TECHNICAL REPORT

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Smart community infrastructures — Review of existing activities relevant to metrics

Infrastructures communautaires intelligentes — Revue des activités existantes applicables à la métrique

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 268/SC 1, *Sustainable development in communities*.

Introduction

Community infrastructures – energy, water, transportation, waste, information and communications technology (ICT), etc. – support the operations and activities of communities and have a significant impact on economic and social development. They are a means towards ensuring the delivery of goods and services that promote economic prosperity and growth, and contribute to the quality of life. Insufficient, inadequate community infrastructures can create obstacles to achieving a change in the distribution of relative incomes through the growth process to favour the poor (pro-poor growth). Furthermore, the demand for community infrastructures, as scalable and integrable products, will continue to expand significantly in the decades ahead, driven by major factors of change, such as population growth and urbanization.

It has long been argued that human activity is surpassing the capacity of the Earth. Community infrastructures developing in line with global population growth sometimes have less desirable consequences to sustainability. This is because the imperative for further infrastructure (i.e. accelerated population growth) conflicts with a path to sustainability. As a result, there is a need for community infrastructures to play a role in sustainable development to balance economic, social and environmental aspects and to meet the needs of communities more effectively and efficiently.

This indicates an urgent need to develop and implement more effective and efficient technological solutions in terms of environmental impact, economic efficiency and quality of life. Such solutions are often referred to as "smart." A number of plans and projects to build "smart cities" are currently underway. In addition, there are increases in international trade for community infrastructure products and services.

In planning and procuring community infrastructures to contribute to sustainable development, a wide range of evaluation concepts and metrics are available or under consideration. Some of these evaluation methods are not publicly available. Though they are helpful, their complexity, redundancy and lack of transparency make it difficult for public and private buyers (e.g. governments, city planners, investors, operators of community infrastructures) to evaluate multiple proposals or plans consistently and fairly, thereby increasing the burden of decision making. Different concepts and metrics are creating uncertainty in which infrastructure vendors have difficulty in developing new technology without an appropriate International Standard.

The purpose of standardization in the field of smart community infrastructures is to promote the international trade of community infrastructure products and services and disseminate information about leading-edge technologies to improve sustainability in communities by establishing harmonized product standards to evaluate their technical performances contributing to sustainability of communities. The users and associated benefits of these metrics are illustrated in Figure 1.

In this Technical Report, the concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities as defined in ISO/TC 268.

This Technical Report reviews existing activities relevant to metrics for "smart" community infrastructures and provides directions for further standardization. This Technical Report discusses metrics which is designed to help buyers to evaluate technical performances of community infrastructure products and services for procurement and, through the development of future technical standards in this area, may additionally be used in real-time monitoring for the operation of an existing community infrastructure. The users and associated benefits of these metrics are illustrated in Figure 1.

It is expected that this Technical Report will be useful to the following individuals/groups:

— national and local governments;

— regional organizations;

— community planners;

— developers;

— community infrastructure operators (e.g in the field of energy, water, waste, transportation, ICT);

— community infrastructure vendors (e.g. constructors, engineering firms, system integrators or component manufacturers);

— non-governmental organizations (e.g.. consumer groups).

This Technical Report uses a model of the community functions in Table 1 and reviews activities relevant to metrics for community infrastructures.

Table 1 — Layers of a community

Layers	Examples of functions
Community services	Education, healthcare, safety and security, tourism, etc.
Community facilities	Residences, commercial buildings, office buildings, factories, hospitals, schools, recreation facilities, etc.
Community infrastructures	Energy, water, transportation, waste, ICT, etc.
NOTE "Water" includes sewage and wastewater as well as drinking water.	

Contribution

As illustrated in Table 1:

— Functions of community infrastructures are fundamental to support the other two layers;

— Products and services of community infrastructures are more technology-oriented, more internationally-tradable than those in other layers and therefore appropriate for international standardization.

NOTE 1 This compilation of existing activities is indicative only.

This Technical Report is intended to be used in the following ways:

— as a reference document

— to analyze the commonalities and gaps in existing activities relevant to metrics on smart community infrastructures

— to review the value of deploying smart community infrastructures

— as a basis for future standardization

— to assist stakeholders to have a better understanding of state-of-the-art smart community infrastructures around the world

NOTE 2 The environmental, social and economic subsystems of the global system interact and are interdependent. They are often referred to with phrases such as the three dimensions or pillars of sustainability. [SOURCE: ISO/DGuide 82:2013 3.1].

NOTE 3 OECD states that a pace and pattern of economic growth that helps poor women and men to participate in, contribute to and benefit from it is in short pro poor growth.

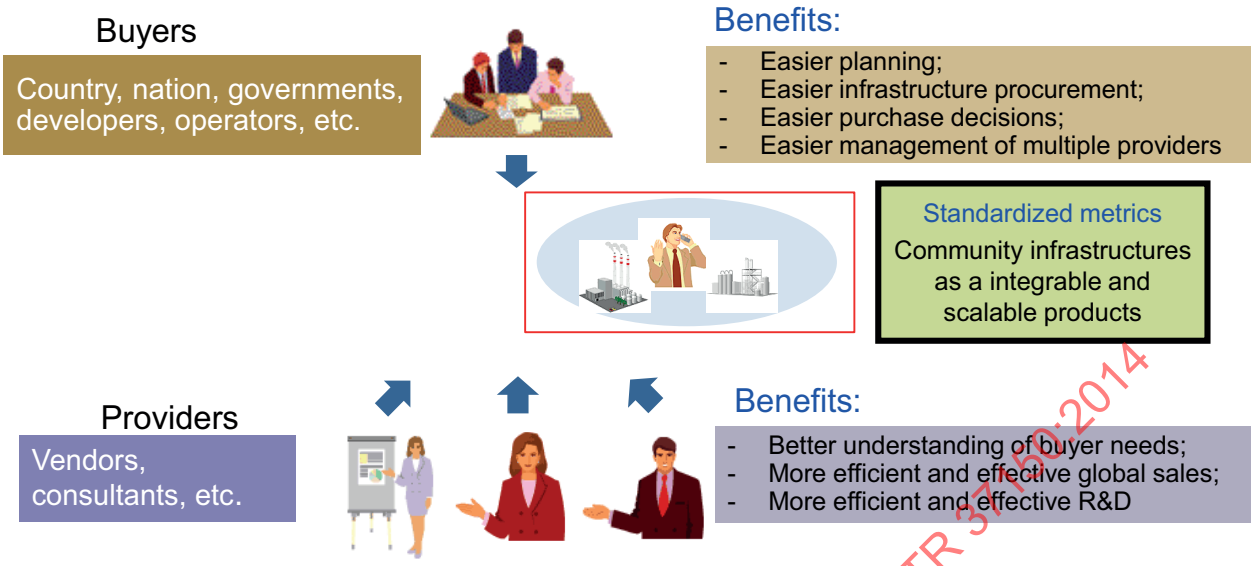


Figure 1 — Users of the metrics and associated benefits

Smart community infrastructures — Review of existing activities relevant to metrics

1 Scope

This Technical Report provides a review of existing activities relevant to metrics for smart community infrastructures.

In this Technical Report, the concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities, as defined in ISO/TC 268.

This Technical Report addresses community infrastructures such as energy, water, transportation, waste and information and communications technology (ICT). It focuses on the technical aspects of existing activities which have been published, implemented or discussed. Economic, political or societal aspects are not analyzed in this Technical Report.

NOTE This Technical Report is not a recommendation document for best practices. Although sustainability objectives have been considered, the main subject of this Technical Report is the analysis of existing methodologies for smart community infrastructures.

2 Normative references

There are no normative references.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
buyer
person who aims to get possession of a good, service and/or right through providing an acceptable equivalent value, usually in money, to the person providing such a good, service and/or right

[SOURCE: ISO/IEC 15944-1:2002, 3.8]

3.2
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects

[SOURCE: ISO 14001:2004, 3.7]

3.3
interoperability
ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together

[SOURCE: ISO 21007-1:2005, 2.30]

3.4
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal

[SOURCE: ISO 14044:2006, 3.1]

3.5
metric
the defined measurement method and the measurement scale

[SOURCE: ISO/IEC 14598-1:1999, 4.20, modified — Note 1 and Note 2 have been removed.]

3.6
pro-poor growth
stimulate economic growth for the benefit of poor people (primarily in the economic sense of poverty)

[SOURCE: OECD, 2008]

Note 1 to entry: Pro-poor growth can be defined as absolute, where the benefits from overall growth in the economy, or relative, which refers to targeted efforts to increase the growth specifically among poor people.

EXAMPLE A pace and pattern of economic growth that helps poor women and men to participate in, contribute to and benefit from.

3.7
provider
person or organization involved in or associated with the delivery of products and/or services

[SOURCE: ISO/TR 12773-1:2009, 2.40, modified]

3.8
snapshot
capture of the status of a data resource at a given moment in time

[SOURCE: ISO 12620:2009, 3.6.2]

3.9
sustainable development
development that meets the needs of the present without compromising the ability of future generations to meet their own needs

[SOURCE: The U.N. Brundtland Commission, 1987]

4 General

4.1 Overview for developing this Technical Report

In order to propose the directions of future standardization in the field of smart community infrastructures, this Technical Report collects and analyzes existing activities relevant to metrics. This Technical Report also describes desirable features of the community infrastructure metrics suitable to improve the sustainability of the community (4.2.2). In addition, this Technical Report identifies gaps between these desirable features and the reviewed activities and proposes future directions for standardization in the field of smart community infrastructures.

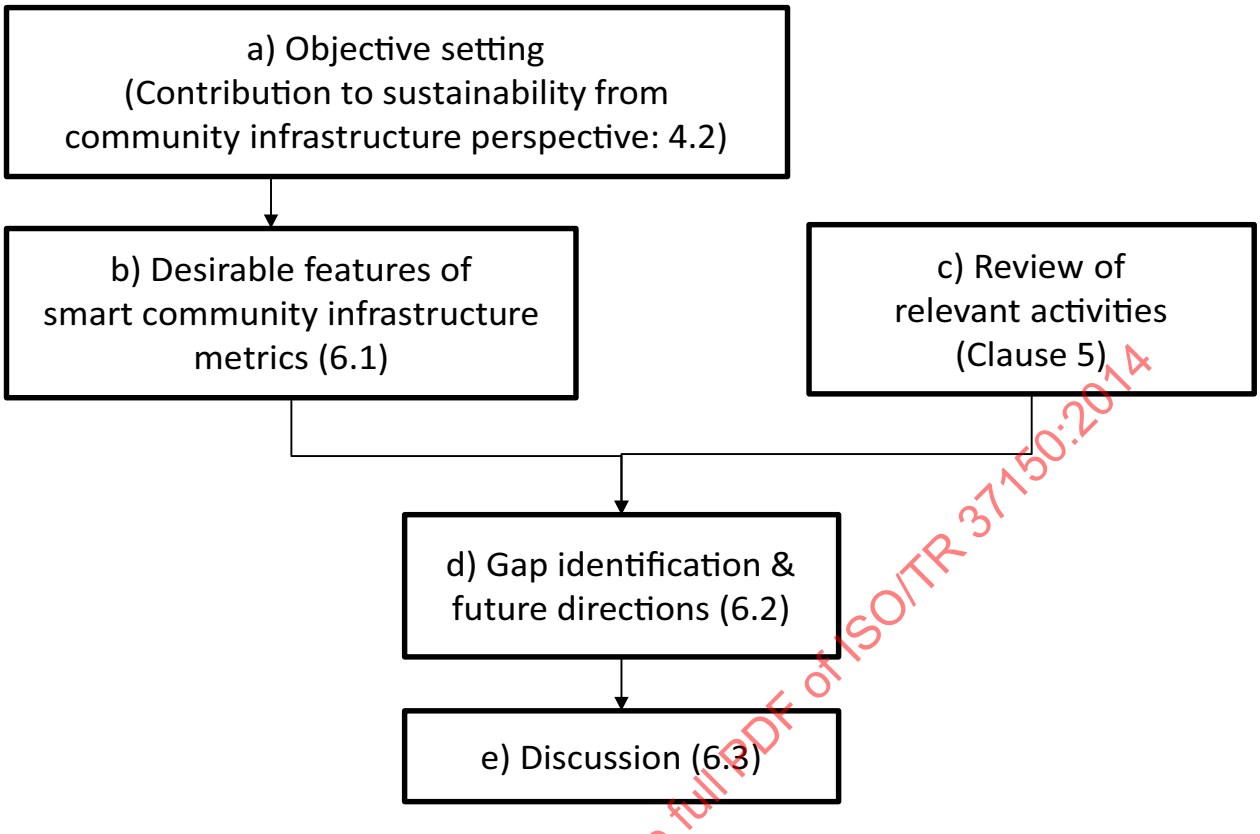


Figure 2 — Approach for developing this Technical Report

a) The objectives of this Technical Report are to create a non-exhaustive repository of information and documents and to provide directions for future standardization (See 4.2).

b) By considering lessons from existing relevant activities with regard to metrics, this Technical Report describes desirable features of smart community infrastructure metrics necessary to contribute to sustainability (See 6.1).

c) This Technical Report collects and reviews the following two types of activities relevant to community infrastructure metrics (See 5.1):

   1) International standards, concepts and theoretical frameworks; and,

   2) projects.

d) This Technical Report identifies gaps between the existing relevant activities and the desirable features by mapping c) onto b) above. Taking the identified gaps into account, this Technical Report proposed future directions for standardization in the field of smart community infrastructure metrics (See 6.2).

e) This Technical Report discusses future possible areas of standardization related to the field of smart community infrastructure metrics.

4.2 Objectives

4.2.1 Background

In line with the concept of sustainable development and promoting pro-poor growth (as emphasized by OECD), enabling a pace and pattern of growth that enhances the ability of poor women and men to participate in, contribute to and benefit from growth will be critical in achieving a sustainable trajectory out of poverty and meeting the Millennium Development Goals (MDGs). All 193 United Nations member

states and at least 23 international organizations have agreed to achieve these goals by 2015. Although a number of countries have demonstrated that progress in achieving the MDGs is possible, efforts need to be intensified in order to make this a reality.

As the OECD-DAC Guidelines on Poverty Reduction show, poverty has multiple and interlinked causes and dimensions: economic, human, political, socio-cultural and protective/security.[7] It is further recognized that insufficient, inadequate community infrastructure is among the most pressing obstacles to achieving pro-poor growth.[7] By raising labour productivity and lowering production and transaction costs, community infrastructures – energy, water, transportation, ICT, etc. – enhance economic activities and so contribute to growth, which is essential for poverty reduction.

Community infrastructures are a priority on the international development agenda. Investment in community infrastructures is an important enabler of communities and nations in achieving the MDGs, of which there are eight international development goals: 1) eradicating extreme poverty and hunger; 2) achieving universal primary education; 3) promoting gender equality and empowering women; 4) reducing child mortality rates; 5) improving maternal health; 6) combating HIV/AIDS, malaria, and other diseases; 7) ensuring environmental sustainability; and, 8) developing a global partnership for development. Table 2 outlines links between community infrastructures and seven of the eight MDGs listed above.

It has long been argued that the activity of human being is surpassing the capacity of the Earth. Community infrastructures are increasingly developing and operating in line with global population growth. This can have less desirable consequences. For example, turning the spotlight firmly on the inherent tensions between the imperative for further community infrastructures (i.e. growth) and sustainability. As a result, there is a need for community infrastructures to play a role in sustainable development to balance economic, social and environmental aspects and to meet the needs of communities more effectively and efficiently.

That situation indicates an urgent need to develop and share more effective and efficient solutions in terms of environmental impacts and the quality of life. Such solutions are often referred to as “smart.” A number of plans and projects to build “smart cities” are currently underway and the international trade of community infrastructures has become more common than before.

In general, International Standardization helps facilitate international trade by reducing technical barriers among the countries. However, there are currently no International Standards in the field of smart community infrastructures, e.g. harmonized metrics to evaluate them as integrable and scalable products.

4.2.2 Objective of this Technical Report

Taking into account the background information described in 4.2.1, the objectives of this Technical Report are:

— to create a non-exhaustive repository of information that will enable the creation of a future International Standard for community infrastructures;

— to provide directions for future standardization to improve the sustainability of communities by providing a common language for and access to knowledge about smart community infrastructures to support market activity.

NOTE This Technical Report acknowledges the necessity of consistency among related existing International Standards, work items under development (e.g. ISO/WD 37101 and ISO/WD 37120) and the technical standard for community infrastructures.

Table 2 — Links between community infrastructures and the Millennium Development Goals (MDGs)

Infrastructure sector	Millennium Development Goals (MDGs)				
	Poverty and hunger (MDG 1)	**Primary education** (MDG 2)	**Gender equality and women's empowerment** (MDG 3)	**Health** (MDG 4, 5, 6)	**Environmental sustainability** (MDG 7)
Energy	- modern energy services increase productivity of human labour, while enabling enterprise development and income - energy can increase productivity and help reduce post-harvest losses - more efficient energy use (i.e. cooking, lighting) reduces expenditures on less efficient energy resources - improved cooking can reduce fuel and related labour demands	- electricity and lighting allows studying and educational tools and services in schools (computers, projectors, etc.) and promotes teacher retention - more efficient cooking can reduce time spent fetching wood and give more time for studying	- improved cooking can reduce time/labour burden and reduce indoor air pollution - street lighting improves women's safety	- permits cold chain for vaccines, reagents, sterilization, operation of essential laboratory equipment and operating theatres - modern energy can be safer (i.e. less accidents) - electricity enables pumped clean water and purification - increases hours of facility operation/ night-time services - helps retain qualified staff	- efficient cooking and switch to modern fuels (LPG) can reduce demand for charcoal or other biomass sources reducing pressure on local ecosystems from fuel collection - more efficient agriculture (including fertilizer, mechanization) can reduce need for additional land clearing - improved cooking can reduce greenhouse gas emissions and black carbon
Transport	- facilitates market access and reduces costs of trade, inputs prices, and monopoly power of agricultural middlemen - reduces social/ family travel costs	- can improve students' access to school, reducing drop-out rates, particularly for girls	- reduces time and transport burden and eases independent movement for women - Can save time, and increase access to health services for women	- increases access to health facilities - reduces emergency response times - improved roads can be safer for drivers and pedestrians	- improved public transport services reduces overall environmental impact
[SOURCE: Freeman, K.: Infrastructure from the Bottom Up, 2011, modified.[16]]					
NOTE This report documented progress and lessons learned from the first five years of the Millennium Village Project (MVP) with a focus on investments made in infrastructure and services related to energy, transportation, communications and piped water supply.[16]					

Table 2 *(continued)*

Infrastructure sector	Millennium Development Goals (MDGs)				
	Poverty and hunger (MDG 1)	**Primary education** (MDG 2)	**Gender equality and women's empowerment** (MDG 3)	**Health** (MDG 4, 5, 6)	**Environmental sustainability** (MDG 7)
Information and communications technology (ICT)	- increases access to weather, market and income-related information - enables extension, outreach and other training for increased incomes (agriculture, business)	- enables distance learning, access to educational media and communications - aids in teacher retention - improves record-keeping and school management	- reduces isolation of working at home - enables education at home - enables emergency communication and reporting of violence	- increases access to emergency care - supports improved medical information systems (ChildCount), 'distance medicine', and access to health education media - improves access to and quality of public and community health systems	- improves natural resource information gathering, mapping and monitoring
Water and Sanitation	-irrigation (combining improved water access and energy) can dramatically raise agricultural productivity	- rainwater harvesting can reduce water gathering labour for schools by children - reduced water-borne disease, improves school attendance	- improved/piped water sources or systems reduces women's time/ labour burden of fetching water	- clean water is essential for health services - cleaner drinking water reduces water-borne diseases - safe disposal of medical waste prevents spread of disease	- increased availability of water and sanitation can improve local environments

[SOURCE: Freeman, K.: Infrastructure from the Bottom Up, 2011, modified.[16]]

NOTE This report documented progress and lessons learned from the first five years of the Millennium Village Project (MVP) with a focus on investments made in infrastructure and services related to energy, transportation, communications and piped water supply.[16]

5 Review of existing activities relevant to metrics

5.1 Review method

5.1.1 Collect information on existing activities relevant to metrics

5.1.1.1 Points of consideration

This Technical Report is intended to discuss metrics to evaluate technical performances of community infrastructures on a community-wide basis. There are several views of "smartness" and "infrastructures." Those who are responsible for this document, ISO TC 268/SC 1/WG 1 therefore applied a wide scope in sampling the existing relevant activities with regard to metrics in order to avoid specific biases.

