



Invenergy

**FutureFund**

**Energy Innovation:  
*Optimizing Infrastructure Through the Application Layer***

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# Invenergy



**16**

years in business



**\$20B**

Capital  
raised



**800+**

Employees



**16,000+**

megawatts  
of energy in  
production



Wind



Solar



Battery  
Storage



Natural Gas

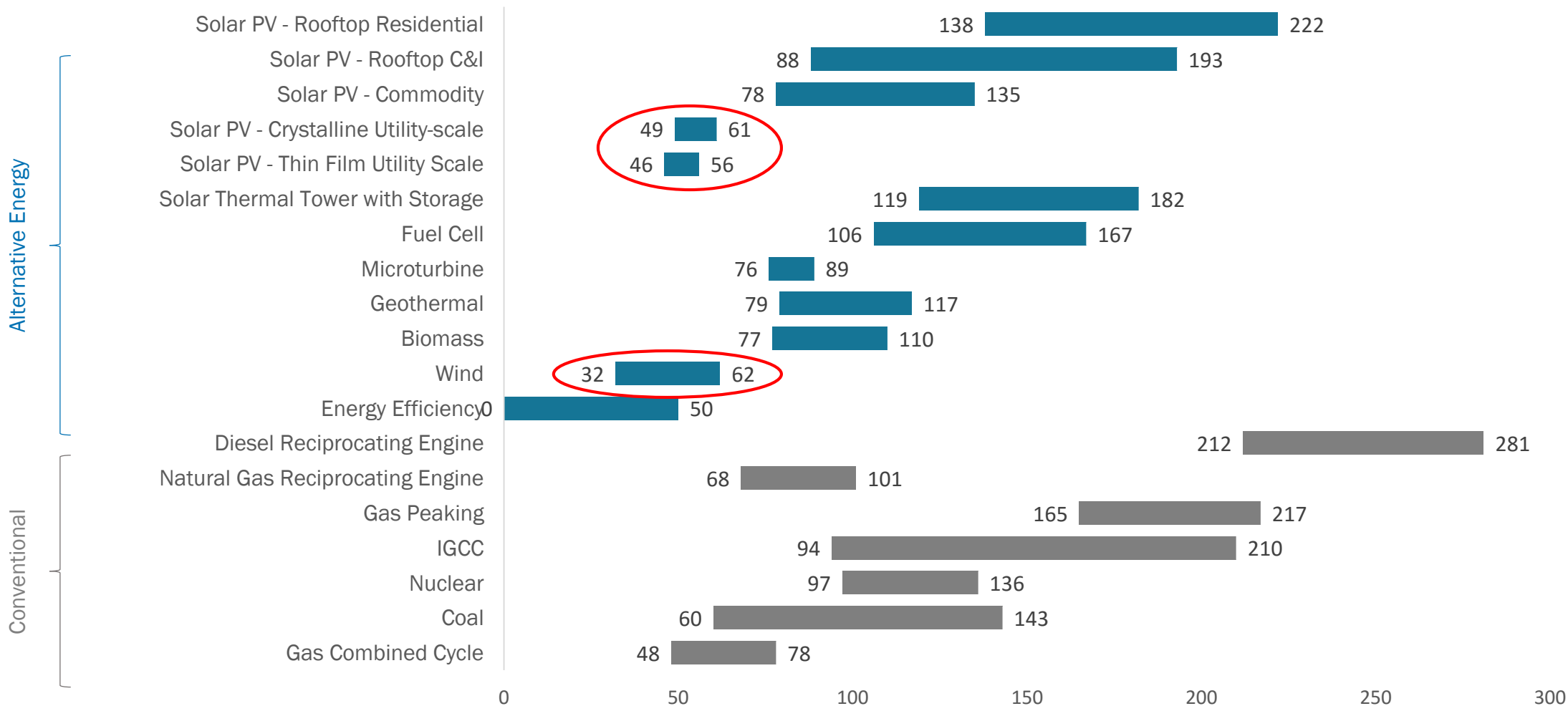


# Update: Clean Energy

# WIND & SOLAR BEATS FOSSIL & NUKES



## Unsubsidized levelized costs of energy (LCOE)



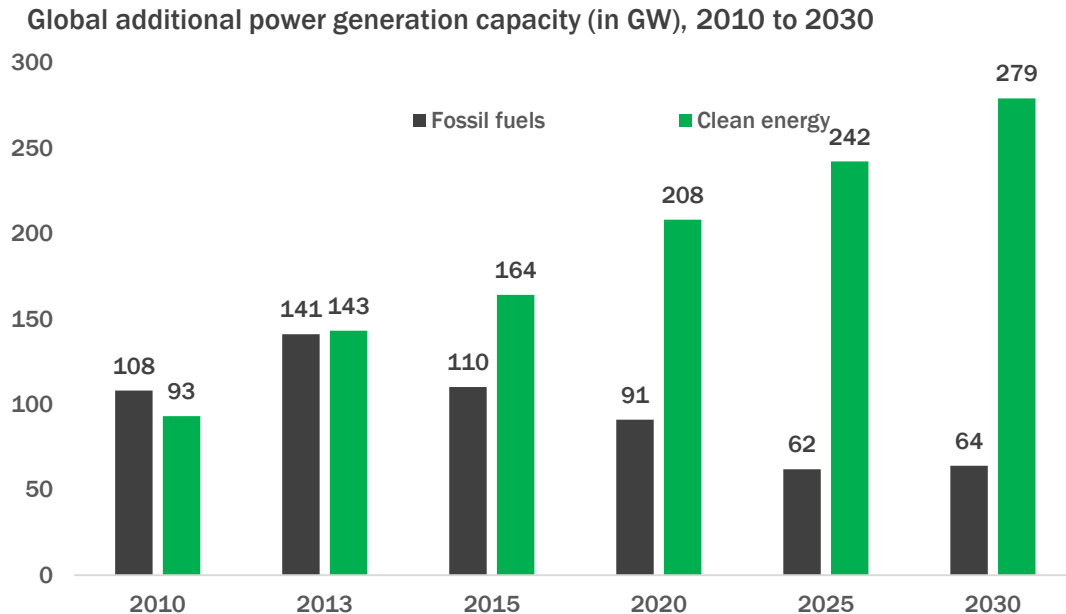
