

THE 21ST CENTURY UTILITY

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A CONSTANT STATE OF REVOLUTION: CHANGE ON THREE FRONTS SINCE 1978

- Wholesale competition
- Generation Mix and Climate Change
- Disruptive Retail Revolution (Distributed Energy Resources/Systems)

HOW FAR HAVE WE COME?

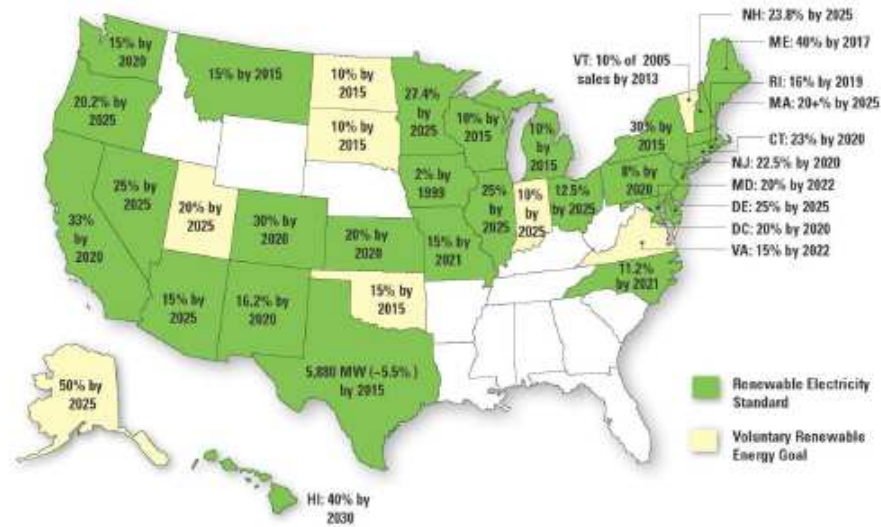


- **1978**
 - No independent power production or renewable development
 - Public Utilities Regulatory Policies Act of 1978 (PURPA) launched the Independent Power Producer sector.
- **August of 2015**
 - Energy Information Administration (EIA) reported that IPP production is approaching half of installed utility generation (150,000 Gigawatt Hours v. 225,000 Gigawatt Hours). (Electric Power Monthly, October, 2015)
 - Renewable generation mandated in many states through renewable portfolio requirements
 - EPA's Clean Power Plan will effectively mandate renewable generation

RENEWABLE PENETRATION

- Largely driven by state law, prior to EPA’s Clean Power Plan

Figure 1. State Renewable Portfolio Standards⁵



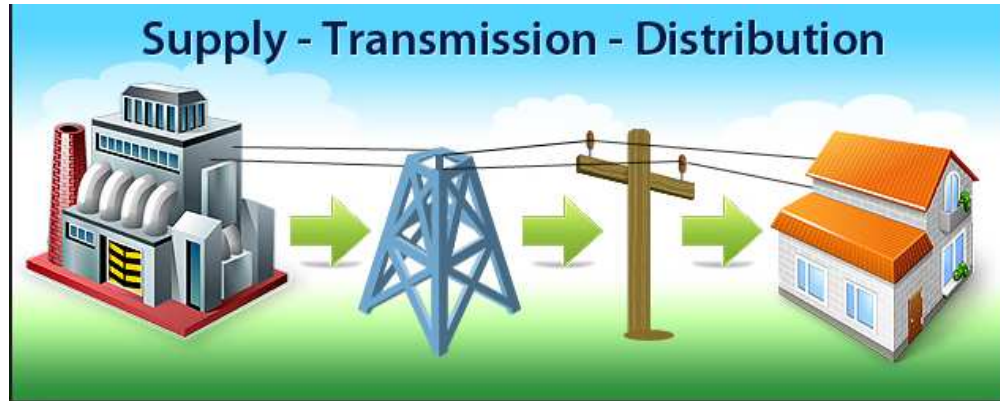
- Source: Union of Concerned Scientists, 2013
- Renewable Portfolio Requirements pick up:
 - NY - Governor Directs PSC to move to 50% by 2030
 - CA – 10/15 Legislation moves from 33% by 2020 to 50% by 2030

UNDERSTANDING THE ELECTRIC INDUSTRY

- **Structure of Utility Industry**
 - Historically: Fully integrated “natural monopolies”
 - Today - Substantial regional differences exist, but much has been unbundled:
 - ◆ Full integration (SE US, NW)
 - ◆ Wholesale competition varies dramatically
 - ◆ Emerging distributed generation market fragmented



