



Energy-Saving

HOMES, BUILDINGS,
& MANUFACTURING

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy

How Energy Efficiency Programs Can Support State Energy Planning: State-Level EE Potential & Resources

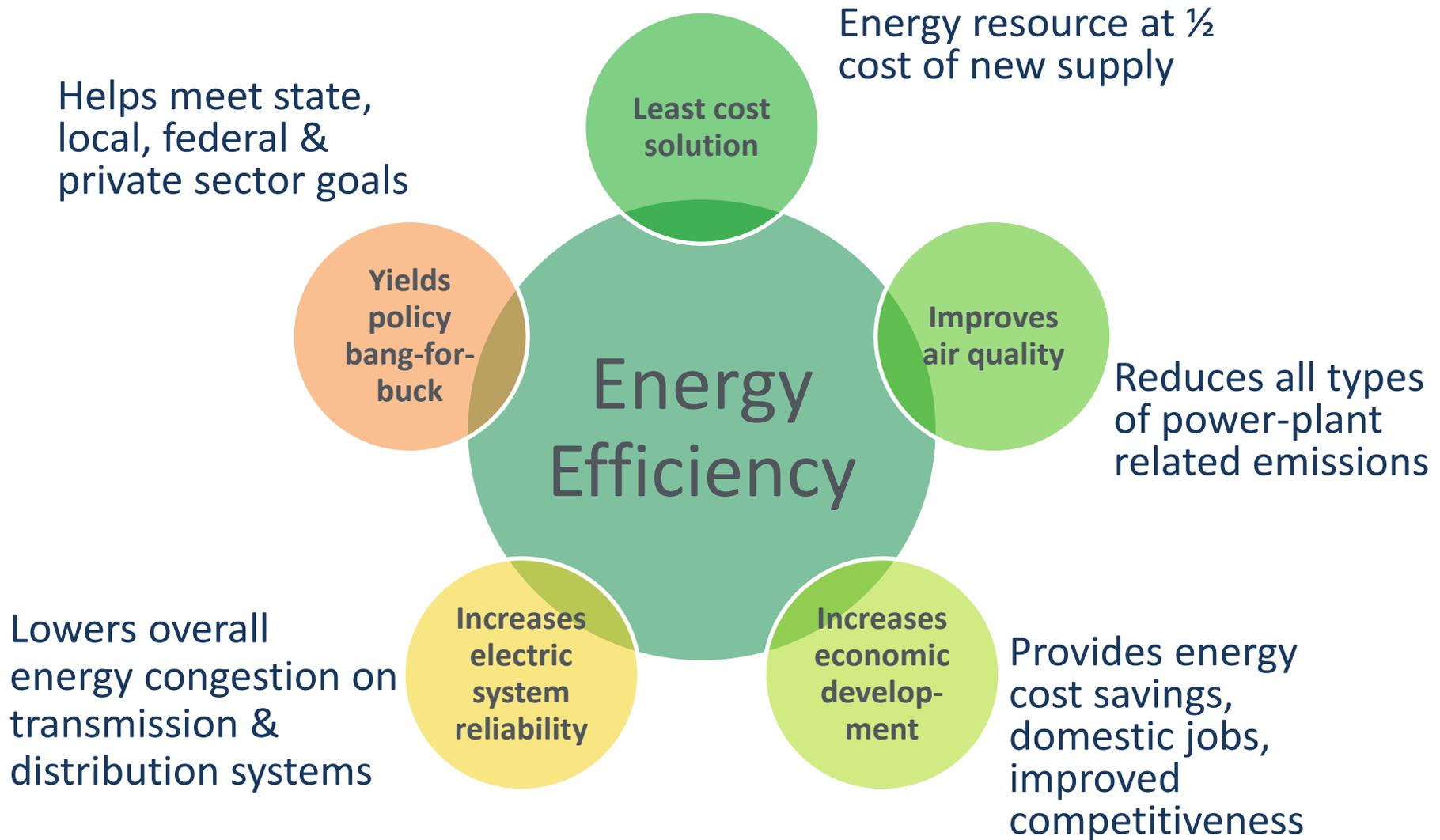
energy.gov/eere/slsc/EEopportunities

Outline

Energy Efficiency as a State Energy Strategy:

- Energy savings benefits
- Energy efficiency potential estimates
- Synopses of seven major opportunity areas and related savings potential
- DOE technical assistance available for energy planning and implementation, by sector
- Appendix – assumptions and data sources

Energy Efficiency Offers Numerous Benefits



Capturing Energy Efficiency Savings is Feasible

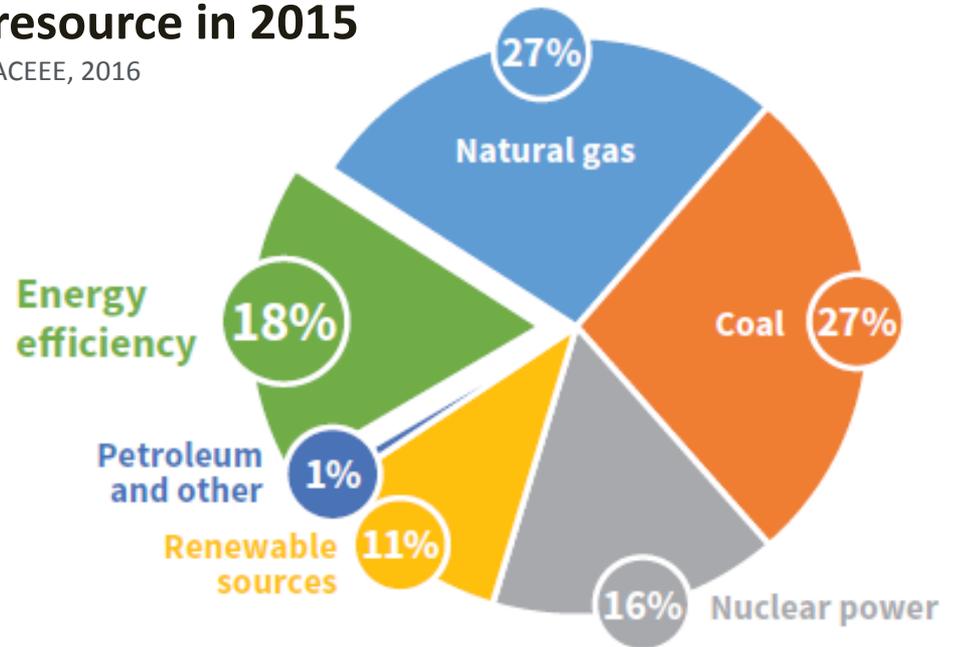
- 16 states (1/3) **achieving** $\geq 1\%$ annual incremental electricity savings
- 34 states (2/3) achieving $\geq 0.5\%*$

Top 10 States

State	2015 net incremental savings, MWh	% of 2015 retail sales
RI	222,822	2.91%
MA	1,472,536	2.74%
VT	110,642	2.01%
CA	5,040,603	1.95%
ME	183,347	1.53%
HI	144,240	1.52%
CT	435,740	1.48%
WA	1,275,447	1.42%
AZ	918,582	1.19%
MI	1,177,277	1.16%

