

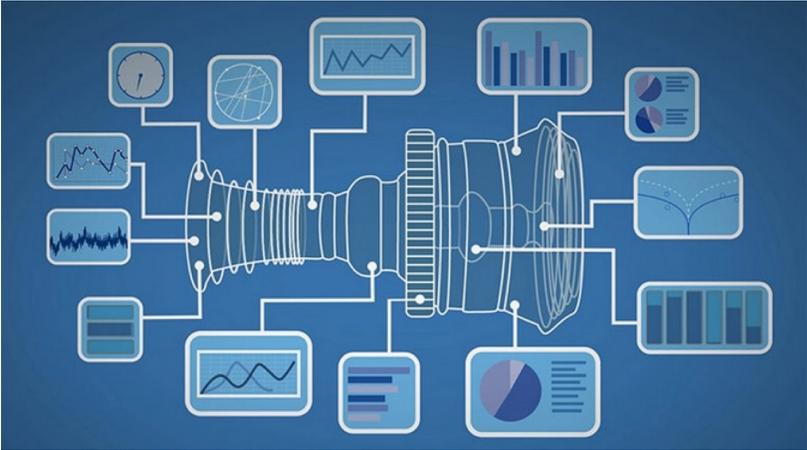


# Industrial Machine Learning

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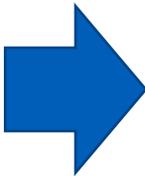
Artificial Intelligence and Learning Lab.  
General Electric Global Research

# Industrial Machine Learning: Opportunity



PGT25+G4 Aeroderivative

200 sensors generate  
total of 300 data points  
per second



All Operational Assets

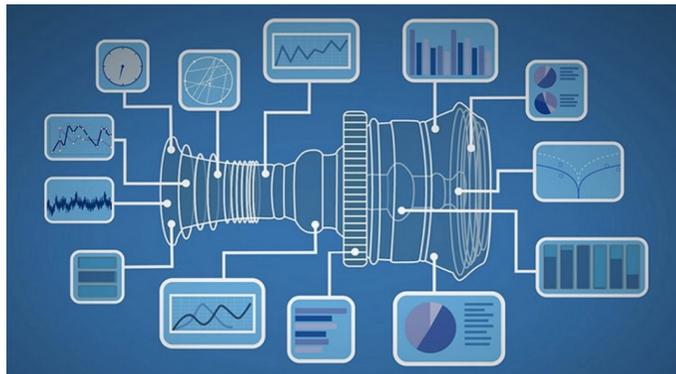
10MM sensors generate  
total of 50 MM data points  
per second

# Industrial Machine Learning Examples

## Fleet Analytics

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- 2-6 % increased availability
- 10-40 % reduction in reactive maintenance



## Wind Optimization

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- 5 % increase in annual energy production
- 20 % increase in profit per turbine



## Load Forecasting

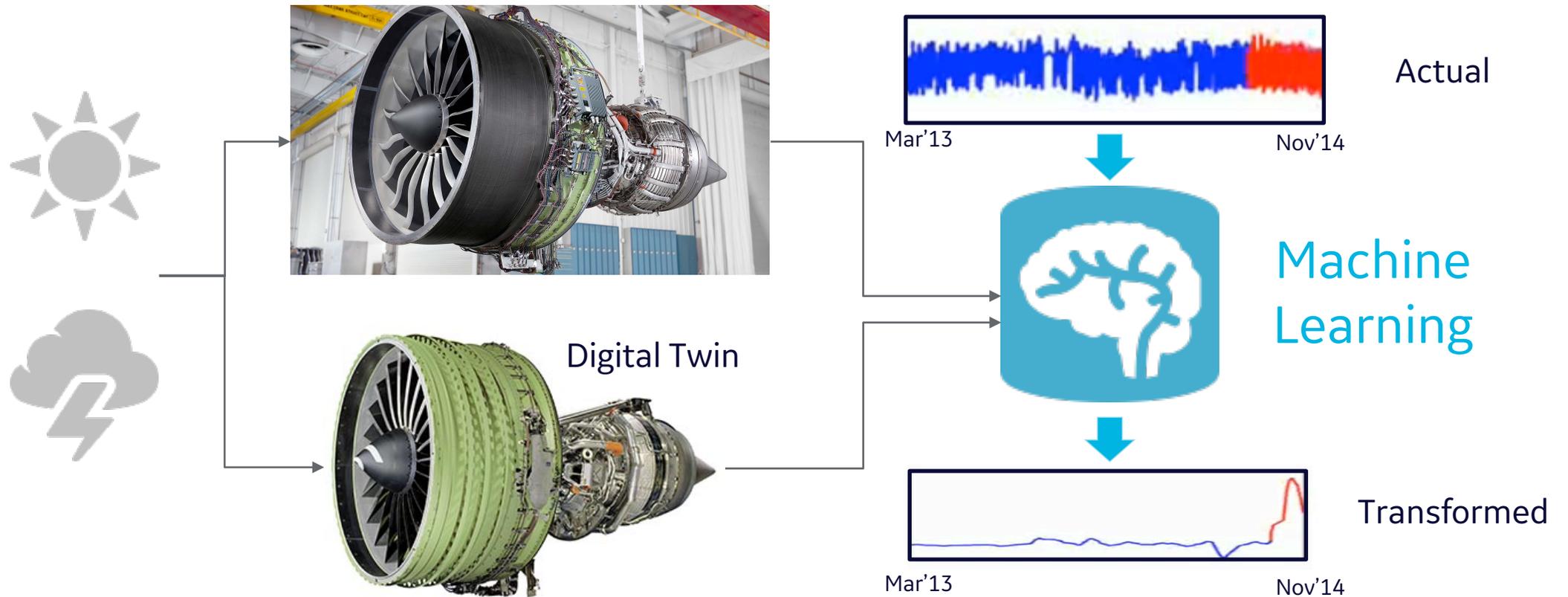
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- Reduce renewables curtailment from 21% to 6%
- Offset 3.3 quads of thermal generation



