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State Compliance Evaluation Rev 2

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Pacific Northwest
NATIONAL LABORATORY

Introduction

The Department of Energy's (DOE's) Building Energy Codes Program (BECP) is developing guidelines and tools for measuring and reporting compliance with building energy codes in each of the states. These will assist states in responding to and implementing conditions specified in the State Energy Program (SEP) Formula Grants American Recovery and Reinvestment Act (Recovery Act) Funding Opportunity, Number: DE-FOA-0000052. The funding opportunity announcement contains the following conditions:

(2) *The State, or the applicable units of local government that have authority to adopt building codes, will implement the following:*

(A) *A residential building energy code (or codes) that meets or exceeds the most recent International Energy Conservation Code, or achieves equivalent or greater energy savings.*

(B) *A commercial building energy code (or codes) throughout the State that meets or exceeds the ANSI/ASHRAE/IESNA Standard 90.1-2007, or achieves equivalent or greater energy savings.*

(C) *A plan to achieve 90 percent compliance with the above energy codes within eight years. This plan will include active training and enforcement programs and annual measurement of the rate of compliance.*

This document identifies preliminary plans for development of guidelines and tools designed to assist states in addressing the conditions specified in activity 'C' above, specifically measuring and expressing the energy code compliance rate in the state. Previous direction from DOE to the BECP for drafting these guidelines included:

“Prepare a ‘Straw man’ code compliance evaluation procedure, templates, and suggested tool(s) as a basis for a dialogue with the states about code compliance evaluation. Prepare the “straw man” in such a way that the evaluation results from individual states can be compiled with those from other states to provide regional and national perspective.”

In addition to the Recovery Act conditions, DOE's guidance indicates that desired outcomes include the ability to roll up the results for each state into regional and national metrics. The guidelines and processes described below are intended to foster uniformity in measuring and expressing these compliance rates, making the aggregation of results feasible. Additionally, by providing procedures and tools that states can adapt for their own use, DOE hopes to eliminate the need for each state to develop their own procedures and tools and in so doing allow them to focus on the task of addressing compliance.

Activities To-Date

A first draft of the State Compliance Evaluation (“Strawman”) document was developed and distributed to interested stakeholders for their review and feedback in March 2009 and that dissemination was augmented by a web cast specifically targeted for the states. This document, *State Compliance Evaluation Rev 2*, is a revision of the previously distributed Strawman and has been revised to incorporate the feedback received from a number of stakeholders, including energy advocates and state and local government. This second draft will be more widely disseminated in an effort to secure additional guidance from states and other stakeholders on the revised procedures and tools described below, which at this time should *not* be considered final.

The initial Strawman proposed a 3-tier approach, where tiers 1 and 2 were focused on evaluating local jurisdictions¹ through an assessment of their processes and capabilities by securing answers to questions such as:

¹ The term jurisdiction as used in this document refers broadly to local government such as city, county, borough, or township and is intended to include all public offices and agencies therein. Within a jurisdiction, there can be multiple entities each having responsibility for various portions of the building and/or site. While energy code compliance would typically be addressed by the building department, other offices or agencies could be involved in determining compliance.

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- Do you require energy code documentation prior to issuing a building permit?
 - Do you conduct plan reviews for energy code compliance?
 - Do you have inspectors specifically trained on the energy code?

Tier 3 proposed an onsite audit to evaluate compliance based on a randomly selected sample of buildings. The BECP received a great deal of very constructive feedback pertaining to this initial Strawman, with a fairly unanimous conclusion that an onsite audit was required for meeting the Recovery Act conditions for demonstrating a 90% compliance rate, as opposed to drawing conclusions about compliance based on an assessment of processes, capabilities, and other related data. Assuming there is a correlation between a jurisdiction's capabilities and processes and compliance in the field, process evaluations continue to be proposed as useful for interim measurements and as a useful tool for collecting information about best practices in the jurisdictions. Initial process assessments might also be used to refine the degree to which further on-site inspections are needed.

Other feedback received from reviewers of the initial Strawman encouraged:

- the inclusion of the design and construction industries in the assessments
- training, corrective measures to enhance compliance, and follow-up as part of the process so as to improve compliance on an ongoing basis once the initial rate of compliance was measured, and
- a request for BECP to provide detailed methodologies which would ensure national uniformity and comparability of results.

