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Solar Energy Implementation Strategies on Picuris Pueblo



Dylan T. Hammond

Student Intern

Photovoltaics & Materials Technology Department

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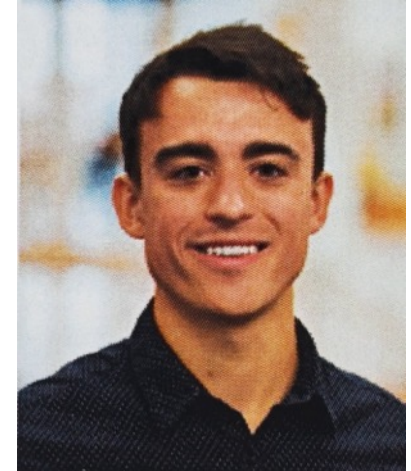
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About Me



- Mechanical Engineering Student at Utah State University
 - Completed Junior year
- Member of Zuni Tribe
- Hobbies Include:
 - Sports
 - Playing piano
 - Exploring the outdoors!



Outline



1. Introduction
2. Past solar project on Picuris Pueblo
 1. 1995 Project
 2. 2016 Project
3. Current solar project
 1. Potential microgrid project outcomes
 2. Microgrid engineering considerations
4. Reflections and Conclusion
5. Future Work

Introduction: Picuris Pueblo



- 306 Members
- 86 Homes
- Poverty Rate:
 - Picuris: 25%
 - National: 12.3%



Google Maps



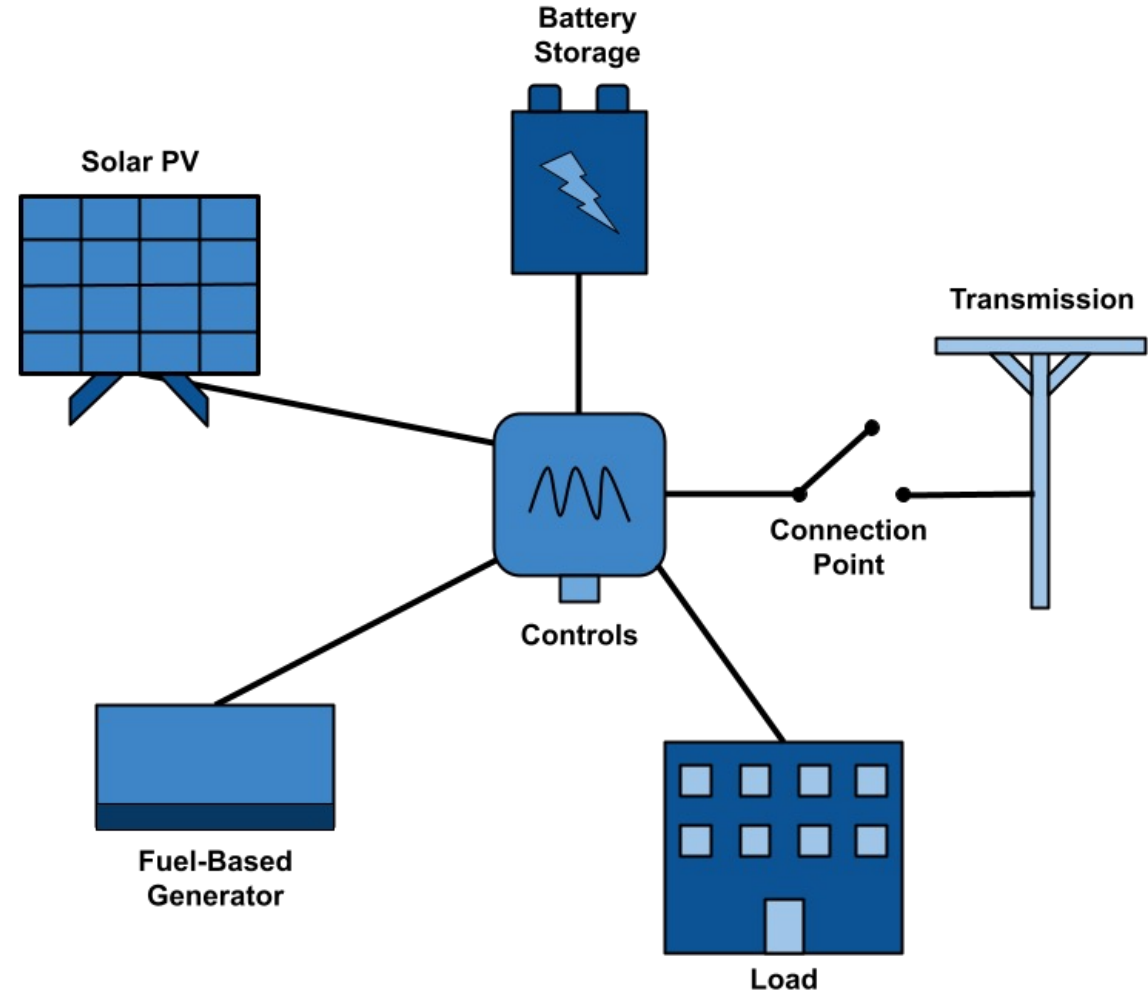
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Introduction: Microgrid Technology



