UTAH OFFICE OF
ENERGY DEVELOPMENT

Utah's Strategic Energy Plan: Consumer First Policies

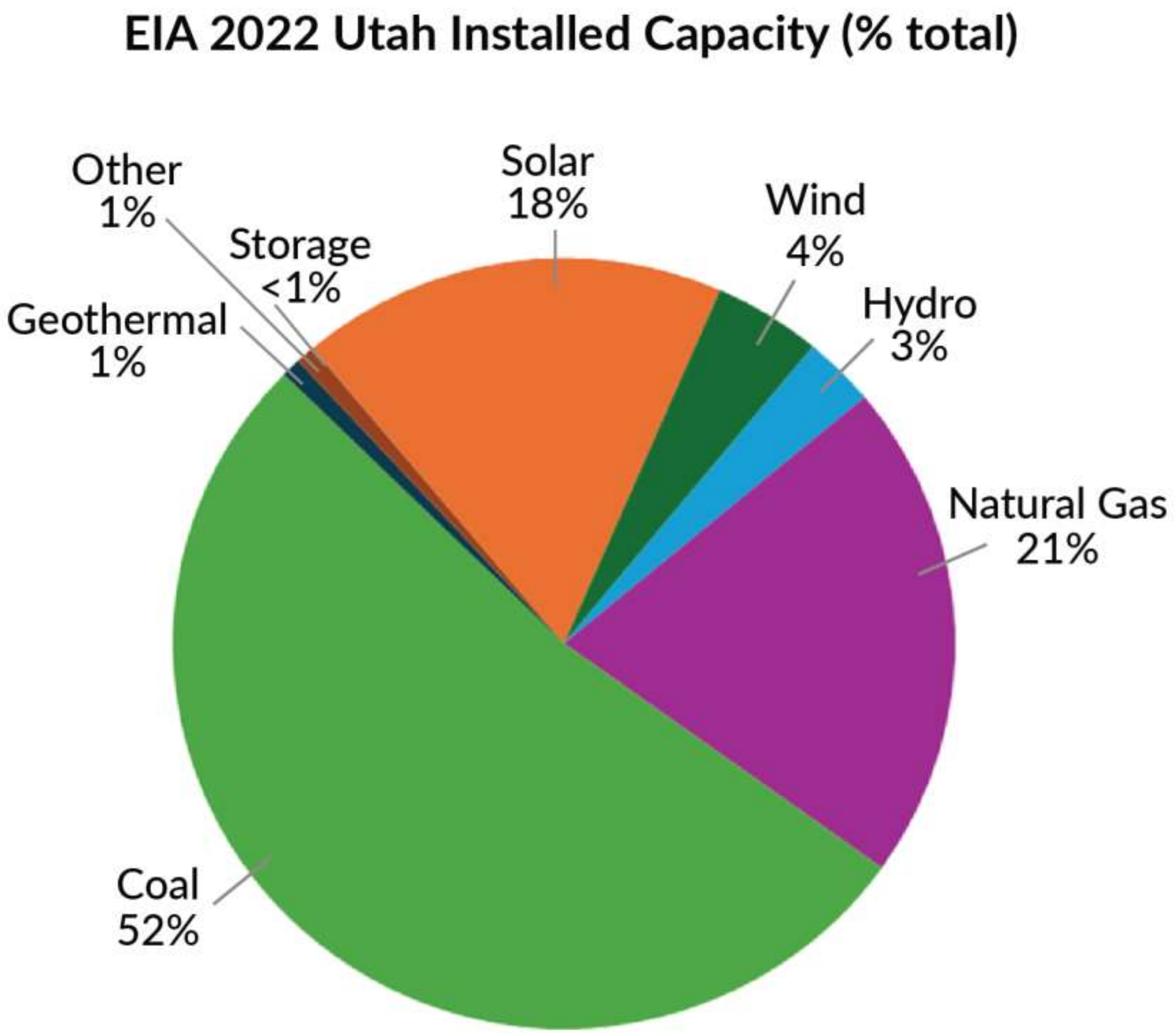
Energy Council Conference

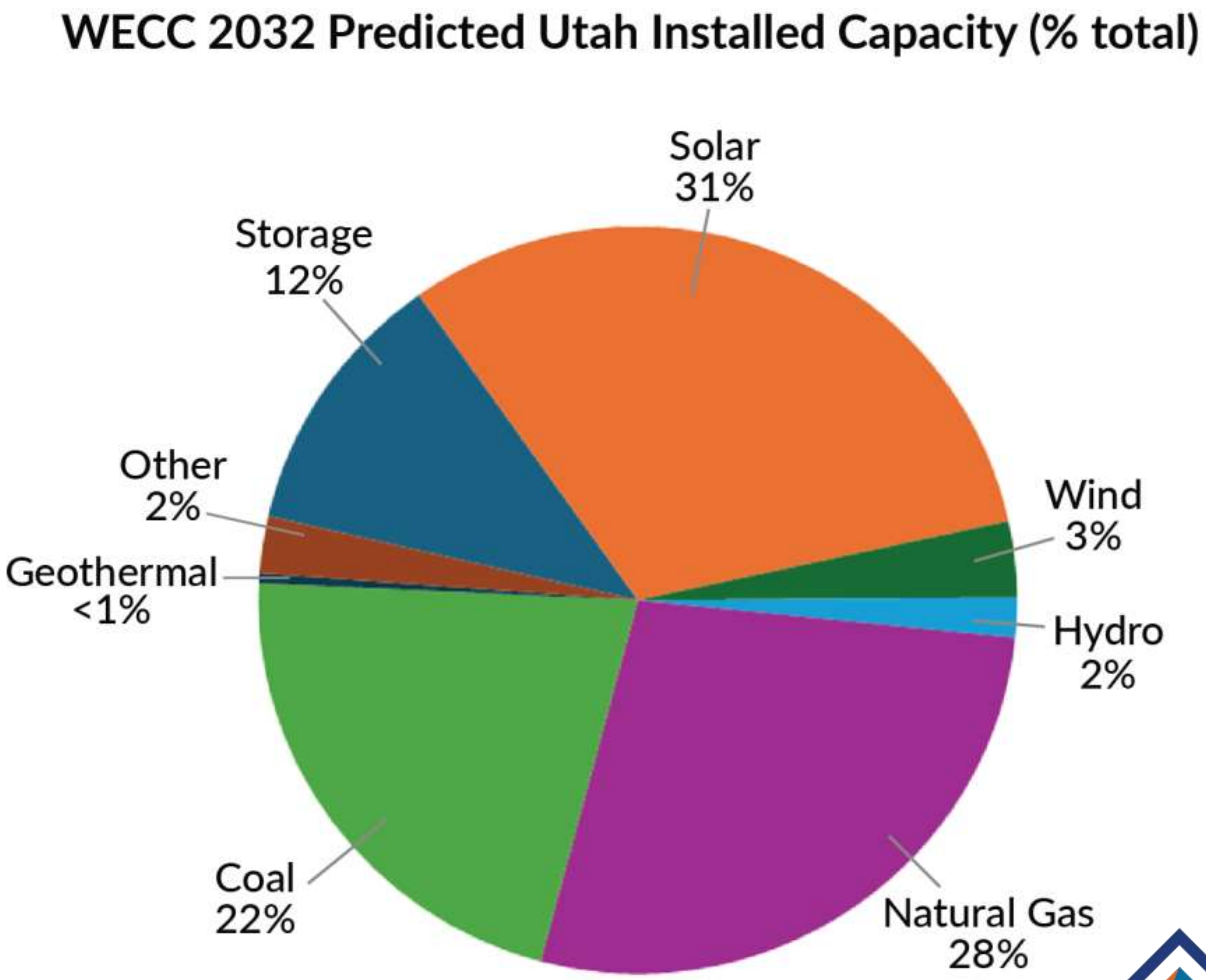
The Power of Energy

"The bottom 2% of Americans ALL live better than John D. Rockefeller was living when I was 6 years old. John D. Rockefeller was the richest man in the world, and today you can get better medicine, better education, better entertainment, better transportation–you can do everything better than he could."

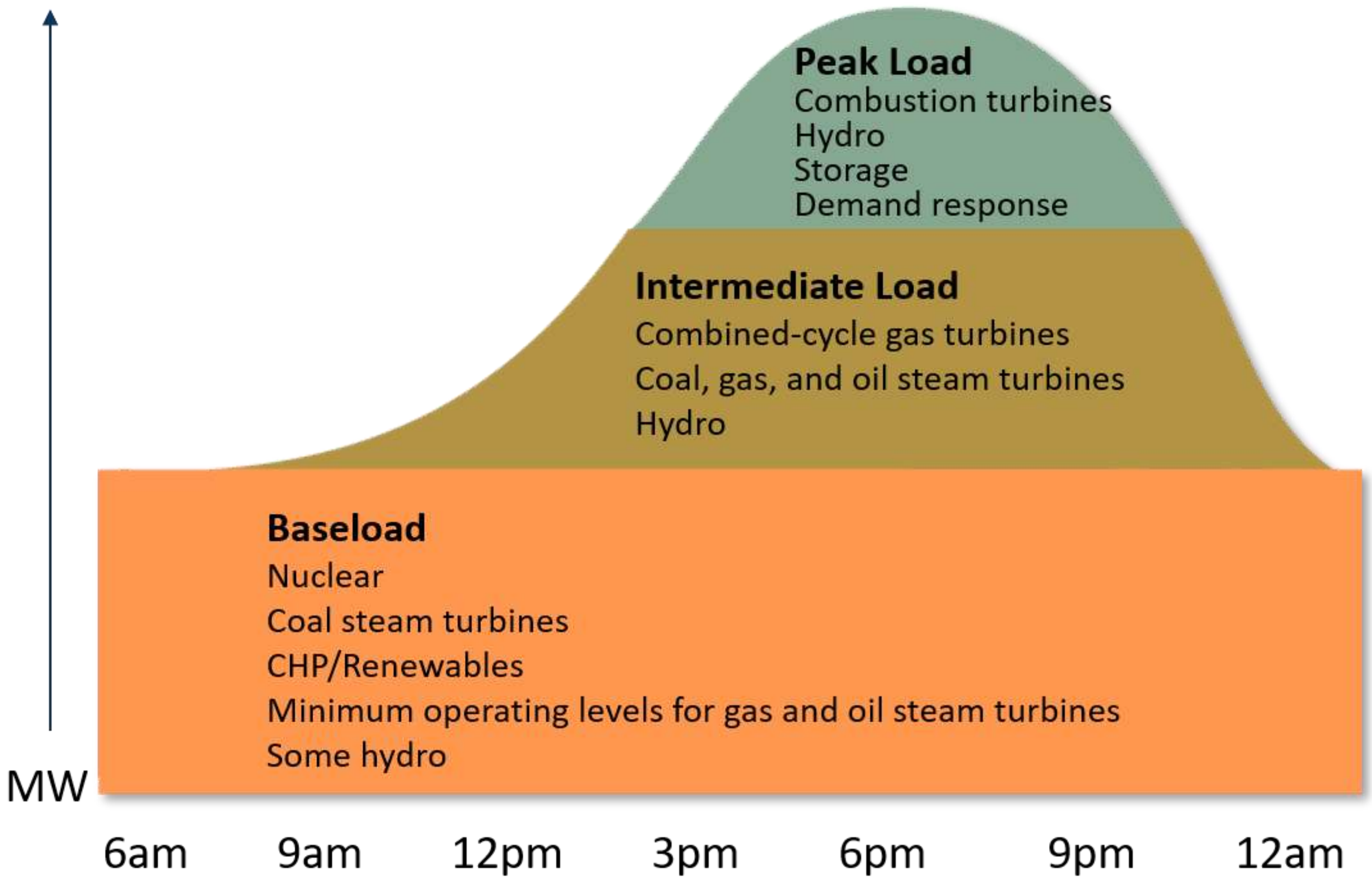
– Warren Buffett

Resource Focus

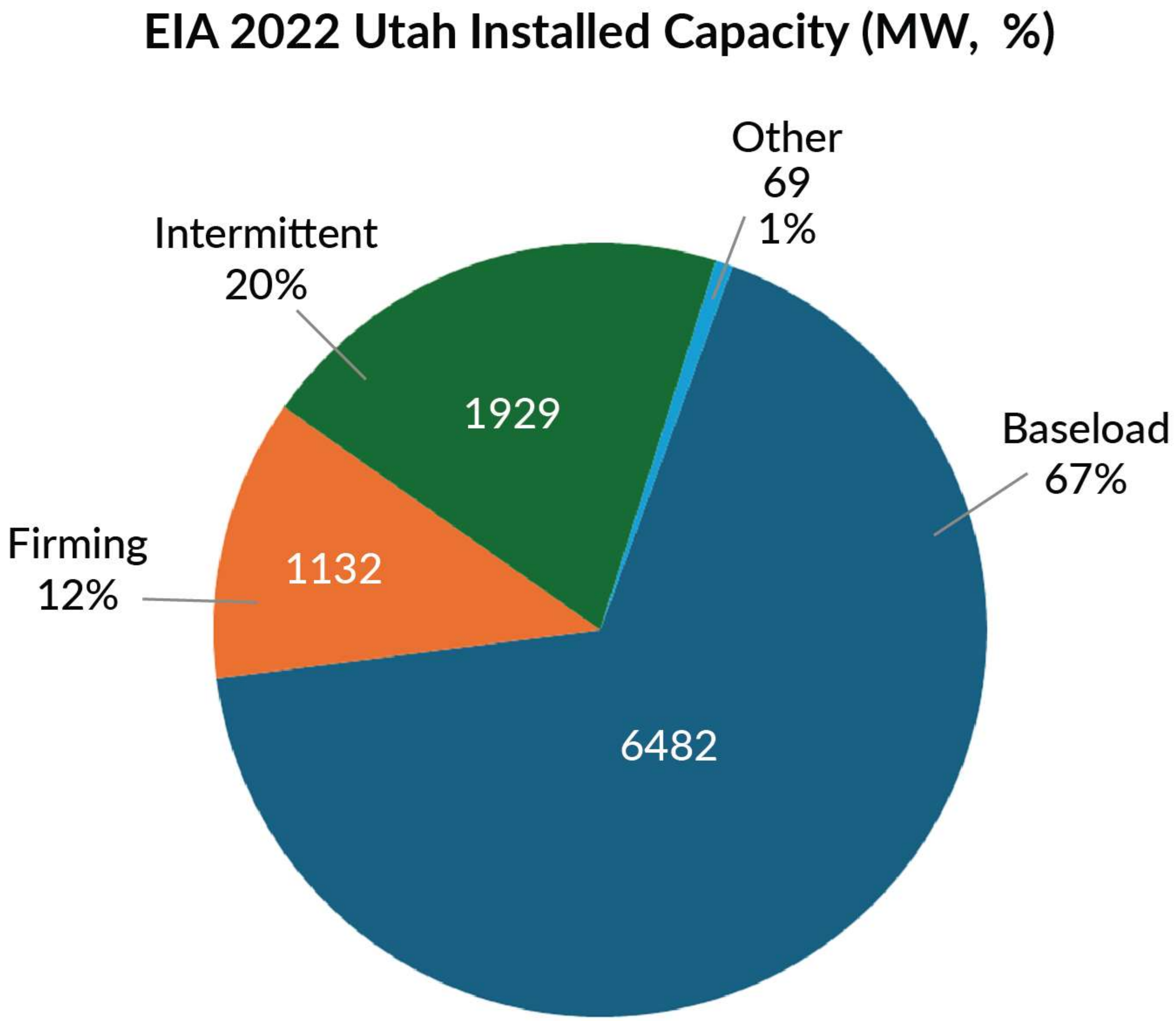


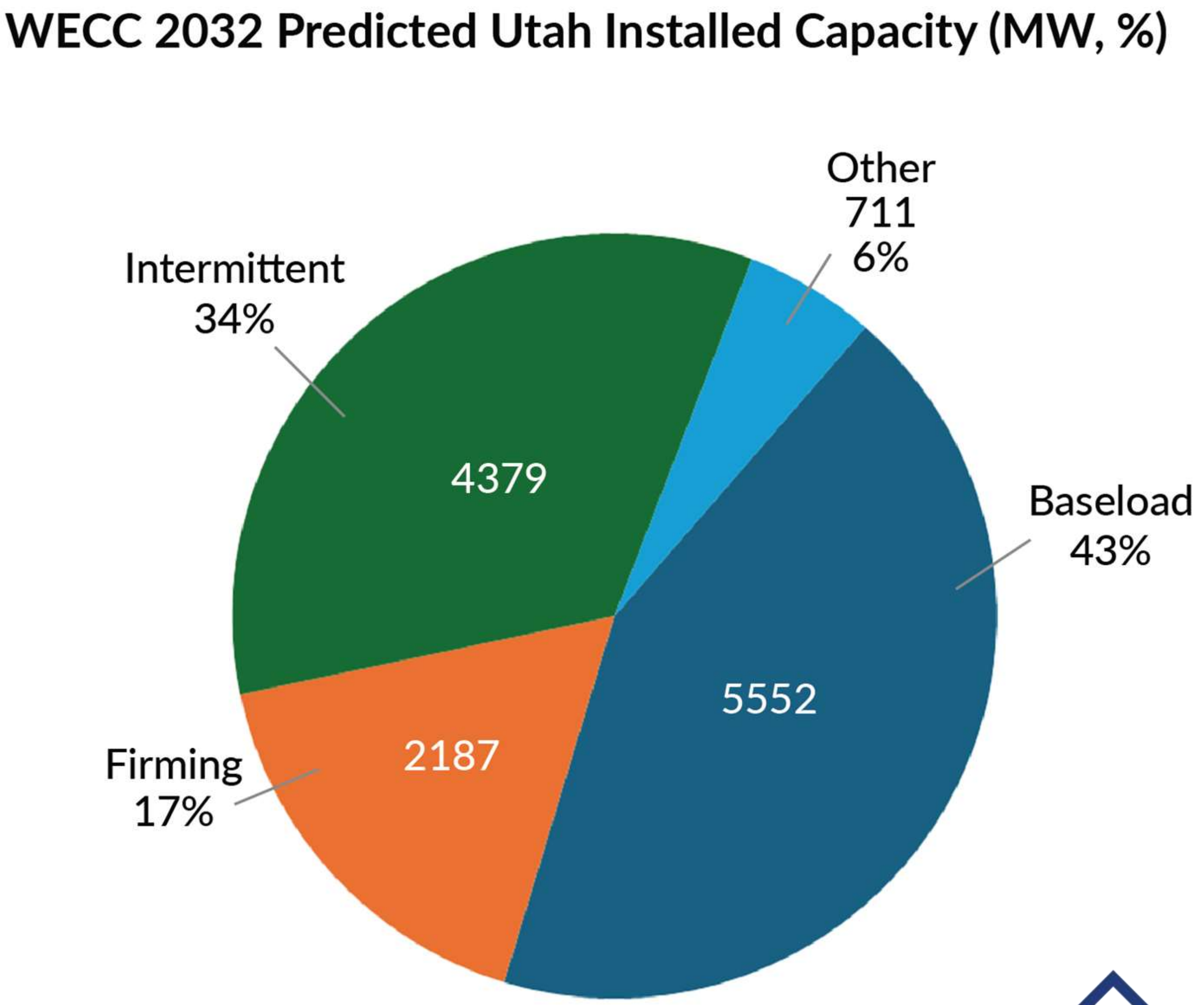


Consumer Demand & Capacity Values



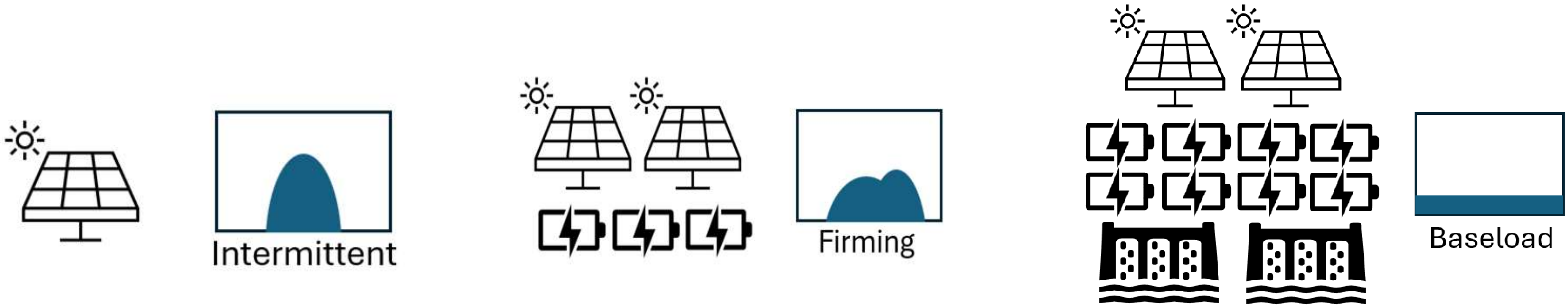
Systematic Value





*The gains in intermittent and firming resources do not cover the losses in baseload

