

HOW VIRTUAL GRID MAKES SOLAR PROFITABLE FOR MULTI-FAMILY HOUSING



Evolving the way shared buildings create, use, and think about energy.

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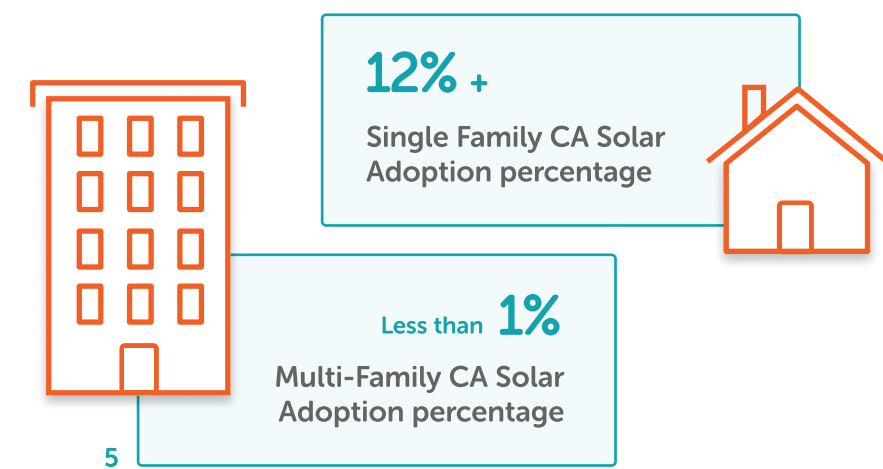
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How the virtual grid makes solar profitable in multi-family housing

The new opportunity for building owners and renters to make money on solar

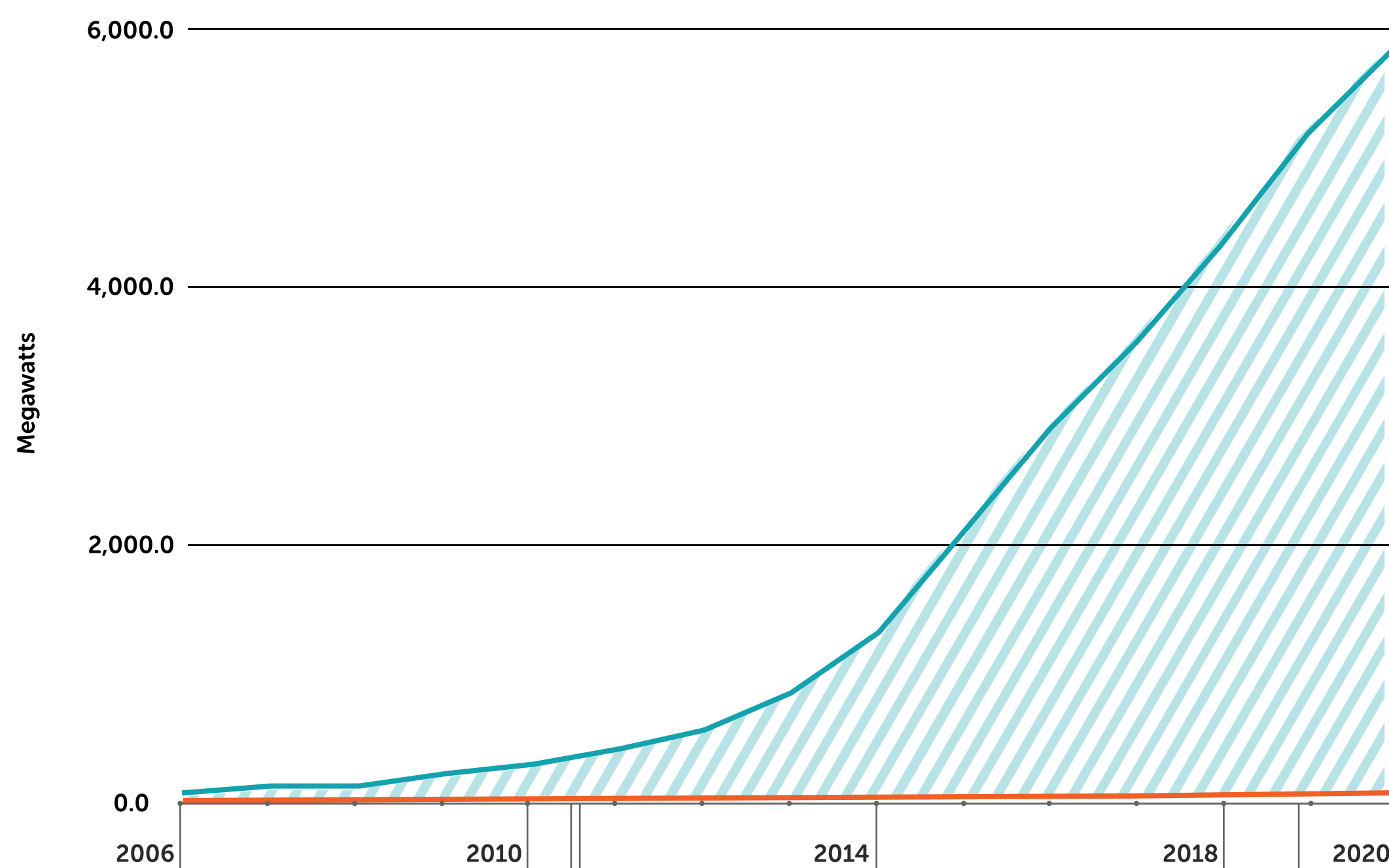
For much of the past decade, as the market for residential solar has exploded, few investors have challenged the assumption that solar on multifamily housing is uneconomical. The differences between solar on single-family homes and multifamily buildings are enormous. Individual homeowners have come to expect a simple transaction with unmistakable value. Owners of apartment buildings and condominiums who evaluate rooftop solar can note all the uncertainty in the business. How many residents will sign up to be solar customers? How do you fairly manage project financials for everyone involved? The wrong answers can lead to an unpredictable return on investment, or no return at all.