Share of U.S. electricity generation by resource in 2015

ACEEE, 2016

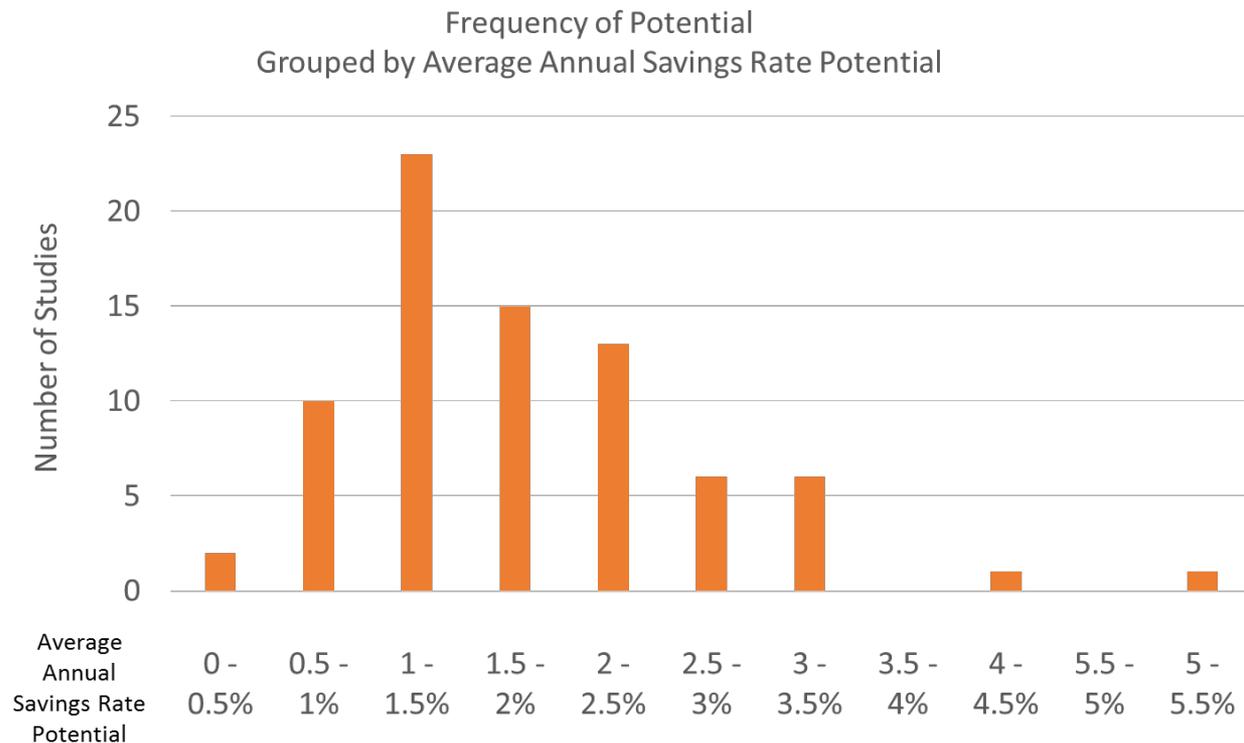


Sources: ACEEE, 2016, [The 2016 State Energy Efficiency Scorecard](#). ACEEE, 2016, [The Greatest Energy Story You Haven't Heard](#).

* Includes states achieving $\geq 1\%$ annual incremental electricity savings

Energy Efficiency Potential Studies & Achieved Electricity Savings

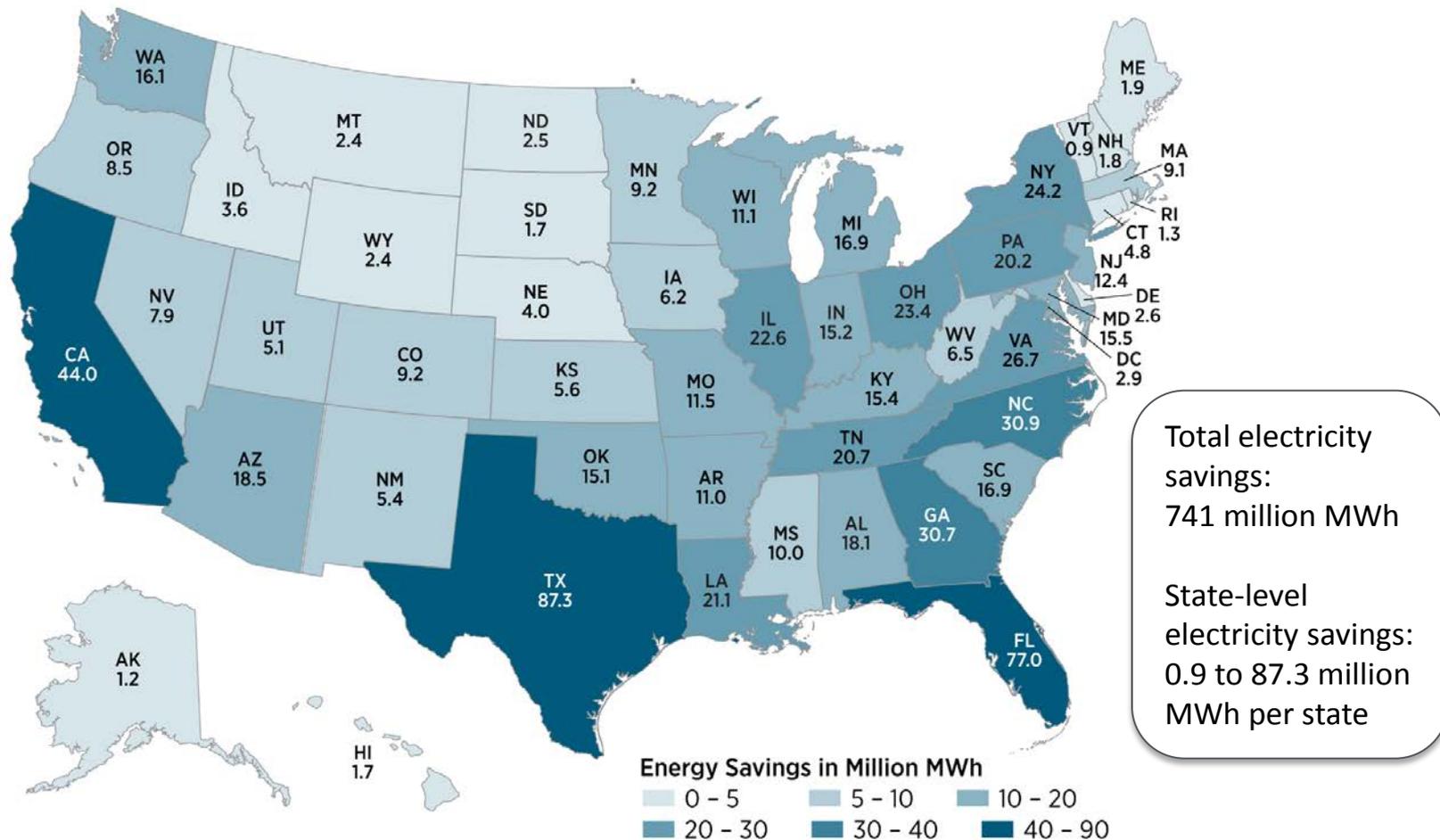
- DOE identified ~80 energy efficiency potential studies published between 2007 and 2016 completed for states, utilities, and NGOs.¹ They provide estimates across 44 states.
- The majority (66%) found an average savings rate of 1 to 2.5% from prior year electricity sales in economic or achievable potential.



