Sustainable Energy Trust – Multifamily Solar Photovoltaic System Financial Analysis

Washington State Housing Finance Commission

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Section 1.0 Executive Summary

The Washington State Housing Finance Commission (Commission) commissioned David Paul Rosen & Associates (DRA) to conduct a financial analysis of solar photovoltaic (PV) energy generation systems that can be financed by the Commission's Sustainable Energy Trust (SET). In a previous phase of this study, DRA analyzed solar PV systems as applied to single family residential use, non-profit or government-owned school use and agricultural use. For this phase of the study, DRA examined the financial feasibility of providing SET financing for solar PV systems for multifamily residential use. DRA analyzed the following multifamily prototypes:

- Prototype #1: New Construction Multifamily Apartments
- Prototype #2: Substantial Rehabilitation of Multifamily Apartments

DRA assumed that both prototypes' baseline project costs already include energy efficiency measures and therefore we do not model additional costs for these features. DRA modeled the incremental development costs represented by a solar PV system that provides electricity for individual units and common areas for each prototype, as well as the available financing through federal, State and local funding programs. For each prototype, we examined the available funding sources under two scenarios:

- The development is affordable to lower income households and is financed with 4 percent Low Income Housing Tax Credits (LIHTC) and tax-exempt bonds.
- The development is a market rate apartment complex.

This report summarizes DRA's analysis of the alternative financing for each solar system prototype. Our analysis assumes that the funding gap between the cost of installing the solar PV system and the financing available to the system's owner is filled by a loan provided by the SET. We then model the system owner's repayment

of the SET loan and project the amount of time required to pay the loan back in full. We assume that the property owner's savings in common area electricity costs as a result of the solar PV system and, for the LIHTC prototypes, the increase in rental income collected from the tenants as a result of lower utility allowances, increase the permanent mortgage supportable by the project. The SET loan amount is therefore reduced dollar for dollar as the project's supportable permanent mortgage increases. The sources for repayment of the SET loan include, as appropriate to the prototype and ownership structure modeled, the Washington Renewable Energy Incentive payments received by the project owner and tax and depreciation benefits that accrue to the owner.

Key Findings

DRA's analysis, based on conservative assumptions regarding multifamily solar system financing and costs, finds that none of the prototypes studied are financially feasible and none of the prototypes analyzed result in paying back the SET loan in full by the end of the loan's 25 year term.

While the affordable prototypes, as modeled here, cannot financially support the installation of solar PV systems, we note that there is potential for such systems to prove financially feasible. The financing gaps filled by the SET loans for the affordable scenarios are approximately $208,000 for the new construction and $385,000 for the rehabilitation prototype, representing relatively small gap loans. The system sizes can therefore likely be reduced in order to eliminate this gap. For example, the prototypes used in this study assume large common areas, based on a survey of 4 percent tax credit properties in the State. Reducing the common area space in the properties and thereby reducing the size of the solar system could eliminate the financing gap. This assumes the project's eligible basis has not already reached threshold basis limits prior to adding the solar system so that they can take full advantage of the additional tax credit equity generated by the costs of the system. Additionally, in a 9 percent financing scenario, the additional LIHTC equity resulting from the increased project cost due to the solar PV system can fill the financing gap, assuming the project's eligible basis does not reach threshold basis limits prior to including the solar system costs. Therefore, while the prototypes modeled here show no source of repayment for the relatively small SET loans required to finance the solar PV systems, and therefore are financially infeasible, there is potential to eliminate the need for the SET loan entirely in both 4 percent and 9 percent tax credit scenarios.

Because there is no evidence to support the assertion that market rate apartments with solar PV systems can charge higher rents to tenants, the only cash flow benefits resulting from the solar PV system in the market rate scenarios are reduced operating costs for the project's common areas and accelerated depreciation benefits. This results in the outstanding balance of the SET loan being paid down in the 6 years that depreciation benefits accrue and then increasing in subsequent years. Together, then, the cash flow benefits resulting from the PV system are not sufficient to repay an SET loan. This finding holds true when the size of the solar system is reduced to only provide power for the project's common area electricity needs and not the units' needs. Therefore, solar PV systems are not feasible for market rate multifamily properties.

The primary reason for the long payback period for the solar systems on market rate apartments is the limited ability of apartment owners to take advantage of the electricity cost savings enjoyed by tenants as a result of a solar PV system. This obstacle to installing solar systems in tenant-occupied buildings is known as the "split incentive," in which the savings from the solar PV system accrue to the tenants while the building owner pays for the upfront costs of the system. This is less of an obstacle for tax credit multifamily properties because utility allowances can be decreased, and tenant-paid rent increased, due to solar PV systems and energy efficiency improvements. However, in the prototypes modeled here, this is still not sufficient to render the projects feasible, due in part to the relatively low electricity cost in Washington and the resulting relatively low baseline utility allowances in tax credit properties. Washington's average electricity rate is approximately $0.068 per kWh compared to California's average cost of approximately $0.14 per kWh and a national average cost of $0.10 per kWh[1].

Washington's low average electricity rate is due in large part to the State's supply of hydroelectric power, which, at a cost as low as $0.02 per kWh, is a very low-cost source of electricity compared to electricity generated with fossil fuels. About three quarters of the State's electricity is produced by hydroelectric power.[2] While there are environmental impacts from this source of electricity, including modification or loss of fish habitats, it produces zero greenhouse gas (GHG) emissions and is considered a renewable energy source. Therefore, replacing low-cost hydroelectric power with renewable energy produced through solar panels at a high capital cost, may not be the most efficient and effective use of public

[1] *Electric Power Monthly with data for June 2009*, Energy Information Administration.
[2] *Washington State Hazard Mitigation Plan, January 28, 2008,* Washington Military Department Emergency Management Division.

resources. In addition, it may not be the optimal strategy for Washington to increase its supply of renewable energy and reduce its GHG emissions.

Another reason for the long payback period of solar PV systems in Washington is the structure of the State's Renewable Energy Incentive. This incentive, paid to owners of solar systems, is low in relation to other states with more active solar markets. The $5,000 per year cap on the incentive means that all solar systems larger than approximately 33 kilowatts receive the maximum incentive. Medium and large systems, such as those modeled in this multifamily analysis, do not receive incentive payments proportional to their size or electricity produced, thus limiting the effect of the incentive on the system's cost and payback period. Therefore, the relatively modest nature of the State's incentive system fails to make larger systems financially feasible, thus limiting the number of such systems installed in Washington. Larger systems, then, are not good candidates for SET financing, due to their inability to repay debt over the long term.

Due to the annual incentive payment cap of $5,000, payback projections for the multifamily prototypes will not improve if the systems include equipment manufactured in Washington, thus earning the State incentive at a rate of $0.54 per kWh. The prototypes modeled here reach the incentive cap even at the lower incentive rate offered for equipment manufactured outside of Washington.