UNDERSTANDING THE ELECTRIC INDUSTRY



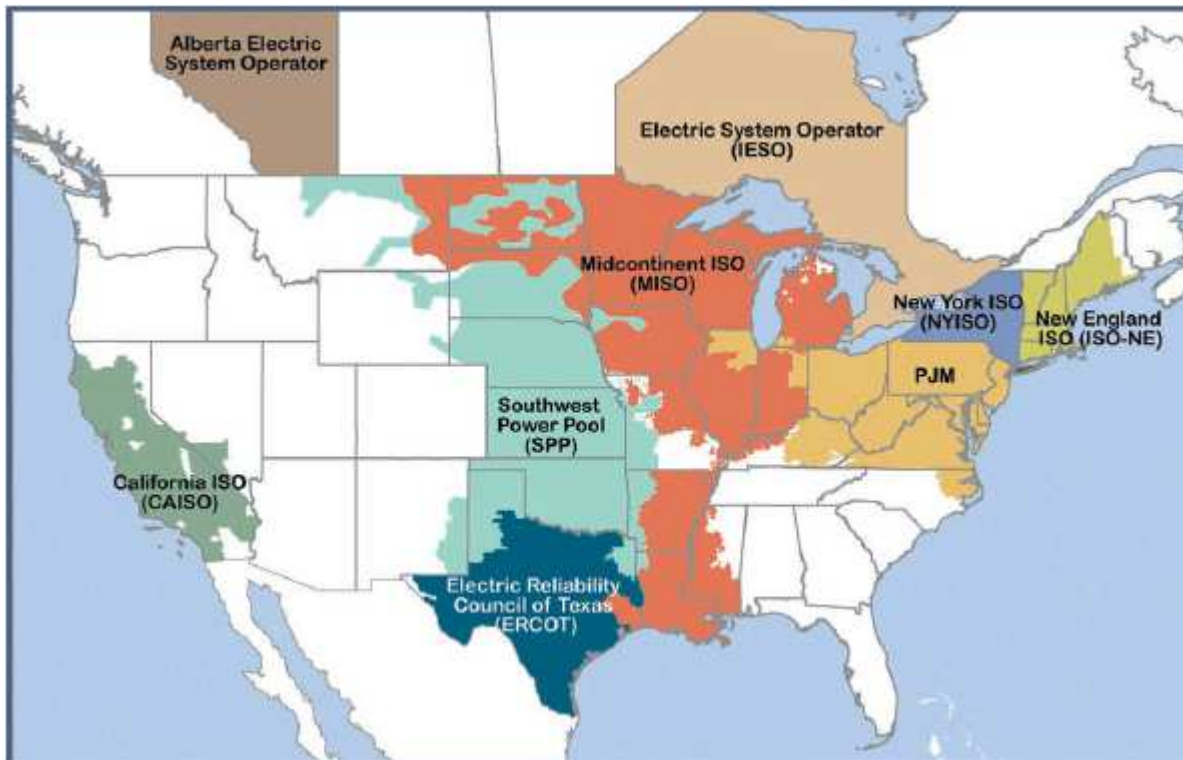
- Federal-State Jurisdiction
 - Federal Energy Regulatory Commission (FERC) Jurisdiction:
 - ◆ Wholesale Sales (sales for resale)
 - ◆ Interstate transmission (unbundled)
 - State Jurisdiction:
 - ◆ Retail “Distribution” Service
 - ◆ Siting authority for generation/transmission/distribution

EVOLUTION OF THE WHOLESALE POWER MARKET

- **FERC Order No. 888, 75 FERC ¶ 61,080 (1996)**
 - Vertically integrated utilities must provide open access transmission service
 - Legal Basis: Anti-discrimination provisions in Federal Power Act
 - ◆ Built on Order 636 unbundling in gas pipeline industry
 - ◆ Drew on telecommunications experience
- **Regional Transmission Organization/Independent System Operator Formation and Order No. 2000, 89 FERC ¶ 61,285 (1999)**
 - RTOs are independent transmission operators, designed to operate transmission system independently over a wide region.
 - RTOs now manage wholesale power markets
 - ◆ Generation was fully divested by utilities in some regions (CAISO, NYISO), but not all.

