DISTRIBUTED SUN

EMP SIG SUMMIT

ELECTRICITY INVERSION:

CAPITAL MARKETS IMPLICATIONS ON EMP SIG

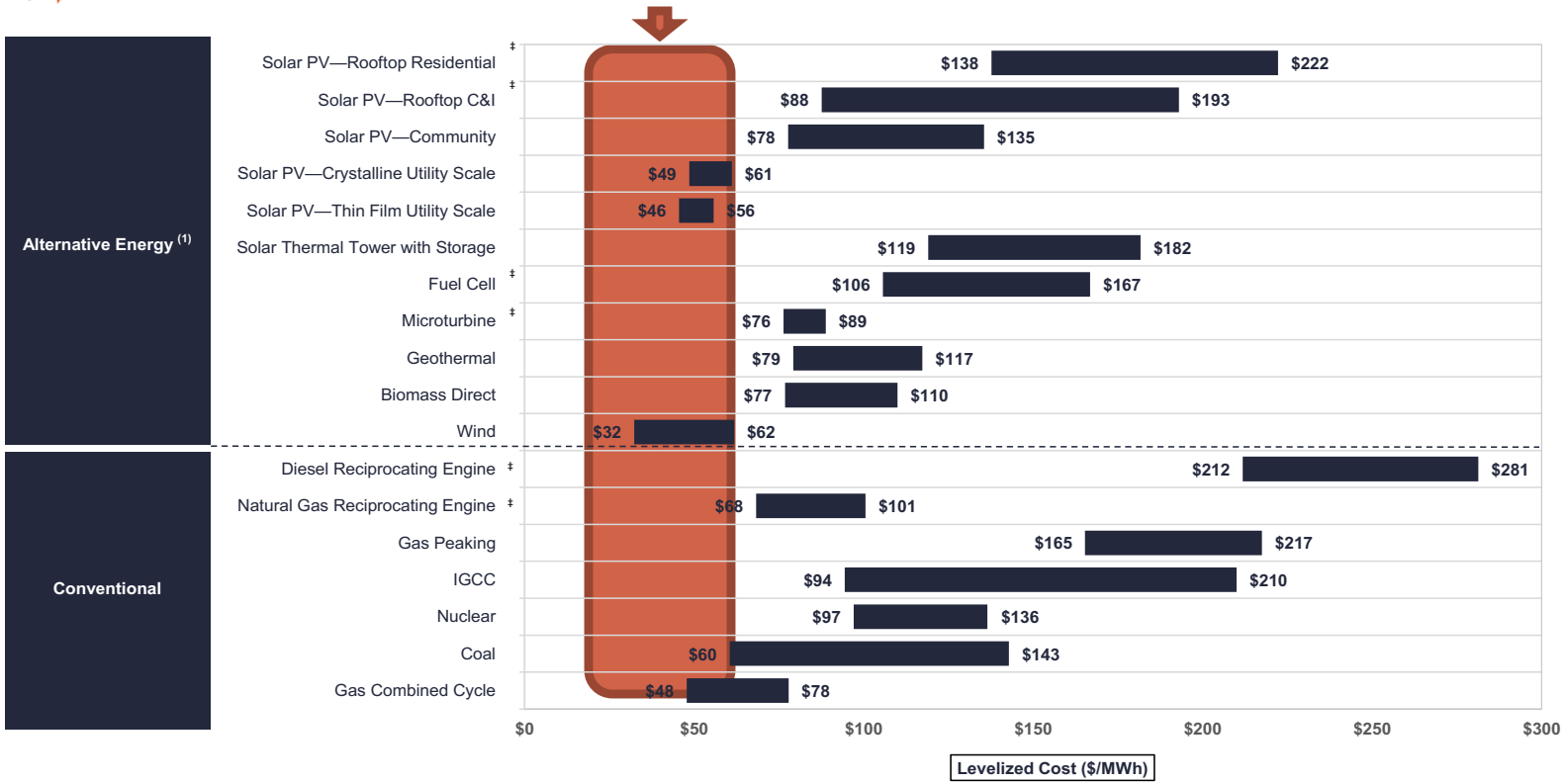
JEFF WEISS, EXECUTIVE CHAIRMAN

DECEMBER 7, 2018

ELECTRICITY INVERSION – DRIVING EMP INVESTMENT

- Markets demand **resilient, secure, affordable** power
- Transmission: 20th century grid no longer offers the best price with the best technology
- **As the grid becomes a mesh network, resilience improves**
  - Customer demand, solar < $1/Watt, plunging storage costs, EV, smart transmission, drive this
- States are key – need pricing transparent, streamline interconnection & permitting
- LCOE and cost of capital accelerate this inversion
- Customers require providers address their needs

