



## Conference Proceedings



ASES National Solar Conference 2016

San Francisco, CA, USA July 10-13, 2016

# The Hazards of Exponential Growth for the Solar Industry – and How Innovating Stronger Business Models is Key to Survival

Evan I. Schwartz

Innosight, Lexington, Massachusetts (USA)

### Abstract

Living through exponential growth can be both exhilarating and hazardous. The solar industry has experienced both sides of this challenge. Installed solar capacity has grown globally from barely 1 gigawatt in 2000 to over 5 gigawatts in 2005 to an expected 320 gigawatts by the end of this year<sup>i</sup>, as costs have plummeted by 70 percent over the past decade.<sup>ii</sup> Forecasts now call for a tenfold power surge, to 3,000 GW, by 2030. Growth that multiplies this fast can be both deceptive and dangerous to those who depend on the sustainability of sustainability. At the same time that new capacity has been roughly doubling every year, we've seen a string of business failures, most notably the news that the industry's largest player, SunEdison, has fallen into bankruptcy with \$16 billion in liabilities<sup>iii</sup>, one of the largest non-financial business failures in history. There are red flags and warning signs that put the entire industry at risk. The precarious financials of Solar City recently induced founder Elon Musk to arrange for his other company, Tesla Motors, to acquire it in a financial rescue. The solar industry needs to come to terms with the fact that growing at such a breakneck pace with even slightly wrong business models can be a "train wreck," as one former CEO put it, with companies collapsing into bankruptcy faster and faster. The solar sector needs to focus as much effort on innovating the way it makes money as it does on innovating the way it produces technology. This paper highlights the obstacles that industry leaders face while also pointing the way toward solutions.

**Keywords:** *Business model innovation, solar capacity, power purchase agreement, photovoltaics, exponential growth, SunEdison, SolarCity, Elon Musk, Tesla Motors, battery storage, Sonnen, transactive energy.*

## 1. Introduction

Living through exponential growth can be both exhilarating and hazardous. The solar industry has experienced both sides of this challenge. Installed solar capacity has grown globally from barely 1 gigawatt in 2000 to over 5 gigawatts in 2005 to an expected 320 gigawatts by the end of this year<sup>iv</sup>, as costs have plummeted by 70 percent over the past decade.<sup>v</sup> Forecasts now call for a tenfold power surge, to 3,000 GW, by 2030<sup>vi</sup>. Growth that multiplies this fast can be both deceptive and dangerous to those who depend on the sustainability of sustainability. At the same time that new capacity has been roughly doubling every year, we've seen a string of business failures, most notably the news that the industry's largest player, SunEdison, has fallen into bankruptcy with \$16 billion in liabilities<sup>vii</sup>, one of the largest non-financial business failures in history.

Ignoring red flags and warning signs put the entire industry at risk. Another case in point involves how the precarious financials of Solar City induced founder Elon Musk to arrange for his other company, Tesla Motors, to acquire it in an attempted rescue. The solar industry needs to come to terms with the fact that growing at such a breakneck pace with even slightly wrong business models can be a "train wreck," as one former CEO put it, with companies collapsing into bankruptcy faster and faster. The industry needs to focus as much effort on innovating the way it makes money as it does on innovating the way it makes panels and other technologies.

To do so, we need to understand how we arrived at this state of high growth and high peril. Ten years ago, I served as writer and producer for *Saved by the Sun*<sup>viii</sup>, a documentary which aired on the NOVA science series on PBS and has since been seen by about 20 million people on television and online. For me, one of the biggest *aha!* moments in the filming came when we followed a little-known entrepreneur named Jigar Shah onto the roof of a Whole Foods supermarket, where he explained how the store didn't need to purchase the solar panels up there, just as consumers don't need to purchase power plants that run on coal or natural gas. Rather, the store would simply pay for the electricity generated on an ongoing basis for the next 20 years. His startup, SunEdison, had come up with the business model innovation that seemed to unlock the growth equation for an industry that had been struggling to take off for its entire history: No money down, yet totally predictable costs for clean energy while also protecting consumers from rising fossil fuel prices.

## 2. Envisioning exponential growth

The power purchase model seemed brilliant up on that one roof, but it didn't take into account the exponential growth that would help unleash. Indeed, since exponential growth is so rare, the human mind often has trouble processing it. To envision that kind of growth, imagine a pond with clear waters and a single green lily pad on the surface. Now imagine that the sunlight helps the number of lily pads to double each day for a month—so that there are two pads on the second day, four on the third, eight on the fourth, and so on until the entire pond is covered lily pads by the end of the month. The paradox is that you would hardly notice that such rapid proliferation was even happening during the first, the second, and even the third week. Even on the 25<sup>th</sup> day, the pond would only be *one-sixteenth* covered with lily pads.

