Toward a Consensus Path to Continuous Improvement in Residential Model Building Energy Codes

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ABSTRACT

After two decades of relatively small overall efficiency gains in triennially developed residential model energy codes, the 2009 and 2012 updates to the International Energy Conservation Code (IECC) boosted residential building energy efficiency by at least 32.1% – and more likely by 38-54% over the 2006 IECC.[1] Furthermore, despite changes in the code development process that tilted the field in favor of efficiency backsliding (code-weakening) proposals, the 2015 IECC consolidated and refined the 2012 IECC, by embracing a new, reasonably rigorous index-based compliance path while generally rejecting efficiency rollbacks in the residential energy code.

This dramatic model code development transformation resulted from a near-consensus among a diverse and unlikely coalition of stakeholders, policymakers and governmental officials. Because buildings are America's largest energy consuming sector – using 54% of its natural gas and 71% of its electricity – the impact of the IECC's efficiency gains are already achieving real energy savings for owners and occupants of new buildings. But, code development process changes make future gains (and the defeat of rollbacks) far from certain.

Our 2010 Summer Study paper, "Re-Inventing Building Energy Codes as Technology and Market Drivers" (Harris, J. *et al*. 2010) reviewed then-emerging trends – some of which have since faded – and envisioned future code proposals that explore new frontiers. In this paper, we review on-the ground developments over the past four years, experiential insights from the historic 2012 and 2015 code cycles, recent field experience with code adoption and implementation, and the emergence of efficiency opponents attempting to chart a far different course for the future of energy codes.

The broader challenge is to advance approaches that can win over an increasing share of the building community and enhance pro-efficiency consensus while simultaneously confronting the intransigent opposition's efforts to roll back efficiency levels in the current code.

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[1] DOE estimated 32.1% energy savings between the 2006 and 2012 residential model energy codes, but did not consider efficiency gains from the 2009 and 2012 IECC's elimination of equipment trade-offs, which a 2013 ICF analysis estimated at a minimum of 6% and as much as 22% per home, depending upon the extent to which builders claimed "credit" (under the 2006 code only) for installing efficient HVAC and water heating equipment.

Introduction: Codes at a Crossroads

In a previous paper presented at the 2010 Summer Study (with other co-authors), we summarized several key trends related to the national model energy codes, trends that seemed significant even though their eventual outcome was not yet clear.

Some of those trends have faded while others continue to influence code adoption and effectiveness. Overall, though, we continue to see policy makers at the national, state, and local level paying increased attention to energy-efficient new construction in general, and to codes in particular, as a core strategy for peak energy demand management, grid stabilization and, in some jurisdictions, environmental quality and climate change mitigation. Some trends that seem less significant now, compared with four years ago, are:

- the level of congressional interest in enacting a federal energy code;
- reinforcing the linkage (established in the American Recovery & Reinvestment Act of 2009) between federal grants to states and specific state commitments to adopt and enforce building energy codes; and
- an overall expansion of the federal role in building energy codes, including explicit federal targets for model code energy efficiency and state compliance..

On the other hand, trends that continue to evolve and influence the codes process include:

- early success with a new approach to model energy code development, one that unites efficiency advocates to focus on specific improvement targets and whole-building performance (rather than individual, incremental proposals);
- effective collaboration among these same advocates to defeat proposals that would roll back the efficiency gains already achieved;
- successful efforts to transform the process of code development, by engaging and recruiting support from a new group of stakeholders with shared interests in strengthening the energy code: state and local elected officials, progressive private industries, utilities, labor, and consumer and low-income housing advocacy groups; and
- recognition of the need for new concepts for future energy code improvements, including new dimensions for energy performance, not limited to reductions in annual energy use.

Unfortunately, proving General Colin Powell's admonition that "no battle plan survives contact with the enemy," the successes of the 2009, 2012, and 2015 IECC have prompted efficiency opponents to redouble their efforts, by mounting aggressive campaigns against IECC gains, attacking U.S. Department of Energy involvement in code development, expanding their efforts to influence the International Code Council process, and engaging their considerable political and grassroots base to oppose state and local adoption of stronger building energy codes. While this paper focuses primarily on residential energy codes, and in particular the IECC residential provisions, commercial energy codes (both the IECC and ASHRAE 90.1) have also improved remarkably over the same period.

The results of these trends – good and bad – have varied depending on the jurisdiction, with some adopting stronger energy codes and others weakening already weak codes and doubling the statutory period of time to consider energy code updates.

Increased Attention to New Construction and Codes

This section reviews how various code enhancement efforts, and the political support for stronger energy codes, have fared over the last four years.

