

What the Solar Power Industry Can Learn from Google and Salesforce.com

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Introduction

It looks like the time has come for the solar power industry. Global warming, concerns about energy security and generous subsidy programs for photovoltaics in Japan, Germany and now California have combined to fuel 44% annual growth rate for the last 5 years (PV News). Forecasts for the future are rosy as well. One example – the U.S. Photovoltaic Industry Roadmap, published by the Solar Energy Industry Association, envisions that the industry will grow from 340 megawatts of capacity capable of generating 650 million kilowatt-hours of electricity in 2005 to 200,000 megawatts of capacity capable of generating 380 billion kilowatt-hours of electricity in 2030, a 58,000% increase!

Given the industry's recent performance, upbeat outlook, and the enormous investment going into creating new technologies to lower the cost of solar power equipment to make it more competitive with conventional electricity generation, it might seem that the future of solar power is well assured. However, history demonstrates that even hypergrowth industries are subject to ups and downs and concurrent shifts in market share as some market players successfully navigate challenging times. The Semiconductor industry is a great example. Despite growing by 30,000% over the last forty-five years, the industry suffered several painful downturns including six separate years when revenues actually shrank. Furthermore, many of former market leaders are no also-rans or out of the market altogether. While we are very bullish on the long-term prospects for the solar power industry, we also believe that the industry will face challenges – challenges which left unaddressed have the potential to lead to slowdowns or even downturns and tectonic shifts in market dynamics.

This paper addresses the fundamental challenge the photovoltaics industry faces – achieving widespread, mainstream adoption. Unlike all other conventional and alternative electricity generation technologies whose scale and economics lead them to be sold to and operated by utilities, photovoltaics are most economical when purchased by smaller electricity purchasers who pay the highest rates. The net result is that for the industry to reach its potential, it will need to sell its equipment to tens of millions of individual home and business owners.

Today, with less than a fraction of 1% of US electricity generated by solar power, the solar power industry is selling to only a tiny group of early adopters. It is in the transition from serving a few thousand technology-loving, risk-tolerant early adopters to serving tens of millions of mainstream buyers where we see a challenge... and an opportunity. It is a challenge because unless the solar power industry prepares itself to meet the needs of the mainstream, needs that are very different than those of the early adopters, it will face a slowdown and challenging shake-out as it struggles to adapt to the needs of the new mass market. It is an opportunity because those that successfully navigate the transition will grow market share and help grow the market as a whole grow even faster than anticipated.

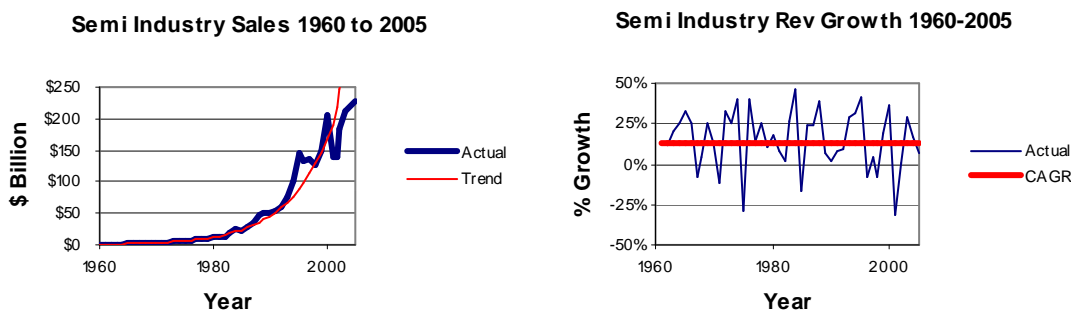
So why is Google relevant here? Google is a prime illustration of what Topline Strategy considers a "**Short Fuse**" technology, that is a technology that has a shorter early adopter period and achieves widespread mainstream adoption far faster than traditionally thought possible. When mainstream buyers consider the cost-benefit of a new technology, they consider far more than just its price – they see hidden costs and potential risks and build them into their purchase decision. Short Fuse technology solutions are ones whose developers anticipate these costs and risks and design them out right from the start. By doing so, they attract mainstream buyers far sooner than solutions created and deployed under the **Long Fuse** paradigm of slowly building credibility with the earliest adopters before bridging product and marketing efforts to the mainstream. Google's AdSense solution did exactly that for online advertising and rapidly brought millions of new customers into the market – customers for whom the favorable economics of Internet advertising alone was not enough.

