



# Digital Solutions to Improve Coal Plant Efficiency, Flexibility and Emissions

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GE Power Digital Solutions

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Today, **TWO BILLION PEOPLE**  
have insufficient or unreliable power.

And **MORE THAN A BILLION PEOPLE**  
don't have any access to electricity at all.

# Global Trends Transforming the Power Industry



## CHALLENGES



Slower GDP Growth



Resource Restraints



Financing Constraints



Growth in Emerging Regions



Global Clean Energy

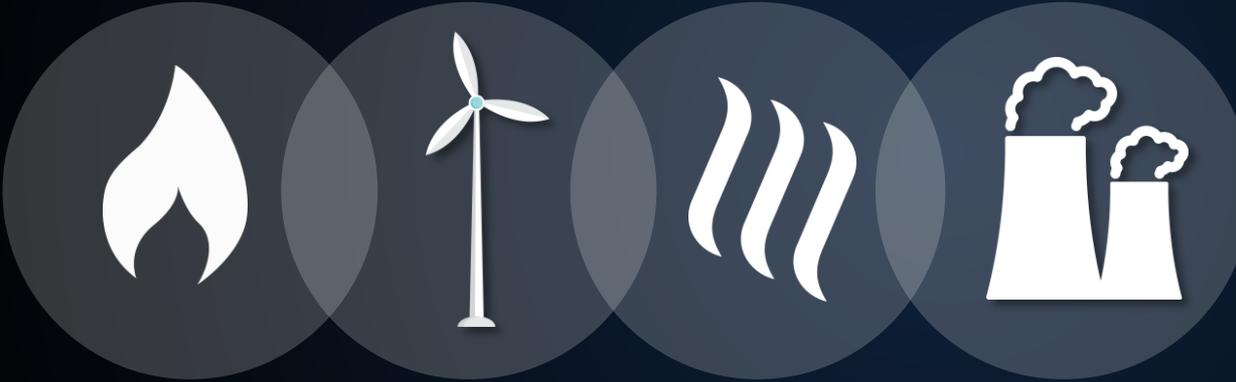


Digital Capabilities

## OPPORTUNITIES



# An Energy Mix Is Required to Meet the World's Growing Demand



## INDUSTRY DYNAMICS

**Fossil Fuels**  
Remains 60%+ of industry and a must to stabilize the grids

**Renewables**  
Fastest growing segment

**Emerging Markets**  
85% of electricity growth, each country with unique needs

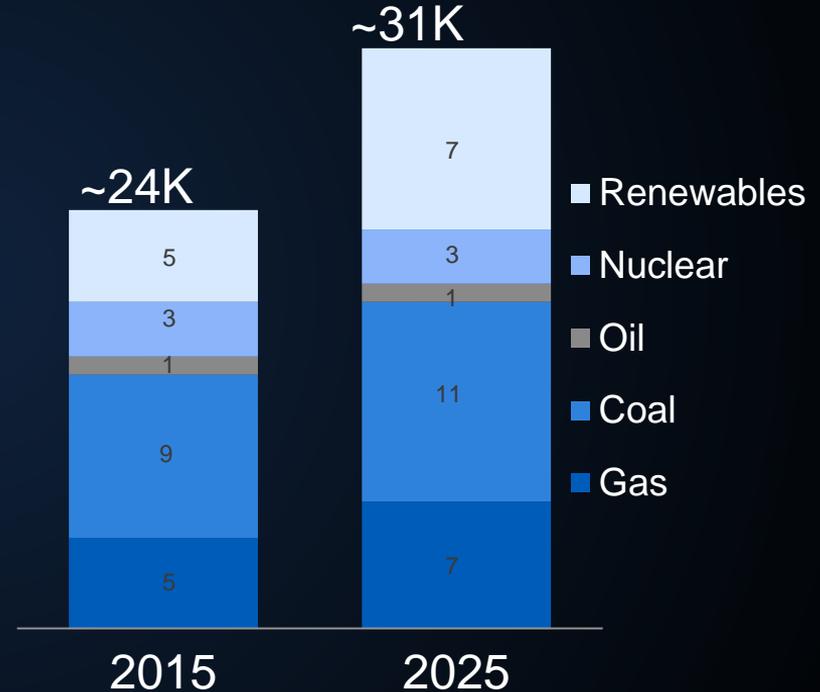
Affordable, reliable and sustainable power



