BUILDING INTEGRATED PHOTOVOLTAICS

Systems, Benefits and Sustainability

Alberta Infrastructure

DESIGN & TECHNOLOGY SERIES **04**

University of Alberta Medical Isotope & Cyclotron Facility

Solar Carport, Blue Oak Energy

Building Integrated Photovoltaics

Building Integrated Photovoltaics (BIPV) are photovoltaic systems that replace conventional building materials in parts of the building envelope such as the roof, windows, skylights, or facades. They are increasingly incorporated into the construction of new buildings as a principal or ancillary source of electrical power (existing buildings may be also retrofitted with similar technology).

One of the primary benefits to BIPV systems is that they can replace other exterior cladding components. Integrating photovoltaic panels into the facade design eliminates the need for a separate cladding material, as the photovoltaic panels serve as rainscreen and power source. Eliminating redundant materials saves resources and capital costs, and allows the BIPV to complement the design of a building, rather than appearing as a "bolt-on" accessory. Photovoltaic panels are available in an increasing number of colours and patterns, allowing more freedom in facade design, including panels that seamlessly integrate with Alberta Infrastructure's recommended PERSIST approach to exterior walls.

When applied to a particular building typology such as Alberta's schools, BIPV presents a unique opportunity: the schools themselves become teaching tools. Monitoring of energy production and use develops a greater understanding of the environment, resources, and sustainability. Students and staff may seek out further ways to reduce energy use, while parents and the general public may also become aware of issues of sustainability through interaction with the facility and its occupants. Additionally, the incorporation of BIPV into public buildings demonstrates the GoA's committment to responsible environmental stewardship through its built infrastructure.

Cost premiums in adopting solar technology have been significantly reduced as the technology has evolved. For example, in 1977 a photovoltaic cell cost $76.67 per watt; in July of 2016 a photovoltaic cell is available for as little as $0.26 per watt[1]. The cost of other system components such as inverters, batteries, and racking systems has also decreased. Moreover, the unused energy produced by a photovoltaic system can be distributed to the grid in exchange for power or cash credits. Battery storage may also be a viable option for providing base or emergency power to a facility when compared to the cost of running new utilities and maintaining backup generators (especially for remote sites).

Getting the Most Out of Photovoltaics

In order to maximize the value of a PV/BIPV installation, consider the following:

Design: While PV systems may be retrofitted to existing buildings, the greatest benefits are achieved when energy efficiency has been designed into the building right from the start. Select lighting, equipment and other fixtures to meet user requirements and minimize energy consumption. Situate the building for best solar exposure, and identify possible locations for PVs such as roofs, walls, shading devices or standalone arrays. Take advantage of natural light and solar heat gain to reduce power and gas consumption. Design the structure to support PVs, and allow or provide conduit for future PV installation. Provide sufficient space for inverters and other equipment.

Education: Teach users that energy conservation is a practice that should be applied to every building, regardless of whether or not it is outfitted with PVs. Publicly visible displays, mobile apps or other software could be used to provide information on how much energy the building is consuming, with the goal of further reducing the energy and the carbon footprint of the facility.

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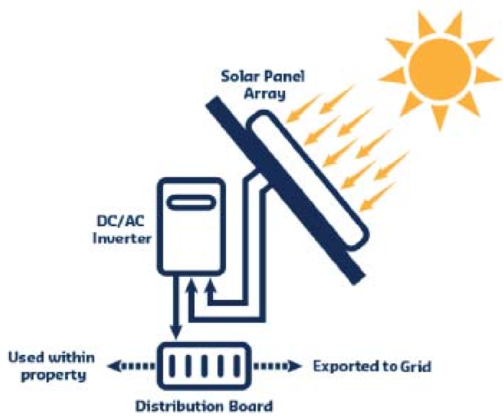

Schematic of Photovoltaic System (Roof or BIPV)

Where To Incorporate on Buildings

Main Entrance: Depending on the nature of the building, PV panels located at the main entrance can provide a unique visual statement and useful teaching tool. Prominent placement near the entrance provides staff and visitors with an opportunity to view PV technology. These panels can be installed to act as solar shading devices above windows or they may be seamlessly integrated into the building facade, similar to traditional metal panel systems. Public areas can be outfitted with "dashboard" interfaces that display metered energy performance information in a clear, attractive, and accessible manner.

Gymnasium Walls & Mechanical Penthouses: Installation of a photovoltaic system on the southern portion of a gym or penthouse wall is ideal, as it maximizes sun exposure while separating the PV arrays from maintenance activities and vandalism. Similar to typical rooftop PV systems, BIPV installed on mechancial penthouse facades can still be easily accessed for maintenance. Depending on the size of the penthouse, useful vertical surface area may be significantly reduced, when compared to a horizontal roof system.

BIPV Facade, PAW Centre, UofA
Edmonton, Alberta

Maintenance

Vertical BIPVs are subject to reduced snow and dirt accumulation and may be more accessible than roof-mounted systems for cleaning and inspection. In addition to solar exposure, consider the location of BIPVs to avoid accidental damage or willful vandalism.

Products

Building Integrated Photovoltaic modules are available in several forms:

Pitched Roofs: solar shingles are modules designed to look and act like regular shingles, while incorporating a flexible thin film cell[2].

Facade Systems: technological advances now allow panels to be "pre-tuned" for specific sites/climates. This permits efficient vertical application onto a structure or facade, as well as a more integrated appearance for the overall facade.

Glazing: (semi)transparent modules can be used to replace a number of architectural elements commonly made with glass or similar materials, such as window glazing.

Shading Devices: Wall-mounted BIPVs may be installed over windows and doors, or designed into building features such as entrance canopies or bike/car parking shelters to provide protection from the elements, unwanted solar heat gain, and glare.

Emerging: Organic PV, Dye Sensitive Solar Cells[2] , Thin-film[3]: Organic and Dye Sensitive PV are new innovations that approach truly transparent PV glazing. Thin-film PVs are flexible and useful for applications where traditional PVs are not feasible. Note that thin-film energy output is currently lower than standard PV panel systems.

Information Sourced From:

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