REGIONAL TRANSMISSION OPERATORS

- RTOs cover $\frac{1}{2}$ U.S. land mass and $\frac{2}{3}$ of US population

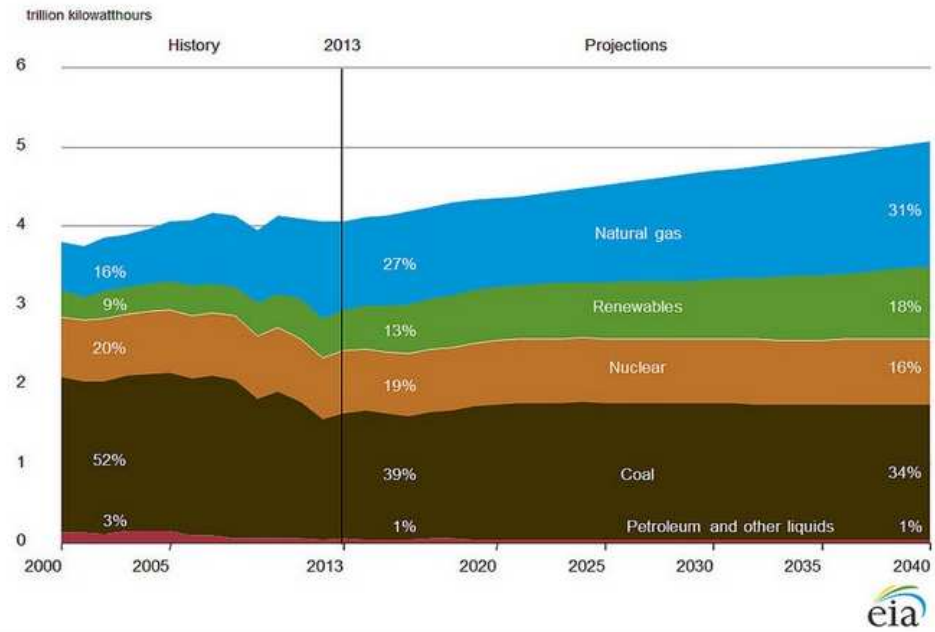


RENEWABLE PENETRATION – WITHOUT CLEAN POWER PLAN

- 2014 Energy Information Administration

- Coal = 39%
- Natural gas = 27%
- Nuclear = 19%
- Hydropower = 6%
- Other renewables = 7%
 - Biomass = 1.7%
 - Geothermal = 0.4%
 - Solar = 0.4%
 - Wind = 4.4%
- Petroleum = 1%
- Other gases < 1%

Figure 31. Electricity generation by fuel in the Reference case, 2000-2040



EPA CLEAN POWER PLAN

- 32% reduction in power sector CO₂ emissions from 2005 levels to 2030
- State-specific goals established based on “best system of emission reduction”
 - Reductions calculated by reference to feasibility of three building blocks
 - ◆ Improved Power Plant Efficiency
 - ◆ Shifting generation from coal to natural gas plants
 - ◆ Shifting generation to zero-emitting renewables
- Glide Path in three phases:
 - 2022-24
 - 2025-27
 - 2028-29
- Optional “mass-based” approach (vs. lbs/Mwh – “rate-based”) allows reliance on energy efficiency and demand response
- 28% Renewables by 2030

RETAIL REVOLUTION? – ENGINES OF CHANGE



- **Information and Communications Technology (ICT)**
- **Distributed Energy Resources (behind the meter)**
 - Distributed Generation
 - Distributed Energy Storage
 - Demand Response
 - Electric Vehicles
- **Distributed Energy Systems Combine ICT and DER**
 - **Microgrids**

