

Capturing the Sun's Rays: An Economic Impact Assessment of Solar Development in Southwest Virginia



Joey James
Evan Hansen
Alan Collins

Downstream Strategies
911 Greenbag Road
Morgantown, WV 26508
www.downstreamstrategies.com

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ABOUT THE AUTHORS

Joey James

Mr. James is a multi-disciplinary researcher specializing in sustainable economic development and renewable energy systems in Appalachia. He has professional experience in the public, non-profit, and private sectors and has worked extensively in energy policy analyses, geographic information system development, economic modeling, environmental data analysis, and environmental outreach.

Evan Hansen

Mr. Hansen explores resource and environmental problems and solutions in three areas: energy, water, and land. He manages interdisciplinary research teams, performs quantitative and qualitative policy and scientific analyses, provides litigation support and expert testimony, develops computer tools, provides training, and performs field monitoring.

Alan Collins

Dr. Collins is Professor, Graduate Coordinator, and Assistant Director in the West Virginia University Division of Resource Management. He teaches classes in environmental and natural resource economics, and his research interests include economic and policy issues related to energy, watershed management, water quality, performance-based incentives, agricultural land valuation, and solid plus agricultural waste management. He has received research grants from numerous government agencies, and he has published in *Agricultural and Resource Economics Review*, *American Journal of Agricultural Economics*, *Ecological Economics*, *Energy Policy*, *Journal of Environmental Management*, *Journal of Spatial Analysis and Policy*, *Review of Agricultural Economics*, *Land Economics*, *Risk Analysis*, and *Water Resources Research*.

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ABBREVIATIONS

| | |
|-------|--|
| DSIRE | Database of State Incentives for Renewables and Efficiency |
| GW | gigawatt |
| IRP | integrated resource plan |
| ITC | investment tax credit |
| JEDI | Jobs and Economic Development Impact |
| KUC | Kentucky Utilities Company |
| kW | kilowatt |
| MW | megawatt |
| MWh | megawatt-hour |
| ODP | Old Dominion Power |
| PACE | property-assessed clean energy |
| PV | photovoltaic |
| PVEC | Powell Valley Electric Cooperative |
| RPS | renewable portfolio standard |
| SEIA | Solar Energy Industries Association |
| TVA | Tennessee Valley Authority |
| USBLS | U.S. Bureau of Labor Statistics |
| USDOE | U.S. Department of Energy |
| USEIA | U.S. Energy Information Administration |
| VCEDA | Virginia Coalfield Economic Development Authority |

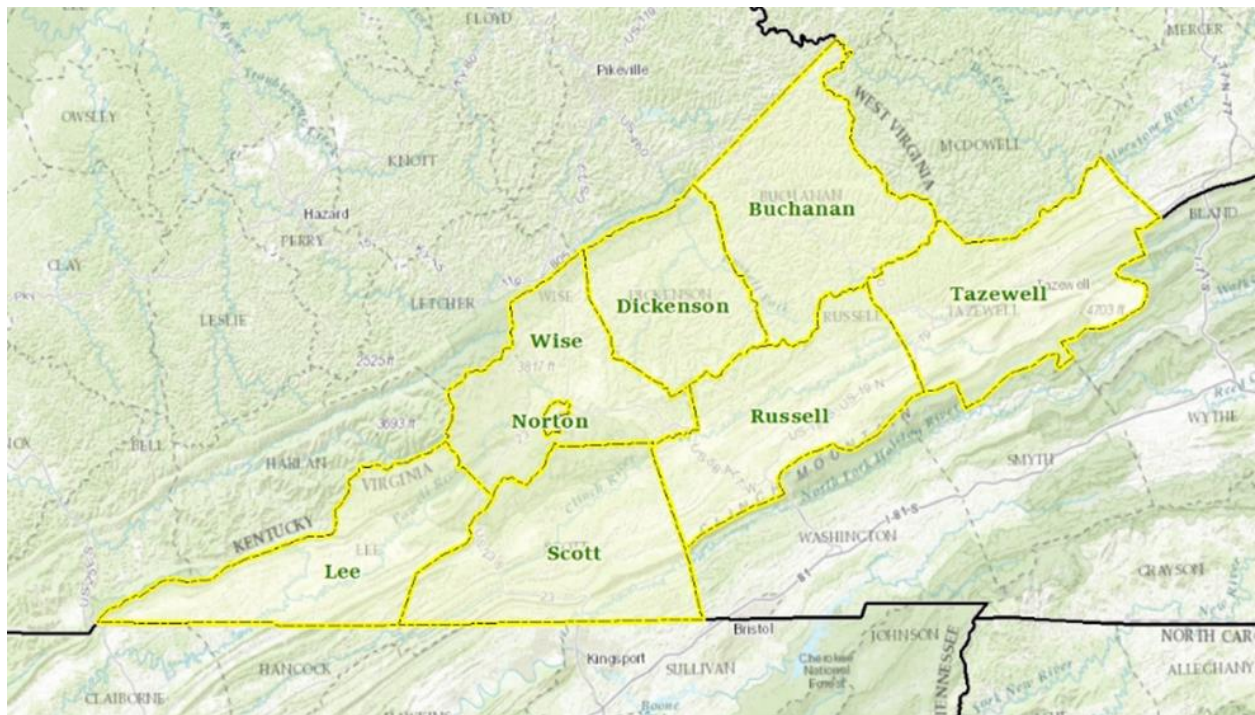
1. INTRODUCTION

Global investment in renewable energy is at an all-time high. In the United States, despite low wholesale electricity rates, uncertainty about policy and incentives, and low natural gas prices, growth in the renewable energy sector continues to outpace projections. Solar photovoltaic (PV) energy, in particular, has had record-breaking growth year over year (James & Hansen, 2017). In just the first quarter of 2017, more than 2 gigawatts (GW) of solar capacity was installed in the U.S. market (GTM Research, 2017).

In Southwest Virginia, a group of nonprofit and community action agencies, colleges, state agencies, planning district commissions, and other interested citizens and businesses seek to develop a solar energy industry cluster in the seven coalfield counties of Southwest Virginia. The workgroup is co-convened by the University of Virginia-Wise Office of Economic Development & Engagement, People Inc., and Appalachian Voices. (Solar Workgroup of Southwest Virginia, 2017)

Electricity demand is expected to grow in Southwest Virginia (USEIA, 2016). Development of some or all aspects of the solar industry value-chain—from component manufacturing and sales to engineering and installation—will not only grow the local economy, but also provide new businesses with abundant, redundant, and renewable energy. Understanding this potential economic boon provides lawmakers and energy industry officials in the region a powerful leverage point for scaling up a diverse renewable energy sector.

Figure 1: Southwest Virginia



Southwest Virginia (Figure 1) faces both direct and indirect challenges related to the downturn of the Central Appalachian coal industry. This area, which includes seven counties and one city, has historically led the state in coal production and employment; however, today, this reliance on the coal industry has reversed the region’s fortune. As shown in Table 1, the combined unemployment rate of the region, 6.1%, is much higher than Virginia’s 3.6% unemployment rate (USBLS, 2017).

Table 1: Unemployment by area

| County | Population | Unemployment rate |
|---------------------------|------------------|-------------------|
| Buchanan | 22,178 | 8.0% |
| Dickenson | 14,968 | 7.4% |
| Lee | 24,179 | 5.7% |
| Norton City | 3,958 | 5.2% |
| Russell | 27,370 | 5.3% |
| Scott | 21,930 | 4.0% |
| Tazewell | 42,150 | 5.9% |
| Wise | 39,228 | 6.8% |
| Southwest Virginia | 195,961 | 6.1% |
| Virginia | 8,411,808 | 3.6% |

Sources: USBLS (2017), U.S. Census (2017).

The ripple effects of a declining mining industry extend to locally owned service industries, including businesses that offer mechanical, electrical, and transportation services. Further exacerbating the issue, declining property and coal severance tax revenues have placed stress on public services, including education. These factors, which have become common across the Appalachian region, have contributed to negative population trends—as young and unemployed people leave the area seeking work, education, or personal and professional growth opportunities.

Fortunately, in Southwest Virginia, efforts are underway to combat these challenges. There is no silver bullet to solve the economic woes of Southwest Virginia and the greater Appalachian region. However, when taken together, a number of economic and educational initiatives in the region are cause for optimism. One particular opportunity, the development and promotion of the region’s solar energy industry has received buy-in from a broad range of stakeholders that wish to diversify and strengthen Southwest Virginia’s economy.

This report, part of a larger roadmap for solar industry development in Southwest Virginia, profiles candidate projects and presents an economic impact analysis of solar development in the region over the next 10 years.

2. BACKGROUND

2.1 Successful solar markets across the country

Once thought of something that could only be successful on the West Coast and in the American Southwest, solar energy is now creating jobs around the country. Notably, five of the top-ten solar states are east of the Mississippi River (Table 2).

Table 2: Top 10 solar states

| State | Electricity market | Installed capacity (MW) | Installed in 2016 (MW) | Watts per capita | Solar jobs |
|----------------|--------------------|-------------------------|------------------------|------------------|------------|
| California | Deregulated | 18,296 | 5,096 | 466 | 100,050 |
| North Carolina | Regulated | 3,016 | 923 | 297 | 7,112 |
| Arizona | Regulated | 2,982 | 657 | 430 | 7,310 |
| Nevada | Regulated | 2,191 | 984 | 745 | 8,371 |
| New Jersey | Deregulated | 1,991 | 350 | 223 | 6,056 |
| Utah | Regulated | 1,489 | 1,241 | 488 | 4,408 |
| Massachusetts | Deregulated | 1,487 | 406 | 218 | 14,582 |
| Georgia | Regulated | 1,432 | 1,023 | 138 | 2,924 |
| Texas | Deregulated | 1,215 | 672 | 43 | 9,396 |
| New York | Deregulated | 927 | 287 | 46 | 8,135 |

Sources: SEIA (2017a), Electric Choice (2017). Note: MW=megawatt.

2.2 Key solar incentives

While these states have all integrated a significant amount of solar capacity and cumulatively employ tens of thousands in the solar industry, each state has attracted this type of development with different mixtures of state-specific legislation and incentives. These state incentives—in addition to federal incentives, declining costs of solar, and private-sector investment in renewable energy—have made these states leaders in the solar U.S. marketplace. Notably, both regulated and deregulated markets are represented in this list of states.

This section describes several key state, local, and utility-sponsored incentives. Appendix A includes additional information about incentives available in Southwest Virginia.

2.2.1 Net metering

For electric customers who generate their own electricity, net metering allows for the flow of electricity both to and from the customer—typically through a single, bi-directional meter. When generation exceeds use, electricity from the customer flows back to the grid, offsetting electricity consumed at other times. The customer is credited for what they produce and only charged for use in exceedance of the customer’s electricity production. (Sutch et al., 2014)

Nine of the top-ten states have net-metering or other statewide distributed generation compensation rules in place. While Texas does not have a mandatory statewide rule, certain utilities within the state allow net-metering.

Net metering in Virginia is available to all electricity customers. However, there are system capacity limits: 20 kilowatts (kW) for residential systems, 1 megawatt (MW) for non-residential systems, and 500 kW for agricultural applications. Virginia limits net-metered generation to less than 1% of peak load for each utility, but the currently net-metered systems come nowhere close to this limit. While systems generally will not be sized to exceed an electricity customer’s annual consumption, the customer can roll over any excess

generation or opt to receive payment from the utility at an avoided-cost rate. (Virginia State Corporation Commission, 2013)

2.2.2 Renewable portfolio standards

Renewable portfolio standards (RPSs) require electricity producers within a given state to integrate a certain amount of renewable energy. Most states have an RPS—including eight of the top ten solar states. Some states plan to integrate as much as 50% renewables in the near future—and solar represents a large portion of this planned renewable integration.

While Virginia has enacted a renewable energy goal, this legislation does little more than encourage investment in renewable resources. It is entirely voluntary. (DSIRE, 2017)

Table 3: Renewable portfolio standard requirements for the top 10 solar states

| State | Requirement | Year |
|----------------|------------------|---------|
| California | 50% | by 2030 |
| North Carolina | 12.5% | by 2021 |
| Arizona | 15% | by 2025 |
| Nevada | 25% | by 2025 |
| New Jersey | 20.38% | by 2020 |
| Utah | Non-binding goal | N/A |
| Massachusetts | 15% | by 2020 |
| Georgia | None | N/A |
| Texas | 5,880 MW | by 2015 |
| New York | 50% | by 2030 |

Source: DSIRE (2017). Note: MW=megawatt. N/A=not applicable.

2.2.3 Property-assessed clean energy financing

Property-assessed clean energy (PACE) financing allows commercial property owners to borrow money for energy efficiency and renewable energy projects and repay the amount borrowed through an assessment added to their property tax bill. Energy savings more than offset the yearly assessment costs.

Enabling legislation for PACE financing has been passed in every top-ten state except for Arizona (DSIRE, 2017b).

The State of Virginia has authorized local governments to establish PACE financing programs. However, since this enabling legislation passed in 2009, only Loudon County has done so. (PACENation, 2017)

2.2.4 Local and utility-sponsored incentives

Federal- and state-sponsored legislation and incentives, like the ones listed above and in Appendix A, have undoubtedly had a positive impact on solar industry development. Supportive local ordinances and incentives and utility-sponsored programs also build community awareness and buy-in.

There are numerous examples in the top-ten solar states and beyond. In Texas, The City of Austin provides a per-watt rebate through its Austin Energy Solar Solutions program (City of Austin, 2017). In the northeast, New York City provides four-year property tax abatement equal to a portion of solar installation expenditures (New York City, 2017). Out west, the Los Angeles Department of Water and Power offers per-watt rebates to residential and commercial entities that install solar (USDOE, 2017).

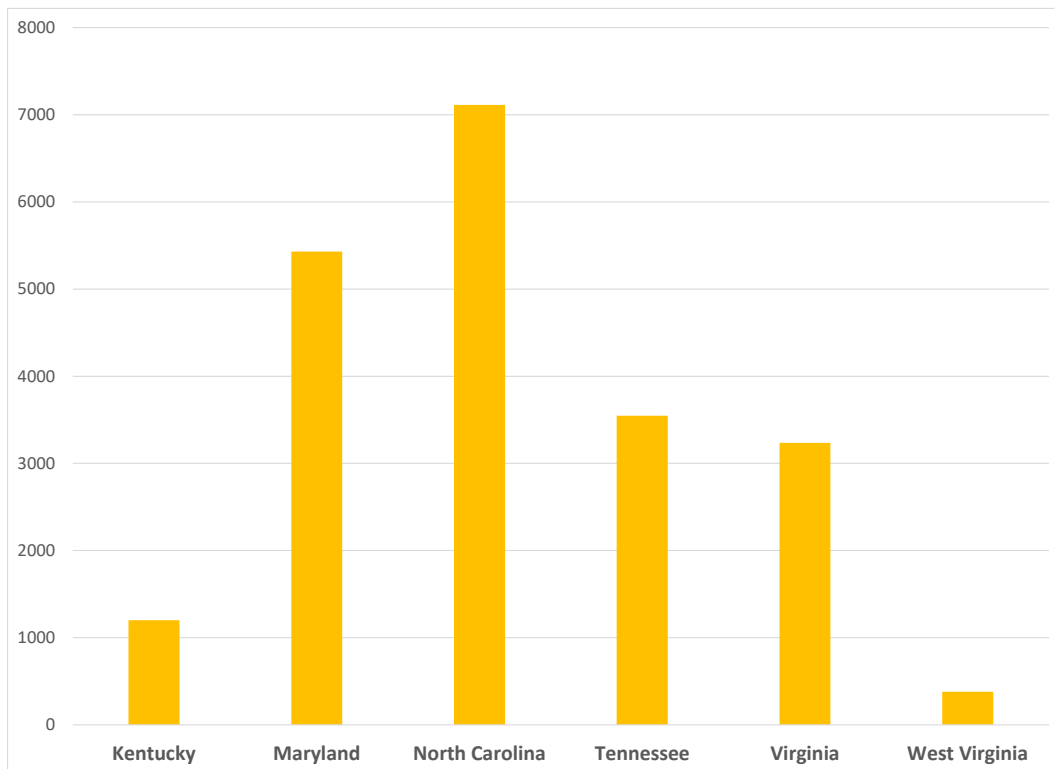
In Virginia, the City of Charlottesville adopted a solar tax credit ordinance in 1993. The tax credit applies a portion of the cost of solar equipment, based on the current tax rate, to a property owner’s local tax bill for a period of five years following installation (Charlottesville, 2017). From July 2014 to July 2016, 111 projects

representing 767 kW of new capacity were installed with assistance from this program. While the City has studied the impact of this incentive, it has received a very positive reaction and interest from residents when talking about the incentive. The City currently has 65 active tax incentive applications, which cumulatively represent \$49,807 in tax abatements. (Elliot, 2017)

2.3 Solar jobs

Solar creates more jobs per unit of energy output than any other electric generating technology. As illustrated in Figure 2, it contributes a significant amount of jobs to Virginia and its neighboring states (Wei et al., 2010). In fact, in Virginia, there are now more jobs in solar than coal (The Solar Foundation, 2017).

Figure 2: Solar jobs per state



Source: The Solar Foundation (2017)

Currently, 217 Virginia companies employ over 3,000 people throughout the solar energy value chain (SEIA, 2017b). Generally, jobs in the solar industry can be broken into five sectors: installation, manufacturing, sales and distribution, project development, and “other” (The Solar Foundation, 2017).

2.3.1 Installation

Those working in the installation sector assemble, install, and maintain solar photovoltaic systems. According to the U.S. Bureau of Labor Statistics (USBLS), the average annual wage for solar installers is just over \$39,000 (USBLS, 2016). Over 93,000 U.S. jobs were created in this sector between 2010 and 2016, accounting for approximately half of all job growth in the solar industry (The Solar Foundation, 2017).

2.3.2 Manufacturing

Solar manufacturers produce the upstream components of solar PV systems, including panels, inverters, racking and mounting systems, and module connectors. Manufacturing wages averaged just less than \$21 per hour in July 2017 (Trading Economics, 2017). While many manufacturing companies only derive a portion of their business from solar, it is estimated that over 38,000 people are employed in the manufacturing of upstream components in the United States (The Solar Foundation, 2017).

2.3.3 Sales and distribution

Wholesale- and retail-trade establishments make up the sales and distribution sector of the solar industry. Employment in this sector, which currently rests at more than 32,000 people, is expected to grow faster than any other sector in industry (The Solar Foundation, 2017). This sector is very diverse; thus, no sector-specific wage data is available.

2.3.4 Project development

The project development sector is comprised of utility companies and others that develop utility-scale projects. Workers in this sector engage in land acquisition, financing, permitting, and other aspects of large-scale PV development. Just under 35,000 people work in this sector. (The Solar Foundation, 2017) Similar to the distribution sector, jobs in project development are very diverse, and no sector-specific wage data is available.

2.3.5 Other jobs

Finally, the “other” sector, comprises about 7% of the total solar workforce, just over 18,000 workers. This diverse sector includes workers at research and development firms, law firms, nonprofits, universities, training centers, and government agencies. (The Solar Foundation, 2017)

2.4 Solar workforce development in the region

Over 80% of firms in the solar industry report having difficulty finding qualified applicants for employment. Notably, the top reasons for reported difficulty in hiring are a lack of experience, insufficient qualifications, and the small size of the applicant pool. (The Solar Foundation, 2017) Indeed, attracting and retaining qualified talent is challenge. However, many replicable models have emerged for solar workforce training throughout the United States. While participation in job training programs does not necessarily guarantee employment, solar training programs provide valuable opportunities to move into stable-wage careers in as little as 12 months (The Solar Foundation, 2017).

Two notable solar workforce development programs in the region are Rewire Appalachia and the North Carolina Clean Energy Technology Center.

2.4.1 Rewire Appalachia

A program of the Coalfield Development Corporation, Rewire Appalachia is a social enterprise that employs Coalfield Development Corporation’s 33-6-3 model. The program provides southern West Virginia’s youth and unemployed with 33 hours per week of paid on-the-job training in the solar industry. Six hours per week, these individuals attend a local community college to complete courses in science, technology, engineering, and mathematics. The remaining 3 hours of the work week are spent on life skills training. (Rewire Appalachia, 2017)

2.4.2 *North Carolina Clean Energy Technology Center*

Administered by the College of Engineering at North Carolina State University, the North Carolina Clean Energy Technology Center provides continuing education and professional development opportunities for people interested in renewable energy technologies, including solar. This includes a non-degree continuing education diploma program in renewable energy technologies, a certificate in renewable energy management, and non-certificate short workshops. (NC State, 2017)

2.5 **Non-solar businesses in driving solar development**

Virginia's e-Region, marketed by the Virginia Coalfield Economic Development Authority (VCEDA), includes Lee, Wise, Scott, Buchanan, Russell, Tazewell, and Dickenson counties and the City of Norton. VCEDA promotes e-business job growth creation and regional economic diversification. Businesses that have located significant facilities in the e-Region include Northrop Grumman, CGI, Tempur-Sealy, and Crutchfield Corporation. Recently, Frontier Communications announced it will locate a 500-employee customer care center in Wise County near the Lonesome Pine Airport, in addition to the already-planned 65,000-square-foot data center that DP Facilities, one the world's leaders in data center construction and design, is building near that site. (VCEDA, 2017)

Nationwide, entities that build and manage large data centers are making vigorous commitments to sustainability and renewable energy. Google, for example, powers 100% of its operations, including many data centers, with renewable energy through power-purchase agreements (Google, 2017).

