Innovative Energy Efficiency Trends

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Illinois Energy Efficiency Stakeholder Advisory Group

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ACEEE
American Council for an Energy-Efficient Economy

The American Council for an Energy-Efficient Economy is a nonprofit 501(c)(3) founded in 1980. We act as a catalyst to advance energy efficiency policies, programs, technologies, investments, & behaviors.

Our research explores economic impacts, financing options, behavior changes, program design, and utility planning, as well as US national, state, & local policy.

Our work is made possible by foundation funding, contracts, government grants, and conference revenue.

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Outline

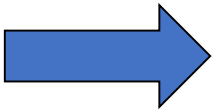
1. **Framing the Challenge**

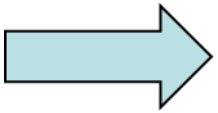
2. **Emerging Program Design Approaches**
   - Integrated Programs
   - New Emerging Approaches
   - New Segments

3. **Promising Technologies**

Transformation and evolution of customer EE programs and technologies

What's next?





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Where to find new savings?

Savings from energy-efficient lighting

- Typically have been single largest source of savings in portfolios
- More stringent codes and standards along with rapid technological/market changes➔ squeezing available program savings

New expectations for programs: longer-term savings, alignment with carbon reduction, achieving energy equity/reducing energy burdens

Big questions: What's next? Where will large savings come from to meet savings targets (from EERS and IRPs)?

Emerging program areas
Most common among ~50 largest utilities

- Midstream programs
- Data centers
- Quality HVAC installation
- High efficiency consumer electronics (residential)
- Conservation voltage reduction (CVR)
- Pilot programs

Preliminary ACEEE research, forthcoming

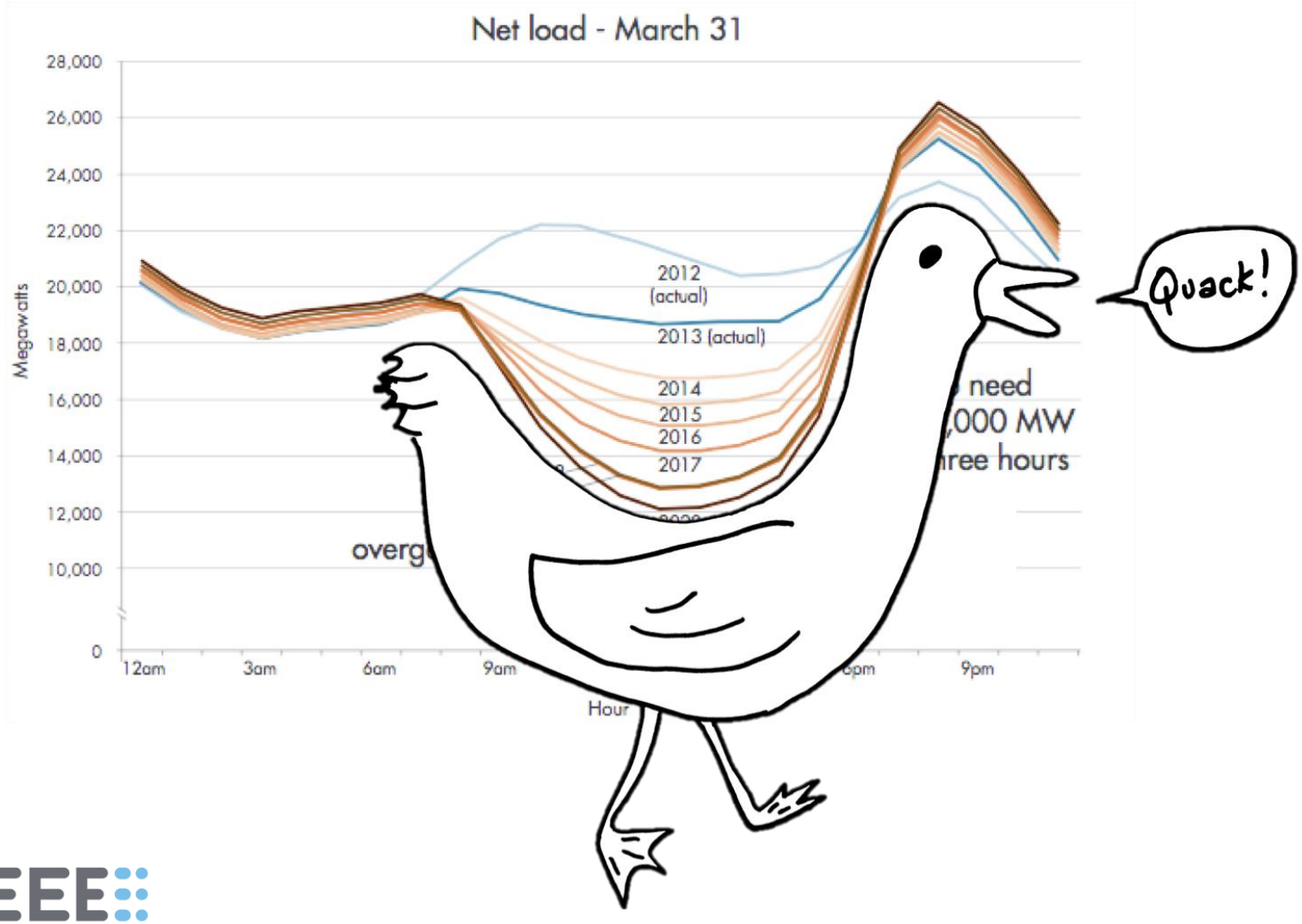
Emerging program areas
Next most common (~50 largest utilities)

