The Energy Efficiency Revolution

2017 Annual Meeting & *Conference*

April 3-4, 2017

The Energy Efficiency Revolution

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Energy Efficiency by the numbers

From 1976 - 2008, PG&E's energy efficiency programs:

- Helped California avoid building 24 large power plants
- Saved 329.7 million MWh and 17.5 billion therms
- Saved customers over $24 billion
- Kept 155 million tons of CO_2 emissions out of the air

▶Equivalent to taking over 15 M cars off the road for one year.

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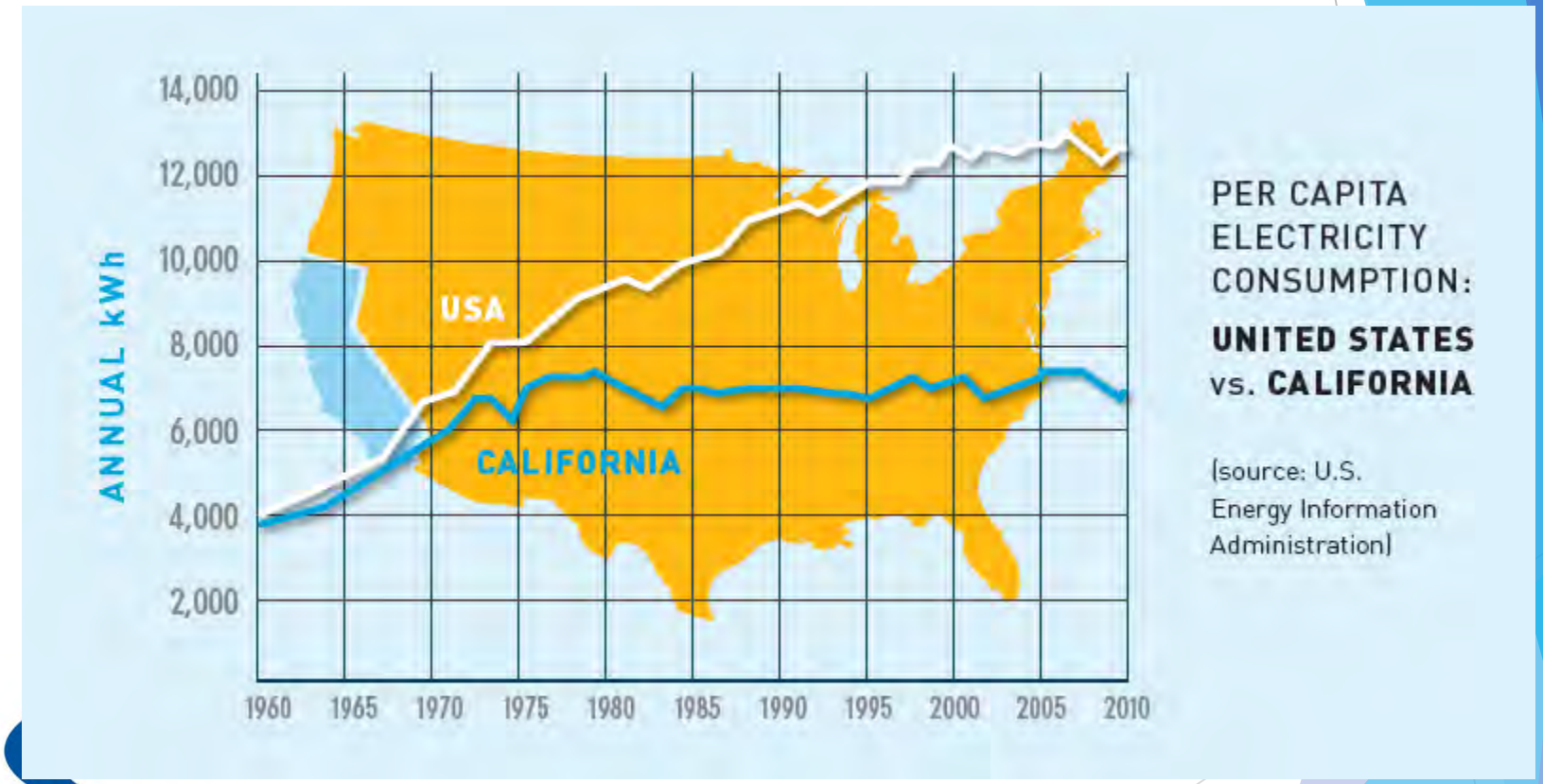
Per capita energy consumption in California has remained flat since the 1970s



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California Energy Efficiency Legal Requirements

- An electrical corporation's proposed procurement plan shall include, but not be limited to, all of the following . . . . (9) a showing that the procurement plan will achieve the following . . . . (B) The electrical corporation will first meet its unmet resource needs through all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible. PUC § 454.5 subd. (b)(9)(B).

- The Commission . . . in consultation with the [CEC] shall identify all potentially achievable cost-effective electricity efficiency savings and establish efficiency targets for an electrical corporation. PUC § 454.55

- A gas corporation shall first meet its unmet resource needs through all available natural gas efficiency and demand reduction resources that are cost effective, reliable, and feasible. PUC § 454.56 (b)

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California Senate Bill 350 – Clean Energy and Pollution Reduction Act of 2015

- SB 350 increases California's renewable electricity procurement goal from 33 percent by 2020 to 50 percent by 2030. This will increase the use of Renewables Portfolio Standard (RPS) eligible resources, including solar, wind, biomass, geothermal, and others.

- SB 350 requires the state to double statewide energy efficiency savings in electricity and natural gas end uses by 2030 . To help ensure these goals are met and the greenhouse gas emission reductions are realized, large utilities will be required to develop and submit Integrated Resource Plans (IRPs).

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California Senate Bill 350

- Public Utilities Code Section 454.55 (a) states:
- The [California Public Utilities] commission, in consultation with the Energy Commission, shall identify all potentially achievable cost-effective electricity efficiency savings and establish efficiency targets for an electrical corporation to achieve pursuant to Section 454.5, consistent with the targets established pursuant to subdivision (c) of Section 25310 of the Public Resources Code.
- Public Resources Code 25310 (c) (1) states:
- . . .The [California Energy Commission] in collaboration with the Public Utilities Commission and local publicly owned electric utilities, in a public process that allows input from other stakeholders, shall establish annual targets for statewide energy efficiency savings and demand reduction that will achieve a cumulative doubling of statewide energy efficiency savings in electricity and natural gas final end uses of customers by January 1, 2030 . . . .

