CITY OF GOLETA

**Agenda Item B.3**
**PRESENTATION**
**Meeting Date: October 20, 2020**

**TO:** Mayor and Councilmembers

**FROM:** Peter Imhof**,** Planning and Environmental Review Director

**CONTACT:** Cindy Moore, Sustainability Coordinator

**SUBJECT:** City Hall Solar and Energy Storage Feasibility Assessment

## RECOMMENDATION:

Receive a presentation from staff and Optony, Inc. on the results of the City Hall Microgrid Feasibility Assessment and provide feedback to staff.

## BACKGROUND:

The purpose of this item is to provide an update on the findings of Optony, Inc.'s Microgrid Feasibility Assessment for City Hall (Attachment 1), present the timeline for next steps, and obtain feedback from the City Council.

On August 18, 2020, the City Council received a presentation on the results of the City Hall Solar and Energy Storage Feasibility Assessment. At that meeting, the City Council authorized additional support from Optony, Inc. and Willdan to provide information that would assist the City in making a final decision about whether to procure a solar-only system or an "islandable" solar and storage microgrid for City Hall.

Optony was authorized to proceed with additional analysis to determine the resilience benefits and financial impacts of procuring a microgrid, provide procurement management, and participate in public decision-maker meetings. The procurement management task includes such actions as developing the Request for Proposal (RFP) documents; issuance of the solicitation; review, comment and support for negotiations of a final agreement (Power Purchase Agreement (PPA) or similar). Willdan would provide structural and electrical engineering support under their existing contract to assess the roof's potential to hold a solar photovoltaic (PV) layout and confirm feasibility to construct as designed; confirm interconnection requirements for integration with the existing generator and solar PV with the building, and highlight any additional construction feasibility issues (electrical, mechanical, interconnection, circuit constraints, ADA compliance, etc.).

Willdan's support is in process and will inform the vendor selection when complete. The contract amendment with Optony was finalized in early September 2020 and the City provided Optony with a Notice to Proceed on September 9, 2020. Optony's final report is included in Attachment 1 and highlights are summarized below.

### City Council Energy/Green Issues Standing Committee

The City Council's Energy/Green Issues Standing Committee received a presentation on the results of the Microgrid Feasibility Assessment on October 12, 2020. At the meeting, the Committee unanimously supported the item being brought forward to the City Council for an update on October 20, 2020, as well as release of the RFP on October 13, 2020.

## DISCUSSION:

### <u>Report Overview</u>

### Summary

Optony conducted additional analysis to determine the resilience benefits and financial impacts of procuring a microgrid at City Hall. This analysis included consideration of how a solar and storage system could incorporate the existing diesel back-up generator, the estimated resilience duration provided by the combined (solar + storage + generator) system, the balance of system costs required to configure a microgrid, and an updated financial analysis of various procurement and ownership alternatives[1] identified in the original Feasibility Assessment for solar photovoltaic and energy storage that incorporates both the costs and an estimated value of resilience during planned and unplanned power outages. To allow for easy comparison of the net savings for each proposed project, Optony continues to use Net Present Value (NPV)[2] as the metric to determine whether the opportunity cost of investing in a project now is worth it.

Optony's analysis indicates that a microgrid consisting of solar, storage and the existing back-up generator could provide a minimum of six weeks of resilience. Financing the system via a Power Purchase Agreement[3] with a buyout in Year 7 would lead to a positive NPV of approximately $80,000 without considering a monetary value of resilience. While Optony determined that a solar-only system has a higher NPV in all financing scenarios without considering a monetary value of resilience[4], quantifying the value of resilience for the combined system indicated an additional NPV of approximately $117,000, for a total NPV of approximately $189,000.

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[1] The Solar and Energy Storage Feasibility Assessment dated June 19, 2020 analyzed four financing options: 1) Direct Purchase; 2) PPA with no buyout; 3) PPA with buyout in year seven; and 4) Lease.
[2] Net Present Value is defined as the difference between the total costs and total savings over the lifetime of the project discounted to present value (2020 dollars). In the case of a financing mechanism with no upfront cost (e.g., Power Purchase Agreement), the total project costs are also discounted to present value.
[3] The site host enters into a contract with a third party to purchase at a fixed rate all energy produced by a solar PV system installed on the property in question. The third party would own the solar PV system and be fully responsible for all ownership costs, including financing, O&M, insurance, and system output.
[4] Please see Table 5 in Attachment 1, Page 6.

## Approach

Optony first determined the current level of resilience at City Hall based on capacity and operational characteristics of the existing 378-gallon, diesel-powered back-up generator. Although there is no ability for the City to isolate critical loads currently, if the City had the ability to isolate and support only critical loads, the generator could provide power for a longer outage. Isolating critical loads prioritizes only the most important electrical loads for support during a grid outage, thereby increasing the resilience provided by a given system.

Second, to understand the level of resilience provided by an “islandable” solar and storage system, Optony sought to identify an expected critical load profile and modeled performance of a 175 kW solar PV system and a 45 kW, 180 kWh battery, both with the generator and without the generator, under two scenarios:

1. A planned outage such as a specified Public Safety Power Shutoff (PSPS); and
2. An unexpected outage such as an unspecified grid failure or disaster.

Specifically, the consultant sought to answer two questions:

1. Can the system support critical loads through a specified outage like a 48-hour PSPS?
2. What is the probability of the system supporting critical loads through an unspecified outage of varying lengths at any hour of the year?

## **<u>Key Findings</u>**

### Resiliency

Without the use of the existing generator, the above-mentioned system is capable of supporting critical loads at Goleta’s City Hall through the planned 48-hour outage and, on average, can provide 277 hours of resilience. However, since the City has the existing diesel generator, any installed system would likely be integrated with it. If integrated with the existing generator, the system is still capable of surviving the 48-hour outage and the average resilience increases substantially to 1,467 hours (~8 weeks).

With regard to the combined system’s ability to sustain a range of outage durations, Optony states that the most important takeaway from the resilience analysis is that, if a solar and storage system were integrated with the existing generator in a microgrid configuration, the system could survive a ~3.5-week outage with 100% certainty. This is a robust level of resilience that would enable the City to maintain operations for a significant period and potentially leverage City Hall in a range of community-facing emergency response uses.

## Financial Results

In order to achieve the resilience benefits discussed above, the solar and storage system must be able to island from the grid and be integrated with the existing generator. Building a system that can island and operate independently from the grid has additional costs, related primarily to associated equipment. These “balance of system” costs are for items such as an automatic transfer switch and/or smart panel to isolate critical loads, a microgrid controller to coordinate operation of all assets and a relay to sense changes in grid operation and communicate the need to island. Optony determined that a 20% increase in total system cost was an appropriate estimation of the balance of system costs required to transition a solar and storage system to a microgrid. Given the expected system size, this additional capability equated to an approximately $112,000 increase in system cost.

Optony incorporated these costs into the financial modeling completed during the initial Feasibility Assessment to enable a comparison of the costs and benefits of installing a microgrid compared to a solar-only system (the financially preferable technology configuration in the original Feasibility Assessment). This first step of the financial analysis only included benefits in the form of bill savings. Since, as discussed in the initial Feasibility Assessment, the majority of available bill savings can be captured by a solar-only system, the microgrid has a lower NPV across all financing options because of the higher system costs and low marginal bill savings from adding storage.

Table 5 below, taken from page 6 of the report, provides a summary of the financial analysis *not* including any value of resilience. It illustrates that, if financed via a PPA with a buyout, such a system is financially beneficial to the City *without* incorporating any additional quantified resilience benefit that it provides.

