



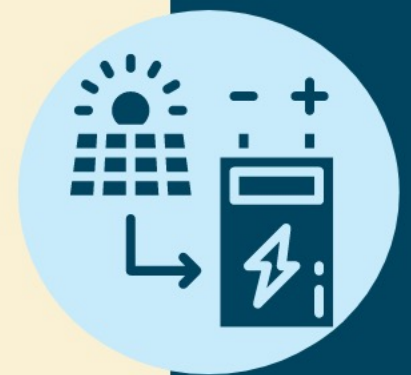
UTILITY SCALE SOLAR & STORAGE WEBINAR

SEPTEMBER 30TH, 2021

11:30-1:00PM CST



Utility Scale Solar & Storage Webinar



Dorothy Barnett
Climate + Energy Project
Host



Bill Roush
CEP Board Member
Moderator



Robert Wright
Burns & McDonnell
Presenter



Frank Jakob
Black & Veatch
Presenter

Community Agreements

- **Platinum Rule** - *treat others the way you want to be treated.*
- **Notice the Room** - *build awareness together.*
- **Be Curious, Open, and Respectful** - *call in, not out.*
 - *Throw sunshine, not shade.*
- **Be Conscious of Your Intent vs. Impact** - *Your intentions may be good, but the impact on another may be hurtful. You are responsible for the impact of your words.*



Mission

The Climate + Energy Project (CEP) builds resilience in Kansas through equitable clean energy solutions and climate action.

Purpose

The Climate & Energy Project:

- connects people, organizations, and ideas;
- presents science-based facts;
- facilitates critical thinking and community engagement; and
- co-creates equitable and productive solutions.



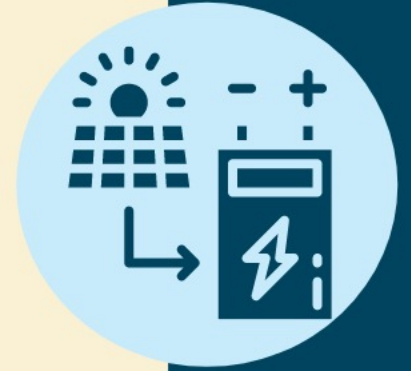
Bill Roush

CEP Board Member



Bill Roush is retired from the Black & Veatch Renewables group. While at Black & Veatch, he was a Project Manager assisting solar developers with Interconnection Applications. He also was the utility scale solar plant warranty manager.

Bill has an undergraduate degree in Urban Affairs and an MBA from UMKC. He has also worked as an aide to the City Council of KCMO. Bill currently is a Board member of the Climate and Energy Project.



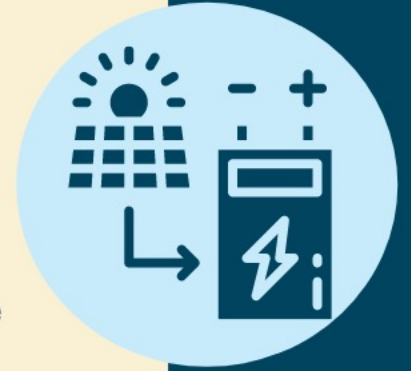
Robert Wright

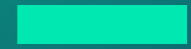
Burns & McDonnell



Mr. Robert Wright is the Renewable Energy Development Manager for the technical development and implementation of new renewable generation for Burns & McDonnell's Energy Division. His duties include technology comparisons, cost estimating, performance optimization, economic analysis, conceptual design, siting studies, and project coordination. Additionally, Mr. Wright helps clients determine overarching project strategies to go from conception through regulatory approval focusing on competitive and winning approaches.

Mr. Wright incorporates current market conditions, policies, and tax benefits into his analyses. He has his professional engineering license in mechanical engineering as well as a master's degree in Engineering Management and a bachelor's degree in Engineering Physics, both from the Colorado School of Mines.





