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TURNING BIG DATA INTO POWER

MAY 21, 2014

NATIONAL TOWN MEETING
ON DEMAND RESPONSE
AND SMART GRID

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Over $1 Trillion Investment in Energy

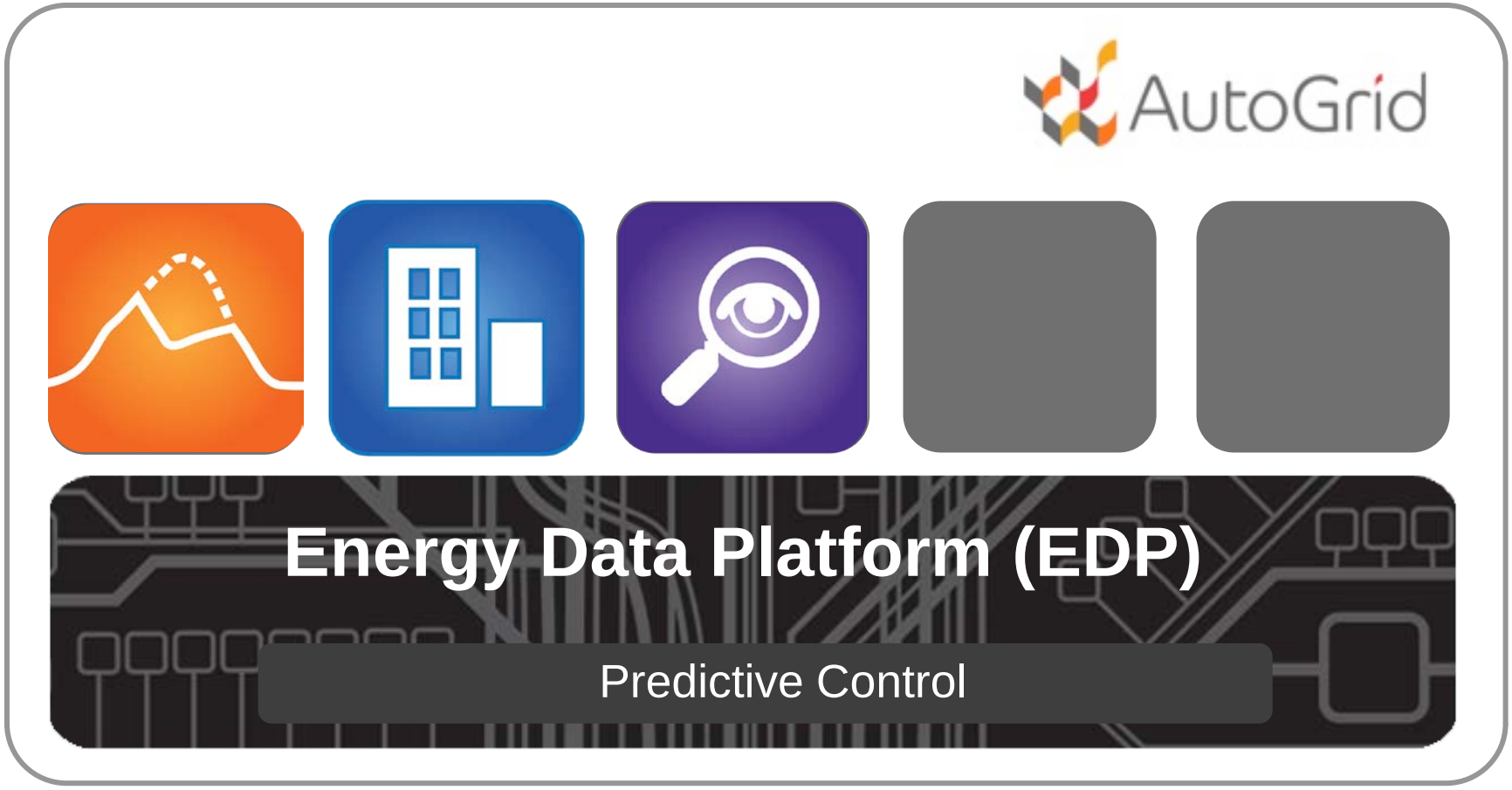


1000X More Data from Energy Internet of Things

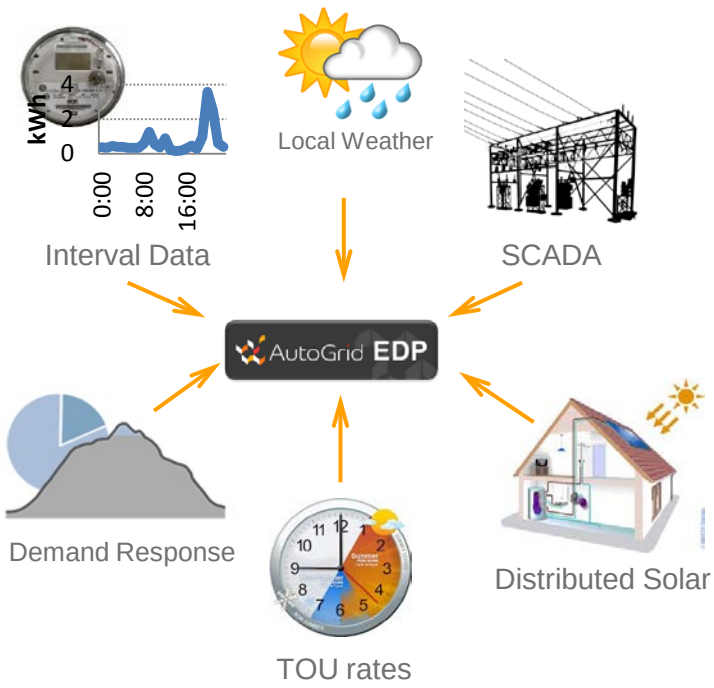
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The Application Platform for the Energy Industry



Smart Forecasting Essential for a Smart Grid



A Smart Forecasting Methodology Includes:

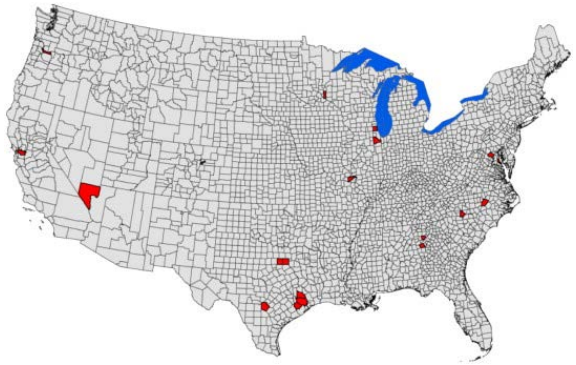
- **Meter-level Forecasts**: Unique individual load models
- **Real-Time**: Frequent re-forecasts using new data to improve accuracy and reduce imbalances
- **Smart Grid Enabled**: Accounts for TOU rates, demand response, distributed generation
- **Configurable**: Changes to grid configuration easy to load and re-forecast
- **Accessible**: Forecasts available by APIs
- **Scalable**: Parallel computing accommodates large volumes or faster speed