Table 5: Summary of Financial Analysis[5]

| Technology Configuration | Cash Purchase | | | PPA | | | PPA with Buyout | | | Tax Exempt Lease Purchase | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Cost | Total Savings | Net Present Value | Total Cost | Total Savings | Net Present Value | Total Cost | Total Savings | Net Present Value | Total Cost | Total Savings | Net Present Value |
| **Solar Only** | $692,462 | $1,255,467 | **$194,243** | $727,740 | $1,255,467 | **$331,626** | $506,121 | $1,255,467 | **$420,489** | $901,384 | $1,255,467 | **$132,585** |
| **Microgrid** | $1,086,736 | $1,449,642 | **($35,089)** | $1,423,633 | $1,449,642 | **($17,666)** | $1,083,601 | $1,449,642 | **$81,895** | $1,454,914 | $1,449,642 | **($128,290)** |

**Quantified Value of Resilience**

In order to enable a direct financial comparison incorporating all benefits of a microgrid, Optony placed a conservative value on the resilience provided by the system. Utilizing a calculator developed by Lawrence Berkeley National Laboratory, Optony determined an estimated “Value of Lost Load” representing the cost of an unserved kWh of critical load. To incorporate the value of resilience, this figure was applied to the amount of energy served by the microgrid in the planned outage scenario over the period of the financial analysis, discounted to 2020 dollars and added to the NPV of the microgrid. This creates a present value of resilience of $117,189.

Optony’s report concludes:

- While the existing generator at City Hall can provide back-up power for a significant period of time (41 hours to ~1 week depending on the electrical load), an integrated microgrid (solar + storage + generator) can provide back-up power to City Hall for a minimum of ~3.5 weeks.

- If financed via a PPA with a buyout, such a system is financially beneficial to the City *without* incorporating the additional quantified resilience benefit that it provides. If financed via another mechanism, a monetary value of resilience can be considered as an additional benefit to inform an investment decision.

- While the NPV of developing a microgrid is less than a solar-only system, the fact that it could result in a positive NPV, with or without adding a monetary value of resilience, while providing additional community benefits, indicates that it would be a justified investment for the City.

- If it is determined that a microgrid system is currently infeasible or undesirable at the present time, the City could invest in a solar-only system designed to be “microgrid-ready” by working with a chosen developer to ensure that system hardware and contracting arrangements enable a battery storage system and microgrid controls to be added in the future.

**Next Steps / Timeline**

Following the August 18th City Council meeting, staff was directed to update the Energy/Green Issues Standing Committee on progress and return to the City Council following the completed RFP process for consideration of approval of a contract to proceed with procurement and installation of the desired configuration under the approved financing option. As mentioned above, staff provided an update to the Energy/Green Issues Standing Committee on October 12, 2020 and is providing this progress update to the full City Council. Staff will continue to proceed with next project steps per the City Council’s previous direction. The estimated timeline listed below identifies key steps necessary to capture the existing Investment Tax Credit level this year:

- 10/13: Issue Request for Proposals (RFP)
- 10/20: City Council Update – Microgrid Feasibility Assessment
- 10/21-10/22: RFP vendor meeting and optional site walk-through
- 10/30: Deadline for vendor questions
- 11/12: RFP proposal due date
- 11/19: Interview with shortlist firms
- 11/24: Selection of preferred vendor for pursuing contract negotiations
- 12/1: Vendor begins due diligence and design/engineering finalization; contract review begins
- 12/2: Update to Public Safety & Emergency Preparedness Committee with selected vendor and preliminary offering (contract terms under negotiation--focus on resiliency aspect)
- 12/9: Update to Energy/Green Issues Standing Committee (focus on nearly finalized contract and expected design and energy production)
- 12/15: City Council – Consideration of negotiated contract for approval (with 50% design) - public hearing requiring 2-week notice

**FISCAL IMPACTS:**

There are no fiscal impacts at this time. Staff will return to the City Council following the completed RFP process for consideration of approval of a contract to proceed with procurement and installation of the desired configuration under the approved financing option.

**CONCLUSION:**

The City Council has set a visionary target to transition to clean energy in the form of the adopted 100% Renewable Energy goal by 2030. The results of the attached analysis indicate that integration of a microgrid with the existing back-up generator would result in significant additional community benefits and overall cost savings, with or without the monetary value of resilience included, and therefore the system would be a justified investment.

| **Reviewed By:** | **Legal Review By:** | **Approved By:** |
|---|---|---|
| Kristine Schmidt<br>Assistant City Manager | Michael Jenkins<br>City Attorney | Michelle Greene<br>City Manager |

**ATTACHMENT:**

1. City Hall Microgrid Feasibility Assessment
2. City Hall Microgrid Feasibility and Distributed Energy Resource Procurement Approach Presentation

**ATTACHMENT 1**

CITY HALL MICROGRID FEASIBILITY ASSESSMENT

PREPARED BY OPTONY, INC.
September 28, 2020

To: City of Goleta
From: Optony Inc.
Date: September 28, 2020
Subject: Feasibility of Installing a Microgrid at City of Goleta City Hall
Attention: Cindy Moore, Sustainability Coordinator, Planning & Environmental Review, City of Goleta


## Summary

In July 2020, Optony completed a detailed feasibility assessment to determine the technical potential and financial opportunity of adding solar photovoltaics and battery storage at the City of Goleta's City Hall. That study considered three technology configurations; (1) solar-only, (2) solar + storage optimized for bill savings and (3) solar + storage optimized for resilience. Upon completion of the financial analysis for each configuration, it was determined that further exploration into the resilience configuration was warranted in order for the City to make a final decision on whether to procure a solar-only system or a "islandable" solar and storage microgrid.

The intention of this follow-on analysis was to determine the exact resilience benefits and financial impacts of procuring a microgrid. The analysis considered how a solar and storage system could incorporate an existing back-up generator in a microgrid, the estimated resilience duration provided by the combined system, the balance of system costs required to configure a microgrid and an updated financial outlook that incorporates these costs and an estimated resilience value.

The analysis indicated that a microgrid consisting of solar, storage and the existing generator could provide **a minimum of 3.5 weeks of resilience**. Financing the system via a PPA with a buyout in Year 7 would lead to a positive NPV of **approximately $80,000 without considering a monetary value of resilience**. Quantifying the value of resilience indicated an additional NPV of about **$117,000**, for a total NPV of approximately **$189,000.**


## Background – Existing Back-up Power

The first step in the resilience analysis was to determine the current level of resilience at City Hall. In 2009 the City purchased a 175-kW diesel-powered back-up generator to serve City Hall. This generator can currently serve all electrical loads on the first floor and the City has received a grant to interconnect the generator to electrical loads on the second floor. There is currently no ability for the City to isolate critical loads. In the event of an outage, the generator will serve all electrical loads on in the building. To date, the generator has not been used to serve a major outage and the City has never needed to refill the fuel tank.

The City has a 378-gallon fuel storage tank on-site. Given a full fuel tank, Table 1 illustrates the duration of outages that the existing generator could sustain depending on the percentage of operating capacity. Given the size of the generator and electrical loads in the building, it is expected that the generator would be operating at around 50% capacity, but this could be lower if the City strategically managed electrical loads during an outage (see below).

Table 1: Estimated Resilience Provided by Existing Generator

| Generator Operating Capacity | Survivable Outage Duration (hours) |
|---|---|
| 50% | 41 |
| 75% | 32.8 |
| 100% | 26.6 |

If the City had the ability to isolate critical loads, the generator could provide power for a longer outage. In the near term, the City may be able to manually manage electrical loads during an outage by turning off certain equipment. If the City were to install a dedicated critical load circuit or smart panel, equipment that would be installed as part of a microgrid, it would be possible to more accurately isolate critical loads. For reference, Table 2 includes a minimum, maximum and average survivable outage duration if the generator were supporting *only* the critical loads at City Hall. These figures were calculated using NREL's ReOPT Tool and *do not* directly reflect current resilience at City Hall since critical loads cannot currently be isolated.[1]

[1] See the **Resilience Analysis** section below for further discussion on how critical loads were identified and how resilience was modeled using the ReOPT Tool.

Table 2: Potential Resilience Provided by Existing Generator (Critical Loads Only)

| Ability of Existing Generator to Support Critical Loads | |
|---|---|
| Average Resilience Duration | 246 hours |
| Minimum Resilience Duration | 179 hours |
| Maximum Resilience Duration | 282 hours |

Additionally, the ability to refill the fuel tank means that the generator could provide power for a longer duration with a brief interruption. However, the ability to refuel is dependent on the availability of diesel fuel. While diesel is readily available during "blue-sky" conditions, increased competition, and disruption to supply chains may decrease its availability during an emergency situation with widespread power outages.