Some interest was also expressed in exploring the use of data associated with building operations (e.g. utility costs and metered energy use) for this effort. We see value in looking at utility data as it could be used:

- to identify outliers that could then be inspected (e.g. to determine why some buildings are not performing as expected),
- to identify trends, such as isolated builders/contractors or state/local agencies performing differently than others, and
- to evaluate how well code-compliant buildings really perform.

However, a performance-based evaluation of metered energy consumption of existing buildings would be a major undertaking, potentially very expensive, and it is unclear how it could be directly and readily applied to derive compliance metrics. If the codes were purely performance-based rather than prescriptive, this might be feasible. But currently there are a number of factors which could dramatically affect building energy use and are not addressed in a prescriptive code or standard, such as the climate conditions, use, occupancy schedule, and operations and maintenance activities. The results of such a study would additionally be subject to considerable discussion and debate. Therefore, the BECP is not suggesting this approach for demonstrating compliance as per the Recovery Act conditions.

ARRA Interpretations

The Recovery Act legislation specifies a compliance measurement against the most recent International Energy Conservation Code (IECC) for residential buildings² and the ANSI/ASHRAE/IESNA Standard 90.1–2007 for commercial buildings³, or equivalent codes. This is interpreted as a reference to the 2009 IECC and the 2007 Edition of Standard 90.1 as the target codes for which compliance is to be measured against. The 2009 IECC was not referenced directly because it was still being acted on when the legislation was drafted and therefore could not

² Residential buildings include attached and detached homes, townhouses and multi-family residential buildings (condominiums, apartments, etc.) three stories or less in height above grade.

³ Commercial buildings include all multi-family residential buildings over three stories in height above grade, all other residential type occupancies such as hotels, motels, dormitories, etc and all other non-residential buildings.

be referenced. In this document, “target codes” will be used to refer to the 2009 IECC for residential buildings and 90.1-2007 for commercial buildings, or equivalent. Chapter 5 of the 2009 IECC adopts by reference Standard 90.1-2007. As such, adoption of the 2009 IECC would be deemed equivalent to 90.1-2007. However, Chapter 5 also contains an alternative approach for commercial buildings which is based on but not identical to 90.1-2007. Work is currently underway within the BECP to determine if Chapter 5 of the IECC meets or exceeds 90.1-2007.

The Recovery Act conditions specify the adoption of these target codes and an *annual measurement of the rate of compliance*. This is interpreted to mean that when the target codes (or equivalent) are adopted and, if at any time over the 8-year period, a 90% compliance rate is demonstrated, no further requirement for formally reporting annual measurement to DOE will apply, assuming the direction in the legislation is not subsequently changed. Because the Recovery Act represents a one-time infusion of funds for this effort, the DOE is not comfortable requiring continued assessments once the 90% compliance rate is demonstrated. However, changes in building department staff and processes, and changes in builders, designers, and contractors, make periodic evaluations a necessity in order to ensure continued high energy code compliance rates. This is supported through jurisdictional evaluations performed over past years. Such evaluations have demonstrated that changes yield consequences that are not always in a positive direction, and can depend on many variables that require ongoing review to understand and address. To demonstrate the 90% compliance rate, an onsite audit of buildings, based on a statistically valid sample of buildings across jurisdictions in the state, will be deemed necessary.

States and local jurisdictions having codes meeting or exceeding the target codes are not being asked to adopt the target codes, but will still have to demonstrate the 90% compliance rate with their adopted codes in addition to documenting that their code meets or exceeds the target codes. State and local jurisdictions having codes not meeting the target codes must adopt the target codes and will have to demonstrate the 90% compliance rate with those newly adopted codes.

Onsite Building Audits

Onsite audits based on a randomly selected sample of jurisdictions and buildings are necessary for meeting the Recovery Act conditions for demonstrating a 90% compliance rate. In an effort to provide support for states choosing to perform an onsite audit, the BECP anticipates developing the following materials. The content of these materials is further explained in this section. All materials developed will be made available in formats that can be downloaded and used by states, and/or combined into a packet of materials made available to onsite auditors.