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California Assembly Bill 802

- Requires the CPUC to authorize utilities to provide financial incentives to their customers that increases the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions.
- CPUC Rules required utilities to pay incentives only on the incentives above Title 24 Building Code requirements.
- Public Utilities Code Section 381.2 (b):
- . . . . the commission, in a separate or existing proceeding, shall, by September 1, 2016, authorize electrical corporations or gas corporations to provide financial incentives, rebates, technical assistance, and support to their customers to increase the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions, taking into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings. Those programs shall include energy usage reductions resulting from the adoption of a measure or installation of equipment required for modifications to existing buildings to bring them into conformity with, or exceed, the requirements of Title 24 of the California Code of Regulations, as well as operational, behavioral, and retrocommissioning activities reasonably expected to produce multiyear savings

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The Energy Efficiency Revolution Panel:

What do we know and how do we know it?

David Nemtzow
Director
Building Technologies Office
U.S. Department of Energy

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DOE Research Has Moved the Needle on Energy Savings

Past

- $1200 purchase
- $200/year to operate
- 18 cubic feet

- $8/year
- 60 Watts
- 1000 hour life

- Single-pane
- High heat loss

Present

- ✓ $550 purchase
- ✓ $50/year to operate
- ✓ 22 cubic feet

- ✓ $2.00/year
- ✓ 15 Watts (or less)
- ✓ Up to 25,000 hours

- ✓ Double-pane & low-e
- ✓ Low heat loss
- ✓ 3x more efficient

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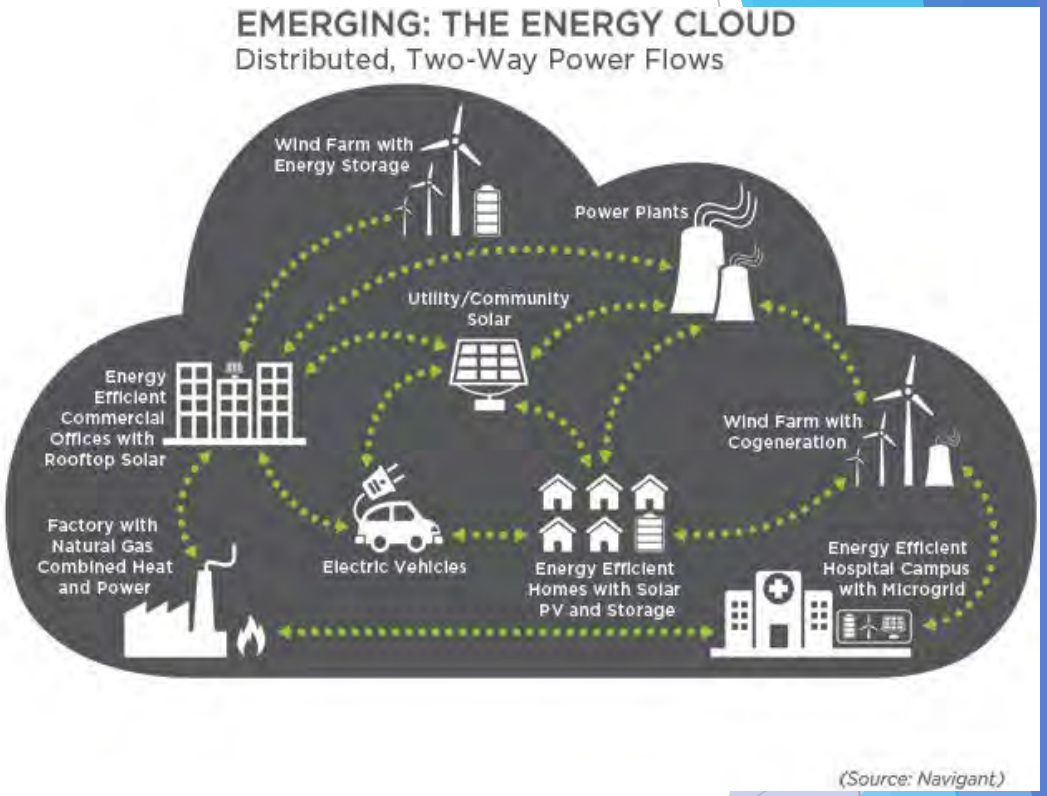
A typical household saves about $320 per year off their energy bills today, and as people replace their appliances with newer models, they can expect to save more than $450 annually by 2030

Brave New World?



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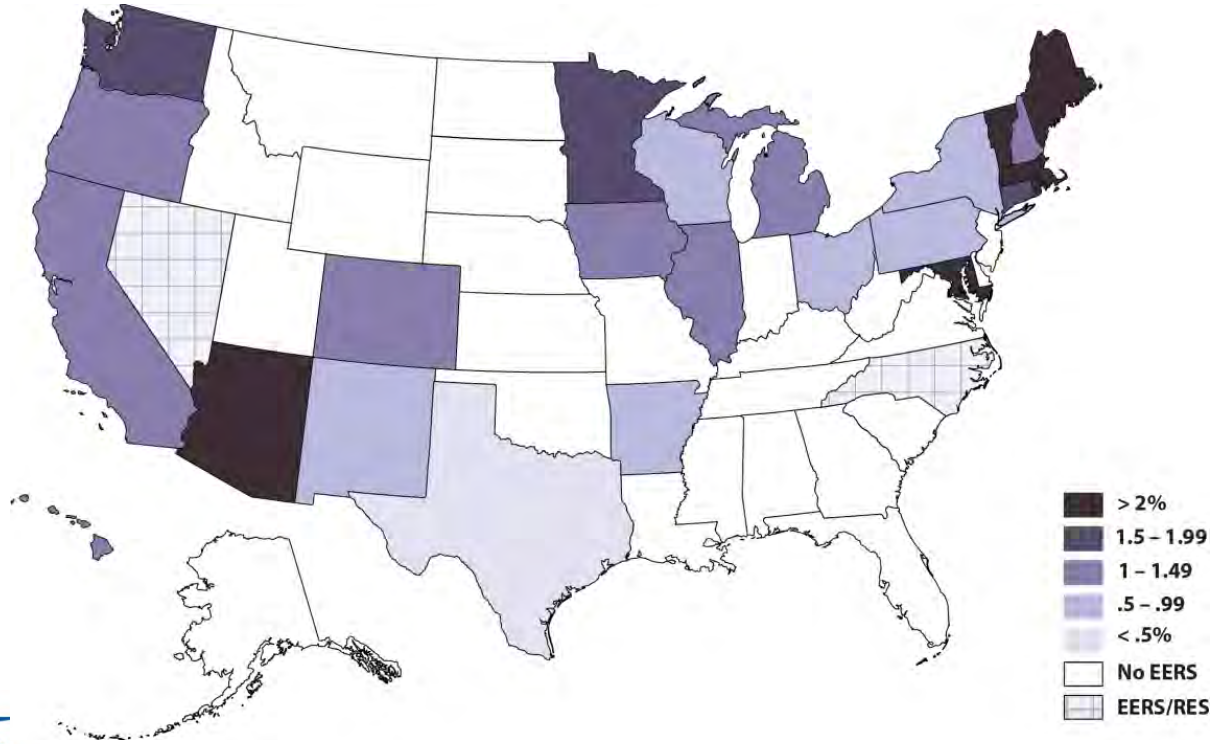
Energy Efficiency Resource Standards (2017)



