Suburban sprawl to power cities of the future

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A city's suburbs could hold the solution to dwindling fuel supplies by producing enough energy to power residents' cars and even top up power resources, pioneering new research has found.

It is commonly assumed that compact cities, with built-up central business districts and densely-populated residential areas, are more energy efficient than the low-density suburban sprawl that surrounds them, which are dependent on oil for high levels of private transport use.

In a future with photovoltaic solar panels on suburban roofs and increasing use of electric vehicles however, experts have predicted that suburbia will adopt a valuable new role – transforming from a high energy consumer into a vital power provider for the city.

Newly published research, conducted by Professor Hugh Byrd from the University of Lincoln, UK, and collaborators including Professor Basil Sharp from the New Zealand Energy Centre and experts from the University of Auckland, New Zealand, challenges the conventional theory that compact urban form offers the best solution for a sustainable city.

Instead, the team of researchers highlight the potential of suburbs for harnessing solar energy, with detached suburban houses capable of producing ten times the amount of energy created by skyscrapers and other commercial buildings.

The findings also reveal that lower density housing in suburbia not only

has the greatest capacity for collecting solar energy, but also the greatest surplus after its own energy uses have been taken into account to help out city centre peak electricity loads.

Professor Byrd, from Lincoln's School of Architecture, said: "This study challenges conventional thinking that suburbia is energy-inefficient, a belief that has become enshrined in architectural policy. In fact, our results reverse the argument for a compact city based on transport energy use, and completely change the current perception of urban sprawl.

"While a compact city may be more efficient for internal combustion engine vehicles, a dispersed city is more efficient when distributed generation of electricity by photovoltaic installations is the main energy source and electric vehicles are the principal mode of transport.

"However, if this energy contribution is to be effective, controls of new suburban development may be needed that require the installation of photovoltaic roofing, along with smart meters and appropriate charging facilities for vehicles. City planners will need to make the changes necessary to control suburban development."

Funded by the University of Auckland under the "Transforming Cities" initiative, the research was conducted in Auckland, by evaluating the energy usage and potential for power generation across typical cross-sections of the city. However, the findings are also applicable to energy systems across 'new world' cities, designed and developed around the growth of the motor vehicle.

Professor Byrd said: "This research could have implications on the policies of both urban form and energy. Far from reacting by looking to re-build our cities, we need to embrace the dispersed suburban areas and smart new technologies that will enable us to power our cities in a cost-effective way, without relying on ever dwindling supplies of fossil fuels.

"It is more a case of building for the future – when the climate will be warmer, harvesting solar energy will be cheaper than the grid and emerging technologies will replace the internal combustion engine. Particularly for city centre travel where longevity isn't an issue, electric vehicles will become increasingly more attractive as their price drops with mass production and the cost of fuel continues to rise.

"Photovoltaics on rooftops of course also have all the advantages of renewable energy systems, such as reduced carbon emissions, offsetting dependent on the electricity grid and long-term energy security, all of which will only become more important in cities of the future."

More information: Byrd, H. et al. Measuring the solar potential of a city and its implications for energy policy, *Journal of Energy Policy* (July 2013). www.sciencedirect.com/science/ … ii/S0301421513005272

Provided by University of Lincoln