



Spreading the rooftop revolution: What policies enable solar-as-a-service?



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HIGHLIGHTS

- Solar third-party ownership (TPO) firms can boost solar rooftop growth.
- 5 in-depth cases of US TPO firms and their ecosystem of partners are analyzed.
- Policy options to enable solar TPO emergence in new markets are suggested.
- Avoiding prohibitive rules and facilitating solar self-consumption are key measures.
- Lock-out of new and innovative solar technology is a downside to the TPO model.

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ABSTRACT

Firms using third-party-ownership (TPO) business models transform solar rooftop installations into a simple service. TPO firms sign long-term agreements with building owners or users to install, finance and manage locally sited solar panels. Customers simply buy solar electricity. The business model can increase total PV market demand by removing central barriers to PV adoption including technology risk, financing needs, and learning costs. TPO is now the dominant US model for residential solar and attempts to use the business model are underway in Europe and Asia.

This study discusses how policy makers can enable emergence of solar TPO business models in new markets, a theme novel to extant literature. The paper is based on a comprehensive study of the US solar TPO ecosystem including 50 interviews with key market actors.

A downside to the TPO model is potential lock-out of innovative solar technology. Crucial policy actions to enable TPO emergence in new markets are to ensure the legality of the TPO model and to facilitate solar self-consumption (the ability of customers to offset grid electricity costs by using locally generated solar electricity).

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1. Introduction

Firms with solar third-party-ownership (TPO) business models sign long-term agreements with customers to install, finance, and manage solar installations (Coughlin and Cory, 2009; NREL, 2009). The TPO customer (a building owner or user) buys the electricity from the locally sited panels at a predetermined rate. This eliminates the need for upfront investment on behalf of customers and transforms solar installations into a simple service. TPO is now the dominant model for residential solar in the US (Munsell, 2014) and attempts to use the business model are underway in Europe (e.g., DZ-4, 2014; Sungevity, 2014) and Asia (e.g., Sunseap, 2014).

In their analysis of the TPO market in California, the US state where the business model has the longest track record, a group of

researchers (Drury et al., 2012) finds that TPO has increased total residential market demand for solar photovoltaic (PV) panels. The business model may also attract new types of PV customers who are younger and have less education and disposable income than customers who prefer PV ownership (Drury et al., 2012). The authors conclude that TPO has removed several central barriers to PV adoption, including technology risk and complexity, financing needs, and learning costs. This finding corresponds well to those of other observers of the TPO market (e.g., Corfee et al., 2014; Hobbs et al., 2013).

Facilitating the emergence of TPO firms has proven an efficient way for US policy makers to support rooftop solar:

Policies that enable third-party PV products [...] frequently represent low-cost or cost-neutral policies that have the potential to dramatically increase PV demand by enticing new customers to adopt PV (Drury et al., 2012, p. 689)

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This study seeks to answer how policy makers can enable emergence of the solar TPO business model in new markets. The paper analyzes policy conditions that impacted the emergence of solar TPO in the US in order to suggest lessons for geographies to which the model has yet to spread.

The theme is novel to extant literature and responds to calls (e.g., Chowdhury et al., 2014) for more research on policy options available to support further growth of solar PV. Although some writers mention the solar TPO business model (e.g., Alafita and Pearce, 2014; Friebe et al., 2013; Huijben and Verbong, 2013) and analyze its value for consumers (e.g., Davidson et al., 2015; Kulatilaka et al., 2014; Liu et al., 2014; Rai and Sigrin, 2013), no analysis of the model from the perspective of TPO providers and with a focus on policy actions has been carried out to the knowledge of this author. Drury et al. (2012) suggested the value of enabling policies for solar TPO in the quote above but provided few policy suggestions. Outside of academic discourse, a group of climate analysts (Hobbs et al., 2013) have looked at solar TPO firms in California mainly to consider the influence of the business model on general policy objectives. Also, a consultancy (Corfee et al., 2014) has provided recommendations for how Californian policy makers may regulate the large solar TPO market of the state.

The growth of the TPO market was researched through a comprehensive two-year study of US solar TPO firms and their partners including 5 case studies, 50 interviews with key market actors and industry experts, and extensive archival material. This article uses ecosystem theory to emphasize how TPO entrepreneurs built and educated a network of actors with different roles in order to make the business model work.

