How Energy Efficiency Programs Can Support State Climate and Energy Planning:

*Efficiency as an Emission Reduction Approach*

energy.gov/eere/slsc/EEopportunities
Outline

Energy Efficiency as an Emission Reduction Approach:
• Energy savings potential and achievements
• Electricity and carbon savings opportunity estimates
• Synopses of seven major opportunity areas
• DOE technical assistance available for energy and climate planning and implementation, by sector
• Appendix – assumptions and data sources for calculations of electricity and carbon savings
Energy Efficiency Potential Studies & Achieved Electricity Savings

- DOE identified 79 energy efficiency potential studies published between 2007 and 2015 completed for states, utilities, and NGOs.\(^1\) They provide estimates across 44 states.
- The majority (60%) found an average savings rate of 1 to 2.5% from prior year electricity sales in economic or achievable potential.

The 10 states leading on energy efficiency are already achieving 1.25 to 3.5% in annual electricity savings.\(^2\) Many of these states have been running energy efficiency programs for decades and are continuing to increase savings.

Many Substantial, Well Documented Energy Savings Opportunities

Savings come from EE activities across:
- industrial, commercial, public, residential bldgs
- ratepayer-funded (e.g., utility) programs
- private sector initiatives
- state / local government-run programs

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<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Private Sector</td>
<td>Ratepayer-Funded Efficiency Programs</td>
<td>645-895 million MWh</td>
<td>368-510 short tons</td>
</tr>
<tr>
<td>S/L Gov't</td>
<td>Industrial Efficiency</td>
<td>85-130 million MWh</td>
<td>48-74 short tons</td>
</tr>
<tr>
<td>Utility</td>
<td>Combined Heat and Power</td>
<td>75-115 million MWh</td>
<td>43-66 short tons</td>
</tr>
<tr>
<td></td>
<td>Energy Savings Performance Contracting</td>
<td>45-90 million MWh</td>
<td>26-51 short tons</td>
</tr>
<tr>
<td></td>
<td>Building Energy Codes</td>
<td>50-60 million MWh</td>
<td>29-34 short tons</td>
</tr>
<tr>
<td></td>
<td>City-Led Energy Efficiency Efforts</td>
<td>25-50 million MWh</td>
<td>14-29 short tons</td>
</tr>
</tbody>
</table>

*DOE calculations of ballpark achievable potential based on sector-specific assumptions for activities occurring 2013-2030; see appendix.

**Carbon emissions estimates based on national average total output emission rate published in 2012 eGRID; see appendix.

NOTE: Savings Pathways may have overlapping savings, so estimates are NOT additive.

S/L Gov't = state or local government
EE Savings Pathways Can be Incorporated into Climate Planning

<table>
<thead>
<tr>
<th>Typical Lead</th>
<th>Savings Pathways</th>
<th>Helps reach carbon reduction goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Sector</td>
<td></td>
<td>Reduces smokestack emissions</td>
</tr>
<tr>
<td>S/L Gov't</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Utility</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓ ✓ ✓ Industrial Efficiency</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓ ✓ ✓ Combined Heat and Power</td>
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</tr>
<tr>
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<td>✓</td>
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<tr>
<td>✓ Ratepayer-Funded Efficiency Programs</td>
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<td>✓</td>
</tr>
<tr>
<td>✓ ✓ Low Income Energy Efficiency Programs</td>
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<td>✓</td>
</tr>
</tbody>
</table>

S/L Gov't = state or local government
### Ratepayer-Funded Efficiency as an Emission Reduction Approach

#### Possible Leads
- Utilities (investor-owned, rural cooperatives, municipal utilities)
- Non-utility program administrators

#### E-Savings
- Savings in compliance year vs 2012 baseline

#### Potential Program Components
- New and existing residential buildings (single family, multi-family, low income)
- Small, medium & large commercial buildings
- Industrial facilities

#### Potential Electricity Savings
- 645 – 895 million MWh in 2030
- 368 – 510 short tons CO₂

### Activity

#### Energy Savings Approaches
- Program administrators generate energy savings from:
  - EE programs that support improvements to residential, commercial, industrial buildings

