Smart Cities – Reshaping the European Urban Landscape

An IEEE European Public Policy Initiative Position Statement

Adopted 15 September 2016

IEEE[1] European Public Policy Initiative (EPPI) recognizes that one of the greatest challenges that Europe faces is how to best plan new and adapt established cities and in general urban areas into smarter, sustainable environments. Hence, IEEE EPPI, representing European technologists willing to contribute to the public debate, welcomes European Commission (EC) initiatives encouraging the development of smart cities, such as the European Innovation Partnership on Smart Cities and Communities[2].

The figures below demonstrate the role of cities and urban areas in Europe:

- **Cities** drive much of Europe's economic growth, creating some **80% of the EU's GDP** (gross domestic product) with their concentration of business and "people expertise".
- 68% of the EU population lives in urban areas, which consume **70% of energy**. This accounts for **75% of the EU's total greenhouse gas (GHG) emissions.**
- Cities will become even more important as the proportion of **Europeans living in urban areas** grows from just over two-thirds today to a forecasted **85% by 2050**.

The development of comprehensive "cities-oriented" policies is absolutely indispensable. In particular, EU strategies and policies should aim at improving quality of living, decarbonising the energy footprint, and reducing local pollution in urban areas. These goals can be supported by restructuring city-wide energy systems into smarter ones.

• Smart Cities – Overview

In the context of Smart Cities, Smart Grid technologies based on **advanced use of Information and Communication Technologies (ICT)** will allow widespread deployment of **low-carbon distributed energy resources**. In addition, **integration of all energy-related sectors** (electricity, fuels, heat, cooling, transport, water, waste, etc.) and partial electrification of heating and transport will contribute to make European cities smarter and more sustainable. At the same time, Smart Cities could also be **more resilient** to weather-related shocks, for instance owing to **deployment of Microgrids that are capable to self-sustain in the case of loss of the main grid supply**.

However, various obstacles should be removed in order to facilitate the rise of Smart Cities. The EU can play a key role in this. In particular, **policy, regulatory and commercial**

[1] www.ieee.org
[2] http://ec.europa.eu/eip/smartcities/index_en.htm

interventions should:

- prompt **different sectors to optimally interact** at both operational and planning stages;
- enable competitiveness of technologies such as **Microgrids** and **district energy systems**;
- foster the development of **aggregation concepts such as virtual power plants** to optimally integrate low carbon technologies and support energy system operation.

- ## The Smart European City of the future

Owing to the development of enabling ICT, the concept of a Smart Grid is becoming more pervasive within the energy system. Much of this acceptance is a result of new technologies which enable us to optimally monitor, control and plan for the allocation of available resources, thus also boosting deployment of renewable energy, maximizing infrastructure utilization, and increasing overall energy system efficiency.

Considering the paramount role of urban areas in future scenarios, the concept of Smart Cities is arising in the same context of the Smart Grid, with the aim of increasing citizens' quality of living while reducing the environmental footprint of the City's activities. On the energy side of the discussion, this aligns perfectly with the targets set out in the EU 2020 Climate and Energy Package (widely known as the 20-20-20 targets), which were later reconfirmed in the 2030 policy framework for climate and energy that was agreed upon at the European Council meeting in October 2014[3].

All energy-related sectors besides electricity (gas, heat, transport, water, waste, etc.) **can benefit from ICT solutions** such as advanced monitoring for operational optimization and fault detection, in order to improve their techno-economic performance. In addition, while these sectors **have been traditionally decoupled** at both the operational and planning stages, **their integration, with a primary role played by electricity, has the potential to bring significant energy saving and emission reduction benefits in a cost effective manner to a wide variety of situations.** Take, for instance, the case of combined heat and power production supplied by waste products or low carbon gas (for instance, biogas), possibly also including trigeneration options for cooling generation. However, this requires the strategic and integrated planning and operation of a distributed energy infrastructure whose competition and cooperation need to be adequately regulated. For example, technologies that may enable optimal district energy solutions such as heat networks, which require asset-heavy up-front investment, need to be adequately supported as *regulated* infrastructure and need the involvement of local communities.

Clear rules for coordinated market operation of electricity and heat resources should also be defined. This could prevent, for instance, conflicts between renewable electricity (e.g., from wind or photovoltaics) dispatched with priority, and heat-driven combined heat and power, with electricity as a by-product. Partial electrification of heating (through electric heat pumps) and transport (through electric vehicles) also represent a viable option for both decreasing the environmental burden of energy-related activities (especially with increasing decarbonisation of power systems) and improving citizens' quality

[3] http://ec.europa.eu/clima/policies/2030/index_en.htm

of living (via monitoring of the service provided).

Such distributed energy resources, including demand response and storage of various forms (in particular thermal), need to be managed at the local level, for which aggregation concepts such as Microgrids and virtual power plants should be promoted as both technical and commercial solutions. In particular, owing to its capability of islanding themselves from the main grid in case of contingency, Microgrids might increase system reliability and resilience to severe weather events as well. However, in order to do so, Microgrids need to be recognized in terms of operational and planning standards (i.e., local islanded operation needs to be allowed) and its benefits need to be explicitly internalized through specific markets (for instance, via reliability contracts with the distribution network operator).

Virtual power plants represent key commercial options to integrate all distributed energy resources into market operation and compete with large scale generation on a level playfield. Such aggregating entities need to be explicitly recognized (for instance, by allowing self-balancing, or participation in markets with decreasing capacity entry level). Further, operational arrangements need to be put in place so that commercial operations are carried out securely taking into account network constraints, for which coordination with the distribution system operator is crucial.

- Recommendations

The EU should foster **development of European Smart Cities by leveraging the research and technology know-how of its member states and facilitating the development of a commercial and regulatory framework that could foster strategic developments and realization of wider economic and environmental benefits to its citizens**.

Notwithstanding the different energy system characteristics of different cities and countries, optimizing the **integration of electricity with other energy-related sectors** (fuels, heat, cooling, transport, water and waste), partially electrifying sectors such as heating and transport, and boosting enabling technologies and concepts such as district energy systems, Microgrids, and virtual power plants are seen as key to develop Smart Cities forward. To prevent the risk of resulting in a suboptimal overall energy system, **smart technologies shall be used in a coordinated way taking into account system constraints arising at different levels and across sectors.**

This requires **regulation and policy interventions** that facilitate commercial and market integration of different energy sectors (e.g., electricity, heat and gas), coordinating the planning of different urban infrastructures involving local communities (e.g., heat networks), and suitable regulation and design standards for emerging aggregation schemes (e.g., allowing physical (islanded) operation of Microgrids and suitable business models as well as commercial aggregation as virtual power plants at different levels) with coordination with distribution system operators.

This statement was developed by the IEEE European Public Policy Initiative and represents the considered judgment of a broad group of European IEEE members with expertise in the subject field. IEEE has nearly 60,000 members in Europe. The positions taken in this statement do not necessarily reflect the views of IEEE or its other organizational units.

About IEEE:

The Institute of Electrical and Electronics Engineers, IEEE, is the largest and most global of the world's engineering professional societies, with about 430,000 members in 190 countries. It publishes 150 prestigious journals, organizes about 1300 conferences annually, has led the development of over 900 consensus-based international standards, and supports science and engineering education at all levels. IEEE has members in every European country, and over 200 European organizational units. The IEEE European Public Policy Initiative provides opportunities for engineers and scientists from across the continent to share their expertise in the development of sound technology policies.

Contact Information:

More information about the IEEE European Public Policy Initiative is available at http://www.ieee.org/about/ieee_europe/index.html