CHAPTER 12

Financing Rooftop Solar for Single-Family Rental Properties

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1 Background

The US solar energy industry has grown rapidly over the past decade, largely due to manufacturing and installation cost decreases, federal tax credits, state clean energy mandates, net metering, and innovative financing tools like the power purchase agreement (PPA). Low interest rates following the 2008 financial crisis reduced financing costs for solar investments and assisted in spurring deployment of the renewable energy technology. This chapter focuses on the residential solar industry, where the tenants of more than 15 million single-family rental [SFR] homes are often unable to access rooftop solar, even when installing solar panels would save renters money.

Cost decreases have assisted in the growth of solar energy. As global installations increased exponentially, residential solar costs in the United States decreased by 56%, from $7.06 to $3.11 per installed watt, from year-end 2009 through the first quarter 2016 (Fu et al., 2016). Decreases in hard costs, or the combined expense of modules, inverters, and other electrical or mechanical components, have outpaced declines in soft

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costs—spending on labor, overhead, advertising, and permitting—so that soft costs increased from 50% to 58% of total installation expense for residential solar in the 2009–2016 period (Fu et al., 2016). Soft costs for residential installations make up a much higher percentage of total installation expenditures than for commercial and utility-scale solar, where soft costs made up only 49% and 34% of build costs, respectively. The US solar industry reached a cumulative one million installations in February 2016, and the pace of deployment is largely expected to increase over time, further depressing prices as economies of scale improve (Pyper, 2016).

Tax benefits at the state and federal levels also contributed to the boom in the residential solar industry. The main subsidy for solar installations is a 30% Investment Tax Credit (ITC) that applies to the cost of installation for all solar arrays. Such an incentive allows the owner of a solar project to deduct 30% of a solar system's installation cost from his or her tax burden. Also, Modified Accelerated Cost Recovery System (MACRS) depreciation allows solar system owners to deduct 85% of the cost of a system from their income over a period of five years (*"How to depreciate property," 2016*). Normally the tax deduction for a capital investment is spread over the useful life of the investment—anywhere from 25 to 30 years for a solar system—but the IRS allows the cost of a solar installation to be deducted over a much shorter time frame, reducing the tax obligation of a solar system's owner and increasing the attractiveness of investments in solar energy. Some states, like California, also offer property tax exemptions for solar energy, which means that even though rooftop solar installations increase property values, property tax appraisals do not consider the solar systems' positive impact on a home's market value.

PPAs are financial agreements that enable homeowners to access rooftop solar without upfront costs. The innovative mechanism enables an investor to fund the installation of a residential solar system after a homeowner agrees to purchase the electricity generated by the panels at set prices over a fixed time period, typically at a rate lower than that offered by the local utility. The homeowner enters into an agreement to purchase the electricity produced by the system for a predetermined period of time, typically 15–20 years. The PPA contract guarantees future payments at fixed rates that gradually increase each year and allows the investor to project future cash flows from the solar system so as to ensure a predictable return on investment. With a PPA, a homeowner does not own the solar panels, but does pay for the electricity generated. The panel owner is liable to repair any damages to the system, so the homeowner is able to acquire the less expensive solar energy without risks associated with the solar

system's performance. The energy consumed by the home beyond that produced by the panels is drawn from the grid at retail rates and any excess energy produced by the panels is typically sold back to the grid at rates that vary by state and local utility. The current market for solar PPAs is led by a few major players: SolarCity (now Tesla Energy), Sunrun, and Vivint Solar. Since much of the data cited in this chapter is from SolarCity's period as a standalone company prior to its late-2016 acquisition, the company that is now a part of Tesla will be referred to as SolarCity.

