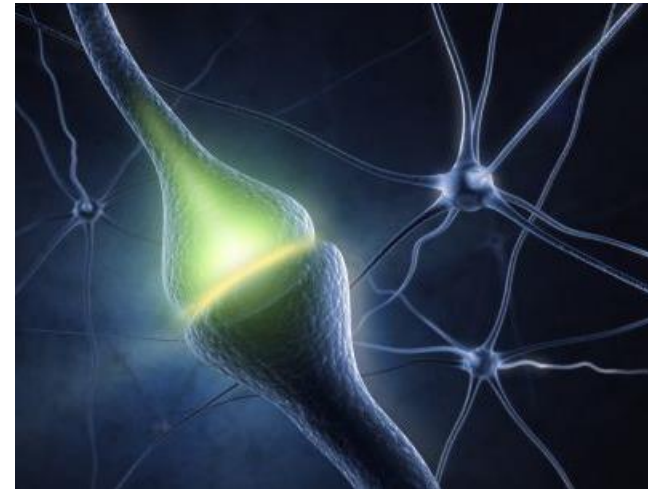
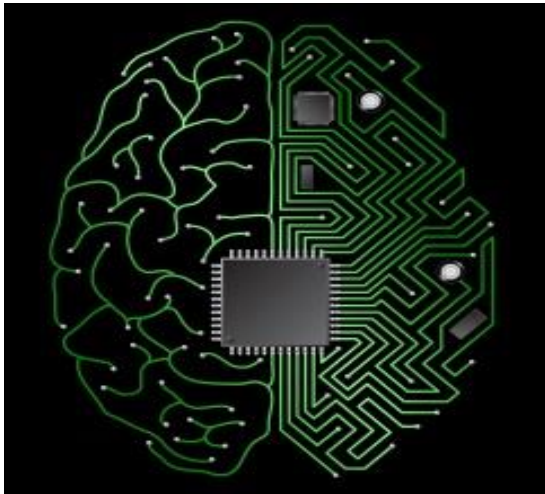


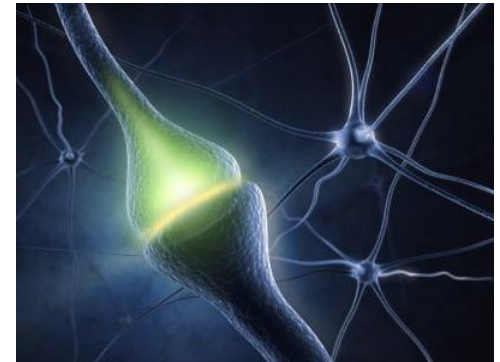
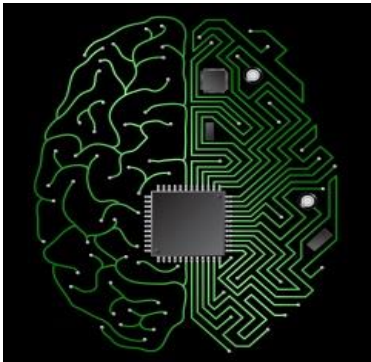
# Control and Management of Enabling Technologies



Tim Maurer  
Director, Energy Information Services  
Nxegen

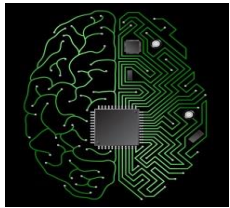
# Agenda

- Overview of *Smart*, Enabling Technologies
- The Why
- The How
- Examples – Current State & Future



# Overview of *Smart* Enabling Technologies

Enabling end-point interfaces to achieve economic dispatch strategies and meet obligations