In terms of solar capacity, we are still in the second week of the month, so to speak. Solar sources only reached supplying 1% of energy needs in the U.S. and globally in 2015.<sup>ix</sup> Yet by 2050, many forecasters are painting a picture of solar as the planet's leading source of energy,<sup>x</sup> meaning that solar will fast become a trillion dollar market in a world that desperately needs to reduce its carbon emissions in order to avert the worst ramifications of climate change. The Paris Climate Agreement lays out the risks, goals, and incentives, but the solar industry won't be able to get there without the right business models.

### **3. The precarious state of the solar industry**

Before we get to the solutions, it's vital to understand the scope of the problem, as experienced first by SunEdison and then by Solar City. The good news is that the bankruptcy of SunEdison had nothing to do with the viability of solar as a technology. Founded in 2003, the startup was privately held and profitable after its first five years. Although it employed only 300 people and completed just a few hundred installations, the Maryland-based company was already America's largest solar energy supplier. Then, in November 2009, semiconductor manufacturer MEMC (for Monsanto Electronic Materials Company) acquired it for \$200 million. By then, MEMC had an impressive global scope, manufacturing and supplying solar cell technologies to major partners in Germany, China and Taiwan. Founder Jigar Shah exited the company as the MEMC executives took over.

What happened next was a classic case of hubris and a blind belief in financial engineering. MEMC changed its name to SunEdison as its executives came up with a dangerous model called a "yieldco." The idea was that when a solar energy project was sold, investors could essentially look at it as a bond that would create a steady stream of payments over its lifetime. The investment money would help offset the collateralized debt that such solar projects required. But any back of the envelop calculation could show the ramifications of this. If you completed 10,000 residential, commercial or utility-scale solar installations at an average cost of \$100,000, you would incur about \$1 billion million in debt, which required borrowing. Under this model, SunEdison's TerraForm yieldco's acquired even more solar projects, piled on more debt, and sold their yield streams to investors in a way not dissimilar to the way Wall Street packages and sells mortgage bonds.

There's nothing wrong with solar panel debt, just as there's nothing wrong with home mortgages. The problem comes in when financial engineers package that debt into new kinds of investment vehicles. Since the 2008-09 financial crisis, many institutional investors have learned their lesson, and problems with SunEdison's yieldco model were becoming known.

Just as investors were losing confidence in the model, SunEdison overreached even more, agreeing to acquire rival Vivant Solar for \$2.2 billion in July 2015. Already overstretched, SunEdison couldn't find investors who were willing to foot the bill. SunEdison's stock plunged from about \$31 to near zero over the next year as the entire scheme imploded into lawsuits and a bankruptcy filing which listed \$16 billion in liabilities. Most of TerraForm's solar bonds were downgraded by Standard & Poor's to junk status.

"You are combining a relatively new energy sector with a brand new investment vehicle," Dan Reicher, executive director of Center for Energy Policy and Finance at Stanford University, told *Fortune*. "We shouldn't be terribly surprised that we've had some problems."<sup>xi</sup>

### **4. How the fallout could cause a collapse in cleantech**

That leaves SolarCity as the largest solar power installer in the U.S. By the end of 2015, SolarCity installed nearly 2 GW of solar capacity. Installations grew 54% last year as the total cost per watt hit another record low of \$2.71. But SolarCity posted a net loss of \$375 million.<sup>xiii</sup> Although that loss was narrower than the year before, it still amounted to losing more than \$1 million per day installing solar panels.

As the founder of three concurrent startups, Tesla Motors, Space-X and SolarCity, Elon Musk is a bold and brilliant entrepreneur. SolarCity has been raising money from a variety of sources, but Musk went a bridge too far last when he began selling "solar bonds" to sister company Space-X, including a \$90 million sale in the spring of 2016.<sup>xiii</sup> The rationale was that Space-X gets paid in advance for many of its rocket projects, so that it had the cash on hand to make such an investment. But this couldn't go on for long.

In June 2016, Musk announced that Tesla Motors would acquire SolarCity for \$2.8 billion. "It's now time to complete the picture," said Tesla's announcement. "Tesla customers can drive clean cars and they can use our

battery packs to help consume energy more efficiently, but they still need access to the most sustainable energy source that's available: the sun.<sup>xiv</sup> While powering electric cars with the sun is no doubt the way to go, the entire Tesla ecosystem is now put in immediate peril by SolarCity's faulty business model.

All told, this shifting of solar projects from one balance sheet to another is creating a financial bubble, not unlike the mortgage bond implosion of 2007-09. If the industry expects to grow tenfold over the next 15 years, this cannot continue. Indeed, the stakes are higher than even what happened in the financial crisis, since the fallout here could cause a collapse in clean energy investment that is critical for averting the worse effects of climate change.

"Solar has been a boom-and-bust business to date," said retiring First Solar CEO Jim Hughes.<sup>xv</sup> Warning of an industry "train wreck," he added, "I think everybody would like us to move to a little more stable environment."

### **5. Five principles for the future of solar business models**

In order to prevent a damaging industry meltdown, the industry would do well to embrace these five principles for not safer business models that that harness key trends based around customer needs.

