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Cost-Benefit Analysis of Behind-the-Meter Energy Storage and Distributed Generation

A Case Study for the San Carlos Apache Tribe

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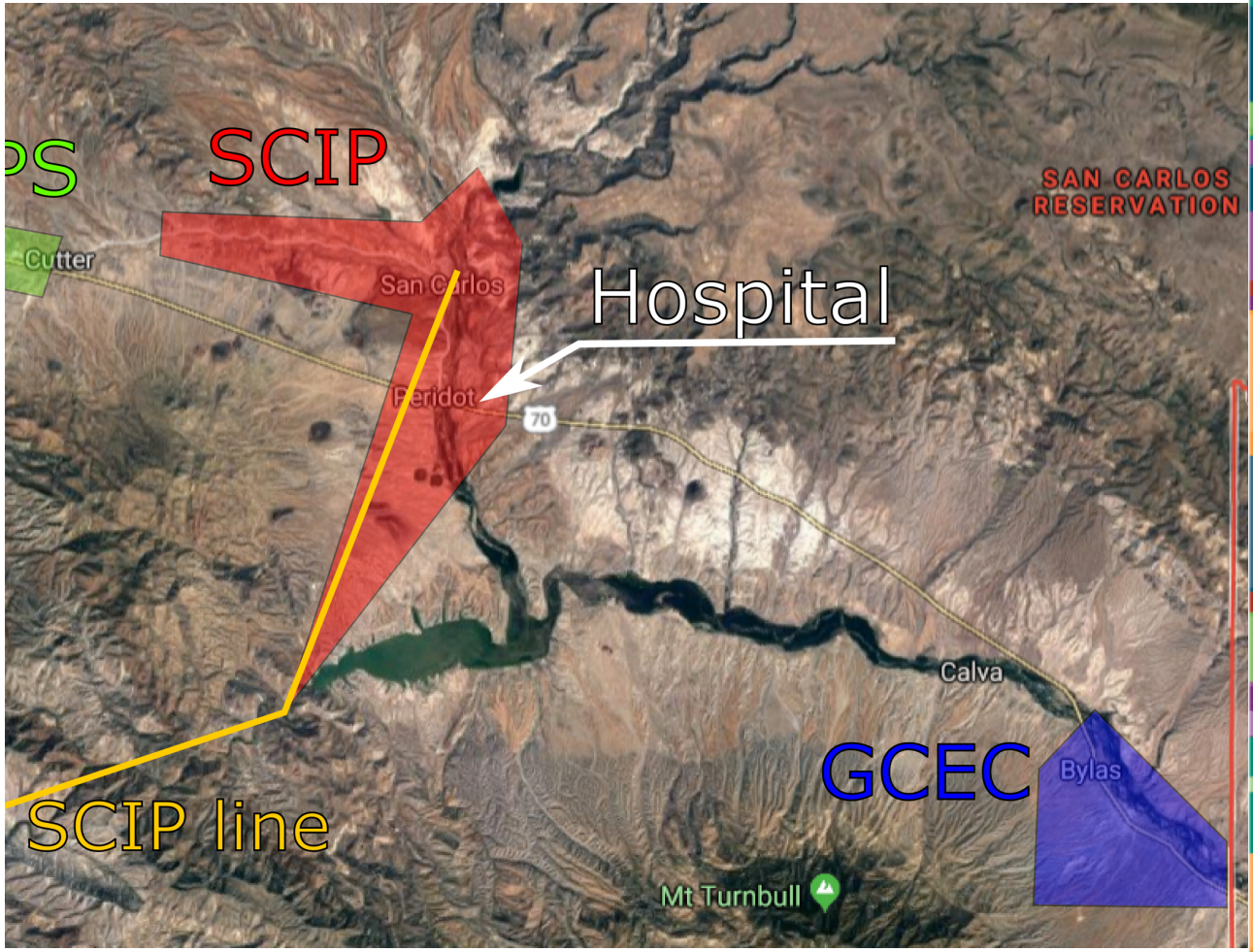
Background – San Carlos Apache Tribe

- ~17,000 enrolled members
- Area: 1.8 million acres
  - Larger than Delaware
  - Low population density
- Over 100 power outages per year
- PV projects under way to decrease tribe's energy dependency
- Projected 2-3 MW solar PV co-located at tribe facilities under consideration
- Community PV project
- Investigating battery energy storage (BESS) for critical load support



Source: Google Maps.