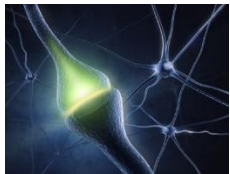
## **Brain/Software:**

Tracks Grid, Utility, Distributed Energy Resources and Costs



## **Neural Network/Protocols:**

Monitors Two-way Asset Connections and Status



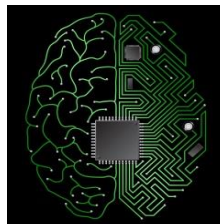
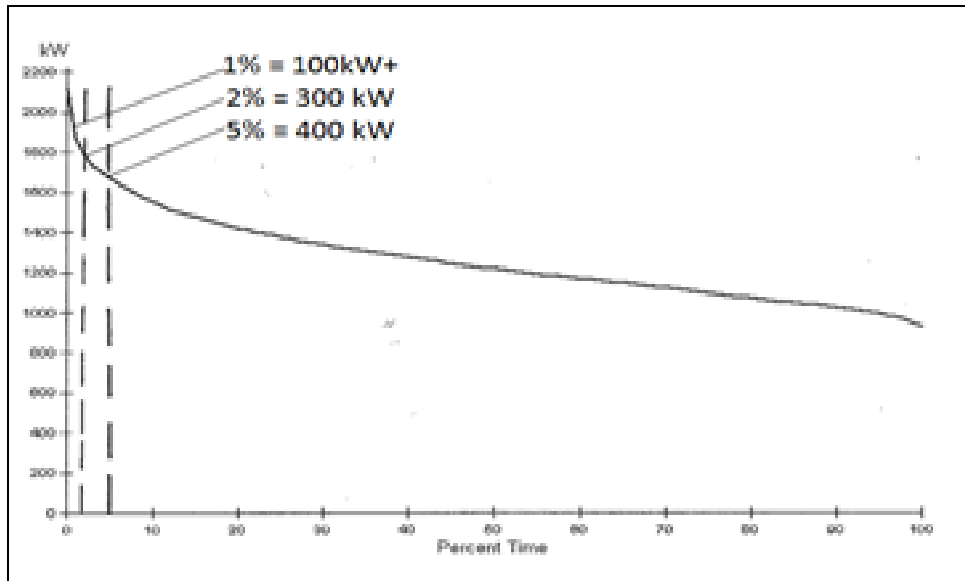
## **Synapse/Nodes:**