Energy Codes and Climate Change

In the 2010 paper we suggested that policy-makers' increased attention to climate change may be in part responsible for the increased interest in longer-term energy efficiency measures, including energy codes and other means of improving efficiency in new construction. Unlike energy savings achieved through building retrofits or efficiency upgrades of fast-turnover appliances and lighting, savings in new buildings (at a typical construction rate of about 2 percent of stock) can take many years to cumulate to a significant level. On the other hand, efficiency measures incorporated in a building's design, orientation, structural components and mechanical systems (etc.) typically last much longer than a lighting or appliance measure, and *failing* to maximize efficiency at time of construction represents a lost opportunity than can be only partially remedied – and at greater cost and occupant inconvenience – through post-construction retrofits.

A compelling 2007 McKinsey report for the Conference Board analyzed resource cost and abatement potentials for more than 250 measures that could "reduce or eliminate GHG [greenhouse gas] emissions." This report identified building efficiency measures as "many of the most economically attractive GHG abatement measures" (McKinsey 2007). As their Mid-Range Abatement Curve chart shows (Fig. 1), measures that are purview of building energy codes show a "negative-cost." McKinsey strongly urged rapid pursuit of greater building energy efficiency, lamenting that "these energy efficiency savings are not being captured today," and adding that "every year we delay, the more negative-cost options we lose." This is especially true for new residential and commercial buildings, with expected lifetimes of 70-100 years or more. And even aside from these longer-range concerns about mitigating climate change, energy code adoption and enforcement are amply justified by tangible dollar savings and near-term reductions of energy-related air and water pollution.

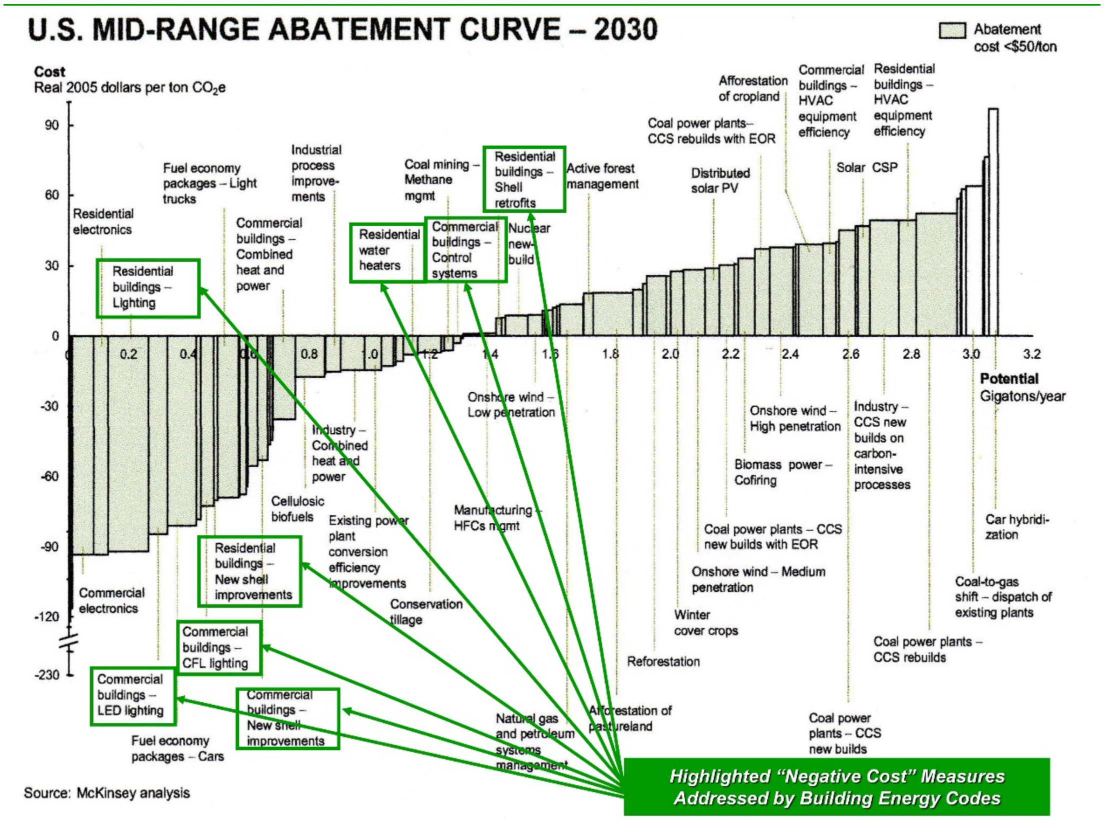

Figure 1. Energy-saving measures related to building codes.