Source: Lazard Levelized Cost of Energy Analysis, Version 9.0. Published December 2016. Unsubsidized figures exclude the U.S. Federal Investment Tax Credit and Production Tax Credit. These values do not take into account potential social and environmental externalities or reliability-based considerations (i.e. transmission).

# CLEAN ENERGY TRANSITION UNDERWAY



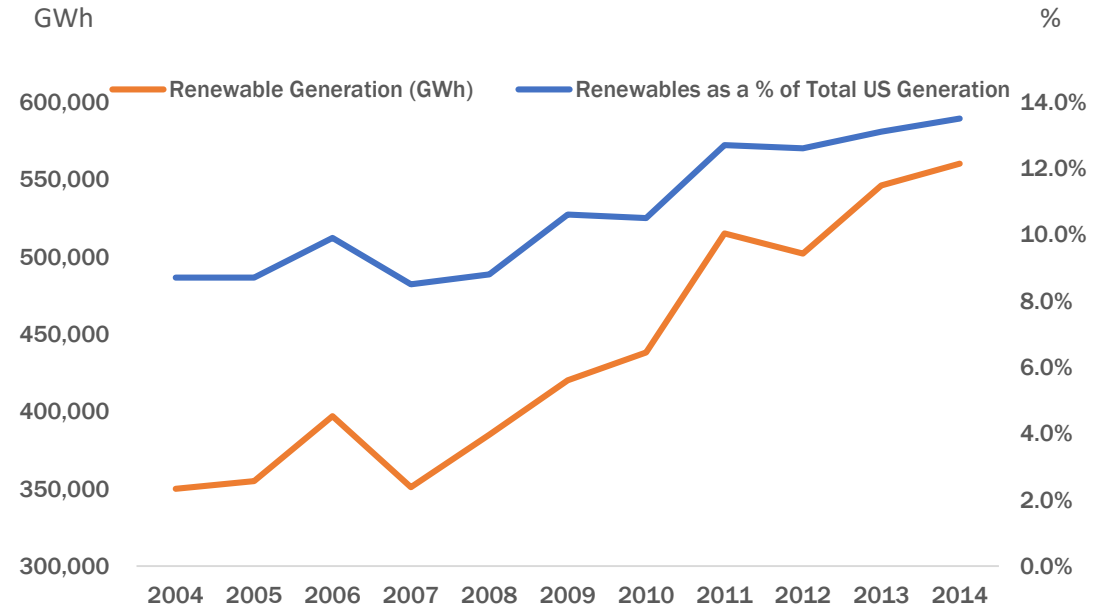
The continuous decline in renewable energy costs is **accelerating a new form of infrastructure investment**