Affects RT Shed Signals for Economic Dispatch of End-Points

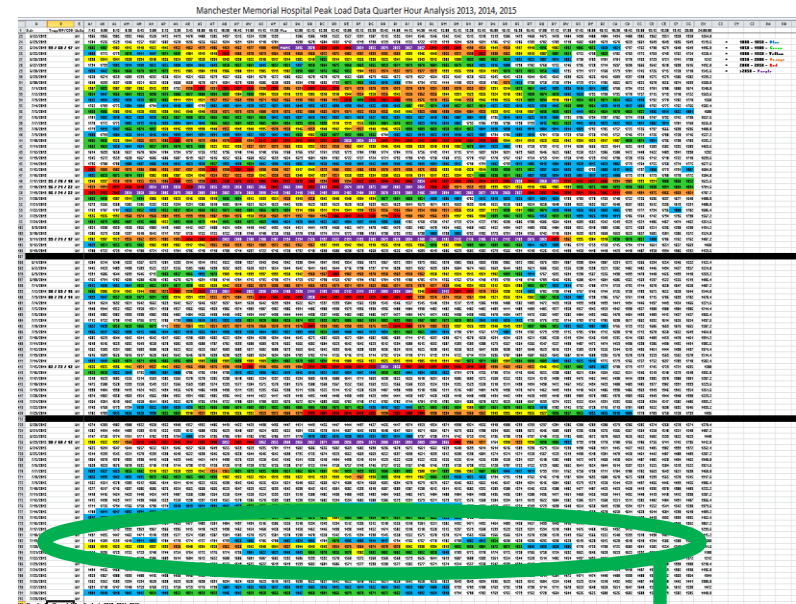
# The Why

## Operational Characteristics: Address Infrequent Peaks To Avoid Excess Demand Costs

Just 1%-5% of annual use causes very excessive and likely manageable costs



3 years of use shows peaking infrequency, including managing via BAS



Above 2000 kW



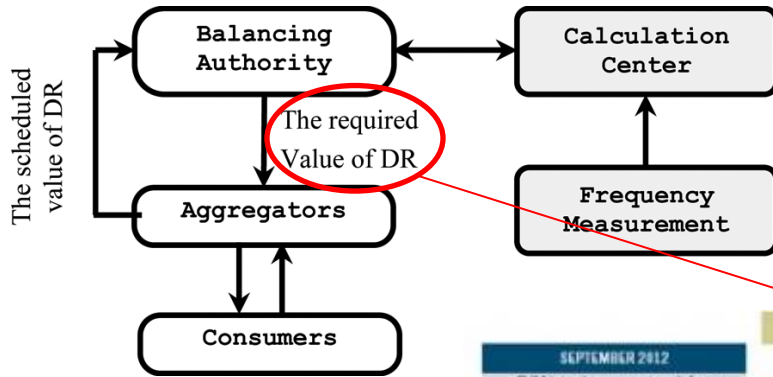
Above 2100 kW

Trend Logs  
Prove Limiting  
Is Achievable

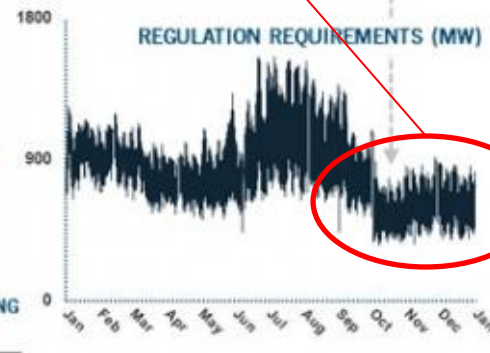
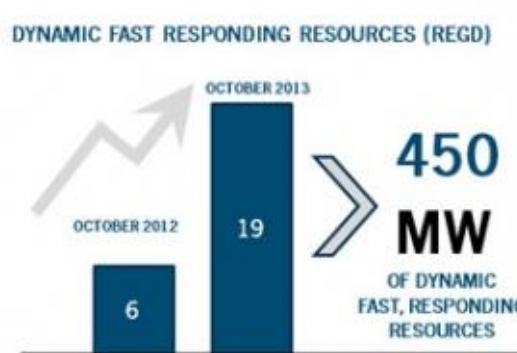


# The How

## Compensating Faster DR Based On Integration Will Balance Supply & Demand



Compensate active generation and controlled load adjusted to quickly balance and maintain/restore frequency



More Fast DR Resources = Less Regulation Requirements

PJM coordinates a frequency regulation through two different control signals:  
 RegD - fast moving dynamic regulation (e.g. batteries, flywheels)  
 RegR - Traditional regulation resources (e.g. single cycle gas turbines)



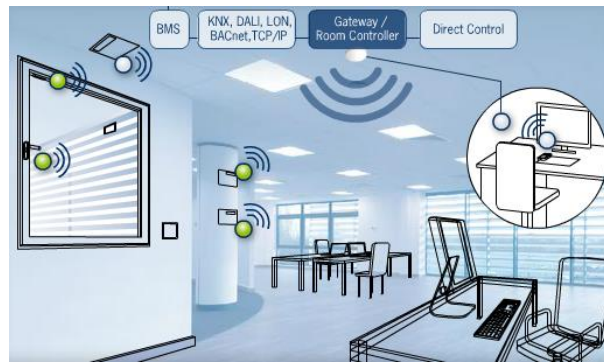
# The How

## Fast DR Requires Diverse Access Across All Markets

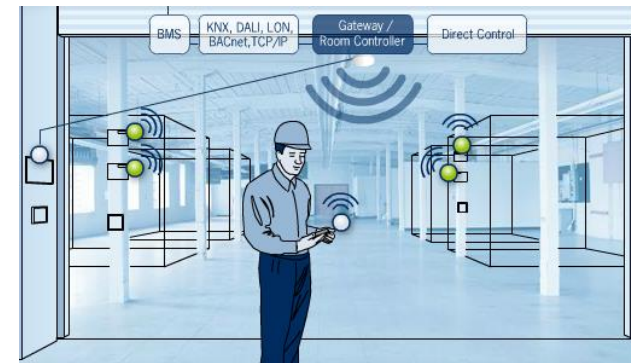
### Home Automation



### Intelligent Buildings



### Smart Manufacturing



# The How

## Diverse Communications & Controls Enablement



### Communications Protocols



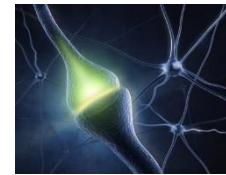
SNMP



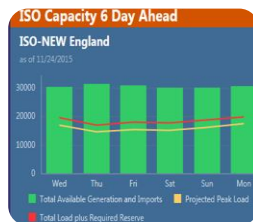
Web Services



enocean alliance



### Data Access, Visibility, Analytics and End-Point Control



### Software Integration

IoT, Protocols, Data, Analytics, Historian:

Cost, Schedules, Trends, Triggers;

