

Integration of Distributed Energy Resources

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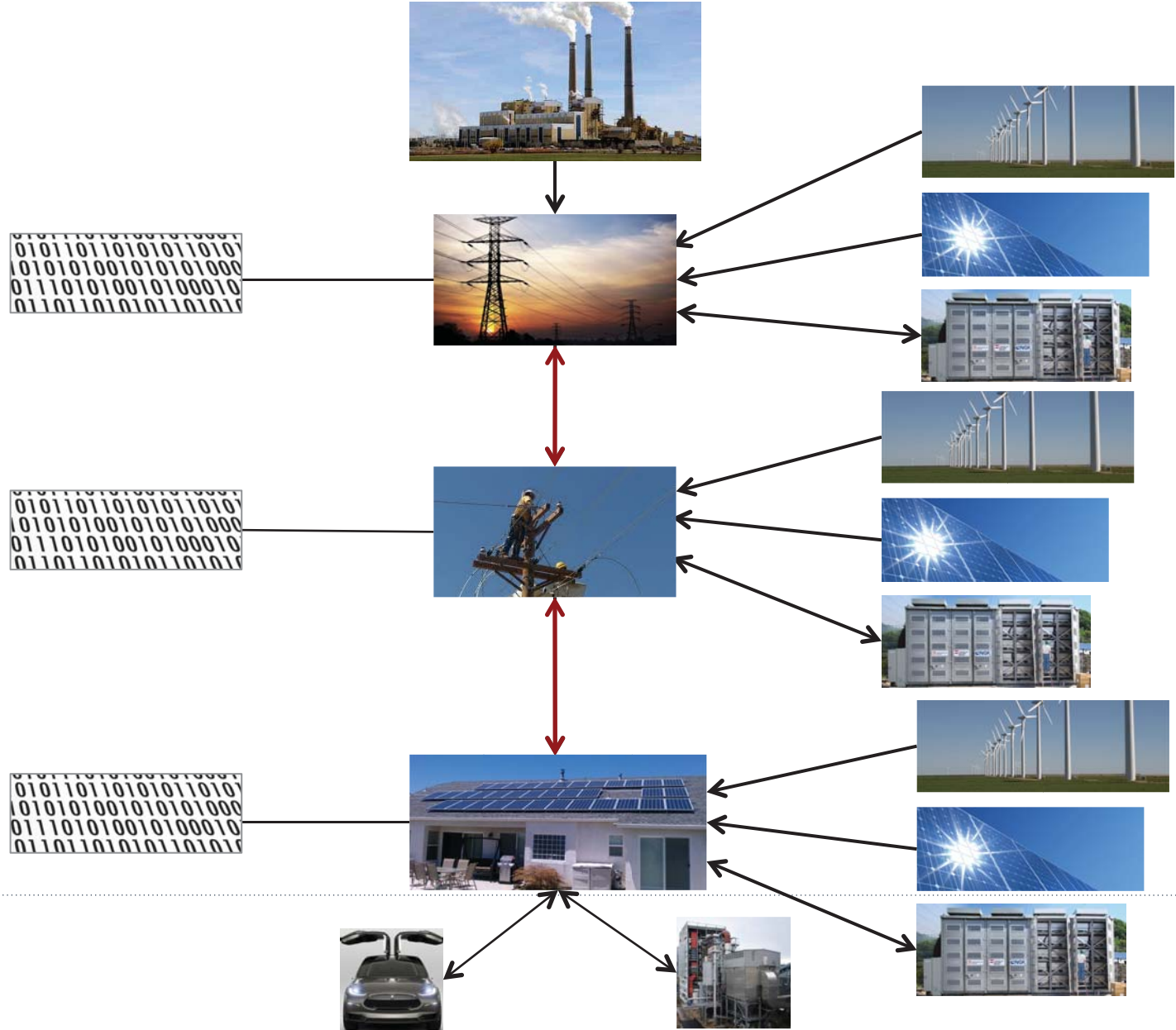
DR Expert at Google

Grid Integration Solar Energy Technical Workshop

October 29, 2015

Our Changing Grid - Technology

PMU
 SCADA
 μPMU
 PV generation
 EV Charging Stations
 Smart Meters
 Interval Meters



Renewable
 Portfolio Standards
 State Energy
 Efficiency Resource
 Standards
 Million Solar
 Rooftops
 Storage Mandate
 (1.3GW by 2020)
 Smart Meter
 deployments
 1.5M EVs by 2025
 Reforming the
 Energy Vision