The carbon emissions impact of using a diesel generator for back-up power are significant. Burning an entire tank of fuel would result in about 3.84 $mtCO^2$.[2] This is equal to about 8.6% of the carbon emissions associated with the grid electricity used at City Hall. As noted above, the City has not used the generator to provide power during any extended outage, so these emissions have not occurred historically.

**Resilience Analysis**

*Background & Methodology*

To understand the level of resilience provided by an "islandable" solar and storage system, the analysis sought to answer two questions. First, can the system in question provide power to critical loads for the duration of a specified outage? The specified outage chosen was September 9th at 10am. This time was chosen to reflect the risk of a Public Safety Power Shutoff (PSPS) during fire season. PSPS are *planned* outages, meaning that City will be able to operate the system in order to maximize resilience during the specified period (i.e. limit battery cycling for economic purposes to reserve capacity for resilience).

The second question asked by this analysis was as follows; what is the probability of the system providing power to critical loads during unspecified outages (unexpected outages of varying lengths occurring throughout the year)? This question simulates a situation where a disaster or grid failure causes a grid *unplanned* outage and the City is unable to adjust system operations in advance.

To answer these questions, Optony used the NREL ReOPT Tool[3] to model the performance of a 175-kW PV system and a 45-kW, 180-kWh battery system, with and without a generator. The following assumptions were used in the analysis:

- Modeling assumed perfect foresight of the specified outage
- In the resilience probability simulation (unplanned outage scenario), battery state of charge at the beginning of each outage is determined by economic dispatch of the battery
- Variation in solar performance is not considered, assumed to be as expected give time of year and conditions

To assess the system's ability to sustain the specified outage ReOPT simulates battery charge/discharge, solar production and critical load to determine if the system can provide enough energy to meet critical load during the specified 48-hour period. To assess the system's ability to sustain an unplanned outage, ReOPT simulates outages across a range of durations (0-8760 hours) occurring in every hour of the year. Based on solar production and the battery state of charge in any given hour of the year, the probability of the system providing enough energy to sustain each outage duration is calculated. ReOPT also calculates the minimum, maximum and average resilience duration provided by the system.

*Identifying Critical Load*

Prior to completing this modeling, however, it was necessary to determine an expected critical load profile. While the City does not currently have the ability to isolate critical loads during a grid interruption, it is expected that this would be done during the installation of a solar and storage system (see *Balance of System Costs* section below). Isolating critical loads prioritizes only the most important electrical loads for support during a grid outage, thereby increasing the resilience provided by a given system.

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[2] Calculated using the Energy Information Association (EIA) $CO_2$ Emissions Coefficients (22.40 pounds $CO_2$ per gallon of diesel). https://www.eia.gov/environment/emissions/co2_vol_mass.php

[3] ReOPT is an open-source tool that enables users to simulate the operation of distributed energy resources to determine the given financial and resilience benefits. Given the limited flexibility of ReOPT's financial analysis, Optony used ReOPT only for the resilience portion of the analysis.

Through conversations with City staff about building operating hours and a review of building equipment, Optony constructed a critical load profile. This profile consisted primarily of HVAC, lighting and server/computer load. The average load was 20.6 kW and the peak load was 54.8 kW. This represents 62% of the average and peak loads expected during normal operation.

*Results*

A 175-kW solar system and 45-kW, 180-kWh battery system is capable of supporting critical loads at Goleta's City Hall through the planned 48-hour outage and, on average, can provide 277 hours of resilience *without* use of the existing generator. There is, however, a risk that the system could not provide any resilience (see Minimum Resilience Duration). This would occur in a worst-case scenario where an outage occurs in the evening and the battery has no charge. It is important to note that the resilience provided by a solar and storage system on its own is shown primarily for reference. Since the City has an existing diesel generator, any installed system would likely be integrated with the generator, as discussed in Table 4 and Figure 2 (pages 4-5).

Table 3: Estimated Resilience Provided by Solar + Storage

| **Resilience Provided by Solar + Storage** | |
|---|---|
| Survives specified outage? | Yes |
| Average Resilience Duration | 277 hours |
| Minimum Resilience Duration | 0 hours |
| Maximum Resilience Duration | 1,516 hours |

**Figure 1** (next page) shows a probability distribution of the system's ability to sustain a range of outage durations. This distribution enables the City to pick an acceptable risk threshold (e.g. 90% of sustaining the outage) and see what length of outage corresponds with that risk threshold (e.g. 13 hours).

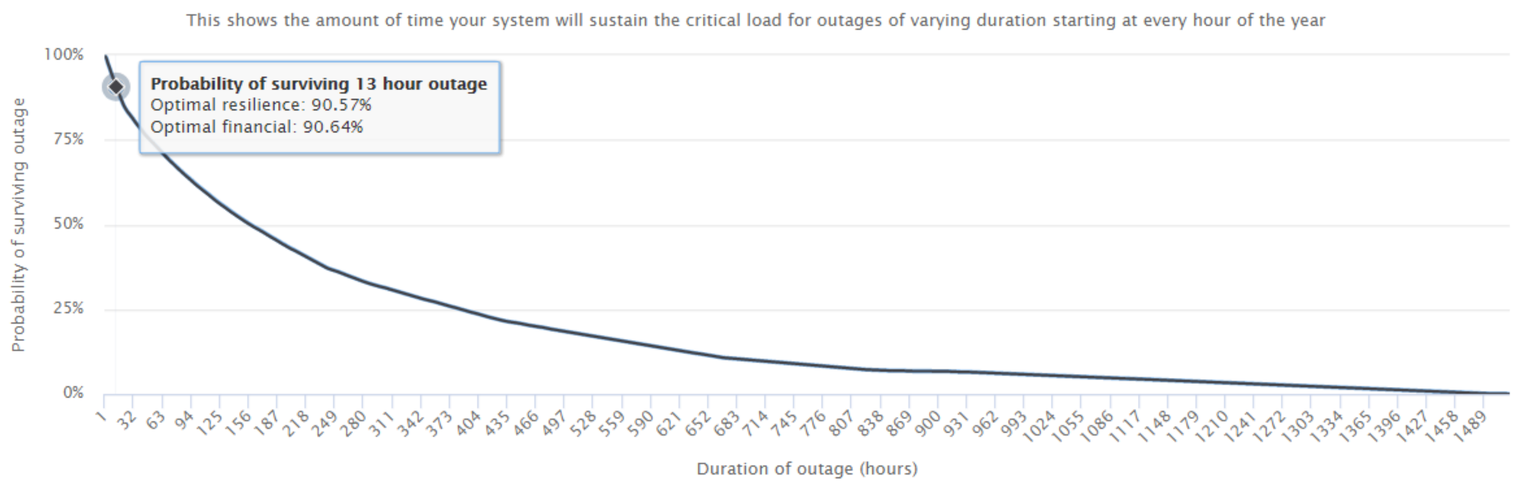


Figure 1: Resilience Probability Distribution (Solar + Storage)

If integrated with the existing generator, the system is still capable of surviving the 48-hour outage and the average resilience increases to 1,467 hours (~8 weeks).

Table 4: Estimated Resilience Provided by Integrated Microgrid

| Resilience Provided by Solar + Storage + Generator | |
|---|---|
| Survives specified outage? | Yes |
| Average Resilience Duration | 1,467 hours |
| Minimum Resilience Duration | 574 hours |
| Maximum Resilience Duration | 2,807 hours |

**Figure 2** shows a probability distribution of the combined system's ability to sustain a range of outage durations. The most important takeaway from the resilience analysis is that, if a solar and storage system were integrated with the existing generator in a microgrid configuration, the system could survive a **~3.5-week outage with 100% certainty**. This is a robust level of resilience that would enable the City to maintain operations for a significant period and potentially leverage City Hall in a range of community facing emergency response uses.