## FOSSIL FUELS AND RENEWABLE POWER GENERATION



Sources: BNEF, New Climate Economy  
Values beyond 2013 are estimates

## RENEWABLES LEADING THE TRANSITION



Sources: EIA, LBNL, SEIA/GTM, US Department of Energy.  
Includes generation from CSP and grid-connected PV; assumes a 25% capacity factor for CSP and an 18% capacity factor for PV

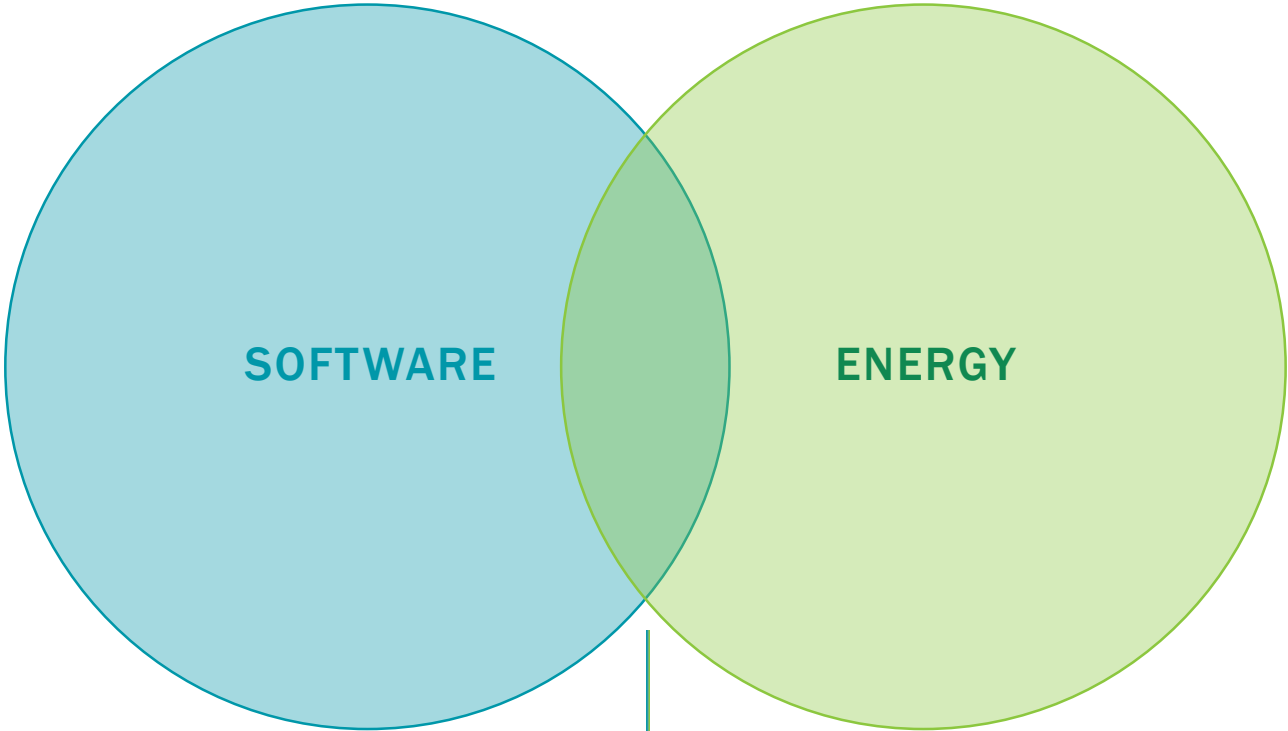


# **Energy 2.0:** the Digital Application Layer.



# ENERGY 2.0: DIGITAL APPLICATION

Significant investments in distributed and modern energy infrastructure enable the **growth of the digital application layer.**



**Our 5 Application Layer Verticals fit within this growing overlap**

## Characteristics of Application Layer Opportunities

- Capital light
- Integration of hardware & software