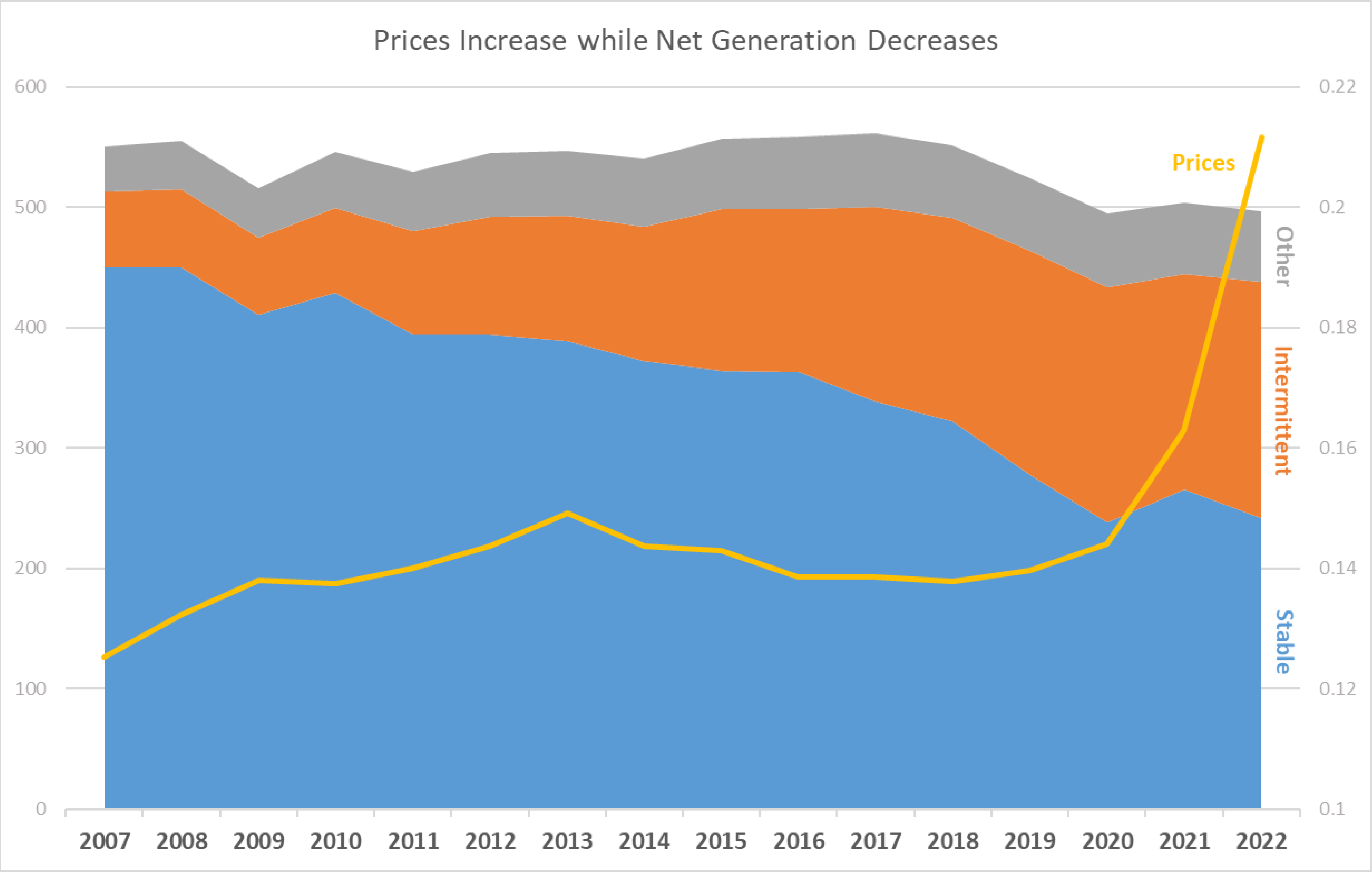
Resource Design and System Value



*The design of a resource decides how it acts within the system

Not All “Megawatts” are the same

Is it possible to double nameplate “capacity” but produce less power?



Areas of consideration:

- Misleading capacity values
- Time of need value
- Resource intensity to get a MW to a consumer

Levelized Costs

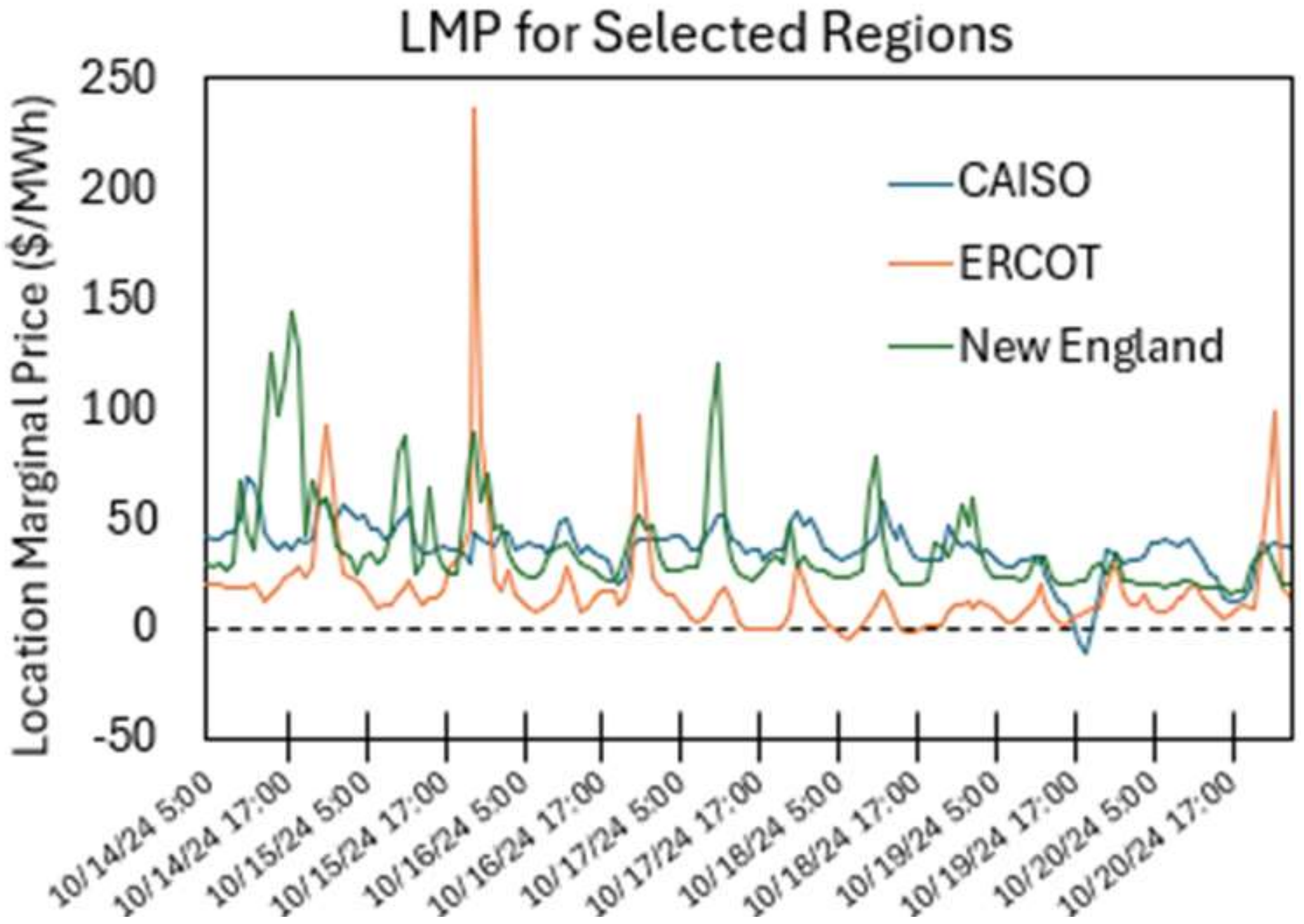
Levelized cost of energy (LCOE) is a financial tool for comparisons between diverse resources

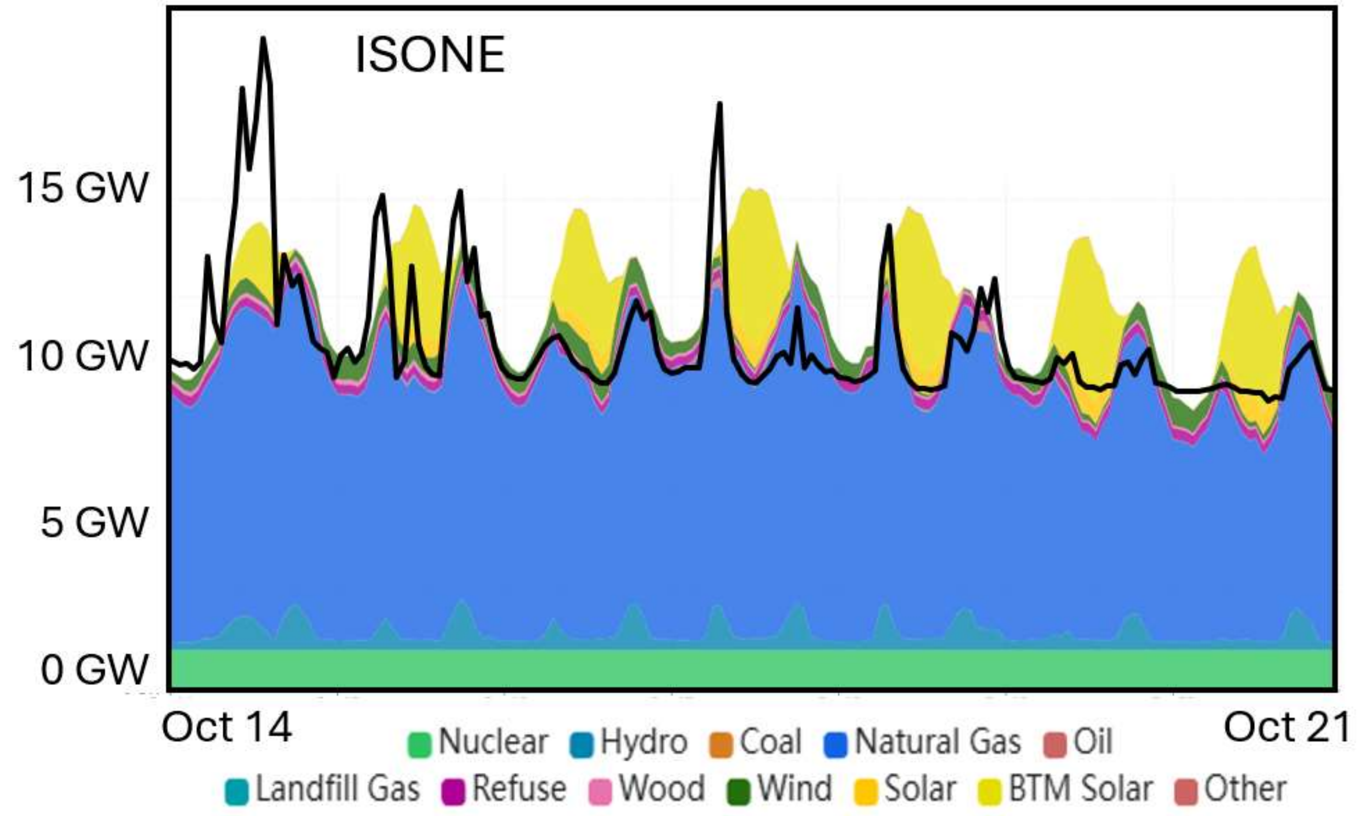
LCOE is used to:

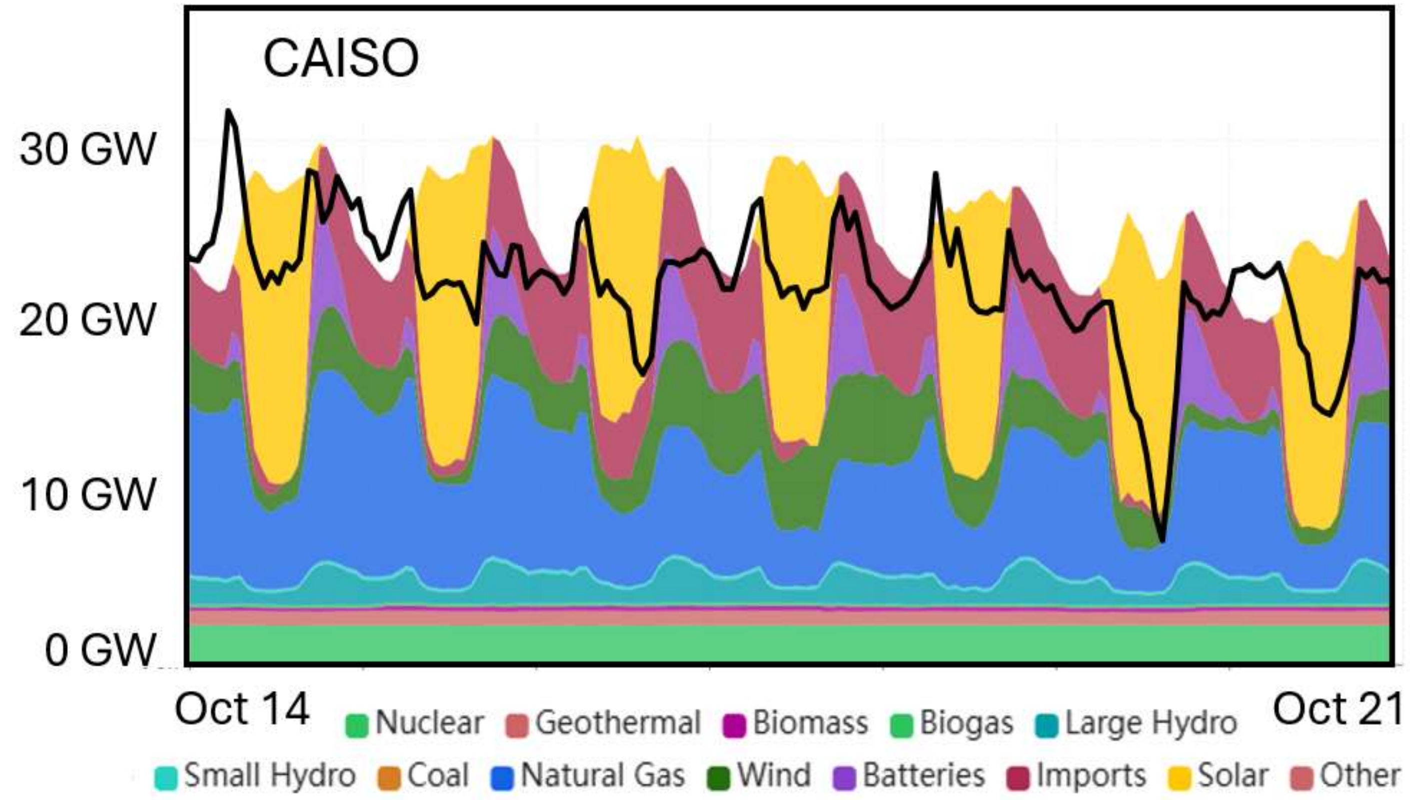
- Average total costs of building and operating an asset per unit of electricity over a specific period
- Primarily financial metric, not operation or system focused
- However, it is being used to drive decisions when cost is only one factor
  - Demand – not accounted for
  - Integration – not accounted for
  - Systemic Operation - not accounted for

*Building the cheapest option does not necessarily translate into savings

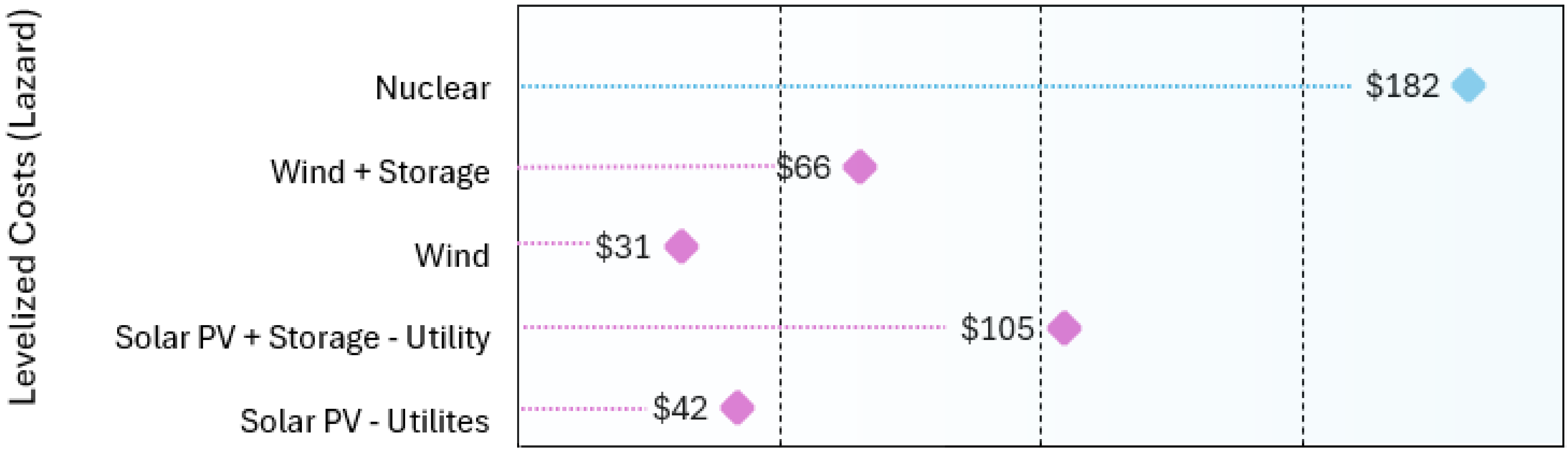
Levelized Costs - Where are the Savings?