# Global Power Market

Power generation and coal generation is growing globally

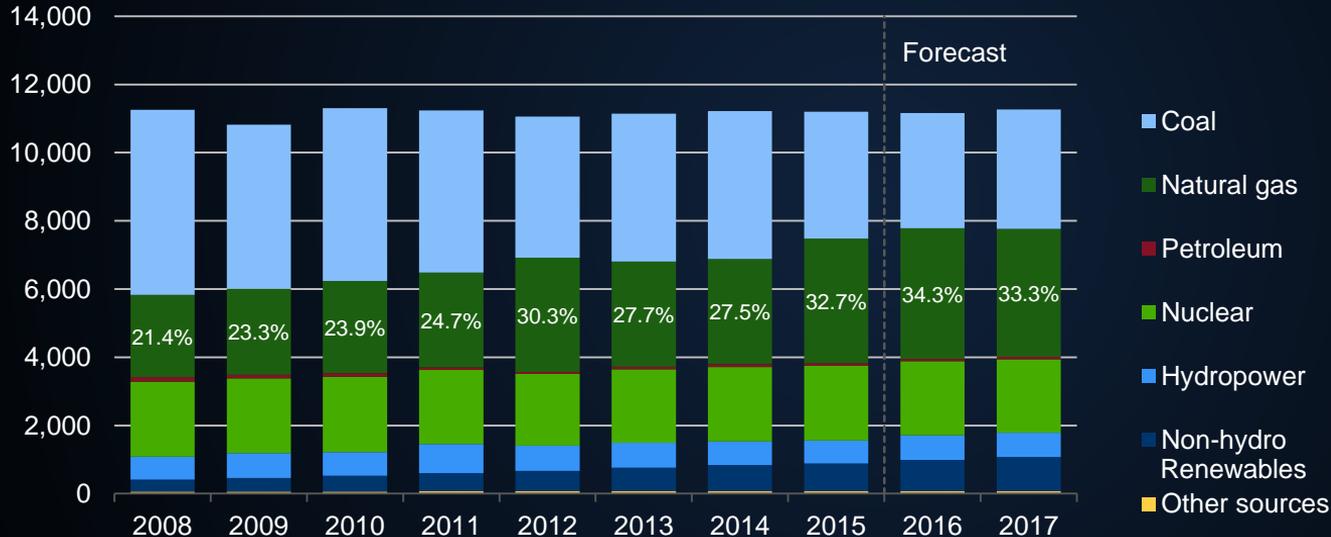
World electrical generation by fuel  
(TWh in '000s)



# US Power Market

## U.S. Electricity Generation by Fuel, All Sectors

thousand megawatthours per day



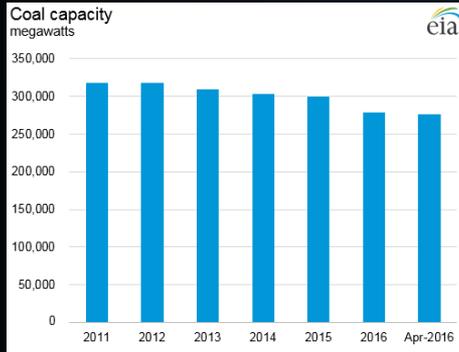
Note: Labels show percentage share of total generation provided by coal and natural gas.



Power generation is stable, and coal generation is shrinking a lot



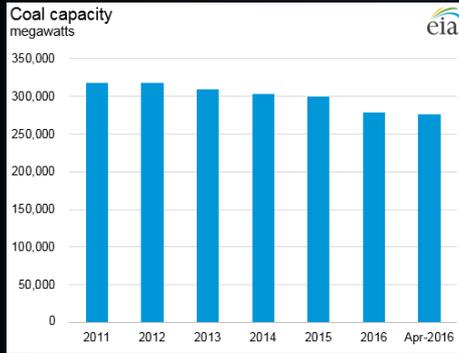
# What Are the Consequences?