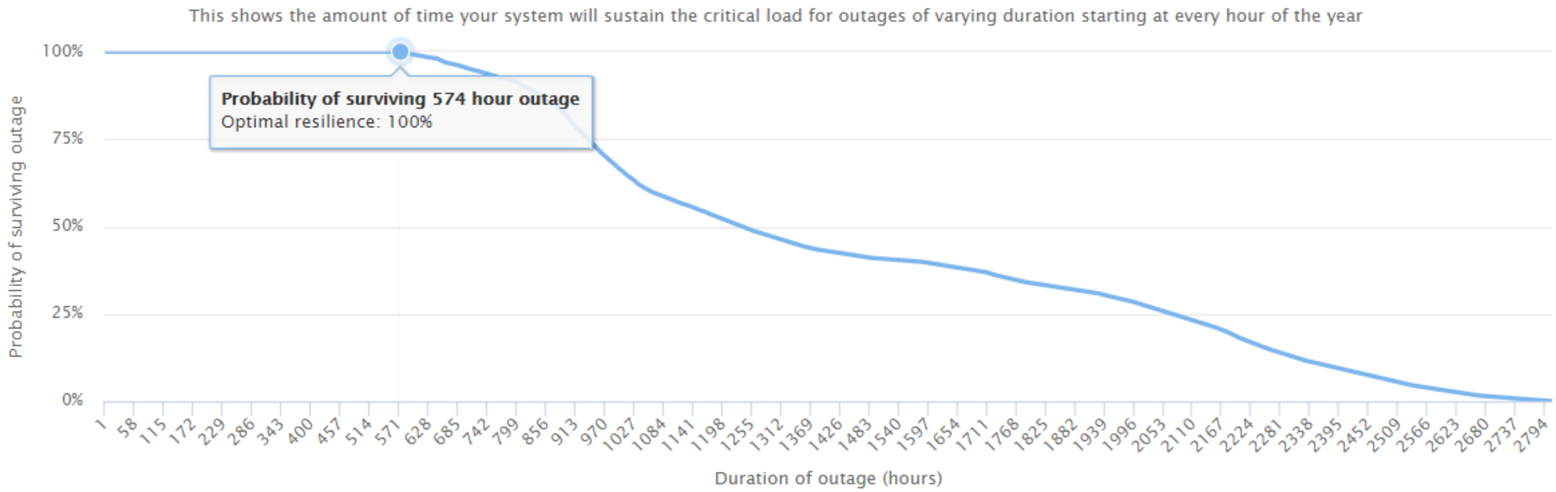

Figure 2: Resilience Probability Distribution (Integrated Microgrid)

## Financial Analysis

*Background & Methodology*

In order to achieve the resilience benefits discussed above, the solar and storage system must be able to island from the grid and be integrated with the existing generator. Building a system that can island and operate independently from the grid has additional costs. These costs, referred to as "balance of system" costs, stem primarily from equipment such as an automatic transfer switch and/or smart panel to isolate critical loads, a microgrid controller to coordinate operation of all assets and a relay to sense changes in grid operation and communicate the need to island. The exact scale of the balance of system costs is hard to determine given the confidential nature of the information. Through discussions with developers and a review of existing studies, Optony determined that a 20% increase in total system cost was an appropriate estimation of the balance of system costs required to transition a solar and storage system to a microgrid. Given the expected system size, this equated to approximately a $112,000 increase in system cost. Optony incorporated these costs into the financial modeling completed during the initial Feasibility Assessment to enable a comparison of the costs and benefits of installing a microgrid compared to a solar-only system (the financially preferable technology configuration in the Feasibility Assessment). This first step of the financial analysis only included benefits in the form of bill savings. Since, as discussed in the initial Feasibility Assessment, the majority of available bill savings can be captured by a solar-only system, the microgrid has a lower net present value (NPV) across all financing options because of the higher system costs and low marginal bill savings from adding storage.

In order to enable a direct financial comparison incorporating all benefits of a microgrid, the next step of the analysis placed a conservative value on the resilience provided by the system. Optony used the Interruption Cost Estimate (ICE) Calculator, developed by Lawrence Berkeley National Labs, to determine an estimated Value of Lost Load (VoLL).[4] To do this, Optony used the ICE Calculator to model a case of a single customer losing power in Goleta. The VoLL represents the cost of an unserved kWh of critical load in Goleta. **Figure 3** includes the outputs of the ICE Calculator with the VoLL of various sectors circled.

[4] https://www.icecalculator.com/home

| Sector | # of Customers | Cost Per Event (2016$) | Cost Per Average kW (2016$) | Cost Per Unserved kWh (2016$) | Total Cost (2016$) |
|---|---|---|---|---|---|
| Residential | 0 | $5.20 | $6.33 | $7.30 | $0.00 |
| Small C&I | 1 | $607.57 | $294.05 | $339.29 | $1,446.00 |
| Medium and Large C&I | 0 | $8,074.73 | $154.11 | $177.81 | $0.00 |
| **All Customers** | **1** | **$607.57** | **$294.05** | **$339.29** | **$1,446.00** |

Figure 3: Estimated VoLL in Goleta (ICE Calculator)

In order to choose the appropriate VoLL value, Optony had to determine which sector was most applicable to City Hall. While City Hall would usually be considered a Small Commercial & Industrial (C&I) property, Optony deemed the residential sector as the most equivalent VoLL sector. The VoLL calculated by the ICE Calculator is based on a series of surveys that gathered information on customers' willingness to pay to avoid an outage. Accordingly, the Small and Medium C&I figures reflect the willingness to pay of customers like hotels or manufacturing facilities, to which an outage has significant negative economic impacts. Thus, given the similarity in the critical loads present in a residential context and City Hall (IT equipment, lighting, and HVAC), Optony determined $7.30 as the most appropriate VoLL. To incorporate the value of resilience, this VoLL was applied to the amount of energy served by the microgrid in the planned outage scenario (a 48-hour outage once a year) over the 25-year period of the financial analysis. This value was then discounted to 2020 dollars and added to the NPV of the microgrid.

*Results*

Table 5 shows the NPV of a solar-only system compared to a microgrid across four financing scenarios. These results do **not** include any value of resilience. While a solar-only system has a higher NPV in all scenarios, financing a microgrid via a PPA with a buyout leads to a positive NPV without incorporating any value of resilience.

Table 5: Summary of Financial Analysis[5]

| Technology Configuration | Cash Purchase | | | PPA | | | PPA with Buyout | | | Tax Exempt Lease Purchase | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Cost | Total Savings | Net Present Value | Total Cost | Total Savings | Net Present Value | Total Cost | Total Savings | Net Present Value | Total Cost | Total Savings | Net Present Value |
| **Solar Only** | $692,462 | $1,255,467 | **$194,243** | $727,740 | $1,255,467 | **$331,626** | $506,121 | $1,255,467 | **$420,489** | $901,384 | $1,255,467 | **$132,585** |

[5] The Net Present Value figure for the solar-only configuration presented in this memo is slightly larger from the figure in the initial Feasibility Assessment. This is due to a slight change in the methodology used to calculate the buyout amount that more accurately reflected the remaining operations and maintenance costs borne by the system owner after the buyout.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Microgrid** | $1,086,736 | $1,449,642 | **($35,089)** | $1,423,633 | $1,449,642 | **($17,666)** | $1,083,601 | $1,449,642 | **$81,895** | $1,454,914 | $1,449,642 | **($128,290)** |

**Figure 4** and **Figure 5** illustrate how the value of resilience over 25-years impacts the NPV of a microgrid in a cash purchase and PPA with buyout scenario, respectively. In both cases, using a VoLL of $7.30 applied across one 48-hour outage a year creates a present value of resilience of $117,189.[6] In the cash purchase scenario, this value makes up for a previously negative NPV. In the PPA with buyout scenario, this value increases an already positive NPV. **Figure 4** and **Figure 5** should be read from left to right. Blue bars indicate a positive value (benefit), orange bars indicate a negative value (costs), and green bars represent a final value.

