practice energy planning methodologies, including two residential area energy plans in Malmö. The project promoted the economic, social and environmental benefits of developing a low-carbon economy and shaping a sustainable energy community.

¹²¹ http://ec.europa.eu/information_society/activities/sustainable_growth/docs/charter/green_d_charter.pdf

Appendix B: List of organisations consulted in the study

22@Barcelona

Amsterdam Innovation Motor

Cisco

City of Malmö

E.ON

European Investment Bank

European Commission

GE

HSB

IBM

Institute of Sustainability

Jones Lang La Salle

Manchester City Council

Manchester Digital Development Agency

Manchester: New Economy

Mazars

MKB

Municipality of Amsterdam

Nuon

Riksbyggen

Siemens

Smart Grids GB

SOM Architects

WSP

Urban Splash

Appendix C: Masdar, United Arab Emirates

Masdar is one of the first examples of a development which has sought to incorporate smart technology throughout the development to achieve sustainable outcomes. However, Masdar is a new city and presents opportunities that are challenging to achieve in an existing urban area, although interviewees stress the importance of such examples to trial and demonstrate new technologies, planning and design approaches, and in developing the financing market.

Masdar aspires to be one of the most sustainable cities in the world with an extension of approximately 6km² situated 17km from downtown Abu Dhabi. Masdar City is an emerging global clean-technology cluster placed at the heart of the global renewable energy and clean-tech industry. Masdar is a high-density, pedestrian-friendly City where current and future renewable energy and clean technologies are showcased, marketed, researched, developed, tested and implemented. Masdar has been designed to use integrated waste, water, plus energy from renewable sources, and all through integrated and connected systems monitored by central data centres aiming to achieve zero carbon zero waste. WSP provided sustainable master planning and building design services for the development, giving priority to:

- Minimal energy consumption,
- Low to zero net carbon emission footprint,
- Pedestrian comfort
- Minimum consumption of resources,
- Minimal environmental impacts
- Minimal archaeological impacts,
- Design for a full life cycle of the project and its compounds, including dismantling and upgradeability.

The Masdar Institute MIST, developed in cooperation with the Massachusetts Institute of Technology, is already operating in Masdar City, and its students are the city's first residents. This first completed building on the site is underscoring key role of university and technology development and knowledge to 'smart and sustainable city development. The library has also been built and the Courtyard building is currently under construction as part of the 'Project One' site designed to optimise building design and systems.

Appendix D: EU Regulations and Guidance of relevance to JESSICA

Legislative Provisions

In the context of the Structural Funds, the regulatory framework regarding financial engineering instruments for urban development includes primarily:

- Council Regulation (EC) No 1083/2006 of 11 July 2006¹²² laying down general provisions on the European Regional Development Fund, the European Social Fund and the Cohesion Fund as amended by Council Regulation (EC) No 284/2009 of 7 April 2009 and Council Regulation (EC) No 539/2010 of 16 June 2010;
- Regulation (EC) No 1080/2006 of the European Parliament and of the Council on the European Regional Development Fund of 5 July, 2006, amended by the Regulation (EC) No 397/2009 of the European Parliament and of the Council of 6 May 2009 and Regulation (EC) No 437/2010 of the European Parliament and of the Council of 19 May 2010;
- Commission Regulation (EC) No 1828/2006 of 8 December, 2006¹²³ that sets out rules for the implementation of Council Regulation (EC) No 1083/2006, amended by the Commission Regulation (EC) No 846/2009 of 1 September 2009.

According to Article 44 of Council Regulation (EC) No 1083/2006 of 11 July 2006, UDFs are “funds investing in public-private partnerships and other projects included in an integrated plan for sustainable urban development.” The regulatory framework further specifies that “urban development funds shall invest by means of equity, loans and guarantees.”⁶

In addition to the above provisions, JESSICA operations will have to comply with other applicable EU and national legislation like for instance public procurement legislation, state aid rules, environmental legislation, etc.

Guidance Notes

The Commission has also prepared several guidance notes which were transmitted to the Coordination Committee of the Funds⁷ and provide interpretations and recommendations relevant for the implementation of JESSICA instruments:

- Guidance Note n°1 on Financial Engineering in the 2007-2013 programming period (16/07/2008);

¹²² Amended seven times, most recently 'Regulation (EU) No 1310/2011 of the European Parliament and of the Council of the 13 December 2011 amending Council Regulation (EC) No 1083/2006 as regards repayable assistance, financial engineering and certain provisions related to the statement of expenditure'

¹²³ Amended three times, most recently ' Commission Implementing Regulation (EU) No 1236/2011 of 29 November 2011'

- Guidance Note n°2 on Financial Engineering (22/12/2008) including replies from the European Commission to the questions submitted by the JESSICA Expert Working Group of the Member States;
- Guidance note on eligibility of energy efficiency and renewable energies interventions under the ERDF and the Cohesion Fund (2007-2013) in the building sector including housing (COCOF 08/0034/02/EN of 29/10/2008);
- Guidance Note on Financial Engineering Instruments under Article 44 of Council Regulation (EC) No 1083/2006. COCOF_10-0014-04-EN of 21//02/2011.