#### State Policy Options
- Could include
  - Requiring a specified level of EE savings (e.g., EERS)
  - Requiring inclusion of EE as a resource in capacity planning (e.g., Integrated Resource Planning)
  - Regulatory policies to incentivize successful utility delivery of EE
  - Consider options for energy efficiency delivery agent

#### Low Income Opportunities
- EE programs in low income neighborhoods

<table>
<thead>
<tr>
<th>Activity</th>
<th>EM&amp;V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Savings Approaches</td>
<td>Recent resources provide guidance, including:</td>
</tr>
<tr>
<td>- Program administrators generate energy savings from:</td>
<td>- <a href="#">SEE Action Energy Efficiency Program Impact Evaluation Guide</a></td>
</tr>
<tr>
<td>- EE programs that support improvements to residential, commercial, industrial buildings</td>
<td>- <a href="#">SEE Action EM&amp;V Resource Portal</a></td>
</tr>
<tr>
<td>- EE programs that support improvements to residential, commercial, industrial buildings</td>
<td>- <a href="#">DOE Uniform Methods Project</a></td>
</tr>
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<td>- EE programs that support improvements to residential, commercial, industrial buildings</td>
<td>- <a href="#">NEEP EM&amp;V Forum</a></td>
</tr>
<tr>
<td>- EE programs that support improvements to residential, commercial, industrial buildings</td>
<td>- <a href="#">Regional Technical Forum of the Northwest Power and Conservation Council</a></td>
</tr>
<tr>
<td>State Policy Options</td>
<td></td>
</tr>
<tr>
<td>Low Income Opportunities</td>
<td></td>
</tr>
</tbody>
</table>
# Industrial Energy Efficiency as an Emission Reduction Approach

## Activities

### Energy Savings Approaches

- SEOs, program administrators, industrial end users, ESCOs generate energy savings from:
  - Energy management
  - Energy management system
  - Training
  - Metering
  - Technical assistance
  - Capital improvements

### EM&V

- Third-party verification of savings occurs within Superior Energy Performance in accordance with Superior Energy Performance EM&V Protocol

### Forthcoming resources:

- Library of common industrial EE projects/practices and accepted savings calculation methodologies
- Uniform Methods Project Protocols for Strategic Energy Management/Superior Energy Performance (Summer 2016)

## E-Savings

- Metered electricity savings after installing measures or making operational and behavioral changes compared to project start

## State Policy Options

- Could include:
  - Energy efficiency resource standard (EERS)
  - Registry of energy savings from ISO50001 certification or Superior Energy Performance

## Potential Program Components

- Strategic Energy Management (SEM)
- ISO50001
- Superior Energy Performance (SEP)

## Potential Leads

- State Energy Offices (SEOs)
- Utilities / Program Administrators
- Industrial End-Users
- ESCOs

## Potential Electricity Savings

- 85 – 130 million MWh in 2030
- 48 – 74 short tons CO₂
Combined Heat and Power as an Emission Reduction Approach

Possible Leads
- State energy offices (SEOs)
- City energy or sustainability office
- Utilities / program administrators
- Industrial end-users
- ESCOs

E-Savings
- kWh / MWh generated on site

Potential Program Components
- District energy / microgrids

Activities

<table>
<thead>
<tr>
<th>Energy Savings Approaches</th>
<th>EM&amp;V</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Large energy users, utility, or state energy offices generate energy savings from:</td>
<td>• Recent resources provide guidance, including:</td>
</tr>
<tr>
<td>- Incentives to support CHP installation in buildings</td>
<td></td>
</tr>
</tbody>
</table>

State Policy Options
• Could include
  - CHP in state energy resource standard (e.g., EERS, RPS)
  - Interconnection standards

Low Income Opportunities
• CHP projects in low income neighborhoods (e.g., multifamily housing, schools, community centers, hospitals, facilities)

Potential Electricity Savings
75 – 115 million MWh in 2030
43 – 66 short tons CO₂
## Energy Savings Performance Contracting as an Emissions Reduction Approach

