

## Conference Proceedings

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### Research Reveals the Hidden Methods to Democratize Solar

Warren Schirtzinger<sup>1</sup>

<sup>1</sup> High Tech Strategies, Inc., Seattle (United States)

info@hightechstrategies.com

#### Abstract

Several US cities stand out as being relatively effective in broadening the access to and use of solar power. The locations where adoption of solar has been the most prolific are located across the nation, from California to New Jersey. They represent various geographies, climate zones, and population demographics. But they all have in common a noticeable increase in solar panel installations thanks to the same mainstream-solar-adoption formula.

The conventional beliefs surrounding solar adoption focus on a few key factors: reducing the cost of solar panels, the importance of solar in combating climate change, and pro-solar policies or incentives. Yet an examination of the real reasons people adopt solar reveals factors and motivations that are very different than what is commonly believed. The formula for encouraging people to make a lasting transition to a clean energy future is based on reducing perceived risk.

Strategic initiatives designed to reduce the perceived risk of adoption are required to achieve a sustainable transformation. These initiatives create permanent change so the market does not regress to lower levels of utilization at some later time.

Drawing on the transformational success of specific locations across the US, the author guides stakeholders who are promoting the acceptance and adoption of solar power, how to increase adoption, boost policy effectiveness and reduce costs.

*Keywords: solar adoption, market transformation, grid-connected photovoltaics, electric power, renewable energy, distributed generation, clean energy*

#### 1. Introduction

The solar industry has long been characterized by ups and downs that are often triggered by external forces or policies beyond its control. Continued reliance on policy makers to adopt favorable political frameworks and instruments to promote fast and steady growth of solar and other renewables is, at best, a strategy that will lead to unpredictability.

Whenever government support for solar declines, we are reminded of how important it is for renewable energy markets -- especially solar power -- to operate independently of government support. The solar industry needs regulatory certainty, but it also needs to become sustainable on its own; a process that is

referred to as *market transformation*.

Market transformation is the strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective solar power as a matter of standard practice. The key words here are *lasting change*. Because government subsidies do not create lasting change, we need to identify ways to intervene in the solar market in a way that accelerates the adoption of solar, but also leads to a sustainable market.

Several useful models of market transformation describe industry transitions in terms of the changing nature of the user. The model called Diffusion of Innovation for example describes a market's acceptance of a new technology in terms of the types of consumers it attracts throughout its useful life. The underlying thesis of the Diffusion of Innovation model is that the adoption of new products or technologies occurs in a specific order through a social system comprised of five distinct segments. It is probably the most well established model in many high-tech industries because it provides useful insight at all stages of market development.

Subsequent adaptations of the diffusion model -- including *The Tipping Point* and the *Technology Adoption Lifecycle* -- maintain a reliance on the psychological and social attributes of various end users, rather than the product. However, studies of successful and lasting market transformation in the solar industry reveal that it is the product that determines the degree of solar acceptance and adoption.

## 2. Innovation Frameworks and Models

Originally published in 1957 by Joe M. Bohlen, George M. Beal and Everett M. Rogers at Iowa State University, the underlying thesis of the Diffusion Process is that innovations are absorbed into any given user base in stages corresponding to psychological and social profiles of segments within that user community<sup>1</sup>. The process can be represented by a bell curve with definable stages; each associated with a definable group, and each group making up a predictable portion of the whole community. Everett Rogers extended this popular theory about how, why, and at what rate new ideas and technology spread in his book *Diffusion of Innovations*<sup>2</sup>.



Fig. 1: Diffusion of Innovation model

The prescription for success in introducing a new product or technology into any community is to work the curve from left to right, focusing first on the innovators, growing that market, then moving on to the early adopters, growing that market, and so on. To do this effectively, it is necessary to know and understand the psychological characteristics of each group of buyers.

The psychographics of each group in the adoption process influences the development and dynamics of the market. For example, each group places a different value on product intangibles, and on endorsements or references from other groups. As products move through the adoption process, intangibles and user references assume more importance. Often, pioneering new products lose their initial prominence because a new entrant is more successful in product positioning based on a more effective mix of intangibles. This can be the case even if the second product is not technically superior.

The concept of dynamic change in the perceptions of products is reinforced by the concept of the adoption process. In 1957, researchers at Iowa State College were able to track the diffusion of information and purchase patterns of a new product: hybrid seed corn. They found that purchase and use (or adoption) behavior fell into understandable patterns. They found that five distinct “segments” of an adoption population could be described. They noted the different characteristics of persons in these five groups, and hypothesized about the way word-of-mouth influences purchase behavior.

