Solar+Storage for Clean Energy and Cost Savings at Albuquerque Public Schools

November 5, 2021
Webinar Logistics

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The Energy Storage Technology Advancement Partnership (ESTAP) is a US DOE-OE funded federal/state partnership project conducted under contract with Sandia National Laboratories.

ESTAP Key Activities:

1. Facilitate public/private partnerships to support joint federal/state energy storage demonstration project deployment

2. Disseminate information to stakeholders
   - ESTAP listserv >5,000 members
   - Webinars, conferences, information updates, surveys.

3. Support state energy storage efforts with technical, policy and program assistance

ESTAP Project Locations

- **Oregon**: Eugene resilient energy storage system
- **New Mexico**: Energy Storage Task Force
- **New York**: $40 Million Microgrids Initiative, $350 Million Storage Incentive
- **Vermont**: 4 MW energy storage microgrid & customer-sited batteries
- **Massachusetts**: $40 Million Resilient Power/Microgrids Solicitation, $10 Million energy storage demonstration program, Sterling project
- **Connecticut**: $45 Million, 3-year Microgrids Initiative
- **Iowa**: 3 mWh battery
- **Maryland**: Game Changer Awards: Solar/EV/Battery & Resiliency Through Microgrids Task Force
- **New York**: $40 Million Microgrids Initiative, $350 Million Storage Incentive
- **Hawaii**: 6MW storage on Molokai Island and 2MW storage in Honolulu

ESTAP Project Locations
Thank You!

Dr. Imre Gyuk  
Director, Energy Storage Research, U.S. Department of Energy

Dan Borneo  
Engineering Project/Program Lead, Sandia National Laboratories
Webinar Speakers

**Dr. Imre Gyuk**
Director, Energy Storage Research, DOE Office of Electricity

**Anthony Sparks**
Staff Project Manager for HVAC Systems, Albuquerque Public Schools

**Kimberli Roth**
Director of Sales and Marketing, OE Solar

**Dan Borneo**
Engineering Project/Program Lead, Sandia National Laboratories

**Todd Olinsky-Paul**
Senior Project Director, Clean Energy States Alliance (moderator)
Energy Storage for Resiliency and Revenue at an Albuquerque Highschool

IMRE GYUK, DIRECTOR, ENERGY STORAGE RESEARCH, DOE-OE
Global Warming is Real!

NY, Hurricane Ida, Aug. 2021

West Coast: 400 year Drought

800,000 years Atmospheric Carbon Dioxide
Floods and Droughts, but also Sea Level Rise, Coastal Erosion, Reduced Crop Yield, and Health Impacts

Global Warming has Emerged as a Paramount Issue - World Wide!
We must Decarbonize, we must change to Renewable Energy!

And we have to do it soon!
24 hours of wind – “the wind blows where it wishes”

Day and night – Clouds drifting by
Variable Generation - Variable Load

- Wind
- Fossil
- Solar PV
- Storage
- Electrification
- Load
- Distributed Generation
Energy Storage provides Energy when it is needed just as Transmission provides Energy where it is needed
Storage Technologies:

Pumped Hydro
Compressed Air
Sodium Sulphur
Lead Acid

Flow Batteries:
• Vanadium, ZnBr, FeCr
MnO₂ (Duracell)
NiMHyd
Li-Ion
Flywheels
Super-Capacitors
It is important to realize that Catastrophic Climate Based Events will continue to escalate.

Energy Storage will be required for both pre-emptive and ameliorating Measures.
Leaving behind Wreckage and Misery

Electrical Infrastructure is particularly vulnerable!
An Autonomous Micro-Grid

THE GRID

STORAGE

DISTRIBUTED GENERATION

VARIABLE LOAD
Developing Business Cases:

The **Cost** of a Storage System depends on the Storage Device, the Power Electronics, and the Balance of Plant.

The **Value** of a Storage System depends on Multiple Benefit Streams, both monetized and unmonetized.

Metrics will depend on locality! And on Regulatory Structure.

- **Power Electronics**: 20-25%
- **Energy Storage Device**: 25-50%
- **Facility**: 20-25%
- **Arbitrage**
- **Frequ. Reg.**
- **Dem. Charges**: month, year
- **Resiliency**
Sterling, MA: Microgrid/Storage Project
$1.5M Grant from MA. Additional DOE-OE Funding, Sandia Analytics

Sterling, MA,
Oct. 2016, NEC, Li-Ion

Dec. 2016, 2MW/2hr Storage, 3MW PC Capital Cost: $2.7M

Actual Savings:
- Arbitrage $11,731
- Monthly Peaks $143,447
- Annual Peak $240,660
- Total $395,839

April 2019: 1 million $ Avoided Cost!