### Possible Leads
- State Energy Office
- State/Local General Services Office
- Local Sustainability Office
- Commercial building owner
- ESCO

### E-Savings
- Annual kWh reduced since project installation date

### Potential Program Components
- Green Bank or other internal state/city funding
- Utility
- State ESPC Support Program

### Potential Electricity Savings
45 – 90 million MWh in 2030
26 – 51 short tons CO₂

### Activities

#### Energy Savings Approaches
- State energy or general services office, building owners, ESCOs, utilities generate energy savings from:
  - Direct energy management
  - Capital improvements
  - Technical assistance
  - Training
  - Metering
  - Utility incentives

#### State Policy Options
- Could include:
  - Energy efficiency resource standard (EERS)
  - Executive Order or legislation to create ESPC program w/target savings or investments
  - State financing for ESPC projects
  - State admin. rules to support ESPCs

### EM&V
- Recent resources provide guidance, including:
  - Federal Energy Management Program M&V Guidelines Version 4.0

### Low-Income Opportunities
- Energy savings projects in low-income neighborhoods (e.g., schools, community centers, facilities, multifamily housing)
**Building Energy Codes as an Emission Reduction Approach**

### Possible Leads
- State code administrator
- State energy office
- Utility
- NGO

### E-Savings
- # new code or beyond code built blgds. X reduction in kWh per bldg. from code in 2012

### Potential Program Components
- Stretch Code Programs
- ENERGY STAR New Homes
- Zero Energy Ready Homes

### Activities

#### Energy Savings Approaches
- State energy office, utility, or NGO generate energy savings from:
  - Education
  - Training
  - Enforcement activities

#### State Policy Options
- Could include:
  - Legislation to require adoption of latest national model energy code upon update
  - Legislation to require reduction in building energy use by date (e.g., 70% by 2030)

#### Low Income Opportunities
- Building code adoption and compliance in low income neighborhoods

### EM&V
- Recent resources provide guidance, including:
  - DOE Building Energy Codes Program (BCEP)
  - Achieving Energy Savings and Emission Reductions from Building Energy Codes: A Primer for State Planning
  - Multi-state in field evaluation (forthcoming)

### Potential Electricity Savings
- 50 – 60 million MWh in 2030
- 29 – 34 short tons CO₂
# City-Led Efficiency Efforts as an Emission Reduction Approach

## Activities

### Energy Savings Approaches

City offices, utility, or community-based organizations generate energy savings from:

- Training, outreach, enforcement of building efficiency policies
- Outreach and technical assistance for voluntary programs
- Installing energy upgrades to municipal buildings, water/wastewater treatment facilities, streetlights

### State Policy Options

Could include:

- Enable cities to implement PACE
- Provide guidance to utilities for streamlining energy data access for building benchmarking
- Create state-led city programming (e.g., MA Green Communities)

## E-Savings

- Aggregate city-wide (municipal, industrial, commercial, residential) electricity savings compared to starting year consumption

## Potential Electricity Savings

25 – 50 million MWh in 2030

14 – 29 short tons CO<sub>2</sub>

## Possible Leads

- City energy or sustainability office
- City general services office
- Municipal utility
- Community-based organizations

## Potential Program Components

- Building performance policies
- Voluntary building efficiency challenges
- Financing (property assessed clean energy [PACE], performance contracting)
- Municipal building efficiency
- Water/wastewater treatment facilities
- Streetlight upgrades
- Homeowner outreach

## EM&V

Recent resources provide guidance, including:

- [DOE Benchmarking & Transparency Policy and Program Impact Evaluation Handbook](#)
- [Assessment of Automated Measurement and Verification (M&V) Methods](#)
# Low-Income Efficiency Programs as an Emission Reduction Approach

## Possible Leads
- State administrators
- State energy office
- Utility
- Housing NGO’s focused on low income

## E-Savings
- # of homes improved x average savings associated with improvement

## Potential Program Components
- Weatherization Assistance Program
- Home Performance with ENERGY STAR
- Proper HVAC maintenance and installation practices
- Duct sealing
- Air sealing and insulation program
- Appliance rebate program