# Advanced Fleet Analytics

Greater predictability & fewer delays, reactive → proactive

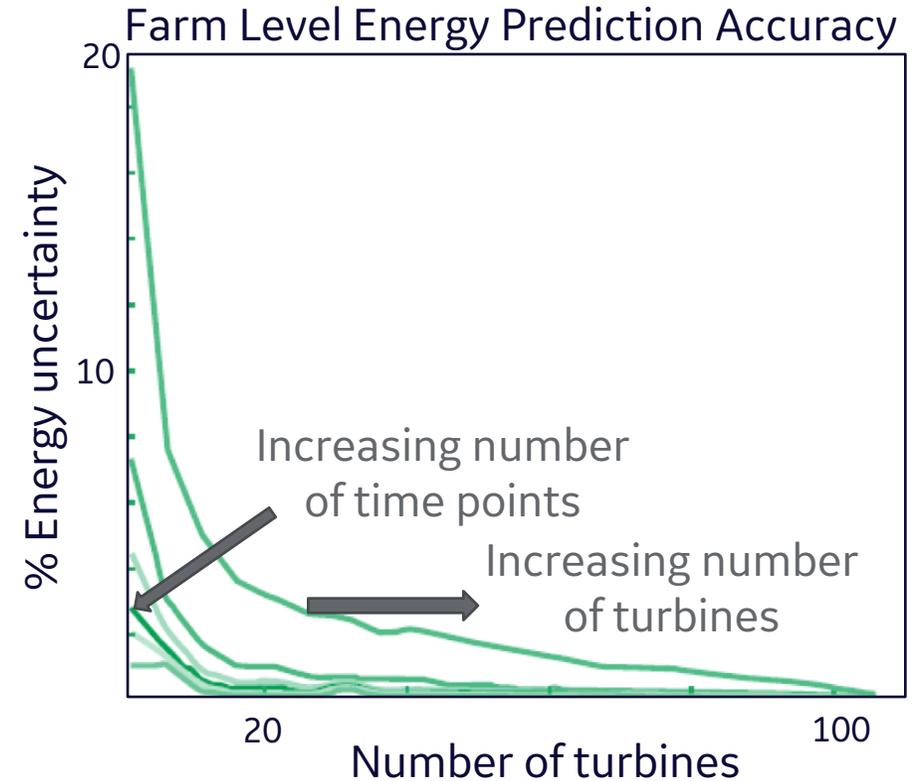
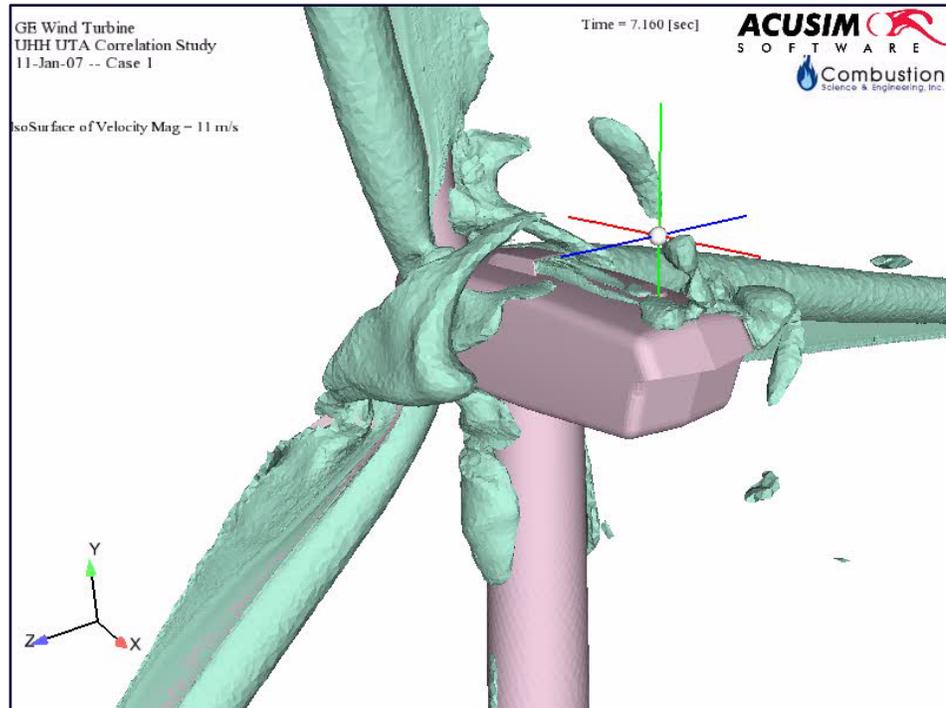