Net Energy Metering (NEM) is a system that allows properties with solar installations to export excess solar electricity back into the grid, offsetting energy imported from the grid over the course of a billing cycle so that the utility customer pays for the net amount of electricity consumed. Forty-one states offer net metering, and some utilities in Idaho and Texas, states without mandated net metering, also offer NEM for distributed energy sources like rooftop solar (Cleveland & Durkay, 2016). NEM rates vary based on the state and utility provider, but a vast majority of solar customers receive credits at retail rates, allowing them to export electricity back into the grid and earn bill credits at the local energy price—above the price paid on the PPA. Such a system forces utility companies to purchase excess solar energy at retail rates, which does not allow room for profit when the energy is sold, at the purchase price, to other grid-connected customers. In fact, utilities pay large fixed costs associated with maintaining a grid and therefore lose money when selling net-metered solar to other customers. Laws surrounding NEM will inevitably change as more distributed energy is added to grids across the United States and the burden on utilities, and therefore ratepayers, increases as more customers begin to export energy onto the grid at retail rates. A number of states have instituted caps on the total installed capacity of net-metered systems. Other electricity providers, like Austin Energy in Texas, offer Value of Solar rates that take into account the grid costs and benefits of distributed energy, like the value of reduced emissions and avoided new power plant construction, energy production, and transmission costs.

2 The Problem for Renters

Despite the success of the aforementioned policies and the resulting growth in solar deployment in the United States, a number of existing barriers prevent widespread adoption of distributed solar energy. One major obstacle for residential solar growth is found in the single-family home rental market, where a split incentive between renters and landlords hinders rooftop solar adoption.

A split incentive is a situation in which the costs and benefits of an investment accrue to differing parties. In the case of rooftop solar on rental homes, an investment in solar energy might reduce utility bills for the tenant but requires a cash investment that both the renter and the property owner lack the financial incentive to make. Tenants do not want to make long-term investments in properties they do not own because they might not occupy these properties long enough to recoup their costs. Furthermore, tenants rarely have the legal authority to install solar panels on a property they do not own. Since landlords typically do not pay the utility bills of their residents, there is little incentive for a property owner to invest in solar energy if the renter will receive the benefits of the reduced utility bills offered by solar energy—even if the solar system increases property value. Additionally, landlords would not see much benefit if a PPA was signed with a company like SolarCity because tenants would benefit from the electricity cost savings, and property owners would have little incentive to spend the energy to approve an installation or repair a roof in advance of a solar project.

3 The Current "Solution"

Right now the leading "solution" to the split incentive is Community Solar.

Community Solar, also known as Shared Solar or Virtual Net Metering, is a solar ownership structure that allows renters and homeowners whose roofs are unfit for solar to offset their energy use by acquiring stakes in local, ground-mounted solar installations. Customers can collectively pay to build a solar array or subscribe to the electricity produced by a system owned by a utility or solar developer and use pro rata shares of the energy produced to offset home electricity consumption the same way a net-metered rooftop system would.

Though Community Solar could prove a suitable option for some renters seeking to consume solar energy, a number of impediments exist, delaying or preventing widespread adoption. First, many utility companies are opposed to any expansion of net metering and lobby against shared solar legislation. As previously explained, net metering often erodes utility profits, and though Shared Solar has at times been implemented without legislation, Community Solar bills vastly improve the success rates of projects of this type. Additionally, utilization of tax credits on customer-owned systems can be difficult when dividing shares of a project between a number

of owners that may not have enough income or the accounting wherewithal to take full advantage of the tax credits and depreciation write-offs. For utility-sponsored installations, customers can choose to have their energy supplied by a solar array but typically must pay above-retail prices for the electricity. As of early 2016, only 102 megawatts of shared solar had been installed in the United States, representing a small fraction of total solar deployment.

Though Community Solar holds long-term potential, its current financial and legislative constraints leave the market for single-family home renters seeking access to solar open to other potential solutions.

4 A Superior Solution

A potentially viable solution to this split incentive could be a Renter's PPA [RPPA].

An **RPPA** is a straightforward concept—property owners install solar panels on their properties and require tenants to purchase the produced energy. Property owners can include electricity PPAs into rental agreements by including a clause requiring renters to purchase solar electricity at fixed, below retail rates. Existing rental agreements would not be altered to include language regarding electricity purchases, but future rental agreements could be designed to incorporate the sale of electricity to captive tenant customers. The RPPA provides a number of benefits over standard PPA contracts by removing the need for tax equity investors and by eliminating a large portion of the soft costs associated with solar installations. These benefits are discussed at length below. Renters would benefit from electricity rates below market levels and enjoy access to clean solar energy, while property owners would be able to create a new, immediately cash flow positive revenue stream if electricity sales exceed borrowing costs. Repayment risks would be low and predictable because landlords would already have access to rental payment histories and could be able to target reliable renters with high credit scores for the RPPA. Landlords without the expertise or infrastructure to add solar to their properties themselves could contract out installation and operations and maintenance (O&M) to third-party experts like SolarCity and Enphase that would build and manage the solar systems. The concept will likely perform best on single-family home rental properties that only have one meter because multifamily rentals contain a number of meters, complicating the process of determining the end users of the energy produced by a solar

system. Though this problem likely could be addressed with technology that tracks the consumption of the solar energy on a meter-to-meter basis in a rental building, this chapter focuses exclusively on the potential of the RPPA in the single-family home rental market.