1.1. Solar PV technology

To policy makers focused on achieving a sustainable and resilient supply of energy – an urgent issue worldwide (GEA, 2012) – PV technology can be an essential instrument. PV panels operate without consuming input commodities, are reliable and well-proven (Bazilian et al., 2013), and have a minimal manufacturing carbon footprint relative to their long lifespan (GEA, 2012). The technology has spread rapidly as the average price of solar modules has come down by at least two thirds since 2003 (Bazilian et al., 2013). Global installed capacity of solar panels reached 100 GW in 2012 (REN21, 2013) and commercial-scale solar rooftop installations can now generate electricity at a price in parity with the socket price of electricity in parts of the US (Reichelstein and Yorston, 2013). Prospects are good for further reductions of solar panel and installation costs (Dong and Wisner, 2013; Reichelstein and Yorston, 2013).

Yet the world's installed solar capacity is still only sufficient to meet 0.5% of global electricity demand (REN21, 2013). Solar enters a marketplace designed for conventional power, dominated by incumbents with political and financial clout (GEA, 2012; Neuhoff, 2005). As the cost and risk of conventional energy to the world is not fully internalized, the playing field could be leveled further (GEA, 2012; Neuhoff, 2005). Although a vast number of policies have been used (Klessmann et al., 2011; Li and Yi, 2014) to support solar electricity, policy still has a role to play to lower soft costs and remove barriers to deployment (Dong and Wisner, 2013; Li and Yi, 2014; Sener and Fthenakis, 2014).

1.2. Industry background

Solar TPO firms typically offer solar rooftop installations as a full service, accessible to customers (often called “hosts”) in exchange for long-term payment contracts. These contracts are called solar leases or Power Purchase Agreements (PPA). Both typically last 15–20 years, but whereas a lease stipulates a regular

amount to be paid by the customer in exchange for a minimum yearly amount of solar energy, a PPA sets a price per kilowatt hour of solar power (Coughlin and Cory, 2009; Kollins et al., 2010). Customers may buy the installation at specified points in time during the contract term if they want to end the contract (Corfee et al., 2014). At the end of the contract term customers can buy the panels, let the solar TPO firm remove them, or extend the contract (Coughlin and Cory, 2009; NREL, 2009). A solar TPO installation is formally owned by the financial partners (the “third parties”) of the TPO firms and these partners can access tax breaks, renewable energy credits and other support mechanisms granted to the installation (Coughlin and Cory, 2009; NREL, 2009).

Solar TPO firms first emerged in the US around 2005 (Drury et al., 2012). SunEdison and MMA Renewable Ventures, both focused on solar TPO for commercial and industrial customers, pioneered the business model simultaneously (Kollins et al., 2010) with customers such as Whole Foods and Staples (Himmelman, 2012). The industry grew rapidly as firms put the business model to use in new geographies or with new customer groups (Cather, 2010; Daley, 2009; Woody, 2010).

The TPO model offers customers benefits both compared to grid power and to solar panel ownership. Compared to only using grid electricity, the solar TPO model typically offers (Drury et al., 2012; Kollins et al., 2010):

- Solar electricity at a lower rate per kilowatt hour.
- A locked-in rate for the duration of the contract.
- Clearly visible green credentials.

Compared to ownership of solar panels, the TPO model helps customers avoid key barriers to rooftop solar use such as (Drury et al., 2012; Hobbs et al. 2013):

- Upfront investment needs.
- Initial efforts for design, procurement, installation or permitting.
- Operation and maintenance concerns.

Simplicity and relief from risk and responsibility makes the TPO model fit a larger segment of customers than the traditional ownership model (Drury et al., 2012). An in-depth case study of Staples, a large US retail chain, describes how the firm saw environmental and financial benefits of solar power, yet did not consider the construction, financing and managing of solar panels a core business activity (Feldman and Margolis, 2014). Staples has good access to funding and a competent team, but other priorities than solar (Feldman and Margolis, 2014). In 2005 Staples became one of the first solar TPO customers in the US and it now has TPO-installed solar panels on 37 of its US facilities (Feldman and Margolis, 2014).

National US statistics for the TPO share of the market for commercial solar installations have not been identified during this research project. In the residential market, the TPO model accounted for 66% of installed US solar capacity 2013 (Munsell, 2014) as total new capacity in the segment amounted to 0.8 GW (GTM/SEIA, 2014). Yet this average market share for TPO may not do the business model justice, as it to date only is fully allowed in 22 US states (DSIRE, 2014b). In some of the states where it is allowed, such as Arizona and Colorado, it represents over 80% of the residential market (GTM/SEIA, 2013).

There are similarities between TPO solar contracts and energy performance or energy service contracts. Such contracts have been used to remove the burden of financing and maintenance from users of local energy installations through third-party solutions, financing investments through the savings achieved (e.g., Duplessis et al., 2012; Sorrell, 2007; Steinberger et al., 2009). Solar

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