INTERIM REPORT TO TOWN COUNCIL:
EXPLORATION OF FAIRFAX PAVILION UPGRADE AND MICROGRID

Submitted by the Microgrid Subcommittee of the Fairfax Climate Action Committee:
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David Haskell - Solar Business Owner and CAC Member
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This report is intended to inform Town Council members, staff and the public of what the Subcommittee has learned thus far and what we believe might be next steps. In these difficult times in which we cannot meet as easily (CAC meetings are curtailed for the present month), this subcommittee wishes to provide Council with an update so that the ideas described can be considered in the Council's annual priorities and budgeting discussions.

Vice-Mayor Ackerman wishes to express his thanks, on behalf of the Town, to the two other members of this hard-working subcommittee that has prepared the information in this interim report. Courtney Richardson has built valuable connections with both Drawdown Marin and MCE, and has quietly kept our unruly but creative committee on task. David Haskell has contributed his considerable experience designing solar and battery systems, and in turn expresses his gratitude for the Town's policies that make going solar in Fairfax far less expensive than in any other community in California.

Overview

At present the Pavilion has on its roof 31 kilowatts(DC) of solar electric panels. Inverters convert this solar power into AC, synchronized and connected with the electric grid. This "grid-tie" solar system is similar to those on many residences, though larger in size than most, and was installed in 2009. Like the solar systems on most residences, if the power grid goes down, the Pavilion system quits operating. The present system directs energy as well to the Town Hall/Police building and to the Fire Station, but like the Pavilion these buildings are not supplied by the solar system when the grid goes down.

In the short term (Phase 1), we propose adding battery storage to the Pavilion solar system, which would allow the Pavilion itself to have electricity when the grid is down – for example during a Public Safety Power Shutoff (PSPS). The Pavilion would then be able to serve as a Community Resiliency Center during grid power shutoffs. This report will detail what we have learned thus far about the cost of such an upgrade.

In the longer time frame, the other Town buildings on this same block (Town Hall, Fire station, Community Center, Women's Club, Corp Yard, EV Charger(s)) could be incorporated, along with additional solar generation and storage, to create what is referred to as a "microgrid". This means that these linked buildings would share the generation and storage resources located in them, and all together be able to keep operating during grid power shutoffs (called "islanding"). This report will focus on the first phase, which is just the Pavilion.

Phase 1: Community Resilience Center in the Pavilion

During the PSPS events of 2019, the small hallway of Town Hall was opened 24/7 as a charging station for community members. We thank Chief Morin and the Fairfax Police for their swift work providing this

support to the community, and it was heavily used and appreciated. Town Hall had this electricity available because a generator was run continuously; an additional generator kept the Fire Station powered.

We envision the Pavilion becoming a more spacious place where people could gather during a prolonged power outage, not only to charge their devices and access the internet, but also possibly to have an area for children to play, possibly a corner where music could happen, possibly the ability to brew tea in the kitchen… a very Fairfax response to our power being shut off. An additional benefit of the Pavilion being powered by solar during a power shutoff could be that it would demonstrate an alternative to residences and businesses being powered by emergency generators.

If we can move swiftly on this first phase, Fairfax could position itself in the leadership among local communities, many of which are currently exploring their own microgrid ideas. Our subcommittee believes it is entirely possible to get this Pavilion upgrade completed and operational before the Fall 2020 PSPS and fire season, which given the dry winter might involve significant power shutoffs.

Over time there could be (to be determined) an economic benefit to the Town. The present Pavilion solar system sells excess power back to the grid, essentially running the electric meter backwards. This is called Net Energy Metering. The rate structure for electric power is rapidly moving to one in which power is less expensive during the day (when California has abundant solar) and more expensive in the evening (when solar drops off and demand increases). A system with batteries could hold the power generated during the day and sell it back to the grid in the evening. This is called Net Energy Metering with Arbitrage, and could lead to the Town being paid a higher price for our power. We can explore the cost effectiveness of Arbitrage as the system becomes operational.

There is a considerable environmental benefit of our contributing storage to the grid, in that it allows solar energy to displace the need for gas and nuclear generation running during the evening demand peak. This is widely seen as the future of our energy infrastructure: distributed generation (e.g. the solar on the Pavilion roof), distributed storage (e.g our batteries), sophisticated sharing of resources, and the primary form of energy being electric since it can be made renewable and carbon-neutral.

Our subcommittee is developing a preliminary design for this first phase, the Pavilion. It involves adding 40kWh of battery storage, located in the room below the Pavilion where the present inverters are located. One of these present inverters, which is currently not functioning, would be removed and replaced by a 12kW inverter of the type that is able to connect the solar PV with the batteries and the electric load. The inverter room would house the batteries as well. To meet current electrical code this room would need to be improved with fire-resistant interior walls (more details to be learned).

