

# **Energy & Emissions Performance ModelGFO-20-305The Next EPIC Challenge**

# Overview & Instructions

This workbook must be completed as part of the Build Phase application. Projects selected and funded for the Design Phase will be asked to complete and submit a report detailing the results of software modeling of the development’s expected energy and emissions performance and impacts on tenants' energy bills. This workbook is intended to capture a high-level summary of the expected development performance.

General Requirements

1. This workbook should contain quantitative and qualitative information on the development’s expected performance.
2. Values and measurements for a specific item or usage should be consistent across the entire Energy and Emissions Performance Model and all supporting documents and other related documents.
3. Calculations used in analyses must be supported with sufficient detail and include justification of all assumptions.
4. For modeling, the use estimated building annual energy use is suitable for determining both load analysis and the proposed energy use.

# Energy Model Software Selection

1. The Energy Commission will accept energy models developed with software that is compliant with either ASHRAE or California Building Energy Efficiency Standards (Title 24). Qualified, commonly used modeling software incorporating ASHRAE Appendix G includes but is not limited to the following: DOE-2-based modeling programs, eQuest, HAP, TRACE, VisualDOE, EnergyPro, EnergyGauge, and EnergyPlus
2. Supporting documentation as applicable:
* Report from the energy modeling software showing compliance and energy calculations.
* Architectural drawings, including floor plan(s), elevations, and envelope cross sections as needed (mechanical, electrical, plumbing).
* Schematic diagram and equipment schedule for any renewable generation systems not included in the above
* Equipment product information sheets indicating efficiencies, performance values from nationally recognized standards as applicable, and specifications for proposed equipment used in the energy models.

# Project Information

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| Project Name |  |
| CEC Agreement # (EPC-XX-XXX) |  |

# Project Contacts

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| Prime Recipient |  |
| Architect |  |
| Energy Consultant |  |
| Other |  |
| Other |  |
| Other |  |
| Other |  |

# Build Location

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| Address |  |
| Zip Code |  |
| County |  |
| Climate Zone |  |
| Address 2 (if applicable) |  |
| Zip Code |  |
| County |  |

# Building Description

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| --- | --- |
| New construction or renovation/adaptive reuse?  |  |
| Total Building(s) Area (Sq ft) |  |
| Total Number of Dwelling Units |  |

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| Please provide a brief description of the proposed building(s), including expected occupancy(s), intended mixed-use(s), and any unique characteristics. In the case of major renovation clearly identify those building components and systems that are part of the renovation, and the extent to which they will be renovated and/or replaced. |
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# Key Design Strategies

For each section below, please provide a brief description of the applicable energy-related features and describe how each differs between the baseline (code minimum build-out) and proposed building models. This section may also include a description on advanced construction practices as applicable.

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| Domestic Hot Water |
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| Domestic Hot Water |
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| Cooking |
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| Demand Flexibility (Load Shedding & Load Shifting) |
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| Electric Vehicle Charging & V2G (If any) |
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| Envelope |
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| HVAC |
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| Process/Miscellaneous Load  |
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| Renewables & Storage |
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# Approach – Energy Modeling Software & Assumptions

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| Please indicate the modeling software(s) and version(s) used to develop the baseline and proposed models.  |
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| Please provide a summary of what utility rate schedules were selected for the energy modeling process.  |
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| Please provide a summary of the modeling approach and assumptions you used. Describe any modeling solutions utilized, how process loads were approximated, control strategies for the solar + storage system, load management, etc.  |
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# Baseline Design vs Proposed Design Energy Use Intensity by End-Use

1. For the end-use summary table, enter all end-use types as applicable (add rows as needed).

2. Identify the baseline site EUI, proposed site EUI, and % of improvement.

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| --- | --- | --- | --- |
| End-Use | Unregulated?Y/N | Site Energy Use Intensity (kBtu/sf/yr) | GHG Emissions Intensity (kg CO2/sf/yr) |
|
| Baseline | Proposed | % Improvement | Baseline | Proposed | % Improvement |
| Space Heating |  |  |   |   |  |   |   |
| Space Cooling |  |  |  |  |  |  |  |
| Indoor Fans |  |  |  |   |  |  |  |
| Heat Rejection |  |  |  |  |  |  |  |
| Pumps & Misc. |  |  |  |   |  |  |  |
| Domestic Hot Water |  |  |  |  |  |  |  |
| Indoor Lighting |  |  |  |   |  |  |  |
| Load Flexibility |  |  |  |  |  |  |  |
| Receptable |  |  |  |   |  |  |  |
| Process |  |  |  |  |  |  |  |
| Other Lighting |  |  |  |   |  |  |  |
| Process Motors |  |  |  |  |  |  |  |
| Outdoor Lighting |  |  |  |   |  |  |  |
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# Performance Summary

Provide information on all renewable on-site electricity generation, storage, and EV systems included in the baseline and proposed design. Add rows as needed.