While many real estate investors believe the market for solar on multifamily housing still needs to mature, a leader in high-end living experiences that manages 43,000 housing units nationwide has found that solar pencils out on one of its properties in Southern California. The project also showed that residents in the building can reduce electricity costs by going solar. Nothing is stopping apartment buildings and condos across California from immediately earning the financial benefits of solar today, finally joining single-family homeowners in profiting from onsite solar.

To support the economics of solar in general, California regulators use ¹net energy metering, a utility rate tariff that credits solar producers for energy exports to the grid, offsetting the cost of electric service. Net metering has succeeded at bringing solar to single-family homes. But it hasn't spread the benefits equally to everyone, especially residents in multifamily housing. To try and fill the gap, regulators allowed multiple utility customers to share a grid interconnection with one big project, a concept known as ²virtual net energy metering. But the impact of virtual net metering has been limited because it provides no clear mechanism for sharing the financial benefits of solar. California grant programs for multifamily solar projects only scratch the surface of the market. Meanwhile, the state is literally paying millions of dollars to make residential solar more equitable. It would be more cost effective to enable private financing of solar on multifamily housing at no cost to taxpayers. All that's missing is a private-sector solution to unlock the market.

³ California Solar Adoption by Housing Type



Single Family Solar

Solar adoption in CA has increased exponentially since the technology has been able to provide large energy savings for homeowners.

Equity Gap

In CA over 46% of the populations rents, and due to the fact that renters in single family households or multi-family households are not able to make a solar investment themselves, the equity gap in access to onsite solar energy can be largely assumed when comparing solar capacity installed for multi-family through the MASH program and solar installed for SF homes.

Multi-Family Solar

This represents the capacity of solar installed for multi-family housing through the MASH program. There are only a handful of VNM installations installed by landlords for tenants without the MASH program as stated in the ⁴NEM 2.0 lookback study conducted by Itron.

MASH

The multi-family affordable solar housing program (MASH) was developed to stimulate the adoption of solar power in the affordable housing sector through grants.

VNM

Virtual Net Metering enabled solar installations for multi-meter buildings. However the solution seemed to lack last mile solutions to make use of the policy.