We have estimated the cost for Phase 1. The design on which this estimate is based will be reviewed further and may change, but it is clear that Phase 1 would be relatively inexpensive. There are state and federal incentives that could make this cost far less, if the funding is set up properly to avail ourselves of them. Further, David Haskell (of Symmetric Energy and the Fairfax Chamber of Commerce) is committed to rallying the local solar industry to deliver the system at wholesale prices. So, below is a rough cost estimate for a system that could power the Pavilion, *without* any incentives taken into account.

Item	**Cost**
Electriq 5.5 Inverter Plus 40kWh Batterries	20,000

Span	5,000
Estimate for labor	3,500
Improvement to equipment room (estimated)	1,000
Replacement for broken inverter in the existing 11-year old system (not part of Pavilion project)	1,800
TOTAL (estimated, before incentives)	**$31,300**

Some of the incentives are available only if the system is privately funded. This was the case as well when the present Pavilion solar system was installed in 2009, and thus that work was funded by what were called Clean Renewable Energy Bonds (CREBs) an arrangement in which the Town entered into essentially a lease-purchase plan; the Town's last payment on that plan will be made in 2021. The terms of that contract fully allow the Town to modify the system at any time. The funding for Phase 1 might be something similar, or in some other way structured to capture the incentives that would keep the costs minimal. For the later project of building out a microgrid for all the Town buildings, we would want to be creative in our funding, possibly with considerable benefits to the community, and/or obtain outside funding, but that is beyond the scope of this report and does not need to be figured out immediately.

Local Interest in Microgrids

There is a great deal of interest, and funding, in the microgrid area. Marin County, through Drawdown Marin, is actively exploring microgrids. MCE Clean Energy has announced its intention to distribute funding specifically for microgrids powering community resilience centers, and a meeting our subcommittee had with MCE is described below. San Anselmo and Corte Madera are discussing local microgrids. All this interest is in large part due to the PSPS events but also due to the rapid development of the supporting technology (e.g. batteries and inverters), and due to the understanding that our electric grid is actually very fragile. A major framework for making our communities more resilient is to restructure the currently top-down, centralized grid into local smaller grids. These microgrids would connect to the larger grid during normal times, contributing their solar generation and their storage capabilities to the whole (and being paid for this). When the larger grid is not functioning, the microgrids would "island", continuing to operate on their own.

MCE personnel set up a virtual meeting on March 31, in which our subcommittee explained the vision described here and the unique synergies supporting this project in Fairfax, and MCE described their progress getting ready to accept funding requests. This meeting was also attended by Alex Porteshawver of Drawdown Marin. Both MCE and Alex were favorably impressed by the potential for this project, and hopeful that larger funding streams (which are being actively pursued by MCE as we speak) could be used to help Fairfax particularly with the later and larger phase of this work. It might be the case that the much smaller Phase 1 work would be best done without waiting for these large wheels to turn, given the relatively low cost and the advantage of getting it operational this year.

One of the synergies that makes this proposed idea a good fit is that Fairfax is lucky to have our most important Town buildings all on a single block. Under current regulation, it is very difficult for a local entity to transmit power across a public street (this regulation is being challenged by microgrid advocates), and we are lucky to be able to connect our buildings without encountering this obstacle. Another synergy is that, as part of the design of the existing Pavilion solar, we already have underground

conduit and wiring connecting the Pavilion to Town Hall and the Fire Station; this would be very useful in the later phase.

Details of Phase 1

The inverter we are looking at, made by Electriq Power, would connect with a modular stack of Lithium batteries in two safe battery housings. The figure below depicts the inverter on the right and the two battery stacks.

The tentative Phase 1 design costed out above includes a replacement for the main distribution panel of the Pavilion, called Span. This simplifies installation by integrating what could otherwise be multiple "boxes" that all would need to be wired together. Span would allow town staff to monitor exactly how much power the different electrical loads within the Pavilion were using, and individually connect or shed those loads to conserve power during a period of off-grid use. An equally significant benefit of this connectivity would be to allow the public, Council, staff and others to understand the system, and thus provide inspiration to citizens inside Fairfax and beyond to build similarly advanced renewably powered and resilient infrastructure.

