The Next Evolution Connected Buildings

IDEA2018 Conference

Agenda

- Market Trends
- Building Energy Management services
- Expanding Opportunities
- Advanced Grid Services

World of Energy

Utility Capacity Limits

CONVERGENCE OF ENERGY

Corporate Sustainability

Regulations and Policy

ACCELERATES EVOLUTION

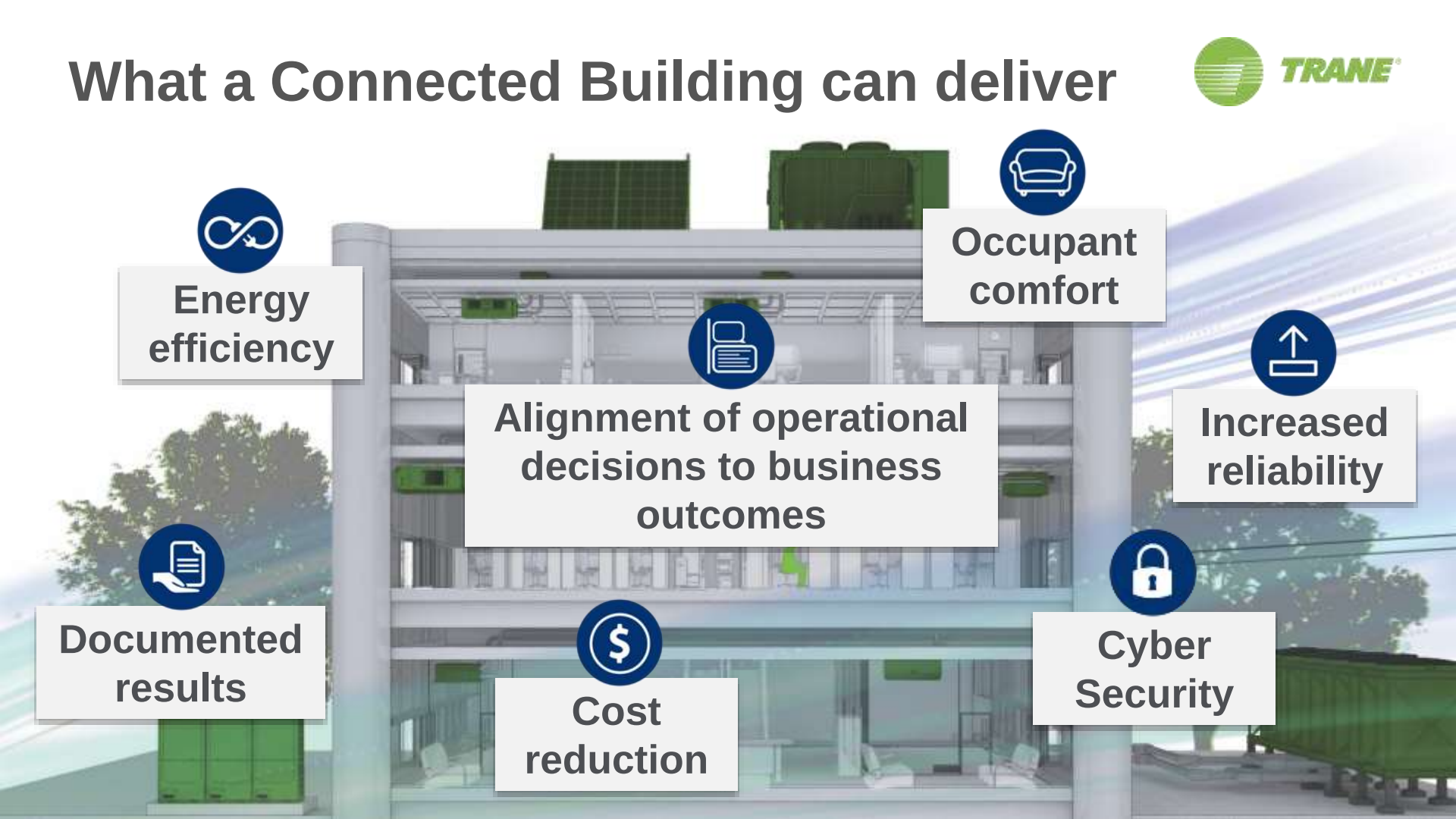
Internet of Building Things (IoBT)

EVOLVING EXPECTATIONS

Building Energy Consumption

BUILDINGS CONSUME +40% OF WORLD'S ENERGY; HVAC AND LIGHTING ARE MAJORITY

What a Connected Building can deliver



Building Energy Management Systems

Building Energy Management Systems (BEMS)

BEMS is an encompassing term for technology and service offerings that deliver business improvements, including cost savings and strategic capital planning, due to the more effective management of energy consumption and building operations.