For the solar power industry, the implication is that driving down the per-watt cost of a photovoltaic system is necessary but not sufficient to achieve mainstream status. Our goal for

this paper is to kick off the discussion about what the industry needs to do beyond just lowering the \$/watt of photovoltaic materials to accelerate its adoption by the mainstream.

The Ups and Downs of Hypergrowth Industries

Despite strong growth trends, the solar power industry cannot be complacent. History shows that the growth of similarly capital-intensive markets is not always uniform, but rather it occurs in fits and starts. For the unabashedly enthusiastic, it is important to remember that a capital-intensive industry that grows only 10% when it is expanding capacity to serve 50% growth will face tough challenges.



Source: Semiconductor Industry Association

Here, the history of the Semiconductor industry illustrates this challenge. Between 1960 and 2005, semiconductor industry revenues grew by over 30,000%. However, that period of astronomical growth was not without several slumps including six separate years in which revenues actually shrank and nine more years where growth was only in the single digits. The fast-growth spurts were frequently interrupted by periods of slow growth or retreat, influenced both by supply and manufacturing capacity constraints and by the rate at which customers adopted the new technologies that use semiconductors such as personal computers and cell phones.

The drivers of market slowdowns will be different for photovoltaics than they were for semiconductors, but the patterns are already emerging. Over the last 18 months, a shortage in silicon feedstock has threatened supplies, growth in Germany has slowed dramatically as subsidies have fallen faster than prices, and we contend that the current spate of challenges the industry faces will pale in comparison to the inevitable challenge the industry faces -- attracting 25 million U.S. customers.

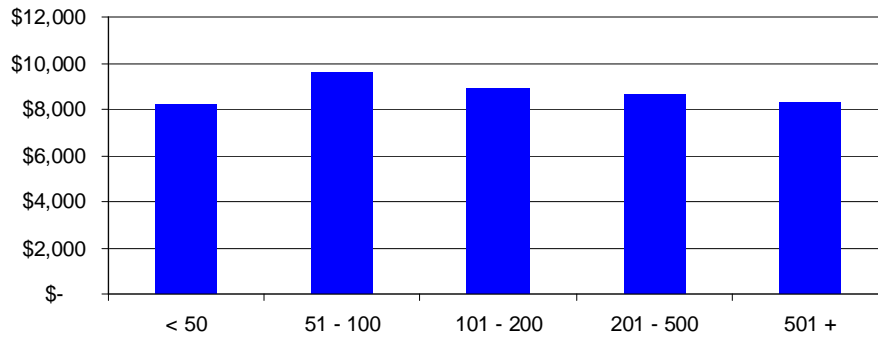
Twenty Five Million Solar Rooftops

In 1994, Japan, with worldwide leadership in semiconductors and electronics and a near-complete dependence on foreign energy sources, launched a photovoltaics market subsidy program called "70,000 Solar Roofs". In 1998, Germany launched a similar program called "100,000 Solar Roofs". In 2006, California passed its own 10-year, \$3.3 billion solar subsidy called the "Million Solar Roofs" program. Though we support and applaud California's ambitious plans, one million solar roofs is just 4% of the 25 million solar roofs that will be required if the industry is to reach the Solar Energy Industry Association's forecast of 200 Gigawatts of generating capacity by 2030.

One of the unique aspects of solar electricity is that is most attractive to the smallest electricity users and not major industrial users and commercial power producers. For all other electricity generation technologies, both conventional and alternative, economies of scale make it more cost-effective for a large utility to buy and operate the equipment and then distribute electricity to end-users over the electrical grid. We all know that coal and gas-fired power plants, hydroelectric dams, and nuclear reactors are not now, nor will they ever likely to be mainstream purchases. All evidence points to similar economies of scale for solar thermal concentrators with their acres of sun-tracking reflective troughs and for wind turbines, which are typically located in remote areas and expensive to connect to the grid, therefore make it far more economical to build large wind farms.