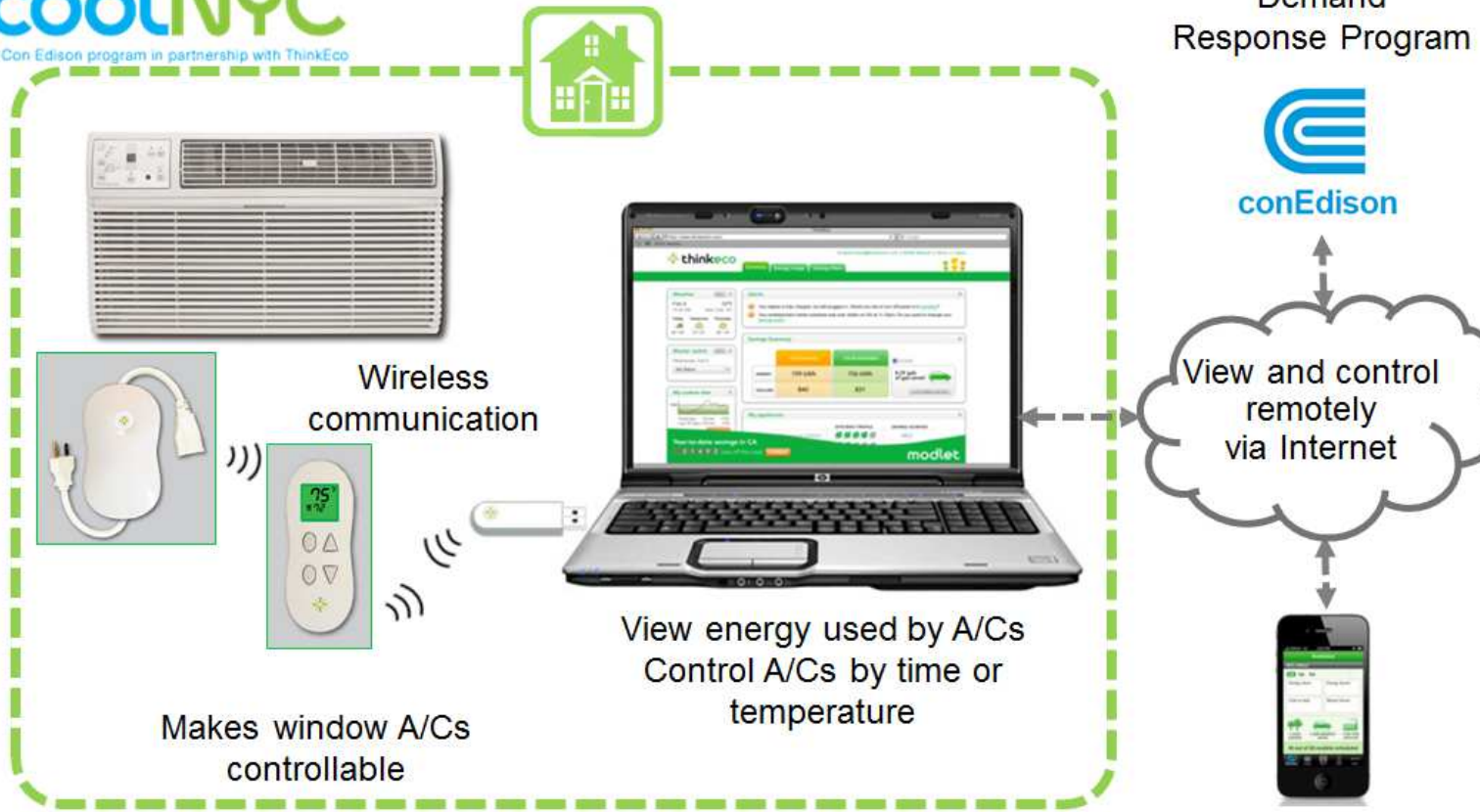
INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT)

- Smart meters:
 - Record and communicate real-time energy usage
 - Enables real-time response to time-of-use rates
- Automated Appliances
- “Energy Box” to manages usage
- Business models
 - Enernoc - remote monitoring and load control
 - Opower
- Customer Issues:
 - Lifestyle
 - Privacy



Con Edison's coolNYC Technology

coolNYC
A Con Edison program in partnership with ThinkEco



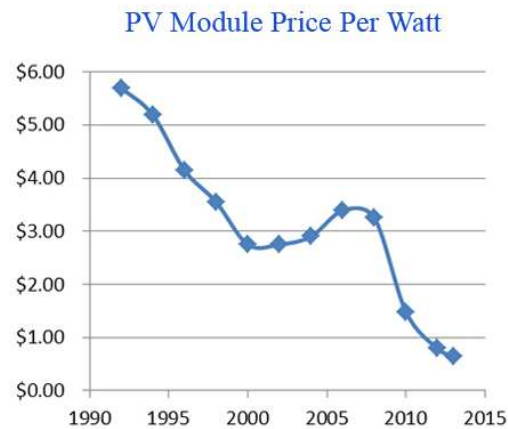
**STINSON
LEONARD
STREET**

DISTRIBUTED ENERGY RESOURCES (BEHIND THE METER)