Congressional Action

In 2010, we wrote of the promising prospects for federal legislation to permanently change the model energy code development process with: 1) a set of multiyear energy savings targets and 2) the backstop of a DOE-defined model energy code if the voluntary code development processes under the International Codes Council (residential) and ASHRAE (commercial) failed to meet those targets. At the time, these code provisions had been introduced multiple times in both Senate and House, as elements of climate bills and omnibus energy bills, and one version had been approved by the Senate Energy and Natural Resources Committee on a bi-partisan vote. In the intervening time, however, we have seen these legislative initiatives repeatedly stalled in Congress and weakened to some degree. Even so, some of the basic code provisions are still included in the latest version of energy legislation re-introduced by Senators Shaheen and Portman in the "Energy Savings and Industrial Competitiveness Act," S.2074[2], but chances of passage in the current Congress remain highly uncertain.

Another new, potentially "game-changing" legislative proposal is designed to correct a serious flaw in the home appraisal and lending processes: the fact that appraisers may fail to assign sufficient value to efficiency improvements that save a home's occupants thousands of

[2] Previous versions were S.1000 (2011) and S. 761 (2013).

dollars in energy bills over the life of the home. The "Sensible Accounting to Value Energy" (SAVE) Act, would change mortgage loan underwriting practices to allow builders or home owners to provide underwriters with an Energy Rating Index (ERI). The bill would also require that both the home appraisal and the home buyer's income-to-debt ratio reflect the added value of energy-saving features. These provisions were also included in the latest version of S.2074.

EPA's Proposed June 2014 Greenhouse Gas Rule for Existing Power Plants

Several energy efficiency advocates have urged that the Environmental Protection Agency (EPA) give credit for enhanced building energy code implementation under its proposed rule to control GHG emissions from existing power plants. This "Section 111(d) Rule," named for that section of the Clean Air Act, is expected to be issued in 2014. Along with the peak demand and grid issues discussed below, this new EPA rule may be a significant stimulus to increased utility involvement in code adoption and implementation.

Peak Energy Demand and Grid Stabilization

Perhaps because residential and commercial buildings are the nation's largest energy consuming sector, the impact of the historic efficiency gains in the last three versions of the IECC and ASHRAE 90.1 are already being felt and, at last, recognized in the utility sector:

- the Institute for Electric Efficiency, the research arm of the nation's investor-owned utilities, found that continued savings of the magnitude of recent efficiency gains in building energy codes and appliance standards "will completely offset the anticipated growth in demand in the residential, commercial, and industrial sectors combined, eliminating the need for additional power plants to serve these sectors through 2025." (IEE 2011)
- in a January 5, 2014 *Financial Times* interview, Duke Energy CEO Lynn Good stated that "Improvements in energy efficiency for buildings and appliances appear to have broken the traditional connection between electricity demand and economic growth."[3]

This growing interest in building energy efficiency has been most apparent to utilities with long-established, "mature" demand-side management programs. In some cases, these utilities have begun to look beyond more short-term energy savings opportunities (such as appliance and lighting rebates) to consider new programs and measures – including expanding their new construction programs and in some cases adding support for energy codes. Most utilities prefer voluntary measures to upgrade the efficiency of new construction, through programs like Energy Star Homes or commercial counterparts such as the California utilities' "Savings by Design" program.[4] A few utilities are beginning to engage in – and claim credit for – energy savings from builder or code official training and other code implementation activities (IEE 2011; IMT 2011; MEEA 2012). However, this is still relatively rare; with very few

[3] Ed Crooks, "Duke Chief Predicts Slow Growth and Consolidation in US," *Financial Times*, January 5, 2014.
[4] http://www.savingsbydesign.com/

exceptions individual utilities have yet to engage actively in code development or local code adoption, or to try to shape energy codes to incorporate measures of special interest to [electric] utilities such as provisions that value on-peak savings more than off-peak savings, or that build in peak-shaving, thermal storage, or demand-response capabilities to structures and mechanical systems.

Finally, interest continues to grow internationally in building codes as a strong component of energy efficiency policy, as evidenced by several recent studies and international workshops (GBPN 2013; IEA 2013; APEC 2011).