Amazon, one of Appalachia's largest employers, is committed to achieving 100% renewable energy usage across its global infrastructure and is currently constructing new wind and solar farms in Ohio, Virginia, Indiana, and North Carolina. When completed, these installations will deliver more than 1.6 million megawatt-hours (MWh) of renewable energy into the electric grids that power Amazon Web Services' cloud data centers.

Amazon is developing significant solar infrastructure in Virginia, within the Dominion Virginia service territory. Amazon Solar Farm US East generates approximately 170,000 MWh annually and is located in Accomack County, Virginia. An additional four solar farms in New Kent, Buckingham, Sussex, and Powhatan counties—each with a capacity of 20 MW—are expected to start generating more than 190,000 MWh annually by the end of 2017. Further, an additional solar farm in Southampton County, Virginia is expected to start generating approximately 210,000 MWh of solar power annually by the end of 2017. (Amazon, 2017)

Ambitious sustainability goals and renewable energy development are not limited to data centers. Large businesses like Target and Walmart are also playing a role in driving renewable industry development. In 2016, Target became the number one company investing in solar. Target has 147.5 MW of installed solar capacity at 193 sites across the country. The company is committed to expanding its solar capacity to offsite locations and lists "expand our investment in offsite renewable energy to complement onsite renewables" as a goal for 2020 in its 2015 Corporate Responsibility Report. (Target, 2017)

Walmart ranks number two for corporate solar installations, with 145 MW. It has more than 340 solar installations across the country and is committed to increasing investments in renewable energy. Walmart's goal is to be supplied by 100% renewable energy by 2020; currently 25% of the company's energy use is supplied by renewables. (Walmart, 2017)

While these commitments do support some jobs in solar, they also help these corporations reduce their bottom line and continue to grow.

2.6 Southwest Virginia’s electric utilities

As illustrated above in Table 2, robust solar markets exist in both regulated and deregulated electricity markets. Virginia is partially deregulated. In the Dominion Electric and Appalachian Power service territories, non-residential customers can choose to have their electricity provided by a competitive service provider—licensed through the State Corporation Commission.

Most of Southwestern Virginia is within the PJM Interconnection. PJM is the regional transmission organization that coordinates the movement of wholesale electricity in all or parts of a 13-state region, including the District of Columbia (PJM, 2017). Outside of the PJM territory, the Tennessee Valley Authority (TVA) coordinates the movement of electricity. TVA operates in parts of 7 southeastern states (TVA, 2017).

Within the project area managed by PJM, there are two electric utilities: Appalachian Power and Old Dominion Power (ODP). The project area managed by TVA is serviced by the Powell Valley Electric Cooperative (PVEC).

Appalachian Power, a subsidiary of American Electric Power (AEP) and the largest electric utility operating within the project area, serves over 429,000 customers in Virginia (Appalachian Power, 2017). The utility’s Virginia-sited generation portfolio totals 1,240 MW, comprised of 170 MW of conventional hydropower, 484 MW of natural gas, and 586 MW of pumped-storage hydropower (Appalachian Power, 2017). According to Appalachian Power’s 2017 Integrated Resource Plan, the utility plans to add 500 MW of utility-scale solar and 123 MW of customer-owned distributed generation capacity by 2031; this distributed capacity is likely to be solar (Appalachian Power, 2017b). Though this does not necessarily mean that these capacity additions will be sited within the subsidiary’s Virginia service territory, the utility has already begun seeking proposals for solar energy projects in Virginia (Appalachian Power, 2017b).

ODP, an arm of the Kentucky Utilities Company (KUC), serves a customer base of nearly 30,000 in Wise, Lee, Russell, Scott, and Dickenson Counties (ODP, 2017). Recently, KUC added Kentucky’s largest utility-scale solar facility to its generation portfolio. The 10-MW facility, located on the banks of Lake Herrington outside of Harrodsburg, Kentucky, boasts more than 44,000 solar panels on fixed tilt rack systems. The facility is expected to produce roughly 19,000 MWh of electricity annually, enough to power over 1,500 homes (Kentucky Utilities, 2017).

PVEC provides electricity to approximately 8,000 customer-members in parts of Lee, Scott, and Wise counties. It serves an additional 22,000 customer-members in Tennessee. As stated previously, PVEC is within the TVA service area. In its 2015 Integrated Resource Plan, TVA laid the foundation for a less carbon-intensive generation portfolio. Among other things, this includes the retirement of half its existing coal fleet and the addition of up to 3,800 MW of solar (TVA, 2015).



3. ECONOMIC IMPACT ANALYSIS

The project team completed an economic impact analysis of residential-, commercial-, and utility-scale solar development¹ in Southwest Virginia over a 10-year period, beginning in 2018. The team used the National Renewable Energy Laboratory’s Jobs and Economic Development Impact (JEDI) model (National Renewable Energy Laboratory, 2017).

3.1 Inputs

3.1.1 *Solar development scenarios*

This analysis models an aggressive growth in solar installations over 10 years; in this sense, it is an aspirational analysis, but is grounded in reality based on the success in rapidly increasing solar capacity in other states. Solar development scenarios were developed for residential-, commercial-, and utility-scale systems.²

By 2028, the residential solar development goal is 9.2 MW. This is based on approximately 2.5% of Southwest Virginia households installing 5 kW of solar at their homes.³ As shown in Table 4, this is modeled as 183 solar installations per year over 10 years.

The commercial sector represents a large opportunity to deploy solar energy, but this sector has experienced relatively slow growth due to a wide range of complexities and complications. Appendix B presents site profiles for 15 opportunities for commercial solar development in Southwest Virginia identified by the Solar Workgroup—over 4 MW of potential capacity. These projects demonstrate the availability of numerous similarly sized projects in the region. One goal of the Solar Workgroup is to facilitate project installation at these facilities over the next two years.

The commercial solar development scenario starts with installing the 15 identified projects in 2018 and 2019 and continues by installing 2 MW per year for the next 8 years. In total, 20.3 MW of commercial-scale solar would be installed in Southwest Virginia by 2027.

For the utility-scale scenario, the project team reviewed solar integration goals found in integrated resource plans (IRPs) for two of the three utilities that serve Southwest Virginia: TVA/Powell Valley and Appalachian Power.⁴ For each IRP, we scaled the solar integration goals to Virginia based on the number of customers in Virginia compared with the total number of customers in the utility service area. For our utility-scale projections, we assume that all new utility-scale solar capacity within these two utilities’ service areas in Virginia will be built in Southwest Virginia. The utility-scale solar development scenario includes 230 MW of utility-scale generation capacity over the next 10 years, with projects of 25 MW, 35 MW, 45 MW, 55 MW, and 70 MW built every other year, starting in 2019.

¹ Residential-scale systems are typically less than 25 kW, commercial-scale systems between 26 kW and 1 MW, and utility-scale systems greater than 1 MW.
² Virginia limits net-metered distributed generation to less than 1% of peak load. The currently net-metered systems come nowhere close to this limit; therefore, we do not consider it to be a barrier to solar development over the next ten years.
³ In 2016, solar was installed on approximately 1 million homes in the United States (Harrington, 2015). While this equates to less than 1% of total households, the number of solarized homes is increasing rapidly. Installing solar at 2.5% of Southwest Virginia’s homes within 10 years is an aspirational, but achievable, target. The 5-kW average system size is based on the average U.S. residential installation size.
⁴ No IRP has been recently filed by KUC/ODP, and it has no generating units in Southwest Virginia; therefore, the solar development scenario includes no new solar generation by KUC/ODP in Southwest Virginia.

Table 4: Cumulative solar capacity and number of installations, 2018-2027

| Year | Residential | | Commercial | | Utility | |
|------|---------------|-------------|---------------|-------------|---------------|-------------|
| | Capacity (MW) | No. systems | Capacity (MW) | No. systems | Capacity (MW) | No. systems |
| 2018 | 0.9 | 183 | 2.0 | 7 | 0 | 0 |
| 2019 | 1.8 | 366 | 4.3 | 15 | 25 | 1 |
| 2020 | 2.7 | 549 | 6.3 | 23 | 25 | 1 |
| 2021 | 3.7 | 732 | 8.3 | 31 | 60 | 2 |
| 2022 | 4.6 | 915 | 10.3 | 39 | 60 | 2 |
| 2023 | 5.5 | 1,098 | 12.3 | 47 | 105 | 3 |
| 2024 | 6.4 | 1,281 | 14.3 | 55 | 105 | 3 |
| 2025 | 7.3 | 1,464 | 16.3 | 63 | 160 | 4 |
| 2026 | 8.2 | 1,647 | 18.3 | 71 | 160 | 4 |
| 2027 | 9.2 | 1,830 | 20.3 | 79 | 230 | 5 |

Note: MW=megawatt.

3.1.2 *Costs of solar development*

We estimated the cost of installing solar based on figures provided by a solar installer who services the Southwest Virginia area. These figures, based on real-world experience in the region, were provided separately for residential and commercial systems. The cost per watt for commercial systems is assumed to also apply to utility systems as a first-cut approximation.⁵

There are many factors that may impact the future cost of solar installations. In general, costs have declined significantly in recent years, and these cost declines may continue as technology advances. However, there is currently great uncertainty regarding the cost of modules based on a pending ruling from the U.S. International Trade Commission on a request by Suniva Inc. for the United States to impose tariffs on imported solar panels (Martin, 2017). If tariffs are imposed, panel prices will likely increase. Due to these uncertainties, we keep the costs constant in our scenarios.

3.1.3 *Local jobs from solar development*

JEDI calculates local direct, indirect, and induced jobs and earnings that result from solar installations by applying multipliers from IMPLAN (IMPLAN, 2017). The multipliers used in this analysis are for the state of Virginia. While the development scenario focuses on solar development in the seven-county area, and while many of the new jobs will be created in the same area, our results include jobs created across the entire state. Just as solar development in Southwest Virginia will generate jobs in other parts of Virginia (and in other states), solar development in other parts of Virginia (and in nearby parts of other states) will also generate jobs in Southwest Virginia.

⁵ Costs are not provided in this report to protect confidential business information.

3.2 Results

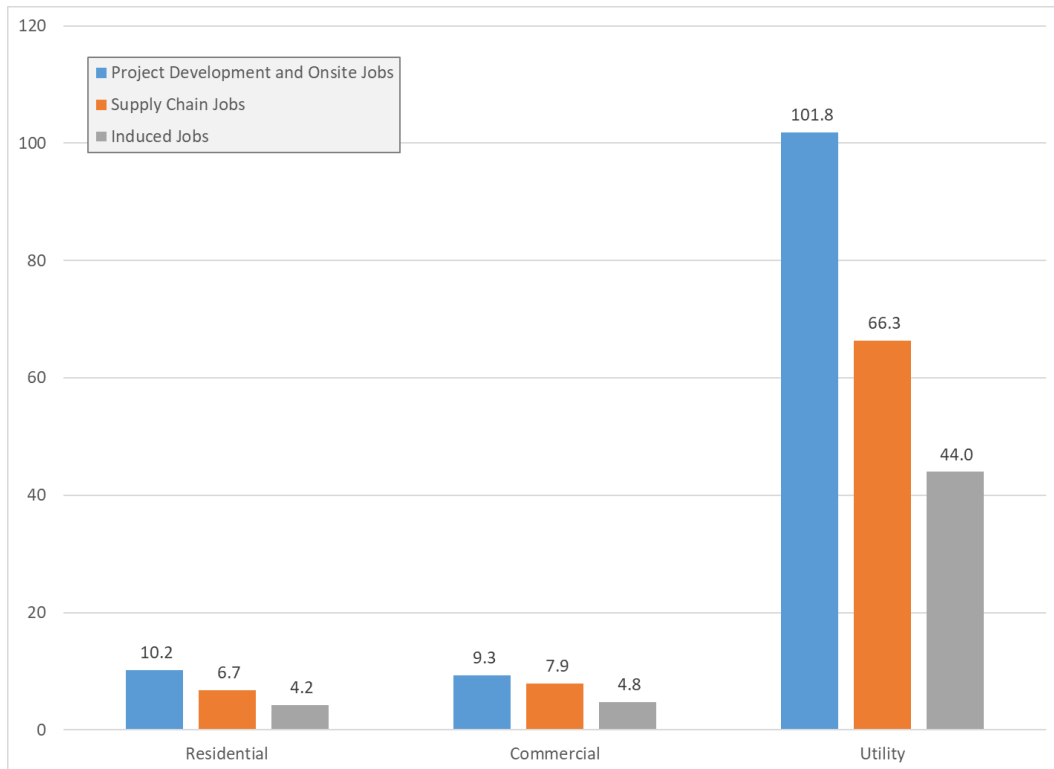
3.2.1 Residential- and commercial-scale solar jobs

As shown in Figure 3, residential and commercial installations will create approximately 20 project development and onsite jobs. These types of jobs are described in Sections 2.3.1 and 2.3.4.

Residential and commercial installations will also create a total of approximately 15 supply chain jobs. These jobs are outlined in Sections 2.3.2, 2.3.3, and 2.3.5.

Finally, residential and commercial installations will create a total of approximately 9 induced jobs. These jobs are created as money earned in direct and indirect jobs cycles through the local economy.

Figure 3: Average annual jobs created



Approximately 90% of these jobs are filled with workers who build new installations, while the other 10% are filled with workers who maintain them. Because the residential and commercial solar development scenarios include a similar amount of installations each year, these 43 jobs will be steady, full-time jobs.

Earnings tied to residential and commercial installations are estimated to total approximately \$2.9 million per year, on average, over the 10-year period. This averages approximately \$68,000 per year per job.

3.2.2 Utility-scale solar jobs

Jobs created by increasing utility-scale solar will be much more significant; however, because our scenario includes one utility-scale solar installation every other year, these installation jobs may be less consistent. Steady maintenance jobs at these sites, however, will ramp up gradually over time. As shown in Figure 3, utility installations will create approximately 212 jobs on average over the 10-year period—including project

development and onsite jobs, supply chain jobs, and induced jobs. Approximately 92% of these jobs are filled with workers who build new installations, while the other 8% are filled with workers who maintain them.

These utility-scale solar jobs are expected to be more sporadic than the residential or commercial jobs, because only five large utility-scale projects are included in the solar development scenario over 10 years. For this reason, it is likely that workers will be a part of the regional solar job market that services large utility-scale solar development not just in Virginia, but also in nearby states that are dramatically increasing utility-scale solar development.

Earnings tied to utility-scale installations are estimated to total approximately \$14.4 million per year, on average, over the 10-year period. This averages approximately \$68,000 per year per job.

3.2.3 Summary

In total, residential, commercial, and utility-scale solar installations would generate 255 jobs. In comparison with the current employment in Southwest Virginia (See Table 5), this would represent an increase of approximately 0.5%.

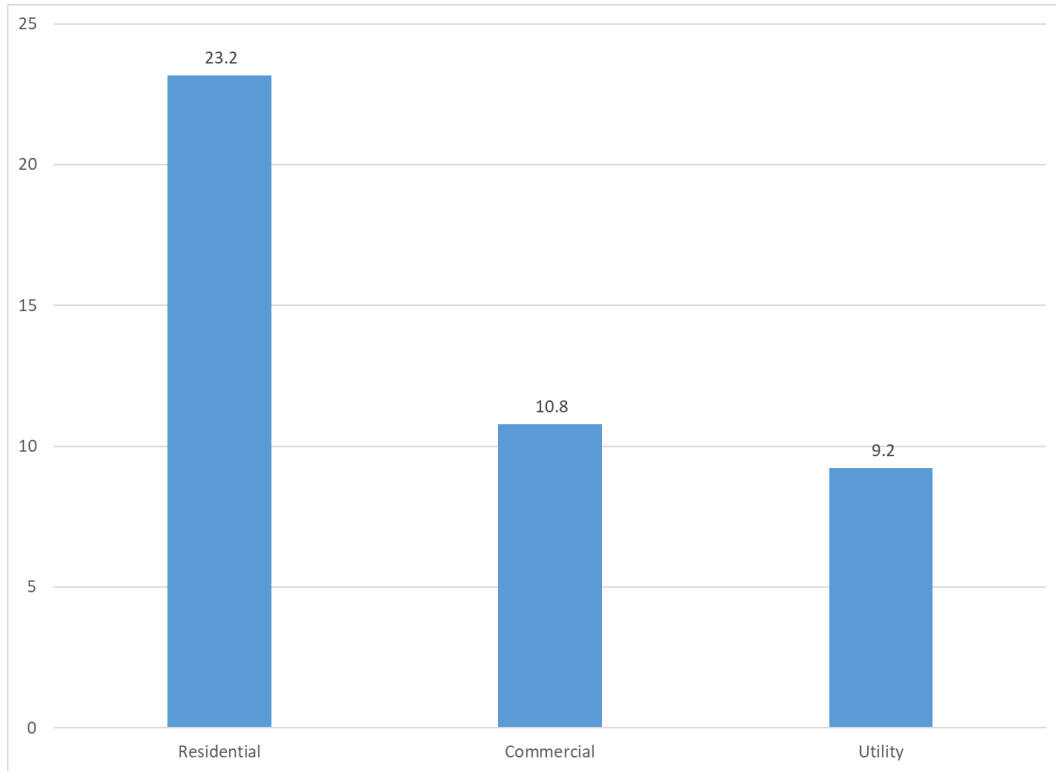
Table 5: Current employment in Southwest Virginia

| County | People employed | Registered businesses |
|--------------|-----------------|-----------------------|
| Buchanan | 5,240 | 414 |
| Dickenson | 1,996 | 200 |
| Lee | 2,705 | 273 |
| Norton City | 5,337 | 242 |
| Russell | 5,822 | 447 |
| Scott | 3,616 | 283 |
| Tazewell | 13,101 | 1,042 |
| Wise | 8,716 | 751 |
| Total | 46,533 | 3,652 |

Source: U.S. Census (2017).

Residential installations would create approximately 23 total jobs per MW of installed capacity over the 10-year period, more than twice the 11 jobs per MW created at commercial installations and the 9 created at utility installations (Figure 4). This suggests that pursuing residential installations would be the most effective strategy for increasing local employment per unit of solar installed.

Figure 4: Total jobs created per megawatt



Note: These total jobs per MW differ from the average annual jobs in Figure 3 in that they include the total of all annual jobs created over the 10-year time period.

While expansion of local employment and income from solar energy investment occurring in Southwest Virginia are obvious economic gains to this region, there is also the possibility of other economic benefits that are not so obvious. Increased wage growth is one such possible benefit. In Germany, Antoni et al. (2015) examined wages across multiple sectors of the economy during 2009 and found what they called “a persistent renewable energy wage premium” in the construction/installation activities for solar and wind energy. Wages of renewable energy employees were more than 10% higher than wages for similar construction/installation activities in other industries. While there is no guarantee that employee wages will rise with solar industry development in Southwest Virginia, research has shown that the solar industry has increased wages for installation employees.

4. CONCLUSIONS AND RECOMMENDATIONS

As demonstrated in Section 3, solar development in Southwest Virginia could bring significant economic benefits to the area—and to Virginia as a whole. The residential and commercial solar development scenario modeled in this report would generate approximately 43 steady, full-time jobs, including project development jobs, onsite jobs, module and supply chain jobs, and induced jobs. The utility solar development scenario would generate an additional 212 jobs per year, on average, over the decade. Earnings would total approximately \$68,000 per year per worker, or \$17.4 million total—including residential-, commercial-, and utility-scale solar installations.

The State of Virginia and local units of government can institute new policies that would incentivize additional investments in solar projects. For example, replacing Virginia’s voluntary RPS with a binding RPS with a solar carve-out would provide additional momentum for utilities to build or help support solar projects. At the local level, establishing PACE financing programs would make it easier for commercial property owners to borrow money to install solar. These and other similar policies—together with local efforts like those spearheaded by the Solar Workgroup of Southwest Virginia—would help make the aspirational scenario modeled in this report a reality.