Consists of:

1. Energy generation (solar PV)
 2. Energy storage (BESS)
 3. Backup fuel-based generators
 4. Controls system
- Ability to operate in grid-tied mode and independently ("island" mode)



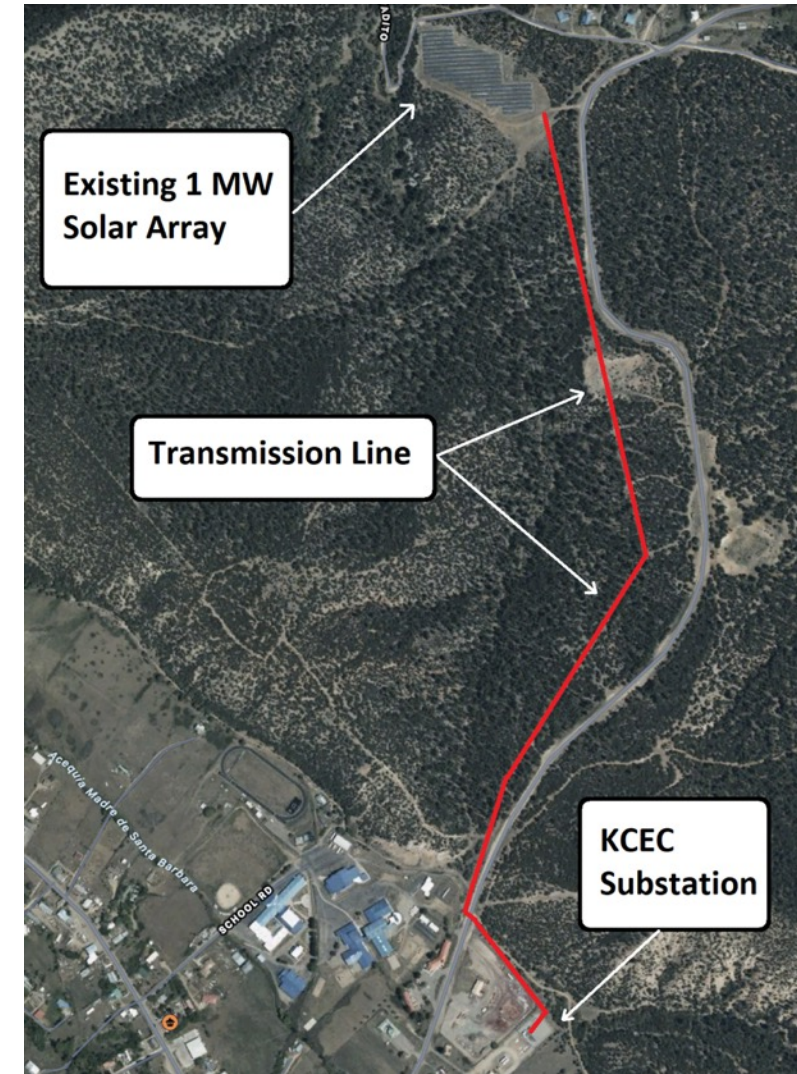
1995 Energy Efficiency and Enhancement Project



- Energy efficiency measures installed into new community center
- Features include:
 - Solar hot water system and ventilation heat recovery
 - High-intensity discharge lights
 - Better insulation
 - Low flow showers
 - Clerestory windows

2016 Solar Project

- 1 MW Solar Array
- PPA with Kit Carson Electric Cooperation (KCEC)
- KCEC purchases energy produced by tribe at \$0.09/kWh



Current Project



- Funding received for another project
 - DOE Office of Indian Energy Policy & Programs
- Tribe looking to implement more solar as well as battery storage
- Decision point: Placement of solar and battery storage design



Current Project: Microgrid Outcomes—Economic Benefits



- Goal to cover 100% of tribal member's electric bills
- Prices of solar power and battery storage have dropped significantly in recent years



