

# Keeping Up with Emerging Technology: Next-Level Advances in Smart Buildings



An aerial night view of a city, likely New York City, with a dense grid of buildings and streets illuminated by city lights. The sky is a mix of blue and orange, suggesting dusk or dawn. A prominent green rectangular box is overlaid on the center of the image, containing white text. The text is arranged in two lines, with the second line being slightly indented to the left.

HOW DATA ANALYTICS CAN MAKE  
ANY BUILDING “SMART”

“It’s unbelievable how much you don’t know about the game you’ve been playing all your life.”

- Mickey Mantle

The whiteboard displays a table of baseball statistics for three teams: OAK 2001, OAK 2002 PROJECTION, and SEA 2001. The table is organized into columns for 'WIN %' (EXPECTED and ACTUAL) and 'RECORD' (EXPECTED and ACTUAL). Handwritten calculations for Runs Scored and Runs Allowed are shown for each team, leading to the Win % values. The records are also listed, with some teams having a 0-0 record.

	Runs Scored <sup>2</sup>		Runs Scored <sup>2</sup> ÷ Runs Allowed <sup>2</sup> = Win %		WIN %		RECORD	
	Runs Scored <sup>2</sup>	Runs Allowed <sup>2</sup>	Runs Scored <sup>2</sup>	Runs Allowed <sup>2</sup>	EXPECTED	ACTUAL	EXPECTED	ACTUAL
OAK 2001	884 <sup>2</sup>	645 <sup>2</sup>	781456	1197481	.6525	.6296	106-56	102-60
OAK 2002 PROJECTION	814 <sup>2</sup>	645 <sup>2</sup>	662596	1078621	.6143	—	99-63	0-0
SEA 2001	927 <sup>2</sup>	627 <sup>2</sup>	859329	1252458	.6861	.7160	111-51	
			722500	1184900	.6097	—	99-63	0
			646416	1154785	.5597	.5864	91-71	

## Organizational Challenges & Opportunities

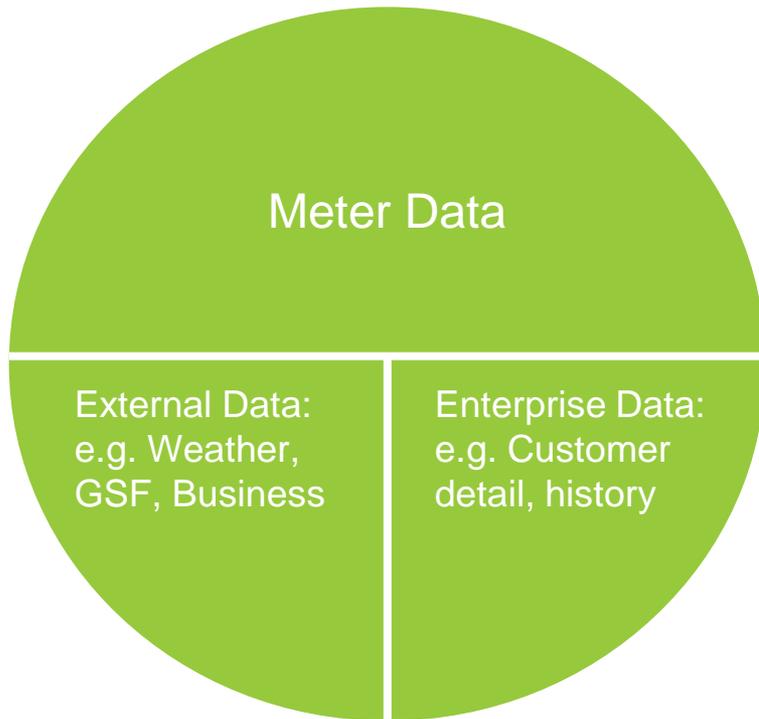
Limited budget & resources

Must do more with same or less

Embrace innovation as an organization

Leverage data analytics as a best practice

# WHAT IS DATA ANALYTICS?



## DESCRIPTIVE ANALYTICS

“What Happened?”

## DIAGNOSTIC ANALYTICS

“Why Did it Happen?”

## PREDICTIVE ANALYTICS

“What Will Happen Next?”

