ROAD TO RESILIENCY

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YEAROUT ENERGY

Photo source: Shutterstock

Agenda

- Grid Trends and Reliability
- Resiliency
- Pop Quiz
- Electrification
- Efficiency
- Micro-Grids
- Project Profiles
- The Perfect Storm
- Grants and Incentives
- Questions

Grid Trends and Reliability

Storm Uri

- February 12–17, 2021 Texas had one of, one of the coldest and most impactful winter storms.
- Record winter demand.
- Generation unit outages cascaded into instability and power losses across the ERCOT power grid.
- 4.5 million Texans without electricity at the peak.
- Primary causes loss of upstream gas/ transmission and loss of power and electricity.

Photo Source: https://www.ksat.com/weather/2021/03/03/februarys-arctic-blast-in-san-antonio-has-few-historical-comparisons/

ERCOT Update

North American Electric Reliability Corporation (NERC) and Federal Energy Regulatory Commission (FERC) issues report with 28 recommendations to prevent and mitigate future outages.

- ☑ Winterization of Power Plants
- ☑ Critical Infrastructure Mapping
- ☑ Designating Gas Infrastructure as Critical
- ☑ Natural Gas Infrastructure Cannot Participate in Demand Response

Source: Texas Energy and Power Newsletter – Three Years Gone Doug Lewin 2.14.24

ERCOT Update

North American Electric Reliability Corporation (NERC) and Federal Energy Regulatory Commission (FERC) issues report with 28 recommendations to prevent and mitigate future outages.

- **Winterization of Gas Supply**

  Texas gas field output dropped about 30% during 2022 and 2023 cold snaps. If temps were 7 to 10 degrees colder with more snow and ice, it could have been worse. Gas supply remains the Achilles heel of the Texas power grid in winter.

- **Seasonal Grid Preparedness**

  Forecasts need to adjust to historical peak loads to reflect the potential for exponential load increase due to the resistive heating used in southern states. This remains a serious weakness in the system.