Section 2.0 Solar PV System Prototypes

DRA and Commission staff identified the following two prototypes for the SET multifamily analysis. Both prototypes are assumed to use commercially available PV technology and equipment and are not demonstration projects or advanced renewable energy technologies. The prototypes are detailed in Table 1 below.

- Prototype #1: New Construction Multifamily Apartments
- Prototype #2: Substantial Rehabilitation of Multifamily Apartments

The project sizes, unit counts, unit sizes and common area sizes for these prototypes were based on a survey of the project owners/managers of Washington's 4 percent LIHTC and tax-exempt bond- financed projects. DRA solicited information from 25 owners of 4 percent/bond projects in the State and received responses from 9 project owners representing 26 new construction projects and 47 acquisition/rehabilitation projects. We base the prototypes' specifications on the weighted average of these projects' specifications. We assume identical project and solar system specifications for the affordable scenarios and market rate scenarios.

2.1 System Capacity

PROTOTYPE 1: NEW CONSTRUCTION MULTIFAMILY APARTMENTS

Based on developer survey responses, the new construction prototype is assumed to contain 150 units each averaging 1,000 square feet and 8,000 square feet of common area space. The common area square footage is assumed to include corridors, lobby and interior circulation, as well as community and office space.

According to a literature review and recent project experience, solar PV systems for multifamily projects range from about 1 kilowatt DC (kW DC) to about 3 kW DC per unit, with the average solar system for an energy efficient unit sized at 2kW DC. The prototype used in this analysis is modeled on the average system size of

2kW DC per unit. As a rough estimate, a 2 kW DC system generates enough electricity to cover about 90 percent of the electricity needs of a 1,000 square foot energy efficient unit. Based on the developer survey responses, which found an average common area electricity use per square foot of approximately 25 kilowatt hours (kWh), we assume a PV system that generates 200,000 kWh per year to cover the project's common area electricity use. This translates into a system rated at 200 kW DC. The project's total PV system is therefore sized at 500 kW DC.

DRA's analysis assumes that the new construction prototype is designed to be energy efficient regardless of inclusion of the solar PV system. This is based, in part, on the updated Washington Building Code that takes effect in 2010. This code is understood to be one of the most aggressive building codes in the country, in regards to achieving energy efficiency. In addition, all of the housing projects receiving tax credit allocations from the Commission must comply with the Evergreen Sustainable Development Standards. Therefore, we assume that any incremental costs in the construction of the project that are due to energy efficiency would be financed with the project's other sources of financing and not through the SET. We therefore do not model these costs in this analysis.

PROTOTYPE 2: SUBSTANTIAL REHABILITATION, WITH ENERGY EFFICIENCY RETROFIT, OF MULTIFAMILY APARTMENTS

In determining the project size, unit count and common area space for this prototype, we again relied on the information acquired through DRA's survey of 4 percent tax credit/bond acquisition/rehabilitation project owners. We assume that the rehabilitation prototype contains 75 units averaging 650 square feet and 9,000 square feet of common area space, inclusive of community room, office space and interior circulation and hallways. We assume the units' solar PV system is sized at 1.5 kW DC per unit to cover 90 percent of each 650 square foot unit's electricity use. The common area solar system is sized to generate 230,000 kWh per year, assuming common area electricity use averages 25 kWh per square foot. The common area system is therefore sized at approximately 230 kW DC and the total system size is approximately 343 kW DC.

For the rehabilitation prototypes, we assume that an extensive energy efficiency retrofit is conducted as a part of the rehabilitation, in order to meet the State's Building Code requirements and the Evergreen Sustainable Development Standards. We assume that the incremental costs of this retrofit are financed with the project's other sources of financing and therefore do not include these costs in the system's total project costs.

2.2 Annual Energy Generation

A solar PV system's annual energy generation varies, depending on the system's size, shading, orientation, tilt, location and panels and modules used. According to our interviews, solar systems in Seattle average about 900 kWh annually per installed kilowatt DC. In Puget Sound, an optimally-oriented system can generate about 1,000 kWh per installed kilowatt DC and in eastern Washington, a system can generate about 1,200 kWh annually per installed kilowatt DC.

Our analysis assumes annual energy generated by the prototypes' systems to be 1,000 kWh per installed kW DC, or 2,000 kWh per new unit, 1,500 kWh per rehabbed unit, 200,000 kWh for the common space of the new construction prototype and 230,000 kWh for the common space of the rehabilitation prototype. We note that, while energy use varies by project and unit, the solar system we model is assumed to generate approximately 90 percent of the average energy efficient multifamily unit's electricity needs and all of the common area's needs.

Per interviews with solar installers and experts, we assume that the solar PV systems degrade slightly each year. Most solar panel producers claim that their panels will produce at least 80 percent of their rated output after 20 to 25 years of use. We therefore assume an annual degradation rate of 0.75 percent for all of the prototypes.

2.3 Space Needed

The number of square feet of roof or ground space required by a solar system depends on the system's size and the efficiency of the panels used, which varies greatly depending on the panels' manufacturer and technology. Per interviews with installers and a review of panels for sale, we assume that a system requires 100 square feet (SF) per kW DC. We assume that both prototypes have sufficient available roof area on their buildings and carports to support a system of this size.

2.4 Development Costs

2.4.1 PV System Cost

The all-in cost of a solar PV system includes the system equipment (panels and inverters), mounting equipment, interconnection equipment and labor costs. Due to recent changes in the economy as well as increases in the market's supply of panels and solar installers, solar system costs are decreasing. According to installers, other Washington solar experts and DRA's experience, the current all-in system cost ranges from $6.75 to $7.50 per watt for residential systems, down from

about $8 per watt one year ago. This analysis assumes the residential system's cost is $7 per watt, or $3.5 million for the new construction prototype and $2.4 million for the rehabilitation prototype. The systems' per unit costs are approximately $23,000 and $32,000 for the new construction and rehabilitation prototypes, respectively, inclusive of the common area systems' costs and $14,000 and $10,500 exclusive of common area systems' cost.

Tax credit allocations are based on total project costs, including contingencies and a developer fee calculated as a percentage of the total project's cost. The affordable scenarios in this analysis therefore include a 10 percent contingency for the new construction prototype and a 15 percent contingency for the rehabilitation prototype, as well as an increase in developer fee equal to 15 percent of the systems' costs for each prototype, per Washington's LIHTC program regulations. The project costs for the market rate scenarios include the costs of the return on the developer's equity contribution to financing the project. We assume the developer contributes 30 percent of the project costs and receives a 12 percent return.

The above assumptions assume the prototypes use the lowest cost systems and installers available. While there are Washington-made inverters currently available on the market, and one Washington-based manufacturer that will soon start selling solar panels, we do not assume the systems use solar panels or inverters manufactured in Washington. Although this assumption prevents the systems from receiving the higher Washington Renewable Energy Incentive rate for using Washington-manufactured products, the higher incentive rate would not result in an increase in the annual incentive payment received by these projects due to the annual payment cap of $5,000.

