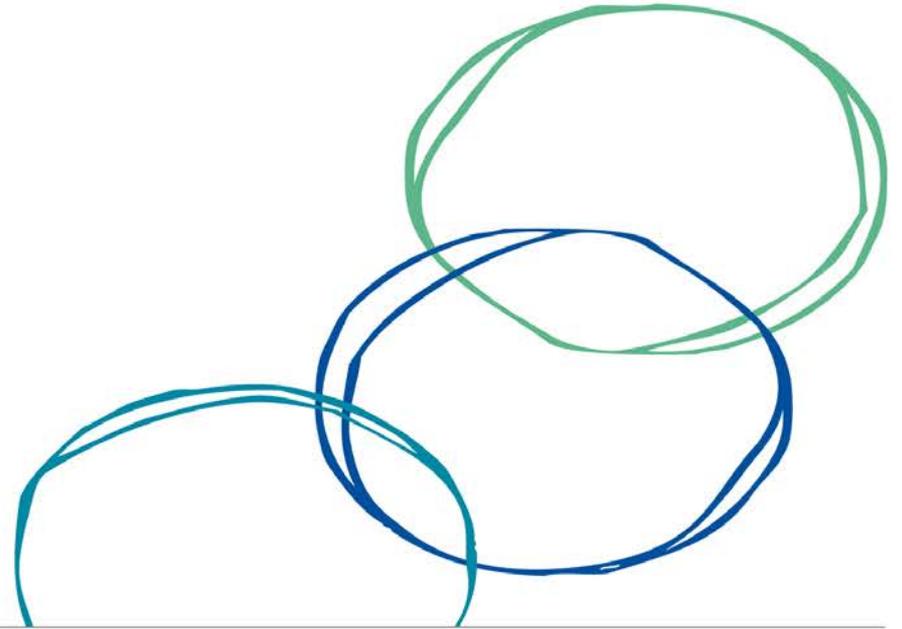


# How will disruptive energy productivity gains influence sustainable urban design?



A/Prof. Alistair Sproul,  
School of PV & RE Engineering  
University of New South Wales



# Low density cities?



<http://www.classicholdencars.com/fx-holden/>

Cheap and abundant oil, affordable cars, growing wealth, baby-boom, post-war immigration – Australian cities sprawled



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CRC

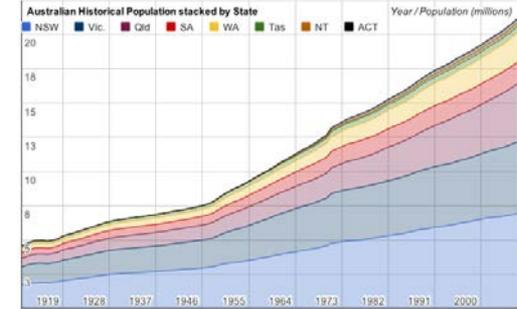
# Bob Carr calls for Australian immigration to be cut by one-half

Former NSW Premier and Australian Foreign Minister Bob Carr has called for Australia to consider reducing its immigration intake by up to one-half **before growing population density on the eastern coast changes the Australian style of living.**

"I think the Australian people, if asked, would want immigration slowed," Mr Carr said at a press conference in Sydney on Tuesday. "We've got a third-world style population growth rate.

"If you bring 100,000 people into the Sydney basin every year, the price of housing goes up .... people wonder why their youngsters can't get houses in the big cities... **the answer is we are going for breakneck population growth.**"

<http://www.smh.com.au/nsw/bob-carr-calls-for-australian-immigration-to-be-cut-by-onethird-20160216-gmv37n>