In order to take various needs in the world into account and respect global relevance when collecting information for this Technical Report on existing activities relevant to metrics, the following points were taken into consideration:

— geographical diversity, representing major continents and climate zones;

— economic diversity, representing both developed and developing countries;

— type of development of community infrastructures including both green fields and brown fields;

NOTE Greenfield sites are areas which are unbuilt land, mostly previously used for agricultural purposes. Brownfield sites are areas which:

— have been affected by former uses of the site or surrounding land;

— are derelict or underused;

— are mainly in fully or partly developed urban areas;

— require intervention to bring them back to beneficial use; and

— may have real or perceived contamination problems

— diversity of lead organizations (proposers), both public and private;

— diversity of development stages: planning, implementation, construction, operation and monitoring.

5.1.1.2 Collection process

a) Questionnaires

A survey was conducted by experts on existing relevant activities with regard to metrics in each region, country or organization.

NOTE Results of the questionnaire are included in Annex B.

b) Literature and internet surveys

Literature and internet surveys were conducted to collect existing activities relevant to the development or improvement of community infrastructures to supplement the work in a) above.

In accordance with the objective of providing future directions for standardization in the field of smart community infrastructures, the following profiles were considered in these surveys:

— International Standards, concepts, theoretical frameworks and indicators, including: those which can be directly referred to in the trade of products and services of smart community infrastructures.

— Projects, including: those to develop specific communities, which are anticipated to include consideration of procurement of products and services of community infrastructures.

5.1.2 Perspectives for analysis

a) Relevance to community infrastructures

This Technical Report analyzes the relevance of collected activities to community infrastructures with regard to:

— relevance to particular types of community infrastructures, including:

  — community infrastructures as a main target or purpose of improvement;

  — community infrastructures as a means to improve other types of community infrastructures (e.g. ICT to improve energy);

— relevance to interoperability among multiple community infrastructures

b) Relevance to smartness

This Technical Report analyzes the relevance of collected activities to smartness with regard to:

— Contribution to sustainable development: sustainability issues and indicators for a community are relevant to community infrastructures although they are not usually in a direct relationship with community infrastructures. These are usually grouped into economic, environmental and social issues and indicators, in accordance with the framework of sustainability defined by the UN.[11] [12]

— Innovative features: features of relevant activities regarded as contributing to effectively or efficiently providing technical solutions.

c) Relevance to evaluation of technical performance

In order to analyze relevance to evaluation of technical performance of community infrastructures, this review categorizes indicators into:

— Community outcome indicators: the review identifies community outcome indicators for service provision and/or quality of life.

— Technical performance indicators for community infrastructures: the review identifies indicators for technical performance of community infrastructures which avoid discussion of specific technologies or organizational procedures.

5.2 Summary of review

5.2.1 Overview of activities relevant to metrics

5.2.1.1 General

This Technical Report identifies the following existing activities relevant to metrics although they are not exhaustive:

— 28 International Standards, concepts and indicators;

— 124 projects.

NOTE Annex A includes a list of identified activities, Annex B includes details of examples of the selected activities and Annex D includes a detailed review result.

5.2.1.2 Geographical diversity

The majority of the identified International Standards, concepts and indicators are either published by international organizations or originated in Asia or Europe. Identified projects are geographically dispersed across regions.

5.2.1.3 Economic diversity

A half of the identified International Standards, concepts and indicators are made by international organizations. And in the other half, those in developed countries account for a larger part than those in developing countries.

With regard to the identified projects, those implemented in developed countries account for a larger part in a total number of projects, compared to those in developing countries. The majority of the identified projects are brown field projects.

5.2.2 Coverage of sustainability issues

In the identified relevant activities, this Technical Report identifies a wide range of sustainability issues that a community faces, as well as, a broad range of community outcome indicators across all regions.

Major specific issues are categorized into three categories of sustainability issues: economic, social and environmental. Other issues were identified and considered representatives but could not be grouped into the pre-mentioned three main categories and analyzed.

In identified International Standards, concepts and indicators, environmental issues were the most widely covered, with economic and social issues following it with the same coverage rate. Most of them covered more than one category.

A majority of the identified projects covers more than one category for issues. In most cases, an economic issue was most commonly covered and an environmental issue followed it. In comparison between developed and developing countries, both groups show a similar trend: an economic issue was the most widely covered, followed by an environmental issue, and a social issue was the least covered. The most prominent difference between the two groups was that a social issue was covered more frequently in developing countries. In comparison of the number of issue categories covered in identified projects between the two groups, the rate of projects covering all three issue categories is higher in developing countries while the rate of those focusing on only one issue category is also higher.

Compared to the result of the identified International Standards, concepts and indicators, the rate of those projects covering three issues is far less and the majority of projects are dealing with two issue categories only.

5.2.3 Relevance to community infrastructures

In the review of community infrastructures covered in the identified International Standards, concepts and indicators, as well as projects, coverage on a total of five community infrastructures, i.e. energy, water, transportation, waste and ICT, was analyzed.

Among the five types of community infrastructures mentioned above, energy is the most commonly covered by the identified International Standards, concepts and indicators. All five community infrastructures are set as both a main purpose of development and a means to improve other types of community infrastructures.

In the identified projects, a large part of them covers energy and ICT. A number of projects cover energy as a purpose of development and a vast majority of them set ICT as a means to improve it. Meanwhile, there are projects which use other community infrastructures, such as transportation, water, and waste as a means to achieve a purpose of energy.

In comparison of developed and developing countries, the prominent difference is that energy is more widely covered in developed countries. Water, transportation and waste are more commonly dealt with in projects within developing countries, although energy is still a factor as a purpose or a means.

For example, as a means to achieve a purpose of energy, ICT is the most commonly set as a means, followed by transportation, water and waste. This seems to be due to the fact that many of the identified projects place the establishment of smart grid systems as a main aim.

5.2.4 Relevance to evaluation of technical performances

Various indicators are identified in the review. According to their properties, they can be categorized into the following groups and sub-groups:

a) community outcome indicators which are relevant to the community itself rather than community infrastructures;

b) indicators relevant to community infrastructures, including:

   1) status-quo of a specific design of each community infrastructure in a community;

   2) output or technical performance indicators of community infrastructure.

For sub-group 2), indicators for various particular types of community infrastructures are identified, while no single indicator commonly applicable to multiple community infrastructures was identified.

5.2.5 Innovative features

This Technical Report identifies qualitative features unique to individual activities, which are not suitable to be tallied and summarized in a graph. Examples of such features include: project implementation from a life cycle perspective (B-DASH, see B.1.2), consideration of synergies and trade-offs among multiple issues (Sustainable development of urbanization and smart city in China (see B.1.8) and CASBEE for Cities[21]) application to diverse geographical areas (The Green City Index series, see B.1.5), Interoperability of systems (BSI – A Standard Strategy for Smart Cities, see B.1.3), consideration of the synergies and trade-offs between infrastructures and buildings sites (INTEGRATION, see B.2.5).

6 Discussion on possible future directions

6.1 Desirable features of smart community infrastructure metrics

6.1.1 General

To contribute to sustainable development, smart community infrastructure metrics should:

— be harmonized;

— include items useful for as many stakeholders as possible involved in trades of community infrastructure products and services (e.g. local governments, developers, suppliers, investors);

— facilitate evaluation of the technical performance of community infrastructures, contributing to sustainability and resilience of communities;

— be applicable to different stages of the development of communities and community infrastructures;

— reflect the dynamic properties of the community infrastructures.

Harmonized metrics allow buyers (e.g. community planners, governments, operators of community infrastructures) to compare proposals for the introduction or renovation of community infrastructures introduced by multiple suppliers with the same criteria, thereby contributing to the creation of a fair competitive market.

It is one of the core ideals of sustainable development to consider the benefit for future generations. Accordingly, it is desirable that the metrics are designed to enable evaluation and decision-making in the trade of community infrastructure products and services in the long term, e.g. taking different stages of the development of communities and the benefit of community infrastructures throughout their lifecycle into account.

It should be noted that the metrics under discussion change with time and tend to be time-related measurements, such as flows, gradients, graphs and, therefore, are dynamic.

6.1.2 Smart

Smart community infrastructure metrics in aggregate should:

— be selected with consideration for the synergies and trade-offs of multiple issues or aspects that a community faces, such as environmental impacts and quality of community services. Only addressing a single issue or aspect might not be considered smart;

— focus on advanced features of community infrastructures such as interoperability and efficiency rather than the status-quo.

Sometimes sustainability claims are made for a specific activity using indicators which cover only a single aspect, such as carbon dioxide (CO_2) emission reduction. However, it is desirable that metrics to evaluate technical performances of community infrastructures take social, economic and environmental sustainability into account (sustainable development).

Advanced technological features are also essential to resolve trade-offs between multiple aspects of sustainability, as well as, to achieve efficient coordination between multiple infrastructure services.

6.1.3 Community

Smart community infrastructure metrics should:

— be applicable to a diverse range of communities (e.g. geographical location, sizes, economic structures, levels of economic development, stages of infrastructure development).

6.1.4 Infrastructure

Smart community infrastructure metrics should allow:

— consideration of multiple community infrastructures (e.g. energy, water, transportation, waste, ICT) that support the operations and activities of communities;

— technologically implementable solutions;

— a holistic perspective of multiple community infrastructures. (More specifically, to consider an integrated system which includes the interaction and coordination of multiple community infrastructures).

Five types of community infrastructures (energy, water, transportation, waste and ICT) have already been recognized as key elements that support the operations and activities of communities now and in the future.

In general, solutions can be not only technological but also social or cultural (e.g. governmental policies, life style). However, the societal or cultural diversity of communities should be respected as traits of each community. Thus, it is desirable that the metrics are designed to focus on evaluating the technical aspects of community infrastructures, rather than societal or cultural aspects.

As the five and associated services are mutually inter-related through the activities of a community, sub-optimizations in only one type of infrastructures do not always lead to the desirable solution for sustainability of the community as a whole. Accordingly, it is desirable that metrics be designed to allow a holistic perspective across community infrastructures.

6.1.5 Metrics

Smart community infrastructure metrics should:

— allow evaluation of the technical performance (e.g. efficiency, effectiveness) of community infrastructures rather than characteristics of specific technologies;

— be based on transparent and scientific logics.

Metrics based on performance will enhance innovative development of smart community infrastructure technologies.

EXAMPLE CO_2 emission per passenger kilometer as a metric, instead of the number of electric vehicle technologies, is an example of such an approach.

Scientific and transparent logics are required for metrics to be internationally accepted and widely used.

6.1.6 Smart community infrastructure metrics

Smart community infrastructure metrics are a measurement or quantification method and scale of the technical performance of community infrastructures which:

— allow a holistic perspective of multiple infrastructures in communities;

— have dynamic properties;

— take into account the long-term aspects of communities;

— enable understanding of the diversity of communities.

NOTE 1 Infrastructures such as those for energy supply, water supply and treatment, transportation means, waste control, and ICT are all responding to the dynamics of the activities in a community.

NOTE 2 A smart community infrastructure metric might:

— be a measurement or quantification of the dynamic flows and operations of systems within communities

— be a measurement or quantification at a point in time, leading to multiple measurements over time

— consist of flows, movements, levels or volumes that can be used as inputs to systems dynamics modelling or can be used for understanding community infrastructures and their strategic planning and management.

6.2 Identified gaps and possible future directions for smart community infrastructure metrics

Identified gaps between the desirable features and the activities relevant to metrics and consequently suggested future directions of standardization are summarized in Table 3.

Table 3 — Identified gaps and future directions

Desirable features	Identified gaps and future directions
General	
Be harmonized.	A lack in an overall comprehensive evaluation framework for technical performance of community infrastructures was identified. Therefore, it is worthwhile to develop smart community infrastructure metrics as a series of International Standards and other deliverables.

Table 3 *(continued)*

Desirable features	Identified gaps and future directions
Include items useful for as many stakeholders as possible involved in trades of community infrastructure products and services (e.g. local governments, developers, suppliers, investors).	Because of the lack of information, it is generally difficult to judge from a literature survey whether an identified relevant activity has this feature or not. However, this feature is important and should be fully considered in developing smart community infrastructure metrics.
Facilitate evaluation of the technical performance of community infrastructures contributing to sustainability and resilience of communities	Because of the lack of information, it is generally difficult to judge from a literature survey whether an identified relevant activity has this feature or not. However, this feature is important and should be fully considered in developing smart community infrastructure metrics.
Be applicable to different stages of the development of communities and community infrastructures.	In general, identified relevant activities do not explicitly claim to either have this feature or limit their applicability to a specific development stage. However, this feature is important and should be fully considered in developing smart community infrastructure metrics.
Reflect the dynamic properties of the community infrastructures.	Some relevant concepts highlight dynamics (e.g. TAHI) and life cycle perspectives of community infrastructures (e.g. B-DASH). Accordingly, dynamic properties should be fully considered in developing smart community infrastructure metrics.
Smart	
Be selected with consideration for the synergies and trade-offs of multiple issues or aspects that a community faces, such as environmental impacts and quality of community service. Only addressing a single issue or aspect might not be considered smart.	Most of the relevant activities address multiple issues. Some of them point out the synergies and trade-offs among them (e.g. the sustainable development of urbanization and smart city in China). A few of them further quantify the synergies and trade-offs though they are intended for cities themselves rather than exactly for community infrastructures (e.g. CASBEE for cities). Accordingly, aspects such as trade-offs between environmental impacts and quality of community should be fully considered in developing smart community infrastructures.
Focus on advanced features of community infrastructures such as interoperability and efficiency rather than the status-quo.	In terms of community infrastructures, many of the relevant indicators address their status-quo, such as the prevalence rate of particular types of community infrastructures in a community, etc. On the other hand, some of the relevant concepts and projects (e.g. BSI and Smart Cities) indicate advanced features of community infrastructures such as interoperability and efficiency. Accordingly, in developing smart community infrastructure metrics, such advanced features should be fully considered.
Community	
Be applicable to a diverse range of communities (e.g. geographical location, sizes, economic structures, level of economic development, stages of infrastructure development).	Some of the relevant activities (e.g. Siemens Green City Index series) include both a general framework and its application to specific geographical regions. Accordingly, such a combination of general frameworks and applications should be fully considered in developing smart community infrastructure metrics.
Infrastructure	
Allow consideration of multiple community infrastructures (e.g. energy, water, transportation, waste, ICT) that support the operations and activities of communities.	Some concepts address multiple community infrastructures. Thus, these concepts might be helpful to identify the boundary of each community infrastructure to be measured (e.g. energy, water, transportation, waste, ICT).

Table 3 *(continued)*

Desirable features	Identified gaps and future directions
Allow technologically implementable solutions.	In terms of solutions, most of the relevant activities discuss a variety of social solutions (e.g. governmental policies, life styles) or designs of specific technologies relevant to community infrastructures (e.g. smart grids, electric vehicles). However, the development of smart community infrastructure metrics should focus on the performances of technologically implementable solutions of the community infrastructure layer.
Allow a holistic perspective of multiple community infrastructures.	Most identified activities cover multiple indicators for each particular community infrastructure individually. Therefore they do not have a community-wide holistic perspective. Some relevant concepts and projects (e.g. BSI and Smart Cities, INTEGRATION) suggest interoperability, synergies and trade-offs among multiple infrastructures. Accordingly, learning from these activities should be considered in developing smart community infrastructure metrics.
Metrics	
Allow evaluation of technical performance (e.g. efficiency, effectiveness) of community infrastructures rather than characteristics of specific technologies.	Most of the identified indicators address the prevalence rate of specific technological designs (e.g. renewable energies, non-stop commercial flights) rather than technical performances of community infrastructures. Accordingly, smart community infrastructure metrics should be developed to address technical performances of community infrastructures on a community-wide basis. NOTE On a particular community infrastructure such as water and wastewater, there are some performance indicators (e.g. ISO 24510, ISO 24511, ISO 24512)., These indicators are normally applicable to the entire community, but can, at the needs of the organization be calculated on individual service sectors within the community. For example, water loss indicators can be calculated on individual sectors of the distribution system infrastructure as a means of prioritizing maintenance activities.
Be based on transparent and scientific logics.	Evaluation methods of relevant activities are not always publicly available and therefore it is difficult to judge whether they are based on scientific logics. Then, smart community infrastructure metrics should be developed based on scientific logic. International standardization in this field will secure the transparency of the evaluation methods.

Since there is no existing activity meeting all the desirable features, this Technical Report recommends a newly developed general principles and requirements of smart community infrastructure metrics, taking into consideration the lessons learned from relevant activities.

6.3 Discussion

6.3.1 Overview

6.3.1 discusses possible areas of standardization, related to the field of smart community infrastructure metrics and the roadmap.

Table 4 shows the overall structure of possible development of smart community infrastructure metrics.

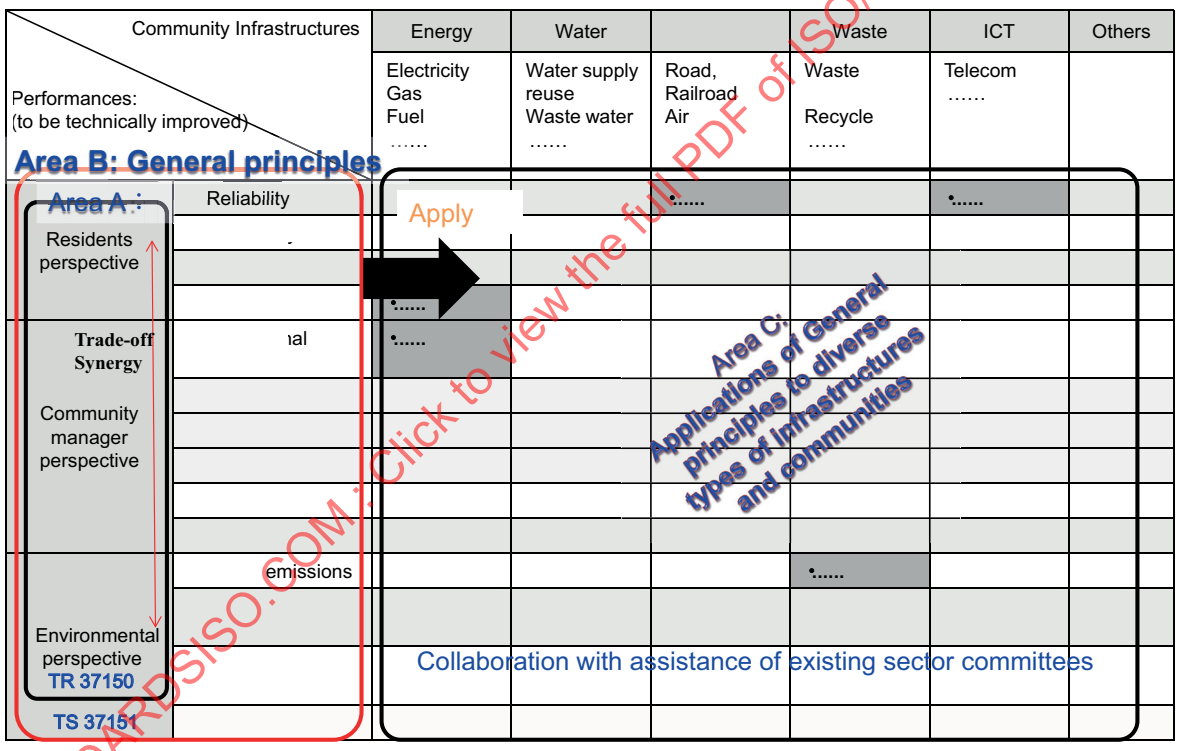
Area A in Table 4 illustrates one of the desirable features of smart community infrastructure metrics given in this Technical Report: consideration of synergies and trade-offs among multiple perspectives

(i.e. residents, community managers and environment). The three perspectives are the projection of the three areas of sustainability issues (social, economic and environmental) to the field of community infrastructures.

Following this Technical Report, a subsequent deliverable will be developed to address more detailed evaluation of the generic and overall technical performance of community infrastructures (as illustrated in Area B in Table 4). The deliverable will define the general principles and requirements of technical performance metrics that are relatively independent of particular types of community infrastructures or communities (for more details, see 6.3.2).

After the completion of the deliverable for general principles and requirements, their applications to particular types of communities or particular types of community infrastructures and an operational metrics having dynamic properties (as illustrated in Area C of Table 4) may be considered (For details, see 6.3.3). There are existing International Standards covering particular types of community infrastructures and some of their provisions can be applied to this area.

Table 4 — Possible development of a series of smart community infrastructure metrics



NOTE Items in Table 4 are indicative examples.

6.3.2 General principles and requirements of smart community infrastructure metrics

As suggested in 6.3.1, none of the relevant activities, as far as identified in the review, has all of the desirable features of smart community infrastructure metrics. Thus, development of new general principles and requirements of the metrics is required. This development should take into account some useful features of relevant activities. Incorporation of these features may not be a simplistic exercise of just importing or combining the specific details or documents from relevant activities.

The general principles and requirements should be developed to define the basic concept of the metrics in the community level and be generic (neutral) against particular types of communities or particular types of community infrastructures. They should be developed based on a scientific logic so as to minimize the arbitrariness resulting from commercial or political interests of specific entities.