5 Addressable Market: Single-Family Rentals

The **SFR** market has seen tremendous growth since 2005. Currently, 15.1 million SFR homes account for 13% of the entire US housing market and 35% of all occupied rental housing stock (Smith & Koch, 2016). The 2008 financial crisis sparked or accelerated a number of major trends in the American real estate market. Housing prices fell as a result of a wave of subprime mortgage foreclosures and nationwide job losses. Institutional investors began to acquire single-family properties that they correctly identified as undervalued relative to achievable market rental prices. By mid-2017, the seven largest institutional SFR portfolios included approximately 200,000 properties, largely concentrated in "Sun Belt" states like Arizona and Nevada (Dezember & Kusisto, 2017).

Additionally, lending standards for mortgages became more stringent following the financial crisis, preventing individuals from purchasing homes. From 2007–2012, all-cash home sales increased from 23.1% to 39.5% of total home sales, explained by the decrease in mortgage-fueled home purchases and the increase in all-cash institutional investments (Goodman, Zhu, & George, 2014). As average student debt among college graduates rose by 53% from 2004–2014 to nearly $27,000 per borrower, fewer graduates could afford to purchase homes, especially considering tightened mortgage lending standards and a poor job market ("Student debt and the class of 2014," 2015). These factors led to a sea change in the American housing market as the number of single-family rental units increased by 3.8 million from 2005–2014, accounting for 89% of the net increase in single-family units and 62.5% of the growth in total occupied housing over the same period (Smith & Koch, 2016). After peaking at 69.2% in 2004, the American homeownership rate declined to 62.9% in mid-2016, the lowest level in 50 years (Gopal, 2016). The market for SFR homes is large, continues to grow, and is increasingly dominated by a number of institutional investors who could successfully implement the RPPA at scale.

6 Why the Renter's PPA Could Work: The Economics of Rooftop Solar

Three installers comprise a large portion of the rooftop solar market. In the second quarter 2016, SolarCity (now Tesla), Sunrun, and Vivint Solar together commanded 47.5% of the rooftop solar market (Mond, 2016). Despite their dominance, all three of these corporations remain unprofitable for a few reasons. SolarCity will be used as the primary example herein as it is the largest individual company in the industry.

Sales costs, the expenses associated with acquiring new customers, are high in the rooftop solar industry. SolarCity has successfully reduced hard costs, cutting such installation expenses per watt from $2.40 in the first quarter 2014 to $1.98 through the same period in 2016 ("SolarCity Q1 2016 earnings presentation", 2016). Despite the reduction in hard installation expenditures, the company struggles with its soft costs. In Q4 2015, 20% of total costs per watt were associated with sales. In 2016s first quarter, sales expenditures ballooned from $0.54 to $0.97 per watt, representing 38% of total installation expenses of $3.18 per watt. The RPPA would require no advertising because existing tenants are captive customers and would have little choice but to agree to purchase the electricity or to live somewhere else. With the RPPA, there would be limited administrative costs associated with installing the solar systems other than the expenses associated with rewriting rental agreements and billing tenants.

Solar companies do not currently recognize SFR homes as a market for potential sales and therefore likely target none of their marketing toward renters. Sales to single-family rentals would, therefore, involve limited sales costs. Additionally, advertising costs are fixed in the short term for sellers, meaning that they are motivated to spread such expenses over a larger installation base by increasing sales volume. As the number of installed watts increases, the sales expenditure per watt decreases. The cost to a company like SolarCity to install an additional watt is equivalent only to the marginal expense of installing a new watt, which would exclude sunk costs like past advertising spending. As a result, installers might agree to sell solar arrays for less than their total published costs per watt and still earn a profit. For institutional SFR owners that might purchase solar for thousands of roofs at once, the pricing benefits could be more pronounced.