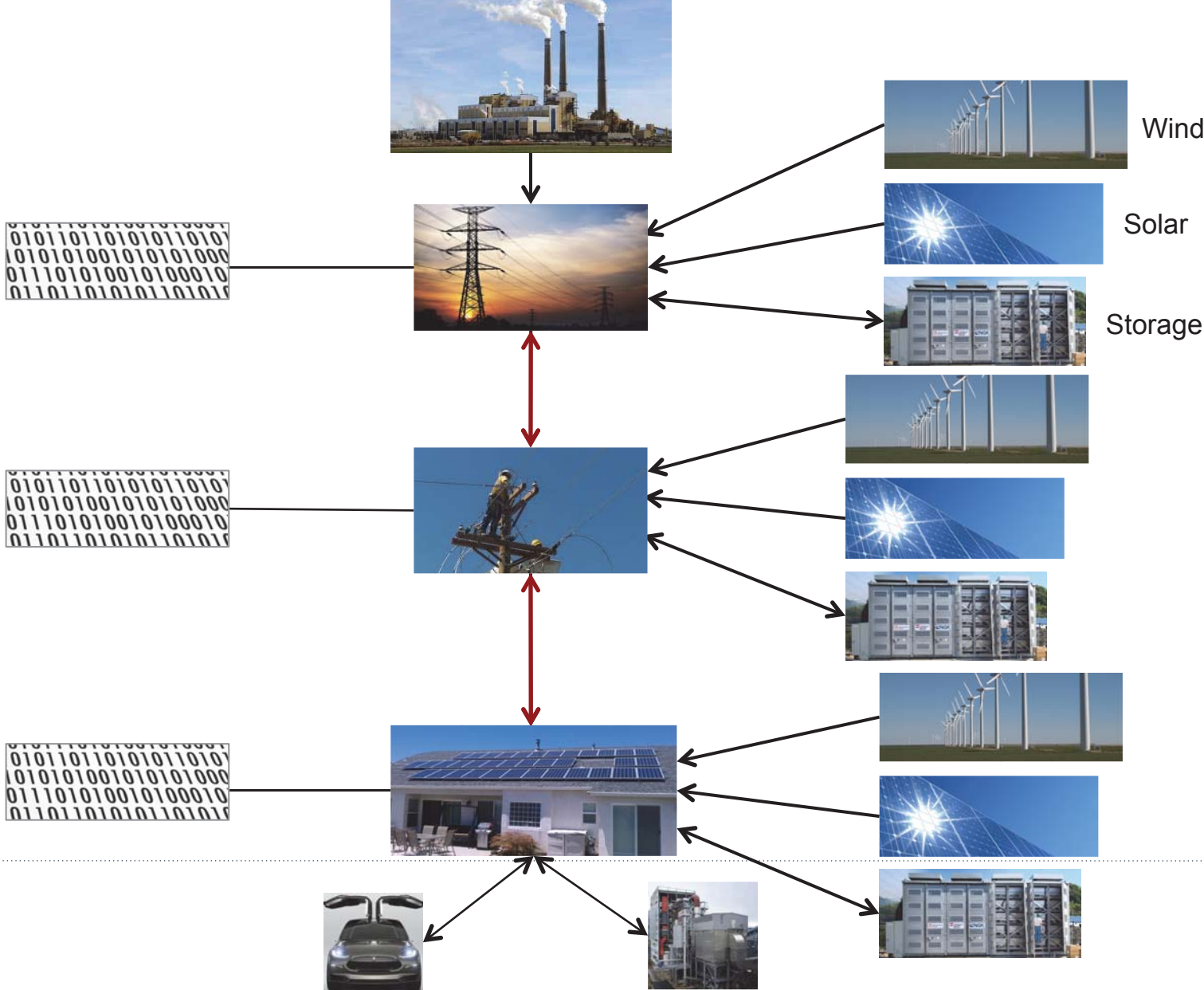
Our Changing Grid - Markets

More or different products

