Green ICT: Sustainability for the 21st Century

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Overview

In the policies and plans for sustainability and eco-responsibility in cities, much attention has been directed to three sectors: the built environment, energy, and mobility. At the commencement of the 21st century, it is obvious that a fourth, equally important element must be addressed: information and communications technology (ICT). ICT is both an environmental problem and an enabler of environmental benefits, but lacks a common framework for data, performance metrics, and solution sets for urban sustainability.

This panel is the start of a dialogue about how cities can create coherent, long-term policies and plans to manage the environmental impacts of ICT and utilize ICT strategically to create sustainable 21st century cities.

ICT Environmental Footprint in Cities

ICT products and systems are a significant and rapidly growing part of the environmental footprint of modern urban life. They are resource-intensive in manufacturing and distribution, consuming ever-greater amounts of energy while in use, and creating escalating volumes of solid and toxic waste. ICT products may also have negative effects on human and social health as they are produced, used, and discarded.

ICT Enablement of Sustainable Cities

ICT products, systems, and networks are the essential driver of productivity improvements and innovation for the 21st century. They will be the enabler of sustainability solutions in all networks of urban life: buildings, energy production and use, mobility, water and sewage, open spaces, education, and public health and safety. ICT innovation is also the catalyst for changes in personal, work, and community life that will be a fundamental requirement for sustainable economic development.

Green ICT Master Planning

Until now, little attention has been given to measuring the eco-footprint of ICT in cities, or to clearly understanding its role in enabling other sustainability initiatives. Because ICT systems and products are literally everywhere in modern life, it is difficult to see and understand that each device is part of a whole system—globally linked networks to create, manipulate, store, move, and present information for humans and machines. To successfully manage the ICT environmental footprint and realize the benefits for enabling sustainability, a city must have a vision and strategy for ICT that encompasses all organizations and constituencies.

Connected Urban Development Perspective

When considering green ICT strategies for cities, seven key points must be addressed, spanning both the mitigation of ICT's own environmental footprint and the positive impact ICT can have in promoting sustainable cities.

1. **ICT is both an environmental problem and an enabler of environmental benefits, but lacks a common framework for data, performance metrics, and solution sets for urban sustainability.**

   Viewed systemically, the environmental footprint of ICT is large and growing rapidly. ICT also has significant potential as an enabler of new solutions to environmental challenges related to mobility, energy, buildings, and land use, and for driving sustainable economic development. No comprehensive system exists, however, for assessing, managing, and employing ICT to achieve goals for sustainability.

2. **No major city has a comprehensive and systematic analysis of energy consumption and greenhouse gas emissions attributable to ICT. ICT, however, does represent a significant portion of the total.**

   Global carbon emissions for ICT as an industry are estimated at 2 percent to 2.5 percent of world totals, but would be much higher (14 percent) if indirect energy use were included.[1] Estimates of total electricity consumption by ICT range from 3 percent to 10 percent in the United States and Europe[2]; consumption growth rates for ICT have been 10 percent to 20 percent per year since 2000.[3] Estimates of ICT-driven electricity usage in commercial office buildings are 20 percent to 40 percent of the total. For buildings with efficient lighting and HVAC, along with a high density of ICT equipment, ICT-based electricity consumption may be as high as 65 percent of total electricity used by the building.[4] Large cities with a high concentration of knowledge workers, office buildings, and ICT are likely to find ICT energy use is significantly higher than national averages.