1. **No new financial instruments for solar.** It's alluring to say that solar bonds are backed "by the power of the sun," as SolarCity says in press statements. But there is no real reason to treat solar any differently than any other kind of capital equipment. Spinning solar bonds off into "yieldcos" can be deadly, as SunEdison found out. There is no reason to create a new class of securities.
2. **Solar installers that don't have sufficient capital should simply partner with banks.** We need to decouple debt risk from the business models of solar installers. SolarCity and companies like it have other ways to make money. They can take the financing off its balance sheets. It's true that the attractive depreciation schedules for renewable energy project make self-financing alluring, but installers should find ways to work with banks so that the accounting not only benefits them but also helps end consumers.
3. **Disrupting the bigger energy business—transportation—is the key to fueling sustainable growth.** While the total market for electricity is huge—over \$350 billion annually in the U.S.—what's equally huge is the market for gasoline, which also amounts to a U.S. market of about \$350 billion per year. This is where it's strategically smart to combine SolarCity and Tesla. At its gigafactory in Nevada, Tesla will ramp up production of its PowerWall storage batteries. When you charge your car with a solar-powered battery, you are taking money out of the pockets of the oil companies. What's more, this distributed clean energy can be produced and stored during peak solar hours. That's why the future of solar lies in the unification of these two previously separate energy systems.
4. As a result, **the storage battery becomes the linchpin of the future business model.** Tesla isn't the only company betting big on this market. German startup Sonnen shipped its 10,000 battery earlier this year.<sup>xvi</sup> In one way, the battery to the solar industry is what the cable box is to the cable industry: an essential piece of hardware that can be purchased or rented for a monthly fee but can also lock you into one supplier. Solar companies need to figure out how to build value-added services on top of the battery, in the same way that cable companies really make their money by bundling bandwidth and content.
5. Which brings us to the final principle: **that he who supplies the best remote control or mobile app wins.** Just as Uber is disrupting traditional taxis and Apple and Netflix are disrupting cable companies with better interfaces and better business models, there is still much to be figured out in terms of what the ideal solar business model will look like. So far, the transactive energy concept holds out much promise. What started

out as a way for the grid to manage and supply distributed energy resources<sup>xvii</sup> is evolving into a way for end-consumers to control and monitor their energy needs in the palm of their hand, with mobile apps that track their photovoltaics, combined heat and power systems, battery storage, and electric vehicles. This is where the real action and money should be made, not in dangerous new financial instruments.

## 6. Conclusion

We have reached a bizarre paradox in the solar industry: unprecedented, exponential growth is also leading to disastrous financial failures with more to come unless things change. Solar installation financing should be left to banks and other well capitalized institutions. The solar industry itself should instead focus on evolving smarter business models that harness new opportunities that matter to consumers.

## 7. References

- 
- <sup>i</sup> Greentech Media report: <http://www.greentechmedia.com/articles/read/gtm-research-global-solar-pv-installations-grew-34-in-2015>
- <sup>ii</sup> Solar Industry Association report: <http://www.seia.org/research-resources/solar-industry-data>
- <sup>iii</sup> FORTUNE: <http://fortune.com/2016/04/21/sunedison-files-bankruptcy-protection/>
- <sup>iv</sup> Greentech Media report: <http://www.greentechmedia.com/articles/read/gtm-research-global-solar-pv-installations-grew-34-in-2015>
- <sup>v</sup> Solar Industry Association report: <http://www.seia.org/research-resources/solar-industry-data>
- <sup>vi</sup> <https://www.theclimategroup.org/what-we-do/news-and-blogs/bloombergs-new-energy-outlook-2015-report-predicts-phenomenal-renewable-energy-growth>
- <sup>vii</sup> FORTUNE: <http://fortune.com/2016/04/21/sunedison-files-bankruptcy-protection/>
- <sup>viii</sup> The documentary is available for streaming here: <http://www.pbs.org/wgbh/nova/tech/saved-by-the-sun.html>
- <sup>ix</sup> <http://cleantechnica.com/2015/06/12/solar-power-passes-1-global-threshold/>
- <sup>x</sup> Renewables 2016; Global Status Report, by REN21, the Renewable Energy Policy Report for the 21<sup>st</sup> Century
- <sup>xi</sup> <http://fortune.com/2016/04/25/sunedison-drowned-debt/>
- <sup>xii</sup> See <http://investors.solarcity.com>
- <sup>xiii</sup> <http://venturebeat.com/2015/03/30/elon-musks-spacex-buying-90-million-of-elon-musks-solar-city-solar-bonds/>
- <sup>xiv</sup> <https://www.teslamotors.com/blog/tesla-makes-offer-to-acquire-solarcity>
- <sup>xv</sup> <http://www.greentechmedia.com/articles/read/First-Solars-Jim-Hughes-Touts-a-Bulletproof-Balance-Sheet-Warns-of-an-I>
- <sup>xvi</sup> <http://www.greentechmedia.com/articles/read/sonnen-ships-its-10000th-battery-putting-pressure-on-tesla-and-utilities>
- <sup>xvii</sup> <https://www.greenbiz.com/blog/2013/06/04/transactive-energy-helps-buildings-strengthen-grid>