

Levi Strauss or Also Rans?

Diverse Opportunities in Solar PV



Abstract

Most discussions and interactions on the opportunities in the solar PV domain tend to focus on opportunities available in power production. There have been relatively fewer discussions on the opportunities available along the other parts of the solar PV value chain, and even fewer about niche opportunities available in these segments.

On the other hand, solar PV has long a business value chain, providing ample and diverse opportunities in manufacturing, trading or services. Many of these opportunities are niche opportunities that have not been well researched and are subsequently not well known, thus providing entrepreneurs with fertile areas with relatively little competition. In addition, some of these opportunities will require existing businesses in a variety of industries to only provide minor tweaks to their operations in order to participate and contribute.

This white paper reviews the diverse opportunity spectrum in the solar PV value chain and provides a broad framework using which companies could make their entry into an appropriate segment to reap the benefits from this fast growing industry. The paper has a specific focus is on the niche opportunities that are available in these sectors.

The California Gold Rush

The California Gold Rush offers an interesting insight into entry strategies for entrepreneurs. There were over a hundred thousand gold diggers during the rush. The city of San Francisco, which was a small hamlet before the gold rush began, grew into a large and bustling town in a short period of time. In order to support the extraordinary growth in the population of the city – primarily from the thousands entering every day prospecting for gold – a diverse support ecosystem evolved quickly. The comprised a number of businesses such as lodging, transport and logistics, merchandise, food, entertainment and so on.

An analysis of the profits made by the entire ecosystem showed that, while the gold diggers made modest profits, the support businesses made much higher profits on average than the gold diggers. Rather than dismissing this as a quirky statistic, detailed analyses will show that the support businesses monetarily did much better simply because there was less competition among them than among the gold diggers, and the extent of risk for these businesses was much less than that for the diggers.

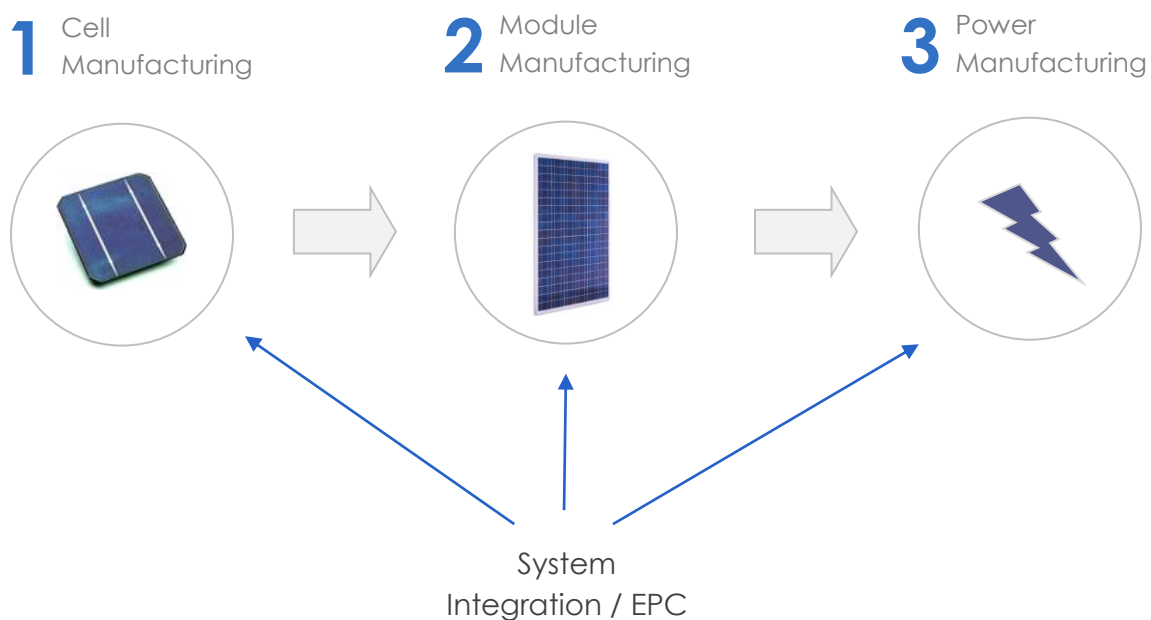
One of the support businesses was a small shop that provided the rugged canvas cloth required for the gold diggers. The name of the person who ran this shop was Levi Strauss. History will record that he was one of the businesses that made the most money during the California Gold Rush. Today, we know the business as the multi-billion \$ Levi Strauss & Co, the global leader in jeans and casual wear. It is quite possible that Levi Strauss is the only company born out of the Gold Rush that has evolved into a billion dollar company.