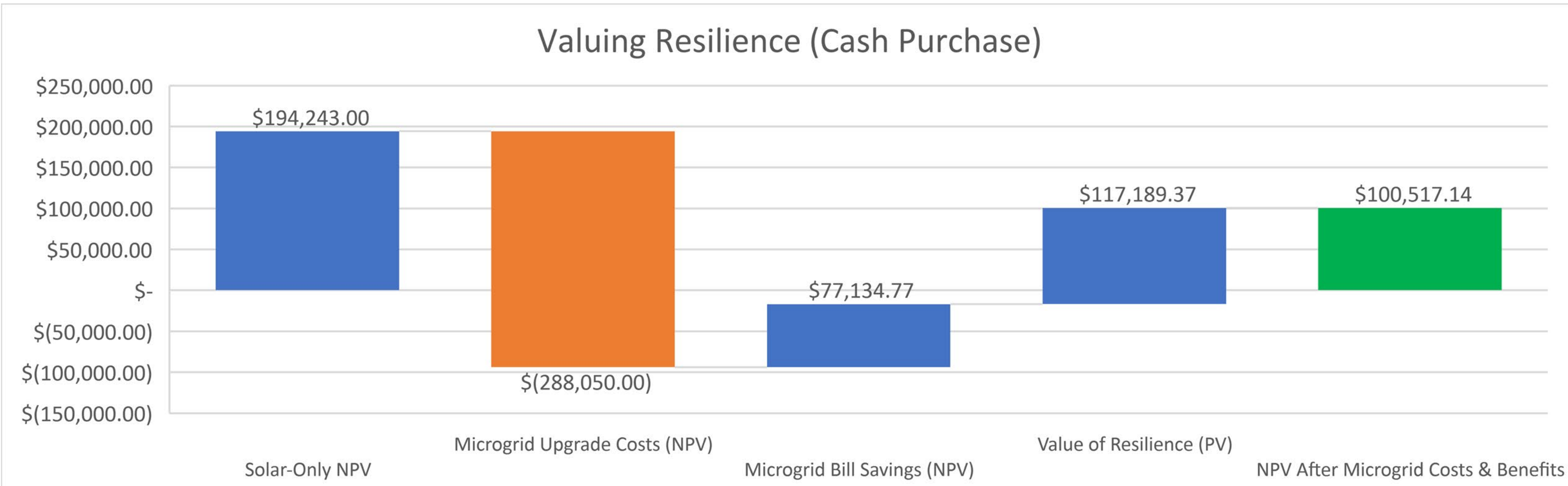


Figure 4: Impact of Resilience Value on System NPV (Cash Purchase Scenario)

[6] This value is calculated independent of any costs or benefits associated with the existing generator. It is estimated that the NPV of the generator, including purchase, permitting and maintenance costs from 2009 through 2045 is approximately negative $131,000. Incorporating estimated resilience benefits and associated refueling costs from 2021 through 2045, the NPV increases to approximately negative $31,000.

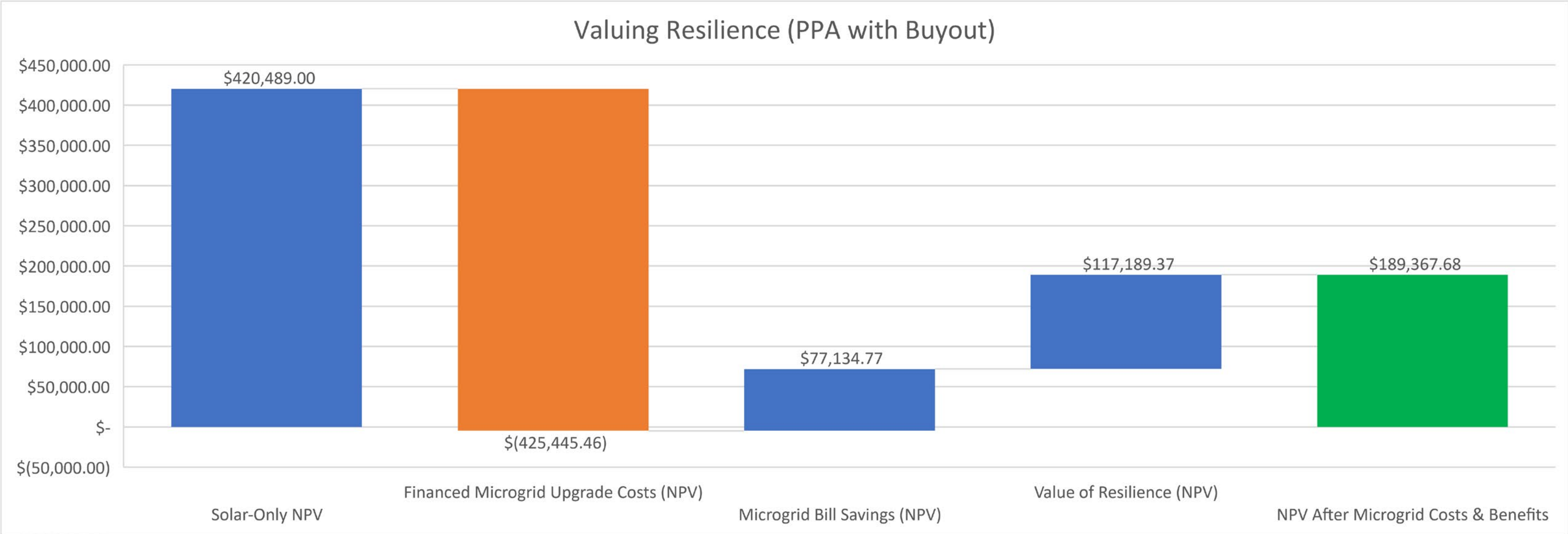

Figure 5: Impact of Resilience Value on System NPV (PPA with Buyout Scenario)

This analysis shows that valuing resilience can significantly impact the NPV of a given technology configuration. However, it still does not place a value on the extended resilience, and potential community services, that an integrated microgrid could provide. The City may determine that this value cannot (or should not) be quantified in financial terms because the value of supporting a community through a disaster is a necessity that must be invested in.

**Conclusions**

**While the existing generator at City Hall can provide back-up power for a significant period of time (41 hours to a ~1 week depending on the electrical load), an integrated microgrid (solar + storage + generator) can provide back-up power to City Hall for a minimum of ~3.5 weeks while also minimizing carbon emissions in line with the City's renewable energy goals and maximizing electricity savings.** If financed via a PPA with a buyout, such a system is financially beneficial to the City *without* incorporating the additional quantified resilience benefit that it provides. If financed via another mechanism, a monetary value of resilience can be considered as an additional benefit to inform an investment decision. While the NPV of developing a microgrid is less than a solar-only system, the fact that it could result in a positive NPV, with or without adding a monetary value of resilience, while providing additional community benefits, indicates that it would be a justified investment for the City.

If it is determined that a microgrid system is infeasible due to budget impacts from the COVID-19 crisis, the City of Goleta could invest in a solar-only system designed to be "microgrid ready" by working with a chosen developer to ensure that system hardware and contracting arrangements enable a battery storage system and microgrid controls to be added in the future.

## ATTACHMENT 2:

City Hall Microgrid Feasibility and Distributed Energy Resource Procurement Approach Presentation

# CITY HALL MICROGRID FEASIBILITY & DISTRIBUTED ENERGY RESOURCE PROCUREMENT APPROACH

OPTONY

Presentation to the City Council

October 20, 2020

Presentation by:
Cindy Moore, Sustainability Coordinator
Sam Hill-Cristol & Maddie Julian, Optony, Inc.