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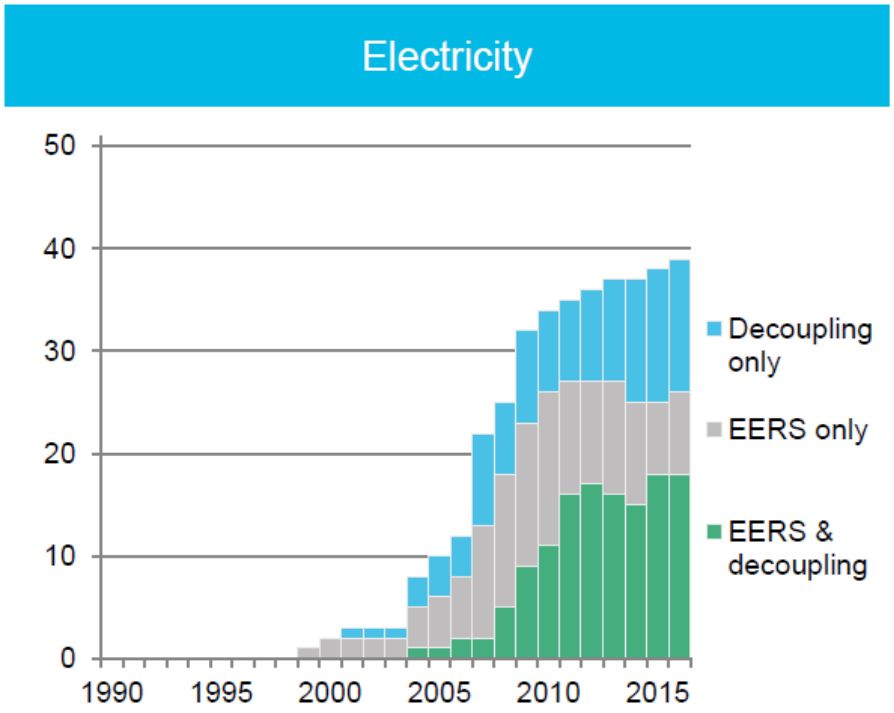
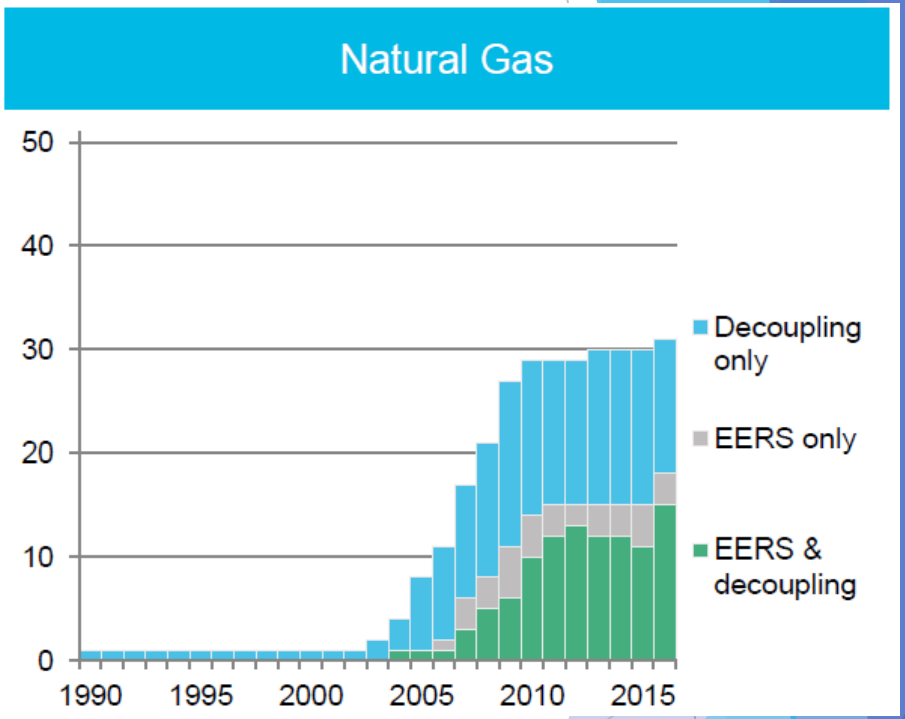
Source: ACEEE "State Energy Efficiency Resource Standard Activity" January 2017