The general principles and requirements should be developed first and may be followed by their applications to particular types of communities and particular types of community infrastructures.

The possible beneficiaries of the general principles and requirements include e.g. community planners, governments, urban consultants, constructors, facility and manufactures.

The use of general principles and requirements might include:

— to provide a common language among multiple stakeholders, including buyers and providers of community infrastructure products and services, when they discuss the issue of the community and the introduction or improvement of community infrastructures;

— to compare multiple proposals of the introduction or improvement of community infrastructure products and services from multiple providers;

— to prioritize the area of the improvement among the multiple community infrastructures, providing the basis for estimating the effect of the introduction or improvement of community infrastructures;

— to monitor the performance of community infrastructures on a community-wide basis.

NOTE It is left to the users of the whether setting targets or not when applying general principles and requirements.

6.3.3 Application of metrics

6.3.3.1 Application to diverse types of communities

In order to apply the general principles and requirements to diverse communities, it is useful to develop guidance on the practical use of the framework in some typical categories of communities. It is also expected to develop some supplemental metrics that are more detailed and tailored to each category.

The typical categories of communities might be defined by:

— economic structure or major industry (manufacturing, commercial, tourism, etc.);

— population (large, medium, small, etc.);

— climate zone (tropic, subarctic, arid, etc.); and

— developed and developing countries.

NOTE Those typical categories are indicative and not exhaustive.

6.3.3.2 Application to particular types of community infrastructures

After the development of general principles and requirements, the discussion on the applications to particular types of community infrastructures follow (as illustrated in Area C of Table 4), whereby metrics of particular types of community infrastructures (e.g. energy, water, transportation, waste, ICT) share the same general principles and requirements and enable to measure technical performances of the community infrastructures as a whole.

As the first step, energy, water, transportation, waste and ICT should be the area of application.

In the development in this area, the utilization of existing International Standards and cooperation with other existing ISO/IEC committees is crucial.

6.3.3.3 Application to something other than the five types of community infrastructures.

There is also a possibility that general principles and requirements are additionally applicable to something other than the five types mentioned before (energy, water, transportation, waste and ICT).

For example, public facilities such as libraries could be considered after application to the five initial types.

6.4 Discussion on related areas and actions

6.4.1 Overview

Subclause 6.4 includes discussions on possible standardization areas and possible action items to develop standards in relation with smart community infrastructure metrics.

6.4.2 Possible related areas

Table 5 outlines possible areas of standardization that ISO/TC 268/SC 1 should be responsible for in the future standardization process. This list is non-exhaustive. The actual standardization works for those areas will start only if there is a sufficient support from stakeholders.

Table 5 — Possible related areas

Possible related areas	Rationales
Measurement, reporting and verification (MRV)	In the operation of smart community infrastructure metrics, it is essential to develop a method to determine the value of technical performances of community infrastructures, e.g. greenhouse gas emissions reduction achieved by the introduction of the community infrastructure. It is also necessary to communicate related information with the intended users without misinterpretation and to confirm that specified requirements have been fulfilled. From this viewpoint, related standardization areas are specifications for measurement, reporting and verification. Additionally, specifications for real-time monitoring of actual dynamic technical performances of existing community infrastructures would be useful for responsive operation of community infrastructures. Learning from existing International Standards and other documents (e.g. international performance measurement and verification protocol) would be useful for standardization.
Use of smart community infrastructure metrics in multiple types of operation schemes (e.g. performance contracts)	Community infrastructures currently involve multiple types of operation schemes. For example, types of schemes between public authorities and private parties include, for example: concession; build, operate and transfer (BOT); and, privatization. There are also multiple types of contracts, such as performance contracts which relate the contracting payment to performance against measured performance of community infrastructures. Because smart community infrastructure metrics can be used in these different schemes, it is useful to provide specifications for application to different schemes. Such specifications might include guidance to illustrate savings and benefits of community infrastructures for cities and citizens.
Handling of a large volume of information data”	Data infrastructures are essential as a basis for city management. For example, in order to govern and operate community infrastructures with a holistic viewpoint in a community, it is necessary to handle and utilize massive amounts and various types of data across systems (e.g. technical performances of community infrastructures, demands for their outputs and geographical data), ensuring security and transparency.

Table 5 *(continued)*

Possible related areas	Rationales
Safety (e.g. functional safety)	Because community infrastructures support operations and activities of communities, their safety is an essential point of consideration. In particular, it is important to design community infrastructures to prevent dangerous failures or to control them when they arise. From this viewpoint, a related standardization area might be functional safety (as indicated by IEC/SC 65A, *System aspects*), which is the detection of potentially dangerous conditions resulting in the activation of a protective or corrective device or mechanism to prevent hazardous events arising or providing mitigation to reduce the fight consequence of the hazardous event.
Terminology	Although certain terms and definitions relevant to particular types of community infrastructures already exist, ones intended for community infrastructures in community levels and generic (neutral) against the particular types are lacking. In order to promote communication and standardization in this field, harmonized terminology is essential.
Best practices for implementing smart city projects	Because the development of smart community infrastructures requires a wide range of considerations, including trade-off of multiple issues and having a holistic viewpoint across multiple community infrastructures in a community, it would be useful to collect best practices for implementing smart city projects.

6.4.3 Possible related actions

Table 6 outlines possible related actions that should be considered in the future standardization process. This list is non-exhaustive and includes the possible standardization areas mentioned in 6.4.2.

Table 6 — Possible related actions

Possible related actions	Rationales
Use of the deliverables for education	In general, International Standards are an important source of technological know-how. For example, International Standards provide access to advanced knowledge for users in areas where they may lack expertise and/or resources. The series of International Standards and other deliverables in the field, mentioned in this Technical Report, can be used for capacity building in the field of smart community infrastructures. Using the International Standards and other deliverables as educative tools for community administrative staff can improve their knowledge in the field and promote positive decision making when considering implementing or starting a project with a concept of community infrastructures that contributes to sustainability.

Table 6 *(continued)*

Possible related actions	Rationales
Pilot testing of the general principles and requirements of smart community infrastructure metrics by communities for feedback	To engage potential relevant stakeholders in International Standardization (see the next action item) and to gather practical feedback for the deliverables in this field, it is recommended putting the future deliverable of general principles and requirements in pilot testing by actual communities to confirm their suitability for users' needs and to derive lessons learnt for further work.
Involving relevant stakeholders in standardization	Because there are various types of stakeholders involved in and affected by planning, financing, developing and operating community infrastructures, it is desirable to engage them in the International Standardization process to assure the practicality and relevance of future deliverables to them. Possible stakeholders might include: — international organizations (e.g. UN, OECD) — communities or cities (e.g. top management, those involved in water services); — industries of buyers (e.g. international industrial organizations) and vendors of community infrastructures (e.g. manufacturers); — financial and insurance institutions; — consumers (e.g. consumer associations).

Annex A
(informative)

Identified relevant activities

A.1 General

This Annex contains non-exhaustive lists of possible activities relevant to metrics to evaluate technical performance of community infrastructures identified through the development of this Technical Report.

The objective of these lists is to widely identify the possible relevant activities without discrepancy, as much as possible (i.e. in terms of geographical locations, etc.). By listing these activities and examples of work in the field, this information was reviewed in this Technical Report.

A.2 List of identified International Standards, concepts, theoretical frameworks and indicators

The following list gives examples of identified International Standards, concepts, theoretical frameworks and indicators relevant to smart community infrastructures. These include:

- ISO 24510 series:
  - ISO 24510:2007, *Activities relating to drinking water and wastewater services — Guidelines for the assessment and for the improvement of the service to users*
  - ISO 24511:2007, *Activities relating to drinking water and wastewater services — Guidelines for the management of wastewater utilities and for the assessment of wastewater services*
  - ISO 24512:2007, *Activities relating to drinking water and wastewater services — Guidelines for the management of drinking water utilities and for the assessment of drinking water services*
- ISO 50001, *Energy management systems – Requirements with guidance for use*
- Aalborg commitment
- Blue book of urban competitiveness
- Breakthrough by dynamic approach in sewage high technology project
- British Standards Institution (BSI), A standards strategy for smart cities
- Comprehensive Assessment System for Built Environment Efficiency (CASBEE) City
- China city informanization evaluation index
- Cities of opportunity, Business-readiness indicators for the 21st century
- City biodiversity index (or Singapore index)
- European green capital
- European smart cities
- Global city indicators Facility
- Global power city index

— International Council for Local Environmental Initiatives' (ICLEI)
— Information marketplaces: The new economics of cities
— Intelligent community awards
— Leadership in Energy and Environmental Design (LEED)
— Livability ranking
— RFSC/Sustainable city project
— Smart city framework
— Smart city realized by ICT (Fujitsu)
— Smart community by Toshiba
— Smarter cities
— Sustainable development of urbanization and smart city in China
— Sustainable smart town concept
— The green city index series
— The urban sustainability index

A.3 List of identified projects

Table A.1 gives examples of identified projects relevant to smart community infrastructures. These include:

Table A.1 — List of identified projects

Region, country or organization of main proposer or owner	Title of projects
Afghanistan	Kabul Metropolitan Areas Development Program in Afghanistan
Australia	Smart Grid, Smart City project
Australia	Solar Flagship Program
Brazil	Rio Operations Center
China	Changxindian Eco-city
China	Chongming Dongtan Eco-city
China	Comprehensive Operation Platform of Smart Lecong
China	Dezhou Sun-city
China	Liaoyuan Smart Card
China	Shangsha, Zhuzhou, Xiangtan, Two-oriented Society
China	Shenzhen Guangming Eco-city
China	Sino-Singapore Guangzhou Knowledge City
China	Sino-Singapore Tianjin Eco-city project
China	Smart Changzhou
China	Smart Chongqing
China	Smart City Projects of MOHURD in China

Table A.1 *(continued)*

Region, country or organization of main proposer or owner	Title of projects
China	Smart Dezhou
China	Smart Hun Nan District, Shenyang
China	Smart Jiyuan
China	Smart Liaoyuan
China	Smart Luohe
China	Smart Tongling
China	Smart Wanning
China	Smart Wenjiang
China	Smart Zhenhai District
China	Tangshan Caofeidian Eco-city
China	Wanzhuang, Langfang Eco-city
Denmark	EDISON (Electric vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks) Smart Grid Project
Denmark	Lolland Island Smart Grid
Denmark	zero emission mobility
Eastern Europe. Middle East	Smart community business study PJ
Europe	CONCERTO
Europe	Greening European Transportation Infrastructure for Electric Vehicles
Europe	Grid for Vehicles (G4V)
Europe	North Seas Countries Offshore Grid Initiative (NSCOGI)
Europe	Reference Framework for European Sustainable Cities (RFSC)/ Sustainable city project
Europe	Smart cities in Europe
Europe/Middle East/ Africa	DESERTEC
France	Linky project & pilot
France	Smart Community Demonstration Project in Lyon
Germany	E-Energy
Germany	E-mobility (Electric Mobility)
Germany	E-mobility Berlin
Germany	Hamburg-Harburg project
Germany	T-City
Iceland	Geothermal Energies utilization
Indonesia	Enhancement of Urban Development Management in the Mamminasata Metropolitan Area
Indonesia	Indonesia Economic Development Corridor (IEDC)
Indonesia	Metropolitan Priority Area (MPA)
Indonesia	Smart Community FS in Indonesia Jawa Island's industrial park
Indonesia	Spatial Plan and Urban Development Program for GKS Zone in East Java Province
Indonesia	Surabaya Urban Development Project

Table A.1 *(continued)*

Region, country or organization of main proposer or owner	Title of projects
Italy	Telegestore
Japan	Aizuwakamatsu Area Smart Community Deployment Project.
Japan	B-DASH (Breakthrough by Dynamic Approach in Sewerage High Technology)
Japan	Breakthrough by Dynamic Approach in Sewage High Technology Project: Kobe green sweets project
Japan	Hachinohe Microgrid Demonstration Project
Japan	Yokohama Smart City Project
Korea	Smart Grid Test-bed in Jeju Island
Korea	U-City (Ubiquitous city) Project /New Songdo Green City
Malawi	Urban Development Master Plan for Lilongwe in Malawi
Malaysia	Iskandar Malaysia Project
Malaysia	The Multimedia Super Corridor (MSC) Project
Malta	Smart Grid Utility
Middle East & North Africa	collaborative smart communities project in MODON's industrial areas
Mongolia	Urban Development in Ulaanbaatar City
Netherlands	Amsterdam Smart City (ASC)
Philippine	Intelligent Operations Center in Davao City
Portugal	PlanIT Valley
Russia	Moscow
Singapore	CleanTech Park
Singapore	EV Taskforce(Electric Vehicles (EVs) Test-Bedding Programme)
Singapore	Intelligent Energy Systems (IES)
Singapore	Pulau Ubin Project
Singapore	Punggol Eco-Town
South America	INTEGRATION - Integrated Urban Development in Latin America
Spain	Smartcity Malaga/Spain Intelligent Community Practical Business
Sweden	Stockholm Royal Seaport
Thailand	Smart City in Nakhon Nayok Province
United Arab Emirates	Masdar City
U.S.	20MW Flywheel Frequency Regulation Plant
U.S.	Arizona Public Service (APS) Community Power Project
U.S.	Avista Utilities Smart Grid Project
U.S.	Baltimore Gas and Electric Company Smart Grid Project
U.S.	CenterPoint Energy Smart Grid Project
U.S.	Consolidated Edison Company of New York, Inc. Smart Grid Project
U.S.	Detroit Edison Company Smart Grid Project
U.S.	Duke Energy Business Services LLC Smart Grid Project
U.S.	EV project
U.S.	Florida Power & Light Company Smart Grid Project

Table A.1 *(continued)*

Region, country or organization of main proposer or owner	Title of projects
U.S.	gridSMART SM Demonstration Project
U.S.	Hawaii Electric Co. Inc. Smart Grid Project
U.S.	Japan-US Collaborative Smart Grid demonstration project in Albuquerque
U.S.	Japan-US Collaborative Smart Grid demonstration project in Los Alamos
U.S.	KCP&L Green Impact Zone SmartGrid Demonstration
U.S.	Long Island Smart Energy Corridor
U.S.	Madison Gas and Electric Company Smart Grid Project
U.S.	NV Energy, Inc. Smart Grid Project
U.S.	Pacific Northwest Smart Grid Demonstration
U.S.	Pecan Street Smart Grid Demonstration Project
U.S.	PECO Energy Company Smart Grid Project
U.S.	Potomac Electric Power Company Smart Grid Project
U.S.	Progress Energy Service Company, LLC Smart Grid Project
U.S.	Sacramento Municipal Utility District Smart Grid Project
U.S.	SDG&E Grid Communication System
U.S.	Secure Interoperable Open Smart Grid Demonstration Project
U.S.	Smart Grid Demonstration Project
U.S.	Smart Grid Program
U.S.	Smart Grid Regional Demonstration
U.S.	SmartGridCity project
U.S.	Southern California Edison Company Smart Grid Regional Demonstration Project
U.S.	Southern Company Services, Inc. Smart Grid Project
U.S.	Sustainable Dubuque
U.S.	Technology Solutions for Wind Integration
U.S.	Urban Grid Monitoring and Renewables Integration
U.S.	Vineyard Energy Project
UK	Orkney Smart Grid
UK	Smart Cities
UK	Smart Metering Implementation Programme
UK	Sustainability Appraisal (SA)
Vietnam	Comprehensive Urban Development Program in Hanoi Capital City
Vietnam	Golden Hills
Vietnam	Hoa Lac High-Tech Park
Vietnam	Hong Ha Eco City

Annex B
(informative)

Examples of identified relevant activities

B.1 Summary of relevant concepts or theoretical frameworks

B.1.1 Aalborg Commitments

Title	Aalborg Commitments
Proposer	European Sustainable Cities and Towns Campaign/City of Aalborg
Purpose and scope	For European local governments to accelerate their efforts towards local sustainable development aiming at translating a common vision for sustainable urban futures into tangible sustainability targets and action at local level. The Aalborg Commitments are a resource from which local governments' select priorities appropriate to their local situations and needs, taking into account the global impact of their activities. It commits local governments to initiate a local, participatory process to identify specific targets and time frames to monitor progress towards achieving them.
Key aspects relevant to "smartness"	The Aalborg Commitments are one of the most important tools available for local governments to address sustainable development (in Europe).
Indicators or criteria	There are 50 overall objectives (qualitative indicators). For more information see: http://www.aalborgplus10.dk/media/pdf2004/finaldraftaalborgcommitments.pdf
Time frame	None
Application results	To date, 665 local governments have signed.
URL	www.aalborgplus10.dk
Additional description	

B.1.2 Breakthrough by dynamic approach in sewage high technology project

Title	Breakthrough by dynamic approach in sewage high technology project
Proposer	Kobelco Eco-Solutions and Kobe City (in cooperation with Osaka Gas)
Purpose and scope	Co-digestion of regional biomass and sewage sludge Low life cycle cost (LCC), highly functional steel digestion tank system Low LCC new biogas upgrading system
Key aspects relevant to "smartness"	Drastically reduce greenhouse gas emissions Reduce the construction costs based on high efficiency sewage treatment and sewage energy extraction
Indicators or criteria	Reduction of greenhouse gas emissions by ground breaking technology Reduction of construction costs by ground breaking technology
Time frame	2011, 2012

Application results	Regional biomass intake facilities: - Food biomass: 11t/day; - Wood biomass: 4t/day(proposed). Digestion tank and heating facilities: - Steel digestion tank: 220m3; - High efficiency heat pump: 266kW. Biogas upgrading system gas holder: - Biogas upgrading capacity: 300m3/h; - Cylindrical medium-pressure gas holder: 60m3x3units
URL	
Additional description	The project aims to verify and promote the introduction of ground-breaking technology designed to drastically reduce greenhouse gas emission and construction costs based on high-efficiency sewage treatment and sewage energy extraction. The project began in 2011 under commission from the National Institute for Land Infrastructure Management (Ministry of Land, Infrastructure, Transportation and Tourism).