The cost of capital is also high across the industry. In the first quarter 2016, SolarCity claimed it held a blended debt rate of 5.1%, but its more recent debt offerings carried higher rates. In Q2 2016, SolarCity could

not sell 18-month bonds paying 6.5% interest before Elon Musk and two other senior executives at the company purchased a combined $100 million of the $124 million offering (Owens, 2016). Though Tesla's merger with SolarCity might reduce borrowing costs for the company, many lenders view direct lending to rooftop solar installers as risky. Additionally, because the PPA originators are all unprofitable, they have no choice but to partner with tax equity investors in order to take advantage of the ITC and MACRS depreciation incentives. Tax equity investments are situations in which a taxable entity invests in a project with a tax incentive attached in order to take advantage of the tax benefit. Since Tesla, and by extension SolarCity, is not yet profitable, it must work with tax equity investors and sacrifice large portions of project cash flows as a result. According to the US Department of Energy SunShot Initiative, tax equity investments typically offer a cost of capital of 9.8% and repayment periods are weighted heavily toward the first seven years following the investment (Feldman, Boff, & Margolis, 2016). In SolarCity's case, approximately 30% of project cash flows are returned to the tax equity investor in each of the first seven years after a project is completed. SolarCity requires about 40% of each project to be funded by tax equity, so the blended cost of capital between both debt and tax equity is likely well above 5.1%. For a stable and profitable firm that owns thousands of properties, tax equity would be unnecessary and borrowing costs would likely be much lower than at SolarCity. As an example, Blackstone was able to raise €300 million in 2015 at an interest rate of 2% ("Blackstone form 10-K 2015," 2016). At the time, the company owned the nation's largest portfolio of SFR homes through its former subsidiary Invitation Homes.

7 Hypothetical Target Company

An institutional investor that owns a large number of single-family rental properties, like Blackstone before it spun off Invitation Homes, would be an ideal target to implement the RPPA at the lowest possible cost. Such a large company would be able to borrow at relatively low rates, take full advantage of subsidies for solar without the need for tax equity, and achieve economies of scale by negotiating installation prices for bulk purchases. Additionally, as an RPPA-generated electricity, it would provide the panel owner with Renewable Energy Certificates (RECs). These companies could gain a public image boost by claiming the greenhouse gas emission reductions associated with the RECs or could sell the certificates

in the open market. Even with the high cost of capital and substantial selling, general, and administrative (SG&A) expenses, SolarCity was cash flow positive in Q1 2016 excluding its investment in a solar panel factory, demonstrating the potential for the PPA model to produce a profit even under difficult conditions. SolarCity claimed that its increased SG&A expenses in first quarter 2016 were due to installations failing to meet expectations, resulting in the spread of fixed sales expenses over a smaller number of projects. An institutional investor could partner with a leading installer like SolarCity to utilize its excess installation capacity and take advantage of the company's track record and expertise in building reliable solar systems at low cost.

8 Asset-Backed Securities

Many large institutional SFR investors aggregate and securitize their real estate portfolios. By selling asset-backed securities (ABS), or bonds backed by the rental payments on portfolios of homes, companies like Blackstone are able to raise billions of dollars of new cash at low interest rates to invest in purchasing more homes. Through April 2014, rental-backed securities issued by major institutional investors in SFR real estate totaled $9.45 billion (Layton, 2015). If an institutional investor installs enough solar systems on its properties, it could sell an ABS secured by the solar electricity payments or combine the solar and rental payments for future ABS offerings, allowing the companies to raise more capital while shifting repayment risk to outside investors. SolarCity has already raised hundreds of millions of dollars by securitizing the payments from its distributed solar assets (Maloney, 2016).

9 An Alternative RPPA

Though the SFR market has seen substantial institutional investor engagement since 2008, many property owners are incorporated as real estate investment trusts (REITs). A REIT is a company structured in a way that enables income from real estate assets to avoid taxation if at least 90% of profits are paid to investors as dividends. Large single-family rental REITs like American Homes 4 Rent, Colony American Homes, and Invitation Homes own tens of thousands of properties in markets like California, Texas, and Arizona. These companies are tax-exempt and therefore would be unable to utilize tax credits on rooftop solar installations. In order to

overcome such a gap, these institutional investors could utilize more expensive tax equity investments or take on a "Pass-Through PPA."