Better algorithms

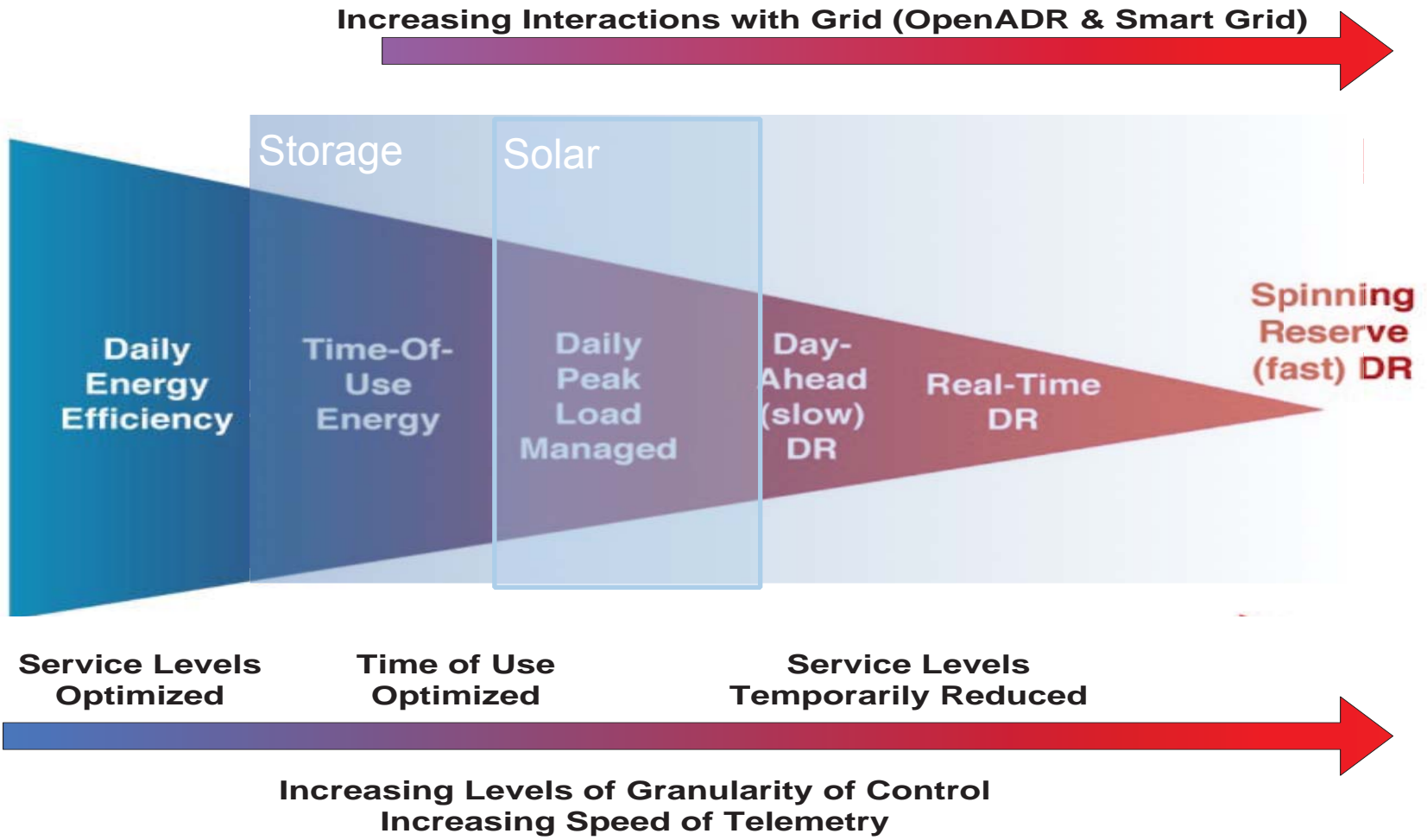
New markets, more services and/or different products