RENEWABLE INVESTMENT DRIVEN BY COMPETITIVE LCOE



Unsubsidized LCOE, without social, environmental, location, reliability, security, or back-up generation costs factored in. Source: Lazard

CUSTOMERS GIVE THE PARTY

Michael Terrell, *Head of Energy Strategy*, Google

THE **ULTIMATE PRIZE** IS TO ENABLE **CARBON-FREE POWER** IN EVERY HOUR OF EVERY DAY. JUNE 2018, NY TIMES

Lisa Wood, VP Customers, Edison Electric Institute

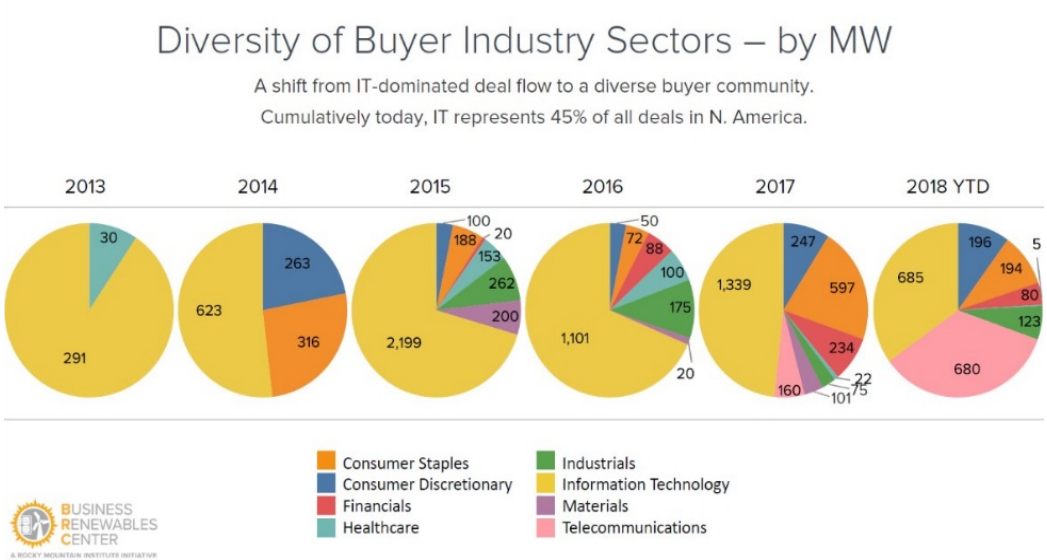
WE THINK (BUYING ENOUGH RENEWABLE POWER TO MATCH 100% OF (ELECTRICITY USE) IS A **MAJOR TREND**. **CUSTOMERS** ARE BECOMING THE **DRIVER**. JUNE 2018, NY TIMES

Because of the **wall of capital** chasing limited operational asset opportunities, investors are seeking more innovative solutions to access operating assets. As a result, investors are increasingly seeking to enter into framework and **platform agreements** with developers. Under these agreements, they would provide financial support during the development phase with an option to acquire the assets either at pre-construction or post-construction, broadly at market prices.

Deal-making in the Renewable Energy Sector – **KPMG**, 2018

Buyer Diversity Increasing

- Apple, Google, Amazon & Microsoft led remote purchasing of clean energy.
- Today, the F500 intends to reduce its carbon footprint.
- Progress is just beginning…



Customers Demand Energy as a Service

Post PPA contracts include contracts for differences, hybrid services with SLA's, time shifting, black start, arbitrage.

Off-site Solutions

Solar & wind-based power generation and storage

Product-centric model; low-cost LCOE, predictable short-term contracts for off-takers; long-term de-risking from other revenue sources.