The Pass-Through PPA would occur if a landlord signed a PPA with a company like SolarCity in which she would purchase and immediately sell the electricity to a tenant at a slight premium. This way, the electricity would "pass-through" the property owner to the tenant. For example, in a market with electricity prices of $0.12 per kWh, a typical SolarCity PPA might cost $0.08 per kWh. A Pass-Through PPA would enable a property owner to sign a PPA with a solar installer and, like in an RPPA, work electricity purchases into a rental agreement with a tenant. The property owner might charge the tenant $0.095 per kWh, offering a below market rate and satisfying tenants with cheap, clean electricity while retaining the profitable "spread" of $0.015 between the two contracts.

Such an arrangement would offer property owners a number of benefits and disadvantages compared to the RPPA. The Pass-Through PPA would allow property owners to avoid upfront investments and any associated increases in borrowing. The model would also allow property owners to bypass other ownership risks such as the obligation to repair any damage to a solar system. The main risk associated with the Pass-Through PPA would be associated with guaranteeing payments to the installer. Companies like SolarCity would not agree to build the rooftop solar systems without a committed, creditworthy buyer for the electricity produced. When tenants cannot afford electricity payments or homes with solar systems sit unoccupied, the cost of the energy produced would be borne by the property owner, who might be only able to monetize the electricity on the grid at a wholesale price below that paid to the installer. As a result, property owners would require a substantial enough spread between rates received from tenants and rates paid to installers to justify the risk of guaranteeing electricity payments to an installer. The necessary spread might limit the use of this model to states with abnormally high electricity prices and favorable policy environments.

10 A Risk to Consider Regarding the Renter's PPA and Rooftop Solar

Changes to NEM laws and regulations might pose the largest long-term threat to the rooftop solar industry. As distributed energy sources increase as a percentage of total electricity generation, NEM will become a burden

for utilities and ratepayers, requiring alterations to NEM policy. Technological innovations will ease this transition, as will decreasing energy storage costs, but inevitably the laws are likely to change. Smart inverters, a technology that can help regulate the output of a rooftop solar array based on grid conditions, will likely become ubiquitous as utilities in a number of states, including Arizona and California, are currently testing and implementing the technology. California began requiring smart inverters on all new solar installations beginning in September 2017 (St. John, 2016). Smart inverters can reduce voltage during periods of overproduction and direct electricity between a home, the grid, or a battery system in order to maximize panel efficiency and reduce grid strain. They will help prevent grid damage during peak solar production periods and will likely be complemented by cheaper batteries. Though the laws surrounding net metering are set to change, old systems are likely to be grandfathered into new regulatory schemes, meaning that the net-metered rates for solar systems built prior to any regulatory changes will not be affected by future alterations to the NEM scheme.

11 Where This Might Work: California

California is a preferred state for investing in solar. The state has very high levels of solar radiation, especially in Southern California. In 2015, residential electricity prices were $0.169, ranking seventh highest in the country (Annual Electric Power Industry Report, 2016). There are no property taxes applied to solar systems in the state. California recently updated its net-metering laws but grandfathered in old systems, which indicates that future changes will likely include grandfather clauses for old systems. As a result of California's drought, hydroelectric production decreased 67.5% from 2011–2015, making up only 7% of Californian electricity in 2015 compared to over 21% in 2011. Similarly, nuclear energy production declined from 18.2% to 9.4% of electricity generated in California over the same period. Both of these trends leave room for growth in solar generation, which remained at only 7.5% of energy produced in the state in 2015 (Annual Electric Power Industry Report, 2016).