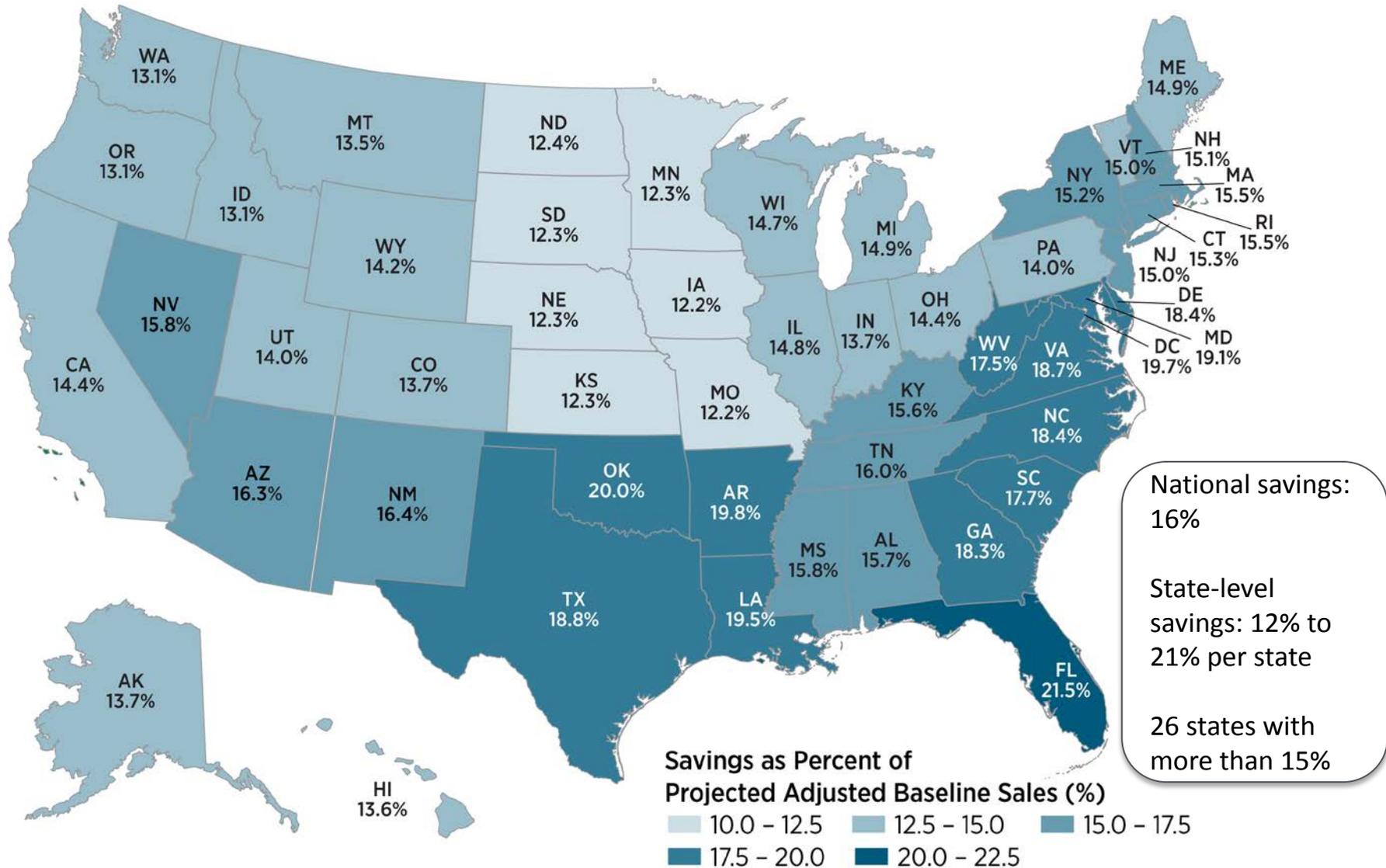
¹U.S. Department of Energy, 2016, [Energy efficiency potential studies catalog](#). Note: With a variety of sponsoring organizations and consultants undertaking these efforts and a range of ways in which these studies are used, assumptions, methodologies, and coverage differ.

Total Economic Electricity Savings Potential (2035) by State (million MWh) – Residential, Commercial, Industrial Sectors

- In a first attempt at identifying economic EE potential in a consistent way across all states, EPRI completed a national / regional potential study and disaggregated it to a state level
- Note: Analysis excludes behavioral or program efficiency; limited technology improvement

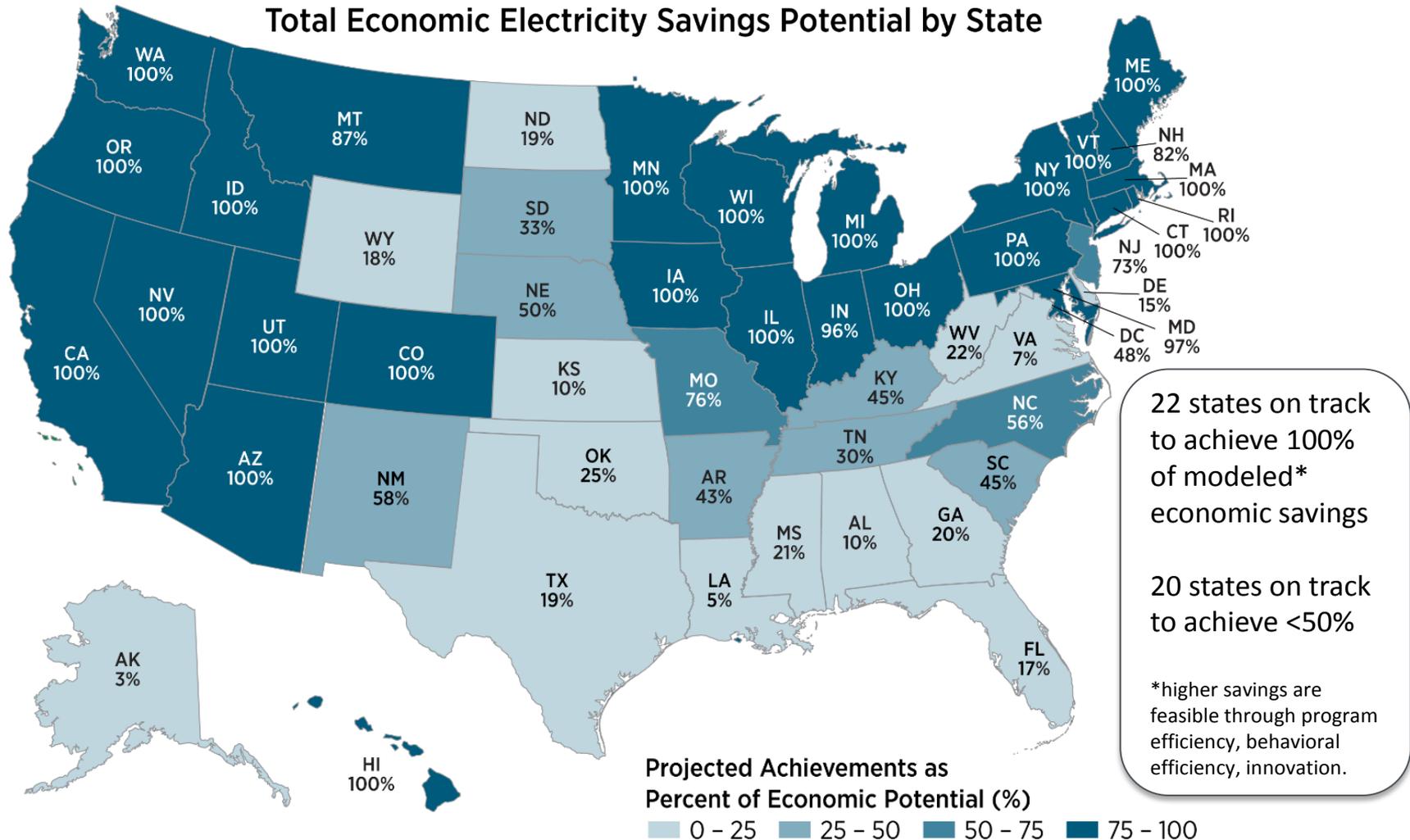


Total Economic Electricity Savings Potential (2035) as Percent of Projected Adjusted Baseline Sales by State



State Progress Towards Achieving EE Potential Varies Widely

Electricity Savings that could be Achieved through a Continuation of Current Approaches (2035) as a Percent of Total Economic Electricity Savings Potential by State



Source: Electric Power Research Institute (EPRI), 2017. [State-Level Electric Energy Efficiency Potential Estimates](#). Data on savings rates from [ACEEE State Scorecard](#).