B.1.3 BSI Smart Cities consultation document

Title	BSI Smart Cities consultation document
Proposer	BSI
Purpose and scope	Establishing the conceptual framework for smart infrastructure projects
Key aspects relevant to "smartness"	Conceptual basis Responsively matching supply & demand within the city (incl. resilience) Reducing waste of infrastructure supply Interoperability of systems Interoperability ecosystem (in ITU meaning) Using one datum to supply other channels Delivery channels and horizontal integration & complementarity BSI Rubik cube
Indicators or criteria	Level of interoperability
Time frame	Not applicable (historic document)
Application results	Used for consultation with smart cities stakeholders in the UK and as the basis of BSI strategy for smart cities standardization
URL	http://shop.bsigroup.com/en/Browse-By-Subject/Smart-Cities/?t=r
Additional description	

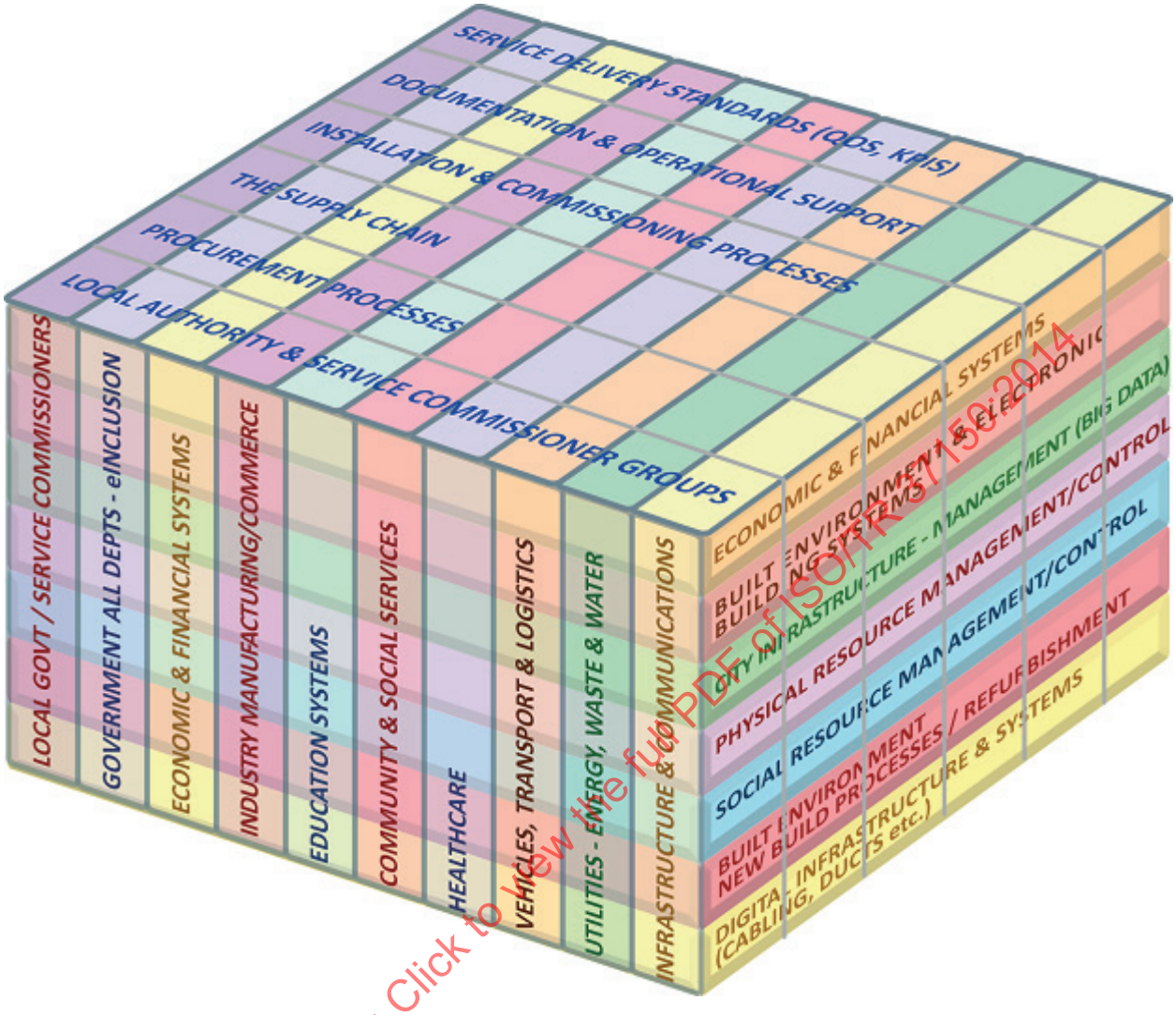


Figure B.1 — BSI Rubik Cube

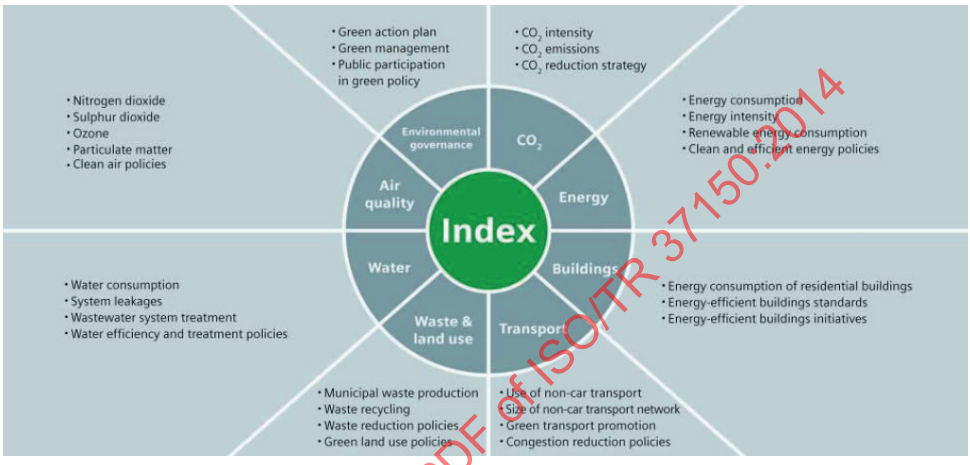
B.1.4 Global City Indicators

Title	Global City Indicators
Proposer	Global City Indicators Facility (GCIF)
Purpose and scope	The Global City Indicators Facility responds to the urgent need for a globally standardized set of city indicators. The GCIF hosts a network of over 240 cities (and growing) and provides a globally standardized system for data collection that allows for comparative knowledge and learning across cities globally.
Key aspect relevant to "smartness" [a]	The Global City Indicators are designed to assist cities in monitoring their performance of city services and quality of life by providing a framework to facilitate the collection of city indicators. The GCIF includes a set of indicators that are standardized, consistent, and comparable over time and across cities. This standardization enhances the ability of cities to observe trends and to facilitate comparisons with other cities.

Indicators or criteria	Standardized set of indicators across two broad categories of city services and quality of life. There are over 120 indicators across 20 themes and this current set is still evolving as it is being developed as an International Standard. Examples of city service indicators include: education, energy, finance, recreation, fire emergency, response, governance, health, safety, solid waste, transportation, urban planning, waste water and water. Examples of quality of life indicators include: civic engagement, culture, economy, environment, shelter, social equity, and technology and innovation The indicators under each of the themes were selected on the basis of the following criteria: - answer important questions and tell a story about the city; - available, up to date and able to report against them annually; - readily comparable among cities globally; - relevant for public policy-making and/or linked to established goals (e.g. UN MDGs); - cost effective to collect; - meaningful to cities across the globe regardless of geography, culture, affluence, size, or political structure; - understandable and not over complex; - clear as to whether changes in the indicator are good or bad.
Time frame	Over 240 cities have been reporting on this set of indicator since 2008. This set of indicators is currently being established as an International Standard (ISO 37120 under development by TC 268/WG 2). The scheduled publication date is summer 2013.
Actual application results	Cities use global city indicators for the evaluation of city service and aspects of quality of life in order to ensure better management and planning practices.
URL	www.cityindicators.org
Additional description	

B.1.5 The Green City Index series

Title	The Green City Index series
Proposer	Conducted by the Economist Intelligence Unit Sponsored by Siemens AG, Munich, Germany
Purpose and scope	To focus attention on the critical issue of urban environmental sustainability by creating a unique tool that helps cities benchmark their performance, share best practices, and learn from each other.
Key aspect relevant to "smartness", if any [a]	The Green City Index helps cities to become smarter in a sense that they can minimize their environmental footprint while at the same time accommodating population growth and promoting economic opportunity for their inhabitants.

Indicators or criteria	Approximately 30 indicators across eight to nine categories, covering CO2 emissions, energy consumption, buildings and land use, transport, water, sanitation, waste management, air quality and environmental governance. About half of the indicators in each index are quantitative (e. g. CO2 emissions per capita), while the remainder are qualitative assessments of the city's environmental policies (e. g. its commitment to sourcing more renewable energy). For a graphical representation of the Green City Index and its indicator set up, see below (example of the European Green City Index): 
Time frame	The series began with Europe in 2009 and since then has gone on to cover a total of more than 120 cities in the US and Canada, Asia, Latin America and Africa, with Australia and New Zealand planned for late 2012.
Actual application results, if any	**European Green City Index** (2009) — In Europe, Copenhagen led the Index, with the neighbouring Nordic cities of Stockholm and Oslo close behind. **US & Canada Green City Index** (2011) — San Francisco topped the U.S. and Canada Index, driven by strong policies across all categories. **Latin American Green City Index** (2010) — Curitiba was the clear leader in the Latin American Index, the only city to score well above average. **Asian Green City Index** (2011) — Singapore was the only city in the Asian Index to score in the well above average performance band. **African Green City Index** (2011) — In the African Index, although no city scored "well above average", three out of four South African cities (Cape Town, Johannesburg and Durban) placed in the above average band.
URL	http://www.siemens.com/greencityindex
Additional description	Attached document: The Green City Index series: Highlights from a unique benchmarking tool

B.1.6 Smart city realized by ICT (Fujitsu)

Title	Smart city realized by ICT (Fujitsu)
Proposer	Fujitsu Limited

Purpose and scope	Promoting environmentally conscious cities to balance environmental stewardship with comfortable living (including the infrastructure) in the world
Key aspect relevant to "smartness"	— promoting smart cities as an impetus for social change — in line with its longer-term vision of realizing a human centric intelligent society, striving to leverage ICT to create a society where people's lives are prosperous and more secure — promoting innovation acceleration, energy management, regional economy revitalization, knowledge transfer and prosperous networking by ICT — the smart city goal is based on the social value cycle model whereby it takes more to build a smart city than simply using ICT to link and manage social infrastructure. Providing new value and services that residents truly need is also essential. Approach 1: — Local energy production and consumption: optimize management of dispersed generation utilizing renewable energy sources by using ICT to perform detailed demand forecast simulations and project electrical output. Approach 2: — Local healthcare network: enhance community-based healthcare networks and build wide-area networks linking communities by sharing electronic medical records across healthcare facilities, from major hospitals to nursing care facilities and medical clinics. Approach 3: — Smart houses: monitor some home status information to support energy management, home healthcare and welfare services, parcel delivery, and other service provision using home and home appliances as interfaces.
Indicators or criteria	Service: — annual gross products of a community, per-capita (USD) — number of in-patient hospital beds per 100,000 population — fuel efficiency of vehicles Environmental impact: — environmental impact of the city. Energy: — power outage frequency rate in a community (%) — annual greenhouse gas (GHG) emissions of a community (CO_2 equivalent ton) — ratio of renewable energy in the total energy Biodiversity: — ratio of biodiversity conservation Water: water-leakage rate in a community (%)
Time frame	2012 Survey and consultations to assess need for new theoretical framework 2012 Publication of the draft framework 2013 Pilot testing by several communities 2014 Publication of the final framework 2014 Review of the framework

Actual application results, if any	Communities that have applied this: Fukushima-Aizuwakamatsu-City, Chiba-Urayasu-City and Kagoshima-Satsumasenndai-city. Countries that have applied this: Japan Other applications: None.
URL	http://www.fujitsu.com/global/about/responsibility/feature/2012/smartcity/
Additional description	

B.1.7 Smart Community by Toshiba

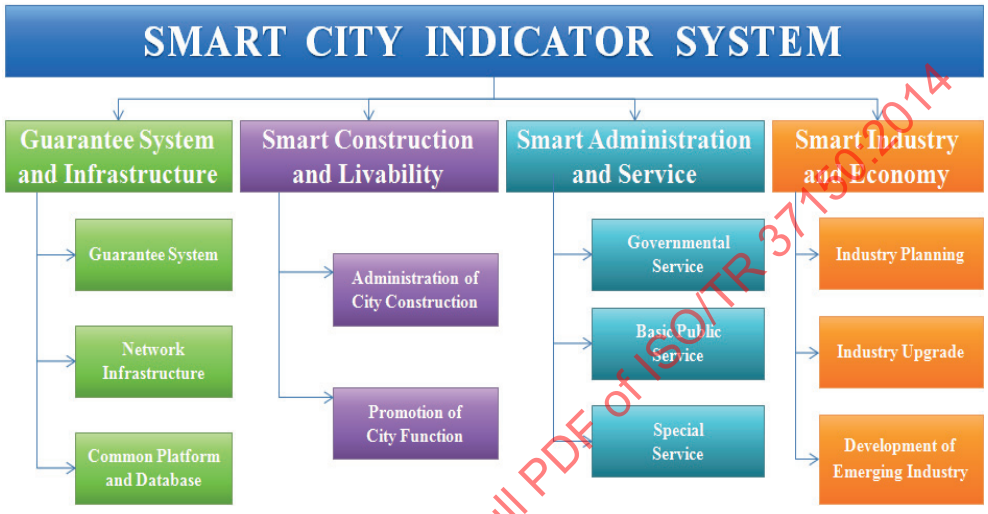
Title	Smart Community by Toshiba
Proposer	Toshiba
Purpose and scope	Promoting the Smart Community which is a next-generation community in which the management and optimized control of various infrastructures such as electricity, transportation, logistics, medicine, and information are integrated
Key aspect relevant to "smartness"	Toshiba Group is striving to ensure that the Smart Community will provide comprehensive solutions encompassing energy, water, and medical systems in order to realize a synergetic balance between environmental consideration and comfortable living

Indicators or criteria	**Energy solutions:** The idea is to stabilize the supply of energy through the optimal use of both conventional power systems and distributed generation – including renewable energy – and to coordinate power supply and consumption through bidirectional communication. For example: μEMS, MDMS, Smart meter, Battery, Fuel Cells, HEMS, BEMS, FES, CEMS. **Water solutions:** A huge amount of energy is used by water supply and sewage systems, and ways to save energy are being explored. In our efforts to realize a good balance between environmental considerations and comfortable living, Toshiba will continue to address energy saving, waste reduction, and reducing environmental impact by employing advanced control systems and innovative technologies. This will contribute to the creation of a sustainable water circulation system. **Information and security solutions:** In the Smart Community, there is a need to have smart control of vast amount of data – such as that related to the optimal control of energy and other resources, and well as date related to people, products, and finances. Energy equipment is managed using information and communication technologies that are open and standardized, and power supply and consumption are coordinated through bidirectional communication. Technologies with a high level of security are utilized to counter the growing threat of cyber attacks from the outside. **Transportation solutions:** Both trains and automobiles are steadily evolving with the increasing use of electric vehicles that feature low carbon dioxide emissions. Toshiba provides transportation solutions that can efficiently utilize energy regenerated from electric trains as well as solar power generated at train station facilities to charge electric-powered card, buses and rechargeable bicycles. **Medical solutions:** In a rapidly aging society, there is a need for healthcare systems to support the active lives of senior citizens. We believe that the creation of an environment in which everyone can live without anxiety requires the introduction of a healthcare process that incorporates medical examinations, tests, diagnosis, treatment, and rehabilitation in the community. In order to realize the provision of early detection of disease, reliable diagnosis, and treatment without excess demand on the body, Toshiba is enhancing systems and solutions in the area of "examinations and tests" and "treatment and cure" as it expands Community Solutions.
Time frame	2009 Smart Community division was established. Started Smart Community feasibility studies worldwide. 2011 M&A: Landis+Gyr (smart meter), UNISON (wind power equipment) 2013 Establish Smart Community Centre in Kawasaki
Actual application results, **if any**	Communities applied to: 27 communities including Yokohama, Lyon etc. Country applyied to: 10 countries
URL	http://www.toshiba-smartcommunity.com/EN/index.html#/about http://www.toshiba.co.jp/about/ir/en/pr/pr2012.htm
Additional description	

B.1.8 Sustainable development of urbanization and smart city in China

Title	Sustainable development of urbanization and smart city in China
Proposer	MOHURD(Ministry of Housing and Urban-Rural Development of China) CSUS(Chinese Society for Unban Studies)
Purpose and scope	Background of smart city development in China Relationship between urbanization and smart city in China Basic research on smart city The evaluation index system of smart city (SCI 2012) Study on the security system of smart city
Key aspect relevant to "smartness	The Chinese word "ChengShi" (city) has carried a meaning of economy and security for thousands of years. Based on the background of the high-speed smart city development in China, people now focus not only the GDP and economy, but also on other aspects of life and environment, such as public policy, transportation, security, etc. The Chinese concept of "the smart city" strengthens characteristics under special Chinese urbanization background. An understanding of the relationship between Chinese urbanization and the smart city development might help Chinese urban planning experts and government managers make correct decisions.

Indicators or criteria	The evaluation index system of the smart city has four first-level indicators: basic infrastructure; industry and economy; governmental management and public service; and, environmental liveability. It also has 26 second-level and 136 third-level indicators. The index system contains considerations for different aspects of the economy, people's livelihood, society, ecology, science and technology. It shows the concept of "wisdom", "people-oriented core values" and the requirement for "sustainable development" of Chinese government (SCI of China).



Smart City Indicator System (Pilot, SCI)

First Level	Second Level	Third Level
Guarantee system & Infrastructure	Guarantee System	Planning Outline, Implementation Scheme, Organization Guarantee, Policy and Regulation, Funds Guarantee, Management of Operation.
	Network Infrastructure	Wireless Network, Broadband Network, Next Generation Broadcasting Network.
	Common Platform and Database	City Common Basic Database, City Common Information Platform, Information Security.
Smart Construction & Livability	Administration of City Construction	Urban and Rural Planning, Digital City Administration, Construction Market Administration, House Property Administration, Landscaping, Historical and Cultural Preservation, Building Energy Conservation, Green Building.
	Promotion of City Function	Water Supply System, Drainage System, Water Conservation Application, Gas System, Garbage Classification and Disposal, Heat Supply System, Lighting System, Underground Pipeline and Spatial Integrated Administration.
Smart Administration & Service	Governmental Service	Decision Support, Information Disclosure, Online Service, Governmental Service System.
	Basic Public Service	Basic Public Education, Labor Employment Service, Social Insurance, Social Service, Medical and Health Service, Public Culture and Sports, Service for Disabled, Basic Housing Guarantee.
	Special Service	Smart Transportation, Smart Energy, Smart Environmental Protection, Smart Land Administration, Smart Emergency, Smart Security, Smart Logistics, Smart Community, Smart House and Home, Smart Payment, Smart Finance.
Smart Industry & Economy	Industry Planning	Industry Planning, Innovation Investment.
	Industry Upgrade	Industrial Factors Agglomeration, Traditional Industry Transformation.
	Development of Emerging Industry	High and New Technology Industry, Modern Service Industry, Other Emerging Industry.

Time frame	From July, 2012
Actual application results	Smart City Projects of MOHURD in China (2012-2015, China)
URL	www.dcitycn.org www.mohurd.gov.cn www.most.gov.cn
Additional description	

B.1.9 Sustainable Smart Town Concept

Title	Sustainable Smart Town Concept

Proposer	Panasonic Corporation
Purpose and scope	A community designed to offer a comfortable and more environmentally-friendly style of living
Key aspect relevant to "smartness"	Smart town: including Energy, Mobility and Security Sustainable town: including Smart Landscape, Networking and Town Brand
Indicators or criteria	Global warming prevention: reducing CO_2 emissions Water conservation: reducing household water consumption Biodiversity promotion: creating wind and green networks
Time frame	Fujisawa Sustainable Smart Town: the town will open in the fiscal year ending March 2014. Total Energy Solution Test-Bed Project for Public Housing in Singapore: the project was launched the end of 2011 and will run till 2013
Actual application results	
URL	Fujisawa Sustainable Smart Town: http://panasonic.net/fujisawasst/ http://panasonic.co.jp/corp/news/official.data/data.dir/en110526-3/en110526-3.html http://news.panasonic.net/archives/2011/0526_5407.html Total Energy Solution Test-Bed Project for Public Housing in Singapore: http://news.panasonic.net/archives/2011/0803_6123.html http://panasonic.co.jp/corp/news/official.data/data.dir/en110801-2/en110801-2.html
Additional description	•

B.2 Summary of relevant projects

B.2.1 Aizuwakamatsu Area Smart Community Deployment Project

Title of the project	Aizuwakamatsu Area Smart Community Deployment Project
Project owner	Fujitsu Limited
Project participants	Fujitsu Limited
Purpose	For the creation of a smart community in Fukushima Prefecture's Aizuwakamatsu region. Project goals include: developing a community that uses the combined heat and power system with distributed biomass co-generation, promoting the deployment of renewable energy in tandem with local disaster preparedness measures, and building an energy control centre.
Performance indicators or targets, if any	Construct an Energy Control Center for practical utilization of the new energy; Use Electric Vehicles (EV) to ensure necessary energy supply in case of disasters; And apply the concept of local production for local consumption in biomass to realize local energy balance between supply and demand.
Relevance to "smartness"	
Profile	
Time frame	10 years
Reference document	
URL	
Additional description	

B.2.2 Breakthrough by dynamic approach in sewage high technology (B-DASH)

Title of the project	Breakthrough by dynamic approach in sewage high technology (B-DASH)
Project owner	Ministry of Land, Infrastructure, Transport and Tourism
Project participants	Japan Sewage Works Agency, METAWATER Co., Ltd.
Purpose	Demonstration study for an energy management system in the municipal wastewater treatment using an intensive solid-liquid separation technology
Performance indicators or targets	Energy self-sufficiency rate within wastewater treatment plant etc.
Relevance to "smartness"	Because the project aims to develop an energy-independent municipal wastewater treatment system by maximizing biogas generation and by a smart power generation
Profile	Demonstration plant treatment capacity: 5,700m3/d Power generation: 100kW Demonstration site: Nakahama WWTP, Osaka Project budget: 1.1 billion JPY
Time frame	2011 Construction and commissioning 2012 Operation, data collection and reporting
Reference document	
URL	
Additional description	

B.2.3 Breakthrough by dynamic approach in sewage high technology project: Kobe green sweets project

Title of the project	Breakthrough by dynamic approach in sewage high technology project: Kobe green sweets project
Project owner	National Institute for Land and Infrastructure Management (Ministry of Land, Infrastructure, Transport and Tourism)
Project participants	Research consortium consisting of Kobelco Eco-Solutions and Kobe City (in cooperation with Osaka Gas)
Purpose	Co-digestion of regional biomass and sewage sludge Low LCC, highly functional steel digestion tank system Low LCC new biogas upgrading system
Performance indicators or targets	Reduction of greenhouse gas emissions by ground breaking technology Reduction of construction costs by ground breaking technology
Relevance to "smartness"	Drastically reduce greenhouse gas emissions and construction costs based on high efficiency sewage treatment and sewage energy extraction.