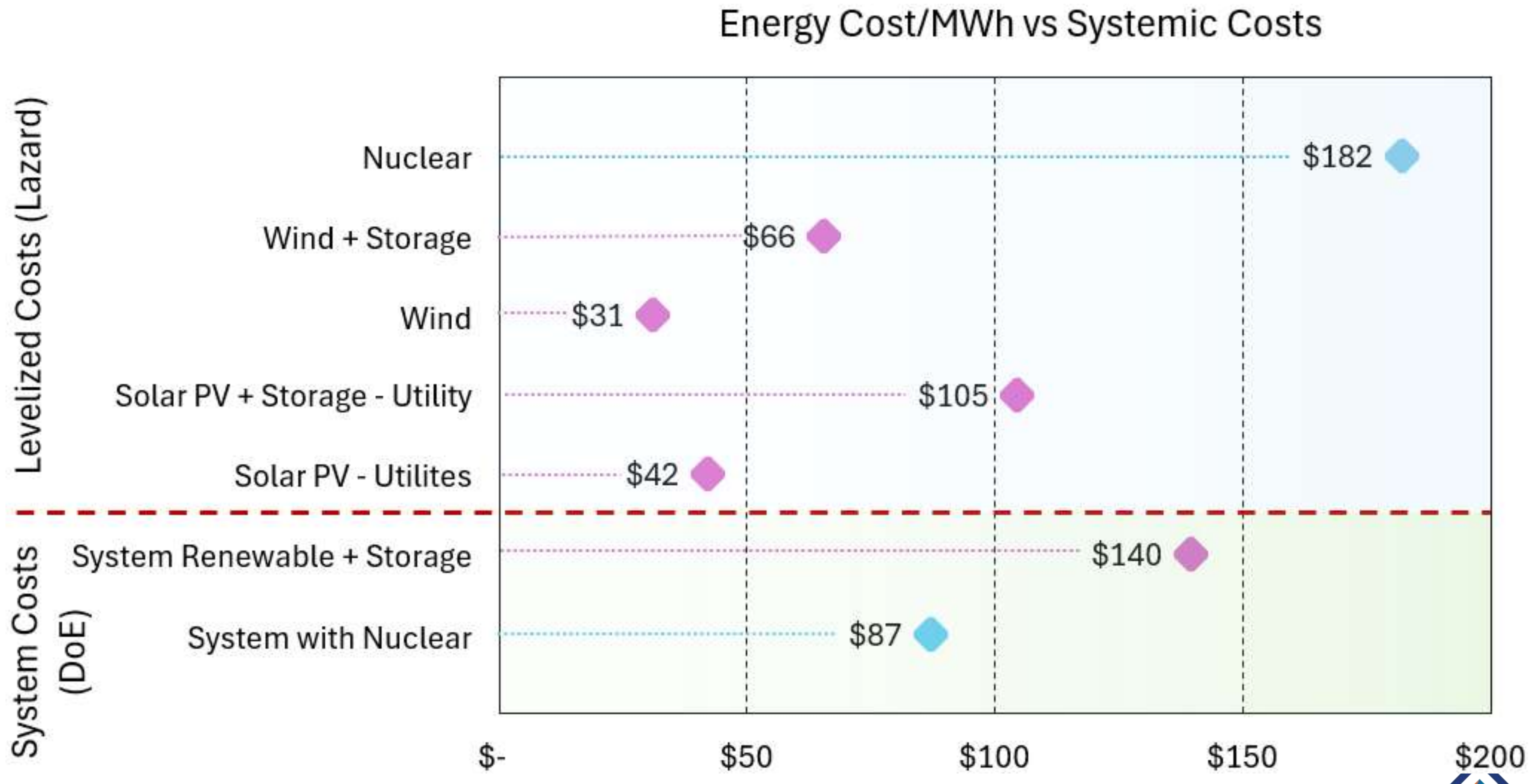






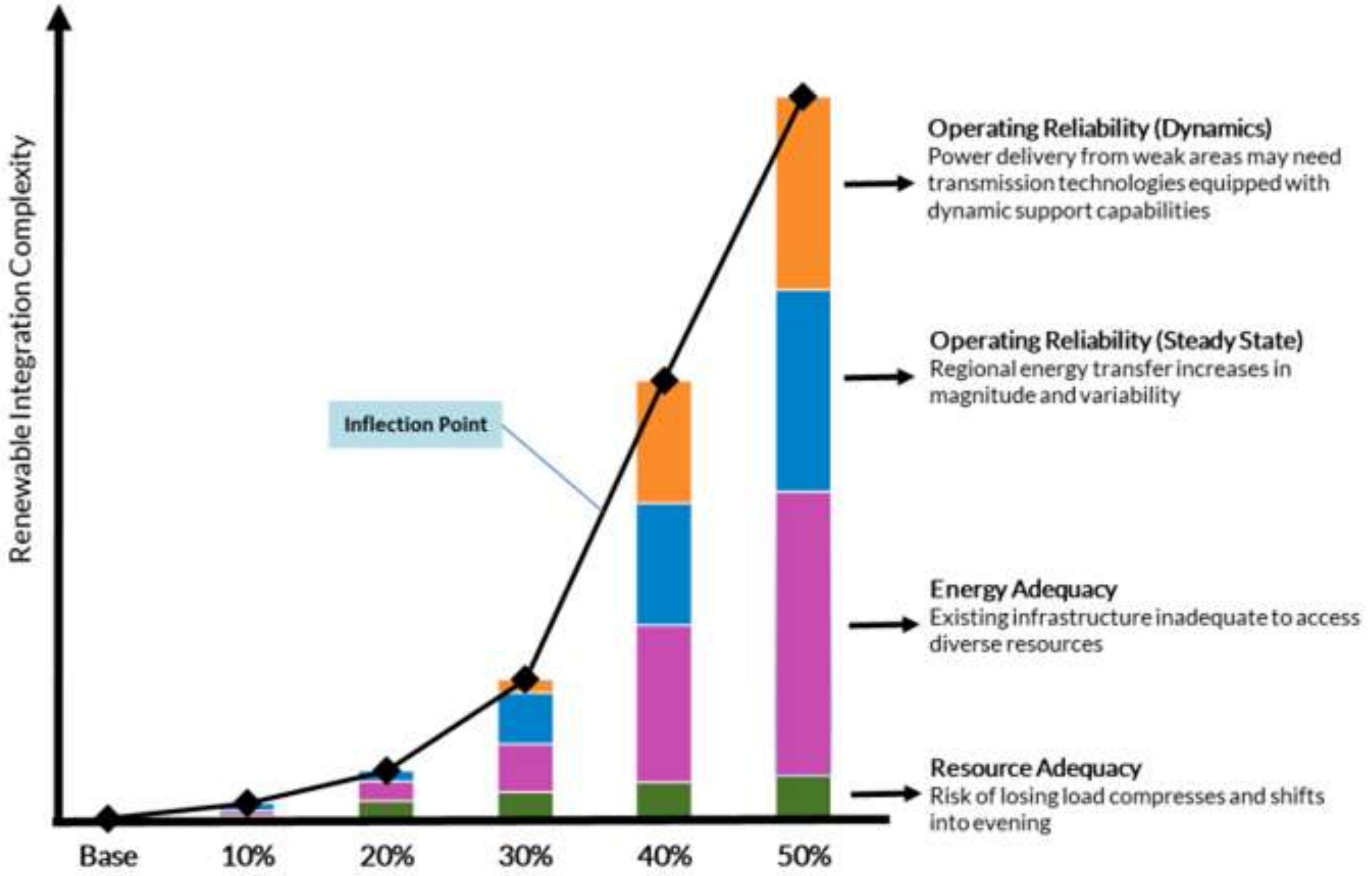
Levelized Costs

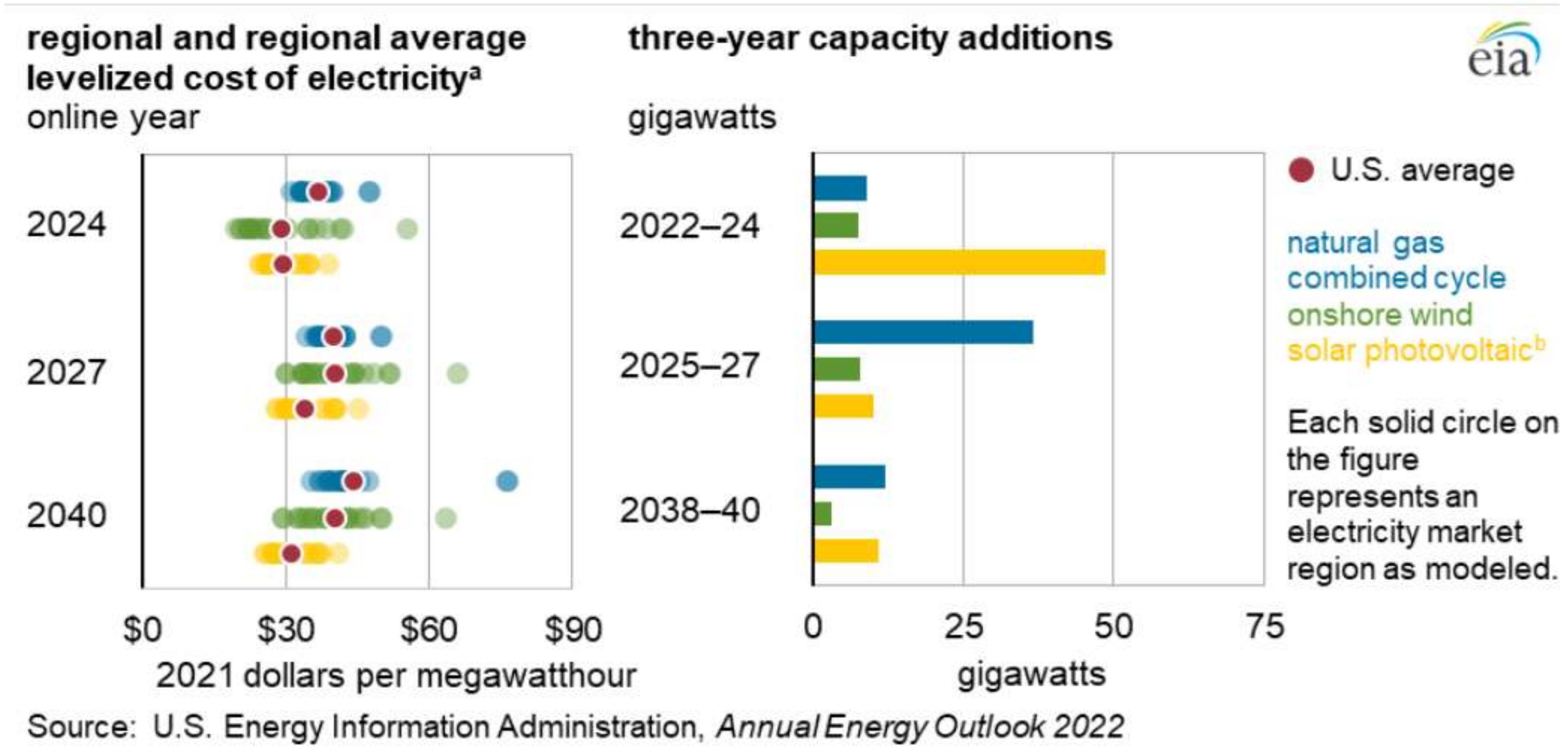




Energy Cost/MWh vs Systemic Costs
Levelized Costs (Lazard)
Nuclear
$182
Wind + Storage
$66
Wind
$31
Solar PV + Storage - Utility
$105
Solar PV - Utilites
$42
System Costs (DoE)
System Renewable + Storage
$140
System with Nuclear
$87
$-
$50
$100
$150
$200

Systemic Costs - Complexity in the Grid





*Energy needs to be looked at holistically to account for the systemic costs

- As intermittent generation reaches greater penetrations, huge complexity arises
- This necessitates entirely new management and infrastructure needs
- Considering only LCOE, in 2027 solar should be primarily built
- Instead natural gas is being predicted, because it fits the systemic needs

Drivers of Systemic Costs

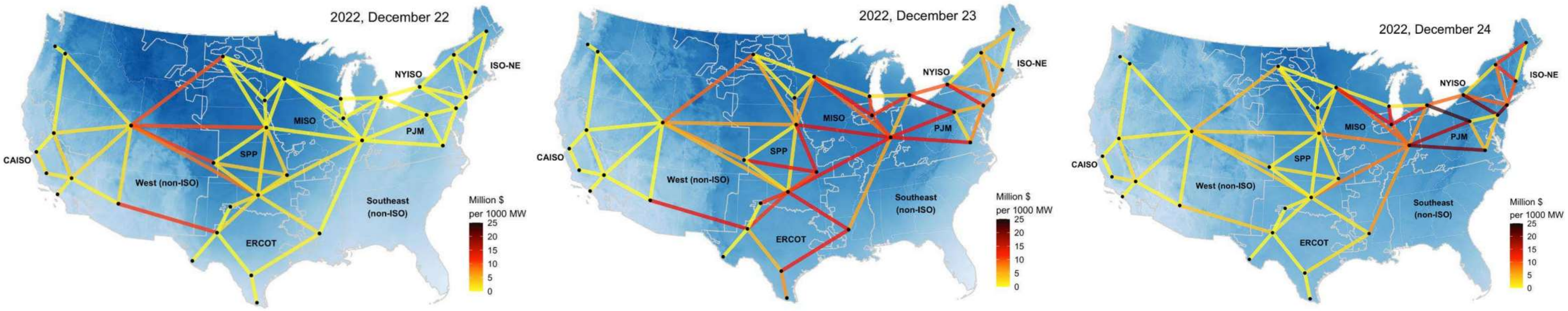
Considering the system-wide picture of energy is complex

- Many parameters impact each other in unpredictable ways

Factors that impact the system:

- Weather
- Storage
- Infrastructure
- Materials
- Load Profiles

Drivers of Systemic Costs - Extreme Weather

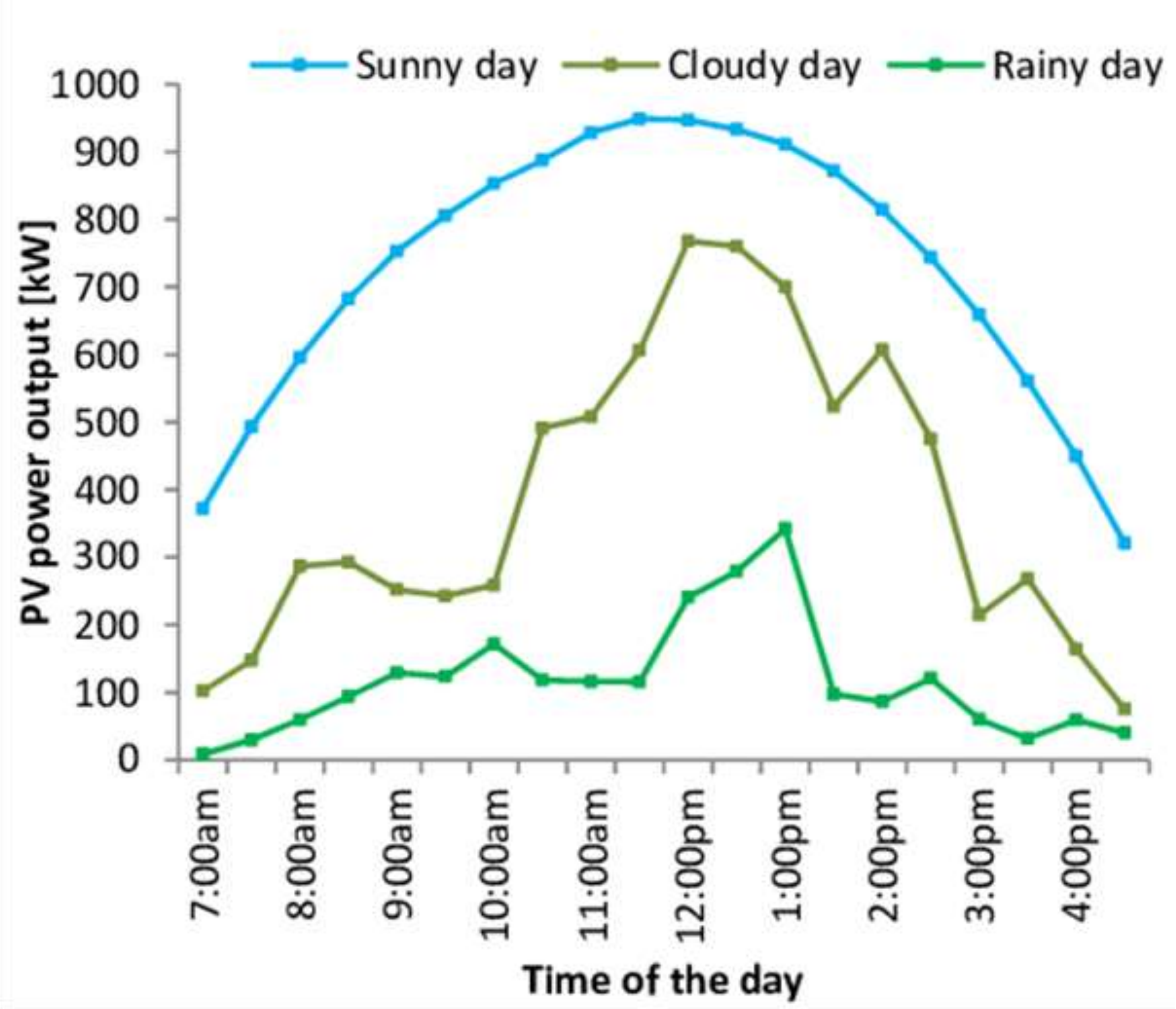


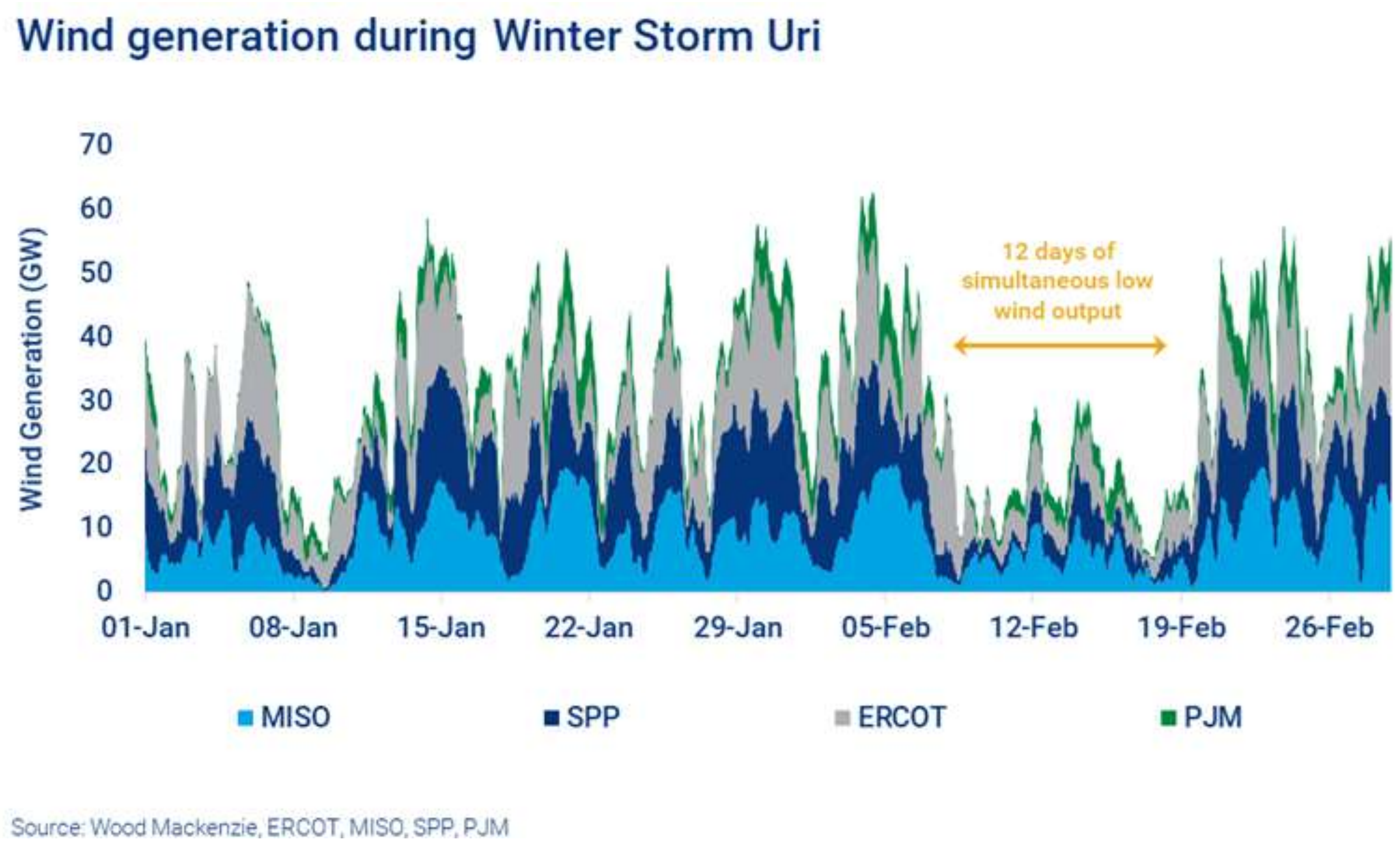
Source: Lawrence Berkeley National Laboratory (Millstein, et al. 2023).

Note: Transmission value is measured in cumulative daily million USD of a hypothetical 1000 MW transmission link between two nodes. Darker blue background colors reflect colder surface temperatures.

*The larger an area the grid takes up, the more susceptible to weather

Drivers of Systemic Costs - Mild Weather





*Less extreme weather patterns are an issue as intermittent energy share increases

- Requires building extra capacity, storage, or transmission

Drivers of Systemic Costs - Storage

*The type of storage used matters as well

- Of the 15.8 GW of storage in the USA (2023), 10.5 GW, 66%, was primarily used for arbitrage

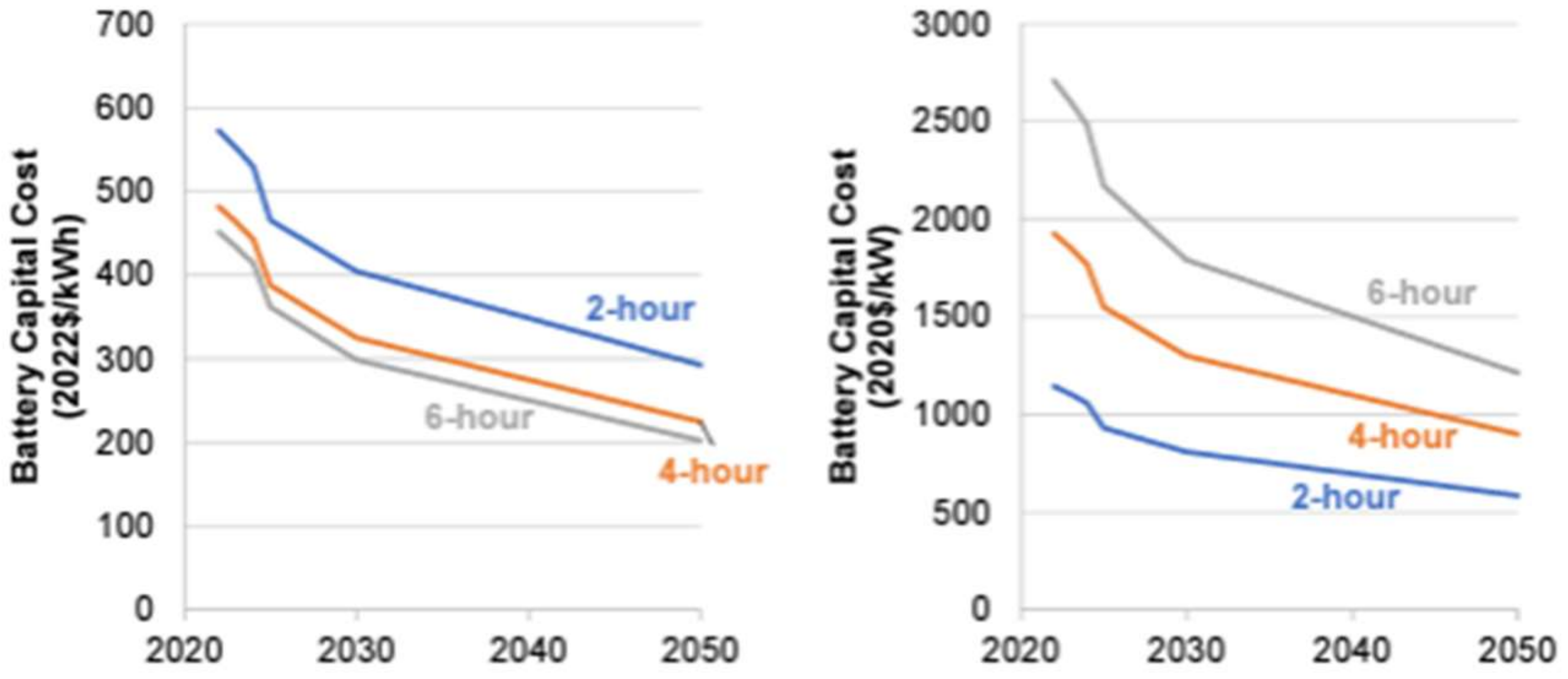
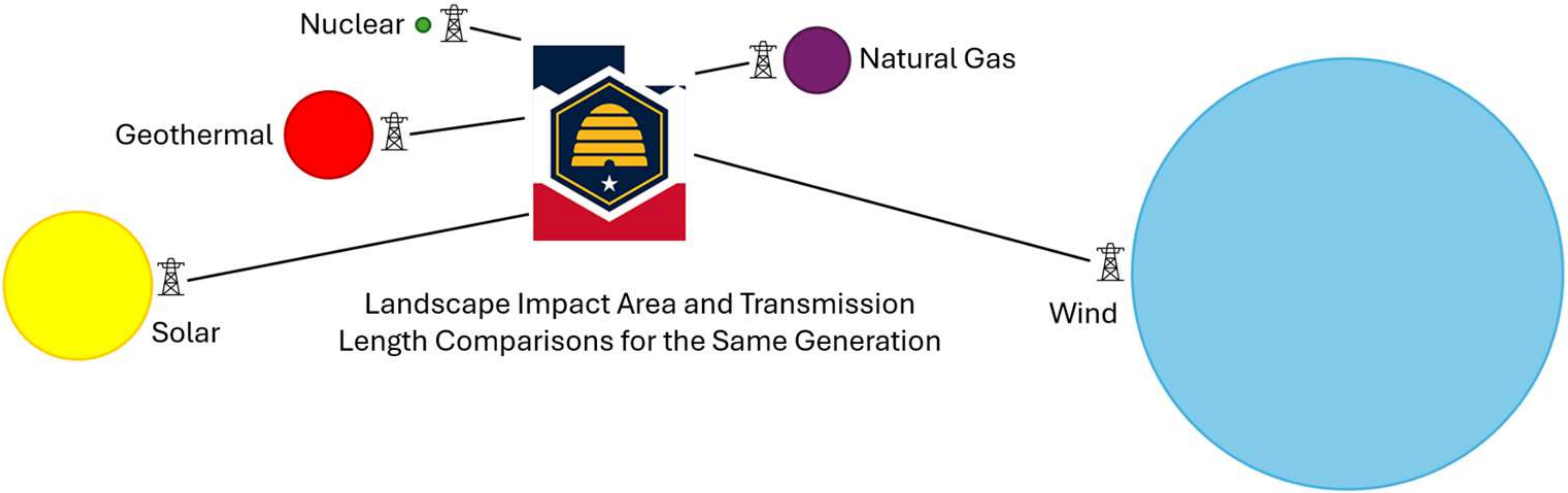


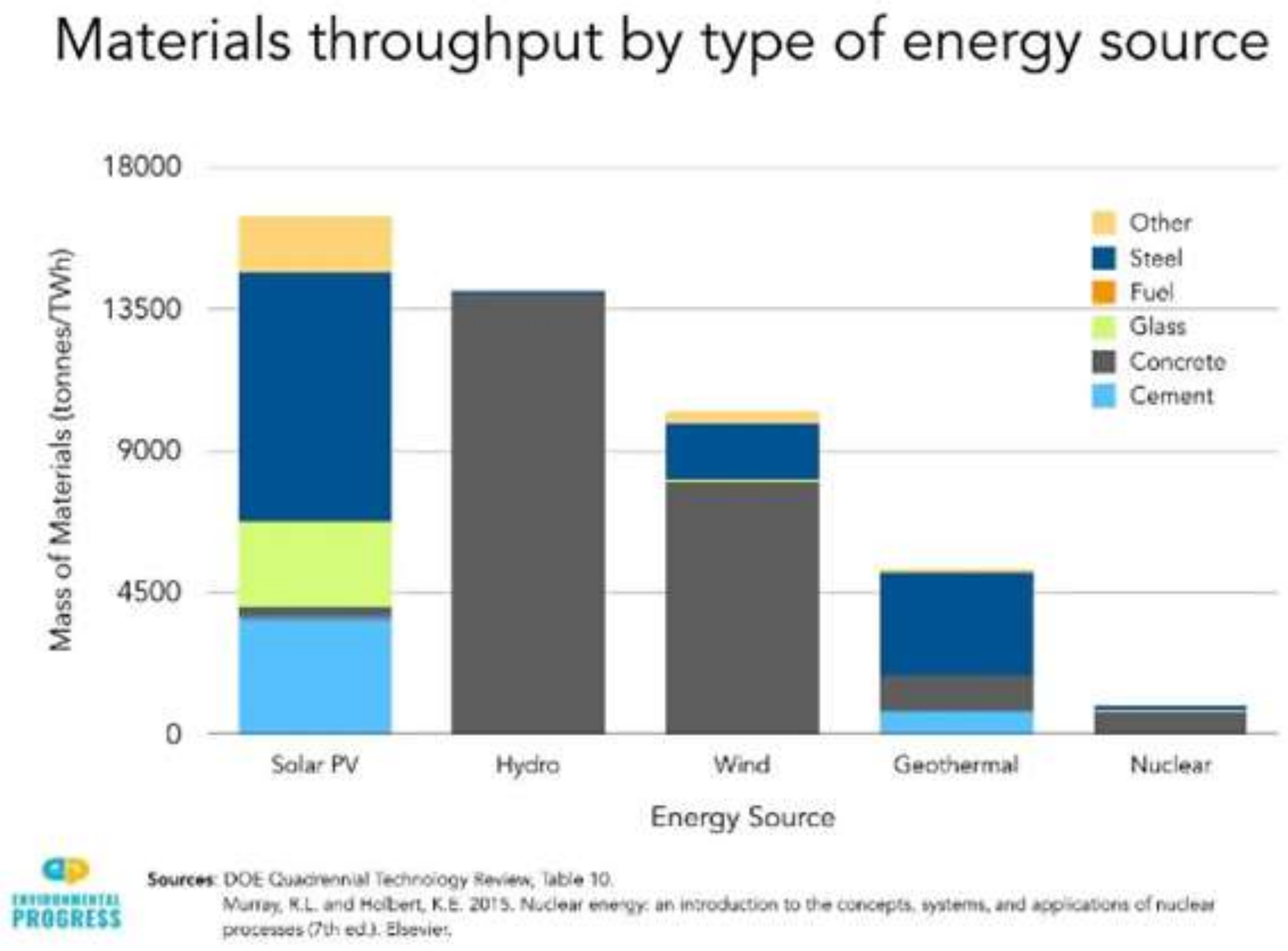
Figure 5. Cost projections for 2-, 4-, and 6-hour duration batteries using the mid cost projection.
Left shows the values in $/kWh, while right shows the costs in $/kW.

Drivers of Systemic Costs - Infrastructure



*Energy density of resources also equates to land use and transmission

Drivers of Systemic Costs - Materials



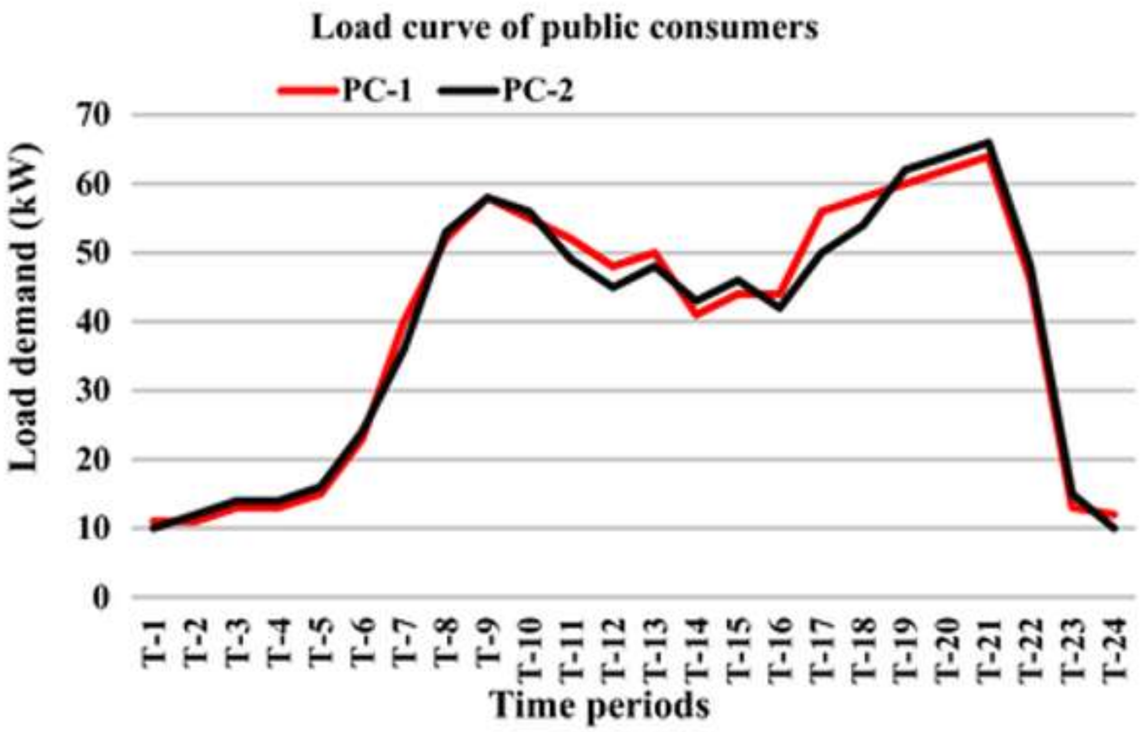
# of equipment per milestone	MISO Only				MISO + Eastern Interconnect			
	30%	40%	50%	Sub-total	30%	40%	50%	Total
Batteries (30min)	-	-	118	118	-	-	1,233	1,233
Controls Tuning	-	-	319	319	-	-	1,787	1,787
Dispatch Adjustment	-	60	17	77	-	169	60	229
HVDC	1	4	-	5	1	4	-	5
Power System Stabilizer	-	-	4	4	-	-	109	109
STATCOMs	25	8	5	38	47	31	23	101
Switched Shunts	-	-	-	-	-	-	1	1
Synchronous Condenser	2	10	163	175	5	14	248	267