Source: Navigant Research

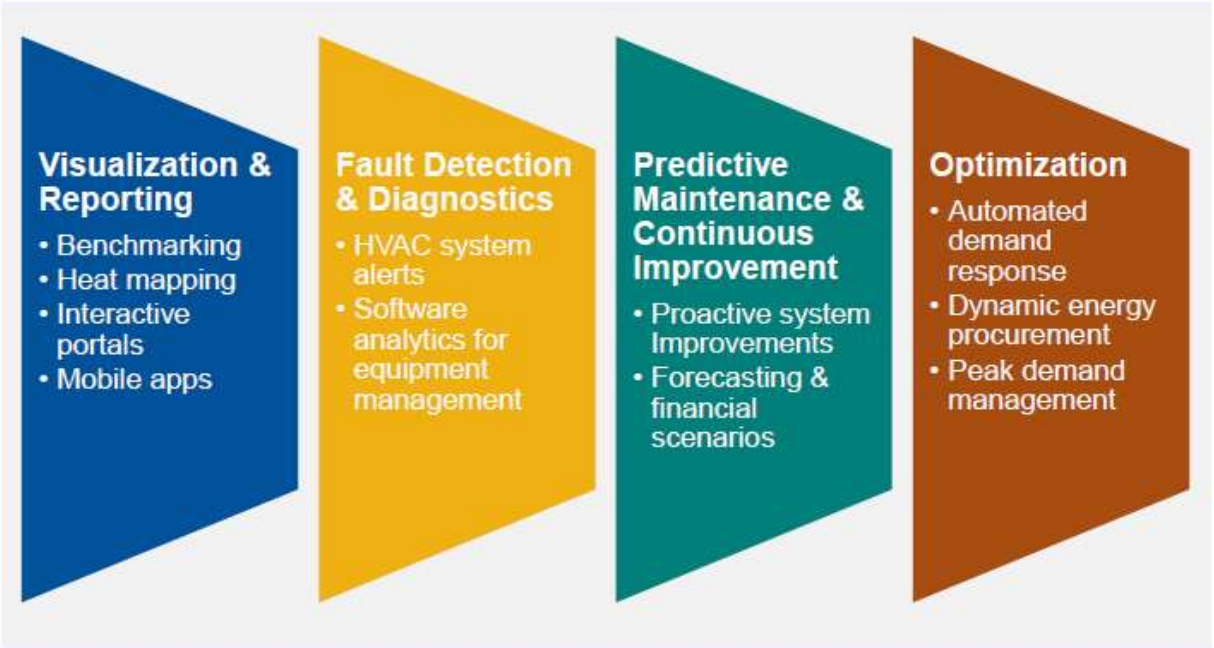
Hardware

Software

Services

What do these technologies deliver?

Figure 1.1 BEMS Offering Classes

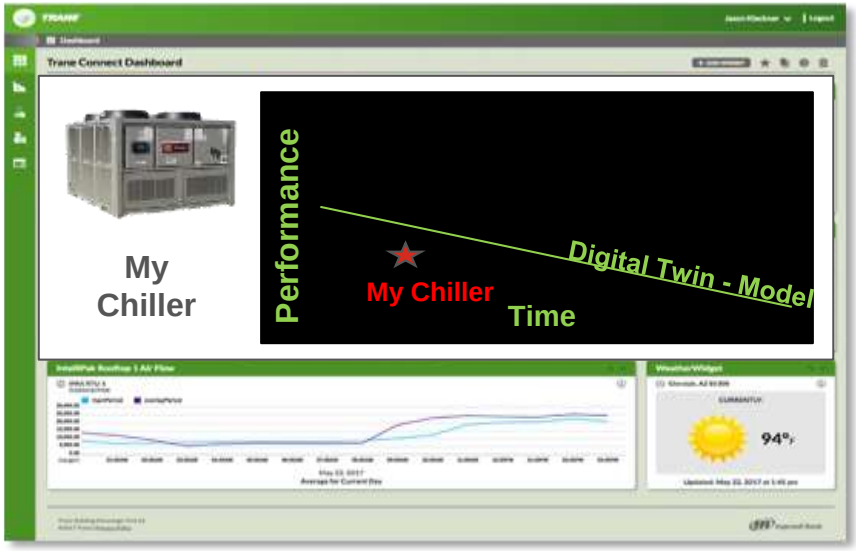


(Source: Navigant Research)

Optimization is becoming more POWERFUL!