Table 1 Multifamily PV Prototypes and Assumptions		
System Use:	**Prototype #1: New Construction**	**Prototype #2: Substantial Rehabilitation,**
Housing Prototype Specifications		
Number of Units	150 Units	75 Units
Common Space (SF)	8,000 SF	9,000 SF
Solar PV System Specifications		
Per Unit System Capacity (kW DC)	2 kW DC	1.5 kW DC
Common Area System Capacity (kW DC)	200 kW DC	230 kW DC
Total Project System Capacity (kW DC)	500 kW DC	343 kW DC
Annual Electrical Production (kWh)	500,000 kWh	343,000 kWh
Annual System Degradation[1]	0.75%	0.75%
Annual Replacement Reserve Funding[2]	1.00%	1.00%
Development Costs		
System Development Cost (per watt)	$7.00	$7.00
System Development Cost per Unit	$23,000	$32,000
Total PV System Development Cost	$3,500,000	$2,400,000
Other Assumptions		
WA Renewable Energy Incentive Rate[3]	$0.15	$0.15
Maximum Energy Incentive per year	$5,000	$5,000
Annual interest rate on SET loan	6.75%	6.75%

[1] Percent by which the PV system's electricity output is diminished annually, on average, due to degradation of equipment and components.

[2] As a percentage of the system's total cost.

[3] Base Renewable Energy Incentive rate for solar, per kWh produced, to be paid annually until 2020, per RCW 82.16.120.


Section 3.0 Development Sources and Uses

DRA modeled the sources and uses for each prototype's solar PV system, under two scenarios: one in which the project is an affordable housing development financed with 4 percent LIHTC and tax-exempt bonds and one in which the project is a market rate apartment development. Depending on the nature of the housing development, different financing sources may be available for the same system.

The financing required by the Sustainable Energy Trust to render the system feasible is equal to the gap between the total funding available from all applicable financing sources and the total cost of the system. The prototypes' sources and uses are shown in Tables 2 and 3 below.

3.1 Development Financing Sources

DRA produced, under separate cover, a summary of federal, State and local funding sources available to leverage SET funds in financing solar PV systems. These profiles include the major sources of financing available for solar PV systems in Washington. DRA's SET Multifamily Financial Analysis includes the following financing sources, as appropriate for the prototypes analyzed:

- Federal Business Energy Investment Tax Credit
- Increase in Low Income Housing Tax Credit Equity
- Increase in Supportable Permanent Mortgage
- Increase in Developer Equity
- Washington Renewable Energy Incentive

Table 2

Development Sources and Uses

Multifamily Prototypes

Affordable Housing Use

	New Construction	Substantial Rehabilitation
Uses:		
System Cost[1]	$4,427,500	$3,170,700
Total Uses:	$4,427,500	$3,170,700
Sources:		
Federal Business Energy Investment Tax Credit[2]	$750,800	$537,600
Increase in LIHTC Equity[3]	$2,042,600	$1,435,000
Increase in Permanent Supportable Mortgage[4]	$1,426,500	$813,500
SET Loan Financing	$207,600	$384,600
Total Sources:	$4,427,500	$3,170,700
Total SET Financing per watt produced/saved	$0.42	$1.12
SET Financing as % of total cost	4.7%	12.1%

[1] Includes 10 percent contingency for new construction and 15 percent contingency for rehabilitation projects. Includes increase to developer fee equal to 15 percent of the total system cost.

[2] Federal Business Energy Investment Tax Credit is equal to 30 percent of the system's cost. Assumes a tax credit price equal to the LIHTC Factor of $0.65.

[3] Due to the increased total project costs resulting from the solar system costs, the projects' eligible basis for determining their tax credit allocations are increased. The increase in tax credit equity assumes an Applicable Percentage of 4 percent and the WSHFC's minimum Tax Credit Factor in 2010 of $0.65. Increased equity also includes the net present value of the system's depreciation benefits, assuming a discount rate of 6 percent.

[4] Assumes common area operating costs and unit utility allowances are reduced, thus allowing increased rents, an increased net operating income and an increased supportable mortgage. Assumes a debt coverage ratio of 1.25 and an interest rate of 7 percent.

Table 3

Development Sources and Uses
Multifamily Prototypes
Market Rate Housing Use

	New Construction	Rehabilitation With Energy Efficiency Improvements
Uses:		
System Cost [1]	$3,630,700	$2,487,000
Total Uses:	$3,630,700	$2,487,000
Sources:		
Federal Business Energy Investment Tax Credit[2]	$1,050,000	$719,200
Increase in Developer Equity[3]	$1,089,200	$746,100
Increase in Permanent Supportable Mortgage[4]	$96,100	$108,100
SET Loan Financing	$1,395,400	$913,600
Total Sources:	$3,630,700	$2,487,000
Total SET Financing per watt produced/saved	$2.79	$2.67
SET Financing as % of total cost	38.4%	36.7%

[1] Includes 12 percent return on developer's equity contribution.

[2] Federal Business Energy Investment Tax Credit is equal to 30 percent of the system's cost.

[3] Assumes the developer's equity contribution is equal to 30 percent of the solar system project cost, inclusive of return on developer equity.

[4] Assumes operating costs are reduced due to solar PV system, thus resulting in an increased net operating income and an increased supportable mortgage. Assumes a debt coverage ratio of 1.25 and an interest rate of 6 percent.

3.1.1 Federal Business Energy Investment Tax Credit

The primary source of financing for privately-owned solar PV systems is the Federal Business Energy Investment Tax Credit (ITC) for commercial and industrial users. Both tax credits are equal to 30 percent of the system's equipment and installation costs, with no maximum credit. The credit is taken in the year the system is placed in service and systems must be placed in service before December 31, 2016.

To claim the ITC, the original use of the system must begin with the taxpayer, or the system must be constructed by the taxpayer. Businesses claiming the ITC may opt for a US Treasury Department grant in the same amount of the ITC.

DRA's financial analysis shows the ITC as equal to 30 percent of the system's cost for all prototypes. For the LIHTC scenarios, we assume that the ITC is taken by the development's Limited Partner who also provides the LIHTC equity. In these scenarios, we assume the Limited Partner provides equity in exchange for the ITC at the same rate as equity is provided for the Low Income Housing Tax Credits, or $0.65 per tax credit dollar. Because the credit is claimed in the year in which the system is placed in service, in all scenarios, the credit is shown as a development source for the PV system. The credit, then, reduces the SET gap financing required on a dollar-for-dollar basis.

3.1.2 Increase in Low Income Housing Tax Credit Equity

Because a LIHTC-financed project's allocation of tax credits is calculated as a percentage of its eligible development costs, any increase in the project's eligible basis below threshold basis limits can increase its tax credit allocation. The costs of a solar system and its installation are eligible costs for calculating a project's tax credit allocation. Four percent tax credit allocations are awarded on a non-competitive basis and therefore there are no maximum allocations per 4 percent tax credit project. Therefore, the affordable prototypes in this study are assumed to receive an increase in annual tax credits equal to the cost of the system and energy efficiency improvements multiplied by the Applicable Percentage, or 4 percent. The project is allocated this annual credit amount for the 10 year credit period.