Access and Visualization – Devices



### Control Systems



SCADA/PLCs

Energy Management Systems

Bluetooth / Wi-Fi HANs

### Equipment/DER



Chillers, Boilers, Ventilation

Lighting

Compressors

# The How

Monitor Supply, Demand, Reliability, Assets and COGS to Dynamically Manage Loads

Grid Analytics



Utility Analytics



Meter Data Analytics



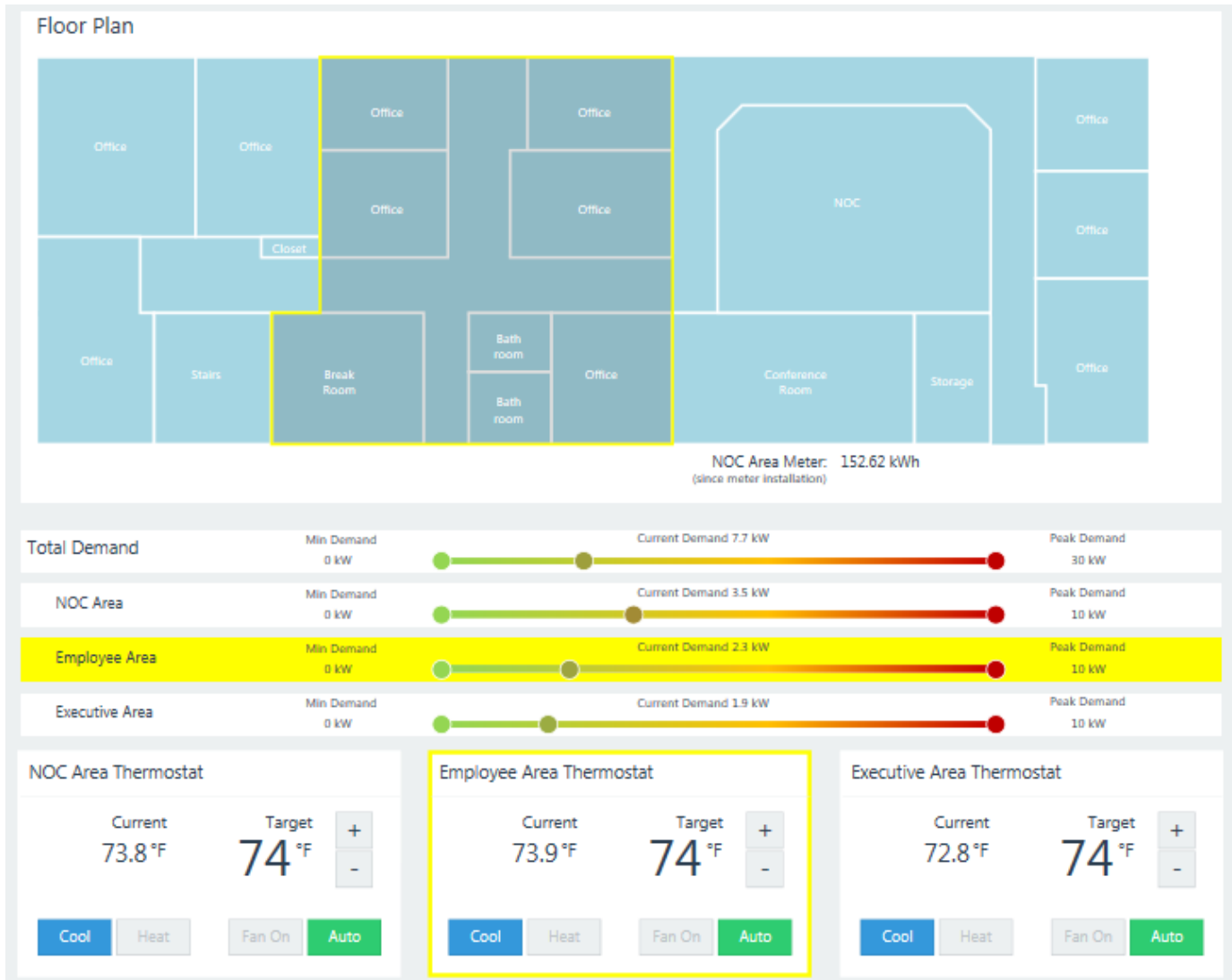
Asset Analytics





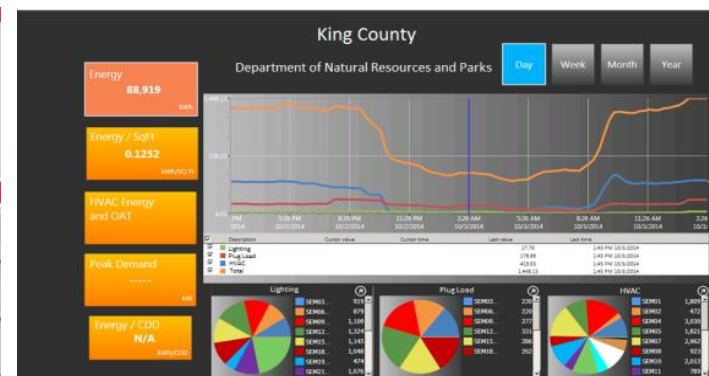
# The How

Integrated Building Automation and Load Monitoring, Involves Sub Metering, Asset Status and Controls



# The How

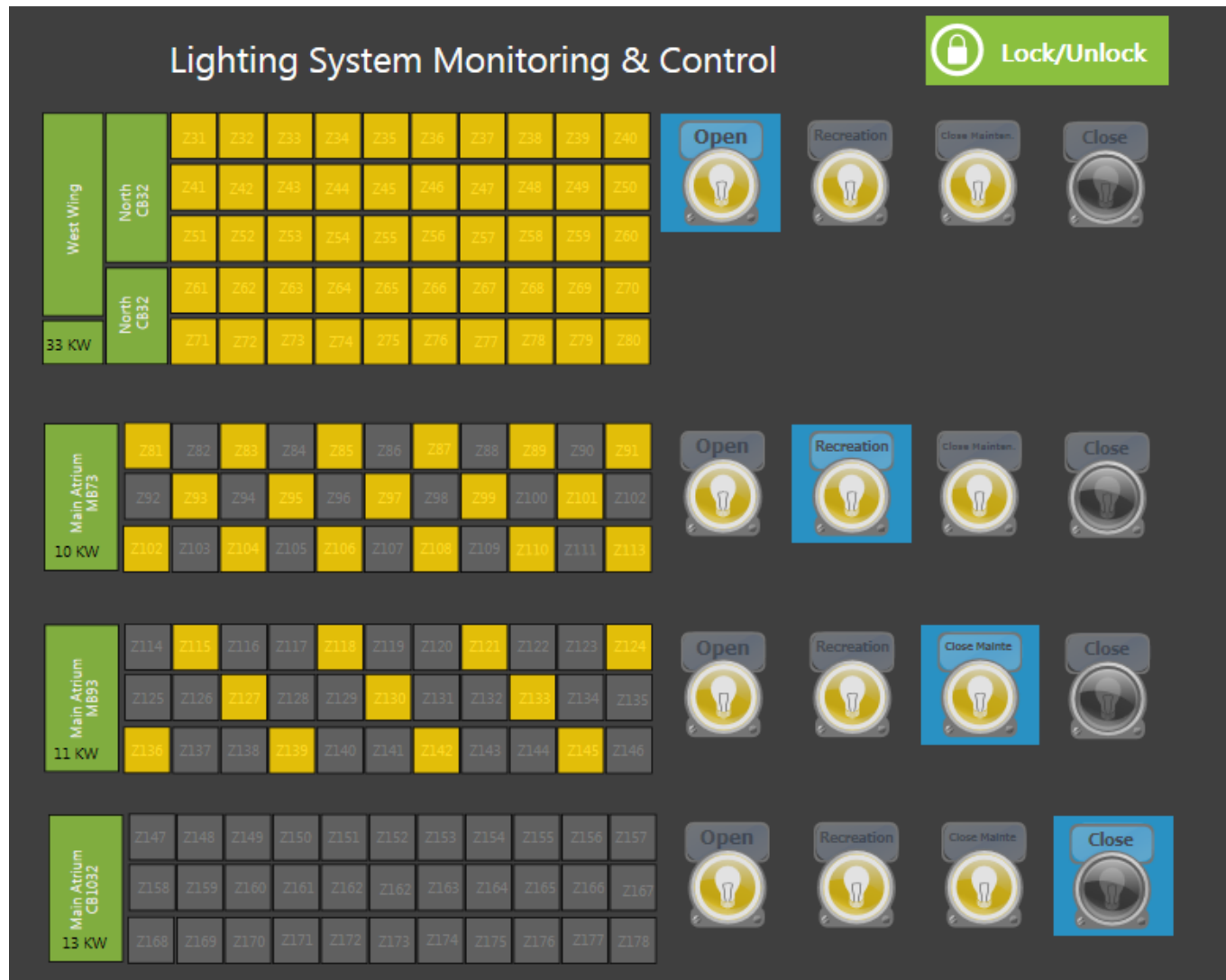
## Integrated Dynamic Load Management of Existing Controls