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# Lead Consultant Expertise

OPTONY

- Local Energy Program Design
- Clean Energy Strategic Modeling
- Policy & Technology Roadmap Creation

Jonathan Whelan

Sam Hill-Cristol

Maddie Julian

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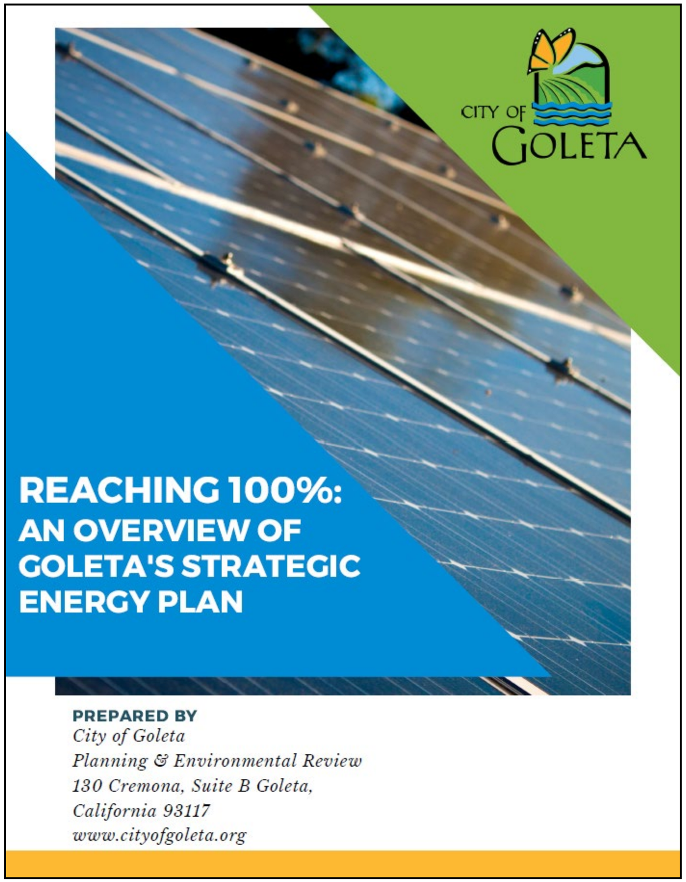
# Presentation Overview

1. Actions to Date
2. Overview – Summary, Approach & Assumptions
3. Existing Resilience
4. Results
5. Updated Financial Analysis
6. Conclusions
7. Next Steps

# 1. Actions to Date




- 100% Renewable Energy Goals
  - ✓ Strategic Energy Plan Implementation
- 1st Step - Technical & Financial Analysis of Solar PV & Energy Storage Opportunities
- 2nd Step - Additional analysis of Solar PV and Battery Energy Storage for Resilience Purposes

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# 2. Microgrid Feasibility Overview

A. Determine Expected Resilience of Microgrid
   - ✓ What length of outage can City Hall survive?

B. Update Financial Analysis to Determine Cost of Resilience
   - ✓ Re-run financing scenarios with updated system costs

*Note: Resilience is defined as the duration (hours) that a system can provide power to critical loads during an outage.*

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# 2. Summary of Results

A Solar + Storage + Generator Microgrid could provide a Minimum of **3.5 Weeks of Resilience**

(And Potentially have a Positive NPV of ~$80,000 *Before* Resilience Benefits are Included)

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# 2. Approach

c. Model performance of 175 kW PV & 45 kW, 180 kWh Battery Under Two Scenarios:
   - ✓ With Generator
   - ✓ Without Generator

# 2. Approach

D. Answer Two Questions:

- ✓ Can the system support critical loads through a specified outage like a PSPS?
- ✓ What is the probability of the system supporting critical loads through an unspecified outage of varying lengths at any hour of the year?

# 2. Assumptions

E. Critical Load Includes Lighting, HVAC & IT
   - ✓ Peak critical load is ~65% of overall peak load

F. Modeling Methodology Assumes:
   - ✓ Perfect foresight of specified outage (48-hour scenario)
   - ✓ Battery state of charge is determined by the economic dispatch for probability simulation of unspecified outage
   - ✓ Solar production is not varied

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# 3. Existing Resilience

- ✓ 175 kW generator, interconnected to entire first floor & will be expanded to second floor
- ✓ 378-gallon diesel storage tank
- ✓ No ability to isolate critical load

| Generator Operating Capacity | Survivable Outage Duration (hrs) |
|---|---|
| 50% | **41** |
| 75% | 32.8 |
| 100% | 26.6 |

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# 3. Existing Resilience

- ✓ Existing resilience comes with significant GHG impacts
    - 3.84 mtCO2 per tank of fuel
- ✓ ~8.6% of annual carbon emissions associated with the grid electricity used at City Hall
- ✓ Does not align with City’s 100% Renewable Goal

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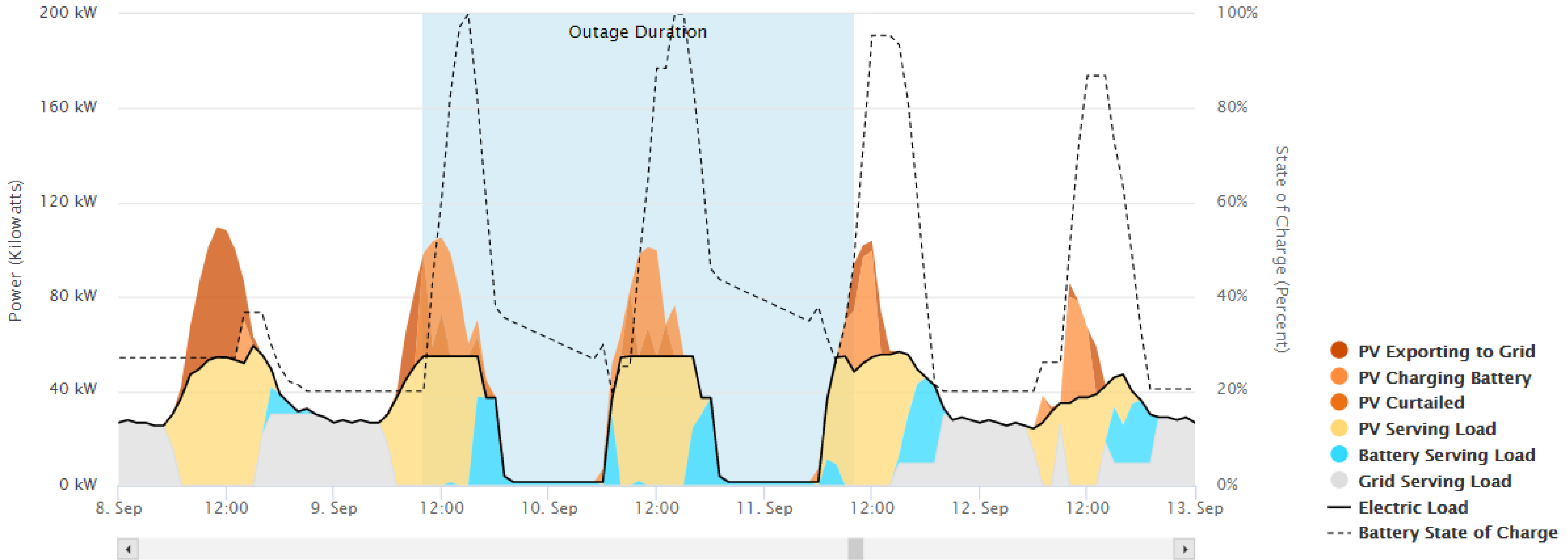
# 4. Results: Without Generator

G. System survives planned outage



# 4. Results: Without Generator

## H. Variable Outage Simulation

| Resilience Provided by Solar + Storage | |
|---|---|
| Survives specified outage? | Yes |
| Average Resilience Duration | 277 |
| Minimum Resilience Duration | 0 |
| Maximum Resilience Duration | 1,516 |