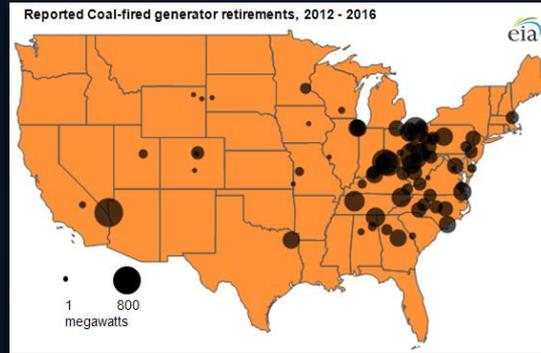
Coal capacity  
dropping



# What Are the Consequences?



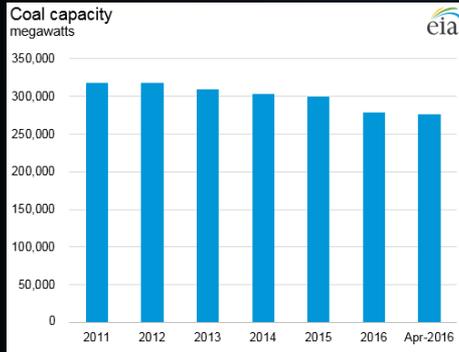
Coal capacity  
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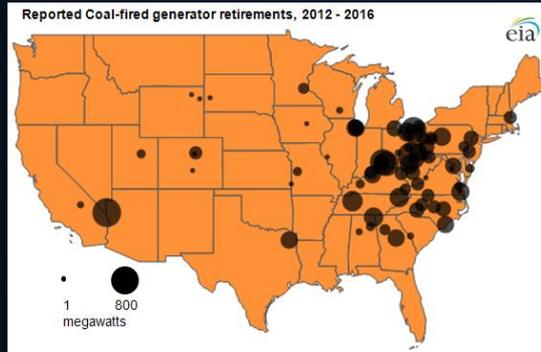
Remaining boilers —  
larger, cleaner,  
newer



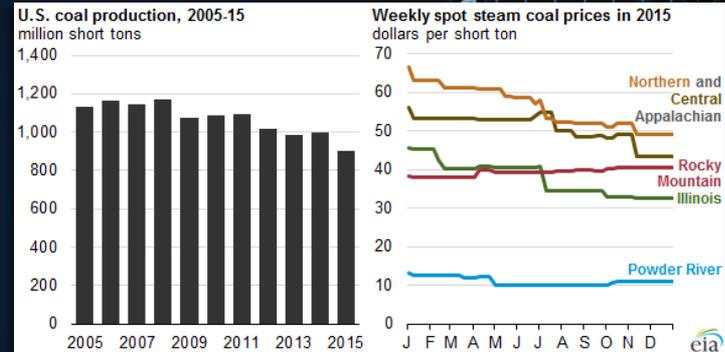
# What Are the Consequences?



Coal capacity  
dropping



Remaining boilers —  
larger, cleaner,  
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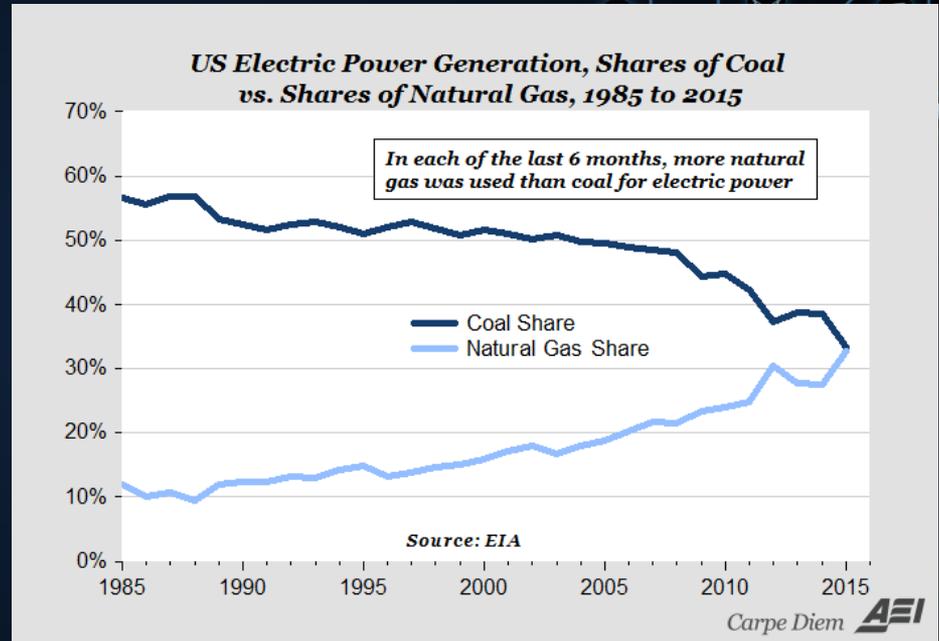