Source:  
NXEGEN & MacDonald Miller

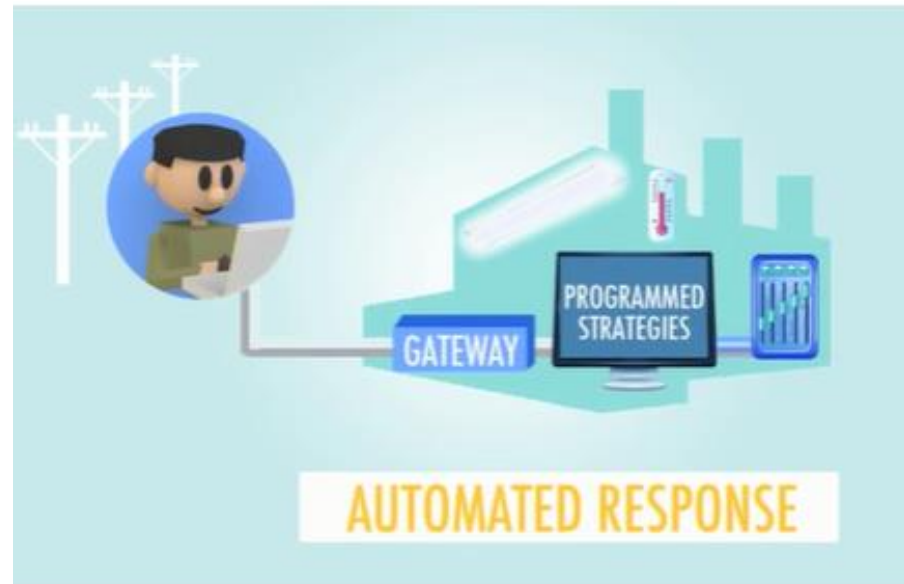
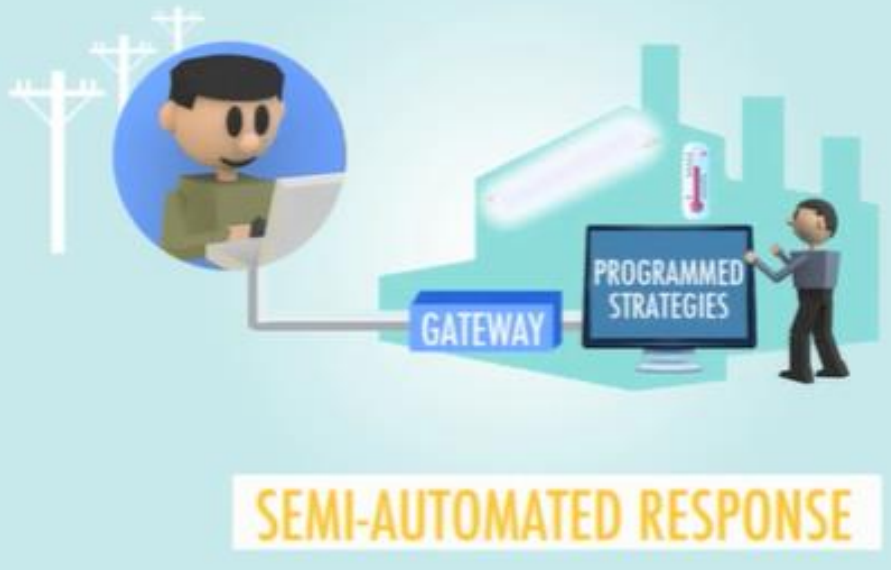
# The How

The Key is Offering Economic Dispatch Options for Varying Grid, Utility and Facility Financial Triggers and Durations