- Guidance for home rule states and states with codes other than the target codes
- Informational sheets on approaching the jurisdiction prior to the onsite audit
- Guidelines for developing a random sample of jurisdictions and buildings within those jurisdictions
- Recommended certification for those conducting the onsite audits
- Training materials for onsite auditors
- Guidelines for conducting a plan check audit on the selected buildings
- Guidelines for conducting an onsite building audit on the selected buildings
- Inspection checklists to be used by auditors performing the onsite inspection
- Guidelines for derivation of the overall state compliance metric
- Training materials for the target codes, and to address specific code infractions
- Guidelines for meeting the annual measurement requirements

Additional materials referenced elsewhere in this document but not pertaining directly to the onsite audit include:

- Suggestions for additional information gathering opportunities that might be afforded by this effort
- A survey of questions for evaluating administrative and permitting/inspection processes of the jurisdiction and guidelines for collecting and using that information

Home rule states and states with codes other than the target codes

States and local jurisdictions having codes meeting or exceeding the target codes are not being asked to adopt the target codes, but will still have to demonstrate the 90% compliance rate with their adopted codes in addition to documenting that their code meets or exceeds the target codes. As a service to the states, the BECP is currently evaluating the majority of state codes against the target codes to determine if they meet or exceed those codes. The framework being established for these comparative evaluations will simplify similar evaluations in the future. States and localities not included in this current study are those having predominately “home grown” codes that are not readily traced to the IECC or Standard 90.1. Those states may request that the BECP evaluate their code against the target codes.

As mentioned in the Recovery Act interpretations, jurisdictions having codes not meeting the target codes must adopt the target codes and will have to demonstrate a 90% compliance rate with those newly adopted codes. However, onsite building audits could prove beneficial for states with codes that are outdated or do not meet the target codes. Such a study might provide a better understanding of current compliance challenges which could lead to implementation of corrective training, process changes, and modifications to the administrative provisions of the codes. This might also be an opportunity to train on new features that will be implemented when the target codes are adopted, such as the residential duct blaster test. However, the compliance measurements should be repeated when the target codes are adopted.

In home-rule states⁴, local jurisdictions can apply the same processes for measuring compliance, since these processes will be defined at the building jurisdiction level. Local jurisdictions may also request an evaluation if they believe their local code meets or exceeds the target codes.

Approaching the jurisdiction prior to the onsite audit

Previous audit studies indicate the importance of preparing the jurisdiction and affected designers, specifiers, builders, contractors, owners, and developers for an upcoming audit to obtain their support. Advice on how to approach the jurisdiction and affected parties will be provided as well as identification of any significant concerns or issues that may need to be addressed. The BECP anticipates developing informational and promotional fact sheets that the states will find helpful to distribute prior to the scheduling and conduct of an onsite audit.

Developing a random sample

Because it would be impossible to visit all jurisdictions and audit every building, detailed guidelines for developing a statistically valid and random sample of jurisdictions and buildings in which to perform onsite audits will be made available as part of the guidelines being developed by the BECP. The sample will be weighted to favor audits of jurisdictions experiencing new construction and retrofits, based on permitting information. Selection of buildings will include a combination of new commercial and residential construction, additions and renovations.

Certification for those conducting the onsite audits

DOE will provide guidance as to what qualifications might be expected for those conducting the field audits and data gathering efforts. This will include criteria related to training, professional certification and possibly testing of auditors to ensure they are capable of performing these services. Professional or personal credentialing programs could be referenced as a foundation for auditor certification (e.g. certifications from the International Code Council or the Home Energy Rating System Program). The BECP also anticipates developing and delivering training materials that may help in preparing auditors for this work.

⁴ A home rule state is one where the state has no authority to adopt an energy code and mandate that local government enforce the adopted code. Such states can adopt an energy code and apply it to state owned and/or funded construction. They can also adopt a state code, but the lack of authority over local government means that those designing and constructing buildings would not likely have their work verified for compliance outside the courts or any professional licensing laws.

Training materials for onsite auditors

Training materials will be developed for auditors and will cover the basics of conducting an onsite audit, instructions on how to complete the audit checklists, and an overview of additional tools available to assist with the onsite audit.

Conducting the plan check and the onsite building inspection

The guidelines will include guidance on how to audit each building, what to look for on the plans and specifications and in the agency records associated with plan review and permitting, what building elements to inspect, how the findings are measured and recorded and how the results are documented. The guidelines will also address the most impactful building measures to be evaluated, which will vary by location and building occupancy and use (e.g. cooling versus heating dominated climate or commercial retail vs. hotel/motel rooms).