Five groups were identified as follows:

**Innovators—2.5% of the population**

They pursue new technology products aggressively. Because technology is a central interest in their life, Innovators embrace the nuts and bolts of how a new technology actually works. And they play perhaps the most straightforward and unambiguous role: to understand and assess new technologies or methodologies and endorse those with true technical superiority over currently available alternatives.

**Early Adopters—13.5%**

They buy into new product concepts very early in their life cycle, but unlike innovators, they are not technologists. Often referred to as visionaries, early adopters match emerging technologies or new ideas with industry-specific opportunities to drastically reshape existing markets. In other words, they identify business opportunities for a strategic leap forward. Early adopters have the imagination to see the world as it could be (rather than as it is) and the ambition to try to make those possibilities the new reality.

**Early Majority—34%**

They are driven by a strong sense of practicality and seek demonstrable gain backed by a defensible cost-benefit analysis. Referred to as Pragmatists, the Early Majority wants to see well-established references before investing substantially. As a group they are comfortable with their ability to handle a technology product. Members of the Early Majority insist on following industry standards and best practices.

**Late Majority—34%, and**

They share all the concerns of the early majority, but are not comfortable with their ability to handle a technology product. Members of the late majority always wait until something has become an established standard. The Late Majority is risk averse, price sensitive, and has the tendency to follow rather than lead.

**Laggards—16%**

They simply don't want anything to do with new technology, for any variety of reasons, some personal and some economic. Laggards avoid adoption to the bitter end.

The core insights embedded in Rogers' Diffusion of Innovation is that the adoption of new ideas occurs in a specific order through a social system. Rogers' research was updated specifically for high-tech products by Lee James while working at Regis McKenna, Inc. in Portland, OR<sup>4</sup>. Lee James was also the person who created the Right Turn on Red Law while working at the Federal Energy Administration during the 1970s oil crisis, using his marketing skills to encourage conservation.

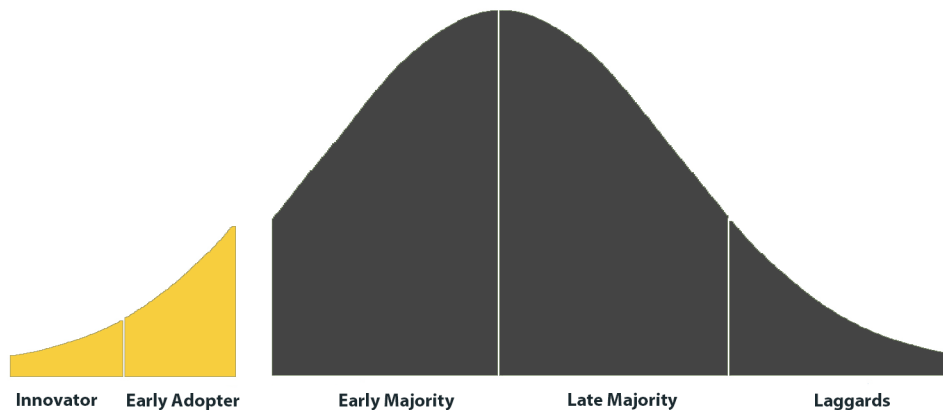


Fig. 2: High-Tech Marketing Chasm model

As a technology marketer and consultant Lee James recognized the need for a key modification: a significant gap, or *chasm*, between early adopters and the early majority<sup>4</sup>. James noticed that high-tech products don't follow the same pattern of adoption as other non-technical products. He observed that high tech products often struggle to gain mainstream acceptance, and even fail, even though they are initially well received. If a company can “cross the chasm,” commercial success becomes inevitable, as sales then occur largely through a social process of one peer imitating another.

The research demonstrated a number of elements of purchase behavior, including the dynamic nature of how products are purchased. Innovators, for example, are motivated by being first, while late adopters are primarily interested in a proven, fully-tested solution. The primary value of the research was the development of the idea of an *adoption process*. New product acceptance could finally be understood and even diagramed.

### 3. Public Policies Blur Market Effects

The principles behind Diffusion of Innovations have repeatedly guided high-tech products and companies to the achievement of mainstream market acceptance, public support and commercial success. And some of the history and experience behind diffusion theory can be translated into helpful guidance for the solar industry.

However there is a fundamental difference between subsidized markets for solar power, and unsubsidized markets for technology-based products. The strategies historically employed to spur expansion of the solar (PV) market include some type of policy-based incentive or subsidy. Lowering *cost per watt* through public policy has been the key to unlocking a vast potential market for photovoltaics.

Solar products are typically subsidized or supported with the primary goal of achieving economies of mass production and eliminating barriers to use. Examples include:

- federal and state buy-down programs
- coordinated government procurement of PV
- elimination of barriers to capital formation
- legislative packages supporting distributed energy
- legislative and regulatory assistance to states
- prohibition of restrictive covenants and ordinances

End-user research shows these policy-based incentives act to blur the adoption effects of the market for solar products. The psychographic sequence that is the foundation of diffusion theory (innovator - early adopter - early majority - late majority) is actually skewed by government or utility programs designed to encourage or accelerate the adoption of solar. Public policy blurs market dynamics.

