Abstract
The Energize Fresno Project Pipeline Report provides a detailed overview of a diverse portfolio of projects and programs to be developed within the “Energy Opportunity Zone” in the City of Fresno. The report includes details on (1) the various project pipeline components, (2) the development and analysis process, (3) the resource savings from the pipeline, (4) the process by which the projects will support the buildout of development sites and activity centers, (5) the implementation process for the program components of the pipeline, and (6) how the performance of the portfolio will be measured, verified and reported.

The information presented in this memorandum reflects the work accomplished by the Energize Fresno team as of the publication date, and may not necessarily reflect the program’s design in its most recent form.

Project Specifics

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<td>Partners:</td>
<td>Tierra Resource Consultants, City of Fresno, CalSTART, Fresno Metro Ministry</td>
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<td>Amount:</td>
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<td>Co-funding:</td>
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EXECUTIVE SUMMARY

The Energize Fresno (EF) project created an “Energy Opportunity Zone” (EOZ) that includes the Blackstone Corridor and Downtown planning areas, two regions of the city that are targeted for redevelopment in the Fresno 2015 General Plan. The EF project pipeline (the Pipeline) represents a diverse portfolio of projects and programs to be developed within the EOZ that includes the following characteristics:

1. Inclusive of projects in the mid to large commercial sector that are in early stages of planning and thus represent opportunities for the EF team to collaborate with developers and encourage the projects to incorporate energy efficiency designs that exceeded current Title 24 standards, as well as the maximum distributed generation capacity (i.e. solar PV) potential for each site, and provide demand management capability that is grid interactive.

2. Define enhancements to existing customer programs operating in Fresno that will help achieve advanced energy community (AEC) goals in the residential low income and small commercial markets.

3. Define a set of technologies for deployment that will advance the electrification of transportation.

Table 1 provides a summary of estimates pipeline resource savings as further defined in Chapter 3: Results.

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Electric Energy Savings (KWh/Yr.)</th>
<th>Natural Gas Energy Savings (Thersms/Yr.)</th>
<th>Electric Energy Generation (KWh/Yr.)</th>
<th>Peak Demand Reduction (KW)</th>
<th>Annual Energy Cost Savings ($/Yr.)</th>
<th>Annual GHG Reduction (MT CO2e/yr.)</th>
<th>Estimated Project Cost ($)</th>
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<td>1,140</td>
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<td>13,971,330</td>
<td>3,370</td>
<td>$1,654,900</td>
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<td>8,900</td>
<td>$3,521,000</td>
<td>6,930</td>
<td>$26,446,000</td>
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Source: Tierra Resource Consultants

The component of the Energize Fresno Pipeline which focusses on mid to large commercial facilities (referred to as Development Sites and Activity Centers) includes energy efficiency and distributed generation resources that include grid interactive demand management capability.

1 Fresno General Plan, adopted December 18, 2014
2 The transportation measure is a fuel-switching initiative, so only GHG reduction values and project costs are reported
In order to align with AEC criteria addressing grid reliability and resiliency\(^3\), the EF analysis includes load shape modelling and, as discussed in more detail in report Chapter 2 and Chapter 3, Figure 1 shows the summer peak day load shape for the total Pipeline portfolio if designed to Title 24 baseline, while Figure 2 shows the expected load shape if the portfolio is built consistent with the EF analysis. The collective demand savings of 4,640 MW for as development sites and activity centers represents the cumulative impact of energy efficiency from design that exceed Title 24 section 6 and distributed generation coupled with a network of batteries that are supportive of the AEC grid resiliency and reliability criteria.

**Figure 1. Summer Peak Day Load Shape Impacts of Pipeline - Baseline Scenario**

![Figure 1. Summer Peak Day Load Shape Impacts of Pipeline - Baseline Scenario](Image)

Source: Tierra Resource Consultants

**Figure 2. Summer Peak Day Load Shape Impacts of Pipeline - Demand Management Scenario**

![Figure 2. Summer Peak Day Load Shape Impacts of Pipeline - Demand Management Scenario](Image)

Source: Tierra Resource Consultants

The financial analysis completed on the development sites and activity centers is intended to identify how the portfolio can be funded in a way that is financially attractive from a market

---

\(^3\) Relevant AEC criteria include:

1. Minimize the need for new energy infrastructure costs such as transmission & distribution upgrades.
2. Support grid reliability and resiliency by incorporating technologies such as energy storage.
3. Provide easier grid integration and alignment with the California Public Utilities Commission's (CPUC) Long-Term Procurement Plan, and the California Independent System Operator's local capacity requirements process.
The analysis focused on the use of all market ready funding and finance products such that the EF project development approach can be replicated and scaled-up to further drive down costs (AEC criteria 5). Table 2 shows how $29.4M from various types of funding and financing mechanisms will be used to fund the incremental cost of above-code energy efficiency, and the full cost of distributed generation systems.\(^4\)\(^5\) The capitalized value\(^6\) of the reduced operating costs associated energy spending on commercial properties is estimated at $21.8.9M.

The portfolio of development sites and activity centers is expected to save about $3.2M in annual purchased energy costs, resulting in an average annual cash flow of approximately $1.1M after $2.1M in debt service and contract payments, as shown in Figure 3. Loan terms are estimated at 5 to 15 years with rates ranging from 0% to 7.5%, depending on the financing product.

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<th>Capital Stack Component</th>
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<td>ECAA Loans</td>
<td>$5,642,878</td>
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<td>PACE Loans</td>
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<td>OBF Loans</td>
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<tr>
<td>Cash Match Funding</td>
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<td>Self-Generation Incentive Program</td>
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<td>Fee Waiver (New Market Street Growth)</td>
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<td>PG&amp;E Savings by Design</td>
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<td>ITC - Rehabilitation Credit</td>
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<td>IRS LIHTC</td>
<td>$60,755</td>
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<td>PG&amp;E Custom Incentives (kW)</td>
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<td>CA LIHTC</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$29,369,790</strong></td>
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Source: Tierra Resource Consultants

\(^4\) In order provide an accurate assessment of financial performance, financing and funding was applied to the incremental cost of energy efficiency, though the same financing tools can be applied to full project costs in a way that improves the overall performance of a project’s capital stack. The full project cost of all building energy system being upgraded and distributed generation systems is estimated at approximately $61.1M.

\(^5\) The network of grid interactive batteries will be installed using 10-year energy service agreements that do not present a capital cost but are reflected in the cash flow analysis.

\(^6\) ‘Capitalized Value’ is the current value of an asset, based on the total income expected to be realized over its economic life span. Savings on energy spending improve the income of a property, thus increasing its capitalized value. The anticipated savings are discounted by a capitalization rate (‘cap rate’) so they take into account the time value of money. The EF analysis used a 6% cap rate.
The program component is focused primarily on the residential low income and small commercial markets. The residential program will be cost competitive with other low income focused programs while the small commercial program will perform with a total resource cost (TRC) test consistent with similar direct install and mid-market programs. Transportation measures are primarily designed to reduce GHG by supporting the electrification of cars and lite trucks. They are considered to be market transformation initiatives and thus were not analyzed from a cost effectiveness perspective.

In support of AEC criteria 9, align with other state energy and environmental policy goals at the community level, the performance of all components of the pipeline will be evaluated and reported consistent with the best practices discussed in Chapter 6.
The report is structured as follows:

**Chapter 1: Overview of Energize Fresno Project Pipeline**, provides detail on the various Pipeline components.

**Chapter 2: Pipeline Development Process**, discussed the development and analysis process for the various pipeline components.

**Chapter 3: Results**, present details on the resource savings from the Pipeline.

**Chapter 4: Development Sites and Activity Centers Buildout**, details the process by which the EF project will support the buildout of the development sites and activity centers.

**Chapter 5: Program Implementation**, discusses the implementation process for the program components of the Pipeline.

**Chapter 6: Measurement, Verification, and Reporting**, discusses how the performance of the portfolio will be measured, verified and reported.
CHAPTER 1: Overview of Energize Fresno Project Pipeline

The Energize Fresno (EF) Project Pipeline is comprised of a set of projects and programs that are designed to meet Advanced Energy Community (AEC) criteria by deploying a full spectrum of energy demand and supply side technologies across multiple market segments. The Energize Fresno Project Pipeline consists of three primary components distributed across the Energy Opportunity Zone (EOZ) define by the Energize Fresno project:

1. **Development Sites** - These are individual buildings that are either a new construction project, a building undergoing a major renovation, or a retrofit of an existing operating building. The Pipeline contains sixteen individual sites, comprised of commercial and mixed use buildings. These sites are being developed by six private commercial development companies. It is expected that all of the development sites will be constructed between 2018 and 2022.

2. **Activity Centers** - These are major hubs of commercial or social activity that offer the opportunity to accomplish large scale resource savings projects, but can also serve as platforms to ‘lead by example’ and also to engage and influence large numbers community stakeholders. The Pipeline contains two activity centers: City of Fresno municipal operations and Fresno City College.

3. **Programs** - These are enhancements to existing programs operating in Fresno which will expand services provided to particular geographic and demographic profiles in the EOZ. Whereas, development sites and activity centers are focused on individual commercial new construction/major renovation sites and anchor developments, programs are targeted at expanding services to the built environment with a focus on the low-income residential, multi-family, and small commercial markets.

Each of these components of the Pipeline is described below.
Development Sites and Activity Centers

There 15 development sites and activity centers in the Pipeline, engaging eight separate developers distributed throughout the EOZ, as shown in Figure 4.

Figure 4. Location of Development Sites and Activity Center Projects

Source: Tierra Resource Consultants
Figure 5 provides a summary of estimated development site and activity centers savings.

**Figure 5. Summary of Estimated Development Sites and Activity Centers Savings**

![Graph showing annual electricity and peak demand reduction savings](image)

**Development Sites**

The Project Pipeline includes sixteen different development sites clustered in the EOZ in the downtown area and along the Blackstone Avenue corridor. Table 3 provides a summary table of the active Pipeline Development Sites, their primary features, and the AEC measures that have been analyzed for each site. In addition to these active sites, the Project Team has assembled a database of over 79 sites that could be recruited for future project development. Table 3 provides a summary of estimated development site savings and profiles of each development site are provided in Appendix A.
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<th>Project Number</th>
<th>Location</th>
<th>Building Type</th>
<th>Project Type</th>
<th>Conditioned Area (sqft)</th>
<th>Energy Efficiency Measures</th>
<th>On-site Solar Generation</th>
<th>Demand Mgmt. – Battery Storage</th>
<th>Demand Mgmt. – BIEMS</th>
<th>Grid Interactive Technology</th>
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<td>Office</td>
<td>Major Renovation</td>
<td>112,000</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
</tr>
<tr>
<td>9</td>
<td>Downtown</td>
<td>Mixed Use Commercial</td>
<td>Major Renovation</td>
<td>46,400</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td>Downtown</td>
<td>Office</td>
<td>Major Renovation</td>
<td>47,000</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>11</td>
<td>Downtown</td>
<td>Office</td>
<td>Retrofit</td>
<td>59,000</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>12</td>
<td>Blackstone</td>
<td>Mixed Use Commercial</td>
<td>New Construction</td>
<td>79,692</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>13</td>
<td>Blackstone</td>
<td>Mixed Use Commercial</td>
<td>New Construction</td>
<td>205,000</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
Table 4. Summary of Estimated Development Site Savings.

<table>
<thead>
<tr>
<th>Project Num.</th>
<th>Planning Area</th>
<th>Project Type</th>
<th>Annual Cost Savings ($/yr)</th>
<th>Annual Electricity Savings and On-Site Generation (kWh/yr)</th>
<th>Annual GHG Emissions Reduction (MT CO2e / yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Downtown</td>
<td>Office Building</td>
<td>$92,300</td>
<td>500,700</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>Downtown</td>
<td>Mixed Use Commercial</td>
<td>$148,400</td>
<td>797,700</td>
<td>157</td>
</tr>
<tr>
<td>3</td>
<td>Downtown</td>
<td>Multi-Family Residential</td>
<td>$80,400</td>
<td>484,800</td>
<td>96</td>
</tr>
<tr>
<td>4</td>
<td>Downtown</td>
<td>Mixed Use Commercial</td>
<td>$78,300</td>
<td>445,700</td>
<td>88</td>
</tr>
<tr>
<td>5</td>
<td>Downtown</td>
<td>Mixed Use Commercial</td>
<td>$63,500</td>
<td>393,100</td>
<td>78</td>
</tr>
<tr>
<td>6</td>
<td>Downtown</td>
<td>Office Building</td>
<td>$97,900</td>
<td>540,900</td>
<td>107</td>
</tr>
<tr>
<td>7</td>
<td>Downtown</td>
<td>Office Building</td>
<td>$54,300</td>
<td>281,800</td>
<td>56</td>
</tr>
<tr>
<td>8</td>
<td>Downtown</td>
<td>Office Building</td>
<td>$119,700</td>
<td>771,200</td>
<td>152</td>
</tr>
<tr>
<td>9</td>
<td>Downtown</td>
<td>Mixed Use Commercial</td>
<td>$61,400</td>
<td>423,300</td>
<td>64</td>
</tr>
<tr>
<td>10</td>
<td>Downtown</td>
<td>Office Building</td>
<td>$36,500</td>
<td>222,100</td>
<td>44</td>
</tr>
<tr>
<td>11</td>
<td>Downtown</td>
<td>Office Building</td>
<td>$63,000</td>
<td>364,700</td>
<td>72</td>
</tr>
<tr>
<td>12</td>
<td>Blackstone</td>
<td>Mixed Use Commercial</td>
<td>$88,000</td>
<td>114,900</td>
<td>164</td>
</tr>
<tr>
<td>13</td>
<td>Blackstone</td>
<td>Mixed Use Commercial</td>
<td>$543,429</td>
<td>946,600</td>
<td>187</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$1,527,129</td>
<td>6,287,500</td>
<td>1,382</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Activity Centers

The current Activity Center projects in the Pipeline are:

- Fresno City College – Two new construction projects incorporating AEC measures, and AEC retrofits of existing campus facilities.
- City of Fresno Municipal Operations – Retrofits and AEC technology upgrades to existing City facilities.

Profiles of each of these activity centers is provided in Appendix B. The Project Team is also engaged with other hubs or anchor facilities for possible inclusion in phase 2 as activity center developments, though these sites have not yet been fully evaluated, including:

1. The Power the Tower District
2. The High-Speed Rail Station
3. The Regional Medical Center
4. Manchester Shopping Center

Table 5 provides a summary of the primary characteristics and AEC measures being considered for each activity center. Additional details on the AEC measures, including transportation, may be found in Chapter 2. Table 6 provides a summary of estimated activity center savings.

---

7 ‘Power the Tower’ is a ZNE initiative currently underway with Fresno District 1 Councilmember Esmeralda Soria and the Environmental Defense Fund.
### Table 5. Summary of Evaluated Activity Centers

<table>
<thead>
<tr>
<th>Activity Center</th>
<th>Location</th>
<th>Facility Type</th>
<th>Project Type</th>
<th>Scope</th>
<th>AEC Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresno City College</td>
<td>Blackstone</td>
<td>Education Campus</td>
<td>New Construction</td>
<td>Addition of a new 75,000 square foot Math/Science/Engineering building and 1,200 space parking solution</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>34 of 40 existing structures comprising 712,431 of 744,029 square feet</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>City of Fresno Downtown</td>
<td>Municipal</td>
<td></td>
<td>Retrofit</td>
<td>22 existing facilities owned and operated by the City of Fresno</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

### Table 6. Summary of Estimated Activity Center Savings

<table>
<thead>
<tr>
<th>Project Num.</th>
<th>Planning Area</th>
<th>Project Type</th>
<th>Annual Cost Savings ($/yr)</th>
<th>Annual Electricity Savings and On-Site Generation (kWh/yr)</th>
<th>Annual GHG Emissions Reduction (MT CO2e / yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Blackstone</td>
<td>Education</td>
<td>$655,600</td>
<td>6,672,600</td>
<td>1,317</td>
</tr>
<tr>
<td>15</td>
<td>Blackstone</td>
<td>Education</td>
<td>$121,700</td>
<td>737,200</td>
<td>145</td>
</tr>
<tr>
<td>16</td>
<td>Downtown</td>
<td>Mixed Use Commercial</td>
<td>$877,600</td>
<td>10,628,800</td>
<td>2,097</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>$1,654,900</strong></td>
<td><strong>18,038,600</strong></td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
Programs

The program activities are targeted at market segments that are not covered by development site and activity center projects. All program concepts for the Energize Fresno project will be implemented by the City of Fresno as an incremental effort to the existing Home Energy Tune-Up (HETU) and Business Energy Tune-Up (BETU) programs currently implemented in partnership with PG&E. The existing programs offer energy audit services for residential and business customers to help identify upgrade opportunities and assist customers in navigating utility rebates, financing and other energy resources available in the Fresno county area. The program enhancement concepts blend smart meter data mobilization, energy efficiency, community/shared solar projects in residential and multifamily applications, and connected devices to drive meaningful savings and peak load reductions. The primary objectives of the program enhancements are to:

1. Increase the access of hard-to-reach populations to advanced energy technology including:
   a. Low-Income home owners and renters in both single-family and small multi-family dwellings.
   b. Small-business retail, restaurants, and office space.
2. Deliver meaningful bill savings, while minimizing the cost of acquisition.
3. Deliver a high penetration of connected devices for aggregated load shifting impacts.
4. Implement community/shared solar in targeted residential and multifamily sites as feasible. Plans for the deployment of community solar remains in the conceptual phase pending clarification on various policy matters, as discussed in greater detail Analysis of Programs section.
5. Implement ongoing performance tracking for customer feedback and energy savings education, while providing continuous community feedback.
6. Provide support for analysis of existing Pipeline projects, and enrollment of new projects using the tools developed during phase one of the AEC grant.

Both the HETU and BETU approaches offer similar implementation plans, customized to the specific needs of the market segment. In total, the HETU and BETU program concepts will reach 5,000 residential customers and 150 small businesses. Resulting in annual bill savings of $858,000, annual electricity savings of 3,426,420 kWh, and a reduction in on-peak demand by 4,230 kW. Additional descriptions of key components of the HETU and BETU program enhancements are provided in Appendix C.

Table 7 provides a summary of the HETU and BETU program enhancements. Figure 6 provides a summary of estimated program savings.
### Table 7. Program Summary

<table>
<thead>
<tr>
<th>Activity Center</th>
<th>Location</th>
<th>Building Type</th>
<th>Project Type</th>
<th>Scope</th>
<th>AEC Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>HETU Enhancement</td>
<td>EOZ</td>
<td>Single- and Multi-Family Homes</td>
<td>Retrofit</td>
<td>5000 Residential Customers</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>BETU Enhancement</td>
<td>EOZ</td>
<td>Small Commercial</td>
<td>Retrofit</td>
<td>150 Small Businesses</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

### Figure 6. Summary of Estimated Program Savings

- **Annual Electricity Savings (kWh)**: 3,330,300
- **Peak Demand Reduction (kW)**: 4,250
- **Annual Gas Savings (therms)**: 297,000
- **Annual Energy Cost Savings ($)**: 845,790

Source: Tierra Resource Consultants
CHAPTER 2: Pipeline Development Process

The development of the Project Pipeline involved a multi-step process that is outlined in Figure 7. Each of these steps is discussed in detail below.

**Figure 7. Project Pipeline Development Process**

- **Alignment with AEC Objectives**
- **AEC Measure and Technology Identification**
- **Project Enrollment and Development**
- **Project Savings and Funding Analysis**
- **Pipeline Roll-up and Savings Summary**

Source: Tierra Resource Consultants

**Align with AEC Objectives**
The first step in the Project Pipeline process was to understand the Advanced Energy Community guiding criteria as they were laid out in the AEC grant funding opportunity (GFO). This exercise established the criteria by which the portfolio of projects were identified and recruited, as well as the technology solutions that were selected and assessed. The GFO presented nine key AEC criteria which are summarized in Table 8. The resulting alignment of the project Pipeline is further discussed in Chapter 3.
Table 8. AEC Guiding Criteria

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minimize the need for new energy infrastructure costs such as transmission &amp; distribution upgrades.</td>
</tr>
<tr>
<td>2</td>
<td>Provide energy savings by achieving and maintaining zero net energy community status (accounting for behavior and increasing loads from vehicle and appliance electrification).</td>
</tr>
<tr>
<td>3</td>
<td>Support grid reliability and resiliency by incorporating technologies such as energy storage.</td>
</tr>
<tr>
<td>4</td>
<td>Provide easier grid integration and alignment with the California Public Utilities Commission’s (CPUC) Long-Term Procurement Plan, and the California Independent System Operator’s local capacity requirements process.</td>
</tr>
<tr>
<td>5</td>
<td>Can be replicated and scaled-up to further drive down costs.</td>
</tr>
<tr>
<td>6</td>
<td>Are financially attractive from a market standpoint (developers, home buyers, renters).</td>
</tr>
<tr>
<td>7</td>
<td>Provide affordable access to renewable energy generation, energy efficiency upgrades, and water efficiency and reuse technologies that reduce electricity consumption for all electric ratepayers within the community.</td>
</tr>
<tr>
<td>8</td>
<td>Makes use of smart-grid technologies throughout the community.</td>
</tr>
<tr>
<td>9</td>
<td>Align with other state energy and environmental policy goals at the community level such as the Sustainable Communities and Environmental Protection Act (Senate Bill 375, Steinberg, Chapter 728, Statutes of 2008) and Governor Brown’s Executive Order B-29-15 for the drought.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

AEC Measure and Technology Identification

The Energize Fresno project offered the opportunity to examine the full spectrum of AEC demand-side energy management measures. The assessment of AEC measures and technologies followed the conventional loading order by considering energy efficiency improvements first, followed by demand-side energy generation (primarily in the form of on-site solar photovoltaic electricity generation), and demand management technologies including battery storage. The ability to examine all of these technologies in a comprehensive and integral fashion provides an opportunity to estimate how a true AEC would function from an energy utilization and supply perspective. This is an expansion of how demand-side energy resources have been viewed conventionally over the last few decades. Where the focus has been largely on energy efficiency in the context of utility planning (prescribed by cost-effectiveness criteria such as the Total Resource Cost Test), and where climate change mitigation has not been a major policy driver. The expanded energy management potential of this full spectrum examination is effectively compared to more traditional ESCO and utility program delivery models in Figure 8.

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8 Note: On-site energy generation, energy storage, and end-use electrification are all considered demand-side technologies as they occur on the customer side of the meter.
The suite of energy technologies examined in the project included those that are currently mature in both their technical development and deployment, as well as those that are rapidly emerging in the marketplace. These technologies included a range of building energy efficiency applications; distributed generation systems including solar photovoltaic systems; demand management systems including battery storage system, building energy management systems, smart thermostats, and grid interactive technology; and, transportation electrification technology.

Importantly, the project team did not examine these technologies in isolation. Rather, the team analyzed the interactive effects of technologies at the site level and the aggregate effects at the portfolio level. The Pipeline was developed with the aim of providing a sample that is a good representation of the effects of these applications at scale.

When considered at the individual site level and as a network system at the community level these technologies have distinct load shape impacts. The strategic deployment of these technologies can be used to achieve load shape impacts that reduce “duck curve” challenges (mid-day load deterioration, rapid demand ramp up, early evening peak load spikes), and increase grid reliability and resiliency. Figure 9 presents a concept for how distributed energy technologies can be networked together to influence grid level impacts.
Transportation

The Pipeline also includes two transportation measures intended to support the electrification of cars and lite trucks. This include building out electric vehicle (EV) DC fast charging (DCFC) infrastructure and the deployment of autonomous EV chargers.

Ten DC fast chargers will be deployed on city owner properties based on PG&E’s DCFC Mapping project which suggests the number of DCFCs to be installed in each priority area following minimum eligibility and site suitability criteria

1. Site has grid capacity to support a DCFC station
2. Site is within the PG&E priority bubble
3. Site is within Energize Fresno planning area

9 This project provides useful information on potential locations for siting Direct Current Fast Chargers (DCFCs) for electric vehicles within PG&E's service territory and can be found at https://www.pge.com/en_US/about-pge/environment/what-we-are-doing/electric-program-investment-charge/direct-current-electric-vehicle-fast-chargers.page
4. Site has parking capacity for EV chargers and potential for future expansion
5. Site has nearby amenities
6. Site is safe and can provide shelter from inclement weather

Autonomous EV chargers are transportable, solar powered EV charging station that do not require any permits, civil engineering or planning, foundations, trenching or electrical connections. An example of this technology is the EV ARC™ which can deliver up to 225e miles daily, while charging up to six EVs at a time. Equipped with on-board battery storage, it will charge EVs day or night and during a black out or other grid failure. Figure 10 provides a map of possible DCFC and autonomous EV charger locations. Energize Fresno will deploy five EV autonomous EV chargers along Blackstone and twenty DC Fast Chargers downtown across five sites (four per site).

**Project Enrollment and Development**

Project identification, enrollment, and development was a multi-step process. Project identification was primarily conducted by our local community partners, Fresno Metro Ministries and the City of Fresno Sustainability Department. These partners’ intimate knowledge of the local market as well as their relationships with property owners and developers, city managers, department heads, and

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other local agencies was an invaluable resource. Without which, the process of project recruitment would have been much more difficult and less effective.

The steps followed for project enrollment and development are discussed below, and the overall process flow is shown in Figure 11.

1. **Review City and Regional Planning Documents**

   The initial step in the process was to review regional and City of Fresno planning documents to identify and prioritize development initiatives consistent with local planning. The review included:

   **Primary planning activities**
   - General Plan
   - Housing Plan Chapter
   - Water Plan
   - Transportation Plan
   - Use of Codes

   **Secondary planning activities**
   - San Joaquin Regional Air Quality District
   - San Joaquin Valley PEV Readiness Plan
   - Climate Action Plan

2. **Define Energy Opportunity Zones**

   In order to focus project activities within geographic and demographic boundaries that were consistent with local planning efforts and achievable within the budget and schedule limitations of the project, an Energy Opportunity Zone (EOZ) was defined. The EOZ consists of the downtown area and the Blackstone Avenue corridor, a major transportation and commercial artery in Fresno. These EOZ boundaries were chosen because the City of Fresno is currently targeting this area for revitalization, and the area also contains significant opportunities for the deployment of AEC technologies. The process of scoping the EOZ served to profile key community stakeholders and inform the project filtering process.

3. **Identify Key Stakeholders**

   It was necessary to identify and engage key stakeholders in order to identify and recruit project opportunities into the Pipeline. Key stakeholders included community based organizations (including our project partner, Fresno Metro Ministries), the City of Fresno (including our project party, the City Sustainability Department), the local development and property owner community, and key anchor activity centers such as Fresno Community College (FCC), the High-Speed Rail Station (HSR), the Regional Medical Center (RMC), and the Manchester Shopping Center. Again, our local community partners were key in identifying and making initial contacts with these important
stakeholders. The Technical Advisory Committee (TAC) included representatives of these different entities, and has provided valuable input to Pipeline development throughout the process.

4. **Enroll Stakeholders and Projects**

The project enrollment process itself was conducted in several steps. The first step was to identify a list of potential sites and projects that could be candidates for the project. This list was then subjected to a two-phase filtering process (i.e. screening analysis) to determine if the project was in the EOZ, could be completed within the timeline for phase two, and was aligned with AEC objectives. This filtering process led to a rank ordering of projects according to their fit. For those projects that passed the filtering process, the project owner or developer was then requested to execute a Memorandum of Understanding (MOU) which described the AEC analysis process, what would be expected of them during the process, and what they would receive by participating in the project. Once the executed MOU was received, the project data collection process was begun. The first step in data collection was to interview the project owner/developer and complete an initial data collection survey in order to profile the project. Copies of the Phase 1 and 2 filters, the MOU template, and the initial data collection form are included in the appendices.
Figure 11. Pipeline Enrollment and Development Process Flow

Source: Tierra Resource Consultants
Project Savings and Funding Analysis

Analysis of Development Sites and Activity Centers

Once an MOU was on place, the project team conducted an analysis of AEC technologies for each element of the pipeline.

The project energy savings and funding analysis involved the following activities:

a. **Interview project developers to assess AEC opportunities.** This interview was conducted to determine the nature, scope and timing of the project as well as gather enough details to begin the analysis process. For new construction and major renovation projects, an effort was made to engage the developers as early as possible in the development cycle, specifically between the pre-design and design development phases. Consequently, most of the development sites are early in the development process. For the activity center and program categories, retrofit opportunities were more of a focus. An example of the AEC project interview guide is included in APPENDIX F.

b. **Conduct energy savings/generation and cost analysis.** In this step, the project team conducted the analysis of energy savings, on-site generation, load profiles, demand management, and incremental measure cost for each project. For buildings, the energy analysis framework was a whole building approach using the EnergyPlus building energy simulation tool and associated software SketchUp and OpenStudio. For example, Figure 12 provides an example of the SketchUp model created to inform the energy benefits modeling of the Energize Fresno design for a mixed-use project within the EOZ. The general building geometry was modeled in SketchUp, and appropriate space types were assigned to the building. The building shape and space types were set based on floor plans or other documentation provided by the developers. This model was then imported into OpenStudio, where lighting, HVAC, water, interior equipment and on-site PV systems were incorporated into the building. Within OpenStudio, assumptions about energy-consuming systems were altered to encompass five scenarios:

1. Baseline energy performance - in conformance with the Title 24 energy code for new construction and major renovation projects
2. Energy efficiency level 1 – at least 10% more efficient than Title 24 baseline
3. Energy efficiency level 2 – a higher level of energy efficiency compared to baseline
4. On-site generation – solar electric generation
5. Demand management – typically using battery storage as the demand management technology
c. **Conduct initial project review with developers.** Once the initial analysis was complete, the results were presented to project owners/developers, and feedback was gathered on the models. The models were adjusted based on this feedback to assure that the analysis was consistent with the project's design intent, and the revised modeling results were presented in a follow-up meeting. Figure 13, Figure 14, and Figure 15 provide samples of the outputs of the analysis. Details on the results of the analysis, including a profile on each project, are presented below in the Analysis Results section of this report.