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| **Proposed Renewable Electricity Generation Systems Overview** |
| Technology Type | Rated Electricity Generation Output Capacity (kW) | Annual Electricity Generation (kWh) | Avoided GHG Emissions (Metric ton CO2) |
| Photovoltaic System |  | Baseline Design | Proposed Design | Baseline Design | Proposed Design | % improvement |
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| Other |  |  |  |  |  |  |
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| **Renewable Thermal Energy Systems** |  |  |  |  |  |  |  |
| Technology Type | Rated System Capacity (Btu/h) | Annual Thermal Energy Generated (MMBtu) | Avoided GHG Emissions (Metric ton CO2) |
| Baseline Design | Proposed Design | Baseline Design | Proposed Design | % improvement |
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| **On-Site Storage Summary** |
| Technology Type | Rated Capacity (kW) | Energy Storage Duration (Tier/1/2/3) |
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| **Electric Vehicle Stations** |  |
| Model | Output Rating | Level (1,2,3) | # of stations | # of stations with grid- or building-interactive capability |
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# Peak Offset

Demonstrate the system's capability to meet daily peak electricity demand using onsite renewables, onsite storage, and load management (load shedding or load shifting). The reported peak demand (kW) and energy consumption (kW) should represent the entire development.

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| **Peak Demand** |  |  |  |
| (1) | (2) | (3) | (4) = [(2)+(3)]/(1) |
| Highest Peak Demand in a Year (kW) | Peak clipping due to onsite solar and storage on the highest peak day in the year (kW) | Peak clipping due to load management on the highest peak day in the year (kW) | % Peak reduction from onsite solar, storage and load management |
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| **Energy Consumption During Peak Hours (4-9 PM)** |
| (1) | (2) = (3) + (4) + (5) | (3) | (4) | (5) | (6) = [(4)+(5)]/(2) |
| Annual electricity consumption (kWh) | Annual consumption during peak hours (kWh/year) | Annual Grid Purchase during peak hours (kWh/year) | Annual load reduction from onsite solar and storage during peak hours (kWh/year) | Annual load reduction from load management during peak hours (kWh/year) | % Peak reduction from onsite solar, storage and load management |
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| **Electric Bill Reduction due to Peak Management**  |  |
| (1) | (2) = (3) + (4) + (5) | (3) | (4) | (5) | (6) = (4) + (5) | (7) = (6)/(2) |
| Annual electricity bill ($/year) | Expected annual electricity cost during peak hours ($/year) before solar, storage, and load shifting | Cost of purchasing from grid during peak hours ($/year) | Avoided grid electricity purchases due to solar and storage ($/year) | Avoided grid electricity purchases due to load management ($/year) | Total bill reduction caused by onsite solar, storage, and load management ($/year) | % Bill reduction compared to baseline bill |
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Note: Peak hours are defined as 4 PM-9 PM; The electric bill reduction should combine energy charge reduction and demand charge reduction (if applicable).

# Total Utility Bill Savings Estimates

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| Please provide a summary of what utility rate schedules were selected for the energy modeling process. Indicate whether average hourly rates were used or detailed down to each hour with associated rates (8670 hours/year). |
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| **Total Estimated Residential Space Electricity Bill** |
| Baseline | Proposed Design |  |  |
| First-Year Bill ($) | First Year Bill ($) | First-Year Saving ($) | Percentage Reduction (%) |
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| **Total Estimated Non-Residential Space Electricity Bill** |
| Baseline | Proposed Design |  |  |
| First-Year Bill ($) | First-Year Bill ($) | First-Year Saving ($) | Percentage Reduction (%) |
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| --- | --- | --- | --- |
| Baseline | Proposed Design |  |  |
| Lifetime Bill ($) | Lifetime Bill ($) | Lifetime Saving ($) | Percentage Reduction (%) |
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Note: If there are different types of non-residential units, please report an average number from the non-residential units. Or present them individually by adding more rows.