Bottom-up Forecasting

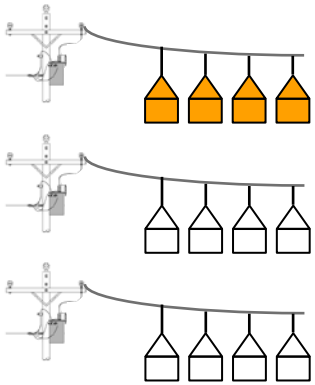
Granularity allows aggregation and deeper insight into customer groups and activities:



By Demographic



By Geography



By Distribution Asset

Key Benefits of meter-level forecasting approach:

- More accurate data-driven predictive modeling approach
- Utilizes localized weather data = better regional forecasts
- Highly granular asset, geography, or demographic-specific analysis

Forecasting Optimizes Decision Making

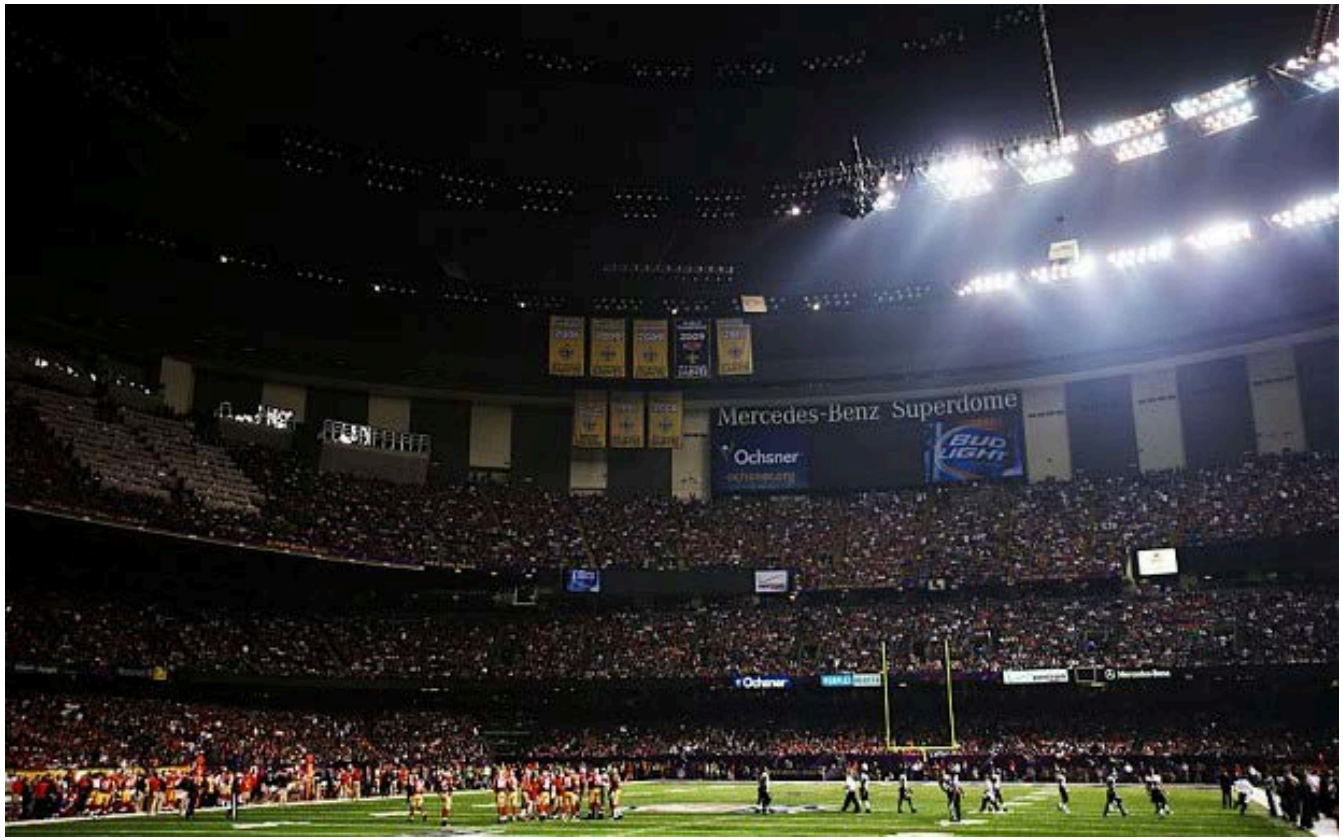
Supply		Demand
• Distribution network planning • Long-term energy contracts	**Strategic** > 1 year	• What geographic markets to upgrade • What demand-side technology investments to make?
• Theft detection • Outage detection • Medium-term energy contracts	**Tactical** 1 day – 1 yr	• Program/rate design • Customer recruitment/scoring • Program costing (“plan selector”) • Device failure detection
• Spot market purchases • Imbalance market trading	**Operational** <= 1 day	• DR event dispatch (“when, what, where”) • Voltage regulation, EV load balancing