States with EERS and Decoupling Laws





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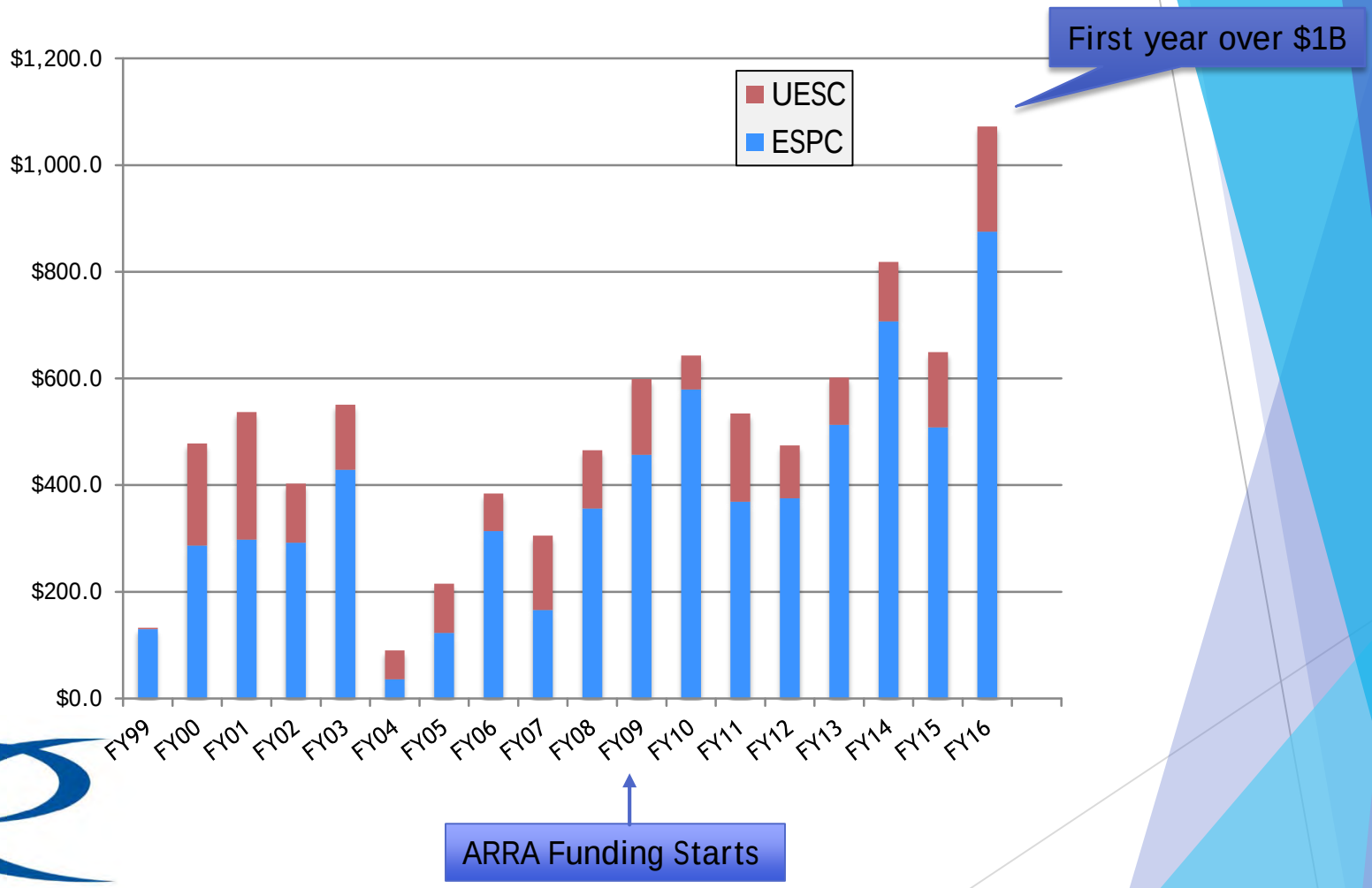
Source: ACEEE, Bloomberg via Business Council for Sustainable Energy. *Sustainable Energy in America*. (2017)

Performance Contracting Federal Awards



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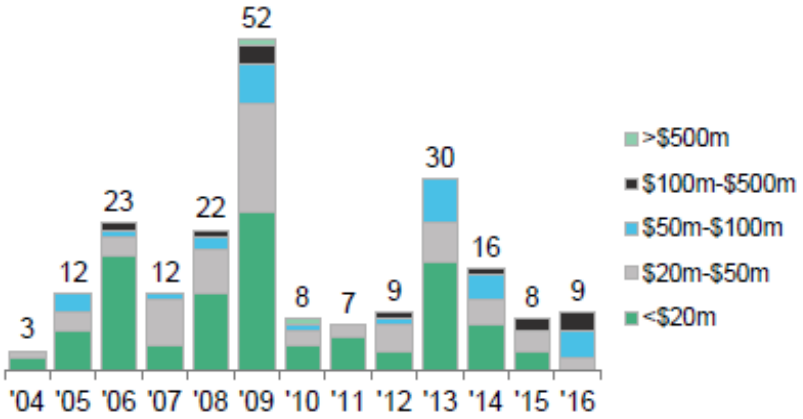
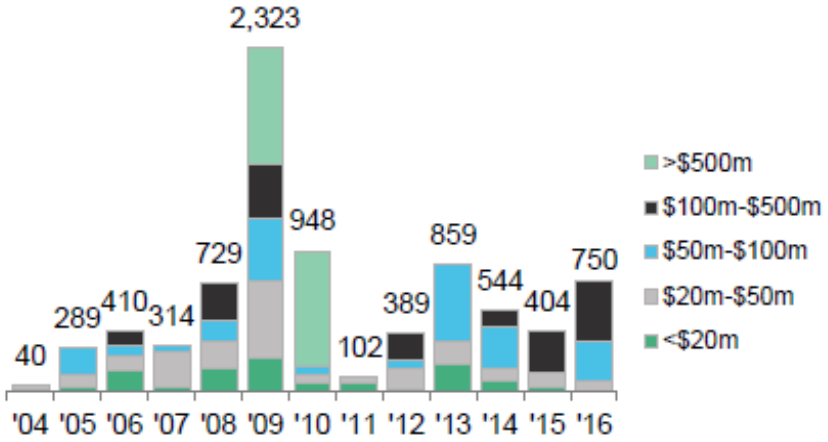
Federal ESPCs

Number of ESPCs



Total contract value of ESPCs ($m)