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APPENDIX A: SOLAR INCENTIVES AVAILABLE IN SOUTHWEST VIRGINIA

| Incentive | Description |
|--|---|
| Net metering | <p>For electric customers who generate their own electricity, net metering allows for the flow of electricity both to and from the customer—typically through a single, bi-directional meter. When generation exceeds use, electricity from the customer flows back to the grid, offsetting electricity consumed at other times. The customer is credited for what they produce and only charged for use in exceedance of the customer’s electricity production. (Sutch, Simcoe, & Hansen, 2014)</p> <p>Net metering in Virginia is available to all electricity customers; however, there are system capacity limits: 20 kW for residential systems, 1 MW for non-residential systems, and 500 kW of aggregated capacity for agricultural applications. While systems cannot be sized to exceed an electricity customer’s annual consumption, the customer can roll over any excess generation or opt to receive payment from the utility at an avoided-cost rate.</p> |
| Residential and Business Renewable Energy Federal Tax Credits | <p>In December 2015, The Consolidated Appropriations Act was signed, delaying the sunset of the Solar PV Residential Renewable Energy Tax Credit. This tax credit covers up to 30% of expenditures related to residential and business solar PV installations.</p> <p>The maximum tax credit for solar PV installations set forth in the Consolidated Appropriations Act will decrease year-over-year beginning in 2019. Taxpayers may claim a credit of 30% for systems installed by December 31, 2019. In 2020, the maximum credit will decrease to 26%. Finally, in 2021, the incentive’s final year, the tax credit will decrease to 22% of qualified expenditures. (DSIRE, 2017)</p> |
| Fannie Mae Green Rewards Program | <p>The Federal National Mortgage Association offers green financing programs to owners of rental or cooperative properties with five or more units. This includes the Green Rewards Program, which offers fixed- and variable-rate loans to entities for capital improvements that target a 20% or greater energy consumption reduction.</p> |
| Modified Accelerated Cost Recovery System | <p>The Modified Accelerated Cost Recovery System (MACRS) is used by businesses to recover investments in certain types of property over a schedule of annual depreciation deductions. Most solar energy investments are eligible for an accelerated cost recovery schedule of five years; after this period, the total cost of the solar investment will be depreciated. If used in conjunction with the 30% investment tax credit (ITC), the business owner must reduce the project's depreciable value by half the value of the ITC. In other words, if a business owner received a 30% ITC, the depreciable value of the project would be 85% of the total cost.</p> |
| USDA Rural Energy for America Loans and Grants VirginiaSAVES Green Energy Program | <p>The United States Department of Agriculture (USDA) Rural Energy for America program provides guaranteed loan financing and grant funding for small businesses and agricultural producers in Southwest Virginia. Loan guarantees are available for up to 75% of total project cost, and grants are available for up to 25% of project costs. The grant and loan financing combined can only fund up to 75% of total project costs. Administered by CleanSource Capital, LLC under the guidance of the Virginia Department of Mines, Minerals, and Energy, the VirginiaSAVES Green Community Program is available to private commercial, non-profit, industrial, and local government entities. With funding from Qualified Energy Conservation Bonds, the program provides low-cost financing options for solar retrofits and new construction installations. Projects must demonstrate a projected 10-year or better payback period to qualify.</p> |
| Commercial Solar Property Tax Exemption | <p>Commercial facilities under 20 MW are exempt from state and local taxes in Virginia.</p> <p>Projects less than 20 MW that serve an institution of higher education or file an interconnection request before December 31, 2018, and projects 5 MW or less that file an interconnection request before January 1, 2019, qualify for a 100% property tax exemption for the assessed value of solar equipment and facilities. Projects greater than 20 MW that start construction before January 1, 2024 qualify for an 80% property tax exemption on the assessed value of the solar equipment and facilities. Additionally, projects greater than 5 MW that file an initial interconnection request form after January 1, 2019 will qualify for an 80% exemption. Land that a solar facility is located on does not qualify.</p> |
| New Market Tax Credit | <p>Private entities investing in renewable energy projects in Southwest Virginia may qualify for a dollar-for-dollar reduction in tax liability. A tax credit equal to 39 percent of the total investment cost may be recouped over a seven-year period, 5 percent each year for the first three years and 6 percent annually for the subsequent four years. (New Markets Tax Credit Coalition, 2017)</p> |

Source: Unless otherwise noted, information on solar incentives was obtained from DSIRE (2017b).

APPENDIX B: SITE PROFILES

Food City Grocery Stores – Southwestern Virginia



Headquartered in Abingdon, Virginia, Food City operates 122 locations in Georgia, Kentucky, Tennessee, and Virginia. The grocery chain currently has four locations across Southwest Virginia. The U.S. Environmental Protection Agency estimates that an average grocery store pays approximately \$4 per square foot for energy per year. Southwest Virginia’s Food City stores no doubt consume a lot of electricity and pay a significant amount of money for it.

Food City’s Southwest Virginia locations all have flat rubber membrane roofs, and each can accommodate a different amount of solar. Together, these stores have an installed capacity potential of 351.48 kW. This installation would produce enough electricity to displace a significant amount of electricity purchases from the region’s utilities.

| Store location | Potential capacity (kW) |
|----------------|-------------------------|
| Wise | 73.08 |
| St. Paul | 46.4 |
| Coeburn | 146.74 |
| Big Stone Gap | 85.26 |

Installing solar on Food City’s Virginia locations is no doubt a costly endeavor—\$587,000. However, the grocery chain is eligible for three financial incentives that significantly reduce the expected payback period for this investment.

- ✓ USDA REAP Grant
- ✓ Federal Investment Tax Credit
- ✓ Modified Accelerated Cost Recovery

| Value |
|-----------|
| \$89,898 |
| \$176,091 |
| \$193,271 |

Norton Green Apartments – Norton, Virginia



Source: People Inc.

People Incorporated manages a 40-unit low- to moderate-income apartment complex near the Norton Community Emergency Hospital. The complex is an EarthCraft-certified development. From June 2015 to January 2016, apartments in this complex cumulatively consumed 160,000 kWh of electricity, which was purchased from Old Dominion Power Company. The average one-bedroom apartment in Norton Green pays \$761 per year for electricity.

Norton Green's buildings have pitched asphalt shingle roofs that are clear of any obvious obstructions. Three of the buildings are oriented north/south and one is oriented east/west. The buildings oriented north/south can accommodate 28.5 kW of PV on their south-facing side. The east/west oriented building can accommodate 57 kW. A 114-kW installation would produce enough electricity to entirely displace electricity purchases.

Installing 114 kW of solar on Norton Green's four rooftops would cost an estimated \$213,000. The property is owned by a for-profit entity; thus, it is eligible for tax incentives and grants available exclusively for individuals and for-profit entities.

- ✓ USDA REAP Grant
- ✓ Federal Investment Tax Credit
- ✓ Modified Accelerated Cost Recovery

| Value |
|----------|
| \$32,650 |
| \$63,314 |
| \$69,492 |

Jonesville Manor– Jonesville, Virginia



People, Inc. owns and manages a 40-unit low- to moderate-income apartment complex off of Main Street in Jonesville. The complex is an EarthCraft-certified development. From June 2015 to January 2016, a nearly identical apartment complex in Southwest Virginia, also managed by People, Inc., consumed 160,000 kWh of electricity, which cost the average one-bedroom apartment \$761.

Jonesville Manor's buildings have pitched asphalt shingle roofs that are clear of any obvious obstructions. Two of the buildings are oriented north/south, and two are oriented east/west. The buildings oriented north/south can accommodate 29 kW [Total or per building? Be consistent with NS and EW buildings] of photovoltaics on their south facing sides. The east/west-oriented buildings can accommodate a total of 58 kW.

Installing solar on Jonesville Manor's four rooftops would cost an estimated \$162,000. It is owned by a for-profit entity; thus, it is eligible for tax incentives and grants available exclusively for individuals and for-profit entities.

- ✓ USDA REAP Grant
- ✓ Federal Investment Tax Credit
- ✓ Modified Accelerated Cost Recovery

| Value |
|----------|
| \$24,917 |
| \$48,319 |
| \$53,033 |

Deskins Apartment Complex – Vansant, Virginia



Photo source: People Inc.

People, Inc. owns and manages a 20-unit low- to moderate-income apartment complex near Vansant. The complex is an EarthCraft-certified development.

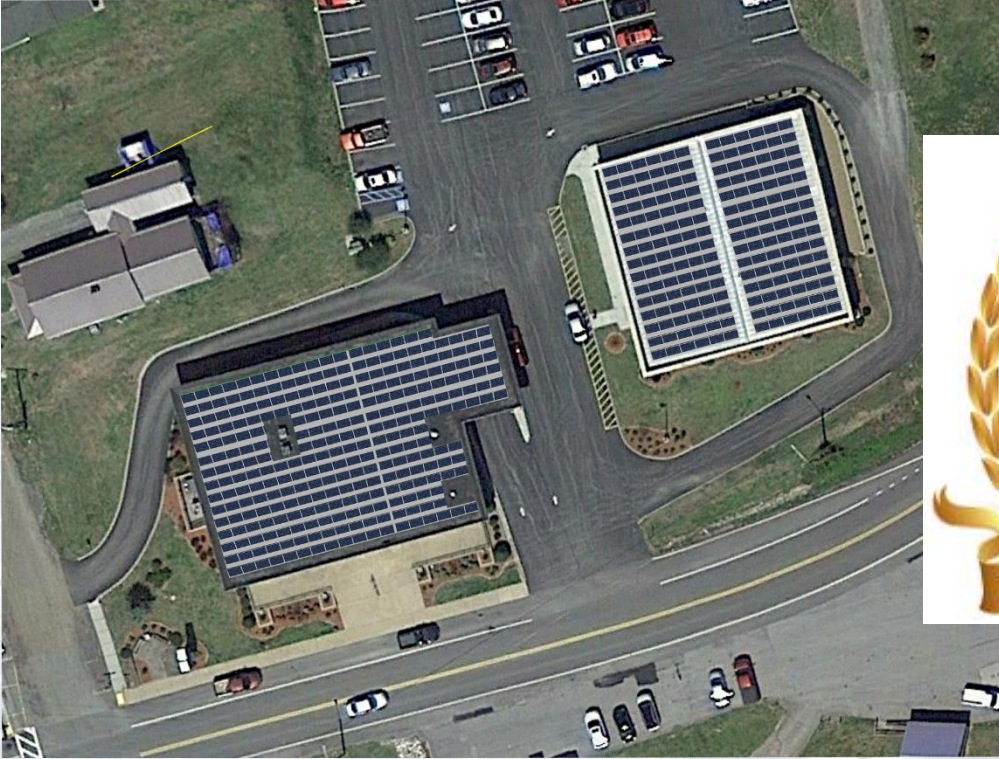
Its two buildings have pitched asphalt shingle roofs that are clear of any obvious obstructions. The buildings are oriented east/west and can accommodate a total of 120.06 kW of solar.

Installing solar on the Deskins Apartment Complex would cost nearly \$225,000. However, like other apartment complexes managed by People Inc., the complex is eligible for three financial incentives that significantly reduce the expected payback period.

- ✓ USDA REAP Grant
- ✓ Federal Investment Tax Credit
- ✓ Modified Accelerated Cost Recovery

| Value |
|----------|
| \$34,385 |
| \$66,680 |
| \$73,186 |

Powell Valley National Bank– Norton, Virginia



Powell Valley National Bank has been in business since 1888. Its headquarters are located on Main Street in Jonesville.

The two-building business campus in Norton is an ideal location for solar. Both buildings have flat roofs, which could accommodate [a total of?] 138.04 kW of solar panels.

Installing solar at Powell Valley National Bank would cost approximately \$231,000. However, the bank is eligible for three financial incentives that significantly reduce the expected payback period.

- ✓ USDA REAP Grant
- ✓ Federal Investment Tax Credit
- ✓ Modified Accelerated Cost Recovery

| Value |
|----------|
| \$35,307 |
| \$69,158 |
| \$75,905 |

Ridgeview High School – Clintwood, Virginia



Opening its doors during the 2015-2016 school year, Ridgeview High School took more than two years to construct. The \$110 million project, the largest school project in the history of Dickenson County, consolidated the former Clintwood and Haysi High Schools. From January 16' to January 17', Ridgeview High School used nearly 3 million kilowatt hours of electricity, which it purchased from Appalachian Power. In January 17', the schools electricity bill was \$23,159.

Ridgeview High School has a flat rubber membrane roof. While the roof is scattered with air conditioning units and other appliances, there is a considerable amount of space that could be dedicated to a large solar photovoltaic system. The project team has determined a 700 kW fixed rack system would be appropriate for this situation. A system of this size would displace approximately 1/3 of the schools electricity purchases from Appalachian Power.

Financing

Installing solar at Ridgeview High School would cost nearly \$1.2 Million. The High School, owned and controlled by a unit of government, is not eligible for any grants or tax incentives that individuals or for-profit entities can take advantage of. This translates into larger upfront capital expenses and a longer loan payback period. This just won't cut it, our cash-strapped school districts can't be going into the red on any investment they are making. So we must be innovative. The system would generate 2.9 million in avoided costs over a 25 year period on a 1.2 million dollar investment. 1.7 million is a significant amount. So this means we need to rally for public or private investment from unconventional sources.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If the school district was able to secure private support in the amount of \$175,000—15% of the expected project cost—it would only need to strategically disburse \$21,000 to make this project cash positive almost immediately. In other words, with \$196,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers similar solar cost-reduction mechanisms that taxable entities have access to. By participating in Secure Futures' Solar Self-Generation Agreement program, the school district could install a photovoltaic system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms aren't the only ones the school district may qualify for, they show that financing for a tax-exempt entity is possible.

Mutual Drugstore – Big Stone Gap, Virginia



Photo source: Bristol Herald Courier.

Located in downtown Big Stone Gap, Mutual Drugstore closed its doors in 2013 after more than 60 years of business. The property has since switched hands to the Wise County Industrial Development Authority (IDA), which has received a considerable amount of money to redevelop the property.

Mutual Drug has a flat roof that is clear of obstructions. This unused space could be dedicated to a large solar PV system. A 43.5-kW fixed rack system would be appropriate for the building. While it is impossible to say what proportion of a future tenant's electricity consumption would be covered with this system, a solar array would no doubt be an added perk for anyone renting this historic space.

Financing

Installing solar at the Mutual Drugstore would cost approximately \$72,000. If the Wise County IDA put \$25,000 down and financed the remaining amount, the energy savings from the solar installation would more than pay for the system. The system installation represents nearly \$110,000 in savings potential over 25 years.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, the Wise County IDA could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the IDA may qualify for, they show that financing for a tax-exempt entity is possible.

Lonesome Pine Regional Technology and Business Park – Wise, Virginia



The Wise County Industrial Development Authority (IDA) is developing the Lonesome Pine Regional Technology and Business Park on nearly 200 acres of land adjacent to the Lonesome Pine Regional Airport to attract technology-based businesses to Southwest Virginia. Part of this development, 5934 Windswept Drive, is currently home to Micronic Technologies. Large and small businesses around the world are making commitments to sustainability, which often include renewable energy. As the IDA continues to attract technology-based businesses to the Business Park, the availability of abundant and renewable energy can only help.

5934 Windswept Drive has a flat membrane roof, which can accommodate 104.69 kW of solar. Additionally, solar awnings can be added on the front and rear sides of the building. This will add 44.08 kW of capacity to the system.

Financing

Installing solar at the Lonesome Pine Regional Technology and Business Park is no doubt a costly endeavor—\$248,000. As a tax-exempt entity, the IDA is not eligible for grants or tax incentives that individuals or for-profit entities can take advantage of. Typically, this translates into larger upfront capital expenses and a longer loan payback period. However, there are financing options that make this project financially viable.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If the IDA were able to secure private support in the amount of \$37,000—15% of the expected project cost—it would only need to spend \$7,000 to make this project cash positive almost immediately. In other words, with \$44,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, the IDA could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the IDA may qualify for, they show that financing for a tax-exempt entity is possible.

Eastside High School and Coeburn Primary— Coeburn, Virginia



EASTSIDE HIGH SCHOOL HOME OF THE SPARTANS



Eastside High School

Coeburn Primary School

Eastside High School and Coeburn Primary School form a campus just off of Laurel Avenue in Coeburn. Eastside High School opened its doors in 2011 after the consolidation of the former Coeburn and St. Paul High Schools. Coeburn Primary first opened its doors in 1973, but the building has undergone considerable renovations since then. Both structures have flat membrane roofs, which are ideal for the installation of a considerable amount of solar PV. A 166.46-kW fixed rack system would be appropriate for Eastside High School, and a 369.75-kW system could be installed on Coeburn Primary School—after avoiding potential obstructions.

Financing

Installing solar on these schools would cost over \$895,000. The schools, owned and controlled by a unit of government, are not eligible for grants or tax incentives that individuals or for-profit entities can take advantage of. This translates into larger upfront capital expenses and a longer loan payback period. Because cash-strapped school districts cannot go into the red to make long-term investments, innovative financing is required. The system would generate \$2.2 million in avoided costs over 25 years on an \$895,000 investment—saving more than \$1 million over this period. This means that the school district must find public or private investments from unconventional sources.

One option, private investment for use as a down payment, could significantly increase the financial viability of the project. If the school district were able to secure private support in the amount of \$134,000—15% of the expected project cost—it would only need to spend \$55,000 to make this project cash positive almost immediately. In other words, with \$189,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, the school district could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the school district may qualify for, they show that financing for a tax-exempt entity is possible.

Mountain View Regional Medical Center – Norton, Virginia



**Mountain View
Regional Medical Center**
A Member of Wellmont Health System



Mountain View Regional Medical Center is a small, full-service hospital located in Norton. Like commercial spaces, hospitals no doubt consume a lot of electricity and pay significant amount of money for it.

Mountain View's flat rubber membrane roof can accommodate 148.19 kW of solar capacity.

Financing

Installing solar here would cost nearly \$250,000. Mountain View Regional Medical Center is a part of the Wellmont Health System, a non-profit entity. Therefore, the hospital does not qualify for many of the solar tax incentives and grants available to individuals and for-profit entities. This translates into larger upfront capital expenses and a longer loan payback period. However, innovative alternative financing mechanisms are available.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If the hospital were able to secure private support in the amount of \$37,000—15% of the expected project cost—it would only need to spend \$4,000 to make this project cash positive almost immediately. In other words, with \$41,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, the hospital could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the hospital may qualify for, they show that financing for a tax-exempt entity is possible.

Lonesome Pine Hospital – Big Stone Gap, Virginia



Lonesome Pine Hospital is a small, full-service hospital located in Big Stone Gap. Like commercial spaces, hospitals no doubt consume a lot of electricity and pay significant amount of money for it.

The Hospital's flat rubber membrane roofs can accommodate 293.48 kW of solar capacity.

Financing

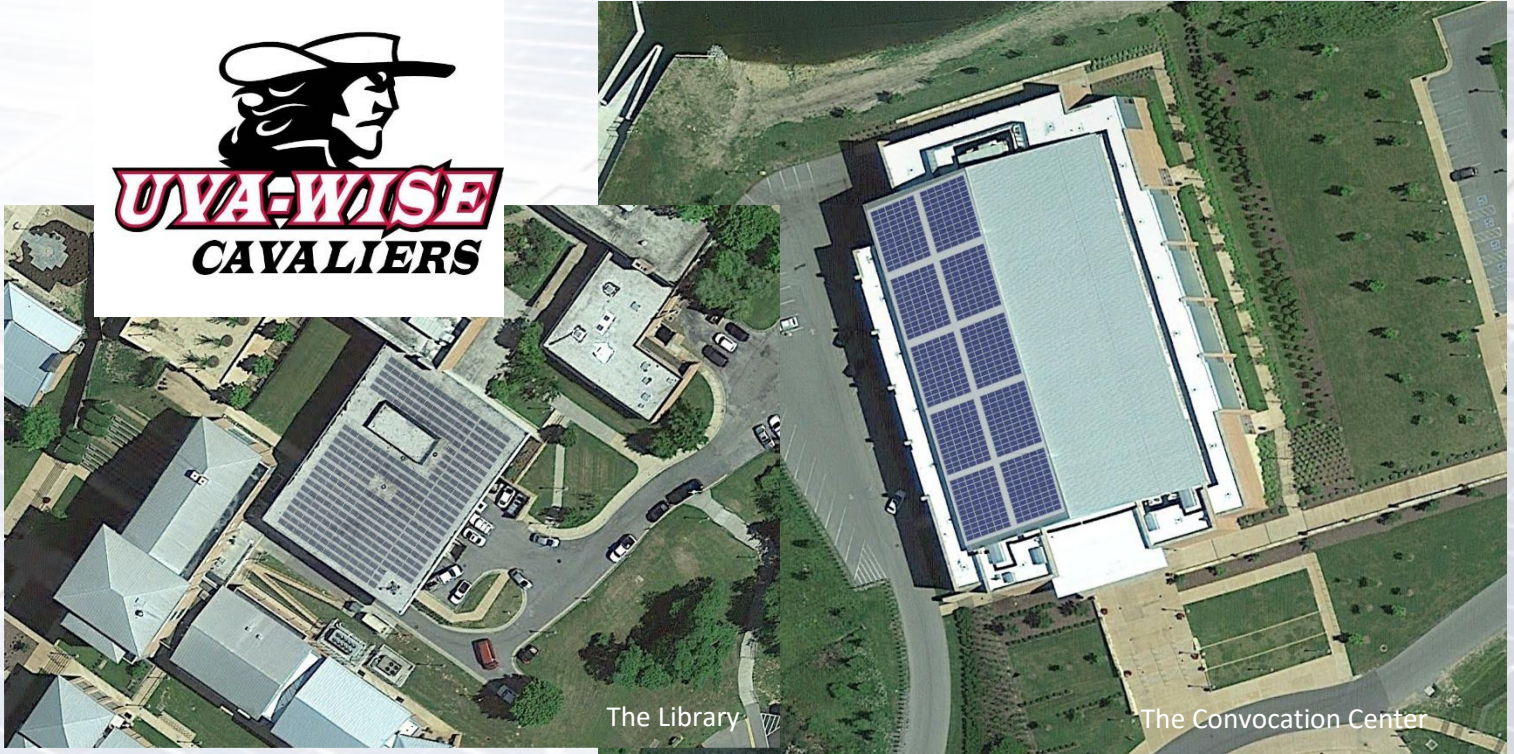
Installing solar here would cost more than \$490,000. Lonesome Pine Hospital is a part of the Wellmont Health System, a non-profit entity. Therefore, Lonesome Pine does not qualify for many of the solar tax incentives and grants available to individuals and for-profit entities. This translates into larger upfront capital expenses and a longer loan payback period. However, innovative alternative financing mechanisms are available.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If the hospital were able to secure private support in the amount of \$75,000—15% of the expected project cost—it would only need to spend \$9,000 to make this project cash positive almost immediately. In other words, with \$84,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, the hospital could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the hospital may qualify for, they show that financing for a tax-exempt entity is possible.