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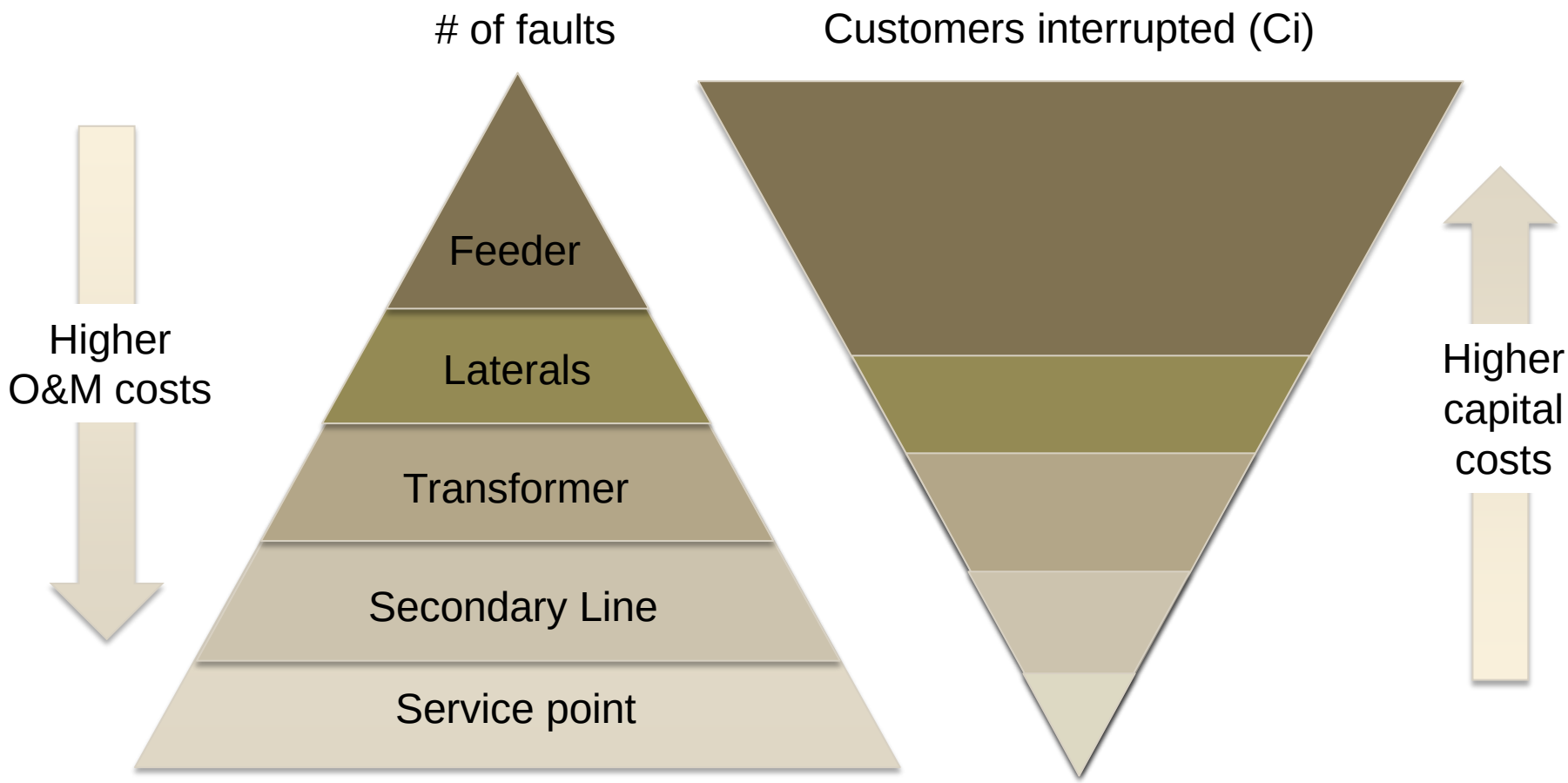
Distribution Forecasting