CEP Webinar – Solar

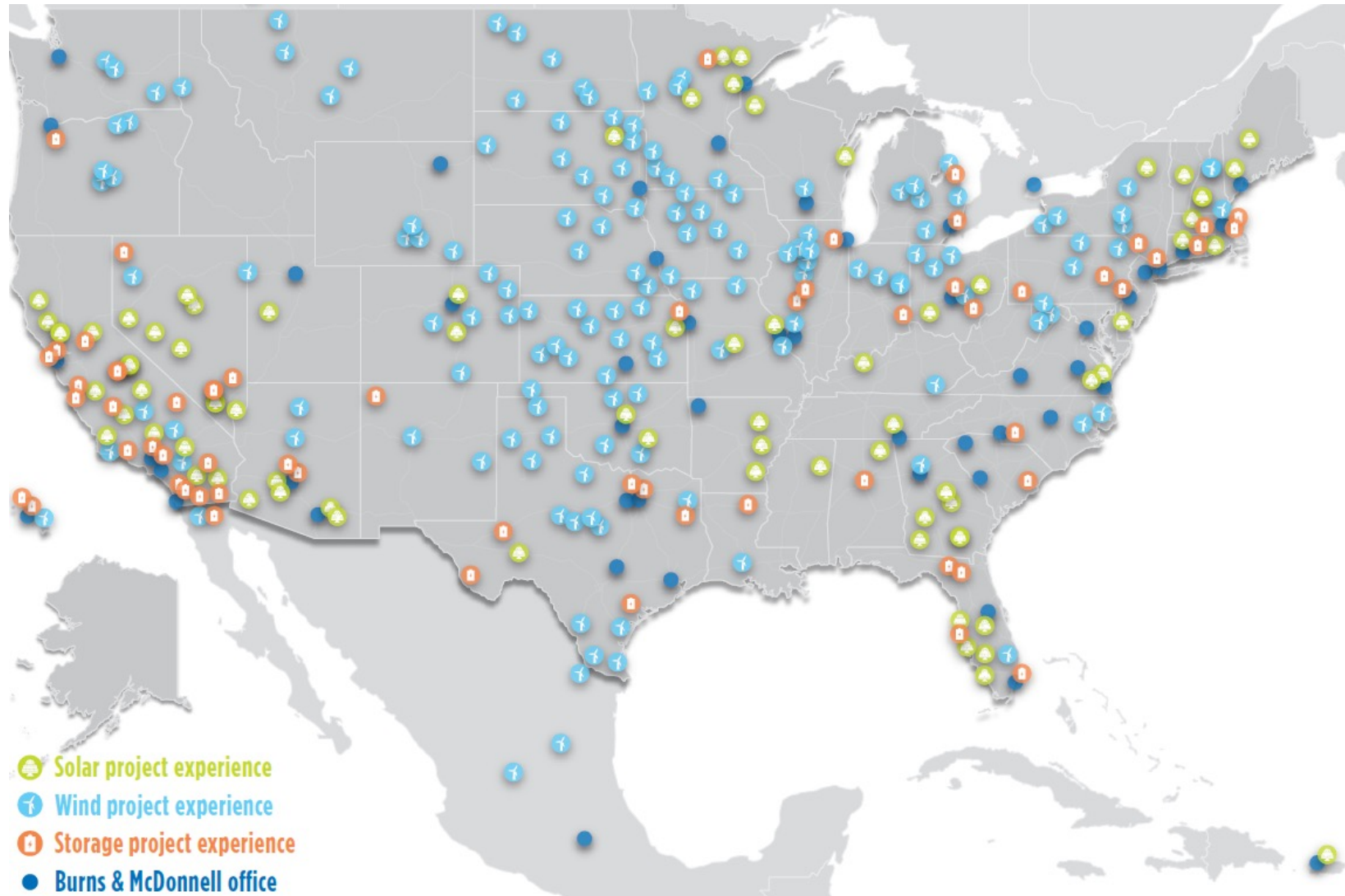
September 30, 2021



Robert Wright

Renewable Energy Development Manager

Burns & McDonnell Renewables

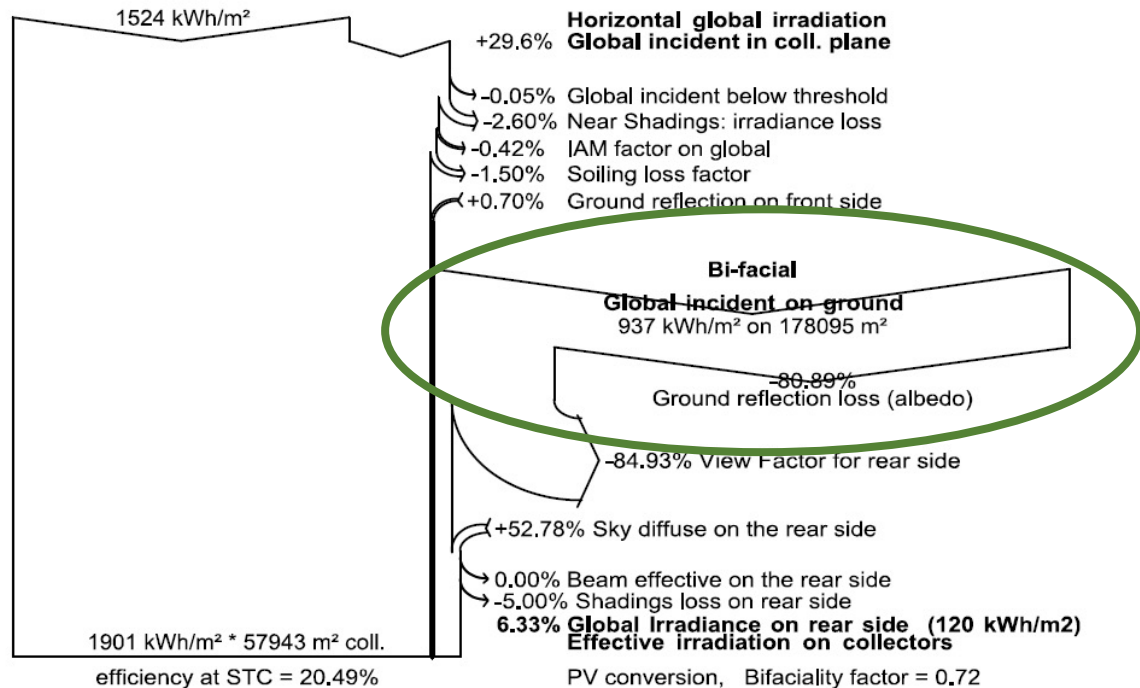


TECHNICAL TRENDS

A large-scale solar farm is shown, with rows of solar panels supported by metal structures in a dry, open landscape. The panels are tilted and connected by a network of cables. The ground is covered in dry, yellowish grass, and the sky is clear with a few wispy clouds. The overall scene is bright and sunny, suggesting a clear day.

Modules

- Bifacial gains to module efficiency
- Module wattage/size continues to increase



FRONT



BACK

Tracker/Racking System



Fixed Tilt

VS

Tracking



Construction Approach



LAND USE

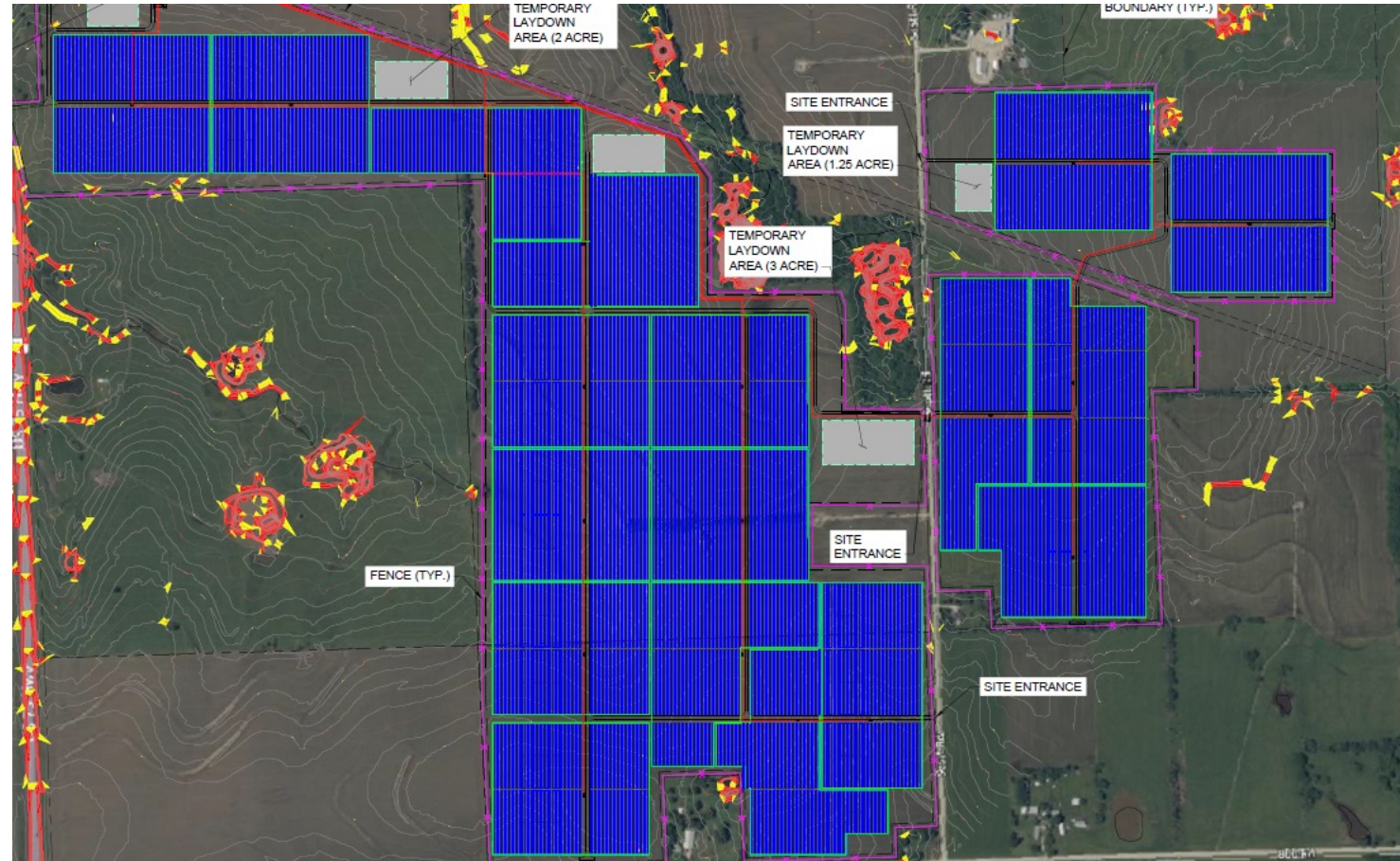


Ground Coverage Considerations



Space Optimization

- ~6 acres for every MW_{AC}
- 100 MW_{AC} project = 600 acres
- Larger sites → lower cost per MW