- Advanced space-heating heat pumps
- Commercial and industrial geo-targeting
- Energy use feedback to consumers in real time
- High-efficiency residential clothes dryers
- Reduction of plug and miscellaneous loads in commercial buildings

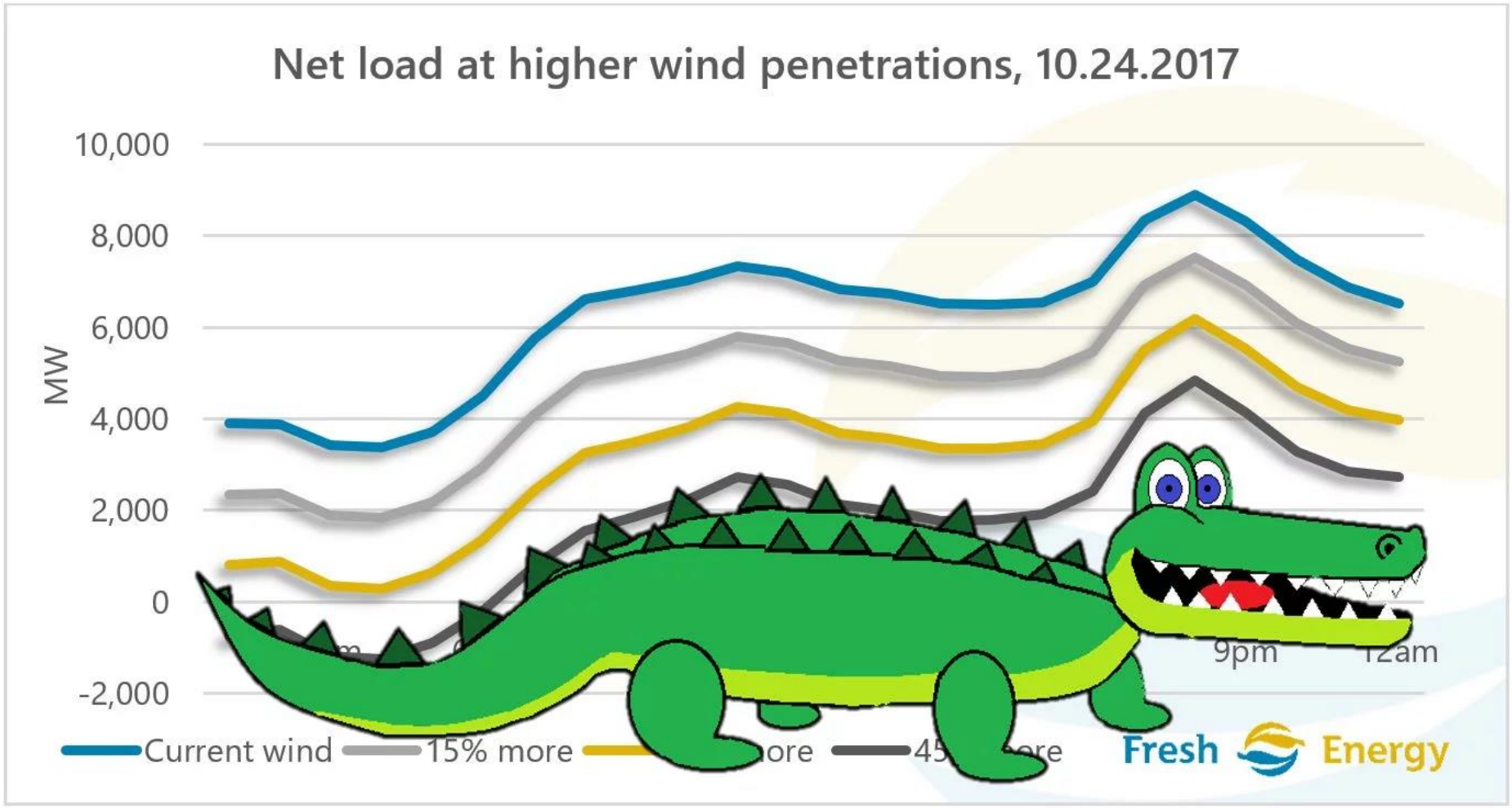
Preliminary ACEEE research, forthcoming

Utility transformation: Rapid rise of Distributed Energy Resources (DERs)

Impacts of DERs ➔ need for flexible grid (impact of solar on California demand curve)



Impact of wind production in the Midwest



Source: Fresh Energy

Help from rapid rise of smart technologies

- Connected
- Communicating
- Integrated
- Responsive
- Data-rich

- Real-time
- Diagnostic
- Analytical
- Predictive
- Learning

Integrated energy efficiency (EE)/demand response (DR) programs offer many benefits

- Example: Baltimore Gas & Electric
- Quick Home Energy Check-up with PeakRewards
- 2017-18 results
  - **1062 MWh savings**
  - **330 MW savings**
- Program in a nutshell
  - **On-site assessment, direct-install measures—WiFi t-stat**
  - **Enroll in DR**
  - **Primary driver: increase customer satisfaction**
  - **Parallel AMI enabled, peak-time rebate program – 1 million customers – can participate in both programs**