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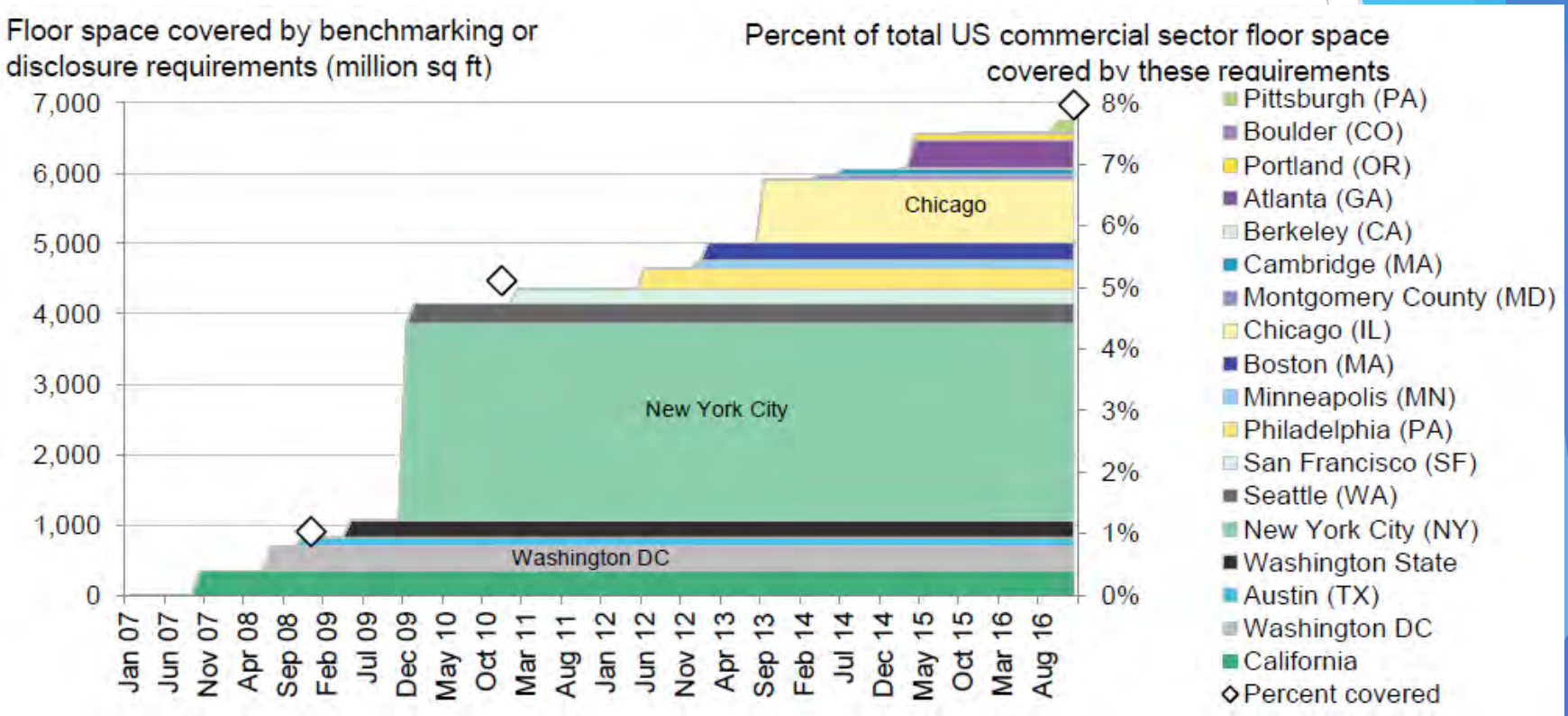
Source: US DOE via *Sustainable Energy in America*. (2017)

Benchmarking/Disclosure Policy Coverage



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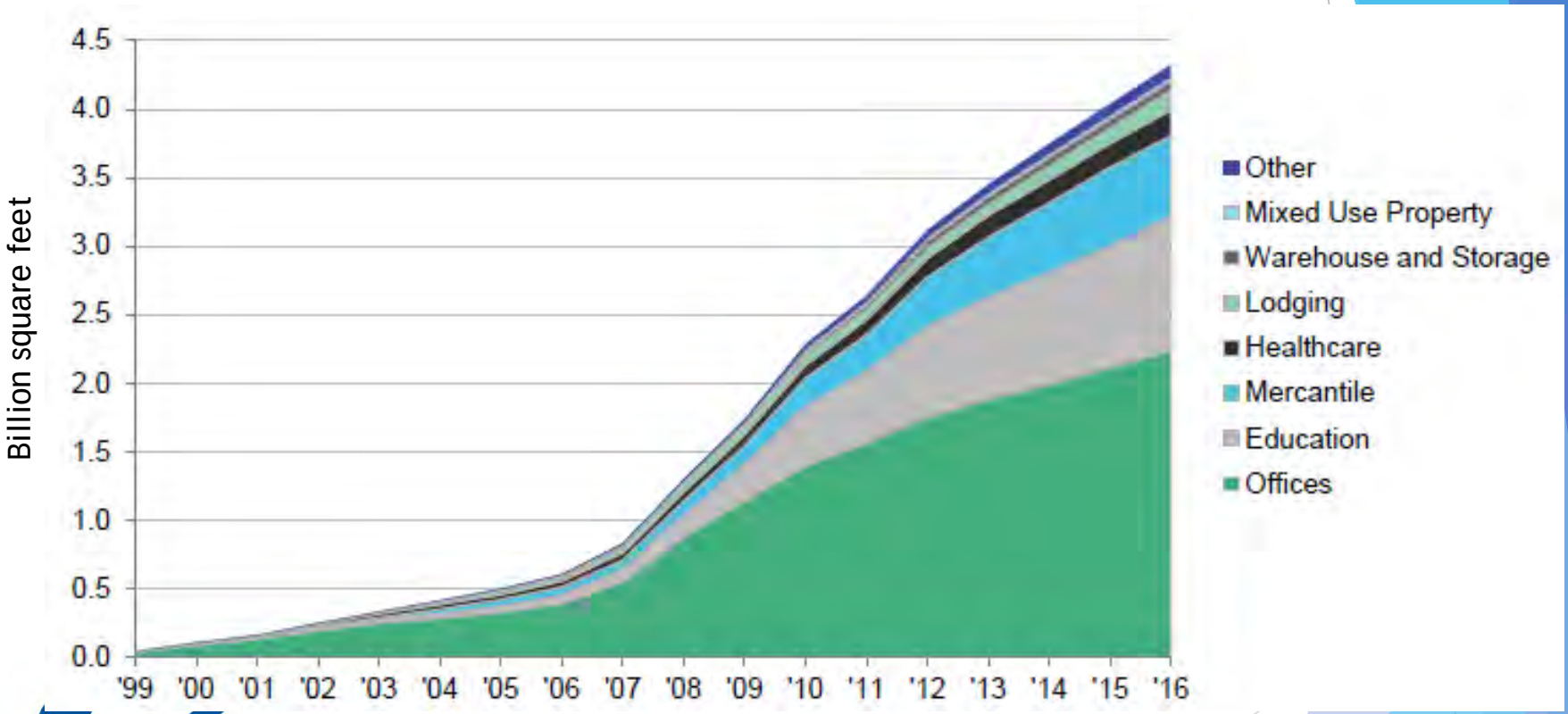
Source: Business Council for Sustainable Energy. *Sustainable Energy in America*. (2017)

