

How building integration can save PV: the business case

Lawrence D. Gasman, Principal Analyst, NanoMarkets LC, Glen Allen, Virginia, USA

ABSTRACT

Recent industry analysis from NanoMarkets has suggested that although current business cases for PV are running out of steam, the building-integrated PV (BIPV) sector may be able to revive PV's fortunes. The arrival of 'true' BIPV – not just flush-mounted BIPV panels, but PV-enabled glass, tiles, siding, etc. – renders possible new business cases that would otherwise simply not be an option with conventional PV. This paper puts forth a business analysis of the BIPV industry, providing case studies and data on the burgeoning sector.

In its earliest days, the business case for building-installed PV was typically concerned with off-grid applications. While this was mostly based either on purely environmental or survivalist grounds, there were also some PV buildings that were located too far away from the grid and were therefore *inherently* off-grid. The business case for installing PV in buildings at that time was essentially that there were enough people who, for what were essentially ideological reasons, wanted to live off the grid, thus making it profitable to supply them with solar panels.

But the number of people likely to ever live off-grid (for whatever reason) will most likely always be low. One reason for this is that the addressable markets for PV in the off-grid era were so small that making the decision to live off the grid would be considered quite eccentric. As a result, it can be assumed that there is a cultural factor at play in the determination of size and amounts of addressable markets. In addition, during PV's off-the-grid era, it was just about impossible to make any kind of purely economic case for deploying PV, with the exception of remote areas. PV users were essentially paying the full cost of PV in order to satisfy subjective needs. Taking into account the cultural factor, it is likely that only a relatively small proportion

of the population was ever intending to take this road less travelled, and even then, only in certain geographical regions. Even today, PV insiders do not tend to refer to those living off the grid, partly a result of a strong association that has grown between PV and on-grid developments.

With the advent of on-grid PV came a sudden need for a new kind of business case for PV. The term 'on-grid PV' refers to buildings that use PV to supplement electricity accessed and bought from the grid. More recently, this term has come to include arrangements whereby buildings that produce energy using PV have the option of selling this back to the local utility.

In this new era, it has become much easier to cost justify PV, although this now has to be done with respect to subsidies and feed-in tariffs. As returns on investment (ROI) have now become real possibilities, the ideological/subjective aspect of the PV business case has become somewhat less vital to the overall PV consideration. However, PV firms are also finding themselves having to deal with a broader set of issues in their communication with potential customers, ranging from energy efficiency as a social good, to the environmental friendliness of the solar panels themselves, to the positive impact that a switch to PV would mean from a climate change perspective.

These issues have been among the staples of the business cases made by PV firms in the past five to seven years (at least). However, we think that this kind of approach has inherent limits, and that these limits, as outlined below, may soon be reached.

- The community for whom environmental issues are a prime determinant in their energy purchasing decisions remains a relatively small segment of the population, especially when this issue is considered on a global basis. Consequently, the market for PV technology as it is now addressed may not be that large to begin with. It should also be noted that at this point in time, the 'environmentally conscious' community is already reasonably well informed about what PV has to offer. This suggests that quite soon it will become harder to find first-time buyers for PV. Although potential PV users among the environmentally conscious community have not yet bought PV in the past, it is becoming less and less likely that this is because they don't 'get' what PV is all about.
- There are reasons to suspect that the environmentally conscious community may contract or have its growth significantly curtailed in the next few years, at least compared to what might once have been expected. The generally poor world economy and the weak state of the construction industry in particular – situations that are likely to persist for some time – suggest to us that people in many developed parts of the world will place immediate economic considerations over long-term environmental considerations. Moreover, the intellectual setbacks that the climate change movement has suffered in the past year will only reinforce this trend.