Appendix E Urban Development Fund Analysis

	<u>LONDON GREEN FUND, ENGLAND</u>	<u>NORTHWESTERN FUND, ENGLAND</u>	<u>WEST POMERANIA FUND, POLAND</u>	<u>LITHUANIA FUND</u>
	WASTE AND ENERGY EFFICIENCY	URBAN REGENERATION AND JOB CREATION	TOURISM, CULTURE AND REGENERATION	ENERGY EFFICIENCY RETROFIT IN THE RESIDENTIAL SECTOR
Fund Objective	<ul style="list-style-type: none"> To improve the competitiveness of economically and socially deprived areas of London to secure their long term regeneration through supporting the development of high quality working environments and low/zero carbon employment sites and premises with particular focus on green businesses and low carbon demonstration projects. To help accelerate investment in environmental projects to support sustainable development and regeneration in Greater London. 	<ul style="list-style-type: none"> To create or safeguard thousands of jobs in the Northwest by 2015 and provide a boost in Gross Value Added (GVA) for the Northwest economy. 	<ul style="list-style-type: none"> To revitalize disadvantaged areas in cities To strengthen the regional innovation system 	<p>Two main funds with the following objectives:</p> <ul style="list-style-type: none"> To support renovation of multi-apartment houses for energy efficiency purposes. The primary activity is around allocating modernisation loans for energy efficiency in the housing sector in multi apartment buildings. To support the development of urban infrastructure in general <p>A third fund could be considered in order to target medium-size towns identified as regional centres and problem territories. Alternatively this may be addressed as a specific section in the second fund.</p>
Geographical and/or priority areas for investment	<p>Investment in climate change sectors, which are eligible under the London Operational Programme 2007-2013. This includes sectors such as waste, decentralised energy and energy efficiency.</p> <p>Eligible projects are located in opportunity, regeneration, or intensification areas of London as set out in the London Plan.</p>	<p>Investment in “Creating the Conditions for Sustainable Growth”, and specifically Action Areas which:</p> <ul style="list-style-type: none"> seek to develop high quality sites and premises of regional importance. supporting high value and knowledge-based sectors <p>Investment is targeted at the 36 Strategic Regional Sites defined in the RES and agreed by the NWOP Programme Monitoring Committee as being eligible for ERDF support.</p> <p>Investment in “Growing and Accessing Employment” and specifically Action Area 4.3 which seeks to support employment creation for areas of deprivation and regeneration need. Priority geographies include:</p> <ul style="list-style-type: none"> some spatial areas, such as Barrow, Halton, Knowsley some Urban Regeneration Companies’ (URC) areas such as Liverpool, East Manchester, Central Salford, Blackpool, West Cumbria some Housing Market Renewal Areas such as Liverpool/South Sefton/North Wirral; Oldham/Rochdale; East Lancashire; Manchester/Salford. 	<p>Investment in tourism, culture and regeneration. This relates to non-metropolitan areas of the Region, namely urban areas outside the Szczecin Metropolitan Area. In terms of geographies, JESSICA aims at increasing the economic potential of the region by regeneration of urban areas which are in an unfavourable situation and can obstruct the long term sustainable development potential of cities.</p> <p>Investment in the development of metropolitan functions. This relates to the Szczecin Metropolitan Area - JESSICA Initiative in metropolitan areas. Within this priority, JESSICA aims at economic and social revitalization of Szczecin Metropolitan Area through the regeneration of urban infrastructure, including city centres.</p>	<p>Investment in support for energy efficient renovation of multi-family apartment houses.</p>



Appendix E Urban Development Fund Analysis

	<u>LONDON GREEN FUND, ENGLAND</u>	<u>NORTHWESTERN FUND, ENGLAND</u>	<u>WEST POMERANIA FUND , POLAND</u>	<u>LITHUANIA FUND</u>
Sources of finance contained in the Fund	<ul style="list-style-type: none"> Originally the fund includes £50m of European Regional Development Fund (ERDF); £18m from the London Waste and Recycling Board (LWARB); £32m from the London Development Agency; Additional contributions include £8m from the London Development Agency and £6m from ERDF 	<p>The North West Urban Investment Fund’s investment strategy requires UDFs to source £50 million of match funding. Once this is sourced, the original Match funding provided by the North West Development Agency will be treated as follows:</p> <ul style="list-style-type: none"> £10 million from the cash allocation will be invested in the Lot 2 - Rest of North West UDF The remaining £12 million of cash will be retained by the North West Urban Investment Fund’s and may be used in due course to provide further funding to UDFs or Urban Projects <p>The North West Development Agency is considering utilising some of its £28 million land asset contributions in viable Urban Projects coming forward within UDF Business Plans once they are substituted out of the North West Urban Investment Fund.</p>	<ul style="list-style-type: none"> Under the Funding Agreement, an amount PLN 148 736 672 from the Regional Operational Program for Westpomerania has been allocated for the JESSICA mechanism. 	<ul style="list-style-type: none"> Initial capital committed by the Lithuanian Ministries of Finance and Environment to the JESSICA holding fund is EUR 227 million. This is one of the largest funds and one of the first JESSICA holding funds established. Loan agreements signed between the EIB, as manager of the JESSICA holding fund in Lithuania, the “Šiaulių bank” (€ 21 million, through two agreements, 2010), SEB (€ 6 million, 2011) and “Swedbank” (€ 6 million, 2010). All banks will provide modernisation loans for energy efficiency to individual apartment owners.
Fund size	<p>Total fund size is £100 million. This is allocated so far between investment into a waste UDF (£35m) and an energy efficiency UDF (£50m)</p>	<p>Total fund size is £100 million. The two UDFs will be initially awarded investment of £60 million from the NWUIF as follows:</p> <ul style="list-style-type: none"> £30 million is ring fenced in the NWOP for the Merseyside sub-region to be invested by one of the selected UDFs (the ‘Merseyside UDF’) £30 million for the other UDF (the ‘Rest of the North West’ UDF) to invest in the rest of the Northwest outside Merseyside. 	<p>Available amount of approximately € 73.8 million (PLN 290 million). This includes:</p> <ul style="list-style-type: none"> 60% (€ 44.3 m) for projects in large cities (over 50 thousand inhabitants) 40% (€ 29.5 m) for projects in smaller cities- equivalent of € 10 m for urban projects strengthening institutions that support the business environment 	<p>Total fund size is EUR227 million. The amount allocated to the first Call for Expression of Interest is EUR 54 million.</p>



Appendix E Urban Development Fund Analysis

	<u>LONDON GREEN FUND, ENGLAND</u>	<u>NORTHWESTERN FUND, ENGLAND</u>	<u>WEST POMERANIA FUND , POLAND</u>	<u>LITHUANIA FUND</u>
Financial instruments of fund (e.g. loan, equity and/or financial guarantees)	Equity or equity type form	Investment in the form of equity, loan or guarantee.	Involvement in a revolving way (in the form of loans and/or equity) in public-private partnerships or other Urban Projects included in Integrated Plans for Sustainable Urban Development	<ul style="list-style-type: none"> • 20-year loans with fixed interest rate (3%) provided directly to homeowners. • Agreements signed with “Šiaulių bank” (€ 21 million, through two agreements, 2010), SEB (€ 6 million, 2011) and “Swedbank” (€ 6 million, 2010). All banks will provide modernisation loans for energy efficiency to individual apartment owners. • Lithuanian Government also supports the preparation of technical documentations and the supervision of construction works with financial support of 50% of the costs. • The Lithuanian government also will provide a support of 100 % for low income families.
Anticipated Project Typologies	<p><u>Waste management fund</u> Project typologies include:</p> <ul style="list-style-type: none"> • Projects which are on the primary rather than secondary market (i.e. Urban Projects in the development or construction phase, rather than in the operating phase). • Projects that contribute to diversion of waste from landfill, CO2 reduction, number of jobs created, MWh of energy production where applicable and London Green Fund/total Urban Project costs ratio. Must involve the establishment of value adding re use recycling and or reprocessing facilities; waste to energy facilities and or other facilities displacing fossil fuel such as waste to fuel. <p><u>Energy efficiency fund</u> Project typologies include:</p> <ul style="list-style-type: none"> • Projects must involve the establishment of the adaptation and/or refurbishment of existing public/voluntary sector buildings or improvements to existing social housing to make them more energy efficient (max. London Green Fund commitment of £11m). 	<p>Project typologies include:</p> <ul style="list-style-type: none"> • The clearance of derelict land and treatment of contaminated land • Provision of site servicing and related site infrastructure • Site-specific access into Strategic Regional Sites • Site-specific public transport facilities where this is part of a sustainable transport strategy for the site; • Activities that support the development of the high quality business environments, including premises, landscaping, public realm and gateway features, energy / resource management and use, including green infrastructure, and site specific IT/broadband infrastructure. • Support for development of employment sites providing employment for residents of target areas, including environmental improvements, energy and resource use management and site specific IT/broadband infrastructure which help to create an appropriate business environment and support the development of knowledge based industries at the local level. 	<p>Project typologies include:</p> <ul style="list-style-type: none"> • Initiatives employing local potential and enhancing local entrepreneurship in those urban areas which lag behind in terms of development; • Regeneration of degraded town centres in smaller towns as well as selected deprived districts of larger cities • Regeneration of large elements of degraded or de-capitalized urban infrastructure; • Improvement of the condition of housing stock within the framework of applicable EU regulations (including adaptation of buildings for inhabitants with low income); • Reinforcement of the pro-development potential of post-military and post-industrial areas; • Creation and development of existing business environment institutions; • Creation and development of entrepreneurship incubators and industrial parks. 	<p><u>Renovation of Housing for Energy Efficiency Fund</u> Project typologies include:</p> <ul style="list-style-type: none"> • Energy efficiency projects to support the renewal of multi- apartment houses and student dormitories with a focus on modernisation of block of flats in bigger cities. • Projects must achieve a D class according to Energy Performance Certification classification. If the building demonstrates C class, 15 % state support for energy efficiency measures is foreseen. • Apartment owners in multi-apartment buildings can apply for 20-year loans with low and stable interest rates which must be used for energy efficiency investments.