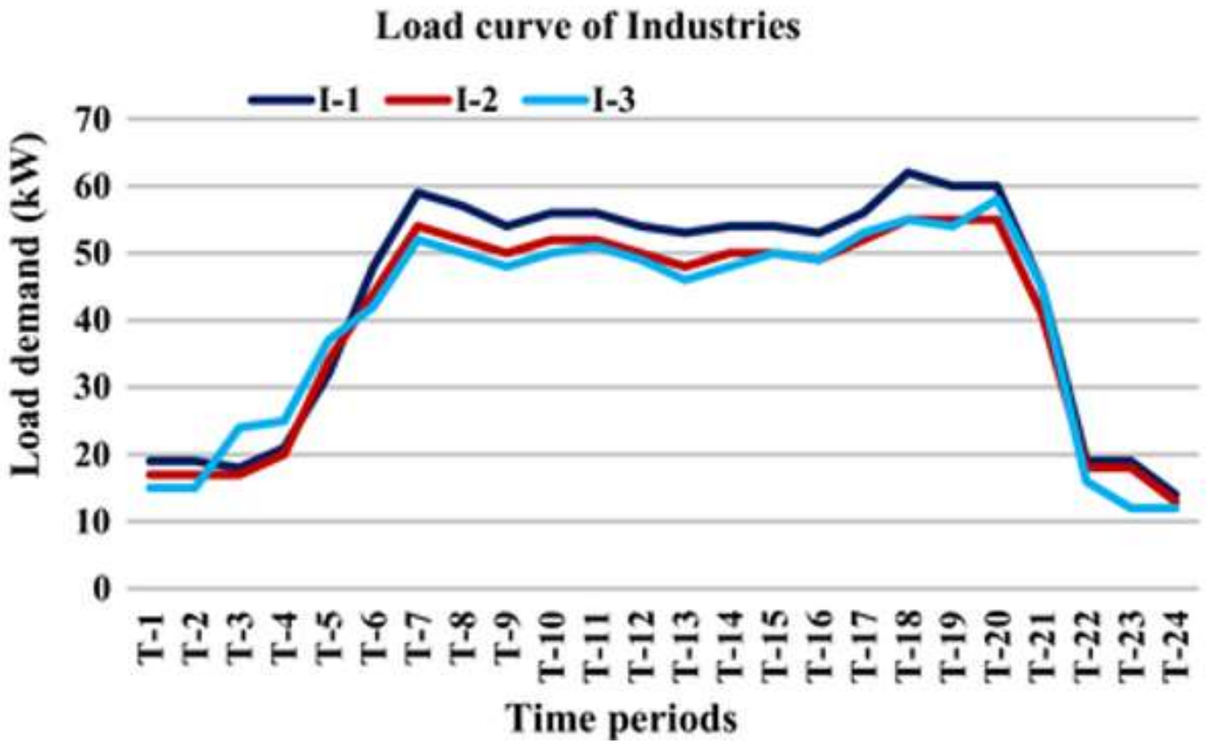
Figure UC-11: Dynamic stability solutions heatmap of thermal mitigation at renewable milestones and installed units of technology

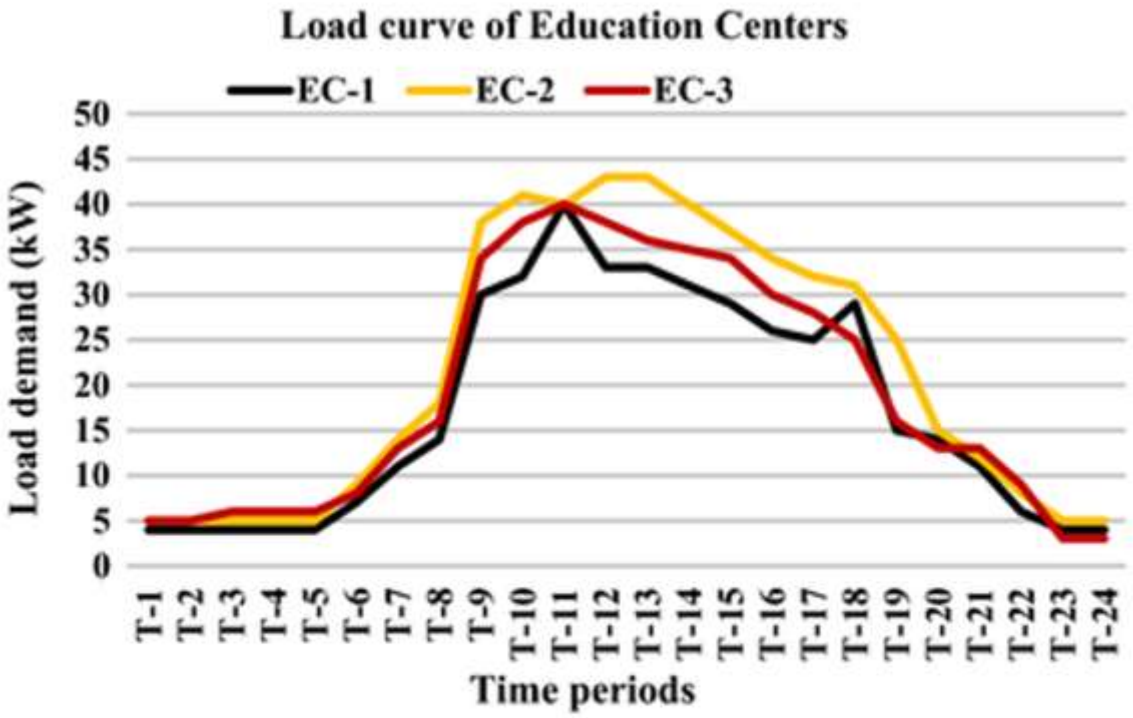
*The various generators have vastly different material requirements

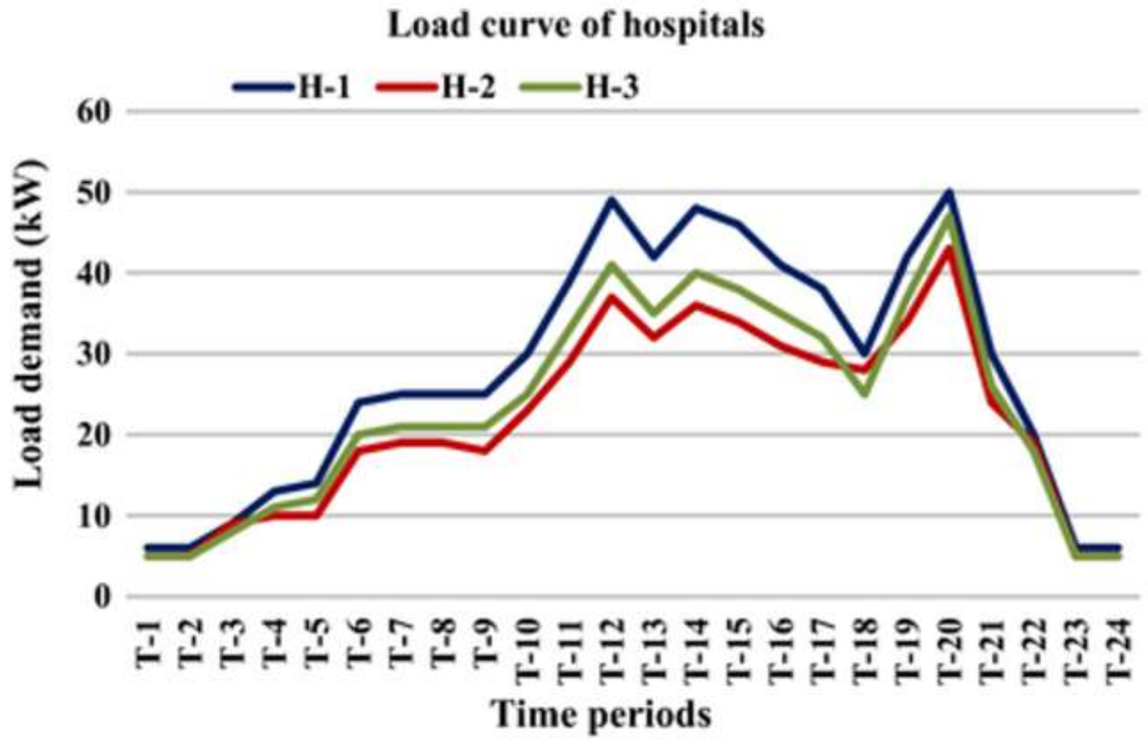
- Not limited to critical elements, base material costs vary substantially
- Increasing variable penetration also requires grid components
  - Cascading system costs arise that the generators typically don't own

Drivers of Systemic Costs - Load Profiles



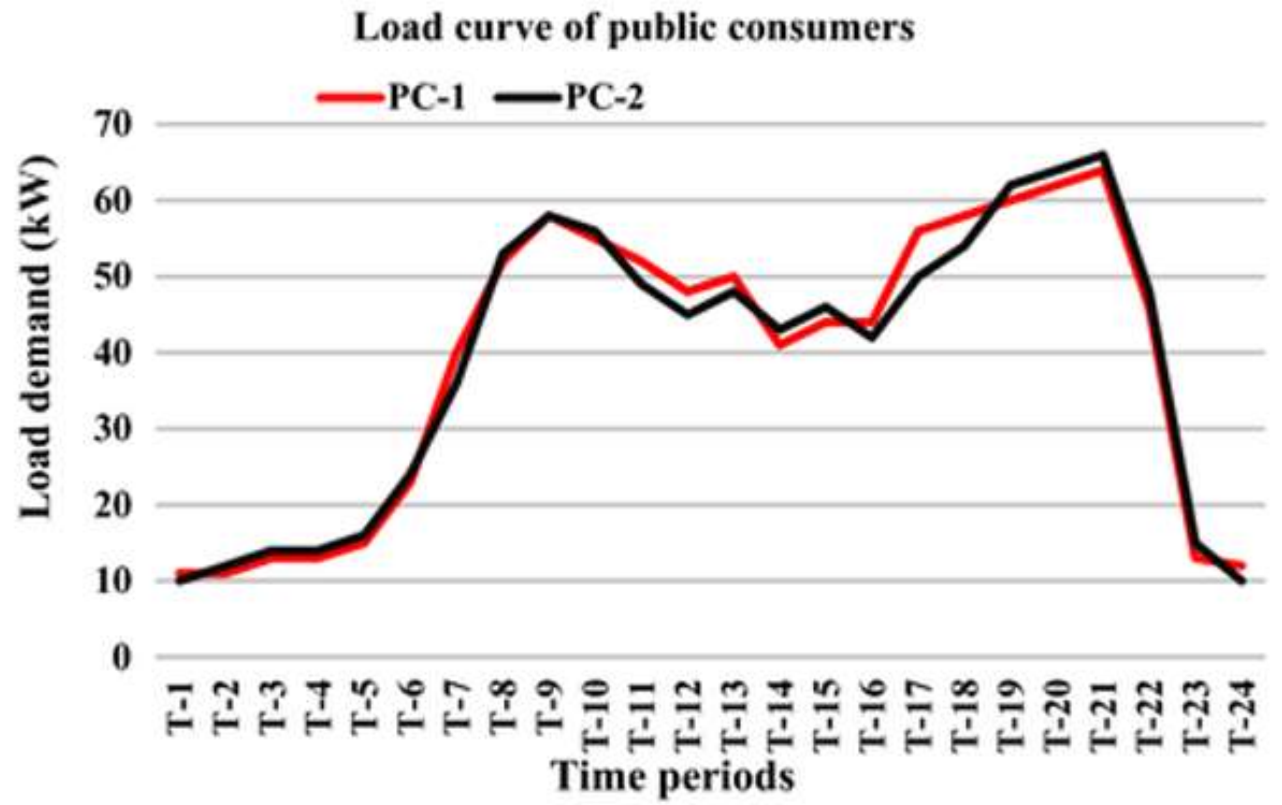


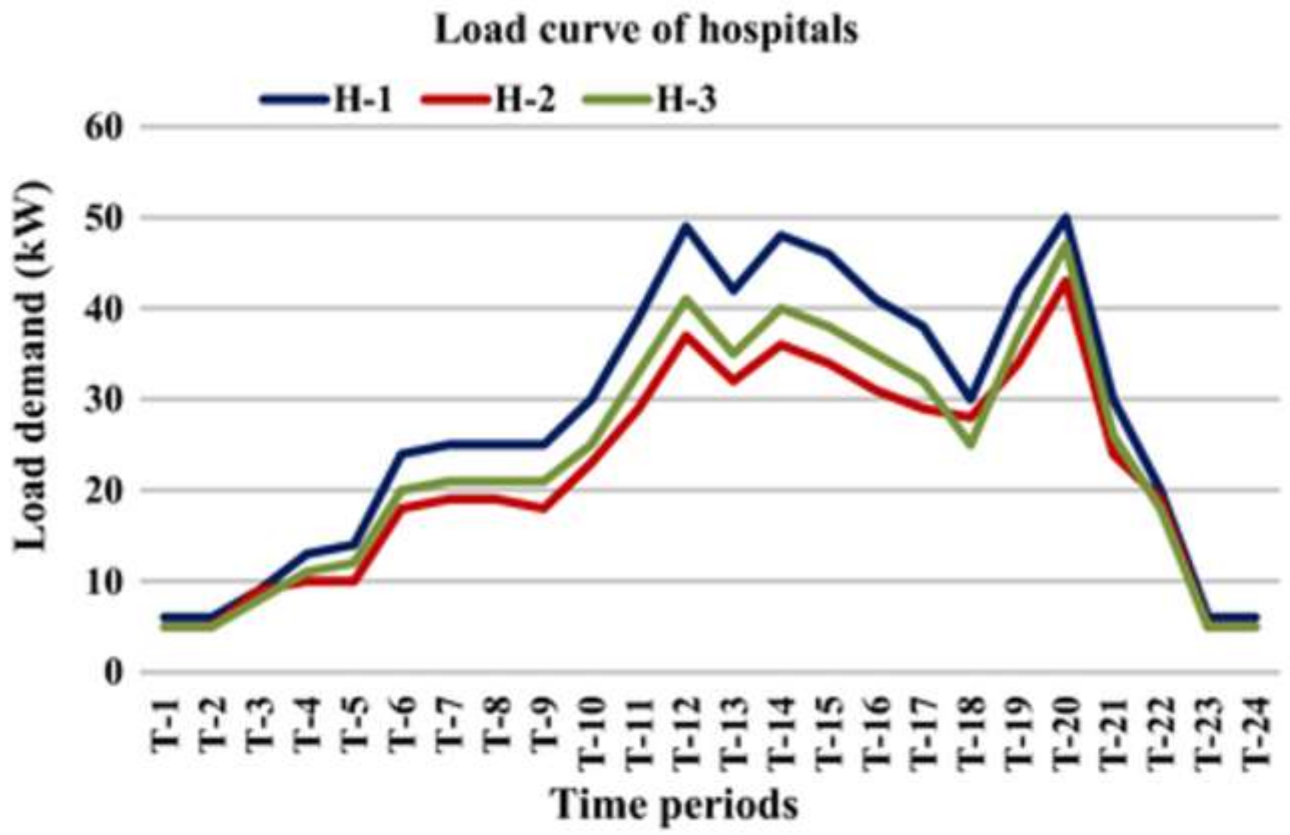


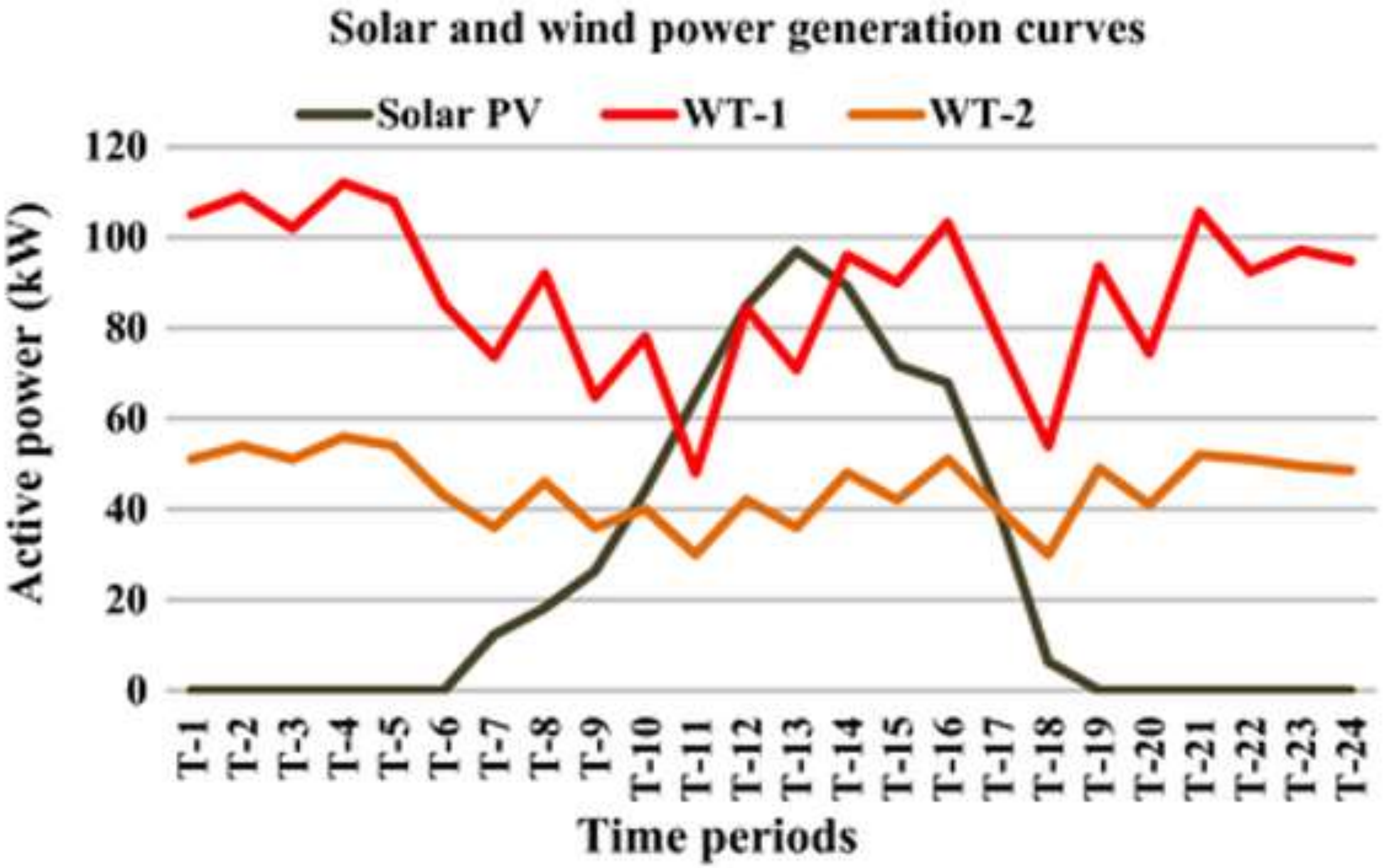


*Mismatch between demand and generation is the heart of the intermittent challenge