The California Gold Rush story in general, and the Levi Strauss story in particular, shows a powerful theme: there are a number of niche but attractive business opportunities that happen during a business revolution that are not well known but at the same time add significant value, thus increasing the likelihood of entrants achieving global leadership in these segments.

This white paper is dedicated to exploring these niche, but attractive opportunities in the solar PV value chain. We recommend that entrepreneurs and investors keen on attractive business opportunities explore these niche domains rather than only the most obvious ones before making investment decisions.

A sample of obvious opportunities (for PV)

Ask anyone in the solar PV industry about the business opportunities available in the sector and he or she will most likely inform you about the following.



While these are indeed the prominent business opportunities, these are ones in which there is significant competition, making success that much difficult.

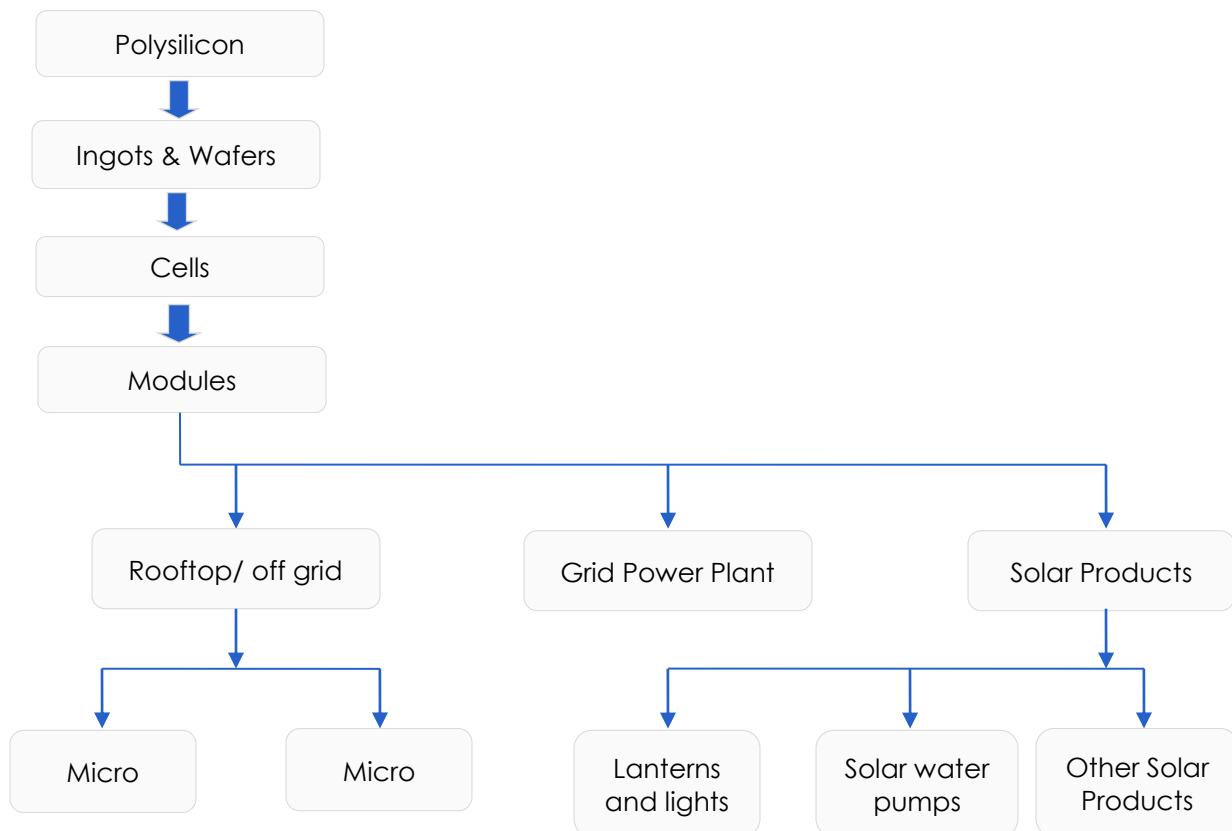
At the same time, there are a number of opportunities in the solar PV value chain that are not so obvious. These opportunities are analysed in this paper along the following dimensions.