Appendix E Urban Development Fund Analysis

	LONDON GREEN FUND, ENGLAND	NORTHWESTERN FUND, ENGLAND	WEST POMERANIA FUND, POLAND	LITHUANIA FUND
Assessment of whether the fund is already considering ICT/smart technologies	The fund on energy efficiency retrofit of public buildings implicitly considers smart technologies in order to contribute to low carbon retrofitting. The retrofitting projects typically look at such technologies as: <ul style="list-style-type: none"> - using variable speed pumps and fans - PC shutdown software - Voltage optimisation - Insulation - Building Management Systems 	The fund partially considers the use of ICT/smart technologies as it is looking to "build on the region's strengths in culture and media – investing in this sector to enhance the region's strength in this sector including developing and enhancing growth in the digital/new media sector". In particular the fund mentions projects which include IT/broadband infrastructure which then could support ICT/smart technologies.	The inclusion of ICT/smart technologies does not seem to be explicitly considered as part of the fund strategy.	The fund currently does not consider explicitly smart technologies.
Project typologies which could be potentially funded by JESSICA investments, which combine ICT and sustainable urban development (urban regeneration or energy efficiency/renewable energy (EE/RE) funds and projects. How urban regeneration or EE/RE projects and fund could potentially incorporate ICT elements to be 'smarter' and more sustainable.	<p>In terms of energy efficiency projects and retrofitting projects of public buildings, the incorporation of ICT/smart technologies in the project specifications should not be the central criteria for eligibility of projects. A large proportion of energy savings in existing buildings can be achieved through using existing technology in buildings. It is recommended to look at projects that favour recommissioning of the building, using existing technology to optimise performance and minimal intrusion or further expenditure.</p> <p>One of the key areas to consider is optimising Building Management Systems and Building Energy Management Solution systems. In order to achieve aggregated energy savings, it is important to ensure that there is greater consistency around the management of these systems between co-located buildings, and the fund could incentivise this trend.</p> <p>This could be an example of projects where funding from the UDF could be used. Projects that are implemented across a number of buildings should be prioritised over those that are targeting individual buildings. If a project is targeting a portfolio of buildings, the most energy intensive assets should be targeted to ensure the greatest effect and energy savings.</p> <p>In terms of waste management, ICT could be</p>	<p>Some examples of projects that could be supported by the UDF include:</p> <ul style="list-style-type: none"> • Use of ICT specifically to support the development of Small and Medium Enterprises incubators. • Incorporating superfast broadband in sites that are being redeveloped (rather than into individual buildings) • Provision or incentives for the development of car clubs. Currently some private developers are partnering with vehicle manufacturers to implement and integrate electric charging points into cities in partnership with the local authorities. However, this approach has the potential to hinder market wide solutions. An alternative project to support a city wide sustainable transportation policy would be to use ICT technologies to support the development of car clubs in areas where only a small percentage of the population has access to private cars and therefore employment. This would serve urban regeneration purposes through enabling individuals to have access to cars and encourage an alternative to private car ownership. • Support the implementation of superfast broadband in new developments allowing developers to bid for support in this area. • Supporting the development of additional communal space that is flexible and well- 	<p>Some examples of projects that could be supported by the UDF include:</p> <ul style="list-style-type: none"> • Using UDF technical assistance (if available) to facilitate town-wide feasibility regeneration plans. This could enable an optimum development approach with packaging of lots to be sold to developers or built out by contractors. • Installation of super-fast broadband infrastructure so that integrated public, free wireless hotspots into regeneration schemes • Supporting the creation Energy Service Companies (ESCOs) for projects • Supporting the development of systems that improve passenger information on public transport (location, availability, cost) through the use of ICT technologies 	<p>ICT in private housing could be used to improve energy efficiency. The funding could also be used to support infrastructure aimed at driving behavioural change in private households. It could be explored to see whether funding could be used in the following projects:</p> <ul style="list-style-type: none"> • The development of community level data regarding energy efficiency so that households within local communities could compare and benchmark their energy consumption. • The installation of the infrastructure needed to install an optical fibre network for high speed broadband • The installation of a small combined and heating power plant in apartment buildings • To accelerate the installation of smart meters in building blocks or in homes through partnering with utility companies or local authorities. The local authority could use the data to use the development of further planning requirements. The biggest energy efficiency savings of existing private housing units is around insulation of the fabric of the building. Funding could be used to implement a pilot project where home occupants could feedback whether their comfort levels are right within the home.