PROMISING ECONOMICS

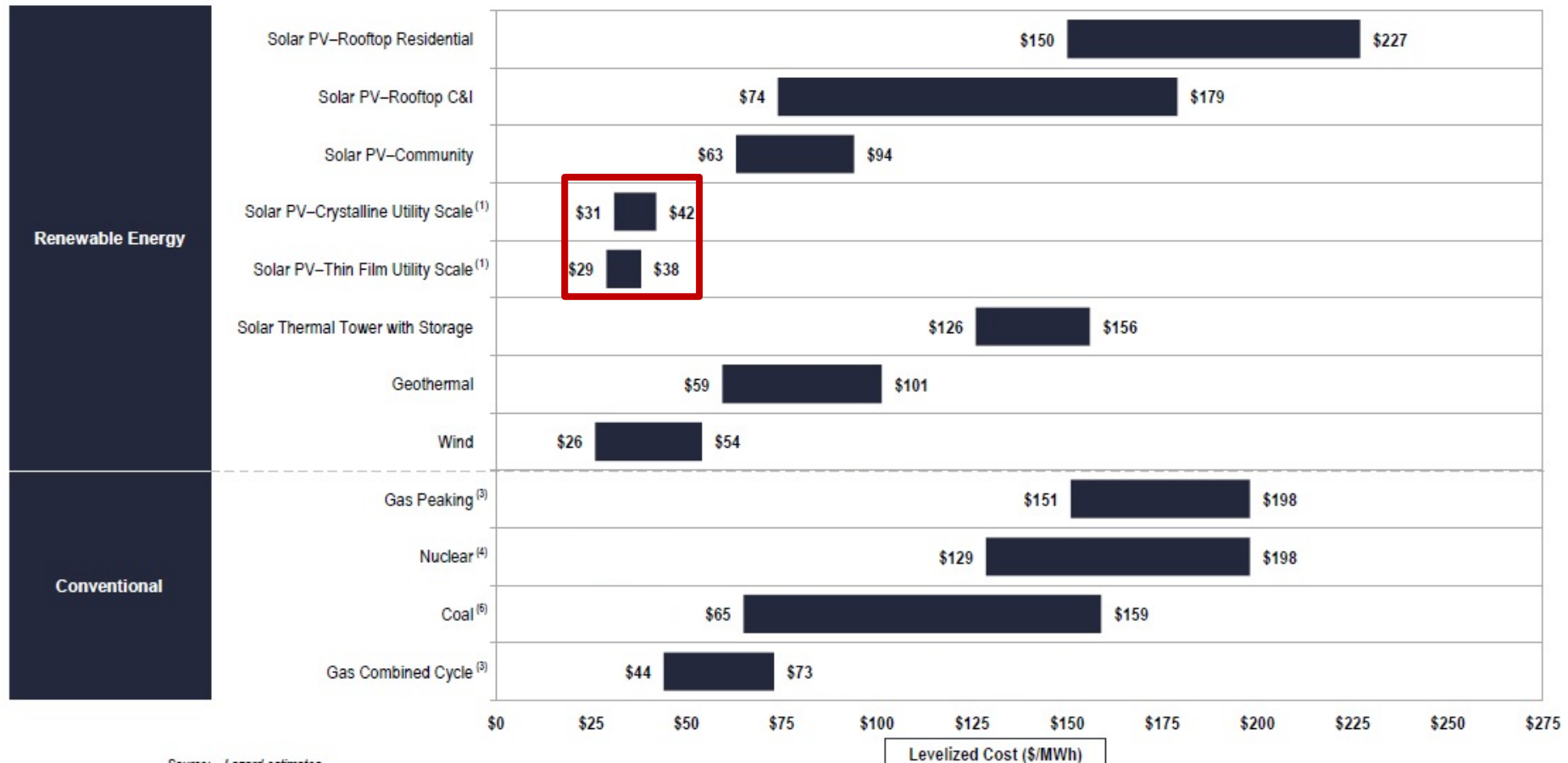
Lowest Cost Energy

LAZARD

LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS V14.0

Levelized Cost of Energy Comparison—Unsubsidized Analysis

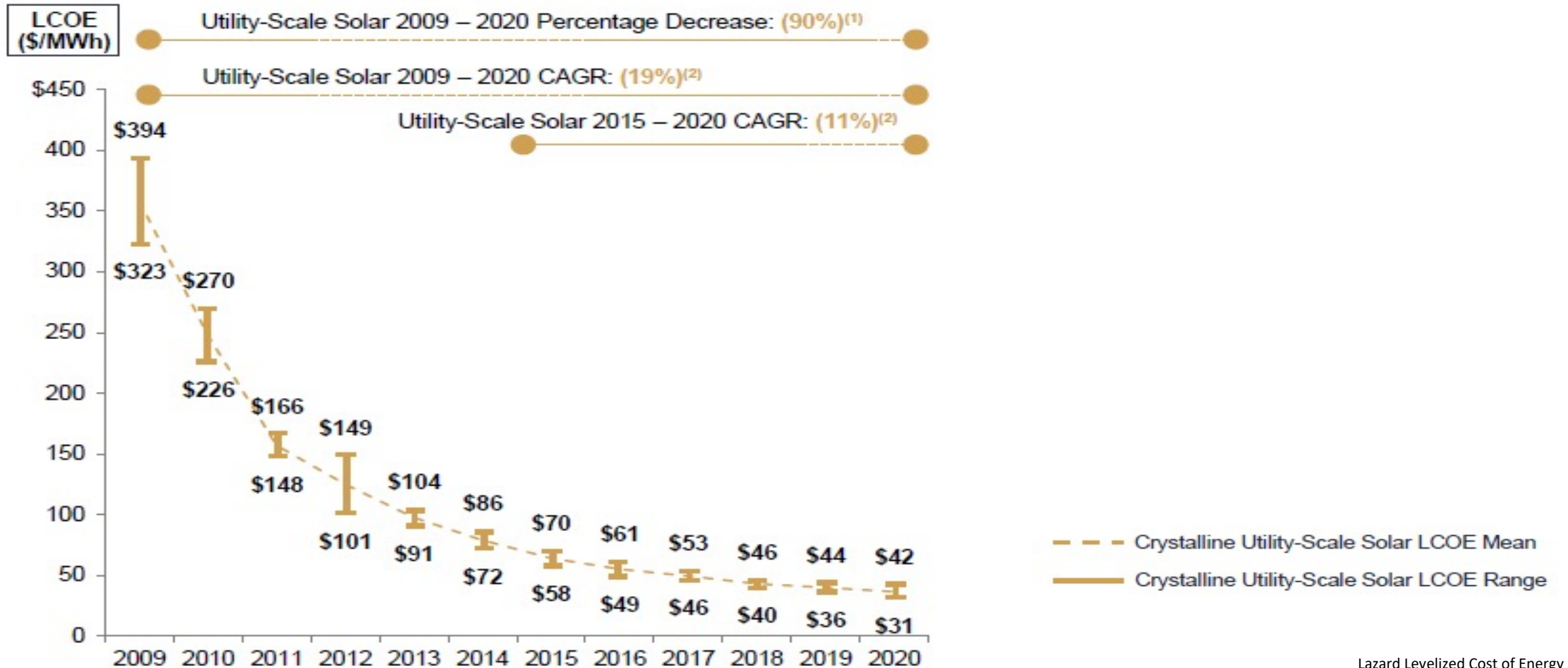
Selected renewable energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances



Source: Lazard estimates.