## Energy Savings Approaches
- State energy office, utility, or NGO generate energy savings from:
  - Education
  - Training and certification of technicians
  - Manage homeowner relationships
  - Outreach
  - Connect clients with contractors to improve homes
  - Monitor EM&V

## State Policy Options
- Could include:
  - Legislation to provide funds for retrofit program with incentives
  - Legislation to provide low-cost financing
  - Rate payer funded programs directed at low-income

## Low Income Opportunities
- This program is targeted to low-income households

## Activities

<table>
<thead>
<tr>
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<td>Energy Savings Approaches</td>
<td>Recent resources provide guidance, including:</td>
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<tr>
<td>- State energy office, utility, or NGO generate energy savings from:</td>
<td>- Weatherization Works-Summary of findings from the Retrospective Evaluation of the U.S. Department of Energy’s Weatherization Assistance Program</td>
</tr>
<tr>
<td>- Education</td>
<td>- Better Buildings Residential Program Solution Center</td>
</tr>
<tr>
<td>- Training and certification of technicians</td>
<td>- Appliance Rebate Program-Design Guide</td>
</tr>
<tr>
<td>- Manage homeowner relationships</td>
<td>- The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures</td>
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<td>- Outreach</td>
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<td>- Connect clients with contractors to improve homes</td>
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<td>- Monitor EM&amp;V</td>
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</table>
Get More Information on These Pathways

Visit: energy.gov/eere/slsc/EEopportunities


Seven presentations (one for each pathway) of features and benefits associated with including energy efficiency opportunities in climate and energy plans, covering:

- current activity at the national and state levels
- best practices
- energy savings examples
- cost-effectiveness
- evaluation, measurement, and verification (EM&V) approaches
- DOE support


New State and Local Energy Efficiency Action Network (SEE Action) resource presents the pathways through:

- case studies of successful regional, state, and local approaches
- sources for more information
- resources to understand the range of expected savings from energy efficiency
- common protocols for documenting savings
Existing DOE Technical Assistance & Resources Available
## DOE Provides Support for Clean Energy Planning & Implementation

Based on inquiry and resources available, technical assistance can include...

### Existing Resources
- **Published Resources**
  - Provide resources or links to toolkits, guides, webinars, data, and other technical materials
- **Partnerships / Initiatives**
  - Share opportunities to join or leverage work from existing facilitated efforts

### Launching New Projects
- **Expand Efforts Underway**
  - Add new info, cases, or partners to existing projects to address a request
- **DOE Expert Consultations**
  - Provide access to DOE and Lab staff for consultation and/or analytical assistance
- **Direct Funding**
  - Provide funding through DOE funding announcements (e.g., SEP competitive, SunShot)
Fastest Way to Access Technical Assistance

STATE, LOCAL AND TRIBAL TECHNICAL ASSISTANCE GATEWAY

ENERGY.GOV/TA

The State, Local and Tribal Technical Assistance Gateway provides an access point to DOE’s technical assistance and cooperative activities with state, local and tribal officials. Through its program and staff offices, DOE has engaged extensively with various levels of state, local and tribal governments, providing technical assistance on a range of energy issues. Our existing technical assistance and other activities, as well as relevant information offered by other federal agencies, are provided below by program or topic.

If you’re a state, local or tribal official, or a representative from an organization of such officials, with a specific question or need for assistance, email us and we’ll work collaboratively across the DOE to address your inquiry. Responses could include access
## Wide Range of DOE Existing Resources & Partnerships Available

<table>
<thead>
<tr>
<th>Typical Lead</th>
<th>Savings Pathways</th>
<th>Example Best Practice Programs, Policies, EM&amp;V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Sector</td>
<td>![Checkmark]</td>
<td>Ratepayer-Funded Efficiency Programs</td>
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# Industrial Sector Resource Highlights

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<thead>
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</tr>
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<tbody>
<tr>
<td>Private Sector</td>
<td>Industrial Efficiency</td>
<td>Superior Energy Performance</td>
</tr>
<tr>
<td>State / Local Utilities</td>
<td>Combined Heat and Power</td>
<td>Better Buildings Better Plants</td>
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<td></td>
<td></td>
<td>Industrial Assessment Centers</td>
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<td></td>
<td></td>
<td>CHP Technical Assistance Partnerships</td>
</tr>
</tbody>
</table>