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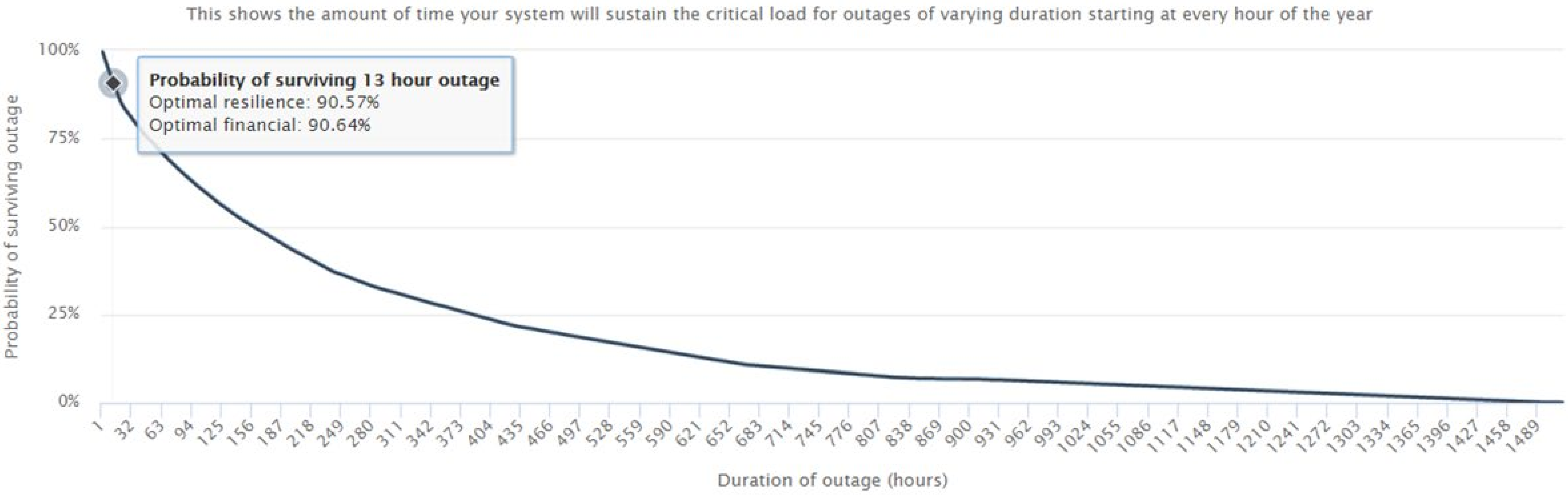
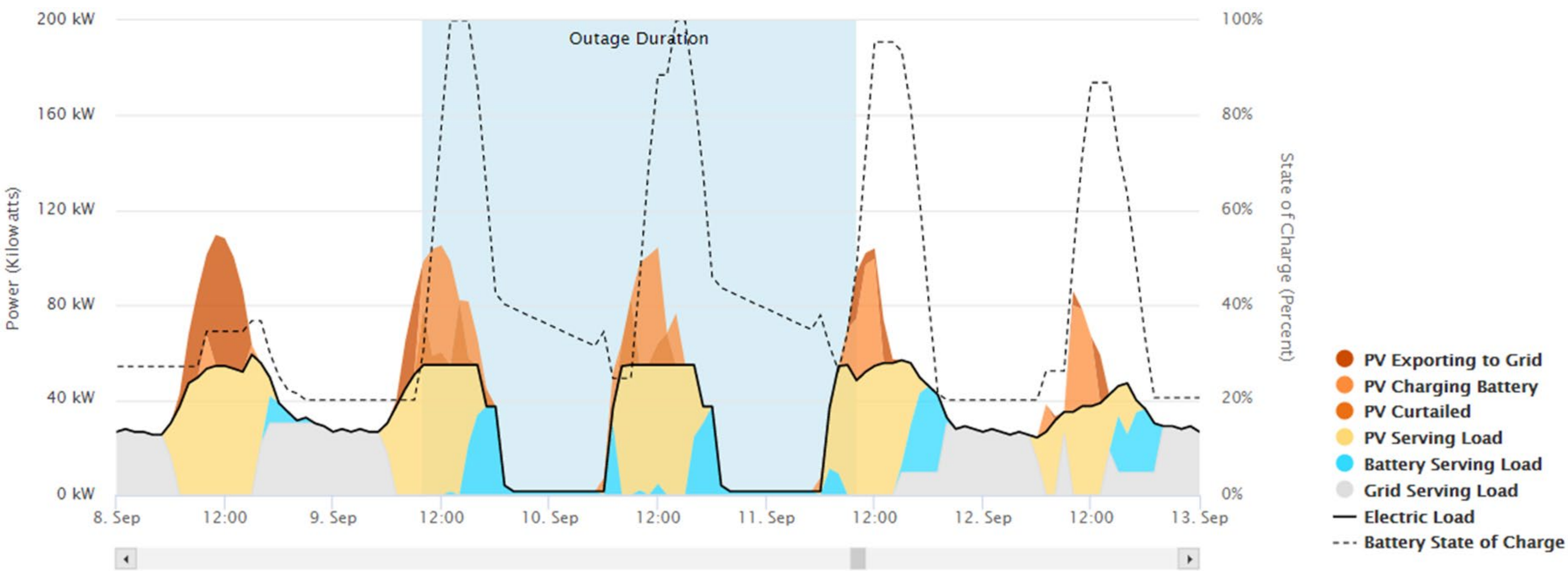
# 4. Results: Without Generator

## H. Variable Outage Simulation



# 4. Results: With Generator

I. System survives planned outage

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# 4. Results: Without Generator

## J. Variable Outage Simulation

| Resilience Provided by Solar + Storage + Generator | |
|---|---|
| Survives specified outage? | Yes |
| Average Resilience Duration | 1,467 |
| Minimum Resilience Duration | 574 |
| Maximum Resilience Duration | 2,807 |

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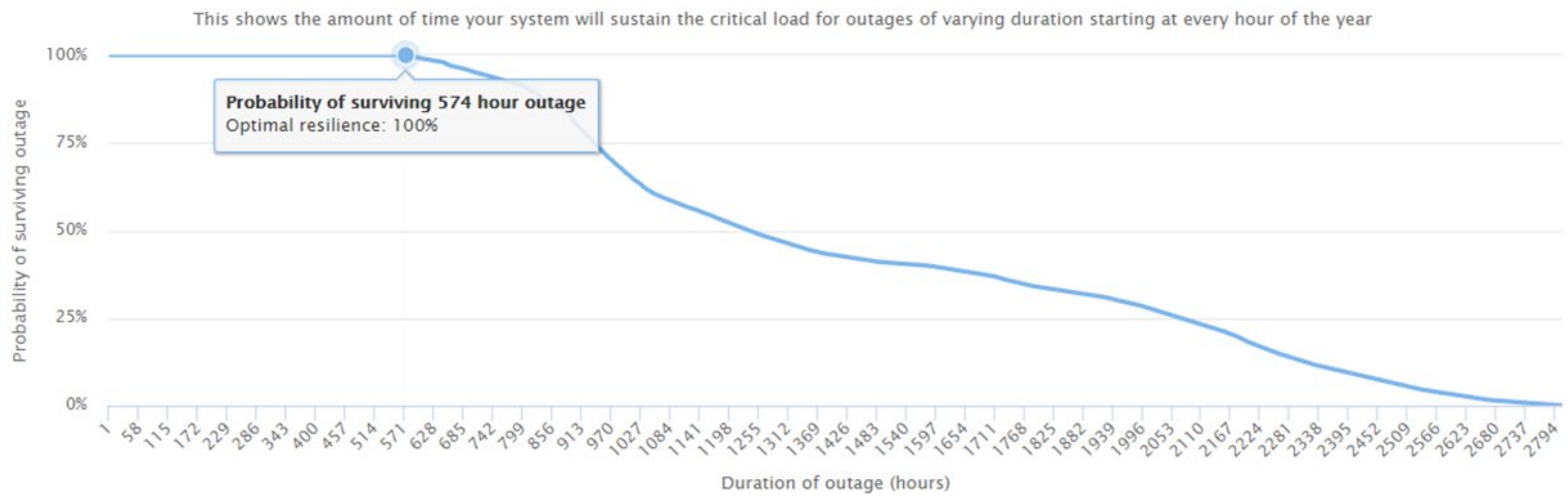
# 4. Results: Without Generator

J. Variable Outage Simulation

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# 5. Updated Financial Analysis

| | Cash Purchase | | | PPA | | | PPA with Buyout | | | Tax Exempt Lease Purchase | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Total Cost** | **Total Savings** | **Net Present Value** | **Total Cost** | **Total Savings** | **Net Present Value** | **Total Cost** | **Total Savings** | **Net Present Value** | **Total Cost** | **Total Savings** | **Net Present Value** |
| **Solar Only** | $692,462 | $1,255,467 | $194,243 | $727,740 | $1,255,467 | $331,626 | $506,121 | $1,255,467 | $420,489 | $901,384 | $1,255,467 | $132,585 |
| **Microgrid** | $1,086,736 | $1,449,642 | ($35,089) | $1,423,633 | $1,449,642 | ($17,666) | $1,083,601 | $1,449,642 | $81,895 | $1,454,914 | $1,449,642 | ($128,290) |