- 1** Diversity
- 2** Technology
- 3** Sectors
- 4** Size

1 Diversity of Opportunities

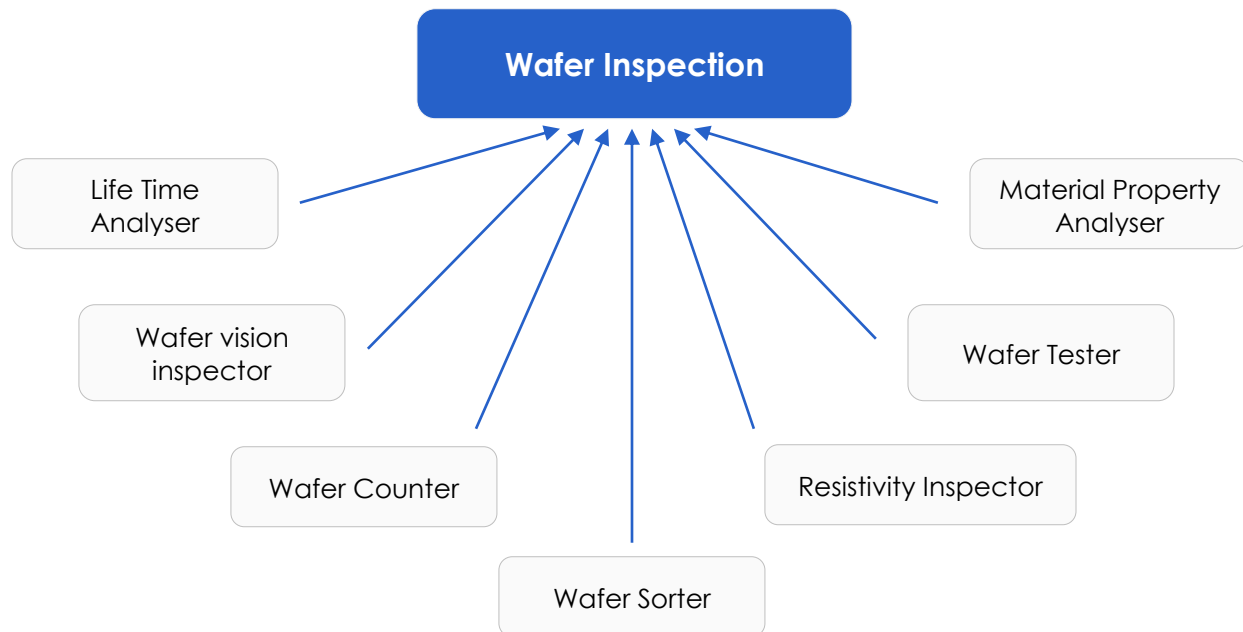
There are different types of opportunities all along the solar PV value chain – all the way from polysilicon manufacturing (which is a core manufacturing operation) to managing solar PV farms (which is essentially a services business).

The Diverse Scope of Opportunities along the Solar PV Value Chain



The above chart shows the main segments in the solar PV value chain (We have considered only the crystalline solar cells in the above diagram). There are six distinct segments starting with production of polysilicon and ending with the power generation from power plants or from distributed solar products such as solar PV based lanterns and water pumps.

While the above diagram shows the wide breadth of opportunities in solar PV, what is interesting is the number of opportunities present at every point in the value chain (depth). Let's look at, for instance, the different operations for a small section of the value chain viz., for wafer inspection.



The wafer inspection part alone requires seven machines. A closer look at the list of machines provided above will show that some of these machines test material properties, others test electrical properties and a third variety tests optical properties. Such testing for distinctly different properties imply that it is possible for specialist companies to make a mark in one or a subset of these.

What has been mentioned above is not unique to the wafer inspection segment alone. At many points along the value chain, there are present similar opportunities – for instance, an inverter alone requires hundreds of different components. Such a wide breadth and depth of activities in the solar PV value chain implies opportunities in a wide variety of industries, such as:

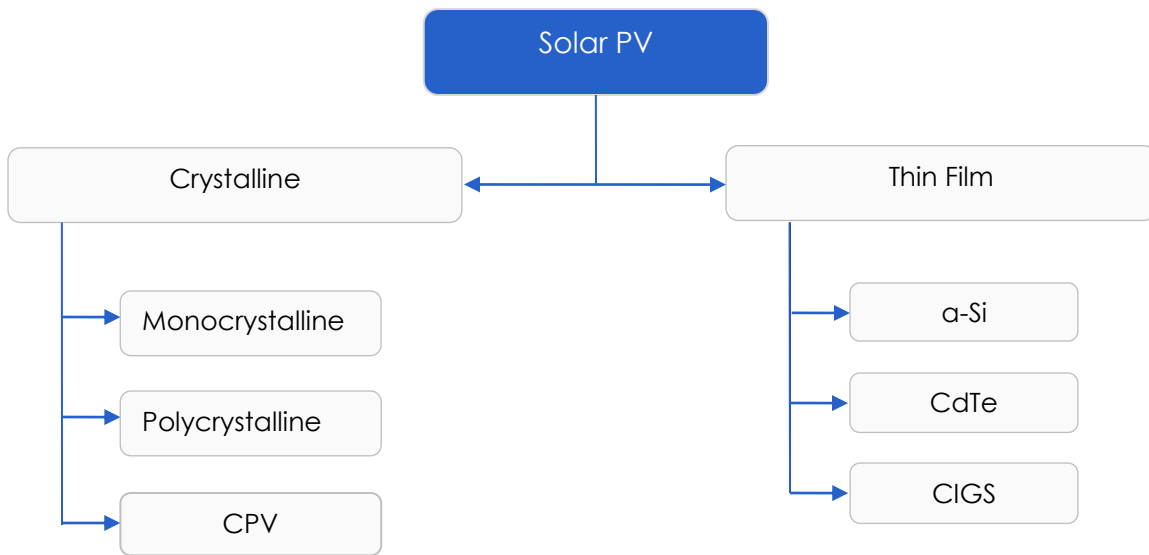
- ✓ Electrical
- ✓ Construction
- ✓ Chemical
- ✓ Instrumentation
- ✓ Materials - glass and steel...
- ✓ Finance
- ✓ Engineering design and services...
- ✓ Software

2 Opportunities across Technologies

Solar PV is a dynamic industry, with significant changes taking place continuously along the entire industry value chain. Except for some of the commodity components such as cables, wires and transformers, and a few other such “nuts and bolts” components, significant changes are happening elsewhere.

Broadly, solar PV can be segmented into crystalline and thin film technologies. While crystalline solar PV is a fairly mature and established technology, there are developments taking place within it in terms of concentrated PV technologies in which the efficiencies of solar cells could go as high as 30% (traditional crystalline solar cells can reach a maximum of 19%). In addition, developments in technologies such as tracking mechanisms also can result in significantly higher efficiencies.

In the domain of thin film technologies, the amount of innovation and changes happening are quite dramatic. Thin film solar modules today follow one of the three technologies – amorphous silicon (a-Si), Cadmium telluride (CdTe) or Cadmium-Indium-Gallium-di-Selenium (CIGS). While a-Si is currently having a dominant position, there are significant benefits that the other two technologies provide making it difficult to say which of these would be a winner. And even within these three technologies, there are variants coming in. For instance, rather than the plain old a-Si which had an efficiency of about 6-6.5%, currently a-Si has a tandem avatar (in which there are multiple p-n junctions) that has an efficiency as high as 8.5%.



Such significant technology variations coupled with the fast pace of innovation in this field provides fertile ground for many niche opportunities.

3 Opportunities across Sectors

Not surprisingly, considering the long value chain with diverse operations, the solar PV value chain presents opportunities across all the three major industry sectors – manufacturing, trading and services. Here again, while there are many prominent opportunities (such as manufacturing of PV cells, or running a service such as a solar PV power plant), there are a number of niche opportunities as well in each of the sectors. We list some of these niche opportunities below for each of the sectors:

Manufacturing

- Silicon carbide & crucibles for wafer manufacturing
- Inverters, wires and transformers for power plants
- Chemicals for solar PV ingot and cell production
- Production of machinery and equipments for solar wafers, cells or module manufacturing

Trading

- Wires and cables for solar farms
- Marketing solar products - lamps and lanterns, solar water heaters...

Services

- Software such as forecasting and system monitoring tools for solar farms
- Training support for solar PV power plant engineers and technicians

The above present only a sampling of the niche opportunities available in each of these, but we hope they provide a glimpse into the wide spectrum of opportunities available.

4 Opportunities across Sizes

Many small and medium entrepreneurs who are watching the solar PV revolution unfold in their countries ask themselves whether this is an industry in which they could play a role and reap the benefits of an early mover in an exciting industry. The answer is a firm yes.

Similar to many other industries, the solar PV industry too has innumerable opportunities that small and medium enterprises could target.

Below is a sample list of niche opportunities within solar PV that could be of interest to small and medium businesses.

