IMPACTS ON STRATEGY, BUSINESS MODELS AND OPERATIONS

DISTRIBUTED ENERGY RESOURCES

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GLOBAL ENERGY PRACTICE LEAD

APRIL 2016
MEGA TRENDS THAT DRIVE ENERGY INDUSTRY TRANSFORMATION

The following mega trends underpin the industry transformation:

1. Greater customer choice and demand for more (sustainable) energy options.
2. Increased policies and regulations to reduce carbon emissions.
3. Search for shareholder value: new ventures and increased M&A.
5. Merging of mega industries around growth opportunities.
6. Replacement of old infrastructure and transition toward an increasingly decentralized and smarter power grid architecture (the energy cloud - DER).

The Energy Industry transformation includes a wide range of strategic, operational, technological, commercial, environmental, and regulatory changes that are transforming the traditional strategies and business models.
ENERGY INDUSTRY TRANSFORMATION
THE ENERGY CLOUD

TODAY - Traditional Power Grid
Central, One-Way Power System

EMERGING - The Energy Cloud
Distributed, Two-Way Power Flows

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DER is one of the most disruptive factors affecting the grid today and into the future.

Resources can be utility or 3rd party owned on the grid in front of the meter or customer owned behind the meter.
ACROSS THE US, WE FORECAST STRONG DER PENETRATION GROWTH OVER THE NEXT DECADE

Drivers
- Declining System Costs
- Supporting Policies and Incentives
- New Business Models
- Reliability Concerns
- Product Availability
- Access to Financing

Observations
- DR, DG and EE have biggest share
- DG new build will be larger than centralized generation new build, from 2017-2018 onward.

US DER Forecast*

Source: Navigant Research Distributed Energy Resources Global Forecast, Q4 2015
1. ENERGY EFFICIENCY: THE IMPACT OF DOE RULEMAKING ON LOAD GROWTH WILL BE SIGNIFICANT

Energy Efficiency savings from DOE rules issued since 2000
- 100 quads of energy savings\(^1\)
- Equivalent to eliminating all U.S. residential energy consumption for 4 years

\(^1\)energy savings based on rules issued since 2000 over a period of 30 years after they were issued
2. DISTRIBUTED GENERATION: RESIDENTIAL AND COMMERCIAL SOLAR PV CONTINUES TO GROW

- Solar PV Cost (installed) will continue to decline.
- The 5 year extension of the 30% federal investment tax credit (ITC) will drive continual market growth.
- Utility and Community scale solar most cost effective, but residential and commercial will continue to grow.

**U.S. Annual Capacity Additions (MW)**

*Source: Navigant, January 2016*
Whole Foods Market Inc. is embracing solar power. The Texas-based grocery chain has signed agreements with SolarCity and NRG Energy Inc. to install rooftop solar units at up to 100 stores and distribution centers in 9 states.
3. DEMAND RESPONSE: TECHNOLOGY IS ENABLING DR RESOURCES TO RESPOND MORE LIKE GENERATION

**Availability**
- 24/7, year-round availability
- Dispatch-able dozens or hundreds of times per year

**Speed of Response**
- Spinning reserves (<10 min.)
- Frequency response/ Regulation services

**Performance**
- Ramp-up and down
- ISO-qualifying precision of delivered megawatts
- Real-time visibility from control room
- Improved customer experience
4. DISTRIBUTED STORAGE: COMMERCIAL & INDUSTRIAL

- Business case based around reduction of demand charges and energy cost mgmt.
- Vendors are now offering third party financing.
  - No money down installation
  - Shared savings model
  - Minimal risk or involvement required of customers
- Leading vendors include: Stem, Green Charge Networks, Coda Energy, Sharp

### Battery Pack Forecasts, World Wide Pricing

- **Advanced Flow Battery**
- **Advanced Lead-Acid**
- **Advanced Li-ion**
- **NaS Battery**
- **Sodium-Metal Halide**

### Reduction of Demand Charge

Source: Sharp

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Source: Navigant, January 2016
5. ELECTRIC VEHICLES: ALTHOUGH EARLY, ADOPTION WILL CONTINUE

- Electric Vehicles are large opportunity for utility load growth
- Workplace and home charging can be timed to grid requirements (peak load)
- Investments in charging infrastructure is beneficial for utilities
- EV adoption rates differs greatly by region and will depend on:
  - Regulations
  - Gasoline prices & battery costs
  - Range & recharge time
  - Charging infrastructure
  - Electric resale rules
  - Consumer preferences

(Source: Navigant Research)

Road Transportation Electricity Consumption, U.S. : 2015-2035

(Source: Navigant Research)
IMPLICATIONS FOR UTILITIES - YOUR **ECOSYSTEM** WILL EVOLVE TO ACCOMMODATE DER PENETRATION.