# High density urban form is more sustainable than sprawl?

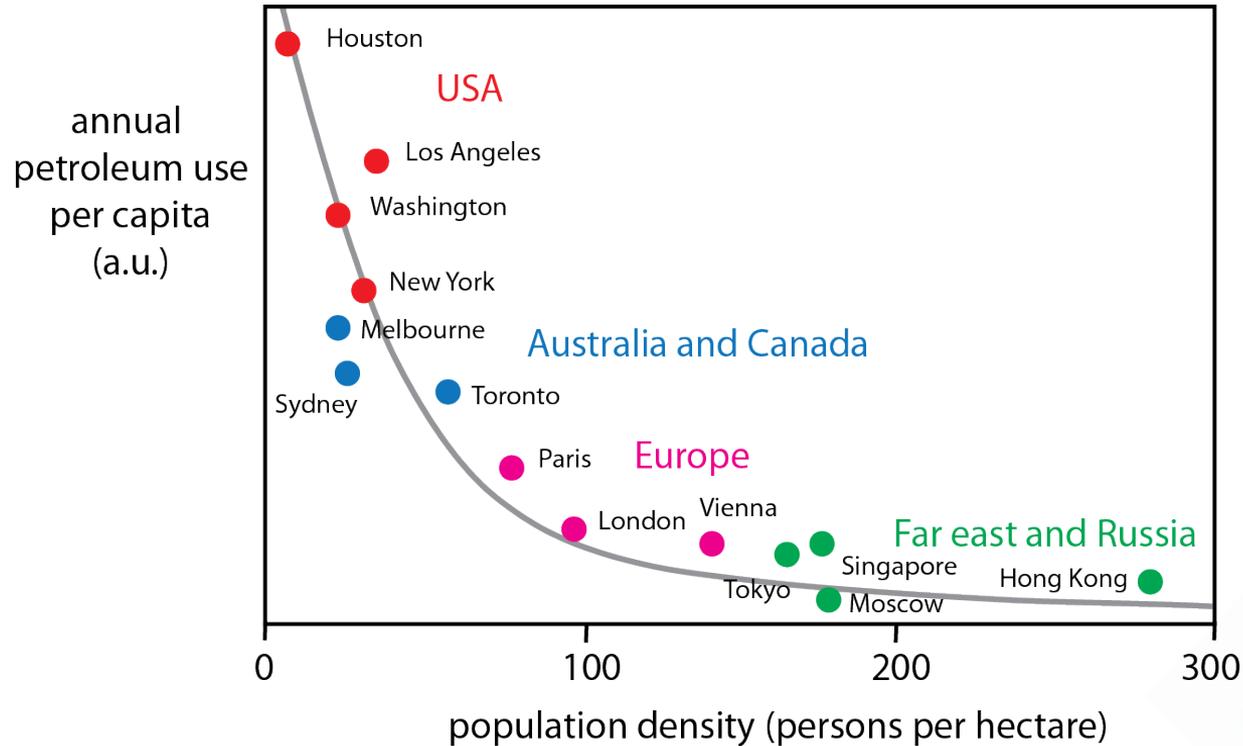


<http://www.thefifthstate.com.au/articles/high-rise-living-%E2%80%93-is-it-the-sustainable-answer/20345>



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CRC

# Less density means more petroleum usage



[http://www.qside.eu/urban\\_sus.html](http://www.qside.eu/urban_sus.html)



# Hi-rise living is sustainable right?

**Green Building Council of Australia and World Green Building Council chair, Tony Arnel,** *“no conclusive evidence that vertical living was more sustainable than conventional homes.”*

**CEO of the Low Carbon Living CRC, Prof Deo Prasad**

*“Even with the energy downsides of high-rise, urban sprawl is a far worse option. Transport problems alone have enormous social and health effects. People who travel long distances to work spend less time with their families and their health is impacted. Then there are increased emissions and health costs associated with urban air quality,” says Prasad.*

*And more sustainable high-rise is definitely achievable, says Prasad.*

<http://www.thefifthstate.com.au/articles/high-rise-living-%E2%80%93-is-it-the-sustainable-answer/20345>



# Disruptive energy is here or fast approaching but old rules of thumb remain?

- Transport considerations mean high density urban forms are the most sustainable
- Population must always increase
- Coal power is cheaper than rooftop solar
- Natural gas is the best option for space heating and hot water
- Energy demand must always increase
- Electricity must always flow into a building/precinct/city.
- Electric vehicles, batteries, LEDs, high efficiency appliances and zero energy buildings are unaffordable.