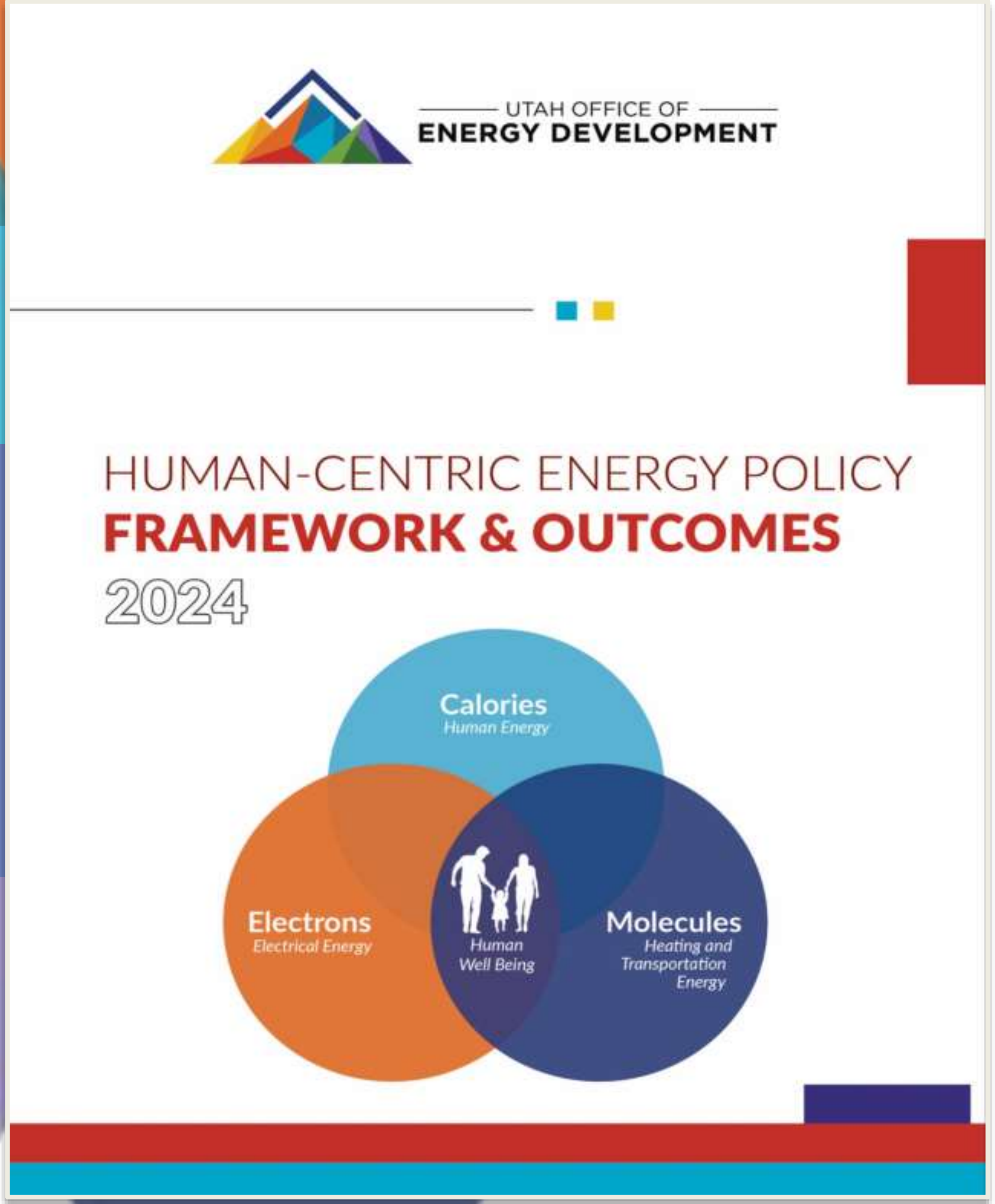
Drivers of Systemic Costs - Load Profiles with Consumer

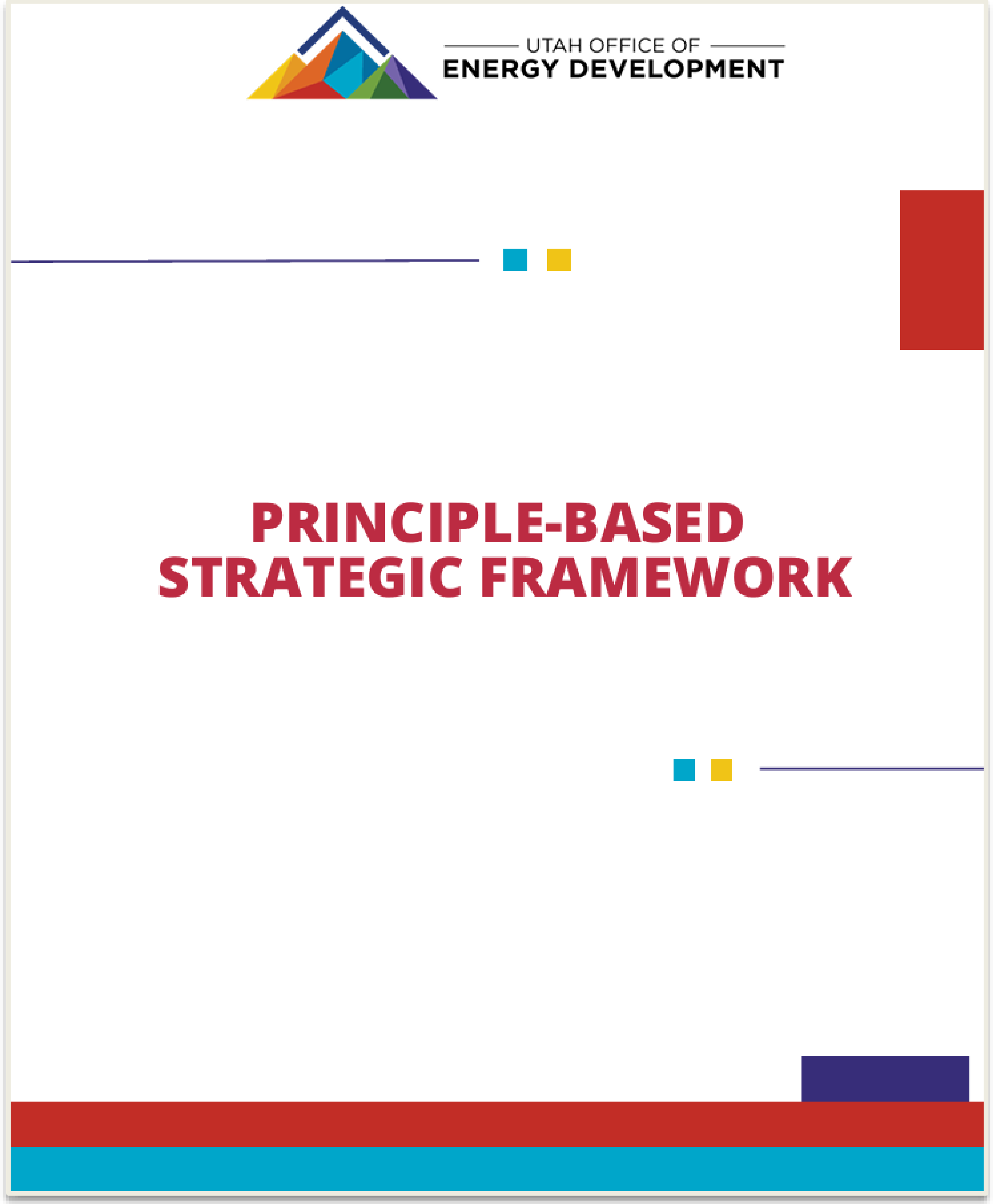




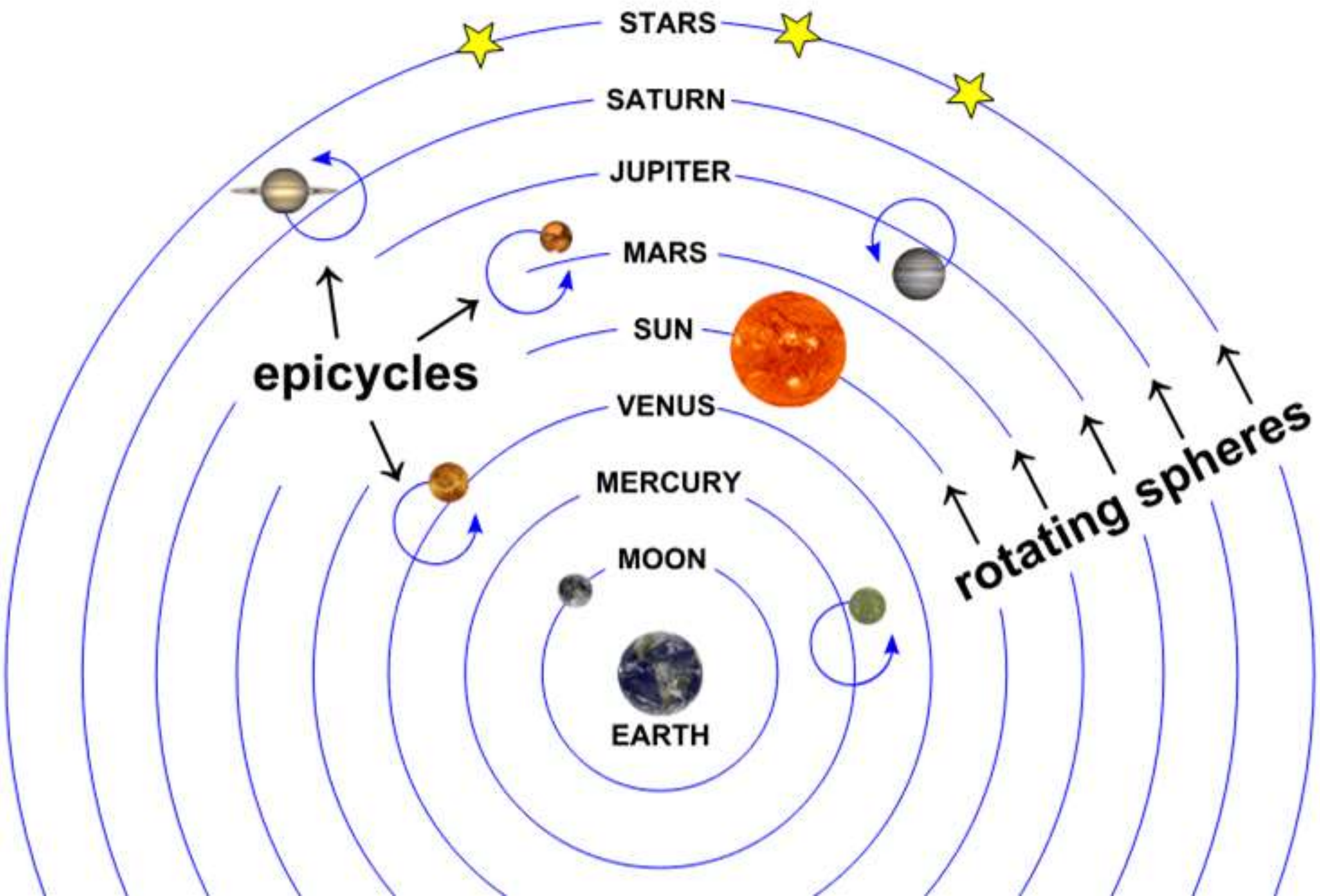


Principle vs Preference Strategies





Starting with the correct foundation is critical



Energy the Utah Way: Consumer-First Policies

"Utah will develop its energy resources and plan its energy future with a focus on human well-being and quality of life, recognizing that reliable access to energy is vital for human health, adaptation, economic growth, and prosperity" - Utah State Code 79-6-301 (1)(a)(i)

Seven attributes (in priority order)

- Adequate
- Reliable
- Dispatchable
- Affordable
- Sustainable
- Secure
- Clean

Truing Market and Consumer Impact

Market Truing:
Correcting Market signals to align with impact and value to the consumers. e.g. move from energy only market to a capacity type of market.

Enhance System Reliability: Set performance standards and require resources to meet the standard. Ensuring that any changes to the utility's asset portfolio do not compromise the reliability and affordability of the electric service, especially during times of peak demand. Maximizing value not necessarily production.

Promote Accountability: Hold utilities accountable for their investment decisions by requiring evidence demonstrating the efficacy and reliability of new asset designs and how they systematically meet consumers' needs in a reliable and affordable manner. Strengthen the front end by enhancing the Integrated Resource Planning (IRP) review process, giving it as much emphasis as we do rate cases.

Facilitate Transparent Decision-Making: Mandate detailed disclosures and evaluations in rate adjustment applications based on metrics that align with consumer value and impact, enabling better regulatory oversight and informed decision-making by the commission.

Thank you!

UTAH OFFICE OF
ENERGY DEVELOPMENT

The Water–Energy Nexus

Robert B. Sowby, Ph.D., P.E., ENV SP
Brigham Young University

The Energy Council
2024 Global Energy and Environmental Issues Conference
Dec. 6, 2024 | Salt Lake City

BYU Civil & Construction Engineering
IRA A. FULTON COLLEGE OF ENGINEERING

1986 and 2022

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Pumping Pacific Ocean Water to Great Salt Lake

400 MW

11% of UT elec.

$300M/yr

1 MMT CO_2e/yr

200,000 cars

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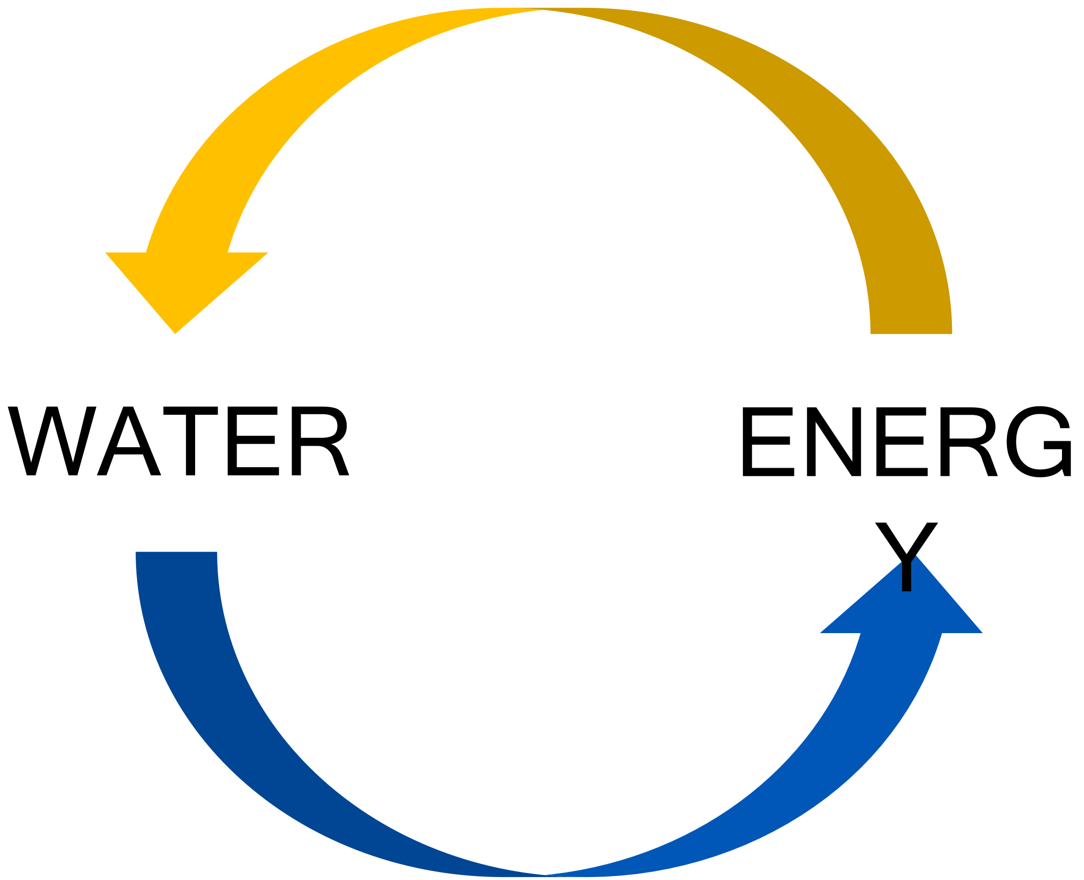
The Nexus



Energy for Water
(pumping, treatment, water heating, wastewater)
WATER
ENERGY
Water for Energy
(thermoelectric cooling, steam, hydropower)

Water for Energy

Thermoelectric power: 41% of all U.S. water withdrawals
(Dieter et al. 2018)

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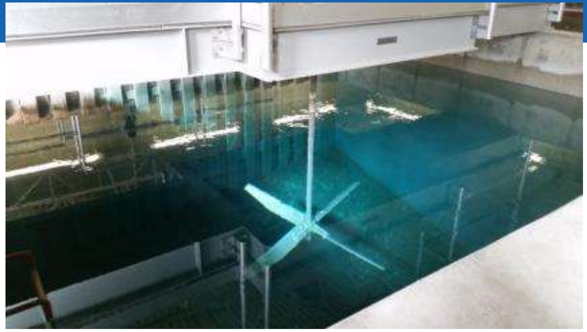

Energy for Water

- U.S.: 13% of total energy (Sanders and Webber 2012)
- Utah: 7% of total energy (DWRe 2012)
- California: 19% of electricity and 30% of natural gas (CEC 2005)
- Idaho: 34%-49% of electricity (Tidwell et al. 2014)