In striking contrast, photovoltaics offer very few economies of scale. As the data from the California Energy Commission show, the cost of solar power systems remains relatively the same regardless of whether the purchaser installs just a few kilowatts or several megawatts. This is because the basic unit of solar power is a single photovoltaic module, which typically generates 180 to 230 watts of power and takes up approximately 13 to 15 square feet. As the CEC data show, installations with 5,000 modules are not much more cost-effective than ones with 50 modules. The economies of scale that do exist are mostly driven by transaction costs, not the core technology.

Average Cost of PV Installations in California
\$/KW of Peak Capacity Installed



Source: California Energy Commission

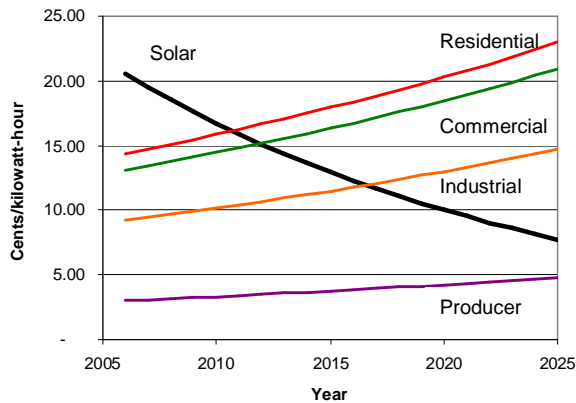
In contrast, there is enormous leverage associated with buying electricity, as large customers of electricity buy at significantly lower rates. On average, utilities pay power producers under \$.03 per kilowatt-hour. Major industrial customers such as aluminum smelters typically locate their operations near hydroelectric dams, which can provide ample low cost power at a fraction of commercial and residential customers pay. And even large commercial customers are able to negotiate far lower rates than smaller businesses and homeowners.

Buyer	Avg Price \$/KW	% of Highest Price	Share of Electricity Usage
Residential	9.40	100%	37%
Commercial	8.70	92%	35%
Industrial	5.60	59%	28%
Commercial Utility	<3.00	<32%	NA

Source: US Department of Energy

Even in the best case today, solar power still requires substantial subsidies. However, because the cost of solar power is relatively flat regardless of the size of the installation, it is those people who pay the most for their electricity - small customers - for whom it is the most economically viable. As the charts below demonstrates, these customers are the ones who require the least amount of subsidies today and are the ones for whom solar will first reach the breakeven point – the point where it becomes economical without subsidies.

PV Break-even Analysis



Customer	Breakeven Year	Subsidies to Breakeven (\$B)
Residential	2015	3.7
Commercial	2016	4.8
Industrial	2021	12.0
Producer	NA	NA

Source: *Topline Strategy Analysis*

Therefore, to achieve success, the PV industry will need to focus on serving the 109 million U.S. households and 25 million businesses that make up those categories. Given that the average U.S. household uses just 10,000 kilowatt-hours of electricity per year (~\$75 per month) and 50% of all businesses use only 7,800 kilowatt-hours per year, for the solar power industry to meet the objective of generating 382 billion kilowatt-hours in 2030, twenty to thirty million homes and businesses must purchase and install photovoltaic systems.

Some, in the face of this seemingly considerable challenge, might suggest re-visiting the idea of first targeting just the largest commercial and industrial power users, but as previously noted, the handful of very large corporations that make up the largest power users negotiate favorable electricity rates from their existing utilities, making solar less economical for them and making them not only unlikely to be early adopters, but more likely to be the last adopters.

Barriers to Mainstream Adoption

So what does the industry need to do to attract 25 million buyers? In 2005, solar electricity accounted for far less than 0.1% of Northern California's Pacific Gas & Electric's retail electricity sales. According the California Public Utilities Commission, as of August 2006, there are roughly 21,000 photovoltaic installations in California, a state with 36 million residents, 11 million households, and over 825,000 private non-farm establishments (U.S Census, 2006). In light of this impressive but ultimately small market penetration, we think it can be safely said that those who have purchased solar power systems are the earliest of adopters.

As with most technologies, the earliest adopters are the visionaries, the true believers in the technology – they understand the technology's economic promise and its potential to transform the market. While they still seek some return on their investment, they are also optimists – they believe the technology will work as expected and deliver the promised benefits. They overlook the rough edges and potential challenges of being among the first and jump into the market early.