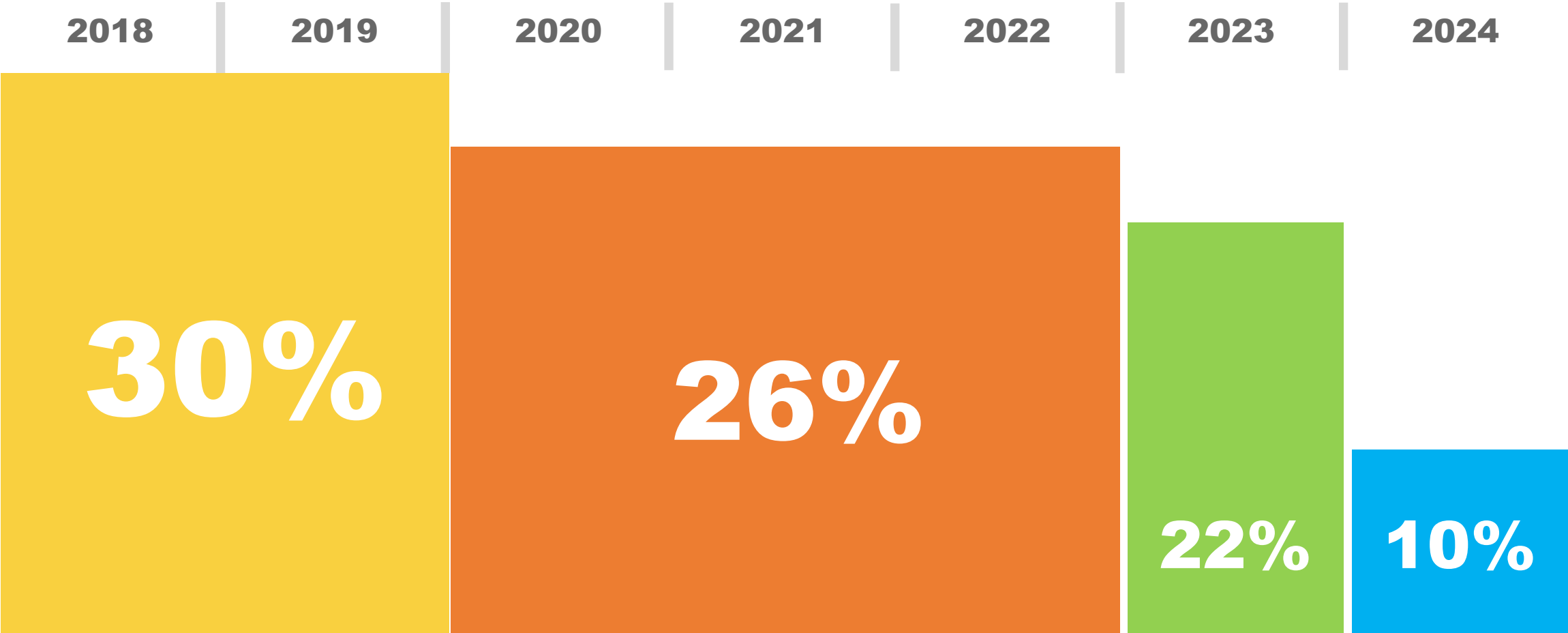
Historically Declining Costs

Unsubsidized Solar PV LCOE



Lazard Levelized Cost of Energy Analysis v14.0

2021 Investment Tax Credit Schedule

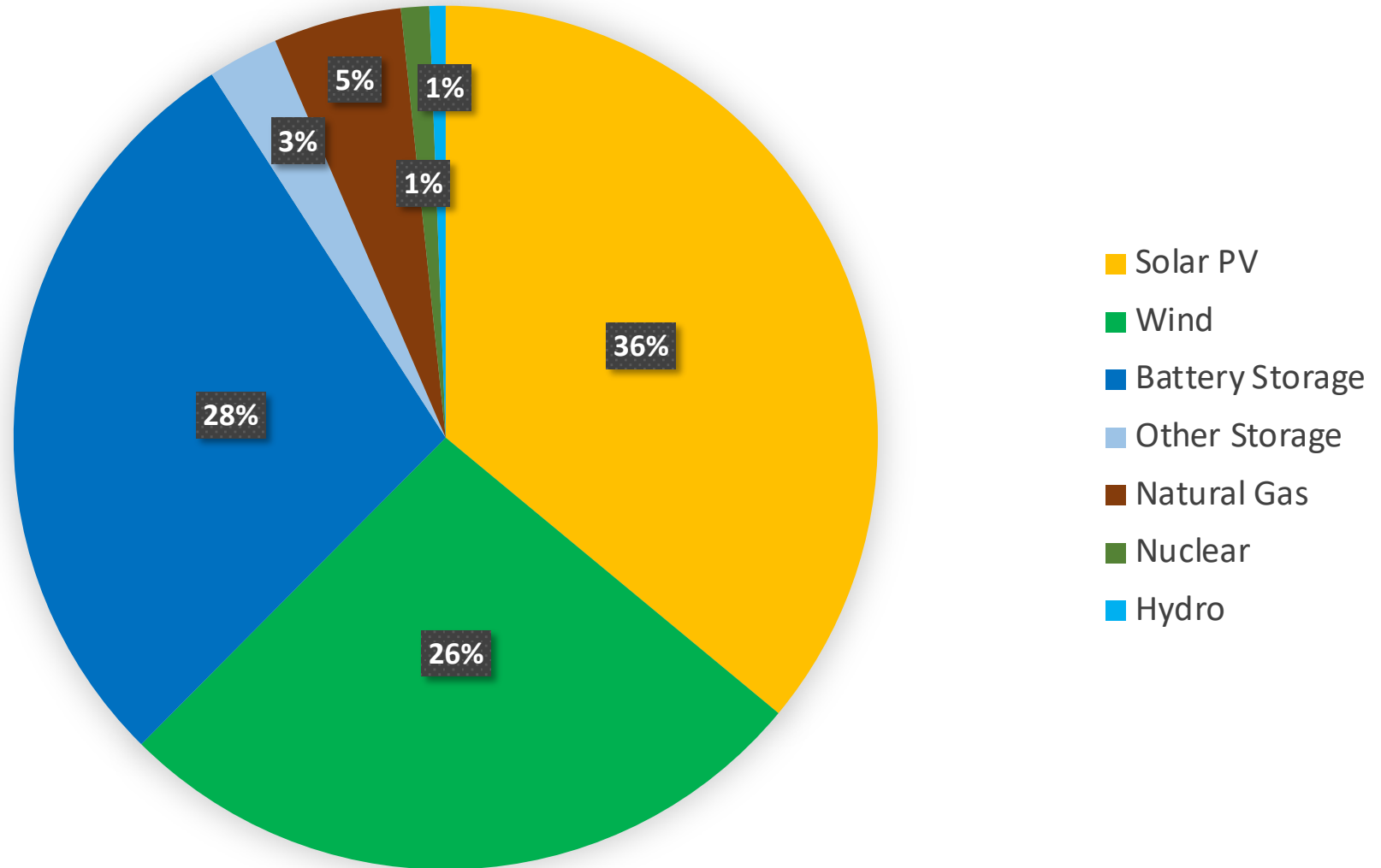


- Step-down Occurs on December 31 of each year
- Continuous Construction Test waived if projects complete within four years (before 1-Jan-2026)

