El Rito Microgrid Project Report

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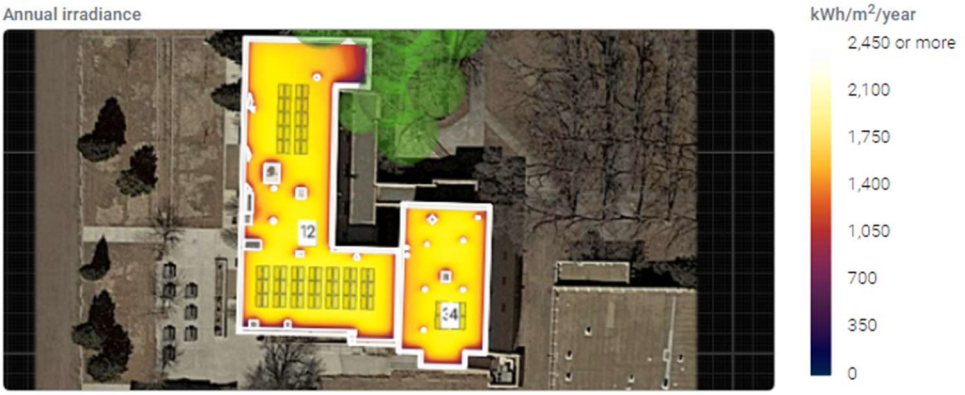
For this El Rito Microgrid Project, I contacted Aurora Solar, the PV modeling company I had worked with in the previous DOE/NREL Solar District Cup competition (National 2nd Place Victory). Aurora supplied a complimentary license, which I used to model the whole campus of Northern New Mexico College (NNMC), images in Table 2.

This enabled me to model the amount of energy generated by each building, identifying pathways for my customer, NNMC, to maximize savings. I conducted research regarding the advantages of roof-mounted vs ground-mounted photovoltaic panels and summarized them in Table 1 below.

Feasibility Benefits/Barriers to Roof and Ground Mounted PV Panels	
Benefits of Roof Mounted	Barriers of Roof Mounted
• Utilize space that would otherwise be unused, no hindrance for walking areas • Cost of installation is lower than that of a ground-mounted system • Limits interference and vandalism from unauthorized visitors without additional required fencing • Panels can protect roof from UV exposure wear	• Roof penetration is required for shingled • May require new roof prior to install (cost analysis would need to be done, could either qualify or disqualify a building… if a building is due for a new roof, it could be a good option and bring building up to current code) • Hinders roof maintenance if roof needs repairs • May void the roof warranty
Benefits of Ground Mounted	Barriers of Ground Mounted
• Can face any direction/angle for optimal insolation • Easily accessed for maintenance • May provide shelter for vehicles for parking areas	• Higher cost of install • Easy access for unauthorized visitors • Accidental damage likelihood is higher (i.e., rocks thrown from mowers and other equipment) • Likely requires fencing installation as well • Typically requires mowing around posts under low clearances or other growth-prevention measures • Could require leveling or clearing land

Table 1: Feasibility Benefits & Barriers to Roof and Ground Mounted PV



Summary

Array	Panel Count	Azimuth (deg.)	Pitch (deg.)	Annual TOF (%)	Annual Solar Access (%)	Annual TSRF (%)
1	31	271	15	81	98	79
2	31	91	15	85	96	82
3	4	272	15	81	96	77
4	4	92	15	86	97	84
Weighted average by panel count	-	-	-	-	96.8	80.4

Table 2: Aurora Solar NNMC Building simulation

NNMC provided me with a wintertime Propane Cost for El Rito Campus, from this I extrapolated the Useful Heat, or the heating demand based on the possible losses from propane and electricity. This is illustrated in tables 3 and 4 below.

18,000 gal * 91,500 BTUs (gal to BTUs)
= 1,647,000,000 BTUs
1,647M BTU / 4.44 mos. / 30 days / 24 hrs.
= 515,202.7027 BTU/h actual | 489,442.5676 BTU/h efficient | 360,641.8919 inefficient
515k BTU/h / 3.41 (same as * 0.000293071)
(BTU/h to W)
= 151,086 W actual
Necessary = 143,532 W eff. | 105,760 W ineff. ~ necessary Wattage based on possible efficiencies of propane heating
or 144 kW eff. | 106 kW ineff.
Running 24/7
during those months
Figuring for range of microgrid **electrical losses in a microgrid**,
between 11% to 15%
will **ADD** this value to both efficient and inefficient scenarios.

