

Optimizing site selection decisions in a changing solar marketplace

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ABSTRACT

Whether in the USA as a part of a manufacturing resurgence or elsewhere in the world, solar producers need to be smarter than ever about where they choose to locate new operation centres. Solar manufacturing site selection demands analytical rigour. The intent of this article is to share strategies and tools that can help owners make the best-informed choices about where to locate new manufacturing operations.

Introduction

In the last few years things have been tough for the solar industry. It has been buffeted by recession-reduced demand, surprising new discoveries of fossil fuels, evaporating government incentives and brutal price wars. Yet through it all, this battered industry is deeply rooted for long-term viability.

We can all debate how fast the solar industry will grow and change in view of its many challenges, but the industry's growth at some rate is a strong bet, as energy resources become increasingly critical to modern life, and solar manufacturing technology continues to make steady progress towards and beyond grid parity.

In short, solar is here to stay, and despite all the volatility in the solar manufacturing marketplace, those who figure out how to manufacture solar products profitably will enjoy the benefits of solar's ultimate market expansion.

Bolstering optimism about the global solar industry's long-term fortune is increasing enthusiasm and discussion in the USA of 'reshoring' or 'insourcing' solar manufacturing. This trend is driven by multiple factors, including transportation costs, decreases in US energy costs, aggressive US state incentive programmes, and increases in Chinese labour cost and trade policies. In 2010 President Barack Obama set a goal of doubling American exports around the world by the start of 2015. In 2011, for the second straight year, the number of manufacturing jobs in the USA increased, after declining every year since 1998. Since December 2009 the manufacturing sector has added 300,000 jobs, including 50,000 in January 2012 alone, the biggest monthly increase in a year. President Obama has proposed lowering tax rates for manufacturers to fuel the reshoring trend.

Site selection process

Business cost drivers around the globe vary widely; taxes, government incentives, land costs, labour laws, labour costs, power costs, regulatory issues,

infrastructure conditions, logistics and supply chain considerations are all critical business issues, varying site to site. Some approaches and methods for improving site selection decision-making processes are presented here.

“The site selection process can be broken down into project definition, location screening, location analysis, site analysis and due diligence.”

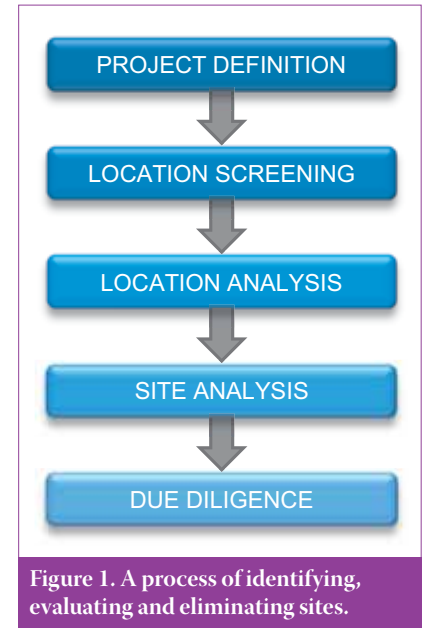
The site selection process (Fig. 1) can be broken down into five general phases:

1. **Project definition:** define the geographic search area and the facility, site, cost, infrastructure and risk criteria against which locations and sites will be evaluated.
2. **Location screening:** utilize site selection models and client's preferences to identify locations for further study.
3. **Location analysis:** collect data and refine analytical models; evaluate qualitative criteria; rank and select locations for site analysis.
4. **Site analysis:** identify and analyze sites in priority locations.
5. **Due diligence:** review in detail a site's development feasibility (incentives, environmental, zoning, infrastructure, costs, etc.).

Each of the five site selection steps is described below.

Project definition

The site selection process begins with a **project definition** stage. This process develops a detailed understanding of a manufacturing facility's operating



parameters and requirements, and determines the criteria against which the locations and sites will be judged, and the relative importance of each criterion.

Location screening

Once the key site selection criteria have been defined, the next step is **location screening**. CH2M HILL utilizes a proprietary total cost of ownership (TCO) model and utility and site resource model (SRM) to efficiently evaluate and rank locations and narrow the search. Decision-making methodologies can also be used at this stage, to provide a framework for defining, weighting and scoring qualitative criteria.

Location analysis

The location screening lays the groundwork for the **location analysis** to follow. Requests for proposals (RFP) are prepared and sent to locations of interest. The responses, which typically include preliminary incentive offers, are then analyzed, and locations are re-evaluated from a financial and qualitative perspective. The outcome of this phase is a shortlist of preferred sites.

Site analysis

Site analysis is when the process begins to focus on details. The goal of site analysis is to identify and assess potential sites in a target region. If necessary, a follow-up site RFP will be sent to state and local economic development officials in a target region. The RFP will specify detailed site requirements, including size, topography, access, zoning, cost, development review, development constraints, site improvements and environmental concerns. On the basis of a desktop review of sites and data from the TCO model and SRM, sites are ranked and the top sites are visited. A more detailed assessment of the sites is conducted based on the site visits and additional research into site development costs and potential development constraints. At this stage, analysis is performed at a high level of detail. The thorough understanding of a manufacturer's requirements and priorities, developed in the project definition stage, ensures the best fit between site and project. A preliminary development schedule, TCO model and SRM will be developed for the top sites. On the basis of this analysis, a final site ranking will be performed, and negotiations can be initiated with site owners and local and state governments for the top sites. During these negotiations, site studies and surveys (wetlands, endangered species, past practices, cultural resources, natural resources, archaeology, noise, traffic, and impacts on visual air and water) are carried out.