SOMAH

Solar on multi-family affordable housing (SOMAH) was developed to continue providing solar benefits for affordable housing to leverage GHG tax dollars to fund solar on affordable housing.

⁴ "Areas with low rates of home ownership might be expected to have lower residential NEM installations since rental property owners normally do not pay utility electricity bills and therefore are not motivated to install energy saving measures."



Any viable solution needs to generate high-quality data on solar production and household energy consumption for each user. To fairly distribute the benefits of solar, you have to calculate each user's value of solar energy, the cost of electricity from the grid, and the combination of the two. You also have to ensure that savings are distributed equitably while providing a margin for the building owner and incentivizing residents to shift loads to periods of high solar output.

"From 2018 to 2020, Ivy Energy has achieved market validation for a solution called virtual grid. Virtual grid is a turnkey service using innovative software design that includes proprietary load algorithms and community solar cost averaging logic to make onsite shared solar profitable for building owners and residents."

Ivy Energy's virtual grid solution can unlock a burgeoning market for solar on multifamily housing. Starting in 2020, California's Building Energy Efficiency Standards require solar on all new home construction. This first-of-its-kind US mandate will drive up demand for solar on multifamily housing, as projects will have to cover 50 to 70 percent of building load with on-site solar. The virtual grid also contributes to grid stability. Within the existing regulatory framework, it encourages an important step towards a true microgrid, one that not only increases solar energy adoption but prompts users to favor self-consumption and reduce their impact on the distribution grid.

A private-sector key to a public policy puzzle

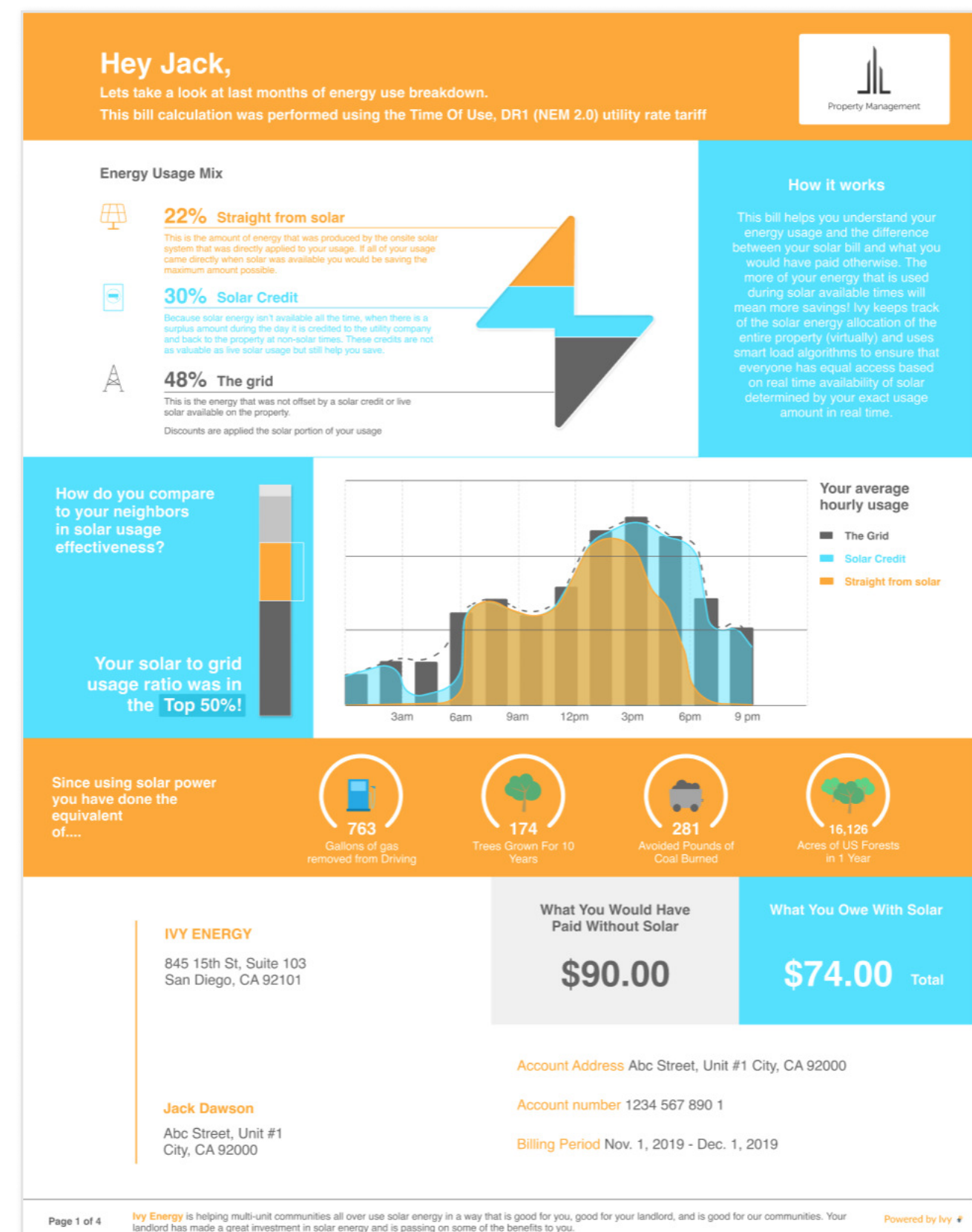
Regulators have clearly signaled the path forward for California's electricity market. The transition to low carbon and carbon-free energy sources will continue and most likely accelerate. The grid will become more resilient, no longer forcing preemptive power outages when heat waves and high winds coincide. And local communities will take more control over the types of energy we use. You can trace the vision of a new energy future by connecting the dots from net metering to newer regulatory ideas like community choice aggregation, which transfers energy procurement authority away from investor-owned utilities and over to municipal leaders. But you can also see the need for a private-sector solution that extends solar access to multifamily housing, helping to fulfill the promise of clean, reliable energy for all.