Well Documented Opportunities Exist to Increase Energy Efficiency through Various Pathways



Ratepayer-Funded Programs



Industrial Efficiency



Combined Heat & Power



Energy Savings Performance Contracting



Building Energy Codes



City-Led Efficiency

Savings Come from EE Activities Across all Building and Sponsor Types

- Industrial, commercial, public, residential bldgs
- Ratepayer-funded (e.g., utility) programs
- Private sector initiatives
- State / local government-run programs

Typical Lead			Savings Pathway	Estimate of National Energy Savings Potential*	Type of Savings Estimate
Private Sector	S/L Gov't	Utility			
		✓	Ratepayer-Funded Efficiency Programs	741 million MWh in 2035	Economic
	✓	✓	Building Energy Codes	12,824 trillion Btu in 2040	Achievable
✓	✓	✓	Industrial Efficiency	7,500 trillion Btu in 2030	Economic
✓	✓	✓	Combined Heat and Power	148,936 megawatts	Technical
	✓		City-Led Energy Efficiency Efforts	55-110 million MWh in 2030	Ballpark Achievable
✓	✓		Energy Savings Performance Contracting	45-90 million MWh in 2030	Ballpark Achievable

S/L Gov't = state or local government

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

¹⁰ *See appendix for pathway-specific estimation methodologies and reference publications.

Ratepayer-Funded Efficiency as an Energy Savings Approach

Possible Lead

- Utilities (investor-owned, municipal, rural cooperative)
- Non-utility program administrators

Energy Savings

- Savings at end of each year, as determined through EM&V, relative to prior year

Potential Program Components

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

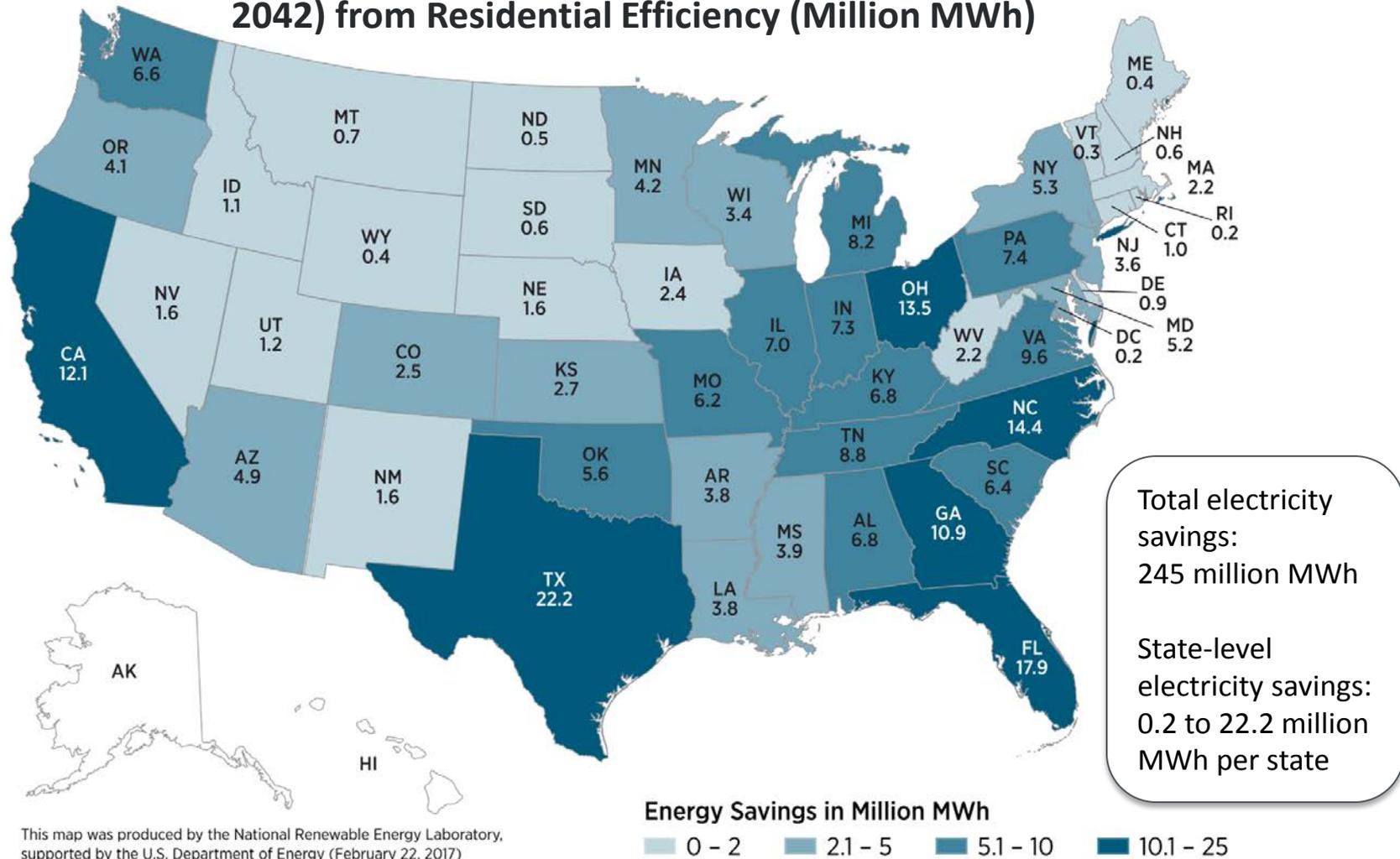
Opportunity:

741 million MWh (16%) in national electricity savings 2016-2035
 12% to 22% savings as a percent of sales per state 2016-2035

Activity	EM&V
Energy Savings Approaches	
<ul style="list-style-type: none"> • Program administrators generate energy savings from: <ul style="list-style-type: none"> - EE programs that support improvements to residential, commercial, industrial buildings 	Recent resources provide guidance, including: <ul style="list-style-type: none"> - SEE Action Energy Efficiency Program Impact Evaluation Guide
State Policy Options	
<ul style="list-style-type: none"> • Could include: <ul style="list-style-type: none"> - 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 	<ul style="list-style-type: none"> - SEE Action EM&V Resource Portal - DOE Uniform Methods Project - NEEP EM&V Forum - Regional Technical Forum of the Northwest Power and Conservation Council

Example: Large Savings Opportunity from Efficiency in Existing Homes

Economic Electricity Savings Potential by State (2012-2042) from Residential Efficiency (Million MWh)



Would also save 4,200 trillion Btu of source energy (24% of consumption)