## Best Practice Programs and Policies
- [Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector](#)
- [SEP Cost Effectiveness Screening Tool](#) (NEW)
- [SEP Program Planning Template](#) (NEW)
- [SEP Program Transition Tables](#) (NEW)

## Evaluation, Measurement, and Verification (EM&V) Resources
- [Superior Energy Performance EM&V Protocol](#)
- Uniform Methods Project Protocols for CHP (forthcoming, Summer 2016)
## Commercial / Public Sector Resource Highlights

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<thead>
<tr>
<th>Typical Leads</th>
<th>Savings Pathways</th>
<th>Direct Technical Assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>State / Local Utilities</td>
<td>Building Energy Codes</td>
<td>• Building Energy Codes Program</td>
</tr>
<tr>
<td></td>
<td>Energy Savings Performance Contracting</td>
<td>• Better Buildings ESPC Accelerator</td>
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<tr>
<td></td>
<td>City-Led Energy Efficiency Efforts</td>
<td>• Better Buildings Challenge</td>
</tr>
<tr>
<td></td>
<td>Ratepayer-Funded Efficiency Programs</td>
<td>• Better Buildings Alliances</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• State Energy Program</td>
</tr>
<tr>
<td></td>
<td>Combined Heat and Power</td>
<td>• CHP Technical Assistance Partnerships</td>
</tr>
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</table>

### Documentation of Best Practice Programs and Policies
- State and Local Solution Center
- Benchmarking and Disclosure: State and Local Policy Design Guide and Sample Policy Language
- New York City Benchmarking and Transparency Policy Impact Evaluation Report
- Energy Data Access Toolkit

### Evaluation, Measurement, and Verification (EM&V) Resources
- DOE Benchmarking & Transparency Policy and Program Impact Evaluation Handbook
- Assessment of Automated Measurement and Verification (M&V) Methods
- FEMP M&V Guidelines Version 4
### Residential Sector Resource Highlights

<table>
<thead>
<tr>
<th>Typical Leads</th>
<th>Savings Pathways</th>
<th>Direct Technical Assistance</th>
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<tbody>
<tr>
<td>• State / Local Utilities</td>
<td>Building Energy Codes</td>
<td>• Building Energy Codes Program</td>
</tr>
<tr>
<td>• Utilities</td>
<td>Low Income Energy Efficiency</td>
<td>• Weatherization Assistance Program</td>
</tr>
<tr>
<td></td>
<td>Ratepayer-Funded Efficiency Programs</td>
<td>• Home Performance with ENERGY STAR</td>
</tr>
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<td>• Home Energy Score</td>
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<tr>
<td></td>
<td></td>
<td>• Zero Energy Ready Homes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Better Buildings Residential Network</td>
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</tbody>
</table>

#### Documentation of Best Practice Programs and Policies
- Weatherization Assistance Program Technical Assistance Center
- Building America Solution Center, Better Buildings Residential Program Solution Center
- SEE Action Policy Makers’ Guide to Home Energy Upgrades (NEW)

#### Evaluation, Measurement, and Verification (EM&V) Resources
- Achieving Energy Savings and Emission Reductions from Building Energy Codes: A Primer for State Planning
- Savings and Cost Analysis for Zero Energy Ready Homes
- EM&V of Residential Behavior-Based EE Programs Guide
- Home Energy Upgrade Program Cost-Effectiveness Screening Tool
## Cross-Cutting Resource Highlights

<table>
<thead>
<tr>
<th>Typical Leads</th>
<th>Topics</th>
<th>Direct Technical Assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>State / Local Utilities</td>
<td>State Energy Planning</td>
<td>- State Energy Program</td>
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<tr>
<td></td>
<td>Evaluation, Measurement &amp; Verification</td>
<td>- DOE Technical Assistance Program</td>
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<tr>
<td></td>
<td>Financing (e.g., on bill, PACE)</td>
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</tr>
</tbody>
</table>

**Documentation of Best Practice Programs and Policies**

- Energy Efficiency Savings Opportunities and Benefits
- State and Local Solution Center

**Evaluation, Measurement, and Verification (EM&V) Resources**

- Uniform Methods Project
- Energy Efficiency Program Impact Evaluation Guide
- Evaluator Certification (forthcoming, 2016)
Appendix:
Calculations of Electricity and Carbon Savings
## Estimates of National Electricity and Carbon Savings Potential in 2030

NOTE: Pathways may include overlapping savings, so estimates are NOT additive.