**Figure 13. Results Dashboard Summary**

![Results Dashboard Summary](image)

Source: Tierra Resource Consultants
Figure 14. Results Dashboard Demand Curves

Source: Tierra Resource Consultants

Figure 15. Results Dashboard Monthly Utility Bill Analysis

Source: Tierra Resource Consultants
d. **Assess and funding and financing opportunities.** The ICRM Funding Platform leverages a broad set of funding and financing products for AEC measures and sustainability projects. Each project in the Pipeline was subjected to a funding and financing alignment analysis with the Funding Library. A sample funding match report is provided in APPENDIX G.

Once the funding match report was completed, each project was submitted to an analysis of options for funding and financing the AEC improvements, as well as a financial analysis that examined energy cost savings, incremental measure cost, return-on-investment in the form of payback with and without funding incentives, and property value improvement.

The Funding and Financing analysis focused on the following options.

**Funding opportunities**

- Grants
- Rebates and technical assistance
- Tax incentives
- Fee waivers
- Service contracts such as capital/financial leases or PPAs.

**Financing opportunities**

- PACE financing
- PG&E On-Bill Financing (OBF)
- Non-PACE financing

Figure 16 provides an example of the financial analysis presented to project owners/developers, and Figure 17 shows a sample funding and financing match analysis along with their contribution to the overall investment capital stack. Figure 18 shows the cash flow analysis for a project, illustrating the annual contract payments and debt service.
Figure 16. Results Dashboard Financial Summary

Financial Summary | Apartment Building

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cumulative Annual Energy Cost ($/y)</th>
<th>Cumulative Annual Energy Cost Savings ($/y)</th>
<th>Cumulative Measure Cost ($)</th>
<th>Incremental Measure Cost ($)</th>
<th>Cumulative Funding Incentives ($/y)</th>
<th>Cumulative Payback w/o Incentives (yrs)</th>
<th>Cumulative Payback w/ Incentives (yrs)</th>
<th>Capitalized Value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>$192,100</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>EE L1</td>
<td>$176,200</td>
<td>$15,900</td>
<td>$14,100</td>
<td>$14,100</td>
<td>$8,162</td>
<td>0.9</td>
<td>0.4</td>
<td>$265,000</td>
</tr>
<tr>
<td>EE L2</td>
<td>$157,900</td>
<td>$34,200</td>
<td>$139,900</td>
<td>$124,900</td>
<td>$80,864</td>
<td>4.1</td>
<td>1.7</td>
<td>$570,000</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>$115,900</td>
<td>$76,200</td>
<td>$533,700</td>
<td>$394,700</td>
<td>$445,758</td>
<td>7.0</td>
<td>1.2</td>
<td>$1,270,000</td>
</tr>
<tr>
<td>Demand Management</td>
<td>$111,700</td>
<td>$80,400</td>
<td>$533,700</td>
<td>$0</td>
<td>$593,758</td>
<td>7.0</td>
<td>1.2</td>
<td>$1,340,000</td>
</tr>
</tbody>
</table>

* Capitalized value of operating cost savings at 6% cap rate

Source: Tierra Resource Consultants

Figure 17. Example of Results Dashboard Capital Stack

Capital Stack Summary

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Capital Stack Component</th>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Management</td>
<td>Phase 2 AEC Allocation</td>
<td>Grant</td>
<td>$256,600</td>
</tr>
<tr>
<td>Demand Management</td>
<td>PG&amp;E Savings by Design</td>
<td>Rebates</td>
<td>$13,600</td>
</tr>
<tr>
<td>Demand Management</td>
<td>PG&amp;E OBF</td>
<td>Financing</td>
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</tr>
<tr>
<td>Demand Management</td>
<td>PACE</td>
<td>Financing</td>
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</tr>
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<td>ITC Energy Credit</td>
<td>Tax Incentive</td>
<td>$120,900</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
e. **Review final project analysis with developers.** Upon completion of the savings analysis, funding and financing match process, and financial analysis a final briefing was held with the project owners/developers to present the benefits, costs and financial returns of participating in the AEC process. Each project owner/developer was presented access to an online analysis dashboard where they could review the results at their leisure, as well as, review a written summary report on their project. Examples of the online analysis dashboard are provided above, and the summary reports for each project, activity center, and program can be found in Appendices A, B, and C.

f. **Complete a letter of intent.** The final step in the Project Pipeline Enrollment and Development process was to obtain an agreement in the form of a Letter of Intent from each project owner/developer (including representatives of Activity Centers) to proceed with the Energize Fresno project, if our team is awarded funding for Phase 2 of this EPIC grant.
Analysis of Programs

The programs' savings potential was evaluated using the best available data for Fresno, and included estimates of electricity savings (kWh), gas savings (therms), utility bill savings ($), peak demand reduction (kW), as well as avoided greenhouse gas emissions (MT CO₂e). The steps followed for program evaluation are outlined below.

1. **Estimate Program Participation.** The HETU programs will be run throughout the city of Fresno, but will target the Lowell Neighborhood and the region from Cambridge to Shields based on their status as low income neighborhoods targeted by the city of Fresno for redevelopment efforts. It is estimated that 175 single family homes and 375 multifamily units within the Lowell Neighborhood will participate in the HETU program and 320 single family homes and 44 multifamily units from Cambridge to Shields. Throughout all of Fresno, it is expected that the total number of HETU participants will be 2,000 single family homes and 3,000 multifamily units. The BETU program was designed to serve 75 restaurants and 75 retail participants that comprise the licensed commercial establishments operating in the Tower district.

2. **Determine Baseline Consumption.** The baseline energy consumption for homes participating in HETU was collected from various audits completed by the HETU program over a period of approximately five years. These data show that the average monthly electricity usage per single family home is 939.5 kWh in the summer and 520.4 kWh in the winter, giving an annual electricity usage of 8,759.4 kWh. Based on industry literature, it is expected that the average multifamily unit consumes 30% less electricity than a single-family home; so, the baseline annual electricity consumption for the multifamily component is 6,131.6 kWh.

Commercial sector baseline energy consumption for BETU participants was based off CALMAC (California Measurement Advisory Council) data, which profiles annual energy consumption of over 1,400 California commercial buildings. The CALMAC data set shows electricity and gas consumption disaggregated by end-use for 8 different commercial building types, per square foot. An average business size of 1,200 sqft was assumed for BETU participants, based on conversations with stakeholders and business owners in Fresno.

3. **Determine Savings Quantities by Technology.** The savings potential of the different program components was determined from market data, and evaluations of existing programs. The savings values were determined by technology and fuel type, as described below.

**HETU App** - The app is a behavior-based tool that encourages energy savings through increasing the transparency of an individual’s energy consumption. A variety of case studies have demonstrated electricity savings percentages ranging from 4-18% for similar residential programs, so a conservative savings estimate of 5% was used for this evaluation. The HETU app has a peak demand reduction potential of 0.25 kW per single family home or multi family unit.
**HETU DI-Thermostat** - A 5% electricity savings potential is assumed for each installed DI-thermostat

**HETU DIW (Direct Install Weatherization)** - Data on savings for the DIW program came from a pilot with Johns Mansville. This pilot claimed 15-20% electricity savings without the installation of the smart thermostat. This evaluation used the conservative end of this savings range (15%), plus an additional 5% savings for the installation of the smart thermostat, consistent with savings described above for the DI-Thermostat measure. Altogether, the electricity savings from the DIW program is 20%. [Insert data on therms savings and kW reduction].

**HETU Cost Savings** - It is assumed that HETU participants are on the CARE utility tariff, so the average electricity price of $0.13661/kWh was used to calculate cost savings associated with energy consumption reduction. The standard PG&E gas rate of $1.2/therm was applied to gas savings.

**BETU Cost Savings** - It is assumed that BETU participants will be on the PG&E A-10 utility tariff, with an average electricity price of $0.19/kWh. The PG&E commercial gas rate is GNR1, at a price of $0.97/therm. These values were applied to the electricity savings, gas savings, and peak demand reduction, to determine the total cost savings of the BETU program.

4. **Estimate of Solar Energy Generation.** Consistent with the recommendation of the SB 350 Barriers Report, the HETU Expansion program will seek to enable the economic advantages of community solar to be readily accessible to low-income and disadvantaged populations.” In order to improve access to solar benefits and overcome barriers such as high populations of renters and general poor roof conditions found in the target neighborhoods, the HETU expansion will seek to install 2-3 large commercial scale photovoltaic arrays on centrally located on site at local schools, municipal facility, or brown field development sites. Community members would be allowed to receive benefits of the array through Virtual Net Energy Metering (VNEM). This model would allow for community development funds to drive solar benefits to low-income and disadvantaged populations, while sharing the value of these investments with schools and municipal facilities.

Because current VNEM policies do not allow for this type of arrangement to exists, for VNEM to be utilized in this way exemptions would need to be made to VNEM to be utilized beyond a single delivery point and extended to multiple residential properties in the immediate area. Multiple organizations and the City of Fresno are seeking to work with the CPUC to identify potential policy approaches to allow for such arrangements to be explored.

Based on a solar generation analysis performed using OpenStudio, consistent with the solar generation analysis for the portfolio projects. This community solar program will generate roughly 4.22 million kWh of clean electricity per year, and the total system size of approximately 1.8 MW (spread across 2-3 individual sites). This is sized to serve approximately 200 homes. It is assumed that these PV systems will be installed at the
market rate of $3.71 per installed watt, for a total system cost of $6.6 million. This
community solar program will offset approximately 831 MT CO2e each year. It is further
recommended that battery systems be installed as a part of these installations to ensure
that systems can adapt to a changing system peak over time and not negatively affect grid
operations.

5. **Calculate Total Savings Estimates.** Once the baseline consumption values and savings
values are established, as described above, it is a simple multiplication exercise to
determine the total program impact.

6. **Calculate Greenhouse gas emissions reduction potential.** The greenhouse gas savings of
the HETU and BETU programs is associated with the avoided electricity and gas
consumption from the measures. Each kWh of electricity that is consumed has a
greenhouse gas footprint depending upon the generation resource mix. This study
assumes the average GHG emissions factor of 197 g CO2e/kWh of electricity, as reported
for the PG&E territory in 2014 (the most recently reported year). The unit CO2e is “carbon
dioxide equivalent,” such that it includes the global warming potential of other greenhouse
gases along with carbon dioxide (primarily methane and nitrous oxide).

The GHG emissions factor of natural gas is based off of the carbon content of a unit of
natural gas: 5.311 kg CO2e/therm. This number varies slightly with the method of gas
combustion, but is overall much less variable than electricity GHG emissions factors. Figure
19 displays the programs savings potential, disaggregated by technology type for
electricity, gas, and cost savings, and peak demand reduction. This figure shows that the
HETU program has a greater potential overall impact than BETU, and that the App will be
the most impactful technology.
Pipeline Roll-up and Resource Savings Summary

As noted above in the introduction, the Project Pipeline is comprised of three primary components: 1) individual development sites, 2) activity centers, and 3) geographically/demographically targeted programs. Each of these components consists of a unique set of projects that contribute to realizing the goals of an AEC. In order to assess the overall contribution of the Pipeline to the achievement of AEC objectives in a systematic and quantifiable framework, it is necessary to view the results in terms of their load shape effects and aggregate grid level impacts. To do this, the project team referred to the traditional load shape objectives of utility demand-side planning and aligned the Pipeline’s energy impacts with these objectives. In summary, the energy impacts of Pipeline projects align with traditional load shape objectives as follows:

- **Energy efficiency improvements** typically reduce overall energy consumption across the facilities operating load profile in a, more or less, uniform way; the load shape impact is traditionally referred to as Conservation.

- **On-site generation** reduces the facilities load shape during the time that the generation occurs. For solar electric installations, this occurs in the mid-day with the sun is shining.
Demand management applications have the objective of load Peak Clipping or Load Shifting to off-peak periods.

End use and transportation electrification have the effect of adding electric load to the system. When strategically applied, these technologies have the goal of Valley Filling and/or Strategic Load Growth.

AEC Measure Load Shape Objectives and Benefits Goals

From an AEC perspective, examining the interactive and integral effects of these technologies at a community scale shows that they can be deployed to achieve key AEC objects, such as improved grid reliability and resiliency, reduced need for new electric system infrastructure, and overall reduced costs to maintain and operate the electric system. Moreover, these effects can be realized at the local distribution feeder level, and, at scale, at the regional distribution level. The load shape objectives and societal benefits of AEC measures are summarized in Table 9 shows how different components of the Pipeline interact with different load shape objectives needed to achieve AEC objectives and societal benefits.

Table 9. Load Shape Objectives and Benefits of AEC Measures

<table>
<thead>
<tr>
<th>AEC Measure</th>
<th>Load Shape Impact</th>
<th>Benefit Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conservation</td>
<td>Generation</td>
</tr>
<tr>
<td></td>
<td>Peak Clipping</td>
<td>Load Shifting</td>
</tr>
<tr>
<td></td>
<td>Valley Filling</td>
<td>Load Building</td>
</tr>
<tr>
<td></td>
<td>Reduce GHG</td>
<td>Reduce Customer Costs</td>
</tr>
<tr>
<td></td>
<td>Manage Adverse Grid Impacts</td>
<td>Provide Locational Grid Benefits</td>
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<td>Energy Efficiency Improvements</td>
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</tr>
<tr>
<td>On-site Rooftop Solar Generation</td>
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<td></td>
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<tr>
<td>Ground Mount Solar Generation</td>
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<td></td>
</tr>
<tr>
<td>Community Solar Generation</td>
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<td>Demand Management – Battery Storage</td>
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<tr>
<td>Grid Interactive Technologies</td>
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<td>End-use Electrification</td>
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<tr>
<td>Electric Vehicle Infrastructure</td>
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</table>

Source: Tierra Resource Consultants
Figure 20. Pipeline Impacts and Benefits

Project Pipeline

Source: Tierra Resource Consultants

Load Shape Impacts

Societal Benefits

Energy Efficiency

Conservation

Generation

Energy Storage / Demand Management

Peak Clipping

Load Shifting

Electric Vehicle Charging

Valley Filling

Load Building

+/− Change in:

kWh

kW

On-site Generation

Onsite Energy Generation

Onsite Energy Storage

Electric Vehicle Charging

Energy Efficiency

Energy Management

GHG Reduction

Customer Benefits

System Benefits

Locational Benefits

Source: Tierra Resource Consultants
CHAPTER 3: Results

Pipeline Resource Savings

The resource impact analysis was conducted using EnergyPlus as the primary calculation tool. This enabled an annual hourly analysis that yielded load shape profiles for each scenario analyzed. As shown above, this further enabled a load shape impact analysis when comparing the different scenarios to baseline conditions.

In this section, the overall resource management impacts are presented for the portfolio of projects in the Pipeline. Table 10 presents a summary of energy impacts by Pipeline component and for the total Pipeline.
Table 10. Pipeline Resource Savings Summary

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Electric Energy Savings (kWh/Yr.)</th>
<th>Natural Gas Energy Savings (Therms/Yr.)</th>
<th>Electric Energy Generation (kWh/Yr.)</th>
<th>Peak Demand Reduction (kW)</th>
<th>Annual Energy Cost Savings ($/Yr.)</th>
<th>Annual GHG Reduction (MT CO2e/Yr.)</th>
<th>Estimated Project Cost ($)</th>
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<td>Development Sites</td>
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<td>HETU Enhancement</td>
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<td>Solar Arc</td>
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<td>Pipeline Total</td>
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<td>9,390</td>
<td>7,340</td>
<td>$30,832,700</td>
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</table>

Source: Tierra Resource Consultants
Pipeline Load Shape Impacts

The following sequence of figures present an integrated load shape analysis of the development sites and activity centers. While the contribution of program impacts is not included in this roll-up, this figure is a reasonable representation of the load shape impacts that could be expected at a community scale. The figure provides a comparison of the five analytic scenarios for a peak summer day, and clearly shows that the sequential deployment of energy efficiency, distributed generation in the form of solar electric generation, and demand management via battery storage technology can achieve the desired load shape impacts of an AEC. Figure 21 provides an illustration of the baseline load shape produced for each development site/activity center based on discussions with developers about their baseline plans and assumptions. Figure 22 and Figure 23 show the load shape impact from increasing levels of energy efficiency, while Figure 24 shows the impact from the addition distributed generations (i.e. Solar), including provisions for both roof mount and ground mount (i.e. parking lot) systems that are sized for both locational and structural considerations.

Figure 25 illustrates the installation of demand management strategies based on grid integrated battery storage systems.

![Figure 21. Peak Day Load Shape Impacts of Pipeline - Baseline Scenario](source)

Source: Tierra Resource Consultants

![Figure 22. Peak Day Load Shape Impacts of Pipeline - EE L1 Scenario](source)

Source: Tierra Resource Consultants
Figure 23. Peak Day Load Shape Impacts of Pipeline - EE L2 Scenario

Source: Tierra Resource Consultants

Figure 24. Peak Day Load Shape Impacts of Pipeline - Distributed Generation Scenario

Source: Tierra Resource Consultants

Figure 25. Peak Day Load Shape Impacts of Pipeline - Demand Management Scenario

Source: Tierra Resource Consultants
Alignment with AEC Objectives

The following discussions define the alignment of the project Pipeline with the AEC criteria presented in Table 8.

Alignment with AEC Grid Reliability and Resilience Criteria

Of the nine AEC guiding criteria driving the project enrollment and development process, four align with Grid Reliability and Grid Resiliency (GR&R); specifically, criteria 1, 3, 4, and 8. Grid reliability and resiliency are fundamentally interlinked; Grid Reliability is a measure of system service (e.g., uninterrupted power delivery), while Grid Resiliency is a measure of a system’s ability to adapt and recover (e.g., from a service outage).

Although there are numerous quantitative and qualitative metrics used to characterize GR&R, the project team reviewed and leveraged data from existing statewide research initiatives that are continuing to explore methods for expressing the value of GR&R technologies and initiatives. The outcome of this effort resulted in a broader interpretation of GR&R impacts from the perspective of site- and community-level load shape impacts attributed to each project, and how these resulting load shape impacts affect GR&R on a locational basis. The project team’s load shape analysis of energy efficiency, solar generation, and demand management/energy storage options for each site, and for the Pipeline as a whole, is discussed in more detail within Chapter 2. Overall, supporting grid reliability and resiliency was a key consideration in the development of the Pipeline.

Minimize the Need for New Energy Infrastructure

As noted earlier, Criteria 1 of the AEC objectives aims to minimize the need for new energy infrastructure costs such as transmission and distribution upgrades. In addition to analyzing the energy cost implications of each project measure, their incremental costs of deployment, and return-on-investment considering a range of funding and financing options, the project team characterized the broader relationship between the Pipeline and its relative impact on grid reliability and resiliency, thereby reducing the need for other grid investments.

A key consideration for Criteria 1 is the fact that all new gas plants constructed or authorized for construction within the last seven years have been designed to fill an identified Locational Capacity Requirement (LCR) need within the state. Similarly, the breadth of other grid infrastructure investments is driven primarily by peak load considerations. These attributes drove

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11 Grid reliability is reflected in the planning standards of the Western Electricity Coordinating Council (“WECC”) that incorporate standards set by the North American Electric Reliability Council (“NERC”) (collectively “NERC Planning Standards”)


13 The Distributed Energy Resource Growth Scenarios and Distribution Load Forecasting working group is at http://drpwg.org/growth-scenarios/

14 Local Capacity Requirement in a Low Carbon Grid Study, May 2017
the project team’s focus on load shape impacts as the primary metric to characterize the GR&R benefits of the pipeline.

More specifically, the analysis of each project included a baseline load shape analysis, followed by a sequential analysis of the savings and load shape impacts of each AEC measure scenario. The corresponding review of load shape impacts demonstrated how each technology has the capacity to significantly impact peak loads, thereby minimizing the need for new energy infrastructure. The load shape analysis also clearly demonstrated that demand management technologies, notably electric energy storage, have the capacity to moderate and manage undesirable grid level impacts of solar deployment at scale. Strategically deployed with grid level impacts in mind, demand management can make a significant contribution to minimizing the need for new electric system infrastructure at the local and regional distribution level.

Support grid reliability and resiliency

Criteria 3 of the AEC objectives aims to prioritize the implementation of technologies that further advance grid reliability and resiliency metrics. This prioritization process was complementary to the load shape impact analysis completed for each project in the pipeline. The project team leveraged statewide GR&R analysis methodologies and metrics through the collaboration with utility representatives, software developers, and approved toolsets used to calculate GR&R impacts of local Demonstration Projects across the state. The feedback obtained through this research effort has enabled the project team to map the application of standardized and consistent guidelines for characterizing GR&R impacts across the state to the Pipeline upon completion in Phase 2.

The project team leveraged insight from the Investor Owned Utility (IOU) Integration Capacity Analyses (ICA) and Locational Net Benefit Analysis (LNBA) which seeks to identify DER integration capacities, and corresponding benefits to the grid, at the substation bank, feeder, and line section levels across the state. Under this analytic framework, illustrated in Figure 26, the core metrics aligning with the characterization of GR&R benefits for projects in the pipeline, include:

1. Deferred Infrastructure Investments: The installation of DER at strategic geographic locations along the grid served to satisfy Local Capacity Requirements (LCR) and minimize the need for new capacity additions / resource procurement. This benefit to grid reliability and resiliency was expressed as a deferred dollar value ($) per kW of DER capacity installed.

2. Thermal Criteria: The addition of DER to the distribution feeders may cause power flow to exceed equipment thermal ratings. A key performance metric involves calculating the highest value of DER which could be connected at a particular node, without exceeding the thermal rating of any piece of upstream equipment on the distribution circuit or substation.

3. Protection Criteria: Protection criteria determine whether the addition of DER to the grid will reduce the ability of existing protection measures / schemes to monitor the grid, to promptly disconnect areas during abnormal system conditions. The reduction of ability to
detect a faulted condition is referred to as “reduction of reach.” A key planning consideration involves accounting for its relative impacts to existing and future protection efforts to keep employees, public, and assets safe from potential electrical disturbances on the grid.

4. Power Quality / Voltage Criteria: These criteria determine whether the addition of DER to the distribution feeders will cause the distribution primary feeder to operate outside of allowable power quality and voltage limits. Accordingly, calculations associated with power quality analysis are mandatory to ensure that new resources are evaluated for sufficient voltage and quality of service.

5. Safety / Reliability Criteria: High DER penetration may have the potential to cause excess back flow that may result in congestion and affect reliability during system events. From this perspective, all DER planning and implementation efforts must assess safety and reliability consideration to ensure that all customers are secure under abnormal operating conditions and high penetration scenarios that may occur on the grid.

In addition to the line section and node analysis, feeder level impacts and substation level impacts were also calculated and informed the broader analysis objectives of the ICA and LNBA. The detailed results from these studies are made publicly available online and in a downloadable format, and served as a framework for the project team’s characterization of other metrics used to prioritize the implementation of technologies that advance grid reliability and resiliency. Statewide research and reporting of regional ICA and LNBA outputs are ongoing through the IOU Distribution Resource Planning initiatives and regular Load Forecasting Working Group meetings. The project team is continuing to collaborate with both regulatory and utility working group members to develop consistent methodologies and reporting metrics for ICA / LNBA outputs. And as noted earlier, a key analytic objective during the implementation of projects in the pipeline during Phase 2 will be to contrast and compare project-/ pipeline-level LNBA outputs and their relative contribution to each of the AEC criteria advancing grid reliability and resiliency.

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15 http://scedrpdemo.azureedge.net/R1408013SCEDemoProjectsABFinalReports.pdf
Grid Integration and Alignment

Criteria 4 aims to provide easier grid integration and alignment with two key resource planning efforts across the state: (1) CPUC Long-Term Procurement Plan,\textsuperscript{17} and (2) the California Independent System Operator's (CAISO) Local Capacity Requirements.\textsuperscript{18} The project team thoroughly reviewed each resource procurement plan when characterizing the pipeline's grid reliability and resiliency benefits.

Historically, the objective of each of these planning documents is to identify specific geographic areas that have limited import capability and determine the minimum generation capacity (MW) necessary to mitigate the local reliability problems in those areas. From this perspective, the Long-Term Procurement Plan and Local Capacity Requirements align with the aforementioned ICA and LNBA analysis objectives. A key outcome of the analysis process involved identifying overlapping and intersecting GR&R impacts. More specifically, whatever one Balancing Authority Area does, can affect the reliability of other Balancing Authority Areas (e.g., deferred infrastructure investments and increased locational capacity from projects in the pipeline); this relationship served as another analysis input when calculating project-level GR&R impacts and benefits for the Pipeline during Phase 2.

\textsuperscript{17} 2018 LOCAL CAPACITY TECHNICAL ANALYSIS, FINAL REPORT AND STUDY RESULTS, California Independent System Operator, April 30, 2015
Makes Use of Smart-Grid Technologies

Criteria 8 aims to make use of smart-grid technologies throughout the community. It continues to build upon Criteria 3 of the AEC objectives which is intended to prioritize the implementation of technologies that further advance grid reliability and resiliency metrics.

Accordingly, a key project development consideration included the characterization of demand management opportunities and the deployment of technologies such as energy management systems, grid interactive technology, and battery storage systems. We note that many of these technologies are also complementary to the utilities investment in, and integration of, a wide range of advanced communications and control technologies (e.g., Distribution Control Centers, Smart Grid Technology, SmartMeters™ etc.) which have produced increased reliability and resiliency year-over-year since 2015.¹⁹ The project team identified and characterized the increasing number of market ready, smart-grid technologies implemented by projects in the pipeline within Section 6. Pipeline and Integration Rollup. Furthermore, the relative GR&R benefits for these technologies may be separated into three sub-categories:

1. **Smart-Grid Technologies**: Specific measures implemented across each component of the project pipeline
2. **Smart-Grid Controls**: The specific ability to control the performance of each technology deployed and improve GR&R metrics
3. **Smart-Grid Algorithms**: The algorithms and / or strategies built into the smart-grid controls to further automate the procurement of GR&R benefits

One of the ongoing analytic objectives of Phase 2 will be to characterize and quantify project performance across these three sub-categories. The disaggregation of resource savings and load shapes at the measure sub-component level will enable the team to more accurately determine project elements that contribute most cost-effectively to each AEC criteria.

Achieving and Maintaining Zero Net Energy Community Status

Criteria 2 specifically identifies ZNE status as a feature of an AEC. The project team assessed ZNE opportunities for each element of the project beginning with an assessment of energy efficiency strategies, followed by a build-out of renewable energy resources (primarily in the form of on-site solar electric generation). This clearly makes an important contribution to achieving GHG reduction targets. In addition, due to the importance of grid level impacts for an AEC, this analysis was consistently accompanied by an evaluation of demand management/energy storage options. The effect of the progressive deployment of these technologies can be clearly seen in the load shape analysis.

Attaining or approached ZNE status was a key variable for each component of the Pipeline. At the individual site level, a ZNE strategy requires that a building’s demand for energy resources first be minimized through energy efficiency and passive solar design strategies. Then, the design must

¹⁹ 2015 marked the seventh consecutive year of improved PG&E reliability. Since 2009, the utility has consistently reduced the average duration of power outages from 158 minutes to 96 minutes, a 39 percent improvement.
provide sufficient on-site generation capacity to offset the buildings energy requirements. In order to be most effective in new construction and major renovations, ZNE considerations must begin as early in the design process as possible, as illustrated in Figure 27. Many of the development site and activity center projects have been engaged early enough in the cycle to have a significant influence.

Figure 27. Illustration of the Level Design Influence by Stage of Project Development

![Diagram showing Level Design Influence by Stage of Project Development](image)

Source: Tierra Resource Consultants

The ZNE design process is typically conducted in the absence of grid level impact considerations. When the wide-scale deployment of ZNE strategies is examined, however, grid level considerations become important in order to manage grid level impacts and minimize adverse conditions such as those posed by the worst-case scenarios of the “duck curve”. The project team thus examined demand management technologies, such as battery storage, to minimize this impact.

Figure 28 is an example of the load shape for a typical baseline, code design project, while Figure 29 is an example output from one the project analyses that shows how site level load shapes are effected by efficiency and solar installations, and moderated by battery storage for a summer peak day.

Figure 28. Example of Baseline Project Load Shape

![Diagram showing Baseline Project Load Shape](image)

Source: Tierra Resource Consultants
Replicability and Scale

Criteria 5 calls for the process to be replicable and scalable to further drive down the cost of energy resources. The project team’s objective from the outset of the project was to develop tools and resources that could be scaled to any size of a community and deployed across the State. The project development process, engineering analysis tools, funding and financing tools, information resources, and verification protocols are all designed to be scalable and drive down both project development and implementation costs.

The ICRM approach provides an innovative and necessary solution to filling a gap in the market between the energy services mechanisms offered by utility programs and private sector energy service companies.

As shown in Figure 30, ICRM offers the following advantages over these traditional services:

- Provides comprehensive integrated resource /sustainability approach that includes:
  - Building energy efficiency
  - Onsite generation
  - Energy storage and demand management
  - Water conservation
  - Electrification of end-use applications and transportation
  - GHG reductions

ESCO projects typically offer a more limited set of these elements, and focus on market segments where their business model is most effective. Utility programs tend to be technology or application specific and limited in their capacity to integrate energy efficiency, DER, and demand management under one umbrella.

Coordinated with community development initiatives. The ICRM approach is designed to leverage all city planning activities and engaged stakeholders to drive more sustainability projects, and
increase the sustainability content of each project. ESCO and technology/market segment programs (‘utility programs’) are not typically related to community planning initiatives or stakeholder / community capacity.

Leverages all market ready financing and funding options including:

- Grants
- Financing mechanisms such as PACE and OBF
- Rebates and technical assistance programs
- Tax incentives
- Fee waivers
- Leases and power purchase agreements

ESCO and utility programs typically have limited offerings that are proprietary or technology specific. Utility financing tools are typically limited to measures promoted by specific programs and do not account for other sustainability funding and financing mechanisms in the market.

Capable of leveraging a portfolio of projects to achieve cost benefits through economy of scale. The ICRM is designed to develop project portfolios consisting of multiple elements including individual buildings/projects, community based programs, and major activity centers. This allows for economies of scale in design/financing/construction that are not present in utility programs. ESCOS are effective at leveraging economies of scale but this is constrained to their target market segments and measures with high return-on-investment premiums.

