

Smart UrbanEnergy for Schools

An Innovative *Connected and Sustainable Energy* Pilot by the Cisco Internet Business Solutions Group (IBSG) and the Portuguese Ministry of Education in the City of Lisbon

Background

In recognition of the profound trends of urbanization, climate change, and innovation at the beginning of the 21st century, Connected Urban Development (CUD) was born from Cisco's commitment to the Clinton Global Initiative to participate in helping reduce carbon emissions in cities. Launched at the end of 2006, CUD consists of building partnerships with cities worldwide to focus on applying information and communications technology (ICT) to promote innovative practices for reducing carbon emissions, while fostering economic growth and improving the quality of life. Innovation is transforming urban life, and is making it possible to design and manage cities in radically different ways. With the advance of broadband, wireless, and increasingly smart city infrastructures, collaboration and connectivity are becoming essential to urban sustainability.

CUD envisions that the same principles of openness that have made the Internet a thriving ecosystem over the past 20 years can be applied to make cities a smarter platform for people, products, and services. This global, open-standards approach will support all urban and natural environment-related applications, tools, and technologies. It will provide real-time, tangible information to enable citizens, communities, cities, countries, and business organizations to make smarter decisions and to develop policies that improve the sustainability of cities. Following are the program's urban technology principles:

- Wired communications provide infrastructure
- Wireless communications provide mobility
- Miniaturized, inexpensive electronic devices provide access points everywhere
- Digital memory and processing power provide intelligence everywhere
- Software and online content provide new functionality and services

Through its partnership with Lisbon and the Portuguese Ministry of Education, CUD has created a global best practice—Smart UrbanEnergy for Schools—that will provide new services through a pilot project, with the aim of scaling and replicating these services in CUD cities and other urban areas around the globe.

Overview

Smart UrbanEnergy for Schools is a landmark innovation and a key element of CUD's Connected and Sustainable Energy and Buildings frameworks. Begun in fall 2008, the pilot project is a collaborative effort involving Cisco IBSG—the global strategic consulting arm of Cisco—the Portuguese Ministry of Education, EDP - Energias de Portugal, and the CUD

partner city of Lisbon. The organizations are jointly applying an urban services platform approach toward which visionary cities and the ICT industry are moving. Lisbon is the first city worldwide to launch a Smart UrbanEnergy for Schools service.

Through a single, integrated, end-to-end approach to energy generation and management, the pilot intends to showcase how technology can improve global energy efficiency simultaneously in both the built environment and energy networks.

Schools were chosen as test beds because, besides being housed in complex buildings common to every city, they are the best gateway for raising awareness, changing behaviors, and disseminating good practices on sustainability across all sectors of society, attaining a relevant multiplying effect. The pilot takes a people-centric approach to energy efficiency that (1) promotes active involvement of a school's population (students, teachers, families) and community in all stages of the program, and (2) makes the pilot's results available as a source of educational material.

Three of Lisbon's public secondary schools—all currently undergoing retrofitting—were selected to participate in the pilot. These three schools form a representative sample of the different types of secondary schools one is likely to encounter in Portugal.

The pilot seeks to improve the educational experience through the use of ICT, while increasing productivity and effectiveness of school administrative activities through dematerialization and streamlining of processes. Regarding energy efficiency, the ultimate goal is to combine energy savings—through intelligent use of technology solutions such as Cisco EnergyWise and behavioral changes in energy usage—with local, renewable energy production to achieve substantial reduction of energy consumption and carbon footprint—all while taking a user-friendly, people-centric, globally replicable approach. This proof of concept is being supported by an economic and environmental value case to establish the sustainability metrics for the pilot, and to aid in scaling and replicating this approach to promote connected and sustainable energy and buildings in urban environments.

Figure 1. Three Lisbon Secondary Schools Are Participating in the CUD Pilot



E.S. D. Dinis

E.S. D. João de Castro



E.S. D. Rainha D. Amélia (still undergoing retrofitting)

An Urban Services Platform Approach

CUD ultimately envisions Smart UrbanEnergy for Schools as part of a global urban services platform for—and among—cities. Services will include, but are not limited to, citizen engagement, collaboration, community-building, professional geo-referential data, real-time environmental and energy metering and monitoring, simulations for real estate development, transportation planning, location marketing, and city scenario planning. Incorporating Smart UrbanEnergy for Schools into this platform will enable the Portuguese Ministry of Education and the City of Lisbon to offer services that reduce energy consumption and carbon footprint, while creating a framework that can be replicated by other cities around the world.