UVA Wise – Wise, Virginia



The University of Virginia's College at Wise is situated on a nearly 400-acre campus just east of the Town of Wise. From August 2015 to June 2016, UVA Wise consumed 11.5 GWh of electricity, which was purchased from Old Dominion Power Company. During these months, the college paid nearly \$90,000 per month on average for electricity.

While many buildings and land are viable for solar installations across the campus, two buildings have particularly striking potential—the David J. Prior Convocation Center and the John Cook Wyllie Library. Combined, 304.4 kW of solar PV could be installed. While these installations would not entirely displace electricity purchases from ODP, they do provide a unique environmental, economic, and education opportunity for the College.

Financing

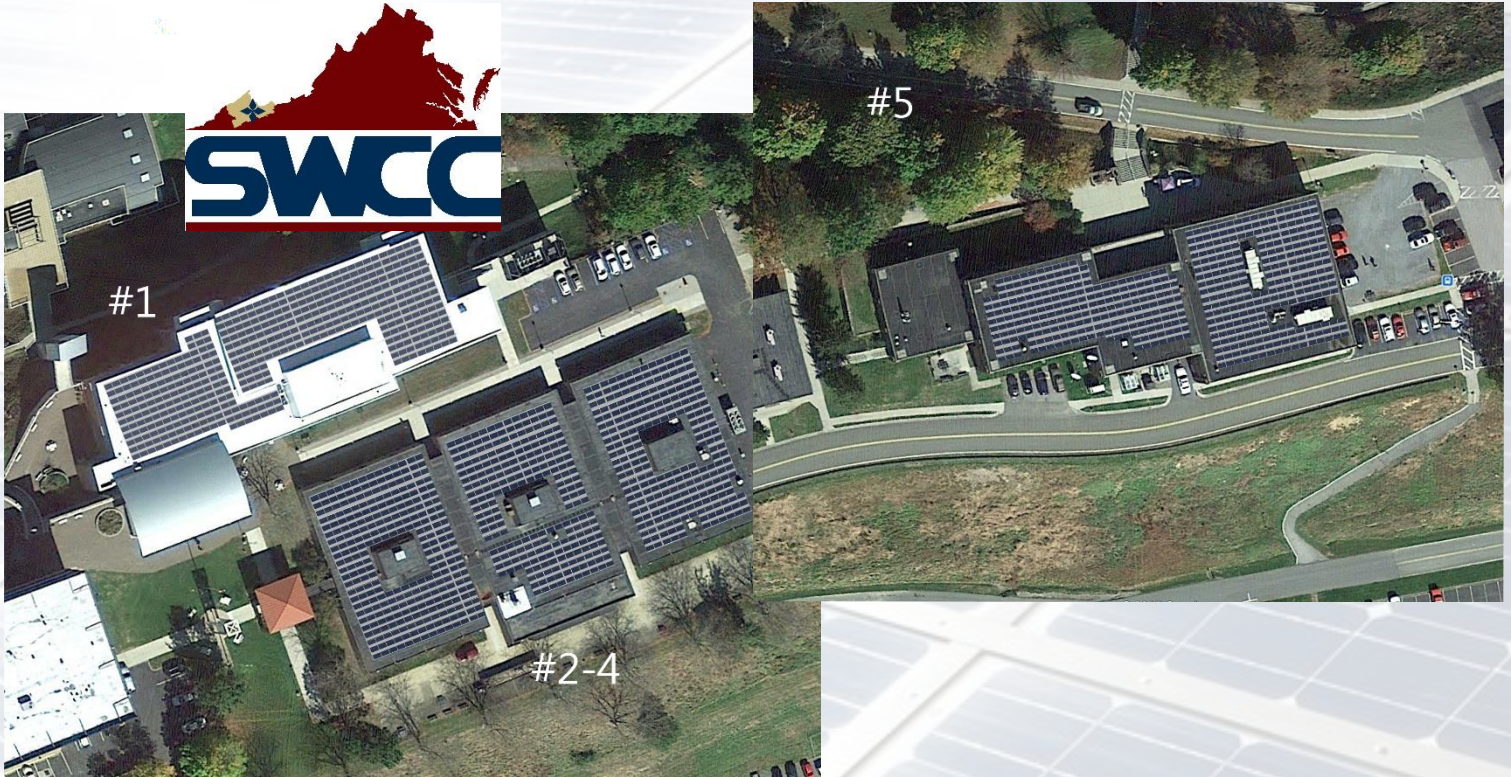
Installing solar on at these locations is no doubt a costly endeavor—over \$500,000. As a public university, UVA Wise it is not eligible for many of the financial incentives available to individuals and for-profit entities. This translates into larger upfront capital expenses and a longer loan payback period. However, innovative financing options are available that would make this project financially viable.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If UVA Wise were able to secure private support in the amount of \$76,000—15% of the expected project cost—it would only need to spend \$55,000 to make this project cash positive immediately. In other words, with \$131,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, UVA Wise could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the school district may qualify for, they show that financing for a tax-exempt entity is possible.

Southwest Virginia Community College – Cedar Bluff, Virginia



Established in 1968, Southwest Virginia Community College (SVCC) is a two-year community college that serves residents from Buchanan, Dickenson, Russell, and Tazewell counties.

Five buildings have flat rubber membrane roofs that are perfect for solar PV installations. Cumulatively, 503 kW of solar PV can be installed on these buildings.

| Building | Potential capacity (kW) |
|----------|-------------------------|
| 1 | 131.4 |
| 2-4 | 226.2 |
| 5 | 145.3 |

Financing

Installing solar on at these locations is no doubt a costly endeavor—nearly \$840,000. As a public university, SVCC is not eligible for many of the financial incentives available to individuals or for-profit entities. This translates into larger upfront capital expenses and a longer loan payback period. However, innovative financing options are available that would make this project financially viable.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If SVCC were able to secure private support in the amount of \$126,000—15% of the expected project cost—it would only need to spend \$2,000 to make this project cash positive immediately. In other words, with \$128,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, SVCC could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

While these financing mechanisms are not the only ones the school district may qualify for, they show that financing for a tax-exempt entity is possible.

Mountain Empire Community College – Cedar Bluff, Virginia



Established in 1972, Mountain Empire Community College (MECC) is a two-year community college that serves residents from Dickenson, Lee, Scott, and Wise counties.

In addition to having tremendous opportunities for ground-mounted solar PV systems near the entrance of the college, three buildings have flat rubber membrane roofs that are perfect for solar. Cumulatively, 371 kW of solar PV can be installed on these buildings.

| Building | Potential capacity (kW) |
|----------|-------------------------|
| 1 | 96.0 |
| 2 | 107.3 |
| 3 | 167.6 |

Financing

Installing solar at MECC is no doubt a costly endeavor—nearly \$620,000. As a tax-exempt entity, MECC is not eligible for many of the financial incentives available to individuals or for-profit entities. This translates into larger upfront capital expenses and a longer loan payback period. However, innovative financing options are available that would make this project financially viable.

One option, private investment for use as down payment, could significantly increase the financial viability of the project. If MECC were able to secure private support in the amount of \$93,000—15% of the expected project cost—it would only need to spend \$1,000 to make this project cash positive immediately. In other words, with \$43,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, MECC could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

Central High School – Norton, Virginia

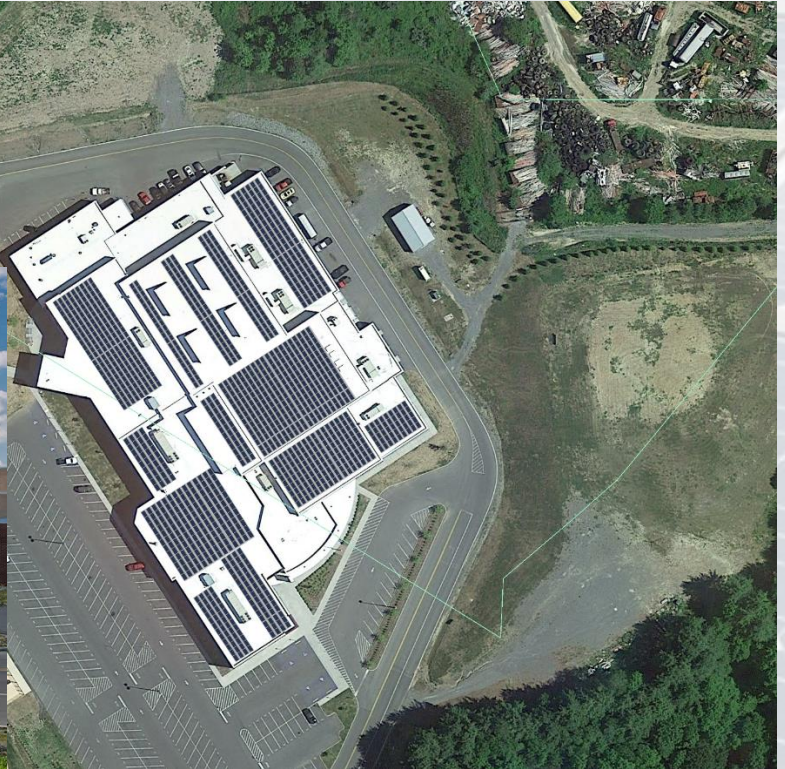


Photo source: Irwin Seating Company.

Opening its doors in the winter of 2014, Central High School took more than two years to construct. The \$25 million project consolidated the former J.J. Kelly and Pound High Schools.

Central High School has a flat rubber membrane roof. While the 13-sectioned roof is scattered with air conditioning units and other appliances, there is a considerable amount of space that could be dedicated to a solar PV system. A 486-kW fixed rack system would be appropriate and would displace a large portion of the school's electricity purchases from Old Dominion Power Company.

Financing

Installing solar at Central High School would cost \$812,000. The school, owned and controlled by a unit of government, is not eligible for many of the financial incentives available to individuals or for-profit entities. This translates into larger upfront capital expenses and a longer loan payback period. Because cash-strapped school districts cannot go into the red to make long-term investments, innovative financing is required.

One option, private investment for use as a down payment, could significantly increase the financial viability of the project. If the school district were able to secure private support in the amount of \$122,000—15% of the expected project cost—it would only need to spend \$8,000 to make this project cash positive almost immediately. In other words, with \$130,000 in strategic private support, the electricity cost savings from the solar installation will outpace loan payments.

Another option, Secure Futures out of Staunton, provides tax-exempt customers with solar cost-reduction mechanisms similar to those available to taxable entities. By participating in Secure Futures' Solar Self-Generation Agreement program, the school district could install a PV system with no upfront capital costs, no maintenance responsibilities or costs, predictable payments, and guaranteed performance.

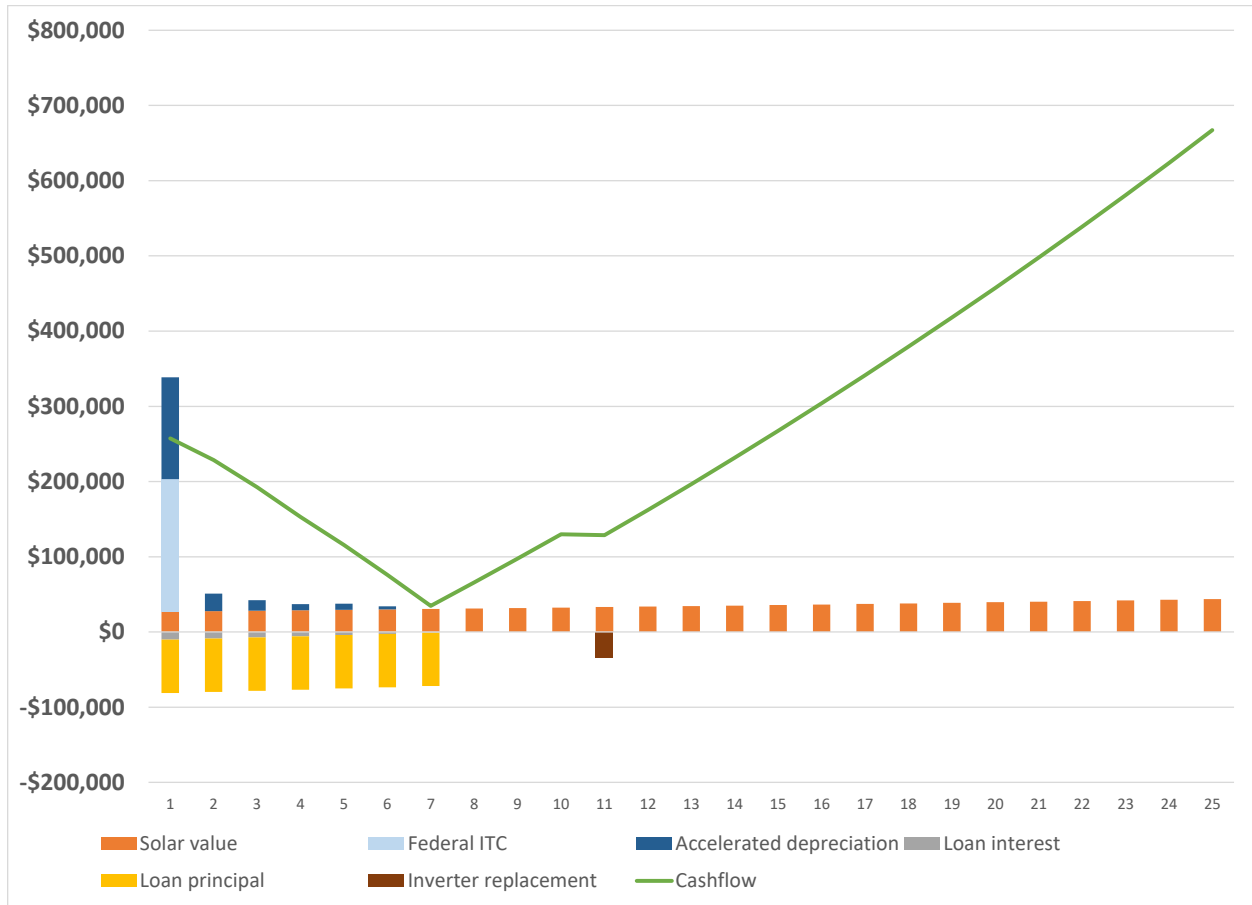
While these financing mechanisms are not the only ones the school district may qualify for, they show that financing for a tax-exempt entity is possible.

APPENDIX C: SITE PROFILE FINANCE CHARTS

The project team completed site assessments, including financial charting, of a number of featured projects. These projects occur at for-profit and non-profit entities. Below, we have charted one payback scenario for each for-profit entity¹ and two payback scenarios for each non-profit entity.

For-profit entities

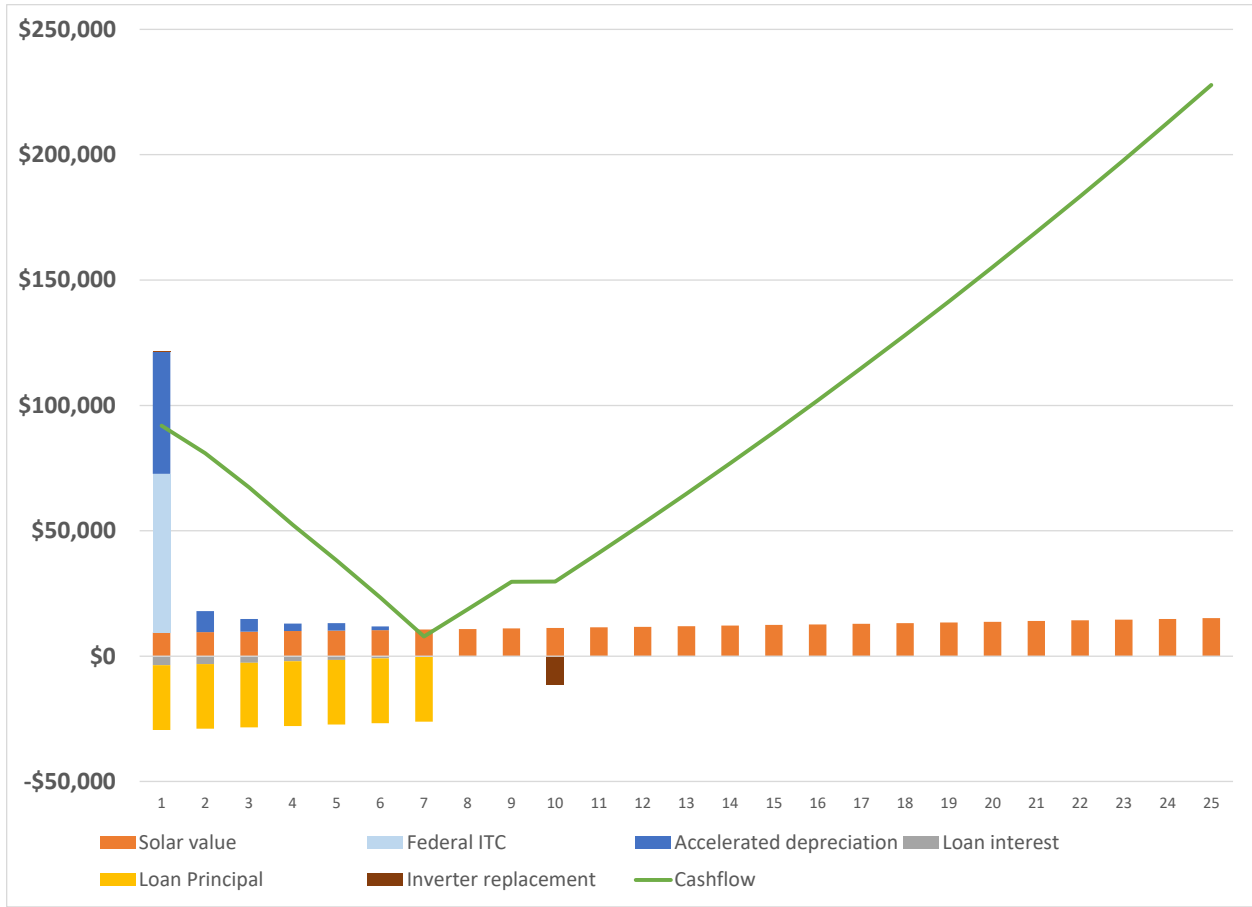
Figure 1: Food City Grocery Stores



Payback schedule on a 7 year 3.5% interest loan.

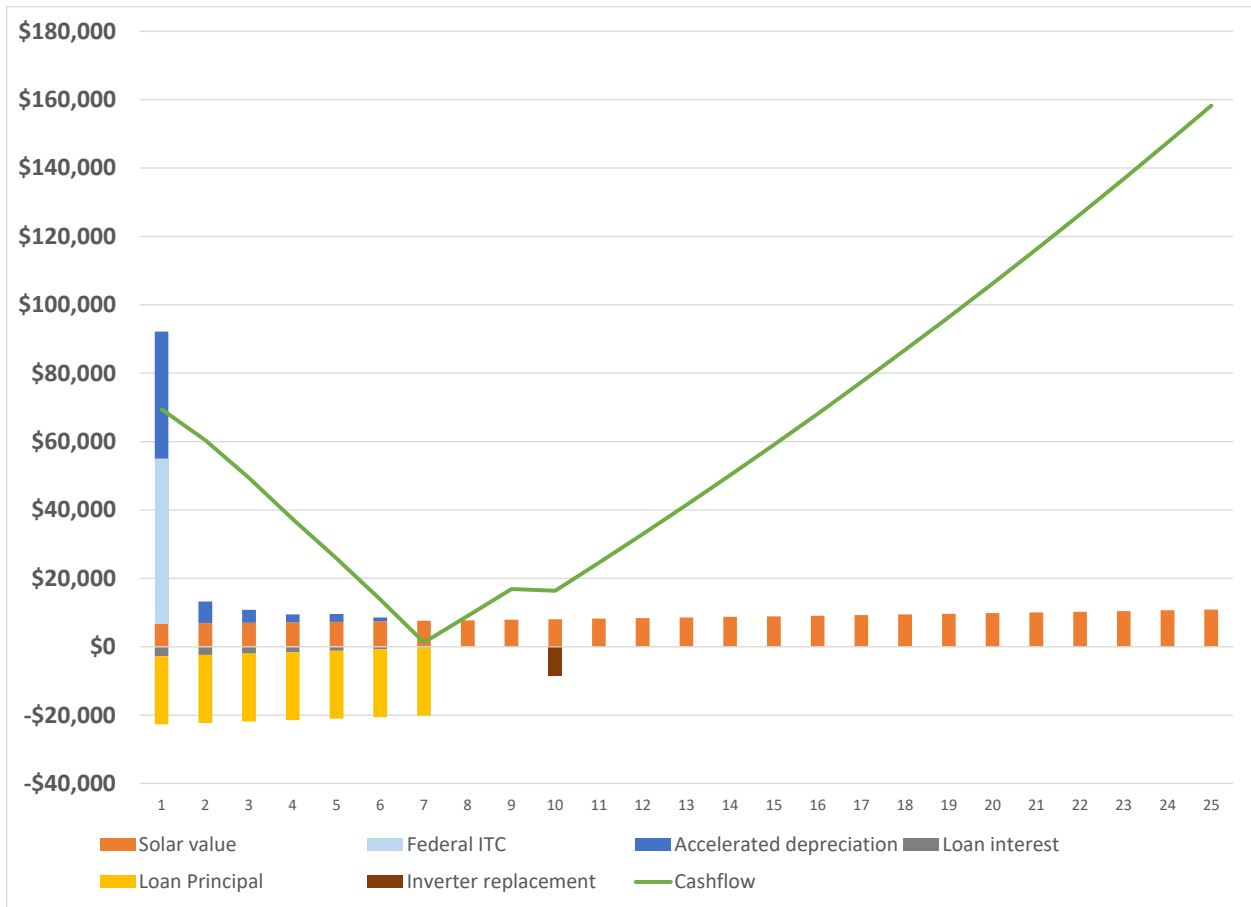
¹ Charts for for-profit entities include a 25% USDA REAP grant in year 1 that decreases the total loan amount. This is not explicitly stated in each chart.