The project's Limited Partner is assumed to provide equity in exchange for the increased tax credit allocation at a rate equal to the Commission's minimum Tax Credit Factor for 2010, or $0.65. This increase in equity is shown as a source of

financing for the system's installation in the affordable housing scenarios, thereby reducing the gap financing filled by the SET loan.

The solar PV system is also eligible for accelerated depreciation benefits under the Modified Accelerated Cost Recovery System (MACRS), discussed in more detail below. In order for an affordable housing project owned by a non-profit housing developer to take advantage of MACRS, we assume that the Limited Partner claims the depreciation benefits and in turn increases their equity contribution to the project. We assume the Limited Partner's equity contribution is increased by the net present value of the solar system's depreciation benefits, assuming a discount rate of 6 percent. This is an appropriately conservative assumption, given that there are few, if any, tax credit properties implementing this structure. In the affordable scenarios, then, the MACRS depreciation benefits are not shown as an annual revenue source for the system owner but instead contribute to the increase in equity provided as a development source by the Limited Partner.

3.1.3 Increase in Permanent Supportable Mortgage

Multifamily housing developments' permanent mortgages are sized based on the project's net operating income and debt service capacity. Therefore, any permanent increase in net operating income can lead to an increase in the project's supportable permanent mortgage. The solar PV systems modeled in this study increase the prototypes' net operating incomes in two ways. First, the PV system reduces the project's operating costs by reducing the electricity costs for the development's common areas. Second, the system and improvements reduce the electricity needs and costs for the project's units. With cooperation from the Commission and the local Public Housing Authority, a tax credit property can use a reduced utility allowance due to inclusion of a solar PV system, thereby increasing the collectable rent from the tenant, without increasing the tenant's net housing cost. This increases the LIHTC project's net operating income.

Based on 19 utility allowances from throughout the State, a two bedroom affordable apartment unit in which the tenant pays for electrical heating, cooking, water heating and other electricity has an average utility allowance for electricity of $78. Assuming the solar PV system reduces the unit's electricity use by 90 percent and the project can raise the tenant's rent by an amount equal to the reduction in electrical utility charges resulting from the solar PV system, the projects are able to increase tenant-paid rent by approximately $70 per unit per month.

For the market rate prototypes, we assume no increase in rent as a result of installing the solar PV system. While some market areas report this "green rent premium" for very sustainably-designed buildings, we found no evidence of such a premium in Washington. According to interviews with market rate apartment owners and apartment associations in Washington, very few of these types of apartment buildings have been built in the State. Those interviewed had not heard of landlords being able to charge a green premium for apartments with solar PV systems, although some mentioned that they had heard that "green" buildings have faster absorption rates than conventional apartment buildings. We therefore show no effect on the market rate prototypes' rental income due to installing the solar PV system.

We note that the concept of "green leases" for energy efficient apartments is gaining popularity around the country. With a green lease, a tenant agrees to a higher rent rate in exchange for the landlord investing in energy efficiency measures. The higher rent is tied to projected utility cost savings resulting from the energy efficiency improvements made. While this is still a new and relatively untested concept, it could improve net operating income for market rate apartment owners who invest in solar PV systems or energy efficiency retrofits in the future.

According to information provided through DRA's developer survey, 4 percent tax credit/bond projects pay an average of approximately $2 per square foot of common area space for common area electricity. We assume the prototypes' operating costs are reduced by this amount due to the solar PV system supplying all of the common area electricity needs. Operating costs are therefore reduced by $16,000 annually for the new construction prototype and $18,000 for the rehabilitation prototype.

The increase in supportable permanent mortgage is then calculated using the amount by which the net operating income is increased, and assuming a debt coverage ratio of 1.25 and an interest rate of 7 percent for the affordable scenarios and 6 percent for the market rate scenarios, based on current multifamily loans' terms and pricing. This increased loan amount is shown as a source of financing for the system, thereby reducing the gap financing filled by the SET loan.

3.1.4 Increase in Developer Equity

For the market rate housing prototypes, we assume that the project's developer contributes his/her own equity to finance 30 percent of the project's cost and receives a return on this investment of 12 percent.

3.1.5 Washington Renewable Energy Incentive

The Revised Code of Washington Section 82.16.120 establishes an investment cost recovery incentive for the installation of renewable energy generation systems. This incentive is provided to individuals, businesses, government entities and participants in community solar projects who own a solar system in the State. The incentive is calculated based on the energy produced by the system and is provided as an annual payment by the recipient's utility provider. The incentive cannot exceed $5,000 per year and will be paid for the system's annual energy production through June 30, 2020.

The Renewable Energy Incentive base rate for solar is $0.15 per kWh produced. This rate can increase up to $0.54 per kWh if the system's inverters and modules are manufactured in Washington. For the purposes of this analysis, we assume that the systems' inverters and modules are manufactured outside of Washington and that the systems' owners are therefore eligible for the base incentive rate of $0.15 per kWh.

In order to show the discounted present value of these incentive payments as a development source for financing the purchase and installation of the PV system, we would have to assume that the system's owner could provide the present value of the incentives in cash up front. This is not likely to be feasible for most system owners. Therefore, DRA's financial analysis assumes that the incentive payments received by the system owners are not used as an up-front source of financing for the system but instead are shown as an annual source of repayment for the SET loan.

3.1.6 Renewable Energy Certificates

Washington's Initiative 937, passed in 1996, requires all electric utilities that serve more than 25,000 customers to obtain 3 percent of their electricity from renewable sources by 2012, and thereafter gradually steps up to a requirement that they obtain 15 percent of their electricity from renewable sources by 2020. Seventeen of Washington's 62 utilities, representing about 84 percent of the State's electricity load, must meet this standard. Utilities will meet this requirement by producing renewable electricity themselves or by buying Renewable Energy Credits or Certificates (RECs) from producers of renewable energy.

While there is a growing market for buying and selling RECs in Washington through the Bonneville Environmental Foundation (BEF), RECs currently typically sell in increments of 1 MW. It is likely that as the requirements on the State's utilities step up, utility providers will enter the market for purchasing RECs from solar system owners. When this happens, they may attempt to aggregate the RECs from many small users to achieve the 1 MW threshold or may only purchase from large producers in the State.

DRA's current analysis does not show RECs as a financing source for the PV prototypes since the market for buying RECs from solar systems smaller than 1 MW is currently nonexistent. However, we note that in the future the ability to sell one's RECs to BEF or a Washington utility may provide solar PV system owners with additional sources of financing.