**Figure 30. Market Gap Filled by ICRM Approach**

<table>
<thead>
<tr>
<th>Utility Programs</th>
<th>Current Market Paradigm</th>
<th>ESCOs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Gap</strong></td>
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</table>

ICRM Approach
1. Comprehensive sustainability Solutions
2. Coordinates with community development
3. Leverages all available market funding and financing mechanisms
4. Leverages portfolios of projects

Source: Tierra Resource Consultants
Financially Attractive

Two of the nine criteria relate to the financial impacts and viability of AEC applications from a market standpoint (criteria 6 and 7). With this in mind, the project team analyzed the energy cost implications of the AEC technologies assuming current and proposed PG&E tariff structures, the incremental costs of AEC measure deployment, and return-on-investment considering a range of funding and financing options.

A key part of the project development analysis process is to present the financial benefits of AEC technologies from the building owner/operator perspective, and provide funding and financing tools that enhance the financial viability of AEC projects. An example of a project funding and financing analysis is presented below in the Project Savings and Funding Analysis section of the report.

Affordable Access to Technology

As noted above, the financial viability for AEC applications was a key part of the project development cycle. This involved detailed cost savings, funding and financing options, and return-on-investment analysis for AEC scenarios for each component of the Pipeline. This project had a specific focus on community revitalization/ rehabilitation and disadvantaged neighborhoods and how AEC measure deployment could be deployed to reduce energy costs for all ratepayers and provide economic benefits to the community.

Alignment with State Energy and Environmental Policy Goals

Finally, criteria 9 required the project to align with other applicable state policy goals at the community level such as the Sustainable Communities and Environmental Protection Act (Senate Bill 375 (Steinberg, Chapter 728, Statutes of 2008) and Governor Brown’s Executive Order B-29-15 for the drought. One of the initial steps in the process, was to examine the various State policies that impact this type of project, as well as, the local municipal planning and policy initiatives that set the context for the implementation of AEC criteria. As an example of the latter, the project team was informed throughout the project by a team member from the City of Fresno sustainability department on related and complimentary initiatives in the City. The project team was also actively engaged with various City departments to assess how AEC criteria could be best applied in the context of City planning initiatives, and AEC measures could be deployed at City facilities.
CHAPTER 4: Development Sites and Activity Centers Buildout

The Energize Fresno team views that the implementation of development sites and activity centers will occur in a five-step process as discussed below and illustrated in Figure 31.

1. **Obtain Developer Commitment.** The team has been reviewing analysis and funding opportunities and will be completing letters of intent with developers to confirm the energy analysis and funding platform has been reviewed and is agreeable to proceed to implementation when the projects are built, with certain caveats based on conditions the developer may face that are extraneous to Energize Fresno. The initial construction timeline for the development sites and activity centers is provided in Figure 34.

2. **Complete Investment Grade Designs.** As discussed in CHAPTER 2: Pipeline Development Process, the project team conducted an analysis of energy savings, on-site generation, load profiles, demand management, and incremental measure cost for each project based on a whole building approach using the EnergyPlus building energy simulation tool and associated software SketchUp and OpenStudio. Because most of the development sites and activity centers projects are still in the conceptual or in early design phases, this component of the buildout plan will allow the Energize Fresno team to complete investment grade design work that will further refine savings estimates and provide the information necessary to finalize the financial analysis and development of the capital stack. While we expect some refinement of savings and cost estimates, we do not anticipate material changes to the overall viability of each project in the pipeline.

3. **Secure AEC Project Funding.** This component of the development process involves securing the funding and financing components unique to each project. We expect that
funding the full build out of the portfolio, including incremental costs for energy efficiency and full costs for distributed generation and demand management technologies, will require approximately $40M in funds from various mechanisms, including:

- Financing (loans and bonds)
- Grants
- Rebates and technical assistance
- Cash match funding
- Tax incentives
- Fee waivers

The financial analysis completed on the development sites and activity centers is intended to identify how the portfolio can be funded in a way that is financially attractive from a market standpoint (AEC criteria 6). The analysis focused on the use of all market ready funding and finance products such that the EF project development approach can be replicated and scaled-up to further drive down costs (AEC criteria 5). Table 11 shows how $29.4M from various types of funding and financing mechanisms will be used to fund the incremental cost of above-code energy efficiency, and the full cost of distributed generation systems.\(^{20,21}\) Figure 32 further summarizes the funding and financing mechanisms to be used by broad product category. The capitalized value\(^{22}\) of the reduced operating costs associated energy spending on commercial properties is estimated at $21.8.9M.

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20 Financing and funding was applied to the incremental cost of energy efficiency. The full project cost of all building energy system being upgraded and distributed generation systems is estimated at approximately $61.1M.

21 The network of grid interactive batteries will be installed using 10-year energy service agreements that do not present a capital cost but are reflected in the cash flow analysis.

22 ‘Capitalized Value’ is the current value of an asset, based on the total income expected to be realized over its economic life span. Savings on energy spending improve the income of a property, thus increasing its capitalized value. The anticipated savings are discounted by a capitalization rate (‘cap rate’) so they take into account the time value of money. The EF analysis used a 6% cap rate.
Table 11. Estimated Pipeline Capital Stack Components and Value

<table>
<thead>
<tr>
<th>Capital Stack Component</th>
<th>Value</th>
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<tbody>
<tr>
<td>Tax Free Bonds</td>
<td>$7,719,270</td>
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<tr>
<td>Phase 2 AEC Grant Allocation</td>
<td>$6,030,855</td>
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<tr>
<td>ECAA Loans</td>
<td>$5,642,878</td>
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<tr>
<td>ITC - Energy Credit</td>
<td>$2,564,672</td>
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<tr>
<td>PACE Loans</td>
<td>$2,934,531</td>
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<tr>
<td>OBF Loans</td>
<td>$1,997,741</td>
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<tr>
<td>Cash Match Funding</td>
<td>$600,000</td>
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<tr>
<td>Self-Generation Incentive Program</td>
<td>$522,000</td>
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<tr>
<td>Fee Waiver (New Market Street Growth)</td>
<td>$520,000</td>
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<tr>
<td>PG&amp;E Savings by Design</td>
<td>$469,871</td>
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<tr>
<td>PG&amp;E Custom Incentives (kWh)</td>
<td>$190,689</td>
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<tr>
<td>ITC - Rehabilitation Credit</td>
<td>$59,382</td>
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<tr>
<td>IRS LIHTC</td>
<td>$60,755</td>
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<tr>
<td>PG&amp;E Custom Incentives (kW)</td>
<td>$37,400</td>
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<tr>
<td>CA LIHTC</td>
<td>$19,746</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$29,369,790</strong></td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Figure 32. Energize Fresno Capital Stack Component Summary

Source: Tierra Resource Consultants
The portfolio of development sites and activity centers is expected to save about $3.2M in annual purchased energy costs, resulting in an average annual cash flow of approximately $1.1M after $2.1M in debt service and contract payments, as shown in Figure 33. Loan terms are estimated at 5 to 15 years with rates ranging from 0% to 7.5%, depending on the financing product.

Figure 33. Energize Fresno Capital Stack Component Summary

During the analysis process, the Energize Fresno team worked with developers to define the process and conditions necessary to acquire funding for construction. Appendix I provides an example of the financial summary provided to developers during the review process, which included the following caveats and provisos regarding the availability and application of funding and financing:

- The Energize Fresno analysis is limited to what is known about the projects at the time we completed our analysis and understand your design might change.
- The funding and financing products (‘Products’) shown are available in the market and have been successfully on similar projects. The actual application and availability of these Products might change by the time your projects are built.
- The analysis includes an estimate of how much of any potential phase 2 AEC grant might be applied to your project. The team used several general rules in allocating these funds:
  - AEC grant funds are not being applied to cost of the Energy Efficiency level 1 and 2 scenarios, because the technologies are cost effective without grant funding and can be installed using currently available financing products.
• AEC grant funds are being applied to cost of the distributed generation (i.e. solar) scenario to offset 25% of the cost of the system.

• The allocation of AEC grant funds toward solar required that scenario 4, demand management also be pursued. The AEC grant requires consideration for PG&E grid resiliency and reliability, and solar installations without demand management (e.g. battery storage) can be counterproductive to that objective.

• AEC grant funds are being applied to scenario 4, demand management, to offset the cost of battery storage. Grant funds are being applied because the Energize Fresno team views energy storage as an emerging technology that requires supplemental funding support for market adoption. The underlying assumption is that grant funds will be applied to buy down the cost of power purchase agreements, to a level that is financially attractive for project owners.

4. **Project Construction.** The Energy Fresno project Phase 2 funding request will include resources to support the following activities during project construction:
   - Investment grade technology definition and energy analysis based on design recommendations
   - Support for technical specification development
   - Support during the technology procurement process

5. **Project Measurement and Reporting.** The Energy Fresno project Phase 2 funding request will include resources for the project measurement and reporting process defined in detail in Chapter 6.
**Figure 34. Initial Construction Timeline for Development Sites and Activity Centers**

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Q1</th>
<th>Q2</th>
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**Color Key**

| Light Gray | Design, planning, permitting |
| Dark Gray  | Construction |

Source: Tierra Resource Consultants
CHAPTER 5: Program Implementation

The following discusses the seven steps to be used to implement the program components of the Pipeline, as defined in Figure 35.

**Figure 35. Program Implementation Process**

- **Plan**
  - Complete and File Program Implementation Plan (PIP)
- **Develop**
  - Develop technology and trade partner network
- **Build**
  - Prepare delivery support systems
- **Enroll**
  - Conduct customer marketing, outreach and enrollment activities
- **Support**
  - Provide technical and financial support services
- **Verify**
  - Conduct project verification and data tracking activities
- **Report**
  - Conduct ongoing project management, QA/QC and reporting activities

Source: Tierra Resource Consultants

The program elements of the Pipeline will be delivered in Phase 2 of the project to install AEC technologies throughout the EOZ. As noted above, the programs fulfill an important role in the Pipeline insofar as they are targeted at existing operating facilities in the residential and small commercial facilities. Summary program descriptions are provided in Appendix C.

Program delivery is a multi-faceted process requiring outreach and marketing to the target market, engagement with potential customers and enrolling them in the program, installation and operation of AEC measures, and tracking and reporting of program results. Program implementation involves the following key steps:

- **Develop Program Implementation Plan (PIP)** – While the descriptions in Appendix C provide a summary of the residential and small commercial programs, the Program Implementation Plan (PIP) will lay out the specific details, logistics, and plans for
program implementation. Preparation of the PIP will be one of the first tasks for the project team after the kick-off of Phase 2. The components of the PIP include:

- A program management and administration plan
- Customer marketing and outreach plan
- Customer engagement and technical, funding and financing support services plan
- Trade partner outreach, engagement and training plan
- Definition of program policies and procedures
- A financial and incentive disbursement plan
- A CVETU Project Management Plan (PMP) and Budget
- A project verification, tracking and reporting plan

**Develop technology and trade partner network** – Program delivery requires a strong trade partner network to deliver and install technical solutions promoted by the program. Key partners include thermostat and grid interactive technology providers and installers, energy efficiency measure installers, and solar system installation providers. Development of the trade partner network entails the following:

- Onboarding trade partners who have already been identified and recruiting/onboarding new partners as needed so as to provide the full spectrum of services needed to meet the goals of the program.
- Training trade partners on program policies, procedures and support services.
- Informing partners of expected performance metrics and quality control procedures.

**Prepare delivery support systems** – Program delivery is dependent on well develop administrative and support systems that assure a satisfying customer experience, provide the customer and trade partner tools and infrastructure for efficient and timely delivery of services, and provide the backbone for sound program management practices. Support systems include:

- An online portal with application and dashboard tools
- Marketing and promotional materials
- Project analysis and funding/financing origination tools
- Contractor and trade partner implementation tools

**Conduct customer marketing, outreach and enrollment activities** – As described in Appendix C, marketing of the HETU and BETU program enhancements is a multi-faceted process that is designed to attract and enroll the target number, type and size of projects needed to meet program goals. The elements of this process include:
City of Fresno Neighborhood Revitalization Program Partnership -- The City of Fresno is launching a new initiative called the Rental Housing Inspection Program, implemented by the Neighborhood Revitalizations Department. The aim of the effort is to improve the quality of rental housing in Fresno through a comprehensive landlord engagement and property inspection initiative. In many of the communities within the opportunity zone, over 80% of customers are renters. Energize Fresno will coordinate efforts directly with this initiative to help pre-qualify rental units throughout the energy opportunity zones.

Community Organizing/Outreach -- The marketing team will target neighborhoods within the opportunity zones and work with community groups, small business groups, revitalization initiatives, churches, and schools to conduct event-based marketing and outreach.

Public/Private Partnerships – Marketing and program promotion will occur through the project team’s public and private community partnerships including: Fresno Metro Ministries, local neighborhood associations, private contractors and local businesses.

Direct Marketing -- In coordination with the local HETU and BETU efforts, PG&E small business outreach, and the project team will conduct direct marketing to customers inside the opportunity zones via direct mail, email, print media, and social media channels.

Environmental Defense Fund (EDF) Collaboration – The project team will work closely with EDF to reach many of the businesses within the Power the Tower project district.

Provide technical and financial support services – Project development and implementation requires a range of technical, engineering, and funding/financing support services to deliver projects with broad and deep sustainability content. This is particularly true in the context of this program where a full range of AEC technologies are being deployed to achieve multiple objectives (e.g., GHG reductions, customer benefits, grid reliability). Support services include:

- Technical analysis and engineering of AEC applications for projects that come into the program.
- Funding and financing support and origination for project incremental costs.
- Assessment of new technologies that may be deployed in the program and performance assessment of installed technologies.

Develop community/shared solar sites. The EOZ includes multiple sites that are candidates for community or shared solar development. The project team will work with property owners and trade partners to develop and install community or shared solar installations that will benefit all of the residents in the target area. This will include:
- Assessing solar potential of sites
- Estimated generation, energy cost savings, and design and installation costs
- Providing assistance with funding and financing mechanisms
- Assisting with the preparation of solar lease, shared ownership, and power purchase agreements

- **Conduct project verification and data tracking activities** - Data will be collected and tracked on each project, and verification activities will be deployed to assure verify installation data. The project team will maintain a project tracking database and online dashboard of program achievements and project progress.

- **Conduct ongoing project management, quality control and reporting activities** - The program will be managed on a day-to-day basis by a dedicated program manager and support team. The program manager will report program progress and implementation issues on a regular basis to the Energize Fresno project management team.

Implementation support services are summarized in Figure 36.

**Figure 36. Program Implementation Support Systems**

Source: Tierra Resource Consultants
CHAPTER 6:  
Measurement, Verification, and Reporting

The Verification Toolkit (Toolkit) defines comprehensive verification methodologies and data recording infrastructures that the project team would use to verify the resource savings of projects in the pipeline that have signed Letters of Intent to proceed with the Energize Fresno project during project buildout in Phase 2. Development of the Toolkit required the project team to clearly distinguish differences between analytic methodologies and verification methodologies. The former seeks to calculate the performance and resource savings of a given project, while the latter verifies that performance and resource savings are calculated correctly, transparently, and consistently across the breadth of standards, mandates, policies that apply to the AEC criteria, etc. In the context of the project pipeline, the Verification Toolkit accomplished the following research tasks:

1. Established comprehensive, standardized, and industry-best practice methods for verifying and reporting project savings accruing communitywide for all resources, the results of which allow the project team to characterize project and pipeline contributions for each of the nine AEC criteria.

2. Determined optimal data verification strategies that align with each of the components in the project pipeline, along with critical verification inputs and outputs required to accurately verify projects and pipeline accomplishments.

3. Developed the supporting Data Recording Infrastructure that streamlines and efficiently integrates inputs, algorithms, and outputs for project and pipeline performance metrics in a format that is compliant across local, state, and federal legislative initiatives.

Verification Methodology Alignment

A key consideration when vetting appropriate verification methods to include in the Verification Toolkit involved the development of prioritization criteria; attributes of verification methodologies adopted by industry and government organizations beyond their inherent accuracy, transparency, consistency, etc. Through this process, the project team developed the following prioritization criteria to rank (and ultimately assign) best-in-class verification methodologies for inclusion within the final Verification Toolkit:

- Methods that are not restricted to specific resources, but instead, offer broader principles to guide the verification of project and pipeline performance metrics (i.e., load shape impacts, AEC criteria, etc.)

- Strategies that effectively balance the relationship between verification rigor and available verification funding, while providing insight into the different verification procedures that are applicable across each pipeline component
• Regionally relevant verification methodologies that acknowledge the geographic, demographic, etc. attributes unique to projects implemented within the state

• Protocols currently adopted and implemented by Investor Owned Utility (IOU) programs, local conservation initiatives, etc.

• Verification frameworks that are adaptable and focused on continuous improvements to facilitate the timely and accurate measurement of state, regional, and local impacts of energy technologies and building efficiency measures (e.g., M&V 2.0 in Table 12)

• Methods that effectively integrate with existing building energy code compliance activity, along with other verification efforts to improve compliance rates on energy, GHG, and water measures, while yielding timelier city inspection and approval processes for the City of Fresno relating to energy code compliance.

Collectively, verification methods that uniquely aligned with each of these criteria were included in the final Verification Toolkit, and applied appropriately across each component of the project pipeline to confirm key analytic inputs and outputs, as shown in Table 12.

<table>
<thead>
<tr>
<th>Verification Methodology</th>
<th>Development Entity</th>
<th>Scope of Verification Protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standards and Guidelines</td>
<td>American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)</td>
<td><a href="https://www.ashrae.org/standards-research--technology/standards-guidelines">https://www.ashrae.org/standards-research--technology/standards-guidelines</a></td>
</tr>
<tr>
<td>Measurement &amp; Verification (M&amp;V) 2.0 / Enhanced Evaluation Practices Currently Being Developed</td>
<td>New and Evolving Evaluation Practices Currently Being Developed</td>
<td>A key attribute of this new and evolving verification methodology is that the M&amp;V 2.0 principles are not limited to a single entity or organization; rather, M&amp;V 2.0 focuses on the collaboration of numerous relevant data streams to provide continuous verification feedback.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
As illustrated by the last row in Table 12, the project team developed the Verification Toolkit to be dynamic and fluid in such a way as to evolve with the market as improvements and updates to verification methodologies are adopted within the broader evaluation industry. For example, M&V 2.0 (otherwise referred to as enhanced M&V) is representative of the ongoing evolution of verification methods within the broader energy industry. Whereas traditional verification methods focus on collecting data on projects after a project or program has been completed (oftentimes a year or more), M&V 2.0 leverages new software platforms, the increased deployment of Advanced Metering Infrastructure (AMI), and secure data transfer protocols to continuously verify and analyze input parameters throughout the project or program implementation process. The benefits of collecting and analyzing project data in real time serve to improve the timing with which mid-course corrections may be made, while facilitating the continuous optimization of project and program performance. However, the practice of successfully implementing M&V 2.0 procedures and supporting infrastructure is decidedly more complex and a subject of ongoing research within the industry. The project team focused on existing lessons learned and Best Practices in the design and implementation of optimal verification methods / toolsets for the final Verification Toolkit.

This process by which notable improvements to verification methodologies are documented and, to the extent possible, implemented in future project pipeline verification efforts, was captured through the project team’s Verification Gap Analysis and Verification Implementation Specification. The outcome of this approach to continuous improvement is reflected in the subsequent discussion of “Verification Data Collection Inputs and Outputs” and “Data Recording Infrastructure,” below.

**Verification Data Inputs and Outputs**

A key component of the Verification Toolkit involved the identification of project and pipeline data inputs and outputs that inform key performance metrics ranging from load shape impacts to the characterization of each project’s contribution to each of the nine AEC criteria. Moreover, identifying the process and timing by which these data parameters are verified is pivotal to the overall functionality of the Verification Toolkit. And as noted earlier, the optimal verification process varies based on the different components of the project pipeline, along with the availability of data unique to each project and technology installation.

In light of these considerations, the project team developed verification procedures and data collection protocols to be implemented on projects in the pipeline that have signed Letters of Intent to proceed with the Energize Fresno project during project buildout in Phase 2. This component of the Verification Toolkit is designed to not only guide the application of verification protocols in an integrated project environment, but to also provide a framework for addressing a broad range of challenges that may be encountered during the Verification process. And although it is impractical to articulate every possible scenario or outcome that may be encountered during the Verification process on a project-by-project basis, the Verification Toolkit methodologies demonstrate broader guiding principles to apply in support
of verification Best Practices. As an example, the project team identified how verification efforts should precede and integrate with the Project Savings and Funding Analysis, below:

- **Interview project developers to assess AEC opportunities.** In order to understand the nature, scope, and timing of the project as early in the design process as possible, the Verification Toolkit may be deployed early on in the project development phase to capture pre-existing measures and operation conditions, along with project plans. The early project development phase also represents an opportunity for the project team to explore the data storage and data transfer infrastructure available for each project, and identify how it may be leveraged to support the implementation of M&V 2.0 principles among the different market actors and agencies involved.

- **Conduct energy savings/generation and cost analysis.** Concurrent with the analysis of energy savings, on-site generation, load profiles, demand management, and incremental measure cost for each project, the Verification Toolkit will document the exact data points, analysis methodologies, and corresponding assumptions used in this task.

- **Conduct initial project review with developers.** Feedback from project owners/developers on analytic inputs and outputs are key components of the Verification Toolkit; this information is used to compare project results against initial project planning objectives.

- **Define funding and financing opportunities.** The Verification Toolkit is also used to verify funding and financing inputs, along with the corresponding financial analysis of energy cost savings, incremental measure costs, return-on-investment in the form of payback with and without funding incentives, and property value improvements.

- **Review final project analysis with developers and complete a Letter of Intent.** It is within these final steps of the Project Pipeline Enrollment and Development process that the project team identifies how the Verification Toolkit will be deployed after project implementation to ensure the legitimacy and credibility of project savings, while facilitating the process of reporting project accomplishments in accordance with appropriate local, state, and federal conservation initiatives (e.g., AB32, SB350, etc.).

This process of beginning verification procedures early in the project development phase is consistent with the project team’s commitment to developing a dynamic and fluid Verification Toolkit that continues to evolve with the market as improvements and updates to verification methodologies are adopted within the broader evaluation industry. Moreover, the project team anticipates an expanded pipeline, along with the need for additional verification protocols as new technologies emerge in the market and make their way into the project pipeline. The verification process is modular and designed to accommodate additional procedures and data parameters as new protocols augment the Verification Toolkit.

Moreover, the project team continues to review, and add to, the suite of Verification Toolkit methodologies used to verify project and pipeline performance, as well as identify the most critical and overlapping data inputs and outputs for each verification method. This process
ensures that the final outcome of the Verification Toolkit framework is compatible with key resource conservation initiatives / databases established across the state, a key component of the nine AEC criteria. Overall, the final subset of verification inputs and outputs are designed to strike a balance between verification rigor and supporting resources, while not overburdening the financing process with data collection and verification requirements. As project verification and reporting priorities evolve, the project team will continue to consolidate and streamline the data collection inputs and outputs to capture unique, non-overlapping data points that will verify project performance. Appendix H provides a list of key verification input and output parameters. Similarly, Figure 37 provides a draft data collection framework identifying unique and overlapping data elements of different verification methodologies in a relational schema. An ongoing task of the Verification Toolkit will be to continue refine this schema as optimal verification and reporting objectives continue to evolve. This schema serves as a guiding framework for the development of the subsequent Data Recording Infrastructure component of the Verification Toolkit.
Figure 37. Overview of Verification Data Input and Output Parameters

Source: Tierra Resource Consultants
The final inputs and outputs, along with the optimal verification methodologies, will vary on a project-by-project basis. Table 13 shows the likely application of the Verification Toolkit methodologies to each of the projects in the pipeline, along with the activity centers and programs. Of importance to note is that the Verification Toolkit identifies the overlapping and complementary elements of different verification methodologies, while implementing these methodologies within the broader framework of M&V 2.0 enhancements.

<table>
<thead>
<tr>
<th>Protocols / Methods</th>
<th>Alignment and Integration with M&amp;V 2.0 Principles</th>
<th>ASHRAEL Level II</th>
<th>ASHRAE Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IPMVP Option A</td>
<td>IPMVP Option B</td>
</tr>
<tr>
<td>Development Sites</td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>✓</td>
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<tr>
<td>10</td>
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<td></td>
<td>✓</td>
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<td>11</td>
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<td>12</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Centers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresno City College</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Municipal Operations and Facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HETU Enhancement</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>BETU Enhancement</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
Data Recording Infrastructure Development

The repository of verification methods available within the Verification Toolkit will allow for the application of optimal and cost-effective verification methods to verify outputs from the project-level and pipeline analysis process. The data recording infrastructure represents a platform by which verified data may be stored and analyzed in support of the project’s broader data objectives. Specifically, the data recording infrastructure is designed to achieve the following objectives:

- Compile savings goals from all agencies and initiatives
- Compile data from existing source databases that house project activities
- Establish algorithms to standardize and aggregate data from source databases
- Integrate resource valuation algorithms
- Report resources savings into state agency data reporting systems

Additionally, the insights offered by advanced software platforms and market-ready data analytic infrastructures used by the project team to design the Verification Toolkit’s data recording infrastructure align with the evolution of the evaluation industry. Along with M&V Best Practices, this includes:

- Leveraging computation and Information Technology (IT)
- Capturing and analyzing more data (e.g., quantity, time resolution, sub-meters, device recording, etc.)
- Continuous accessibility via modern software platforms
- Analytic foundation built upon proven savings estimation techniques

A key component of this process involved leveraging the Verification Input and Output Data Schema to characterize how the unique data requirements and overlapping elements of Verification Toolkit methodologies will be stored in, and reported from, the final data recording infrastructure. The project team also researched, assembled, and analyzed a comprehensive inventory of local (Fresno-specific), state, and federal conservation initiatives and to facilitate the process of reporting project accomplishments in an appropriate format. This process was complemented by a similar review of statewide conservation reporting databases to ensure that the data recording infrastructure was storing project verification data and analytic outputs commensurate with the data recording needs / requirements of other resource conservation efforts. Table 14 provides a sample of key conservation reporting sources and databases within the state of California; the review of which informed the final design of the project team’s Verification Toolkit Data Recording Infrastructure:

23 The resulting database of policies and initiatives is available online to project stakeholders and representatives at the following location: https://docs.google.com/spreadsheets/d/1bttMK9cR0Sz3MhMATpPuS6wIBWEAXatjsCrMYF2Bkaw/edit?usp=drive_web
Table 14. Sample Conservation Reporting Sources and Databases within the State

<table>
<thead>
<tr>
<th>Verification Methodology</th>
<th>Development Entity</th>
<th>Scope of Verification Protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>CalTRACK (Supportive of M&amp;V 2.0)</td>
<td>PG&amp;E, OpenEEMeter</td>
<td>Calculates normalized metered savings for the PG&amp;E Advanced Home Upgrade program. All consumption and project data is aggregated and anonymized to comply with CPUC regulations and calculations are powered by the open source</td>
</tr>
<tr>
<td>California Energy Data and Reporting System (CEDARS)</td>
<td>CPUC Energy Division (ED)</td>
<td>Statewide EE claims from IOUs and three Community Choice Aggregates (CCAs) / Regional Energy Networks (RENS)</td>
</tr>
<tr>
<td>Quarterly Fuel and Energy Report (QFER)</td>
<td>California Energy Commission</td>
<td>Annual generation by county, plant unit, power plant stats</td>
</tr>
<tr>
<td>Building Energy Data Exchange Specification (BEDES)</td>
<td>U.S. Department of Energy (DOE)</td>
<td>We note that BEDES is a data dictionary standard; not a database or reporting standard. However, this data exchange facilitates consistent and accurate representation of building characteristics and energy use data between different tools and databases.</td>
</tr>
<tr>
<td>Database for Energy Efficiency Resources (DEER)</td>
<td>CPUC ED</td>
<td>Estimates of energy and peak demand savings values, measure costs, and effective useful life</td>
</tr>
<tr>
<td>California Technical Forum (Cal TF)</td>
<td>Collaborative of experts</td>
<td>Provides independent professional judgment and a transparent, technically robust process to review and issue technical information related to California’s integrated demand side management portfolio.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

As noted earlier, the design considerations for the data recording infrastructure were also dependent upon, and aligned with, the needs of the evolving verification industry. Moreover, the data recording infrastructure was developed to address concerns that traditional M&V approaches provide only a subset of insights that could be gleaned from the wealth of available data for each project. These insights may often arrive too late to provide actionable recommendations that may improve overall project performance metrics. From this perspective, the improved availability, transparency, and breadth of project data offered by advanced software platforms and market-ready data analytic infrastructures enable a much more accurate assessment of resource conservation impacts associated with projects implemented through the pipeline.

As an example, the project team's analysis efforts characterized the electric energy impacts of projects in the pipeline in terms of their site level and community scale load shape impacts (see Figures 21 - 25. Peak Day Load Shape Impacts in Section 6. Pipeline Roll Up and Resource
Savings Summary). The resulting data recording infrastructure which leverages principles of M&V 2.0, advanced software platforms, and market-ready data analytic software, serves to enhance the load shape analysis and the verification of other project performance metrics. This is a function of improving the timeliness of data captured and received, thereby enabling proactive, real-time dialogue with management, regulators, and other project stakeholders. By verifying a broader subset of project analytic inputs and outputs, and facilitating transparent, continuous, and expandable data streams, the project team’s data recording infrastructure offers benefits to all components of the project pipeline, including:

- **Phase 2 project management** can use timely data feedback to adjust project development efforts, program designs and budgets more quickly. Project management can get this early feedback by automating the delivery of usage data and by using advanced data analytics to estimate savings, enhance program targeting and marketing, etc.

- **Phase 2 project development team** can benefit from data driven outreach and project identification efforts, and from early feedback on individual project performance, particularly with real time data, enabling the development team to identify and correct operational problems, thereby facilitating improved project performance and higher total savings.

- **The Energy Commission, ISO, PG&E and other parties interested in grid management** can benefit from opportunities created by the Verification Toolkit’s data recording infrastructure to conduct detailed load shape impact analyses, and target and deliver time- and location-dependent impacts and peak load reductions. As the industry seeks to increase reliance on energy efficiency, distributed generation, and advanced demand management technologies as a grid resource, grid planners need to predict short-term demand. These organizations also need reliable savings data for specific hours of the year. Additionally, as grid planners struggle with congestion zones and resiliency issues, interval-level targeting and evaluation represent an important value stream for automated analytics.

- **The City of Fresno local government** can benefit from reliable and well documented assessments of achievements toward key City planning objectives including climate action planning, sustainable communities, affordable house, economic development and workforce development.

