

BIPV Markets Analysis and Forecasts 2014-2021

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OBJECTIVES AND SCOPE OF THIS REPORT

The objective of this report is to present the latest trends in the BIPV markets. We have broadly segmented the market into glass and non-glass products. The report analyzes the emerging trends in BIPV products and discusses the impact of emerging technology trends, especially thin-film technologies, on the BIPV glass market. This industry analysis is based on the research that NanoMarkets has conducted in the PV space over the past several years.

Under the non-glass BIPV product segment, discussions are based around highlighting the significant market trends occurring in the different types of non-glass BIPV products, especially those employed in roofing systems of buildings. The report covers the use of BIPV glass and non-glass products in all the important end-user segments: green buildings, commercial, government, and multi-tenant and single-family residential buildings. This report also discusses BIPV markets by region as well as by country.



METHODOLOGY AND INFORMATION SOURCES

The information presented here is gathered from several sources. It has been derived from secondary sources including relevant company websites, technical literature, press articles, commercial and government databases, as well as information gleaned from technical conferences and trade shows.

The forecasting approach used in this report is explained in more detail in Chapter Four, but the basic approach is to 1) identify and quantify the underlying BIPV glass and non-glass application markets, and 2) assess the technological and market demands that affect the penetration rates in each sector. The eight-year forecasts project the market in both megawatt (MW) and dollar terms for BIPV products, with breakouts by end user, type of product and type of PV technology.



PLAN OF THIS REPORT

Chapter Two discusses the emerging market trend in non-glass BIPV products, and talks about how technology trends are changing the face of present-day BIPV glass products. This chapter also discusses the characteristics and market potential of non-glass BIPV roofing and wall systems.

This chapter also examines the impact of technology on the evolution of BIPV glass products. It describes how BIPV glass has progressed from its first-generation counterpart Building Attached PV (BAPV). It also takes a look at the potential of the current technologies to evolve further as well as their limitations. It emphasizes the need for better materials and technologies for the development of BIPV glass. This chapter points out future candidates of technologies such as thin films, dye-sensitized (DSC), and organic cells (OPV) for BIPV glass.

In Chapter Three we explore the critical markets for BIPV in terms of sectors as well as regions. Here we analyze the dynamics of the PV market and demands of the builders and architects. We also analyze how the market can and would respond to government incentives in terms of subsidies. Importance is given to sectors where BIPV glass and non-glass products are being sold – mainly residential and commercial buildings, however special attention is on “prestige buildings” where early revenues were generated.

We also analyze the BIPV markets worldwide by including regions like the U.S., Europe, Japan, and China and point out how cultural and climatic conditions and government policies influence actual demand for BIPV products.

In Chapter Four, we present the eight-year forecasts for BIPV markets categorized by the type of product, type of PV technology, and type of building. We have forecasted BIPV demands in terms of shipment volume, market revenues, and materials used. In this chapter, we discuss in detail the forecasting methodology and the source of information. Macroeconomics as well as regulatory and pricing assumptions are considered. We also discuss alternative scenarios for BIPV.



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Related Reports

- [BIPV Glass Markets-2014 & Beyond](#)
- [Building-Integrated Photovoltaics Markets - 2012](#)
- [BIPV Glass Markets -2012](#)
- [BIPV Wall Markets - 2012](#)
- [BIPV Roofing Markets - 2012](#)
- [Substrates and Encapsulation for BIPV](#)

Chapter One: Introduction

OPPORTUNITIES FOR BIPV

PV Market— From A Demand-Constrained To Supply-Led Environment

This year (2014), the Ardour Solar Energy Index kicked off with 8% and 17% gains in January and February, and continued to be in positive territory throughout the first quarter. This clearly suggests that the PV market has changed from being demand-constrained (characterized by oversupply and rapidly declining prices) to a supply-led one, leading to strong demand growth and price stabilization.