# Australian rooftop PV amongst the cheapest in the world

- The cost of installing solar PV systems on Australian households and businesses is among the cheapest in the world, according to the latest global PV report from the International Energy Agency, released on Monday.
- The report, the IEA's 20th Trends in Photovoltaic Applications report, shows that in Australia, along with many regions of the world, solar PV is now recognised as one of the least-cost options for electricity generation

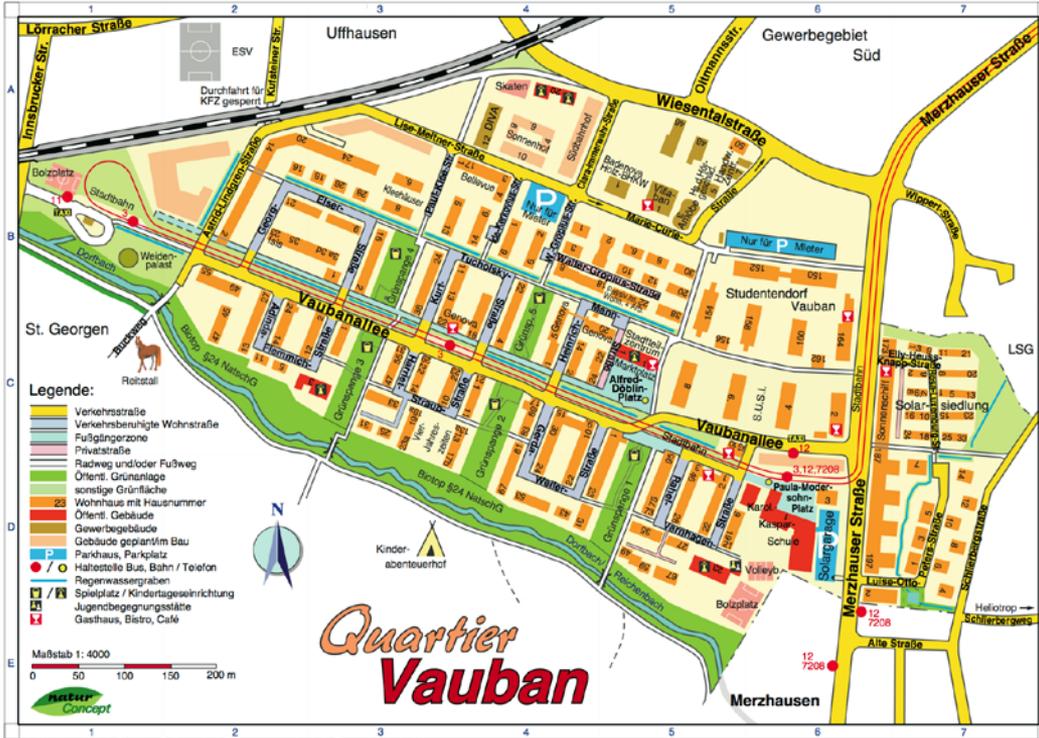
<http://reneweconomy.com.au/2015/australian-rooftop-solar-pv-cheapest-in-world-says-iea-report-78982>