3.2 SET Financing

In each prototype, we model the SET providing gap financing to the system's owner in an amount equal to the difference between the solar PV system's total cost and the total financing available from other sources. Because the affordable scenarios are able to take advantage of increased tax credit equity and an increased permanent mortgage, the SET loan required is relatively modest: $207,600 for the new construction prototype and $384,600 for the rehabilitation prototype. The market rate scenarios do not benefit from the same increase in equity due to increased project costs and therefore require larger SET loans: $1,395,400 for the new construction prototype and $913,600 for the rehabilitation prototype.

We then model the repayment of the loan by the system's owner. The annual SET repayment amount for the market rate scenarios is equal to the annual cash benefits of depreciation and the annual Washington Renewable Energy Incentive amount. For the affordable scenarios, the only source for repayment of the SET loan is the Washington Renewable Energy Incentive payment, since the system's depreciation benefits are taken by the project's Limited Partner and shown as a development source. The electricity savings that accrue due to the solar PV system are not shown as a source for repaying the SET loan in either the affordable or market rate scenarios because this revenue stream is already assumed to be used to resize, and repay, the project's permanent mortgage. We assume an interest rate on the SET loan of 6.75 percent and a term of 25 years, equal to the estimated useful life of the solar system.


Section 4.0 Payback Projections

DRA projected the payback period for the SET loan for each of the prototypes studied, under the two ownership structures modeled. Given the assumptions described below, none of the scenarios modeled are able to pay back the SET loan within the 25 year term projected.

4.1 Payback Projection Assumptions

4.1.1 Modified Accelerated Cost Recovery System

MACRS allows the owner of eligible renewable energy systems, including solar PV systems, to take a depreciation deduction for the property and depreciate it over a six-year schedule. This accelerates the payback period for a solar PV system. The depreciation schedules, and the cash effect of the systems' depreciation, are detailed in Tables 4 and 5 below.

INCOME TAX RATE

DRA assumes the following tax rates for the purposes of calculating the cash effects of MACRS for the systems' owners:

	Federal Income Tax Rate	State Income Tax Rate
Corporate:	35%	0.15%

The federal corporate income tax rate above applies to corporations with taxable income over $18,333,333. The state corporate income tax rate shown above refers to Washington's 2009 Business and Occupation Tax for service and other activities.

4.1.2 Operations and Maintenance

Solar PV systems require minimal yearly maintenance. The only material maintenance cost for a PV system is replacing the inverters as they wear out. Many solar industry experts model replacing inverters after 10 years of use, although many are said to last up to 15 years and some manufacturers are starting to offer warranties on their inverters for up to 20 years. A safe assumption for accounting for the operations and maintenance cost of a system is to set aside 1 percent of the system's cost annually, per Mike Nelson of WSU Energy. This amount will be sufficient to replace inverters in 10 years, taking into account the fact that inverters will likely become less expensive and have longer useful lives as more are produced and technology improves.

Table 4

Depreciation Calculations

New Construction Multifamily Prototype

Total System Capital Cost	$3,500,000
(Less Federal Tax Credit – 30%)	($1,050,000)
Total Depreciable Basis[1]	$2,975,000
Federal and State Tax Rate[2]	35.15%

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
MACRS Depreciation Schedule	20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
MACRS Depreciation Amount	$595,000	$952,000	$571,200	$342,720	$342,720	$171,360
Cash Effect of Depreciation	$209,143	$334,628	$200,777	$120,466	$120,466	$60,233
Federal Tax Credit	$1,050,000					
Total Annual Tax Savings	$1,259,143	$334,628	$200,777	$120,466	$120,466	$60,233

[1] Depreciable Basis is calculated as the system's total cost, less 50 percent of the Federal Investment Tax Credit Amount.

[2] Assumes a federal tax rate of 35 percent and Washington's 2009 Business and Occupation Tax for service and other activities of 0.15 percent.

Table 5

Depreciation Calculation

Substantial Rehabilitation Multifamily Prototype

Total System Capital Cost	$2,397,500
(Less Federal Tax Credit – 30%)	($719,250)
Total Depreciable Basis[1]	$2,037,875
Federal and State Tax Rate[2]	35.15%

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
MACRS Depreciation Schedule	20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
MACRS Depreciation Amount	$407,575	$652,120	$391,272	$234,763	$234,763	$117,382
Cash Effect of Depreciation	$143,263	$229,220	$137,532	$82,519	$82,519	$41,260
Federal Tax Credit	$719,250					
Total Annual Tax Savings	$862,513	$229,220	$137,532	$82,519	$82,519	$41,260

[1] Depreciable Basis is calculated as the system's total cost, less 50 percent of the Federal Investment Tax Credit Amount.

[2] Assumes a federal tax rate of 35 percent and Washington's 2009 Business and Occupation Tax for service and other activities of 0.15 percent.

4.2 Payback Projection Results

The results of the payback projections show none of the solar PV system owners being able to repay the SET loan in full by the end of its 25 year term. This is the result of the payback projections for both multifamily prototypes studied and both rental scenarios modeled. This finding means that the solar PV prototypes as modeled are not financially feasible in the current Washington market.

While the affordable prototypes, as modeled here, cannot financially support the installation of solar PV systems, we note that there is potential for such systems to prove financially feasible. The financing gaps filled by the SET loans for the affordable scenarios are approximately $208,000 for the new construction and $385,000 for the rehabilitation prototype, representing relatively small gap loans. Reducing the PV system sizes can therefore likely eliminate this gap. For example, the prototypes used in this study assume large common areas, based on a survey of 4 percent tax credit properties in the State. Reducing the common area space in the properties and thereby reducing the solar systems' sizes could eliminate the financing gap. Additionally, in a 9 percent financing scenario, the additional LIHTC equity resulting from the increased project cost due to the solar PV system can eliminate the need for gap financing, assuming the project's eligible basis does not reach threshold basis limits prior to including the solar system costs. Therefore, even though the affordable housing prototypes show no source of repayment for the relatively small SET loans required to finance the solar PV systems, and therefore are financially infeasible, there is potential to eliminate the need for the SET loan entirely in both 4 percent and 9 percent tax credit scenarios. Thus, solar PV installations on affordable tax credit multifamily projects can be feasible without SET assistance.

Because there is no evidence to support the assertion that market rate apartments with solar PV systems can charge higher rents to tenants, the only cash flow benefits resulting from the solar PV system in the market rate scenarios are reduced operating costs for the project's common areas and accelerated depreciation benefits. This results in the outstanding balance of the SET loan being paid down in the 6 years that depreciation benefits accrue and then increasing in subsequent years. Together, then, the cash flow benefits resulting from the PV system are not sufficient to repay an SET loan. This finding holds true when the size of the solar system is reduced to only provide power for the project's common area electricity needs and not the units' needs. Therefore, solar PV systems are not feasible for

market rate multifamily properties. We note that the use of a "green lease," whereby tenants agree to pay higher rents in exchange for projected utility cost savings resulting from the building owner's investment in energy efficiency and/or renewable energy systems, would improve the market rate scenarios' cash flows. However, given Washington's low electricity rates, it is unlikely the decrease in utility costs and the resulting rent increase would be sufficient to render the system financially feasible.