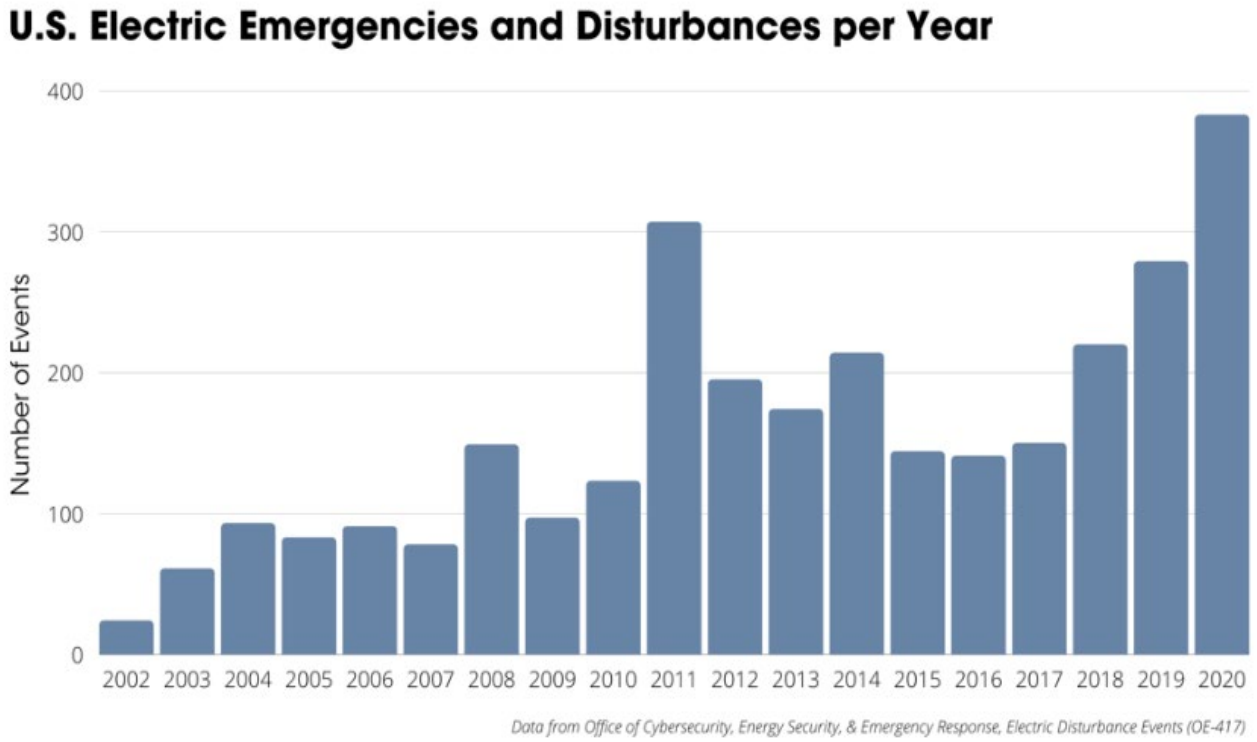
- **Reducing Demand**

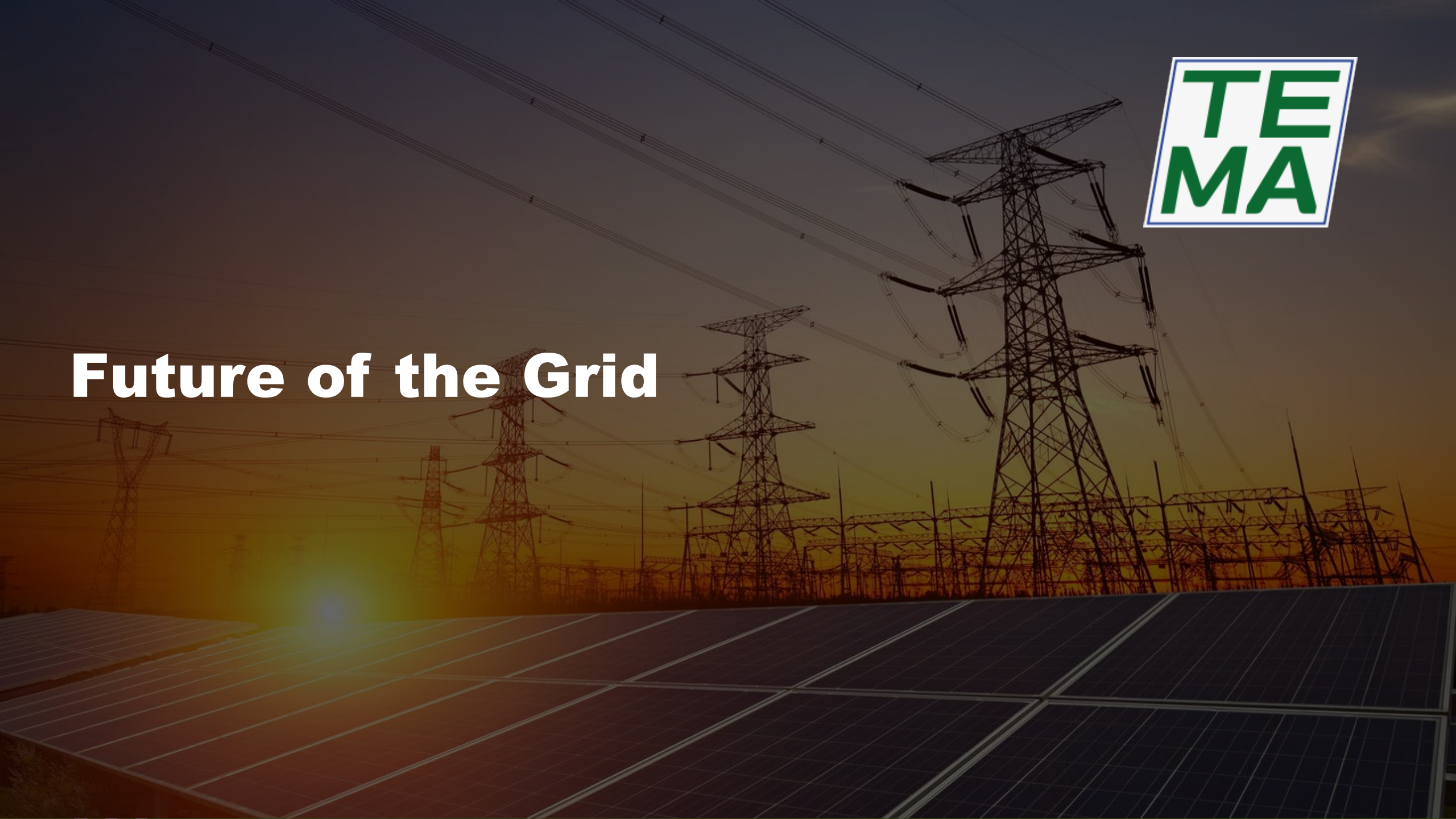
  Focus has been on adding supply, but they have neglected reducing demand. A solution proposed is a program that could cycle outages only to certain home appliances instead of taking out entire circuits.

Source: Texas Energy and Power Newsletter – Three Years Gone Doug Lewin 2.14.24

Grid Trends and Reliability

- Extreme Weather Patterns
- Population Growth
- Aging infrastructure
- Insufficient Transmission Capacity
- Demand Fluctuations
- Fuel Supply Issues
- Increased Electrical Use (Electric Vehicles)
- Others

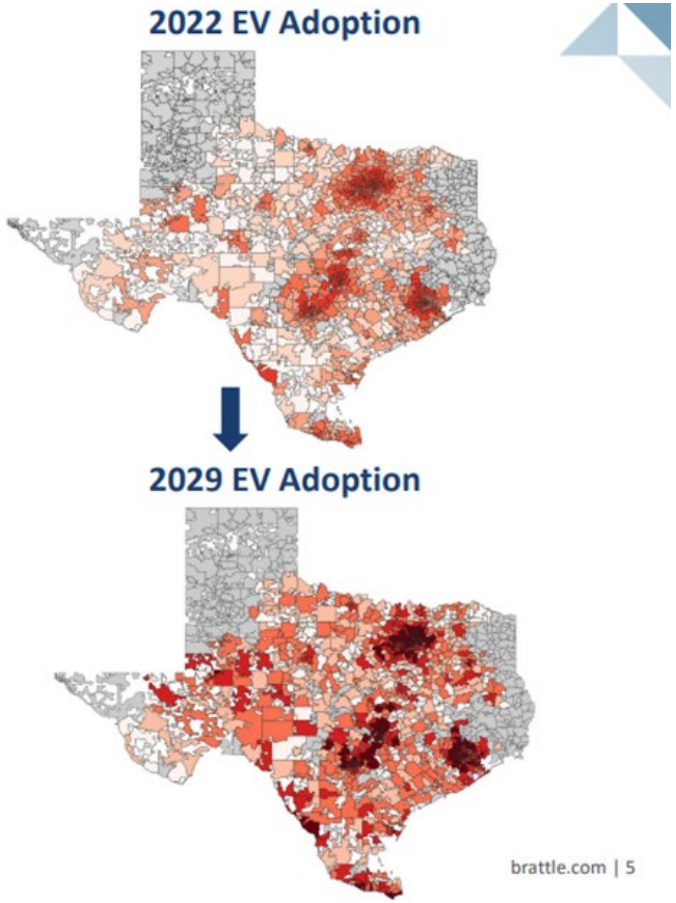




Future of the Grid

The Future Electricity Infrastructure

- Department of Energy (DOE) -A significant amount of future U.S. electricity generation will be low to no emissions.
- Will include various distributed energy resources (DERs) like stationary batteries, responsive loads, fuel cells, and renewable energy.
- Microgrids are identified as fundamental in addressing challenges of interoperability and scalability in the envisioned future.



Source: Department of Energy and Pacific Northwest National Laboratory white paper: Microgrid R&D Program White Papers March 2021

Photo Source: Ercot EV Allocation Study by Brattle

POP QUIZ

POP QUIZ

How many kBtus are in 1 kWh of Electricity?

3.412 kBtu/kWh

How many kBtus are in 1 therm of Natural Gas?

100 kBtu/therm

POP QUIZ

Assuming a rate of $0.05/kWh, what is the cost of electricity in $/kBtu?

$0.01466 / kBtu

Assuming a rate of $0.50/therm, what is the cost of natural gas in $/kBtu?

