13 July 2017
Issue 492

Subscribe to free weekly News Alert

Source: Kolokotsa, D. (2017). Smart cooling systems for the urban environment. Using renewable technologies to face the urban climate change. *Solar Energy*. DOI:10.1016/j.solener.2016.12.004.

Contact:
dkolokotsa@enveng.tuc.gr

Read more about:
Climate change and energy, Resource efficiency, Sustainable consumption and production, Urban environment

1. United Nations Department of Economic and Social Affairs: http://www.un.org/en/development/desa/news/population/2015-report.html

2. Ecole Polytechnique Federale de Lausanne. Conference Paper: *Benefits of a translucent building envelope made of DSC-integrated glass blocks*: https://infoscience.epfl.ch/record/215296

European Commission

Science for Environment Policy

Renewable-energy technologies can help meet the increased cooling demand in cities due to climate change

The available and emerging renewable technologies suitable for urban environments have been assessed in a recent study. Wind and solar technology can now be integrated into building design, and smart grids and metering can more efficiently manage energy production and demand at a local level. Investing in community-level renewable-energy projects can, therefore, help meet the future energy needs of towns and cities.

Providing for the increasing demand for energy and mitigating the effects of climate change are major challenges facing society. By 2050, 70% of the world's projected population of nine billion will live within urban areas[1], which are likely to face significant environmental challenges. For example, higher temperatures will increase the energy demand for cooling (e.g. from air conditioning).

Renewable-energy technologies in the urban environment, such as solar and wind power, are increasingly regarded as an important solution to deal with climate change and energy security. Certain cities have already made progress in integrating renewable energy. For example, Rotterdam has adopted an Energy Approach Plan called REAP, where renewable technologies are brought into urban planning. In addition, Copenhagen aims to achieve 100% of its energy from renewables, in order to become the first carbon-neutral capital by 2025.

This study examined the potential role of renewable and zero-carbon technologies in meeting the growing energy demand for cooling. From existing literature, the researcher reviewed the emerging and more established renewable-energy technologies and how they can, or have been, integrated into towns and cities. Technologies outlined include micro-wind turbines, suitable for a built-up environment; how to incorporate solar panels in urban areas; and the role of information, computer technology and smart metering to manage energy use.

Emerging technologies include a variety of wind-turbine designs, which reduce the impact of erratic wind flow in built-up environments, and solar cells that are incorporated into pavements and floors, which are being piloted at the Solaroad project in the Netherlands. The efficiency of urban energy supply can also be improved on a local scale with small Combined Heat and Power (CHP) plants (which combine the production of heat and power). In Denmark, over 50% of the country's energy demand is met by CHP connected to district heating and cooling systems. CHP can also be used with renewable technologies such as solar power.

Building owners have previously been discouraged from incorporating renewable technologies due to high costs and aesthetic and technical considerations. However, the researcher suggests that new technologies, such as micro-wind turbines, may be a more attractive prospect. There has also been considerable research into integrating solar-cell technology into building design. For example, a recent development has been to create dye-sensitised solar cells (DSCs) that can be incorporated into glazing facades. For example, replacement of the glazing facades in an office building in Palermo, Sicily produced 112,000 kilowatt (kW) of electricity annually and also reduced energy consumption from air conditioning due to the extra shading provided[2]. Hybrid technologies can also have a significant role in increasing renewable use. Windrail technology can be installed on rooftops and produces electricity from both wind and solar energy.

Continued on next page.

European Commission

Science for Environment Policy

Renewable-energy technologies can help meet the increased cooling demand in cities due to climate change *(continued)*

13 July 2017
Issue 492
Subscribe to free weekly News Alert

The researcher says that the technologies summarised demonstrate that renewables have the potential to cope with the potential increases in cooling demand in the urban environment. She says the use of renewables is hampered by two factors:

- most incentives for their installation are at the individual level, limiting community or district-level incentives, which might have a larger impact on total energy produced.
- the high initial investment required limits those on lower incomes from installing renewable technologies.

Information and Computer Technology and smart grids are suggested as a way to overcome these barriers. Smart grids — electricity supply networks that use digital technology to monitor and react to variations in usage — are described as a potential revolution in towns and cities to replace the centrally controlled grids of the 20th century. The researcher says smart grids, smart meters and district-level energy-gathering data can allow better balancing of energy generation. This allows for a better response to energy demand and can improve efficiency, reliability and interconnection of energy supply, and a reduction in energy costs. For example, a study assessing the use of smart metering in hospitals indicated a reduction of energy costs of 25–30%.

Community-scale demonstrations, such as the LEAF Microgrid in Italy, show that all energy needs can be supplied from renewables (achieving a zero-energy goal) by combining renewable and energy-management technologies to balance supply and demand. Smart meters also help individual users to manage their own consumption. At the Technical University of Crete, smart meters installed throughout the campus, combined with an awareness-raising campaign, led to a 17% reduction in energy consumption.

The researcher says that renewable-energy use in the future can be part of a more sustainable way of living within urban communities. Generating renewable energy at a neighbourhood or district scale means less infrastructure is needed to transfer energy to where it is needed. The researcher says that incentives should be provided for joint public and private renewable-energy projects at community or district level, where the energy produced can be used by local residences.

Source: Kolokotsa, D. (2017). Smart cooling systems for the urban environment. Using renewable technologies to face the urban climate change. *Solar Energy*. DOI:10.1016/j.solener.2016.12.004.

Contact:
dkolokotsa@enveng.tuc.gr

Read more about:
Climate change and energy, Resource efficiency, Sustainable consumption and production, Urban environment