# The energy landscape is changing



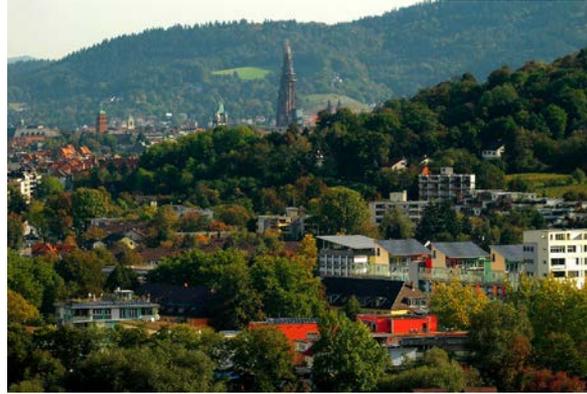
# Vauban quarter – Freiburg Germany



Alle Urheberrechte bei eFlich Lutz, Freiburg. Vervielfältigungen nur mit schriftl. Einverständnis des Urhebers.

- Sustainable model district" - site was a former French military base
- Medium density
- Low energy, Passiv Haus, Solar plus apartments
- Good to excellent solar access
- Green spaces
- Bicycle and pedestrian friendly
- Few cars

# Vauban quarter – Freiburg Germany



<http://www.vauban.de>



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# Vauban - trams, buses, bicycles, pedestrians and car sharing



<http://www.vauban.de>

# Living laboratory – Lochiel park



Lochiel Park is a model 'green' village located 8 kilometres from the Adelaide Central Business District, alongside the River Torrens in the suburb of Campbelltown. Launched in 2004, there are now 106 dwellings at Lochiel Park including an innovative apartment building with 23 residences.

<http://joshshouse.com.au/star-performers/lochiel-park-adelaide/>



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# Living Laboratory - Lochiel Park

The 15 hectare site is a former TAFE college that was originally earmarked for a typical suburban housing development. An alternate plan was proposed and delivered by the South Australian State Government's urban renewal authority, Renewal SA, which resulted in only a third of the 15 hectare site being allocated for medium density residential development, with the remaining area set aside for public parkland, incorporating urban forest and stormwater wetlands.

All houses have a minimum 7.5 Star NatHERS rating and were designed and built in-line with strict energy and water efficiency guidelines that far exceeded what was the norm for residential design and construction, even today.



# Living Laboratory Lochiel Park

Aim is to reduce non-renewable energy consumption by 66% and GHG emissions by 74% (measured against Adelaide average).