Visitores: Germany, Switzerland, Denmark, Sweden, England, Ireland, Australia, Japan, Malaysia, Taiwan, Brazil, Chile, .... Thailand
Cordova, Alaska, Municipal System

Total Capacity: 7.25MW Hydro; 2x 1MW Diesel
0.5MW Deflected as Spinning Reserve
Hydro: $0.06/kW; Diesel: $0.60/kW

1MW/1hour Battery, Commissioned June 7, 2019
Bad River Band of Lake Superior Chippewa in Wisconsin (DOE Indian Energy)

July 2016 Flood caused Multiday Power Outage

Energy Sovereignty: $2M Microgrid
• Admin. Building
• Wastewater Treatment Plant
• Health & Wellness Center

May 2021: 500 kW Solar
500kW/1 MWh Storage

Resiliency, Sustainability, Predictable Budget
For the past decade electricity prices have been rising substantially.
Average Energy Burden (% of Income)

From S. Baker/Yale
Households Experiencing Energy Insecurity from Electricity Prices and Outages

Lower income households are disproportionately non-white
Energy Storage offers itself as a tool to alleviate many of these problems

e.g. Storage to replace Fossil Fuel Peakers

Microgrids with Storage for outage mitigation

Solar + Storage for Remote Tribal communities
Being prepared for Climate Disasters Everywhere and Assuring Energy Equity for Urban, Rural, and Tribal Disadvantaged Communities should be High Priorities for the U.S.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Largest school district in New Mexico: 84,000 students, 12,000 employees

2100+ buildings; 13 high schools; $50,000+ per day in utility spend.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

With invaluable help from partners and consultants!

APS Energy Team Members

• Utility Analyst
• Water Resource Specialist
• Facilities Usage Specialist
• Controls Specialists
• Energy Educator / School Engagement Specialist
• Team Coordinator / Project Manager
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

APS Energy Team and Partners

Constantly working toward improvement and results.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Milestones and Steps

Establish Goal & Baseline
Create/Ratify District Policy
Define Team and Roles
Gain Visibility Everywhere
Implement Controls
Establish Standards
Monitor & Evaluate
Implement Projects

Step-By-Step to Success.
Objective
• Reduce the entire school district's energy and water consumption by 20% in 10 years.

District Wide EUI: Total kBtu/Ft^2
District Wide Usage: Total Gallons/Occupant
Baseline Year: July 1, 2013 thru June 30th, 2014

Monitor gas, water, electricity, and operations daily. Report to leaders and Board of Education regularly.
Adding Photovoltaics now a standard for all new construction.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Building Buddies / Green Space Programs

84,000 pairs of ‘Boots on the Ground’ – meeting our educational mission.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Sandia Mountain Natural History Center – Off the Grid!

Another bold pilot project.
Looking for Opportunities . . . Next Steps?

- Battery Storage
- Solar Projects
- Academics
- Electric Vehicles
- LED Retrofits
- Artificial Turf
- Utility Partnerships
- Net-Zero or Off-the-Grid Sites (like Sandia Mountain Learning Center)

Always thinking ahead, moving forward.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

APS’ largest campus, largest utility bills.

Summertime electricity bills over $50K; demand charges more than 50%.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Center of the Community

Large disadvantaged population.
• Serves 2200 students (impacting thousands of families)
  • 14% from disadvantaged households (below Federal poverty line)
    • 99% eligible for Federal free or reduced lunch (APS average is 65%)
      • 20% English language learners
        • 28% Special education
          • On-site community health clinic

An ideal location.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Avengers Movie 2012 – Opening Scene

Nick Fury’s Helicopter Arrives at Avenger’s Headquarters.
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving

Project objectives

- Charge from grid ‘off-peak.’
- Deploy strategically during ‘on-peak.’
- Reduce daily peak demand to below 500 kW.
- Test case for replication elsewhere in District.
- Potential for resiliency during power emergency.

Is it cost-effective?
Atrisco Heritage Academy HS – Battery Storage for Peak Shaving
The importance of partners

• Expertise, experience
• Detailed, reliable analysis
• Many eyes, many viewpoints
• Shared financial burden

A win for everybody!
Atrisco Heritage Academy Goes Solar + Storage!
Demand charges occur during hours that the utility defines as "on-peak" (8 a.m. - 8 p.m. M-F).

Due to high demand pricing the cost of power can increase up to 100%.

Currently, Atrisco Heritage Academy spends $50,000 in utility costs in some months.

Maximizing energy deployment from the battery with solar energy production during peak hours will reduce costs exponentially overtime.
The local utility creates "rate cases" to classify costs based on energy usage.

Atrisco is under rate case 4B.

The battery will save the school approximately $3,500 each month by reducing amount of energy purchased in peak times.