Declining demand,  
declining prices



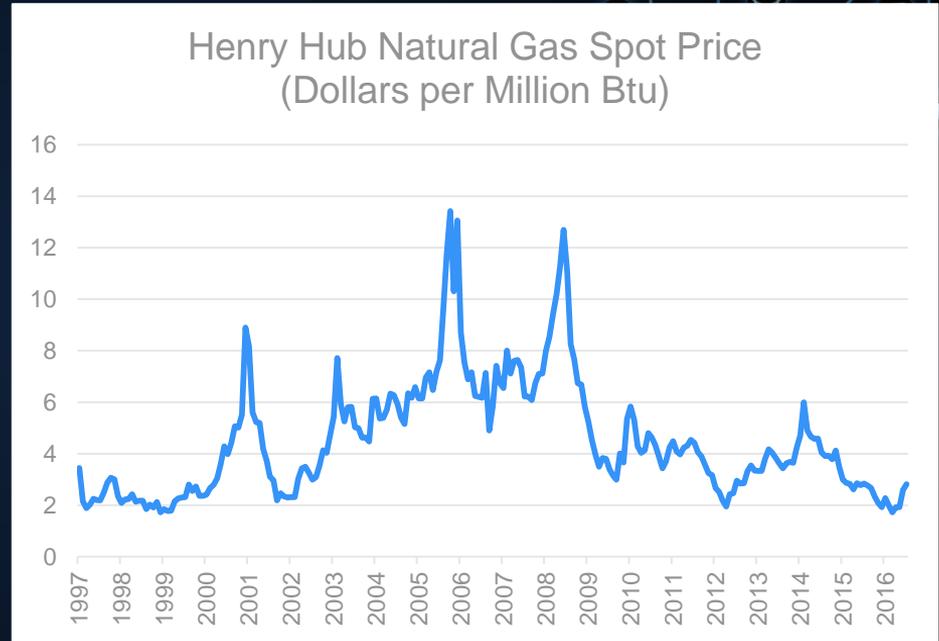
# US Power Market — What Are the Drivers

- Competition for base load drives *efficiency*



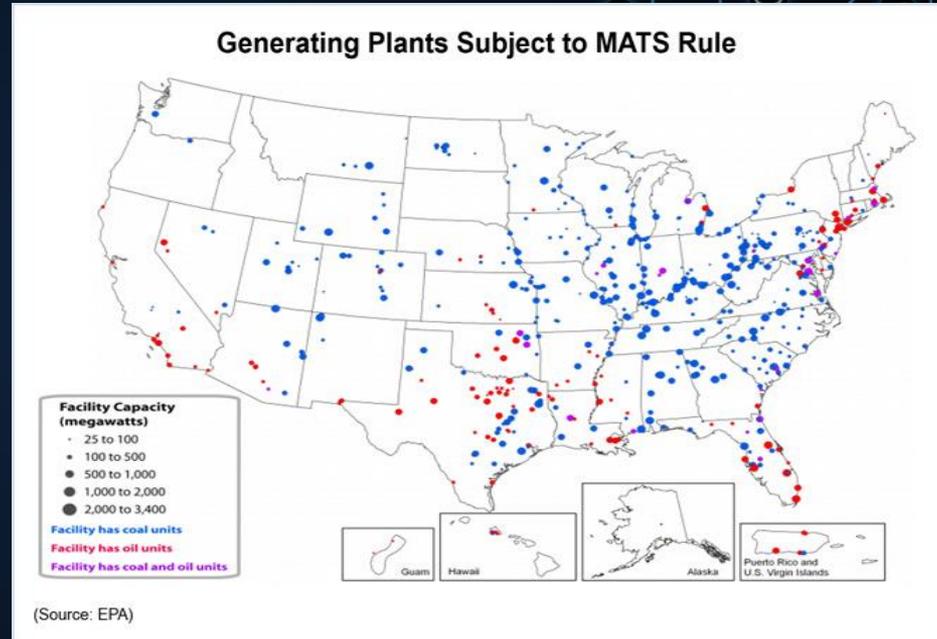
# US Power Market — What Are the Drivers