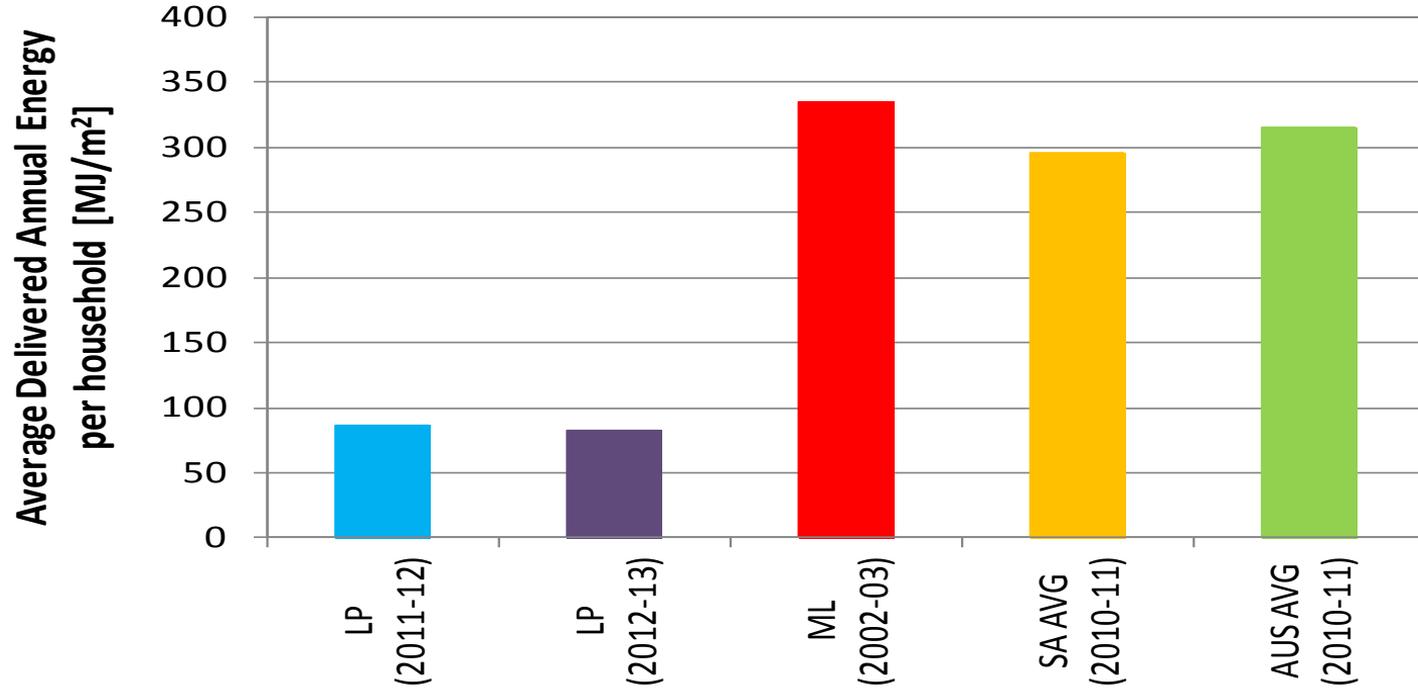


Lochiel Park, Campbelltown  
Urban Design Guidelines  
August 2009



<http://www.greenwayarchitects.com.au/lochiel-park-affordable-housing/>

# Lochiel Park



# CRC Living Laboratories

## **RP3017: Adelaide Living Laboratory Hub**

**Project leader:** Professor Wasim Saman and Dr Kathryn Davidson

<http://www.lowcarbonlivingcrc.com.au/research/program-3-engaged-communities/rp3017-adelaide-living-laboratory-hub>

## **RP3009: High Performance Housing - Monitoring, Evaluating and Communicating the Journey**

**Project leader:** Prof. Peter Newman

<http://www.lowcarbonlivingcrc.com.au/research/program-3-engaged-communities/rp3009-high-performance-housing-ii-monitoring-evaluating-and>



# The role of the urban planner

How can urban planners take solar energy seriously in the urban planning process?