$0.00500 / kBtu

$/kBtu, Electricity is roughly 3 times the cost of Natural Gas

ELECTRIFICATION

Electrification - Definition

- Refers to the process of replacing technologies that use fossil fuels (coal, oil, natural gas, etc.) with technologies that use electricity as a source of energy.
- The carbon reduction benefits from electrification is heavily dependent on the resources used to generate the electricity.

HVAC Systems in Schools

- **~70%** of the K-12 school floor area nationwide currently uses on-site fossil fuels for heating
- **~56%** of all energy use in K-12 facilities is attributed to the HVAC system

Source: Rocky Mountain Institute – HVAC Choices for Student Health and Learning

Electrification – Heat Pumps

- Air-Source Heat Pumps (ASHP)
  - Capable of operating at 300% - 400% efficiency during winter months in moderate climates
- Ground-Source Heat Pumps (GSHP)
  - Capable of operating at 300% - 600% efficiency during winter months (Remember how Electricity was roughly 3 times more expensive than natural gas in terms of $/kBtu)
- Variable Refrigerant Flow (VRF)

Modern heat pump technology can maintain 100% load capacity even at temperatures below 0°F

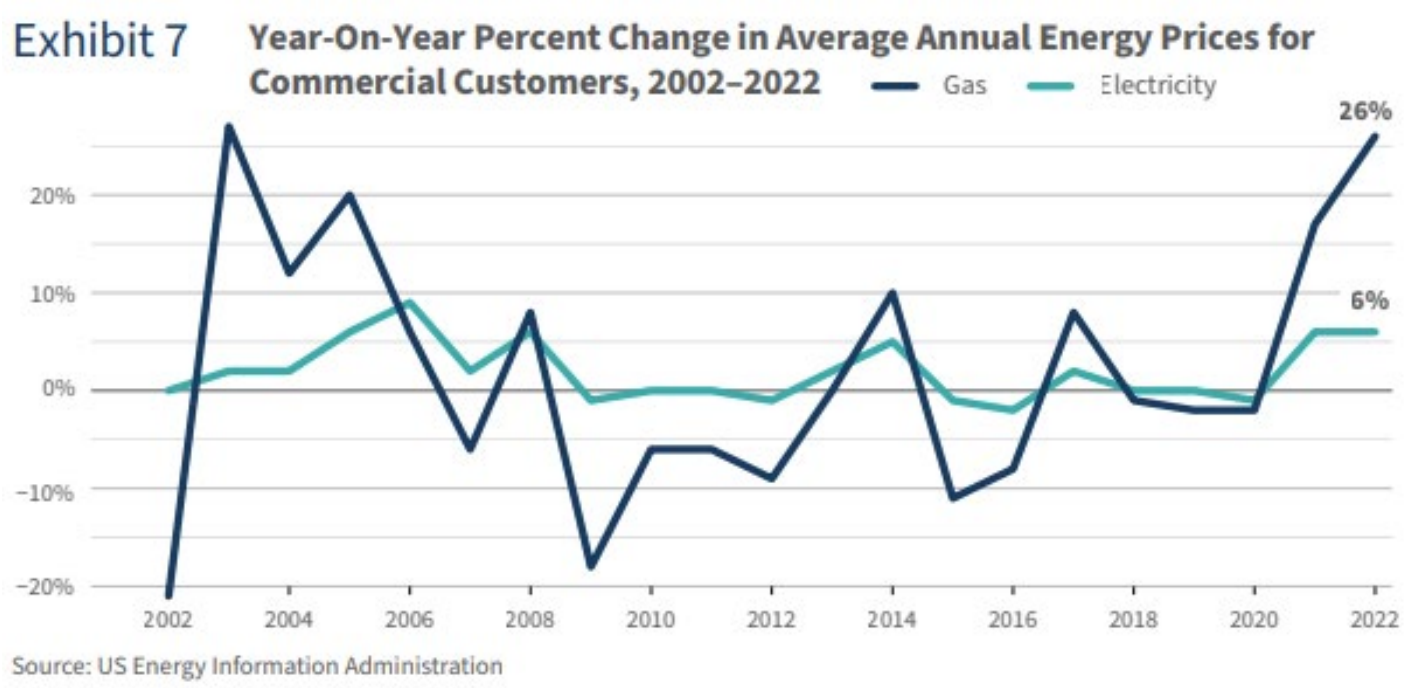
Source: Rocky Mountain Institute – HVAC Choices for Student Health and Learning

Electrification – Heat Pump Water Heater

- Tank-Type Unit
  - 3 – 4 times more efficiency than natural gas units
  - Optional backup electric heating elements for use during peak demand periods
- New Tankless Heat Pump Options

Electrification – Price Volatility

- Historically, the price of electricity has been less volatile than the price of gas.



Source: Rocky Mountain Institute – HVAC Choices for Student Health and Learning

Electrification – Benefits

- **Environmental Sustainability**
- **Energy Efficiency**
- **Reduced Air Pollution**
- **Cost Savings**
- **Diverse Energy Sources**
- **Technological Innovation**
- **Grid Resilience**
- **Transportation Electrification Benefits**

EFFICIENCY

Efficiency - Waste

- For every dollar spent on utility costs, a significant portion is wasted on inefficiencies…
- The EPA Estimates that on average facilities use 30% more energy than what is necessary to properly operate the facilities.