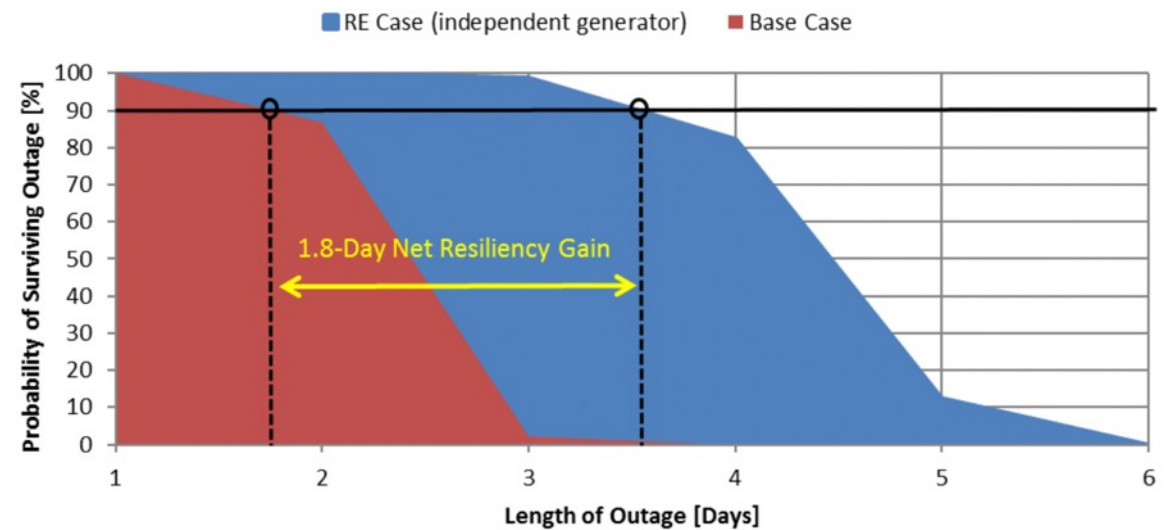
Current Project: Microgrid Outcomes -- Resiliency



- Microgrids increase resiliency
- Increase in natural disasters leads poses a threat to grid



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Current Project: Microgrid Outcomes – Tribal Sovereignty



- More self-reliant and energy-independent
- Less dependency on third party utility companies
- Better long-term sustainability for the tribe

Blue Lake Rancheria Microgrid (Northern CA)



Current Project: Engineering Considerations



- Sizing of microgrid components crucial to optimize benefits
 - Particularly sizing of BESS
- Proper sizing can reduce generator usage in island mode operation



Reflections and Conclusions



- A microgrid project is best for Picuris Pueblo
 - Better economic benefits
 - Better resiliency
 - Increases tribal sovereignty





- Solar array analysis using Sandia's PVlib Library in Python
 - Analyze power output based off solar module orientation
 - Decide best module orientation for Picuris
- Other Implementations
 - Axis tracking: may not be ideal at the current moment, cost considerations must be considered

Month	kWh	PPA Revenue (\$0.09/kWh)
Jan-18	53,451	\$ 4,811.00
Feb-18	98,853	\$ 8,897.00
Mar-18	137,280	\$ 12,355.00
Apr-18	214,689	\$ 19,322.00
May-18	235,691	\$ 21,212.00
Jun-18	83,745	\$ 7,537.00
Jul-18	128,927	\$ 11,603.00
Aug-18	200,514	\$ 18,046.00
Sep-18	195,997	\$ 17,640.00
Oct-18	149,142	\$ 13,423.00
Nov-18	140,677	\$ 12,661.00
Dec-18	103,348	\$ 9,301.00
Jan-19	96,186	\$ 8,657.00
Feb-19	90,733	\$ 8,166.00
Mar-19	149,337	\$ 13,440.33
Apr-19	176,355	\$ 15,871.95
May-19	203,726	\$ 18,335.34
Jun-19	203,956	\$ 18,356.04
Jul-19	50,786	\$ 4,570.74
Aug-19	190,542	\$ 17,148.78
Sep-19	156,388	\$ 14,074.92
Oct-19	65,623	\$ 5,906.07
Nov-19	32,301	\$ 2,907.09
Dec-19	25,496	\$ 2,294.64
Jan-20	76,276	\$ 6,864.84
Feb-20	45,829	\$ 4,124.61
Mar-20	173,951	\$ 15,655.59

[9]



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- [7] "Blue Lake Rancheria Microgrid." Schatz Energy Research Center, 2019. <https://schatzcenter.org/blrmicrogrid/>.
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- [9] Northern Pueblos Housing Authority. Rep. *Phase 1 Community Solar Project*. Department of Energy Office of Indian Energy Policy and Programs, May 29, 2020. <https://www.energy.gov/sites/default/files/2020/06/f75/northern-pueblos-2016-solar.pdf>.