Figure 2: Norton Green Apartments



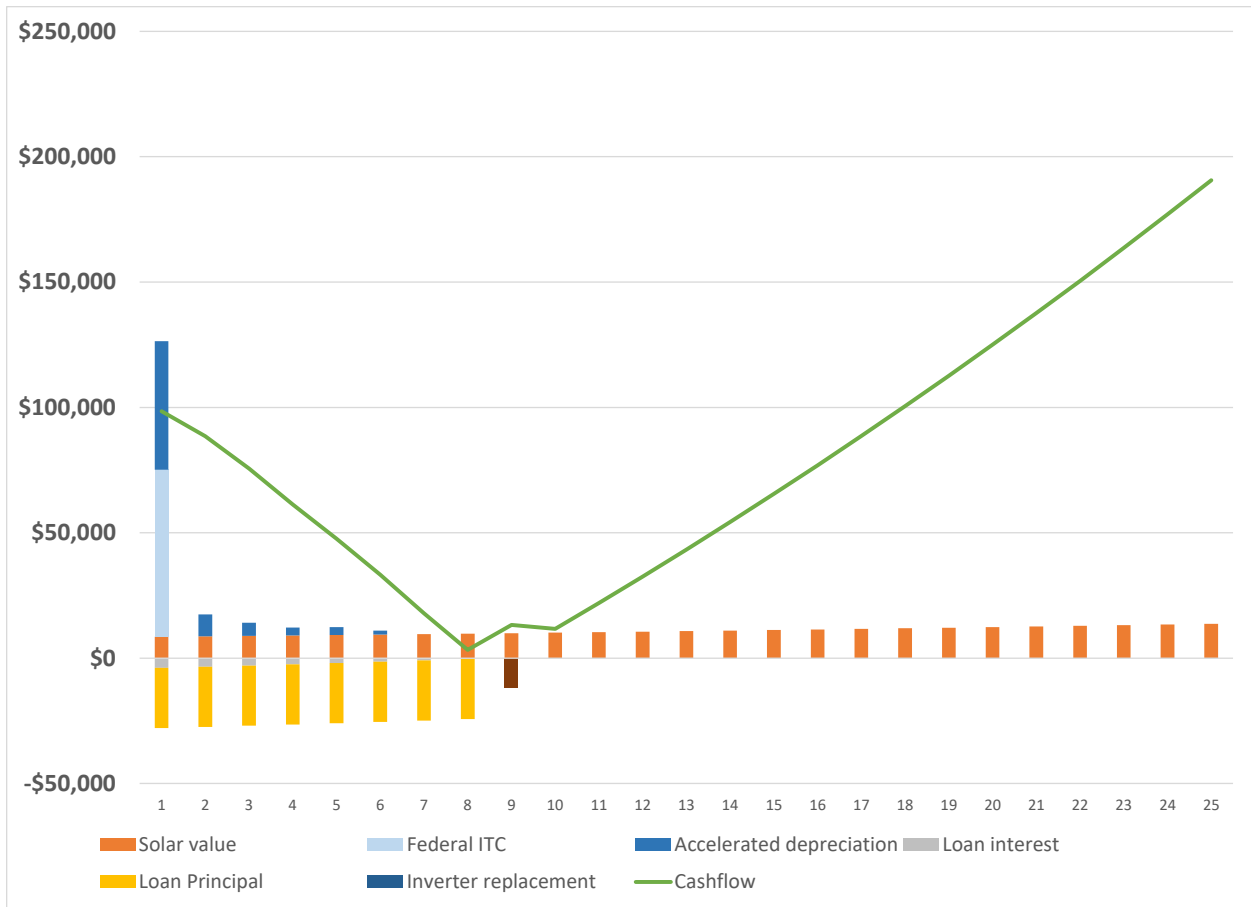
Payback schedule on a 7 year 3.5% interest loan.

Figure 3: Jonesville Manor Apartments



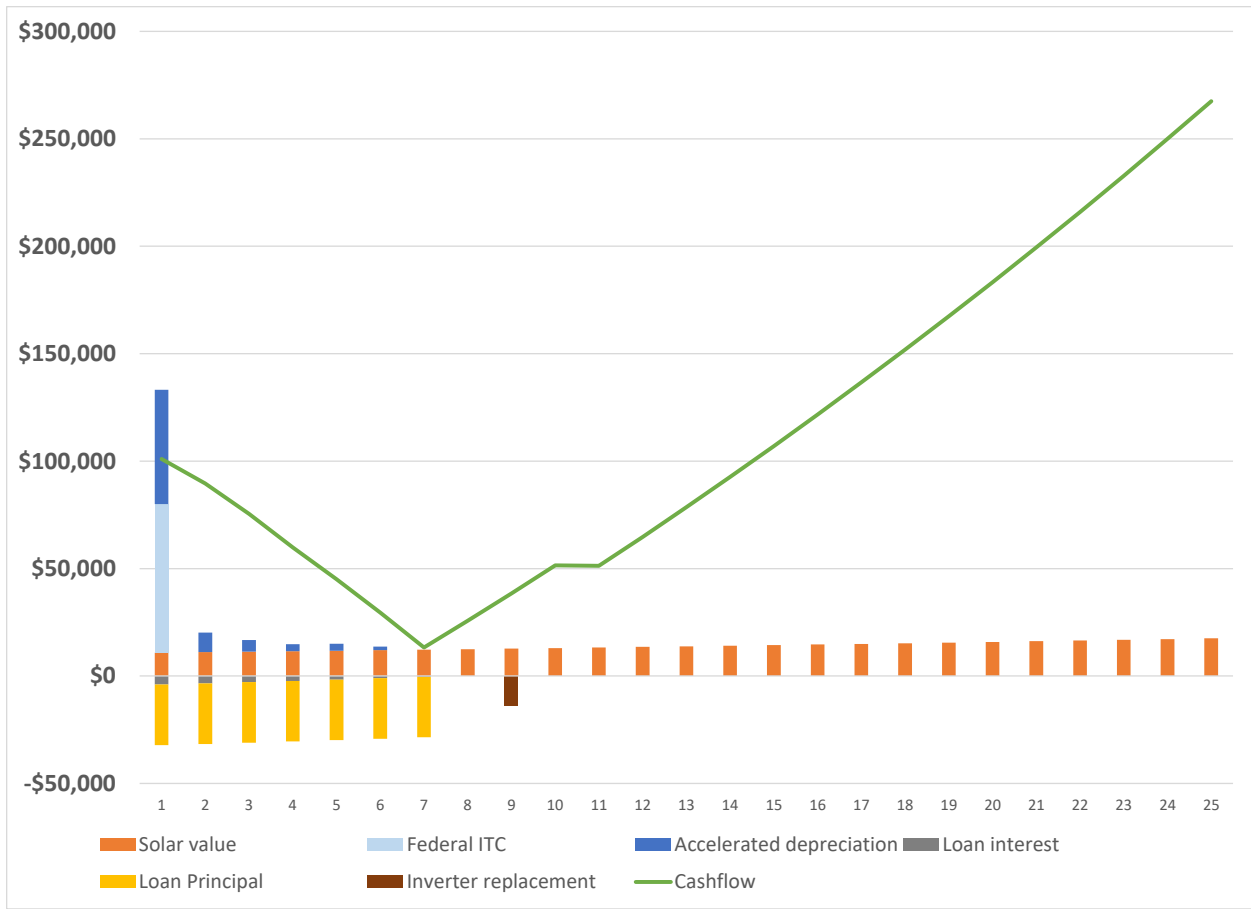
Payback schedule on a 7 year 3.5% interest loan.

Figure 4: Deskins Apartment Complex



Payback schedule on a 7 year 3.5% interest loan.

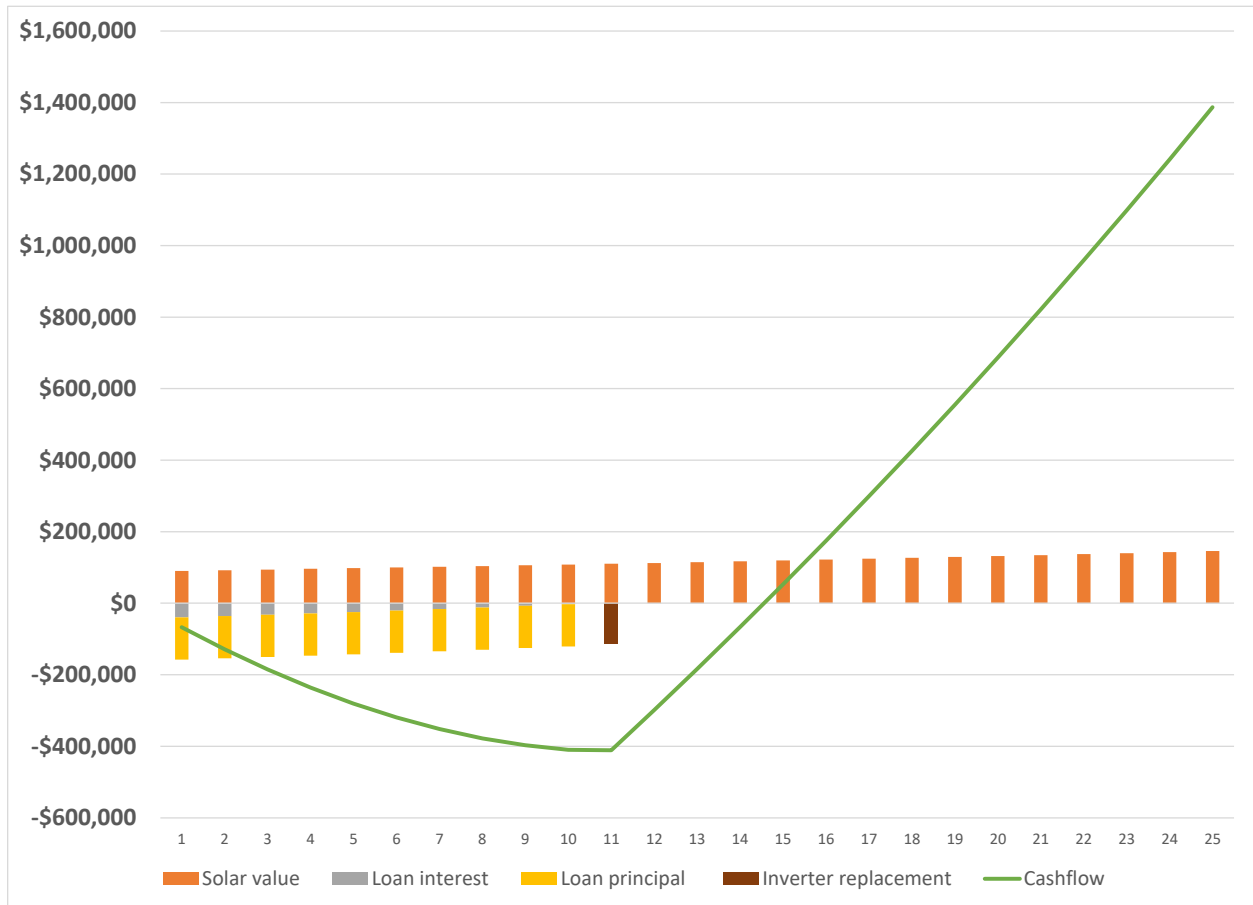
Figure 5: Powell Valley Bank



Payback schedule on a 7 year 3.5% interest loan.

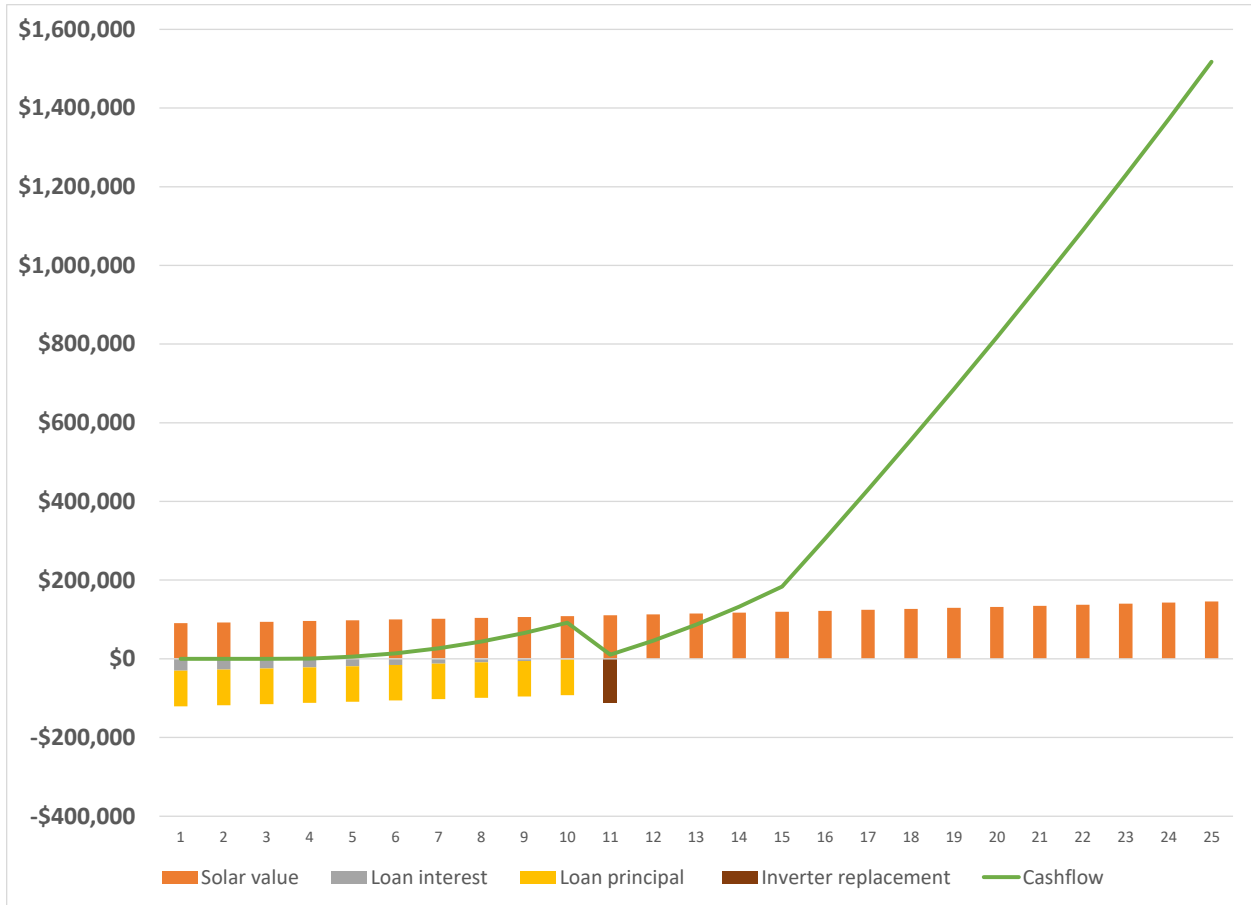
Non-profit entities

Figure 6: Ridgeview High School without financial assistance



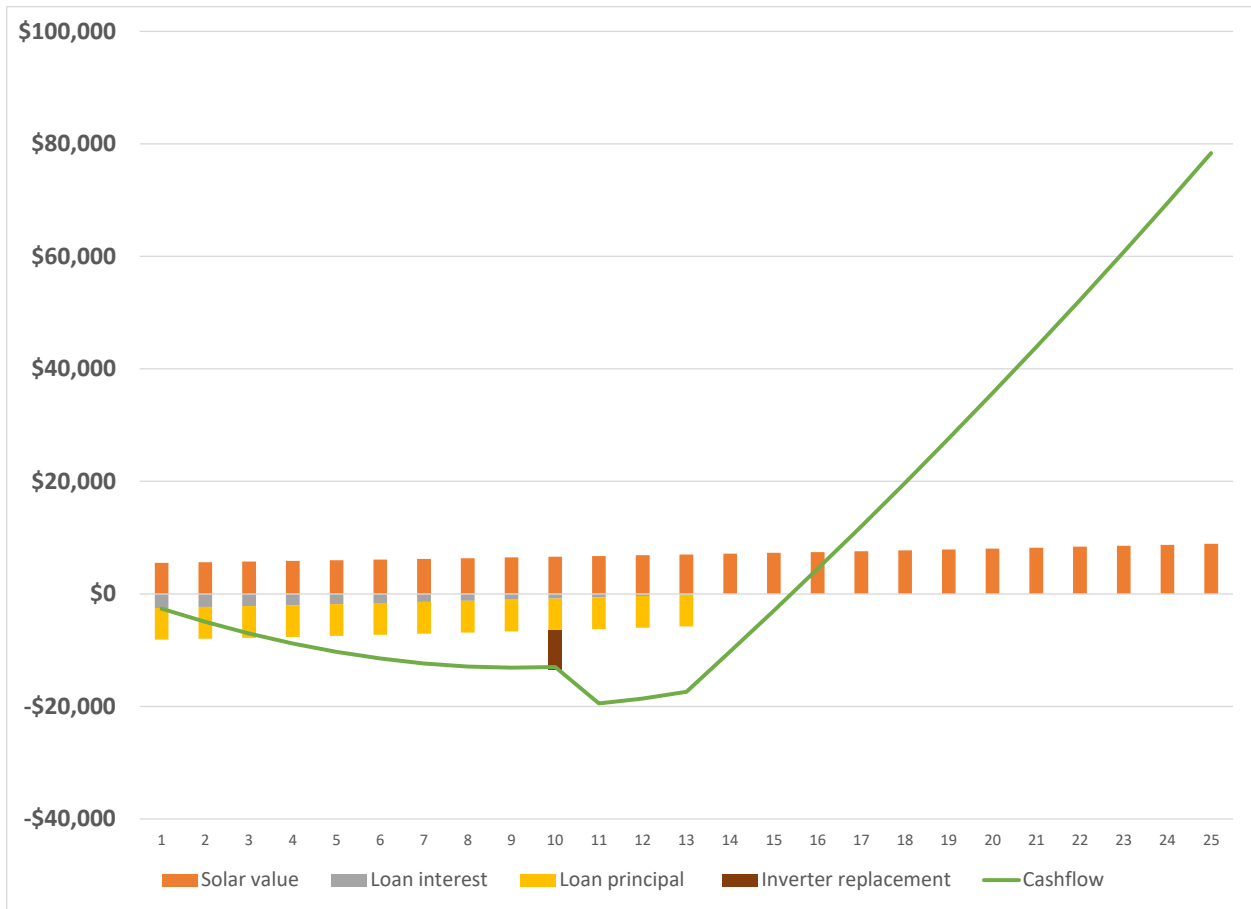
Payback schedule on a 15 year 3.5% interest loan.