- **The funding and financing community** seeks to reduce the investment risk in energy efficiency, renewable energy, and advanced demand management strategies, such as battery storage projects, since private investment can be hampered by uncertainty in how and when energy savings will be verified. This stakeholder group is looking to enhanced data recording infrastructures to standardize approaches to calculating savings, where applicable, and to improve overall investor confidence in sustainability projects.
Building owners, developers and operators can benefit by gaining an understanding of how specific interventions affect facility energy use and costs in a near-real time basis, the return on investment in sustainability projects, and how community based AEC solutions affect the overall reliability and cost of the energy services to their facilities.

The project team also developed the data recording infrastructure to contribute towards the metrics outlined within the California Energy Efficiency Policy Manual; the Manual serves to guide the use of energy efficiency as a procurement resource, as well as the implementation of California's Energy Efficiency Strategic Plan, and the design of energy efficiency, distributed energy, and demand management programs. The final Verification Toolkit data recording infrastructure aligned with these same objectives, in addition to the other Verification Toolkit considerations previously discussed.

Overall, the evolution of the evaluation industry and benefits of the project team's advanced data recording infrastructures will greatly enhance the quality and accuracy of project analysis findings. Table 15 provides an overview of the attributes of the Verification Toolkit's data recording infrastructure in alignment with Best Practices and Enhanced M&V, and how these attributes will improve project- and pipeline-level performance in the context of the deployment of AEC guidelines and criteria.

### Table 15. Attributes of the Data Recording Infrastructure in Alignment with Enhanced M&V

<table>
<thead>
<tr>
<th>Enhanced M&amp;V Attributes</th>
<th>Attributes in Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capable of determining resource savings impacts and load shapes (e.g., peak demand, water, GHG, etc.)</td>
<td>Ability to analyze gas consumption</td>
</tr>
<tr>
<td>Capable of determining historical performance</td>
<td>Ability to track additional performance metrics beyond resource savings and load impacts (e.g., contractor / vendor satisfaction, developer costs, etc.)</td>
</tr>
<tr>
<td>Capable of analyzing AMI data</td>
<td>Further track project development phases and associated verification inputs / outputs</td>
</tr>
<tr>
<td>Web-accessible and easily-customizable</td>
<td>Customization by data recording infrastructure users</td>
</tr>
<tr>
<td>Dashboard generates easily-customizable and on-demand performance metrics</td>
<td>Design elements to minimize training</td>
</tr>
<tr>
<td>Supports all components of the project pipeline</td>
<td></td>
</tr>
<tr>
<td>Scalable to include / aggregate the whole portfolio of projects in the pipeline</td>
<td></td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

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## GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEC</td>
<td>Advanced Energy Community</td>
</tr>
<tr>
<td>ARB</td>
<td>California Air Resources Board</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating and Air-Conditioning Engineers</td>
</tr>
<tr>
<td>BEDES</td>
<td>Building Energy Data Exchange Specification</td>
</tr>
<tr>
<td>BETU</td>
<td>Business Energy Tune-Up</td>
</tr>
<tr>
<td>CAISO</td>
<td>California Independent System Operator</td>
</tr>
<tr>
<td>Cal TF</td>
<td>California Technical Forum</td>
</tr>
<tr>
<td>CALMAC</td>
<td>California Measurement Advisory Council</td>
</tr>
<tr>
<td>CPUC</td>
<td>California Public Utilities Commission</td>
</tr>
<tr>
<td>CPUC ED</td>
<td>California Public Utilities Commission's Energy Division</td>
</tr>
<tr>
<td>CVETU</td>
<td>Central Valley Energy Tune-Up</td>
</tr>
<tr>
<td>DCFC</td>
<td>Direct Current Fast Chargers</td>
</tr>
<tr>
<td>DEER</td>
<td>Database for Energy Efficiency Resources</td>
</tr>
<tr>
<td>DER</td>
<td>Distributed energy resource</td>
</tr>
<tr>
<td>DI-Thermostat</td>
<td>Direct install thermostat</td>
</tr>
<tr>
<td>DIW</td>
<td>Direct install weatherization</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
</tr>
<tr>
<td>ECAA</td>
<td>Energy Conservation Assistance Act Loan</td>
</tr>
<tr>
<td>EDF</td>
<td>Environmental Defense Fund</td>
</tr>
<tr>
<td>EE</td>
<td>Energy efficiency</td>
</tr>
<tr>
<td>EF</td>
<td>Energize Fresno</td>
</tr>
<tr>
<td>EOZ</td>
<td>Energy Opportunity Zone</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>EPIC</td>
<td>Electric Program Investment Charge</td>
</tr>
<tr>
<td>ESCO</td>
<td>Energy Service Company</td>
</tr>
<tr>
<td>EV</td>
<td>Electric Vehicles</td>
</tr>
<tr>
<td>FCC</td>
<td>Fresno City College</td>
</tr>
<tr>
<td>GFO</td>
<td>Grant funding opportunity</td>
</tr>
<tr>
<td>GHG</td>
<td>greenhouse gas</td>
</tr>
<tr>
<td>GR&amp;R</td>
<td>Grid Reliability and Grid Resiliency</td>
</tr>
<tr>
<td>HETU</td>
<td>Home Energy Tune-Up</td>
</tr>
<tr>
<td>HSR</td>
<td>High-Speed Rail</td>
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<tr>
<td>ICA</td>
<td>Integration Capacity Analyses</td>
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<tr>
<td>ICRM</td>
<td>Integrated Community Resource Market</td>
</tr>
<tr>
<td>IOU</td>
<td>investor owned utility</td>
</tr>
<tr>
<td>IPMVP</td>
<td>International Performance Measurement, Verification, and Protocols (IPMVP)</td>
</tr>
<tr>
<td>IRS</td>
<td>Internal Revenue Service</td>
</tr>
<tr>
<td>IT</td>
<td>Information technology</td>
</tr>
<tr>
<td>ITC</td>
<td>Investment Tax Credit</td>
</tr>
<tr>
<td>kWh</td>
<td>kilowatt hours</td>
</tr>
<tr>
<td>LCR</td>
<td>Locational Capacity Requirement</td>
</tr>
<tr>
<td>LIHTC</td>
<td>Low-Income Housing Tax Credit</td>
</tr>
<tr>
<td>LNBA</td>
<td>Locational Net Benefit Analysis</td>
</tr>
<tr>
<td>M&amp;V</td>
<td>Measurement and verification</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MT CO2e</td>
<td>Metric tons of carbon dioxide equivalent</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
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<tr>
<td>NREL</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>OBF</td>
<td>On-Bill Financing</td>
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<td>PACE</td>
<td>Property Assessed Clean Energy</td>
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<td>Pacific Gas &amp; Electric</td>
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<td>Program Implementation Plan</td>
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<tr>
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<td>Photovoltaic</td>
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<td>QA/QC</td>
<td>Quality assurance and quality control</td>
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<td>Quarterly Fuel and Energy Report</td>
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<tr>
<td>RMC</td>
<td>Regional Medical Center</td>
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<tr>
<td>TAC</td>
<td>Technical Advisory Committee</td>
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<tr>
<td>UMP</td>
<td>Uniform Methods Project</td>
</tr>
<tr>
<td>VNEM</td>
<td>Virtual Net Energy Metering</td>
</tr>
<tr>
<td>VRF</td>
<td>Variable refrigerant flow system</td>
</tr>
<tr>
<td>ZNE</td>
<td>Zero net energy</td>
</tr>
</tbody>
</table>
APPENDIX A. DEVELOPMENT SITE PROJECT PROFILES

This Appendix contains the project summary reports for the Energize Fresno portfolio projects (Project 1 – 13).
Project 1

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 1 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area: 112,000 sqft
- Total Conditioned Area: 112,000 sqft
- Total Unconditioned Area: 0 sqft
- Number of Stories: 3
- Number of Space Types: 2
- Number of Thermal Zones: 3
- Type of Mechanical System: VRF
  - Baseline Electricity Use Intensity: 10.9 kWh/sqft
  - Baseline Gas Use Intensity: 0.013 therm/sqft
  - Baseline Annual Utility Cost: $245,980 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiMGEzN2JjMTgtZDI5OS00NzJiLWliMGQtZjc1NmZlYmYyODI3IiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

Annual Utility Cost by Scenario

Savings Opportunities

Lighting Efficiency
- Annual utility cost reduction $23,900
- Payback time 0.8 year
HVAC Efficiency

- Annual utility cost reduction $30,100
- Payback time 4.4 years

On-Site Photovoltaic Array

- Annual utility cost reduction $34,800
- Payback time 8.2 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>3,076</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>43,698</td>
<td>39%</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>6,151</td>
<td>5%</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>3,076</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>3,076</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>46,773</td>
<td>42%</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>6,151</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>0.95</td>
<td>0.65</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>0.60</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

Lighting Measures

- Assign ASHRAE 90.1-2010 Daylighting Controls
Mechanical System

- **System type:** VRF
- **Number of thermal zones:** 3
- **System configuration:** One VRF system terminal per thermal zone
- **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system
- **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system
- **Heating System Capacity:** 1,470 kBtuh
- **Cooling System Capacity:** 122 tons

Hot Water System

- **System equipment and efficiency rating:** 82%
- **Annual building water consumption:** 159,300 gal
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information

- **Annual electricity generated:** 227,935 kWh
- **System size:** 95 kW
- **Type of system:** Rooftop
- **Available space for array:** 9,600 sqft (based on analysis of rooftop using google maps)
  - Assume 25% module loss factor, resulting in total PV cell area of 7,200 sqft
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 2
Building Modeling Summary Document

Modeling Narrative and Scenario Definition
The energy consumption of Project 2 was evaluated using the building modeling software Energy Plus. The building was evaluated for six different scenarios, as defined in the table below. The scenarios are cumulative; such that EE L4 contains the lighting efficiency, lighting system, and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Scenario Definition Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>EE L1</td>
</tr>
<tr>
<td>EE L2</td>
</tr>
<tr>
<td>Distributed Generation</td>
</tr>
<tr>
<td>Demand Management</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot
- Total Building Area 76,400 sqft
- Total Conditioned Area 76,400 sqft
- Total Unconditioned Area 0 sqft
- Number of Stories 3
- Number of Space Types 5
- Number of Thermal Zones 12
- Type of Mechanical System VRF
  - Baseline Electricity Use Intensity 30.9 kWh/sqft
  - Baseline Gas Use Intensity 0.374 therm/sqft
  - Baseline Annual Utility Cost $514,300 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiZjdiZDhhMjiRkZDctYWE2Ni00MWIxLTthMGUtY2ViNTAzNTUwYzkiIiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMiIsImMiOjZ9

Energy End-Use Breakdown

Annual Utility Cost by Scenario

Savings Opportunities

*Lighting Efficiency*
- Annual utility cost reduction $27,800
• Payback time: 0.5 years

**HVAC Efficiency**

• Annual utility cost reduction: $64,200
• Payback time: 1.4 years

**On-Site Photovoltaic Array**

• Annual utility cost reduction: $48,800
• Payback time: 7.8 years

**Building Geometry and Space Types**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Service Restaurant</td>
<td>Dining</td>
<td>25,488</td>
<td>33%</td>
</tr>
<tr>
<td>Full Service Restaurant</td>
<td>Kitchen</td>
<td>7,320</td>
<td>10%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Deli/Bakery</td>
<td>5,356</td>
<td>7%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Dry Storage</td>
<td>19,082</td>
<td>25%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Office</td>
<td>12,812</td>
<td>17%</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Sales/Produce</td>
<td>6,406</td>
<td>8%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

**Lighting**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Service Restaurant</td>
<td>Dining</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Full Service Restaurant</td>
<td>Kitchen</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Deli/Bakery</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Dry Storage</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Office</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Supermarket</td>
<td>Sales/Produce</td>
<td>1.20</td>
<td>0.82</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.
The efficient lighting case represents switching the lighting system to LEDs.

Source: Tierra Resource Consultants

**Lighting Measures**

• Assign ASHRAE 90.1-2010 Daylighting Controls
Mechanical System
The efficient HVAC case represents upgrading the VRF system to Term with heat recovery.

- **System type:** VRF
- **Number of thermal zones:** 12
- **System configuration:** One thermal zone assigned per space type per floor
- **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L3 and above)
  - *Note:* This COP rating represents the upgrade to include heat recovery
- **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L3 and above)
  - *Note:* This COP rating represents the upgrade to include heat recovery
- **Heating System Capacity:** 282 tons
- **Cooling System Capacity:** 3,390 kBtuh

Hot Water System

- **System equipment and efficiency rating:** Electric hot water heater, 82% efficient
- **Annual building water consumption:** 1,103,00 gal
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information

- **Annual electricity generated:** 299,060
- **System size:** 125 kW
- **Type of system:** Rooftop
- **Available space for array:** 12,690 (this is 50% of the entire rooftop area)
- **Percent of available space covered with functional PV cells:** 75%
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 3

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 3 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Demand Management scenario contains the lighting efficiency, lighting system, and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area 117,980 sqft
- Total Conditioned Space 104,980 sqft
- Total Unconditioned Space 12,700 sqft
- Number of Stories 5
- Number of Space Types 5
- Number of Thermal Zones 22
- Type of HVAC Mechanical System VRF
  - Baseline Electricity Use Intensity 7.32 kWh/sqft
  - Baseline Gas Use Intensity 0 therm/sqft
  - Baseline Annual Utility Cost $192,070/year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiZjQ4MjQ0M2UtODMxOS00Yzg3LTk1YjYtYTE3OTAzMDI1MTY0IiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

Source: Tierra Resource Consultants
Savings Opportunities

Lighting Efficiency
- Annual utility cost reduction: $15,900
- Payback time: 0.9 years

HVAC Efficiency
- Annual utility cost reduction: $18,300
- Payback time: 6.8 years

On-Site Photovoltaic Array
- Annual utility cost reduction: $42,000
- Payback time: 9.4 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midrise Apartment</td>
<td>Apartment</td>
<td>66,495</td>
<td>57%</td>
</tr>
<tr>
<td>Midrise Apartment</td>
<td>Corridor</td>
<td>9,150</td>
<td>8%</td>
</tr>
<tr>
<td>Retail</td>
<td>Retail</td>
<td>6,805</td>
<td>6%</td>
</tr>
<tr>
<td>Small Hotel</td>
<td>Exercise</td>
<td>12,705</td>
<td>11%</td>
</tr>
<tr>
<td>Office</td>
<td>Storage</td>
<td>22,523</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midrise Apartment</td>
<td>Apartment</td>
<td>0.5</td>
<td>0.34</td>
</tr>
<tr>
<td>Midrise Apartment</td>
<td>Corridor</td>
<td>0.6</td>
<td>0.41</td>
</tr>
<tr>
<td>Retail</td>
<td>Retail</td>
<td>1.2</td>
<td>0.82</td>
</tr>
<tr>
<td>Small Hotel</td>
<td>Exercise</td>
<td>1.0</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Storage</td>
<td>0.6</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

The efficient lighting case represents replacing the lighting system with LEDs. The 32% reduction is based off of market research for lighting efficiency upgrades.

Source: Tierra Resource Consultants
Lighting Measures
- Assign ASHRAE 90.1-2010 Daylighting Controls

Mechanical System
The baseline COP values are based off of Title 24 standards. The efficient case represents switching to a VRF with heat recovery system.
- **System type:** Variable Refrigerant Flow
- **Number of thermal zones:** 22
- **System configuration:** One thermal zone assigned per space type per floor
- **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
- **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 Baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
- **Heating System Design Capacity:** 993 kBtu/h
- **Cooling System Design Capacity:** 83 tons
- **Pump type and quantity:** no HVAC pumps

Hot Water System
- **System equipment and efficiency rating:** Electric water heater, 82% efficient
- **Annual building water consumption:** 3,700 m³
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information
- **Annual electricity generated:** 310,800 kWh
- **System size:** 130 kW
- **Type of system:** Rooftop
- **Total Area of Array:** 10,300 sqft
  - The area available for the PV array was based on a conversation with the project architect, and the following assumptions
• Assume 75% of the “L” portion of the roof is available for rooftop PV
• “L” roof portion = 18,300 sqft
• Assume a 25% loss factor
• 18,300 sqft * 75% * 75% = 10,300 sqft
  o Total PV area = 10,300 = 32 % of total roof area
• Cell efficiency: 18%
• Inverter efficiency: 98%
Project 4

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 4 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that Demand Management scenario contains the efficiency upgrades and on-site solar generation of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area 35,700 sqft
- Total Conditioned Space 35,700 sqft
- Total Unconditioned Space 0 sqft
- Number of Stories 3
- Number of Space Types 4
- Number of Thermal Zones 9
- Type of Mechanical System VRF
  - Baseline Electricity Use Intensity 31.8 kWh/sqft
  - Baseline Gas Use Intensity 0.52 therm/sqft
  - Baseline Annual Utility Cost $240,900/year
Link to Power BI Dashboard

https://app.powerbi.com/view?r=eyJrIjoiNGU4ZDc1ZWYtNjQ4My00ZTNkLTlhMWOtM2M1OTEyNDNmOGMzIiwiaCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

Source: Tierra Resource Consultants

Savings Opportunities

*Lighting Efficiency*

- Annual utility cost reduction: $8,200
- Payback time: 1.9 years
**HVAC Efficiency**
- Annual utility cost reduction: $31,600
- Payback time: 1.3 years

**On-Site Photovoltaic Array**
- Annual utility cost reduction: $34,300
- Payback time: 7.8 years

**Building Geometry and Space Types**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>11,900</td>
<td>33%</td>
</tr>
<tr>
<td>Full Service Restaurant</td>
<td>Dining</td>
<td>3,224</td>
<td>9%</td>
</tr>
<tr>
<td>Full Service Restaurant</td>
<td>Kitchen</td>
<td>2,726</td>
<td>8%</td>
</tr>
<tr>
<td>Quick Service Restaurant</td>
<td>Dining</td>
<td>3,224</td>
<td>9%</td>
</tr>
<tr>
<td>Quick Service Restaurant</td>
<td>Kitchen</td>
<td>2,726</td>
<td>8%</td>
</tr>
<tr>
<td>Retail</td>
<td>Back Space</td>
<td>11,900</td>
<td>33%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

**Lighting**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Full Service Restaurant</td>
<td>Dining</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Full Service Restaurant</td>
<td>Kitchen</td>
<td>1.20</td>
<td>0.81</td>
</tr>
<tr>
<td>Quick Service Restaurant</td>
<td>Dining</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Quick Service Restaurant</td>
<td>Kitchen</td>
<td>1.20</td>
<td>0.81</td>
</tr>
<tr>
<td>Retail</td>
<td>Back Space</td>
<td>0.60</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

**Lighting Measures**
- Assign ASHRAE 90.1-2010 Daylighting Controls
Mechanical System

- **System type:** Variable Refrigerant Flow
- **Number of thermal zones:** 9
- **System configuration:** 2-3 thermal zones per floor; each thermal zone has its own VRF terminal
- **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5 – HVAC efficiency upgrade (EE L2 and above)
- **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 Baseline
  - COP 5 – HVAC efficiency upgrade (EE L2 and above)
- **Heating System Capacity:** 1,580 kBtu/h
- **Cooling System Capacity:** 129 tons
- **Pump type and quantity:** no HVAC pumps

Hot Water System

- **System equipment and efficiency rating:** Gas water heater, 82% efficient
- **Annual building water consumption:** 152,980 gal
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information

- **Annual electricity generated:** 209,440 kWh
- **System size:** 88 kW
- **Type of system:** Rooftop
- **Available space for array:** 8,925 (this is 75% of the rooftop area)
- **Percent of available space covered with functional PV cells:** 75%
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 5
Building Modeling Summary Document

Modeling Narrative and Scenario Definition
The energy consumption of the Project 5 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area 69,000 sqft
- Total Conditioned Area 69,000 sqft
- Total Unconditioned Area 0 sqft
- Number of Stories 9
- Number of Space Types 4
- Number of Thermal Zones 11
- Type of Mechanical System VRF
  - Baseline Electricity Use Intensity 8.95 kWh/sqft
  - Baseline Gas Use Intensity 0.014 therm/sqft
  - Baseline Annual Utility Cost $125,000 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiZmMwNmI0M2MtYmVhNS00YzAzLWVE2M2YtODMxODRkNDAtYWFhliwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

Source: Tierra Resource Consultants
Savings Opportunities

*Lighting Efficiency*
- Annual utility cost reduction $8,300
- Payback time 1.3 years

*HVAC Efficiency*
- Annual utility cost reduction $17,100
- Payback time 4.8 years

*On-Site Photovoltaic Array*
- Annual utility cost reduction $35,300
- Payback time 9.5 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>41,400</td>
<td>58%</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>4,360</td>
<td>6%</td>
</tr>
<tr>
<td>Office</td>
<td>Storage</td>
<td>15,160</td>
<td>21%</td>
</tr>
<tr>
<td>Retail</td>
<td>Retail</td>
<td>10,800</td>
<td>15%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>0.95</td>
<td>0.65</td>
</tr>
<tr>
<td>Office</td>
<td>Storage</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Retail</td>
<td>Retail</td>
<td>1.20</td>
<td>0.82</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

Lighting Measures
- Assign ASHRAE 90.1-2010 Daylighting Controls
Mechanical System

- **System type:** Variable Refrigerant Flow (VRF)
- **Number of thermal zones:** 11
- **System configuration:** One VRF terminal per thermal zone
- **Heating coil efficiency rating:**
  - COP 3.3 (Baseline)
  - COP 5.0 (Efficient case; EE L2 and above; representing adding heat recovery to VRF system)
- **Cooling coil efficiency rating:**
  - COP 3.2 (Baseline)
  - COP 5.0 (Efficient case; EE L2 and above; representing adding heat recovery to VRF system)
- **Heating System Capacity:** 1,200 kBtuh
- **Cooling System Capacity:** 100 ton

Hot Water System

- **System equipment and efficiency rating:** Gas hot water boiler, efficiency 82%
- **Annual building water consumption:** 97,000 gal
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information

- **Annual electricity generated:** 263,358 kWh
- **System size:** 110 kW
- **Type of system:** Rooftop on adjacent parking structure
- **Available space for array:** 11,560 sqft
  - 125’ x 185’ on adjacent parking structure (23,125 sqft)
  - Assume 50% of this can be covered in PV modules, and then add 25% loss factor
    - Shading surface in OpenStudio model is 77’ x 150’
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 6

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 6 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area 100,000 sqft
- Total Conditioned Area 100,000 sqft
- Total Unconditioned Area 0 sqft
- Number of Stories 5
- Number of Space Types 7
- Number of Thermal Zones 8
- Type of Mechanical System VRF
  - Baseline Electricity Use Intensity 10.91 kWh/sqft
  - Baseline Gas Use Intensity 0.013 therm/sqft
  - Baseline Annual Utility Cost $219,620 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiNmNiYzg1NmOtYzl4ZS00ZjYwLWE4ZTYtYTVkNzg5YjJjYmVhIiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

![Energy End-Use Breakdown Chart]

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

![Annual Utility Cost by Scenario Chart]

Source: Tierra Resource Consultants

Savings Opportunities

*Lighting Efficiency*
- Annual utility cost reduction: $21,300
- Payback time: 0.8 years
HVAC Efficiency

- Annual utility cost reduction: $26,900
- Payback time: 4.4 years

On-Site Photovoltaic Array

- Annual utility cost reduction: $45,300
- Payback time: 8.2 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>2,746</td>
<td>3%</td>
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<tr>
<td>Office</td>
<td>Closed Office</td>
<td>39,016</td>
<td>39%</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>5,492</td>
<td>5%</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>2,746</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>2,746</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>41,792</td>
<td>42%</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>5,492</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>0.95</td>
<td>0.65</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>0.60</td>
<td>0.51</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

Lighting Measures

- Assign ASHRAE 90.1-2010 Daylighting Controls

Mechanical System

- System type: VRF
• **Number of thermal zones:** 8

• **System configuration:** 2 thermal zones per floor, and one VRF terminal per thermal zone

• **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system

• **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system

• **Heating System Capacity:** 1,850 kBtuh

• **Cooling System Capacity:** 154 tons

**Hot Water System**

• **System equipment and efficiency rating:** Gas water boiler, 82% efficient

• **Annual building water consumption:** 142,260 gallons

• **Pump type and quantity:** 1 constant speed pump

**Photovoltaic System Information**

• **Annual electricity generated:** 293,340 kWh

• **System size:** 123 kW

• **Type of system:** Rooftop
  - Available space for array: 12,500 sqft
  - Assume that 50% of the rooftop area (total of 25,000 sqft) is available to be covered in PV modules

• Assume 25% module loss factor

• **Cell efficiency:** 18%

• **Inverter efficiency:** 98%
**Project 7**

Building Modeling Summary Document

**Modeling Narrative and Scenario Definition**

The energy consumption of Project 7 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

**Building Performance Snapshot**

- Total Building Area: 80,000 sqft
- Total Conditioned Area: 80,000 sqft
- Total Unconditioned Area: 0 sqft
- Number of Stories: 3
- Number of Space Types: 2
- Number of Thermal Zones: 3
- Type of Mechanical System: VRF
  - Baseline Electricity Use Intensity: 10.9 kWh/sqft
  - Baseline Gas Use Intensity: 0.013 therm/sqft
  - Baseline Annual Utility Cost: $175,700 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiZTc5ODMyMmQtNWZmNi00MmZkLWE5ZjctMGYyOTk1ZWU1NTFmliwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmIwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

![Electricity Consumption by End-Use](Image)

![Gas Consumption by End-Use](Image)

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

![Annual Utility Cost by Scenario](Image)

Source: Tierra Resource Consultants

Savings Opportunities

**Lighting Efficiency**

- Annual utility cost reduction: $17,100
- Payback time: 1 year
HVAC Efficiency

- Annual utility cost reduction $21,500
- Payback time 4.4 years

On-Site Photovoltaic Array

- Annual utility cost reduction $13,100
- Payback time 8.2 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>2,197</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>31,213</td>
<td>39%</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>4,394</td>
<td>5%</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>2,197</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>2,197</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>33,410</td>
<td>42%</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>4,394</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>0.95</td>
<td>0.65</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>0.60</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

Lighting Measures

- Assign ASHRAE 90.1-2010 Daylighting Controls

Mechanical System

- System type: VRF
• **Number of thermal zones:** 3

• **System configuration:** One VRF system terminal per thermal zone

• **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system

• **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system

• **Heating System Capacity:** 123 ton

• **Cooling System Capacity:** 1,480 kBtuh

**Hot Water System**

• **System equipment and efficiency rating:** 82%

• **Annual building water consumption:** 113,800 gal

• **Pump type and quantity:** 1 constant speed pump

**Photovoltaic System Information**

• **Annual electricity generated:** 86,010 kWh

• **System size:** 36 kW

• **Type of system:** Rooftop
  - Available space for array: 2,720 sqft
  - The total rooftop area for Project 7 was based off of a simple analysis using Google Earth → rooftop area = ~70’x105’
  - Assume that 50% of the rooftop area is available to be covered in PV modules

• Assume 25% loss factor

• **Cell efficiency:** 18%

• **Inverter efficiency:** 98%
Project 8

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 8 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

![Scenario Definition Table]

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area 85,600 sqft
- Total Conditioned Area 85,600 sqft
- Total Unconditioned Area 0 sqft
- Number of Stories 3
- Number of Space Types 7
- Number of Thermal Zones 8
- Type of Mechanical System VRF
  - Baseline Electricity Use Intensity 11.07 kWh/sqft
  - Baseline Gas Use Intensity 0.06 therm/sqft
  - Baseline Annual Utility Cost $202,150 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiZDU4YzlhNmUtMWI4Mi00MzQ3LTg3YWEtZmYyYzc5ZTO3ZjFmIiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

Source: Tierra Resource Consultants

Savings Opportunities

Lighting Efficiency

- Annual utility cost reduction $23,700
- Payback time 0.5 years
HVAC Efficiency

- Annual utility cost reduction: $33,200
- Payback time: 1 year

On-Site Photovoltaic Array

- Annual utility cost reduction: $56,800
- Payback time: 10 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>72,210</td>
<td>84%</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1,450</td>
<td>2%</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>945</td>
<td>1%</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>1,226</td>
<td>1%</td>
</tr>
<tr>
<td>Office</td>
<td>Elec/Mech Room</td>
<td>1,226</td>
<td>1%</td>
</tr>
<tr>
<td>Office</td>
<td>Corridor</td>
<td>7,595</td>
<td>9%</td>
</tr>
<tr>
<td>Quick Service</td>
<td>Dining</td>
<td>945</td>
<td>1%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>0.95</td>
<td>0.65</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Office</td>
<td>Elec/Mech Room</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Office</td>
<td>Corridor</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Quick Service</td>
<td>Dining</td>
<td>1.00</td>
<td>0.68</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants
Lighting Measures

- Assign ASHRAE 90.1-2010 Daylighting Controls

Mechanical System

- **System type:** Fan coil with electric chiller for cooling coils and gas heater for heating coils
- **Number of thermal zones:** 8
- **System configuration:** 2-3 thermal zones per floor
- **Heating equipment and efficiency rating:** Electric heating coil
  - 80% - Title 24 baseline
  - 90% efficiency - HVAC efficiency upgrade (EE L2 and above)
- **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 - Title 24 baseline
  - COP 5 - HVAC efficiency upgrade (EE L2 and above)
- **Heating System Capacity:** 1,140 kBtu/h
- **Cooling System Capacity:** 95 ton
- **Pump type and quantity:** 4 variable speed pumps (two for chilling loop and 2 for heating loop)

Hot Water System

- **System equipment and efficiency rating:** Gas hot water heater, 82% efficient
- **Annual building water consumption:** 116,690 gal
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information

- **Annual electricity generated:** 494,028 kWh
- **System size:** 207 kW
- **Type of system:** Ground mount
- **Available space for array:** 21,040 sqft
  - A crude google earth assessment shows that the total side lot area is 108,000 sqft
Assume that 30% of this area is covered in PV modules (conservative assumption for solar carports)

The total side lot PV is distributed proportionately between Project 8 and Project 9 based on building square footage (65% goes to Project 8)

- **Module loss factor:** 25%
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 9