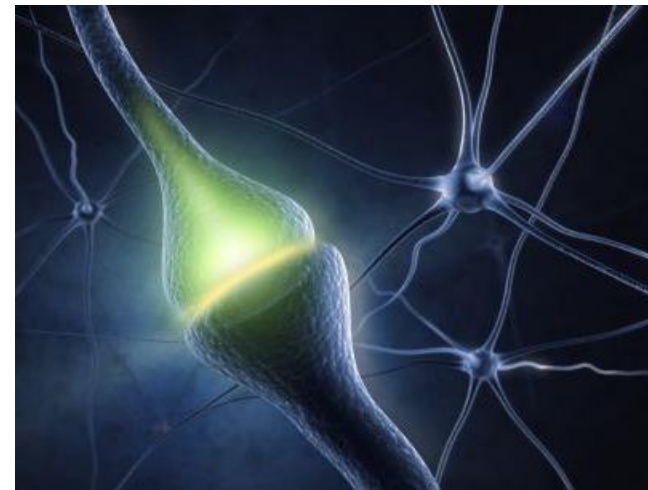
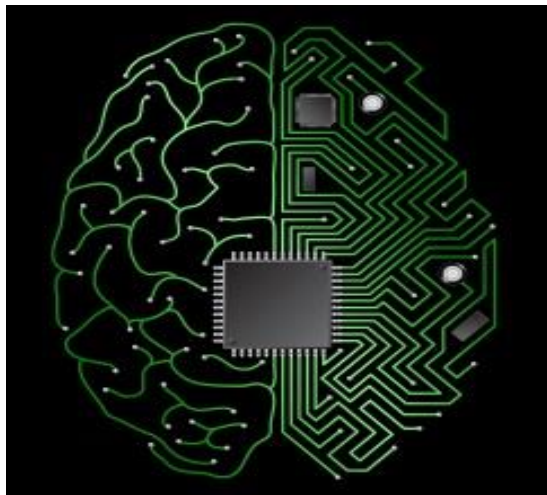


## *The How*

The Key is Flexibility in Response:  
Semi-Automatic Or Auto-DR



# Examples – Current & Future State





## Example

# Smarter Connected Homes – Bring Your Own Devices (BYOD)

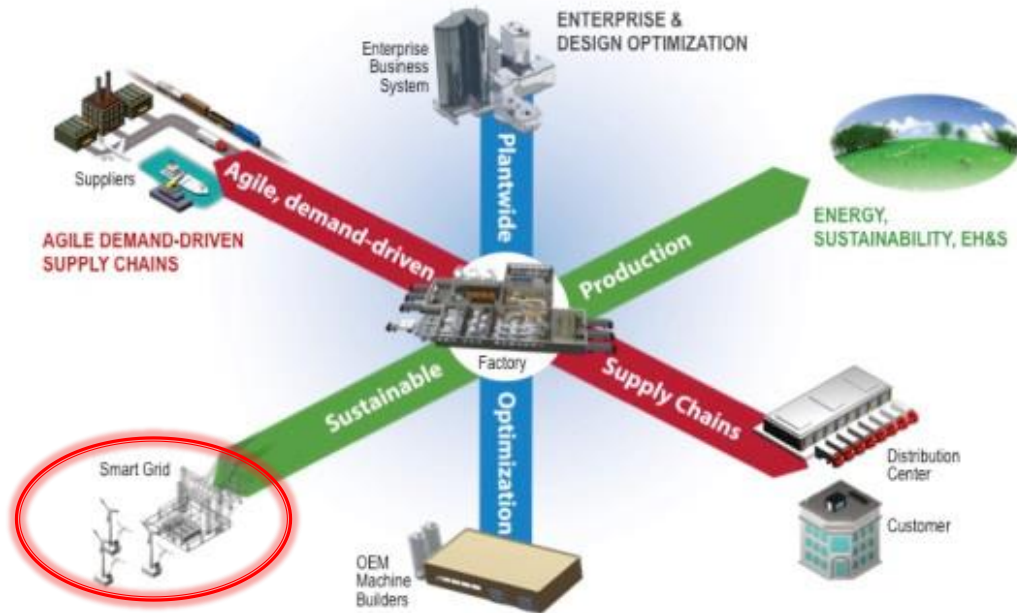


Sources:  
iDevices; ilumil energy hub

# Example

## Smart Manufacturing Will Make Load Dynamic and Reduce Cost per Output Across an Enterprise and Suppliers

### What is Smart Manufacturing? Industrial Internet of Smart, Connected Plants



Availability	Performance	Quality	OEE	Alexandria
96 %	100 %	98 %	97 %	67°

Washington DC Plant

Mash tun	Lautertun	Brew Kettle	Whirlpool	Fermentation Tanks
Green Feed OK Water Feed OK In Valve Closed Out Valve Closed	In Valve Closed Out Valve Closed	Temp: 156 F Pressure: 10 psi Tank: 500 Hops	In Valve Closed Out Valve Closed	Duration: 5d 06:00 / 10d 00:00 Specific Gravity: 1.012 Original Gravity: 1.055