Energy Star-Certified Commercial Floor Space



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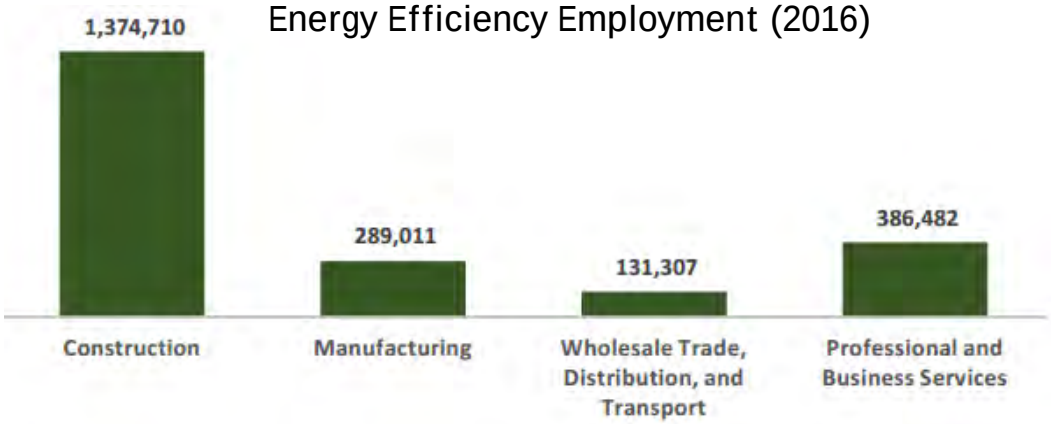
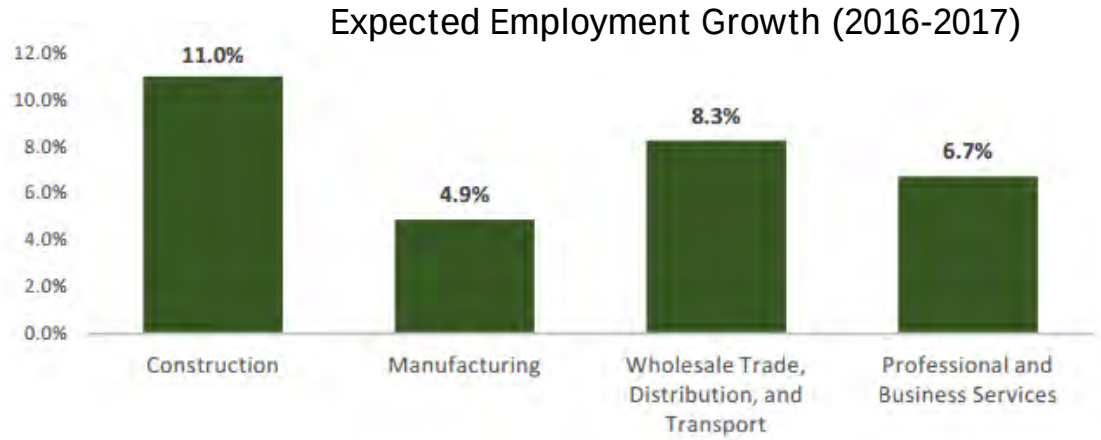
Source: EPA via *Sustainable Energy in America*. (2017)

Energy Efficiency Employment





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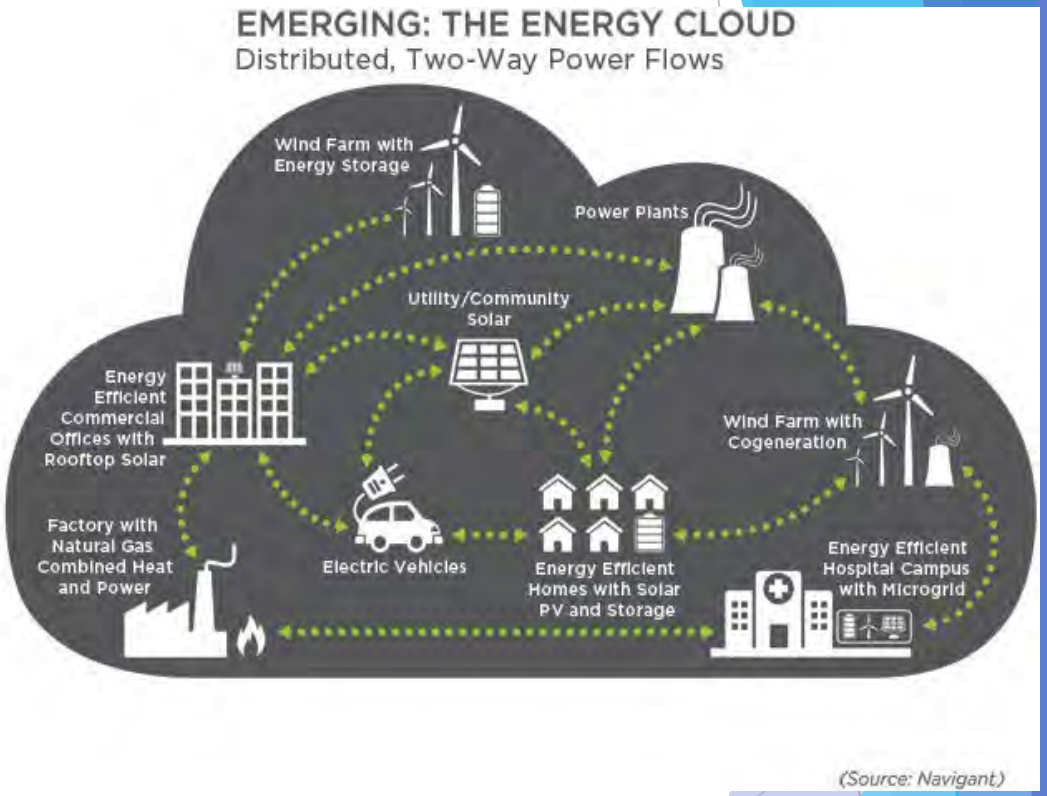
Source: Department of Energy. *U.S. Energy and Employment Report*. (2017)

Brave New World?