The introduction of virtual net metering in 2011 resolved some challenges for solar on multifamily housing, but not all of them. It improved the logistics for one big solar project shared across multiple customer accounts, removing the need for separate electric meters and simplifying the assignment of bill credits for energy production. It was also a step in the right direction in terms of fairness. Net metering was never intended to favor single-family homeowners over renters, but it has. Virtual net metering can help roll back the growing inequities in solar adoption and prevent a cost shift among utility ratepayers from homeowners who have enjoyed the benefits of solar to renters, many of whom have not.

Why hasn't the market for solar on multi-family housing developed further after nine years of virtual net metering? For one thing, there's no built-in mechanism to adjust net metering credits in line with newer utility rate tariffs where electricity prices vary according to time of use. There's no way to account for actual utilization of a shared solar resource either. The cost of on-site solar is different than the cost of energy from the grid. But under virtual net metering, your energy consumption may have no effect on your compensation as a solar energy producer. Lastly, virtual net metering does not assure customer satisfaction for building owners or residents. Owners cannot estimate a likely return on investment until they know how many people will accept solar service and how the benefits will be distributed throughout the group. Residents, meanwhile, need to know how the cost of solar will compare to their utility service. And they need an opportunity to choose better payment terms for solar.

At the municipal level, California has begun offering more choice to residential electricity users, and more renewables in particular, through community choice aggregation. As nonprofit public agencies with community oversight, community choice aggregators (CCAs) increase transparency and accountability in electric resource procurement. This means communities can decide for themselves how they want to balance investments in resources like solar and energy storage with less concern about short-term, incremental impacts on rates. There's less concern about cost shifting too. Because CCA territories are far smaller than utility territories, procurement decisions in the San Francisco Bay Area have no impact whatsoever on electricity costs in the Central Valley or up in the Sierra Nevada mountains. CCAs also provide partnership opportunities for community-based organizations seeking to develop multifamily solar initiatives. At least one CCA, Central Coast Community Energy, has expressed interest in multifamily initiatives. Programs like these promote equity and clean energy access.