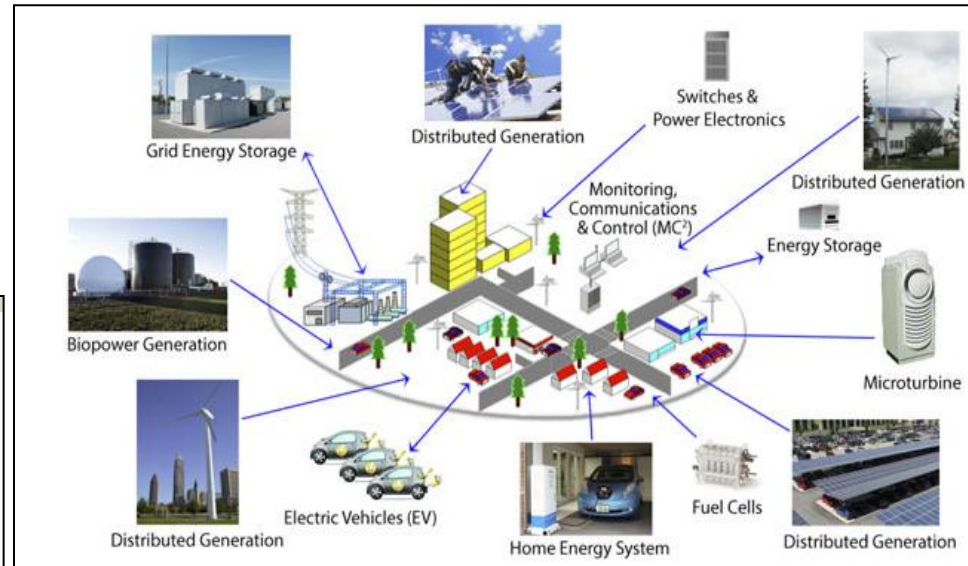
Powered by ICONICS

Source:  
ICONICS;  
Smart Manufacturing Alliance ;

# The Future

## Distributed Energy Resources / “Intelligent Community” Microgrids

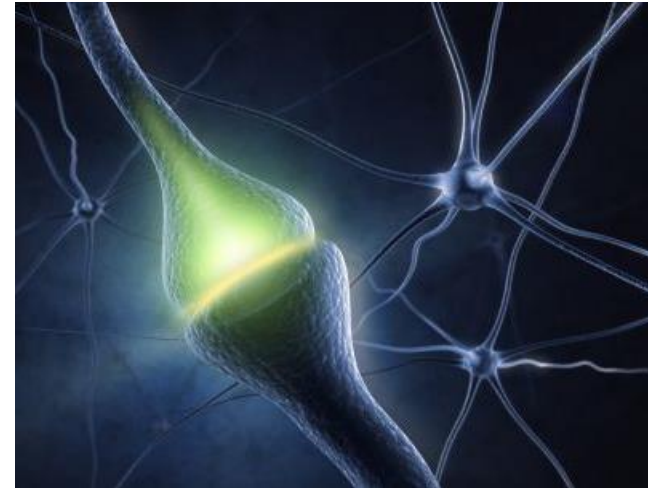
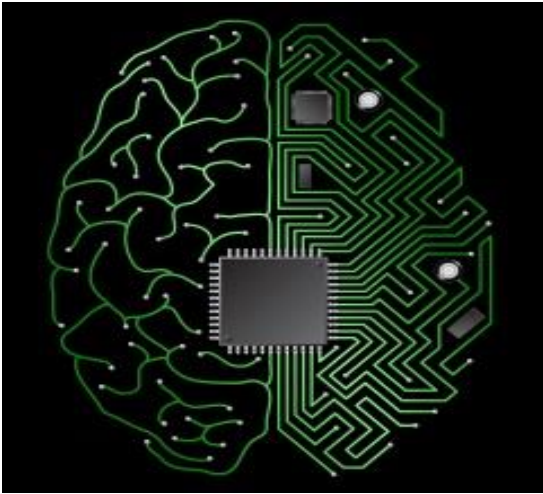
- Make or buy power analysis
- Island expansion – resiliency
- Participant financial settlement



Source: NYSERDA



# Thank You!



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402-212-7973