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Issues/Opportunities/Challenges include

- Scoring, Benchmarking
- Measurement & Verification, including M&V 2.0, pay-for-performance
- Big data & Big analysis, incl. cybersecurity, privacy
- Buildings-to-Grid
- Non-Energy Benefits incl. environmental, resilience, jobs/competitiveness
- Advanced technologies, processes and practices

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Thank you for attending this EBA Program

For more information on EBA and upcoming events:

www.EBA-Net.org

For more on US DOE's Energy Efficiency programs:

www.energy.gov/eere/efficiency

david.nemtzow@ee.doe.gov

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The Energy Efficiency Revolution Panel:

So: where's the Revolution?

Bill Campbell
Head of Structuring and Sustainability
Equilibrium Capital Group

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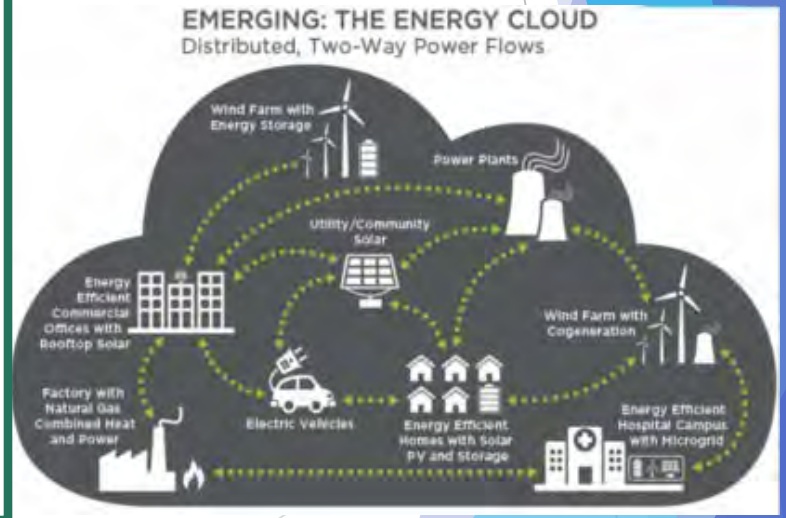
DER Transaction Structures

- Old world: All customer-premises resources reduce grid supply.
  - Net metering, savings, incentives.
  - Each building its own separate microgrid utility.
  - Rate death spiral. (Decoupling accelerates.)
  - Success destroys utility & grid economics (kills rate base.)
  - Economically inefficient, socially regressive, hard to aggregate investable value in many building types (split incentives, hold period.)

- New world: Customer-premises resources part of grid supply.
  - No death spiral. Robust fractal smart grid with healthy economics – capital flows, grid is stable. Efficient value aggregation at scale.
  - Rediscovers utility's community finance-public/private solution roots, high social equity.
  - Competes (choice!) with old model at same value.
  - Market Based.



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A Pattern Emerges –

- Qualified Facilities– PPAs to treat on-premises co-gen "as if" grid-side resource – energy sold to grid, purchased back by building.
  - PURPA, U.S., 1978
  - Same power to same places as old world (physics.) Just moves meter to customer side of cogen connection point.
- Solar Feed-in Tariff (~2004) – PPAs to treat rooftop solar "as if" grid-side resource – energy sold to grid, building buys energy from grid
  - Germany, 2004; U.S., 2008 (Gainesville Regional Utilities, Florida)
  - Same power to same places as old world (physics.) Just moves meter to customer side of solar connection point.
- Metered Energy Efficiency Transaction Structure (MEETS) – PPAs to treat DER generally – including efficiency -v"as if" grid side resource – delivered to the grid instead of consumed in building.
  - U.S., 2015 - Seattle City Light, EE only. Multi-DER proposed for 50mW phase I, 300mW phase II in first "all source" LCR RFO at Southern California Edison, 2014. PG&E commits to pilot, 2016.
  - Same power to same places as old world (physics.) Just moves meter *economically* to customer side of connection point, for *all* DER.

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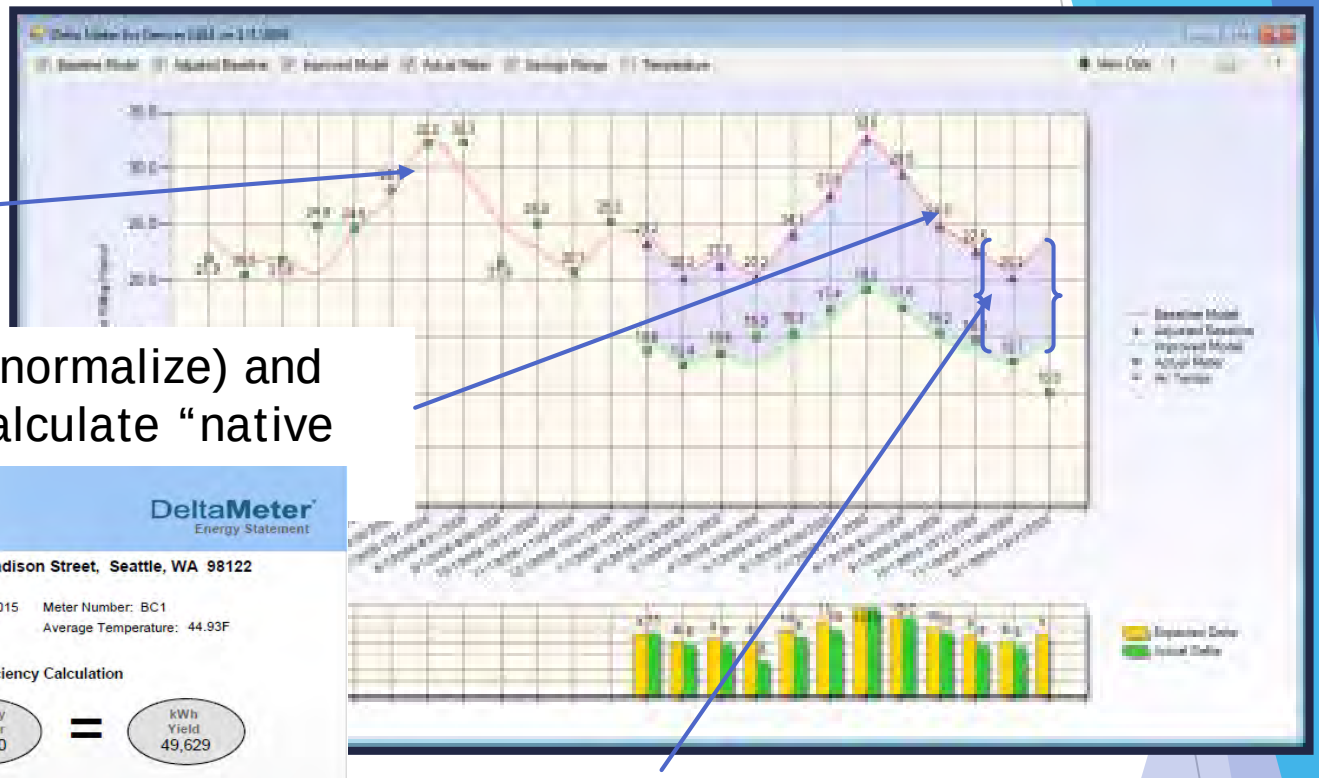
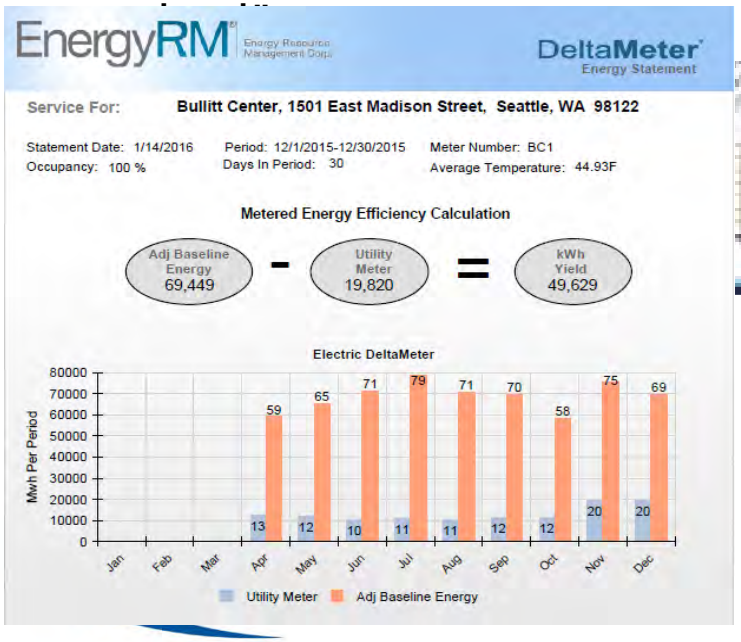
Metering Efficiency