Use Case 1: Improve grid reliability



Correlate observable phenomenon with SAIDI and SAIFI impact

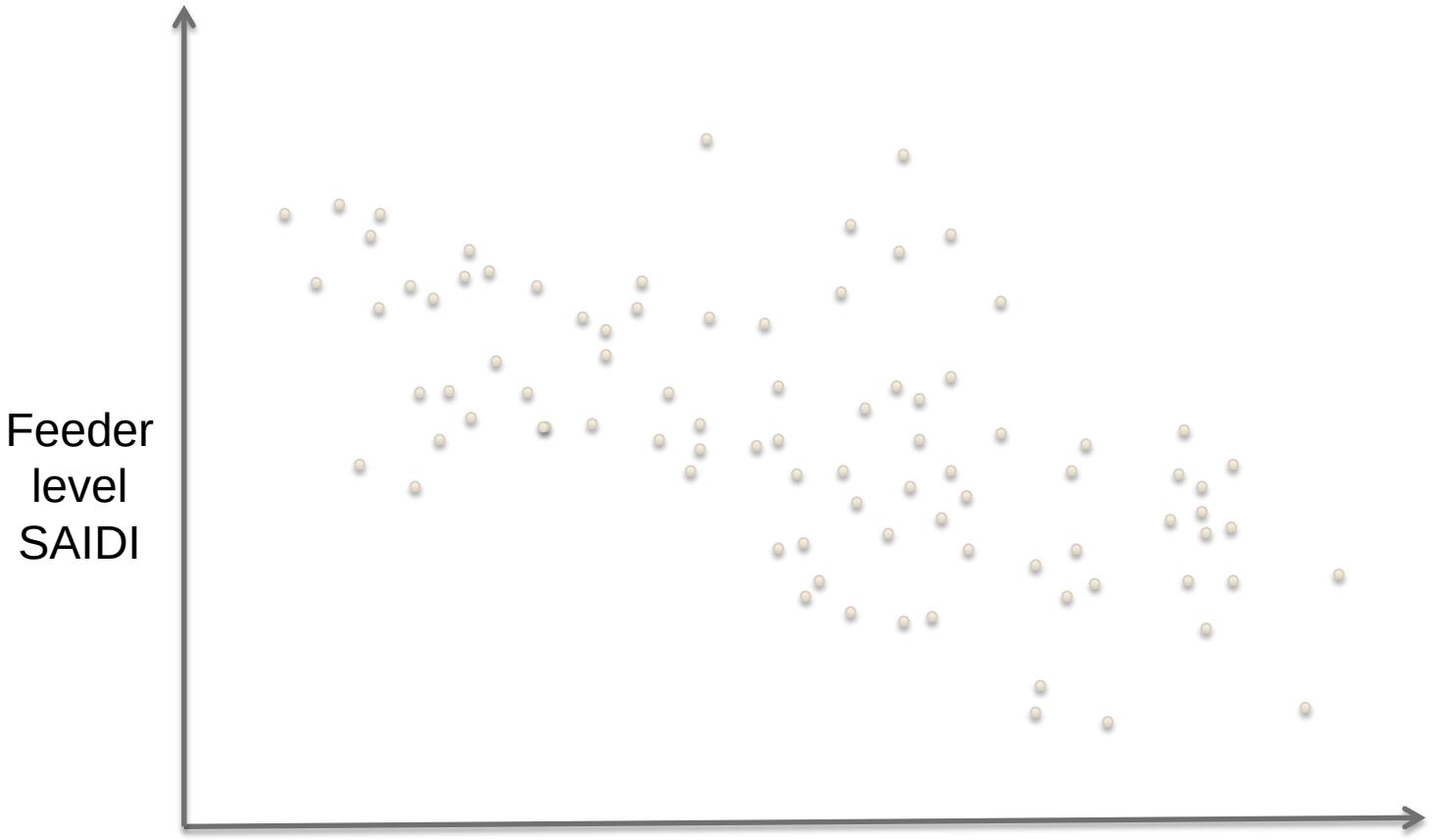
Predictive Asset Maintenance



Drive more efficient capital expenditures