Example: Predictive Maintenance

- Lowest Lifecycle Cost
- Digital Twin concept
- Digital Inspections



Cost savings & improved reliability!

Digital Facts

Connected Buildings

EXPAND OPPORTUNITIES

Other market drivers

- Energy Pricing
- System Design & Age
- Energy Supply Services
- Rate Redesign

Comprehensive approach

Identifying...

opportunities to be more energy efficient and sustainable by leveraging data and expertise —and then proving the payoffs with documented results

Energy conservation projects generate on average **20-40%* in energy reductions**

Selecting...

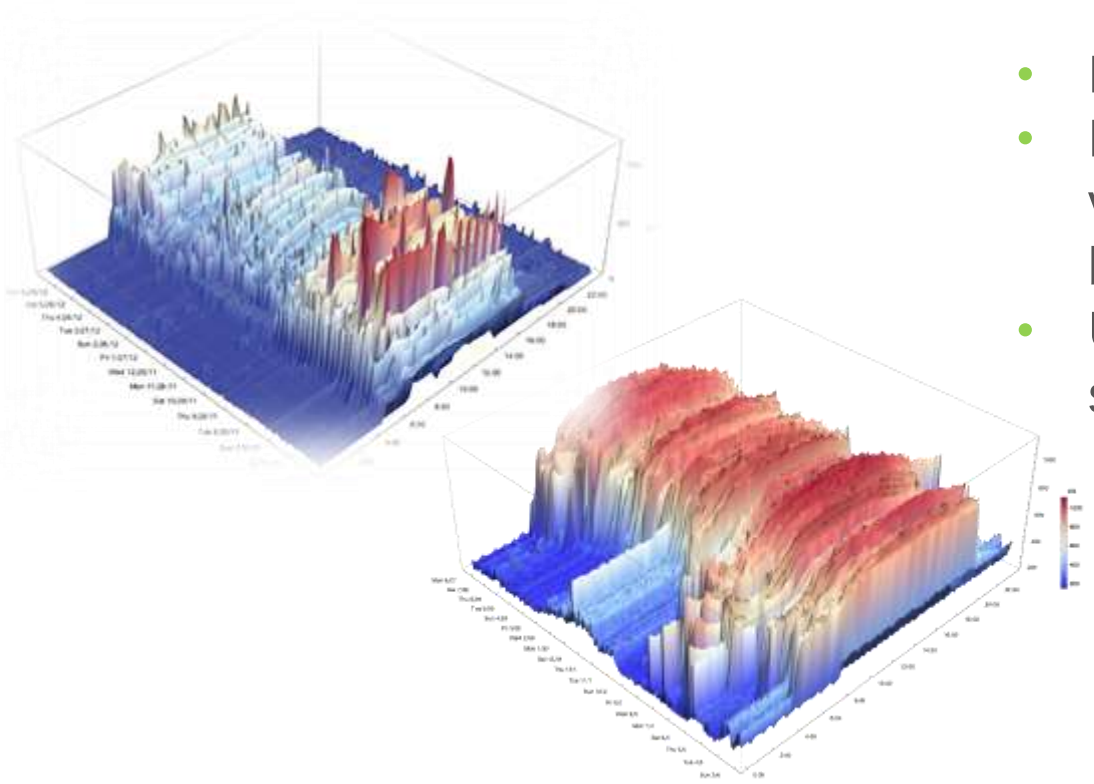
solutions based on deep customer understanding, industry leading modeling tools, data driven analysis and over hundred years of experience

Leveraging...

- Consultative Approach
- Data Driven Decisions
- Comprehensive Solutions
- Documented Results
- Financing Options
- Flexibility
- Scalability

*Energy savings estimates are based on past projects completed by Trane. Actual energy savings will be dependent on the building, geography and solutions provided.