Engaging New Stakeholders

A New Approach to Building Energy Codes – the Energy Efficient Codes Coalition

After more than two decades of only modest efficiency gains (see Fig. 2, below), in 2007 several leading efficiency groups united to create the Energy Efficient Codes Coalition (EECC) and set an ambitious initial goal of achieving at least a 30% energy efficiency improvement over the 2006 IECC residential model code. Since its formation, EECC has submitted comprehensive code change packages to the International Energy Conservation Code (IECC) and actively participated in the code development process to improve the efficiency of the 2009, 2012, and 2015 versions of the IECC (EECC has focused more the residential provisions of the code, but has also addressed many commercial proposals). Residential proposals by EECC included:

- comprehensive code change packages that would collectively boost the most recent IECC's efficiency by substantially more than 30% over the 2006 edition;
- the elimination of the "equipment trade-off loophole" in the 2009 IECC (see below) and defeating attempts to reinstate this loophole in subsequent code editions; and
- establishing the IECC as the sole source for energy efficiency requirements in the International Code Council's (ICC) model codes by eliminating a separate, weaker energy section of the International Residential Code.

Adding Voices to EECC's Advocacy Choir

EECC began by assembling an improbable coalition of efficiency advocates representing organizations that more frequently find themselves on opposing sides of the debate: business and labor, utilities and ratepayers, manufacturers and environmental groups, builders and homebuyers. Representing buyers were both consumers groups and affordable advocates, who argue that low-income occupants need to be able to afford not just the rent but also the utility costs of their home. The glue that bound disengaged stakeholders and rivals together was a complicated mix that included changing times, frustration over modest (at best) progress, and a focus on the integrated synergy of a whole-house approach to energy efficiency. Slowly but steadily, EECC's support base grew to include representatives from government, national energy efficiency groups and all six regional energy organizations, academia and think tanks, architecture, green and energy-efficient builders, faith-based groups, business and insurance, environmental groups, labor, and electric utilities. At the same time, the Coalition's focus broadened to include early code adoption as well as improving the model code.

The importance of this broad-based collaboration – each approaching energy efficiency from a different perspective – is incalculable, and its results impressive. One anecdote showcases the value of bringing historically diverse voices together in supporting adoption of improved energy codes. In Houston, EECC's advocacy team achieved what was seemingly impossible: winning mayoral and city council support for a 15% improvement in the city's energy code – after being told that a more modest 5% improvement was "set in stone." The line-up of witnesses and supporters was the key, with chemical company executives and the former CEO of Shell joining up with the Sierra Club and Environment Texas to deliver the same message from very different perspectives.

Reaching Out to Local and State Elected Officials to Close the Loop between Code Officials and the Jurisdiction's Energy Policy

In early 2009, EECC made a brief presentation in support of its "30% Solution" to the Energy Committee of the U.S. Conference of Mayors (USCM). That meeting was the beginning of a significant commitment by mayors to support the adoption of EECC's "The 30% Solution," oppose weakening amendments, and encourage USCM mayors to support sending their code officials to the final action hearings that completed each triennial code development process. At their annual meetings in 2008, 2010, and 2013, the U.S. Conference of Mayors unanimously approved strong resolutions calling for the adoption of EECC's "30% Solution" in both the 2009 and 2012 IECC, and supporting EECC's follow-on proposal for the 2015 IECC: "Builder Flex Beyond the 2012."

Similarly, the National Association of State Energy Officials (NASEO) has facilitated the attendance of its members at the IECC code hearings, educated them on building energy code proposals through webinars and seminars, participated in the development of and comments to proposals to update the IECC, and adopted its own resolutions that support the development and adoption of stronger building energy codes.

Other governmental organizations, such as, ICLEI Local Governments for Sustainability, have also mirrored the steps taken by USCM and NASEO, working to educate code officials and local elected officials about the relationship between building energy efficiency and the public goals of those jurisdictions to advance energy efficiency and protect the environment. The result has been an increased alignment of public officials' policies endorsing energy efficiency with concrete actions, as many of their code official representatives at the IECC hearings voted in support of stronger energy codes.

Code Development: From Incremental Change to Targets and Continuous Improvement

The initial success of efforts to set and achieve a specific 30%+ boost in efficiency improvement in the 2009 and, ultimately, the 2012 IECC model energy code has itself produced a new, *de facto*, approach to code development. The U.S. Department of Energy chart (Fig. 2) demonstrates that those two consecutive code cycles were able to "shift into high gear" after more than twenty years of modest 1% or 2% IECC efficiency gains.

ICF International estimated that the prescriptive path of the 2009 IECC achieved an improvement of about 12.2% over the 2006 IECC (ICF 2008). While this was less than half of the targeted 30% savings, the 2009 model code also introduced key compliance measures such as blower door tests and duct air leakage testing for the first time.