ACTUAL UTILITY COST

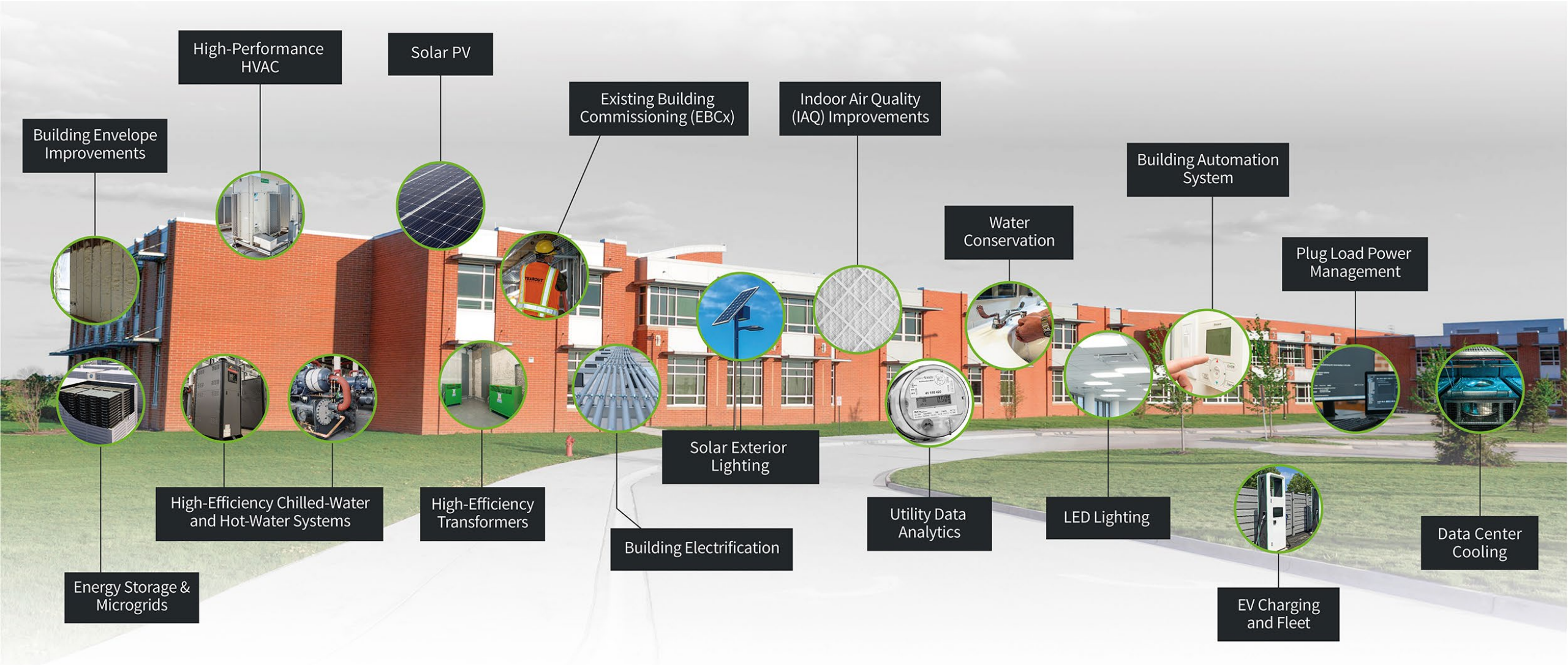
OVERPAYMENT

Facility Improvement Measures- Process

Generation vs Energy Saving

- According to ShellEnergy the cost of Solar Generation for commercial users is cost $0.06-$0.08/kWh
- The American Council for an Energy-Efficient Economy (ACEEE) The levelized program cost of saved energy is $0.024/kWh
- Putting efficiency as the cheapest source of clean energy available on the grid today.
- The cost of generation approximately 3 times higher

Efficiency - Opportunities



MICRO-GRID

Microgrid

- According to the DOE, a microgrid is a group of interconnected loads and distributed energy resources (DERs) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

- A microgrid can connect and disconnect from the larger utility grid to operate in either grid-connected or island mode.

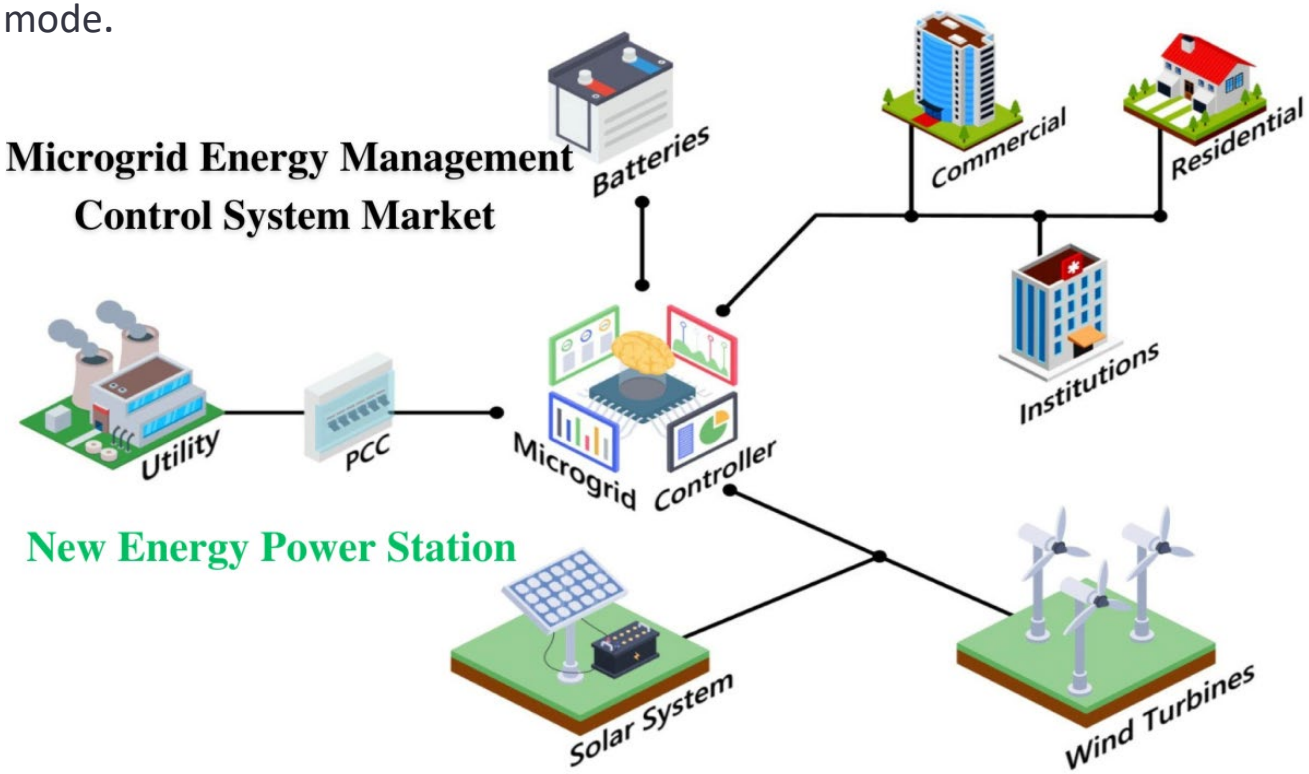


Photo Source: https://www.linkedin.com/pulse/new-research-report-in-depth-analysis-global-microgrid-baliram-dandge/