Once you can allocate the financial benefits of one energy resource shared by many users, like rooftop solar on an apartment building or a condo, it's easy to envision larger groups sharing many on-site resources. Imagine college campuses or business parks with solar-plus-storage projects and power plant controllers that can import power from the grid, export to the grid, or disconnect from the grid altogether, generating and storing all the energy its users need. Prior attempts to develop projects like these in California, regulated as community solar resources, have at times stumbled over the need to create new utility rate tariffs and utility resistance.





“Using Ivy Energy’s virtual grid, with the logic to incentivize behavior, California building owners can move forward with microgrid-like projects without any need to enter into a new the regulatory arena or ask for additional permission from the utility.”



Building owners can deploy the virtual grid today because of intelligent software that provides granular load monitoring across the various energy nodes within a building or a group of properties. Instead of stopping at the user account level, the system will continue to evolve, monitoring along the electrical circuits to rooms, hallways, and outside outlets and fixtures. By improving the quality of energy usage data, the virtual grid gives better choices to renters and a more predictable return on investment to building owners. And it’s all done through established policy in California that allows building owners to operate as independent solar producers, with simple compliance, separate and apart from utility regulation. Read on to find out how Ivy Energy’s virtual grid came about, then how the concept developed into a proven business model and went on to achieve market validation.

The arrival of the virtual grid

The virtual grid from Ivy Energy emerged out of an exploration of new residential solar market opportunities. While working in sales for a large system integrator, Dover Janis had looked at the economics of residential solar and wondered why more projects couldn’t be built on apartment buildings. With a background in real estate investments, Janis created a financial model showing that multifamily solar pencils for everyone: building owners, tenants, and system integrators. He pitched executives but ran up against a litany of logistical complexity. What about all the electric meters? Public policy? Value creation? The idea went nowhere. Janis moved on to start a solar company specialized in energy monitoring. Then, one summer day in 2017, Janis walked past two apartment buildings with open, unobstructed roof space in California’s Central Coast, and he came full circle back to multifamily solar. Only now, from the experience in energy monitoring, Janis and his team had uncovered a software solution that simplifies all the logistics. They had also acquired experience with technology development and residential and commercial project development. In 2018, the team launched Ivy Energy with Janis as CEO and founder.



High-quality data, grid resilience logic, and specific business model functionality are the key pillars to the virtual grid. With unit level consumption data and solar production data, the system can associate consumption of solar energy and energy imports from the grid for each user. The data also assures that end customers achieve solar savings and building owners achieve a return on investment. First, the system calculates what residents would have spent on electricity without rooftop solar, based on applicable utility rates and actual usage. Next, it sums up utility costs for the whole building. The difference is the value generated from on-site solar. Or solar-plus-storage, if the building has capacity to store energy. Building owners split the financial benefits with residents according to a fixed ratio, with generally 5 to 20 percent of the value passed through to residents. The system then allocates a value to each user based on real-time solar self-consumption and credits for solar energy exports to the grid.

Data quality enables transparent, consumer-friendly billing. Customers can clearly see their average hourly usage, their energy usage mix including the portion that came from solar, and other key metrics on the billing statement. The information shows customers how to reduce electricity costs. Most importantly, the data highlights the value of multifamily solar. Ivy Energy financial modeling shows that buildings with an average monthly unit consumption of more than 250 kilowatt-hours (kWh) will most likely pencil out for on-site solar. Data also simplifies the transaction for all parties involved. On average, apartment owners can expect to capture around \$1,090 per unit each year while saving tenants around \$150 each per year.