1. PPAs - Contracts for differences or Physical delivery in liquid, 3-5 year terms; from renewable energy generators.
2. Capacity market, RTO/ISO ancillary services, energy arbitrage, black-start capability, volt-VAR optimization

On-site Solutions

Solar & fuel-cell power generation, storage, geothermal / heat pumps, energy efficiency enhancements (C&I only)

Customer-centric, productized model; predictable service contracts with guaranteed outcome; upside shared from other revenue sources

1. PPAs or leases for new equipment; with industry-specific SLAs.
2. Capacity market, RTO/ISO ancillary services, energy arbitrage, black-start capability – profits shared with host

Hybrid (community-scale)

Solar power, line-sectionalized storage/ back-up power, district heating/cooling – 2 to 10 customers

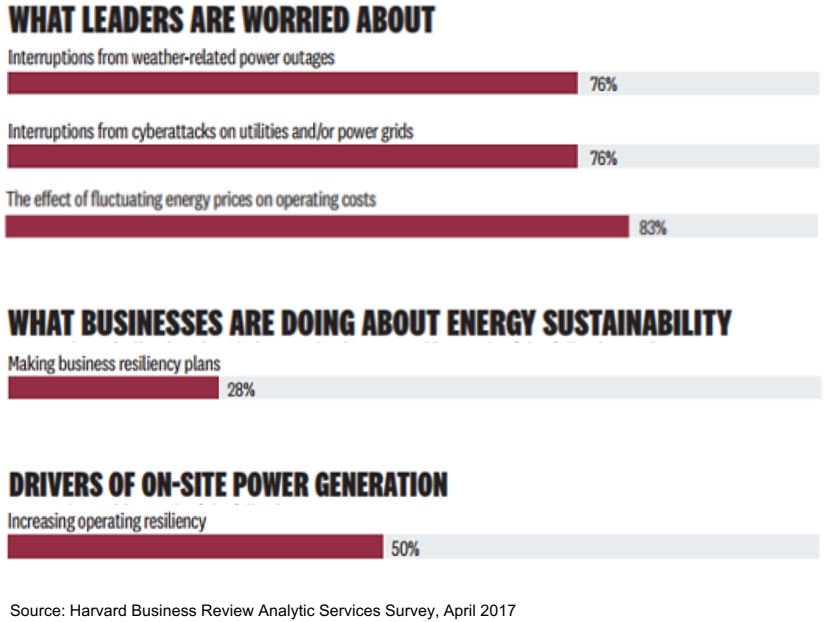
Solution-centric model; predictable service contracts with SLAs;

1. Leases for new equipment or contract for services.
2. Energy & Capacity markets, RTO/ISO ancillary services, energy arbitrage, black-start capability – profits shared with host

Changing Role of Utility Franchise

- Transmission and distribution are natural monopoly roles
  - The generation and delivery of power should be competitive
  - Smart transmission, the non-wires component, should be deregulated to allow competitive services
  - The utility should be the distribution system operator
- Consumers are no longer best served by the monopoly customer sales function of the utility
  - Competition offers better structured consumer offerings and optimized billing and data experience
  - Utilities should be able to offer billing and collection services, not as a monopoly but in a competitive environment. As the long time face to the customer, 21st century service companies can greatly enhance the customer experience.
- While generation is deregulated, interconnection is a natural utility role. As utilities control transmission, interconnection costs should be paid by utilities and added to the rate base
  - This assures best economies of scale and lowest system cost for interconnection

- **Major Concerns**
  - Interruptions from weather-related outages
  - Improve operating resiliency & security
- **Potential Solutions**
  - Business resiliency plans
    - Only a fraction of organizations have done so
  - On-site power generation
    - One-third generate their own power
- **"The time is ripe to accelerate adopting business resiliency and energy procurement strategies**
  - Declining cost of solar storage and microgrid technologies
  - Energy efficiency & integration of technologies to address all energy requirements



Source: Harvard Business Review Analytic Services Survey, April 2017

Generational Investment Opportunity Driven By The Electricity Inversion

- **Key outcomes:**
  - ***Resilient, Secure, Affordable*** power as centralized moves to decentralized
  - Grid as a *distributed network* is stronger and has lower operating costs than hub and spoke
- Largest marginal growth of electricity demand is wireless (cars and devices) versus stationary
- Batteries enable adoption
- Smart grid transmission investment ensures mesh grid resilience and security

- **Vast implications on investment models, resilience, security, cost and customer relationships**

- **Cost reduction and technology advance is driving**
  - Solar under $1 per Watt
  - Storage plummeting & new technologies entering

- **The new LCOE:** Measure and compare investments based on levelized cost of ***secure, resilient, smart, localized, time based, stored energy***