- Scalable from energy into other industrial verticals

# WHAT IS ENABLING THE APPLICATION LAYER?



Converging trends are strengthening the capabilities of the energy application layer.

## ✓ Enabling Industrial Internet of Things (IIoT) Trends



## ✓ Enabling Software Trends

**71%**

price decline  
per sensor  
from 2004–2020

**50%**

annual growth in  
IIoT apps,  
analytics and services,  
versus 15% for hardware and connectivity

**90%**

price decline  
in data storage  
since 2005

**30B**

IIoT sensors sold  
annually by 2020,  
up from 6 billion in 2010.  
60% of devices are for the  
enterprise

**\$203B**

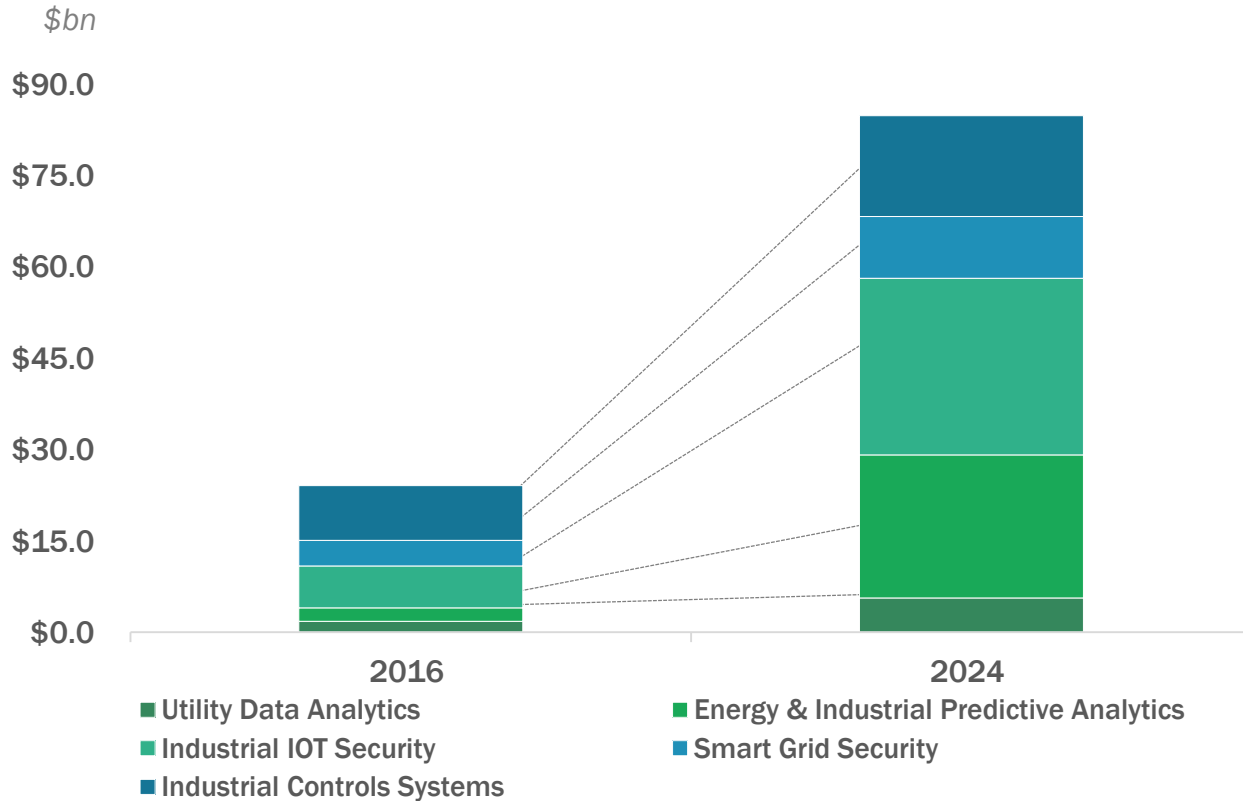
cybersecurity  
market size by 2021,  
up 66% from 2015.  
Cybersecurity is seen as  
the primary impediment to IIoT