## PRESCRIPTIVE ANALYTICS

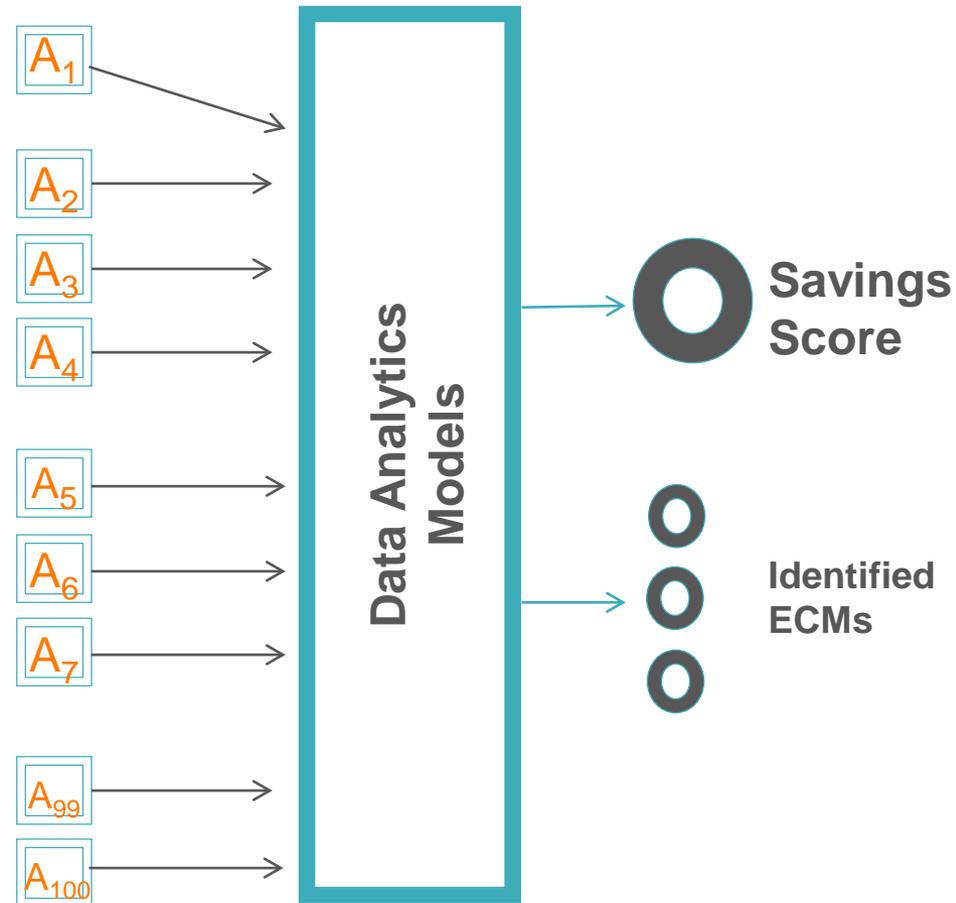
“How to Improve Results?”

# METHODOLOGY

Evaluating each site against 100+ unique usage attributes  
(indicators of savings potential)

## Sample Attributes:

- **Consumption**
  - Annual consumption
- **Demand**
  - Load factor (peak over mean)
  - Occupied/Unoccupied Demand
  - Seasonal Demand
- **Occupancy**
  - Starting/Stopping Time
  - Hours of Operation
  - Seasonal Occupancy
- **Temperature Response**
  - Heating and Cooling Set Points
  - Occupied and Unoccupied



# HOW ANALYTICS CHANGES THE APPROACH TO EFFICIENCY

## Walkthrough Audit



## Remote Audit



VS.

- “Snapshot in time”
- High cost, high touch
- High customer sat

- Dynamic
- Low cost, low touch
- High customer sat

# REMOTE AUDIT: A CLOSER LOOK

Facility Profile

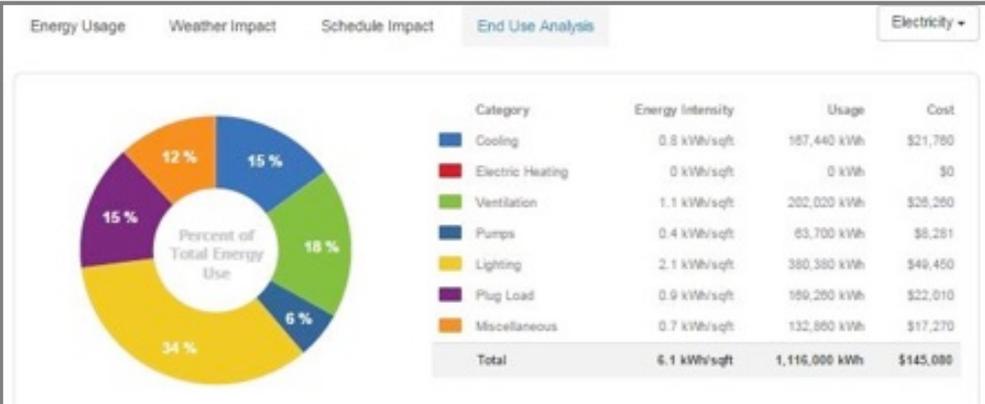
Building Name: WV001422 Carson City FB  
 Building Address: 705 N Plaza St, Carson City, Nevada, 89701, United States  
 Building Size(SqFt): 52,789 GSF  
 Primary Activity: Office  
 Heating Type: Gas  
 Cooling Type: Electricity  
 Average Occupancy(%): 100  
 Year Constructed: 1975  
 Last Renovated: 2010  
 Electricity Cost: 13 cents  
 Gas Cost: 1 cents

Consumption	Total	Per SqFt	Per SqFt
Electricity	481,249 kWh	9.12 kWh	31.91 MBTU
Gas	967,184 cf	18.13 cf	16.60 MBTU
Total	2,627,932 MBTU	49.78 MBTU	49.78 MBTU
Peak Demand (Electric)	224 kW	4.24 W	14.49 BTU/hr