For these reasons, PV will soon be in search of a new business case. We believe that the arrival of BIPV provides that business case both through the medium of improved aesthetics and a radically altered economic justification for BIPV. At the most basic level, BIPV has a very

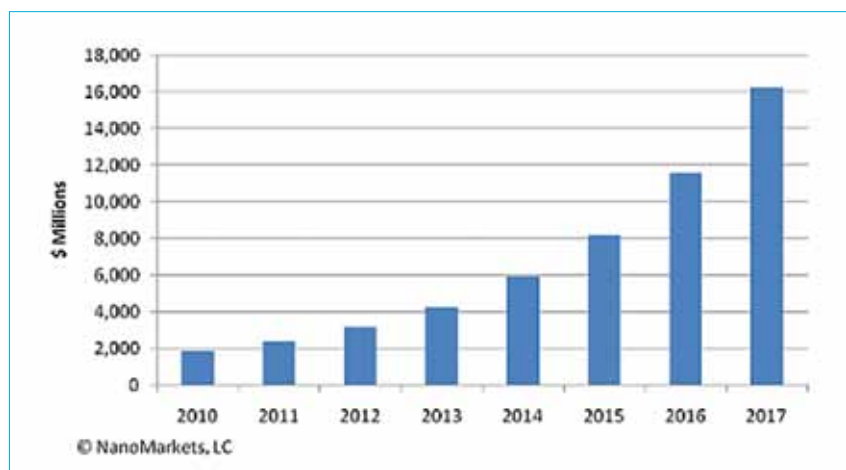


Figure 1. Estimated BIPV shipments to 2017 (NanoMarkets).

different 'look and feel' from conventional PV: while conventional PV is made up of panels that vary primarily only by size and efficiency, BIPV consists of many different products, each with its own advantages, disadvantages and challenges, as outlined in Table 1.

Aesthetics added

By “disguising” PV as building materials, BIPV adds to the PV case by (1) potentially eliminating ugly rack-based PV systems that actually put off potential users from deploying PV, and (2) essentially adding new kinds of building products to the mix that may be considered to have their own special kinds of aesthetics. For example, PV roofing tiles may actually look different from regular tiles or may be considered to have different aesthetics precisely because they include PV.

In any case, what BIPV seems to be able to add to the subjective component of the PV case is a route – through a new PV aesthetics – to extend the addressable market for PV beyond the ideological market that PV now frequently addresses. Aesthetics also creates an opportunity for BIPV product makers to differentiate themselves in the market in a manner that is not available to manufacturers of regular PV panels. For firms in developed countries that have watched the manufacturing of PV panels shift to China, this will come as welcome news.

ROI and BIPV

In the off-grid market era, the economic part of a business case was usually either non-existent or did not need to be made. As outlined previously, the subjective

ideological factor was so paramount that ROI arguments simply did not need to be considered in the buying decision for PV. In some cases, buildings were off the grid because their locations were so remote as to render them too expensive to be hooked up to an electricity source.

The new on-grid PV market was created by a series of subsidies that varies from place to place and includes both direct subsidies of capital expenditures (e.g. tax credits) and feed-in tariffs that are often highly favourable to the PV-based generator. An extensive subsidy regime was largely responsible for expanding the market from just hardcore ideological enthusiasts for PV to (at least) the environmentally concerned.

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The question of whether or not there is a good ROI argument for PV has not been completely settled, but at least with the subsidies in place some aspect of the cost is offset. There are, however, some real questions about how far the ROI argument can be stretched.

Business plans for PV that today rely heavily on ROI tend to throw manufacturers of regular PV back to competing on price; so many of the factors that are taken into account for the ROI calculation are beyond the control of the panel makers themselves, with subsidies

being set by governments, for example. Once a PV firm has made its choices with regard to core materials and the manufacturing processes that it intends to use, it is hard for them to differentiate themselves from other firms that have made similar choices. While they can implement some minor differences in terms of lifetimes, efficiency and reliability, these will be minimal. Reliability can also be affected by the issuing of warranties and guarantees to customers.