Appendix E Urban Development Fund Analysis

	<u>LONDON GREEN FUND, ENGLAND</u>	<u>NORTHWESTERN FUND, ENGLAND</u>	<u>WEST POMERANIA FUND , POLAND</u>	<u>LITHUANIA FUND</u>
	<p>used to help improve the measuring and monitoring of waste production. For instance, some cities have been experimenting a system whereby a chip is located in households' bins to track how much waste is produced and track the destination of the waste. TrashTrack¹²⁴ uses hundreds of small, smart, location aware tags: a first step towards the deployment of smart-dust - networks of tiny locatable and addressable micro-eletromechanical systems. These tags are attached to different types of trash so that these items can be followed through the city's waste management system, revealing the final journey of our everyday objects in a series of real time visualizations.</p> <p>Other relevant projects could include support in the development of</p> <ul style="list-style-type: none"> - closed loop waste recycling systems - waste to energy infrastructure. 	<p>networked facilities that the local community can book for use. This facility could provide a mix between employment and recreation and could be managed by a social housing provider. An example of a housing association providing a similar community facility is East Thames Housing Association in the UK.</p> <ul style="list-style-type: none"> • Private developers with existing pipeline developments could bid for these funds to deliver employment supporting infrastructure on sites that need to be brought forward 		
Europe 2020 Goals - Areas for Potential Contribution	<ul style="list-style-type: none"> • R&D/ Innovation, • Climate Change/Energy • Employment 	<ul style="list-style-type: none"> • R&D/Innovation • Employment • Poverty/Social Exclusion 	<ul style="list-style-type: none"> • Employment, • Poverty/Social Exclusion 	<ul style="list-style-type: none"> • Climate Change/Energy
Documents Reviewed	http://www.eib.org/attachments/ir-893-udf-london.pdf	http://www.nwda.co.uk/media-library/publications/infrastructure/northwest-urban-investment-fun.aspx http://www.bei.org/attachments/ir-887-udf-northwest.pdf	http://www.eib.org/attachments/ir-912-udf-westpomerania.pdf http://www.immo.tu-dortmund.de/EIBURS/Medienpool/presentations_conf1/Presentation%20Rudnicki.pdf http://www.eib.org/attachments/general/ev-ents/krawczykowski.pdf	http://www.eib.org/attachments/li-evaluation-study.pdf http://www.bei.europa.eu/attachments/call-for-expression-of-interest-jessica-ir-865.pdf http://www.cda.nl/Upload/Nistelrooij/2011%2004%2018%20Frank%20Lee%20JESSICA%20and%20Energy%20Efficiency%2014%2004%202011v2.pdf

¹²⁴ <http://senseable.mit.edu/trashtrack>

Appendix F: Seminar Discussion Points

On the 6th December 2011, the European Investment Bank (EIB) hosted a seminar in Luxembourg attended by representatives of the EIB and the European Commission (EC), together with key individuals involved in smart city initiatives from Siemens, IBM, Cisco, EON, HSB, Skanska, and the City of Malmö, as well as representatives of Mazars, WSP, and Edinburgh Napier University acting as consultants to the EIB for the purposes of this study.

The purpose of the seminar was to help improve knowledge and understanding of how financial instruments established in line with the Joint European Support for Sustainable Investment in City Areas (JESSICA) initiative could invest in Smart and Sustainable City projects, in support of achieving Europe 2020 goals. The seminar aimed to share and discuss the findings of the research undertaken in the Autumn of 2011 into Smart and Sustainable Cities, to further explore and highlight the key opportunities, challenges, and issues associated with Urban Development Fund (UDF) investments into smart city projects. Attendees were provided with a Background Paper in advance of the seminar, which contained the findings of the desktop and interview research undertaken. The seminar featured presentations describing key research findings so far, financial instruments such as Urban Development Funds and associated Holding Funds, smart and sustainable cities, and smart city initiatives and projects in Malmö, Sweden, as well as the London Green Fund.

Attendees considered the following set of questions arising from the research findings of relevance to how JESSICA financial instruments can support the delivery of smart and sustainable cities.

Could sustainable urban development projects be 'smarter' and how could investments in cities better contribute to the realisation of the EU's 2020 goals?

- To what extent could a technology-led approach support the delivery of smart city investments and be integrated into city strategies or Urban Development Fund investment strategies?
- Which smart-city project types seldom require public sector support and which aspects most influence the commercial viability of smart-city projects?
- Where are the market gaps for financing smart and sustainable urban development projects? What forms of public-sector support would be most appropriate to tackle this?
- What types of smart city projects are most suited to JESSICA financing of sustainable urban development?
- What is the supply of JESSICA-compliant and investment-ready smart city projects in European cities? If this supply needs to be further developed, what actions would encourage and enable this?
- To what extent could financing from JESSICA financial instruments address market failure in the delivery of smart and sustainable urban development projects? How could this be optimised?
- What other actions are needed to ensure 'smart investments' deliver sustainable outcomes?
- Many smart city technologies are easier to implement in new cities than existing cities. How can existing cities learn from smart city development and delivery in other areas of the globe? How can European cities learn from each other in becoming smarter and more sustainable? How can UDFs learn from each other in this area? To what extent can the JESSICA initiative assist with knowledge dissemination, information exchange and learning on smart city development?
- What are the issues that the EIB, EC, and UDF managers should be aware of in seeking to support smart and sustainable city initiatives and projects that might influence the ability for JESSICA-type



financial instruments to be effective (e.g. capex/opex, ERDF eligibility criteria, public procurement, city leadership etc)? How can these issues be managed/addressed? Are there greater opportunities in the next programming period? Are there any simple actions that could be taken in this period to increase the contribution JESSICA-type financial instruments could make to smart and sustainable cities in the next programming period?

A summary of the main points of the discussion follows in Appendix G.

Appendix G: Summary of Seminar Discussion

The main elements and points raised during the JESSICA Smart and Sustainable Cities Seminar are set out below.

City Strategies and Initiatives

The Background Paper research found that cities which are proactively seeking technology solutions to the sustainability of their cities tend to have city wide strategies and initiatives to provide the strategic context for projects, such as the London Plan or the Environmental Programme for the City of Malmö, and/or may set out a 'road map' or appropriate spatial plans to guide development such as the Manchester Digital Plan and London Heat Maps. Cities also seem to establish forums for debate and discussion to encourage and develop new ideas and projects. City wide strategies which seek to integrate ICT and technology to drive city sustainability are important due to the requirement for urban development projects (UDPs) which are part financed by UDFs to be part of an Integrated Plan for Sustainable Urban Development (IPSUD) in JESSICA Operations.

City Authority and local government leadership and commitment to smart cities was cited in the seminar as a key ingredient to enable the start up and development of smart city initiatives and projects.

Research and Development

Seminar attendees noted that discussion and idea generation between the City Authorities and private companies (including utility companies, technology service providers and suppliers) was important to get smart city initiatives started. Seminar attendees had generally been engaged in exchanges that were either bilateral or included a number of players depending on the city objective, relationships, and nature of the potential projects. These discussions were felt to lead to idea generation for pilot projects which trial new technologies, test user acceptance, and provide the information to understand potential savings and/or revenues generated. Those pilot projects attendees were involved in tended to be area based and small scale in nature and were cited as important to establish the business case for such projects in order to inform and facilitate larger scale roll out at a later date.