Peer Comparison



End Use Disaggregation



# CAN SMART BUILDING SYSTEMS FIX THIS PROBLEM?

5.6M

COMMERCIAL  
BUILDINGS IN THE  
UNITED STATES

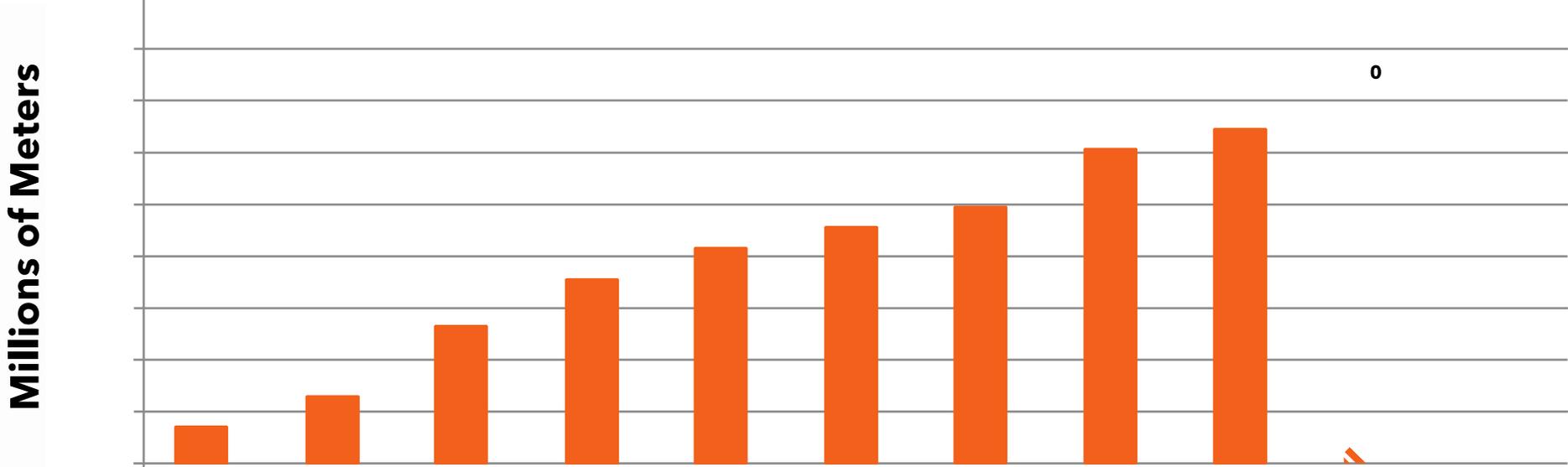
44%

ENERGY USE BY  
SMALL BUILDINGS  
(<50K SQ FT)

*Source: Department of Energy*

# SMART METERS ARE THE NEW “BUSINESS AS USUAL”

## Smart Meter Deployments by U.S. Electric Power Utilities



Source: IEI, *Electric Company Smart Meter Deployments: A Foundation for the Smart Grid*, 2016

# ANALYTICS FROM METER...TO BUILDING...TO PORTFOLIO MANAGER

25+  
Meters

10+  
Accounts

Gas &  
Electric

2  
Street  
Addresses

→ Portfolio Manager



# CLOUD COMPUTING MAKES ANALYTICS POSSIBLE AT LARGE SCALE

## DATA



### A. UTILITY DATA

Meter Data

Address



### B. DATA USABILITY

Meter-Building mapping

Data cleaning/validation



### C. IMPORT DATA

Weather

GSF

Business Type

## CLOUD ANALYTICS



### D. ADVANCED ANALYTICS

Weather & Operations

End-Use Disaggregation

Bill Compare/Determinants

ENERGY STAR

Recommendations

Savings Estimates

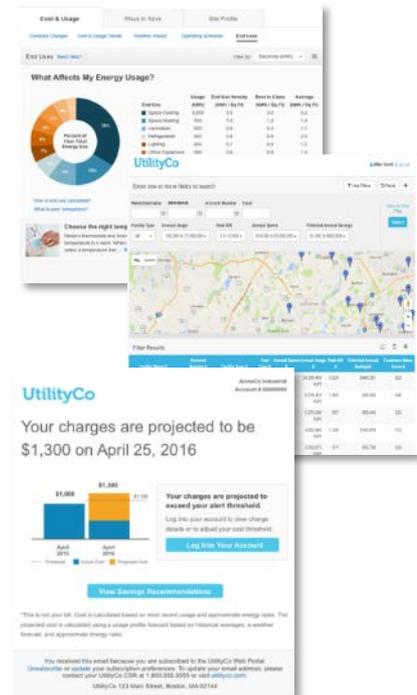
High Bill Alerts/Forecast

DER / Solar / Storage

## SOFTWARE/SAAS



### E. CLOUD APPLICATIONS



# MY WORK IN ENERGY DATA ANALYTICS: ADVISING FIRSTFUEL SOFTWARE

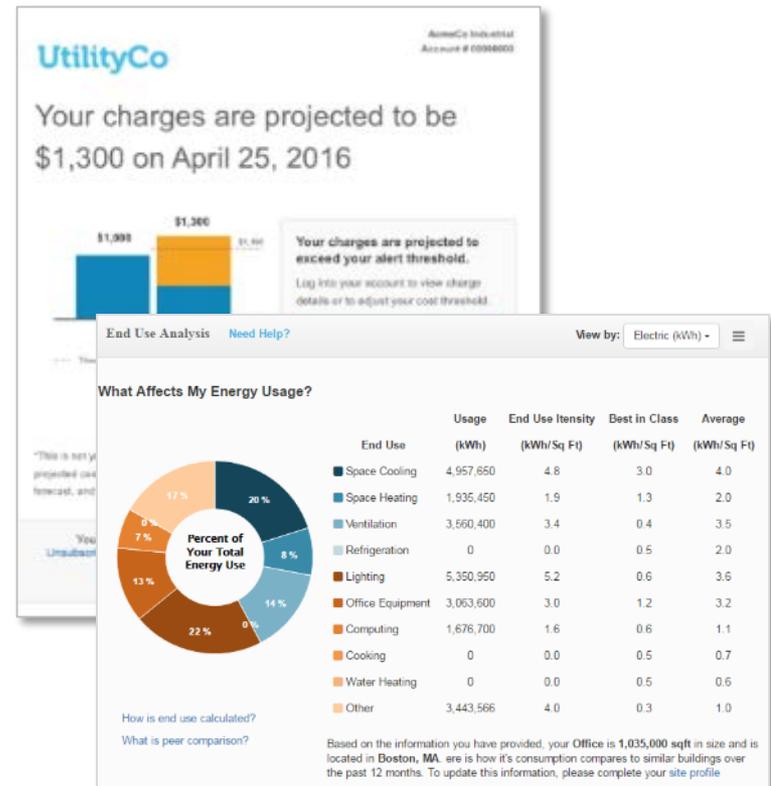
**About FirstFuel:** B2B customer engagement leader