In contrast, the mainstream buyers are pragmatists. When they weigh the costs and benefits of solar power, they anticipate hidden costs and potential risks and place a great weight on them when making their purchase decision and as a result are far slower to adopt.

Despite considerable market success, formal market research conducted by Sunlight Electric and the company's five years of experience selling solar power systems to residential and commercial accounts suggests ample evidence of slow uptake from mainstream buyers today, due to what we consider are five critical factors.

1. Lack of Confidence in “Solar Power” Technology

The solar power industry, especially in California, still lives with legacy of failure of “solar power” that stems from the solar hot water boom that started in the 1979 when President Carter instituted the first federal solar tax credit and ended when President Reagan allowed those tax credits to expire. The expiration of the tax credits in 1986 effectively snuffed out the industry. With the installers and manufacturers all but gone, customers had few options to turn to when their solar hot water system failed – something that happened way too often as the emergence of a market for relatively low-tech products attracted unsophisticated and unreliable manufacturers. As a result, many consumers lump all solar power into the same ‘unreliable’ bucket. Even when the differences between solar hot water and photovoltaics are made clear, there is still considerable skepticism about the efficacy of the technology itself, the degree to which it requires maintenance, and the extent of its service life.

2. Large Initial Investment

Once resolved about the efficacy of PV technology, prospective customers grapple with the idea of paying for 30 years worth of power in one up-front investment. A four kilowatt system, about the typical size for a residential system, requires an initial investment of over \$25,000. Next to a home purchase or remodel, a car purchase, or a college education, a PV system represents the largest single consumer purchase many homeowners may ever make, making the cost of “getting it wrong” quite high. The initial investment for even the smallest businesses is even higher. While government subsidies pick up a higher percentage of the initial cost of a commercial system, the remaining out-of-pocket expense is nonetheless considerable. Exacerbating the size of the initial investment are two additional factors.

- Most buyers must secure their own financing, costing them considerable time to research and apply for loans. Due the scale of the typical vendor of small PV systems (with installations ranging from a few kilowatts to a few hundred kilowatts), these providers do not have the financial wherewithal to provide their own direct financing, nor do they have the type of tight relationships that other retailers have, such as car retailers and independent finance companies. And also unlike car retailers who can provide financing from auto manufacturers, PV system vendors receive no such support from PV equipment manufacturers. The net result is that the best a PV retailer can do is broker a transaction, offering little more benefit to the customer than if he or she were to contact their own bank and shop mortgage or loan sources.
- There is virtually no secondary market for solar equipment, meaning a purchaser has no chance to recoup even a portion of their investment later. With no easy gauge for a potential buyer of used equipment to measure the state of decay in performance and non-transferable warranties, it is not surprising that there is little interest in buying used panels – as evidenced by the fact that on the date of publication of this paper, there were just 4 used PV panels for sale on eBay. The maturity of the industry is partly to blame for the lack of a secondary market, but so are the warranty policies of the major manufacturers, which warrant the products only to the first purchaser.

3. Lack of Standards and Best Practices

Imagine that when going out to purchase your first car, you learned that every manufacturer calculated horsepower differently, and that two cars with the same rating might have a difference of nearly 50%. And since the car came unassembled, you would have to hire a mechanic to put it together, knowing that if it was done wrong, it could be unsafe. And if that wasn't bad enough, now imagine that mechanics were notorious for not answering questions or returning phone calls. If this feels like a scary proposition, now you're starting to understand what the purchase is like for many of today's PV customers.

The chart below illustrates the differences between the manufacturers' ratings and the actual electricity production for five popular modules. The only way to learn the actual production so as to accurately compare them is to go to the California Energy Commission's website since information about product performance using independent standards is rarely included on the manufacturers' specification sheet. But those data are just part of the picture, as the size and efficiency of modules (the amount of electricity generated per square foot) varies dramatically. Thus to make a fully-informed decision, a buyer should consider production under standard test conditions, the size of the module, its efficiency, and its cost and then evaluate it against the space constraints. A similar amount of knowledge about roofing practices and materials is required to evaluate whether an installer will adequately secure the PV system to the roof. While there are plenty of exceptions, small electricians and contractors do not generally have a good reputation for marketing and facilitating customer education, placing a considerable burden on prospective customers to research products, methods, and vendors.