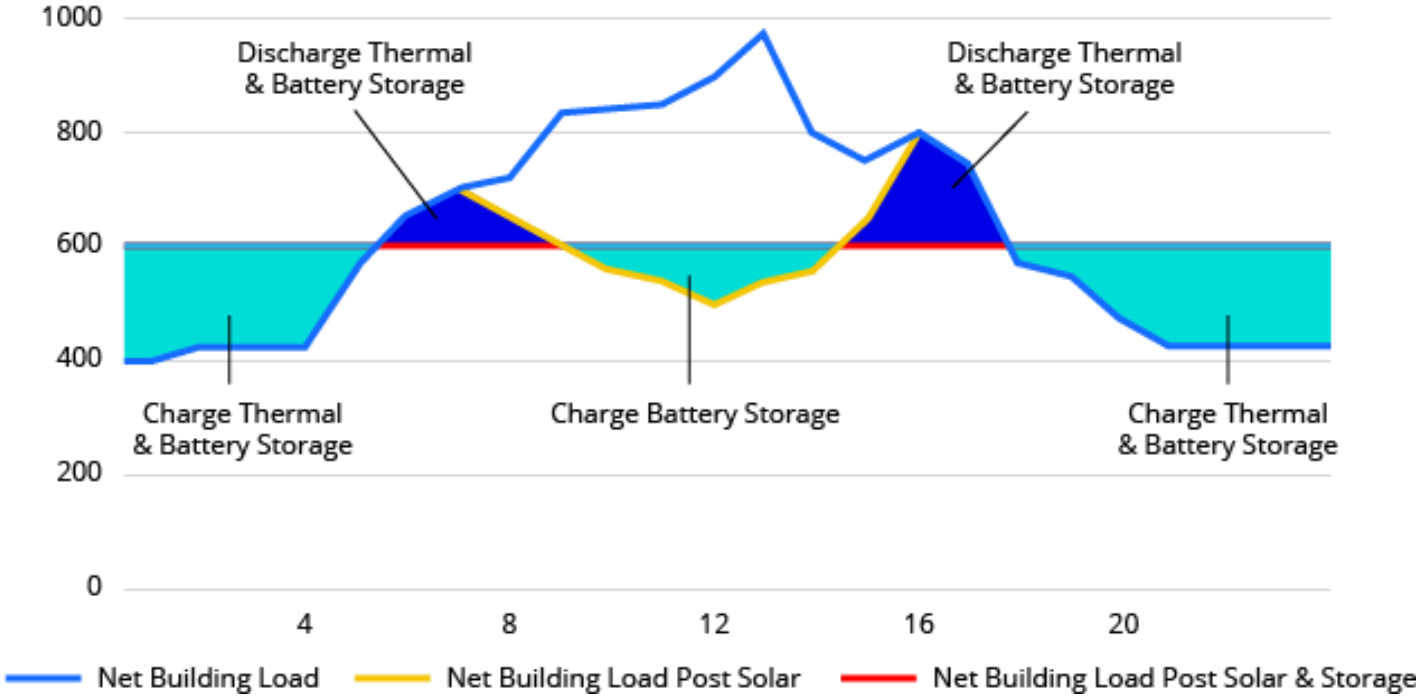
Leveraging Data & Analytics



- Baseline current customer usage
- Look for reduction opportunities via feedback from connected buildings data
- Use data model to predict savings impact

Optimize Buildings AND District Cooling Plant Performance

Peak load management



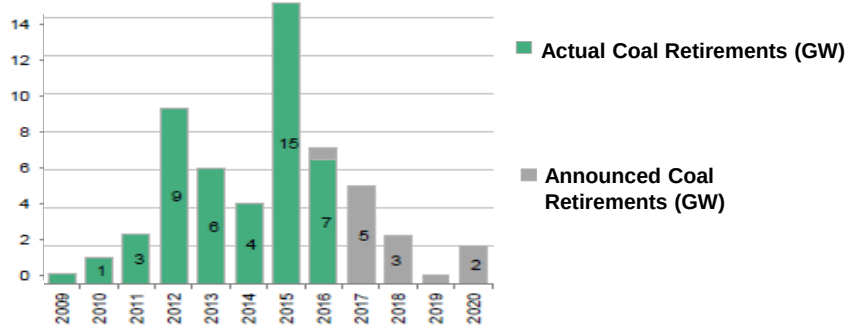
Thermal & Battery Energy Storage Allow for Greater Peak Load Shift Potential

