Bringing Home the Bacon –
The role, cost and benefit of storage in Tribal Context

Positive energy.
Overview of Discussion

- Baker Tilly
- What Storage Does
- What is the Value of Storage
- What is the Cost of Storage
- Why it matters to Native Communities
Baker Tilly at a glance/ Industry experience

> Ranked as one of the top 12 largest accounting and consulting firms in the U.S. with over 2,500 professionals

> Energy Consulting team primarily based in Madison, Chicago, and Austin

> Over 45 First Nation clients (Tribal Utilities and other Professional Services)

- 400+ Serving more than 400 utility clients
- 100+ Serving more than 100 electric utilities
- 40+ More than 40 years of industry experience
- $2B+ More than $2 billion in projects developed
What Storage Does?

> Makes Everything Better!
  - Breaks historic constraint between instantaneously balancing generation and demand
  - Time shifts generation and load
  - Enables new functionality
  - Opens new operating paradigms
  - Encourages new business paradigms
What Storage Does?

The Storage Horizon

- **Generation**
  - Renewable Smoothing, Time Shifting, Backup
  - Replace Gas Peaker Plants
  - Energy Market Arbitrage
  - Frequency Regulation
  - Spinning/Non-spinning Reserves
  - Voltage Support
  - Black Start

- **Transmission**
  - Peak Efficiency Operation
  - Congestion Relief
  - Infrastructure Deferral and Avoidance

- **Distribution**
  - Utility
    - Infrastructure Deferral and Avoidance
    - Demand Management
    - Managing Two-Way Current Flow
  - Customer “behind the meter”
    - Time of Use
    - Demand Charge
    - Demand Response
    - PV Management
    - Virtual Power Plants
    - Back-up Power
    - Customized Micro-grid Services

High cost of storage – stack the benefits
Many stacking options – which are most compelling?
New paradigms for grid operation
New regulatory structures
New business plans
What Storage Does? Behind and Before the Meter

- Peak demand
- Spinning reserves
- Super fast ramping
- Island Microgrid
- Demand response
- Voltage regulation
- Frequency regulation
- Capacity
- Back up power
- Defer T&D
- Increase security
- Zero emissions

Source: RMI Fitzgerald et, al
What is the Value of Storage?

Figure ES1: Energy storage values vary dramatically across leading studies.

ISO/RTO Services
- Energy Arbitrage
- Frequency Regulation
- Spin / Non-Spin Reserves
- Voltage Support
- Black Start

Utility Services
- Resource Adequacy
- Distribution Deferral
- Transmission Congestion Relief
- Transmission Deferral

Customer Services
- Time-of-Use Bill Management
- Increased PV Self-Consumption
- Demand Charge Reduction
- Backup Power

Results for both energy arbitrage and load following are shown as energy arbitrage. In the one study that considered both, from Sandia National Laboratory, both results are shown and labeled separately. Backup power was not valued in any of the reports.

Source: RMI Fitzgerald et al.
Value is derived from Stacking Benefits
The Importance of Location and Externalities

Minimum cost technology by county including externalities and a low price on CO₂

Source: UT Austin Energy Institute, New US Power costs by county with environmental externalities,
**What does it cost?**

### Cost of Storage Too High vs Conventional Alternatives

#### Unsubsidized Levelized Cost of Storage Comparison

<table>
<thead>
<tr>
<th>Technology</th>
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<th>2022</th>
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*Levelized Cost ($/MWh)*

#### Unsubsidized Levelized Cost of Energy Comparison

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*Levelized Cost ($/MWh)*
Total Energy Needs: 171,800 kWh/yr

Current Price of energy: 0.17 $/kWh
Why it matters?
Levelized cost of new service may be greater than doing it yourself.

Admin + New Building: 34,400 kWh/yr

Future Price of energy:
0.17 $/kWh
+ 0.085 $/kWh
($40k expansion)
+ expected electricity price increase @ 3%/y
= 0.27 $/kWh
(levelized cost)
Modeling load profile

Measured Load Data (retrieved from PG&E)

Almost all load during business hours
Micro-Grid Alternative

- 20kW diesel generator
- 75kW Solar Array
- 15 kW Batteries
- 94 kWh average load
- 18kW peak
- Ring Bus
- Microgrid system controller
• Total Estimated Levelized Cost of Energy (LCOE): 0.228/kWh
  • This assumes $0.10 cost recovery from 50% of the energy
• Decrease of 17% ($1,561/year) relative to grid connected power or $21,367 savings over 20 years
• Cost to put in MG is lower than the cost to extend PGE service by $0.045 per kWh
• Average Annual Cost of $4,537 in operating expenses (includes replacement costs)
• Average Annual Revenues of $1,749
Sensitivity analysis varying diesel price and capital cost, solving for levelized cost of energy ($/kWh), with 50% of energy sold @ $0.10/kWh

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Sensitivity analysis varying diesel price and energy sale price, solving for levelized cost of energy ($/kWh), with 50% of energy sold

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Appendix: Three Scenarios

Cumulative Cost @ 6% discount rate

- PGE Extension
- MG w/o cost recovery
- MG w/ cost recovery

Cumulative Costs:
- $140,000
- $105,000
- $70,000
- $35,000
Conclusions

- Storage cost and value are location specific
- Storage cost and value are use case specific
- Stacking benefits is key to economic deployment across all sectors
- Due to historic isolation and frequent LDC neglect deployment in island or grid connected MG for Tribal campus can be economic