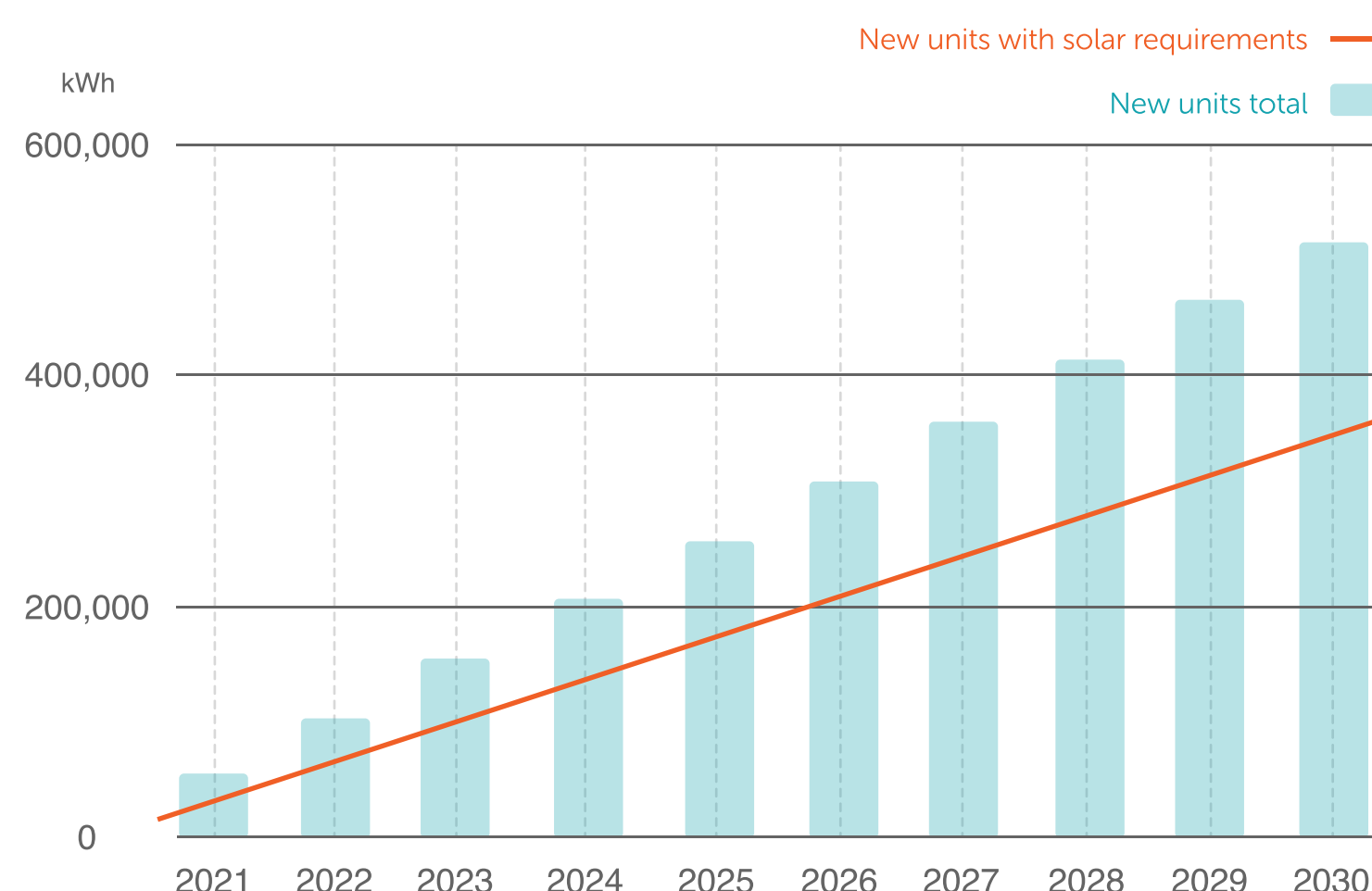
Multi-family solar market potential

The market opportunity for solar on multifamily housing has been building up for over a decade. The same economics that have worked all along for residential solar apply in apartment buildings and condos. Residents have no direct access to on-site solar, but their buildings do have ample roof space and carport space. Ivy Energy surveyed every property larger than 100 units in the San Diego region to confirm site availability.

Now, for the first time, California has imposed a sense of urgency with the Title 24 Building Energy Efficiency Standards requirement for solar to cover 50 to 70 percent of building load, starting with new construction in 2020. Title 24 will drive up demand for solar on multifamily housing. As investors see how well these projects perform, and that projects on existing buildings can get the same results as new construction, demand is likely to climb higher still. Based on third-party data that forecasts about 500,000 units of multifamily housing construction over the next 10 years, Ivy Energy expects to see garden-style construction with space for solar on about 330,000 of those units. With financing terms like those commonly seen in solar projects for single-family homes, building owners and residents can see savings from Day 1 and no added costs for either party.