Generation – Types on Onsite Sources

- Solar Photovoltaic (PV)
- Solar Thermal
- Small Wind Turbine
- Hydropower
- Others

Source: Rocky Mountain Institute – HVAC Choices for Student Health and Learning

Generation

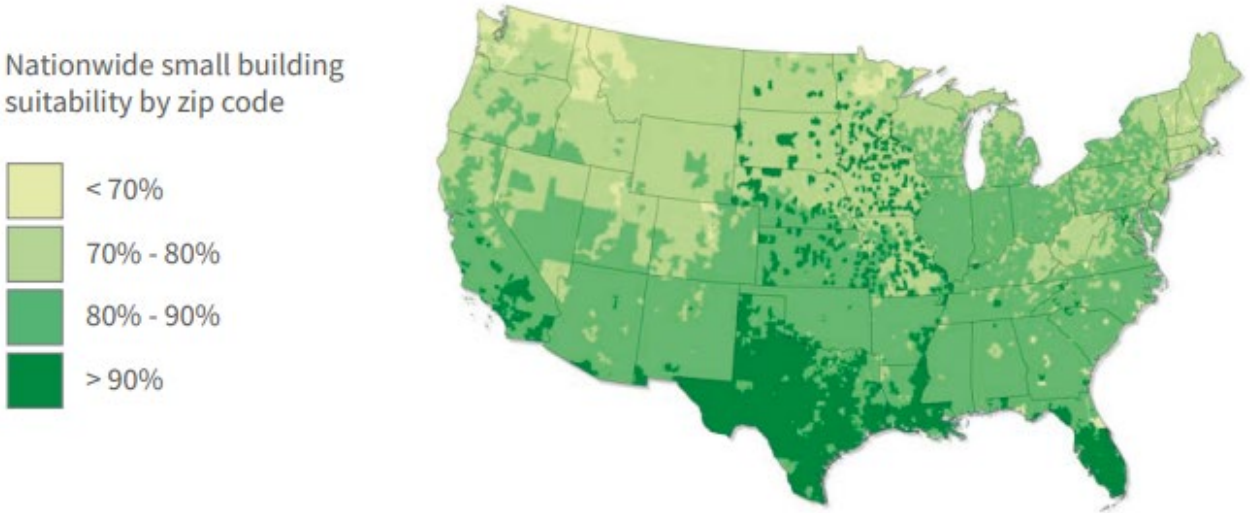
Solar Photovoltaic (PV) is the most common form of on-site distributed energy behind the meter.

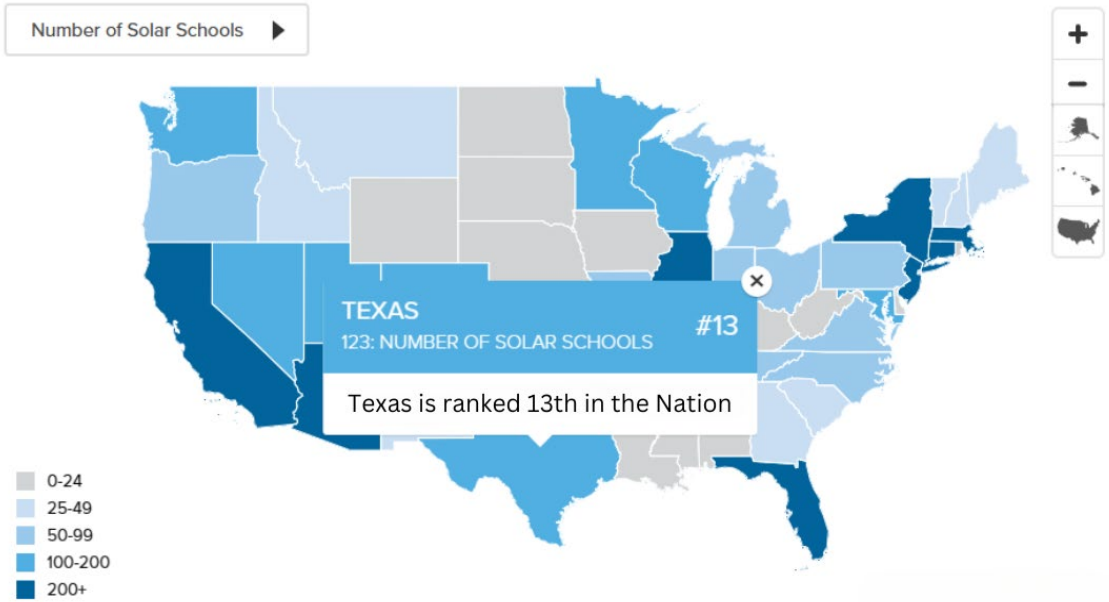
- Generate energy during peak conditions to reduce overall peak demand.
- Contribute to cost savings by minimizing the reliance on purchased energy during generally expensive peak hours.

Source: Rocky Mountain Institute – HVAC Choices for Student Health and Learning

Generation- State of Solar

- Texas is second in the nation for solar potential photovoltaics.
- Total PV installations for the first 9 months in 2023 equaled 19.3 GW. 42% Increase from 2022.
- Texas ranked 3rd in the nation in total PV installed with 11%.
- Currently, Texas has 123 schools who have embraced solar, ranking Texas 13th in the nation.





Battery Energy Storage Systems (BESS)

Battery energy storage systems (BESS) have emerged as an effective tool for addressing on-peak energy consumption. They are in integral part of a microgrid system.