However, once BIPV is brought into the picture, things begin to change. BIPV enables a completely different cost model for PV, while the PV business case changes dramatically. With BIPV (and BIPV alone), the costs can be allocated between the PV functionality and the building material. This allocation process can be largely under the control of the BIPV product maker, since product design will determine how much of the product is made up of the PV panel, and how much comprises cladding or roofing material.

In addition, the advent of BIPV completely changes the ROI equation itself, since some of the costs must/can be allocated to the building materials. Depending on the approach taken in this cost allocation, radical reductions in the cost of the PV can be achieved, making the ROI case for PV much more of a sure thing.

BIPV: opening up new marketing channels

NanoMarkets believes that the case for BIPV is strengthened by the fact that it will open up existing building and electrical product supply chains to PV to a much greater extent than is currently

Type of PV	Main Markets	Advantages	Issues
Flush-mounted panels	Buildings looking for an easy way to improved aesthetics. First-generation BIPV	The primary reason for the existence of flush-mounted panels is aesthetics	Can be expensive compared with traditional PV, although costs have come down
Glass	Non-window glass in larger commercial and prestige residential buildings	Suitable for wall space in tall buildings where roof space is limited	Typically associated with large projects. Unpredictable market, but high value individual projects
Flexible BIPV laminates	Laminates that are applied to building surfaces	Designed to look better than conventional panels. They offer value propositions – and opportunities – that derive from their light weight, ease of installation and versatility	Do not substitute for – or produce any savings from – conventional building materials
Fully-integrated flexible BIPV products	Products like flexible roofing shingles and PV-integrated metal roofing	Good and controllable aesthetics and the ability to allocate costs between categories of PV power generation and architecture with considerable discretion	Many technical challenges including actually installing roofing and siding
Rigid fully-integrated BIPV	Probably some of the earliest markets for fully-integrated BIPV	Good and controllable aesthetics and the ability to allocate costs between categories of PV power generation and architecture with considerable discretion	Sometime have relatively low efficiencies; can be difficult to develop viable commercial products

Table 1. BIPV types, advantages and challenges.

the case. But while this means more competition for the dealers/integrators that have been at the centre of the PV business since its inception in the 1970s, it also seems likely that their business will be strengthened in other ways.

BIPV providers have the opportunity to sell through building and electrical product marketing channels as well as through PV marketing channels. This already happens to some degree (conventional PV products are sold in *Home Depot*, for example), but once true BIPV products are established, it should become much easier to make the case for selling PV through building-industry supply chains.

While this means traditional PV retailers and wholesalers will have more competition, it has the potential to strengthen the businesses of the local PV dealers and installers if they play their cards right. BIPV installations are inherently more complex than conventional PV installations and can prove more difficult for residential and small businesses to install themselves; this may result in local installers seeing an expansion in their installation businesses as the result of BIPV, while the product manufacturers may become more reliant on local dealers/installers to carry through their strategies. However, small local PV firms are likely to require substantial training before they can successfully install what are, in effect, roofs and siding.

The existing wholesale infrastructure for PV is likely to take on BIPV products along with existing conventional PV products. Indeed, NanoMarkets believes that business plans of wholesalers will be enhanced somewhat by these high value-added products and, as a result, BIPV product makers can expect wholesalers to be open to taking BIPV products under their wing.

BIPV and the realities of real estate

BIPV is shifting the PV industry away from one that is entirely focused on energy issues to one that is much more closely aligned with the building industry and all parts of its related supply chains. This means that BIPV business cases must also be different from conventional PV business cases in order to reflect this change.

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BIPV business cases must reflect the current realities of the construction and real estate businesses in various parts of the world. For the most part, these are not attractive realities. Either real estate

markets have collapsed and are (at best) recovering very slowly – a theory that is in fact true in the U.S. and Europe, for example – or there are founded worries that a currently expanding construction market will soon bottom out and may actually represent a bubble that is about to burst – some would say that China is an example of such a market.

