

ABSTRACT

The aim of this research report is to examine and to indicate the need of a rethinking in architectural design and building construction in terms of the basic principles of solar radiation and to introduce solar technologies as design elements. It explores passive solar design issues as future-proof solutions to provide thermal efficiency in buildings and proves that active solar energy is a significant factor to reduce carbon emissions. This research paper is focused on thermal solar and photovoltaic (PV) technologies. The paper illustrates the different types of solar collectors, such as the flat plate collector and the vacuum tube collector, and shows that building-integrated photovoltaic (BiPV) technology is rapidly evolving and is becoming a significant part of building design.

As Randall Thomas argues, the 21st century will be the age of solar energy, such as the 20th century was the age of oil.¹ In context to this thought, this research report considers that the integration of thermal solar collectors and PV-modules in architectural design becomes an important factor to design future-proof buildings. It examines concepts to integrate these systems into a building envelope as well as into a new sustainable project. In this context, the report examines different examples of sustainable buildings in New Zealand. These prove through their energy consumption that sustainable design and the introduction of PV-systems and thermal solar collectors are offering considerable benefits in terms of the energy yield to the building and its occupants. However, the research report indicates that the goal is the full integration of PV-modules and thermal solar collectors into the architectural design and construction process and shows that active solar systems must be used as design elements and not only as a technological bonus.

Overall, this research report considers that some architects are starting to realise their responsibility. They become interested in sustainable design to ensure that new buildings are designed and built with new standards of sustainability to reduce the amount of carbon dioxide emissions and the consumption of energy. However, it especially shows that solar systems are still not realised as design elements in sustainable architecture by New Zealand's leading architects. Furthermore, the paper assumes that the built examples can be a significant possibility to move forward the development of building-integrated solar systems, which helps to reduce the consumption of energy and to achieve a significant carbon dioxide reduction in New Zealand's architecture.

¹ Randall, Thomas (ed). Max Fordham and Partners (ed). *Photovoltaics and Architecture*. London, New York: Spon Press, 2001.