**Client Base:** PG&E, Exelon, EDF, 30+ utilities

**C&I Customers:** 4.5M customer meters in database

**Expertise:** Deep energy profiling via meter data analytics

# FIRSTFUEL

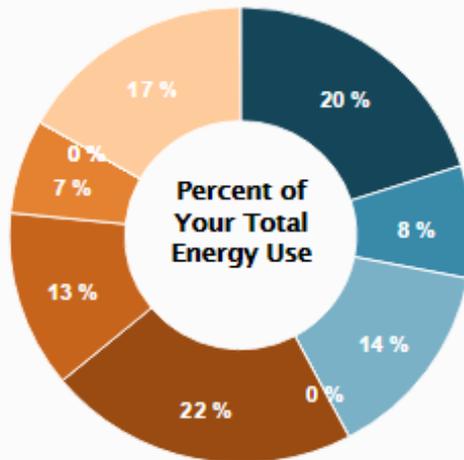


# END USE DISAGGREGATION

End Use Analysis [Need Help?](#)

View by: Electric (kWh) ▾ ☰

## What Affects My Energy Usage?



End Use	Usage (kWh)	End Use Intensity (kWh/Sq Ft)	Best in Class (kWh/Sq Ft)	Average (kWh/Sq Ft)
Space Cooling	4,957,650	4.8	3.0	4.0
Space Heating	1,935,450	1.9	1.3	2.0
Ventilation	3,560,400	3.4	0.4	3.5
Refrigeration	0	0.0	0.5	2.0
Lighting	5,350,950	5.2	0.6	3.6
Office Equipment	3,063,600	3.0	1.2	3.2
Computing	1,676,700	1.6	0.6	1.1
Cooking	0	0.0	0.5	0.7
Water Heating	0	0.0	0.5	0.6
Other	3,443,566	4.0	0.3	1.0

[How is end use calculated?](#)

[What is peer comparison?](#)

Based on the information you have provided, your **Office** is **1,035,000 sqft** in size and is located in **Boston, MA**. Here is how its consumption compares to similar buildings over the past 12 months. To update this information, please complete your [site profile](#)

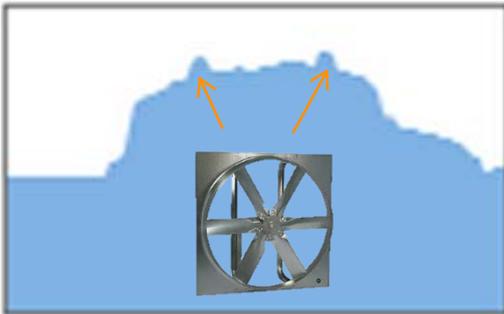
# ANALYTICS CASE STUDY: FEDERAL OFFICE BUILDING