Large PV Module Comparison

Manufacturer	SunPower	Sharp	Sanyo	SunTech	BP
Model Number	SPR-210	ND-208-U1	HIT-200BA3	STP180S	SX170B
Nameplate rating (watts)	210	208	200	180	170
CEC/PTC Rating (watts)	190.9	183.3	188.7	159.1	150.7
Square Footage	13.4	17.5	12.7	13.8	14.2
CEC Watts/Sq. Ft.	14.3	10.4	14.9	11.6	10.6

4. Concerns about Impact on Property Values

On top of the initial investment, buyers are concerned about the impact of solar power on property values. Solar power equipment can continue to produce power for 40 to 50 years, far longer than most property owner expect to hold their property. As a result of the long service life and the limited awareness today of the benefits of a PV system, potential PV buyers are justified in being concerned about whether future prospective property buyers will consider a PV system on the roof as an asset or a liability from an aesthetic standpoint. Though the National Appraisal Institute (Appraisal Journal — Oct. 1999) suggests that home values increases \$20 for every \$1 reduction in annual utility bills, this certainly does not take into account whether or not prospective buyers want to buy a home with a roof covered with PV modules, whether tastefully designed or not.



Residential PV Installations

Aesthetics are a major concern for many potential buyers of solar equipment. As one customer considering solar panels remarked, "I don't want my house to look like the International Space Station."

5. Lack of an Effective Channel to Serve Small Accounts

It would seem that many of the barriers cited in the points above would be addressed if there were a channel that could effectively serve small accounts. A channel with a reputation for quality that could sell starter systems as small as a kilowatt would reduce the initial investment, mitigate property value risks (since the initial investment and footprint would be small), and could introduce their own standards and best practices.

Yet today, the market seems to be moving in the opposite direction, as market players seem to have figured out that there are a fair amount of fixed costs associated with selling and installing solar equipment. The costs of generating leads, qualifying prospects, educating customers, designing an installation, filing rebate paperwork, handling inspections, etc. are largely the same regardless of system size. The net result of these high fixed costs combined solar economics and market pressures make it difficult to charge more than \$9,000 per kilowatt is that this market is largely served by less professional, less sophisticated family contractors. While there are plenty of them to sell and install small PV systems, they often do so by putting much of the burden on the buyer, something that not well tolerated by mainstream buyers.

Accelerating Technology Adoption

Under the classic model of technology adoption, the key to getting mainstream buyers to enter the market is to provide proof of the technology's value by demonstrating success with visionaries. Once the mainstream buyers see the value the visionaries received first-hand, they put aside their concerns and enter the market.

Embedded in this model is the belief that the way to convince the mainstream buyer to purchase is to raise the perceived value of the technology by raising awareness and elevating the importance of the benefits ("what it can do for you", or the *return* on investment) rather than addressing the costs ("what it will take to achieve those benefits", or the *size of the investment itself* in both hard and soft costs).

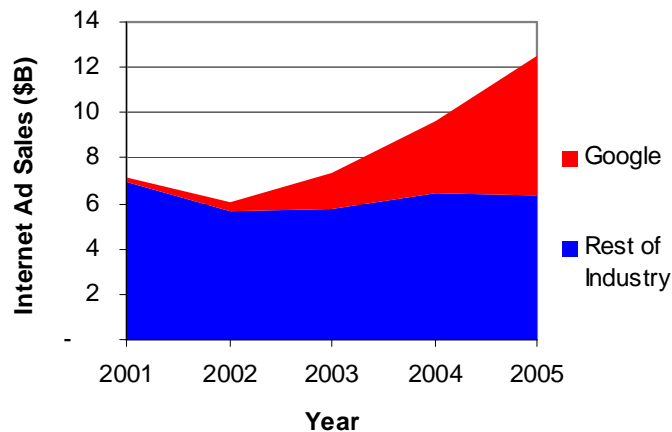
In the solar power industry that belief structure would roughly translate into "Once we demonstrate that it is absolutely less expensive to install solar panels than buying electricity off the grid, customers will not worry about tying up capital or borrowing power, the impact on their

property values, or the potential higher operating costs.” In this light, we can see that though the classic technology adoption has been effective in many markets, it often takes a long time to shift the perception of the relationship between benefits and costs. At Topline Strategy, we refer to technologies that take a long time to make this transition as “**long fuse**” technologies.