Energy for Water

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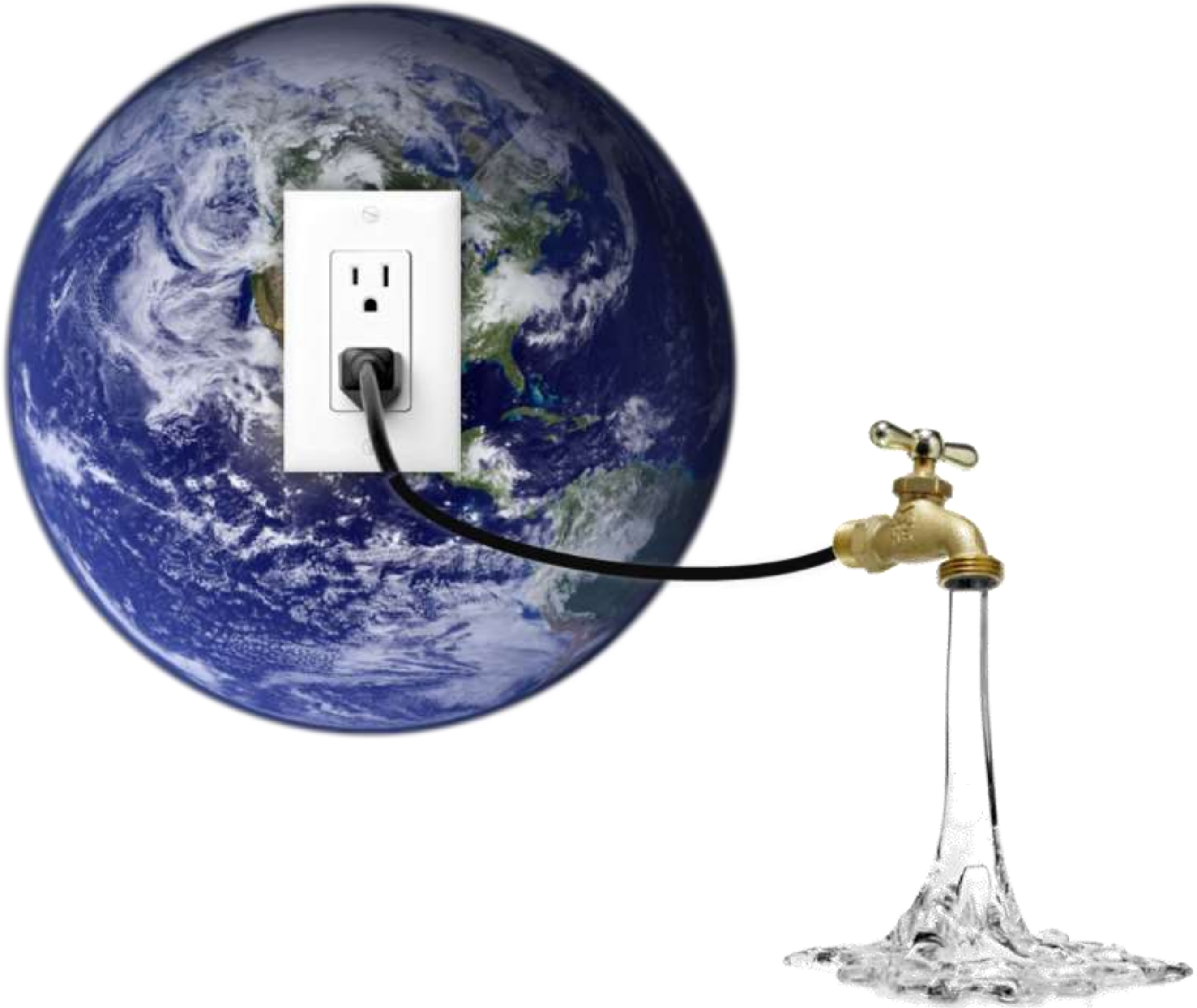
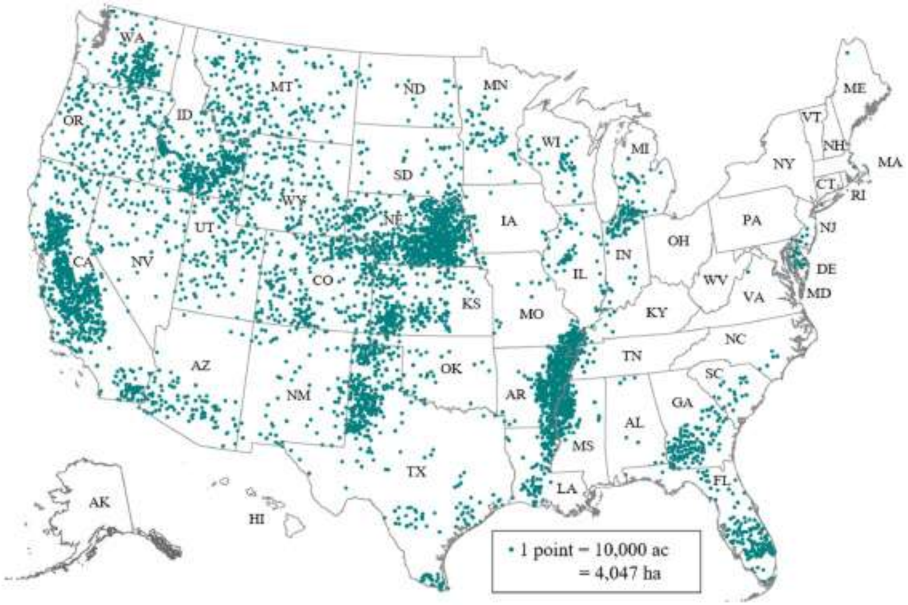
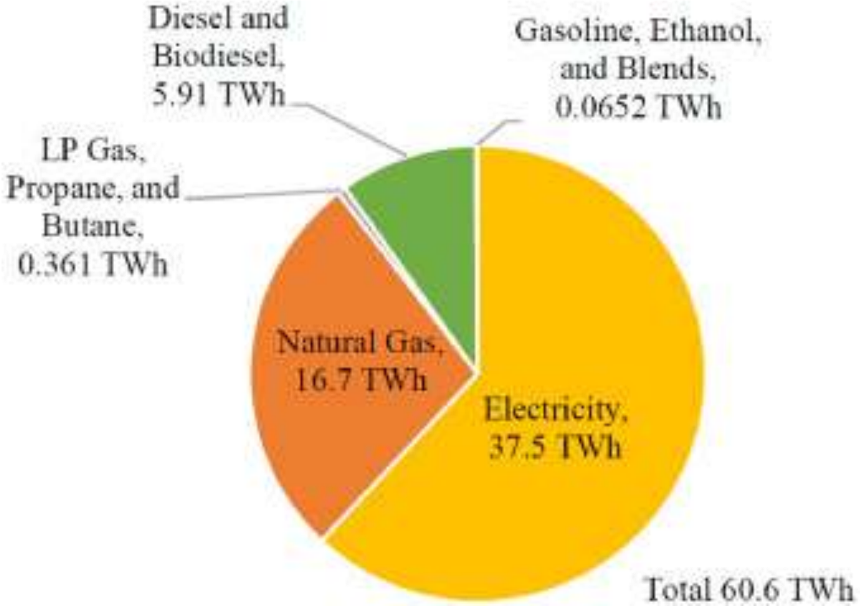


Energy for Water: Irrigation

1% of all U.S. energy





Sowby and Dicataldo 2022

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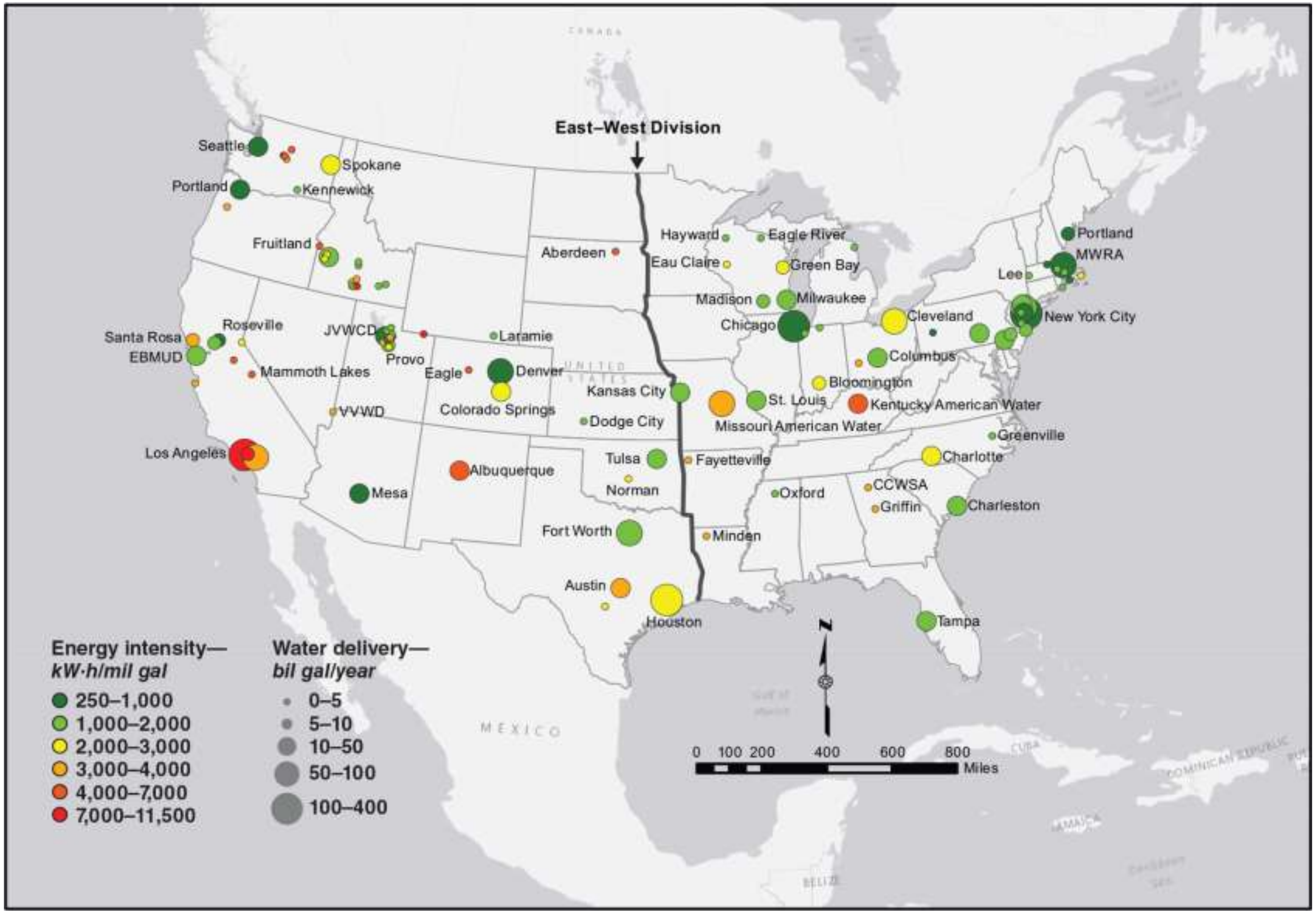
Energy for Water: Drinking Water

1%-2% of all U.S. energy



Sowby and Burian 2017

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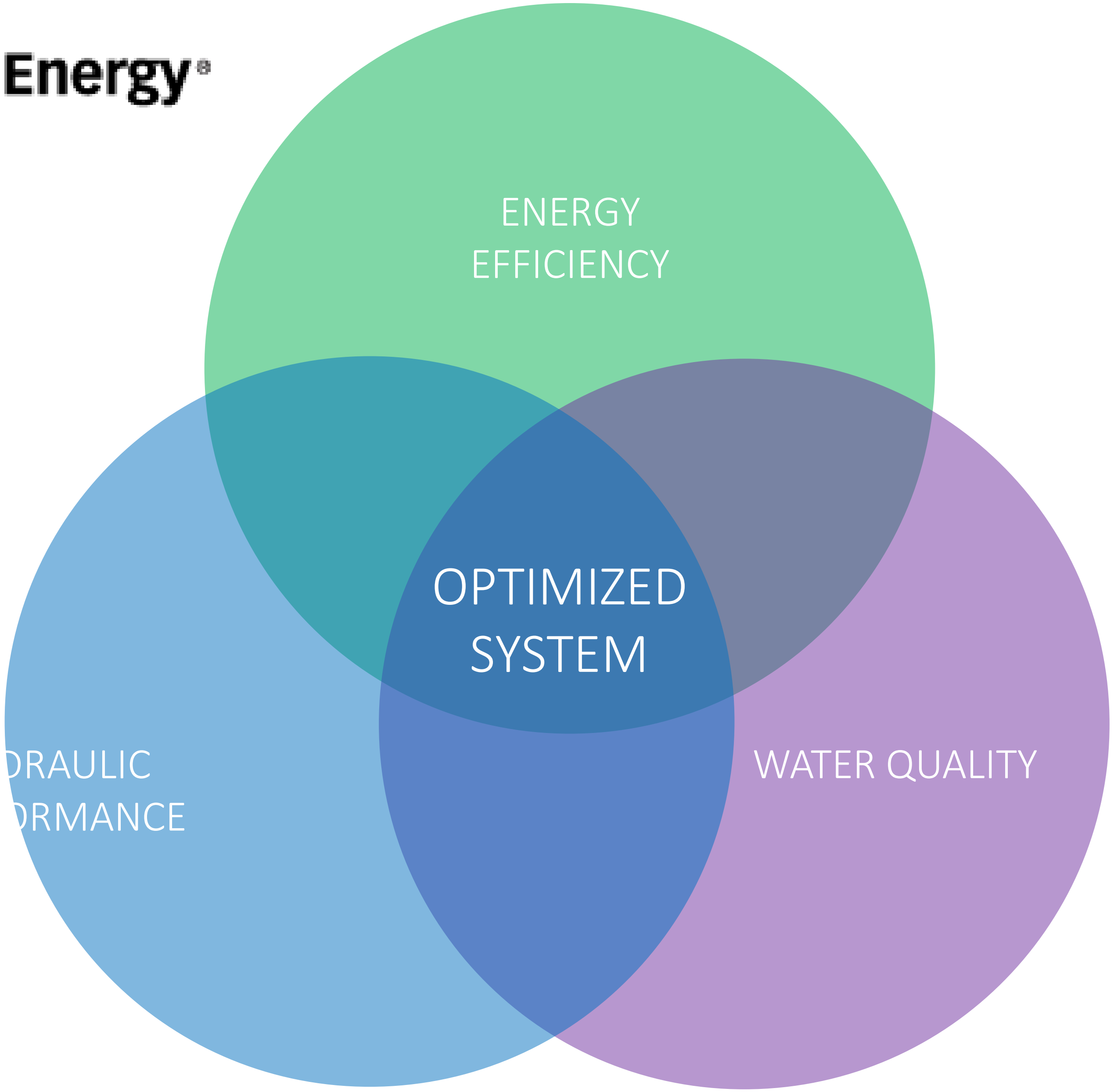
Optimized Water System

Cascade Energy

Hansen Allen & Luce Inc
Engineers



Jones and Sowby 2014

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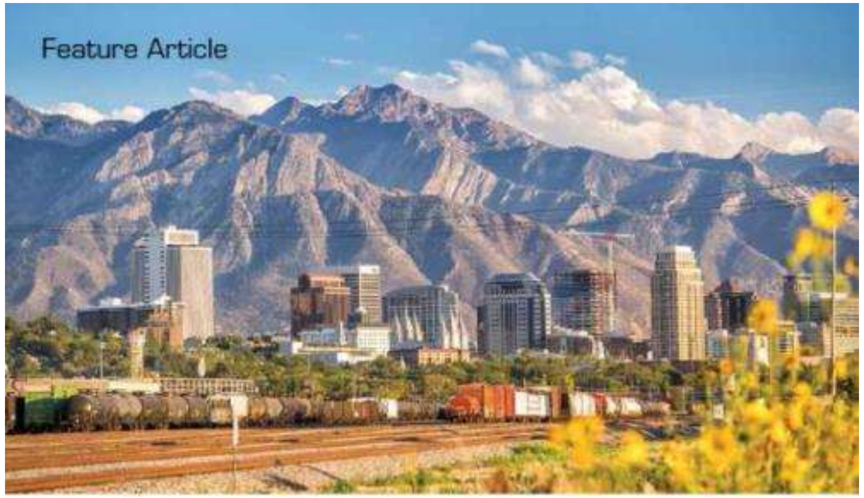
JORDAN VALLEY WATER CONSERVANCY DISTRICT

Salt Lake City, UT | 700,000 people

19% reduction from baseline



Feature Article

ROBERT B. SOWBY, STEVEN C. JONES, ALAN E. PACKARD, AND TODD R. SCHULTZ

Jordan Valley Water Redefines Sustainable Water Supply Through Energy Management

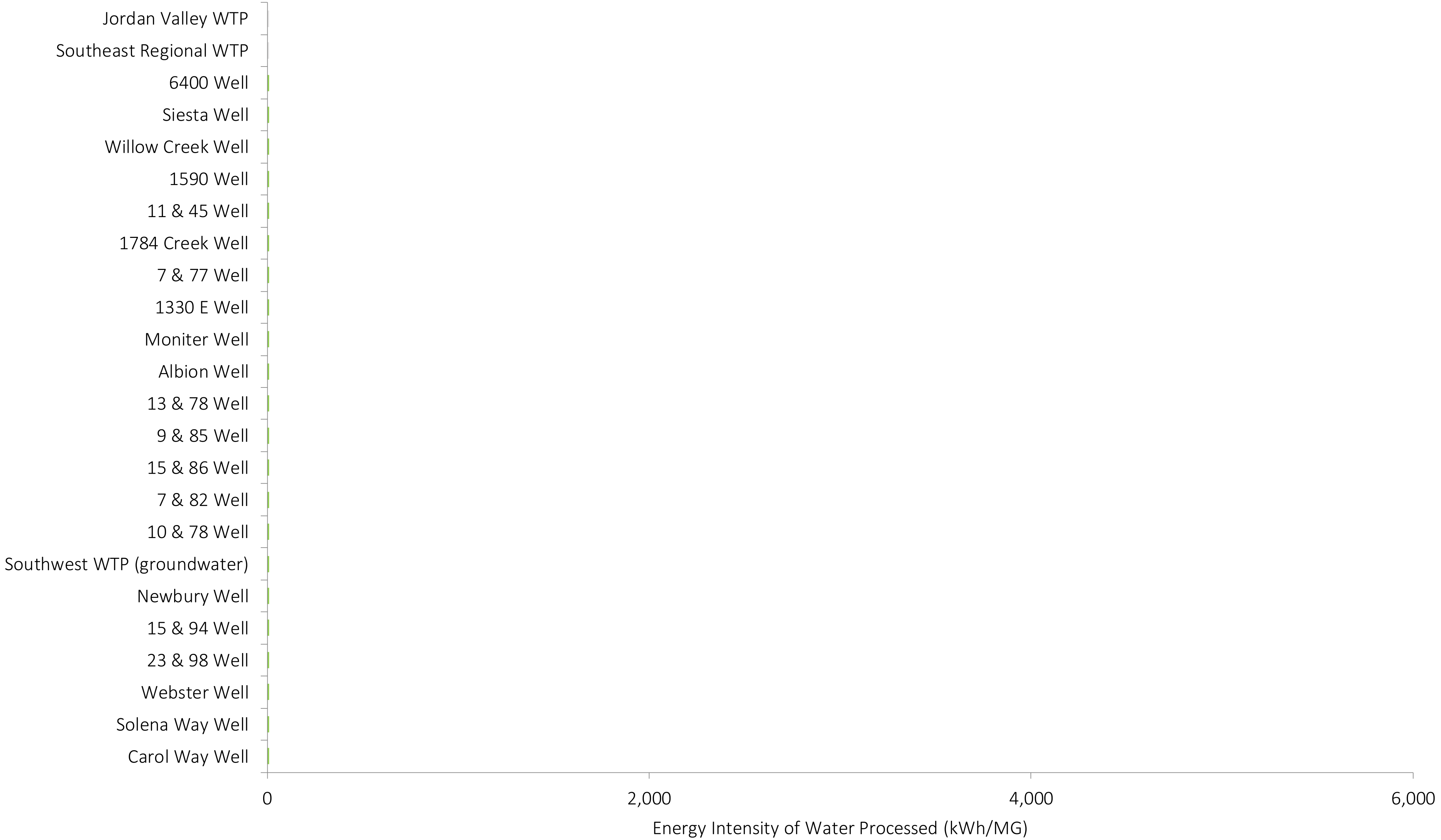
A MAJOR UTAH WATER DISTRICT REDUCED ITS ENERGY FOOTPRINT BY 19% AFTER FOLLOWING A TWO-YEAR ENERGY MANAGEMENT PROGRAM, IMPLEMENTING BOTH TECHNICAL AND ORGANIZATIONAL CHANGE IN PURSUIT OF ITS VISION TO PROVIDE A MORE SUSTAINABLE WATER SUPPLY.