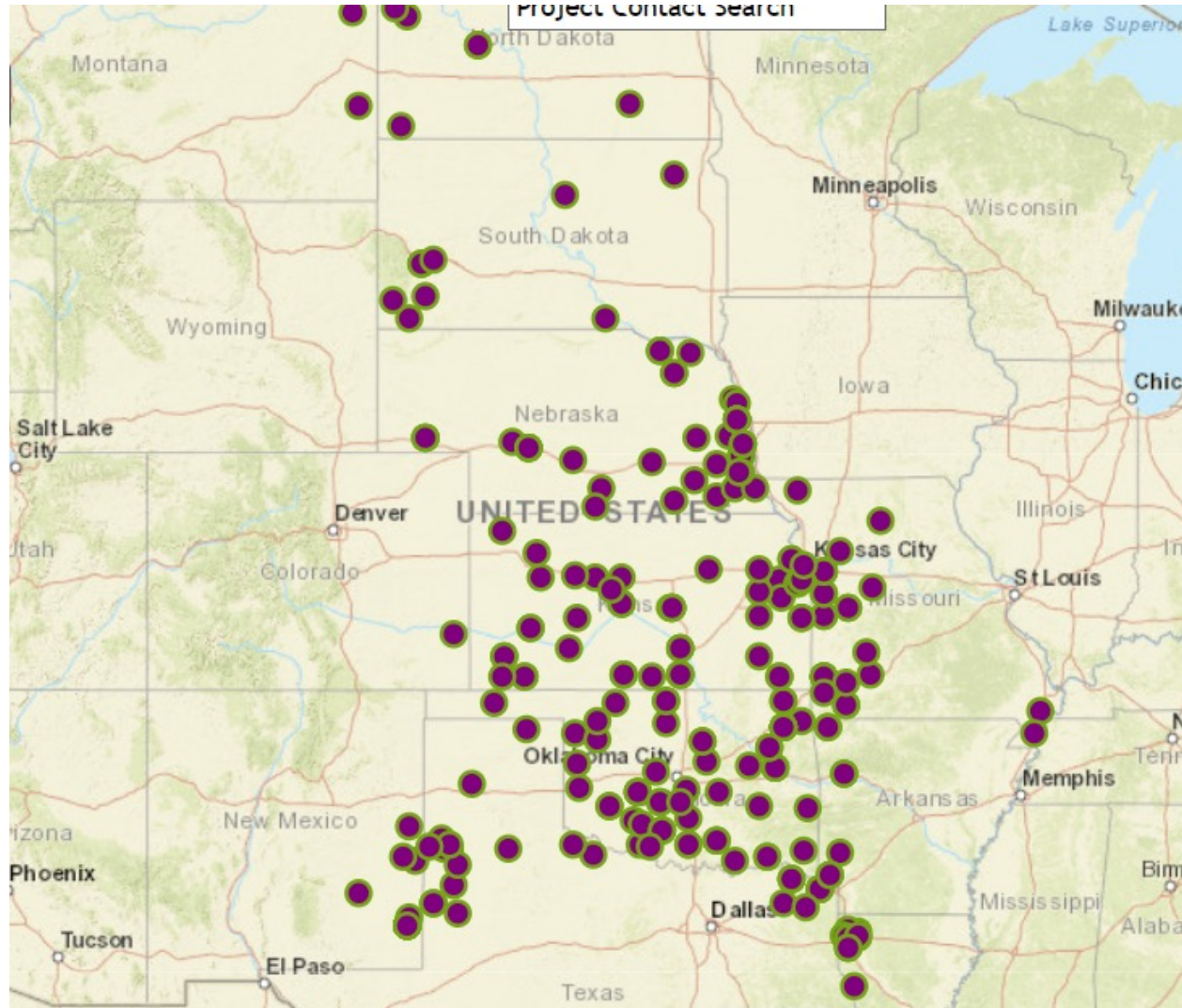
A photograph of a server rack with multiple units. Each unit has a silver handle and a fan. The text 'MOVING FORWARD' is overlaid in a bright cyan color on the left side of the image. The background is a dark blue gradient.

MOVING FORWARD

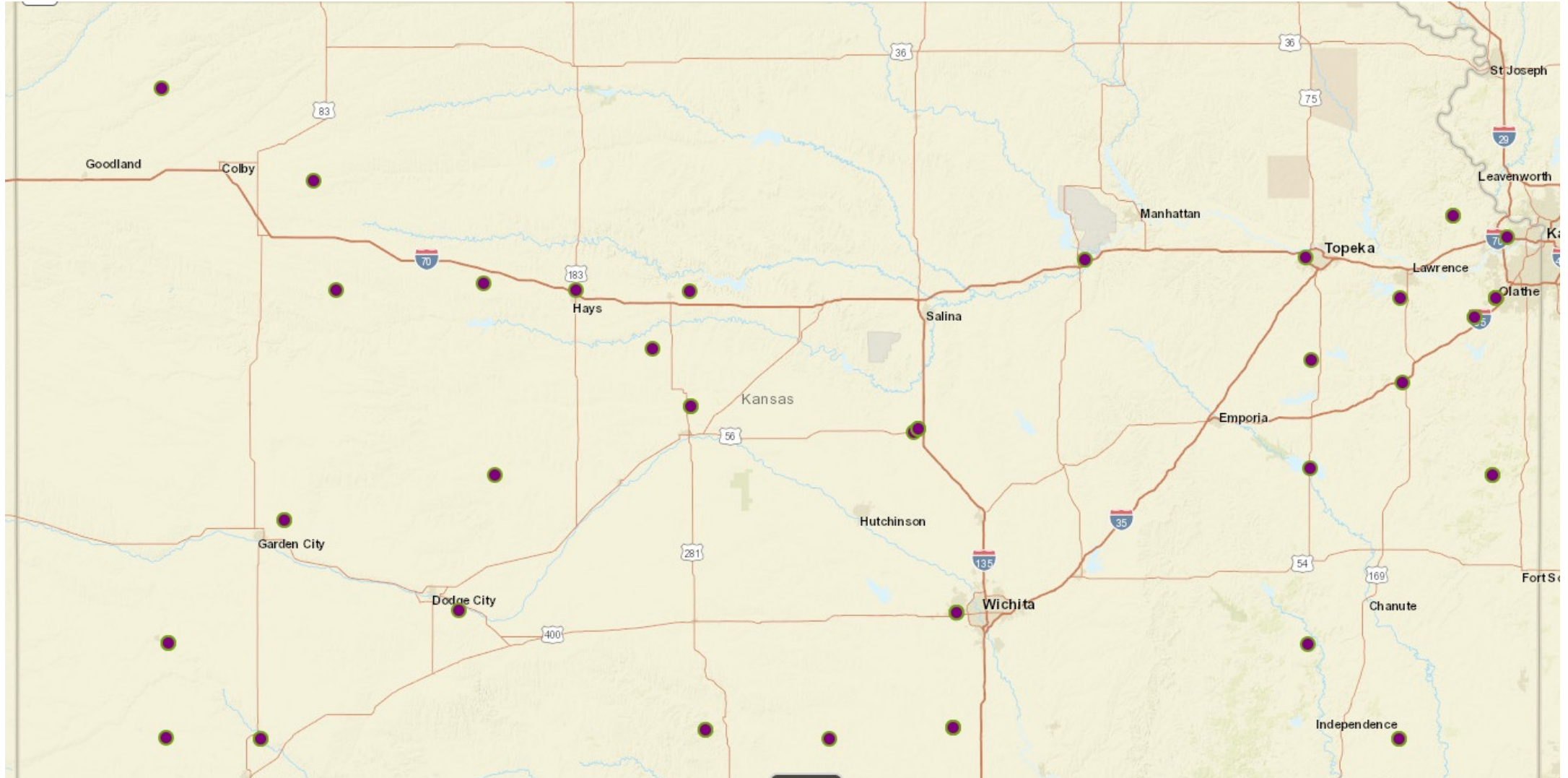
U.S. Solar Projects in the Queue – 215,000 MW