- Resources:
 - Distributed Generation – principally solar
 - Distributed Energy Storage –
 - ◆ Lithium Ion (Tesla)
 - ◆ Compare utility scale storage: pumped storage; lead acid/carbon; Flow batteries
 - Demand Response
 - Electric Vehicles
- Legal Issues:
 - Net Metering v. Wholesale Power Sales
 - ◆ FERC CA Decisions
 - ◆ PURPA Avoided Cost

RETAIL REVOLUTION? – ENGINES OF CHANGE

- Technological Developments
 - Photovoltaic Cost Decline: PV prices fell an average of 6-8%/yr. between 1998 and 2013



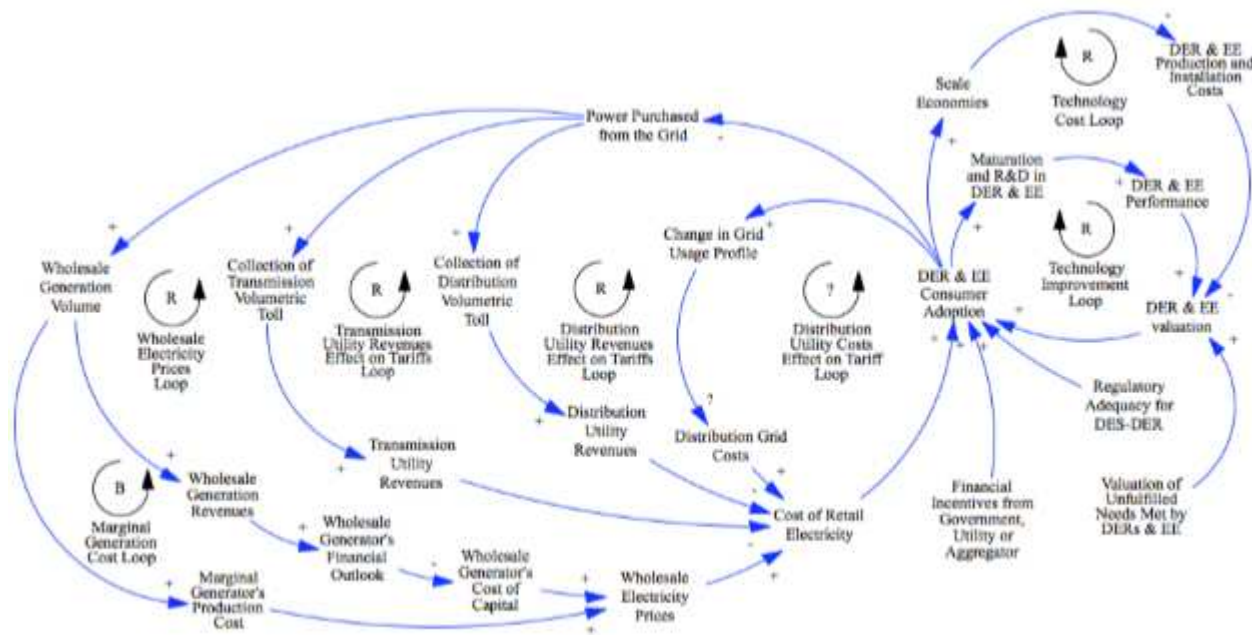
- ◆ Source: Solarcellcentral.com
- ◆ But: 7/2015 Brattle Group Study anticipates that utility-scale solar will still be ½ cost of distributed solar in 2019.

- Storage Developments

MICROGRIDS

- **Defined (DOE):** “[a] group of interconnected loads and distributed energy resources (DER) with clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid [and can] connect and disconnect from the grid to enable it to operate in both grid connected or island mode.”
 - Resources: DER; Storage; Distribution facilities
 - Singular feature: Ability to disconnect from grid
- **Potential advantages**
 - Grid resilience
 - Source of clean energy
 - Demand response potential
- **Regulatory Challenges**
 - Valuing contribution to grid
 - Valuing grid backstop

DISRUPTIVE POTENTIAL (MIT UTILITY OF THE FUTURE STUDY)



DISTRIBUTED ENERGY RESOURCES: THE REMUNERATION PROBLEM

- Electric Grid Cost Components (Resid'1)

- Generation - 60%
- Distribution - 32%
- Transmission - 8%

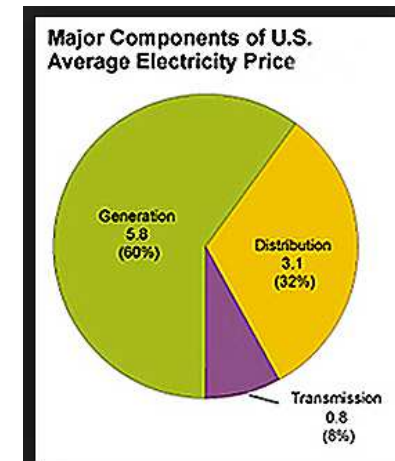
Average monthly bill: \$75 - \$200

- Typical Rate Structure:

- Usage-Based Rates with no fixed charges.