Figure 7: Ridgeview High School with assistance



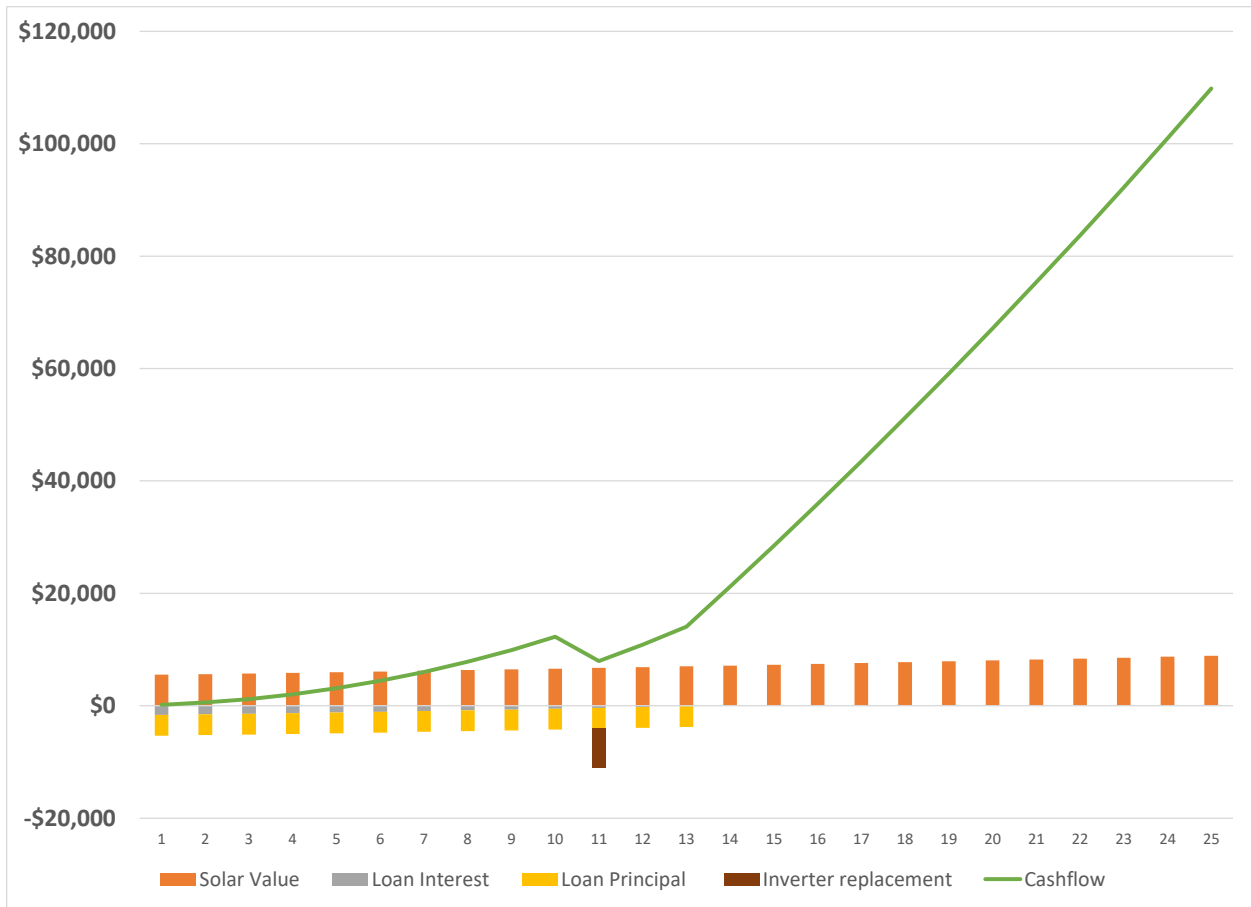
Payback schedule on a 15 year 3.5% interest loan, 15% down payment and disbursement of \$20,932 over the first three years.

Figure 8: Mutual Drugstore without assistance:



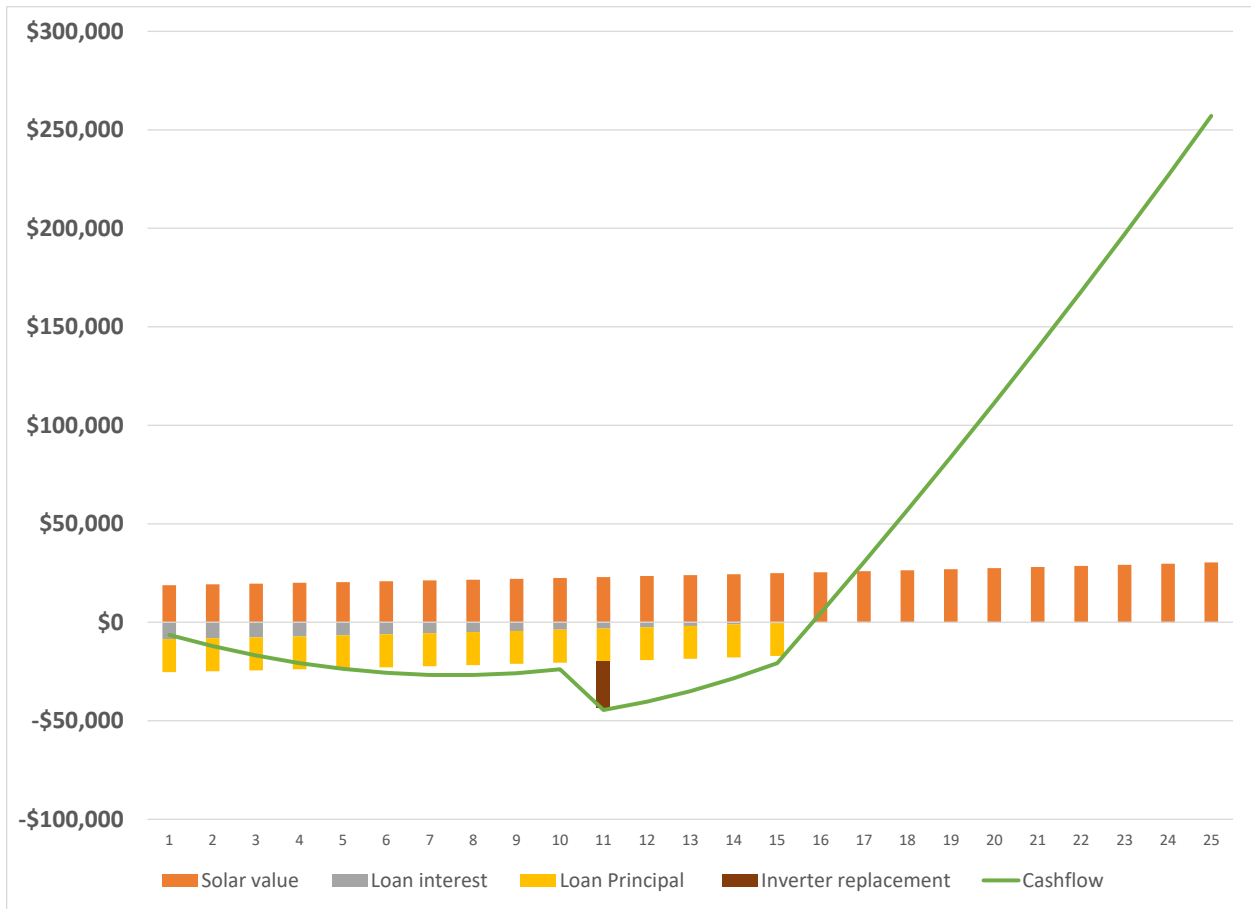
Payback schedule on a 13 year 3.5% interest loan.

Figure 9: Mutual Drugstore with assistance



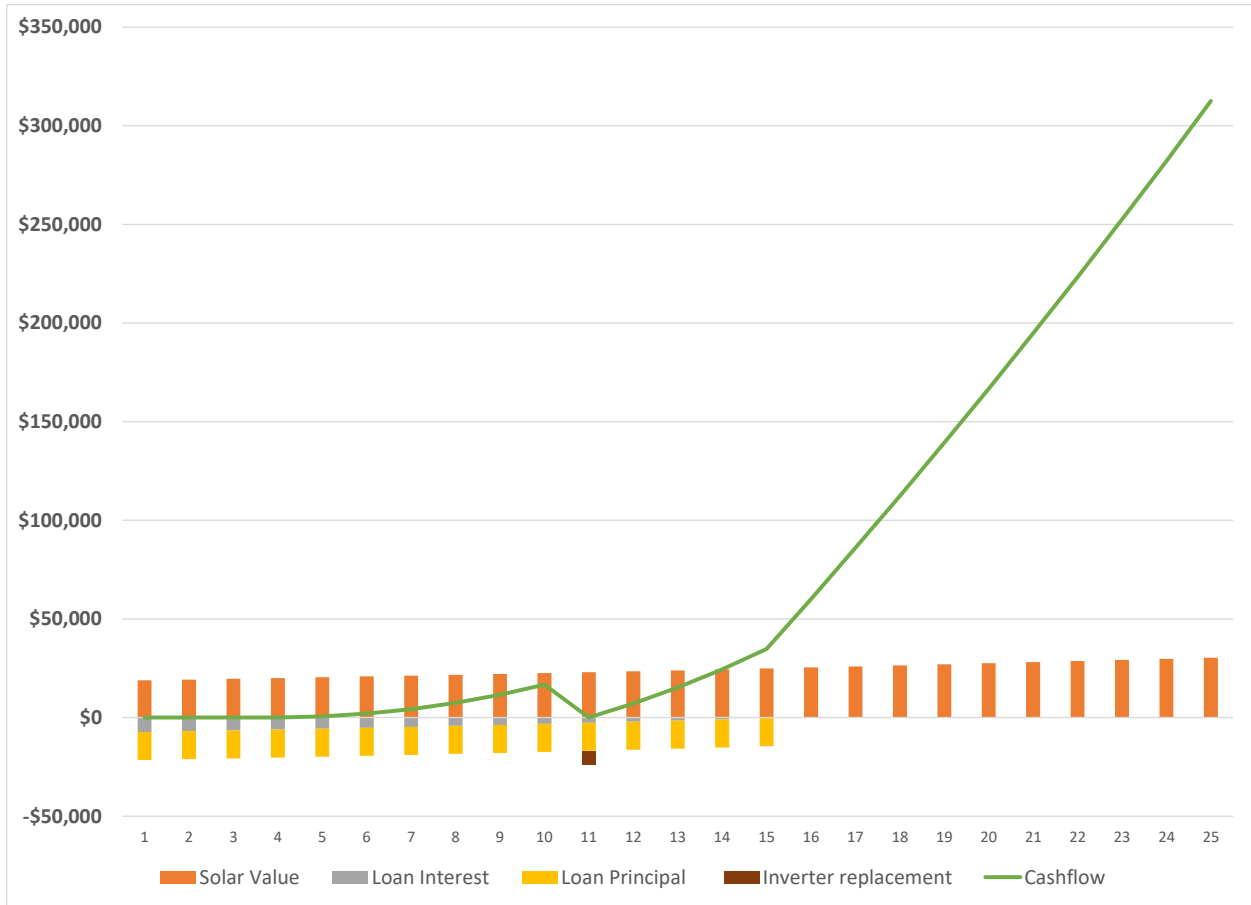
Payback schedule on a 13 year 3.5% interest loan and \$25,000 down payment.

Figure 10: Lonesome Pine Regional Technology and Business Park without assistance



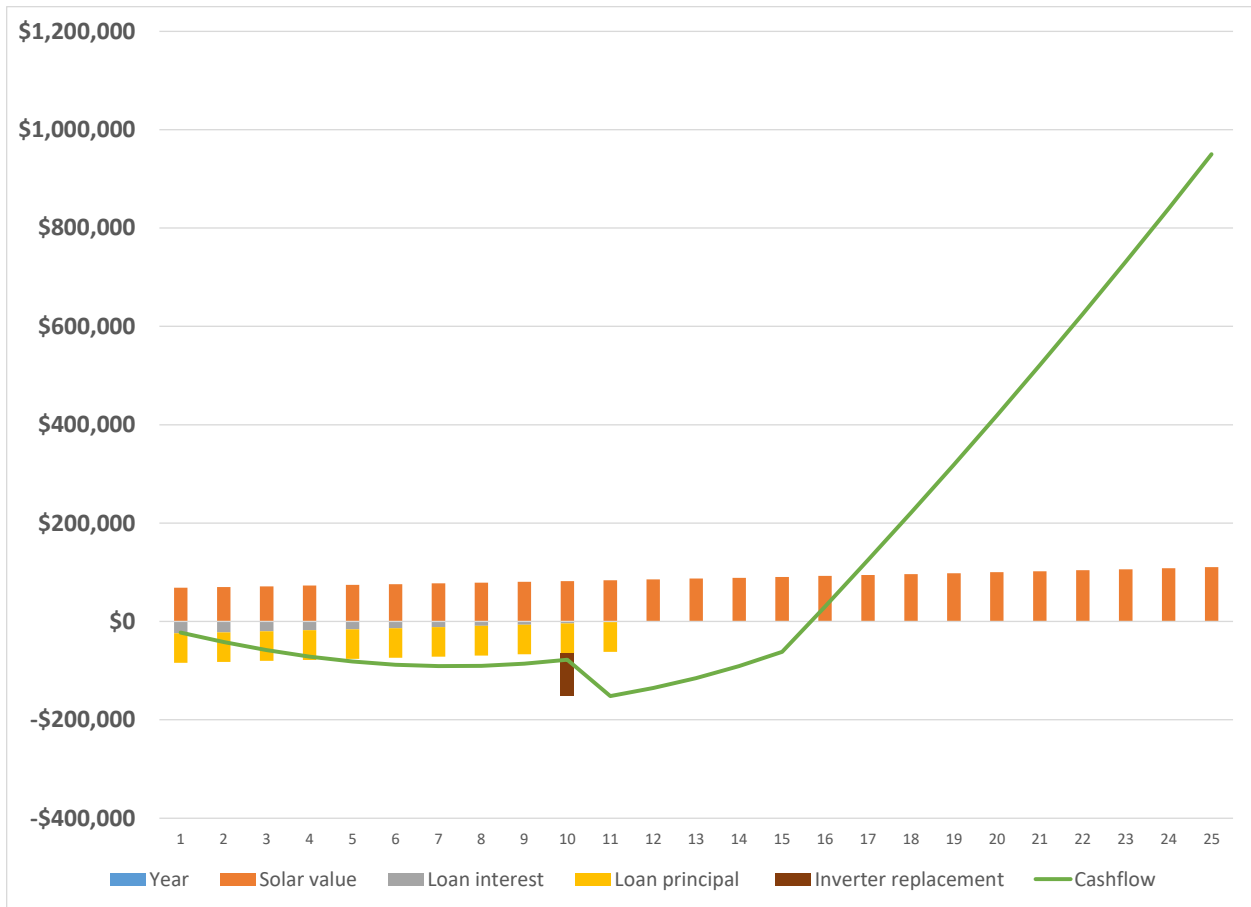
Payback schedule on a 15 year 3.5% interest loan.

Figure 11: Lonesome Pine Regional Technology and Business Park with assistance



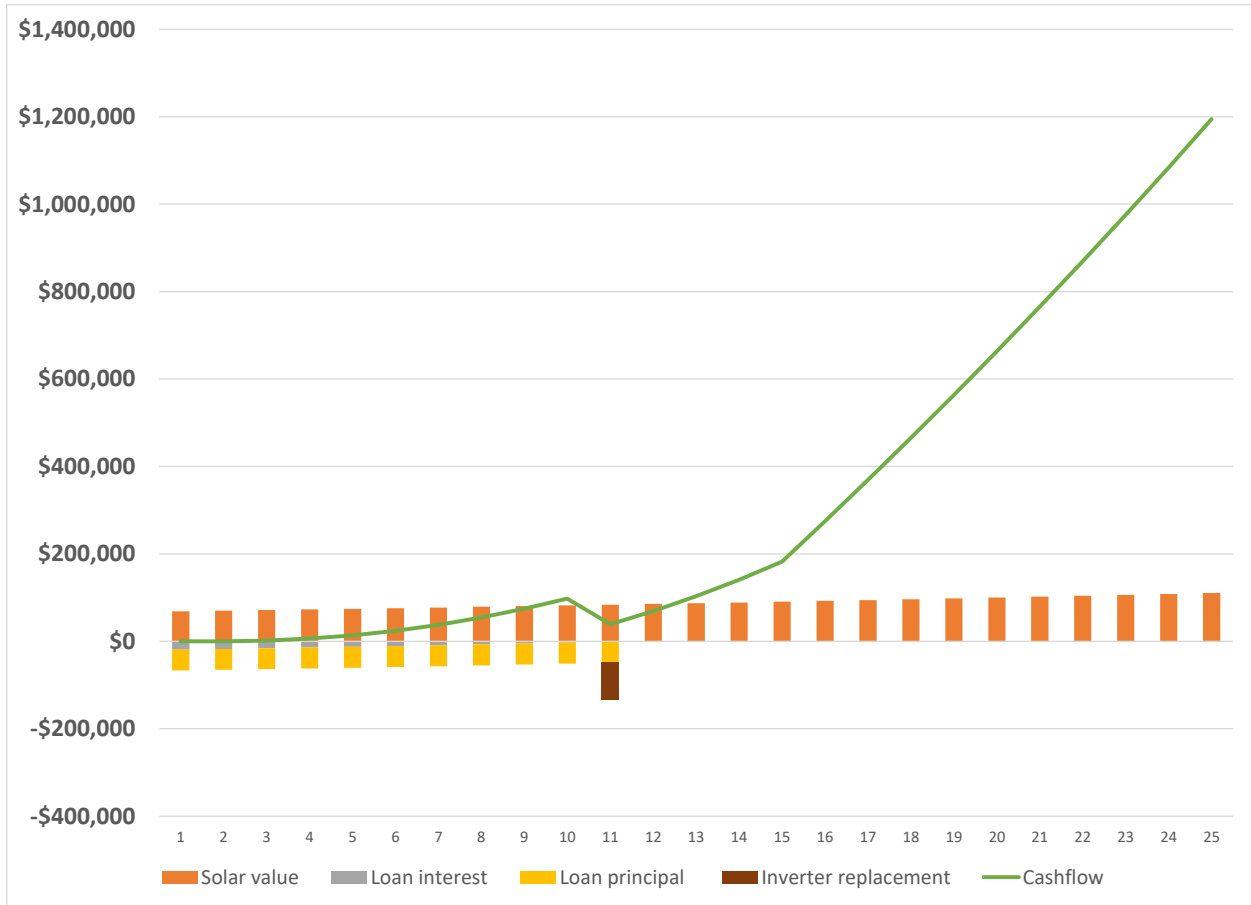
Payback schedule on a 15 year 3.5% interest loan, 15% down payment, and strategic disbursement of \$7,030.

Figure 12: Eastside High School and Coeburn Primary with no assistance



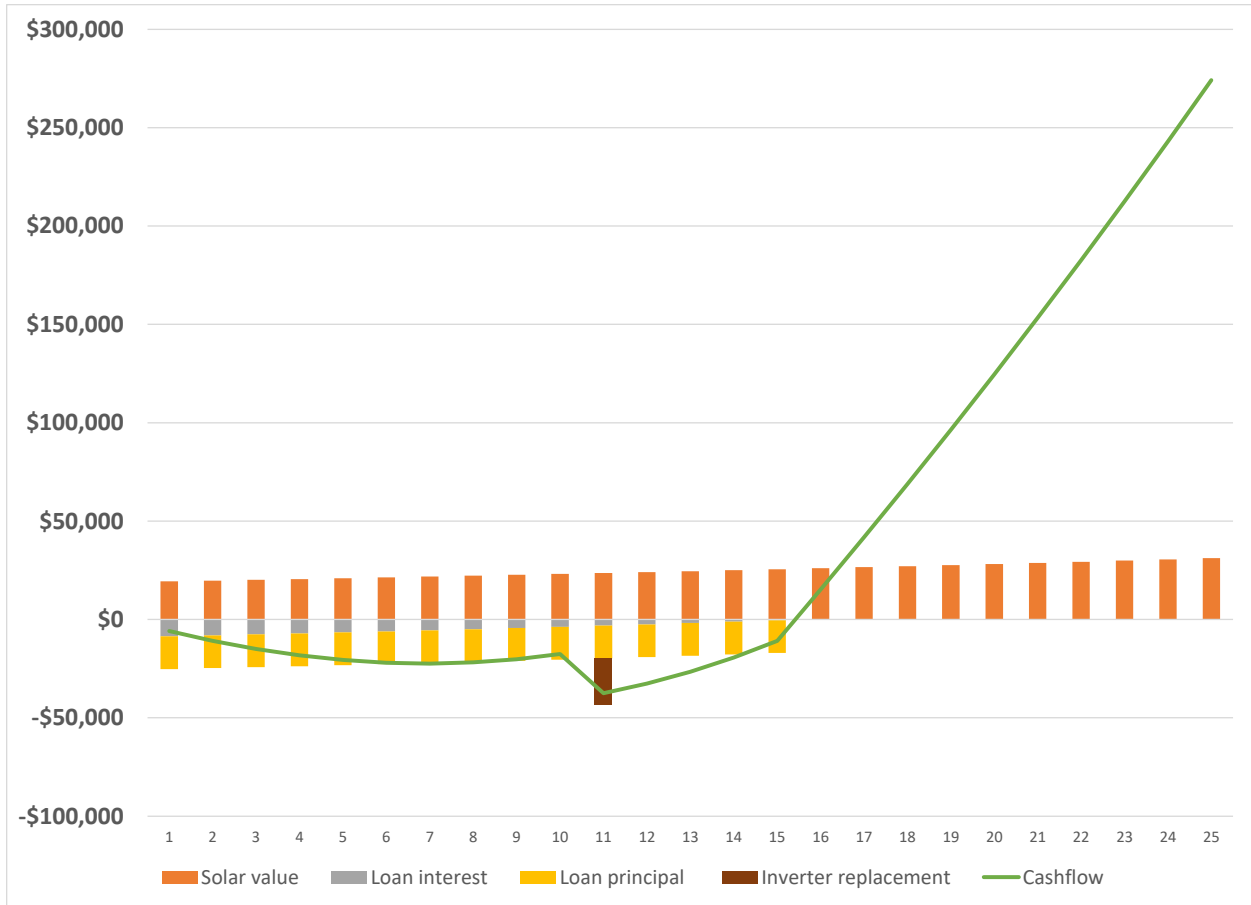
Payback schedule on a 15 year 3.5% interest loan.