SPP Solar Projects in the Queue – 48,000 MW



Kansas Solar Projects in the Queue – 11,000 MW



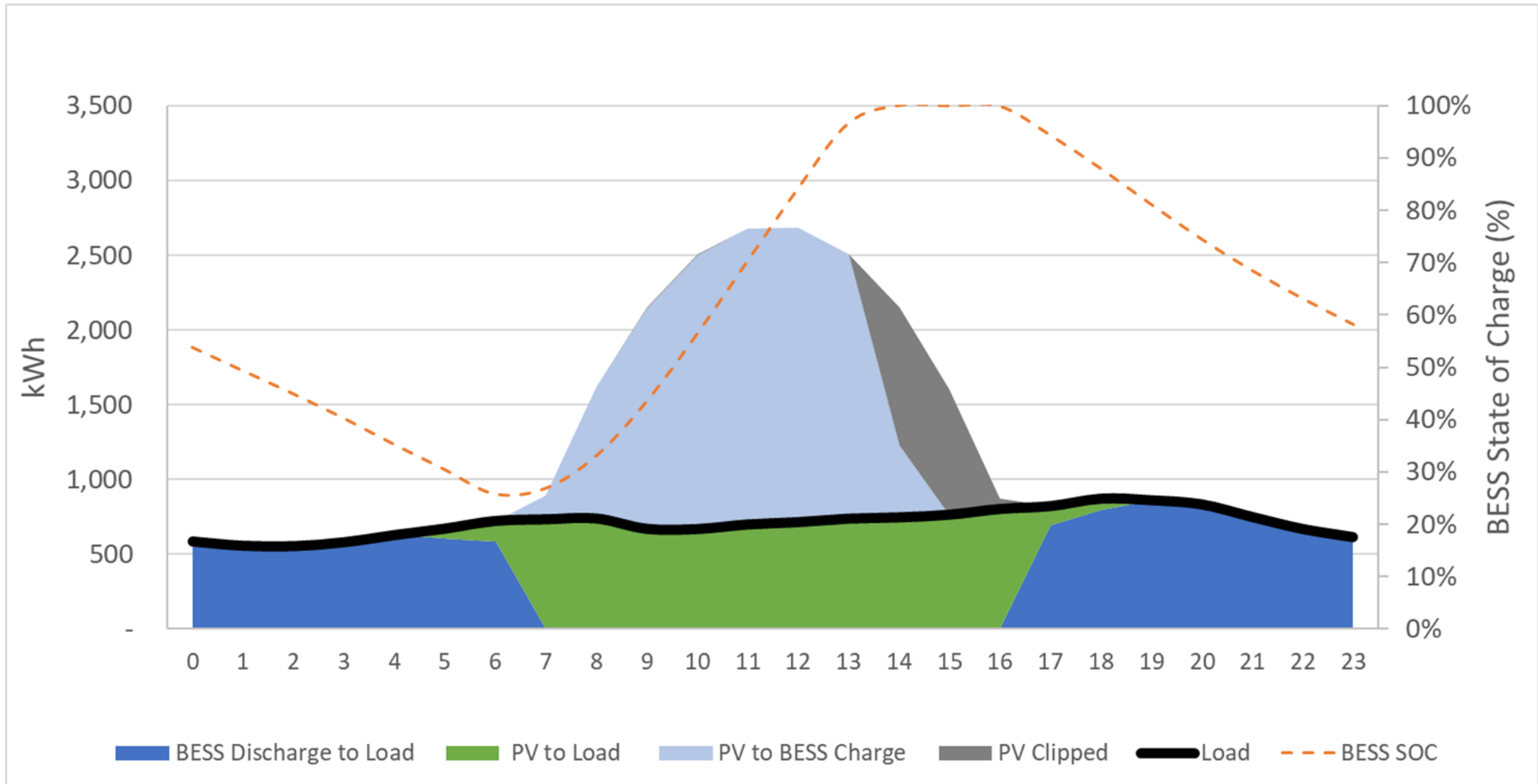
Local Utilities Ramping Up

- Evergy Integrated Resource Plan – 700 MW by 2025
- Evergy Community Solar – Kansas City, 10 MW
- Liberty Utilities Empire District – 100 MW by 2025

SOLAR PLUS STORAGE



Storage with Solar – Example Day



QUESTIONS?

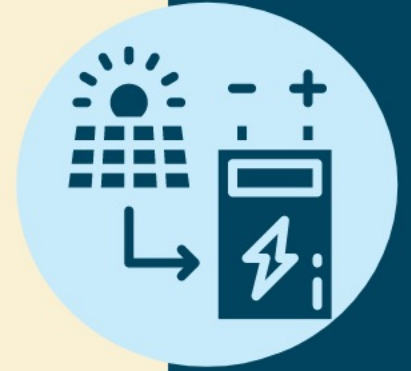


Robert Wright
Renewable Energy Development Manager

Robert Wright
Burns & McDonnell



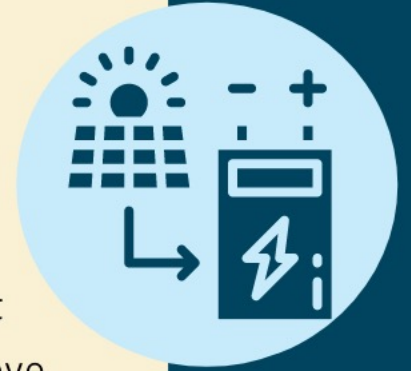
Contact Information:
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Mr. Frank Jakob, P.E., PMP, is the Energy Storage Technology Manager at Black & Veatch. He leads the design of energy storage systems that improve and enhance renewable and conventional electricity generation. He has over 30 years of experience with developing new applications for products. Now his focus is on electrochemical devices (batteries and fuel cells) and bulk storage technology (pumped hydro, compressed air, and sensible & latent thermal heat storage technologies) in short- and mid- and long-term energy storage applications for renewable energy (solar photovoltaic and wind turbine systems) and for conventional generation (turbines, engines; hydroelectric generation, and thermal power plants.) Frank adds energy storage to improve operations, extend life, increase responsiveness, and decrease emissions -- including carbon footprints and greenhouse gasses.