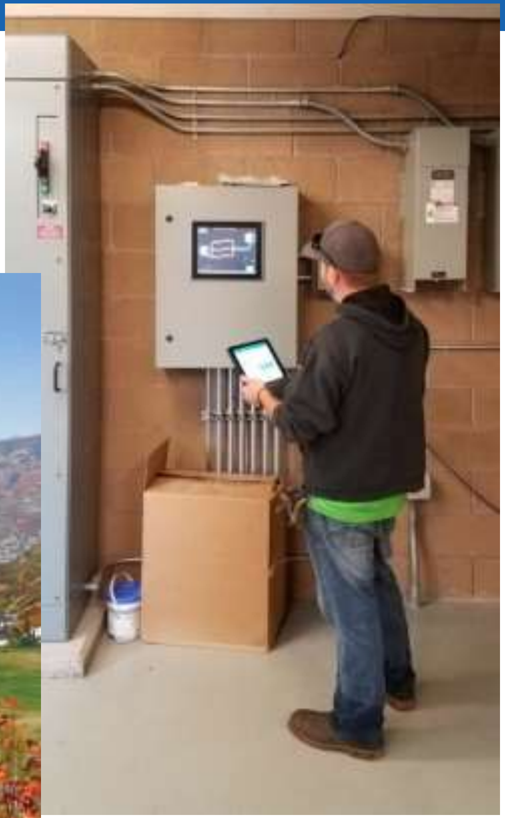
Serving the greater Salt Lake City area, Jordan Valley Water Conservancy District (JVWCD) is one of Utah's largest public water suppliers. Primarily a wholesaler of water to cities and improvement districts, JVWCD serves a population of approximately 680,000. About 75% of its water comes from surface water sources in the Provo River watershed or from local streams of the Wasatch Mountains' east bench. The remaining 25% comes from groundwater deep beneath the Salt Lake Valley.

Sourcing, treating, and delivering high-quality water requires significant energy, which is one of the district's largest operating costs averaging $4 million/year. To improve its sustainability through efficiency, JVWCD realized it needed to optimize its energy use.

MOTIVATION

A water utility's energy footprint plays a role in its financial, environmental, and social impacts. With increasing population, stricter water quality standards, and rising energy costs, energy efficiency in the water sector is emerging as a primary


Jordan Valley WTP
Southeast Regional WTP
6400 Well
Siesta Well
Willow Creek Well
1590 Well
11 & 45 Well
1784 Creek Well
7 & 77 Well
1330 E Well
Moniter Well
Albion Well
13 & 78 Well
9 & 85 Well
15 & 86 Well
7 & 82 Well
10 & 78 Well
Southwest WTP (groundwater)
Newbury Well
15 & 94 Well
23 & 98 Well
Webster Well
Solena Way Well
Carol Way Well
0
2,000
4,000
6,000
Energy Intensity of Water Processed (kWh/MG)



CITY OF NORTH SALT LAKE, UTAH

21,000 people

25% reduction from baseline

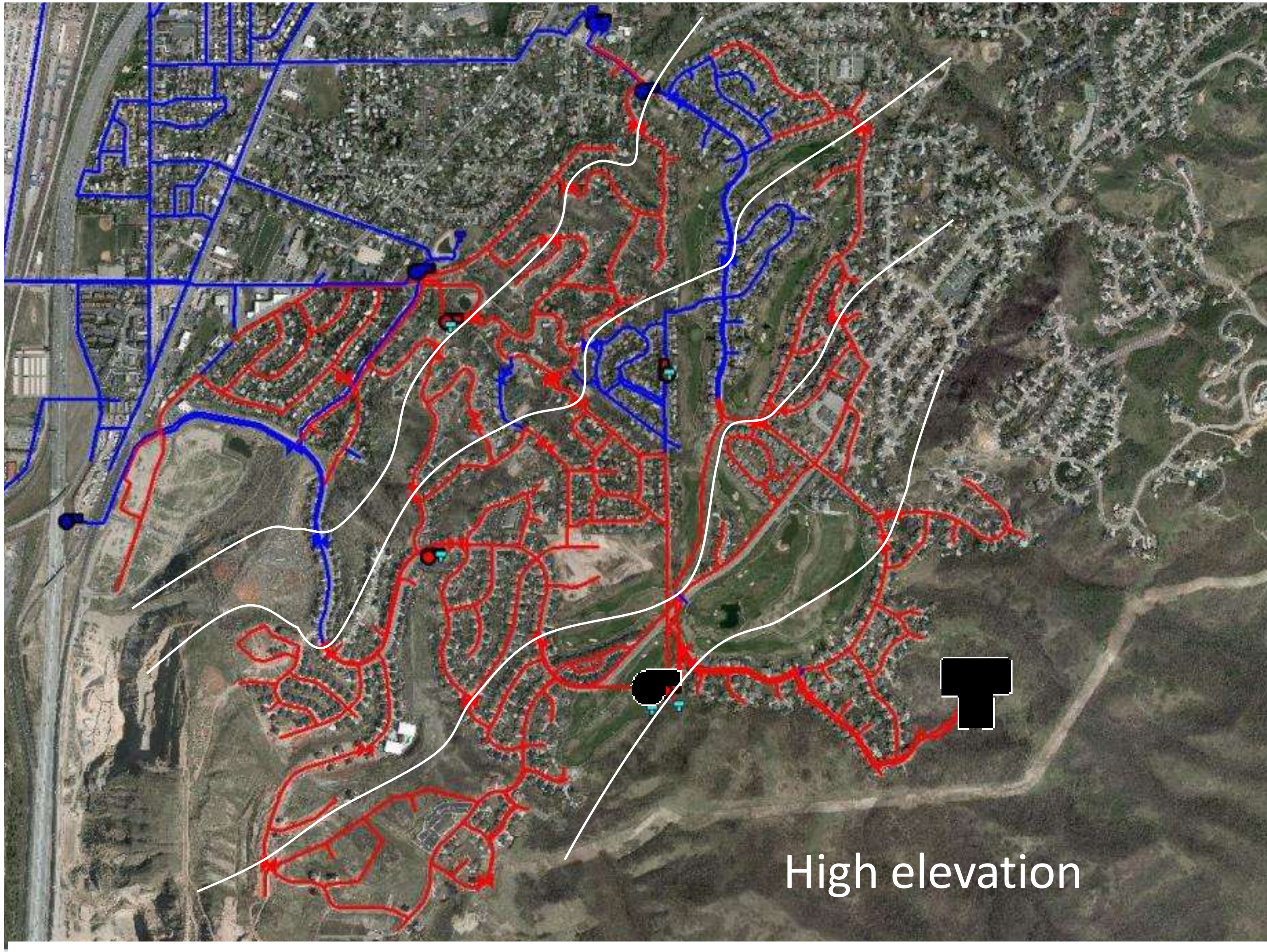
Energy Management

The city of North Salt Lake, Utah, recently reduced its water system's energy use by 25 percent. Distribution system pressures and water quality also improved as the water system staff embraced energy-efficient operations.

ENERGY MANAGEMENT PROGRAM LEADS TO OPERATIONAL IMPROVEMENTS

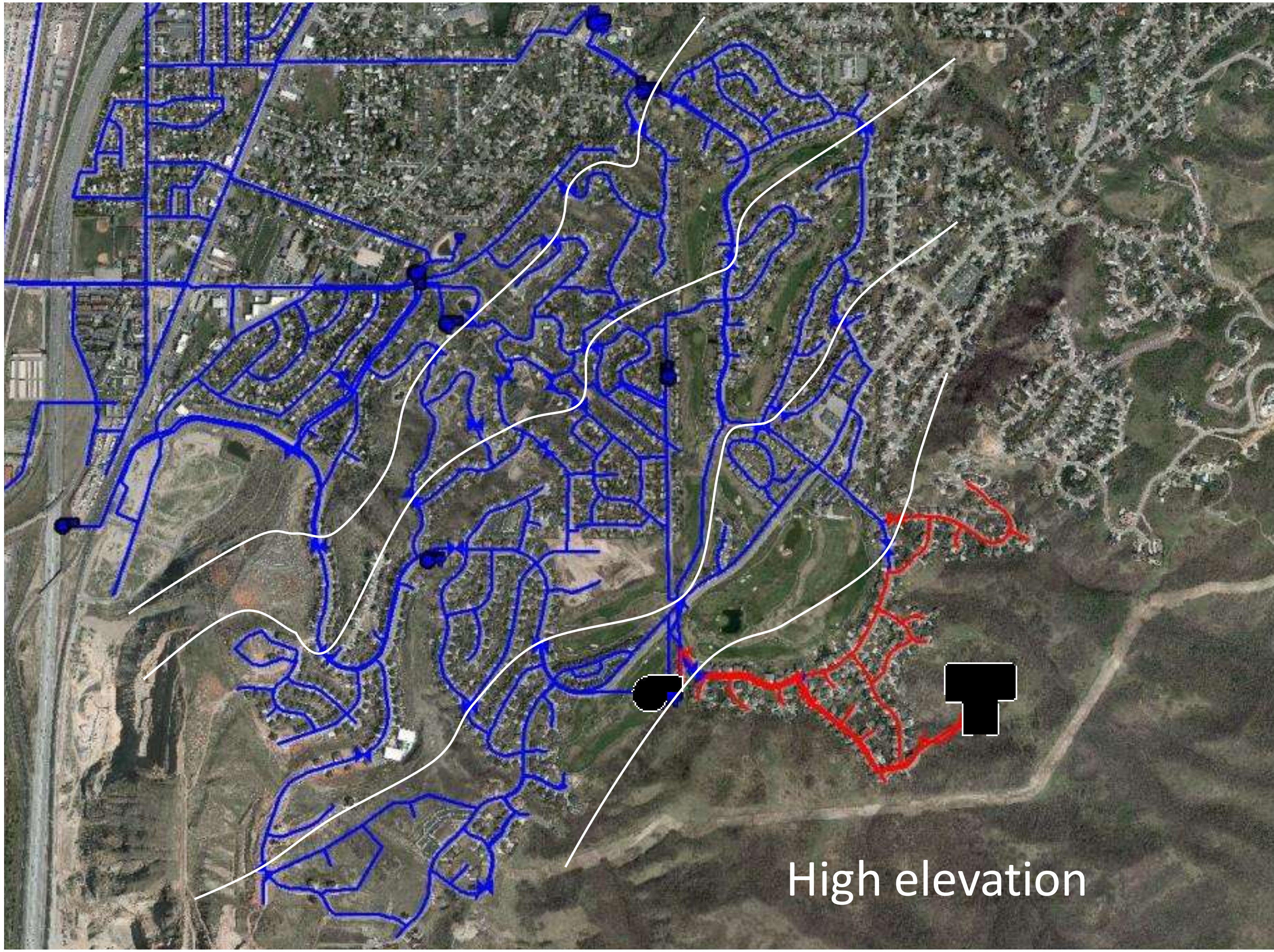
Pumping in Circles
BEFORE

Low elevation



Pumping in Circles AFTER

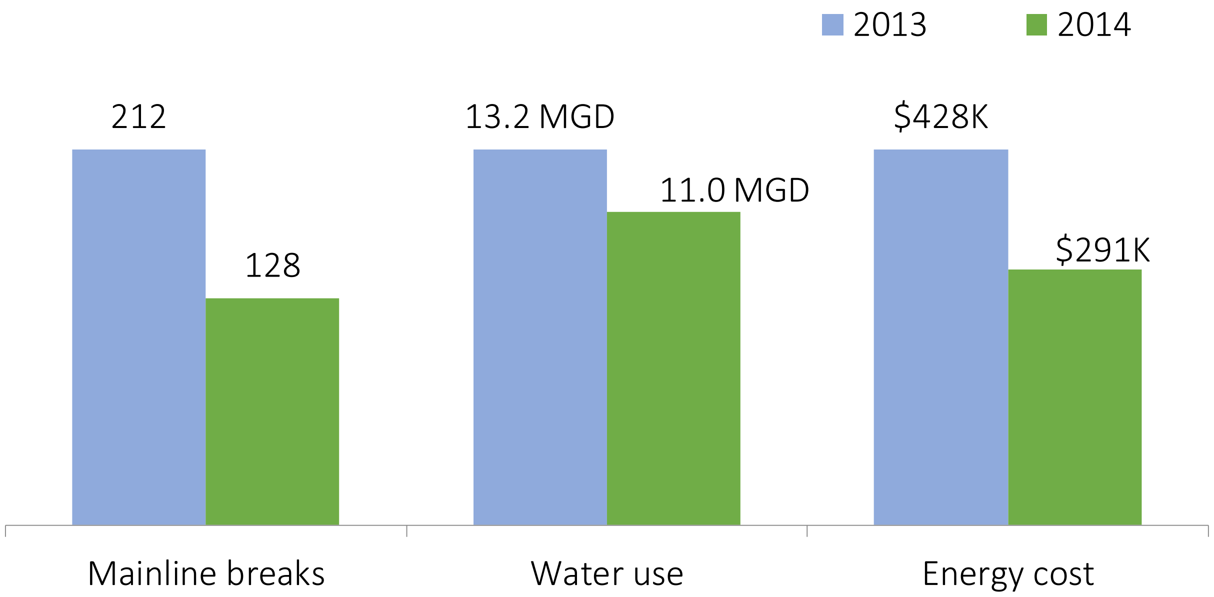
Low elevation



LOGAN CITY, UTAH

50,000 people

32% energy cost reduction from baseline



↓40% ↓17% ↓32%

STEVEN C. JONES, PAUL W. LINDHARDT, AND ROBERT B. SOWBY

Logan, Utah: A Case Study in Water and Energy Efficiency

LOGAN CITY, UTAH, EXPERIENCED FIRSTHAND THE WATER–ENERGY NEXUS WHEN IT UNDERTOOK A COMPREHENSIVE WATER AND ENERGY AUDIT TO DETERMINE ITS BEST PATH FORWARD.

Home to 50,000 residents, dozens of industries, and Utah State University, Logan City is the hub of a growing metropolitan area in northern Utah's Cache Valley. In 2013, after encountering several problems, Logan City began to optimize its water system for water and energy efficiency (Figure 1). Addressing both issues simultaneously is the essence of the water–energy nexus, an emerging field that studies the complex relationships between water and energy resources. Although conventional engineering attempts to balance perceived tradeoffs between water and energy, optimization exploits the benefits at their intersection (Jones & Sowby 2014). Reducing energy does not necessarily mean sacrificing system performance, just as improving service does not always mean a higher power bill. In an optimized system, water and energy solutions can become synergistic rather than antagonistic, as Logan discovered.

72 AUGUST 2015 | JOURNAL AWWA • 107:8 | JONES ET AL.

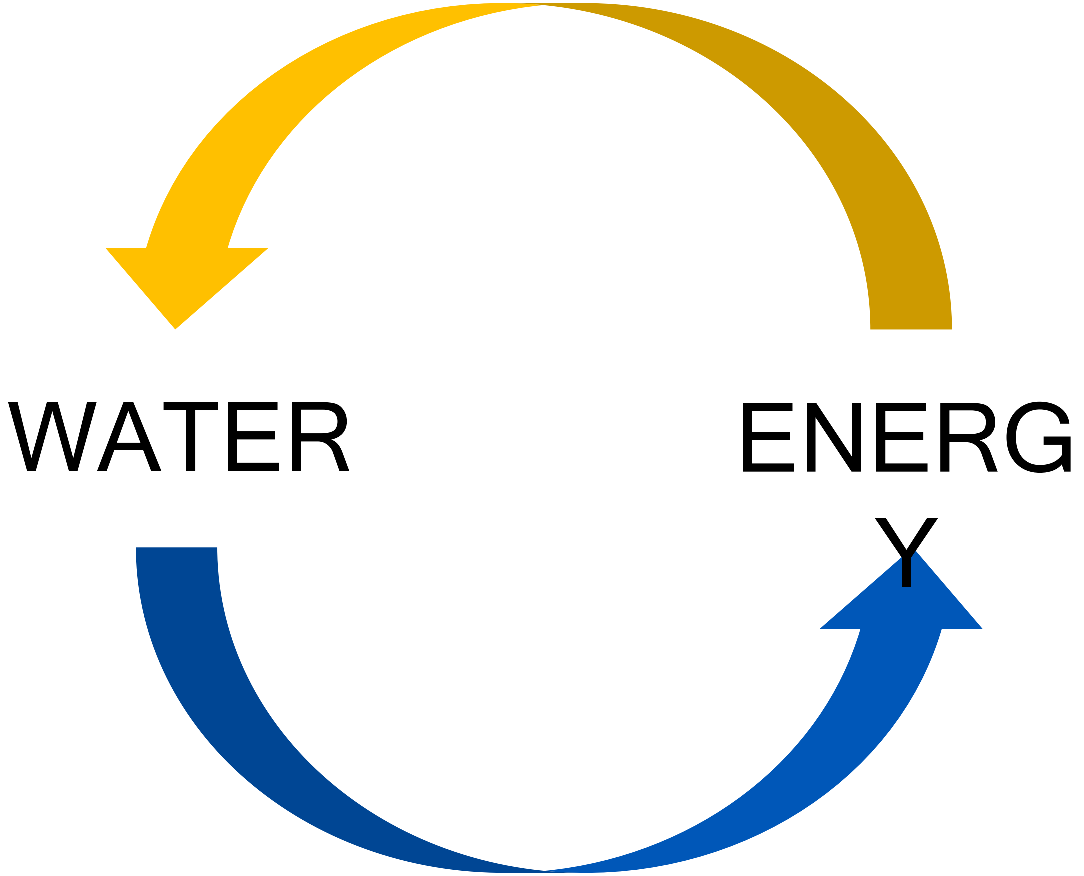
2015 © American Water Works Association

The savings and operational efficiency have continued each year since 2013. … If the current savings continue, the payback period for this project will be shorter than projected.

—Paul Lindhardt, W/WW Manager

The Nexus

Energy for Water
(pumping, treatment, water heating, wastewater)



Water for Energy
(thermoelectric cooling, steam, hydropower)

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"

Water conservation is energy conservation