In addition to understanding the inherent difficulties in measuring localized, psychographic behavior, you must factor in the effect of public policy and incentives. In most cases, government policy will reduce risk in the eyes of a mainstream customer so that adoption occurs before it normally would in a purely commercial [unsubsidized] setting or market.

This skewing effect on solar adoption was first discovered by Steven Strong, Don Osborn, and Dr. Donald Aitken when conducting a review of the Sacramento Municipal Utility District (SMUD) PV Pioneer Program in 1999<sup>5</sup>. People who fit the psychographic description of the early and late majority were among the first to sign up for residential solar because the combined effect of SMUD's multi-faceted solar program lowered risk so dramatically, it caused pragmatic buyers to adopt solar early, rather than late.

The bottom line is solar adoption is influenced by a unique set of artificial variables, making buyer-transition points in diffusion models even harder to recognize.

### 4. The Hidden Formula

The psychographics of each group in the adoption process influences the development and dynamics of an unsubsidized market. Each group places a different value on product intangibles, and on endorsements or

references from other groups. As products move through the adoption process, intangibles and user references assume more importance. Also critical to understanding the adoption process is the underlying motivation of each group. Innovators for example love to be first to try something new. Whereas early adopters are motivated by their desire to transform their company or life into something much better.

With solar, buyer behavior patterns are no longer reliable indicators of market dynamics, therefore stakeholders and promoters of solar power are left with one proven tactic to attract the mainstream population -- using proven, risk-lowering techniques that are known to attract pragmatic buyers.

Decades of research show that the characteristics and motivations of mainstream buyers are consistent regardless of the technology that is being adopted. Before a pragmatic, mainstream buyer adopts a new technology it must meet the following requirements:

- a. the product must be evolutionary, not revolutionary
- b. the product must enhance the system the buyer has now, not overthrow it
- c. the product must improve an existing operation, not change it
- d. the product offering must be a complete solution (also known as the low-risk recipe)
- e. the buyer must not be required to fine tune or troubleshoot the product
- f. the product must work properly and integrate easily with the exiting infrastructure
- g. the vendor cannot disappear after installation
- h. the product or system must be purchased from a market leader
- i. the vendor must provide references and/or referrals from an identical type of customer

Given that 84% of the population looks for ways to avoid risk, a framework for the delivery of low-risk solutions can be applied to accelerate the acceptance and adoption of renewable energy. "The Low Risk Recipe" is a concept that describes the socially acceptable methods of accelerating change when a market has been subsidized. Discontinuous innovations like solar require a very specific set of risk-lowering attributes in order for the mainstream population to accept and then adopt. These proven methods of market transformation have the ability to help scale innovative programs both broadly and rapidly.

For example, utilities and/or one of their partners can deliver the *low risk* requirements of mainstream buyers. Rather than social interaction as the primary driver of solar adoption as highlighted in diffusion theory, a low-risk program (consisting of both tangible and intangible attributes) can be assembled through various agencies, vendors and programs, and offered together in a way that reduces risk and meets the pragmatic needs of the mainstream population.

The impact of a utility or familiar vendor offering a low-risk product makes all the difference. All of the requirements of a pragmatic, mainstream buyer are satisfied:

- a. solar helps the system of electric supply get better or *evolve*
- b. the solar system compliments the electric grid by providing distributed generation. It does not replace the grid
- c. solar provides renewable generation which is an improvement over non-renewable methods
- d. the system delivered is a complete solution, delivered through a combination of providers and programs
- e. the customer receives a turnkey system that does not need to be fine tuned
- f. the solar panels work properly and integrate easily with the exiting [grid] infrastructure
- g. the utility evaluates solar installers and works only with contractors who are reliable
- h. the utility offers a choice of reliable vendors, allowing the customer to buy from a perceived market leader
- i. references and referrals are provided by neighbors or industry-specific users

## 5. Conclusion

Despite diffusion theory's long history of successful guidance for high-tech companies and other innovators, the idea that you can accelerate the adoption of solar through social dynamics alone is incorrect. Because of the blurring effect caused by public policy and regulation, solar must be offered as a complete solution by a known supplier who makes the buying experience familiar and low risk. For solar to achieve mainstream

market acceptance, it must be standardized, minimize disruption and integrate with existing systems. And the system's intangible attributes must be as strong or stronger than the tangible attributes of the technology itself. This formula for democratizing solar has been partially assembled and is starting to be implemented in several locations across the US, and the conclusions of this study have been verified.

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