Most recently Frank has been growing Black & Veatch's energy storage EPC practice and Owners' Engineering services.



We Are Black & Veatch

Working relentlessly to improve
critical infrastructure challenges.

Frank Jakob, P.E., PMP

Power | Renewables | Energy Storage



Cross Section of
Black & Veatch
Integrated BESS
Solution

Render for visualization purposes

Storage is
not new
to the region.

2010 KCP&L “SmartGrid” Project: Battery component 1 MW, 1 hour of storage (1MWh)

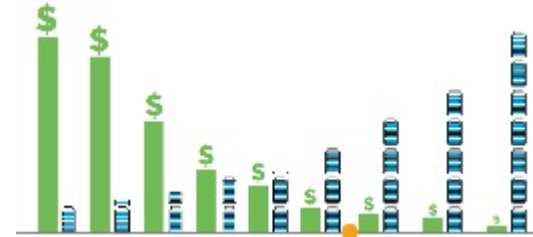
- 2010 1 hour of storage, >\$1000/kW
- 2015 1 hour of storage, >\$500/kW
- 2020 1 hour of storage, >\$250/kW
- **Today: < \$175/kW for 1 hour**
- *2025: <\$100/kW for 1 hour*
- *2030: <\$75/kW for 1 hour*
- Simple LCC: Cost/kW (1h/365d/20y)
 - ~ \$0.02/kWh electricity produced

Ref:

<https://smartgrid.gov/project/kansas-city-power-and-light-green-impact-zone-smartgrid-demonstration>

What's All the Buzz About Energy Storage?

- Energy storage is as inexpensive as ever
 - The storage ... \$/kWh ... 20% of the cost in 2010
 - Projected to be less than half of what it is today by 2030
 - *But it is not cheap, so sizing and optimization are still important*
- Lithium ion battery cells used for mobile devices and electric vehicles
 - Same cells used for stationary energy storage on the grid
 - Economies of scale for manufacturing those cells *drive costs down for us*
- Issues are being addressed
 - Safety, lifetime, decommissioning, repurposing, recycling, ...



Storage is no longer a solution looking for a problem.
It is a solution to many problems
... more so every day as price declines.

Where Does Energy Storage Fit on the Grid?

- Generation **transforms** energy into electricity
- Transmission **moves** electricity from here to there, through space
- Energy storage **moves** electricity from now until later, through time
- Equipment **transforms** electricity into the services we value
 - Lights on, water hot, beer cold, internet fast, phones charged

Energy storage is a new grid asset, enabled by the growth in variable renewable energy generation that compounds variable loads

Energy storage is a solution for grid stability,
balancing the increased *variable renewable energy (VRE)* generation

What does Energy Storage Do?

- **Description**

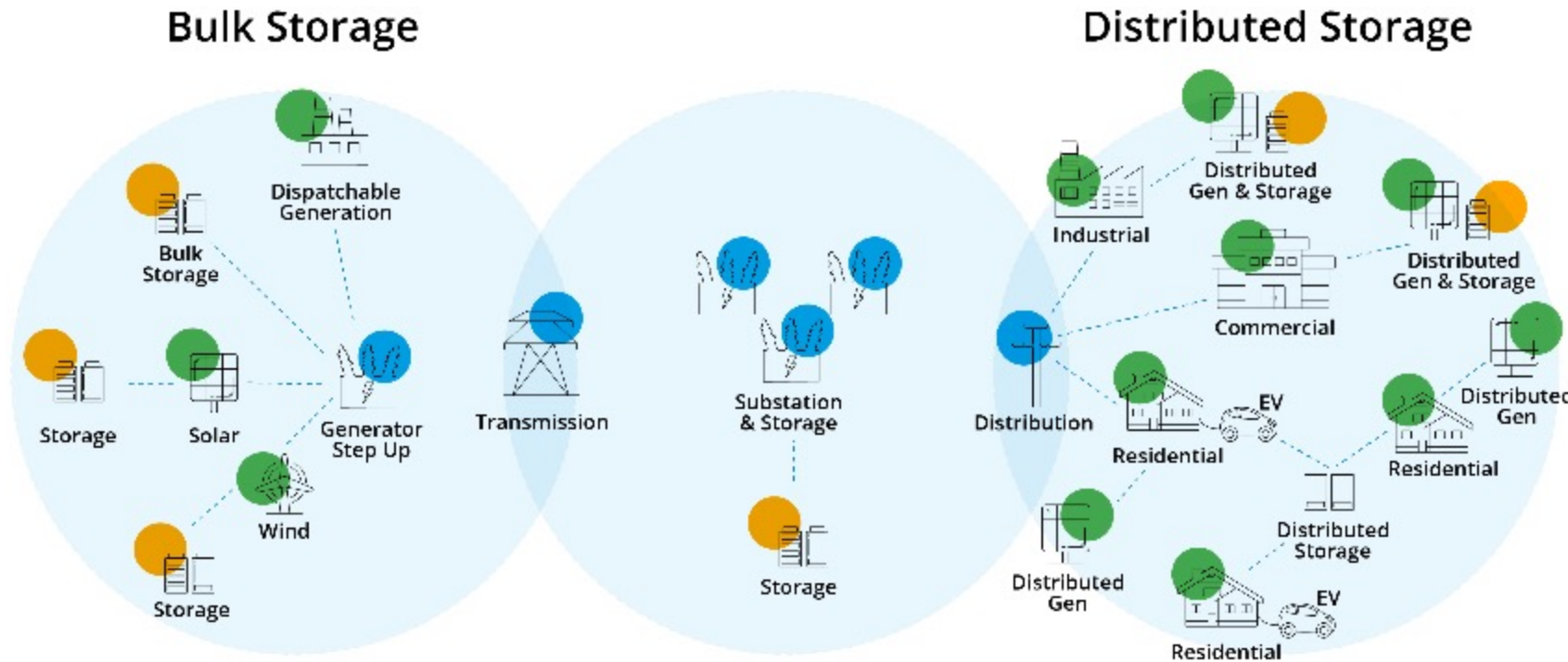
- Peak shaving (facilities)
- Time shifting (generated to needed)
- Non-wires alternatives (NWA)
- Renewable smoothing

- **Application**

- Building air conditioning
- Solar (noon) Wind (over-night)
- Long, rural distribution line
- Stabilize, predictable,
 - *“Firm Dispatchable Generation”*

Energy storage is a new grid asset:
a load (like a building), a generator (injects electricity)

Power Grid: Stand-alone Storage is here and *Hybrid Generation, Generation with Storage, is Emerging*