Due diligence

Lastly, the **due diligence** chapter commences, with negotiation and finalization of incentive and infrastructure agreements, environmental investigations and contracts leading up to site acquisition.

How does plant location influence financial performance?

The solar industry is mature enough to have accumulated solid data for benchmarking solar manufacturing costs in different international locations. These data are an invaluable asset for objective comparison and prediction of business competitiveness. Projects should develop a discounted cash flow model to assess the impact that geographic location has on project net present value (NPV) and unit production cost. These models make the site selection process objective and focused on the factors that have the most influence on financial performance.

Schedule is another critical factor to consider for site selection projects. A number of functions related to site development are notoriously delay-

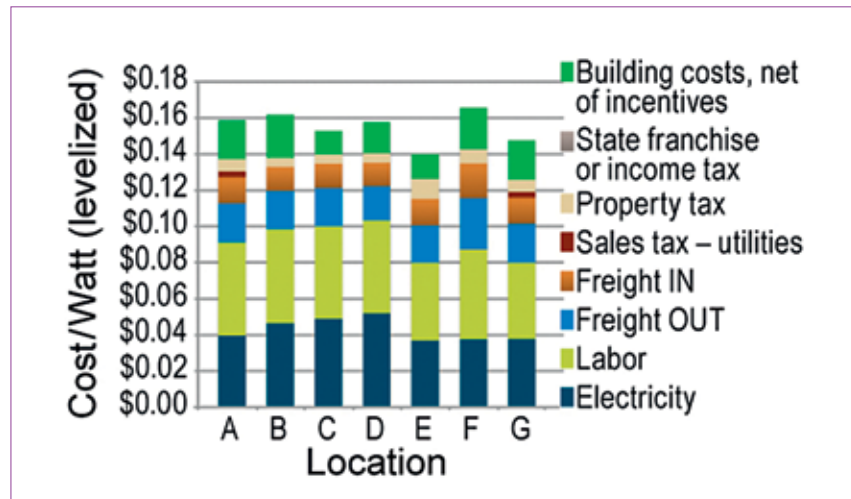


Figure 2. NPV of costs by location of items with significant variability.

prone, such as environmental permitting, the site development approval process, site and infrastructure development, and facility design and construction. Understanding the local manifestations and risks associated with these factors is important, because a large greenfield or redevelopment project in the USA can trigger a number of challenging environmental regulatory programmes that can have a significant impact on schedule and cost. Environmental regulations and permitting programmes vary from state to state and are often more restrictive and involved than federal government environmental programmes. Environmental permitting and site-related environmental review and approvals can result in schedule delays of nine months or more. However, these schedule impacts can be minimized, or possibly avoided, through proper investigation and planning early in the project life cycle.

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Yet another consideration that must be included in the site evaluation equation is business interruption risk. Some of these risks are hazard related – such as threats of natural disaster, security and infrastructure reliability and vulnerability – while a range of other risks pertains to such financial factors as fluctuating labour costs and workforce availability, and unforeseen increases in energy and tax policy.

Site selection net present value (NPV) model

The best quantitative site selection tool is a project NPV model that efficiently forecasts and compares project cash

flows over the life of the project, for each location and site under consideration. The key is designing the model to efficiently focus on costs that change by geography while holding other variables constant.

For solar manufacturers considering US locations, key cost factors that can vary considerably by geography include taxes (sales, property and income), incentives, labour, site and infrastructure development, construction and transportation costs. On the basis of a plant's specific capital and operating cost structure, the NPV model forecasts the estimated cash flow of these costs for each site under consideration.

The resulting total cost of plant ownership, on an NPV basis, provides an objective and normalized financial comparison between site options. The model also provides useful financial insight into the sensitivity that each of the site-specific cost variables has for project NPV.

An NPV model can also be a valuable tool for state and local incentive negotiation and evaluation. Tax structures and incentive packages can vary significantly among states as well as among cities and counties within a given state.

An example of a cost comparison summary (of some of the high-ranking variables only) by location is shown in Fig. 2, based on seven different locations, over a 10-year period of plant operation.

“Location can have a huge impact on a facility's start-up and operating costs and ultimate success or failure.”

Conclusion

Location can have a huge impact on a facility's start-up and operating costs and

ultimate success or failure. While the solar industry continues to face uncertainties and risks, owners can find reassurance in the numerous tools and approaches available to guide them in successful site selection efforts.

About the Authors

Dick Sheehy manages CH2M HILL's Advanced Planning and Site Selection Services group. He has more than 25 years of experience in evaluating site locations and developing projects for advanced technology industries, including many in the solar industry, and has led many projects providing master planning services

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Nate Monosoff specializes in providing business and strategic consulting services to start-up and mature industrial and technology clients in the USA, Asia and Brazil. In consultant, engineer and/or project manager capacities, he has provided business consulting, master planning, business location and economic

development services as well as technology and market analysis for national, regional and local governments and industrial clients. He has expertise in the development of specialized cost modelling and feasibility studies and tools to support high-technology investment decisions.

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