Net Metering 2.0 encourages the implementation of the RPPA in California. The state is one of the first to modernize its net-metering policy. The new regulatory regime, NEM 2.0, will be in effect until 2019, providing ample time to design and implement an RPPA pilot project before the state redesigns regulations. NEM 2.0 allows excess energy fed into the grid

to be credited back to utility customers at retail rates and prohibits fixed monthly charges like demand or grid access charges that undermine the economics of rooftop solar. Investment in California also carries some risks. Mandatory time-of-use (TOU) rates will enter into effect with NEM 2.0, but the rates have not yet been decided. TOU rates might diminish the value of solar energy production by lowering energy prices during times of peak oversupply, which correspond with major solar production periods. Orienting solar arrays to face west will limit the impact of the TOU rates by shifting panel production later into the day, matching peak demand hours while shifting panel production peaks away from those of most grid-tied solar. Such a shift would allow excess energy to be sold back to the grid at increased rates. NEM 2.0 requires interconnection fees of $75–150 depending on system size and local utility and removes a prior exemption on non-bypassable charges, which are fees of $0.02–0.03 per kWh applied to all Californian utility bills to fund energy efficiency and low-income bill assistance programs. The non-bypassable charge will have a limited impact on RPPA customers because it only applies to energy consumed from the grid, not from solar panels, and homes without solar already pay the charge.

12 Where This Might Work: Connecticut

Connecticut is a state where RPPA implementation would likely not initially take place, as there has been very little institutional investment in Connecticut's SFR market. The state would serve as an ideal location for RPPA expansion to non-institutional SFR property owners if the concept was proven successful in a more consolidated SFR market like California. In 2015, Connecticut had the highest residential electricity rates in the contiguous 48 states at $0.209 per kWh—almost double the national average (Annual Electric Power Industry Report, 2016). Connecticut has a strong net-metering framework that requires both major utilities, Eversource and United Illuminating, to provide retail rate net metering with no net-metered capacity cap. Due to the lack of SFR ownership consolidation, the rental property owners in the state own smaller portfolios of homes and would face higher borrowing costs, but high electricity prices and a favorable regulatory environment make Connecticut a top state for solar investments. The smaller property owners would still be able to take advantage of tax credits and avoid the need for tax equity investors, so the most valuable benefits of RPPA would still apply. However, the economies of scale, low borrowing costs, and ability to issue ABS would not apply.

13 Potential Social Impacts

The RPPA has the potential to revolutionize both the rooftop solar and SFR housing industries. By installing 6.5kW solar arrays on just 353,850 homes, 2.3% of the SFR market, 2.9 GW would be added to the grid, equivalent to the total US rooftop solar capacity built in 2015. The RPPA could help diversify the US energy supply and reduce electricity bills for renters, who tend to be less wealthy than those who own homes—49% of SFR homes are categorized as "affordable," compared to just 24% of single-family owned properties and 63% of single-family rental occupants are in the bottom two income quartiles (Drew, 2015). Though no southern states were discussed in this chapter, it is worth noting that 42% of the American single-family detached rental market is located in the South, where solar adoption is very low. A Pew Research survey found that only 35% of homeowners in the South had seriously considered installing solar on their homes, compared to 66% of homeowners in the West (Funk & Kennedy, 2016). When photovoltaic systems are installed on roofs, neighbors within a one-mile radius are significantly more likely to consider installing solar on their own roofs (Graziano & Gillingham, 2014). Implementation of the RPPA in the southern United States could help spark a movement toward rooftop solar in a largely untapped yet sunny region, helping increase solar adoption and reduce fossil fuel dependence in often-conservative states that have historically moved more slowly than the rest of the country toward renewable energy adoption.

14 Concluding Thoughts

As a result of cost decreases for solar installations, net metering, favorable government policy, low interest rates, and financing tools like PPAs, the American residential solar industry has grown rapidly in recent years. The single-family home rental market in the United States has steadily grown since the 2008 recession, and its solar energy potential remains untapped due to the split incentive between property owners and tenants. The RPPA model has the potential to create new revenue streams for both institutional and small-scale SFR property owners alike. Unlike major solar installers like SolarCity that struggle to achieve profits, institutional investors have the capability to take direct advantage of government tax incentives, borrow at low interest rates, and limit most sales and administration costs associated with installing solar systems while securitizing solar

payments into ABS to fund more investments. In states like California, the RPPA model could be viable under current market conditions and state regulations. If institutional investors can demonstrate the value of the RPPA, small-scale SFR owners might also employ the RPPA on their properties across the country, beginning in states like Connecticut with high electricity prices and favorable net-metering policies. The potential social impacts of the RPPA include decreases in greenhouse gas emissions, a reduction in electricity prices for typically middle or lower class home renters, and the possibility of a public demonstration of the economic viability of rooftop solar so that American homeowners more seriously consider installing solar systems on their properties.

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