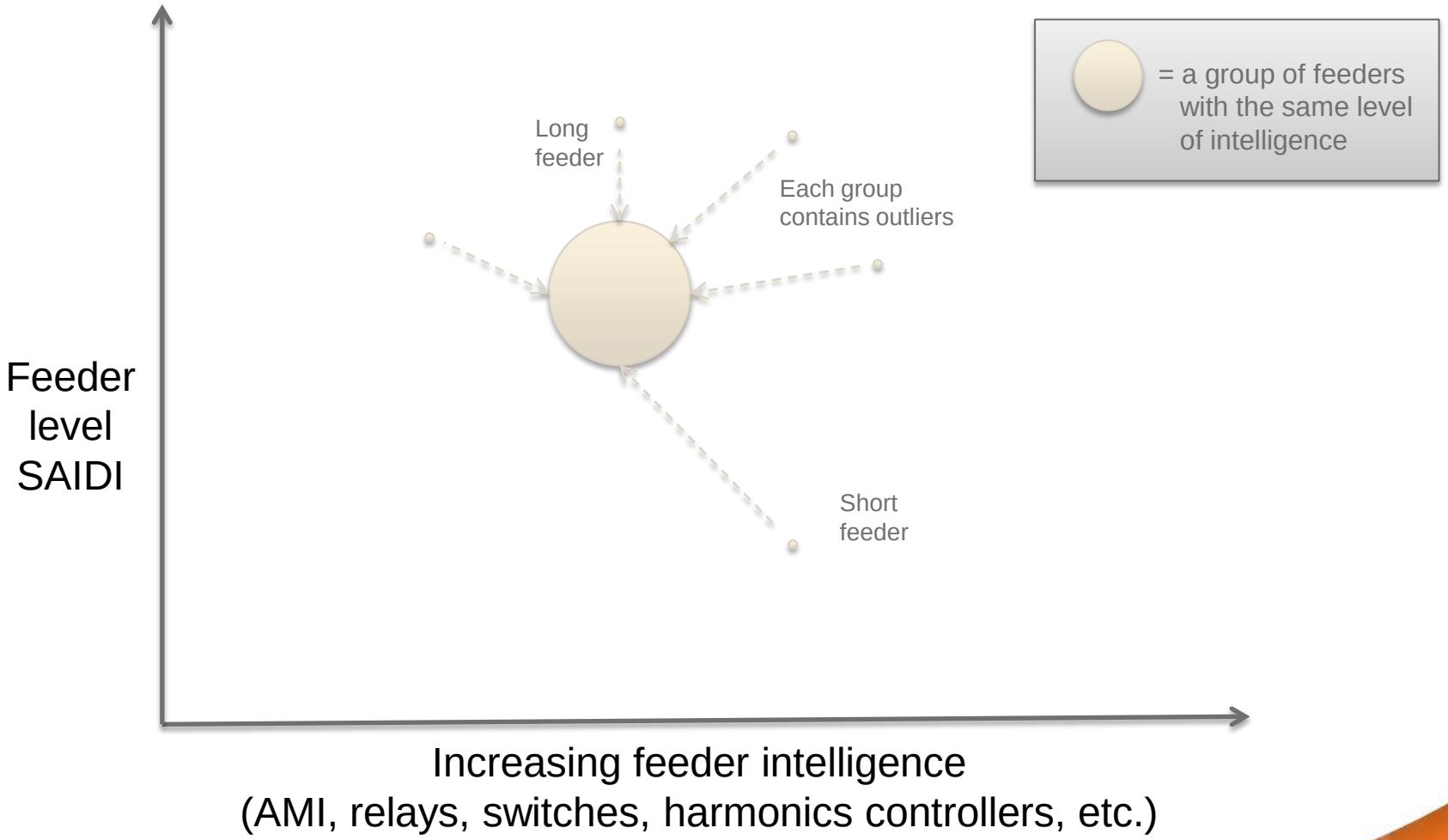
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Asset Upgrade Cost/Benefit



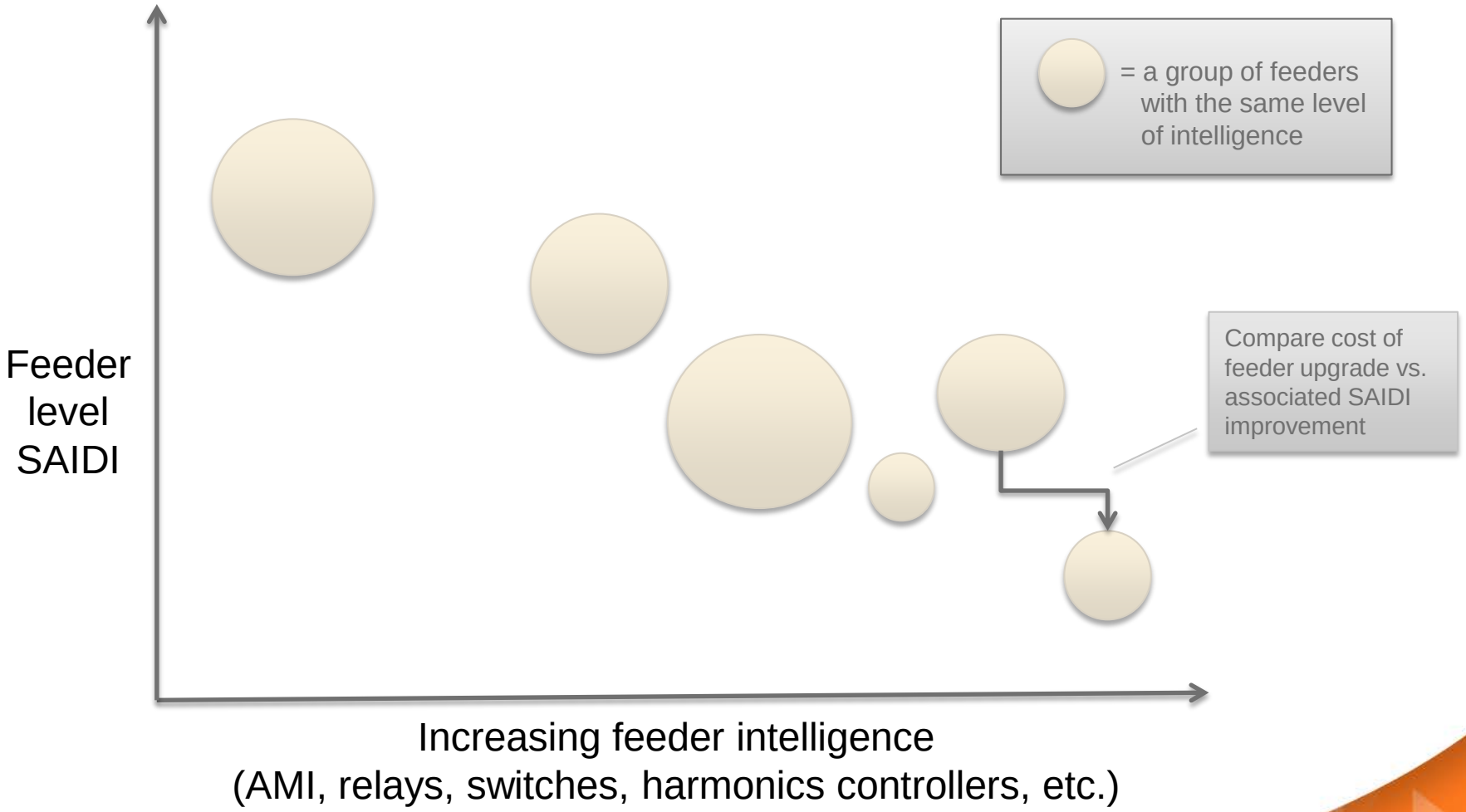
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Asset Upgrade Cost/Benefit