BIPV Market Seen As Promising

- Recent developments in BIPV, such as its capability to not only seamlessly blend into the most challenging environments but also generate significant green energy, have set up a good platform for its growth.
- Due to its low prices and higher efficiencies, crystalline silicon (c-Si) technology has been the major technology segment.
- Thin-film technology is grabbing the attention of market players owing to its flexible design and ease of integration in, for example, curtain wall BIPV and fabrics.
- Other, third-generation technologies such as OPV and DSC are still in the development phase and are improving their conversion efficiencies. For example, the efficiency of OPV has doubled in less than half a decade from 5% in 2007 to over 10% in 2013.



DEFINING BIPV

Building-Integrated Photovoltaics (BIPV) refers to a range of solutions pertaining to embedding solar energy generation into a range of building materials. BIPV can be incorporated into everyday structures such as homes, schools, offices, and hospitals.

BIPV

Glass system

Non-glass system

Windows

Atrium glass

Canopies

Pergolas

Building
façades

Curtain
walls

Roofing
systems

Wall-
attached
PVs

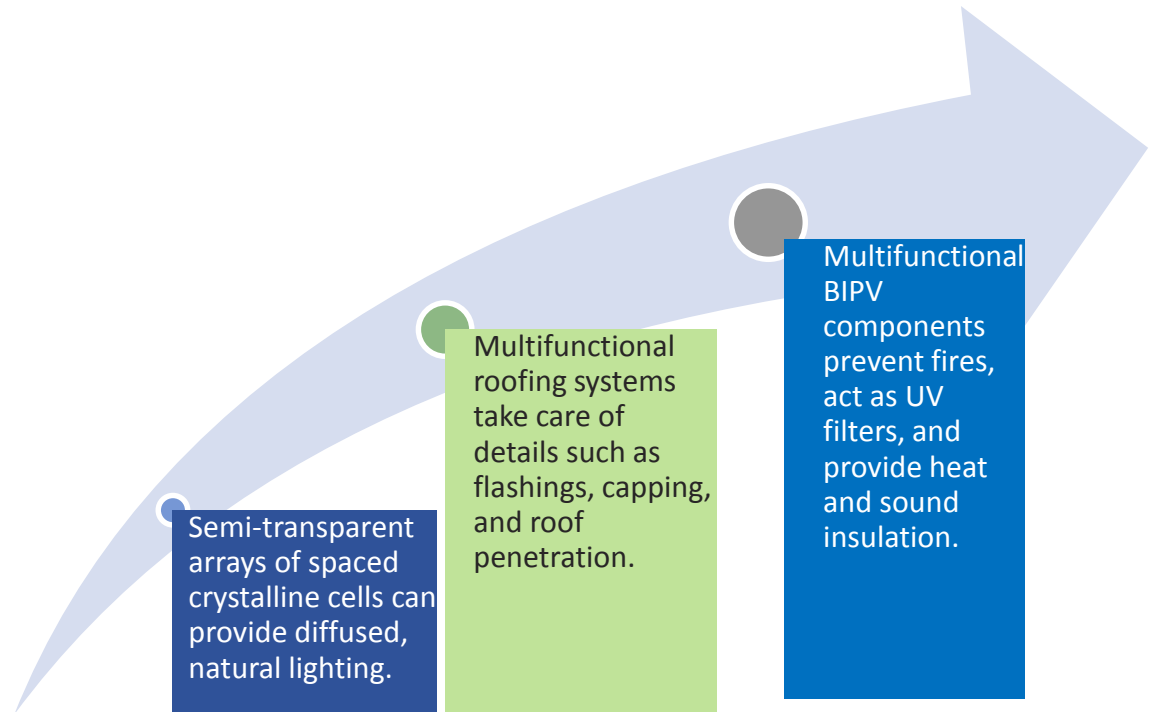
BIPV siding



INTRODUCTION OF MULTI-FUNCTIONAL BIPV

Multi-functional BIPV: Emerging Trends

- Multifunctional BIPV products are expected to be perceived as a better return on investment and justify the higher costs.
- BIPV systems are being designed to blend with traditional building materials and traditional design for a high-technology, future-oriented appearance.
- Onyx Solar's multi-functional BIPV products such as anti-skid PV floors and skylights that reduce thermal transference have made way into the markets.



