ICM Precinct Carbon Assessment (PCA) Tool

PROJECT FACTSHEET

LOW CARBON LIVING CRC

KEY POINTS

i) **whole life cycle of carbon emissions (Scope 1, 2 and 3) on the precinct scale;**
ii) **quantitatively evaluates low carbon scenarios to inform 'Business as Usual' types of development;**
iii) **supports planners, designers, ESD consultants and government agencies for more effective planning and mitigation; and**
iv) **operate across states, urban settings, and the development project life cycle.**

THE OPPORTUNITY/CHALLENGE

The PCA tool provides end-users with the capability to assess different low carbon development options. It aims to:

• Provide both highly aggregated as well as detailed assessments of the operational and embodied carbon of precinct objects (residential buildings, commercial buildings, and infrastructure), building appliances, transport vehicles, and discrete energy generation via solar PVs and storage units;

• Identify and quantify the effects of occupancy and morphological factors on precinct carbon profile;

• Be capable of assessing the offset potential of climate rendering and green energy systems at the precinct scale; and

• Support the analysis of different precinct types and urban development scenarios.

CRC for Low Carbon Living

We are a national research and innovation hub supported by the Commonwealth Government's Cooperative Research Centres programme that seeks to enable a globally competitive low carbon built environment sector.

With a focus on collaborative innovation, we bring together practitioners from industry and government with leading Australian researchers to develop new social, technological and policy tools for facilitating the development of low carbon products and services to reduce greenhouse gas emissions in the built environment. For more information visit www. lowcarbonlivingcrc.com.au/

OUR RESEARCH

The PCA tool can be used as an assessment tool at the final phase of a development project or as a planning tool applied at an early stage of a project. Users may use it in the following two ways: 1) applying the tool to a new/ongoing project to analyse carbon reduction scenarios for precinct development and 2) applying the tool to completed projects for carbon performance assessment.

It is not bound by data sources and allows users to adjust precinct morphological settings, building types, travelling modes, renewable system options, as well as the carbon intensity data of precinct objects for conducting quantitative analysis and finding the optimal solutions.

The tool can be applied to 'Greenfield', 'Greyfield' or 'Brownfield' types of development for Residential or Mixed-use precincts. The spatial scales in modelling and assessments include Street, Neighbourhood, Subdivision and Suburb, as well as CBD and Corridor. The tool is particularly useful in supporting 'as designed' or 'as built' carbon assessment and scenario analysis on Infill or Renewal types of precinct (re)developments. It can also support analysis of various scenarios for Transit-Oriented Development (TOD) and deployment of renewable energy units at a precinct-scale for carbon neutrality targets.

OUTCOMES

The PCA tool is developed to be an operational and 'National Carbon Offset Standard for Precincts' (NCOS-Precincts) aligned. A web version of the PCA tool, i.e. the PCA-'Light', can be accessed at: https://precinculators.info/. It supports 'Basic' assessment and reporting functions. The tool also has a Matlab version, i.e. the PCA-'Full', that is accessible via Remote Desktop Connection. This full version provides advanced modelling and scenario assessment functions and is compliant with the "NCOS Standard for Precincts" (http://www.environment.gov.au/climate-change/government/carbon-neutral/ncos). Both versions of the PCA tool have been reviewed and tested for further industry utilisation.

USERS OF THE RESEARCH RESULTS

The target users for the PCA tool include government agencies and private companies (such as developers and consulting firms), sustainability development consultants, as well as urban and infrastructure planners.

LESSONS

Whilst the PCA tool is not directly aimed at any specific carbon abatement target, it is expected that the use of the tool in planning or assessment of a precinct project's carbon profile and reduction scenarios can help to identify and optimise the options for life-cycle carbon reduction. Based on a case study on urban densification scenarios for a residential precinct redevelopment in Adelaide using the PCA tool (Xing et al., 2019), it is estimated that a 6% of carbon reduction per annum can be achieved with a combination of solutions for high energy-efficient new buildings and households, increase of PV coverage and increased use of public transport for commuting. This can contribute to an accumulated carbon reduction of 67,000 tons in total over 20 years. Secondly, embodied carbon contributes significantly to life-cycle carbon and can account for as much as 38%, when infrastructure, especially transport infrastructure (e.g. roads, driveways, paths and pavements), is considered in the assessment (Huang et al., 2017b).

PROJECT TEAM

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NEXT STEPS

During its development process, the PCA tool has been presented in a number of end user workshops to engage with organisations, including Renewal SA, GBCA, AECOM, Aurecon and DSquared Consulting, for review and feedback.

To date, the PCA tool has been applied to a number of test cases of different precinct contexts and morphological types

Precinct Context	Morphology Type	Scenario Tested
Andrews Farm	Outer-suburban Renewal (for residential)	Effects of energy-efficient buildings and precinct-scale solar PV for carbon reduction vs. 'Business as Usual' (BAU)
Bowden	Inner-city Renewal (for mixed use)	Impacts of TOD and urban densification on precinct carbon performance
Lot 14 (part)	Inner-city Redevelopment (for commercial)	Operational testing and benchmarking of carbon assessment and NCOS compliance
Lochiel Park	Low-carbon Development (for residential)	Precinct-scale Solar PV with vs. without batter storage and impact on payback otal carbon and cost)

While the prototype of the PCA tool is developed for trials, the tool will be further refined to improve its rigor and operability. The project team would like to engage with end users to support further tool testing, calibration and customisation through multiple case studies. Meanwhile, the project team will also use the opportunities of those case projects to tailor the tools towards particular needs of the users and their clients.

PROJECT REPORTS

Xing, K. and Huang, B. (2019) RP2007u2 - ICM Precinct Carbon Assessment Tool Conversion for Cloud-based Interfaces towards Utilisation Project Report, Cooperative Research for Low Carbon Living

Huang, B, Xing, K. and Pullen, S (2017,a) Life-cycle Energy Modelling for Urban Precinct Systems, Journal of Cleaner Production, 142 (4), 3254-3268

Huang, B, Xing, K and Pullen, S (2017,b) Carbon Assessment for Urban Precincts: Integrated Model and Case Studies, Energy and Buildings, 153, 111-125.

Xing, k., Wiedmann, T., Newton, P., Huang, B. and Pullen, S. (2019) Development of Low-Carbon Urban Forms—Concepts, Tools and Scenario Analysis, 227-244, In Newton, P., Prasad, D., Sproul, A. and White, S. (eds.) Decarbonising the Built Environment: Charting the Transition. Palgrave Macmillan. ISBN 978-981-13-7940-6

FURTHER INFORMATION

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