- Competition for base load drives *efficiency*
- Intermittent nature of renewables, and gas prices drives *flexibility*



# US Power Market — What Are the Drivers

- Competition for base load drives *efficiency*
- Intermittent nature of renewables, and gas prices drives flexibility
- Environmental regulations drives emissions



# Industries Re-imagined with Software



**\$50<sub>BN</sub>**  
Taxi Service

The world's largest taxi company that owns no vehicles



**\$18<sub>BN</sub>**  
Consumer App Economy

The world's largest consumer software company only creates a few apps

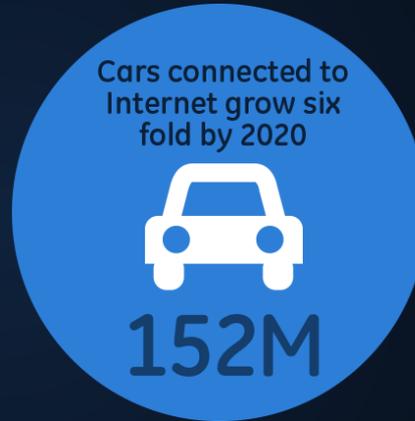
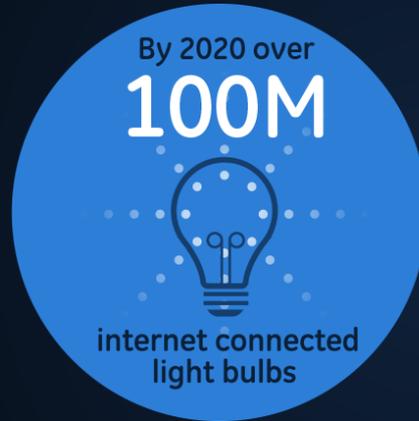