Project types

The types of smart and sustainable city projects which could potentially be supported by JESSICA investments identified in the Background Paper, and further discussed in the seminar are illustrated in the table overleaf:

<p><i>Digital infrastructure projects for urban areas</i></p> <p>The provision of new ICT infrastructure and high speed broadband through fibre optic cables, wireless, and/or networked information systems.</p>	<p><i>City wide data projects</i></p> <p>Data collection, storage, and analysis at a city wide level, potentially through the ‘Cloud’, which can enhance a city’s ability to plan for both current and future services and city development, through the ability to model and analyse data, such as traffic, environmental, demographic or land use.</p>	
<p><i>Smart urban transport and urban mobility</i></p> <ul style="list-style-type: none"> • Cycle hire schemes • Real time bus timetable information • Electric vehicle charging infrastructure, car pools, and batteries • Congestion charging • Intelligent transport systems 	<p><i>Area-based and renewable energy/energy efficiency projects for urban areas</i></p> <ul style="list-style-type: none"> • Combined heat and power • Renewables • Sensors to monitor traffic, pollution, emissions, • Street lighting • Waste collection systems • Smart grids 	<p><i>Smart and sustainable buildings in urban areas</i></p> <ul style="list-style-type: none"> • Smart meters • Building management systems • Energy efficiency measures: Insulation, low energy lighting, efficient boilers • Building integrated renewables • Electric vehicle charging points • Smart appliances • Motion detectors • Automatic weather forecasting

Project actors

Each pilot project discussed involved collaboration between the City Authorities and one or more other actors. Relationships cited varied in scope and formality from loose collaborations, through to joint public statements and formal Joint Ventures. There appears to currently be no fixed or common model of collaboration. As a result, one conclusion of the seminar was that further investigation into different types of project vehicles which might be appropriate for smart city developments was needed.

Project benefits

Projects discussed were commonly found to be at pilot stage with project sponsors seeking to better understand the actual financial returns and/or savings of the project, as well as the broader social, economic, and/or environmental benefits. Quantifying levels of investment and rates of return, and understanding over what time period returns can be generated therefore appears to be one of the key

goals of pilot projects. Understanding this is critical to knowing how repayable JESSICA investments could play a role in supporting such projects.

Similarly, understanding the potential wider socioeconomic or environmental benefits of smart city projects, in addition to the potential financial returns is important given the role of UDFs in contributing to Europe's 2020 goals. UDF investments seek to achieve both financial and broader socio-economic and/or environmental returns, according to the Operational Programme objectives from where the funds are drawn from. To be appropriate for UDF investment, smart city projects therefore need to be configured to create both financial return and achieve wider benefits. Examples of this could include:

- Smart grid projects which aim to regulate but also reduce energy demand, could potentially repay investments through energy savings, which would also reduce carbon emissions
- City wide ICT infrastructure (e.g. for broadband) could potentially be rented to telecommunications providers, providing revenue to repay investments, while providing for free of charge Wi-Fi access in public spaces for city residents, thus allowing inclusive access to internet services and enhancing interaction with the urban environment and related city services.

Behaviour

Changing individual behaviour was considered by seminar attendees as key to achieving the full potential benefits of smart city investments, especially in relation to energy saving investments, such as smart grids, where user behaviour influences how much energy is actually saved. This implies that a key component of certain smart city projects could be education and/or behavioural change programmes to ensure the projected returns (both financial and non-financial) are achieved.

Financing

Interviews conducted as part of the Background Paper and contributions made during the seminar showed that current smart city projects seem to be financed through a combination of Local Government resources, National Government resources, EU Structural Funds, the European FP7 programme, often in the form of grants, and contributions from industry players. To make a shift towards such projects being funded by UDF investments, then greater understanding of the potential financial returns and savings associated with such projects is needed. Increasing the understanding of the business case associated with different types of smart city projects is therefore one of the key conclusions of the seminar.

Revenue/Savings

To repay UDF investments, UDPs need to generate revenue or be able to capture the savings generated through the project so that sufficient returns are made. Most of the smart city projects under discussion appeared to relate to the potential for 'savings'. A number of JESSICA UDFs have been established which enable investments to be repaid in the field of energy efficiency, where the investment is repaid through the energy savings generated. Therefore such types of financial instruments could also be appropriate for other types of energy saving smart city projects, such as smart grids. However, the potential for repaying investments in other smart city projects which create savings was seen as being less clear, either because the savings are not yet known, or the benefits may be accrued by actors other than those making the investment, and therefore may be difficult to capture. For example, investments in city open data projects, which allow entrepreneurial businesses to develop smart phone applications related to city transport, may

create employment and reduce congestion, but any financial savings or other revenues created may be hard to capture by the entity investing in the open data platform.

Consideration of the broader socio-economic and/or environmental benefits of such projects is therefore important, rather than purely a narrow focus on the cost savings that can be captured and monetised by the project promoter, to justify any UDF investment.

Projects which have the potential to create revenue that could be used to repay investments are also not clear cut. If one considers the example of the provision of wireless broadband within a city, this creates the potential to speed up and reduce the cost of doing business by those with access. However, if the cost of using the service prevents some users from accessing the service and its benefits, then this could have socially inequitable consequences. Innovative means of revenue generation may therefore need to be considered to repay the investment while providing the service at no cost (or low cost) to the end user. One of the conclusions of this discussion at the seminar is therefore that detailed research exercises are likely to be needed to understand:

- What types of projects have the potential to generate sufficient revenue or financial savings which allow them to repay the original investment made, whilst simultaneously achieving positive socioeconomic and/or environmental outcomes?
- What are the revenue streams (or potential savings) associated with such projects, and over what time period might enough revenue/savings be generated to repay the initial investment, and what are the dependent factors influencing whether and when the revenue/savings might be generated?
- What are the governance or contractual mechanisms that are needed to capture revenues or savings?
- Who are the key players for different types of projects, and what are their roles and motivations for participating in such projects?

In summary, further detailed understanding is needed of the business case for different types of projects. This could potentially be through detailed evaluation of completed or on-going pilot projects, and/or hypothetical project conception and modelling. Any such research would need to be highly interactive to generate and test ideas.

Such detailed research notwithstanding, lessons can be learned and shared from projects considered as part of the Background Paper and mentioned in the seminar, through presentations at a conference, which may provide ideas and the impetus for the start or further continuation of smart city activity in different European cities.

Knowledge/experience

There were several knowledge gaps noted by seminar participants in relation to moving towards repayable investments for smart city projects. One of these relates to the novelty of the technology. It was felt that few City Authorities are familiar with the variety of technologies available and the opportunities that they offer for improvements in quality of living and competitiveness of cities.

Other barriers mentioned included the general grant funding culture within City Authorities which can inhibit a project development approach which considers the possibilities of repayable investments. Such a change in culture was seen as a challenge for the widespread adoption of JESSICA-type financial

instruments and project investments across Europe, of which smart city projects could form a key area of focus.