Over the last several years, an alternative path than that of long fuse technologies has emerged. Rather than the “long fuse” of time required passing through the early adopter phase and entering the mainstream, companies are accelerating adoption by simply removing objections instead taking considerable time and effort to overcome them. By tearing down the barriers and lowering the risks, companies employing this “**short fuse**” approach make it easy for the mainstream to enter the market far sooner than they ever would under the classic model.

Google is a textbook case of a company that has done this successfully in online advertising. Prior to Google, the pace of adoption of online advertising suggested this was, despite rapid growth, going to be a long fuse technology. Internet advertisers, mostly large traditional advertisers such as automobile companies, movie studios, and consumer products companies, deployed only very small amounts of their total ad budgets to place online banner ads on a cost-per-impression basis. Banner advertising paid for on a cost-per-impression basis requires a designer and media planner and therefore requires customers to work with advertising agencies and aggregators. Because of the costs of working with these service providers, entry costs were prohibitive, making it difficult for small advertisers to try online advertising without a big commitment, indicating a long fuse to burn before mainstream adoption (by millions of small business owners). Google changed the equation by making it simple for small advertisers to try online advertising by making the tools to create, place and track ads easy enough for practically anyone to use and making the cost of entry little more than a few dollars per day. The impact on the industry could not be more profound. As the chart below shows, Google has single-handedly been responsible for nearly all of the growth in Internet advertising since 2002

Internet Advertising Revenues by Year



Source: Hoovers, Internet Advertising Bureau

Google is not just an isolated case. Salesforce.com achieved similar results in the Sales Force Automation (SFA) market where it introduced an easy-to-adopt solution and now commands 20% of the market. Prior to Salesforce.com, the only SFA options available to small customers were products that were little more than stripped down versions of enterprise solutions. They required the user to set up a server, install a database, install the SFA software, and install a copy of the client software on every user’s computer. Furthermore, accessing the system from outside the office, something that practically every sales organization needed to do, required setting up and

managing a remote access infrastructure. Finally, all of this software and infrastructure needed to be managed and maintained. This level of technical expertise put SFA outside the reach of most small companies. Therefore, it is not surprising that in 2000, Salesforce.com's first year on the market, Siebel, the leading enterprise SFA company had revenues of \$1.8 billion while Onyx, the most successful company serving the small and mid market, had revenues of \$109 million.

Salesforce.com changed the equation for small SFA by providing a hosted solution accessed solely through a web browser. In contrast to the existing small business solutions, all a customer needed to do was sign up over the web – no servers, no databases, no remote access infrastructure, and no maintenance. Salesforce.com was an instant hit with small businesses and has grown from nothing to \$309 million in revenues for its fiscal year ending in January 2006. Its results are even more impressive given that during the same time period, the overall SFA market went through a prolonged slump with Siebel's revenue falling to \$1.3 billion and Onyx's to \$60 million.

Applying Lessons Learned from Google to PV

Today, we observe a market following the classic model of technology adoption. There is a huge investment in developing new products and pioneering new manufacturing processes has essentially one aim: to lower the cost per watt of PV-generating material. Whether through use of alternatives to silicon or ways to reduce the volume of silicon required or in improving manufacturing techniques to reduce waste or improve efficiencies, new technology development is considered to be the primary driver of market growth.

While developing the core solar technologies to the point where solar power is less expensive than power purchased off the grid (either with or without subsidies) is necessary to drive mainstream adoption, it is not sufficient. Driving mainstream adoption will require tackling the key objections of PV buyers – Size of the initial investment, concerns about property values, the lack of a reliable channel for small systems and confusion about the technology itself.

What follows are seven steps we believe the PV industry needs to take to address these objections and accelerate adoption of photovoltaics to the mainstream market. The best way to consider the overall impact of these steps is to envision what the experience for acquiring solar power equipment is like for a small purchaser before and after.

Before: The purchaser calls several installers, most who do not call him back. The three that do call back provide three different configurations using equipment from three manufacturers. Conversations with the installers on the differences in the proposals yield conflicting answers about how ratings do not always mean the same thing. The smallest system proposed is three kilowatts, requiring that the purchaser lay out nearly \$20,000, of which some can be recouped after filing for tax credits and rebates.