Study – Benefits of BESS to Local Hospital

San Carlos Irrigation Project (SCIP):

- Primary power provider
- Limited generation and transmission assets
- Very unreliable power from SCIP during monsoon season
  - Power interruptions are common in June – September
  - Costly hospital equipment can be damaged
- Switch to backup diesel generation (DG)

Behind-the-meter (BTM) cost savings with BESS:

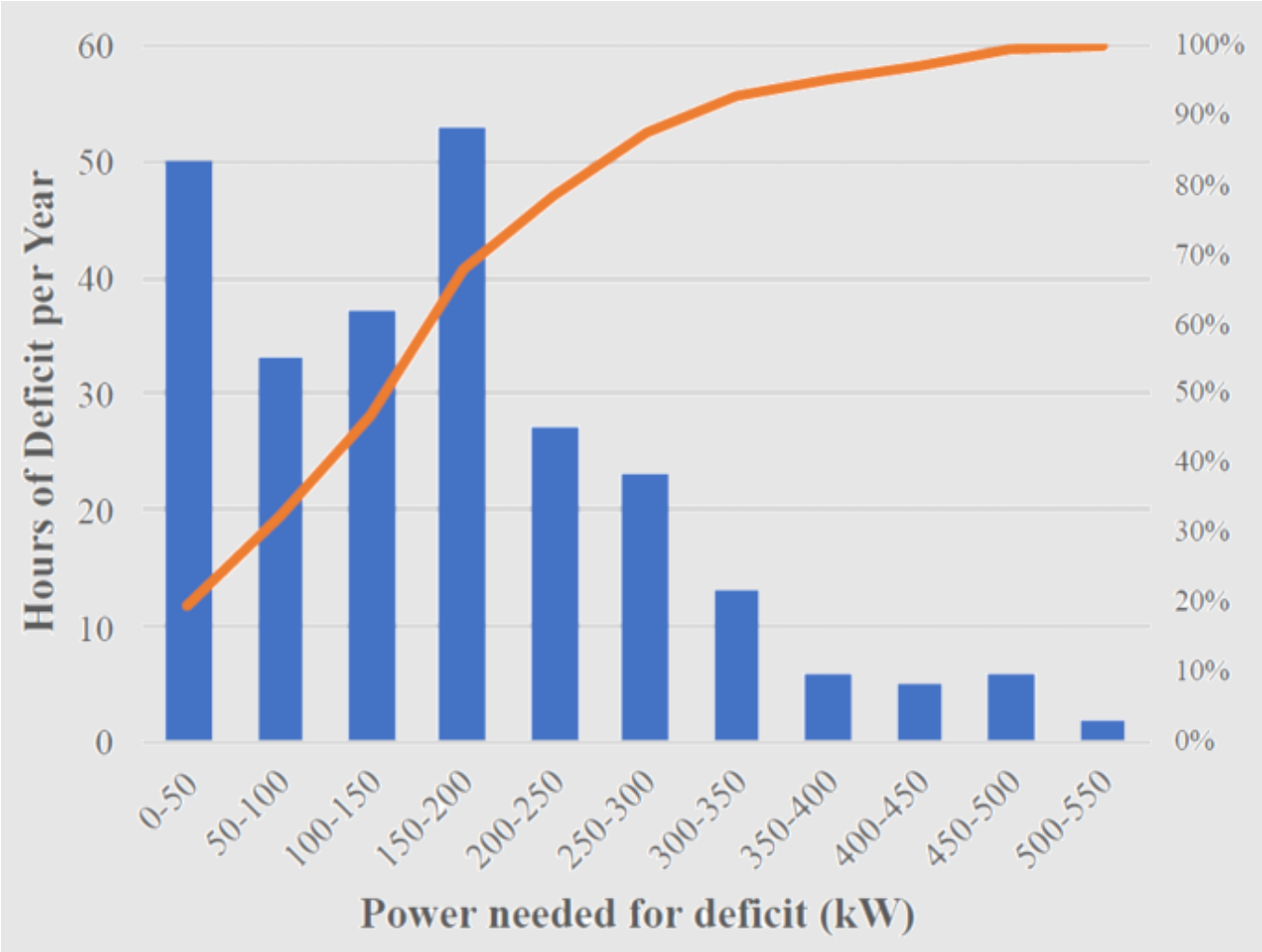
- Reduce demand charges
- Reduce PV curtailment
- Reduce fuel consumption of diesel generators

Fuel savings:

- Operate generators more efficiently
- Close to full load
- Charge BESS to shift DG point of operation

Generator replacement deferral:

- Reducing run-hours and optimize utilization

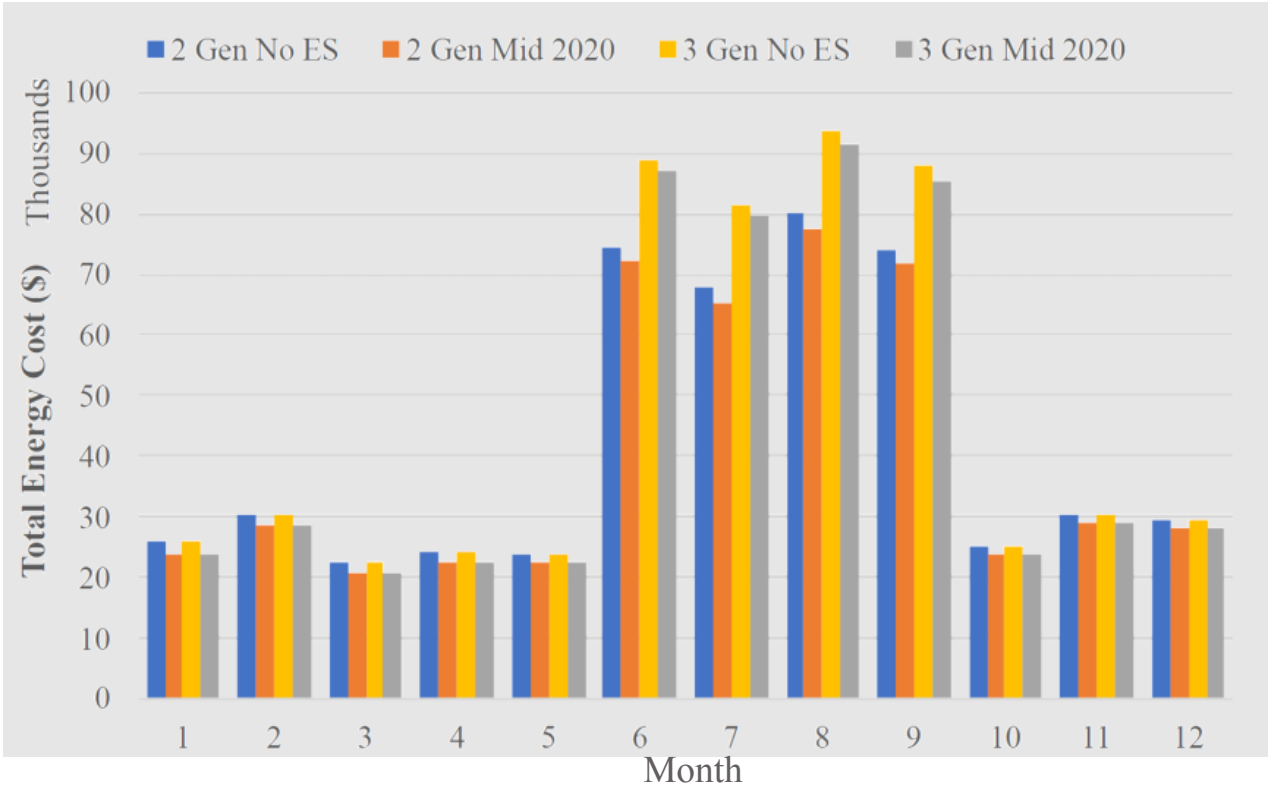


Results – Case Study for San Carlos

Major findings

- Economically optimal sizing of BESS for given $/kW and $/kWh prices has the *potential* to
  - Reduce fuel costs by 29%
  - Reduce electric demand charges by 14%
  - Reduce electric energy charges by 2%
  - Reduce PV curtailment by 27%
  - Reduce total energy costs by 13%
- Could reduce the number of generators in the system with properly sized BESS
  - 2 generator plus solar PV and BESS could be used in microgrid mode
- Much more power needed for reliability concerns than for savings considerations

- Comparison of monthly total energy costs (electricity plus fuel) in 4 scenarios for average 2020 BESS prices:
  - 2 backup DGs and solar PV only
  - 2 backup DGs, solar PV and BESS
  - 3 backup DGs and solar PV only
  - 3 backup DGs, solar PV and BESS



Conclusion

- Integration of BESS to a Hybrid Energy System of remote communities has potential to be economical project.
- We estimate that with optimum operation and sizing of modern, cost effective and efficient BTM BESS, it is possible to obtain positive Net Present Value for a BESS investment for a time horizon of 10 years
- Payback of investment is obtained by fuel (DG) and electricity cost-savings
- Most of the savings come from reduction of fuel costs and electricity demand charges
- By deploying renewables plus storage on tribal lands, the tribe can secure **greater tribal and economic sovereignty** through energy independence and economic development

Project Deliverables

- R.D. Trevizan, A.J. Headley, T. Nguyen, and S. Atcitty, "Energy Storage Valuation Within a Behind-the-Meter Hybrid Energy System" *submitted to 2022 IEEE PES Innovative Smart Grid Technologies North America (ISGT NA)*.

Acknowledgment

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