**IDENTIFY OPPORTUNITY**

**PLAN AND ACT**

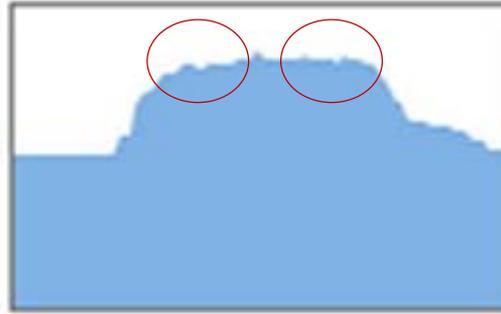
**TRACK SAVINGS**

**Month 1**



**“Consumption spikes”... are actually rogue garage fans**

**Month 3**



**Analytics informs building manager to modify controls and consumption spikes disappear**

**On-going Tracking**



**Energy savings: 6.9 GWh  
Bill savings: \$825,000**

# A TALE OF TWO BUILDINGS

CONVENTIONAL WISDOM: SIMILAR BUILDINGS, SIMILAR ENERGY PROFILES

## OFFICE BUILDINGS CHICAGO, IL

35,000 | Sq Ft | 33,000

1,500 | Daily kWh | 1,540

16 | Energy Intensity (EUI) | 18



# SIMILAR BUILDINGS, DIFFERENT SAVINGS OPPORTUNITIES

## BUILDING 1: REMOTE AUDIT



**\$8k**

Lighting Controls



**\$11k**

HVAC / Plug Controls



**\$7k**

Unoccupied Area Cooling

## BUILDING 2: REMOTE AUDIT



**\$8k**

Lighting Retrofit

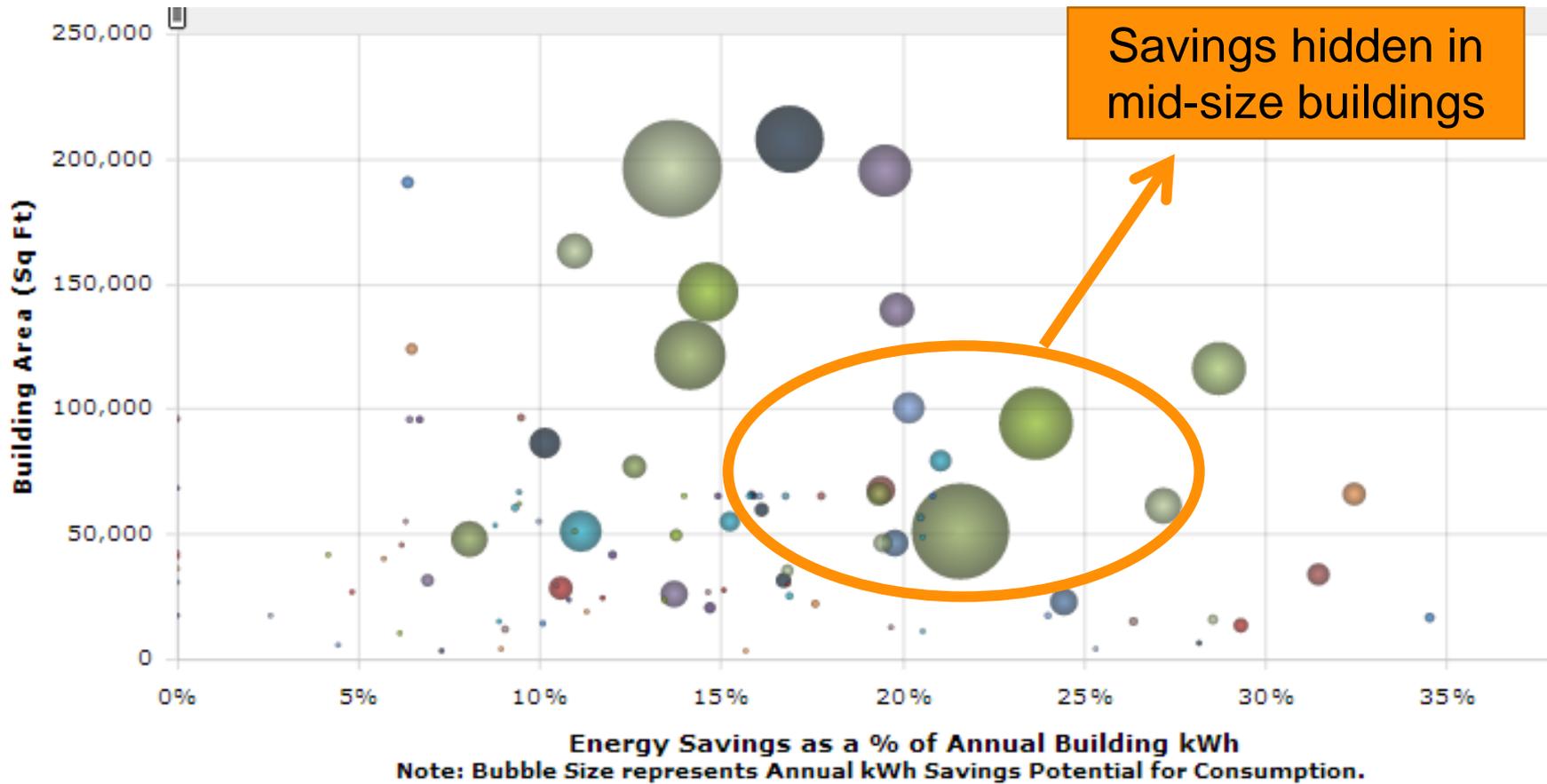