After: The purchaser goes to Home Depot, Costco, or Lowe's and selects a preconfigured 1 kilowatt system off the shelf for \$4,900 after subsidies. As an alternative, the purchaser can opt for financing that costs just \$35 per month. The system includes the cost of installation and a list of installers in the purchaser's area is provided. All the purchaser needs to do is schedule an appointment and within a couple of days, their system is up and running.

1. Introduce Preconfigured Packages

Auto manufacturers learned years ago that offering customers unlimited flexibility in choosing the configuration of their cars was a losing business practice. It introduced incredible cost to their systems without offering much incremental benefit over having a handful of packages. Today, the solar industry is still operating under the unlimited flexibility paradigm. Nearly every PV system is custom designed to the unique specifications of the property, driving up sales costs, installation costs and equipment costs (since each vendor incurs the cost of

selling their components separately and ancillary components, such as inverters, are rounded up to the next size).

Preconfigured packages, perhaps for 1, 2, 3, 4 and 5 kilowatt systems, would positively impact practically every customer objection. By eliminating design costs and simplifying installations, it would make it profitable to sell smaller systems, stimulating the development of a high quality channel for smaller systems. Smaller systems also lower the initial investment and reduce aesthetic concerns.

A Preconfigured System Reduces Concerns about Initial Investment, Property Values, and Aesthetics

House with 6.2KW System



Same House with a 1KW System



2. Introduce Standards

Introducing standards for equipment size, rating, and efficiency, especially when combined with preconfigured systems, would increase confidence in solar power and go a long way to eliminating consumer confusion. Customers would have an easy and reliable way of comparing systems. One simple example would be require manufacturers to label their modules' performance rating based on the results of PV USA testing, the widely-accepted test methodology used by all manufacturers selling in the state. Today, they label their modules based on their "nameplate" or DC performance rating, a frequently misleading piece of information for the purchaser.

3. Simplify Interconnection and Permitting Processes for Small Systems

Building department practices vary widely from county to county and even within counties as municipalities develop their own requirements for photovoltaic systems, often adding significant cost to the purchaser. For example, the Department of Building Inspection in California's Napa County frequently requires "wet-stamped" structural and electrical engineers' drawings and takes 2-4 weeks to review a PV permit application. The added cost of the drawings can be as high as \$1,000 and, at the very least, the successful receipt of the approved permit application will take two trips to the county offices. In contrast, the City and County of San Francisco has developed a streamlined PV permitting process which, as long as a project meets a number of requirements (e.g., minimum set-back from the street, 3' clearance on flat roofs for fire department access, DC disconnect on the roof, etc.), the Building Department will issue the permit "over the counter" – in a matter of a few hours after application. Uniform permitting practices, or at the very least state-sponsored sharing of best practices among municipalities, would likely result in meaningful reduction in complexity, wait times, and cost.

While admittedly more complicated, we believe similar opportunities may exist for streamlining the utility interconnection process. An offshoot of the appropriately rigorous process of allowing power plants to connect to the utility grid, this scaled-down version of the interconnection process nonetheless adds considerable complexity and cost to PV buyers. Even one of the most progressive utilities, Northern California's Pacific Gas & Electric, requires an application, a signed agreement, a detailed list of the PV modules, inverters, and disconnect switches, a single-line drawing of the system to be interconnected, an AC disconnect switch within 10 feet of the utility meter, proof of insurance for the property, a signed building permit from the governing municipality, and a field inspection to verify the system operation and inverter serial number and install a new meter. Imagine the consumer outcry if a utility had similar requirements for installing a hot-tub or an air conditioner, which in some cases can draw more power than a residential PV system generates?

While we agree safety should be a top priority, we wonder why PV purchasers (and their installers by proxy) must go through such great lengths for PV systems that in many cases generate little more than the power required to run a few 1,000-watt hair dryers? Since all approved grid-tied inverters are designed to turn off during grid failure, why isn't this sufficient protection for utility line workers working nearby in the event of a power failure? And if not, why couldn't the installation of an AC disconnect switch close to the meter be the only requirement for small PV systems?