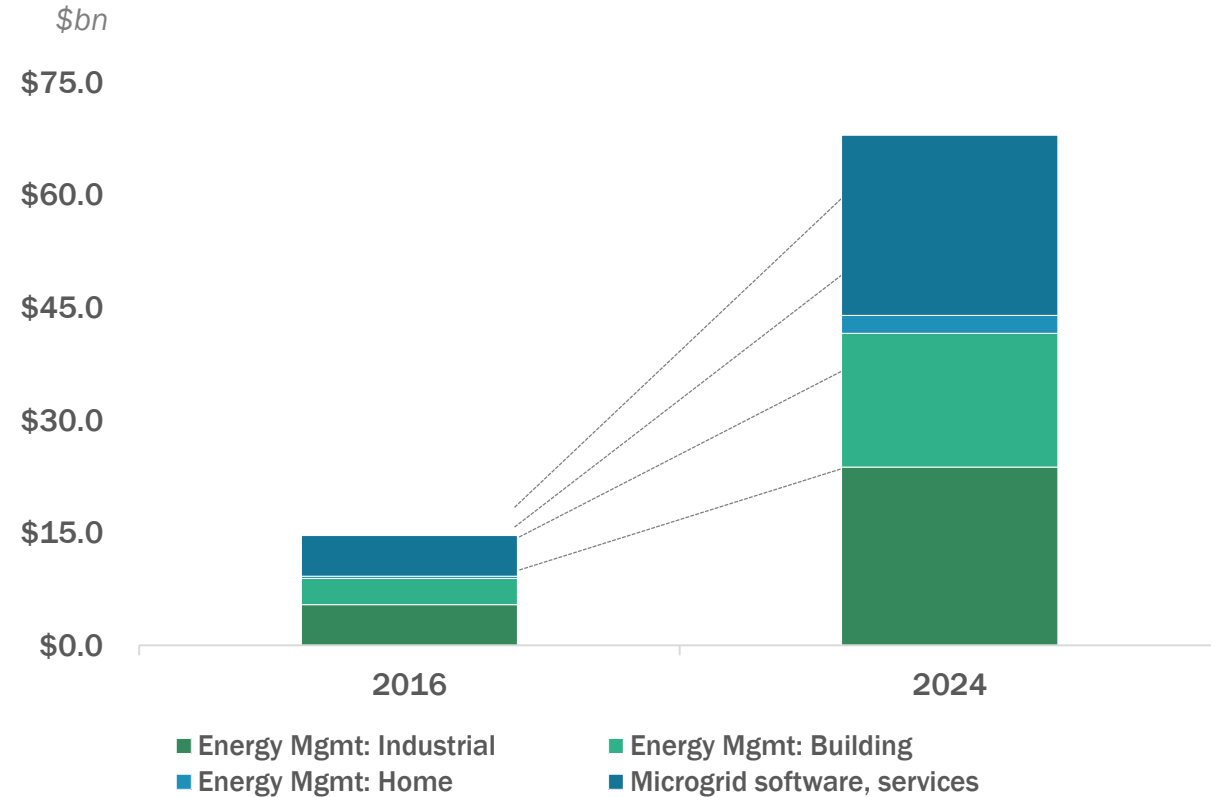
# DATA AND DISTRIBUTED RESOURCES GROWING FAST