Profile	Known for its natural beauty and gourmet food, “Kobe city” is producing newest energy source “Kobe Biogas” in Kobe Higashinada Sewage Treatment Plant. “Kobe Biogas” will be utilized to transform the area into a self-sustaining renewable energy supply stronghold. The project aims to verify and promote introduction of ground-breaking technology designed to drastically reduce greenhouse gas emissions and construction costs based on high-efficiency sewage treatment and sewage energy extraction. The project began in 2011 under commission from the National Institute for Land and Infrastructure Management (Ministry of Land, Infrastructure, Transport and Tourism).
Time frame	2011 (continued in 2012)
Reference document	
URL	
Additional description	

B.2.4 Hachinohe microgrid demonstration project

Title of the project	Hachinohe Microgrid Demonstration Project
Project owner	New Energy and Industrial Technology Development Organization (NEDO) Hachinohe-city
Project participants	Mitsubishi Electric Corporation Mitsubishi Research Institute Inc.
Purpose	To verify the performance of a supply-demand control system in managing the impact of renewable energy on a commercial power grid with real end users for an electrical island (Microgrid).
Performance indicators or targets	The project conducts electrical islanded operations. The project reduces energy (electric and thermal) consumption and CO_2 emission.
Relevance to “smartness”	The project furnishes technical solutions to islanded operations using renewables. The project reduced the energy (electric and thermal) consumption and the CO2 emission to 50 - 60 per cent before the project operation.
Profile	Electrical Islanded Operations on 5,4 km/6,6 kV overhead private distribution grid along with I&C line, with six end users, such as Hachinohe city hall, schools etc. The total demand is 605 kW. It consists of: — supply-demand control systems — PV (130 kW) and wind (20 kW) — digestion gas co-generation (510 kW), — battery (100 kW) The project successfully conducted one-week of islanded operations relying on 100 per cent renewable energy.
Time frame	2003, Site survey and planning 2004, Construction October 2005, Operation

Reference documents	a) The Global Smart Grid Federation 2012 Report b) Y. Kojima, M. Koshio, S. Nakamura, H. Maejima, Y. Fujioka, T. Goda, "A Demonstration Project in Hachinohe: Microgrid with Private Distribution Line" IEEE International Conference System of Systems Engineering 2007, on 16-18 April 2007 c) H. Iwasaki, Y. Fujioka, H. Maejima, S. Nakamura, Y. Kojima, M. Koshio, "OPERATIONAL ANALYSIS OF A MICROGRID:THE HACHINOHE DEMONSTRATION PROJECT", CIGRE 2008 session C6-109
URL	http://www.globalsmartgridfederation.org/ (for reference document a) above)
Additional description	

B.2.5 Integrated Urban Development in Latin America (INTEGRATION)

Title of the project	Integrated Urban Development in Latin America (INTEGRATION) The project is funded by the European Commission's URB-ALIII Programme, a regional cooperation programme with Latin America, whose goal is to contribute to increasing social and territorial cohesion among sub-national and regional groups in Latin America.
Project owner	Department for Environmental Protection, State Capital of Stuttgart, Germany
Project participants	State of Chihuahua, Secretary for Urban Planning and Ecology (Secretaría de Desarrollo Urbano y Ecología), Mexico City of Guadalajara, Direction of Political Cooperation, Mexico City of Sao Paulo, Secretariat of Green Areas and Environment, Brazil City of Quito, Territorial Coordination, Ecuador City of Bogotá, Environmental Office, Colombia City of Rio de Janeiro, Office for Urban planning (Secretaria Municipal de Urbanismo – Instituto Pereira Passos), Brazil ICLEI - Local Governments for Sustainability **Associated project partners:** Federal Environment Agency of Germany, Section I 1.6 Environment and Spatial Planning, Dessau-Roßlau, Germany Municipality of Viña del Mar, Chile Institute for Transportation and Development Policy, Mexico Faculty and competent city organ for urban planning and architectural issues of the City of Guadalajara, Mexico
Purpose	Sustainable inner urban development and brownfield revitalization Inclusion of ecological and social aspects into adequate urban planning concepts Facilitation and encouragement of social house building on brownfield sites by public participation including deprived people Generation of healthy working and living conditions on urban brownfield areas Fortification of administrative competences on local level concerning an environmental friendly and social urban development
Performance indicators or targets	Resulting products (brochures) are available at the website (see below) Performance indicators are currently under evaluation and will be presumably published in March/April 2013
Relevance to "smartness"	The project takes into consideration of the synergies and trade-offs between infrastructures and buildings sites.

Profile	
Time frame	November 2008 – November 2012
Reference document	See below link to the project's website
URL	http://www.urbal-integration.eu
Additional description	a) Sustainable Urban Development in Latin America (The study is available in German and Spanish only.) http://www.urbal-integration.eu/ b) Study on the framework conditions of sustainable inner urban development and brownfield revitalisation in Mexico, Columbia, Ecuador, Brazil and Chile. (The study is available in German and Spanish only.) c) Lessons learned from the pilot projects of brownfield revitalisation in inner city urban areas in Mexico, Columbia, Ecuador and Brazil (The study is available in Spanish only) http://www.urbal-integration.eu/index.php?id=home

B.2.6 Lyon project

Title of the project	Lyon Project
Project owner	City of Lyon New Energy and Industrial Technology Development Organization (NEDO)
Project participants	Project Manager: Toshiba, Toshiba Solutions Inc. Other participants: SANYO, AGC, Mitsubishi Motors, Bouygues, Veolia Transport, PSA Peugeot Citroen
Purpose	To optimize the solar power generations and utilize EV car sharing
Performance indicators or targets, if any	Generate more energy than consumption by energy saving by 25 per cent and generation (15 per cent by solar and 83 per cent by co-generation) Zero CO_2 emissions by use of renewable energy and EVs; Visualization of energy usage in project area such as homes, buildings and transportation.
Relevance to "smartness"	This project was started based on the agreement for a smart community demonstration project between NEDO and Grand Lyon Community.
Profile	Budget: approximately 5 billion yen Duration: FY2011 - FY2015 (approximately 5 years) Area: 150 hectares Residents: 7 000 Employed workers: 7 000
Time frame	2011 Feasibility Study 2012 Project Started 2013 Development 2014 Development 2015 Whole system in operation
Reference document	a) NEDO and Grand Lyon Community sign agreement to start a smart community demonstration project in Lyon, France (see below for website) b) From smart grid to smart community: Technology and experience (see below for website)

URL	a) http://www.nedo.go.jp/english/whatsnew_20111226_index.html b) http://ewh.ieee.org/conf/sge/2012/
Additional description	

B.2.7 Smart city projects of the Ministry of Housing and Urban-Rural Development of China (MOHURD)

Title of the project	Smart city projects of MOHURD, China (2012 to 2015)
Project owner	Ministry of Housing and Urban-Rural Development of China (MOHURD) Chinese Society for Urban Studies (CSUS)
Project participants	Ministry of Housing and Urban-Rural Development of China (MOHURD) Minister of Industry and Information Technology of the P.R.C. (MIIT) Development and Reform Commission of the P.R.C. (DRC) Ministry of Science and Technology of the P.R.C. (MOST) Standardization Administration of the P.R.C. (CSA) Local government of Guangdong province, Zhejiang province, Jilin province. City of Shanghai, Nanjing, Ningbo, Kunshan, Foshan, Jiyuan, Qianan, Xianning, Pingxiang City of Lecong City of Zhenhai City of Liaoyuan **Associated project partners:** Eastdawn, WIOT, ISoftStone, EastLand, Cybernery
Purpose	To improve government administrative capacity; promote industrial restructuring and upgrading, and improve people's livelihood in the urbanization process of China. 15 cities have been selected as pilot projects and are classified as follows: smart towns (5); smart districts (5); smart cities (5). In 3 to 5 years, the initial building and construction of these 15 cities or towns will be completed. To complete the Chinese smart city evaluation index system and smart city construction standard system. To promote the urbanization development based on the smart city construction. To build resource-saving and environmentally friendly cities and to maintain sustainable development. To publish the development report of smart cities in China every year.
Performance indicators or targets	Smart city evaluation index system Smart city construction standard system
Relevance to "smartness"	Concept of smart city, green city, sustainable urban city in China
Profile	a) Application of smart city in China b) MOHURD's smart city projects: — Introduction of pilot demonstration national projects about Smart City (town) — Smart Lecong Project — Smart Zhenhai Project — Smart Liaoyuan Project

Time frame	From November 2012 to November 2015
Reference document	
URL	www.dcitycn.org www.mohurd.gov.cn www.most.gov.cn
Additional description	

B.2.8 Yokohama smart city project

Title of the project	Yokohama Smart City Project
Project owner	City of Yokohama
Project participants	Project Manager: Toshiba Other participants: Accenture, TEPCO, Tokyo Gas, Panasonic, Nissan Motor, Meidensha
Purpose	Establish a low-carbon city in Yokohama
Performance indicators or targets	To construct a society aiming to cut CO_2 emissions by 30 per cent: — PV for 4200 houses — HEMS for 4000 houses — BEMS for 1.6km2 of office floor — CEMS for overall energy management in the city — 2000 sets of EV (Electric Vehicle)
Relevance to "smartness"	This project addresses the introduction of state-of-art technologies described above to establish a low-carbon city.
Profile	Total project cost for the demonstration (five years): Approx. 74 billion yen Population: Approximately 420 000 Number of households: Approximately 170 000 Land area: Approximately 60 km^2 Number of vehicles owned: Approximately 150 000 units
Time frame	FY2010 to FY2011: — Planning: The establishment of an organizational structure for the implementation of the YSCP. Cooperation with other areas' projects. — Market development overseas: Participating in APEC and various other international events and holding independent events — Identifying the necessary operational functions. Management of the Innovation Network. FY2011: Operation of the organizational structure for the implementation of the YSCP 2012 onwards FY2012: Demonstration of the smart city management
Reference documents	a) Master Plan of "Yokohama Smart City Project (YSCP)" (see website below) b) From Smart Grid to Smart Community; Technology and Experience (see website below)
URL	a) http://www.city.yokohama.lg.jp/ondan/english/ b) http://ewh.ieee.org/conf/sge/2012/
Additional description	

Annex C
(informative)

Results of the review on identified activities

C.1 Overview of identified relevant activities

C.1.1 General

This Technical Report identified the following relevant activities:

— 28 International Standards, concepts and indicators;

— 124 projects.

NOTE 1 The identified relevant activities are included in Annex A and C.

NOTE 2 The identified relevant activities are not exhaustive.

C.1.2 Geographical diversity

Table C.1 outlines the geographical distribution of identified relevant activities by region of origin.

With regard to identified International Standards, concepts and indicators, half were published by international organizations. 36 per cent of the total has their origin in Asia, followed by Europe.

With regard to projects, those identified are geographically dispersed.

Table C.1 — Distribution of identified relevant activities by region of origin

Profiles	Region of origin								
	International	Europe	Asia	Oceania	Middle East	Africa	North America	South America	Others (Inter-regional)
International Standards, concepts and indicators	14	3	10	-	-	-	1	-	-
Projects	-	28	51	2	2	1	36	2	2
NOTE The categorization of countries into each region is based on the definition of regional groups published by the United Nations.									

C.1.3 Economic diversity

With regard to International Standards, concepts and indicators, those in developed countries account for 36 %, and those in developing countries; account for 14 %. And the remaining 50 % is those made by international organizations, as mentioned above.

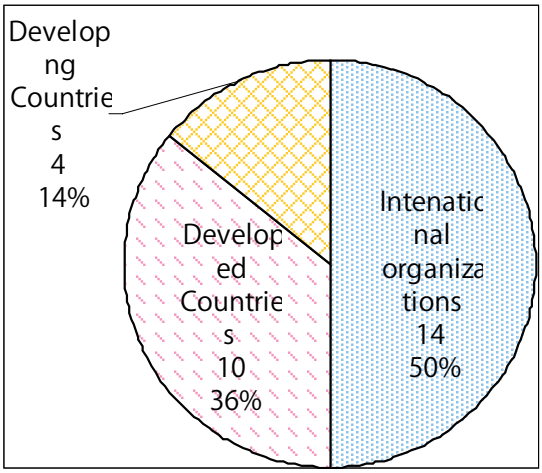


Figure C.1 — Distribution of identified International Standards, concepts and indicators among international organizations, developed countries and developing countries

Out of a total of 124 projects worldwide, those implemented in developed countries account for 57 %, and those implemented in developing countries account for 43 % out of a total of 124 projects worldwide.

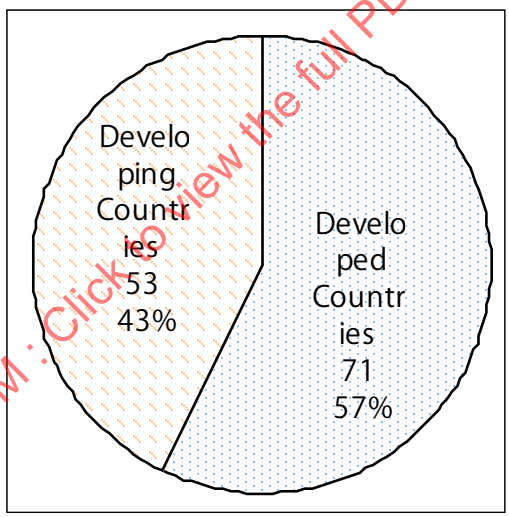


Figure C.2 — Distribution of identified projects between developed countries and developing countries

NOTE The categorization of developed and developing countries is conducted based on the ISO list of developing countries, which is approved by ISO Council.

With regard to brown field projects and green field projects: brown field projects account for 76 per cent, and green field projects account for 14 per cent. Ten per cent are unidentified.

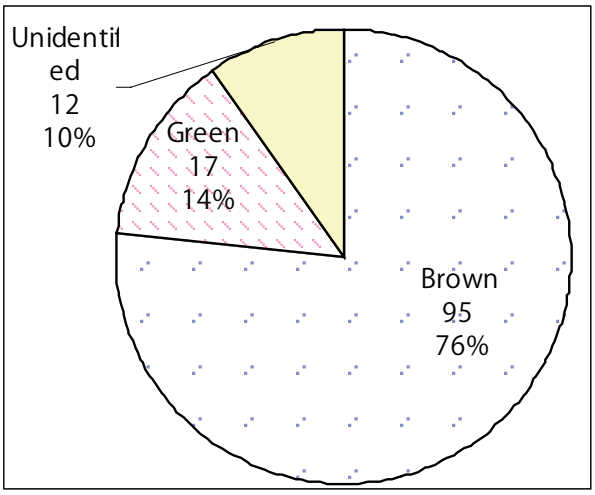


Figure C.3 — Distribution of identified projects between Green and Brown field

C.2 Sustainability issues that communities face/community outcome indicators

This Technical Report identified, in relevant activities, a wide range of sustainability issues that communities face, as well as, a broad range of community outcome indicators across all regions.

The major specific issues associated with sustainability were broken down into three main categories: environmental, economic and social. Table C.2 summarizes these issues.

Table C.2 — Examples of components in three issue categories

Category of issues	Examples of specific issues
Environmental	- reduction in environmental impacts (e.g. emissions of CO_2, wastes, pollutants) - improvement of environmental quality (e.g. quality of air, water, soil) - efficient utilization of resources
Economic	- increase in economy-related factors (e.g. GDP, productivity, job, investment) - reduction in costs (e.g. costs of energy, water, construction) - establishment and improvement of infrastructures (e.g. transport system, public building)
Social	- public services (e.g. education, healthcare, safety, security) - improvement of quality of life - recreational services
Others	- cross-cutting issues (e.g. city planning, energy security)

With regard to identified International Standards, concepts and indicators, the environmental issue was most widely covered (96 per cent of the identified relevant activities). Economic and social issues follow it with a coverage rate of 75 per cent.

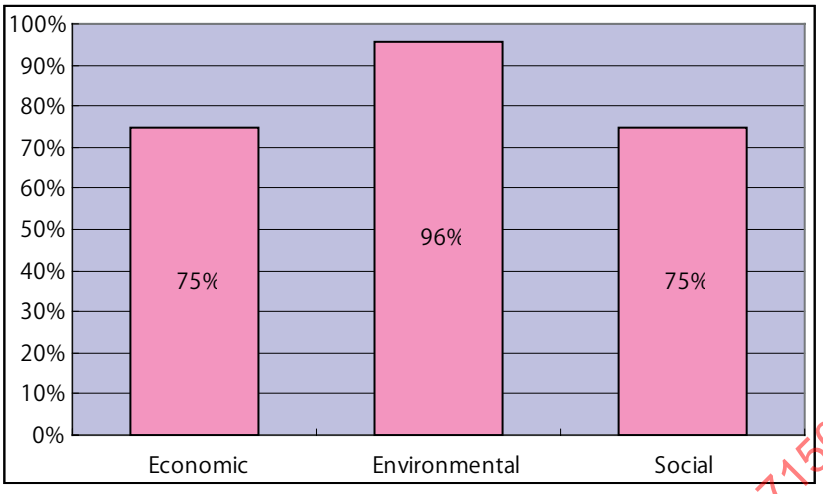


Figure C.4 — Coverage rate of each issue (environmental, economic and social) in identified International Standards, concepts and indicators
(excluding those International Standards, concepts and indicators projects without data on the issue being analyzed)

In terms of the number of issue categories covered in the identified International Standards, concepts and indicators, 87 percent of those identified cover more than one category.

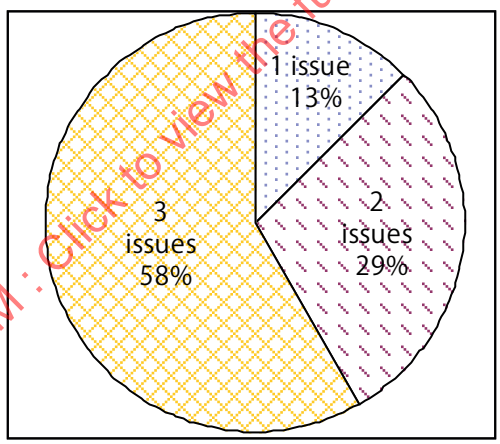


Figure C.5 — Comparison of the number of issues covered in identified International Standards, concepts and indicators
(excluding International Standards, concepts and indicators projects without data on the issue being analyzed)

The same analysis was conducted for the identified projects. Figure C.6 shows that the economic issue was most commonly covered and an environmental issue follows with a coverage rate of 76 %.

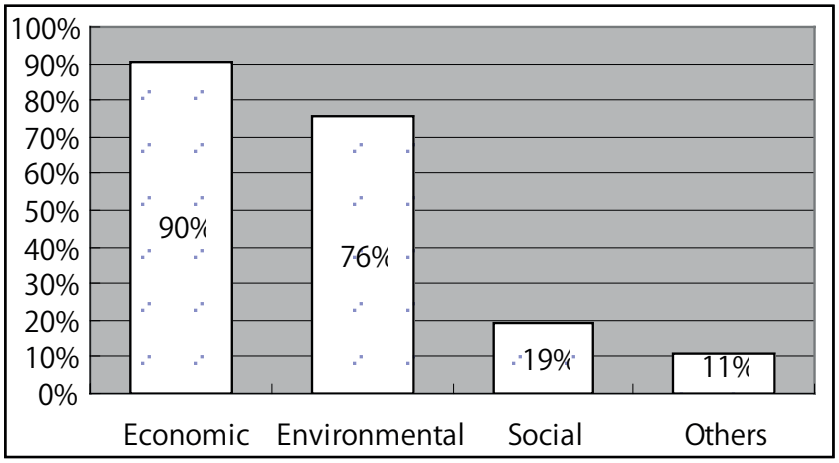


Figure C.6 — Coverage rate of each issue in identified projects
(excluding projects without data on the issue being analyzed)

In addition, the categories were applied to developed and developing countries separately. In the comparison, both groups show a similar trend: an economic issue was the most widely covered, followed by an environmental issue. Social issues were the least covered, as shown in the Figure C.7. The most prominent difference between developed and developing countries is that a social issue is covered more frequently in developing countries.