The primary reason for the long payback period for the solar systems on market rate apartments is the limited ability of apartment owners to take advantage of the electricity cost savings enjoyed by tenants as a result of a solar PV system. This obstacle to installing solar systems in tenant-occupied buildings is known as the "split incentive," in which the savings from the solar PV system accrue to the tenants while the building owner pays for the upfront costs of the system. This is less of an obstacle for tax credit multifamily properties because utility allowances can be decreased, and tenant-paid rent increased, due to solar PV systems and energy efficiency improvements. However, in the prototypes modeled here, this is still not sufficient to render the projects feasible, due in part to the relatively low electricity cost in Washington and the resulting relatively low baseline utility allowances in tax credit properties. Washington's average electricity rate is approximately $0.068 per kWh compared to California's average cost of approximately $0.14 per kWh and a national average cost of $0.10 per kWh[3].

Another reason for the long payback period of solar PV systems in Washington is the structure of the State's Renewable Energy Incentive. This incentive, paid to owners of solar systems, is low in relation to other states with more active solar markets. The $5,000 per year cap on the incentive means that all solar systems larger than approximately 33 kW receive the maximum incentive. Medium and large systems, like those modeled in this multifamily analysis, do not receive incentive payments proportional to their size or the electricity produced, thus limiting the effect of the incentive on the system's cost and payback period. Therefore, the relatively modest nature of the State's incentive system fails to make larger systems financially feasible, thus limiting the number of such systems installed in Washington. Larger systems, then, are not good candidates for SET financing, due to their inability to repay debt over the long term.

Due to the annual incentive payment cap of $5,000, payback projections will not improve if the systems include equipment manufactured in Washington, thus

[3] *Electric Power Monthly with data for June 2009*, Energy Information Administration.

earning the State incentive at a rate of $0.54 per kWh. The prototypes modeled here reach the incentive cap even at the lower incentive rate offered for equipment manufactured outside of Washington.

Table A-1
Washington State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Prototypes
Financing Assumptions

	Affordable Housing - 4 % LIHTC Property		Market Rate Housing	
	New Construction	Acquisition / Rehabilitation	New Construction	Acquisition / Rehabilitation
TAX CREDIT EQUITY (1)				
Increase in Eligible Basis (2)	$4,427,500	$3,170,694	NA	NA
Tax Credit Rate	4.00%	4.00%	NA	NA
Increase in Annual Allow. Credits	$177,100	$126,828	NA	NA
Tax Credit Factor (Equity Raised Per Tax Credit Dollar) (3)	$0.65	$0.65	NA	NA
Increase in Federal Tax Credit Equity (99.99%)	$1,151,035	$824,298	NA	NA
Net Present Value of Depreciation Benefits (4)	$891,600	$610,746	NA	NA
Total Increase in Tax Credit Equity (5)	$2,042,635	$1,435,044	NA	NA
PERMANENT BOND AMOUNT (6)				
Per Unit Increase in Monthly Rent (7)	$70	$70	$0	$0
Monthly Operating Cost Savings (8)	$1,333	$1,500	$1,333	$1,500
Increase in Annual Net Operating Income	$142,360	$81,180	$16,000	$18,000
Debt Coverage Ratio	1.25	1.25	1.25	1.25
Increase in Debt Service	$113,888	$64,944	$12,800	$14,400
Mortgage Term	30 years	30 years	10 years	10 years
Interest Rate	7.00%	7.00%	6.00%	6.00%
Maximum Loan to Value %	N/A	N/A	80.00%	80.00%
Increase in Max. Mortgage Amount	$1,426,519	$813,465	$96,078	$108,088
Developer Equity (8)				
Percent of total costs	N/A	N/A	30.00%	30.00%
Total increase in developer equity	N/A	N/A	$1,089,212	$746,110
Return on developer equity	N/A	N/A	12.00%	12.00%

(1) Represents incremental increase in eligible project costs, tax credit allocation, and tax credit equity due to solar PV system and energy efficiency hard and soft costs.
(2) Includes a 10% contingency for new construction and 15% for rehabilitation prototype.
(3) Assumes the minimum Tax Credit Factor of $0.65, per the WSHFC 2010 LIHTC Application.
(4) Assumes a discount rate of 6 percent.
(5) Equals increase in equity due to increased tax credit allocation and net present value of system's depreciation benefits.
(6) Represents incremental increase in supportable permanent mortgage due to increased net operating income as a result of the solar PV system, energy efficiency improvements, and lower utility allowances. Assumes a lower utility allowance is allowed for projects containing these sustainable development features.
(7) For tax credit properties, equals reduction in utility allowance permitted for including solar system.
(8) Represents savings in common area energy and water costs, assumed to equal $2 per square foot of common area space.

Table B-1
WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

AFFORDABLE HOUSING - 4 PERCENT TAX CREDIT PROPERTY
NEW CONSTRUCTION

Total System Project Cost	$4,427,500	WSHFC Loan Interest Rate	6.75%
System Size Per Unit (kW DC)	2 kW DC	WSHFC Loan Term	25 years
Common Area System Size (kW DC)	200 kW DC		
Total System Size (kW DC)	500 kW DC		
Annual Production (kWh)	500,000 kWh		
Annual System Degradation	0.75%		

	Year 1 2010	Year 2 2011	Year 3 2012	Year 4 2013	Year 5 2014	Year 6 2015	Year 7 2016	Year 8 2017	Year 9 2018	Year 10 2019	Year 11 2020	Year 12 2021	Year 13 2022
Tax Benefits and Savings													
Renewable Energy Tax Credit	$1,155,000												
Cash Effect of Depreciation	$209,143	$334,628	$200,777	$120,466	$120,466	$60,233							
Subtotal-Tax Benefits	*$1,364,143*	*$334,628*	*$200,777*	*$120,466*	*$120,466*	*$60,233*							
Cummulative Depreciation Benefits	$209,143	$543,771	$744,547	$865,013	$985,479	$1,045,713							
SET Loan Repayment													
WA State Solar Energy Incentives	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000		
Replacement Reserve	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)
Subtotal - Amount Available for Loan Repayment	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($39,275)*	*($44,275)*	*($44,275)*
SET Principal Balance	$207,596	$260,884	$317,769	$378,493	$443,317	$512,515	$586,385	$665,241	$749,420	$839,281	$935,207	$1,037,609	$1,151,922
Interest	$14,013	$17,610	$21,449	$25,548	$29,924	$34,595	$39,581	$44,904	$50,586	$56,651	$63,126	$70,039	$77,755
Payment	$39,275	$39,275	$39,275	$39,275	$39,275	$39,275	$39,275	$39,275	$39,275	$39,275	$39,275	$44,275	$44,275
Ending Balance	$260,884	$317,769	$378,493	$443,317	$512,515	$586,385	$665,241	$749,420	$839,281	$935,207	$1,037,609	$1,151,922	$1,273,952

