Audit and Design: Resilience Ready Design Memo Example

About: This memo is a follow-up to a virtual meeting between representatives from the organization creating the Community Center and the contractor for the project, discussing the integration of solar and battery storage systems into the design of the Community Center to make it a resilient hub. The memo outlines the design considerations necessary to incorporate a Photovoltaic (PV) system with a capacity up to 60 kW and a battery storage system with a minimum capacity of 300 kWh. The design also includes provisions for EV charging and other energy system enhancements to ensure the building operates efficiently and remains functional during emergencies.

Usage Description: The memo serves as a detailed guideline for architects, engineers, and planners involved in designing and constructing the community center, ensuring the facility is equipped to handle both normal operational loads and increased demands during emergency situations. It provides:

- Specific design requirements for solar readiness, including roof specifications and structural load considerations.
- Recommendations for battery storage placement and capacity to support the building during outages.
- Suggestions for additional features like EV charging infrastructure and energy-efficient heating and cooling systems.

This document is important for guiding the project team in creating a building that not only serves as a community center but also as a model for sustainable and resilient community infrastructure.

Memo

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

Dear [redacted]

This memo is the follow up to the virtual meeting held on February 5th, attended by:

- [redacted]
- [redacted]

In the meeting it was determined that [redacted] would outline basic guidance for making the proposed [redacted] Community Center solar and resilient hub ready. This guidance is based upon the drawing received on February 5th just before the meeting. It is included as appendix 1 of this memo.

The drawing shows a building footprint of about 3,100 SF. Fully covered with Photovoltaic (PV) panels, this area can support a system of rated capacity as high as 60 kW. 60 kW is the maximum threshold for TMLPs lowest interconnection standard – so it makes sense to keep the array at or below that level. [contractor] [redacted] indicated that they had already planned to make the building "solar ready", with a south sloping roof (20-30 degree slope) designed to accommodate the structural loading of PV panels tied into the roof joists. With average annual shading estimated at 20%, a 60kW system would produce an estimated 64,000 kWh/year. During the lowest irradiation month (December) that same system will produce on the order of 110 kWh/day or 330 kWh over a 72-hour period.

Based on the size of the facility, applying EIA energy density estimates between recreation and library uses, we roughly assume an average annual energy load to run about 10 kWh/SF/year[1] or 31,000 kWh/year under normal operations. In the event of an emergency, we might expect the load to jump to that of somewhere between lodging and a restaurant rating, or 25 kWh/SF/year[1]. This would translate to 212 kWh/day for the 3,100 SF facility or 636 kWh for a 72-hour period (which is a typical resilience hub center time frame.

The following table reflects the estimated PV Production to load comparison.

	PV Production	Building Load	Excess/ (Shortfall)	
Normal Operation (Annual)	64,000	31,000	33,000	kWh
Winter Emergency (72 hours)	330	632	(302)	kWh

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[1] *The actual numbers will vary on several design & equipment selection factors. Efficiency measures will drive it lower which in turn reduce operating costs and the required battery/generator capacity.*

This cursory analysis would recommend installing battery storage capacity of at least 300 kWh. Applying rough battery sizing, a system of this capacity would require 4 electronics and battery cabinets and a 240/480 transformer. The battery pack equipment footprint is 40” (3.33 ft) in depth and 144” (12 ft) in length. The height is 90” (7.5 ft). The transformer would be approximately 36” (3 ft) in depth, 45” (3.75 ft) wide and 60” (5 ft) high. This set up would require a concrete pad of roughly 4 ft x 16 ft. In talking with TMLP about the project, they asked about provisioning for possible EV charging at the site. With that in mind it would make sense to earmark space for a pad on the order of 22 ft or more to accommodate the addition of battery modules and/or backup generator (~25kW).

It should be noted that the equipment would have to be at least 8” away from the building. Also [utility] [redacted] requires that the equipment be near electric meter(s) and a visible-lockable disconnect. These items can be wall mounted on the building. Locating the pad in close proximity to incoming utilities (electric, gas, communications) reduces pipe and wire runs. There is a 6’x 26’ just notch in the building floor plan outside of the mechanical and storage room that could fit the bill quite well. While all the equipment shall be fully outdoor rated, it shouldn’t be located where access to it can be significantly obscured (e.g., roof shedding snow, piles of plowed snow). At the same time, advance consideration should be given to risk of vandalism (e.g., appropriate provisions for fencing and/or shrubbery).

Provisioning for the electrical energy system within the building envelope should be straightforward and add minimal cost. To the extent possible, provisions should enable flexibility for prospective bidders to offer their most competitive system design. In this case, solar readiness should include allocation of floor-ceiling wall space of at least 4 ft wide with 3-4 ft clearance in the mechanical room for PV power conditioning equipment, microgrid controls and display. An accessible wire way or pre-positioned capped off conduit that can accommodate wiring rated for 160 amps or more to the roof is recommended. Similar allowances should be accounted for in utility interconnection. Furthermore, given TMLP’s interest in EV charging at the site, provisioning a conduit for up to 100 amps to the parking area might also be considered. Finally, electrical layout and circuit breaker allocation should consider provisions to maintain operation of critical circuits in the event of constrained availability of power. For example, priority circuits might include communications, heating/cooling, WCs, refrigerator, and critical lighting. Electrical panel selection and/or space around it should account for possible deployment of energy equipment and establishment of resilience protocols.

Outside of the building envelope, provisions should include allocated space for additional electrical meters for solar and battery and disconnect switches. Trenching and other interconnect specifications will be mandated by the local utilities. These provisions should be included in review, guidance and permitting processes with local authorities and utilities.

In addition to accommodations for the power system, we suggest that [redacted] request estimates of incremental budget impact for make the following accommodations in the building design:

- Use of air source or ground source (geothermal) heat pumps perhaps with small [utility, utility] backup/supplemental gas furnace. Heat pumps come with substantial rebates from [redacted] or [redacted]. The use of heat pumps can result in space savings in the mechanical room. However, external placement of condenser units will have to be considered.
- Expansion of WC to include shower facilities and storage for first aid, sanitary and personal hygiene supplies.

- Identification of indoor storage space for spare blankets, pillows, wheelchair(s), crib(s), kids games, etc.
- Identification of means by which community center users in an emergency situation may get access to adequate supply of fresh/clean water and ice. This may call for provisioning space for an outdoor or indoor water storage tank and ice machine.

Resilient hub best practices also include “accessibility” considerations which are generally covered by ADA compliance.

As discussed, there are numerous steps ranging from community/stakeholder engagement and research to identify funding sources and bid solicitation in conducting this resilient hub study. While the list of provisions included in this memo to make the facility solar and resilient hub ready is far from comprehensive, it should be sufficient to accommodate the key resilience features and proceed with the basic community center design without further delay.

Please don’t hesitate to reach out with any questions/concerns that you have.

Sincerely,

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[redacted]