Market design tools integrated with power flows

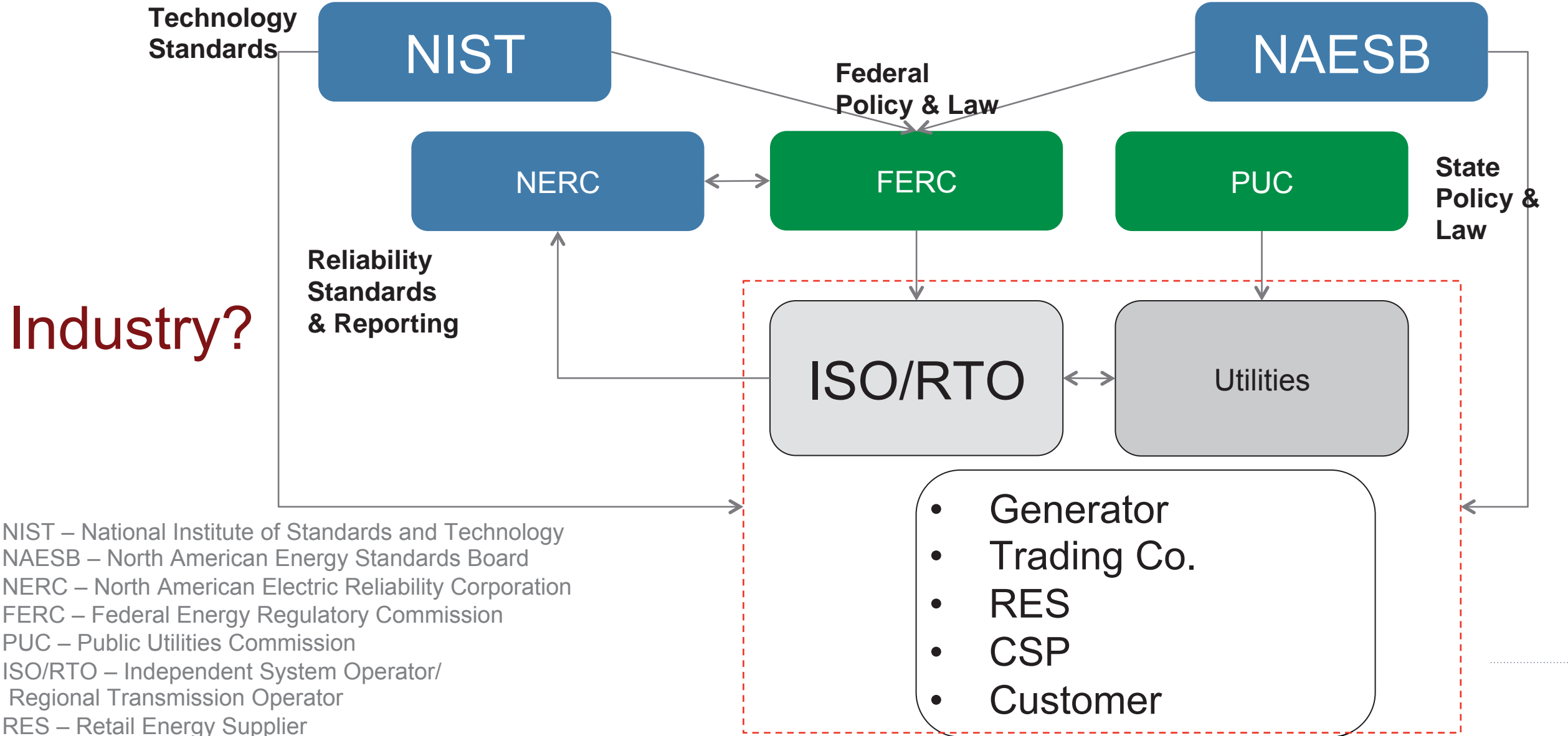


How to quantify the value from new types of services that DERs can deliver?

Demand-side activities are changing



Technology and Market Influences in the US



NIST – National Institute of Standards and Technology
 NAESB – North American Energy Standards Board
 NERC – North American Electric Reliability Corporation
 FERC – Federal Energy Regulatory Commission
 PUC – Public Utilities Commission
 ISO/RTO – Independent System Operator/
 Regional Transmission Operator
 RES – Retail Energy Supplier
 CSP – Curtailment Service Provider

Key issues to consider for an integrated future

- Not everywhere has smart meters
 - Can we deploy metering along with DERs?
 - Can we utilize DERs as grid edge sensors/controllers?
- Access to data
 - Meter data
 - Rates and tariffs
 - Location
- New Power Electronics technologies
- Data Analytics for planning and operations
 - For customer
 - For utilities
- Codes and Standards
 - Safety
 - Interoperability
- Wholesale/Retail Integration
 - Value of services
 - Cost of delivering services

Data Analytics for planning and operations

Google | Project Sunroof



Enter an address

Analysis complete. Your roof has:

- 1,788 hours of usable sunlight per year
Based on day-to-day analysis of weather patterns
- 2,029 sq feet available for solar panels
Based on 3D modeling of your roof and nearby trees

\$12,000 savings
Estimated net savings for your roof with a 20-year lease

[FINE-TUNE ESTIMATE](#) [SEE SOLAR PROVIDERS](#)

Wrong roof? Drag the marker to the right one.

Shade Sun

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Fine-tune your information to find out how much you could save.

Interoperability – Open Field Message Bus Protocol (OpenFMB)

Framework for distributed intelligent nodes interacting with each other

Economical industrial internet technologies applied to Smart Grid

Distributed resources communicating via common semantic definitions

Grid-edge nodes processing data locally for control and reporting

OpenFMB supports field-based applications that enable:

- Scalable peer-to-peer publish/subscribe architecture
- Data-centric rather than device-centric communication including support for harmonized system and device data
- Distributed logic as well as centralized logic



Concluding Remarks

DER adoption will take place in stages:

1. Grid modernization
2. DER integration with new operational capabilities
3. Distributed markets

Industry engagement is important

To industry, the value proposition is key.

Lots of innovation in hardware, software, data science and IoT to apply to power systems

If we were to do it from scratch, what would technologies, markets and policies look like?

Thank you!