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Asset Upgrade Cost/Benefit

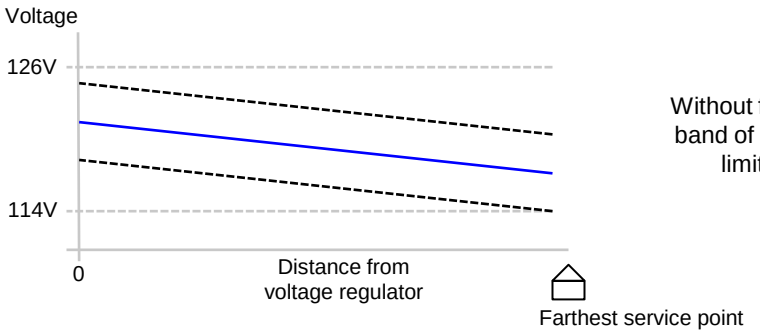


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Distribution Forecasting

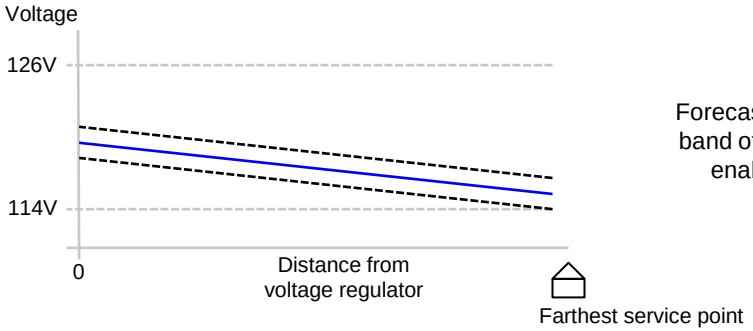
Use Case 2: Conservation Voltage Reduction

Before:



Without forecasting, band of uncertainty limits CVR

After:



Forecasting reduces band of uncertainty, enabling CVR

Use load forecasts to optimize voltage tuning in real-time

Distribution Forecasting

Use Case 3: Volt-Var optimization

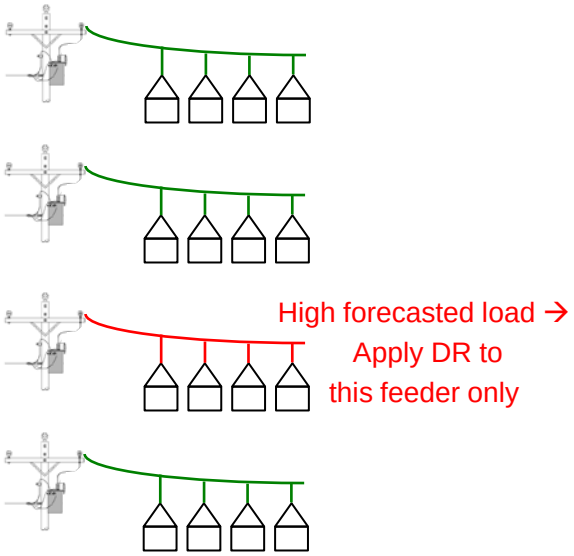


Generate accurate profiles based on AMI Data to replace legacy and inaccurate load allocation and load profile models