<table>
<thead>
<tr>
<th>Savings Pathway</th>
<th>Ballpark Achievable Potential Calculations Based on the Following Low to High Scenarios</th>
<th>Data Sources</th>
<th>Low estimate</th>
<th>High estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratepayer-Funded Efficiency Programs</td>
<td>Total estimated savings in 2030 from reduced electricity load growth rates due to ratepayer-funded energy efficiency programs achieving annual incremental savings of 1.1 - 1.5% from 2012 baseline.</td>
<td>LBNL, 2013, <em>The Future of Utility Customer-Funded Energy Efficiency Programs in the U.S.</em></td>
<td>645 million MWh 368 short tons CO₂</td>
<td>895 million MWh 510 short tons CO₂</td>
</tr>
<tr>
<td>Industrial Efficiency</td>
<td>Total estimated savings in 2030 for 50 - 75% of industrial plants achieving 2% annual energy intensity improvements (based on the Better Plants standard) from the AEO 2015 forecasted baseline for 2030.</td>
<td>EIA 2015 AEO Tables 25-35</td>
<td>85 million MWh 48 short tons CO₂</td>
<td>130 million MWh 74 short tons CO₂</td>
</tr>
<tr>
<td>Combined Heat and Power</td>
<td>Total estimated savings in 2030 from completing 30 - 45% of economical (less than 10 year payback) CHP system installation projects smaller than 100 MW.</td>
<td>American Gas Association, 2013, <em>The Opportunity for CHP in the United States</em></td>
<td>75 million MWh 43 short tons CO₂</td>
<td>115 million MWh 66 short tons CO₂</td>
</tr>
<tr>
<td>Energy Savings Performance Contracting</td>
<td>Total estimated savings in 2030 based on 0 - 8% annual growth rates in volume of ESCO projects from 2012 baseline.</td>
<td>LBNL, 2015, <em>Estimating customer electricity and fuel savings from projects installed by the US ESCO industry</em> and LBNL, 2014, <em>A method to estimate the size and remaining market potential of the U.S. ESCO industry</em></td>
<td>45 million MWh 26 short tons CO₂</td>
<td>90 million MWh 51 short tons CO₂</td>
</tr>
<tr>
<td>Building Energy Codes</td>
<td>Total estimated savings in 2030 from 100% adoption and 70-95% compliance rates for ASHRAE 90.1-2010 / ASHRAE 90.1-2013 commercial building codes (compared to ASHRAE 90.1-2007 baseline) and IECC 2012 / IECC 2015 residential building codes (compared to IECC 2009 baseline)</td>
<td>DOE determinations and supporting analysis and PNNL Codes Impact Analysis</td>
<td>50 million MWh 29 short tons CO₂</td>
<td>60 million MWh 34 short tons CO₂</td>
</tr>
<tr>
<td>City-Led Energy Efficiency Efforts</td>
<td>Total estimated savings in 2030 from 5 - 10% savings in city-wide (residential, commercial, and industrial) electricity consumption for the largest 50 U.S. cities.</td>
<td>ACEEE, 2015, <em>City Energy Efficiency Scorecard</em> Table C6</td>
<td>25 million MWh 14 short tons CO₂</td>
<td>50 million MWh 29 short tons CO₂</td>
</tr>
</tbody>
</table>

*Carbon emissions estimates based on national average total output emission rate (1,136.53 lb/MWh or .57 short tons/MWh) published in [2012 eGRID](https://www.eia.gov/electricity/data/electricity'utilisation/2012_egrid.php)*