The challenge where both financial returns and broader societal benefits are difficult to predict and/or measure and capture in smart city projects was also felt to present a significant challenge for UDF managers and project sponsors to appreciate how repayable investments might be able to support such projects. The business case research mentioned above would assist in providing confidence and examples to the various stakeholders about the nature of projects that might be suitable, and how they might need to be structured.

Challenges also appear to exist within industry to consider applications of their products and services which can enable a city to achieve its wider policy goals, and therefore innovative thinking could be helpful concerning how such products and services can be financed by long term investment, rather than a more short term client/supplier and traditional procurement relationship.

Similarly within City Authorities, working across organisational and departmental boundaries presents perhaps the greatest opportunity to develop smart city projects and to capture the benefits, although such cross department working can often be challenging. ICT, for example, has traditionally not been considered as a tool for city development, and more as an internal service, implying the need for a shift in mind-set and more collaborative working. For the above reasons, and particularly given the early stage of development of many of the project structures seen, it was felt that technical assistance would probably be needed in a large number of cases to support smart city project sponsors.

Innovation

Smart and sustainable city projects present significant opportunities for innovation and contribution to Europe meeting its goals for 2020. Seminar participants discussed how UDF investments might be able to stimulate innovative projects and solutions to help contribute to such goals. It was considered important that fund managers should make UDF investments on the basis of output or outcome criteria (e.g. job creation, carbon emission reduction) to allow flexibility and innovation in project design, and the use of ICT to help achieve these outcomes.

Another aspect highlighted during the seminar was that working in a greenfield environment generally provides greater opportunities for new ideas to be integrated from the start of a project. Whereas, where actors are considering retrofitting into existing infrastructure or buildings, there are often significant additional challenges to be overcome for a smart city project to be initiated, developed, implemented, and be successful. The particular challenges of working with existing infrastructure or existing sites should therefore be considered in investment criteria, outcomes, and decisions. An example would be the laying of new fibre optic cables, which in a new development can be integrated into the design of the development and the construction process, whereas in an existing city environment, necessarily is undertaken in a piece meal manner, and can often be more costly.

Summary

The seminar provided an opportunity to explore many of the key issues arising out of the Background Paper. It further highlighted the pilot status of current smart city projects and the need to better understand their specific configurations, organisational models, and business cases including their potential financial returns, savings, and wider social, economic, and environmental benefits. It also drew particular attention to the importance of assessing project risks. Better understanding of these issues is



needed to enable greater clarity on how UDFs could support smart and sustainable city projects through providing repayable investments.

In order to progress understanding of the role of UDF investment in supporting smart and sustainable city projects, a broader conference programme was then developed focusing on the business case for different types of smart city projects.

Appendix H: Conference Summary

Introduction

On the 29th of March 2012, the EIB and the City of Malmö hosted a conference in Malmö, titled “Delivering Smart City Projects: The role of JESSICA Urban Development Funds in implementing their business cases”. The conference was preceded by study tours of smart city projects in Malmö the day before. The purpose of the conference was to build on the findings of the research undertaken for this study in Autumn 2011, and the workshop held in December 2011. The conference programme was therefore designed to focus on the business cases and financing challenges and/or opportunities of smart city projects in order to inform how the investment strategies of JESSICA type financial instruments could be developed to support such projects and thus the development of smart and sustainable cities. The conference included question and answer sessions throughout the day to facilitate discussion and knowledge sharing.

The event included presentations by representatives of the EIB and the European Commission, along with key individuals involved in smart city initiatives from the Cities of Malmö, Barcelona, Luxembourg and Sala, and from Siemens, IBM, E.ON, GE and Skanska, among others, as well as representatives of Mazars, WSP, and Edinburgh Napier University acting as consultants to the EIB for the purposes of this study. In addition to these core participants, attendees included representatives of various European universities, financial institutions and consultancies, technical and design consultancies, information and communication technology companies, property developers, constructors, and various levels of government.

The conference programme was divided between a number of subject areas, as follows:

- Setting the Policy Context: Delivering Smart Cities by 2020; presentations delivered by EIB and EC (DG-REGIO) representatives.
- Study Findings: “JESSICA for Smart and Sustainable Cities”; presentation delivered by the project team.
- EU Cohesion Policy Framework for Cities 2014 – 2020; presentations delivered by EC DG-REGIO representatives.
- Malmö: Taking Shape as a Smart and Sustainable City; presentations delivered by representatives of Malmö’s government, constructors, energy and technology companies.
- Business Cases for Smart City Projects and Financing Needs; presentations by representatives of the EIB, including the EIB Municipal and Regional Unit, European PPP Expertise centre, technology companies, relevant project champions and design consultancies working around “smart” cities.

Conference Objectives

One of the key objectives of the conference was to shed light on the definition, development, financing and outcomes, of projects which fall into the “smart city” or “sustainable city” category. As the earlier findings of this study asserted, a great many of the projects realised under the “smart city” banner in Europe have only recently been realised, or are still under development, or are pilot projects. The relative youth of these projects has implications for the availability of data regarding their performance in financial, social, economic and environmental terms, and also means that they may not yet provide a “template” business

model for future projects. However, a great deal of insight can be gained from such interventions for future projects, and their financing.

The need for smart urban development in Europe

The need for projects of a smart and sustainable nature in European cities was well established in the early presentations of the day. Thomas C. Barrett of the EIB outlined a series of key European statistics, crucial to underpinning the need for sustainable new urban development and urban regeneration in Europe. Fundamental to discussion of the quality of urban development, is the premise that at present 75% of Europe's population resides in cities. In addition, 85% of the continent's GDP is generated in cities, meaning they not only house the majority of the continent's population, but are undoubtedly its economic engines. However, Barrett went on to illustrate that in spite of rigorous targets and a raft of socio-economic and environmental measures deployed over the past decade, Europe remains in danger of suffering high levels of youth unemployment (among other socioeconomic issues), and of realising only half of the 20% increase in energy efficiency sought in the *Europe 2020* objectives. Thus, focusing on urban areas to address the challenges and opportunities facing Europe was illustrated.

EU Policy and Strategy support

The EIB and EC have a role to play in assisting the development of smart and sustainable cities, which was communicated by Barrett in explaining how the EIB support EU strategies such as Europe 2020, and by Virgilio Martins from DG REGIO. Martins presented the background and state-of-play with regards to financial instruments for urban development and regeneration during the period 2007-2013, and provided an overview of the EC proposal for this type of instrument in Cohesion Policy post 2013.

It was evident that in recognition of the growing challenges faced by urban areas, EU policies are changing, and the EIB is implementing new products that support the common vision of smart and sustainable cities. Barrett noted that the core philosophy of the EIB has evolved in response to the complexity of the current challenge to provide greater levels of advice alongside traditional lending programmes and activities. JESSICA is just one of the new financial instruments introduced, supported by the EIB which draws on the EIB's experience of targeted investing for high socio-economic returns.