11 MM hours of machine data stored from 660+ machines.  
1300 anomaly troubleshooting reports per year.



# Wind Optimization

1-2% increase in annual energy production

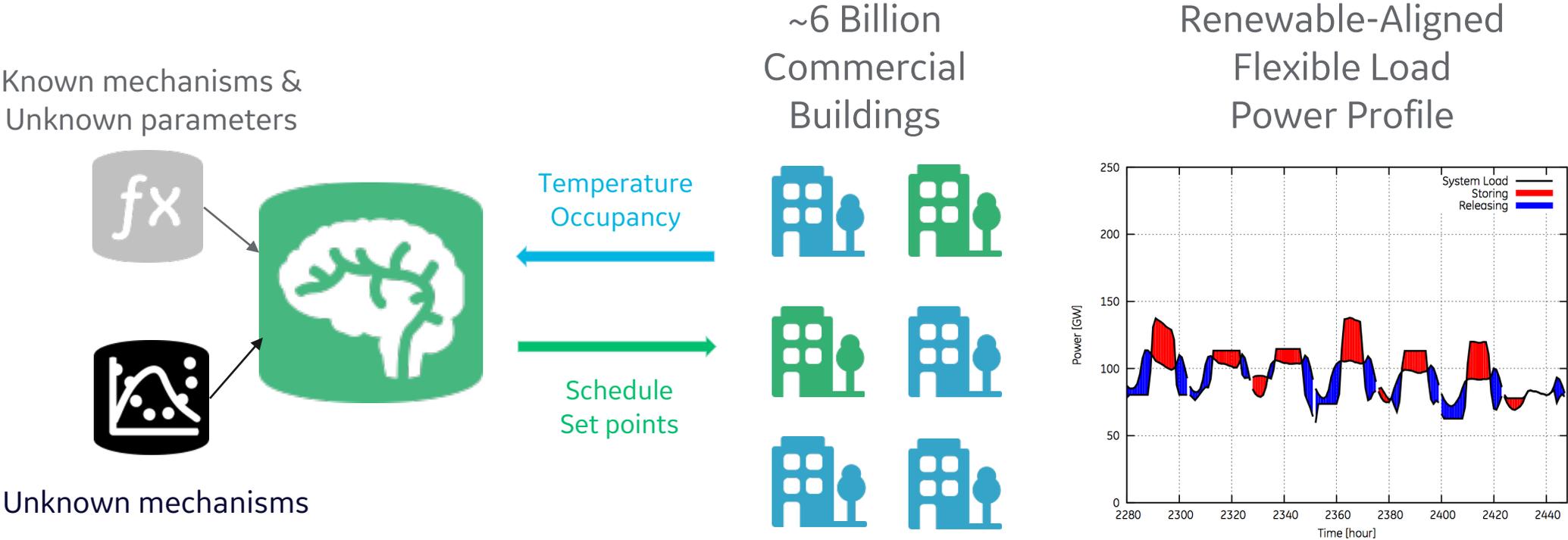


1% energy output increase  
= Power used by 33,000 average U.S. homes



# Power Grid Flexible Load Forecasting

Reduce renewable curtailments from 21% to 6%



Increase utilization of renewable energy by aligning the flexible part of consumption with availability of renewable energy.



# Future Directions for ML in Energy

## Cloud vs Machine

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- Minimize computational delays
- Accommodate fast grid dynamics



## Continuous Learning

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- Adapt to changes in the system & environment
- Improve maximum power tracking



## Meta-algorithms

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- Design algorithms to tune & configure algorithms
- Controller & optimization tuning