Table B-1

WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

AFFORDABLE HOUSING - 4 PERCENT TAX CREDIT
NEW CONSTRUCTION

Total System Project Cost	$4,427,500
System Size Per Unit (kW DC)	2 kW DC
Common Area System Size (kW DC)	200 kW DC
Total System Size (kW DC)	500 kW DC
Annual Production (kWh)	500,000 kWh
Annual System Degradation	0.75%

	Year 14 2023	Year 15 2024	Year 16 2025	Year 17 2026	Year 18 2027	Year 19 2028	Year 20 2029	Year 21 2030	Year 22 2031	Year 23 2032	Year 24 2033	Year 25 2034
Tax Benefits and Savings												
Renewable Energy Tax Credit												
Cash Effect of Depreciation												
Subtotal-Tax Benefits												
Cummulative Depreciation Benefits												
SET Loan Repayment												
WA State Solar Energy Incentives												
Replacement Reserve	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)	($44,275)
Subtotal - Amount Available for Loan Repayment	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*	*($44,275)*
SET Principal Balance	$1,273,952	$1,404,219	$1,543,279	$1,691,725	$1,850,192	$2,019,354	$2,199,936	$2,392,707	$2,598,489	$2,818,162	$3,052,663	$3,302,993
Interest	$85,992	$94,785	$104,171	$114,191	$124,888	$136,306	$148,496	$161,508	$175,398	$190,226	$206,055	$222,952
Payment	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275	$44,275
Ending Balance	$1,404,219	$1,543,279	$1,691,725	$1,850,192	$2,019,354	$2,199,936	$2,392,707	$2,598,489	$2,818,162	$3,052,663	$3,302,993	$3,570,220

Table B-2
WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

MARKET RATE HOUSING
NEW CONSTRUCTION

Total System Project Cost	$3,630,705	WSHFC Loan Interest Rate	6.75%
System Size Per Unit (kW DC)	2 kW DC	WSHFC Loan Term	25 years
Common Area System Size (kW DC)	200 kW DC		
Total System Size (kW DC)	500 kW DC		
Annual Production (kWh)	500,000 kWh		
Annual System Degradation	0.75%		

	Year 1 2010	Year 2 2011	Year 3 2012	Year 4 2013	Year 5 2014	Year 6 2015	Year 7 2016	Year 8 2017	Year 9 2018	Year 10 2019	Year 11 2020	Year 12 2021	Year 13 2022
Tax Benefits and Savings													
Renewable Energy Tax Credit	$1,050,000												
Cash Effect of Depreciation	$209,143	$334,628	$200,777	$120,466	$120,466	$60,233							
Subtotal-Tax Benefits and Rebates	*$1,259,143*	*$334,628*	*$200,777*	*$120,466*	*$120,466*	*$60,233*							
Cummulative Depreciation Benefits	$209,143	$543,771	$744,547	$865,013	$985,479	$1,045,713							
SET Loan Repayment													
Cash Effect of Depreciation	$209,143	$334,628	$200,777	$120,466	$120,466	$60,233							
WA State Solar Energy Incentives	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000		
Replacement Reserve	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)
Subtotal - Amount Available for Loan Repayment	*$177,835*	*$303,321*	*$169,470*	*$89,159*	*$89,159*	*$28,926*	*($31,307)*	*($31,307)*	*($31,307)*	*($31,307)*	*($31,307)*	*($36,307)*	*($36,307)*
SET Principal Balance	$1,395,415	$1,311,771	$1,096,994	$1,001,571	$980,018	$957,011	$992,683	$1,090,996	$1,195,945	$1,307,979	$1,427,574	$1,555,243	$1,696,529
Interest	$94,191	$88,545	$74,047	$67,606	$66,151	$64,598	$67,006	$73,642	$80,726	$88,289	$96,361	$104,979	$114,516
Payment	($177,835)	($303,321)	($169,470)	($89,159)	($89,159)	($28,926)	$31,307	$31,307	$31,307	$31,307	$31,307	$36,307	$36,307
Ending Balance	$1,311,771	$1,096,994	$1,001,571	$980,018	$957,011	$992,683	$1,090,996	$1,195,945	$1,307,979	$1,427,574	$1,555,243	$1,696,529	$1,847,351

Table B-2

WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

MARKET RATE HOUSING
NEW CONSTRUCTION

Total System Project Cost	$3,630,705
System Size Per Unit (kW DC)	2 kW DC
Common Area System Size (kW DC)	200 kW DC
Total System Size (kW DC)	500 kW DC
Annual Production (kWh)	500,000 kWh
Annual System Degradation	0.75%

	Year 14 2023	Year 15 2024	Year 16 2025	Year 17 2026	Year 18 2027	Year 19 2028	Year 20 2029	Year 21 2030	Year 22 2031	Year 23 2032	Year 24 2033	Year 25 2034
Tax Benefits and Savings												
Renewable Energy Tax Credit												
Cash Effect of Depreciation												
Subtotal-Tax Benefits and Rebates												
Cummulative Depreciation Benefits												
SET Loan Repayment												
Cash Effect of Depreciation												
WA State Solar Energy Incentives												
Replacement Reserve	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)	($36,307)
Subtotal - Amount Available for Loan Repayment	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*	*($36,307)*
SET Principal Balance	$1,847,351	$2,008,355	$2,180,226	$2,363,698	$2,559,555	$2,768,632	$2,991,821	$3,230,076	$3,484,413	$3,755,918	$4,045,750	$4,355,145
Interest	$124,696	$135,564	$147,165	$159,550	$172,770	$186,883	$201,948	$218,030	$235,198	$253,524	$273,088	$293,972
Payment	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307	$36,307
Ending Balance	$2,008,355	$2,180,226	$2,363,698	$2,559,555	$2,768,632	$2,991,821	$3,230,076	$3,484,413	$3,755,918	$4,045,750	$4,355,145	$4,685,424

Table C-1
WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

AFFORDABLE HOUSING - 4 PERCENT TAX CREDIT PROPERTY
ACQUISITION/REHABILITATION

Total System Project Cost	$3,170,694	WSHFC Loan Interest Rate	6.75%
System Size Per Unit (kW DC)	2 kW DC	WSHFC Loan Term	25 years
Common Area System Size (kW DC)	230 kW DC		
Total System Size (kW DC)	343 kW DC		
Annual Production (kWh)	342,500 kWh		
Annual System Degradation	0.75%		