Merja Haapakka from DG REGIO further detailed the focus on Europe 2020 objectives in EU Cohesion Policy and its investment priorities for the next period from 2014-2020. In order to 'strengthen the urban dimension', the European Union has proposed that Member States allocate a minimum of five percent of ERDF resources to integrated strategies for sustainable urban development, through for example an Integrated Territorial Investment tool (ITI), with a possibility to delegate its management to cities. The ITI would enable funding to be bundled together from different thematic priorities of cohesion policy programmes into an integrated territorial strategy. The use of ITIs is expected to require increased collaboration and involvement of different stakeholders. Haapakka also highlighted the recent publication of DG Regional Policy, 'Cities of Tomorrow'¹²⁵, which demonstrates the efforts to understand and gain awareness of the challenges faced by European cities, and aims to provide inspiration to urban stakeholders.

¹²⁵ *Cities for tomorrow – Challenges, visions, ways forward* (October 2011), DG REGIO, European Commission, http://ec.europa.eu/regional_policy/conferences/citiesoftomorrow/index_en.cfm

The “smart” European track record

The conference represented an opportunity to learn from smart city projects underway in Europe; see what kind of projects are evolving, and understand how successful they are.

Hyllie, one “smart” project described during the conference as an “integrated new district of the city of Malmö”, currently being built on brownfield land on the edge of the existing built up area, consists of residential units, a shopping centre, and commercial offices, all built around a railway station connecting the district to Malmö Central, as well as Copenhagen in Denmark via the Øresund Bridge. Hyllie is a test bed for developing new energy solutions, with a smart grid system that received 25% funding from the Swedish Energy Agency alongside financing from E.ON, Siemens, the City of Malmö, and property developers. Following project initiation, the vision and framework for Hyllie was set out in a Climate Contract signed by both E.ON and the City of Malmö in February 2011, forming a long term treaty. Hyllie was visited by some of the conference delegates on the 28th March, and featured in a presentation given by representatives of Skanska, a Swedish multinational constructor. Skanska’s presentation included references to smaller projects, around the scale of a single building, or a city block, deemed “smart city” projects also built in and around Malmö.

Examples of successfully delivered “smart” districts presented at the conference were not restricted to Scandinavia. A presentation by Josep Piqué, of the Barcelona City Council, told the story of the redevelopment of a central district of Barcelona, into a thriving “smart” district, which had attracted some 1,500 businesses, 40% of which were new, in the first decade of the twenty-first century. This district, now known as “22@”, was previously made up of over 100 different land plots and a large number of vacant buildings, but now benefits from significant infrastructure investment. Transport and mobility, information technology and the public realm, have all seen a significant upgrading, with investment not only creating an “enabling environment”, but leading to the development of a “knowledge economy ecosystem”.

While the conference contained examples of other “smart” urban projects which had either been developed or were currently under design and construction, the EIB described how one of the three JESSICA UDFs in operation in Portugal, with the support of an EIB Holding Fund, has identified a project portfolio, of which EUR117m (44%) could be seen as delivering against “smart” objectives. In addition, between 2000 and 2010, some 409 urban projects were financed through EIB loans to a value of EUR58bn, pointing to a significant body of experience across Europe in delivering urban projects aligned with EU objectives. Alongside these projects were EIB investments supporting the growth of the “knowledge economy” to the tune of EUR100bn. Despite this collection of projects supported by the EIB, Barrett asserted in his closing remarks, that this “diversity of experience across Europe, had not yet transformed itself into organisational capacity”. That is to say, that while a great number of projects may be being brought forward, the act of doing so had not yet become second nature to the constellation of organisations and actors responsible for or involved in urban development in Europe, suggesting more action was needed.

Collaboration is key

Key to almost every presentation across the day was the idea that collaboration is critical to the success of innovative urban development projects. This collaboration could be between private sector participants, as in the case of E.ON and Siemens, who collaborated on development of Hyllie’s smart grid project. Here it was suggested that collaboration on the design and construction of such development and infrastructure would need to be mirrored by collaboration in the financing of such investments.

The prospects for such cooperation were seen to be positive, as illustrated by Martins' EC (DG-REGIO) presentation, which highlighted that JESSICA, a joint initiative of the EC, EIB and CEB, can act as a catalyst for the creation of partnerships between public and private stakeholders needed to address the issues confronting urban areas. Several speakers noted that when collaborating with other organisations, an important prerequisite is to have a common goal and vision for the project, over and above the individual corporate or stakeholder objectives. It can also be beneficial for parties to clearly identify and set out this common goal by entering into a formal agreement, such as the Climate Contract signed by E.ON and the City of Malmö for example. Furthermore, a message from the Malmö presenters amongst others, was that strong leadership is essential to create a structured and organised approach, and to facilitate communication links between all parties, especially the end user.

Public Private Partnerships

Partnerships discussed during the course of the conference were not restricted to those within the private or public sector, but across the sectors. Europe was described as having the most advanced deployment of public-private partnerships (PPPs) of any economic zone in the world. It was asserted by several of those experienced with the JESSICA framework, that JESSICA in fact "drives" partnership. Indeed, the non-JESSICA cases shared at the conference were often examples of one-off incidental partnerships, rather than strong programmes of public and private players working successfully together. A clear message of the day was that lessons must be drawn from these cases where organisations worked in partnership to achieve smart and sustainable development.

In the morning discussion session a member of the audience, Martin Zaimov, from the JESSICA Urban Development Fund that has been established in Bulgaria, raised the issue of collaboration and communication between cities and decision making bodies, and how this could be improved given the increasing emphasis on forming these relationships. Barrett acknowledged that this is a central point for the EIB, and discussed how the EIB was responding to this challenge by increasing its focus on cities, and by employing the European PPP Expertise Centre (EPEC) to effectively form a knowledge exchange mechanism for PPP projects. This facility can then assist member states in understanding PPP, so that they can better utilise new financial instruments available to them.

Emerging Business Models

As established in the study findings to date, there are no standard accepted business models yet for smart and sustainable city projects. However, based on the presentations of the day, there are clearly models developing which demonstrate potential for return on investment, and the realisation of significant social, economic and environmental benefits. In some cases, organisations are evidently working on methods to ensure that investments pay off. For example, Magnus Rosenblad from GE spoke about electric vehicles, and the problem of securing acceptable returns on investment on existing charging infrastructures. Consequently, GE are looking at other ways to add value and generate revenue from such investments, among them rolling out electric vehicles through fleet schemes, rather than targeting the individual consumer. This approach demonstrates the clear motivation to pursue projects which will help achieve a range of benefits for a city, but where the initial financial business case is not clear cut. In the case of GE, the company are exploring the use of ICT in charging infrastructure, such that electric vehicles will collect and store data on where the vehicle has been for example, and relay this information using ICT when the vehicle is being charged.

