Towards Zero Emission Communities: A multi-dimensional model for energy master planning

Abstract

Although the development of zero emission building clusters is known as a desirable measure for reducing the emissions in the building sector, more research on a robust methodology is required for addressing zero emission objectives in the planning and design process of the energy infrastructure for whole communities. Considering not only individual buildings, but also energy sources, distribution system, renewables, storage, or future energy generation needs at community scale brings both opportunities and challenges. In this work after defining the main concepts, a comprehensive multicriteria decision support framework is developed for energy master planning (EMP) of resilient zero energy communities (ZECs), see Figure 1.

Introduction

ZEC can bring additional economic and environmental benefits, as well as higher energy resilience. Despite the advantages, various interpretation of evaluation metrics for technological solutions for ZECs can lead to completely different results. Thus, a consistent assessment framework is needed to aid the decision-making process of assessing different technical options in various stages of the EMP, in both greenfield and brownfield projects focusing on the Australian context.

Discussion and Outcomes

An EMP framework is proposed including the definitions, client’s requirements and constraints, and performance-based decision-making criteria, especially focusing on energy resilience metrics (see Figure 2 and Table 1). The framework not only maps various aspects of EMP for ZECs and identifies the research scope, but also provides a common ground for the planning, design and assessment of ZEC. Presented metrics and framework can be used as a guideline for various stakeholders (e.g. energy planners, designers, policy makers, owners) consisting of definitions, design and evaluation procedures of ZEC in of both greenfield and brownfield developments. They also enable to have an apples-to-apples comparison of ZECs (each with their own specific characteristics). The proposed framework is aligned with and extends the existing definitions in the field of research. It is flexible to be applied to different projects with different conditions. In the next research step, modelling techniques, case studies, query search of databases and inventories will be employed to develop a multi-dimensional model for structured planning, design and evaluation of ZECs.

For more information

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