For a given frequency of cap switching, reduce reactive losses

Distribution Forecasting

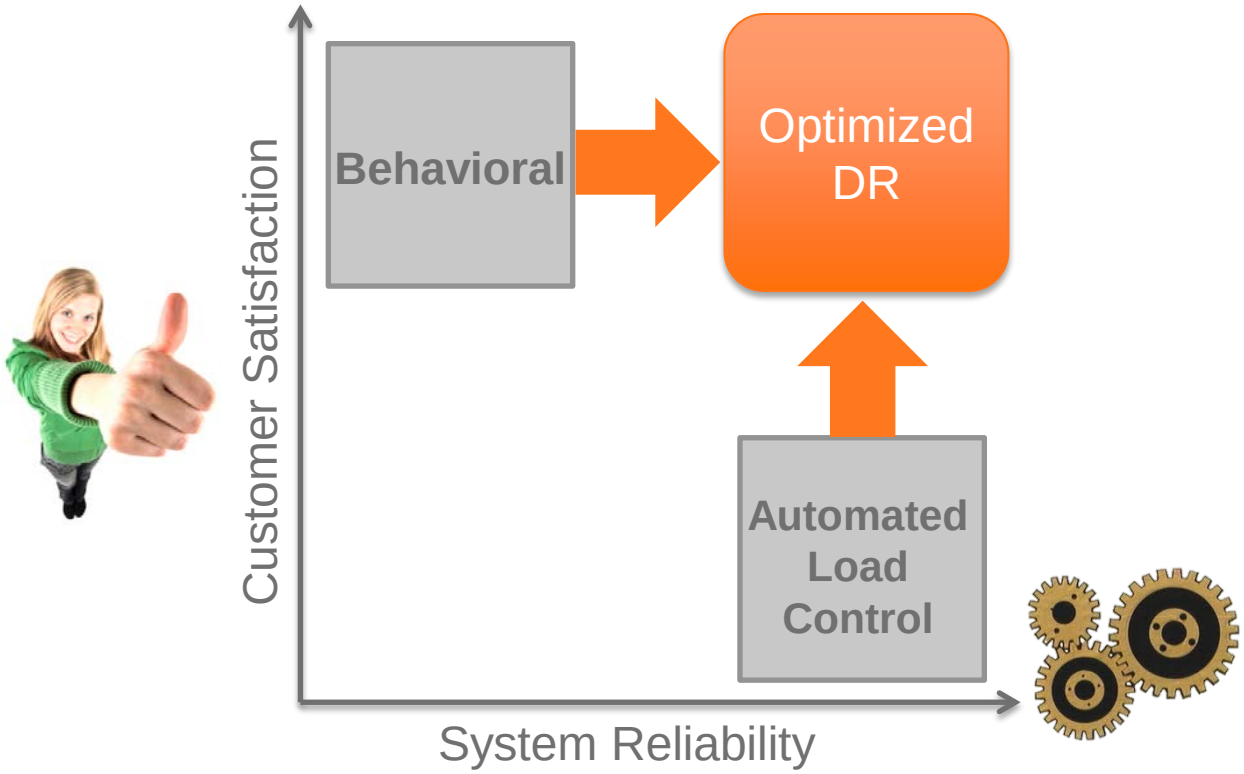
Use Case 4: Asset-level Demand Response



Forecast when feeders are strained; use this to inform DR scheduling

Big Data + Forecasting = Accessible Demand

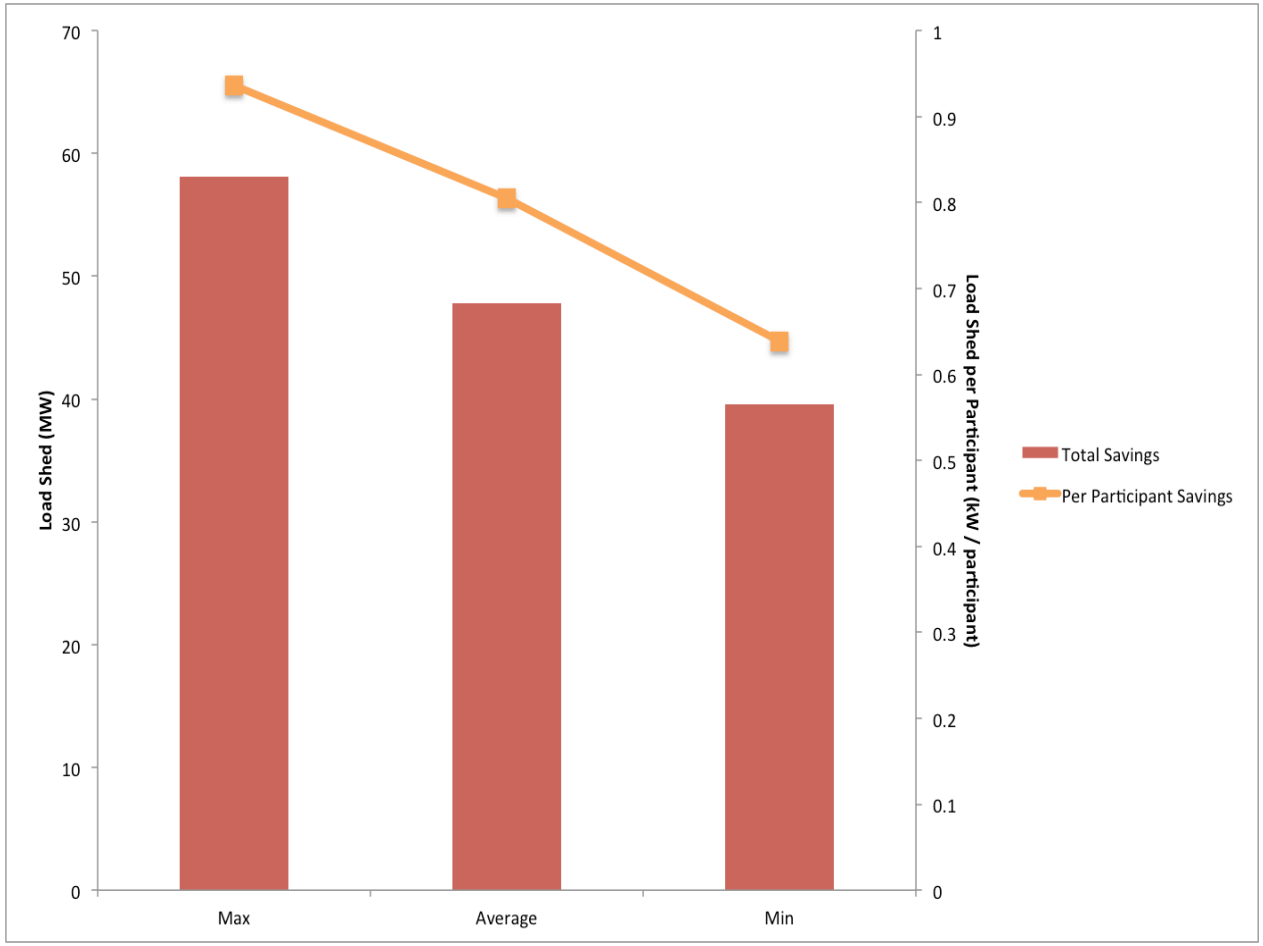
1. *System Reliability*
2. *Customer Satisfaction*



Operational **Demand Resources** through **Analytics**

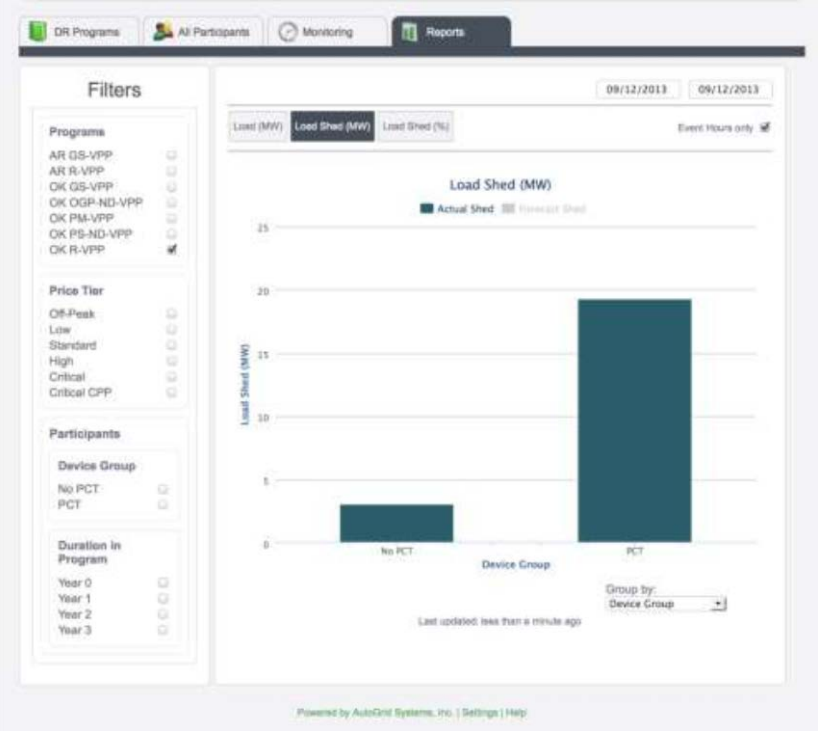
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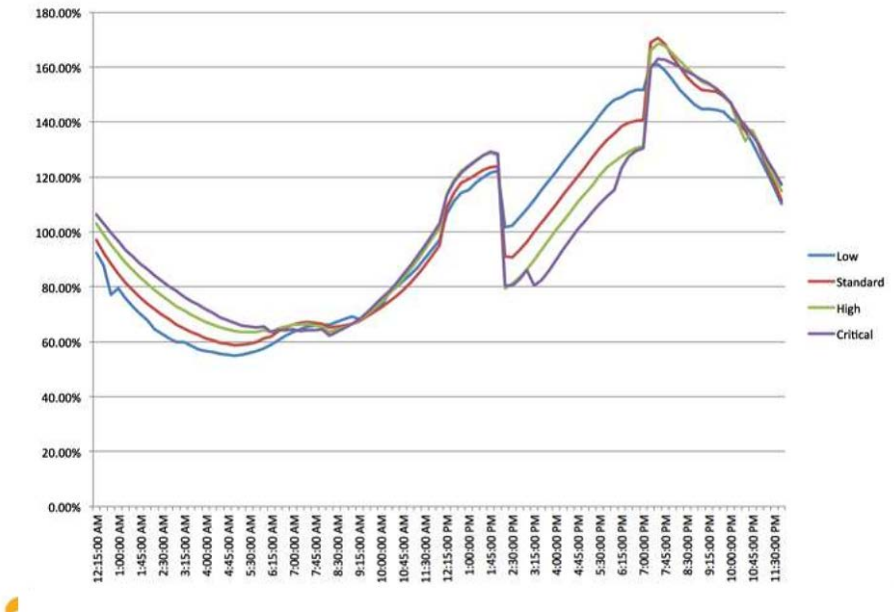
Critical to Accurately Forecast Load Shed