**\$7k**

Building Controls

# CASE STUDY: DEPARTMENT OF DEFENSE

Technically Validated Remote Audits



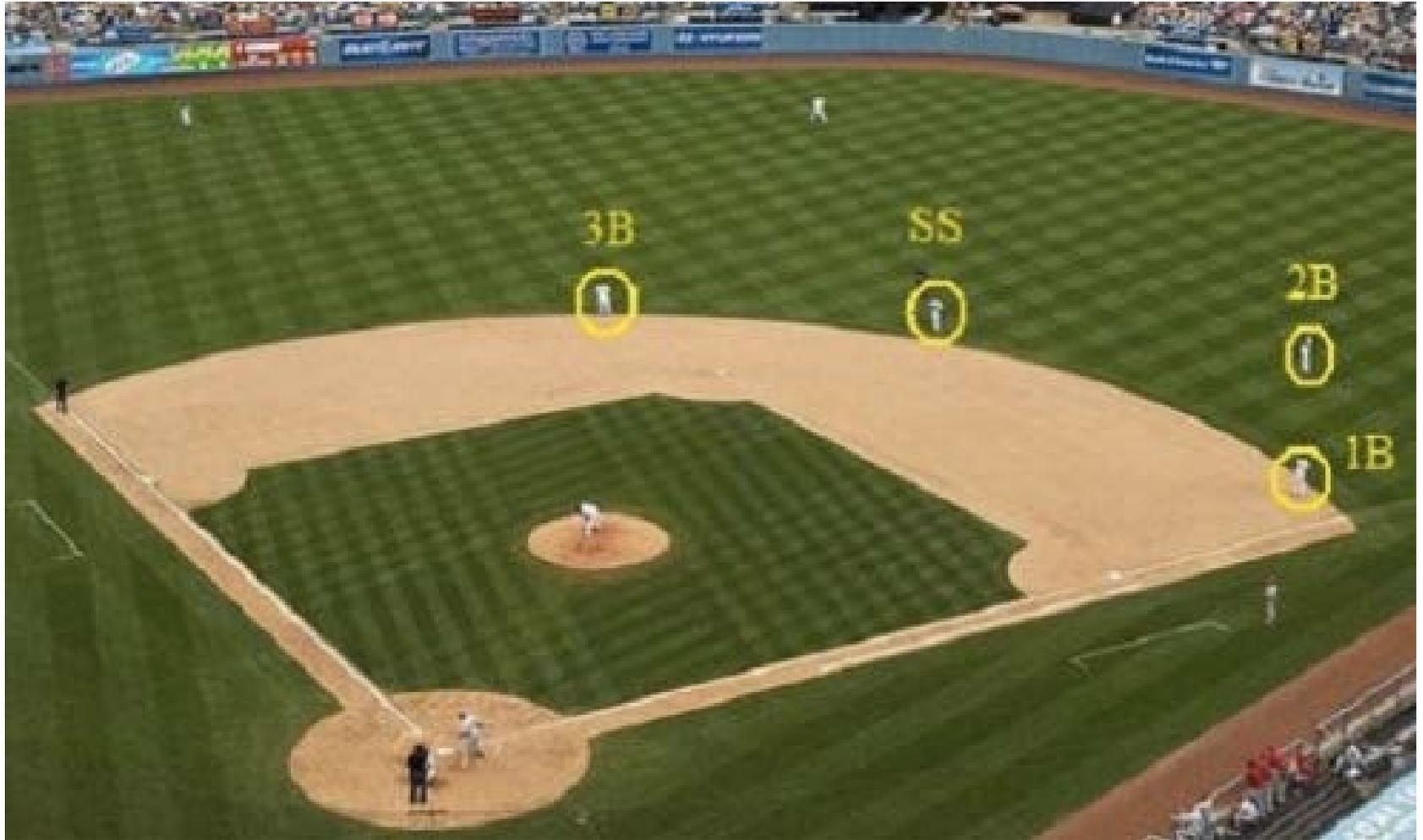
# TAKEAWAYS

**ANALYTICS IS A BIG EFFICIENCY OPPORTUNITY, ESPECIALLY FOR SMALL BUILDINGS.**

**UTILITIES HAVE A BIG ROLE TO PLAY IN CUSTOMER EDUCATION.**

**SMART METER DATA CAN MAKE “DUMB” BUILDINGS “SMART” AND “SMART” ONES EVEN SMARTER.**

# ANALYTICS CHANGES THE GAME



THANK YOU



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# Energy Storage:

## The Critical Hub for a Clean Energy Ecosystem



Energy  
Storage  
Association

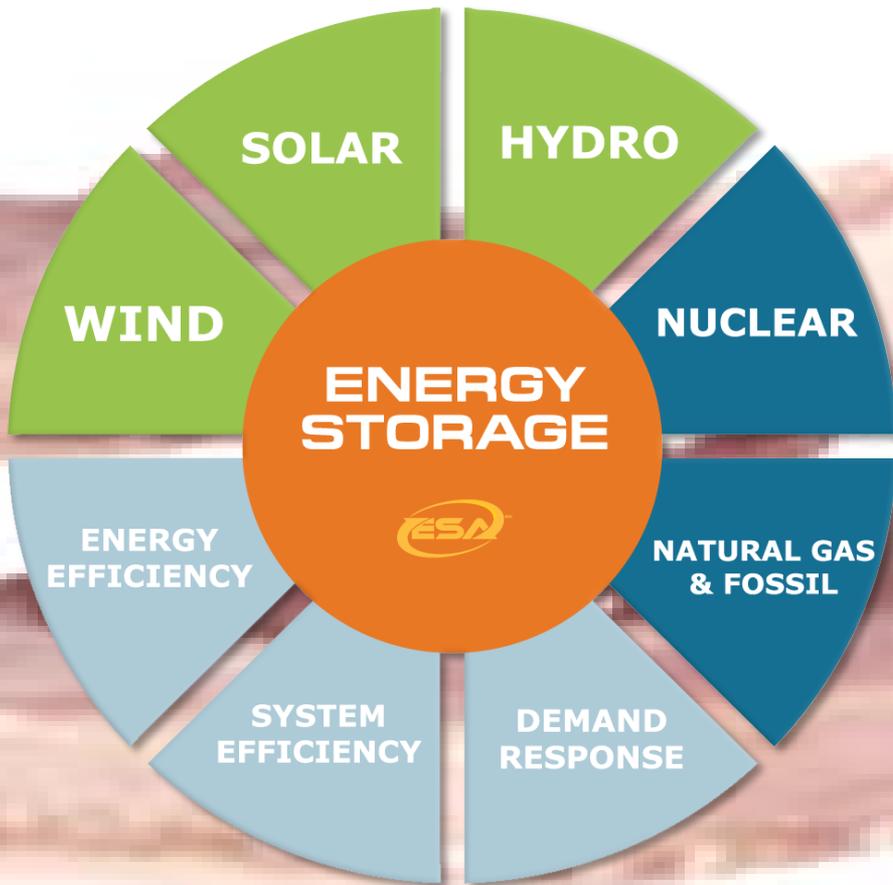
[www.energystorage.org](http://www.energystorage.org)

# ESA represents a diverse group

ESCO	IPP	Electric Utilities
Financiers	Developers	Installers
Manufacturers	Component Suppliers	Integrators
Legal Entities	Insurers	System Support