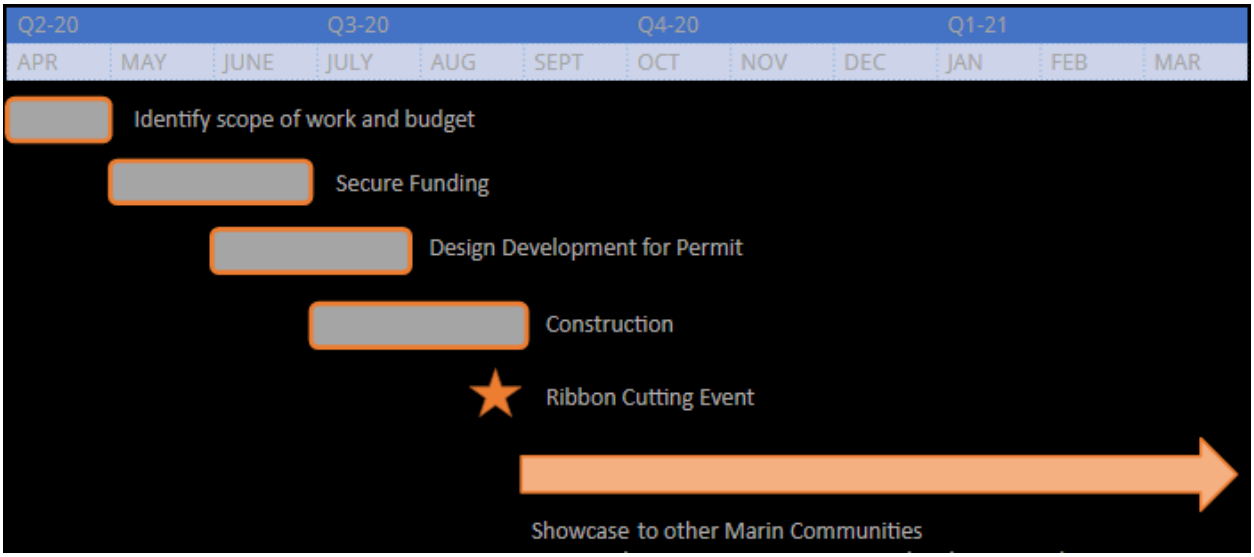
As part of the design it is important to estimate the electrical load of the Pavilion. This would likely be different from the present, as the Pavilion would see a new use as a Community Resilience Center. There is already work underway to improve the Pavilion, and this work should continue to make the electrical loads as efficient as possible (e.g. the ceiling lighting), to make some currently non-functional things work (e.g. the stove, which appears not to be connected), and to move toward electrifying all loads. Appendix A shows an estimated load analysis for the Pavilion, envisioning its use as a Community Resource Center, but without complete electrification as yet.

Hoped-for Timeline – and What We Need Now

Our subcommittee would appreciate Council's and Staff's comments on the ideas here proposed, and in particular, direction as to whether this seems of interest. The next step in our work would be to engage an engineer to review and make drawings of the proposed system, so that permits may be obtained and work could begin. For this, a few thousand dollars in seed money would be required. We would ask that, at the earliest time possible, Council and/or staff find a way to provide this seed money; this would lead to a more final design and cost.

If this proposal is of interest, the funding would need to be considered. The Finance Director could provide guidance as to possibilities, including something like the CREBs used in the 2009 project. The upcoming budget considerations will need to consider this if it is deemed a priority for the Town.

The subcommittee would like to follow an ambitious timeline as outlined below, and we believe this is entirely possible. The goal would be to get this built and operational before PSPS season. We all hope that there is a window of time in which work can be done around the COVID-19 pandemic, but meanwhile it is possible to do the above steps while working at a distance. Unfortunately, the state of the world now seems to be that while planning for power shutoffs, to protect us from increasing wildfire risk, caused by climate change, we are hampered by a pandemic. Let's all take care of ourselves and of our Town in any way we can.



Our subcommittee believes that the community benefits make this project well worth pursuing. Systems of this scale are routinely installed in homes, businesses and public buildings – the obstacle is not the technology, it is the communication required to act on this opportunity, exacerbated by the pandemic.

APPENDIX A: ESTIMATED LOADS FOR FAIRFAX PAVILION								
Loads	**Quantity**	**Surge Load (W)**	**Total Surge Load (W)**	**Continuous Load (W)**	**Total Continuous Load (W)**	**Duration (Hours)**	**Total Energy Required (Wh)**	**Notes**
Water Heater	1	2000	2000	2000	2000	3	6000	2kW resistive electric tank water heater; estimate of hours/day
Stove	1	2000	2000	2000	2000	1.26	2520	Currently gas, not connected; assume install induction, at 0.126 kWh per quart of water boiled (1) x 20 quarts per day
Furnace Fans	4	600	2400	600	2400	3	7200	Fans on ceiling gas heaters; estimate of energy and duty cycle
Refrigerator	1	1500	1500	1000	1000	3	3000	Existing large fridge, 1kW per nameplate; estimate of duty cycle
Microwave	1	1200	1200	1200	1200	0.5	600	Assume 1200 Watts for 30 minutes a day
Ceiling Lights	12	30	360	30	360	3	1080	Assume 30W lamps after planned retrofit
Other LED Lightbulbs	20	8	160	8	160	2	320	
Router	1	30	30	30	30	24	720	
Projector & computer	1	230	230	230	230	2	460	Assume projector and laptop showing movies for entertainment?
Charging etc on outlets	12	15	180	15	180	12	2160	Assume a dozen people charging laptops phones etc all day long
TOTAL			**10060**		**9560**		**24060**	

APPENDIX B: SINGLE-LINE DRAWING OF EXISTING TOWN SOLAR SYSTEM