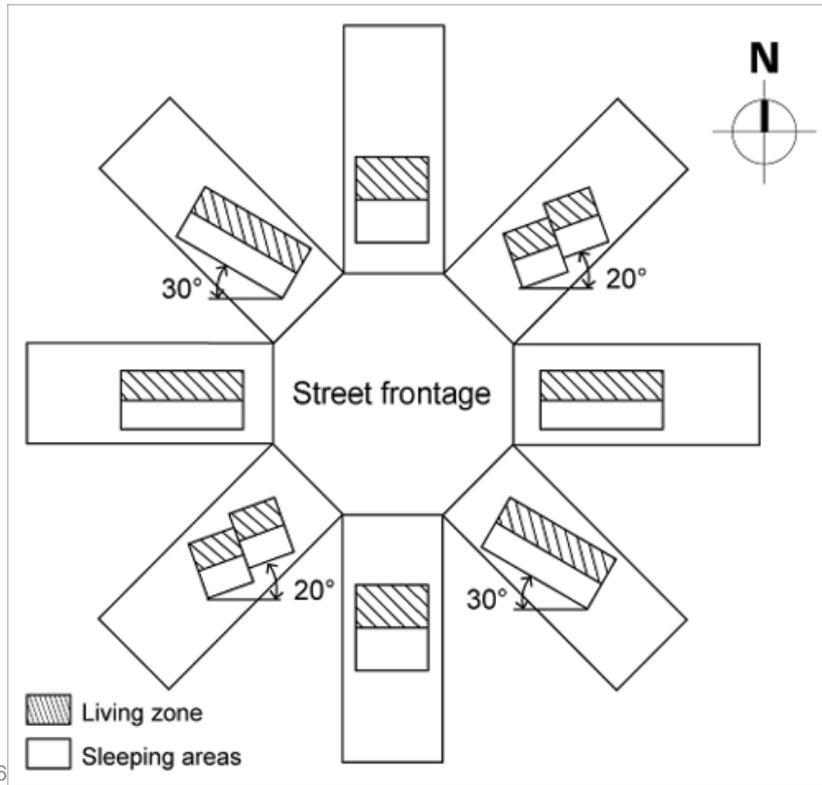


<http://www.solarplanning.org/beta/role.html>



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CRC

# Orientation for winter solar access



2/26/2016

- Good passive solar design
- Solar access - now needed more than ever for solar PV, solar hot water on rooftops.