Connected Buildings

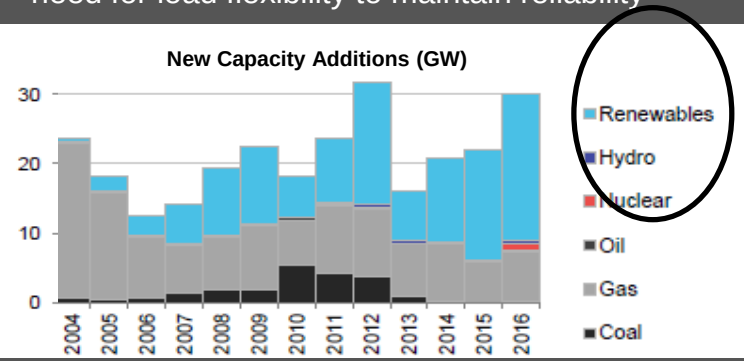
GRID SERVICES

Utility Industry Facing Transformation

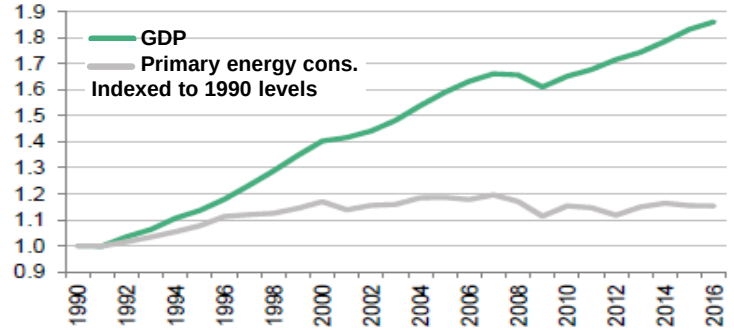
Aging infrastructure – wires & power plants – driving capital investments & rate increases



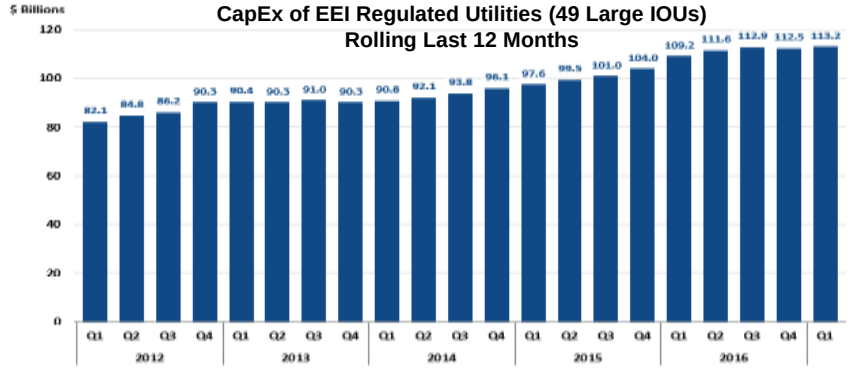
Growth of non-dispatchable generation (solar & wind) driving need for load flexibility to maintain reliability



Flat energy sales – but increasing peak loads – increases value of ability to shape & shift energy use



$190 Billion in Capital Expenditures by U.S. Utilities in 2017 – Growing to >$300 Billion by 2025



Sources: BNEF (https://data.bloomberglp.com/bnef/sites/14/2018/02/Sustainable-Energy-in-America-2018-Factbook.pdf);
EEI (http://www.eei.org/resourcesandmedia/industrydataanalysis/industryfinancialanalysis/finreview/Documents/FinancialReview_2016.pdf)

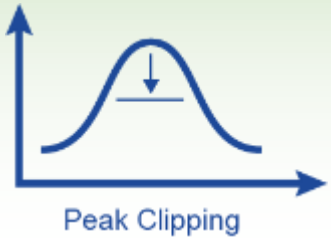
Building and District Plants Can Help

ENERGY EFFICIENCY

- Use less energy over time
- Unscheduled
- One-time incentives
- Not controllable

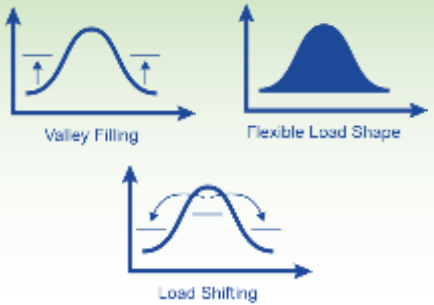
DEMAND RESPONSE

- Sacrifice-type curtailment
- Few times per year
- On/off



GRID RESOURCE

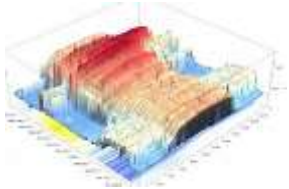
- No sacrifice of comfort / operations
- Utility dispatched
- Frequent / daily



Process and Solutions

Identify

Identify buildings and new solutions



Model

Model impacts

Activate

Connect, optimize, and control load as a grid resource

Monitor

Measure and Verify

Maintain

Maintain & Continually Optimize

QUESTIONS

IR Ingersoll Rand