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 9 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area 46,390 sqft
- Total Conditioned Space 46,390 sqft
- Total Unconditioned Space 0 sqft
- Number of Stories 3
- Number of Space Types 2
- Number of Thermal Zones 7
- Type of Mechanical System Fan Coil
  - Baseline Electricity Use Intensity 11.1 kWh/sqft
  - Baseline Gas Use Intensity 0.06 therm/sqft
  - Baseline Annual Utility Cost $109,730 / year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiZDQyMzBhYzQtM2JjOS00ZDMyLTlhNGMtNzU1MTdmNTI4ZDRmiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmFwMDI2MjlsImMiOjZ9

Energy End-Use Breakdown

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario

Source: Tierra Resource Consultants
Savings Opportunities

Lighting Efficiency

- Annual utility cost reduction: $11,100
- Payback time: 0.6 years

HVAC Efficiency

- Annual utility cost reduction: $17,300
- Payback time: 1 year

On-Site Photovoltaic Array

- Annual utility cost reduction: $31,200
- Payback time: 10.5 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>44,180</td>
<td>95%</td>
</tr>
<tr>
<td>Office</td>
<td>Corridor</td>
<td>2,210</td>
<td>5%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Corridor</td>
<td>0.60</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

Lighting Measures

- Assign ASHRAE 90.1-2010 Daylighting Controls
Mechanical System

- **System type:** Fan Coil
- **Number of thermal zones:** 7
- **System configuration:** 2-3 thermal zones per floor, one fan coil per thermal zone, one air loop per floor
- **Cooling COP:** 2.93 for Baseline, 5.0 for efficient case
- **Heating Efficiency:** 82% for Baseline, 90% for efficient case
- **Heating System Capacity:** 544 kBtuh
- **Cooling System Capacity:** 48 tons

Hot Water System

- **System equipment and efficiency rating:** Gas water heater, 82% efficiency
- **Annual building water consumption:** 66,000 gal
- **Pump type and quantity:** 1 constant speed pump

Photovoltaic System Information

- **Annual electricity generated:** 282,238 kWh
- **System size:** 118 kW
- **Type of system:** Solar Carport
- **Available space for array:** 11,340 sqft
  - Total side lot area = 108,000 sqft
  - Assume 30% of this is covered in solar modules, with a 25% module loss factor.
  - PV production is divided between Project 8 and Project 9 based on building square footage
  - 35% of energy production is attributed to Project 9; with a total square footage of 11,340 sqft
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 10

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 10 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area: 45,300 sqft
- Total Conditioned Area: 45,300 sqft
- Total Unconditioned Area: 0 sqft
- Number of Stories: 2
- Number of Space Types: 4
- Number of Thermal Zones: 2
- Type of Mechanical System: Packaged Rooftop Units
  - Baseline Electricity Use Intensity: 8.53 kWh/sqft
  - Baseline Gas Use Intensity: 0.09 therm/sqft
  - Baseline Annual Utility Cost: $84,250/ year
Link to Power BI Dashboard

https://app.powerbi.com/view?r=eyJrIjoiYWJkYzA5ZTUtODdlZC00Y2RkLThlYzctNTlkZjE5NmEwYTdhIiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MjIiLCJpIjoiMjIzZTAyMDItZjE4OC00NjIwLTg2ZjctNDRiMDJjYzRmNjZiIn0=

Energy End-Use Breakdown

Annual Utility Cost by Scenario

Source: Tierra Resource Consultants
Savings Opportunities

*Lighting Efficiency*
- Annual utility cost reduction: $10,200
- Payback time: 1.4 years

*HVAC Efficiency*
- Annual utility cost reduction: $5,600
- Payback time: 25.4 years*

*Note: this is a retrofit building, so the cost of the HVAC upgrade is the full cost of a new system. For the RTU system installed at this property, the savings from an efficient unit over code are not that significant.*

*On-Site Photovoltaic Array*
- Annual utility cost reduction: $18,900
- Payback time: 8.4 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>10,640</td>
<td>23%</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1,608</td>
<td>4%</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>1,397</td>
<td>3%</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>30,044</td>
<td>66%</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>1,608</td>
<td>4%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1.20</td>
<td>0.81</td>
</tr>
<tr>
<td>Office</td>
<td>Lobby</td>
<td>0.95</td>
<td>0.65</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>0.60</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants
**Lighting Measures**
- Assign ASHRAE 90.1-2010 Daylighting Controls

**Mechanical System**
- **System type:** Packaged Rooftop Units
- **Number of thermal zones:** 2
- **System configuration:** One RTU assigned to each thermal zone, one thermal zone per floor
- **Heating equipment and efficiency rating:** Gas boiler
  - Efficiency 80% - Title 24 baseline scenario
  - Efficiency 90% - HVAC efficiency upgrade (EE L2 and above)
- **Cooling equipment and efficiency rating:** Electric DX cooling coil
  - EER 8.9 (COP 2.62) - Baseline (1980s vintage RTUs)
  - EER 12.5 (COP 3.66) - HVAC efficiency upgrade (EE L2 and above)
- **Heating System Capacity:** 1,520 kBtuh
- **Cooling System Capacity:** 65 tons

**Hot Water System**
- **System equipment and efficiency rating:** Gas boiler, 82% efficient
- **Annual building water consumption:** 66,700 gal
- **Pump type and quantity:** 1 constant speed pump

**Photovoltaic System Information**
- **Annual electricity generated:** 124,844 kWh
- **System size:** 52 kW
- **Type of system:** Rooftop
- **Available space for array:** 17,250
  - Assume 50% of rooftop is covered in PV (total rooftop area = 34,500 sqft)
  - Assume 25% module loss factor
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Project 11

Building Modeling Summary Document

Modeling Narrative and Scenario Definition

The energy consumption of Project 11 was evaluated using the building modeling software Energy Plus. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting and HVAC efficiency upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

- Total Building Area       62,000 sqft
- Total Conditioned Area   62,000 sqft
- Total Unconditioned Area 0 sqft
- Number of Stories         5
- Number of Space Types     7
- Number of Thermal Zones   16
- Type of Mechanical System VRF
  - Baseline Electricity Use Intensity 10.7 kWh/sqft
  - Baseline Gas Use Intensity 0.014 therm/sqft
  - Baseline Annual Utility Cost $132,320/ year
Link to Power BI Dashboard
https://app.powerbi.com/view?r=eyJrIjoiMTcxZGEzMjQtZWU5Yi00NzcyLWl0ZDUtYmQ3ZDZkZjI3NzO4IiwidCI6IjRkYWVjZGFiLTBiNTctNDBiZi1iMTMxLWJlOTZhMmEwMDI2MiIsImMiOjZ9

Energy End-Use Breakdown

Annual Utility Cost by Scenario

Savings Opportunities

*Lighting Efficiency*

- Annual utility cost reduction $11,700
- Payback time 2.2 years
**HVAC Efficiency**
- Annual utility cost reduction $15,200
- Payback time 4.8 years

**On-Site Photovoltaic Array**
- Annual utility cost reduction $33,300
- Payback time 8.6 years

### Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>1,879</td>
<td>6%</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>6,949</td>
<td>22%</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>3,061</td>
<td>10%</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>2,010</td>
<td>6%</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>39,687</td>
<td>31%</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>2,010</td>
<td>6%</td>
</tr>
<tr>
<td>Office</td>
<td>Storage</td>
<td>6,121</td>
<td>19%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

### Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Break Room</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Closed Office</td>
<td>1.00</td>
<td>0.68</td>
</tr>
<tr>
<td>Office</td>
<td>Conference</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Office</td>
<td>IT Room</td>
<td>0.55</td>
<td>0.37</td>
</tr>
<tr>
<td>Office</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Office</td>
<td>Restroom</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Office</td>
<td>Storage</td>
<td>0.60</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

Source: Tierra Resource Consultants

### Lighting Measures
- Assign ASHRAE 90.1-2010 Daylighting Controls
**Mechanical System**

- **System type:** VRF
- **Number of thermal zones:** 16
- **System configuration:** 3-4 thermal zones per floor, one VRF system terminal per thermal zone
- **Heating equipment and efficiency rating:** Electric heating coil
  - COP 3.3 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system
- **Cooling equipment and efficiency rating:** Electric cooling coil
  - COP 3.2 – Title 24 baseline
  - COP 5.0 – HVAC efficiency upgrade (EE L2 and above)
    - This rating represents an upgrade to a VRF with heat recovery system
- **Heating System Capacity:** 1,152 kBtuh
- **Cooling System Capacity:** 96 tons

**Hot Water System**

- **System equipment and efficiency rating:** Gas boiler, 82% efficient
- **Annual building water consumption:** 83,900 gal
- **Pump type and quantity:** 1 constant speed pump

**Photovoltaic System Information**

- **Annual electricity generated:** 21,500 kWh
- **System size:** 9 kW
- **Type of system:** Rooftop
- **Available space for array:** 8,850 sqft
  - Based on engineering drawings, there appears to be roughly 8,850 sqft of available roof area for solar (conservative estimate); 68% of the 13,000sqft roof.
  - Assume 25% module loss factor (51% of total rooftop area covered in functional PV cells)
- **Cell efficiency:** 18%
- **Inverter efficiency:** 98%
Background
The Energized Fresno analysis modelled the estimated energy consumption of the proposed project, and provide multiple advance energy improvements designed to:

- Significantly reduce building energy costs
- Utilities flexible technologies that can adapt to all future energy rates to ensure long term affordability
- Provided backup systems in case of utility outage to protect aging and at-risk populations
- Lower the environmental foot print of the building

Adopting the full spectrum of technologies proposed for the Project 12 property would make the project industry leading and bringing advance energy technology to affordable housing. With the ability to control energy costs over time, property managers can offer rents that include energy costs to further increase the affordability to tenants and deliver consistent financial performance regardless of increases in future energy costs.

Modeling Narrative and Scenario Definition
To calculate the baseline energy consumption of Project 12 was evaluated using a custom energy simulation in the Energy Plus modeling software. The simulations utilize concept drawing for Project 12, combined with technical specifications City View at Van Ness and calibrated to energy bills for sister properties currently operated by the Fresno Housing Authority. The building was evaluated for five different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting efficiency, HVAC efficiency upgrades of the previous scenarios.

Building Performance Snapshot

- Total Building Area          79,692 sqft
- Total Conditioned Area      59,674 sqft
- Total Unconditioned Area    20,017 sqft
- Number of Stories           5 incl. parking garage
- Number of Space Types       10
- Number of Thermal Zones     61
- Type of Mechanical System   VRF
- Baseline Electricity Use Intensity: 16.98 kWh/sqft
- Baseline Gas Use Intensity: 0.29 therm/sqft
- Baseline Annual Utility Cost: $245,100 / year

**Link to Power BI Dashboard**

https://app.powerbi.com/view?r=eyJrIjoiZjkzNDU2NDEtZTEzMS00OGVIeWlWYWYiXyAtOTA2NTg5M1FIMY2YxliwidCI6iLjRkYWVjZGFiLTBiMTctNDBiZi1iMTMxLWJlOTZdMmEwMDI2MyIsImMiOjZ9

**Energy End-Use Breakdown**

![Electricity Consumption by End-Use](image1)

- Interior Lighting
- Cooling
- Exterior Lighting
- Electric Heating
- Fans

![Gas Consumption by End-Use](image2)

- Water Systems
- Cooking Equipment

Source: Tierra Resource Consultants

**Annual Utility Cost by Scenario**

![Annual Utility Cost by Scenario](image3)

Source: Tierra Resource Consultants
Savings Opportunities

Lighting Efficiency
- Annual utility cost reduction: $12,400
- Payback time: 0.7 years

HVAC Efficiency
- Annual utility cost reduction: $19,100
- Payback time: 2.5 years

On-Site Photovoltaic Array and Storage
- Annual utility cost reduction: $110,100
- Payback time: 8.6 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midrise Apartment</td>
<td>Residential</td>
<td>47,590</td>
<td>60%</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Office</td>
<td>8,593</td>
<td>11%</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Retail</td>
<td>216</td>
<td>0.3%</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Kitchen</td>
<td>4,293</td>
<td>5%</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Parking</td>
<td>19,000</td>
<td>24%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midrise Apartment</td>
<td>Residential</td>
<td>0.60</td>
<td>0.41</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Office</td>
<td>0.80</td>
<td>0.54</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Retail</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Kitchen</td>
<td>1.20</td>
<td>0.82</td>
</tr>
<tr>
<td>Mixed-Use Commercial</td>
<td>Parking</td>
<td>0.14</td>
<td>0.14</td>
</tr>
</tbody>
</table>

*LPD = lighting power density averaged

The Title 24 LPD standards are based off of high performance linear fluorescent lights.

The efficient lighting case represents switching the lighting system to LEDs.

Source: Tierra Resource Consultants

25 Onsite solar and storage payback time varies depending on funding and financing opportunities taken.
Lighting Measures
- Assign ASHRAE 90.1-2010 Daylighting Controls

Mechanical System
The efficient HVAC case represents upgrading the VRF system to VRF with heat recovery.
- System type: VRF
- Number of thermal zones: 61
- System configuration: One thermal zone assigned per space type per floor
- Heating equipment and efficiency rating: Electric heating coil
  - COP 3.3 - Title 24 baseline
  - COP 4.0 - HVAC efficiency upgrade (EE L2 and above)
    - Note: This COP rating represents the upgrade to include heat recovery
- Cooling equipment and efficiency rating: Electric cooling coil
  - COP 3.2 - Title 24 baseline
  - COP 4.0 - HVAC efficiency upgrade (EE L2 and above)
    - Note: This COP rating represents the upgrade to include heat recovery
- Heating System Capacity: 84 tons
- Cooling System Capacity: 575 kBtuh

Hot Water System
- System equipment and efficiency rating: 2x Gas hot water heater, 95% efficient
- Annual building water consumption: 5,502,072 gal
- Pump type and quantity: 2x variable speed pump

Photovoltaic System Information
- Annual electricity generated: 714,816 kWh
- System size: 330 kW
- Type of system: Rooftop
- Available space for array: 21,545 sqft
- Percent of available space covered with functional PV cells: 100%
- **Cell efficiency**: 18%
- **Inverter efficiency**: 98%

Notes on Solar Design: Final solar potential will be based on the available roof space on the Blackstone and Simpson property. To maximize the potential the Energize Fresno team would like to coordinate with the architect to maximize the available roof space, including:

- Minimizing changes in roof elevation.
- Optimizing equipment placement maximized space for solar.
- Ensure structural reinforcement for added weight, if needed.
- Evaluate solar potential over exposed parking lots.

**Battery System Information**

The proposed battery system will be installed as a part of an energy management ecosystem, with all devices working together to deliver maximum savings and reliability. The ecosystem of devices will work coordination to manage building loads, maximize energy savings and provide mobile app control to each tenant, these systems include:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Number of Units</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Panels</td>
<td>330 kW</td>
<td>Generates power for building and charges batteries</td>
</tr>
<tr>
<td>Princeton Power PEM-30</td>
<td>30 Units (In garage/outside)</td>
<td>Energy storage for bill savings optimization and backup power</td>
</tr>
<tr>
<td>Rainforest Eagle Gateway</td>
<td>50 Units (Near each panel)</td>
<td>Collects all energy data and sends to cloud</td>
</tr>
<tr>
<td>Emerson Sensi</td>
<td>50 Units (1 per HVAC Unit)</td>
<td>Connected thermostat controls</td>
</tr>
<tr>
<td>Secure Wi-Fi Network</td>
<td>1 Unit (commercial scale)</td>
<td>Allowing devices to securely stay connected to the cloud</td>
</tr>
<tr>
<td>Customer Mobile App</td>
<td>Each tenant</td>
<td>Controls thermostat and receives notifications from property managers</td>
</tr>
<tr>
<td>Dash Board</td>
<td>Up to 20 developer/owner logins</td>
<td>Assists owners in managing building energy usage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
Controls and Operation

The system is self-optimizing to ensure maximum performance. The vendor, Sunverge, will provide continuous system manage and on-going maintenance to offer a hassle-free experience over the life of the system.

Tenants will be offered an enhanced mobile app experience. With the app, tenants can control their thermostats and receive notifications when it is time to change the air filter or to provide seasonal tips. The thermostats will also be self-optimizing, while still giving control of the comfort set-point to the tenant.

Lastly, the property management team will be given an online energy management dashboard, which will allow the user to:

- Track energy usage at the building or unit level
- Track real-time and historical solar production
- Track real-time battery performance
- Receive notifications from the vendor

Monitor overall system performance and health.
Modeling Narrative and Scenario Definition

The energy consumption of the development at Project 13 was evaluated using the building modeling software Energy Plus. The building was evaluated for six different scenarios, as defined in the table below. The scenarios are cumulative; such that the Distributed Generation scenario contains the lighting efficiency, HVAC efficiency and shading upgrades of the previous scenarios.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Baseline to meet Title 24 code</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Shading</td>
<td>+ Shading surfaces on S, E, W, windows</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop or side lot PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ On-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

This document is intended to provide a brief overview of the building profile, and summarize the results. More detailed results are published to a Power BI dashboard on the web, and the building modeling specifications are collected in an excel spreadsheet. More detailed results can be pulled from the models on request.

Building Performance Snapshot

Modeling Approach:

The development for Project 13 was modeled based on two prototypical buildings. Prototype A is a 3-story mixed-use commercial building with ground-floor retail and office space above. Prototype B is a 4-story mixed-use commercial building with ground-floor retail and multifamily residential units above. A complete building model was constructed for these two prototypes, and energy analysis for the entire development was calculated by scaling the prototype results.

Prototype A:

- Total Building Area: 41,985 sqft
- Number of Stories: 3
- Number of Space Types: 7
- Number of Thermal Zones: 5
• Type of HVAC Mechanical System  
  - VRF
  o Baseline Electricity Use Intensity 10.90 kWh/sqft
  o Baseline Gas Use Intensity 0.05 therm/sqft
  o Baseline Annual Utility Cost $92,910 /year

Prototype B:
• Total Building Area 81,000 sqft
• Number of Stories 4
• Number of Space Types 4
• Number of Thermal Zones 10
• Type of HVAC Mechanical System  
  - VRF
  o Baseline Electricity Use Intensity 12.84 kWh/sqft
  o Baseline Gas Use Intensity 0.08 therm/sqft
  o Baseline Annual Utility Cost $209,650 /year

Total Development Area:
  - Total Building Area 203,000 sqft
  o Baseline Electricity Use Intensity 12.67 kWh/sqft
  o Baseline Gas Use Intensity 0.08 therm/sqft
  o Baseline Annual Utility Cost $519,360 /year

Link to Power BI Dashboards
Prototype A (Retail and Office):
https://app.powerbi.com/view?r=eyJrIjoiZjI5M2ViNDUtMDIwMS00MTRhLWEzMDYtMzgxMGlyNDE3N2RkYjIwIiwidCI6IjRkYWVjZGIzLTMwMDI2MiIsImMiOjZ9

Prototype B (Retail and Residential):
https://app.powerbi.com/view?r=eyJrIjoiY2I5ZjI5M2ViNDUtMDIwMS00MTRhLWEzMDYtMzgxMGlyNDE3N2RkYjIwIiwidCI6IjRkYWVjZGIzLTMwMDI2MiIsImMiOjZ9

Total Development (Scaled from Prototypes A and B):
https://app.powerbi.com/view?r=eyJrIjoiY2I5ZjI5M2ViNDUtMDIwMS00MTRhLWEzMDYtMzgxMGlyNDE3N2RkYjIwIiwidCI6IjRkYWVjZGIzLTMwMDI2MiIsImMiOjZ9
Energy End-Use Breakdown (Total Development)

Electricity Consumption by End-Use

- Interior Lighting
- Cooling
- Exterior Lighting
- Electric Heating
- Fans

Gas Consumption by End-Use

- Water Systems

Source: Tierra Resource Consultants

Annual Utility Cost by Scenario (Total Development)

Annual Utility Cost by Scenario

Baseline
EE L1
EE L2
Shading
Distributed Generation
Demand Management

Source: Tierra Resource Consultants

Savings Opportunities

Lighting Efficiency
- Annual utility cost reduction: $38,420
- Payback time: 0.7 years

HVAC Efficiency
- Annual utility cost reduction: $105,860
Payback time 3.6 years

On-Site Photovoltaic Array

- Annual utility cost reduction $180,240
- Payback time 4.5 years

Building Geometry and Space Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Area (sqft)</th>
<th>Percent of Building Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midrise Apartment</td>
<td>Apartment</td>
<td>128,500</td>
<td>63%</td>
</tr>
<tr>
<td>Retail</td>
<td>Retail</td>
<td>57,750</td>
<td>31%</td>
</tr>
<tr>
<td>Office Space</td>
<td>Open Office</td>
<td>11,260</td>
<td>6%</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Lighting

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Space Type</th>
<th>Title 24 LPD* (W/sqft)</th>
<th>Efficient Case LPD (W/sqft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midrise Apartment</td>
<td>Apartment</td>
<td>0.5</td>
<td>0.34</td>
</tr>
<tr>
<td>Retail</td>
<td>Retail</td>
<td>1.2</td>
<td>0.82</td>
</tr>
<tr>
<td>Office Space</td>
<td>Open Office</td>
<td>0.75</td>
<td>0.51</td>
</tr>
</tbody>
</table>

*LPD = lighting power density

The Title 24 LPD standards are based off of high performance linear fluorescent lights.
The efficient lighting case represents replacing the lighting system with LEDs. The 32% reduction is based off of market research for lighting efficiency upgrades.
Source: Tierra Resource Consultants

Lighting Measures

- Assign ASHRAE 90.1-2010 Daylighting Controls

Mechanical System

The baseline COP values are based off of Title 24 standards. The efficient case represents switching to a VRF with heat recovery system.

- **System type:** Variable Refrigerant Flow
- **Number of thermal zones:** 15
- **System configuration:** One thermal zone assigned per space type per floor
- **Heating equipment and efficiency rating:** Electric heating coil
• COP 3.3 – Title 24 baseline
• COP 5.0 – HVAC efficiency upgrade (EE L2 and above)

• Cooling equipment and efficiency rating: Electric cooling coil
  • COP 3.2 – Title 24 Baseline
  • COP 5.0 – HVAC efficiency upgrade (EE L2 and above)

Photovoltaic System Information

• Annual electricity generated: 1,635,408 kWh
• System size: 686 kW
• Type of system: Parking structure
• Total Area of Array: 69,700 sqft

  • The area available for the PV array was based on an estimate of the development
    parking area – approximately 4,100 lineal feet of stalls, with the assumption that
    each stall will be 17’ deep.
      ▪ If each parking stall is 9' wide, this is approximately 450 parking spaces
      ▪ The shading surface modeled in OpenStudio was 34’ x 2,050’; to
        represent a solar canopy spanning parking stalls 2 deep)
  • Assume a 25% module loss factor
  • The energy production of the entire PV array was evaluated for the whole
    development site.
  • The contribution of the PV array to each prototype building was distributed
    proportionately to the building area
    ▪ Prototype A = ~42,000 sqft, or ~20% of development area, so the energy
      and financial benefits of 20% (13,940 sqft as 34’x410’) of PV array were
      distributed to Prototype A
      • 321,669 kWh proportioned to prototype A
    ▪ Prototype B = ~81,000 sqft, or ~40% of development area, so the energy
      and financial benefits of 40% (27,880 sqft as 34’x820’) of PV array were
      distributed to Prototype B
      • 648,516 kWh proportioned to prototype B

• Cell efficiency: 18%
• Inverter efficiency: 98%
APPENDIX B. ACTIVITY CENTER PROFILES

The current Activity Center projects in the Pipeline are:

- Fresno City College
- City of Fresno Municipal Operations

Each of the activity center projects were assessed for the standard AEC scenarios outlined in Error! Reference source not found. with considerations given to the diverse nature of the portfolio of facilities contained within each activity center.

Table 16. Activity Center Standard AEC Scenarios

<table>
<thead>
<tr>
<th>Efficiency Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Business-as-usual</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop, side lot, and/or carport PV array</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ Addition of on-site battery storage</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Overall, the activity center assessments found favorable results for all AEC initiatives and measures. The following subsections summarize the activity center project assessments while the quantitative results of these efforts are summarized by AEC scenario in Table 10. Pipeline Resource Savings Summary.

Fresno City College

Fresno City College (FCC) is a local community-college activity center comprised of 40 existing buildings, one proposed new construction math-science-engineering building and a parking solution for the campus. Given the diverse nature and varying timelines of ongoing projects at the campus, the project team engaged FCC staff and relevant stakeholders through two distinct project paths:

- FCC Existing Facilities
- FCC New Construction

The following subsections provide an overview of engineering activities performed to conceptualize the impacts of various AEC technology scenarios to renovate, improve, and expand the FCC campus and other activity centers to better serve the community now and well into the future.
FCC Existing Facilities

For the 40 existing facilities, the project team engaged with FCC campus staff to review documented baseline characteristics, improvements performed to date, and upcoming maintenance per the district 5-year maintenance plan. Based on discussions with campus staff it was determined that the existing facilities could be binned into the 9 building-type categories summarized in Table 17.

<table>
<thead>
<tr>
<th>FCC Building Type</th>
<th>Count of Buildings in Sample</th>
<th>Total Gross Floor Space (SQFT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>13</td>
<td>336,498</td>
</tr>
<tr>
<td>Assembly</td>
<td>8</td>
<td>188,808</td>
</tr>
<tr>
<td>Shop</td>
<td>4</td>
<td>73,595</td>
</tr>
<tr>
<td>Mixed-Use</td>
<td>1</td>
<td>66,485</td>
</tr>
<tr>
<td>Office</td>
<td>4</td>
<td>47,045</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>4</td>
<td>25,464</td>
</tr>
<tr>
<td>Restroom</td>
<td>4</td>
<td>4,449</td>
</tr>
<tr>
<td>Relocatable Classroom</td>
<td>1</td>
<td>960</td>
</tr>
<tr>
<td>Utility</td>
<td>1</td>
<td>725</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>744,029</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Of the 9 building-type categories, the top 5 representing 96% of the total gross floor space and 30 of the 40 total existing facilities were chosen to have prototypical models developed to assess campus energy use and demand. The prototypical models were developed in the OpenStudio/EnergyPlus software platform based on space-type, major equipment, and construction characteristics obtained via interviews with FCC staff and on-site walkthroughs of sample-representative buildings. Figure 38. Prototypical FCC Existing Office Building demonstrates a prototypical office building developed for use in the FCC existing facilities assessment.
Figure 38. Prototypical FCC Existing Office Building

FCC existing facilities are currently master metered with no provisions for campus sub-metering (electrical or thermal-flow metering) although the campus has planned to actively invest in energy management system (EMS) upgrades to allow for finer tracking and control. As the campus is both diverse in load profiles and metered under the PG&E E-20P TOU rate which accounts for both total and time-dependent energy use (demand) it is insightful for the purposes of forecasting facility improvements to understand the time-dependent individual building contributions to the metered load. Therefore, the approach taken to arrive at the aggregate campus baseline prototype was to first weight each individual prototype contribution by total gross floor space then scale energy consumption and demand to prior year PG&E utility bills. The standard AEC technology scenarios presented in Table 16 were then assessed and the resulting AEC scenario dispositions are summarized in Table 18 below.

Table 18. FCC Existing Facilities AEC Scenario Dispositions

<table>
<thead>
<tr>
<th>Efficiency Scenario</th>
<th>Description</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Business-as-usual</td>
<td>Existing conditions.</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
<td>Forecasted potential represents remaining LED implementation planned to be covered via Proposition 39.</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
<td>Recommend improvements to central plant serving existing facilities including conversion of remaining centrifugal chillers to Turbocor magnetic bearing units and cooling tower upgrades to reduce energy costs and significantly reduce peak demand.</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop, side lot, and/or carport PV array</td>
<td>Forecasted potential represents an ongoing PPA arrangement to install 2400kW campus-wide solar by December 31, 2017.</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ Addition of on-site battery storage</td>
<td>Recommend installing 420 kW / 680 kWh on-site battery storage for real-time demand management.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
The assessment for FCC existing facilities found two primary AEC scenario initiatives not already undertaken by the campus as: (1) HVAC upgrades to the central plant which would largely affect campus-wide load and demand, and (2) 420 kW/620 kWh of on-site battery storage targeted to shave peak demand thereby reducing campus load on the grid.

**FCC New Construction**

FCC New Construction facilities are currently in the architectural feasibility study (pre-design) phase of the project and are conceptualized to be the following 2 additions to the campus:

- 75,000 SQFT Math/Science/Engineering Building
- 1,200 Space Parking Solution

Due to the early phase of development for these projects, at current there have been no concept designs created for the new construction facilities. To simulate the conceptual facilities the team developed custom prototypes based on US Department of Energy prototypical new construction building models, local ordinances, and 2016 Title 24 Codes and Standards. The team then assessed the standard AEC scenarios in Table 16 for the two new construction facilities under the proposed PG&E A-10 TOU rate which accounts for both total and time-dependent energy use (demand). The resulting AEC scenario dispositions are summarized in Table 19 below.

<table>
<thead>
<tr>
<th>Efficiency Scenario</th>
<th>Description</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Business-as-usual</td>
<td>Existing conditions.</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
<td>Reduced lighting power density, controls, and LED upgrades above T24.</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
<td>Add heat recovery and increase HVAC efficiency above T24.</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop, side lot, and/or carport PV array</td>
<td>Add rooftop PV array to new Math/Science/Engineering building.</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ Addition of on-site battery storage</td>
<td>Add on-site battery storage for demand management.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
Given the conceptual state of the projects, the team also examined the three additional scenarios presented in Table 20 to provide campus staff and stakeholders an overview of possible parking solution arrangements paired with renewable generation opportunities and their associated costs.

### Table 20. FCC New Construction Additional Scenario Dispositions

<table>
<thead>
<tr>
<th>Additional Scenarios</th>
<th>Description</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solar Ground Mount ZNE</strong></td>
<td>+ Side Lot PV array</td>
<td>Add side lot PV array to meet ZNE for new Math/Science/Engineering building.</td>
</tr>
<tr>
<td><strong>Solar Parking Garage</strong></td>
<td>+ Rooftop PV array</td>
<td>Add rooftop PV array to parking garage.</td>
</tr>
<tr>
<td><strong>Solar Parking Lot Carport</strong></td>
<td>+ Carport PV array</td>
<td>Add carport PV array to open parking lot.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Given the early and conceptual nature of these projects most design elements have yet to be determined. The project team is hopeful that these early conceptual views of various AEC scenarios and costs reviewed with FCC staff and stakeholders may serve as a template for informing decisions in the near future on adopting market-ready efficiency, renewable generation, and demand management technologies and strategies.