Industrial Energy Efficiency as an Energy Savings Approach

Possible Lead

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

Energy Savings

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

Potential Program Components

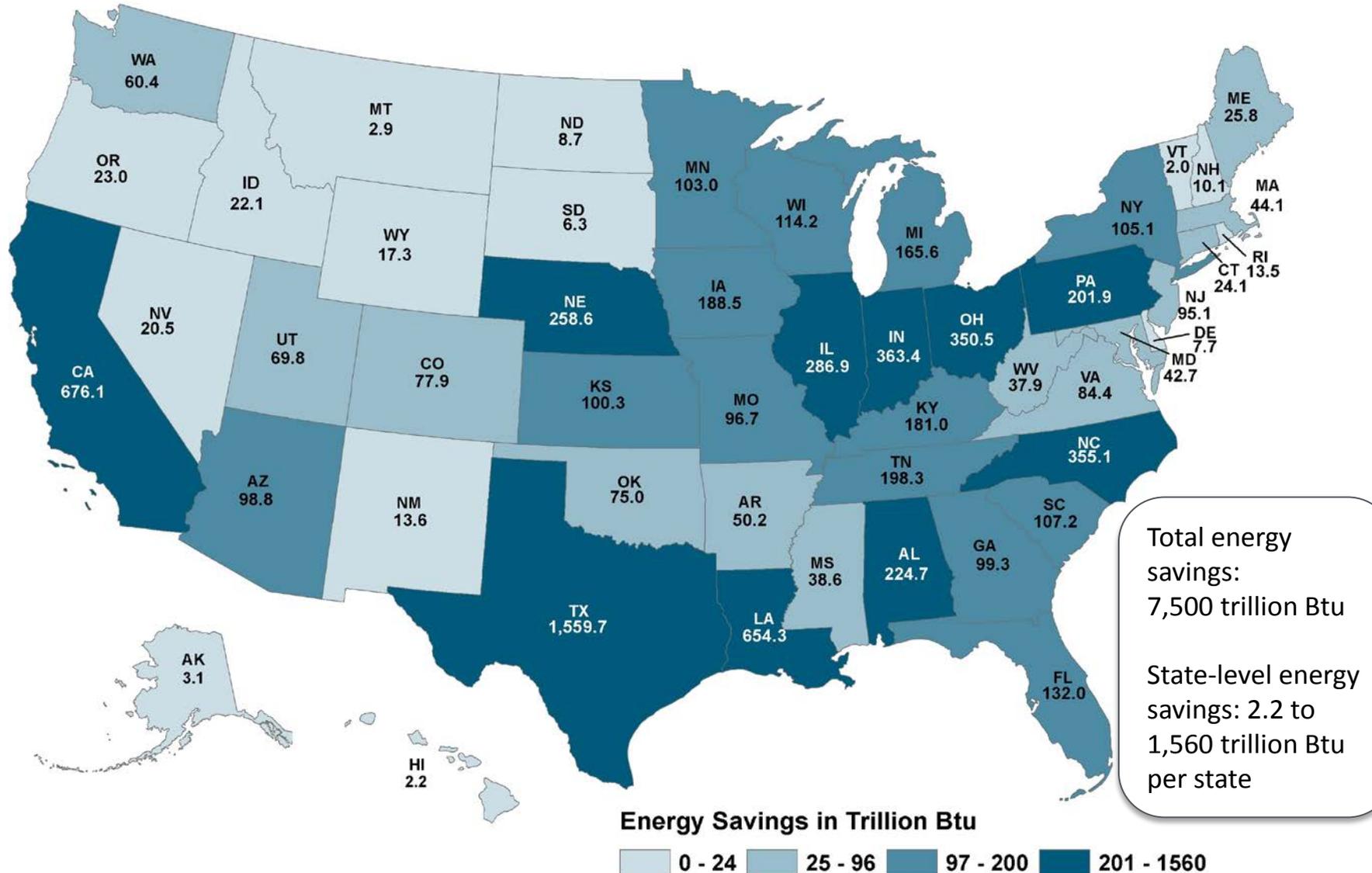
- Better Buildings, Better Plants
- Strategic Energy Management (SEM)
- 50001 Ready
- ISO50001 Certification / Superior Energy Performance (SEP)

Opportunity:

7,500 Trillion Btu national energy savings
2.2 to 1,560 Trillion Btu per state

Activities	EM&V
<h3>Energy Savings Approaches</h3> <ul style="list-style-type: none"> • SEOs, program administrators, industrial end users, ESCOs generate energy savings from: <ul style="list-style-type: none"> – Energy management – Energy management system – Training – Metering – Technical assistance – Capital improvements 	<ul style="list-style-type: none"> • Verification protocol developed for regression-based energy performance improvement through 50001 Ready Protocol and Superior Energy Performance EM&V Protocol • Forthcoming resources: <ul style="list-style-type: none"> – Library of common industrial EE projects/practices and accepted savings calculation methodologies – Uniform Methods Project Protocols for Strategic Energy Management
<h3>State Policy Options</h3> <ul style="list-style-type: none"> • Could include: <ul style="list-style-type: none"> – Energy efficiency resource standard (EERS) – Registry of energy savings from IACs, 50001 Ready or ISO50001/SEP certification 	

Estimated Economic Potential Energy Savings by State (2030) from Industrial EE (Trillion Btu)



Combined Heat and Power as an Energy Savings Approach

Possible Lead

- State energy offices
- City energy or sustainability office
- Community-based organizations
- Utilities / program administrators
- Industrial end-users

Energy Savings

- kWh / MWh generated on site compared to central power plant
- Therms / Btu saved from using waste heat compared to separately fueled heat

Potential Program Components

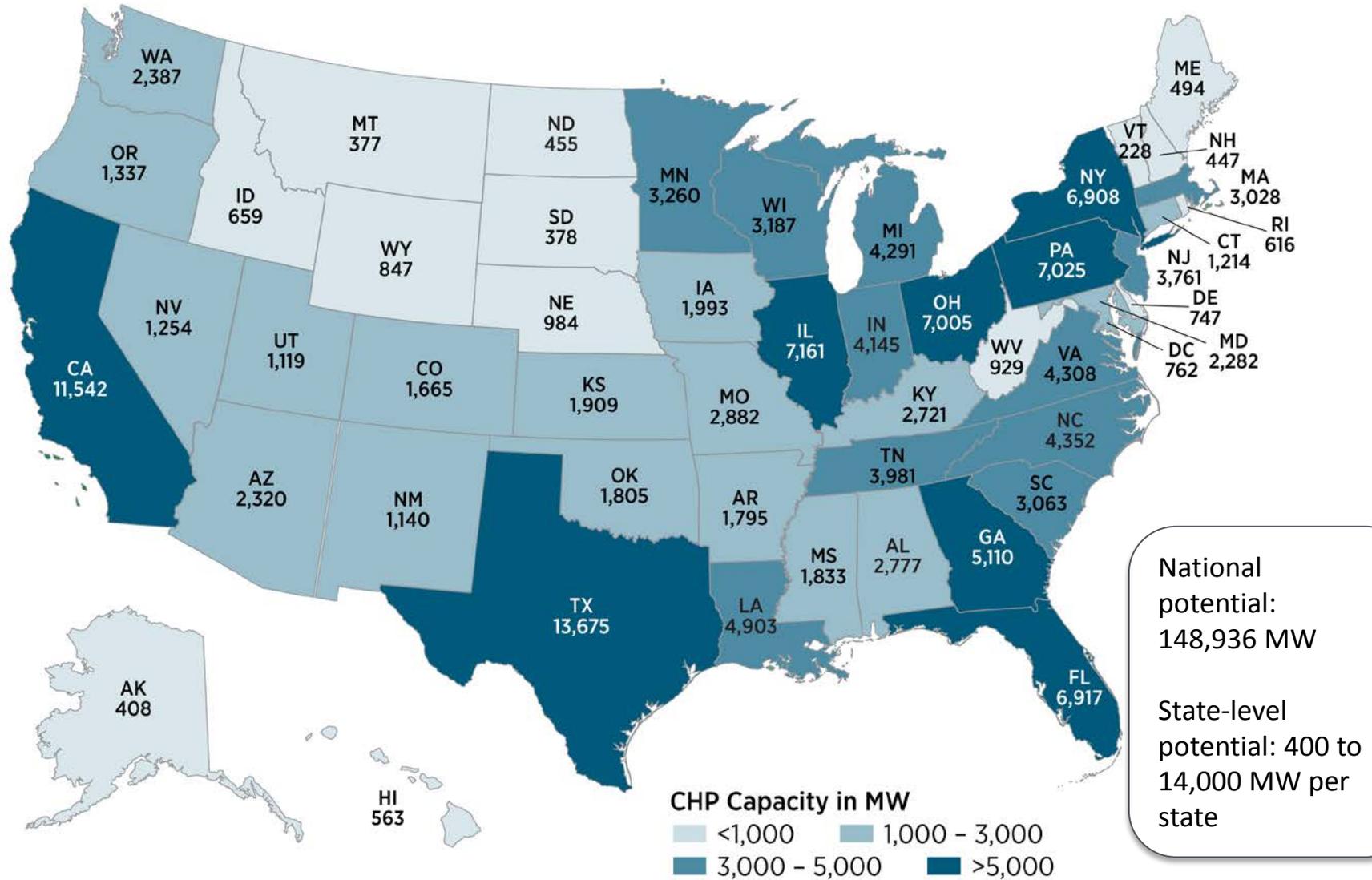
- District energy
- Microgrids
- Resiliency plans