Inspection checklists for the onsite inspection

Checklists will be provided listing the suggested audit items based on the climate zone. The checklist items will be clustered into multiple tiers, and each tier will be given a different weight in determining the overall building compliance rate. The residential code checklist requirements will be clustered into two tiers – the commercial code checklist requirements will be clustered into three tiers. In both cases, Tier 1 requirements are those deemed to be ‘high-impact’ according to the following criteria:

- 1) Items that impact design energy efficiency
- 2) Items that impact long-term operational energy efficiency

A building meeting all of the criteria listed on the appropriate checklist will be deemed to comply with the code and will receive a compliance rating of 100%. Failure to meet one or more items on the checklist will result in a compliance rate below 100%.

Checklists will include instructions for their proper use and for recording the results. These may be made available as paper forms, excel spreadsheets, or online for direct input into a database and/or for use with PDA's. Paper onsite audit checklists will be developed to allow automated reading into an electronic format.

Derivation of the overall state compliance metric

Each building evaluated in the audit will receive a compliance percentage based on the number of checklist items that complied. State compliance will be determined based on averaging the compliance percentage for each building in the sample. The average building compliance from the sample will be used to identify if the state building compliance is below 90%. If the results from an adequate sample and associated statistical analysis cannot show a significant difference from 90% then the Recovery Act conditions will be deemed to have been met. The BECP recognizes there is a large difference in commercial building sizes and therefore in their energy use impacts. To accommodate this, the commercial building samples will be taken from different size categories, and will be weighted to account for the difference in impact imposed by these large size variations.

DOE plans to provide automated mechanisms to help capture and evaluate the building audit checklist data electronically, for use both by the states and in order to roll up the results for regional and national statistics and to facilitate tracking progress on compliance over time. Figure 1 below illustrates how compliance metrics may be collected on individual buildings, then aggregated to state, regional and national levels. The collection of information based on building use type and location will also allow national and regional statistical break-downs in a variety of ways, such as separate compliance metrics for residential and commercial buildings, or for new construction vs. retrofits. Surveys on jurisdictional processes may also be captured and used by states, but will not be part of the final compliance metric.