The battery store power at night when the rates are lower, at off peak times.

The battery will deploy its energy during peak hours to reduce demand charges.
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ABOUT THE PROJECT

BRINGING NEW TECHNOLOGY AND RAISING AWARENESS ON THE IMPORTANCE OF SOLAR FOR SCHOOLS

Albuquerque Public Schools first Tesla Megapack 2 can hold up to 2,887 KWh at a rated maximum power output of 4 hours.

850 KW/DC Solar PV with an annual energy production of 1.3 gigawatts

The school will save up to $3.5 million by offsetting demand charges through peak shaving over the lifetime of the system.
Main System Components

- **Tesla Megapack 2** - Battery System
- **Battery Meter** - Tracking charge and discharge of the battery
- **Site Controller** - Supervisory Control & Data Acquisition (SCADA system)
- **Opticatser** - Optimally dispatches battery system
- **Powerhub** - Monitoring system
- **Site Meter** - Senses power pulled from the grid
- **Switch** - To intertie with campuses radial loop
- **Transformer** - Steps down power to battery voltage
THE ENERGY STORAGE SYSTEM

WE ARE BRINGING NEW TECHNOLOGY TO NEW MEXICO

The Energy Storage System will be the first Tesla Megapack 2 for an APS school. It can hold up to 2,887 KWh.

PEAK SHAVING
The energy storage system will reduce high demand costs by peak shaving

ENVIRONMENTAL CRISIS
In the future, the school could act as a power shelter for the surrounding communities with necessary infrastructure and system updates.
THE TESLA MEGAPACK 2

Specs:
- 8' - 3" Tall
- 5' - 6" Deep
- 25' - 6" Long
- 28 Tons
- Degradation Rates = 2% of nameplate KWh per year
TESLA MEGAPACK BENEFITS

TURNKEY
Megapack ships as a turnkey system and arrives fully assembled and tested keeping install costs down.

INTERNAL COOLING
Integrated heating and cooling at the cell level with dedicated hazard venting.

SOFTWARE
Proprietary optimization software developed in parallel with the Megapack hardware, learns and predicts local energy patterns.

UNINTERRUPTED
Module-level DC/DC converters that can keep the system running uninterrupted in case of partial failure.

REDUCING CARBON EMISSIONS
The PV system will reduce the carbon footprint in the area by 25%.
This solar installation will be the largest solar installation throughout all Albuquerque Public Schools.

The system will be able to produce:
- 1.3 Giga-Watts Hours Annually

The Photovoltaic system will contain:
- 2,208 Solar Panels (About 1 Per Student in enrollment)
- 16 Inverters
The solar modules will be installed on the following campus buildings:

- Performing Arts Academy
- Music Academy
- Film & Fine Arts Academy
- Law & Business Academy
- Freshman Academy
The school will be able to reallocate millions towards educational programs and infrastructure upgrades.

The energy storage system will reduce the electrical demand on the powerlines allowing for the conserved energy to be diverted to the surrounding community via the PNM grid.

The installation sets an example for future generations to bring new/clean technology that gives back to the environment.
PROJECT SUMMARY

PROJECT COST
This project's overall cost is $3,171,927.09.

FINANCIAL PARTNERS
This project received grants from the U.S. Department of Energy, the Office of Electricity, and the New Mexico Department of Energy, Minerals, and Natural Resources.

COST SAVINGS
The school will be able to offset energy consumption and rising utility rates by producing and storing energy on site.

POWER SHELTER
Along with the installation, OE Solar will be conducting a study on the infrastructure necessary to utilize the Tesla Megapack 2 during emergency events.

REDUCING CARBON EMISSIONS
The PV system will reduce the carbon footprint in the area by 25%.
Thank you all for attending.

Kimberli Roth
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oesolarnm.com
Webinar Speakers – Q&A

- **Dr. Imre Gyuk**, Director, Energy Storage Research, DOE Office of Electricity
- **Dan Borneo**, Engineering Project/Program Lead, Sandia National Laboratories
- **Anthony Sparks**, Staff Project Manager for HVAC Systems, Albuquerque Public Schools
- **Kimberli Roth**, Director of Sales and Marketing, OE Solar
- **Mike Blaha**, Director of Operations, OE Solar
- **Adrian Mariah**, Project Coordinator, OE Solar
- **Todd Olinsky-Paul**, Senior Project Director, Clean Energy States Alliance (moderator)
Upcoming Webinar

Exploring Europe’s Approach to Using Offshore Wind for Green Hydrogen Production
*Tuesday, November 9, 11am-12pm ET*

Benefits of Scaling Local Solar and Storage
*Monday, November 22, 3-4pm ET*

Read more and register at: [www.cesa.org/webinars](http://www.cesa.org/webinars)