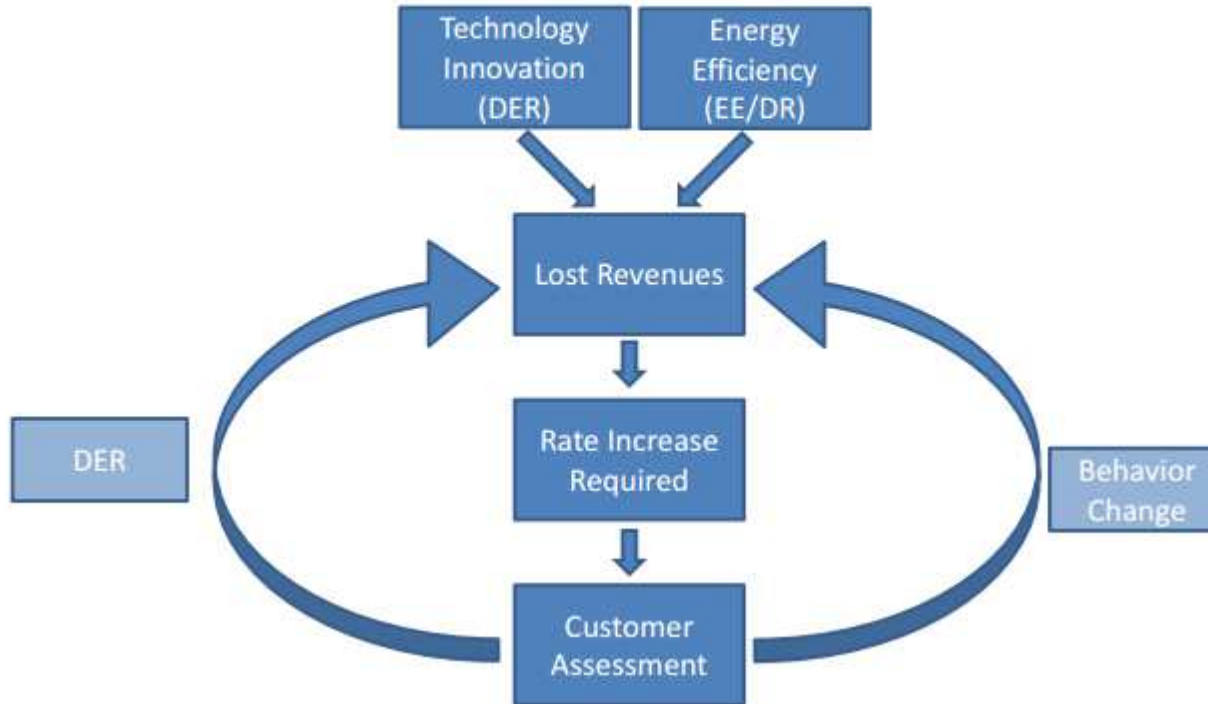
- At Risk:

- Transmission and Distribution investment
- Generation backstop



EDISON ELECTRIC INSTITUTE'S “VICIOUS CYCLE”

Exhibit 3
Vicious Cycle from Disruptive Forces



DISTRIBUTED ENERGY RESOURCES: THE REMUNERATION PROBLEM - NET METERING

- Net Metering: Adopted in many states, the meter rolls backward during operation of DER, undermining fixed cost recovery built into volumetric rate.
 - Net metering “pays” DER the bundled utility rate, which includes utility’s fixed cost.
- FERC has disclaimed jurisdiction, holding that no wholesale sale occurs under the FPA or Public Utilities Regulatory Policies Act (PURPA) unless there is a net delivery of energy to the utility over the course of a month. *MidAmerican Energy*, 94 FERC 61,340 (2001); *Sun Edison LLC*, 129 FERC 61,146 (2009).
 - But see: *So. Cal. Edison v. FERC*, 603 F.3d 996 (D.C. Cir. 2010); *Calpine Corp. v. FERC*, 702 F.3d 41 (DC Cir. 2012) (rejecting monthly netting as irrelevant to FERC jurisdiction)
- Problem: No assured fixed cost recovery.
- Utility argument:
 - DER value is energy-only.
 - PURPA (Section 210) caps compensation at utility “avoided cost”