Solar on multi-family housing has benefits for everyone, in fact, because the projects will contribute to grid stability. By encouraging users to self-consume locally sourced solar energy instead of relying on imports from the grid, apartment buildings and condos can lighten their impact on the grid. They can also begin to challenge the inefficient, increasingly expensive practice of using the grid as a battery

Multi-family new construction forecast (cumulative)





Fairfield Residential research partnership

A cloud implemented virtual simulation with 12 months of real data

In 2020, Ivy Energy partnered with the San Diego-based real estate operator Fairfield Residential to simulate a virtual grid environment using modeled output from a 980kW solar project and customer data from a group of residents who opted into the program. The pilot project was made possible by an award from the California Sustainable Energy Entrepreneur Development Initiative, also known as CalSEED, a California Energy Commission program administered by New Energy Nexus.

One objective was to show the market that residents would sign up, save money, and signal a desire to participate in a full-scale solar project. The Fairfield research partnership succeeded in persuading 40 residents to join in. Using 12 months of simulation data, the pilot project generated customer bills showing the energy usage mix, the billing total without solar, the solar bill amount, and much more.

Customer survey results at the conclusion of the program show that Ivy Energy's user experience made it easy for residents to understand how much they would save on electricity with solar, just by looking at the monthly bill. Twenty-one residents completed the survey overall. All 21 reported that the bill helped them understand their utilization of solar energy, either through direct consumption or through utility bill credits for solar exports to the grid.

Because Ivy Energy's billing statement was so clear and easy to understand, residents also showed a high degree of willingness to use solar energy provided by the building owner. Asked under what circumstances residents would use solar energy, 95 percent said they would use solar if it cost less than energy from the grid. Almost half of this group said they would also use solar energy if it cost the same as energy from the grid. One resident said he or she liked the solar option enough to use solar even if it cost 10 percent more.

Financial modeling showed excellent results for the building owner, too. The internal rate of return for the 980 kW project reached nearly 30 percent. The payback period for this investment would be less than five years. The result is partly due to a high avoided cost of electricity from the grid and a 26 percent federal investment tax credit available for solar projects in 2020. However, even if the avoided energy cost and the value of the federal tax credits go down, projects would continue to be viable with internal rate of return in the range of 10 to 15 percent.



Housing boom, meet solar boom

Almost ten years since California created virtual net metering to stimulate the market for multifamily solar, with little to show thus far, the future's looking bright at last. Policymakers and regulators recognize the urgent need for grid resilience and community choice as a driver of the transition to renewable energy, along with the need for new housing construction. And the private sector has come forward with a solution that can extend the benefits of residential solar—simple transactions, unmistakable value—to multifamily solar. But there is much work still to do.

California has many opportunities to further develop policy for multifamily solar. While virtual net metering delivered much-needed enabling policy to the market, it does not allow users to use solar intelligently. In 2021, California regulators will overhaul the entire net metering program to develop a new framework known as NEM 3.0. Whatever changes are considered, it is important that NEM 3.0 continues to facilitate a strong virtual net metering program so California can continue to make progress on equity goals. Solar must be accessible to all Californians.

The industry can work with community choice aggregators and other load-serving entities to make solar on multifamily housing a key priority and ensure that project development occurs in the neighborhoods where solar is needed most. We can also take further steps to promote the commercialization of microgrids by deploying energy storage and energy monitoring and control systems alongside rooftop solar. Step by step, these measures help to expand the total addressable market for the virtual grid from Ivy Energy.

Meanwhile, the results from the Fairfield Residential research partnership show that the door is open for building owners and renters to realize the value of onsite solar. Residents will opt into a program that increases customer choice in energy services and delivers immediate and long-term savings. For property owners, the benefits are twofold. Solar provides an attractive return on investment, and it improves the residential experience, making housing units more desirable. The timing is right for a solution that can make residential solar accessible to hundreds of people at a time. **The time for the virtual grid is now.**