SEARCH FOR NOVEL SOLUTIONS

Novel Solutions

New technologies with improved efficiencies and durability are being introduced.

Self-cleaning systems are being implemented.


Solutions have been sought out for BIPV elements to help reduce the cooling load and glare associated with large expanses of architectural glazing.

Given the current breakthroughs in cell designs such as PERC, metal wrap-through, perovskite, or smart wire connections are expected to increase the efficiency and consequently marketability of BIPV products.



SEARCH FOR NOVEL SOLUTIONS

Non-Glass BIPV Segment



HyET Solar has introduced a unique process for the production of flexible silicon thin-film solar cells based on a roll-to-roll process. These lightweight and unbreakable solar cells are ideal for integration into the building envelope as a roofing or façade element.

Rear ventilation technology which ensures high energy yields and appropriate ventilation behind the modules to dissipate heat has been developed by Incel.

Hollow glass BIPV products, with vacuum in between the outer and inner glasses, provide acoustic and heat insulation, filter UV and infrared radiations, and have more durable interiors, gaining better scope in the market.

A c-Si laser processing system that provides improved productivity and lowers processing costs in the volume production of PERC is expected to be available shortly by ROFIN-BAASEL Lasertech.



TRENDS IN THE EVOLUTION OF BIPV PRODUCTS

Trends in the Evolution of BIPV Products

New record efficiencies are reported every month, that too owing to the development of different technologies.

Companies are trying to reduce complexities in installation.

BIPV solutions are becoming more durable, unbreakable and flexible.
Aesthetics and transparency are constantly being improved.

Efforts are directed towards offering more energy per roof. Typically, companies are offering systems which perform in all light conditions and are shade tolerant.

Novel solutions to BIPV on the skin of the building with 30% to 40% BOS and installation cost savings.



EMERGING DEVELOPMENTS IN THE NON-GLASS BIPV SPACE

Less Complexity in Installations

Manufacturers are beginning to roll out fully integrated BIPV, as a result of which installation is expected to become simpler. For instance, Smartenergy Renewables has fabricated BIPV curtain walls quite similar to those made with common glass in terms of installation methods and technology, thus enabling a convenient installation process.

Availability of integrated roofing makes installation easier as it does not require mounting hardware, roof penetration, or additional wind load, and reduces the obstacles associated with installing BIPV systems. German firms Belectric Organic (PV division) and Deutsche Amphibolin-Werke (DAW) have formed a joint collaboration aimed at integrating BIPV with façade insulation coatings, which is expected to make PV easier, quicker, and less complicated to implement.

Standardization Expected to Ease Complexity of Installation

Complexity of BIPV installations also is expected to be reduced with the standardization of BIPV products. The trend of standardizing BIPV products has made headway into products such as roof tiles and notably roof shingles in the U.K. In Europe, the diversity in the designs of roof coverings posed a challenge to BIPV manufacturers who are now seeking to bring in standardization.



EMERGING DEVELOPMENTS IN THE NON-GLASS BIPV SPACE

Collaborations

New collaborations are taking place especially in Europe where universities and industry are teaming up to develop cost-effective novel solutions. Smartflex is one such project which aims to demonstrate how photovoltaic building elements can be designed individually and then manufactured on an industrial scale, all at the click of a button. Over the next three years, the partners plan to develop a technical solution that fulfils this aim.

Aesthetics of BIPV and its Improvements

The unique selling proposition of BIPV products is their aesthetic appeal, and manufacturers have constantly focused on providing not just efficient and multifunctional BIPV solutions but aesthetically appealing ones.