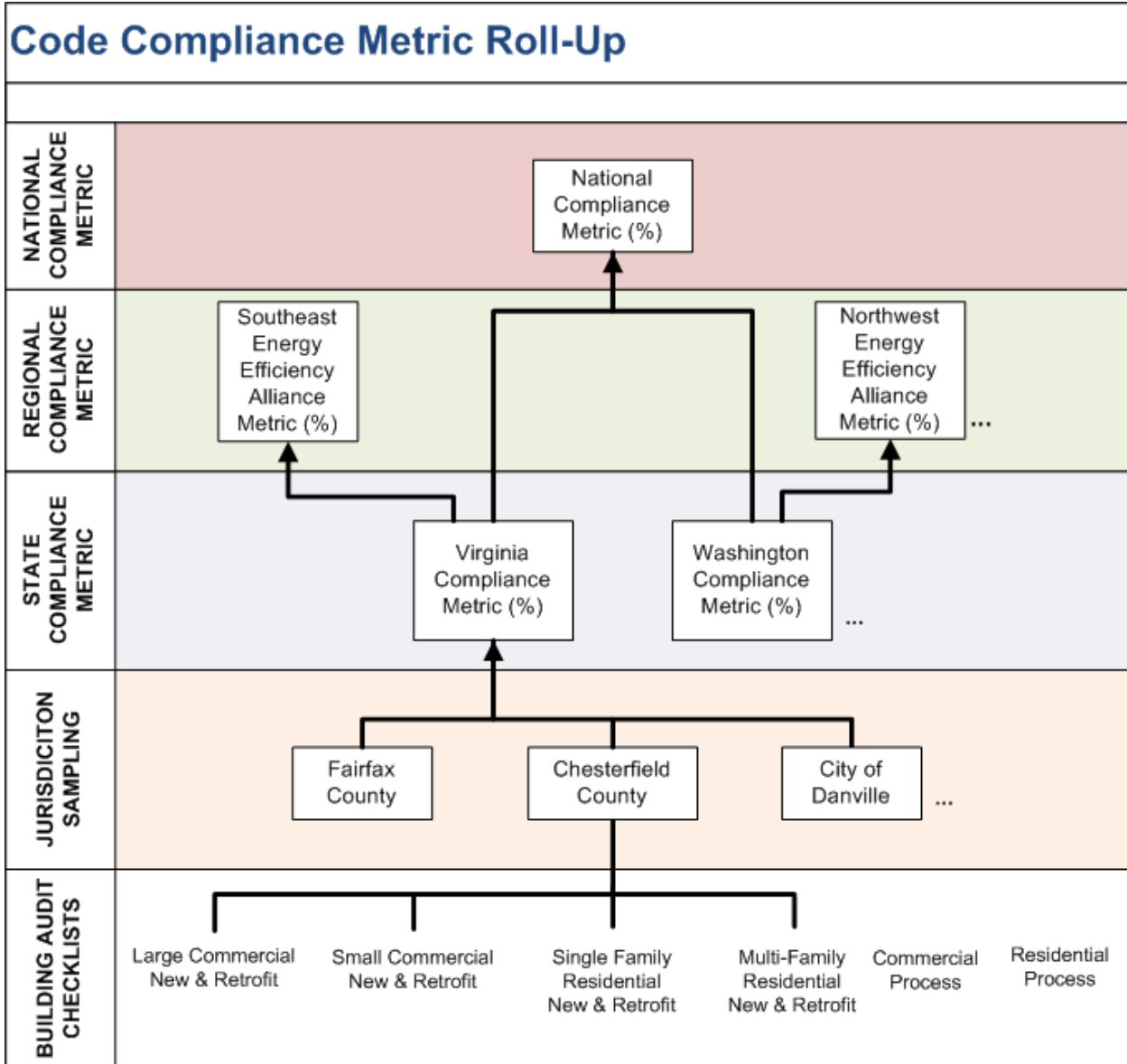


Figure 1. Roll-Up of Individual Building Compliance Metrics

Figure 2 shows one page of an example checklist for a single-family residential building in Climate Zone 3.

Residential Data Collection Checklist							
2009 International Energy Conservation Code							
Climate Zone 3							
Date: _____		Name of Evaluator(s): _____					
Building Name & Address: _____				Conditioned Floor Area: _____ ft ²			
Building Contact Name: _____		Phone: _____		Email: _____			
Compliance Approach: <input type="checkbox"/> Prescriptive (402.1.2 or 402.1.3) <input type="checkbox"/> UA Trade-Off (402.1.4) <input type="checkbox"/> Building Performance (405)							
State: _____		Jurisdiction: _____					
Building Type: 1- and 2-Family, Detached: <input type="checkbox"/> Single Family <input type="checkbox"/> Modular <input type="checkbox"/> Townhouse							
Multifamily: <input type="checkbox"/> Apartment <input type="checkbox"/> Condominium							
Project Type: <input type="checkbox"/> New Construction <input type="checkbox"/> Addition to existing building <input type="checkbox"/> Existing building renovation							
Item Number ¹	Pre-Inspection/Plan Review	Code Value	Verified Value	Complies			Comments/Notes/Findings
				Y	N	N/A	
PR1 [103.2]	Construction drawings and documentation submitted and available			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR2 [103.2]	Insulation R-values and materials on plans			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR3 [103.2]	Fenestration U-factors and SHGC values on plans. Trade-off documentation provided if needed.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR4 [103.2]*	Mechanical system design criteria on plans			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR5 [103.2]*	Mechanical and service water heating equipment types, sizes and efficiencies on plans			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR6 [103.2]*	Duct and pipe insulation and duct sealing on plans			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR7 [103.2]*	Thermal envelope air sealing details on plans			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PR8 [403.6]*	HVAC loads calculations: Heating system size(s): Cooling system size(s):		kBtu: _____ kBtu: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Additional Comments: _____							

Figure 2. Sample Compliance Checklist

Training materials for the target codes and code infractions

Training materials for the target codes will also be made available. Materials have already been developed for 90.1-2007, and training materials for the 2009 IECC will soon be available. These materials will include PowerPoint presentations, frequently asked questions (FAQs), and code notes related to the new requirements in the 2009 IECC, such as the duct tightness testing and the new residential lighting requirements.

As data are collected from onsite audits and common compliance problems are identified, DOE will address these with additional materials as needed. Other educational materials will address procedures such as selecting an appropriate sample set and preparing the jurisdiction for an upcoming audit.

Meeting the annual measurement requirements

The Recovery Act conditions call for annual measurement of the compliance rate until such time as 90% compliance is demonstrated against the target codes. In some states, annual onsite audits may not be feasible or productive due to lack of manpower, or because nothing has changed since a previous onsite audit, or because the state intends to wait until a newer code is adopted. For such years, survey mechanisms or spot checks could provide alternative and less costly interim measures.