Microgrid system cost increased by 20% (~$112,000) from solar + storage system

*Note: No value of resilience included*

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# 5. Updated Financial Analysis

## K. Valuing Resilience

- ✓ Estimate Value of Lost Load (VoLL): Cost of an unserved kWh in Goleta

| Sector | # of Customers | Cost Per Event (2016$) | Cost Per Average kW (2016$) | Cost Per Unserved kWh (2016$) | Total Cost (2016$) |
|---|---|---|---|---|---|
| Residential | 0 | $5.20 | $6.33 | $7.30 | $0.00 |
| Small C&I | 1 | $607.57 | $294.05 | $339.29 | $1,446.00 |
| Medium and Large C&I | 0 | $8,074.73 | $154.11 | $177.81 | $0.00 |
| **All Customers** | **1** | **$607.57** | **$294.05** | **$339.29** | **$1,446.00** |

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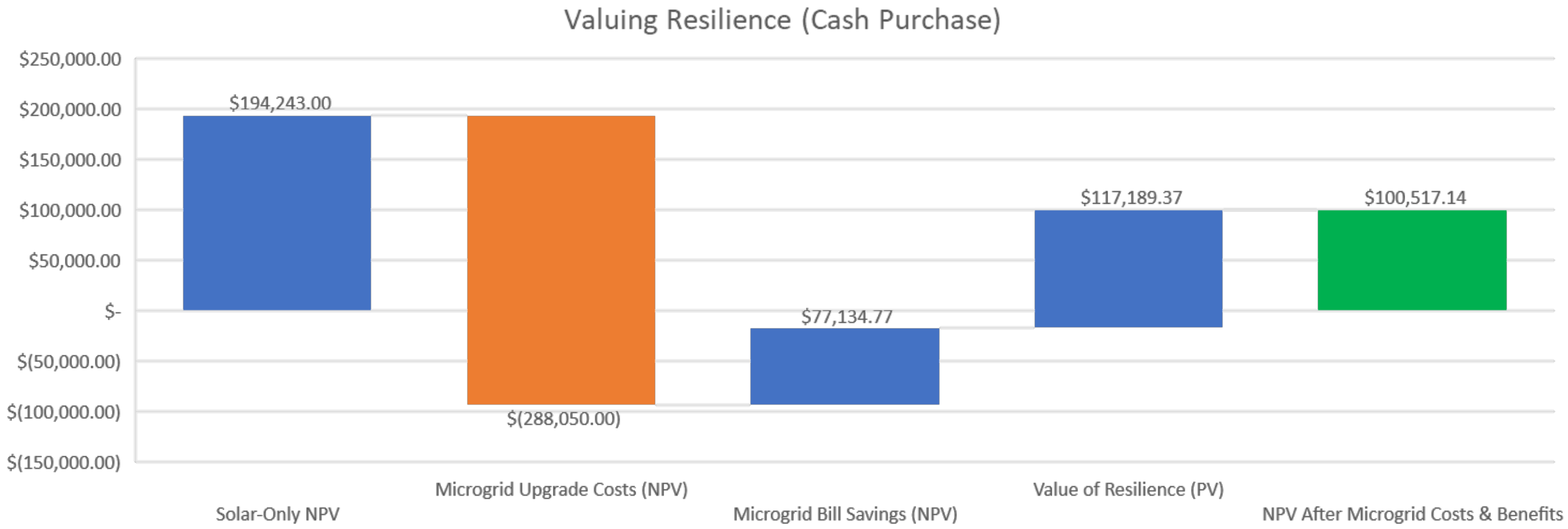
# 5. Updated Financial Analysis

L. NPV of Microgrid with Value of (Renewable) Resilience

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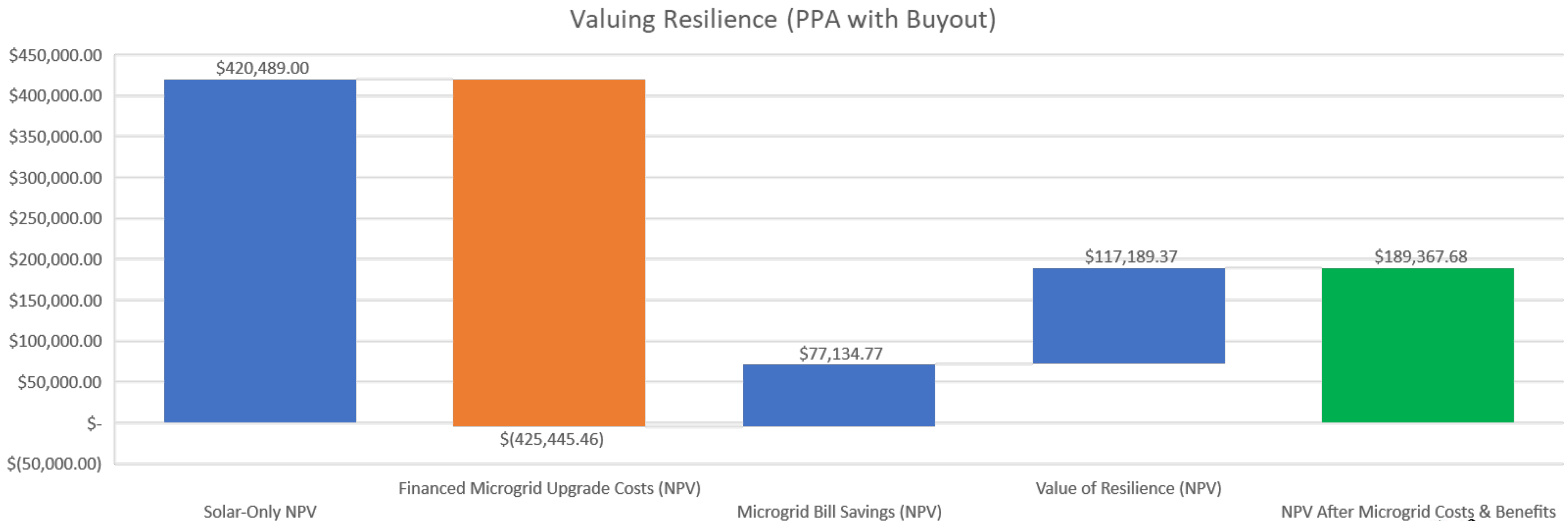
# 5. Updated Financial Analysis

L. NPV of Microgrid with Value of (Renewable) Resilience

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# 6. Conclusions

M. Given the potential for a positive NPV and significant resilience benefits, it is justified to seek proposals on an integrated solar + storage + generator microgrid

- ✓ Pricing may be *better* than what was assumed in the analysis
- ✓ While generator is a short-term solution increased resilience and flexibility from an integrated system may serve the City better in the future

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# 7. Next Steps – RFP Approach

N. Focus on maintaining *optionality* in RFP

- ✓ Issue RFP soliciting proposals for a:
  - Solar-only system that is microgrid ready with EV conduit
  - A microgrid (using existing generator) with EV conduit
- ✓ EV charging stations (City to determine #)

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# 7. Next Steps – RFP Approach

N. Focus on maintaining *optionality* in RFP
- ✓ Ask for cash purchase
- ✓ PPA price
- ✓ OPTIONAL alternative financing scenario (e.g. Microgrid Service Agreement)
  - EV charging stations listed in pricing as separate line item in all pricing proposals

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# 7. Next Steps – RFP Approach

O. Other RFP Requirements
- Mandate City REC Ownership
- Mandate City right to Low Carbon Fuel Standard Credits
- Note potential for increased load to vendors

P. RFP Scoring Sections
- Qualifications & Experience
- Design Components
- Project Approach
- Contracting Terms/Approach
- Pricing

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# 7. Next Steps – RFP Approach

Q. RFP Timeline

- 10/13: Issue RFP
- 10/21 or 10/22: RFP vendor meeting and optional site walk-through
- 11/12: RFP proposal due date
- 11/24: Selection of preferred vendor for pursuing contract negotiations
- 12/2: Public Safety & Emergency Preparedness Committee meeting
- 12/9: Green Committee update
- 12/15: Negotiated contract brought to Council for approval

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# Questions and Comments