<http://www.yourhome.gov.au/passive-design/orientation>

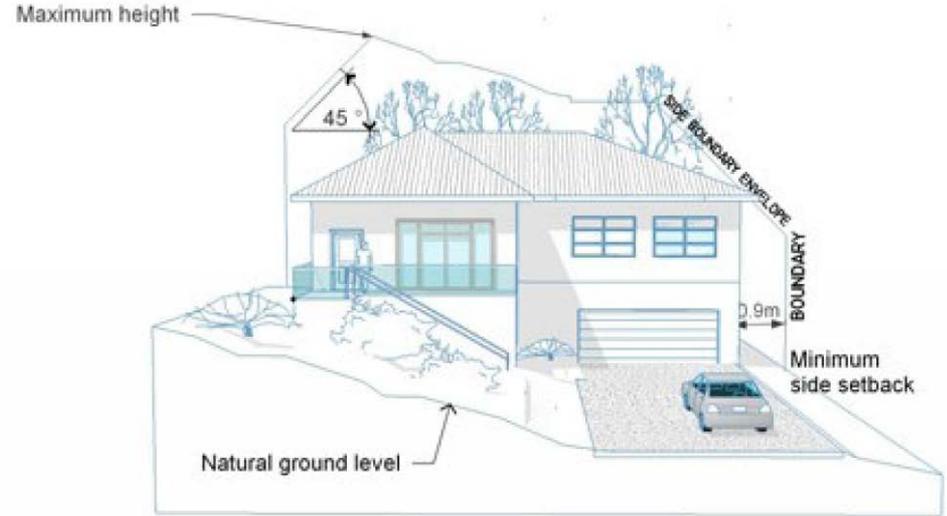
19

# Houses too close to allow solar gains?

## Warringah council Development Control Plans



Measuring the side boundary building envelope



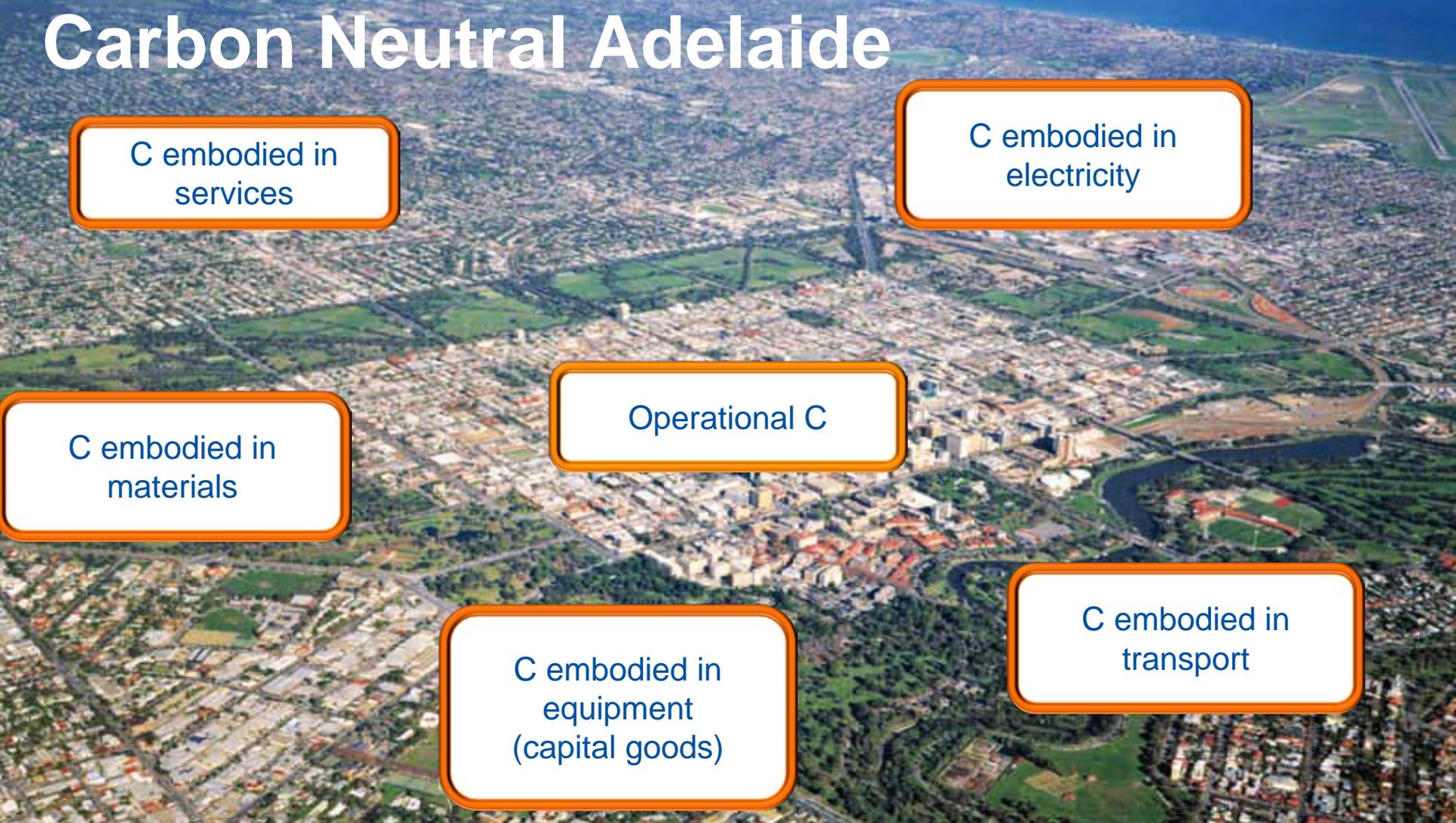
[http://www.denverpost.com/news/ci\\_24935524/adams-county-homes-approved-even-though-they-are](http://www.denverpost.com/news/ci_24935524/adams-county-homes-approved-even-though-they-are) (too close together)

# Precinct Information Modelling

A **Precinct Information Model (PIM)** is a comprehensive 3D digital database **Model** of a **Precinct** that contains all the **Information** needed to support planning, design, development, construction, management, operation, use and retro-fitting of urban precincts.

*The focus is directed towards minimisation of carbon throughout the precinct life cycle, supported by a PIM. In a broader context, a PIM could be used for a whole range of other purposes.*

# Carbon Neutral Adelaide



C embodied in  
services

C embodied in  
electricity

Operational C

C embodied in  
materials

C embodied in  
equipment  
(capital goods)