Opportunity:

148,936 MW national potential
400 to 14,000 MW per state

Activities	EM&V
Energy Savings Approaches	
<ul style="list-style-type: none"> • Large energy users, program administrators, or state / local energy offices generate energy savings from: <ul style="list-style-type: none"> - Incentives to support CHP installation in appropriate facilities 	Recent resources provide guidance, including: <ul style="list-style-type: none"> - <i>Combined Heat and Power: Uniform Methods Project</i>
State Policy Options	
<ul style="list-style-type: none"> • Could include: <ul style="list-style-type: none"> - CHP in state energy resource standard (e.g., EERS, RPS) - Updated standby rates - CHP in utility resource plans - Interconnection standards - Embrace CHP Packaged System eCatalog (in development) 	<ul style="list-style-type: none"> - <i>Combined Heat and Power: A Clean Energy Solution</i> - <i>Guide to the Successful Implementation of State CHP Policies</i>

Estimated On-Site Technical Potential by State from Combined Heat and Power (CHP) (MW)



Building Energy Codes as an Energy Savings Approach

Possible Lead

- State code administrator
- State energy office
- Utility
- NGO

Energy Savings

- # new code or beyond code built buildings X reduction in kWh or Btu per building from code in baseline year

Potential Program Components

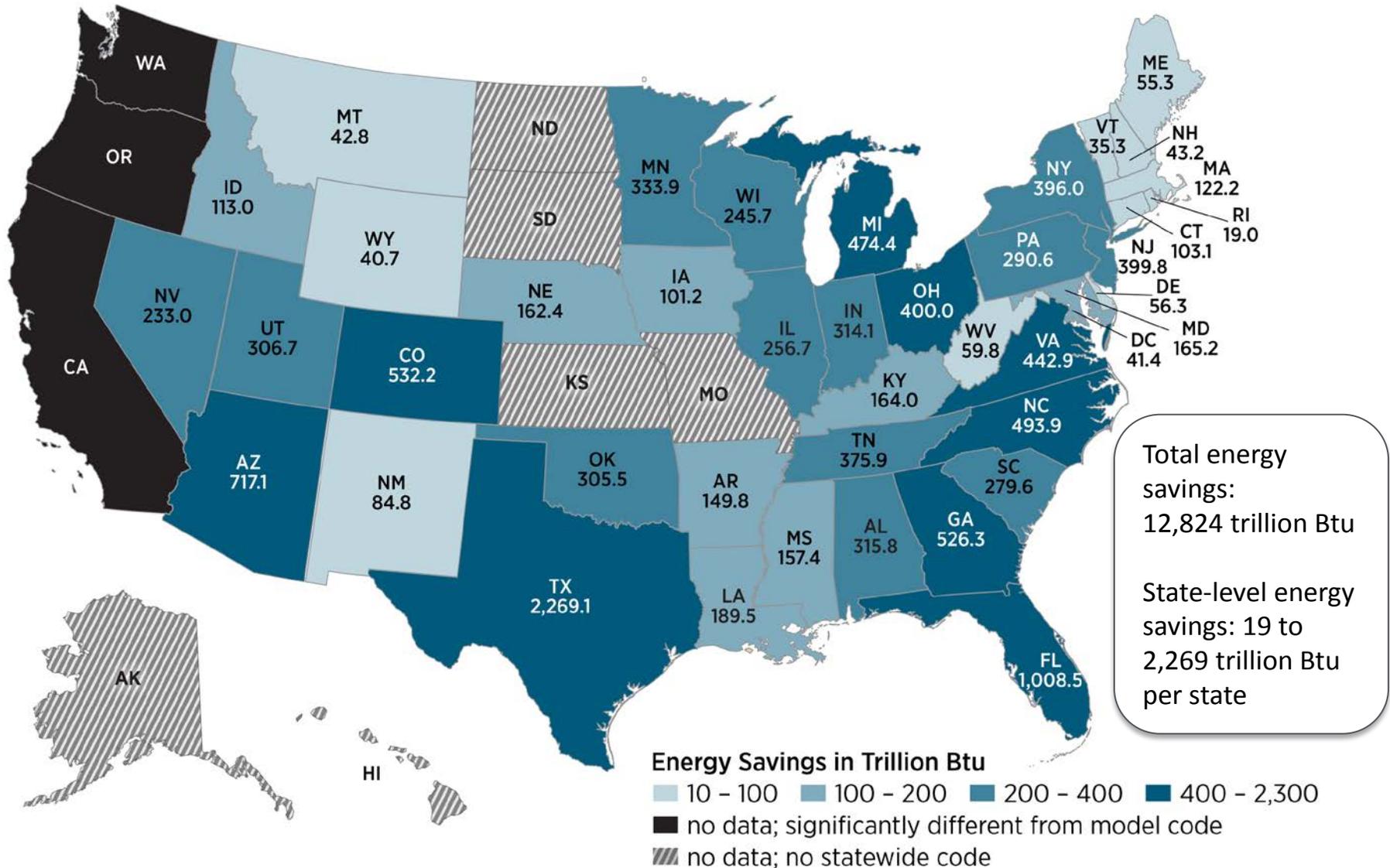
- Stretch Code Programs
- ENERGY STAR New Homes
- Zero Energy Ready Homes

Opportunity:

12,824 trillion Btu national energy savings in 2040
19 to 2,269 trillion Btu per state

Activities	EM&V
Energy Savings Approaches	
<ul style="list-style-type: none"> • State energy office, utility, or NGO generate energy savings from: <ul style="list-style-type: none"> - Education - Training - Enforcement 	Recent resources provide guidance, including: <ul style="list-style-type: none"> - DOE Building Energy Codes Program (BECP) - Achieving Energy Savings and Emission Reductions from Building Energy Codes: A Primer for State Planning - BECP multi-state residential energy code field study
State Policy Options	
<ul style="list-style-type: none"> • Could include: <ul style="list-style-type: none"> - 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) 	

Estimated Achievable Potential Total Energy Savings by State (2010-2040) from Building Energy Codes (Trillion Btu)



City-Led Efficiency as an Energy Savings Approach

Possible Lead

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

Energy Savings

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

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

Potential Savings in 2030
55-110 million MWh

Activities	EM&V
Energy Savings Approaches	
<p>City offices, utility, or community-based organizations generate energy savings from:</p> <ul style="list-style-type: none"> • 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 	<p>Recent resources provide guidance, including:</p> <ul style="list-style-type: none"> • <u>DOE Benchmarking & Transparency Policy and Program Impact Evaluation Handbook</u> • <u>Assessment of Automated Measurement and Verification (M&V) Methods</u> • <u>Federal Energy Management Program M&V Guidelines Version 4</u>
State Policy Options	
<p>Could include:</p> <ul style="list-style-type: none"> • 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) 	

Energy Savings Performance Contracting (ESPC) as an Energy Savings Approach

Possible Leads

- State Energy Office
- State/Local General Services
- Local Sustainability Office
- Commercial building owner
- Energy savings company (ESCO)

Energy 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 Savings in 2030
45-90 million MWh

Activities	EM&V
<p>Energy Savings Approaches</p> <ul style="list-style-type: none"> • State energy or general services office, building owners, ESCOs, utilities generate energy savings from: <ul style="list-style-type: none"> - Direct energy management - Capital improvements - Technical assistance - Training - Metering - Utility incentives 	<p>Recent resources provide guidance, including:</p> <ul style="list-style-type: none"> • <u>Federal Energy Management Program M&V Guidelines Version 4</u> • <u>Energy Savings Performance Contracting (ESPC) Toolkit</u>
<p>State Policy Options</p> <ul style="list-style-type: none"> • Could include: <ul style="list-style-type: none"> - 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 	

Get More Information on How Others Have Used EE and Find Resources to Support State Energy Planning

energy.gov/eere/slsc/EEopportunities

- Compilation of energy efficiency potential studies published by states, utilities, and non-governmental organizations between 2007 and 2016.