## DATA ANALYTICS & CYBERSECURITY 3.5x Growth Over the Next 8 Years



## DISTRIBUTED ENERGY RESOURCE 4.6x Growth Over the Next 8 Years\*



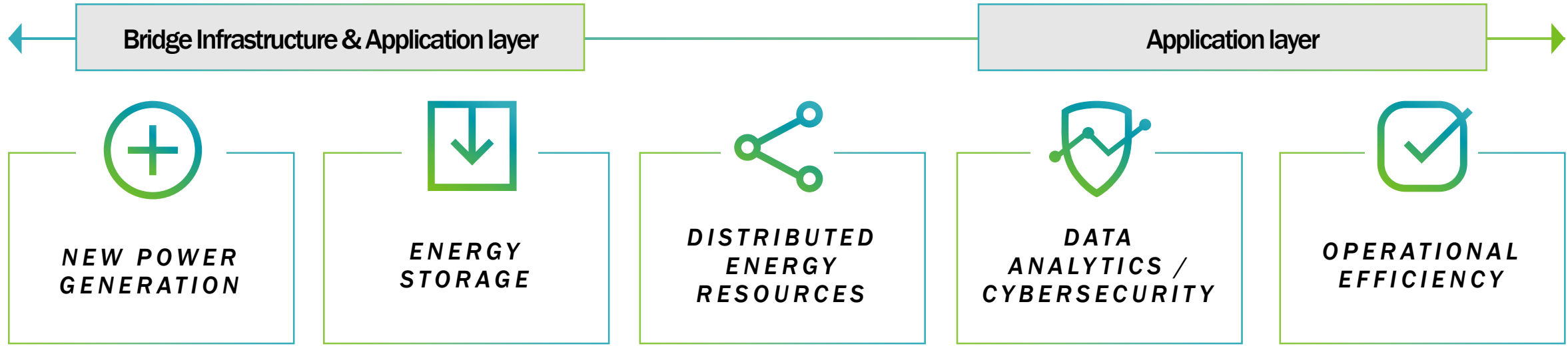
Sources: Grandview Research EMS; Markets & Markets Research EMS, Energy & Utility Analytics, Analytics of Things, ICS, Smart Grid Security; Memori Smart Buildings; Navigant Research Microgrid

Note: Currently excludes distributed solar and wind software applications



# KEY VERTICALS

Technologies that make energy more **reliable, affordable & secure**





# **A Deeper Dive:** **Data Analytics in Energy**



# BIG DATA: WHAT'S THE BIG DEAL?



Hypothesis: **greater data quality, more powerful processing engines, smarter computation algorithms, and more accurate conclusions can lead to better outcomes.**

Reality: businesses are struggling to organize the data. **As the volume, velocity, and variety of data continue to grow exponentially, finding valuable insights leading to actionable steps remains a challenge** for many asset-heavy industries.

In the **transition from centralized energy infrastructure to more dynamic, distributed, and digital networks**, data can be harnessed in three principal areas of operations:

## SYSTEM OPERATIONS

- Cybersecurity
- Enterprise-wide visibility
- Grid planning
- System monitoring
- System control & balance
- Business reporting
- Project planning
- Load aggregation
- Optimized demand management
- Fraud, theft, and loss prevention

## ASSET MANAGEMENT

- Condition monitoring
- Condition forecasting
- Predictive maintenance
- Trading & procurement optimization
- Enhance field operations
- Document management
- Minimize unplanned maintenance