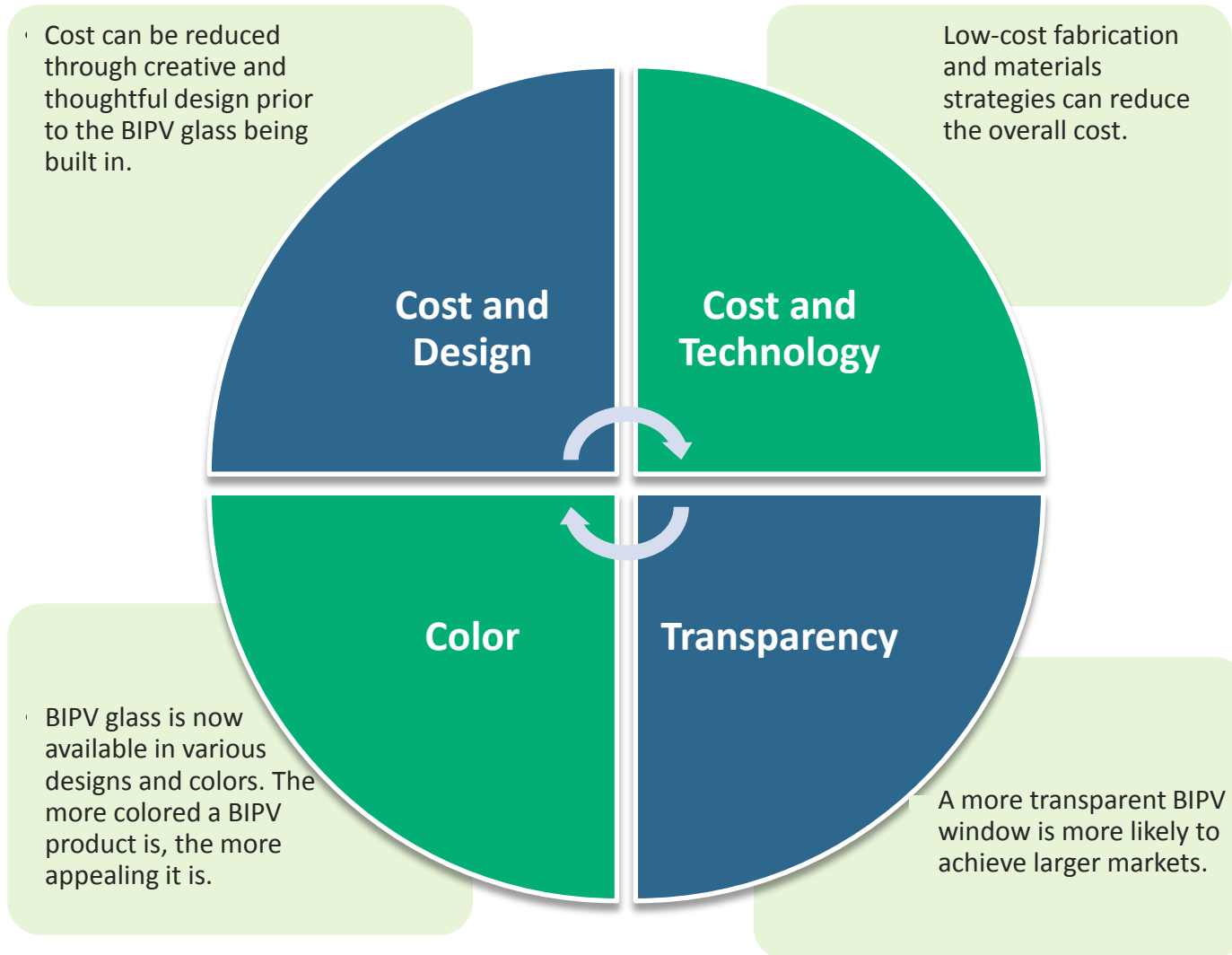
Firms such as Smartenergy Renewables fabricate BIPV products that can be curved to suit a building's aesthetic appeal. The cable and junction box are also hidden behind the curtain wall.

The increasing availability of frameless BIPV modules with uniform color and variety in form and structure ensures that architects enjoy the freedom to experiment with the architectural styles of buildings.

The BIPV components which are available with varying color and transparency to be let into roofs and walls, make it almost impossible for onlookers to discern the building's architecture from installed solar components.