State-Level EE Potential Studies Catalog

- *Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gases and Air Pollution, and Meet Energy Needs in the Power Sector* Includes case studies, expected savings, common protocols, sources of info.

SEE Action Guide for States

- Evaluation, monitoring & verification (EM&V) tools and approaches that can be applied nationally, address EM&V consistency, and are widely recognized.

SEE Action EM&V Portal

- PPT on the basics of power sector capacity expansion modeling that briefly touches on other types of modeling and analytical tools available to provide data on the electric power system, including EE.

Energy Modeling 101 Presentation

- The [2017 USEER State Report](#) provides a demographic and sector analysis of direct energy employment across four categories for each state: power generation, transmission, EE, vehicles.

U.S. Energy & Employment State Report

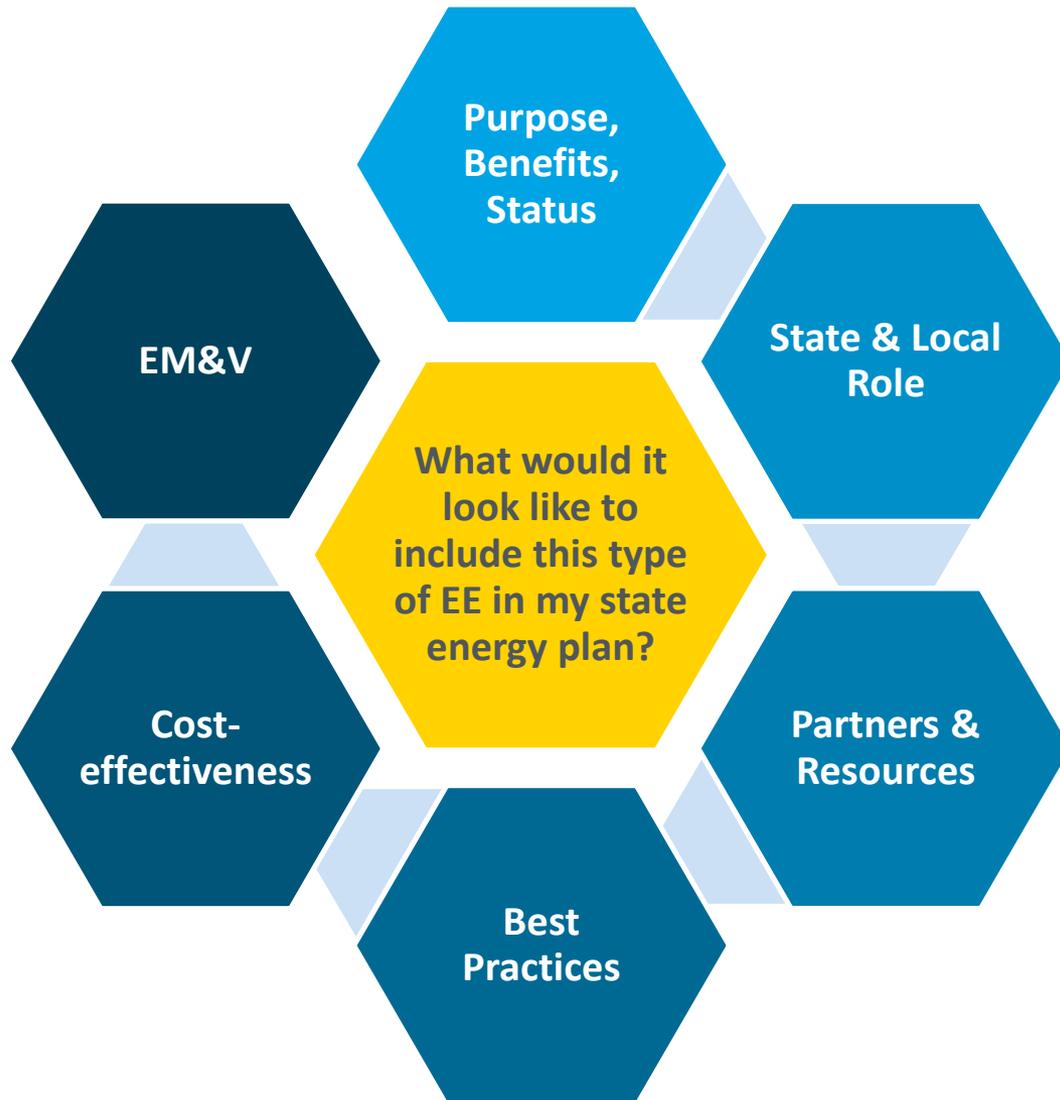
- Brief synopsis presentation of current DOE programs and resources (documents, tools) by sector that can support program administrators and planners interested in pursuing energy efficiency.

DOE Programs and Resources

- Provides an access point to DOE's technical assistance and cooperative activities with state, local, and tribal officials.

DOE Technical Assistance Gateway

What Next? Review Concise Pathway Presentations (15-20 slides each)



Learn how to access your state's EE potential or use as a starting point for familiarizing stakeholders

- [How energy efficiency programs can support state energy planning \(2017\)](#)
- [Building energy codes \(2017\)](#)
- [City-led energy efficiency \(2016\)](#)
- [Combined heat and power \(2017\)](#)
- [Energy savings performance contracting \(2016\)](#)
- [Industrial energy efficiency \(2017\)](#)
- [Ratepayer-funded energy efficiency \(2017\)](#)

Additional DOE Analyses & Updates Underway

- EE Potential:
 - Low income residential
 - Public buildings (energy savings performance contracting)
 - City- / locally-led efficiency
 - Industrial (to county level)
 - Low rise multifamily

- Pathways Presentations:
 - Residential
 - Low income
 - Energy savings performance contracting (update)
 - City- / locally led efficiency (update)

Existing DOE Technical Assistance & Resources Available

DOE Provides Support for State Energy Planning & Implementation

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

Existing Resources

Launching New Projects

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

Expand Efforts Underway
Add new info, cases, or partners to existing projects to address a request

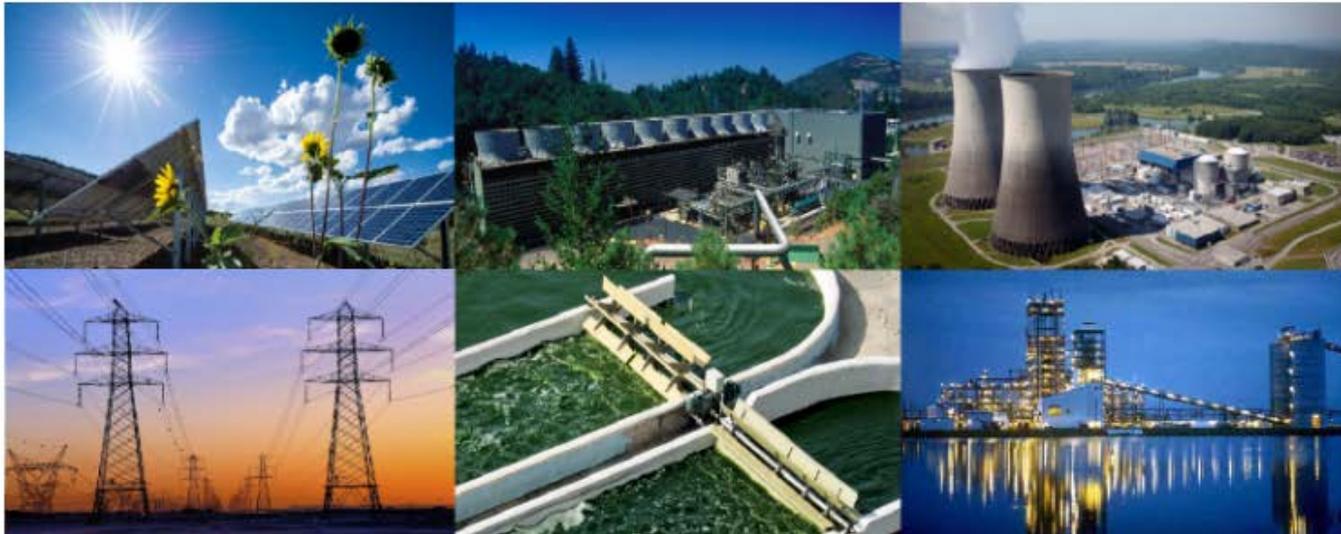
DOE Expert Consultations
Provide access to DOE and Lab staff for consultation and/or analytical assistance