Integrated EE/DR

- Example: Entergy Arkansas
- Home Energy Solutions

2017 results

- 25,757 MWh savings
- 10.1 MW savings
- 7,733 participants

Program in a nutshell

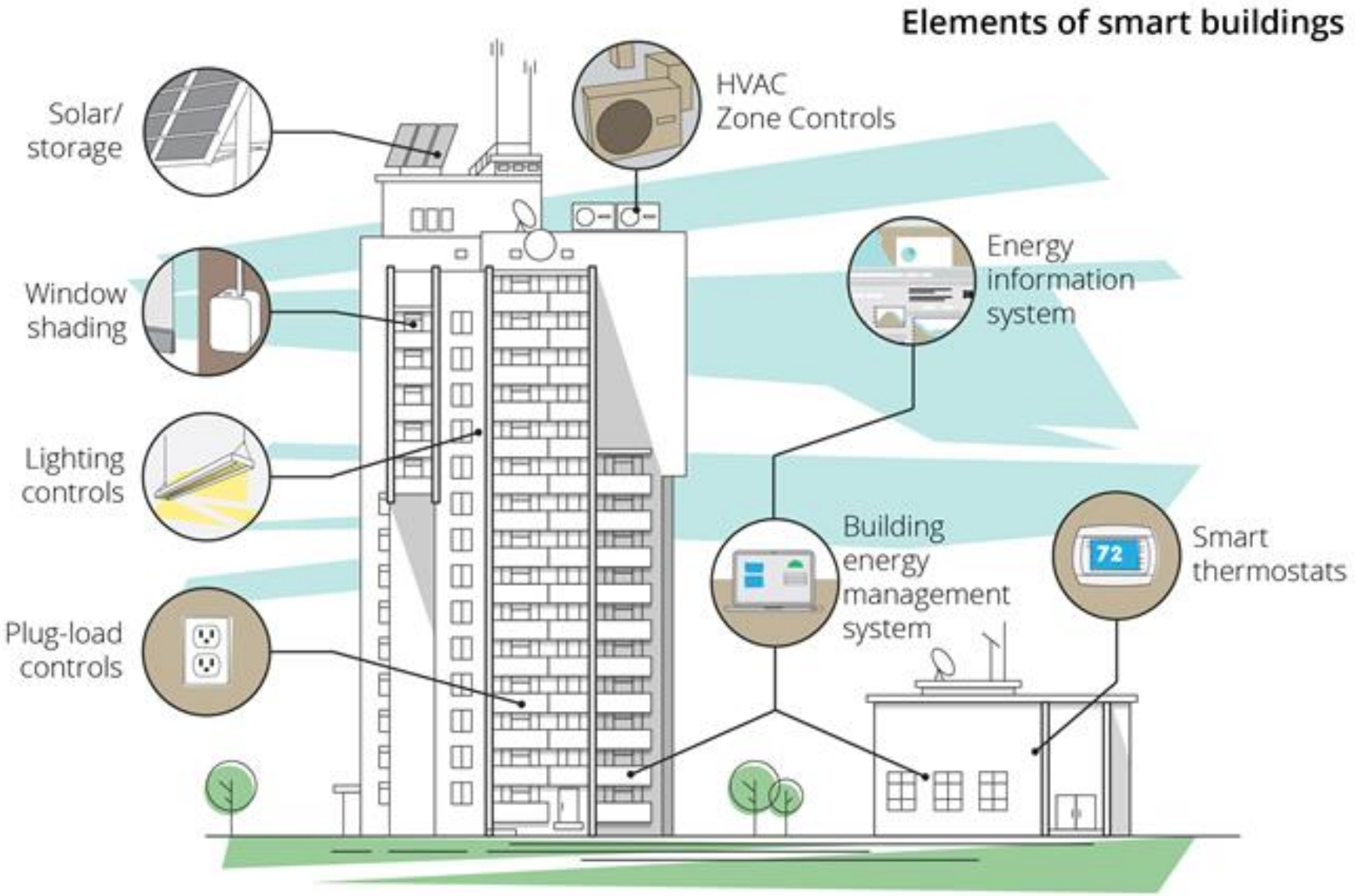
- Home energy assessments – direct installation
- Option to enroll in WiFi t-stat – DR program

Despite benefits—are still few fully integrated EE/DR programs

- Of 44 utility plans ACEEE reviewed, found only 5 at highest level of integration
- Only 22 programs with some degree of integration

Grid-interactive efficient buildings (GEBs)
Smart, connected buildings

- Grid connectivity is rapidly becoming important --- response to/need created by rapid growth of DERS
- GEBs: Energy-efficient buildings with the ability to be demand flexible
- No real programs yet---mostly research and demonstration projects



GEB: Connected, smart, efficient building
(all of the above---connected to and interacting with the grid)

DERs, GEBs, IoT, DERMS, M&V 2.0, Big Data
Welcome to the revolution!

- Rapid convergence of technologies that yield high performance buildings and high performance grid operation
- DR as “facilitator of the new electricity ecosystem”
- Platform to integrate distributed resources –distributed energy resource management systems (DERMS)
- New market and pricing opportunities
- Increased savings via behavioral and operational efficiency initiatives
- EE and DR as players in capacity markets—getting “real!”

Other evolving program approaches and opportunities

End-uses

- Controlled environment agriculture
- Energy storage

Approaches

- Energy as a service
- Utility marketplaces
- Strategic energy management
- Dual fuel programs
- Usage-based program targeting and customer segmentation (use of AMI – big data)

Controlled Environment Agriculture

- Large and rapidly growing industry: $47 billion in 2017—estimated growth of 3.4% from 2018-2023
- Energy-intensive:
  - **Lighting**
  - **Space heating/cooling – optimal growing conditions**
  - **Year-round load**