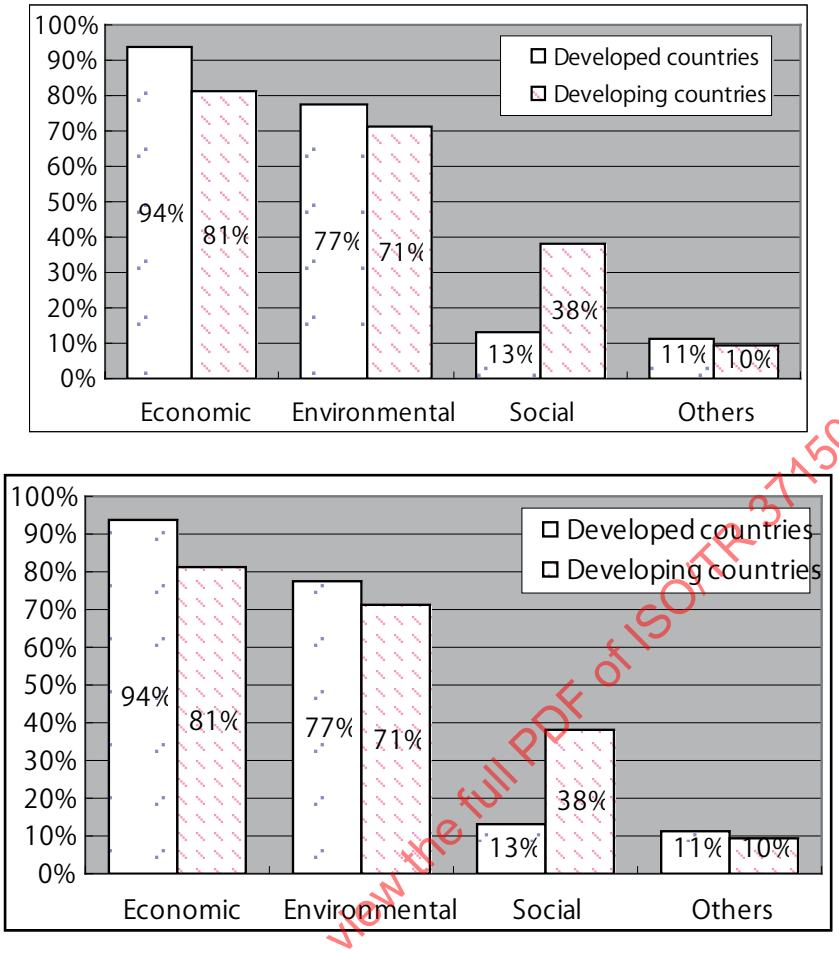


Figure C.7 — Comparison between developed and developing countries in coverage rate of each issue in identified projects

(excluding projects without data on the issue being analyzed)

In the analysis of the number of issue categories covered in identified projects, 71 per cent cover more than one issue category. Compared to the result of the identified International Standards, concepts and indicators, a rate of those projects covering three issues is far less and a majority of projects deal with only two issue categories.

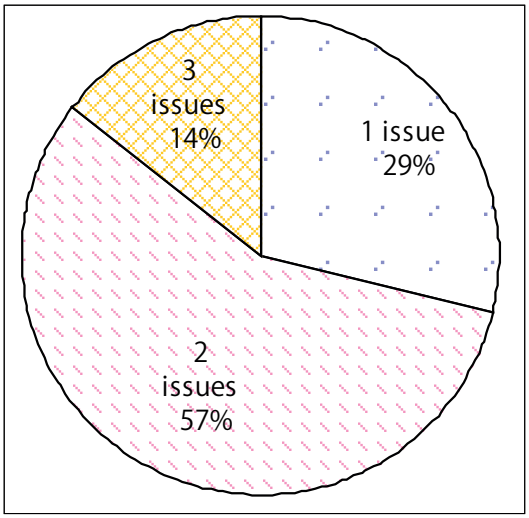


Figure C.8 — Comparison of the number of issues covered in identified projects
(excluding projects without data on the issue being analyzed)

In the comparison of the number of issue categories covered in identified projects between developed and developing countries, the rate of projects covering all three issue categories is higher in developing countries while those focusing on only one issue category is also higher.

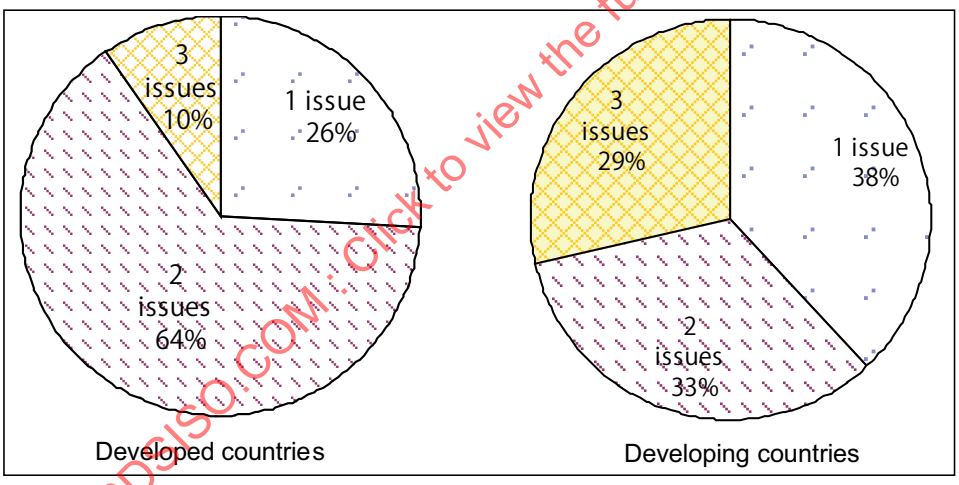


Figure C.9 — Comparison between developed and developing countries in the number of issues covered in identified projects
(excluding projects without data about covered issues from calculation)

C.3 Relevance to community infrastructures

In the review of community infrastructures covered in the identified International Standards, concepts and indicators, as well as projects, a total of five community infrastructures (i.e. energy, water, transportation, waste and ICT) are analyzed.

Analyzing reasons each community infrastructure is covered in the identified International Standards, concepts and indicators, energy is the most commonly covered while all of them are set as both purpose and means.

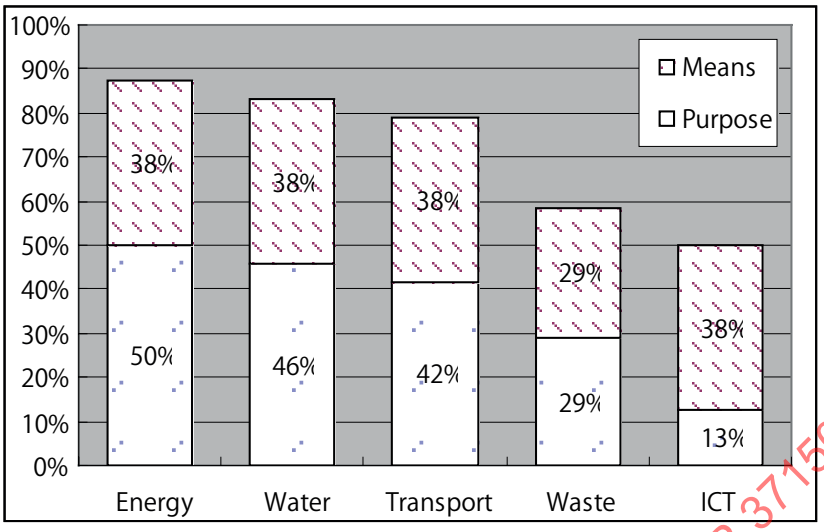


Figure C.10 — Infrastructures covered in identified International Standards, concepts and indicators (excluding International Standards, concepts and indicators, projects without data on issues being analyzsed)

In the identified projects, a large portion of the projects covers energy and ICT. Many projects cover energy as a purpose and a vast majority of them set ICT as a means to achieve it. Meanwhile, there are also projects which use other community infrastructures, such as transportation, water and waste as means to achieve a purpose of energy.

On the other hand, none of the projects identified in this review set ICT as a purpose. All of them regard it as a means to meet a purpose of other community infrastructures.

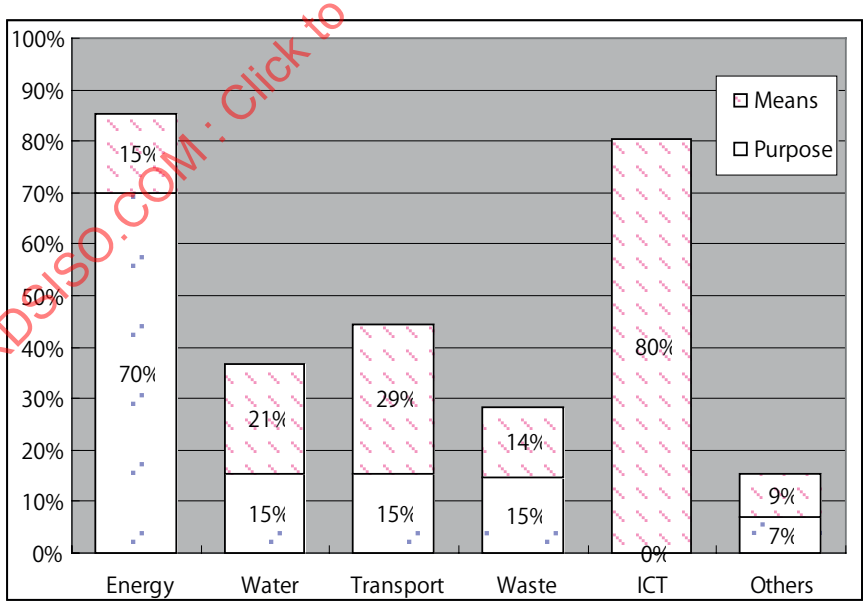


Figure C.11 — Covered community infrastructures and reasons to cover them (purpose or means) in identified projects
(excluding projects without data about covered issues from calculation)

NOTE Multiple large-scaled projects setting ICT as a main purpose were implemented mainly in developing countries by the middle of 1990s. They are dedicated solely for ICT and other community infrastructures are not regarded as means to develop ICT. Such projects are not included in this review.

In the comparison between developed and developing countries, energy is more widely covered in developed countries. Water, transportation and waste are more commonly dealt with in projects in developing countries, although energy is still a factor in purpose or means.

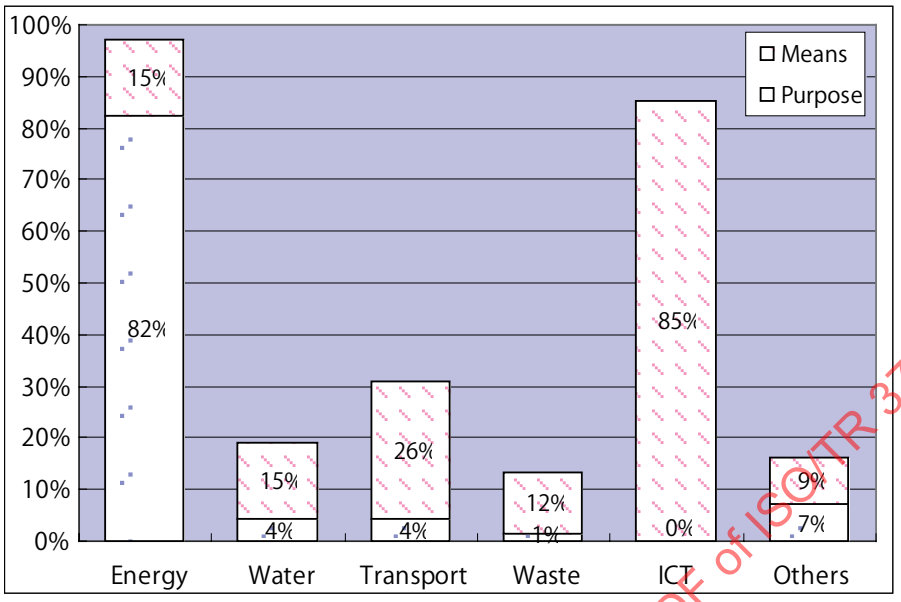


Figure C.12 — Covered community infrastructures and reasons to cover them (purpose or means) in identified projects in developed countries
(excluding projects without information about covered issues from calculation)

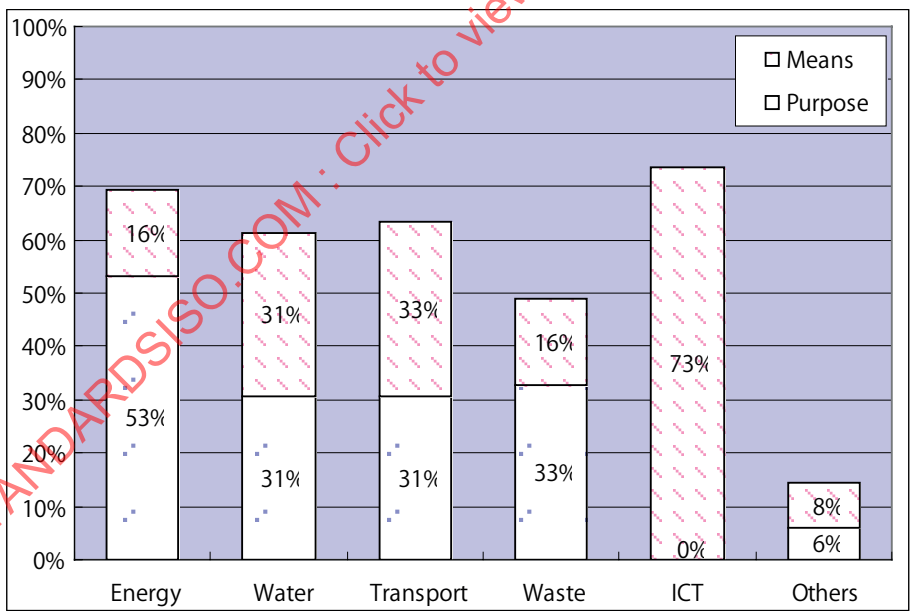


Figure C.13 — Covered community infrastructures and reasons to cover them (purpose or means) in identified projects in developing countries
(excluding projects without information about covered issues from calculation)

As the means to achieve a purpose of energy, ICT is most commonly set as a means, followed by transportation, water, and waste. This seems to be due to the fact that many of the identified projects place the establishment of smart grid systems as a main aim.

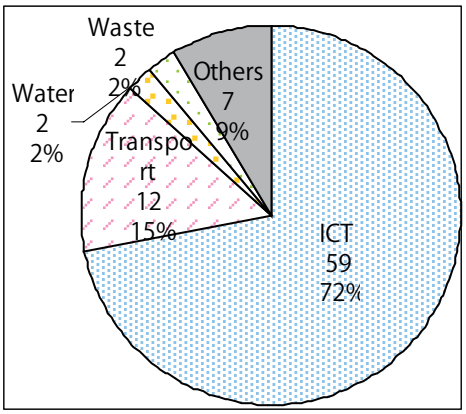


Figure C.14 — Community infrastructures used as means to meet a purpose of energy
(excluding projects without data about covered issues from calculation)

A similar result is shown when comparing developed and developing countires (ICT is most commonly set as a means).

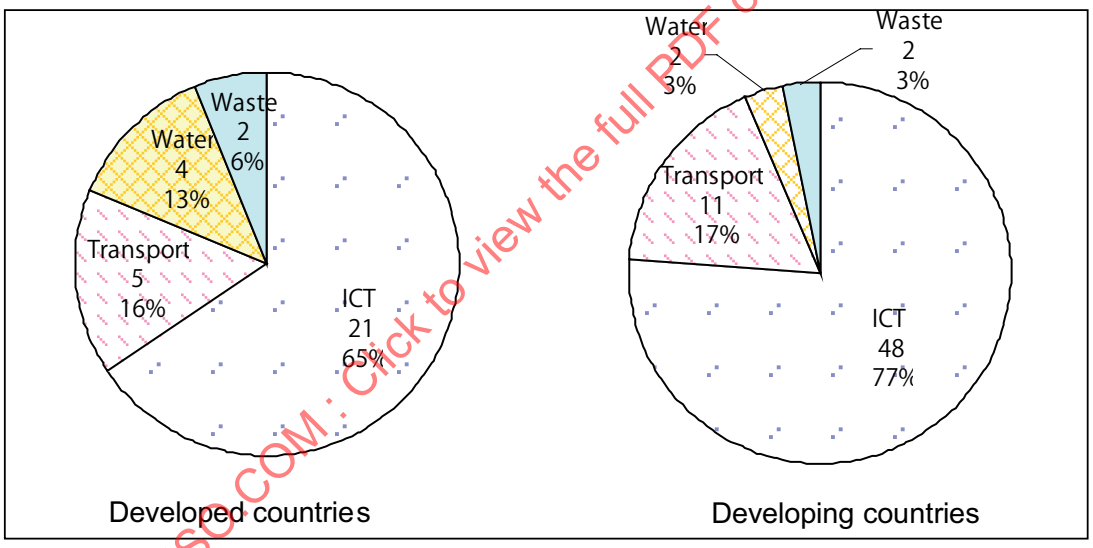


Figure C.15 — Community infrastructures used as means to meet a purpose of energy
(excluding projects without data about covered issues from calculation)

NOTE Several identified projects also recognise other initiatives, such as city planning, energy, security and health care as infrastructures. These are categorized into "other issues."

C.4 Relevance to metrics

In the review of relevant activities, various indicators are identified. According to their properties, they can be categorized into two groups: 1) community outcome indicators relevant to the community itself and 2) indicators relevant to community infrastructures. The second group is further broken down into two: a) status-quo of a specific design of each community infrastructure in a community and b) output or technical performance indicators of community infrastructures.

NOTE This analysis covers multiple types of indicators (e.g. result indicators and status indicators, community-wide indicators and project indicators).

Detailed explanation and concrete examples for each group are provided in Table C.3.

Table C.3 — Properties and examples of indicators identified in the review of relevant activities

Properties of indicators	Examples
Community outcome indicators relevant to the community itself (Group 1)	Greenhouse gas emissions per capita (Global City Indicators Facility (GCIF), The Green City Index, etc.) Amount of cost savings by consumers (various projects) GDP growth rate (various projects) Population density (The Green City Index) Securing minimum utilities for life style by 3 days (Panasonic Sustainable Smart Town Concept) Percentage of city population living in poverty (GCIF) Indicator calculated from environmental quality as the numerator and environmental load as the denominator. (CASBEE-city)
Indicators relevant to community infrastructures (Group 2) a) Status-quo of a specific design of each community infrastructure in a community	Prevalence rate/number of particular types of community infrastructures in a community, e.g.: Percentage of city population with authorized electrical service (GCIF) Usage rate of renewable energy in a total energy consumption (GCIF, etc.) Length of transportation system per a population of 100,000 people (GCIF) Km of light passenger transit system per 100,000 population (GCIF) Number of electric vehicles and charging stations (various projects) Number of Home Energy Management Systems introduced (Yokohama Smart City Project in Japan, and various projects)
Indicators relevant to community infrastructures (Group 2) b) Output or technical performance indicators of community infra-structures	Energy Power outage frequency rate (Smart City realized by ICT in Japan, etc.) Water Water-leakage rate (The Green City Index, Smart City realized by ICT in Japan, etc.) Waste Waste recycling rate (The Green City Index, Cities of Opportunities by PricewaterhouseCoopers, etc.) Community infrastructures in community levels None

C.5 Innovative features

This Technical Report identified qualitative features unique to individual activities which are not suitable to be tallied and summarized in a graph.

Examples of such innovative features of identified relevant activities are as presented by Table C.4.

Table C.4 — Examples of innovative features of identified relevant activities

category	Examples of innovative features and relevant activities
Life cycle perspective	Low life cycle cost of a community infrastructure (Breakthrough by Dynamic Approach in Sewage High technology Project)

Table C.4 *(continued)*

category	Examples of innovative features and relevant activities
Consideration of synergies and trade-offs among multiple issues	Gauging not only the sustainability, but also the level of services (Sustainable development of urbanization and smart city in China) BEE (Building Environment Efficiency): an indicator calculated from Q (built environmental quality) as the numerator and L (built environment load) as the denominator. (CASBEE for Cities)
Application to diverse geographical areas	Evaluation conducted for each geographical area (The Green City Index series)
Focus on a particular type of community infrastructure	Solving a wide range of clients' issues, using information technologies (IBM Smarter cities) Key performance indicators of water and wastewater services (ISO 24510 series)
Covering status-quo of multiple community infrastructures	Various city indicators (mostly focused on prevalence rate of a specific design of each community infrastructure in a community, e.g. a number of non-stop flights in a community)
Holistic perspective across multiple infrastructures	Delivery channels and horizontal integration & complementarity (BSI - A Standards Strategy for Smart Cities) Consideration of the synergies and trade-offs between infrastructures and buildings sites (INTEGRATION - Integrated Urban Development in Latin America) Various smart grid projects
Focus on specific designs of advanced technologies	Introduction of solar panels (various projects); Introduction of wind turbines (various projects); Introduction of electric vehicles (various projects);
Combination with technological and social solutions	The combination of technologies (electricity and water meters, smartphone applications, etc.) and residents cooperation (Sustainable Dubuque)
Comparison/ranking of cities themselves	Set of City indicators that allows for global comparability of city performance and knowledge sharing. (Global City Indicators Facility) Integrated score (one number) & numeric ranking of cities (The Green City Index series)
Focus on performances of a particular type of a community infrastructure	Key performance indicators for water and wastewater utility services (ISO 24510 series)

C.6 Summary of discussions on "smartness" in existing activities

Various discussions on key aspects relevant to "smartness" were found in identified relevant activities. Non-exhaustive examples of the aspects are as follows:

a) Sustainable development:

— the most important tool for local governments to address sustainable development (Aalborg Commitments).

b) Taking into account the synergies and trade-offs among multiple issues:

— minimize their environmental footprint while at the same time accommodating population growth and promoting economic opportunity for their inhabitants (The Green City Index series);

— focus on not only GDP and economy, but also aspects of life and environment (Sustainable development of urbanization and smart city in China);

— comprehensive solutions encompassing energy, water, and medical systems in order to realize a synergetic balance between environmental consideration and comfortable living (Smart Community by Toshiba);

— Smart cities in Europe: We believe a city to be smart when 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.

c) Greenhouse gas emissions reduction:

— reduce the greenhouse gas emissions drastically (B-DASH);

— the project reduced the energy (electric and thermal) consumption and the CO_2 emission to 50 - 60 % before the project operation (Hachinohe Microgrid Demonstration Project);

— the introduction of state-of-art technologies described above to establish a low-carbon city (Yokohama Smart City Project).

d) Efficiency:

— reduce the construction costs based on high efficiency sewage treatment and sewage energy extraction (B-DASH);

— reducing waste of infrastructure supply (BSI Smart Cities consultation document).

e) Responsiveness:

— smart infrastructure responds intelligently to changes in its environment, including user demands and other infrastructure, to achieve an improved performance (Royal Academy of Engineering: Smart infrastructure: the future);

— responsively matching supply and demand within the city (BSI Smart Cities consultation document).

f) Holistic viewpoint across multiple community infrastructures (e.g. interoperability):

— interoperability of systems (BSI Smart Cities consultation document);

— the project takes into consideration of the synergies and trade-offs between infrastructures and buildings sites. (INTEGRATION - Integrated Urban Development in Latin America).

g) Utilization of ICT:

— using one datum to supply other channels (BSI Smart Cities consultation document);

— striving to leverage ICT to create a society where people's lives are prosperous and more secure. (Smart City realized by ICT).

h) Other:

— enhances the ability of cities to observe trends and to facilitate comparisons with other cities (Global City Indicators).