- Store excess energy generated during off-peak hours.
- Utilize stored energy during high-demand hours or grid down times

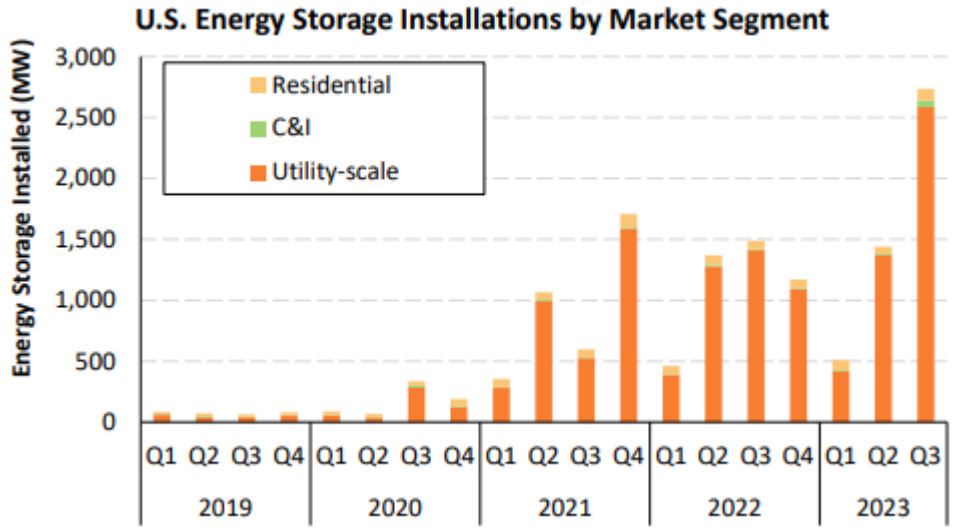
Benefits:

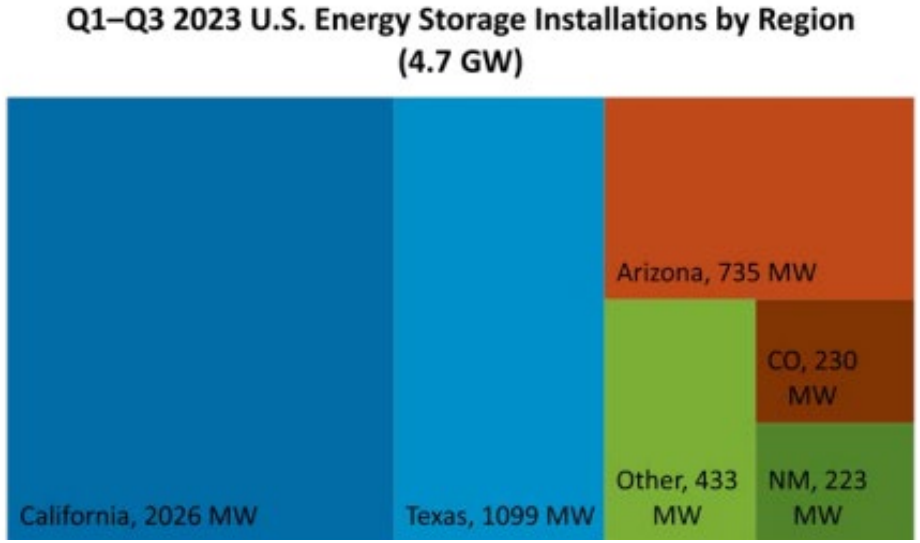
- Demand Reduction- Cost Savings
- Improve Grid Stability
- Increase Energy Independence- Islanding

The State of Energy Storage

The US Energy Information Administration (EIA) reported that the U.S. installed approximately 4.7 GW of energy storage on the electric grid for the first 9 months of 2023, bringing total battery capacity to 16.7 GW.

Texas made up 23% of this capacity with 1099 MW of battery storage installed.





Project Profiles

NM Dept. of Transportation
GO Complex

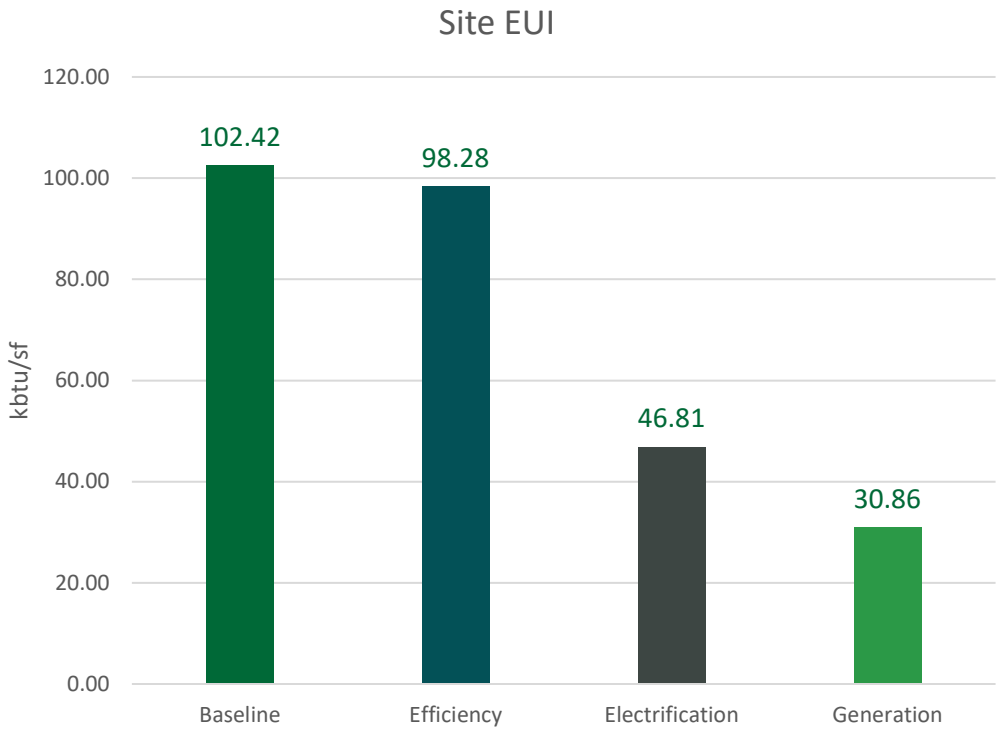
- **Efficiency**
  - LED Lighting & Controls
  - Energy Management System
  - Double-Pane Windows
  - Weatherization
  - Water Conservation
  - Water Line Repairs
- **Electrification**
  - VRF HVAC System with Energy Recovery Ventilators
  - EV Charging Stations
- **Generation**
  - 400 kW Solar PV Carport
- **Other**
  - Utility Billing Corrections