Figure 13: Eastside High School and Coeburn Primary with assistance



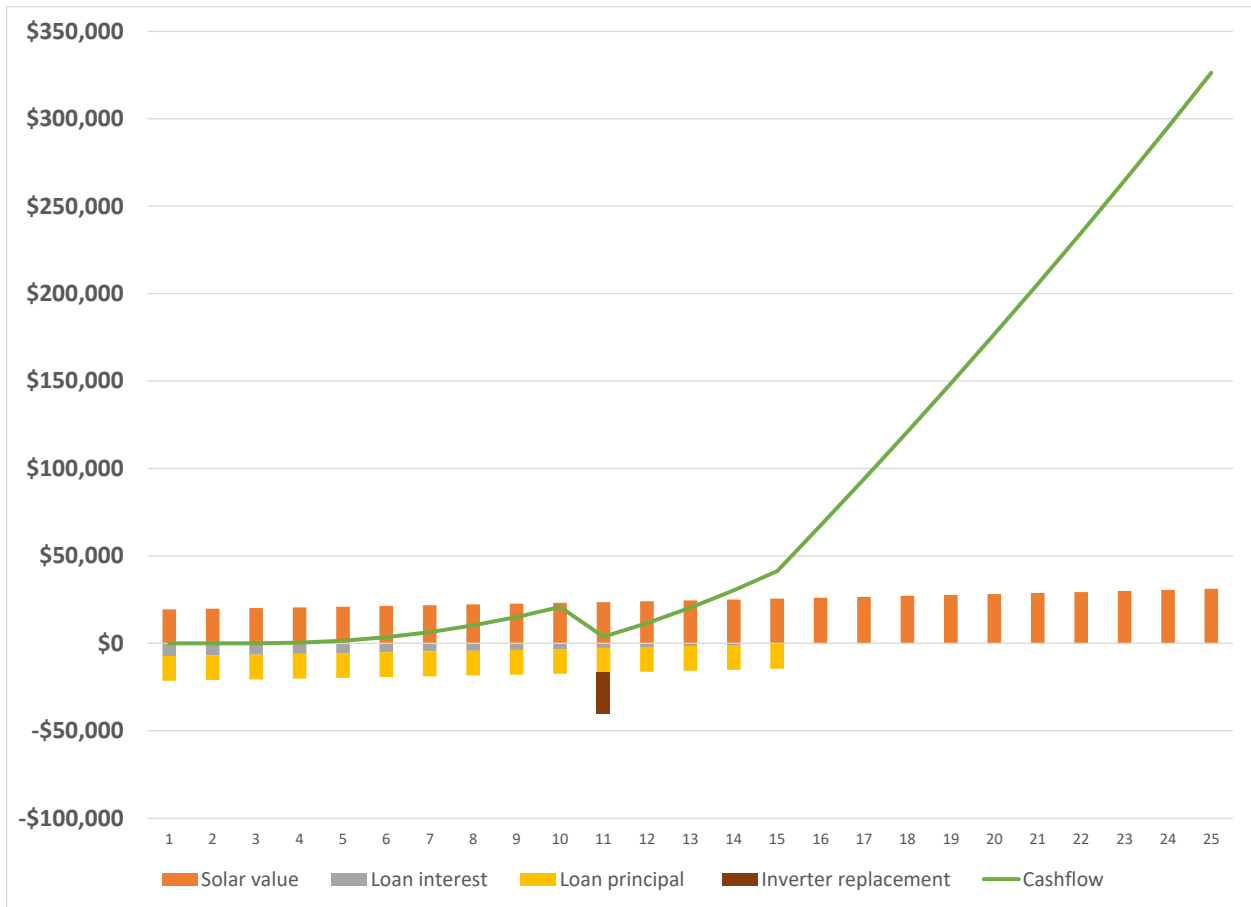
Payback schedule on a 15 year 3.5% interest loan, similar 15% down payment, and strategic disbursement of \$55,000.

Figure 14: Mountain View Regional Health Center with no assistance



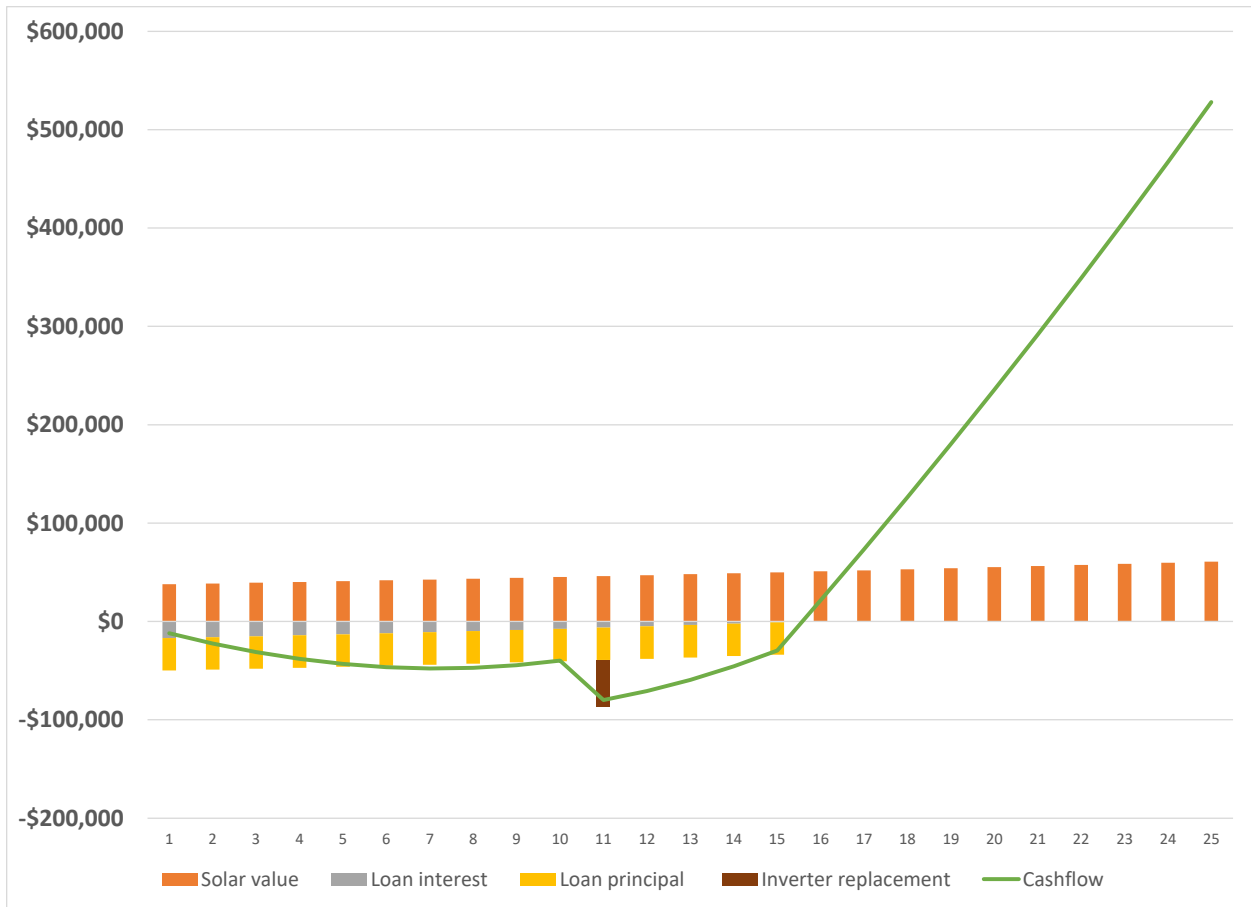
Payback schedule on a 15 year 3.5% interest loan.

Figure 15: Mountain View Regional Health Center with assistance



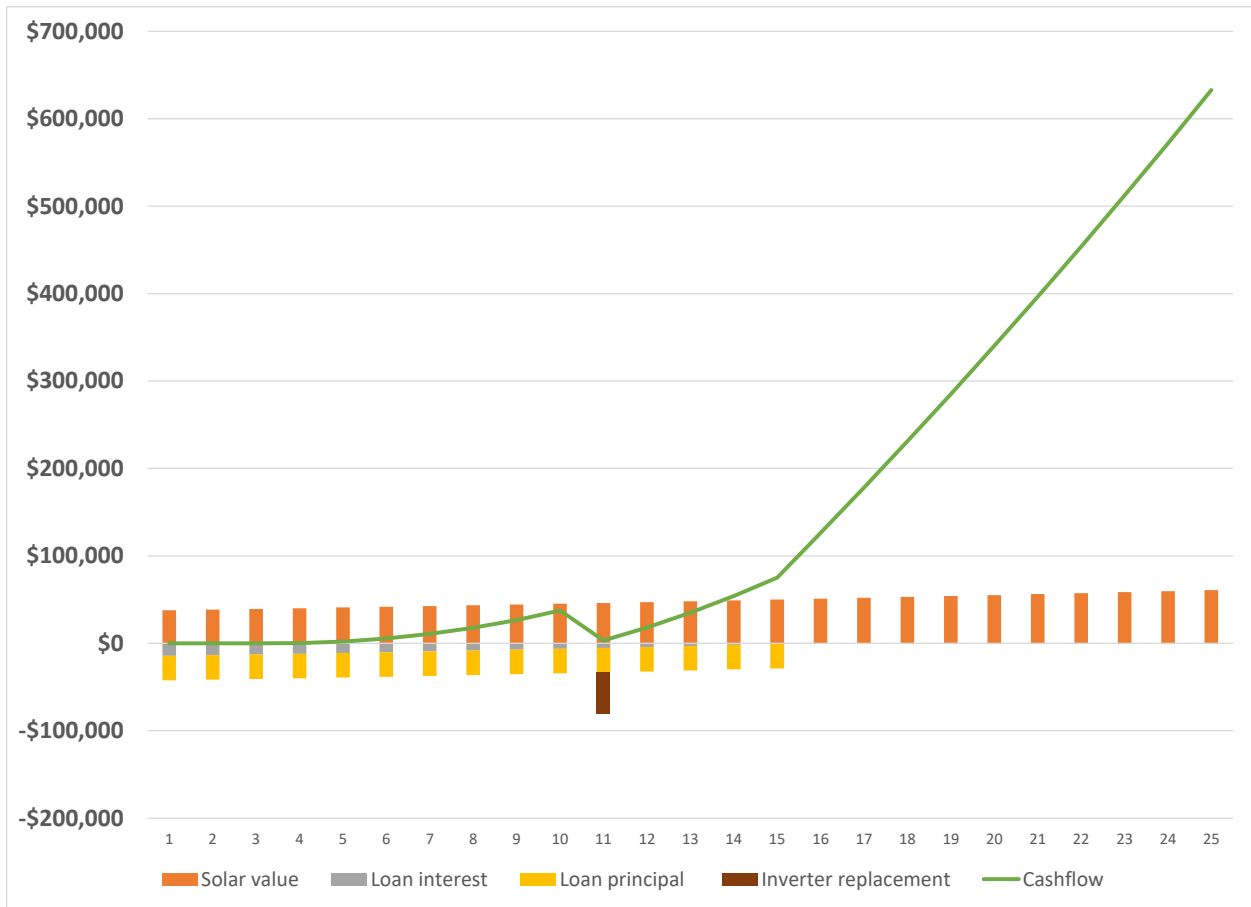
Payback schedule on a 15 year 3.5% interest loan, 15% down payment, and the strategic disbursement of \$3,987 of public or private investment over the first 3 years of solar facility operation.

Figure 16: Lonesome Pine Hospital without assistance



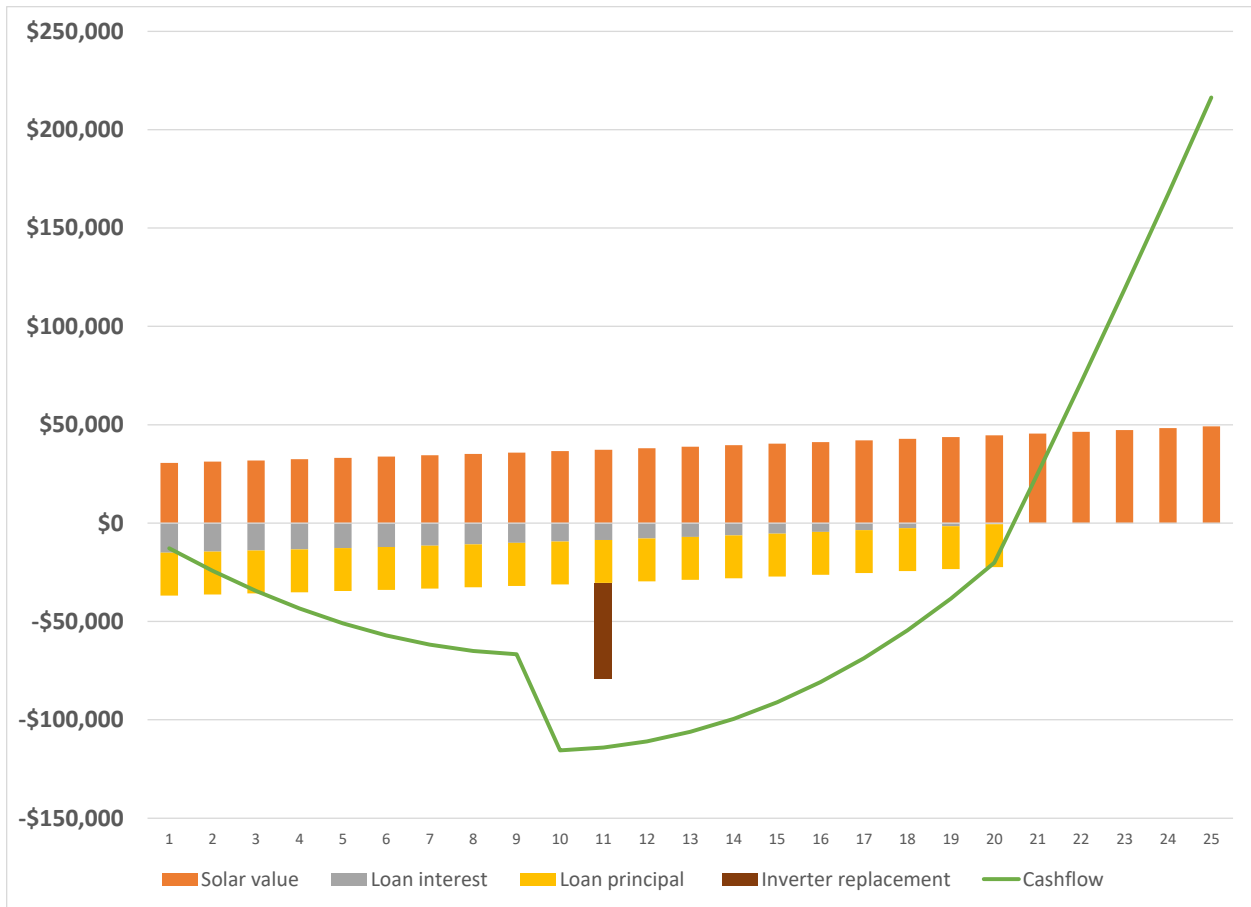
Payback schedule on a 15 year 3.5% interest loan.

Figure 17: Lonesome Pine Hospital with assistance



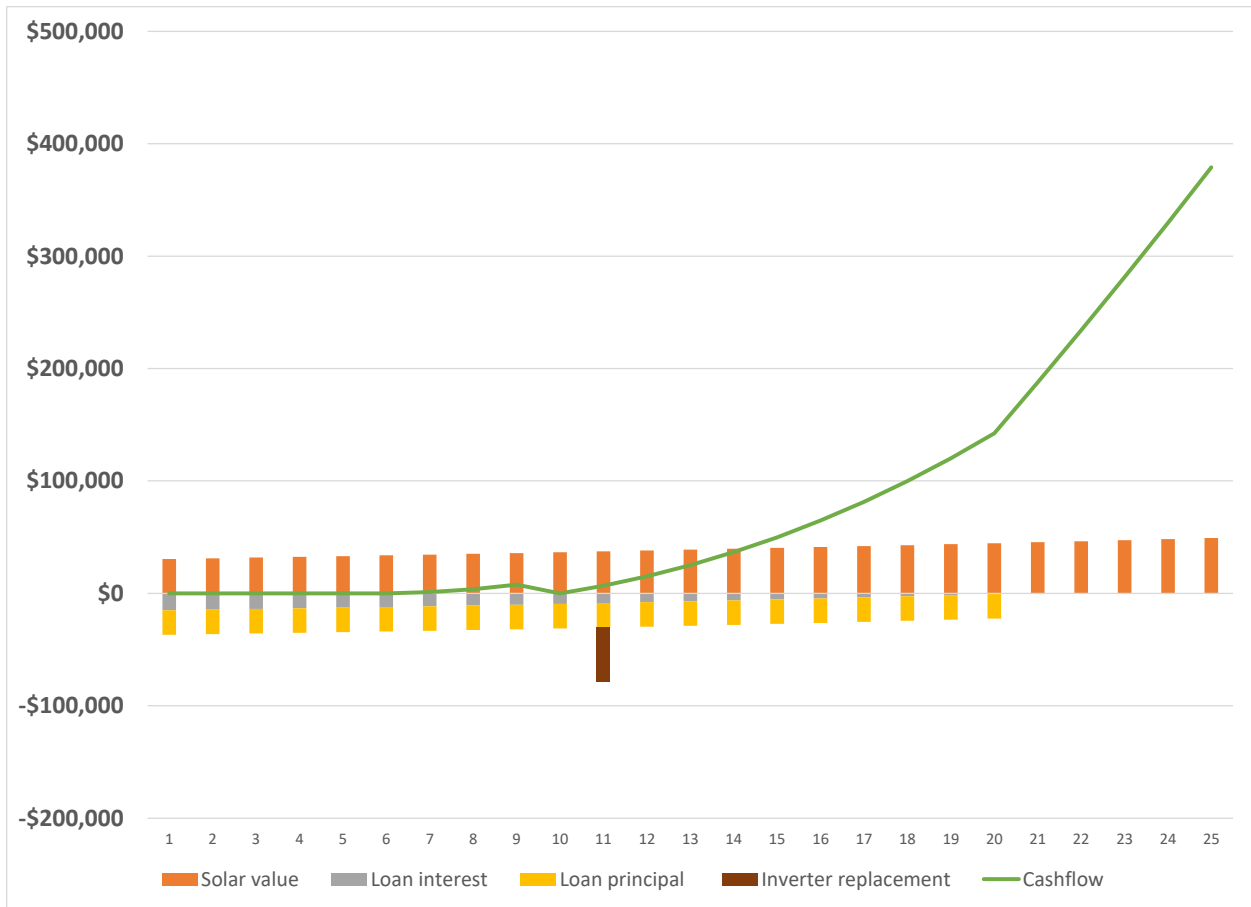
Payback schedule on a 15 year 3.5% interest loan, 15% down payment, and the strategic disbursement of \$9,138.