C embodied in  
transport

# Integrated C Metrics for Adelaide 2: Precinct Modelling

## Precinct (Re)Development Scenarios & Data

**Urban densification**

**Mixed use**  
(retail, car parking, offices, apartments)

**Inner-city renewal**  
(utilising existing buildings)

**Industrial/Commercial redevelopment**

**New Development**

**Old Site**

**Transport-oriented development**

## Precinct Life-cycle Energy & Emission Modelling Tool

Precinct Energy Management System 2015a - Untitled

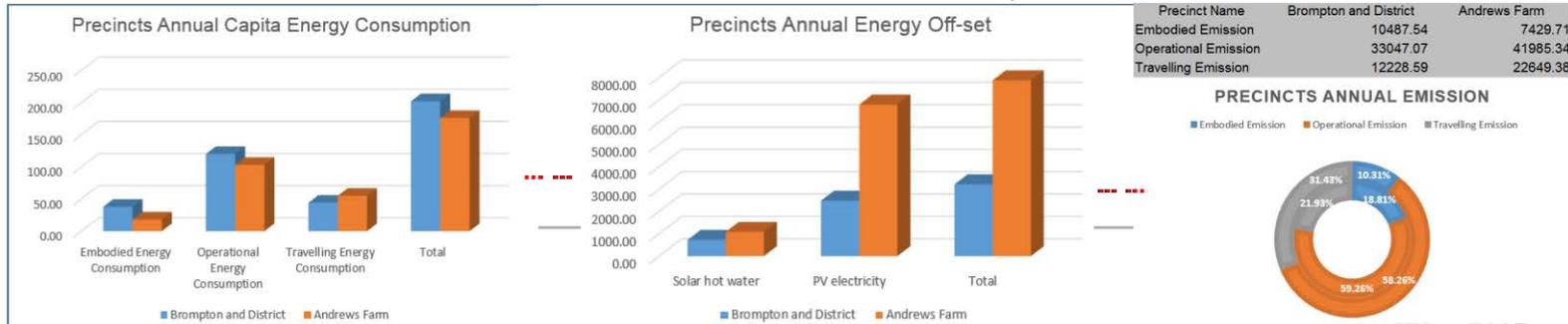
File Precinct Energy Intensity Requirements Solar Simulation

Simulation Scenario: Scenario 1 (Fixed Precinct Density)

Sun path  
Solar radiation on surfaces  
Shades from surroundings

Test User Guide

## Precinct Scenario Analysis and Planning



# ICM Tools for Planning Carbon Neutrality



## The long road to zero – embodied carbon in the built environment



Have Your Say  
Submit an Article »



The focus of emissions in buildings is shifting from the operational phase to building materials. UK data shows cement and steel alone contribute more than 40 per cent of all industrial carbon emissions.

### RP2007: Integrated Carbon Metrics – A Multi-Scale Life Cycle Approach to Assessing, Mapping and Tracking Carbon Outcomes for the Built Environment

**Project leader:** Associate Professor Tommy Wiedmann, UNSW

<http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2007-integrated-carbon-metrics-%E2%80%93-multi-scale-life-cycle>

# CRC LCL Projects

## **RP2011: PIM - An Open Digital Information Standard throughout the Urban Development Lifecycle**

**Project leader:** Jim Plume

<http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2011-pim-open-digital-information-standard-throughout>

## **RP2018: Retrofitting Urban Precincts to Create Low Carbon Communities**

**Project leader:** Roger Swinbourne

<http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2018-retrofitting-urban-precincts-create-low-carbon>



# Conclusions

- Sustainable urban forms – can be achieved at any density – the shape of our cities is a design choice not fate.
- Distributed renewable energy systems, the shift towards electric transport, efficient homes, buildings, precincts with well planned public transport means medium density can be sustainable.
- Green spaces, public transport, pedestrian and bicycle friendly communities, orientation, and solar access – good urban policy and planning needed to deliver these – also strong planning controls and decisions.
- PIM and ICM tools allow us to explore how we can design and deliver low carbon communities
- Communities such as Vauban and Lochiel Park demonstrate that low carbon communities are achievable, liveable and affordable.