Project Amount	**$16.5M**
Year 1 Guaranteed Savings	**$152,503**
Utility Rebates	**$21,500**
Annual Environmental Impact	**1.88M lb CO_2**
Reduction in Annual Utility Cost	**31%**

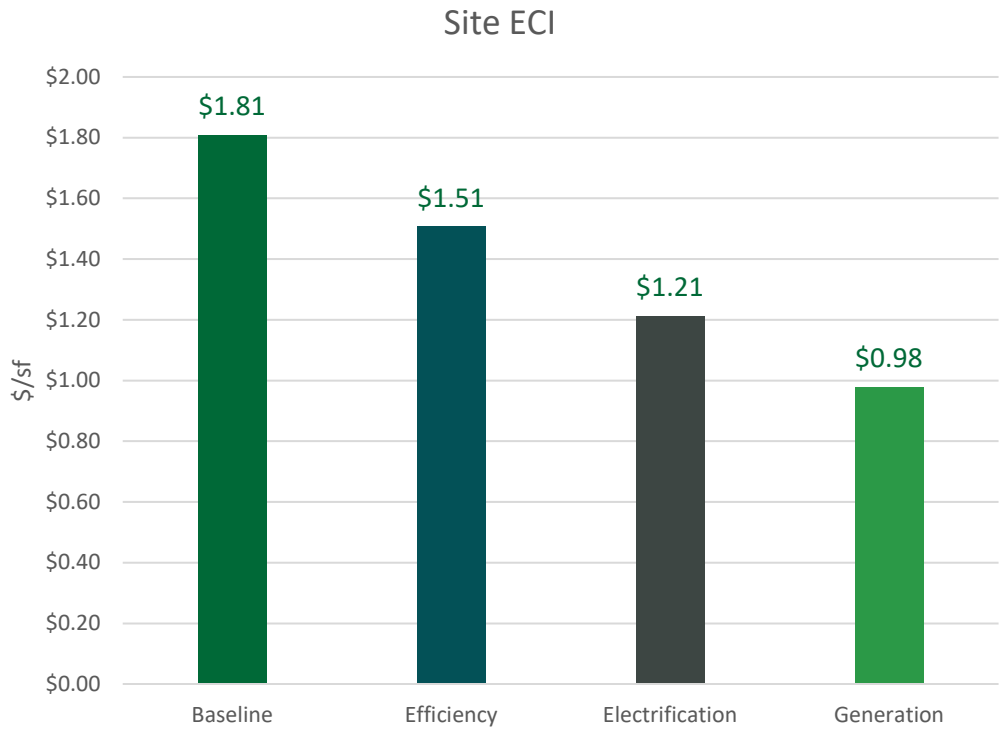
ASSOCIATION OF ENERGY ENGINEERS
ENERGY PROJECT OF THE YEAR 2022
REGION IV

YEAROUT ENERGY

Project Profile – NMDOT GO/Annex Bldg



70% Reduction



46% Reduction

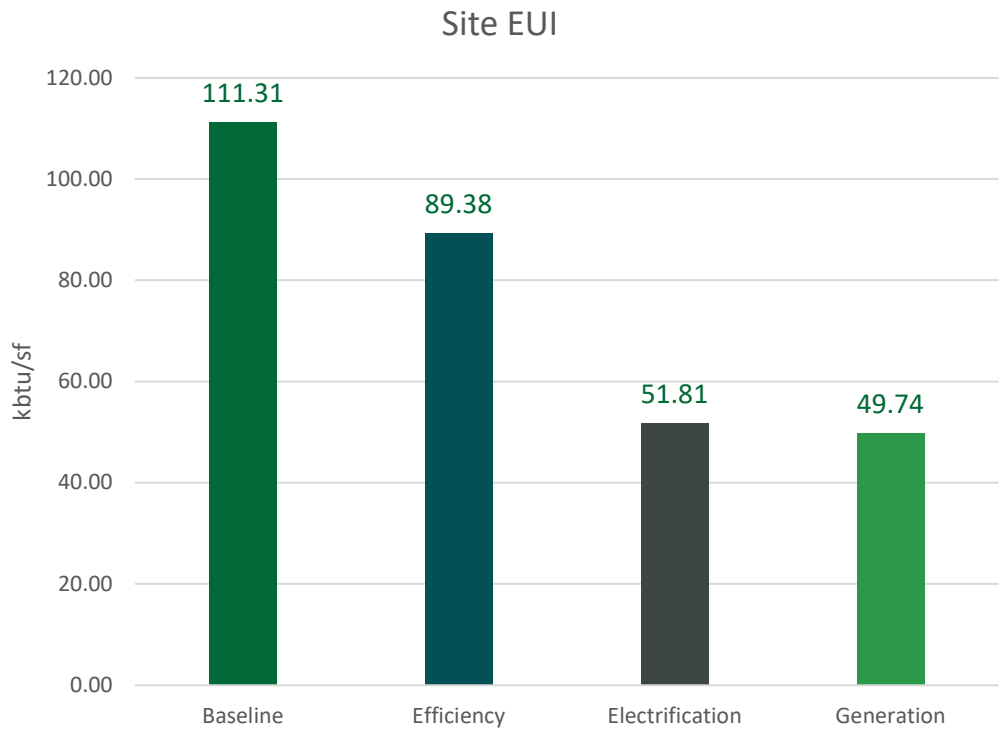
NM Dept. of Workforce Solutions - TIWA Bldg.