**City of Fresno Municipal Operations**

The project team engaged with the City of Fresno (COF) director of facilities to identify 31 facilities and 189 vacant lots existing within the downtown Energize Fresno opportunity zone. Figure 39 provides an aerial overview of the downtown municipal locations considered for these projects.
Of the 31 COF facilities examined, 22 were considered for actionable projects on the basis of being both city owned and operated thereby falling within the purview of the COF director of facilities to implement the proposed upgrades. For the 22 municipal facilities considered, the project team then assembled the prior year of available PG&E billing data to determine the baseline aggregate energy consumption, energy demand, and blend of PG&E rate structures to be used for the AEC scenario assessment. Table 21 provides an overview of typical COF Municipal Facility typical PG&E tariffs:
Once the baseline consumption by facility type were established the team then developed custom prototypical existing construction building models based on US Department of Energy prototypes to represent the load diversity for COF facilities. These prototypes were then scaled based on the PG&E billing data for the facilities to produce the baseline AEC scenario models. A summary of the COF facility types considered for this effort are summarized in Table 22.

Table 22. COF Sample Prototype Facilities

<table>
<thead>
<tr>
<th>COF Facility Type</th>
<th>Typical Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Facilities</td>
<td>Community Centers, Offices, Museums, City Hall</td>
</tr>
<tr>
<td>Police and Fire Department</td>
<td>Offices, Call Centers</td>
</tr>
<tr>
<td>Parks</td>
<td>Playgrounds, Green Space</td>
</tr>
<tr>
<td>City of Fresno Property &amp; Parking Lot</td>
<td>Parking Lots and Parking Garages</td>
</tr>
</tbody>
</table>

The team then assessed the standard AEC scenarios in Table 16 for the sampled COF facilities based on a review of all existing COF Business Energy Tune-Up (BETU) program building audit data and interviews with the COF director of facilities for remaining AEC potential at the individual facilities. The resulting AEC scenario dispositions are summarized in Table 23 below.
<table>
<thead>
<tr>
<th>Efficiency Scenario</th>
<th>Description</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Business-as-usual</td>
<td>Existing conditions.</td>
</tr>
<tr>
<td>EE L1</td>
<td>+ Lighting efficiency upgrade</td>
<td>Reduced lighting power density, controls, and LED upgrades above T24.</td>
</tr>
<tr>
<td>EE L2</td>
<td>+ HVAC efficiency upgrade</td>
<td>For units nearing end of useful life increase HVAC efficiency above T24.</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>+ Rooftop, side lot, and/or carport PV array</td>
<td>Addition of rooftop and carport PV arrays.</td>
</tr>
<tr>
<td>Demand Management</td>
<td>+ Addition of on-site battery storage</td>
<td>Add on-site battery storage for demand management for select facilities representing large (&gt;499kW) load.</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants

Based on the BETU program audit data and interviews with the COF director of facilities, it was found that large potential existed for lighting, distributed generation, and demand management technologies and initiatives. Additionally, the team performed a brownfield-sited solar assessment based on NREL's PVWatts calculator for the 189 vacant lots and found substantial ground-mount solar potential. The COF may perform future investigation to determine the economic feasibility of installing distributed generation resources at these sites with considerations given to location benefits of the installations.
APPENDIX C. PROGRAM DESCRIPTIONS

HETU Program Enhancements

Overview of Program Tactics

There are four primary elements to the proposed HETU program enhancements, each building on the other to provide a comprehensive engagement across the entire opportunity zone. The programs target additional offerings and services to specific populations and building types. Each of the four program elements are described below:

- **Energy Management App** – Customer's will be offered an online/mobile application linked to their green button data from PG&E. The app will help customers better manage their energy costs, generate behavioral savings and serve as the data backbone for customer targeting, program enrollment, performance tracking, and EM&V data collection. The App will be implemented with event based customer prompts, as a part of a demand response effort. App functions will also be offered as a paper mailer for customers without home internet access.

- **Direct Install Smart Thermostat** – Utilizing the energy management app, the program will target customers living in a single-family or low-rise multi-family homes with central HVAC. Participating customers will receive a professionally installed smart thermostat. The thermostat will be programmed to help the customer optimize to PG&E TOU rates. In addition, customer receiving the thermostat will also be offered “points” for participating in demand response events, that are redeemable for awards.

- **Low Income Weatherization Direct Install** – Income qualified customers with sufficient HVAC load in the target areas can receive duct sealing, air sealing, attic insulation and a smart thermostat at no cost to the customer. The initiative will take a neighborhood recruitment approach, to identify several homes within a couple blocks of each other. The proximity and timing of the installations allows for a more cost-effective installation process. In coordination with PG&E, all projects will be enrolled in a pay-for-performance mechanism, further buying down the project costs. The result will improve the thermal performance of the homes and further enable load shifting for peak demand reductions.

- **HETU Technical Coordination** – Implementation of the initiative will be implemented via the HETU implementation team to reduce market confusion and ensure alignment with other PG&E efforts. The scope of HETU engagement will be increased within the

---

26 Demand response events are implemented as a part of the PG&E's Demand Response Action Mechanism (DRAMS), see the implementation and marketing plan in Appendix C for more detail.

27 All thermostats used by the program will be Open ADR compliant and enrolled in PG&E's Smart Thermostat program.

28 The EF team will utilize the PG&E DRAM's mechanism or other offering.

29 Authorized on Assembly Bill (AB) 802, all retrofits will be a part of the PG&E pay-for-performance incentives available at time of project install.
project area, to assist in marketing and customer service of the Energize Fresno project and coordinate other local offerings/programs available (ex. LIHEAP).

The program initiatives are designed to achieve a community energy resource that can not only create a focused energy efficiency impact, but also aggregates connected devices for demand response purposes. The project will demonstrate the value of these resources when implemented at a community level. If successful, the approach can be utilized as a part of neighborhood revitalization efforts to target restrained feeders and/or supplement Community Solar initiatives to create a more flexible load able to respond to the needs of the grid.

Target Market and Eligibility
The goal of the HETU program enhancements is to target hard to reach single family and multifamily populations as a part of the advanced energy community design. The program enhancements being offered as a part of the Energize Fresno initiative will have tiered eligibility based on the program elements.

Marketing and Outreach Strategy
The marketing and outreach strategy for the HETU program enhancements entails three main components, all aimed at overcoming market barriers and driving high density adoption of program offerings at the neighborhood level. Within the Energy Opportunity Zones, renters make up between 60% and 85% of the residential customers in the area. As such, the following marketing strategies will seek to reach home owners, tenants and landlords:

- **City of Fresno Neighborhood Revitalization Program Partnership** – The City of Fresno is launching a new initiative called the Rental Housing Inspection Program, implemented by the Neighborhood Revitalizations Department. The aim of the effort is to improve the quality of rental housing in Fresno through a comprehensive landlord engagement and property inspection initiative. In many of the communities within the opportunity zone, over 80% of customers are renters. Energize Fresno will coordinate efforts directly with this initiative to help pre-qualify rental units throughout the energy opportunity zones.

- **Community Organizing/Outreach** – The marketing team will target neighborhoods within the opportunity zones and work with community groups, churches, and schools to conduct event based marketing and outreach.

- **Public/Private Partnerships** – The Energize Fresno project team maintains public and private partnerships throughout the community, including: Fresno Metro Ministries, local neighborhood associations, private contractors and local businesses.

- **Direct Marketing** – In coordination with the local HETU efforts, the Energize Fresno project will seek to complete direct marketing to customers inside the opportunity zones.

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30 Based on U.S. Census Data for Fresno Census Tracks 6 and 35.
Once a customer is enrolled in the Energy Management App, Energize Fresno will seek to extend the Direct Install offers when a customer’s eligibility can be verified by the Energy Management App.

Implementation Plan

The City of Fresno will implement the program enhancements, with assistance from the Energize Fresno partners, as a part of the HETU program implementation. The City and its partners will be responsible for all marketing, outreach, and technical assistance for the program enhancements and will manage vendor contracts for the Energy Management App, Direct Install Thermostat, and Direct Install Weatherization.

The Energy Management App and Direct Install thermostats will all be procured, implemented, and managed through a single vendor. The approach will allow for centralized data collection and controls across the entire participant group. In addition, the vendor will seek to utilize the PG&E DRAMs mechanism as a means of extracting demand response benefit from the network of participant homes.

The Energy Management App will utilize the PG&E’s data portals to pull in each participant’s smart meter data. Utilizing this data, participants will receive customized recommendations on ways to save energy and money. Customers on a TOU rate will receive recommendations on ways to shift load and lower on-peak energy costs. If a customer does not have access to internet at home, the customer can receive a monthly progress report via the mail. This report will be made available in both English and Spanish. Enrollment in the Energy Management App is prerequisite for participation in any other program element.

Direct install smart thermostats will be offered directly through the Energy Management App for customers who meet the program eligibility requirements. The vendor will subcontract with local HVAC installers to provide a professional installation of the thermostat. Once installed the contractor will provide the customer with an orientation on the device and enroll them in the PG&E Smart thermostat program. Due to the potential for load shifting, customers will be encouraged to move to a TOU rate, if not already on one.

Customers eligible to participate in the Direct Install Weatherization will be qualified by the City of Fresno HETU team. The installation itself will be implemented in partnership with Johns Manville. Johns Manville will utilize a local contracting network to install comprehensive air sealing, duct sealing, and installation of attic insulation. The combination of new products and a neighborhood enrollment approach will facilitate a more cost-effective installation. As a part of this engagement, the HETU team will assist the customer participation in other program as services not covered as a part of the Energize Fresno scope.

Finally, all data collected by the Energy Management App and connected thermostat will be utilized as a part of a comprehensive evaluation plan, as defined in Section 7 of this document.

The goal is to reach 5000 residential customers with the Energy Management App, 2000 of which will receive direct install thermostats and 275 of which will receive direct install weatherization. The overall budget estimate for HETU enhancement efforts is estimated to be
$2,007,500. Estimated resource savings are presented in Section 6 of the proposal, Pipeline Roll-up and Resource Savings Summary.

Total estimated savings and budget for the HETU program enhancement are provided in Table 24:

Table 24. HETU Savings and Budget

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HETU Program Enhancement Budget</td>
<td>$2,007,500</td>
</tr>
<tr>
<td>Units Served (App)</td>
<td>5000</td>
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<tr>
<td>Units Served (DI-T)</td>
<td>2000</td>
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<td>Units Served (DIW)</td>
<td>275</td>
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<tr>
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<tr>
<td>Total Annual Saving DI-T (kWh)</td>
<td>677,370</td>
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<tr>
<td>Total Annual Saving DIW (kWh)</td>
<td>402,932</td>
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<td>Total Annual Savings Per Target Area (kWh)</td>
<td>2,875,979</td>
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<td>Total Annual Saving App (therms)</td>
<td>254,200</td>
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<tr>
<td>Total Annual Saving DI-T (therms)</td>
<td>32,300</td>
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<td>Total Annual Saving DIW (therms)</td>
<td>8,050</td>
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<td>Total Annual Savings Per Target Area (therms)</td>
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<td>Annual On-Peak Demand (kW) Potential (App)</td>
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<td>Annual On-Peak Demand (kW) Potential (DI-T)</td>
<td>1,700</td>
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<td>Annual On-Peak Demand (kW) Potential (DIW)</td>
<td>230</td>
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<tr>
<td>Total Annual Savings Per Target Area (kW)</td>
<td>3,180</td>
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<td>Annual Bill Impact (App)</td>
<td>$553,873</td>
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<td>Annual Bill Impact (DI-T)</td>
<td>$131,744</td>
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<td>Annual Bill Impact (DIW)</td>
<td>$64,816</td>
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<tr>
<td>Total Annual Bill Impact</td>
<td>$750,433</td>
</tr>
</tbody>
</table>

Source: Tierra Resource Consultants
BETU Program Enhancements

Overview of Program Tactics
The BETU program enhancement seeks to leverage a community energy management approach, the technology and management of which are typically only reserved for large corporations or campuses. Focusing on the cultural and economic heart of the community, the BETU program enhancements seek to reach restaurants, retail stores and offices in the small business sector. Mirroring the HETU effort and building off the Energize Fresno project efforts, the BETU program enhancements support the adoption of connected devices through direct install, while providing supplemental technical support beyond the current BETU program scope. There are three primary elements to the proposed BETU program enhancements designed to provide comprehensive impacts across the entire opportunity zone, each of which are described below:

- **Enhanced BETU Technical Coordination** – Implementation of the initiative will be delivered via the BETU implementation team to reduce market confusion and ensure alignment with other PG&E efforts. Under Energize Fresno, the scope of BETU engagement will be increased to include assisting businesses in capturing the full range of AEC technologies opportunities available to them. This engagement will incorporate the tools, methods, and funding platform developed for the Energize Fresno projects during phase 1 of the project. Lastly, the BETU site evaluation for businesses inside the opportunity zone will include scoping for the direct install effort.

- **Direct Install Energy Management Systems** – Working with innovative vendors specializing in the restaurant and retail solutions. Energize Fresno will offer the direct install of an energy management system, with a 3-year energy management services plan at little or no cost to the customer. Business owners will experience energy bill savings from the lighting, HVAC, and refrigeration controls. Supported by the energy management services, business owners will remain engaged with Energize Fresno over time, to drive long-term energy savings and interject financing and incentive opportunity at point of equipment replacement. Figure 40 provides an example of the energy management dashboard for small restaurants currently under evaluation by eh Energy Fresno team.
Community Demand Response -- Through the Direct Install effort, the Energize Fresno project will seek to install 150 energy management systems throughout the opportunity zone. Utilizing the DRAMs mechanism, or an alternative available at the time of installation, businesses will be offered incentives to participate in demand response events.

The program initiatives are designed to achieve a community energy management capacity that not only focuses on energy efficiency impacts, but also aggregates connected devices for demand response purposes. The project will demonstrate the value of these resources when implemented at a community level. If successful, the approach can be utilized as a part of neighborhood revitalization efforts to target restrained feeders and/or supplement Community Solar initiatives to create a more flexible load able to respond to needs of the grid.

Target Market and Eligibility
The BETU enhancements will focus on small businesses throughout the opportunity zone, with an emphasis on restaurants, retail and office buildings. The effort will focus on the Blackstone business corridor and the Tower District. In the Tower district, the Energize Fresno Team will collaborate with the “Power the Tower” initiative, which is a partnership between California State University Fresno, Central Valley Energy Tune-up and the Environment Defense Fund (EDF).
Implementation Plan

The City of Fresno will implement the program enhancements, with assistance from the Energize Fresno team, as a part of the BETU program implementation. The team will be responsible for all marketing, outreach, and technical assistance for these program enhancements and will manage vendor contracts for the Energy Management System vendor and associated installation and services contracts.

Participating businesses will still be required to complete a BETU assessment to confirm eligibility and develop a scope of work for the direct install contractor. At this point the BETU program will offer enhanced technical assistance, utilizing the Energize Fresno funding platform and engineering tools to assess additional opportunities available to the business.

The Direct Install Energy Management Systems opportunity will offer businesses the following features:

- On-site energy monitoring for real time performance feedback
- Lighting controls for automated scheduling and light harvesting.
- Connected thermostats and remote temperature sensors.
- (For Restaurants Only) Refrigeration controls for walk-in units and food temperature sensors.
- Mobile App
- 3-year energy management service, including:
  - Weekly check-in for the vendor's certified energy management team to ensure optimal calibration of all systems for both energy savings and customer satisfaction.
  - Operational reports to inform system maintenance cycles.
  - Trouble shooting and technical assistance.
  - System failure intervention to refer the business back to BETU representative at the point of appliance failure, to ensure that the replacement system is as efficient as possible.
  - Associated EE devices, such as LED lighting, needed as a part of the Energy Management System.

The Energy Management Systems will all be procured, implemented, and managed through a single vendor. The approach will allow for centralized data collection and controls across the entire participant group. Finally, all data collected by the Energy Management System will be utilized as a part of a comprehensive evaluation plan, as defined in section 7 of this document.
Marketing and Outreach Strategy

The marketing and outreach strategy for the BETU program enhancements entails three main components, all aimed at overcoming market barriers and driving high density adoption of program offerings at the neighborhood business level. Much like HETU, many of the businesses are operating under rental agreements and will require landlord authorization. In recognition of this challenge, the following marketing strategies will seek to reach business throughout the opportunity zone.

- **Environmental Defense Fund (EDF) Collaboration** -- As a part of the Power the Tower effort, EDF has cultivate a collaboration of businesses throughout the Tower district, all interested in pursuing energy savings opportunities. Working in close collaboration with EDF, the Energize Fresno team will be able to reach many of the businesses within that district.

- **Community Organizing/Outreach** -- Lead by Fresno Metro Ministries and in coordination with Better Blackstone, the marketing team will target small business groups and revitalization projects along the Blackstone corridor to conduct event based marketing and outreach.

- **Direct Marketing** -- In coordination with the local BETU efforts and PG&E small business outreach, the Energize Fresno project will seek to complete direct marketing to customers inside the opportunity zones.

The goal is to reach 150 business customers with the Energy Management Direct Install offering.

Total estimated savings and budget for the BETU program enhancement are provided in Table 25.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HETU Program Enhancement Budget</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>Total Business Served</td>
<td>150</td>
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<tr>
<td>Annual EMS Saving Lighting (kWh)</td>
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<td>Annual EMS Saving HVAC (kWh)</td>
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<td>Annual EMS Saving Refrigeration (kWh)</td>
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<td><strong>Total Annual EMS Saving (kWh)</strong></td>
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<tr>
<td>Annual EMS Saving Lighting (Therms)</td>
<td>-</td>
</tr>
<tr>
<td>Annual EMS Saving HVAC (Therms)</td>
<td>2,408</td>
</tr>
<tr>
<td>Annual EMS Saving Refrigeration (Therms)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total Annual EMS Saving (Therms)</strong></td>
<td>2,408</td>
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<tr>
<td>Total Annual on Peak Demand Savings (kW)</td>
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<td>Annual Bill Impact EMS Lighting</td>
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<td><strong>Total Annual EMS Bill Impact</strong></td>
<td>$108,562</td>
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</table>

Source: Tierra Resource Consultants
APPENDIX D. PIPELINE PROJECT FILTERS

Energize Fresno Phase I Pre-Filter

Energize Fresno is a partnership between the Local Government Commission, the City of Fresno, Fresno Metro Ministry, CALSTART, and Tierra Resource Consultants, funded by the California Energy Commission to accelerate the deployment of Advanced Energy Communities. In support of this effort, we are seeking to identify potential projects that are candidates for development under the program. In order to streamline identification of projects with strong potential, we have created a “pre-filter” tool to quickly and easily assess projects at a high level.

The pre-filter is utilized as projects are found and is conducted in two phases. This document represents the first phase of that filtering process and is meant to be used for any project that anyone wants us to consider. This “Phase 1 Pre-Filter” is a tool to highlight very broad characteristics of potential projects prior to passing them to the project team for detailed analysis, and ultimately consideration for development through the Energize Fresno program.

Phase I Pre-Filter

The Phase I Pre-Filter is a high-level rapid assessment tool for identifying elements of a given project that suggest it warrants further consideration, or should instead be set aside. This is not meant to be a totally inclusive quantitative methodology, but will rather provide a less subjective evaluation. Projects are evaluated on the merits listed below.

The pre-filter is separated into two main categories: 1.) Critical Path and 2.) Semi-Critical Path and Added Benefits/Support. The first section must earn a passing grade in order to continue on to the second section.

We want to hear from you

As invested community members, we want your input and suggestions to help make Energize Fresno a success.

Please use the Phase I Pre-Filter to suggest projects, initiatives, partner organizations, and geographic areas that you think align with the Energize Fresno model and meet the basic project criteria below.

If you have comments, questions, or suggestions, please contact the Energize Fresno team or visit the Energize Fresno website: www.lgc.org/energize-fresno.

Neil Matouka  
Project Manager, LGC  
nmatouka@lgc.org  
(916) 448-1198 x303

Keith Bergthold  
Executive Director, FMM  
keith@fresnometmin.org  
(559) 485-1416 x101
Project Title: ___________________________________________

Brief Project Description: ___________________________________________

Project Location: ___________________________________________

1. Anticipated build schedule:
   a. Earliest Potential Start
      i. ○ Early-Mid 2017 (1)
      ii. ○ Late 2017 (2)
      iii. ○ 2018 - 2019 (3)
      iv. ○ 2020-2022 (2)
      v. ○ 2023+ (1)
   b. Expected Duration
      i. ○ 0 - 2 years (3)
      ii. ○ 2 - 4 years (2)
      iii. ○ 4+ years (1)

2. Are there “Advanced Energy Community” components to this project?
   a. Grid reliability and resiliency [ ○ No | ○ Maybe | ○ Yes ]
   b. Energy savings [ ○ No | ○ Maybe | ○ Yes ]
   c. Renewable energy [ ○ No | ○ Maybe | ○ Yes ]
   d. Other ZNE or smart grid ______________ [ ○ No | ○ Maybe | ○ Yes ]

3. Are there non-energy resource savings opportunities for this project?
   a. Water [ ○ No | ○ Maybe | ○ Yes ]
   b. Waste [ ○ No | ○ Maybe | ○ Yes ]
   c. Air Quality [ ○ No | ○ Maybe | ○ Yes ]
   d. Transportation [ ○ No | ○ Maybe | ○ Yes ]
   e. Other __________________________ [ ○ No | ○ Maybe | ○ Yes ]

Must pass Questions 1 - 3 with a minimum cumulative score of 20 points.

4. Does the project have strong political momentum or backing from elected officials?
   a. ○ Yes (10)
   b. ○ No (0)
      If yes, briefly describe __________________________

31 Advanced Energy Community is a concept used by the California Energy Commission to denote communities that are employing technologies and strategies that improve grid reliability and resiliency, improve energy efficiency, and deploy renewable energy, smart grid, and zero net energy technologies.
5. Will the project be a keystone project (e.g. becomes an anchor around which other projects will develop)?
   a. Yes (10)
   b. No (0)
      If yes, briefly describe ___________________

6. Will the project be in one of the Energy Opportunity Zone Nodes?
   a. Yes (5)
      i. Blackstone/Shields
      ii. Blackstone/Weldon
      iii. Blackstone/Olive
      iv. High Speed Rail Station
      v. Fulton Street Corridor
      vi. South Stadium Area
   b. No (0)

7. Does the project align with key public policies or initiatives?
   Local
      [ No | Maybe | Yes ]
   State
      [ No | Maybe | Yes ]
      If Yes or Maybe, please describe ______________________

8. Are there strongly engaged/motivated community stakeholders?
   Community Groups
      [ No | Maybe | Yes ]
   Business Groups
      [ No | Maybe | Yes ]
      If Yes or Maybe, please describe ______________________

9. Are there community co-benefits?
   Local job creation potential
      [ No | Maybe | Yes ]
   Focus on disadvantaged neighborhoods
      [ No | Maybe | Yes ]
   Other ______________________
Phase 2 Pre-Filter

Energize Fresno is a partnership between the Local Government Commission, the City of Fresno, Fresno Metro Ministry, CALSTART, and Tierra Resource Consultants, funded by the California Energy Commission to accelerate the deployment of Advanced Energy Communities. In support of this effort, we are seeking to identify potential projects that are candidates for development under the program. In order to streamline identification of projects with strong potential, we have created a “pre-filter” tool to quickly and easily assess projects at a high level.

The pre-filter is utilized as projects are found and is conducted in two phases. This document represents the second phase of that filtering process and is meant to be used for any project that has successfully been through the Phase I Pre-Filter. This “Phase 2 Pre-Filter” is intended to allow team members to do further analysis (though still largely qualitative) of potential projects that emerge from the Phase I Pre-Filter, to get better resolution and clarity about their fit and viability for the full technical analysis.

Phase 2 Pre-Filter

The Phase 2 Pre-Filter is a tool for gathering more information about a given project that, based on the Phase I Pre-Filter, warrants further analysis. While the Phase I Pre-Filter was designed to be filled out with little input from the developer, the Phase 2 Pre-Filter requires either more detailed knowledge of the project, or a basic preliminary conversation with the project lead. This is not meant to be a totally inclusive quantitative methodology, but will rather provide a less subjective evaluation. Projects are evaluated on the merits listed below.

Project Title: ____________________________________________

Brief Project Description: ____________________________________________

__________________________________________

Project Location: ____________________________________________

Questions for Developer:

1. Type of Project
   a. □ New Construction
   b. □ Rehab
   c. □ Program

2. What is the timing for your Project build / implementation?

__________________________________________

STOP: If the timing is not suited to Energize Fresno (e.g. under construction in 2017), do not continue.
3. What is your interest and or ability to add additional (above what is planned already) AEC Features?
   - Achieving and maintaining zero net energy
   - Technologies supporting grid reliability and resiliency (e.g. energy storage)
   - Renewable energy generation
   - Energy efficiency upgrades
   - Water efficiency and reuse technologies

   a. None
   b. Low
   c. Med
   d. High

   If applicable, please make notes on level of interest
   ___________________________________________________________________
   ___________________________________________________________________

   **STOP: If there is no ability to layer in AEC features, do not continue. If there is interest and ability, proceed to ask about further details of the project.**

4. What is the current phase of build schedule?
   a. Pre-design/Ideation [10]
   b. Conceptual/schematic design [10]
   c. Design development [5]
   d. Construction documents [5]
   e. Bid solicitation [0]
   f. Under construction [0]

5. Do you have experience with projects that incorporate advanced energy efficiency and renewable energy technology?
   a. Yes [10]
   b. No [5]
   c. If yes - please briefly describe experience
      ___________________________________________________________________
      ___________________________________________________________________

6. How well does your project support disadvantaged communities?
   Rate 1-10: ______
   Please Describe: ___________________________________________________________________
   ___________________________________________________________________

7. How strongly does your project align with key public policies or initiatives?
a. Local [◯ Low | ☐ Med | ☐ High ]
b. State [◯ Low | ☐ Med | ☐ High ]
c. Describe known alignment with key public (local and state) policies or initiatives; outline how much of a factor this might be in the project’s success.

8. Do you have an internal champion or Point of Contact that will work with the Energize Fresno team to align the project with the design elements of an AEC?
   a. ☐ Yes
   b. ☐ No

Name, email, phone __________________________________________________________

Questions for Reviewer

9. To what extent would Energize Fresno funding opportunities likely encourage greater adoption of energy and resource management measures into the project? (Will this push you forward into deeper, broader savings than what you could do now?)

   Rate 1-10: _____

   • Financing
   • Grants and rebates
   • Tax incentives
   • Other

   Please briefly describe
   __________________________________________________________

10. How well does the project align with the following AEC objectives?

    Rate 1-10: _____

    a. Provides energy savings by achieving and maintaining zero net energy community status (accounting for behavior and increasing loads from vehicle and appliance electrification).
b. Supports grid reliability and resiliency by incorporating technologies such as energy storage.

c. Can be replicated and scaled-up to further drive down costs.

d. Provides affordable access to renewable energy generation, energy efficiency upgrades, and water efficiency and reuse technologies that reduce electricity consumption for all electric ratepayers within the community.

e. Makes use of smart-grid technologies throughout the community.

Notes:
APPENDIX E. MEMORANDUM OF UNDERSTANDING
TEMPLATE

Memorandum of Understanding (MOU)

[project name]

This Memorandum of Understanding (MOU, also referred to herein as the “Agreement”) for joint work efforts to achieve the shared vision and goals of an Advanced Energy Community (AEC) is entered into by, between, and among [project name] (“Project”), and the Energize Fresno Project (EF). This Agreement shall be effective as of the date of signing by all representatives of the named parties to the agreement (the “Effective Date”).

PARTIES TO THIS AGREEMENT

1. [Customer Site Representative], [project description here]

2. The Energize Fresno Project (EF) is a partnership between the Local Government Commission, the City of Fresno, Fresno Metro, CALSTART and Tierra Resource Consultants, LLC. Launched with $1.5M in grant funding from the California Energy Commission, Energize Fresno is developing a blueprint for an “Energy Opportunity Zone” along the Blackstone Corridor and in Downtown Fresno as part of an effort to accelerate the deployment of Advanced Energy Communities in California. The Energize Fresno project team is identifying projects and building partnerships that will deliver significant long term energy and water resource savings and attract more investment into the Fresno community. ([https://www.lgc.org/energize-fresno/](https://www.lgc.org/energize-fresno/)) The Local Government Commission, a 501c3 California nonprofit public benefit corporation, serves as fiscal and lead agency and representative for Energize Fresno for the purposes of this Agreement.

SCOPE OF JOINT WORK EFFORTS

This is cooperative effort to identify resource management opportunities at the Project that are aligned with AEC and EOZ goals. Attachment 1 provides additional detail on the work scope that may be performed by EF team members in partnership with Project staff for each AEC related strategy component, depending on what specific opportunities emerge from this engagement. Representatives from the Project will provide information as needed for the EF team to conduct all to all analysis which the Project and Energize Fresno team deem to be valid and worthy of consideration. At all stages of the Energize Fresno project, the EF team welcomes the opportunity to engage with any design professionals or contractors that the Project is engaged with such that information and insights can be shared for the betterment of all energy management initiatives that the Project may be considering.

TERM AND CANCELLATION

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This Agreement shall have a term of no more than one (1) year beginning on the Effective Date, subject to earlier termination by either party at any point in the engagement in accordance with section 6 below. Parties hereto may terminate this Agreement at any time for any reason or no reason by providing the other party thirty (30) calendar days’ advance written notice.

COMPENSATION

The activities to be conducted by the EF team as part of the execution of this MOU are for the purpose of developing a pipeline of project opportunities for the Energize Fresno Project, and will be conducted at no additional charge to the Project or its representatives.

COMPLIANCE WITH LAW

Project representatives and the Energize Fresno team agree to perform the activities outlined by the Agreement in a professional and a competent manner. Each party hereto agrees to abide by all applicable federal, state and local laws relative to the subject matter of this Agreement.

IN WITNESS WHEREOF, this agreement has been executed by the parties on the date and year written below.