Annex D
(informative)

Attributes of identified activities

Table D.1 — Identified International Standards, concepts, theoretical frameworks and indicators

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
The Green City Index series (http://www.siemens.com/greencityindex.com)												
Region/ Country:	International	on-going	P	P	P	P	—	U	—	- gross domestic product (GDP)	- CO_2 - recycling - water - land use - air quality - green space	—
Economic development stages*:	3											
Region of application:	National, regional, continental, global											
Proposer:	Siemens (supported by Economist Intelligence Unit)											
Intended users:	Economist Intelligence Unit											
Use cases:	Evaluation											
Leadership in Energy and Environmental Design (LEED) (http://www.usgbc.org/leed)												
Region/ Country:	U.S.	on-going since 2000	P	P	P	P	—	U	—	- reduction in management costs - improvement of asset value and profit - improvement of employees' productivity and satisfaction - life cycle economical performance	- improvement and conservation of ecosystems and biodiversity - improvement of air and water quality - reduction in wastes - conservation of natural resources - improvement of air and heat quality	- improvement of comfort and health of residents and lessee - minimization of local burdens to infrastructure - contribution to general quality of life
Economic development stages*:	1											
Region of application:	Building											
Proposer:	U.S. Green Building Council (US GBC)											
Intended users:	Those who apply the certification (i.e. building owners etc.) and auditing organizations											
Use cases:	Evaluation for certification											
Cities of opportunity – Business readiness indicators for the 21st Century (http://www.pwc.co/jp/ja/japan-news/2010/20100406.html)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	International	on-going	P	P	P	P	P	U	—	- intellectual capital and innovation - technology readiness - transportation and infrastructure - economic clout - ease of doing business - cost - city gateway	- sustainability and the natural environment	- health, safety and security - demographics and liveability
Economic development stages*:	3											
Region of application:	Global											
Proposer:	Partnering with New York City (PwC)											
Intended users:	Cities evaluated											
Use cases:	Evaluation (ranking)											
European Green Capital (http://ec.europa.eu/environment/europeangreencapital/index_en.htm)												
Region/ Country:	Europe	on-going (2010 - ...)	M	M	M	M	—	M	—	- urban land use - local transport employment	- CO_2 - pollution (air, noise, water) - waste - energy - environmental management	—
Economic development stages*:	1											
Region of application:	Regional											
Proposer:	European Commission (Environment DG)											
Intended users:	Local authorities											
Use cases:	Urban development and management											
City Biodiversity Index (or Singapore Index) (http://www.cbd.int/authorities/gettinginvolved/cbi.shtml)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Asia/Pacific	on-going	—	—	—	—	—	—		—	- all 23 indicators	- biodiversity provides invaluable recreational and educational services
Economic development stages*:	3											
Region of application:	Cities											
Proposer:	Convention of biological diversity											
Intended users:	National/local government											
Use cases:	Self-checking of biodiversity											
Global City Indicators Facility (GCIF) (http://www.cityindicators.org/)												
Region/ Country:	International	on-going	P	P	P	P	—	U	—	- finance - economy - technology and innovation	- energy - solid waste - transportation - urban planning - waste water - water	- education - recreation - fire emergency response - governance - health - safety - civic engagement - culture - shelter - social equity
Economic development stages*:	3											
Region of application:	City having a population of 100 000 people or more											
Proposer:	GCIF (supported by UN-HABITAT, ICLEI, UCLG, OECD, University of Toronto etc.)											
Intended users:	Participating cities											
Use cases:	Evaluation											
Intelligent Community Awards (http://www.intelligentcommunity.org/index.php?src=)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Canada/ International	on-going	—	—	—	—	P	—	—	- competitiveness in the broadband economy	—	—
Economic development stages*:	3											
Region of application:	Cities											
Proposer:	Intelligent Community Forum (ICF)											
Intended users:	ICF											
Use cases:	Evaluation (Award)											
Smarter cities (http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/index.html)												
Region/ Country:	U.S./ International	on-going	P	P	P	P	M	U	—	—	- energy - water	- government and agency administration - education - social and health - public safety
Economic development stages*:	3											
Region of application:	Local cities, businesses											
Proposer:	IBM											
Intended users:	Local (city) governments, businesses											
Use cases:	When need to solve issues											
Smart City Framework (http://www.cisco.com/web/about/ac79/docs/ps/motm/Smart-City-Framework.pdf)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	U.S./ International	ongoing	P	P	P	P	M	U	—	- transportation (rail, road, air, logistics) - real estate (residential, commercial, retail/hotels, public building)	- Utilities (power, water, waste)	- city services (healthcare, education, fire/police/defense, municipal services)
Economic development stages*:	3											
Region of application:	Local cities, businesses											
Proposer:	CISCO											
Intended users:	Public and private sectors											
Use cases:	When planning and implementing smart city initiatives											
RFSC/Sustainable city project (http://rfsc.tomos.fr/)												
Region/ Country:	Europe	ongoing	M	M	M	M	M	M	—	- economic attractiveness - development of local economy - sustainable local production and consumption - employment	- CO_2 - energy - air quality - water quality - soil pollution - noise, other waste management	- human resources - accessibility - diversity and equality - health and welfare - housing - culture and leisure - public inclusion - governance
Economic development stages*:	1											
Region of application:	Regional											
Proposer:	European Commission (Regional Policy DG)											
Intended users:	Local authorities											
Use cases:	Urban development and management											
Smart cities model (Vienna University of Technology)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Europe											
Economic development stages*:												
Region of application:												
Proposer:	Vienna University of Technology											
Intended users:												
Use cases:												
European Smart Cities (www.smart-cities.eu)												
Region/ Country:	Europe	completed	M	M	M	M	M	M	–	- competitiveness - productivity - flexibility - intellectual property	- energy and CO_2 - natural condition - pollution - resource management	- sustainability - public involvement - diversity and equality - transparency - employment - community safety and security
Economic development stages*:	1											
Region of application:	Regional											
Proposer:	European Smart Cities team (a joint project by 5 scholars, mainly from Vienna University of Technology)											
Intended users:	Local authorities											
Use cases:	As a tool to benchmark with other cities and draw lessons from better performing cities											
Aalborg Commitment (www.aalborgplus10.dk)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Europe	ongoing (So far, 665 local governments have signed)	M	M	M	M	—	M	—	- areal disparities - urban sprawl - redevelopment - productivity - development of local economy	- CO_2 - water - biodiversity	
Economic development stages*:	1											
Region of application:	Regional											
Proposer:	European Smart Cities team and Towns Campaign / City of Aalborg											
Intended users:	Local authorities											
Use cases:	Urban development and management											
Liveability Ranking (http://www.eiu.com/site_info.asp?info_name=The_Global_Liveability_Report#)												
Region/ Country:	UK (international)	ongoing	M	M	M	—	M	M	—	- quality of transport - quality of infrastructure	- weather condition	- level of democracy - social stability - quality of life - education opportunity and quality
Economic development stages*:	3											
Region of application:	Regional											
Proposer:	Economist Intelligence Unit											
Intended users:	Business leaders											
Use cases:	Preparing for opportunity and making business decisions											
Information Marketplaces: The New Economics of Cities (http://www.arup.com/Publications/Information_Marketplaces_the_new_economics_of_cities.aspx)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	UK (international)	Report published in Nov. 2011	M	M	M	M	M	M	—	- reduction of energy/water costs - job creation - business growth in relevant industries - improvement of grid reliability etc.	- C02 reduction - energy (electricity) saving - reduction of pollutants etc.	- healthcare - lower traffic congestion - convenience for waste pickup etc.
Economic development stages*:	3											
Region of application:												
Proposer:	The Climate Group, Arup, Accenture, Horizon, University of Nottingham											
Intended users:	City leaders, business leaders											
Use cases:	A tool to understand "smart city" for their future transition											
British Standards Institution (BSI): A Standards Strategy for Smart Cities (http://shop.bsigroup.com/en/Browse-By-Subject/Smart-Cities/?t=r)												
Region/ Country:	UK	Public consultation closed	M	M	M	M	M	M				
Economic development stages*:	1											
Region of application:												
Proposer:	BSI											
Intended users:	BSI											
Use cases:	As basis of BSI strategy for smart cities standardization											
Council for Local Environmental Initiatives (ICLEI) (http://www.iclei.org/)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	International	on-going since 1990	P	P	P	P					- biodiversity - climate - EcoMobility - management instruments - procurement - resilience and adaptation - sustainable cities - water	
Economic development stages*:	3											
Region of application:	Various size of cities and towns											
Proposer:	ICLEI (supported by UNCSD, UNFCCC, UNEP etc.)											
Intended users:	Local governments of cities and towns											
Use cases:	When solving issues or working on initiatives											
ISO 24510 **series** (www.iso.org/obp)												
Region/ Country:	International	Published in 2007		P							- sustainable use of natural resources - wastewater treatment - environmental impact	- access to water services
Economic development stages*:	3											
Region of application:	Organizations in the world											
Proposer:	ISO											
Intended users:	Relevant stakeholders											
Use cases:	Assessing and improving the service to users											
ISO 50001 **Energy management systems — Requirements with guidance for use** (www.iso.org/obp)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	International	Published in 2011	M							- energy cost	- reductions in greenhouse gas emissions and other related environmental impacts	
Economic development stages*:	3											
Region of application:	Related stakeholders in the world											
Proposer:	ISO											
Intended users:	Organizations											
Use cases:	Enable organizations to establish the systems and processes necessary to improve energy performance											
China City Informanization Evaluation Index (CCID)												
Region/ Country:	China											
Economic development stages*:	2											
Region of application:												
Proposer:												
Intended users:												
Use cases:												
Sustainable development of urbanization and smart city in China (www.dcitycn.org; www.mohurd.gov.cn; www.most.gov.cn)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Trans-portation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	China	Used from July 2012										
Economic development stages*:	2											
Region of application:	Smart City Projects in MOHURD in China (2012-2015)											
Proposer:	Ministry of Housing and Urban-Rural Development (MOHURD) and Chinese Society for Urban Studies (CSUS)											
Intended users:	National/local government											
Use cases:												
The Urban Sustainability Index: A new tool for measuring China's cities (http://www.urbanchinainitiative.org/wp-content/uploads/2012/04/2010-USI-Report.pdf)												
Region/ Country:	China		M	M	M	M		M		- green jobs - investment in environmental protection	- clean air/water - waste recycling - public green space	- urban density - mass transit usage - education - housing - health
Economic development stages*:	2											
Region of application:												
Proposer:	The Urban China Initiative (joint initiative of Colombia University, Tsinghua University and McKinsey & Company)											
Intended users:	National/local government											
Use cases:												
Blue Book of Urban Competitiveness (http://www.gucp.org/en/news.asp?NewsID=10&BigClassID=4&SmallClassID=81)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	China	on-going										
Economic development stages*:	2											
Region of application:	Cities in China											
Proposer:	Chinese Academy of Social Sciences (CASS)											
Intended users:	Cities in China											
Use cases:	Evaluation (ranking)											
Global Power City Index (http://www.mori-m-foundation.or.jp/research/project/6/pdf/GPCI2011.pdf)												
Region/ Country:	Japan (International)	in use			M			M		- market attractiveness - economic vitality - business environment - regulations and risks - R and D	- ecology - pollution - natural environment	- cultural interaction - liveability - accessibility
Economic development stages*:	3											
Region of application:	35 big global cities											
Proposer:	Institute for Urban Strategies, The Mori Memorial Foundation											
Intended users:												
Use cases:	After built											
Smart City realized by ICT (http://jp.fujitsu.com/about/csr/feature/2012/smartcity/)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Japan	publication of the draft framework in 2012	P	P			M	U		- GDP of a community	- environmental impact - energy - biodiversity - water	- in-patient hospital beds
Economic development stages*:	1											
Region of application:	3 communities: Fukushima-Aizuwakama tsu-City; Chiba-Urayasu-City; Kagoshima-Satsumasen dai-city in Japan											
Proposer:	Fujitsu Limited											
Intended users:												
Use cases:												
Sustainable Smart Town Concept (http://news.panasonic.net/archives/2011/0526_5407.html)												
Region/ Country:	Japan	under implementation	P	P	P		M	U		- asset management - finance	- global warming prevention - water conservation - biodiversity promotion	- disaster resistance security - healthcare club service
Economic development stages*:	1											
Region of application:	Fujisawa Sustainable Smart Town and Total Energy Solution Test-Bed Project for Public Housing in Singapore											
Proposer:	Panasonic Corporation											
Intended users:												
Use cases:												
Smart Community by Toshiba (http://www.toshiba-smartcommunity.com/EN/index.html#/about; http://www.toshiba.com.jp/about/ir/en/pr/pr2012.htm)												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Transportation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Japan	2009 smart community division established. Smart community feasibility studies worldwide started.	P	P	P		P	P			- environmental consciousness	- comfortable living
Economic development stages*:	3											
Region of application:	27 communities including Yokohama, Lyon etc. and 10 countries											
Proposer:	Toshiba											
Intended users:												
Use cases:												
Breakthrough by Dynamic Approach in Sewage High Technology Project												
Region/ Country:	Japan	2011 and continued in 2012	P	M						- reduce the construction costs	- reduce the greenhouse gas emissions	
Economic development stages*:	1											
Region of application:	- Regional biomass intake facilities - Digestion tank and heating facilities - Biogas upgrading system gas holder											
Proposer:	Kobelco Eco-Solutions and Kobe City (in cooperation with Osaka Gas)											
Intended users:												
Use cases:												
CASBEE for Cities												

Table D.1 *(continued)*

Description		Status	Relevant infrastructures							Main issues that a community faces		
			Energy	Water	Trans-portation	Waste	ICT	Other	Implicit	Economic	Environmental	Social
Region/ Country:	Japan		P		P					3-1 industrial vitality 3-1-1 gross regional products 3-1-2 number of employees 3-2 economic exchanges 3-2-1 number of visitors 3-2-2 public transportation 3-3 financial viability 3-3-1 tax revenues 3-3-2 outstanding local bonds	Q.1 environmental aspects 1-1 nature conservation 1-1-1 natural land use 1-2 environmental quality 1-2-1 air quality 1-2-2 water quality 1-2-3 noise 1-2-4 dioxins 1-3 resource recycling 1-3-1 recycling of waste 1-4 environmental measures 1-4-1 efforts and policies for the environment and biodiversity L.1 GHG emissions 1-1 CO2 from energy sources 1-1-1 industrial sector 1-1-2 residential sector 1-1-3 commercial sector 1-1-4 transportation sector 1-1-5 energy conversion sector 1-2 industrial processes 1-3 waste disposal sector 1-4 agriculture sector 1-5 other GHGs (HFCs, PFCs, SF6)	2-1 living environment 2-1-1 quality of housing 2-1-2 parks and other facilities 2-1-3 sewage systems 2-1-4 traffic safety 2-1-5 crime prevention 2-2 social services 2-2-1 education services 2-2-2 cultural services 2-2-3 medical services 2-2-4 child care services 2-2-5 services for the disabled 2-2-6 services for the elderly 2-3-1 rate of population change due to births and deaths 2-3-2 rate of population change due to migration 2-3-3 rate of informatization 2-3-4 efforts and policies for injecting vitality into society
Economic development stages*:	1											
Region of application:												
Proposer:	JSBC											
Region/ Country:												
Economic development stages*:												

* Categorization between developed countries, developing countries and international (developed: 1; developing: 2; international: 3)[a]"P" = concept purpose (community infrastructures as the main target or purpose of improvement; "M" = delivery means (community infrastructures as a means to improve other types of community infrastructures (e.g. ICT to improve energy)), "U" = unidentified