Figure 18: UVA Wise without assistance



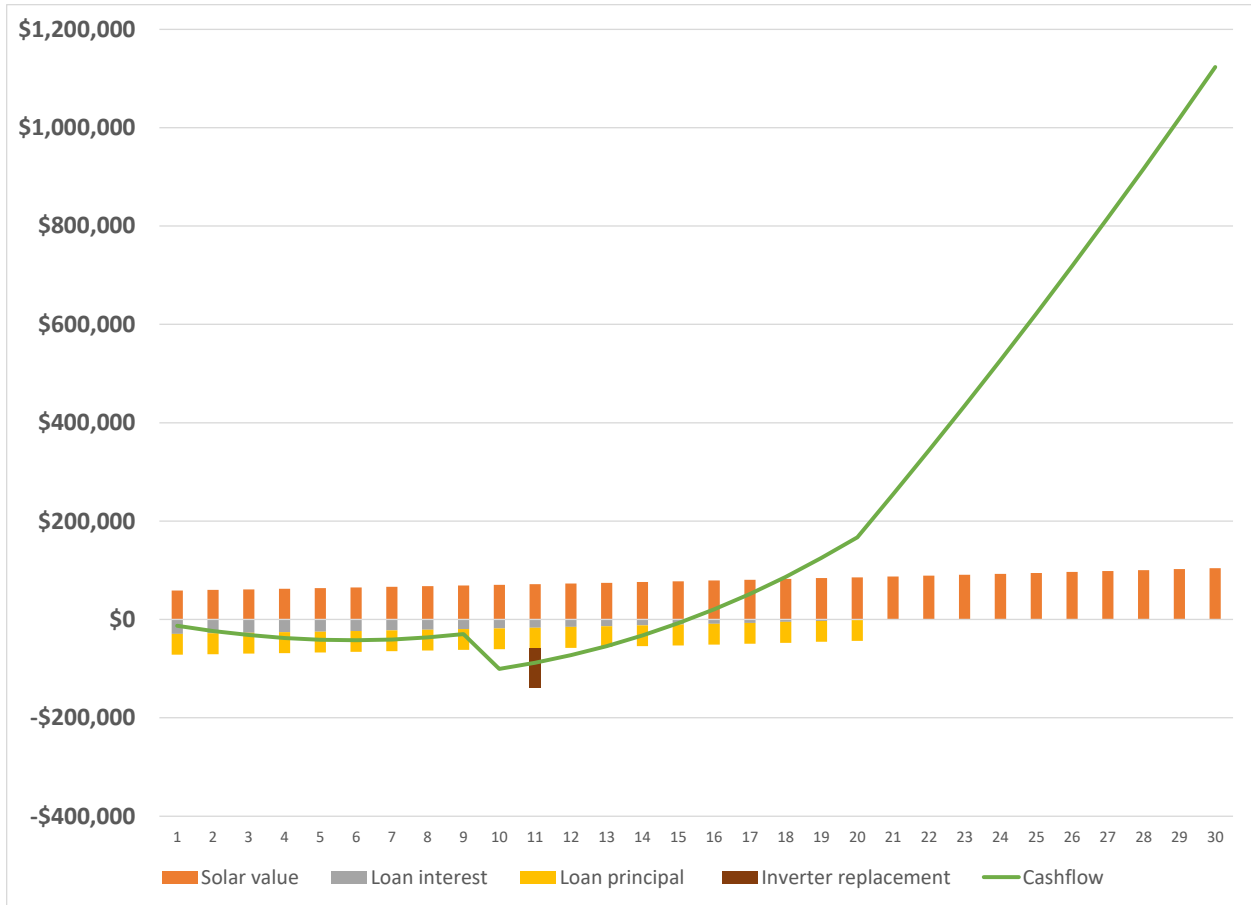
Payback schedule on a 20 year 3.5% interest loan.

Figure 19: UVA Wise with assistance



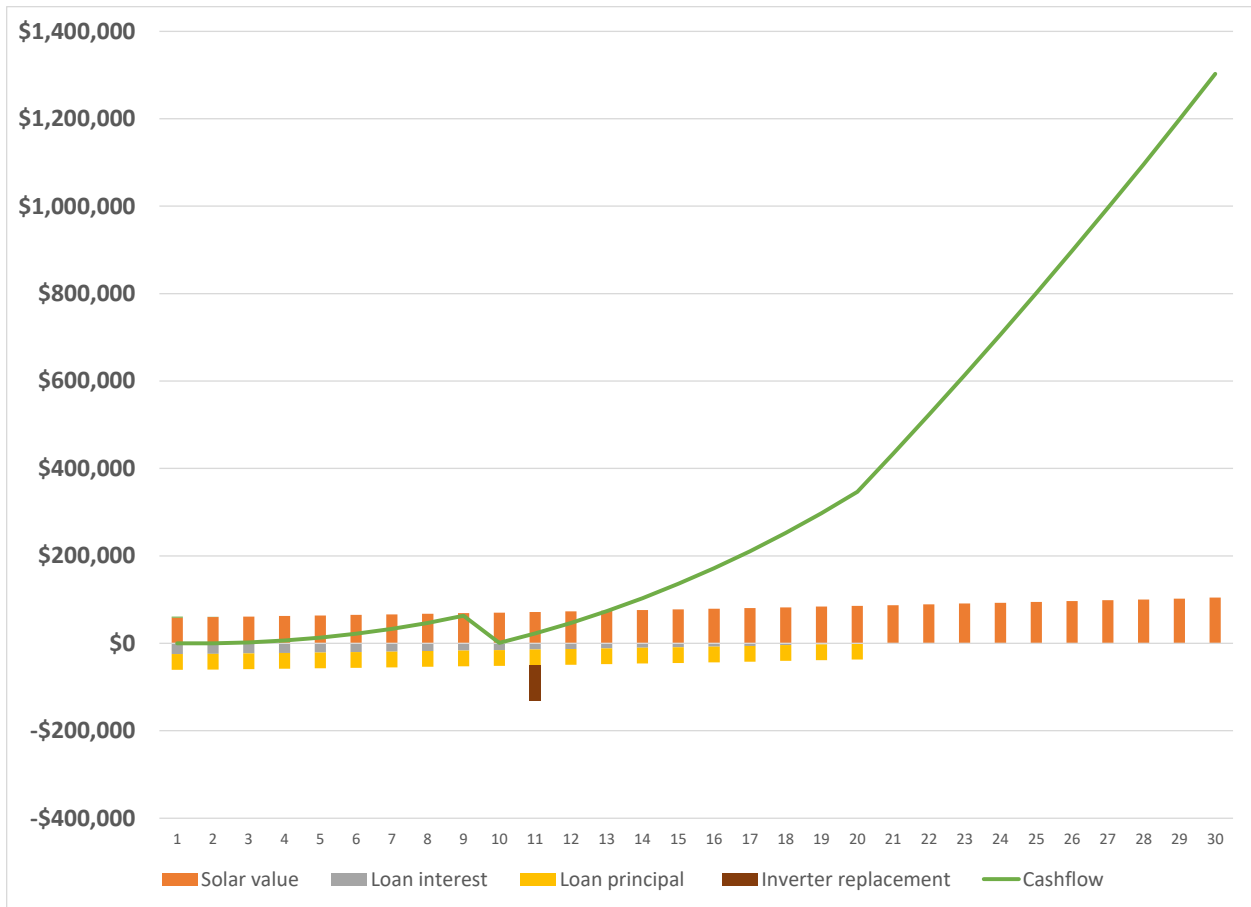
Payback schedule on a 20 year 3.5% interest loan, 15% down payment, and the strategic disbursement of \$55,277.

Figure 20: Southwest Virginia Community College without assistance



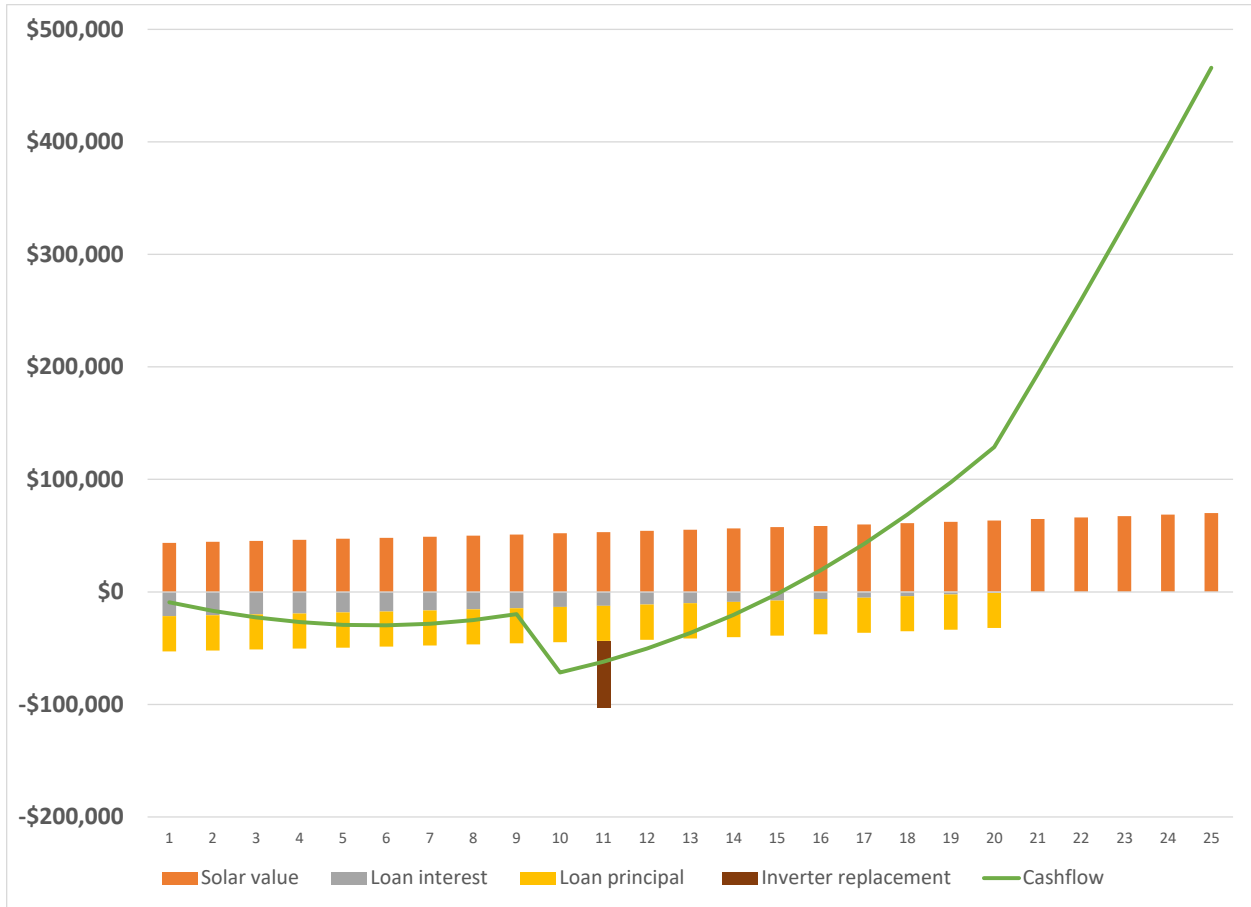
Payback schedule on a 20 year 3.5% interest loan.

Figure 21: Southwest Virginia Community College with assistance



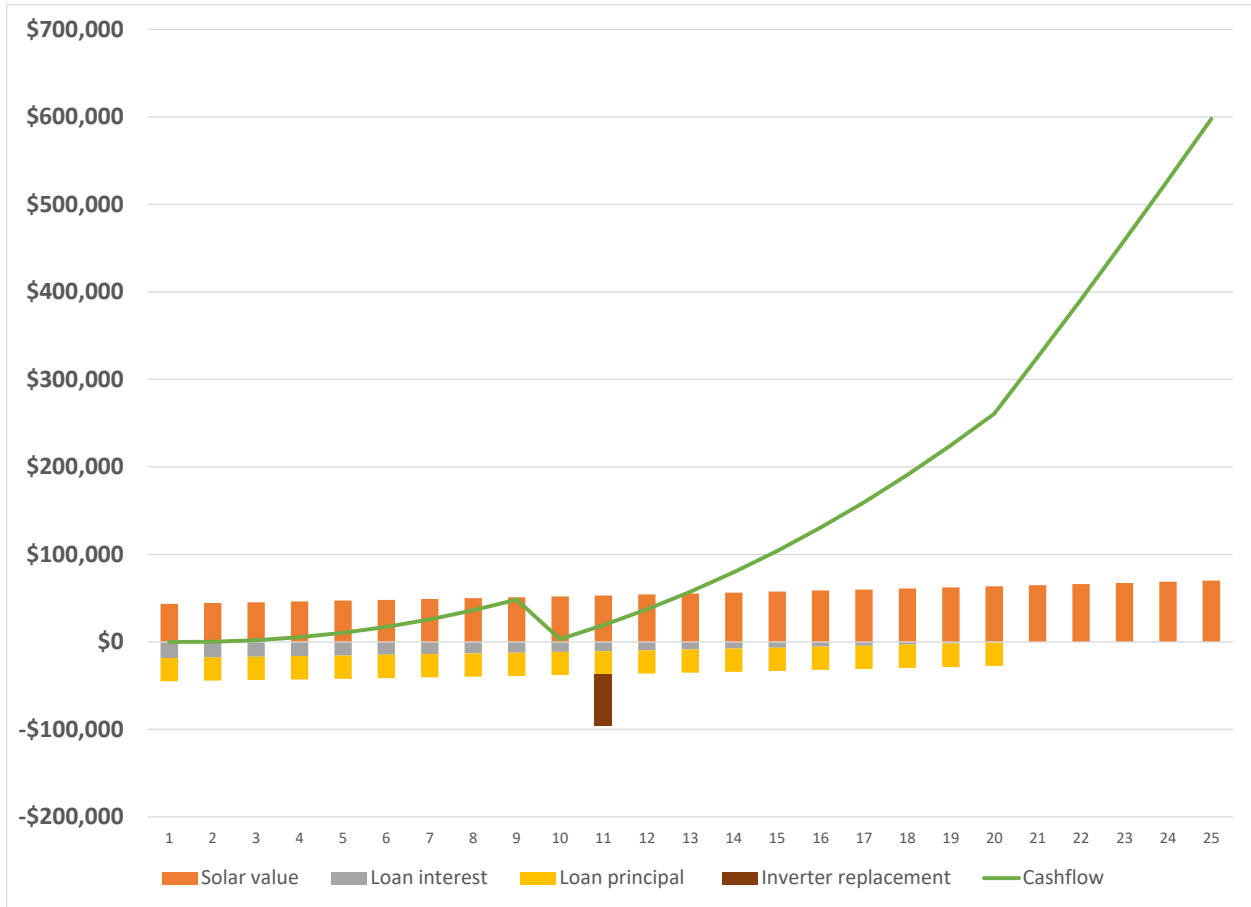
Payback schedule on a 20 year 3.5% interest loan, 15% down payment, and the strategic disbursement of \$2,115.

Figure 22: Mountain Empire Community College without assistance



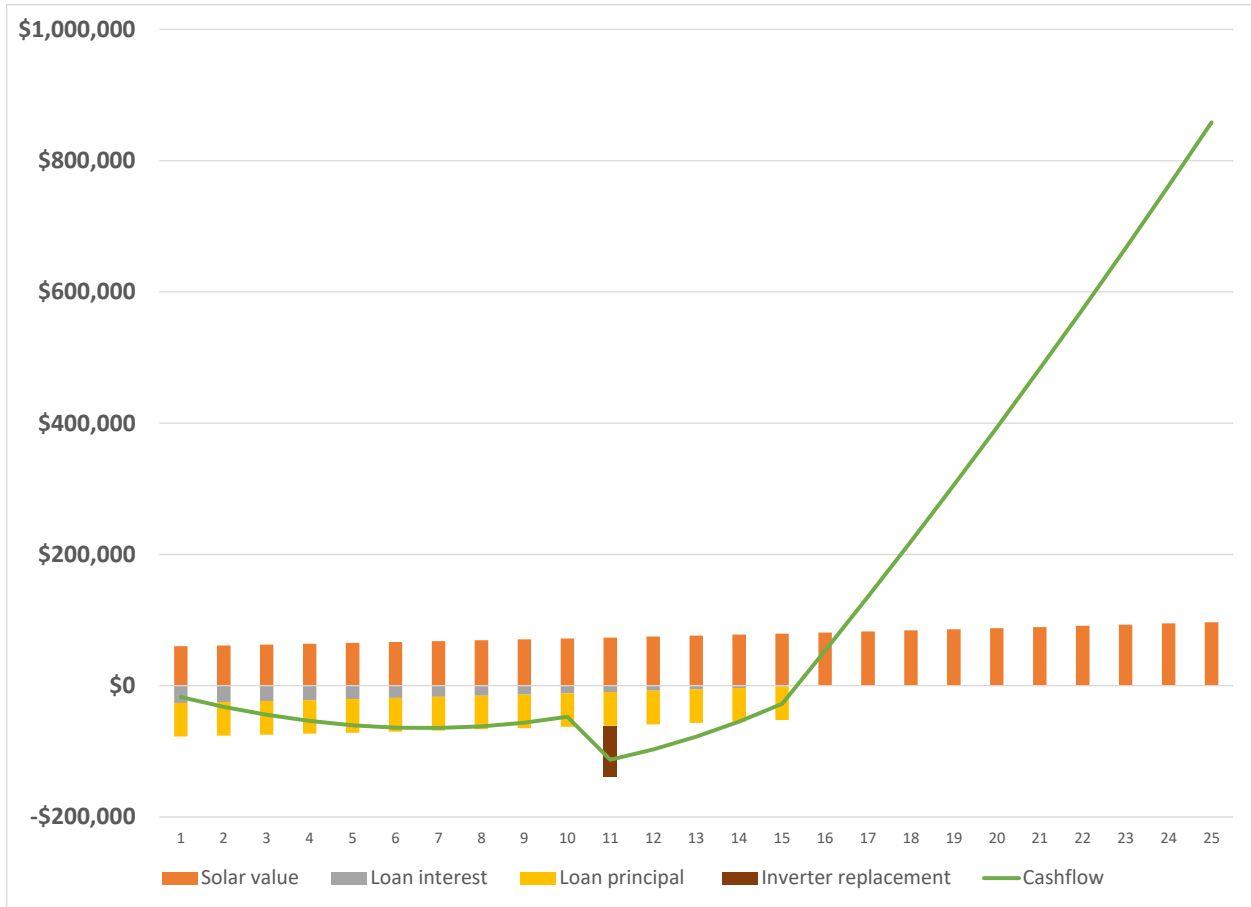
Payback schedule on a 20 year 3.5% interest loan.

Figure 23: Mountain Empire Community College with assistance



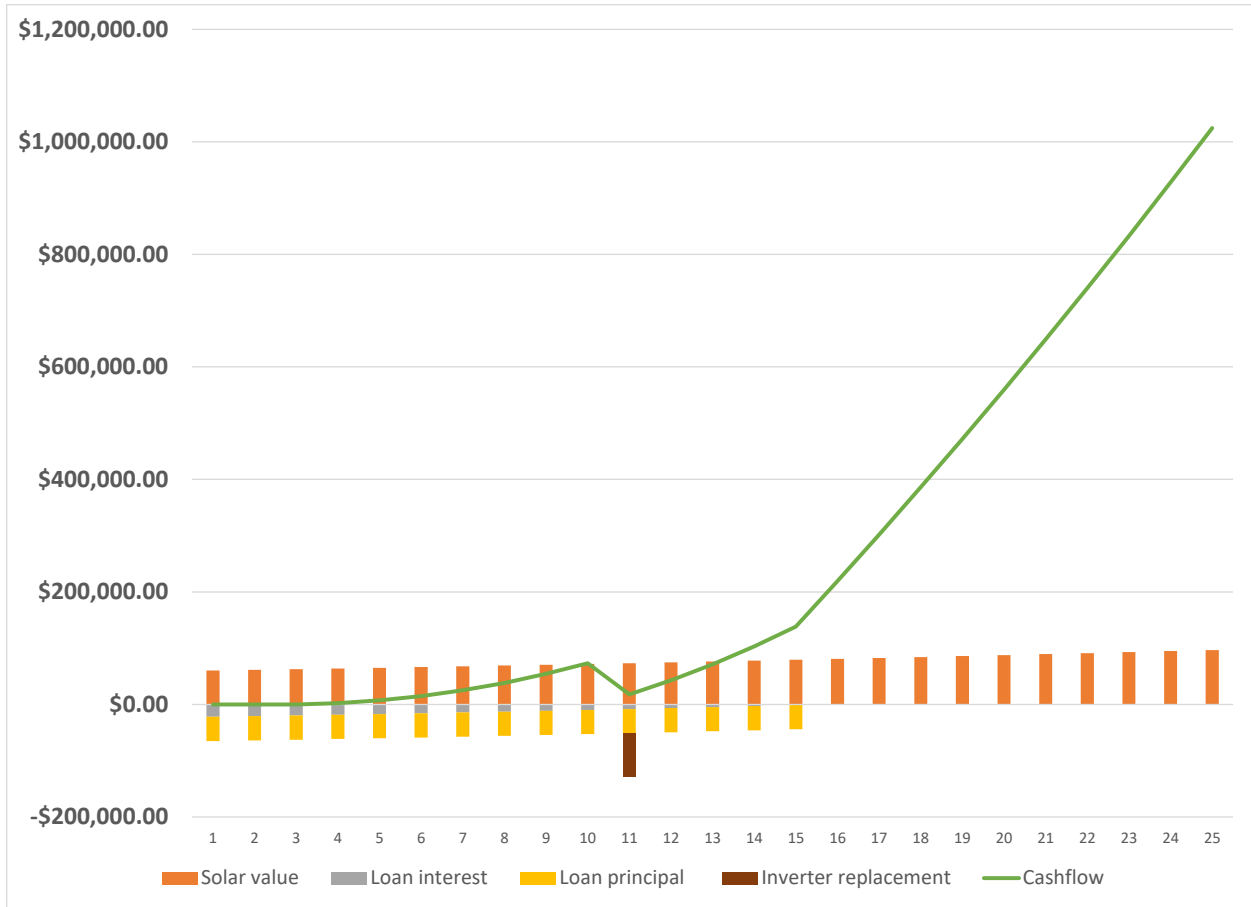
Payback schedule on a 20 year 3.5% interest loan, 15% down payment, and the strategic disbursement of \$1,319.

Figure 24: Wise County Central High School without assistance



Payback schedule on a 15 year 3.5% interest loan.

Figure 25: Wise County Central High School with assistance



Payback schedule on a 20 year 3.5% interest loan, 15% down payment, and the strategic disbursement of \$7.903.