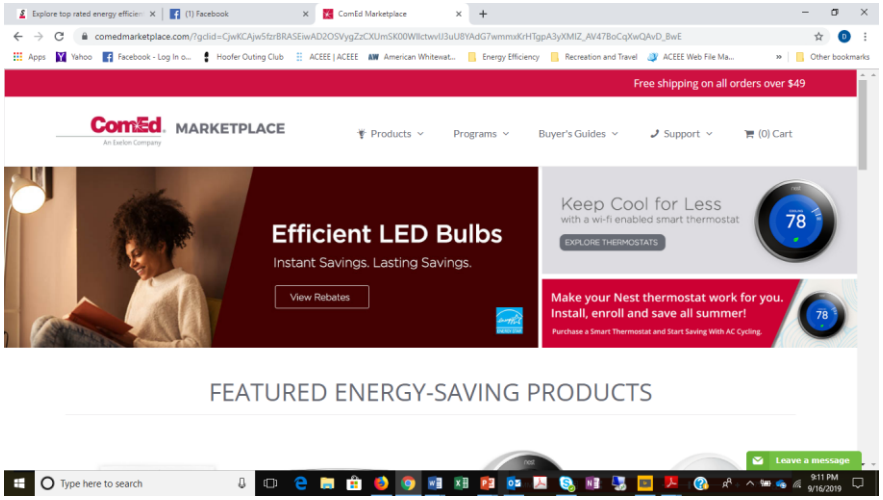
- Illinois in front of the curve for legalized cannabis
  - **Strict energy efficiency standards for indoor ag**
  - **Sets maximum lighting power density allowed and HVAC efficiency requirements**
  - **Requires energy data reporting**

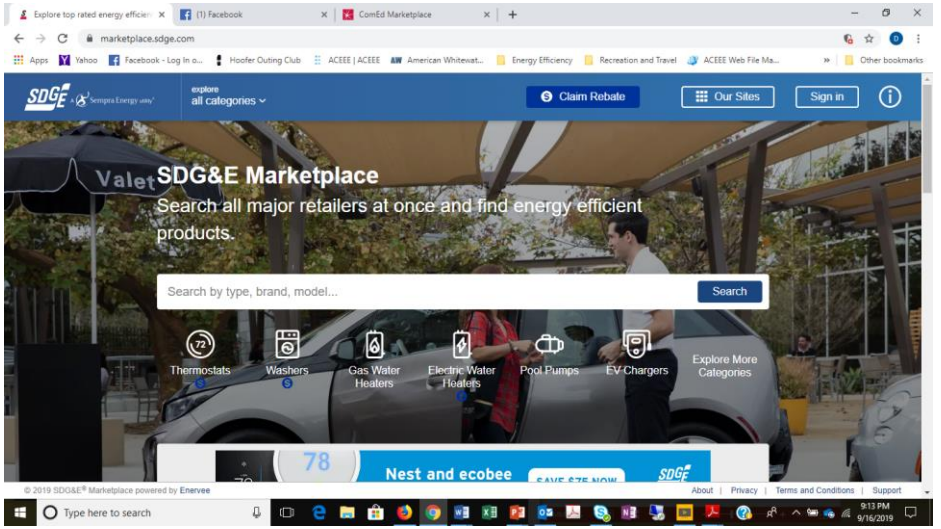
Energy as a Service (EaaS)

- Biz model: service provider owns equipment; customer pays for services provided (e.g., lighting, heating, cooling)
- EaaS provider works with ESCO/EE contractor to design, install and maintain equipment
- Customer contracts with EaaS: *Energy Services Agreement*
- No upfront capital expenditure by customer
- EaaS provider has incentive for high efficiency

Utility Marketplaces

- On-line markets for energy-efficient products and services
- Mass market approach
  - **Reduce barriers: information, availability, convenience**
  - **Trusted source**