## WORKFORCE & CUSTOMER

- Optimize maintenance & repair schedules
- Enhance workforce safety and compliance
- Institutionalize knowledge and insights
- Usage and behavior analytics
- Efficient customer segmentation



# POSITIONING: WHERE IS THE VALUE?



## COLLECTION

Structured Data

Unstructured Data

Edge

Hub

Single Source

Multi-Source

## TRANSFER

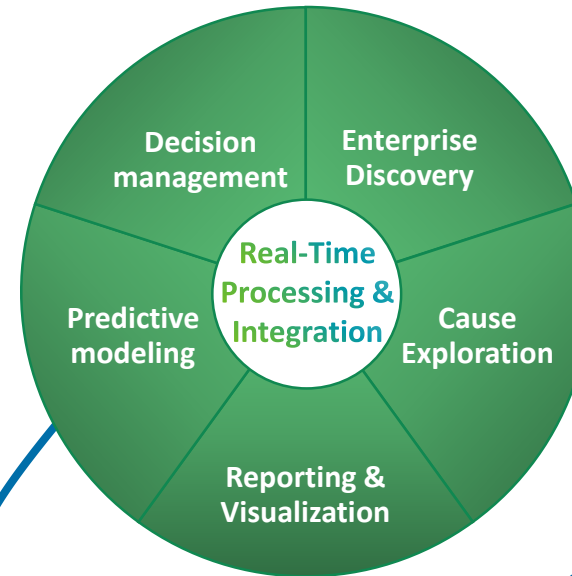
Edge

Cloud

Hub

Storage

## ANALYSIS



most fragmented area

most difficult gap

## INSIGHT

Situation Awareness

Context Awareness

Cognitive Process

*more easily commoditized*  
*more easily scaled across industries*  
*more "energy entrant" companies*  
*more hardware & system architecture focus*  
*more IT focus*

*harder to commoditize*  
*harder to scale across industries*  
*more "energy native" companies*  
*greater software focus*  
*more OT focus*





# POSITIONING: WHAT DRIVES ADOPTION?



## VALUE PROPOSITION

High powered computing resources can help make sense of vast amounts of structured and unstructured data, helping to optimize operations to **reduce operational costs** or **increase organizational revenue**

## TARGET AUDIENCE

In energy, companies with **expensive, complex assets** generating **vast amounts of data**, requiring **intensive maintenance** and management, in markets with **thin margins**, and with highly **localized operations**

## KEY PRODUCT ATTRIBUTES

Adoption (or trials) tend to be skewed towards solutions with **easily identifiable benefits** offering ease of integration and low upfront costs addressing **mission critical** issues

## MAIN BARRIERS

Principal barriers to adoption include: **fear, skepticism** about data and conclusion accuracy, and **reputational risk** for early adopters



**“Information is the oil of the 21<sup>st</sup> century, and analytics is the combustion engine”**

- Peter Sondegaard, Gartner Research

Trends to watch in Data Analytics over the coming quarters:

**1. A majority of the leading data analytics companies first launched their companies by serving other verticals.**

*Why it matters: Scaling start-ups have built solid product and service foundations before targeting energy, de-risking implementation and ongoing support for early energy customers*

**2. The core product solutions for data analytics companies are: predictive consumption, performance, and maintenance. These solutions drive asset optimization, risk mitigation, and greater systems intelligence**

*Why it matters: The software is built well for the energy industry requirements, as energy has: big datasets, expensive assets, increasingly complex & distributed operational models, extremely competitive environment*

**3. These software companies will likely have difficulty entering this market without an anchor partner!**

*Why it matters: The unique, and geographically-specific balance of each client’s asset & IT systems coupled with a lack of standardized IIoT protocols may hinder integration adoption speed versus other industries*

**4. Goal for data analytics companies is to tie into at least TWO parts of the organization**

*Why it matters: Software companies are getting smarter and realize that to be a truly valuable, and entrenched service provider to a big energy company, the software has to connect multiple groups within the organization and provide insights and increased revenue or cost greater cost savings for multiple teams*



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**Thank you!**

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