TRENDS IN THE BIPV GLASS MARKETS



TRENDS IN THE BIPV GLASS MARKETS

Resurgence of CIGS Technology

The “survivors” in CIGS have now come up with new-generation CIGS technology that can effectively cut down production costs, allow mass production, and improve competitiveness in the solar PV market.

Cells jointly made by German high-tech equipment manufacturers Manz and ZSW with co-evaporation preparation technology have set a new record with a conversion efficiency up to 20.8%.

Abundant rare earth resources in China have further laid a solid foundation for the development of CIGS thin-film solar cells in China.

With its advantages of strong light absorption capacity, stable electricity generating performance, high conversion efficiency, low production cost, and short energy collecting cycle — plus the features of good flexibility, excellent light transmission quality, and wide applicability — CIGS thin-film solar cells can be widely applied to the BIPV.

Some of the challenges faced by CIGS technology include smaller active module surface and lower power performance compared to c-Si. The products are limited by a maximum power of 150W, and the prices are above those of c-Si in all regions. Hence technology has to address these challenges to be successful in the market.



TRENDS IN THE BIPV GLASS MARKETS

Flexible Solutions

When c-Si wafers are thinned below 100 microns, they become flexible like metal foil. The production of curved c-Si PV panels is an opportunity that can address markets in the construction of large curved vaults or curved windows on "showcase" buildings.

Better lamination: SABIC's Innovative plastics business is the first polycarbonate (PC) BIPV panels for roofing. The Lexan BIPV panels combine tough, lightweight, transparent Lexan Thermoclear PC sheet with flexible PV laminated crystalline cells.



TRENDS IN THE BIPV GLASS MARKETS

Cost & Design

BIPV glass buildings are custom designed. A creative and thoughtful design can help manufacturers reduce the cost. The Future Business Center, a new purpose-built business innovation center in Cambridge (U.K.) is an example of cost-cutting design of BIPV glass.

The cost per square meter of PV glazing is just marginally higher than the conventional glazing on the building. Polysolar, a local company, installed the Future Business Center's solar PV glass façade, a curtain wall in the stairwell using double-glazed amber-tinted PV glass, and an opaque rain screen cladding system to supplement the rooftop solar array.

Cost & Technology

Low-cost fabrication and materials strategies are the latest trends in BIPV market. Pilkington, for example, now has an alliance with Dyesol to create BIPV glass using DSC. Meanwhile, Heliatek, a German OPV firm, has signed a BIPV glass joint-development agreement with AGC Glass Europe.

These arrangements indicate that big glass firms are sufficiently interested in BIPV glass. Another implication is that solution-processed PV layers are being considered as a way to lower the cost of PV.



TRENDS IN THE BIPV GLASS MARKETS

Color

Availability of various designs and colors in BIPV glass makes it more appealing to the customers. SwissInso has formed a joint venture with Acomet Solar to offer colored solar panels that can be aesthetically appealing. As an example, colorful BIPV glass panels have been installed at the Geneva Airport.

Transparency

No BIPV glass can be completely transparent, since it must absorb light to function as a PV panel. However, a BIPV product that is more transparent is more likely to penetrate new and large markets. While transparent panels are more acceptable to the user, they are also more expensive.

Transparency can be achieved by following the means:

PV cells are made so thin or laser grooved that it becomes possible to see through.

Crystalline solar cells on the laminate are so spaced that light filters through the PV module and illuminates the room.



BIPV FUTURE SCENARIOS

BIPV Struggling

- BIPV limited to prestige buildings
- BIPV products still expensive
- Crystalline technologies dominate
- Reliability issues continue

BIPV as a Success

- CIGS taking increased share in technology
- BIPV products penetrating residential buildings and commercial buildings
- Multifunctional products penetrate the market faster
- Flexible and rigid BIPV products dominate
- DSC/OPV technologies increase market share
- Cost reduction strategies successful
- Increased efficiency levels

We believe that BIPV will succeed well and achieve higher growth. New technologies and cost reduction strategies would help BIPV products to penetrate end-user segments aggressively in the future.

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