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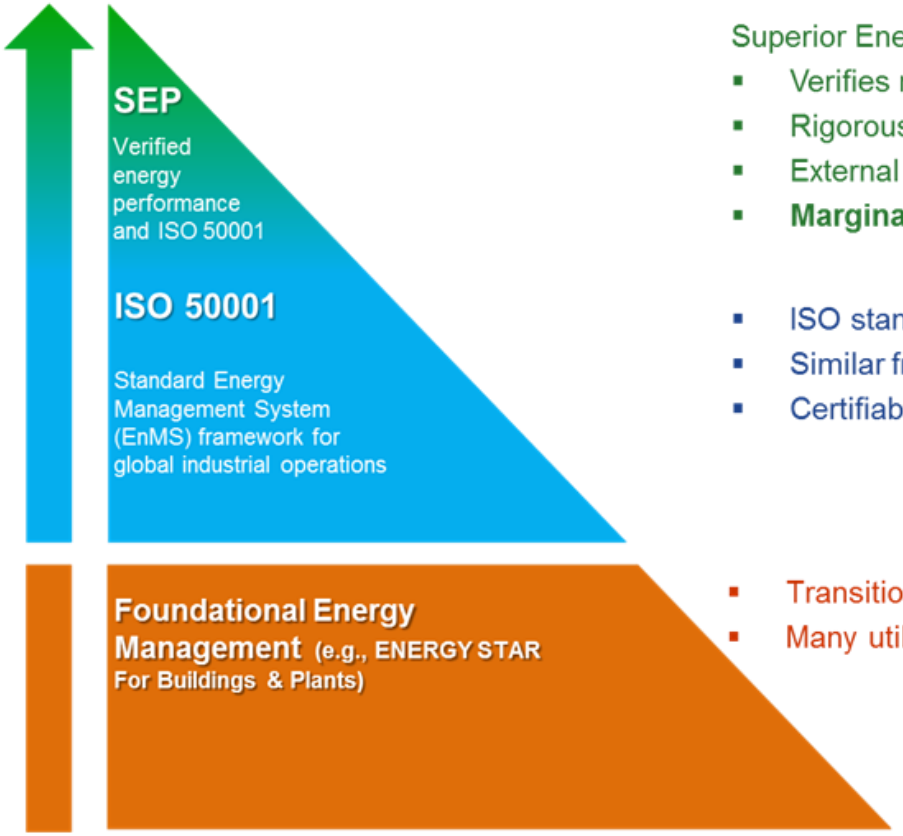
Strategic Energy Management



Superior Energy Performance (SEP):

- Verifies measured results – internal credibility
- Rigorous third-party measurement and verification
- External stakeholder recognition of achievement
- **Marginal effort beyond ISO 50001**

- ISO standard for Energy Management Systems - EnMS
- Similar framework to ISO 9001 and ISO 14001
- Certifiable EnMS, SEM program

- Transition from project to systematic approach
- Many utility SEM programs operate at this level

Expanding programs to new and underserved customer segments

- Multifamily
- Small business
- Rural
- Indoor agriculture
- Low-income/income qualified

Promising EE technologies
(on the horizon – selected set)

- Combined, integrated control systems for commercial lighting and HVAC (smart buildings)
- Expanded smart manufacturing
- High-rise elevator motor upgrades
- Very efficient packaged AC units
- Window attachments

Diversity of EE resources

No single dominant resource in future portfolios

Large reductions in miscellaneous plug loads	3.4%
Conservation voltage reduction	2.1%
New construction programs	1.9%
Comprehensive commercial retrofits	1.7%
Smart manufacturing	1.6%
High efficiency residential air conditioners and heat pumps	1.5%
Combined heat and power systems	1.3%
Advanced commercial lighting design and controls	1.3%
High efficiency heat pumps replacing electric resistance furnaces	1.2%
Smart commercial buildings	1.2%

Savings are percentage of total electricity demand in 2030 (above values are from medium scenario in ACEEE analysis *New Horizons for Energy Efficiency Report* – 2015)

Tomorrow's EE portfolios will be characterized by:

- Diversified technologies/end uses, whole building/systems solutions
- Smart, connected, integrated technologies (demand response, storage, DERs, GEBs)
- Expanded choices--growth of customer markets, expanded pricing options
- Behavior change programs and approaches
- Targeting new and underserved customer segments
- Striving for energy equity—reducing energy burdens

ACEEE resources

- *Integrated Energy Efficiency and Demand Response Programs*. https://aceee.org/research-report/u1906
- *Smart Buildings: A Deeper Dive into Market Segments.* https://aceee.org/research-report/a1703
- *Intelligent Efficiency Technology and Market Assessment.* https://aceee.org/research-report/ie1701
- *Emerging Opportunities Topic Briefs:*
  - ***Controlled Environment Agriculture:*** https://aceee.org/topic-brief/indoor-ag
  - ***Energy as a Service:*** https://aceee.org/topic-brief/eo-energy-as-service
  - ***Residential Window Attachments:*** https://aceee.org/topic-brief/eo-window-attachments
  - ***Achieving Deeper Energy Savings through Integrated Building Systems:*** https://aceee.org/topic-brief/eo-building-systems

Thanks – for more info … questions … contact

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