Much like the San Francisco Department of Building Inspections' streamlined permitting process, we envision progressive utility companies creating a similarly expedited interconnection process. This new streamlined process would allow purchasers of small PV systems (e.g., less than 5 kW) to plug their inverter directly into a standard 110v or 220v outlet, with perhaps only the installation of a new circuit breaker to act as the redundant protection a knife-blade AC disconnect serves today.

4. Develop Surface Mounting or Minimally Invasive Technologies

While some PV racking manufacturers are beginning to offer new attachment mechanisms that can overcome customers' concerns (e.g., in October 2006, one of the leaders in PV racking hardware, UniRac, first offered a ballasted, non-penetrating rack for flat roofs) much remains to address buyers concerns about roof penetrations, ease of installation, and portability. While limited to flat roofs, the ballasted rack nonetheless represents a meaningful advance in addressing buyers concerns – no risk of leaking roofs from holes drilled to attach PV modules. We believe an as-of-yet untapped opportunity exists to market a free-standing 5-module tilted frame to support 5 standard size PV modules at an adjustable tilt of 20-40 degrees, provide room for an inverter underneath and space for ballast (e.g., a half dozen cinder blocks) to make too heavy to easily carry off, and completely enclose the entire affair in a locked cabinet. The only thing that would be outside the locked box would be a long cord to plug the unit into a 110v or 220v outlet. How many of these prefab 1 kW systems could Home Depot or Costco sell if all a buyer had to do was take it home, point it to the right direction and plug it in?

5. Solar Power Loans Terms Merit More Favorable than for Other Loans Made to Homeowners and Small Businesses.

Loan terms, the duration of the loan and the interest rate paid, are a function of risk. Underwriters assess the risk of default based on the payee's assets, cash flow, and credit history. These are all perfectly appropriate for most uses of determine credit risk, whether it's home equity used to build an addition or buy a speedboat or a commercial loan for new production equipment (though capital loans also take into account asset life).

But PV systems are unusual on the risk-assessment scale in that, properly deployed, they create a positive cash flow in the form of savings on electricity no longer purchased. Yet lenders today give this no consideration when determine the amount, term, and interest rate of the loan.

Efforts to more precisely assess risk are ongoing in nearly all industries. For example, earlier in 2006, the California Association of Winegrape Growers working with Pan American Underwriters and Unigard Insurance Company announced an innovative insurance package, which includes a premium credit for sustainable winegrowing practices. The package is based on the fact that practice sustainable farming are less likely to file claims and/or file claims for lower losses and should pay lower premiums accordingly.

We believe it's time to the lending community to take a fresh look at its practices and price loan and leases to reflect the lower risk associated with the positive cash flow from savings on electricity.

6. Implement Manufacturer Financing

Today, the task of finding financing for solar equipment falls largely on the buyer. If car manufacturers have figured out that by providing financing they can sell more cars, it's probably time for GE, BP, Sharp, Sanyo, and other PV manufacturers to apply the same lesson and figure out how to offer financing to end buyers. Imagine the shift in market share to the first company that offers bundled financing?

Furthermore, with the emergence of a secondary market, solar equipment would be very low risk to finance, making it a good candidate for favorable financing rates. It would also be a good candidate for leasing, which would greatly reduce the initial investment.

7. Make Warrantees for Equipment Transferable

Despite the fact that solar equipment depreciates slowly (the panels last 25 years or more with no maintenance and price declines are running only ~5% per year), there is no secondary market for them. We believe the principal reason for this is that manufacturers' warrantees are not transferable. If the panels are sold, the warrantee becomes void.

Changing this policy could help stimulate a secondary market, which in turn would mitigate some of the issues about the size of the initial investment. Not only would it make it possible for a buyer to recoup some of the investment later if they decided to sell the equipment (by our calculations, panels should retain 50% of their value after 11 years), it would also reduce concerns over the impact on property values since the equipment could be taken down and sold if it became an issue.

Conclusion

While the future of the solar power industry looks bright, it must first learn how to serve millions of mainstream buyers. The proposals described in this paper are by no means exhaustive, but our intent is to stimulate a dialog among industry stakeholders – PV product manufacturers, resellers and installers, service providers, government agencies, and legislators. By acting now, we believe, market players who adopt “short fuse” thinking will gain market share at others expense and the industry as a whole will better weather the ups and downs typical of cyclical, hypergrowth industries.