Includes:
(1)Line losses,
(2) Metering error
(3) Meter Consumption
(4) Temporal Metering sampling jitter
(5) Packet loss.

144 kW * 1.11 = 159 kW eff. prop/eff. micro = 509,315,838 Wh
144 kW * 1.15 = 165 kW eff. prop/ ineff. micro = 527,669,562 Wh
106 kW * 1.11 = 117 kW ineff. prop/eff. micro = 375,283,860 Wh
106 kW * 1.15 = 122 kW ineff. prop. / ineff. micro = 388,807,603 Wh

Operating 24/7

But the above are units of Power, not Energy.

So, working backwards, as we now have kW but need kWh
144kW * 4.44mos. * 30 days * 24 hrs. ➔

Working from numbers on previous slide...

18,000 gallons at $1.73 per gallon figures to $31,140.
This means $138,091 / $31,140
= 4.44 months, or total time that propane was used.
Propane losses can be anywhere
between 5% - 30%.

NNMC Heating Demand based on possible losses from Propane and Electricity

Scenario	Microgrid (11% Losses)	Microgrid (15% Losses)
	Useful Heat	
Propane (5% Losses)	509,315,838 Wh **509 MWh**	527,669,562 Wh **528 MWh**
Propane (30% Losses)	375,283,860 Wh **375 MWh**	388,807,603 Wh **389 MWh**

Table 3: Calculation of Useful Heat from provided Propane Cost Provided

NNMC Useful Heat Table

NNMC Useful Heat based on possible losses from Propane and Microgrid Electricity			
Purchased	Microgrid Loss	Propane Loss	Useful Heat
$138,091 *Efficiency Unknown	11%	5%	**509 MWh**
		30%	**375 MWh**
	15%	5%	**528 MWh**
		30%	**389 MWh**

Table 4: Calculation of Useful Heat simplified table

Advancing this project, I created a Request for Information (RFI) by conducting research on RFIs in the energy sector. I specified the following in the RFI: Purpose, Responses, Expected RFI Submission Format, Scope of Work, Ancillary Service Categories, and a Resiliency Rating scale, in which respondents were asked to assess the resiliency of their suggested solutions. A request for proposals (RFP) was drafted, preparing my customer for responses to a Funding Opportunity Announcement (FOA).

An RFI seeks input regarding existing energy resources that might be integrated into the El Rito Microgrid, which serves both NNMC and the El Rito Community (ERC). Our Technical Team Advisors would be better able to advise on project planning if they had access to this request.

The Responses requested outlined the format (written) and introduced the possible necessity of presentations. Site visits were also suggested to properly communicate proposed solutions in the planning phase.

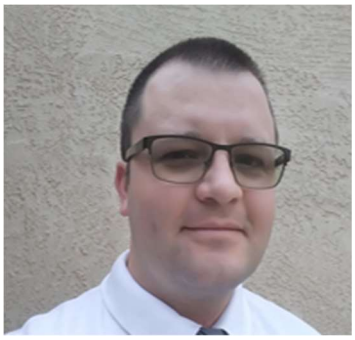
Submission format is vital to ensuring responses are easy for the customer to read, it importantly outlines both the information being sought, as well as the information ***not*** being sought. The scope of the RFI also ensures that responses will not be solving problems that are irrelevant to the customer.

Ancillary Service Categories was asked respondents to submit a categorization of their proposed solutions, including the following categories and justification for each categorization:

- Generation
- Communications
- Back-Up Power
- Resilience
- Physical Security
- Cyber Security
- Environmental Benefits

Last, I asked respondents to give their solutions a Resiliency Rating from 1-10, rating their abilities to cope with disturbances in the system, and justifications for this rating. It was also asked that respondents provide resiliency targets and metrics, such as the implementation timeline and the description of submitted proposal.

In closing, this project has helped me improve my industry expertise by teaching me the language to search for and the procedures to follow to quickly discover relevant information. When things didn't go as planned on the project, I searched for ways to provide value for my customer's future. In my absence, my client will still have access to resources that can add value to the project.



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