Baseline derived from prior use

Calibrate (normalize) and use it to calculate "native





Energy from Efficiency is the difference between native load (normalized baseline), and supplied energy.

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So: you understand the revolution already.

BUILDING

Building deals with cost allocations by agreements (leases, etc.) within it. Not dictated.

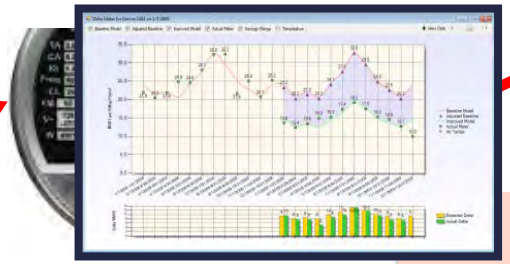
Utility Bills for All Metered kWhs

(Including DeltaMetered kWhs)

Building Pays Energy Bill

UTILITY

Conventional & Dynamic Baseline Meters



kWhs

kWhs

PPA for kWhs

POWER PLANT

Developer/Operator

- Site tenant
- Puts in improvements
- Sells yield to Utility
- Maintains Performance

SITE OWNER

- Receives lease payments

Power Plant Developer/Operator

Investment to Build Power Plant (Requires a PPA)

Investment

$-Returns

Project Investors Equity & Debt

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Utility Counsel: Your clients can *ratebase* DER in this structure.

BUILDING

Building deals with cost allocations by agreements (leases, etc.) within it. Not dictated.

Utility Bills for All Metered kWhs

(Including DeltaMetered kWhs)

Building Pays Energy Bill

UTILITY

kW/ kWh

POWER PLANT

Developer/Operator
- Site tenant
- Puts in improvements
- Sells yield to Utility
- Maintains Performance

SITE OWNER
- Receives lease payments

- **Ratebased, long-term capital deployed on customer premises for energy efficiency yield**
- **Cost justified at competitive price – "savings value" = lost revenue from conventional**

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Grid-side DER Advantages

- **Investment Cost Justification at Retail.**
  - Competes with Net Metering, cost justification LCOE = Net Metering "avoided retail."
  - Surplus DER transacted/justified at grid price (grid need not serve as a *high-priced* battery; it's the building's "native" or "baseline" load that competes at retail.)
- **Aggregates Value.**
  - Enables long-term contracts at whole building scale, so can aggregate value & deliver EE depth. Seattle pilot at 20 years. Solves split incentives, hold period barriers.
- **Delivers Social Equity.**
  - MEETS enhances social equity of the grid. Rely on building's energy economics, not owner balance sheet. Class B and C commercial, low income & working class multifamily.
- **Automatic Scale.**
  - Doesn't force recreation of millions of "micro-utilities" (old world, scale is hard.) Uses existing utilities, at existing "every building" scale (new world, scale is automatic).
- **Ratepayer benefit.**
  - Solves "death spiral" old world creates (fixed costs stay spread.)
- **Utility health**
  - Utilities thrive by cost-justified rate based investments in needed community infrastructure. Rate based investments using MEETS finances needed efficiency, DER renewable infrastructure, and delivers healthy utilities-of-the-future.

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Enablements of the Revolution

- **Meter** emerges from advances in Measurement & Verification.
  - Seattle City Light pioneered an "IPMVP option d" compliant fully normalizing dynamic baseline meter (used DeltaMeter® from EnergyRM, tech extensively tested at NREL, NEEA.)
  - Dynamic baseline meter functional specification circulating on west coast (find at www.MeetsCoalition.org.)
- **Contract solutions are also innovation** – it's not just technology, it's transactions.
- **Big data & Big analysis** –
  - Breakthrough meter tech allows getting at masses of existing data in new ways
  - Low-cost offsite analytics, design & commissioning support, etc – scale enablement.

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MEETS/Advanced DER Principle: Use the same transaction system that lit up the planet 100 years ago, to green it today.

Presented by:
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For more on MEETS:
www.meetscoalition.org

Thank you for attending this EBA Program

For more information on EBA and upcoming events:

www.EBA-Net.org

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