3. **ICT has significant environmental effects beyond direct energy use and greenhouse gas emissions.**

   In comparison to cars and appliances, ICT components and products are material and energy-intensive to create and distribute. Estimates are that 65 percent to 80 percent of a PC's lifecycle carbon footprint/energy consumption occurs during manufacturing.[5] Product inputs include substantial quantities of water, plastics, chemicals, gases, and metals. ICT products also have short lives compared to most other manufactured goods. Few ICT products are designed for upgrade, disassembly, or reuse; only a small percentage of ICT products are recycled at end of life. In the United States, discarded e-waste represents only 2 percent of total municipal waste by weight, but accounts for 70 percent of the heavy metals and 40 percent of the lead in landfills.[6] Although toxic e-waste is banned

from ordinary solid waste disposal systems in many places, most e-waste from developed countries ends life as unmanaged trash in developing countries. ICT products also drive demand for other products that have substantial eco-footprints, such as white paper, building cable and wire, and packaging.

4. **In creation and use, ICT affects the health of individuals and society.**

   The electronics industry is one of the world's largest manufacturing sectors, with social, economic, and ecological impacts across the planet. The manufacture of ICT components and products has been associated with pollution of land, water, and air. The industry also has been accused of causing significant health problems for manufacturing workers and of unjust labor practices. In use, ICT equipment has been shown to contribute to indoor air pollution. In both developed and developing societies, the gap between rich and poor for access to ICT resources is perceived to be a significant social problem.

5. **Benefits of ICT innovation show great potential for energy efficiency and climate protection in cities.**

   Studies in various countries, generally supported by or associated with telecom companies, suggest broad potential for ICT to cut energy use and carbon emissions. One U.S. study projects that changes enabled by broadband networks could save the equivalent of 11 percent of U.S. oil imports through transportation substitution and "dematerialization."[7] An Australian study on the "High-Bandwidth, Low-Carbon" future describes seven opportunities that could reduce national carbon emissions by 5 percent.[8] A recent study supported by the U.S. Department of Energy demonstrated significant results from "Smart Grid" technologies to monitor and adjust home energy consumption, reducing average household consumption by 10 percent. Proactive management of home energy use by consumers in this way could reduce peak loads on utility grids up to 15 percent annually.[9] The UK RAC Foundation has estimated that "through the use of ICT, there is potential within 10 years for a 15 percent reduction in commuter travel, 18 percent reduction in heavy freight, and a 10 percent reduction in shopping journeys by car."[10] Many good ideas for how ICT can support innovation for sustainability have been suggested, but most benefits remain unproven and unrealized.

6. **Integration of ICT into design, planning, and development of urban land and buildings can intensify usage of space and reduce demand for travel.**

   Real-world experience demonstrates that new, ICT-enabled workplace designs in the public and private sectors can intensify usage of building space by 40 percent to 60 percent.[11] For example, the UK government campaign for "Working without Walls" aims to create "better environments using new technology . . . to improve the delivery of public services" and reduce impact from buildings. ICT-enabled developments of mixed-use, walkable, and sustainable neighborhoods can improve the environmental performance of cities significantly. Realizing these benefits on a broad scale, however, requires major changes in the process of financing, creating, and managing the built environment.

7. **ICT is a vital and necessary tool for sustainable social and economic development in 21st century cities.**

   Access to global networks and ICT resources is a requirement for individual and community success in the "Information Age." Some governments see ICT-driven development programs as "a key enabler in addressing social exclusion," and envision creating "a replicable neighborhood model that uses ICT to deliver a step-change reduction in net emissions for all communities." ICT also is both a requirement for and driver of the kind of continuous innovation that will be essential to competing successfully in the global economy. In addition, ICT will be the catalyst for changes in personal, work, and community life that create totally new urban forms. With proper focus, planning, and policies, cities can be centers of ICT-enabled innovation for sustainable growth.

Discussion Points

1. Which portion of a city's environmental footprint is directly and indirectly attributable to ICT?
2. Which environmental effects of ICT can and should cities try to address?
3. Which sustainability benefits can ICT deliver to other major urban networks (e.g., buildings, mobility, water, education, workplace, public health, and safety), and what must cities do to realize those benefits?
4. What is the role of ICT in sustainable economic development and social equity within cities?
5. How can cities create and execute ICT "Master Plans" to ensure they meet current and future goals for sustainability?

Endnotes

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