THE REMUNERATION PROBLEM - NET METERING



- State are reconsidering net metering tariffs
 - **Arizona Corporation Commission** permitted a \$.70/kilowatt/mo. charge vs. staff recommendation of \$3.00/kw and Arizona Public Service proposal of \$8.00
 - ◆ Arizona’s average monthly bill is \$120, of which roughly 40% is fixed transmission and distribution, and another portion is fixed generation
 - **Salt River Project:** Imposed a “self-generation charge” - Appx. \$50 applied only to self-generation customers
 - ◆ Salt River sued for antitrust violation: *Solar City v. Salt River Project* (2:15-cv-00374); refusal to dismiss now on appeal to the 9th Cir.
 - **Hawaii Public Utilities Commission:** October, 2015: Revised net metering to credit solar customers at utility’s avoided cost (energy)
 - **California PUC:** Utility petition filed (October, 2015) to halve net metering payments to solar self-generators

REGULATORY CHALLENGE – ROLE, COST AND REGULATION OF TRADITIONAL UTILITY

- **Weighing the Value of the Grid vs. Value of DER**
 - Value of Grid: Backstop; universal service; economies of scale; value of central generation
 - Potential Value of DER
 - Generation peak shaving (potential wholesale and bundled retail impacts);
 - Avoided Transmission and Distribution costs – esp. load pockets

REGULATORY CHALLENGES

- **Regulation of the Bottleneck** – Role and permissible activity of utility
 - ◆ Independent Distribution System Operator (analogous to a Regional Transmission Operator)
- **Utility Nightmare: The Death Spiral** – Declining customer base for fixed cost recovery
- **Universal Service and the Leftovers**
- **Who Controls the Customer Interface and + the Value Proposition?**
- **Responsibility for Cybersecurity**

RELATED PROCEEDINGS - NEW YORK

- Proceeding on Motion of the Commission in Regard to **Reforming the Energy Vision**, *Order Adopting Regulatory Policy Framework* (Case No. 14-M-0101), issued 2/26/2015.
 - Utility as a “Distribution System Platform” (“DSP”) coordinating distributed energy resources
 - ◆ DSPs’ functions: (i) integrated system planning; (ii) grid operations; (iii) market operations; (v) platform for DER
 - ◆ DSPs will be the traditional utilities (at least for now), but will not generally offer DER (storage is an exception)
 - Value of DER
 - ◆ Avoided transmission
 - ◆ Avoided distribution
 - ◆ Avoided losses
 - ◆ Reduction to wholesale peak

RELATED STATE PUBLIC UTILITY COMMISSION PROCEEDINGS – STATE PROCEEDINGS

- **California:** *Order Instituting Rulemaking Regarding Policies, Procedures and Rules for Development of Distribution Resources Plans Pursuant to Public Utilities Code Section 769, Rulemaking 14-08-013.*
- **Hawaii:** Proceeding to Investigate Distributed Energy Resources Policies, Case No. 2014-092.
- **Texas:** Issues Relating to Energy Storage and Emerging Technologies, Project 40372.

THE WIN-WIN FOR THE GRID

- **Value Grid Appropriately**
 - Provide for full fixed cost recovery
 - ◆ Undermining regulatory bargain undermines the electric grid
 - Usage-Based Charges v. Fixed Cost Charges
 - Recognize need for stable, centrally controlled system.
 - ◆ Benefits:
 - Enables interconnection of utility-scale renewable power
 - Provides Balancing Function and Essential Reliability Services
 - Voltage support; reactive power
 - Secure backstopped customer interface
- **Value DER appropriately** (NYPSC contemplates compensation for grid assistance)
- **Allow Utility to Preserve Customer Interface**
- **Preserve Universal Service**
 - Subsidy questions: (1) for remaining customers; (2) for DER

WHERE ARE WE HEADED?

- Future of DER?
 - Is energy like telecommunications or is the system the answer?
 - ◆ Do we care enough about our choices or just want it off our hands?
 - Policy generally follows economics
 - ◆ Note: Brattle Group (July, 2015) concluded that utility solar is 1/2 the cost of distributed solar