DOE-OE Energy Storage Technology Advancement Partnership (ESTAP) Webinar

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

November 5, 2021







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## DOE-OE Energy Storage Technology Advancement Partnership

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:**

- 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







in Honolulu

## 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

DOE Office of

Electricity

Storage Research,



#### Anthony Sparks

Staff Project Manager for HVAC Systems, Albuquerque Public Schools

#### Kimberli Roth

Director of Sales and Marketing, OE Solar



**Dan Borneo** 

Sandia National

Project/Program Lead,

Engineering

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

ESTAP 11-05-21

## **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



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-lon **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



## **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 <u>unmonetized</u>

Metrics will depend on locality! And on Regulatory Structure



#### Sterling, MA: Microgrid/Storage Project \$1.5M Grant from MA. Additional DOE-OE Funding, Sandia Analytics



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

Dec. 2016, 2MW/2hr

Storage, 3MW PC

Capital Cost: \$2.7M

2016 Dec. till 2017 Nov.				
Actual Savings:				
<ul> <li>Arbitrage</li> </ul>	\$11,731			
<ul> <li>Monthly Peaks</li> </ul>	\$143,447			
<ul> <li>Annual Peak</li> </ul>	\$240,660			
<ul> <li>Total</li> </ul>	\$395,839			
	Sean Hamilton			



Carina Kaainoa

## April 2019: 1 million \$ Avoided Cost!

Visitors: Germany, Switzerland, Denmark, Sweden, England, Ireland, Australia, Japan, Malaysia, Taiwan, Brazil, Chile, .... Thailand

## Cordova, Alaska, Municipal System



Cordoba, Grid Isolated



6MW Run of RiverHydro Power

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

#### **Electricity price trends**

Quarterly change in consumer price index of electricity prices compared with all prices since September 1980.



Prices at 1980 Q3 are indexed to 100. Chart shows percentage change per quarter of each price group. Source: ABC News

#### For the past decade electricity prices have been rising substantially

### Average Energy Burden (% of Income)





#### Households Experiencing Energy Insecurity from Electricity Prices and Outages



#### Lower income households are disproportionally 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.





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



2100+ buildings; 13 high schools; \$50,000+ per day in utility spend.

ALBUQUERQUE PUBLIC SCHOOLS





#### APS Energy Team Members

- Utility Analyst
- Water Resource Specialist
- Facilities Usage Specialist
- Controls Specialists



- Energy Educator / School Engagement Specialist
- Team Coordinator / Project Manager

With invaluable help from partners and consultants!



#### **APS Energy Team and Partners**



Constantly working toward improvement and results.





ALBUQUERQUE PUBLIC SCHOOLS

#### **APS Water & Energy Conservation Update (Metrics)**



#### **Objective**

Reduce the entire school district's energy and water



#### **Consumption by 20% in 10 Years.**

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

9000 10 YEAR GOAL: Natural Gas 70 Total EUI: 53.24 Electric 8000 Gallons: 4149 ■ Water: Gallons (US)/Occupant E: 22.3 60 7000 E: 21.8 E: 21.3 E: 20.6 E: 19.4 E: 20.7 50 E: 20.4 6000 E: 16.2 kBTU/SQ. FT W: 5667 5000 -/occ 40 W: 5267 W: 5186 W: 5179 W: 4745 W: 4843 W: 4647 UPANT NG: 44.3 4000 W: 4419 30 NG: 39.4 NG: 39.4 NG: 39.2 NG: 36.5 3000 NG: 34.7 NG: 34.7 NG: 33.1 20 2000 YEAR 1: YEAR 2: YEAR 3: YEAR 4: YEAR 5: YEAR 6: YEAR 7: 10 BASELINE: 1000 Total EUI: 55.9 Total EUI: 50.9 Total EUI: 60.5 Total EUI: 61.2 Total EUI: 53.5 Total EUI: 60.0 Total EUI: 66.6 Total EUI: 55.4 Gallons: 4647 Gallons: 4745 Gallons: 4843 Gallons: 4419 Gallons: 5186 Gallons: 5267 Gallons: 5667 Gallons: 5179 0 0 13-14 14-15 15-16 16-17 17-18 18-19 19-20 20-21 COVID: COVID: 3 months 9 months

Monitor gas, water, electricity, and operations daily. Report to leaders and Board of Education regularly.









#### **Building Buddies / Green Space Programs**





84,000 pairs of 'Boots on the Ground' – meeting our educational mission.



#### Sandia Mountain Natural History Center – Off the Grid!



Another bold pilot project.



#### Looking for Opportunities . . . Next Steps?



Always thinking ahead, moving forward.

#### APS' largest campus, largest utility bills.



Summertime electricity bills over \$50K; demand charges more than 50%.



#### Center of the Community





Large disadvantaged population.







#### Avengers Movie 2012 – Opening Scene



Nick Fury's Helicopter Arrives at Avenger's Headquarters.



#### **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?







#### The importance of partners

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







E

Energy, Minerals and Natural Resources Department

XICO



ALBUQUERQUE PUBLIC SCHOOLS







#### A win for everybody!

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# Atrisco Heritage Academy Goes Solar + Storage!

Home of the **JAGLIATS** Class of 2013



# **HIGH DEMAND CHARGES**

#### OVERVIEW OF PEAK SHAVING

- 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..



## **PEAK SHAVING AT ATRISCO**

#### THE BENEFIT OF ENERGY STORAGE

The local utility creates "rate cases" to classify costs based on energy usage.

Atrisco is under rate case 4B.

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

The battery will save the school approximately \$3,500 each month by reducing amount of energy purchased in peak times. The battery will deploy its energy during peak hours to reduce demand charges.

# THE COST OF HIGH DEMAND

#### UNDERSTANDING UTILITY RATES

Customor Chargo	<u>June July August</u>	<u>All Other Months</u>
Per Metered Account	\$585.29/Bill	585.29/Bill
<u>On Peak Demand Charge</u>		
Customer Owned Transformer Utility Owned Transformer	\$23.69/kW \$25.61/kW	\$16.49/kW \$18.40/kW
<u>Energy Charge</u>		
On-Peak kWh	\$0.030/kWh	\$0.023/kWh
Off-Peak kWh	\$0.015/kWh	\$0.015/kWh

# **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 Telsa 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



## EVIRONMENTAL 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**



#### **BESS Site Location**

#### 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%.



# ALBUQUERQUE PUBLIC SCHOOLS LARGEST SOLAR SCHOOL

#### ATRISCO HERITAGE ACADEMY

\*1

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















Partners Involved



# THE PV SYSTEM DESIGN

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

#### Design. Build. Maintain.

# **THE BENEFITS**



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 kimberlir@osceolaenergy.com

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)









# This webinar was presented by the DOE-OE Energy Storage Technology Advancement Partnership (ESTAP)

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ESTAP Website: <u>https://cesa.org/projects/energy-storage-technology-</u> <u>advancement-partnership/</u>

ESTAP Webinar Archive: <u>https://cesa.org/projects/energy-storage-</u> <u>technology-advancement-partnership/webinars/</u>







## **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: <a href="http://www.cesa.org/webinars">www.cesa.org/webinars</a>