# ESA represents a diverse group



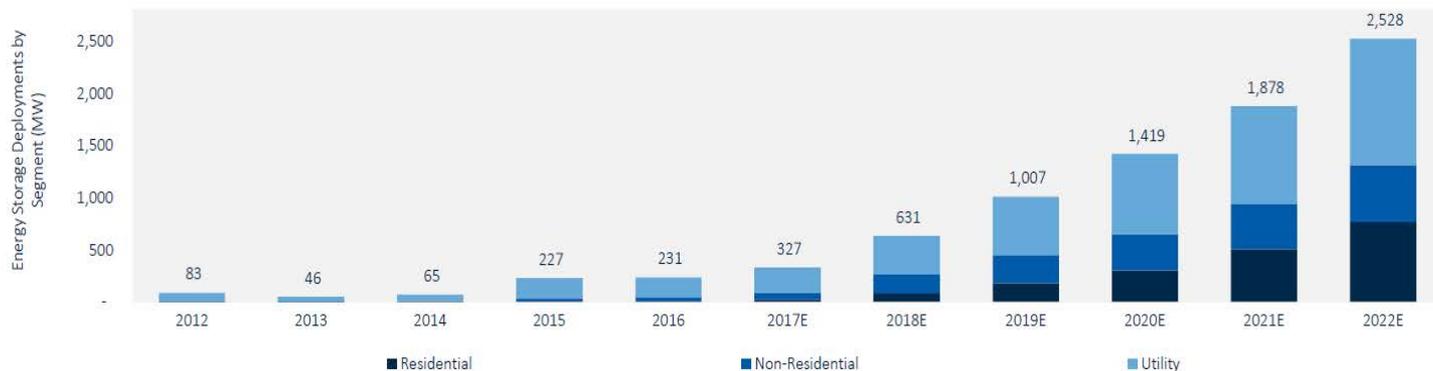


**Storage  
makes  
everything  
better.**

# Battery installations are growing

**IN THE U.S.** annual installation in 2020 expected to be 1400 MW—  
**7x** installation in 2016

U.S. Annual Energy Storage Deployment Forecast, 2012-2022E (MW)

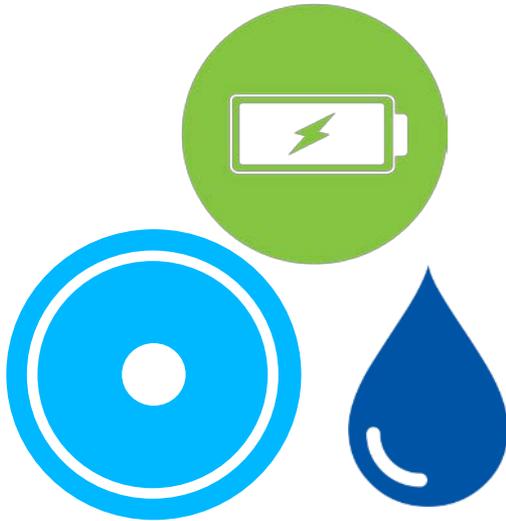


Customer-sited storage to rise from 19% to 50+% of annual capacity **by 2022**

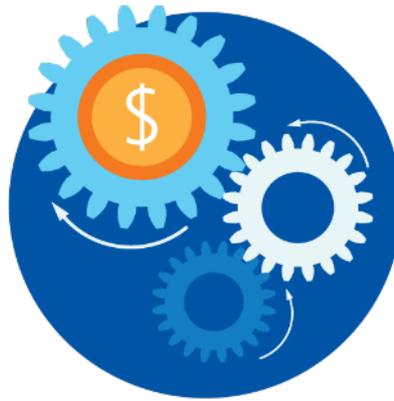
U.S. market sales of battery storage to top \$1 billion annually **by 2019**

Source: ESA/GTM

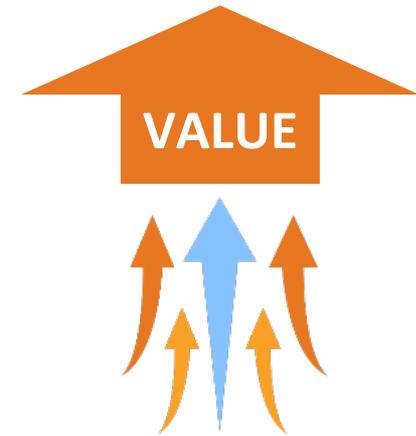
# Why is storage so attractive?