- **Small**
 - Engineering design for solar power plants
 - Recruitment and training services
 - Mobile solar kits for the army/defense

- **Medium**
 - Production of BoS such as inverters currently imported
 - Manufacture of metallization pastes and chemicals for PV cell manufacturing
 - Junction box, connector, frame, sealant and tapes

- **Large**
 - Ingot and wafer manufacturing
 - Innovating in the Building Integrated Photovoltaic (BIPV) market
 - R&D for indigenization of critical components

The sample list provided above is once again instructive. A brief analysis of each of the opportunities above will show that there are opportunities available for all sizes – from the “mom and pop” shops/“one person shows” to conglomerates that are billion dollar businesses.

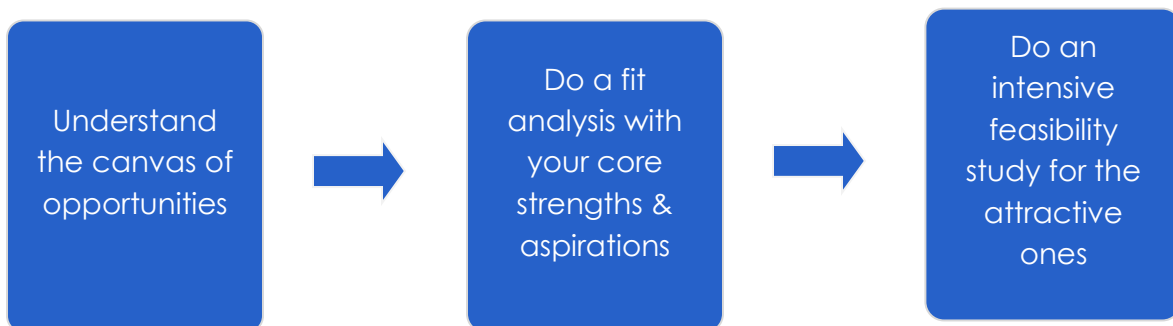
Starting Off in a Solar PV Niche

The above sections provided a glimpse of the range of opportunities – many of them niche with little competition - available to businesses and entrepreneurs, whatever type of business they are in:

- *Small, medium or large business*
- *In manufacturing, trading or services*
- *Across multiple technology domains*
- *In any of a dozen industries*

In some cases, exploiting these opportunities requires only minor tweaks to the existing operations. For instance, if yours is an engineering design firm catering to the traditional power industry, it could take only the addition of one or two solar PV industry experts for you to be in a position to start offering your design services to the solar PV power plants. Companies that are operating in sectors such as junction boxes, connectors and frames need make only minor tweaks to their products in order for those to be used in the solar PV industry.

Thus, it is clear that the fast growing solar PV industry presents attractive, niche opportunities to a wide range of businesses and entrepreneurs. The question that many of these entities have is how to quickly make a start in the solar industry. EAI recommends a three step strategy for the same.



While the cleantech industry is a new industry, the old rules apply when it comes to deciding on an entry or diversification strategy. The first step is to get a better understanding of the key trends and opportunities in this industry. In the next step, analyze and identify opportunities that have a good fit with your core business strengths and your business aspirations. Once you have been able to shortlist attractive opportunities based on the above two criteria, it is imperative that you undertake a detailed research and feasibility analysis for each of the opportunities shortlisted before making your investment decisions.

Summary

The solar PV industry presents attractive opportunities to a wide range of businesses and entrepreneurs. While most of the aspirants are only aware of the prominent opportunities, it might be more beneficial to consider niche opportunities which could be more attractive, owing to the specialty of the business or lack of competition, or both.

These niche opportunities are present across different technologies, sectors and sizes in the solar PV industry value chain. EAI recommends that entrepreneurs keep these perspectives in mind when they are exploring investments in the solar PV industry. Choosing the right segment could make the difference in your business being an also-ran or becoming a Levi Strauss

About

- ✓ EAI is the foremost research and consulting company for the Indian renewable energy industry.
- ✓ We have a dedicated focus on the Indian renewable energy sector.
- ✓ We are unique in our focus on market and strategy research for renewable energy.
- ✓ Our team has assisted businesses large and small on a variety of renewable energy projects.
- ✓ Our expertise has been sought by Fortune 100 companies.
- ✓ Our team comprises professionals from premier institutes such as the IITs and IIMs.
- ✓ The cumulative wisdom of our team, derived from extensive research and hands on consulting, has provided us with deep insights about the industry which few, if any, have.

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