How can BIPV firms usefully build all of this into their business cases? It is hard to overlook the fact that the worldwide construction and real estate industries deemed to be “addressable markets” are not necessarily good places to be. Nonetheless, the BIPV business case can be designed in such a way that it can be made appealing even in the context of today’s sad state of affairs in the real estate market. Specifically, BIPV presents an opportunity to add features and value that can increase the marketability of a building built on spec. For buildings that are built to customer design, the ability of a construction firm to be able to effectively include BIPV features may give that construction firm an edge over other construction firms.

A summing up

BIPV radically changes the business case for PV. Table 2 shows how BIPV can transform the strategic focus in the PV space. Along the subjective dimension, BIPV can help expand the market by taking PV to a new

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	Subjective aspect of PV case	Objective/ROI aspect of PV case	Ability of PV panel manufacturers to differentiate in the market
Off-grid era	Primarily marketing to “hard core” environmentalists and survivalists – intrinsically small market	Not usually made, except for remote locations and then ROI advantage is usually established	Early stage market, where differentiation may not be the primary concern compared to market development
On-grid era	Subsidies broaden market to a much larger market; the “environmentally concerned”. The size/growth of this market is challenged by current global economic problems	ROI cases are heavily dependent on subsidies and are sometimes questionable with regard to validity. Most of the factors that make up ROI cases are beyond (or almost beyond) the control of the PV panel maker – one exception is the price of the panel	Tendency towards commoditization. This is good for very high volume suppliers, but bad for just about everyone else.
BIPV era	Adds aesthetics into the mix and broadens the market even further by eliminating the negative aesthetics associated with regular BIPV and creating a “new aesthetics based on PV”	Fundamentally changes the PV market ROI argument and cost model as a substantial amount of the cost of the panel can be allocated as a building material	BIPV radically increases the ability to differentiate products in the market through aesthetics and multiple cost allocations. Many ways for PV firms to differentiate themselves for the first time

Table 2. Summary of PV business case evolution.

market, one that is primarily concerned with aesthetics. Along the objective dimension, by allocating some of the costs of the panel to building materials, BIPV can change the ROI argument for PV and make it a lot stronger. BIPV also opens up entirely new ways of product differentiation in the marketplace, and effectively presents an impressive new business case.

We believe that the business case for BIPV has a very wide applicability, but the fact that BIPV is about building (by definition) means that there will be important variations from one location to another. BIPV will surely see the greatest adoption rates where conventional PV is already strong, most likely in the regions of Japan, Germany and California. We believe also that future expansion in PV markets is likely to occur where governments remain benevolent towards PV and where energy costs are high, which would include some states in the northeast of the U.S.

The importance and nature of building aesthetics varies considerably from nation to nation, so BIPV may be deployed in Japan, for example, in a way that reflects local tastes and somewhat differently in Chile to reflect aesthetic tastes there. Beyond this, however, BIPV business cases can best be made where aesthetics is a particularly important factor in the construction industry as a whole. This would include affluent communities, of course, but also (at an international level) countries where prestige buildings of various kinds are under construction, for example China, India, smaller Asian nations and some wealthy Arab states.

These variations aside, NanoMarkets believes that BIPV has the potential to be a major money spinner. We think that it could generate US\$11.5 billion in revenues worldwide by 2016 – a figure that should, of course, be thought of as the potential that can be achieved if the right business cases are made for this exciting new technology.

About the Author

Lawrence Gasman is the principal analyst for NanoMarkets, a market research and consultancy firm based in Glen Allen, VA. He has almost 30 years’ experience of analyzing the commercialization potential of complex technologies for a number of high-profile and start-up technology clients and investment firms. His current research focuses on printable, organic, and thin-film electronics, including photovoltaics applications.

Enquiries

NanoMarkets, LC
PO Box 3840
Glen Allen
VA 23058
USA
Email: lawrence@nanomarkets.net
Tel: +1 804 360 2967
Fax: +1 804 360 7259