Multiple  
technologies



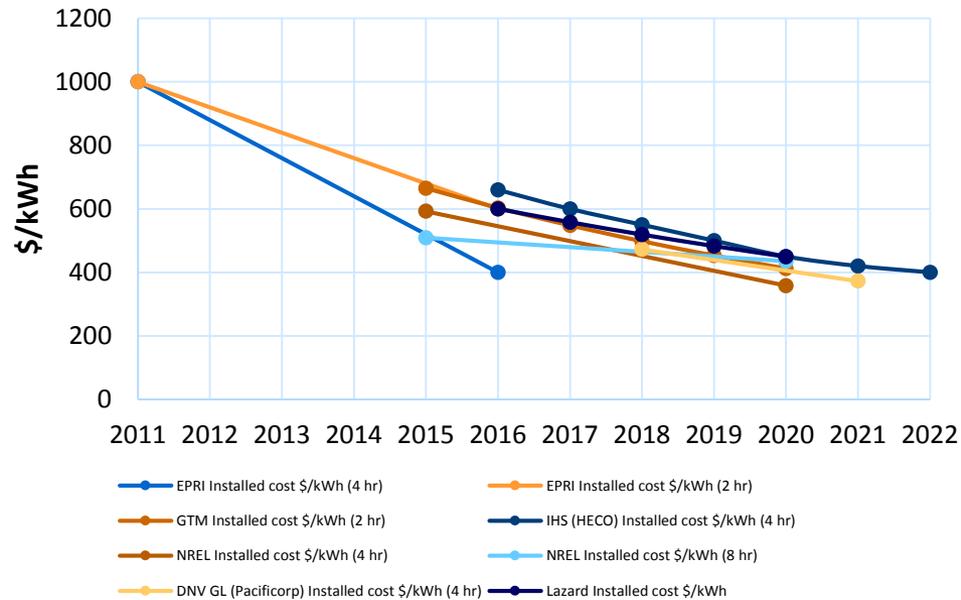
Cost  
Effective



Multiple  
Value streams

# Steep cost declines

Li-ion battery grid storage Installed costs estimates



## TEP (AZ)

30 MW, 4-hr storage

+ 100 MW solar

**\$0.045/kWh**

## KIUC (HI)

20 MW, 5-hr storage

+ 28 MW solar

**\$0.11/kWh**

# Value of storage for consumers

## Operational savings

- Peak reduction
- Power quality (Volt VAR)
- DER firming

## Reliability & Resilience

- Backup power
- Microgrid islanding

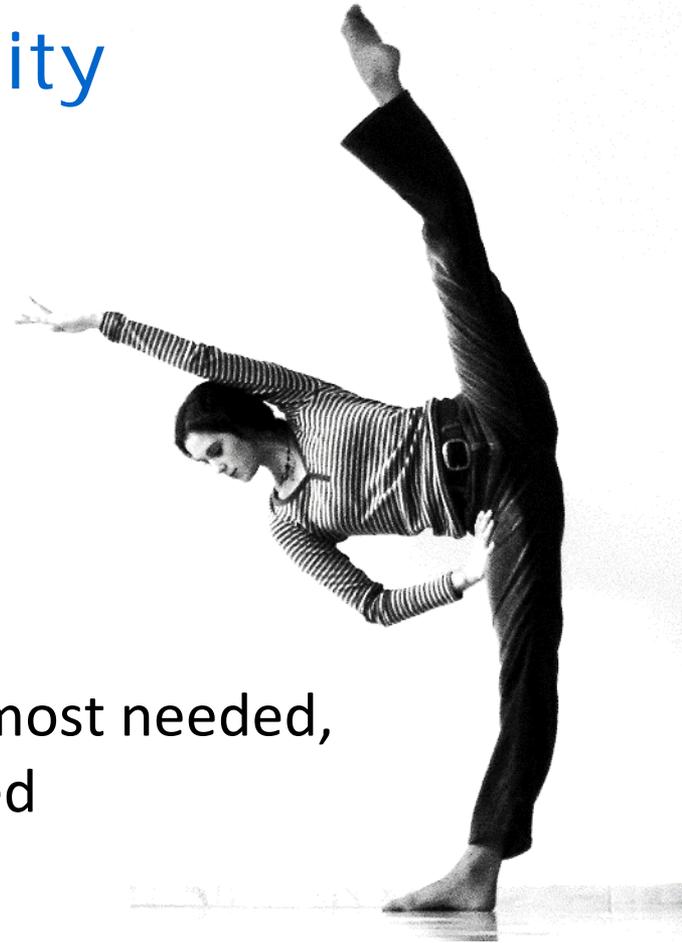
## Ancillary services revenues

- Frequency regulation/response
- Load following
- Ramping
- Curtailment
- Congestion mitigation
- Black start

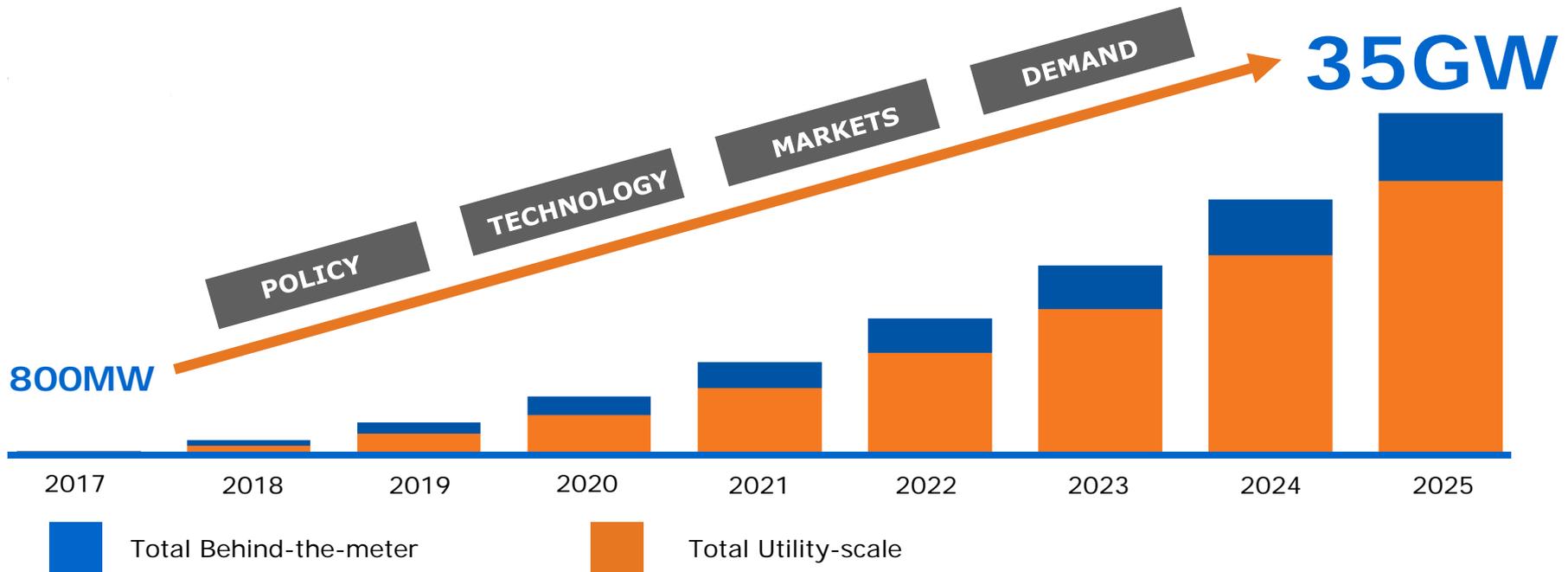
Stacking the full  
value  
of multiple services

# Energy Storage = Flexibility

Use electricity exactly when (and where) it is most needed,  
regardless of when it was generated



# Transforming the power sector



# Thank you

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CEO

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Energy  
Storage  
Association

[www.energystorage.org](http://www.energystorage.org)