**\$50<sub>BN</sub>**  
Retail to Web Service

The world's largest retailer that owns no stores

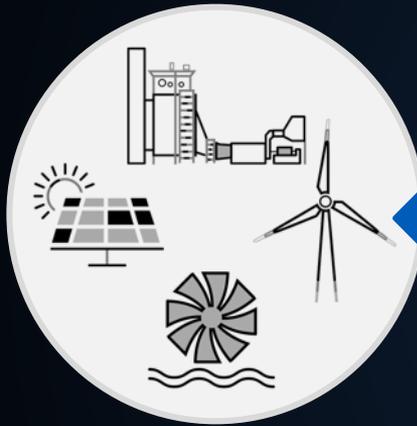


# Industrial IoT — Inevitability, Not a Probability



# Energy Is Going Digital

Generation



T&D



Consumption & Micro Gen



By 2020  
Digital Transformation Spending

**\$90B**  
Utilities

**\$225B**  
Industrial Internet



# What Is the Industry Asking For?

**BETTER  
PERFORMANCE**



**GREATER  
RELIABILITY**



**EMISSIONS  
COMPLIANCE**



**PROFITABLE  
GROWTH**



Leading Efficiency, Increased Flexibility, Lower Emissions, Better Economics



# Industrial Internet Driving OT/IT Convergence



Physical and  
Analytical



Brilliant Machines



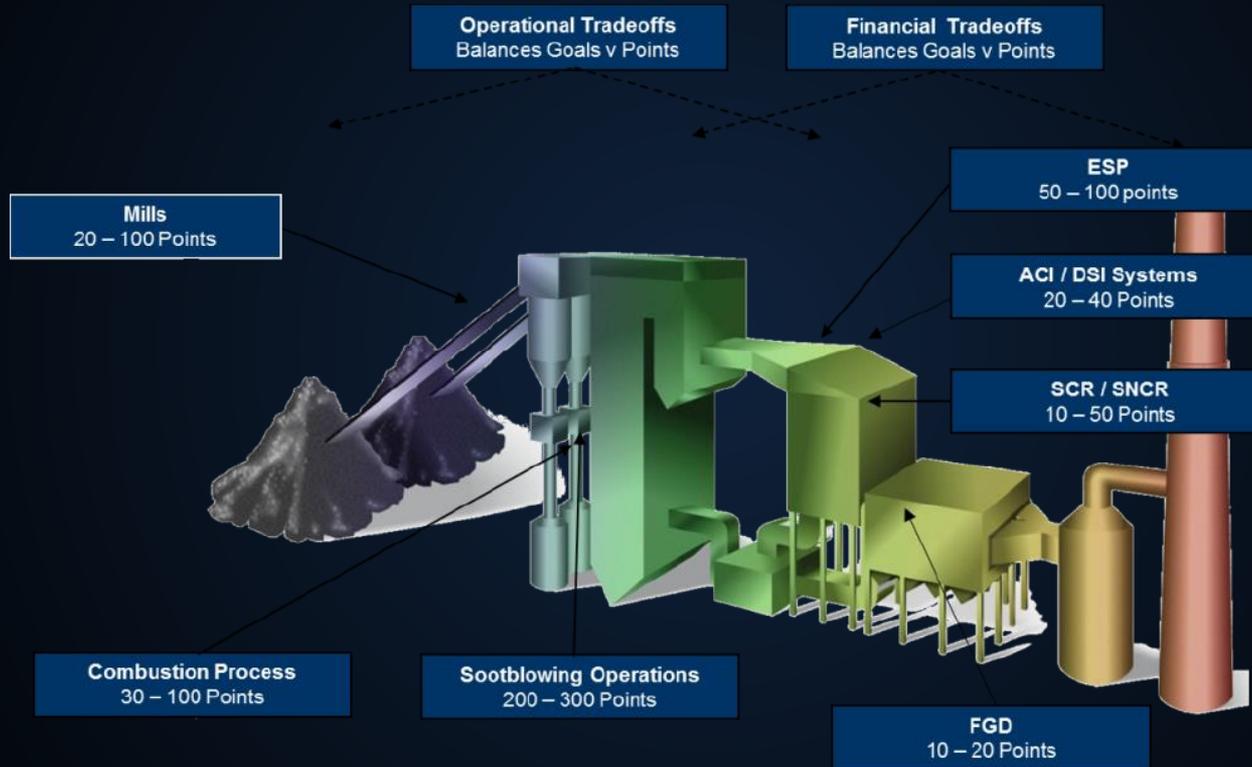
Industrial Big  
Data



People and  
Work



# Coal Plants Are Big Data Machines



# Digital Capabilities

## DIGITAL POWER PLANT FOR STEAM

Performance Optimization – FlexiLoad - Fuel Analyser - Boiler Optimization

↑ 1.5% Efficiency



↓ 5% Unplanned Downtime



↓ 3% CO<sub>2</sub>



Additional power for more than  
**~100,000 homes**

Saving  
**105,000 tons**  
coal per year

Equivalent to more than  
**200,000 cars**  
off the road

Adding  
**\$50,000,000**  
in NPV

Delivering better performance, greater efficiency & improved reliability over the life of the plant

# The Winning Equation



Increased value through digitization



# Key Takeaways



Coal fired assets data heavy and are prime targets for digitization

Implementation of digital software solutions in coal-fired assets has shown:

- Efficiency can be improved by 0.5-1%
- Baseloaded plants can ramp and follow load better
- NO<sub>x</sub>, SO<sub>x</sub>, GHG, and CO excursions can be reduced



# Questions?