Key Features

- **Smart and efficient energy management of school buildings:** Ubiquitous, IP-based, real-time energy monitoring and management, effectively integrating all relevant sources of energy consumption in schools—ICT and networking equipment, HVAC, lighting, appliances, and so on. The three CUD pilot schools were selected as part of the worldwide Cisco EnergyWise Beta Test Program (expected end date: November 2009).¹
- **Local energy production and connection to the grid:** Based on renewable energy sources (solar PV and/or micro wind-turbines) as an additional element of the schools' energy monitoring and management system. Bidirectional, IP-based communication with the electricity network, supporting mechanisms of Demand-Side Management (DSM) to optimize schools' energy efficiency policies and measures.
- **Participation and awareness of school population:** Use of Web 2.0 tools to involve all schools and promote participation. The pilot includes two levels of school population engagement: (1) awareness and behavior change (real-time data, benchmarks, and carbon footprint calculators, allowing increased consumption visibility, sustainable school communities, and interactive spaces) and (2) participation in the technical layers of pilot implementation (school population involved as testers/evaluators; participation in some technical layers of the pilot, allowing students of technical degrees to gain and apply know-how in the field of energy).

Citizen and Policymaker Benefits

More than 50 percent of greenhouse gas emissions come from buildings and homes, which in turn represent more than 50 percent of total energy consumption.² As a result, technology-based energy efficiency policies and measures are becoming effective instruments not only to fight climate change, but also to optimize energy consumption patterns and costs.

This is even truer in the case of offices and open public buildings (such as schools), where the potential for increasing energy efficiency is high, but highly dependent on occupants' behavior. This is a field where ICT can make a clear difference, not only by providing the necessary instruments to optimize end-to-end energy management—from buildings to the

¹ Further information on EnergyWise is available at:
http://www.cisco.com/en/US/solutions/ns726/intro_content_energywise.html

² Arup, 2008.

grid—but also by increasing energy-consumption visibility and awareness, thereby encouraging smart behavior changes.

The Smart 2020 global report,³ as well as two follow-up country reports focused on the United States⁴ and [Portugal](#),⁵ points directly toward the positive impact of ICT in the building and energy-efficiency domains. In fact, these reports identify Smart Buildings and Smart Grids as two out of the five core areas in which ICT can play an essential role in lowering GHG emissions and improving energy efficiency globally. Smart 2020 estimates a 20 percent to 30 percent reduction in building energy consumption achievable only through the deployment of ICT-enabled solutions.

A people-centric, integrated, end-to-end approach to energy management in a city's core office and public buildings—as is currently being developed and tested within the Smart UrbanEnergy for Schools Lisbon pilot—may help achieve these sustainability goals by:

- Allowing **integrated, end-to-end energy management in buildings**, eliminating the traditional silos among multiple systems, applications, and protocols commonly used to manage energy across the different layers of building infrastructure
- Increasing **energy consumption visibility**, as well as occupants' awareness and conscientiousness, by providing real-time, detailed information relevant to changing behaviors, as well as for introducing effective incentive schemes to optimize energy efficiency
- Integrating into this global energy management solution the **use of local energy production based on renewable sources**, increasing energy self-sufficiency and lowering the carbon footprint of buildings, while increasing the exchange of information between the building and electricity network to allow for more effective DSM mechanisms
- Providing a relevant basis for the deployment of **alternative models for energy management** and optimization that are coherent, scalable, and modular—ranging from individuals, to single buildings, to communities of individuals and/or buildings, to global, citywide, or nationwide projects

During the first few months of the pilot, energy savings of 33.4 percent were achieved, without compromising normal operation of the installed systems and pilot schools. This level of savings is expected to continue as the project progresses into new functionalities and technology layers.

Partners

- Portuguese Ministry of Education
- City of Lisbon
- Cisco
- EDP - Energias de Portugal
- Schneider Electric
- SolarWinds

³ Smart2020 (www.smart2020.org), a report by The Climate Group on behalf of the Global e-Sustainability Initiative (GeSI).

⁴ <http://www.theclimategroup.org/assets/resources/publications/Smart2020UnitedStatesReportAddendum.pdf>

⁵ <http://tinyurl.com/Smart2020-Portugal>