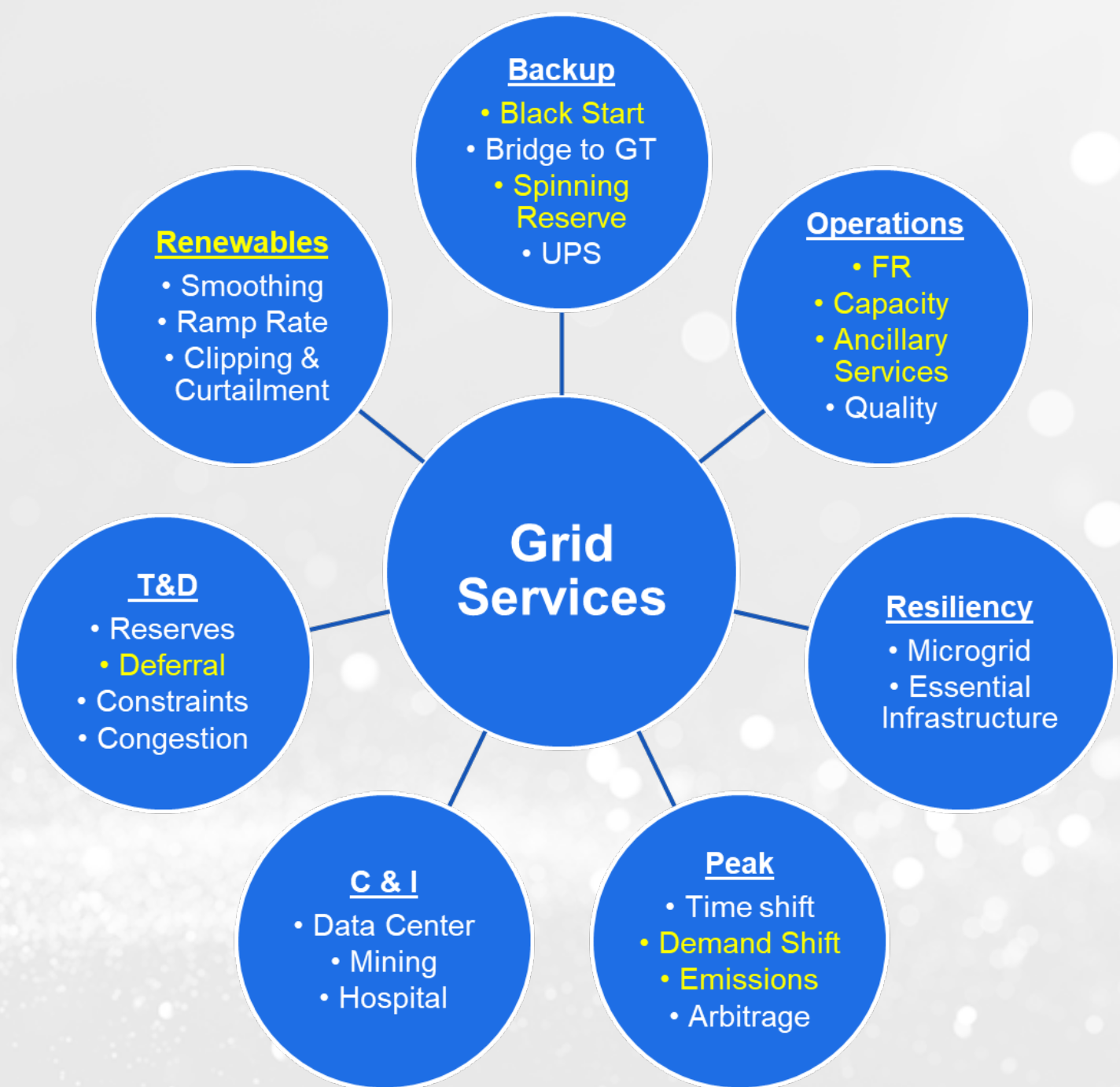


- Hybrid of storage &
 - Buildings (peak load)
 - Solar PV
 - Wind
 - Hydro
 - Gas turbines
 - Power Plants
 - T&D, and Substations
 - ... next

Energy storage, equipment that enables flexibility and increases benefits

Applications Use Cases Services for Energy Storage

- Combining or Stacking Services improves ROI
 - *Some are mutually exclusive*
- **Acronyms:**
 - *C&I: Commercial and Industrial*
 - *FR: Frequency Regulation*
 - *GT: Gas Turbine*
 - *T&D: Transmission and Distribution*
 - *UPS: Uninterruptable Power Supply*
 - *VAR: Volt-Amp Reactive*



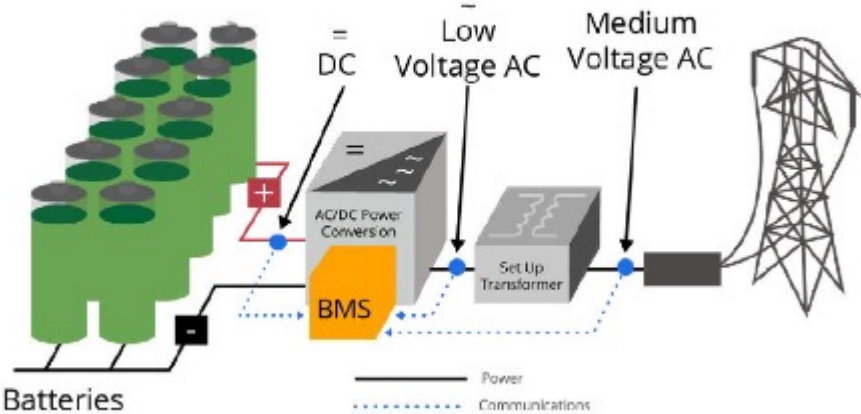


Today and Next Gen Utility BESS



The storage industry is evolving, beyond the inflection point in 2020.

BESS Overview: Battery-to-Transmission Grid



Discussion.





Contact Us

Building a World of Difference

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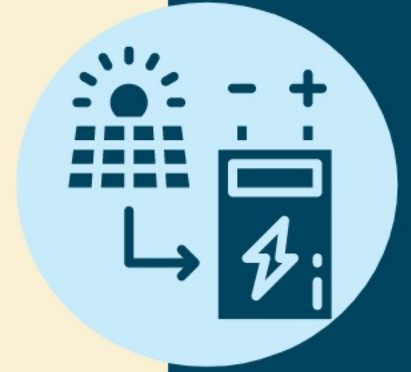
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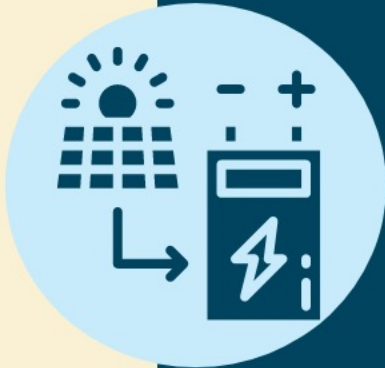
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BLACK & VEATCH



Question & Answers



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The Climate + Energy Project



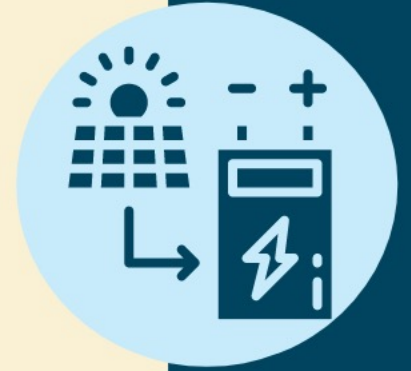
Contact Information:

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THANK YOU!



Our Energy Horizon

A Solar, Storage, & Electric Vehicle Forum

October 25, 2021 | 1:00PM — 5:00PM | Thompson Barn, Lenexa, KS

Join the Clean Energy Business Council and Kansas Advanced Power Alliance for an in-depth afternoon discussing the state's energy future for utility-scale solar, storage, and electric vehicle expansion.

bit.ly/OEHForum