It was noted by E.ON that with projects such as smart grid, the challenge lies in the complexity of the business model, and how to break it down into value savings, division of costs and revenues between the various parties and end users. This reiterates the earlier findings of the study regarding this point.

In the presentation by Piqué, a more developed business model was presented for Barcelona's dark fibre project, whereby over a 25 year business plan, profit was made after year four, and payback was seen at year 10 with an IRR close to 17%. In this instance, the city came up with the solution of investing in "dark fibre" infrastructure themselves in collaboration with Telefónica. Companies then rent the network from the city, thus generating revenue, while delivering new technology to assist regeneration and the development of a knowledge-based economy in Barcelona.

Despite this success, Piqué emphasised that such models are not yet well known, that cities are still in a learning phase, and thus should be seen as "living laboratories". Piqué stressed the importance of this "living laboratories" model in allowing innovation and increasing knowledge on city requirements for the future.

Revolving funds, not grants

In addition to the positive trend for partnerships, UDF financing has an advantage over more traditional grant support: rather than Managing Authorities (regional, municipal, or national as the case may be) being reimbursed by European funds at the end of a project, they can gain access to the resources at the beginning, which is especially useful in times of low liquidity.

Furthermore, as noted previously, EU institutions are seeking to encourage this form of support due to its ability to achieve greater levels of co-investment. Several speakers over the course of the day emphasised the multiple benefits of such lending; that funds can be used several times, and that it promotes the development of more viable projects, since the monies will have to be repaid.

JESSICA-ready projects

As more and more projects are financed by revolving funds, rather than grants, the overall viability of what is being developed ought to increase. Thus, it is not just a question of finding out what types of existing concepts for projects currently configured for grant funding could be suitable for JESSICA financing, but rather beginning a trend where projects are devised from initial concept onward with support from JESSICA UDFs in mind.

Several speakers described projects which would in theory produce revenue streams, but not enough to attract typical commercial private sector investors, as being particularly suitable for JESSICA UDF support. In such situations, co-investment by the private sector in JESSICA UDFs requiring payback over longer periods of time, could prove effective.

Dr Goetz von Thadden from the European PPP Expertise Centre explored the issue of where financing from JESSICA UDFs could fit within Municipal PPPs to provide an additional source of funding. Here such investment was seen as being particularly suitable for development projects which may otherwise present too high a risk for a commercial bank to finance. Such financial instruments were seen as offering the prospect of 'lower default probabilities' for senior lenders. This point was also made by Rakesh Bhana from the EIB, who highlighted cases where UDFs have been setup to take junior debt positions, thereby being equipped to support the roll out of pilot schemes delivering smart city development.

Others touched upon the potential for JESSICA to assist in up-scaling projects from small schemes to wider roll outs. For example, Christoffer Eksandh from NCC, a developer in Malmö, suggested that although

JESSICA UDF support may not be appropriate for an individual project due to its small scale combined with a high level of specificity, by grouping projects over a district or city-wide area, such financial instruments could indeed be of assistance to bring about a programme of investments delivering area-based sustainable urban transformation.

A further example of where JESSICA UDF support was considered a possibility for enabling roll-out was the case of the CERO tool presented by Jesper Johansson from WSP and Markus Robèrt from the Royal Institute of Technology in Sweden. Currently, the model is being used in several organisations to develop mobility management plans that will help meet travel targets, and reduce carbon emissions. With each tailored travel plan, a range of measures are recommended for the organisation to select and implement, which each require certain investments to be made. However, individually the tool has a limited impact, and a wider roll out across a specific city is required to tackle traffic problems on a city-wide scale. Robèrt and Johansson noted that the cost savings from, say, a 10% reduction in traffic could be put forward as justification for early investment in traffic reduction measures. JESSICA UDFs could potentially assist with the consequent city-wide investments required to deliver the recommended measures.

State of Play

In summary, there is still a great amount to achieve before we see a significant body of established business cases for smart and sustainable projects. That said, a number of European cities are currently working as “living laboratories” where various models are being tested, developing their functional areas at the same time into knowledge-based economies. Initiatives to gather, compare, and analyse the data on the methods of collaboration, business performance, and project outcomes must be prioritised, in order to begin to increase skill, knowledge and templates for such projects, across the constellation of agencies and companies working to make Europe’s cities “smarter”. This is critical in order to take full advantage of financial instruments like UDFs. It could be argued that knowledge dissemination needs to be “smarter”, and that stakeholders need to be increasingly “open source” (that is to say, transparent) about their project data, to stimulate learning across Member States.

Projects are evidently, for the most part, still at pilot stage, and some cities are further ahead in delivering such projects than others. A significant challenge lies in how projects can move out of the single-location pilot type, and into continent-wide roll-outs.

Furthermore, when it comes to tackling problems of energy consumption and socio-economic challenges, many of the pilot projects focus on new urban development or redevelopment of existing areas, rather than the retrofitting of existing buildings. However, in the Project Portfolio of the BPI UDF in Portugal, JESSICA UDFs are supporting the re-use of existing building stock in a number of cases, and a number are targeting energy-efficiency investments. While such projects may not yet be the centre of “smart city” discussions, existing building stock could potentially be a strong focus for future investments.

Key Conclusions from the Conference

- Smart and Sustainable Cities are no longer just an ambitious policy statement or future concept. In some cities, actions are being undertaken to help make them a reality
- An evidence base is starting to be created which over time could help to demonstrate the types of projects that are feasible, the kinds of results they can achieve, and the likely costs required to implement them
- The challenge lies in how to move from pilot projects into wide scale roll out
- Public private partnerships are the way forward, but require strong leadership and a shared vision. The cases presented showed that whilst the leadership of specific “smart city” initiatives could be taken forward by private or public actors, the presence of a strong, knowledgeable public city authorities in an overall position of leadership was critical to the successful implementation of projects
- Policy frameworks at municipality, regional, and sometimes even national level, informed by knowledge obtained during pilot project phases, can help facilitate wider scale roll out of similar projects. Ensuring the information and insight from pilot schemes can be fed upwards into policy frameworks was felt to be critical to inform future policy development and investment programmes for cities. The use of JESSICA financial instruments is a potential powerful tool available for financing smart and sustainable projects, by enabling private sector funding that could not necessarily be obtained without the public sector co-financing that JESSICA UDFs can offer
- The ability of UDFs to have long term investment horizons may be a key ingredient to enable smart and sustainable city projects to be realised, which only start to create financial returns after longer periods than sole commercial financing will allow
- Further work is required to develop organisational capacity and enable roll out of individual projects into full programmes
- Knowledge dissemination through platforms such as this conference is essential to ensure that the lessons learned and experiences gained are shared with a wide audience. Knowledge sharing will help to enable replication and evolution of smart and sustainable projects, to generate new ideas and solutions, and to demonstrate the accessibility of EU financing options available to support projects delivering smart and sustainable urban transformation.