A survey of questions pertaining to the jurisdiction's energy code plan review, inspection and administrative processes could be completed during an initial onsite evaluation in addition to the building audits. For interim years, this survey could be updated to see if any processes have changed. If nothing has changed, and the applicable energy code hasn't been updated, it could be assumed that the previous measurement of compliance was still applicable. Likewise, if the jurisdiction's processes have changed and/or a new code had been adopted, this would indicate that perhaps the jurisdiction should be revisited. The survey approach could be supplemented or replaced with 'spot checks' in jurisdictions that received a lower compliance rate compared to others (e.g. smaller sample sizes than those deemed necessary for meeting the Recovery Act compliance metric). Neither the review of the jurisdiction's processes nor the spot checks would meet the Recovery Act's 90% metric, but could meet the annual reporting requirement. As such, these options represent a less costly alternative for interim evaluations.

An evaluation of jurisdictional processes may help inform an understanding of the strength of the correlation between processes and compliance rates, and thus create an opportunity to find out what processes contribute most towards improved compliance. Some reviewers of the initial Strawman suggested the BECP develop materials on 'best practices' for local jurisdictions. Better understanding of the process vs. compliance correlation could enhance the best practices guidance that is generated.

Paper process surveys will be developed to allow automated reading into an electronic format. An online survey tool will be made available to states if they wish to annually query the jurisdictions about their energy code compliance processes. The tool could be customized by each state, although a core set of questions would aid in providing uniform results. Other approaches to better understanding the jurisdictional processes are being evaluated by DOE. For example, the Insurance Services Office (ISO) provides a rating (1-10) for most jurisdictions under the Building Code Effectiveness Grading Schedule (BCEGS). This rating is used by the insurance industry in determining insurance premiums and is focused on safety and health issues that affect those premiums. Under a collaboration with ISO, survey questions related specifically to energy-code processes could be added to this questionnaire, thus providing an on-going opportunity to track jurisdiction processes related to energy code compliance.

State Compliance Portal

DOE BECP anticipates developing guidelines, training materials, fact sheets, and automated and paper tools to assist states in implementing the Recovery Act conditions. An online "portal" will be developed to provide state access to these materials. The portal will also be a collection point for compliance metrics, to be stored in a national compliance database modeled after the state codes database already available online at http://www.energycodes.gov/implement/state_codes/index.stm. The state codes database allows a user to click on a state and bring up information about that state's code and related activities. The state compliance database will provide similar information pertaining to compliance activities. It will allow states to review the activities of other states and to track state, regional, and national trends. The compliance portal and associated database will assist with communication of activities and lessons learned across states; will provide access to tools and documents; will help ensure that compliance efforts are consistently applied; and will provide an opportunity to consolidate results of studies into regional and national metrics.

BECP anticipates making the following information and tools available on the Code Compliance Portal. Some of the features may have restricted access.

- Links to compliance studies, both past studies and studies resulting from this effort
- Metrics collected from onsite audits by jurisdiction, and aggregated to provide regional and national summaries
- Results from process surveys conducted by jurisdiction
- Audit checklists for various building use types and climates

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- Tools for generating appropriate random samples
 - Downloadable pdf files containing much of the information described in this document, including onsite audit guidelines and fact sheets.

DOE welcomes feedback on additional tools that states might find useful in implementing these procedures.

Related Objectives

DOE believes the work described in this document and supported by Recovery Act funding provides valuable opportunities to engage in peripherally related activities, such as the following:

- **Electronic Data.** Jurisdictions are moving towards automation and electronic storage of information. Minor changes in how those data are stored could result in the electronic capture of energy code compliance information, which in turn could be used to automate compliance measurements. Onsite audits and jurisdiction surveys provide an opportunity to better understand how data are currently collected and what changes might enable increased automation.
- **Process vs. Compliance Correlations.** An evaluation of jurisdiction processes can provide a better understanding of what processes contribute to improved compliance. A better understanding of this correlation can enhance 'best practices' guidance developed for jurisdictions.
- **Needs Assessment.** As onsite auditors are engaging the jurisdictions, there is an opportunity to better understand the barriers to achieving energy code compliance. This feedback can be used to identify policies, programs, products, and services which may then help overcome these barriers.
- **Compliance Checklists.** Checklists are important to the building inspection process, but energy code inspection items are difficult to integrate with existing, standard checklists and jurisdiction processes. This effort provides an opportunity to find out more about standard inspection processes and to explore with jurisdiction staff ways that energy code inspection items can be better incorporated into their processes.