- **Efficiency**
  - LED Lighting & Controls
  - Energy Management System
  - Weatherization
  - Water Conservation
  - HE Transformers
  - Data Center CRAC Units
- **Electrification**
  - VRF HVAC System with Energy Recovery Ventilators
- **Generation**
  - 30kW Rooftop Solar PV
- **Other**
  - Utility Billing Corrections
  - Modular DIRRT Wall System
  - Electrical / IT System Overhaul

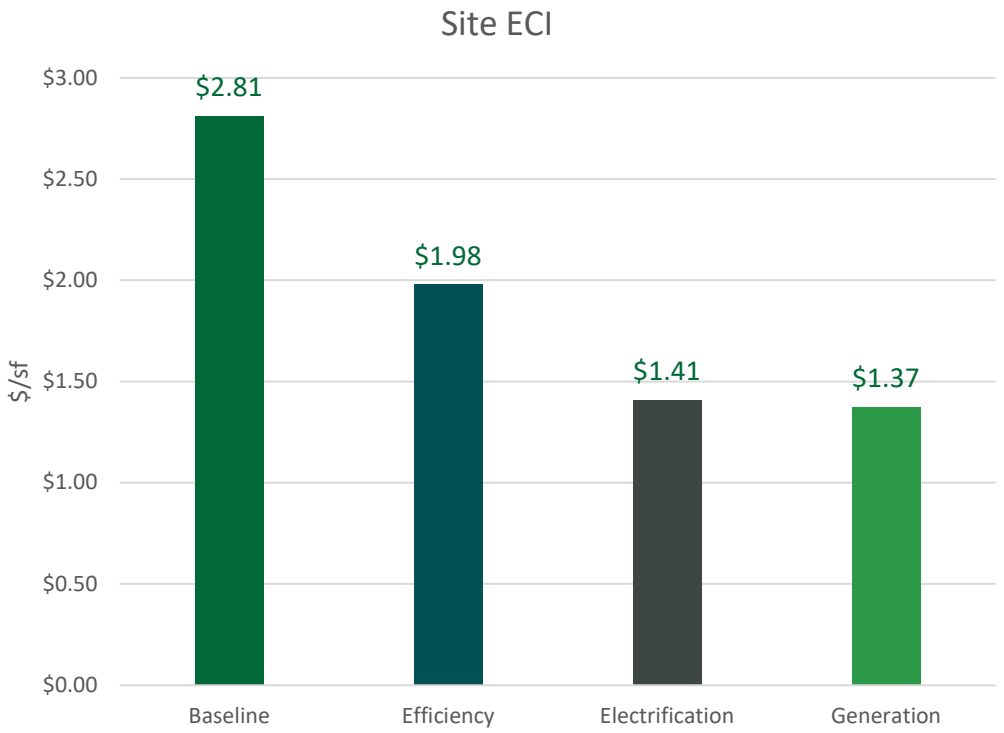
Project Amount	**$22M**
Year 1 Guaranteed Savings	**$258,492**
Utility Rebates	**$41,647**
Annual Environmental Impact	**1.2M lb CO_2**
Reduction in Annual Utility Cost	**50%**

YEAROUT ENERGY

Project Profile – NMDWS TIWA Bldg



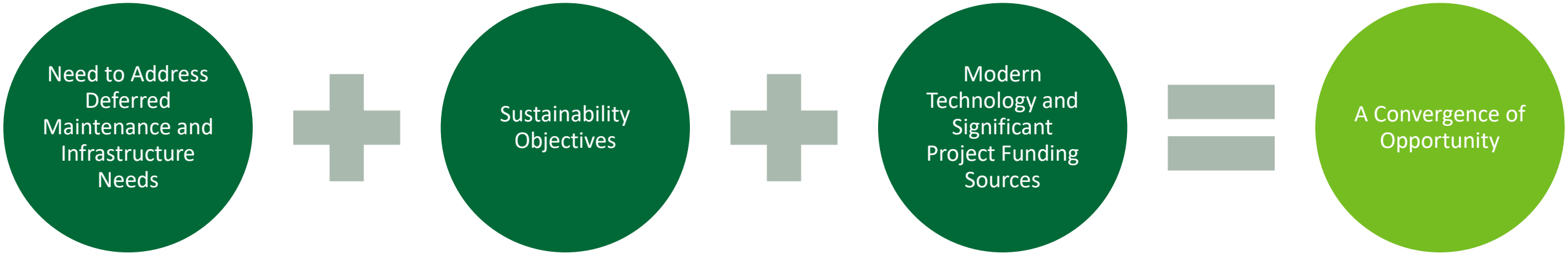
55% Reduction



51% Reduction

PERFECT STORM

The Perfect Storm



Inflation Reduction Act (IRA)

Provides a 30%+ Direct Payment to tax-exempt entities for:

- Investment Tax Credit for Energy Property - Solar, wind, ground source heat pump, battery storage, thermal energy storage, combined heat and power
- Qualified Commercial Vehicle Tax Credit - Electric school buses, electric vans
- Alternative Fuel Refueling Property Credit - EV charging stations in low-income urban or non-urban areas

Additional incentives for:

- 10% for domestic content
- 10% for energy communities
- 10% Tribal

DOE Renew America's Schools

- Between 2022 and 2026, the DOE will administer $500M in grant funding made possible by the IRA and Jobs Act
- Prioritize high-need districts
- Eligible projects include energy infrastructure improvements that reduce building operating costs—like new HVAC and ventilation systems, building envelope and lighting projects, and renewable energy technologies. Funding is also available for alternative fueled vehicles and alternative fueled vehicle infrastructure.

Federal Grants

- Federal Emergency Management Agency (FEMA): These are potential sources of funding for projects that contribute to hazard mitigation efforts.
- Department of Energy (DOE): The DOE often provides funding for advanced energy projects, including microgrids.
- Environmental Protection Agency (EPA): The EPA may provide funding for projects related to clean energy and environmental sustainability.
- U.S. Department of Agriculture (USDA): The USDA may offer grants and loans for rural energy projects, including microgrid development.

Commercial Solutions Incentives

Measure Category/Name	$/kW	$/kWh
Lighting	Up to $325	$0.05
HVAC – Chiller	$525	$0.05
HVAC – DX Units or Controls	$350	$0.05
Refrigeration	$200	$0.03
Custom/Other	$200	$0.05

**Up to 60% of project costs; up to 75% of project costs on non-lighting measures*

Demand Response Incentives

Program Duration	Notice Timeframe	Max Events/Year	Per kW Capacity
June 1 – Sept 30	30 Mins	25	$73
June 1 – Sept 30	2 Hrs	25	$70
June 1 – Sept 30	1 Hr	6	$31
July 1 – Aug 31	2 Hrs	18	$47

YEAROUT ENERGY

THANK YOU

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