- Basic power products for Residential and C&I
  - Safe
  - Reliable
  - Affordable
- Individualized Energy Products and Services
  - S/R/A
  - Clean
  - Distributed
  - Intelligent

- Regulation
- Governance
- Strategy
- Business models
- Processes/systems
- Standards
Customer Choice and Technology (DERs) drive regulatory changes, new entrants and business models.

- Rate design must integrate DER to fairly compensate utilities and DER owners/operators for the value they provide.
- More fluid, incentive-oriented frameworks needed to support innovation and modernization and operations investments.
- Vertically integrated utilities can adapt to DER trends and incorporate into Integrated Resource Planning and Operations, and have to do so without disrupting current model (safe, reliable, affordable power).
### EXAMPLES OF CURRENT DER BUSINESS MODELS

<table>
<thead>
<tr>
<th>Utility</th>
<th>DER</th>
<th>Program</th>
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<tbody>
<tr>
<td>Arizona Public Service</td>
<td>Solar PV</td>
<td>Pilot program where they own and rate base residential PV systems that are grid-tied; participating customers are on specific feeders and receive $30/month for hosting the PV system.</td>
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<tr>
<td>Detroit Edison</td>
<td>Solar PV</td>
<td>Community solar program in which DTE owns and operates the PV systems and offers their customers subscriptions to the projects.</td>
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<tr>
<td>Exelon</td>
<td>Microgrids</td>
<td>Exelon is developing microgrids across its territory. ComEd is moving forward with 6 microgrids in Northern Illinois.</td>
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<td>San Diego Gas and Electric</td>
<td>Energy Storage</td>
<td>Proposed a plan for customers – on targeted feeders - to own energy storage, but SDG&amp;E has ability to dispatch systems during peak events.</td>
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There is broad variance among utilities planning for a transition to the Energy Cloud. They can select from a variety of DER business models for development and ownership.

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<thead>
<tr>
<th>Assess</th>
<th>Strategize</th>
<th>Pilot</th>
<th>Implement</th>
<th>Integrate (iDER)</th>
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<tbody>
<tr>
<td><strong>Model</strong></td>
<td><strong>Selection Rationale</strong></td>
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<tr>
<td>1. Integrate, develop, and own DER</td>
<td>Utility has DER integration experience and has no difficulty with designing, integrating, and controlling with in-house resources.</td>
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<td>2. Develop and own DER</td>
<td>Utility has the in house capability to handle permitting, site selection, financing, and interconnection.</td>
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<td>3. Purchase a turnkey solution</td>
<td>Due to DER specific knowledge, it may be more economical to have a third party handle the project development and site preparation tasks.</td>
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<td>4. Contract services</td>
<td>Due to the regulatory environment, utility contracts services from 3rd Parties.</td>
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UTILITIES AND NON-UTILITIES HAVE STARTED TO PURSUE DER WITH FOCUS ON LARGE C&I

Edison International creates subsidiary to help large energy users. Edison International is launching a business that will help reduce energy costs, improve efficiency and offer more environmentally friendly options for large energy users. The company's new subsidiary, Edison Energy, aims to serve commercial buildings, data centers, retail centers, healthcare operations and educational institutions nationwide.

“GE Current combines GE's products and services in energy efficiency, solar, storage, and onsite power with our digital and analytical capabilities to provide customers – hospitals, universities, retail stores, and cities – with more profitable energy solutions,” said Jeff Immelt, Chairman and CEO of GE.

Customers:
- Walgreens
- Simon Property Group
- Hilton Worldwide
- JPMorgan Chase
- Hospital Corporation of America
- Intel
- Trane

Duke Energy
Greg Wolf Commercial Portfolio president, Duke Energy: “In addition to utility-scale solar projects, we’ve also made investments in distributed generation and energy management systems for commercial and industrial companies.” Last year, Duke Renewables bought majority stakes in REC Solar (for commercial businesses) and Phoenix Energy (energy mgt. systems and services for commercial and industrial customers).
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