Available load shed varies by +/- 20% -

Forecasting Each Customers' Price Elasticity

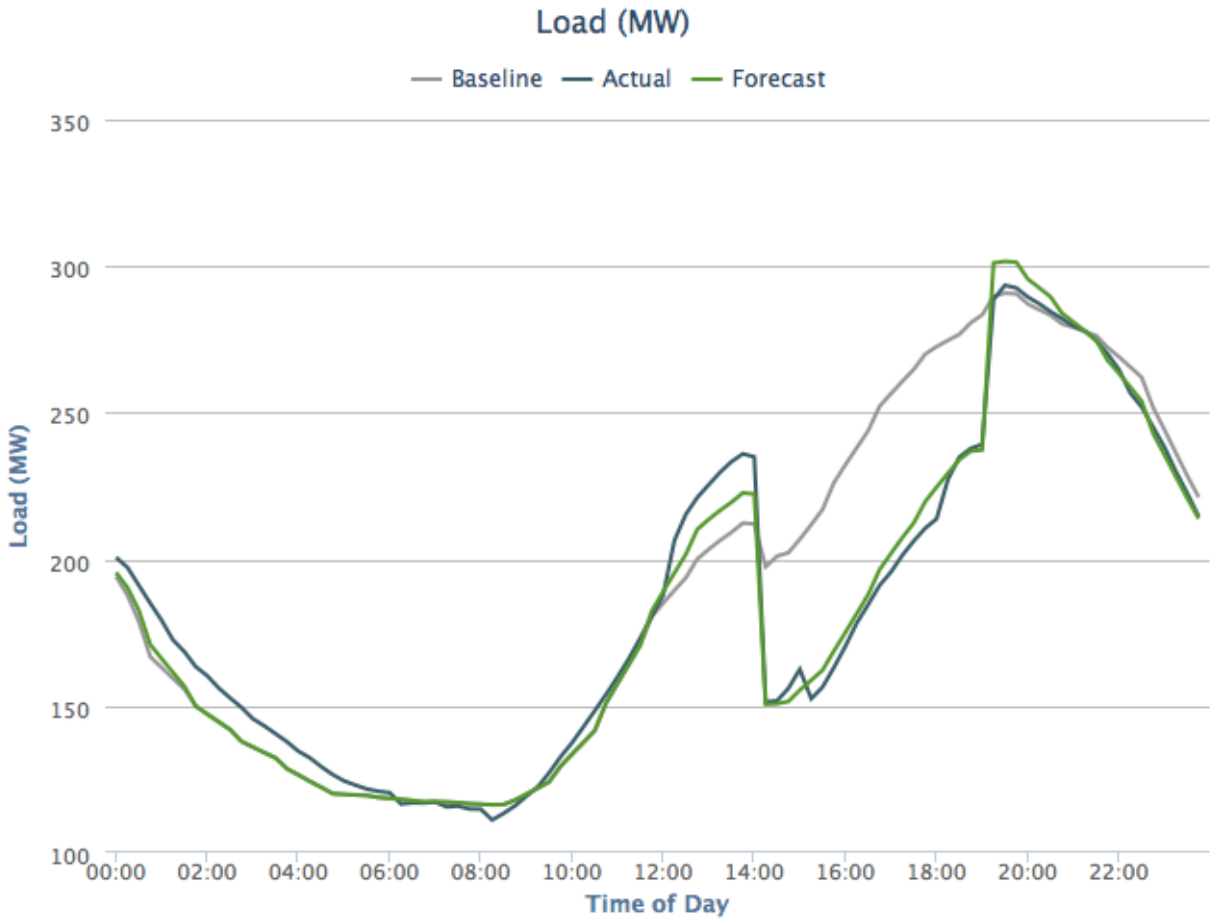




Models predict customer response for each price level

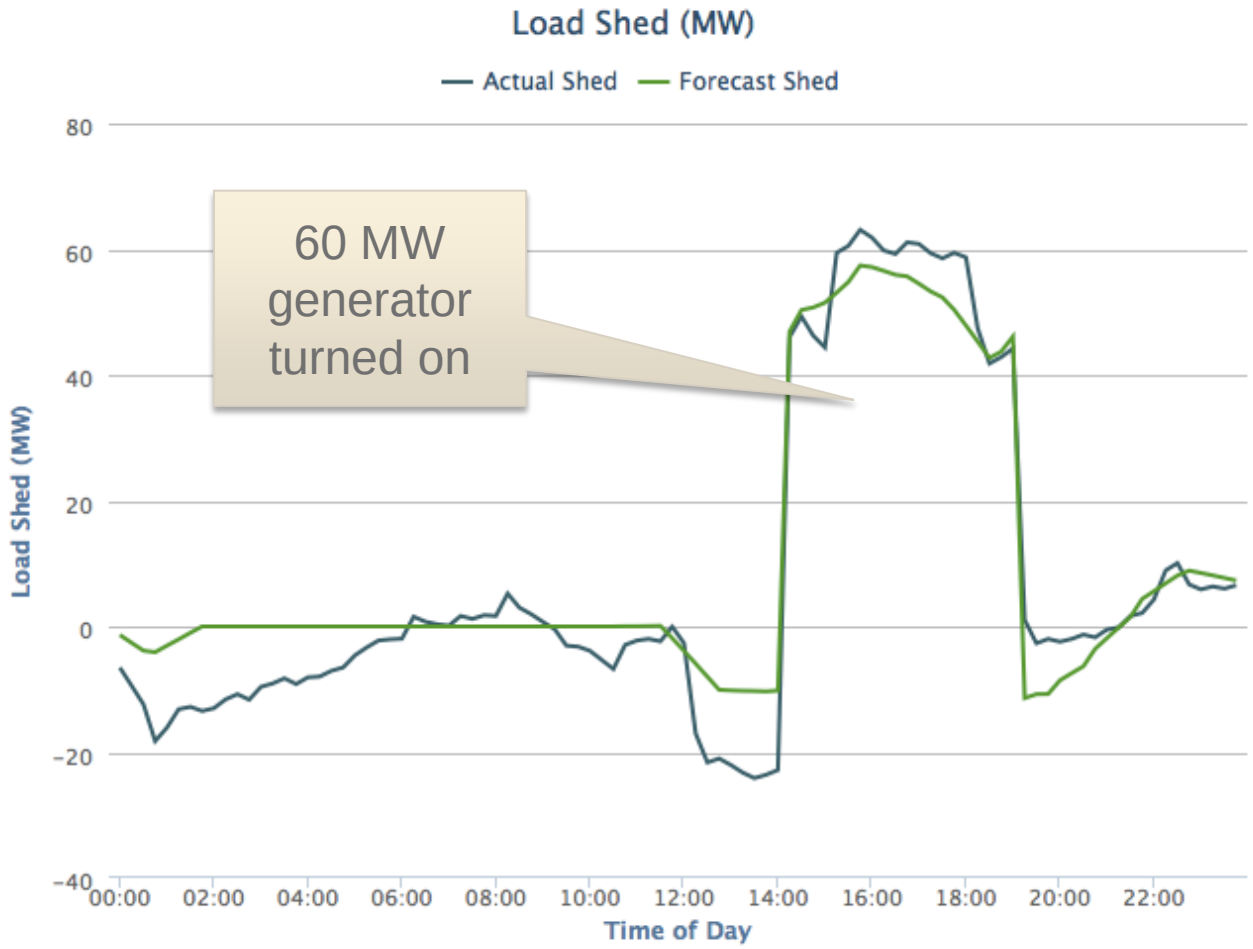
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Traditional DR perspective



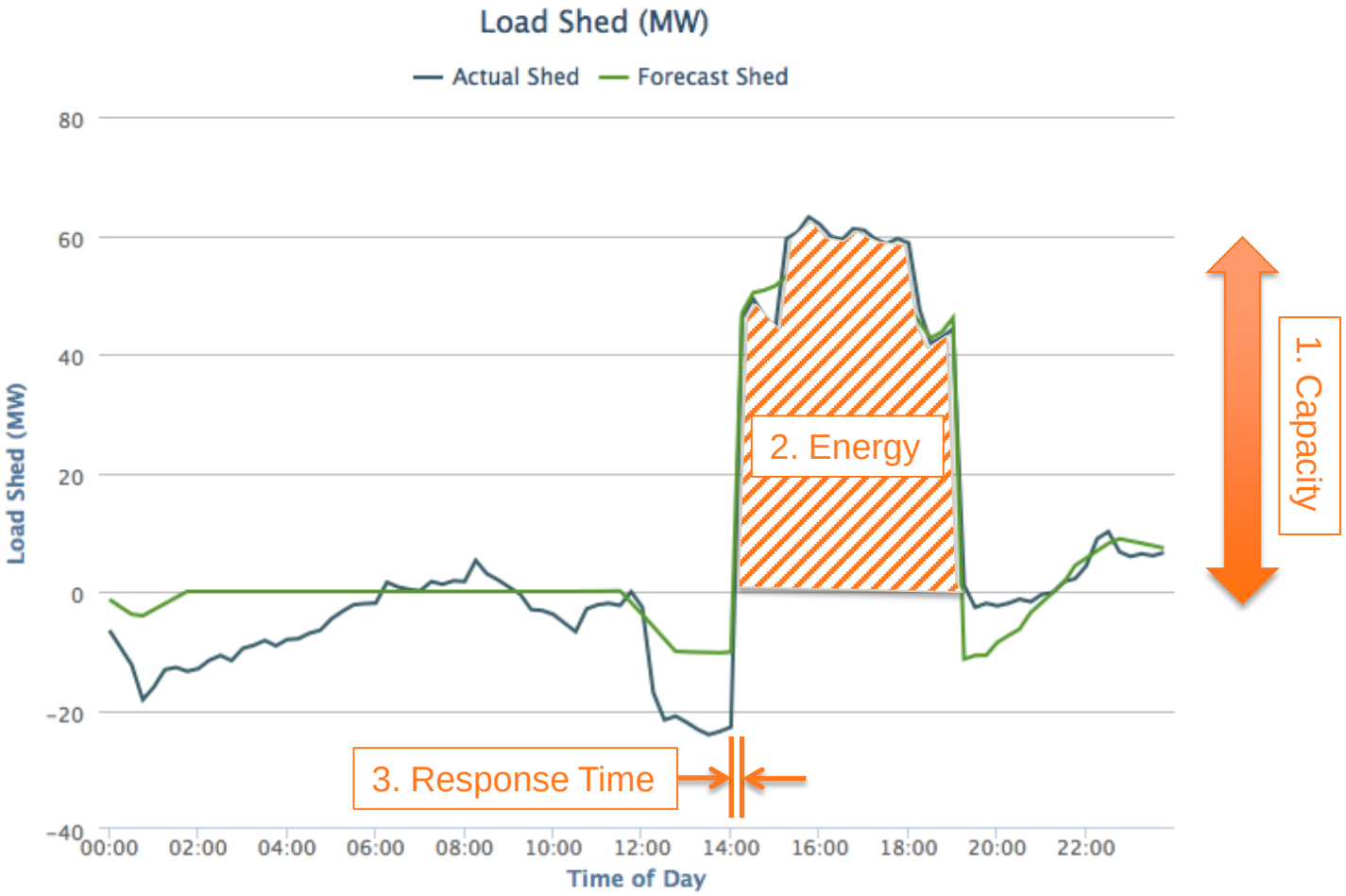
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Forecasting Converts DR into a Power Plant



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Monetizing the DR Power Plant



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Conclusion

Predictive analytics and controls are required to maximize the **energy productivity** across the entire electricity supply chain **today.**