Project Representative

BY: ___________________________ Date: ________________

[Project Representative Name Here]

BY: ___________________________ Date: ________________

Kate Meis, Executive Director Local Government Commission, as lead agency for the Energize Fresno Project
Attachment 1
Energize Fresno Work Plan

Analysis Process

The Energize Fresno analysis process involves three tiers of engagement with [project name] ("Project") designed to ensure that we accurately assess your project opportunities and fit for our respective needs and goals without placing undue burdens on you.

Tier 1 Work Plan

The first tier involves a preliminary analysis leading to a brief high level report summarizing opportunities and rough estimates of costs and potential savings for identified resource management solutions (energy and water efficiency, renewable energy, electrical demand management, etc.) that may be beneficial to the Project. This report will provide general guidance on opportunities and potential priorities. The report will also identify where subsequent analysis could be undertaken (by your design/contractor team or Energize Fresno if we move forward).

- **Project Identification.** The EF team will work with the Project representatives to conduct an assessment of AEC energy and water resource management opportunities at the Project such as:
  
  o Energy efficiency options in new and existing buildings and facilities.
  o Renewable energy generation opportunities including solar electric systems.
  o Low/no carbon transportation strategies including electric vehicle charging station infrastructure and the transition to electric vehicles.
  o Electric load management strategies for managing peak loads and costs including the potential for energy storage systems.
  o Water efficiency measure opportunities and strategies.

**In order to identify and assess project opportunities, the EF team will work with Project representatives to identify and prioritize strong AEC project opportunities. The assessment will entail the following steps:**

1. Review current or planned energy and water usage and patterns.
2. Review existing facility condition reports, prior energy assessments and energy audits, project development plans, and other documentation from the perspective of building and transportation energy and water resource utilization.
3. Conduct an energy use baseline study and benchmarking analysis of selected existing or planned facilities.
4. Conduct new energy audit investigations of facilities relevant to the Project as needed, including an assessment of new construction options.
5. Use the Energize Fresno Project Analysis Tool to profile resource management opportunities including quantifying building and transportation energy and water resource savings, on-site solar electric generation potential, energy and water cost savings including peak demand cost savings, and GHG savings.
6. Prepare a summary report documenting the analysis and summarize potential AEC measures and opportunities.

- **Funding Development.** The EF team will work with Project representatives to identify opportunities to fund the implementation of the measures identified in the assessment. The nature of the funding development effort for tier 1 may include an assessment of the available rebates and first cost discounts, grant funding opportunities, market ready financing opportunities, code support, and other in-kind support mechanisms such as technical assistance and design support. The scope of tier one activities and the resources EF can commit will be further defined as more information on the project becomes available.

**Tier 2 Work Plan**

Depending on results of the first tier and interest in moving forward, the second tier involves a more detailed analysis, cost estimation, and measure specification. Results of this analysis will be shared as a summary report with additional detail about specific opportunities, costs, possible additional funding opportunities, and recommendations of the team.

1. **Detailed Project Analysis.** Additional analysis may be required for opportunities analyzed in tier 1 to further refine savings and cost estimates. For these projects, tier 2 will include additional analysis completed by the EF team, and may require additional data and time to be provided by the Projects team.

2. **Funding Development.** The EF team will work with Project representatives to identify opportunities, if any, for the application for cooperative and/or shared joint grants and mutual resource development to ensure progress to sustain AEC measure implementation efforts on the Project.

3. **Verification Plan.** The EF team will work with Project representatives to identify tools for verifying savings and documenting achievements of AEC measures that could be used in the event that projects move toward implementation.

**Tier 3 Work Plan**

Should a project be recommended for inclusion in the EF proposal to the Energy Commission, the EF team will work with the Project team to include the Project in the Fresno master community design. The Fresno master community design will place your project in a portfolio of other projects being developed by Energize Fresno. The master community design is intended to showcase various projects and the EF will engage the Project to confirm that data being shared about is accurate and appropriate to share with the general public. The EF team does not anticipate additional work on the part of the Project team to support the development of the master community design beyond a review of data to be shared, and any revisions necessary to the Energize Fresno Non-Disclosure Agreement.

Projects included in the master community design will additionally be included in an application to the Energy Commission for Phase 2 grant funding, and non-sensitive information pertaining to the projects may be included in public documents used to promote and disseminate the Energize Fresno platform.
Energize Fresno Non-Disclosure Agreement

Energize Fresno agrees to not disclose, either in whole or in part, to any entity external to Energize Fresno, or the [project name] (“Project”), any information or data provided to Energize Fresno under this Agreement, any information deemed sensitive by Project representatives without first obtaining the written permission of Project representatives. Sensitive information will be defined in writing during the course of this engagement, i.e., by the end date of the agreement. Energize Fresno shall provide immediate advance notification to Project representatives so that Project representatives can authorize such disclosure or have the opportunity to prevent such disclosure. This confidentiality agreement shall be effective for the life of the related project Agreement and for a period of two (2) years after completion of the Agreement.

BY: ___________________________ Date: ____________
[Project Representative Name Here]

BY: ___________________________ Date: ____________

Kate Meis, Executive Director Local Government Commission, as lead agency for the Energize Fresno Project
To: [project developer/owner/representative]  
From: [EF contact]  
Date: [Date]  
Re: Participation in the Energize Fresno Project  

Thank you for your interest in participating in the Energize Fresno project. By participating in this project, you will not only be able to better manage your energy costs, improve the competitive advantage and value of your property, and enjoy more satisfied tenants, but you will also help assure reliable and dependable energy and water resources for the San Joaquin Valley into the future. We believe that your project has the potential to help make Fresno a model of urban innovation, revitalization, and prosperity for California.

In order to get started we will need to gather some basic information on your project. We request that you complete the attached questionnaire and return it to [EF CONTACT] at your earliest convenience. Going forward, our team would like to work with you to assess energy and water efficiency, renewable energy, electrical demand management, and other resource management solutions that would be applicable to your project. Once we've had a chance to look the questionnaire over, we will be back in touch with you to discuss next steps.

Please be sure to contact [EF CONTACT] for any questions about Energize Fresno. Thank you for your prompt attention to this request. We look forward to working with you.
Energy Fresno
Project Initiation Questionnaire

1. Project name: ____________________________________________________________
2. Project location: _______________________________________________________
3. Project developer/owner: ________________________________________________
4. Total square footage of building(s) included in the project: ______________________ Sq. Ft.
5. What percentage of the total square footage of the building(s) is currently occupied? _____ %
6. What are the primary uses of the facility? (please specify in Table 1)

Table 1

<table>
<thead>
<tr>
<th>Type</th>
<th>% floor space</th>
<th>Type</th>
<th>% floor space</th>
</tr>
</thead>
<tbody>
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<td>Office</td>
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<td>0%</td>
</tr>
<tr>
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<td>0%</td>
<td>Condominium/Townhome</td>
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<tr>
<td>Restaurant</td>
<td>0%</td>
<td>Multi-family</td>
<td>0%</td>
</tr>
<tr>
<td>Lodging - Hotel</td>
<td>0%</td>
<td>Other Residential</td>
<td>0%</td>
</tr>
<tr>
<td>Lodging - Motel</td>
<td>0%</td>
<td>Manufacturing</td>
<td>0%</td>
</tr>
<tr>
<td>Primary Education</td>
<td>0%</td>
<td>Agricultural</td>
<td>0%</td>
</tr>
<tr>
<td>Secondary Education</td>
<td>0%</td>
<td>Other (please specify)</td>
<td>%</td>
</tr>
<tr>
<td>Grocery/Supermarket</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convenience Store</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health/Medical</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage/Warehouse</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supermarket</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Commercial</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. What type of project(s) are you considering, and what is the approximate size of the project? (please specify in Table 2)

Table 2

<table>
<thead>
<tr>
<th>Project Type and Size</th>
</tr>
</thead>
</table>
8. Have you updated the following systems in the last 10 years? Are you considering updating the following systems in the next 5 years? *(please fill out all that apply in Table 3)*

<table>
<thead>
<tr>
<th>Building System</th>
<th>Has the system been updated in the last 10 years?</th>
<th>Did the updates include energy or water efficiency improvements?</th>
<th>Are you considering updating the system in the next 5 years?</th>
<th>Do you plan to include energy or water efficiency improvements?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Space Cooling</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Ventilation and Air Distribution</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Energy management / controls</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Indoor Lighting</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Outdoor Lighting</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Water Heating</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Refrigeration Equipment</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Pumping</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Building Envelope</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Other (specify)</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Other (specify)</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Other (specify)</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
<td>Yes / No</td>
</tr>
</tbody>
</table>

9. Are you considering any of the following energy and water management measures for your facility? *(please fill out all that apply in Table 4)*

<table>
<thead>
<tr>
<th>System</th>
<th>Planning to Install</th>
<th>Considerin but have not acted</th>
<th>Have not considere</th>
<th>Not interested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar electric systems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric vehicle charging stations?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion to electric vehicles?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other transportation measures? (<em>specify</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backup generation system?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric storage batteries?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy management system?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water conservation measures?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (<em>specify</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. Are you considering LEED certification for the project? (*please check the appropriate response*)
   - Planning to Certify ________________
   - Considering but have not acted ________________
   - Have not considered ________________
   - Not interested ________________

11. Do you have any other ideas for improving the energy and resource efficiency of your facility? __

12. Will you allow Energize Fresno to access the facility to assess energy and water management opportunities?

   Yes / No

13. Will you authorize Energize Fresno to access the past 2 years of energy usage data from PG&E?

   Yes / No

14. Energize Fresno will need to talk to you or your staff several times throughout the process in order to gather additional information about your plans and vision for energy and water resource management at your facility. This may take a total of several hours over the course of our analysis, depending on the complexity of the project. Will you support this level of engagement?

   Yes / No
15. Do you have any documentation that would help us assess the energy or efficiency of your facility, such as energy audits, plans (e.g. conceptual or detailed architectural or mechanical plans), or other energy or water efficiency studies or proposals?

Yes / No

If yes, please list any documentation that you have.

__________________________________________

__________________________________________

__________________________________________

__________________________________________
APPENDIX G. SAMPLE MATCH FUNDING REPORT

Figure 41. AEC Funding Match Example Report

AEC Project Profile

<table>
<thead>
<tr>
<th>Q1: What is the name of this project</th>
<th>Blackstone - Simpson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2: In what area is the project located?</td>
<td>Within Fresno city limits</td>
</tr>
<tr>
<td>Q3: What is the address where the project will be built?</td>
<td>123345 123345</td>
</tr>
<tr>
<td>Q4: Project Owner Name</td>
<td>Fresno Housing Authority</td>
</tr>
<tr>
<td>Q5: Lead Developer Name</td>
<td>Michael Duarte</td>
</tr>
<tr>
<td>Q6: Do you have any of the following services on the project team?</td>
<td>Financing advisor, Grant writer, Tax advisor, Lead architect, Lead mechanical engineer</td>
</tr>
<tr>
<td>Q7: Is there anything else we should know about the project team? through FHA</td>
<td></td>
</tr>
<tr>
<td>Q8: What type of project is this? (select all that apply)</td>
<td>New construction, Existing building rehabilitation / retrofit</td>
</tr>
</tbody>
</table>

PAGE 2: New Construction Projects

| Q9: Is this a whole new building or a new addition to an existing building? | New addition to an existing building |
| Q10: What type of organizations are involved? | Type of organization developing?, Type of organization owning after development? |
| Government agency | |
| Other organization type | Type of organization owning after development? |
| For 'Other' (please specify) | tax credit investors |

Source: Tierra Resource Consultants
APPENDIX H. VERIFICATION FRAMEWORK

Forthcoming pending Energy Commission review of submitted appendix section.
Energize Fresno Project Financial Analysis

[Developer] Properties

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Energize Fresno Financial Analysis Overview

The following is intended to provide Energy Fresno participants an overview of the costs associated with sustainability, and the approach used to design the funding and financing options and resulting financial performance of participating projects.

- Financial Summary
- Capital Stack Summary
- Cash Flow Analysis

This financial analysis is intended to provide a high-level summary of how various funding and financing products (‘Products’) can be applied to your project and are consistent with the energy analysis we’ve reviewed previously. Our objective in reviewing with you is to discuss our analysis and gather feedback on financial performance and on the funding and financing products we’ve used to model your project. A few items to keep in mind:

2. Our analysis is limited to what is known about the projects at the time we completed our analysis and understand your design might change
3. The funding and financing products ('Products') shown are available in the market and have been successfully on similar projects. The actual application and availability of these Products might change by the time your projects are built.

4. We are including an estimate of how much of any potential phase 2 AEC grant might be applied to your project. We used some general rules in allocating these funds:
   a. AEC grant funds are not being applied to cost of the Energy Efficiency level 1 and 2 scenarios, because the technologies are cost effective without grant funding and can be installed using currently available financing products.
   b. AEC grant funds are being applied to cost of the distributed generation (i.e. solar) scenario to offset 25% of the cost of the system.
   c. The allocation of AEC grant funds toward solar required that scenario 4, demand management also be pursued. The AEC grant requires consideration for PG&E grid resiliency and reliability, and solar installations without demand management (e.g. battery storage) can be counterproductive to that objective.
   d. AEC grant funds are being applied to scenario 4, demand management, to offset the cost of battery storage. Grant funds are being applied because the Energize Fresno team views energy storage as an emerging technology that requires supplemental funding support for market adoption. The underlying assumption is that grant funds will be applied to buydown the cost of power purchase agreements, to a level that is financially attractive for project owners.

5. We did not allocate any TCC grant funds to these projects because the application for, and use of, these funds will be solely at the discretion of the project owner.

Projects and PBi Analysis Links

The following projects were analyzed, and include a link to the online model developed by the team, referred to as the PBi Analysis.

- Development Site #1
- Development Site #2
- Development Site #3

The following provides an overview of the contents of the following sections of the PBi analysis:

1. Financial Summary
2. Capital Stack
3. Annual Cash Flow

Financial Summary

The 'Financial Summary' portion of the PBi presentation is intended to provide key financial performance metrics for each project analyzed by the Energy Fresno team.

It is important to note that the financial metrics presented on this page indicate the performance of only the incremental costs associated with the sustainability measure analyzed. This approach was chosen because it allows the team to model financial performance of the additional costs associated with sustainable design. A discussion of the costs of sustainable design is provided in Appendix 1.
and include the following components:

## Finance Performance Summary

The Finance Performance Summary table includes the following information:

- **Cumulative Annual Energy Cost ($/yr)**. This is annual cost of energy for the project. The baseline scenario assumes a project is built to code only and has the annual highest cost. The term ‘cumulative’ means that that the scenarios and additive and include all previous scenarios.

- **Cumulative Annual Energy Cost Savings ($/yr)**. This is cumulative annual energy cost savings for the project. The term ‘cumulative’ means that that the savings are additive and include the savings from all previous scenarios.

- **Incremental Annual Energy Cost Savings ($/yr)**. This is cumulative annual energy cost savings for the project. The term ‘cumulative’ means that that the savings are additive and include the savings from all previous scenarios.

- **Cumulative Measure Cost ($)**. Is the cumulative costs for the sustainability measure defined in the current and all preceding scenarios. Appendix 1 provides more information on the cost of sustainability.

- **Incremental Measure Cost ($)**. Is the incremental costs for the scenario being reviewed.

- **Cumulative Payback w/ Incentives (yrs)**. This is the simple payback for the scenario based on the incentives provided. Incentives are defined as the funding mechanisms that do not require payback, such as grants or rebates. These incentives are further detailed in the Capital Stack summary analysis.

- **Cumulative Measure Payback w/o Incentives (yrs)**. This is the simple payback for the scenario excluding any incentives.

- **Capitalized Value ($)**. This is the increase in the value of the property based on the reduced operating costs associated with each scenarios. The analysis uses a 6% capitalization rate. The capitalization rate (‘cap rate’) is the rate of return on a real estate investment property based on the income that the property is expected to generate.

## Building Performance per Unit

The Building Performance per Unit table includes the following information:

- **Electricity Cost ($/sqft)**. This is electric energy cost per square foot (sqft) of building space.

- **Demand Charge ($/sqft)**. This is expected electricity demand cost component of the utility bill per sqft of building space.

- **Gas Cost ($/sqft)**. This is natural gas energy cost per sqft of building space.

- **Total Utility Cost ($/sqft)**. This is total cost of energy cost per sqft of building space.

## Capital Stack

The ‘Capital Stack Summary’ portion of the PBi presentation is intended to provide an overview of the funding and financing products used in the financial analysis. The Energize Fresno project refers to this set of products as the ‘capital stack’. These products may or may not be what developers ultimately use, but these represent market ready products that exist now and have been employed on similar projects and allow the EF team to develop a reasonable model of financial performance. This analysis does not include prequalification activities to verify...
that funds can be accessed, nor is does it imply that funding will be available when a project is constructed.

It is important to note that the financing and funding value presented on this page apply towards the **incremental costs** associated with the sustainability measure analyzed. This approach was chosen because it allows the team to model financial performance of loans and funding towards the additional costs associated with sustainable design. Loans such as Property assessed Clean Energy (PACE) or PG&E On-Bill Financing (OBF) program can be applied to the full cost of sustainability measures. For example, the incremental costs associated with high performance HVAC systems might only be 10% more than less efficient code compliance systems, and our model estimates the financial performance of the loan as applied only to incremental cost, but the PACE or OBF loan may be applied to the full cost of the measure.

**Capital Stack Detail by Scenario**

The funding and finance analysis is intended to provide a general indication of the availability and applicability of various products to support the sustainability components of each project. The Capital Stack Detail by Scenario table includes the following information:

7. **Capital Stack Component:** This lists the name of the products included in the analysis
8. **Category:** This lists the category of the product. The capital stack graphic provides a summary of the value of any product from each category.
9. **Value:** This is the value ($) of each product used in the analysis.

The following provides guidance on the financing and funding products listed:

- **Application of Property assessed Clean Energy (PACE) and On-Bill Financing (OBF) Financing:**
  Property assessed Clean Energy (PACE) and On-Bill Financing (OBF) are the financing options used to model financing performance. While there are many options to finance construction, these two products are targeted specifically at financing sustainability and each has unique attributes relevant to these projects:

  **PACE attributes:**
  - PACE loans are a form of tax increment finance such that the loan is attached to and paid though property tax. PACE loans are available through multiple lenders in the Fresno area.
  - Most PACE loans are fully non-recourse and have favorable terms to 15 years with current rates between 6% and 8%.
  - PACE can serve as a portion of equity in the capital stack, and as such can reduce the need for more expensive mezzanine debt. A good discussion of PACE in the capital stack can be found at [http://www.cleanfund.com/financing-programs/pace-capital-stack/](http://www.cleanfund.com/financing-programs/pace-capital-stack/)
  - Provides owners and tenants with benefits in either a triple-net or gross lease scenario.
  - PACE loans are used for only sustainability related equipment, but will finance a very broad range of equipment and systems, building shell measures such as cool roof or windows, most HVAC systems, solar generation, water conservation designs, building management systems, lighting, etc. Some PACE programs also finance seismic retrofits. A good discussion on measure financed by commercial PACE loans can be found at [http://www.figtreefinancing.com/commercial-pace-products/](http://www.figtreefinancing.com/commercial-pace-products/)
Many commercial first mortgage lenders are favorable to the presence of PACE loans. PACE can apply to new construction, retrofit and major rehabilitation projects. PACE can comprise up to 2/3 of the 30% equity requirement in a typical 70% LTV arrangement. This allows PACE to cover the full cost of many building systems.

**OBF attributes:**

✓ OBF—on-bill financing—is a PG&E loan that is paid back through a charge on the utility bill.

✓ OBF loans include recourse provision and are 0% loan available through PG&E available from $5,000 to $100,000 per premises, with up to five years for repayment for commercial projects. Commercial multifamily and Government agencies may qualify for loans of up to $250,000 per premises. Both commercial projects and government agency customers may qualify for up to $4,000,000 in total financing. More information on OBF can be found at [https://www.pge.com/en_US/business/save-energy-money/financing/energy-efficiency-financing/energy-efficiency-financing.page?WT.mc_id=OBF_OBF_adwords_20170619_search&gclid=CjwKCAjwt8rMBRBOEiwA2F2biGA01gJXXEe5nC0hbOJkkWsqwWl4PIZSKRPbbVV403NivEDIxswALaRoCOP4QAvD_BwE](https://www.pge.com/en_US/business/save-energy-money/financing/energy-efficiency-financing/energy-efficiency-financing.page?WT.mc_id=OBF_OBF_adwords_20170619_search&gclid=CjwKCAjwt8rMBRBOEiwA2F2biGA01gJXXEe5nC0hbOJkkWsqwWl4PIZSKRPbbVV403NivEDIxswALaRoCOP4QAvD_BwE).

✓ OBF loans can only be used for sustainability related equipment that also qualify for PG&E rebates. As such rebates can be used to reduce capital costs, with OBF being used to finance the remainder.

✓ OBF can only be used for retrofit and major rehabilitation projects where existing equipment will be replaced. It is not available for the new construction portion of a project but can be used for projects with existing structures to be rehabilitated, regardless of whether or not there is a new addition being added.

**Notes**

✓ While there are many options to finance construction, these two products are targeted specifically at financing sustainability and each has unique attributes relevant to these projects.

✓ Actual applicability of these financing products will depend on the final design specifications for the projects analyzed.

• **Application of Rebate / Technical Assistance (R/TA) Programs:** Rebate / Technical Assistance programs are offered in Fresno by several providers, including local and state agencies and utility such as PG&E. Programs considered in the financial analysis include PG&E Savings By Design (SBD) and PG&E Custom Rebates:

**SBD Attributes**

✓ SBD helps project owners invest in energy efficiency as a major goal in their new buildings

✓ Various forms of financial incentives are available to owners when the efficiency of their new building exceeds the minimum SBD threshold (generally 10% better than Title 24 Energy Efficiency Standards).

✓ SBD also offers financial incentives to design teams who make the extra effort when integrating energy efficiency with exceptional design. The design team may qualify for incentives when the building design saves at least 10% and the owner agrees to participate in the program.

✓ The total SBD incentive can be 200,000 and is divided between owner and design teams.
  o Owner incentives scale according to the building’s efficiency over Title 24 Energy Efficiency Standards. The maximum owner incentive per project is $150,000.
The maximum design team incentive per project is $50,000 and is equal to one-third of the owner’s incentive.

- **Custom Rebates Attributes:** PG&E operates various programs that apply to projects in Fresno, including the Custom Rebate, Advanced Lighting, Central Valley Energy Tune-up, and Fresno Energy Watch programs. These programs offer incentives that can offset up to 40% of the incremental measure cost of high efficiency equipment.

**Notes**

- The value of SBD does not include the $50,000 available for design team assistance to support the potential for additional cost associated with high efficiency designs.
- All R/TA programs have performance requirement and provisions that may ultimately exclude a project from participation.
- All R/TA products also have funding limitations and operating periods such that funding might not actually be available for approved projects by the time they are built.
- Other program that contribute resources like water conservation or electric car charging are operating in Fresno but these were not included in the financial analysis.

- **Application of Grants:** The analysis considers only the application of California Energy Commission grant money that will be applied for in 2018 and used to help fund building the portfolio of projects identified for the Energize Fresno program. This grant is referred to in the capital stack as the ‘AEC grant’. The allocation of grant funding in the financial analysis is based on the following criteria:
  - AEC grant funds are not being applied to cost of the Energy Efficiency level 1 and 2 scenarios, because the technologies are cost effective without grant funding and can be installed using currently available financing products.
  - AEC grant funds are being applied to cost of the distributed generation (i.e. solar) scenario to offset 25% of the cost of the system.
  - The allocation of AEC grant funds toward solar required that scenario 4, demand management also be pursued. The AEC grant requires consideration for PG&E grid resiliency and reliability, and solar installations without demand management (e.g. battery storage) can be counterproductive to that objective.
  - AEC grant funds are being applied to scenario 4, demand management, to offset the cost of battery storage. Grant funds are being applied because the Energize Fresno team views energy storage as an emerging technology that requires supplemental funding support for market adoption. The underlying assumption is that grant funds will be applied to buydown the cost of power purchase agreements, to a level that is financially attractive for project owners.

**Notes**

1. Grants have performance requirement and provisions that may ultimately exclude a project from participation.
2. Grants have funding limitations such that funding might not actually be available for approved projects by the time they are built.
3. The allocation of AEC grants presented in the capital stack is subject to change based on whether projects are ultimately included in the Fresno Master Community design.
We did not allocate any TCC grant funds to these projects because the application for, and use of, these funds will be solely at the discretion of the project owner.

- **Application of Fee Waivers**: The team has provided provisions to include fee waivers as a funding source, and the Energize Fresno team is in discussions with the City of Fresno to define what waiver might be acceptable and the value, but the values modelled are subject to change based on the actual availability to be determined by the city.

**Notes**

- The model currently assumes the New Growth Area Major Street Charge (NGAMSC) will be a possible source of fee waivers, should it continue past its current December 31, 2017 sunset date. The model assumes that this will continue for projects that have a high sustainability design consistent with the Energize Fresno analysis.

- **Application of Tax Incentives**: Tax incentives are identified based on the nature of the project and technologies being installed.

**Notes**

- The financial model assumes that any tax incentive that is recognized against income over a period of years, such as the low-income housing tax credit, is capitalized and used to reduce up-front costs.

- The value of the tax credits provided in the financial model only represent the portion of incremental costs, net of applicable rebates, that can be offset by these credits. These tax credits would typically be applied to the full cost of the measure or other eligible expenditures.

- Some of these tax credits, such as the Investment Tax Credit's Energy Credit, are scheduled to decline in the following years or are set periodically by other governing authorities. The rates used in this analysis are those applicable in the 2017 fiscal year.

- The amount of tax credits received may also be effected by the mix of other funding and financing products not included in this analysis.

- While the team has considered which tax incentives apply, tax advisors outside of the Energize Fresno project will need to review these assumptions based on their knowledge of tax code and each developer's unique tax liability situation.

- The model assumes that all utility rebates are non-taxable and thus the eligible tax basis used in the analysis was reduced accordingly. All other funding products are assumed to be taxable, and thus there was no reduction of the eligible tax basis in the analysis.

**Loan Details by Scenario**

The Loan Details by Scenario table includes the following information:

1. **Loan**: This is name of the loan modeled
2. **Principal**: This is the principal amount of the loan. As noted earlier, this is the principal required to address the incremental cost of high efficiency equipment, such as lighting or HVAC. The actual
principal amount would cover the full cost of the measure, up to the limits of the loan. PACE loans are used to model solar installations, and the principal for PACE loans used for solar is the full cost of the installation.

3. **Rate**: This is the current average APR rate for the loan identified. Actual rates will vary.
4. **Term**: This is the expected term of the loan.
5. **Annual Payment**: This is the annual payment, including interest and principal.

**Annual Cash Flow**

The Energize Fresno team provides and analysis of annual cash flow analysis.

**Annual Cash Flow**

The Annual Cash Flow graphic provide the following analysis for each scenario:

1. **Total Annual Savings**: Total annual savings are the savings for each scenario as presented in the Financial Summary section of the analysis.
2. **Total Annual Debt Service and Contract Payments**: Debt service is calculated based on the loans defined in the capital stack. Total annul contract payments are the sum of the annual payment for leases and power purchase agreements (PPAs). The Energize Fresno analysis did not consider leases, but does use PPAs to model the financial performance of battery storage. PPAs are similar to leases and are the financing mechanism advocated by the Energy Fresno team for battery installation based on the current cost of battery storage and rapid advances in performance. Appendix 2 provides additional details on PPAs.
3. **Annual Cash Flow**: Annual cash flow is the cash flow net of total annual debt service and annual contract payments.

**First Year Debt Service and Contract Payments**

The First Year Debt Service and Contract Payments graphic provide the following analysis for each scenario:

1. **Total Annual Debt Service**: This is the first-year payment on the loans defined in the capital stack.
2. **Total Annual Contract Payments**: This is the first-year payment the PPA used to model batteries used in the demand management scenario.
Energize Fresno Project Financial Analysis Example - Appendices

Appendix 1. Cost of Sustainability

The following is intended to provide Energy Fresno participants an overview of the costs associated with sustainability, and the approach used to design the funding and financing options and resulting financial performance of participating projects. Increasing the energy and water sustainability of a project typically involves additional design and equipment considerations that increase the overall cost of a project in the following ways:

**Design Costs:** Design elements typically include performance modelling to identify what types of systems can optimize the long term financial performance of a building, whether it is new construction or rehabilitation/retrofit. From an energy perspective, the gold standard for sustainable design is a zero-net energy (ZNE) building that produces as much electricity as it consumes by maximizing efficiency of building energy systems, and also matches estimated building energy consumption to the amount of energy that can be generated through technology such as solar panels. The best ZNE designs are also grid interactive, meaning they interact with the electricity grid in a way that helps PG&E continue to deliver reliable energy at reasonable costs. Grid interactive buildings are typically designed to use energy management systems, and increasingly, energy storage systems such as batteries, that are designed to both minimize demand charges for the owner while also allowing PG&E to use the building controls and storage to help mitigate load challenges on the electricity distribution system. Oftentimes, a single building that is grid interactive can be designed within a network of similarly designed buildings such that they can interact with the grid in unison to have a greater collective impact. All of these sustainability considerations add design costs to a project, where the magnitude of increase depends on what designs are needed to exceed California Title 24, and what other non-code systems, such as solar generation, are needed to achieve or come as close as possible to ZNE status.

**Equipment Costs:** The equipment necessary to achieve high sustainably or ZNE designs can typically be thought as systems that manage energy demand and supply as follows:

1. **Energy Efficiency.** Equipment and systems such as energy efficient lighting and HVAC systems that reduce a buildings energy use while providing the same level of service as less efficient systems.
2. **Demand management.** Demand management includes equipment technologies designed to minimize the demand component of a utility bill. These technologies include battery storage and energy management and control systems (EMCS) that control how a building uses energy while providing the operators with the information necessary to optimize operations on a continuous basis. Batteries are effective at this because they can operate when the sun goes down and solar systems are not generating, therefore minimizing demand charges during this time. Utilities are increasing shifting their demand costs to these ‘non-solar’ hours of the day.
3. **On-site or distributed generation.** Equipment associated with distributed energy generation, such as solar power, and other renewable energy technologies. On-site generation is typically installed on the customer side of the meter and is traditionally considered a demand-side management
technology. This is to be distinguished from utility-scale renewable energy generation which is a supply-side technology.