Direct Funding
Provide funding through DOE funding announcements (e.g., SEP competitive, SunShot)

Simplest Way to Access Technical Assistance



STATE, LOCAL AND TRIBAL TECHNICAL ASSISTANCE GATEWAY



[Frequently Asked Questions](#)

[Featured Topic: Greenhouse Gas Reduction Strategies in the Electric Power Sector](#)

CONTACT US

For more information about technical assistance at the Department of Energy, contact us via [e-mail](#).

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

Typical Lead			Savings Pathways	Example Best Practice Programs, Policies, EM&V
Private Sector	S/L Gov't	Utility		
		✓	Ratepayer-Funded Efficiency Programs	State and Local Energy Efficiency Action Network
	✓	✓	Building Energy Codes	Building Energy Codes Analyses of Savings
✓	✓	✓	Industrial Efficiency	Superior Energy Performance
✓	✓	✓	Combined Heat and Power	CHP Technical Assistance Partnerships
	✓		City-Led Energy Efficiency Efforts	Better Communities Alliance
✓	✓		Energy Savings Performance Contracting	Better Buildings ESPC Accelerator
	✓	✓	Low Income Energy Efficiency	Better Buildings Clean Energy for Low Income Communities Accelerator

S/L Gov't = state or local government

Industrial Sector Resource Highlights

Typical Leads	Savings Pathways	Direct Technical Assistance
<ul style="list-style-type: none">• Private Sector• State / Local Utilities	Industrial Efficiency	<ul style="list-style-type: none">• Superior Energy Performance• Better Buildings Better Plants• Industrial Assessment Centers
	Combined Heat and Power	<ul style="list-style-type: none">• CHP Technical Assistance Partnerships

Best Practice Programs and Policies

- [Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector](#)
- [Superior Energy Performance \(SEP\) Guide for the Development of Energy Efficiency Program Plans](#)
- [SEP Cost Effectiveness Screening Tool](#)
- [SEP Program Planning Template](#)
- [SEP Program Transition Tables](#)

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

- ❖ [Superior Energy Performance EM&V Protocol](#)
- ❖ [Uniform Methods Project Protocols for CHP](#)
- ❖ [Uniform Methods Project Protocols for Strategic Energy Management/Super Energy Performance](#)

Commercial / Public Sector Resource Highlights

Typical Leads	Savings Pathways	Direct Technical Assistance
<ul style="list-style-type: none"> • State / Local • Utilities 	Building Energy Codes	<ul style="list-style-type: none"> • Building Energy Codes Program
	Energy Savings Performance Contracting	<ul style="list-style-type: none"> • Better Buildings ESPC Accelerator
	City-Led Energy Efficiency Efforts	<ul style="list-style-type: none"> • Better Buildings Challenge • Better Communities Alliance
	Ratepayer-Funded Efficiency Programs	<ul style="list-style-type: none"> • Better Buildings Alliance • State Energy Program
	Combined Heat and Power	<ul style="list-style-type: none"> • CHP Technical Assistance Partnerships

Documentation of Best Practice Programs and Policies

- [State and Local Solution Center, Better Buildings 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, ESPC Toolkit, Outdoor Lighting 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

Typical Leads	Savings Pathways	Direct Technical Assistance
<ul style="list-style-type: none"> • State / Local • Utilities 	Building Energy Codes	<ul style="list-style-type: none"> • Building Energy Codes Program
	Low Income Energy Efficiency	<ul style="list-style-type: none"> • Weatherization Assistance Program • Home Performance with ENERGY STAR
	Ratepayer-Funded Efficiency Programs	<ul style="list-style-type: none"> • Clean Energy for Low Income Communities Accelerator • Home Energy Score • Zero Energy Ready Home • Better Buildings Residential Network

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](#)

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](#)
- ❖ [Residential Program Energy Efficiency Cost-Effectiveness Tool](#)

Cross-Cutting Resource Highlights

Typical Leads	Topics	Direct Technical Assistance
<ul style="list-style-type: none"> • State / Local • Utilities 	<p>State Energy Planning</p> <hr/> <p>Evaluation, Measurement & Verification</p> <hr/> <p>Financing (e.g., on bill, PACE)</p>	<ul style="list-style-type: none"> • State Energy Program • DOE Technical Assistance Program

Documentation of Best Practice Programs and Policies

- [Energy Efficiency Savings Opportunities and Benefits](#)
- [SEE Action Guide: Energy Efficiency as a Least-Cost Strategy to Reduce Greenhouse Gas Emissions and Meet Energy Needs in the Power Sector](#)
- [State and Local Solution Center](#)
- [Best Practice Guidelines for Residential PACE Financing Programs](#)
- [Current Practices in Efficiency Financing: An Overview for State and Local Governments](#)

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

- ❖ [Uniform Methods Project](#)
- ❖ [Energy Efficiency Program Impact Evaluation Guide](#)
- ❖ [Energy Efficiency Under Alternative Carbon Policies: Incentives, Measurement, and Interregional Effects](#)

Appendix:
**References for Calculations of National and State-Level Energy
Savings Potential**

References for Estimates of National and State-Level Energy Savings Potential

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

Pathway	Type of Estimate	Author, Date	Study Notes	Title
Residential -- Existing Single-Family Homes	Economic Electricity Savings Potential	NREL, 2017	Also reports ancillary fuel savings. 2012-2042	Electric End-Use Energy Efficiency Potential in the U.S. Single-Family Housing Stock
Industrial Efficiency	Economic Energy Savings Potential	DOE, 2016	Reports energy and electricity-only savings 2013-2030	Industrial Energy Efficiency Potential Analysis
Combined Heat and Power	Technical Electricity Potential	DOE, 2016	Reports technical potential for CHP by size range, facility type, and state based on 2015 data	Combined Heat and Power (CHP) Technical Potential in the United States
Building Energy Codes	Achievable Energy Savings Potential	PNNL, 2016	Reports energy, cost, and carbon savings for 2010-2030 and 2010-2040	Impacts of Model Building Energy Codes
City-Led Efficiency Efforts	Ballpark Achievable Electricity Potential	DOE, 2016	Total estimated savings in 2030 from 10 - 20% savings in city-wide (municipal, residential, commercial, and industrial) electricity consumption for the largest 50 U.S. cities.	<i>Extrapolated from Data Sources: ACEEE, 2015, City Energy Efficiency Scorecard Table C6</i>
Energy Savings Performance Contracting	Ballpark Achievable Electricity Potential	DOE, 2016	Total estimated savings in 2030 based on 0 - 8% annual growth rates in volume of ESCO projects from 2012 baseline.	<i>Extrapolated from Data Sources: LBNL, 2015, Estimating customer electricity and fuel savings from projects installed by the US ESCO industry and LBNL, 2014, A method to estimate the size and remaining market potential of the U.S. ESCO industry</i>