Table D.2 — Identified projects

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Yokohama Smart City Project (http://www.city.yokohama.lg.jp/ondan/english)												
Region/Country:	Japan	on-going	2010-	B	P		M		M			
Economic development stages*:	1											
City/state of application:	Yokohama, Japan											
Project owner:												
Duke Energy Business Services LLC Smart Grid Project (http://www.smartgrid.gov/project/duke_energy_carolinas_llc_smart_grid_deployment)												
Region/Country:	U.S.	on-going	2008	B	P				M			None
Economic development stages*:	1											
City/state of application:	IN, KY, NC, OH, SC											
Project owner:	Duke energy Business Services LLC											
CenterPoint Energy Smart Grid Project (http://www.smartgrid.gov/project/centerpoint_energy_houston_electric_llc_smart_grid_project)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	TX											
Project owner:	CenterPoint Energy Houston Electric, LLC											
Florida Power & Light Company Smart Grid Project (http://www.smartgrid.gov/project/florida_power_light_company_energy_smart_florida)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	FL											
Project owner:												
Progress Energy Service Company, LLC Smart Grid Project (http://www.smartgrid.gov/project/progress/energy_service_company_optimized_energy_value_chain)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	NC, SC											
Project owner:	Progress Energy Service Company, LLC											
Baltimore Gas and Electric Company Smart Grid Project (http://www.smartgrid.gov/project/baltimore_gas_and_electric_company_smart_grid_initiative)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	MD											
Project owner:	Baltimore Gas and Electric Company											
PECO Energy Company Smart Grid Project (http://www.smartgrid.gov/project/peco_smart_future_greater_philadelphia)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	PA											
Project owner:	PECO Energy Company											
Southern Company Services, Inc. Smart Grid Project (http://www.smartgrid.gov/project/southern_company_services_inc_smart_grid_project)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	GA, AL, MS, FL											
Project owner:	Southern Company Services, Inc.											
Sacramento Municipal Utility District Smart Grid Project (http://www.smartgrid.gov/project/sacramento_municipal_utility_district_smartsacramento)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	CA											
Project owner:	Sacramento Municipal Utility District											
NV Energy, Inc. Smart Grid Project (http://www.smartgrid.gov/project/nv_energy_inc_nv_energize)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	NV											
Project owner:	NV Energy, Inc.											
Consolidated Edison Company of New York, Inc. Smart Grid Project												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	NY, NJ											
Project owner:	Consolidated Edison Company of New York, Inc.											
Smart Grid Program (http://www.pge.com/about/newsroom/newsreleases/20110630/pgampe_releases_smart_grid_plan_to_modernize_electric_grid.shtml)												
Region/Country:	U.S.	on-going	2011-	B	P				M			None
Economic development stages*:	1											
City/state of application:	CA											
Project owner:	Pacific Gas and Electric Company (P&E)											
Smart Grid City Project (http://smartgridcity.xcelenergy.com/)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Trans-porta-tion	Waste	ICT	Other	Implicit	Interoperability of multiple infra-structures
Region/Country:	U.S.	on-going	2008-	B	P				M			None
Economic development stages*:	1											
City/state of applica-tion:	CO											
Project owner:	Xcel Energy, Inc.											
Pecan Street Smart Grid Demonstration Project (http://www.coned.com/pulicissues/smartgrid.asp)												
Region/Country:	U.S.	on-going	2011-11-02 - 2015-10-02	G	P	P			M			None
Economic development stages*:	1											
City/state of applica-tion:	TX											
Project owner:	Pecan Street Project Inc., Austin Energy, National Renewable Energy Laboratory, Environmental Defense Fund, University of Texas at Austin											
Japan-US Collaborative Smart Grid Demonstration in Los Alamos (http://www.losalamosnm.us/utilities/Pages/LosAlamosSmartGrid.aspx)												
Region/Country:	U.S.	on-going	2009 - 2013	B	P				M			None
Economic development stages*:	1											
City/state of applica-tion:	NM											
Project owner:	PECO Energy Company											
Japan-US Collaborative Smart Grid Demonstration Project in Albuquerque (http://www.japancorp.net/press-release/25228/nine-japanese-companies-launch-japan-u.s.-collaborative-smart-grid-demonstration-project-in-business-district -of-Albuquerque,-new-mexico)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going	2012 - 2014	G	P				M			None
Economic development stages*:	1											
City/state of application:	NM											
Project owner:	NEDO, 9 Japanese companies (Shimizu, Toshiba, Sharp, Meidensha, Tokyo Gas, Mitsubishi Heavy Industries, Fuji Electric, Furukawa Electric, The Furukawa Battery)											
Smart Grid Demonstration Project (http://www.smartgrid.gov/project/consolidated_edison_company_new_york_inc_smart_grid_deployment_project)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	NY, NJ											
Project owner:	Consolidated Edison Company of New York, Inc., Orange and Rockland Utilities, Inc.											
Secure Interoperable Open Smart Grid Demonstration Project (http://www.smartgrid.gov/project/consolidated_edison_company_new_york_inc_secure_interoperable_open_smart_grid_demonstration_)												
Region/Country:	U.S.	on-going	2010-04-01 - 2013-09-30	B	P				M			None
Economic development stages*:	1											
City/state of application:	NY											
Project owner:	Consolidated Edison Company of New York, Inc., Orange and Rockland Utilities Inc., The Boeing Company, Colombia University and 7 others											
Pacific Northwest Smart Grid Demonstration (http://www.smartgrid.gov/sites/default/files/battelle-memorial-institute-oe0000190-final.pdf)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going	2010-01-02 - 2015-01-31	B	P				M			None
Economic development stages*:	1											
City/state of application:	MT, WA, ID, OR, WY											
Project owner:	Battelle Memorial Institute, 3TIER Inc., AREVA T&D, IBM, Quality-Logic Inc.											
EV Project (http://www.ecotality.com/solutions/services/ev-project/)												
Region/Country:	U.S.	on-going	2009-10-01	B	P		P					None
Economic development stages*:	1											
City/state of application:	WA, OR, CA, AZ, TX, GA, TN, IL, PA, NJ, Washington, D.C.											
Project owner:	ECOtality, Inc., State of Oregon, Nissan, Chevrolet, Department of Energy, and 60+ partners											
Sustainable Dubuque (http://www.cityofdubuque.org/index.aspx?nid=606)												
Region/Country:	U.S.	on-going	2006-	B	P	P	P	P	M			Water and energy: promoting water-saving initiatives also from an energy-saving point of view
Economic development stages*:	1											
City/state of application:	IO											
Project owner:	Dubuque City, Department of Energy, IBM, Alliant Energy											
20MW Flywheel Frequency Regulation Plant (http://www.beaconpower.com/files/DOE-ESS-update.ppt-11.10.pdf)												
Region/Country:	U.S.	on-going	2010-01-01 - 2015-09-30	B	P							None
Economic development stages*:	1											
City/state of application:	PA											
Project owner:	Beacon Power, PJM Interconnection, PPL Electric Utilities											
Madison Gas and Electric Company Smart Grid Project (http://www.aps.com/main/various/CommunityPower/default.html?source=commpower)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	WI											
Project owner:	Madison Gas and Electric Company											
gridSMART[SM] Demonstration Project (http://www.smartgrid.gov/project/southern_california_edison_company_tehachapi_wind_energy_storage_project)												
Region/Country:	U.S.	on-going	2010-01-01 - 2013-12-31	B	P				M			None
Economic development stages*:	1											
City/state of application:	OH											
Project owner:	PECO Energy Company											
Arizona Public Service (APS) Community Power Project (http://www.aps.com/main/various/CommunityPower/default.html)												
Region/Country:	U.S.	on-going	April 2010 - April 2030	B	P							None
Economic development stages*:	1											
City/state of application:	AZ											
Project owner:	APS, GE, Arizona State University, National Renewable Energy Laboratory, ViaSol Energy Solutions LLC											
Southern California Edison Company Smart Grid Regional Demonstration Project (http://www.smartgrid.gov/project/southern_california_edison_company_irvine_smart_grid_demonstration)												
Region/Country:	U.S.	on-going	2010-09-02 - 2014-12-31	B	P				M			None
Economic development stages*:	1											
City/state of application:	CA											
Project owner:	PECO Energy Company											
Smart Grid Regional Demonstration (http://www.smartgrid.gov/project/los_angeles_department_water_and_power_smart_grid_regional_demonstration)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going	2010-01-01 - 2015-06-30	B	P				M			None
Economic development stages*:	1											
City/state of application:	CA											
Project owner:	Los Angeles Dept. of Water and power, Jet Propulsion Laboratory, University of Southern California, University of California, LA											
San Diego Gas and Electric Company (SDG&E) Grid Communication System (http://www.smartgrid.gov/project/san_diego_gas_electric_company_sdge_grid_communication_system)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	CA											
Project owner:	SDG&E Company											
Technology Solutions for Wind Integration (http://www.smartgrid.gov/project/ccet_technology_solutions_wind_integration)												
Region/Country:	U.S.	on-going	2010-01-04 - 2015-01-03	B	P				M			None
Economic development stages*:	1											
City/state of application:	TX											
Project owner:	The Center for Commercialization of Electronic Technologies, CenterPoint Energy, American Electric Power, Electricity Reliability Council of Texas and 8 others											
Long Island Smart Energy Corridor (http://www.smartgrid.gov/sites/default/files/long-island-oe0000220-final.pdf)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	on-going	2010-02-05 - 2015-02-04	B	P				M			None
Economic development stages*:	1											
City/state of application:	NY											
Project owner:	Long Island Power Authority, Farmingdale State College, SUNY Stony Brook											
Hawaii Electric Co. Inc. Smart Grid Project (http://www.smartgrid.gov/sites/default/files/09-0384-heco-project-description-07-03-12.pdf)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	HI											
Project owner:	Hawaii Electric Co. Inc.											
Urban Grid Monitoring and Renewables Integration (http://www.smartgrid.gov/project/nstar_electric_and_gas_corporation_automated_meter_reading_based_dynamic_pricing)												
Region/Country:	U.S.	on-going	2010-02-01 - 2013-03-31	B								None
Economic development stages*:	1											
City/state of application:	MA											
Project owner:	NSTAR Electric and Gas Corporation, Tendril Networks Inc., Navigant Consulting, LLC											
Vineyard Energy Project (http://www.smartgrid.gov/sites/default/files/09-0262-vineyard-powe-project-description-06-28-2012.pdf)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of application:	MA											
Project owner:	Vineyard Power Cooperative, Inc.											
Detroit Edison Company Smart Grid Project (http://www.smartgrid.gov/sites/default/files/09-0172-detroit-edison-co-pd-06-13-2012.pdf)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Trans-porta-tion	Waste	ICT	Other	Implicit	Interoperability of multiple infra-structures
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of applica-tion:	MI											
Project owner:	Detroit Edison Company											
KCP&L Green Impact Zone SmartGrid Demonstration (http://www.smartgrid.gov/sites/default/files/kansas-city-pl-oe0000221-final_0.pdf)												
Region/Country:	U.S.	on-going	2010-01-01 - 2014-12-31	B	P				M			None
Economic development stages*:	1											
City/state of applica-tion:	MO											
Project owner:	Kansas City Power & Light, Siemens Energy Inc., Open Access Technology Inc.											
Potomac Electric Power Company Smart Grid Project (http://www.smartgrid.gov/project/potomac_electric_power_company_maryland_smart_grid_project)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of applica-tion:	MD											
Project owner:	Potomac Electric Power Company											
Avista Utilities Smart Grid Project (http://www.smartgrid.gov/sites/default/files/09-0215-avista-project-description-06-13-2012.pdf)												
Region/Country:	U.S.	on-going		B	P				M			None
Economic development stages*:	1											
City/state of applica-tion:	WA											
Project owner:	Avista Utilities											
SmartGridCity (http://smartgridcity.xcelenergy.com/)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	U.S.	ongoing										None
Economic development stages*:												
City/state of application:												
Project owner:												
INTEGRATION - Integrated Urban Development in Latin America (http://www.urbal-integration.eu/)												
Region/Country:	South America	ongoing	November 2008 - November 2012	B		P		P				None
Economic development stages*:	2											
City/state of application:	Chihuahua (Mexico); Guadalajara (Mexico); Sao Paulo (Brazil); Quito (Ecuador); Bogota (Colombia); Rio de Janeiro (Brazil)											
Project owner:	Department for Environmental Protection of State Capital of Stuttgart (Funded by the European Commission), KATE - Center for Ecology & Development, six state/ city gov'ts in Latin America, ICLEI, etc.											
Rio Operations Center (http://www-03.ibm.com/press/us/en/pressrelease/33303.wss)												
Region/Country:	Brazil	ongoing	December 2010 -	B					M	P (Infrastructural base to take action for emergencies)		None
Economic development stages*:	2											
City/state of application:	Rio de Janeiro, Brazil											
Project owner:	IBM, City Government											
CONCERTO (http://ec.europa.eu/energy/res/fp6_projects/doc/concerto/brochure/concerto_brochure.pdf)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	Europe	ongoing (22 projects in operation as of December 2010)	2005-	B	P		M	M	M	M		a completely integrated energy policy, harmonising a substantial use of renewable energy sources with innovative technologies and systems
Economic development stages*:	1											
City/state of application:	58 communities in 23 EU states											
Project owner:	European Commission (Energy DG)											
Reference Framework for European Sustainable Cities (RFSC)/ Sustainable city project (http://rfsc-demo.tomos.fr/http://rfsc-demo.tomos.fr/userfiles/Final%20report%20Nicis%20testing%20RFSC.pdf)												
Region/Country:	Europe	under development (to be available in 2012)	2008-2011 (66 cities in 23 EU member states tested prototype RFSC in 2011)	B	M	M	M	M	M	P		None
Economic development stages*:	1											
City/state of application:	Cities in EU member states											
Project owner:	European Commission (Regional Policy DG)											
Smart Cities in Europe (http://www.smartcitiesineurope.com/)												
Region/Country:	Europe	ongoing		NA	NA	NA	NA	NA	NA	NA		None
Economic development stages*:	1											
City/state of application:	□□											
Project owner:	HBV Communicatie by (Netherlands)											
Grid for Vehicles (G4V) (http://www.g4v.eu/)												
Region/Country:	Europe	completed	2010-01-01 - 2011-06-30	B	P		M		M	M		- EV - grid infrastructure - integration of renewable energy sources - balancing power and other services
Economic development stages*:	1											
City/state of application:	Europe											
Project owner:	G4V consortium (6 energy utilities and 6 research institutions in Europe)											
Greening European Transportation Infrastructure for Electric Vehicles (http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_country/multi_country/2010-eu-91117-p.htm)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	Europe	ongoing	2010-2012	B	P		M		M			- links and interconnections - cross-border - interoperability on major routes
Economic development stages*:	1											
City/state of application:	EU member states											
Project owner:	European Commissions (Transport DG); Beneficiary & Implementing body coordinator: Better Place Denmark A/S											
North Seas Countries Offshore Grid Initiative (NSCOGI) (http://ec.europa.eu/energy/publications/doc/2011_energy_infrastructure_en.pdf; http://ec.europa.eu/energy/infrastructure/tent_e/doc/off_shore_wind/2011_annual_report_annex2_en.pdf; http://www.euractiv.com/energy/eu-countries-launch-north-sea-el-news-500324; http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/north-sea-grid)												
Region/Country:	Europe	under development (analysis and evaluation conducted by WGs)	December 2009-	G	P				M	M		None
Economic development stages*:	1											
City/state of application:	10 North Sea countries, European Commission											
Project owner:	European Commission; Governments of participating countries; Utilities											
T-City (http://www.t-city.de/en/timeline.html)												
Region/Country:	Germany	completed	2007-2012	B	M		M		M	P		None
Economic development stages*:	1											
City/state of application:	Lake Constance, Friedrichshafen (southern Germany)											
Project owner:	Deutsche Telekom, City of Friedrichshafen											
E-Energy (http://www.e-energy.de/en/; http://www.e-energy.de/documents/Brochure_E-Energy_300608.pdf)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	Germany	ongoing	2006: release the concept 2007: 6 model projects selected 2012: evaluation/ standardization on conducted; additional projects selected	B	P		M		M	M		None
Economic development stages*:	1											
City/state of application:	6 cities in Germany (1 city for each model project)											
Project owner:	Federal Ministry of Economics and Technology (BMWi); Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU); international partnership											
E-mobility (Electric Mobility) (http://www.bmvbs.de/SharedDocs/EN/Artikel/UI/electric-mobility.html; http://www.bmvbs.de/cae/servlet/contentblob/88386/publicationFile/61173/electric-mobility-third-report-national-platform.pdf)												
Region/Country:	Germany	ongoing (pre-market phase)	2011: federal program adopted 2009-2011: pilot phase	B	P		M	M	M	M		Vision 2020: "Electric mobility made in Germany" stands for systemic and sustainable solutions that cross the boundaries of traditional industries
Economic development stages*:	1											
City/state of application:	8 Pilot regions: Hamburg; Bremen/ Oldenburg; Rhine-Ruhr (focusing on Aachen and Munster); Rhine-Main; Saxony (focusing on Dresden and Leipzig); Stuttgart; Munich; Berlin-Potsdam											
Project owner:	Federal Ministry of Transport, Building and Urban Development											
E-mobility Berlin (http://www.smartgrid.gov/project/												
Region/Country:	Germany	ongoing	2009-	B	P		M					- EV - renewables - communication interface between the vehicle and the charging station
Economic development stages*:	1											
City/state of application:	Berlin											
Project owner:	Daimler; RWE											
Hamburg-Harburg Project (http://www.ecocity.de/; http://www.tecarchitecture.com/en/32-eco-city-hamburg; http://inhabitat.com/eco-city-seeking-highest-rating-from-the-three-major-major-green-rating-systems/; http://losangeleselectrician.com/eco-city-in-hamburg-green-model-for-a-sustainable-future/)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Region/Country:	Germany	ongoing (under construction)	2009-	B	M	M			M	P, M		The project is an exceptional example of how to integrate efficient technology and building methods while fostering social interaction and community rebirth
Economic development stages*:	1											
City/state of application:	Harburg Harbor, Hamburg											
Project owner:	Hamburg-Harburg Harbor; Tec Architecture; ARUP (global engineering company)											
Amsterdam Smart City (ASC) (http://amsterdamsmartcity.com/)												
Region/Country:	Netherlands	ongoing	2009-	B	M	M	M	M	M	P		- 30 projects under the four aspects (sustainable living, sustainable working, sustainable mobility, and sustainable public space) - renewable energy and electric mobility
Economic development stages*:	1											
City/state of application:	Amsterdam											
Project owner:	Amsterdam Innovation Motor (AIM); Liander (local grid); City of Amsterdam; KPN											
Smart Metering Implementation Programme (http://www.decc.gov.uk/en/content/cms/tackling/smart_meters/smart_meters.aspx)												
Region/Country:	UK	ongoing (program development stage)	2011: policy design; 2014-19: mass roll out of SM	B	P				M			None
Economic development stages*:	1											
City/state of application:	Across the UK											
Project owner:	Department of Energy and Climate Change (DECC); Office of the Gas and Electricity Markets (Ofgem)											
Orkney Smart Grid (http://www.ssepd.co.uk/OrkneySmartGrid/)												
Region/Country:	UK	ongoing	2004: studies initiated; 2009: full implementation	B	P				M			- smartgrid and renewable energies
Economic development stages*:	1											
City/state of application:	Orkney Isles											
Project owner:	Scottish and Southern Energy Power Distribution (SSEPD)											

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Smart Cities (http://shop.bsigroup.com/en/Browse-By-Subject/Smart-Cities/?t=r)												
Region/Country:	UK	under development	strategic mapping exercise in 2012									- digital infrastructure
Economic development stages*:	1											
City/state of application:	UK											
Project owner:	British Standards Institution (BSI); UK Department of Business, Innovation and Skills (BIS)											
Sustainability Appraisal (SA) (http://www.pas.gov.uk/pas/core/page.do?pageId=152450)												
Region/Country:	UK	in force under National Planning Policy Framework 2012 (NPPF)	introduced in 2006	B	M	M	M	M		P, M		- sustainability appraisal is a systematic and iterative appraisal process, incorporating the requirements of the Strategic Environmental Assessment Directive
Economic development stages*:	1											
City/state of application:	UK											
Project owner:	Planning Advisory Service (PAS); Local Government Association (LGA)											
Telegestore (http://www.enel.com/en-GB/innovation/smart_grids/smart_metering/telegestore/)												
Region/Country:	Italy	completed	2001-2006	B	P				M			None
Economic development stages*:	1											
City/state of application:	Across Italy											
Project owner:	Enel											
Geothermal Energies Utilization (http://www.nea.is/geothermal; http://www.rammaaaetlun.is/media/virkjanakostir/2-afangi/Enska-timarit-fra-SIJ-25feb.pdf)												
Region/Country:	Iceland	ongoing	2007: master plan published	B	P							None
Economic development stages*:	1											
City/state of application:	Across Iceland											
Project owner:	National Energy Authority (NEA); Ministries of Industry and Commerce											

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Transportation	Waste	ICT	Other	Implicit	Interoperability of multiple infrastructures
Stockholm Royal Seaport (http://www.stockholmroyalseaport.com)												
Region/Country:	Sweden	ongoing (construction stage)	2008: 2010: construction started 2012: first occupancy 2030: project completion	B	M	M	M	M	M	P, M		None
Economic development stages*:	1											
City/state of application:	City of Stockholm (Norra Djurgården area)											
Project owner:	City of Stockholm; Swedish Energy Agency; ABB; Fortum; Electrolux; Ericsson; Interactive Institute											
Linky Project and Pilot (http://www.erdfdistribution.fr/medias/dossiers_presse/DP_ERDF_210610_1_EN.pdf; http://www.erdfdistribution.fr/medias/Linky/ERDF-CPT-Linky-SPEC-FONC-CPL.pdf)												
Region/Country:	France	ongoing	2007-2013: pilot phase 2008-2020: project implementation	B	P				M			None
Economic development stages*:	1											
City/state of application:	Tours and Lyon regions for pilot projects; across France for full implementation											
Project owner:	Electricité Réseau Distribution France (ERDF)											
Smart Community Demonstration Project in Lyon (http://www.lyon-confluence.fr/en/index.html; http://www.nedo.go.jp/english/whatsnew_20111226_index.html)												
Region/Country:	France	ongoing	2011-2015	B	P		M		M	M		- high efficiency building - EV - smart grid
Economic development stages*:	1											
City/state of application:	Lyon											
Project owner:	NEDO (Toshiba); Le Grand Lyon											
Smart Grid Utility (http://www.enemalta.com.mt/index.aspx?cat=2&art=5&art1=11)												

Table D.2 *(continued)*

Description		Status	Timeframe	Green field or brown field	Relevant infrastructures							
					Energy	Water	Trans-porta-tion	Waste	ICT	Other	Implicit	Interoperability of multiple infra-structures
Region/Country:	Malta	ongoing	2008: pilot phase (5 years) 2010: full operation	B	P	P			M			- a smart meter project to improve efficiency in elec-tricity and water supply simulta-neously in order to save Malta's limited resources
Economic development stages*:	1											
City/state of applica-tion:	Across Malta											
Project owner:	Enemalta Corporation (EMC); Water Services Corporation (WSC); IBM											
EDISON (Electric vehicles in a distributed and integrated market using sustainable energy and open networks) Smart Grid Project (http://www.edison-net.dk; http://www-03.ibm.com/press/us/en/pressrelease/26783.wss)												
Region/Country:	Denmark	ongoing (pilot phase)	pilot project started in 2011	B	P		M		M			- EV - wind power generation - smart grid
Economic development stages*:	1											
City/state of applica-tion:	Across Belgium (field testing con-ducted in Bornholm Isle)											
Project owner:	DONG Energy, Oestkraft; Technical University of Denmark (DTU); IBM; Siemens; Eurisco; Danish Energy Association											
Lolland Island Smart Grid (http://www.seas-nve.dk/upload/pdf/windenergy.pdfhttp://www.islenet.net/docs/BASS_Lolland_CTF.pdf)												
Region/Country:	Denmark	ongoing (pilot test)	1990: con-struction off-shore wind mills started 2008: pilot test of CHP with fuel cell started May 2009: installation of smart meters in households started	B	M	M			M	P		- wind power generation - tidal power generation - fuel cell - district heat supply
Economic development stages*:	1											
City/state of applica-tion:	Lolland Island											
Project owner:	SEAS-NVE groupPublic-private partnership											
Zero emission mobility (http://japan.betterplace.com/global/progress/Denmark)												