In general, the technology options, performance, and cost trends for both these types of equipment have been very favorable, and are likely to continue to improve. For example, LED lighting lasts 2 to 3 times longer than the next best option, and costs have fallen by 60% over the past 5 years. Solar panels that cost $3.00 per watt in 2001 can be purchased at $0.65 per watt in 2017. Newer technologies, such as batteries will likely follow these same cost-performance trends.

The Energize Fresno project estimated costs for various sustainability options in two ways:

1. **Incremental costs** – the additional cost of an energy efficient system compared to a standard efficiency system when installed in a new construction or replace-on-burnout applications.
2. **Full cost** – The full installed cost of a system installed as part of an early retirement or retrofit application. Note that the full installed costs typically apply to solar and battery systems that are not commonly part of a standard practice design.

The cost scenarios modeled for Energize Fresno include the following components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting Upgrade</td>
<td>Incremental measure costs needed to design and install high efficiency lighting systems compared to standard practice or Title 24 energy code minimum requirements</td>
</tr>
<tr>
<td>HVAC</td>
<td>Incremental measure costs needed to design and install high efficiency HVAC systems compared to standard practice or Title 24 energy code minimum requirements</td>
</tr>
<tr>
<td>Solar</td>
<td>Full cost of solar systems based on the size of system applicable to each project based on that building design; baseline assumption is no solar system</td>
</tr>
<tr>
<td>Battery storage</td>
<td>Full cost of battery storage systems based on the size of the solar system, while also considering building demand during non-solar production hours of the day; baseline assumption is no battery storage system</td>
</tr>
</tbody>
</table>

Cumulative analysis scenarios include the costs of the preceding scenario. For example, the HVAC scenario include the costs associated with the lighting scenario, while the battery storage scenario includes the costs of lighting, HVAC, and solar scenarios.

The costs used in the analysis are based on industry standards, and are certain to vary during the actual design/building cycle but should provide reasonable order of magnitude estimates.
## Appendix 2. Review of Power Purchase Agreements

Key Features of Self-Financed/Host-Owned and Third-Party Owned PV Systems

<table>
<thead>
<tr>
<th>Feature</th>
<th>Self-Financed/Host-Owned</th>
<th>Third-Party Owned (TPO)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up-front Cost</strong></td>
<td>Host customer pays for the system up front with some combination of cash or loans (which include accrued interest).</td>
<td>Potential for little to no up-front costs to host customer (though prepay options are available). Monthly payments are usually based on anticipated savings against the customer's utility bill.</td>
</tr>
<tr>
<td><strong>Financial Return</strong></td>
<td>Savings over the host customer's utility bill from PV system production accrue directly to the host customer, less any loan interest and repayments. However, it may take several years before the host customer recoups their initial investment and begins to profit from the system.</td>
<td>Host customer usually benefits from reduced utility bills at the end of the first month of service; however, their amount of monthly savings is generally less than if they purchase the system outright.</td>
</tr>
<tr>
<td><strong>System Maintenance Responsibility and Performance Risk</strong></td>
<td>Host customer usually assumes most of the long-term risk of equipment malfunctions or performance degradation and carries the responsibility for system maintenance, including filing any warranty claims with equipment manufacturers</td>
<td>SFC or TPO investors assume the risk of system malfunction via minimum performance guarantees or reduced customer payments (based on reduced system output). SFC also carries responsibility for equipment.</td>
</tr>
<tr>
<td><strong>Ability to Monetize Tax Credits</strong></td>
<td>Host customer receives any available tax credits, but the ability to monetize those credits is typically limited to businesses and residential customers with sufficient tax liability.</td>
<td>SFC claims any available tax credits and depreciation benefits which can be monetized through its tax equity and other investors.</td>
</tr>
<tr>
<td><strong>System Transfer upon Moving</strong></td>
<td>PV system is an asset that becomes part of the home or building, is easily transferred as part of a property sale (unless the customer</td>
<td>Most TPO contracts provide options for a host customer who wishes to move from their property, including 1) buying out the system, 2) paying to have the system removed early or</td>
</tr>
</tbody>
</table>

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wishes to remove and relocate the system) and adds to the value of the property.

3) transferring the system to the new property owner (assuming the new host customer agrees and also meets SFC financial requirements).

### Key Features and Differences Between Solar Leases and PPAs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Solar Lease</th>
<th>Power Purchase Agreement (PPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Offering</strong></td>
<td>Customer leases the solar PV equipment from the TPO provider to produce on‐site electricity. Monthly payments are for the use of the system</td>
<td>Customer purchases the power produced by the on-site solar PV system, which is owned by the PPA provider, at a predetermined price ($/kWh).</td>
</tr>
<tr>
<td><strong>Escalation Factors</strong></td>
<td>Lease payment amount may escalate on an annual basis to account for inflation; others may incorporate expected inflation into base payment amount.</td>
<td>PPAs typically include an escalation factor that increases the PPA price each year. Escalation factors are based on expected increases in utility electricity rates.</td>
</tr>
<tr>
<td><strong>Contract Duration</strong></td>
<td>Typically 20 years, with some as short as 10 years for residential. Non‐residential leases are more likely to be negotiated, and may be as short as 7 years</td>
<td>Typically 20 years, but as short as 10 years.</td>
</tr>
<tr>
<td><strong>System Monitoring</strong></td>
<td>Performed by TPO provider; many also offer monitoring capabilities or data reports to the host customer.</td>
<td></td>
</tr>
<tr>
<td><strong>Maintenance (including inverter replacement)</strong></td>
<td>Performed by TPO provider.</td>
<td></td>
</tr>
<tr>
<td><strong>Performance Guarantee</strong></td>
<td>Lease provider guarantees system's minimum monthly production levels and compensates host customer for any shortfalls.</td>
<td>No guarantee, but host customer only pays for what the system produces. However, PPA provider's return on investment is based on those customer payments, so provider is incentivized to monitor and maintain system performance.</td>
</tr>
</tbody>
</table>

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System Buy-Out

Host customer typically has the option to “buy out” the PV system equipment from the TPO provider at any point during or at the end of the contract term. The buy-out price or formula is defined in the contract.

Summary of Essential Third-Party Ownership Terms

**Essential Third-Party Ownership Terms:**

All TPO agreements should include the following terms or provisions and clearly label each as to whether they are in effect in that agreement or provided for information only.

<table>
<thead>
<tr>
<th>Financial Terms</th>
<th>Non-Financial Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>o System size</td>
<td>o Event of Property Sale</td>
</tr>
<tr>
<td>o Down-payment and amount</td>
<td>o Most contracts address provisions in the case of the homeowner selling their property. The two most common options in residential contracts are for the agreement to be transferred to the new property owner or the customer to purchase the system. The two most common options in non-residential contracts are for the agreement to be transferred to the new property owner or the system to be moved to the customer’s new property at the customer’s expense.</td>
</tr>
<tr>
<td>o Monthly payments or cost per kWh produced</td>
<td>o Re-Roofing</td>
</tr>
<tr>
<td>o Length of term</td>
<td>o Removal and re-installation of the system is usually the financial responsibility of the host. Sometimes re-roofing provisions are located in a separate limited warranty document.</td>
</tr>
<tr>
<td>o Escalation rates or schedule of payment amounts</td>
<td>o Default</td>
</tr>
<tr>
<td>o Total expenditure or range of expenditures, over the term of the agreement</td>
<td>o All contracts have strict provisions in the case of customer default. In contrast, only some residential contracts offer additional provisions in the case of SFC default. Almost all of the non-residential contracts give the customer the option to terminate the agreement in the case of SFC default.</td>
</tr>
<tr>
<td>o Changes in incentives, taxes, and the regulatory landscape</td>
<td></td>
</tr>
<tr>
<td>o Most residential and non-residential TPO contracts indicate that the Solar Financing Company is responsible for system maintenance and monitoring.</td>
<td></td>
</tr>
<tr>
<td>o Monthly or annual production performance guarantee or range of performance.</td>
<td></td>
</tr>
<tr>
<td>o The majority of contracts include an explicit performance guarantee from the SFC that reimburses the host customer if the system fails to deliver an agreed-upon monthly minimum production level.</td>
<td></td>
</tr>
</tbody>
</table>

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How Leases and PPAs work

**Solar Lease Explained**

In a solar leasing model, the host customer makes a predetermined monthly payment in exchange for the installation and use of a solar energy system at their facility or residence over an extended period of time (often 10-20 years for residential and 7-15 years for non-residential). Similar to other types of equipment leases, making a higher up-front payment can lower the monthly payments over the life of the agreement. Some Third-Party Ownership (TPO) providers may also offer a fully prepaid lease that enables the customer to retain more of the long-term financial benefits of the system, but still leaves the long-term maintenance and repair responsibility with the Solar Finance Company (SFC) and Third-Party Ownership investors who own the system. Customer payments can be either fixed over the life of the contract or escalate annually at a predetermined rate. The TPO provider typically monitors the system’s output, maintains the system as required (including inverter replacement), and offers some form of performance guarantee for the system’s minimum monthly power output. This alleviates the host customer’s need to monitor and maintain the equipment and protects them from system malfunctions. For non-residential customers, particularly businesses, signing a solar lease may have implications for the host organizations’ balance sheet. Accounting rules require that certain long-term equipment leases be classified as a capital lease, which appears as a liability on an organization’s balance sheet. In an effort to minimize such liabilities, such customers may seek shorter contract terms that allow them to classify the system as an off-balance sheet operating lease. Others may simply opt for a PPA arrangement to avoid the issue altogether.

**Power Purchase Agreement Explained**

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In the solar PPA model, the customer pays for the solar power produced by the system each month at a fixed per-kWh rate that is usually structured to be equal to or less than their current electric utility rate. Like a solar lease, the PPA can last up to 25 years, and the price per kWh may escalate at a predetermined annual rate. In addition to the no-money-down option, PPAs can also be partially or entirely prepaid (based on anticipated power production) at the beginning of the contract, resulting in a lower per-kWh rate for the solar PV power produced. As with solar leases, PPA host customers are not usually responsible for monitoring and maintaining the system; they pay only for the electricity it produces. The PPA provider may not provide a specific performance guarantee; however, because the PPA provider’s cash flows (and rate of return) are dependent on the system’s continued performance, it is in the provider's best interest to make sure the equipment is maintained. As a result, both PPAs and solar leases usually include long-term system monitoring, maintenance provisions, and a long-term warranty that place the burden of ensuring system performance on the TPO provider.

Changes to net energy metering or residential rate schedules may have significant ramifications to the financial attractiveness of new TPO arrangements. However, many existing TPO arrangements were specifically sized to eliminate the customers’ most expensive rate tiers. A significant shift or flattening of residential rates could render these existing TPO arrangements less attractive compared to utility-supplied electricity. Customers should enter future TPO arrangements with a full understanding of this dynamic. To this end, customers entering a new TPO arrangement or purchasing a PV installation should acknowledge that they understand that a change in factors like utility retail rates or net energy metering terms could change the financial attractiveness of the decision.

**Important PPA Agreement Details**

- Facility Access and Maintenance by System Operator
  - Access provisions in the case of emergencies
  - Scheduled on-site meter testing.
    - One sample commercial template provided that the purchaser be permitted to be off line for a total of 48 scheduled daylight hours per calendar year during the Term. For scheduled outages over the 48 hour threshold as well as unscheduled outages—that aren’t a “Force Majeure” event—the seller should have to reasonably estimate the amount of electricity that would have been delivered to Purchaser during such excess scheduled outages or unscheduled outages and invoice the host.
  - Notification if the system must be accessed by on-site staff.
  - Change in building ownership
    - Usually, moving or selling the building or property on which the PV system is installed does not release the customer from the contract. Although, ideally the new owner or building tenant will be qualified to take on the PPA directly. If not, the system can be moved to the host’s new location, at the host’s expense.
- Financial incentives
- Typically, the System Owner (SFC) obtains and retains all Green Attributes and Environmental Financial Incentives, as well as any other financial incentives and tax benefits associated with the development of the system, including the installation, ownership, and operation of such System and the sale of the output to host customer.
- Check with utility to ensure that 3rd party ownership of a PV system does not preclude the project from accessing available incentives.

- Solar Renewable Energy Credit (SRECs)
  - One Solar Renewable Energy Credit—representative of the environmental value of the energy produced by your renewable energy system—is created for every megawatt hour (MWh) of electricity produced by solar. Usually the system operator owns and can sell the SRECs generated from the PV system unless in the contract the host negotiates the purchase of the SRECs—often through a higher price per kWh.

- Contract term, and pre-term options
  - Term duration
    - Usually at least 7-10 years so that system owner can collect tax credits, but 15 - 25 years is typical. Some contain a pre-term buyout option at fair market value after a given number of years (typically ~ 6).  
  - Term Expiration
    - Buyout option at the greater of fair-market value or a pre-defined 'residual' cost.
    - Extend and continue arrangement.
    - Removal of the equipment.
  - Force Majeure
    - The length of the contract term can be affected by force majeure—unforeseeable circumstances that prevent someone from fulfilling a contract. The issue is whether the existence of a force majeure during development or during the term of the contract should extend the term, and should be called out in the PPA contract. For example, if there is a one-year permitting delay early in the contract, the force majeure should clarify if another year will be added so that the term of the contract applicable to the operating period of the facility is shifted forward rather than being reduced to the extent of the force majeure.  
  - Projected discount rate
    - Compare all discount rates used in the contract to ensure that they are reasonable and fair. For example, in some sample contracts there was a difference between the discount rate used for calculating damages upon termination for the host and system operator—with the system operator receiving a more favorable discount rate (remember that the larger the discount rate percentage, the smaller the damages).

- Insurance

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38 [https://www.enlfo.org/clientuploads/directory/whitepaper/LaFratta_02.pdf](https://www.enlfo.org/clientuploads/directory/whitepaper/LaFratta_02.pdf) (p. 204)
• Check with your insurance company regarding the additional riders and required coverage for the PV system. Although usually cheaper when covered through the system operator, if for some reason the Host can insure the system at less cost than the system owner, then the host should consider covering the system through their policy because the kWh price reflects insurance costs and thus the kWh rate should reflect these savings.

• Changes to Incentives, Taxes, and the Regulatory Landscape
  o The agreement should explicitly state which party takes the risk of the law or tax regime changing after the date of the agreement in such a way as to diminish the economic returns of the transaction for such party (e.g., increase in taxes on power producers reducing the producer’s returns). In order for PPAs to be bankable, most lenders require the host to take this risk.  
  o Changes in taxes or other laws may be treated differently in a longer versus a shorter term. Generally, the longer the term of the contract the more likely you are to see reopeners of the pricing as a result of changes in law or taxes. Short term contracts generally do not provide such relief. Longer term contracts frequently do.

• Guarantees
  o Assured Minimum Performance
    ▪ The kWh price and total project economics are based on how much usable electricity the PV system will produce over the long term. If the PV system does not produce as much as expected, the customer is purchasing more utility power than they planned and potentially losing expected savings. Customers with large enough projects may seek minimum performance guarantees, and may want to specify compensation should the system fail to produce as expected. Some SSPs don’t include performance provisions in their standard contracts because it is in the system owner’s interest to ensure maximum system production, and therefore maximum kWh income from the host customer.
  o Annual degradation factor
    ▪ The percent of estimated production decrease from year to year to account for system degradation over time. For reference, module warranties often describe that the module should produce at least 80 percent of their original power rating after 25 years in the field, which reflects an annual degradation factor of .08 percent.
  o Force Majeure
    ▪ The agreement should excuse the power producer from performing its obligations if a force majeure event (an event beyond the reasonable control of such party) prevents such performance.

40 https://www.enlf.org/clientuploads/directory/whitepaper/LaFratta_02.pdf (p. 204)
• Municipal-Specific Contractual Issues
  ○ Most state and local governments approve the funding of their operating obligations on an annual basis, so there is a question about the enforceability of a long-term PPA. This is typically addressed through two mechanisms
    ▪ A non-appropriation clause permits the hosting customer to terminate the PPA at the end of any appropriation period without further obligation or payment of any penalty, if and only if, the host was unable to obtain appropriation for funds to meet future scheduled payments and a formal resolution or ordinance is passed. Often, this type of clause will contain a "best efforts" requirement, i.e., the customer promises to use its best efforts to seek and obtain the necessary appropriation for payment. This provision is common in tax-exempt leases and is designed to enable the customer to account for the PPA obligation as a current expense instead of debt.
    ▪ The non-substitution clause is used to protect a project’s viability. If a PPA is canceled due to non-appropriation, the clause prohibits the customer from replacing the hosted equipment supported by the PPA with equipment that performs the same or similar function. A non-substitution period of 365 days is common, and shorter time periods are also used. Decisions regarding the length of the non-substitution period are based partly on the perceived essential nature of the equipment. Generally, the more essential the equipment is, the shorter the non-substitution period will be. Given the host’s right to cancel under the non-appropriation clause, the non-substitution clause is intended to provide some comfort to the investor and the project developer.

• Other Concerns
  ○ Cost of Necessary Site Upgrades
    ▪ The host customer may need to make investments in their property in order to support the installation of the system, lower the cost of installation or to comply with local ordinances. Including unforeseen groundwork such as excavation/circumvention of underground obstacle, upgrades or repair to the Facility or utility electrical infrastructure, payment bonds, performance bond(s), prevailing wage construction, tree removal, or tree trimming.
  ○ Property Taxes
    ▪ There is a potential increase in property taxes when the property value is reassessed due to a rise in the property value.

**PPA Financials**

*Variables Impacting the Initial Price per kWh*  

1. Pricing Structure
   a. Fixed with escalator
      i. In this price structure, the price per kWh is fixed and includes a fixed annual escalation rate (%). The escalation rate accounts for system production decreases over time, and inflation-related cost increases for system operation and maintenance. Typical escalation rates are between 1 and 5 percent.
   b. Fixed non-escalating
      i. With this price structure, the host customer may begin buying the PV kWh at a rate higher than their current utility rate, but the rate does not change over time. This structure makes great sense when the host customer has great confidence their utility rates will be increasing significantly.
   c. Variable with utility.
      i. The kWh price is equal to or less than the utility price, possibly with minimums and maximums defined. This is a fairly rare SPPA price structure and is sometimes referred to as “Business as Usual.”

2. Long term PV system production
3. Size and complexity of the project
4. Incentives available to the system owner
5. Host’s credit rating.
6. SREC contract (which may be separate from or incorporated within)
7. Inflation
8. Time-value of money (Present Value Calculation)
9. Host Transaction Costs
   i. In some cases, the host customer might bill provider for their transaction costs but this is likely reflected in higher kWh prices.

10. System owner ROI

Storage Pricing Model in a PPA

Using the term ‘PPA’ with storage may cause confusion because energy storage systems are not generators (as the term is traditionally used); rather, they store energy from the grid to discharge when there is demand. In its current form, a typical energy storage PPA works by charging the consumer at a negotiated rate for the energy discharged from the battery, plus some monthly service fee. Since the Energy Storage Systems (ESS) market is still maturing and the cost of the technology is still expensive, the service charge or a monthly fee helps recover maintenance and operational costs to the third-party. In this model, the consumer is responsible for providing energy to charge the battery. This means the consumer would 1) pay an electricity rate ($/kWh) to a generator or distributor to charge the battery, and 2) then pay the third-party developer at the contracted PPA rate for the energy discharged from the battery.42

Estimated Costs of Solar Installation

Note that the figures provided below are estimates of CA Solar costs, and that there currently exists a broad range of pricing in the marketplace. Individual quotes will potentially vary

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greatly from these estimates based upon the vendor and the scope of the project. It is advisable to get quotes from at least two vendors before making a decision.

- Mercatus’ Average CA Commercial Solar Total Installed Cost in 2016: $2.69/Wdc
- Mercatus’ Average CA Commercial Off-Take Rate in 2016: $.1271/Wdc
- Mercatus’ Average CA Commercial Solar Internal Rate of Return (IRR) in 2016: 8.11%
  - In general, if the IRR of a new project exceeds a company’s required rate of return, that project is desirable.

**Effective Interest Rate**

In a Navigant study on California, the majority of TPO contracts showed an effective interest rate between 4 and 11.9 percent, which are in line with interest rates for traditional financing options for solar energy systems. The effective interest rate is essentially the interest rate that the customer pays for “loaning” the solar system and paying monthly charges for the system. The customer does not have to pay for the system up front (unless the system is a full pre-payment system), but pays a monthly charge with interest over time for the system. This structure is similar to leasing a car, where the customer uses the car for a specified amount of time and pays a monthly lease with some assumed interest rate. In financial terms, the effective interest rate is calculated as the internal rate of return on the difference in cash flows between a TPO system and a comparable host-owned system, with the host-owned system as the base case.43

**PG&E Whole Sale of Excess Capacity**

- PG&E Net Surplus Compensation Program (Same as Net Energy Metering)44
  - Any extra electricity your business requires is automatically supplied to you by PG&E. At times, your system generates more electricity than your business requires. The unused electricity is sent to the electric grid. The Net Surplus Compensation (NSC) program pays you the fair market value for the balance of surplus electricity at the end of your 12-month billing cycle.
  - The NSC Rate is defined as the simple rolling average of PG&E’s default load aggregation point (DLAP) price from 7 a.m. to 5 p.m., for a 12-month period. PG&E uses the NSC Rate as the value of the electricity portion of its net surplus compensation rate.45
    - July 2017 Rate: $0.02715/kWh.46
- Virtual Net Metering for Multifamily Participants
  - Virtual Net Metering (VNM) allows multifamily participants to install a single solar system to cover the electricity load of both common and tenant areas connected at the same service delivery point. The electricity does not flow directly to any tenant meter, but rather it feeds directly back onto the grid. The participating utility then allocates the kilowatt hours from the energy produced by the solar PV generating system to both the building owner’s and tenants’ individual utility accounts, based on a pre-arranged allocation agreement. The intent of VNM is to help multifamily residents receive direct

43 CPUC Third Party Ownership Market Impact Study
45 http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5558
46 https://www.pge.com/includes/docs/pdfs/shared/solar/AB920_RateTable.pdf
benefits of the building's solar system, rather than all of the benefits going to the building owner.

- VNM rate is equal to the NSC rate.
- PG&E Small Renewable Generator PPA\(^{47}\)
  - This schedule is optional for customers with a total Effective Capacity of not more than 1.5 megawatts.
  - PG&E currently purchases energy according to the following schedule:

- 10-year term: $0.09488/kWh
- 15-year term: $0.10223/kWh
- 20-year term: $0.10859/kWh

**Incentives**

- ITC\(^{48, 49}\)

The solar credit is currently 30 percent of the cost basis, but begins scaling down until 2022

- A company's "basis" is the portion of its investment in eligible property upon which the ITC can be claimed. Basis is generally the cost of the property and, in certain circumstances, may also include a capitalized portion of other costs related to buying or producing the property (e.g., permitting, engineering, and interest during construction).
- In many cases, a solar project developer will not have sufficient tax liability to make immediate use of the ITC. In order to get value for the tax benefits associated with the project, the developer may engage in a 'tax equity' transaction. Such transactions involve a partnership or lease between the

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\(^{47}\) [https://pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_E-SRG.pdf](https://pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_E-SRG.pdf)

\(^{48}\) [https://www.seia.org/research-resources/cost-basis-itc-1603-applications](https://www.seia.org/research-resources/cost-basis-itc-1603-applications)

\(^{49}\) [https://www.sagerenew.com/press/itc](https://www.sagerenew.com/press/itc)
developer and tax equity investor. In some cases, basis for the ITC or 1603 award is calculated on the fair market value of the project.

- Interest paid during construction of larger solar projects that take more than a year to build and cost more than $1 million is added to the basis of the equipment. Interest paid on loans to acquire other solar equipment is normally deducted when paid and does not add to the basis. However, an election can be made under Section 266 of the tax code to fold the interest payment into the basis. Sales and use taxes are normally considered a cost of the equipment purchased and are added to basis. Items that are added to basis have to be deducted over time through depreciation, but they also enter into calculation of the ITC.

- State rebates, buydowns, grants or other incentives do not decrease the amount eligible for the ITC if the company is required to pay federal income tax on the incentive. The majority of incentives must be reported as income for federal income tax purposes and, therefore, do not decrease the basis for the ITC. Additionally, for property acquired after December 31, 2008, and for basis attributable to construction, reconstruction, or erection after December 31, 2008, there is no basis reduction for property financed by subsidized energy financing or by tax-exempt private activity bonds.

- For energy storage to qualify for tax credits, the IRS requires entities to provide proper documentation that at least 75 percent of the battery is charged using the PV system.

  - **Depreciation**
    
    - **MACRS**
      
      - The Modified Accelerated Cost Recovery System (MACRS) is the current depreciation method for most property for the recovery of the cost of tangible property over the useful life of the property.
      
      - Qualifying solar energy equipment is eligible for a cost recovery period of five years.
      
      - For equipment on which an Investment Tax Credit (ITC) or a 1603 Treasury Program grant is claimed, the owner must reduce the project’s depreciable basis by one-half the value of the 30% ITC. This means the owner is able to deduct 85 percent of his or her tax basis.

  - **Section 179**
    
    - Under Section 179, you can deduct in a single year the cost of all tangible personal property (new or used) that you buy and use in your business at least 51% of the time up to the annual $500,000 limit. You can spend up to $2 million on qualifying equipment and still get the full deduction. If you spend more than the $2 million investment limit in any one year, the amount you can deduct under Section 179 is reduced dollar for dollar.

  - **Bonus Depreciation**

  - In response to the economic downturn of 2008, Congress took action to further incentivize capital investment by accelerating the depreciation schedule economy-wide. In December 2015, Congress passed the Protecting Americans from Tax Hikes Act of 2015, which included a 5-year extension of bonus depreciation.

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depreciation, including a phase-out that is structured as follows: 2015-2017: 50% bonus depreciation; 2018: 40%; 2019: 30%, 2020 and beyond: 0%.

- SRECs\(^\text{52}\)
  - 1 SREC = 1 MWh of solar electricity
  - SRECs are sold separately from the electricity
  - Value is determined by market supply and demand mechanics
  - Facilities must be certified by a state to sell SRECs

What types of PPA agreements/features of agreements lead to high risk for the end-user and/or high potential for end-user dissatisfaction?\(^\text{53, 54}\)

**Pros of Solar Power Purchase Agreements**

- No/low up-front cost.
- Ability for tax-exempt entity to enjoy lower electricity prices thanks to savings passed on from federal tax incentives
- Predictable energy costs: A solar PPA allows you to lock in low energy costs and protect your organization from unpredictable fossil fuel-based energy rates.
- No production or performance risks: Once a commercial solar system is up and running, there is always the possibility of issues arising that may cause downtime—such as severe weather damage to the solar array or a transmission outage. With a PPA (unlike an operating lease), if the system doesn’t produce energy, you don’t have to pay.
- No ongoing operations and maintenance (O&M) costs: A third party pays for the O&M of the solar system.
- No need to deal with complex system design and permitting process
- Off-balance-sheet obligation: A solar PPA isn’t looked at as debt. It functions just like a regular utility bill, so it doesn’t tie up capital you could use for other investments.
- Early buyout option: Most PPAs include a buyout option that would allow you to buy the solar system before the end of the PPA term—usually at the end of year six or seven, as specified in the PPA contract.
- Corporate sustainability: By purchasing clean, renewable energy instead of using energy generated with fossil fuels, your organization can make a real difference for the environment and help set an example for sustainable business practices.
- Potential to make claims about being solar powered (if associated RECs are retained).
- Potential reduction in carbon footprint (if associated RECs are retained).
- Potential increase in property value.

**Cons of Solar PPAs**

- Take time to understand your options for financing solar. Often, in the long term you will typically pay less and save more by buying your own solar system with a cash purchase or capital improvement loan than with a PPA.
- Depending on your particular situation, a solar operating lease may make more sense than a PPA. Solar leases have a lower cost of capital because the owner of the lease doesn’t take on performance risks like a PPA provider does. But because leases have shorter terms, your periodic payments would be higher than a PPA. At the end of the lease term, you usually have the option to

\(^{52}\) [http://www.srectrade.com/srec_markets/]


\(^{54}\) [https://www.epa.gov/greenpower/solar-power-purchase-agreements#benefits]
purchase the solar system you’ve been leasing for a reduced price. In contrast, if you have the option to buy the solar hardware in your PPA, it’s usually priced at the higher of Fair Market Value or Termination Value (probably more expensive than at the end of a lease).

✓ With a solar PPA, you don’t own the solar equipment, and you don’t maintain it, so you’re relying on someone else to choose quality equipment and keep it performing at peak efficiency.

**Questions to ask of your PPA Provider**

✓ Does the SFC use high-quality solar equipment and have experienced project leadership and staff? You should also inquire about what solar technology will be used for your installation. If your PPA provider uses inferior solar technology or substandard O&M, you may experience significant system downtime or a sharp drop in performance over time. Though you won’t have to pay when the system isn’t producing, you’ll be forced to buy energy from the grid at a higher rate to make up for it.

✓ Are they fully funded and financially backed by stable investors?

✓ Do they have excellent long-term relationships with credible, high-quality manufacturers, suppliers and financial institutions?

✓ Does its own operations and maintenance, including monitoring, system cleaning and rapid repairs?

✓ Do they offer asset management, including billing, reporting, tax filing, etc.

✓ Have they demonstrated longevity and will likely be around in 20-30 years to honor and maintain the PPA for its entire duration?

✓ They don’t just push PPAs but guides you honestly to the right solution for your organization—which may be a PPA, a lease, a cash purchase, or another financial solution.

✓ Do they seek out all possible federal, state and local tax incentives and passes the savings on to you in a lower PPA rate?

✓ At the end of the PPA, will they remove the system at no cost to you, negotiate a new rate, or let you buy the system at fair market value?

✓ Does the PPA provider subcontract or farm out parts of the PPA arrangement (which typically includes financing, construction, O&M and asset management) to sub-par contractors, financiers and/or O&M providers—or companies that expect you to negotiate each piece separately on your own? The process will go much more quickly and smoothly and have a far better outcome if you work with one company that does it all and/or vets its partners carefully on your behalf.

**Standard PPA and Lease Contract Samples**

*Residential PPA/Lease and Commercial PPA*

https://financere.nrel.gov/finance/solar_securitization_public_capital_finance

*Municipal PPA/Lease*


56 [https://www.epa.gov/greenpower/solar-power-purchase-agreements#benefits](https://www.epa.gov/greenpower/solar-power-purchase-agreements#benefits)