	Year 1 2010	Year 2 2011	Year 3 2012	Year 4 2013	Year 5 2014	Year 6 2015	Year 7 2016	Year 8 2017	Year 9 2018	Year 10 2019	Year 11 2020	Year 12 2021	Year 13 2022
Tax Benefits and Savings													
Renewable Energy Tax Credit	$827,138												
Cash Effect of Depreciation	$143,263	$229,220	$137,532	$82,519	$82,519	$41,260							
Subtotal-Tax Benefits	*$970,400*	*$229,220*	*$137,532*	*$82,519*	*$82,519*	*$41,260*							
Cummulative Depreciation Benefits	$143,263	$372,483	$510,015	$592,534	$675,053	$716,313							
SET Loan Repayment													
WA State Solar Energy Incentives	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000		
Replacement Reserve	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)
Subtotal - Amount Available for Loan Repayment	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($26,707)*	*($31,707)*	*($31,707)*
SET Principal Balance	$384,546	$437,210	$493,429	$553,442	$617,506	$685,895	$758,900	$836,832	$920,025	$1,008,834	$1,103,637	$1,204,840	$1,317,873
Interest	$25,957	$29,512	$33,306	$37,357	$41,682	$46,298	$51,226	$56,486	$62,102	$68,096	$74,496	$81,327	$88,956
Payment	$26,707	$26,707	$26,707	$26,707	$26,707	$26,707	$26,707	$26,707	$26,707	$26,707	$26,707	$31,707	$31,707
Ending Balance	$437,210	$493,429	$553,442	$617,506	$685,895	$758,900	$836,832	$920,025	$1,008,834	$1,103,637	$1,204,840	$1,317,873	$1,438,537

Table C-1
WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

AFFORDABLE HOUSING - 4 PERCENT TAX CREDIT
ACQUISITION/REHABILITATION

Total System Project Cost	$3,170,694
System Size Per Unit (kW DC)	2 kW DC
Common Area System Size (kW DC)	230 kW DC
Total System Size (kW DC)	343 kW DC
Annual Production (kWh)	342,500 kWh
Annual System Degradation	0.75%

	Year 14 2023	Year 15 2024	Year 16 2025	Year 17 2026	Year 18 2027	Year 19 2028	Year 20 2029	Year 21 2030	Year 22 2031	Year 23 2032	Year 24 2033	Year 25 2034
Tax Benefits and Savings												
Renewable Energy Tax Credit												
Cash Effect of Depreciation												
Subtotal-Tax Benefits												
Cummulative Depreciation Benefits												
SET Loan Repayment												
WA State Solar Energy Incentives												
Replacement Reserve	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)	($31,707)
Subtotal - Amount Available for Loan Repayment	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*	*($31,707)*
SET Principal Balance	$1,438,537	$1,567,345	$1,704,848	$1,851,632	$2,008,324	$2,175,593	$2,354,152	$2,544,764	$2,748,243	$2,965,456	$3,197,331	$3,444,858
Interest	$97,101	$105,796	$115,077	$124,985	$135,562	$146,853	$158,905	$171,772	$185,506	$200,168	$215,820	$232,528
Payment	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707	$31,707
Ending Balance	$1,567,345	$1,704,848	$1,851,632	$2,008,324	$2,175,593	$2,354,152	$2,544,764	$2,748,243	$2,965,456	$3,197,331	$3,444,858	$3,709,093

Table C-2
WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

MARKET RATE HOUSING
ACQUISITION/REHABILITATION

Total System Project Cost	$2,487,033	WSHFC Loan Interest Rate	6.75%
System Size Per Unit (kW DC)	2 kW DC	WSHFC Loan Term	25 years
Common Area System Size (kW DC)	230 kW DC		
Total System Size (kW DC)	343 kW DC		
Annual Production (kWh)	342,500 kWh		
Annual System Degradation	0.75%		

	Year 1 2010	Year 2 2011	Year 3 2012	Year 4 2013	Year 5 2014	Year 6 2015	Year 7 2016	Year 8 2017	Year 9 2018	Year 10 2019	Year 11 2020	Year 12 2021	Year 13 2022
Tax Benefits and Savings													
Renewable Energy Tax Credit	$719,250												
Cash Effect of Depreciation	$143,263	$229,220	$137,532	$82,519	$82,519	$41,260							
Subtotal-Tax Benefits and Rebates	*$862,513*	*$229,220*	*$137,532*	*$82,519*	*$82,519*	*$41,260*							
Cummulative Depreciation Benefits	$143,263	$372,483	$510,015	$592,534	$675,053	$716,313							
SET Loan Repayment													
Cash Effect of Depreciation	$143,263	$229,220	$137,532	$82,519	$82,519	$41,260							
WA State Solar Energy Incentives	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000		
Replacement Reserve	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)
Subtotal - Amount Available for Loan Repayment	*$123,392*	*$209,350*	*$117,662*	*$62,649*	*$62,649*	*$21,389*	*($19,870)*	*($19,870)*	*($19,870)*	*($19,870)*	*($19,870)*	*($24,870)*	*($24,870)*
SET Principal Balance	$913,585	$851,860	$700,010	$629,599	$609,448	$587,937	$606,234	$667,025	$731,919	$801,194	$875,145	$954,088	$1,043,359
Interest	$61,667	$57,501	$47,251	$42,498	$41,138	$39,686	$40,921	$45,024	$49,405	$54,081	$59,072	$64,401	$70,427
Payment	($123,392)	($209,350)	($117,662)	($62,649)	($62,649)	($21,389)	$19,870	$19,870	$19,870	$19,870	$19,870	$24,870	$24,870
Ending Balance	$851,860	$700,010	$629,599	$609,448	$587,937	$606,234	$667,025	$731,919	$801,194	$875,145	$954,088	$1,043,359	$1,138,656

Table C-2
WA State Housing Finance Commission
Sustainable Energy Trust Analysis
Multifamily Analysis Payback Projections

MARKET RATE HOUSING
ACQUISITION/REHABILITATION

Total System Project Cost	$2,487,033
System Size Per Unit (kW DC)	2 kW DC
Common Area System Size (kW DC)	230 kW DC
Total System Size (kW DC)	343 kW DC
Annual Production (kWh)	342,500 kWh
Annual System Degradation	0.75%

	Year 14 2023	Year 15 2024	Year 16 2025	Year 17 2026	Year 18 2027	Year 19 2028	Year 20 2029	Year 21 2030	Year 22 2031	Year 23 2032	Year 24 2033	Year 25 2034
Tax Benefits and Savings												
Renewable Energy Tax Credit												
Cash Effect of Depreciation												
Subtotal-Tax Benefits and Rebates												
Cummulative Depreciation Benefits												
SET Loan Repayment												
Cash Effect of Depreciation												
WA State Solar Energy Incentives												
Replacement Reserve	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)	($24,870)
Subtotal - Amount Available for Loan Repayment	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*	*($24,870)*
SET Principal Balance	$1,138,656	$1,240,386	$1,348,982	$1,464,909	$1,588,660	$1,720,765	$1,861,787	$2,012,328	$2,173,031	$2,344,581	$2,527,710	$2,723,201
Interest	$76,859	$83,726	$91,056	$98,881	$107,235	$116,152	$125,671	$135,832	$146,680	$158,259	$170,620	$183,816
Payment	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870	$24,870
Ending Balance	$1,240,386	$1,348,982	$1,464,909	$1,588,660	$1,720,765	$1,861,787	$2,012,328	$2,173,031	$2,344,581	$2,527,710	$2,723,201	$2,931,888