But perhaps the most significant achievement in the 2009 IECC was the ICC's vote to eliminate trade-offs of building envelope efficiency (e.g. insulation, windows, air and duct leakage) for efficiency gains in heating and cooling equipment in the performance path. Such trade-offs were already not permitted under the prescriptive path.

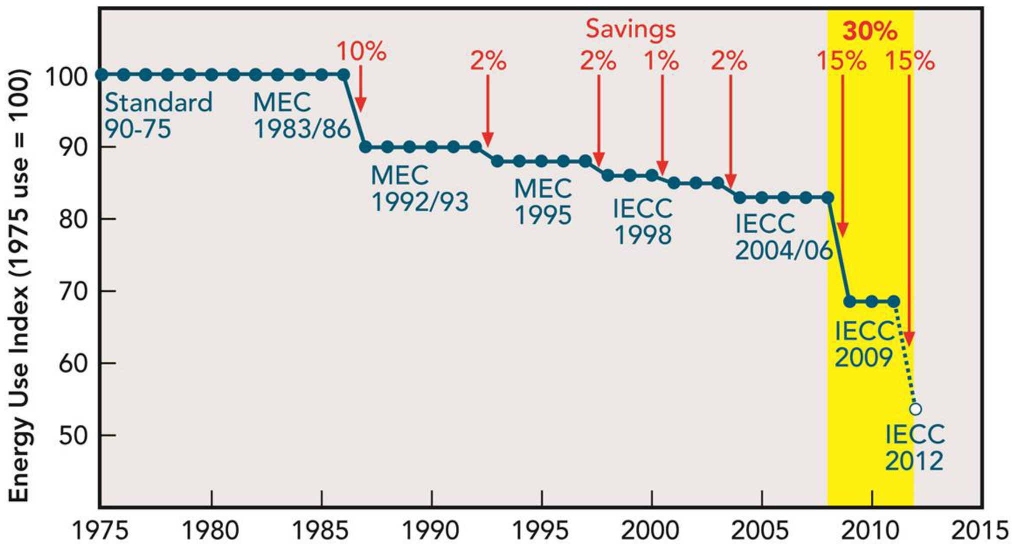

Figure 2. U.S. Department of Energy: Changes over time in the residential model energy code.

Under previous IECC versions, builders could claim trade-off "credit" in calculating an energy performance budget for installing high-efficiency furnaces or other more efficient equipment, and translate this credit into less insulation, less-efficient windows or more air leakage, even though high-efficiency furnaces already accounted for a substantial part of the U.S. market – and a large majority of the market in colder states (ICF 2013). To make matters worse, states are preempted by federal law from requiring by code equipment efficiency that exceeds the federal minimum standards. In other words, builders could build homes that were less efficient than they should be, by taking credit for the efficiency of equipment that would most likely have been installed anyway, while a state is powerless to set more reasonable equipment efficiencies suitable to its climate zone and prevailing market. Eliminating such "free-rider" tradeoffs effectively closed a major loophole in the IECC.

This provision alone may have boosted the overall efficiency of the 2009 IECC by another 6% to 22%, depending upon the extent and type of equipment that would have otherwise been traded off against the envelope (ICF 2013). It is significant that efforts by opponents to reinstate the equipment trade-off in the 2012 IECC and more recently in the 2015 IECC were soundly rejected by the ICC's Governmental Member Voting Representatives.

Dynamic Efficiency Gains for Future Code Cycles

In the 2009 IECC, the Energy Efficient Codes Coalition (EECC) offered "The 30% Solution," a first-ever comprehensive *package* of integrated proposals that represented a "whole-house" approach to new home efficiency.

Perhaps the best evidence of near-term success in selling the concept of continuous code improvement was the introduction of multiple proposals aimed at achieving the rest of the 30 percent savings goal in the 2012 cycle. In addition to the EECC's comprehensive proposal,[5] other code change "packages" were offered by the U.S. DOE, the Northwest Codes Group, and even the National Association of Home Builders (NAHB). Since the NAHB had traditionally opposed more stringent energy codes, the fact that they offered a competing package of proposals for the 2012 model code perhaps indicated how widely accepted the concept of continuous code improvements had become. On the commercial buildings side, a separate package of code improvements was successfully introduced in 2012 by a coalition of DOE, the American Institute of Architects, and the New Buildings Institute, based on the NBI's Core Performance Guide, a "stretch" code.[6]

Still, there remained considerable differences of opinion over how best to achieve that 30 percent goal in the 2012 IECC. The final outcome was adoption by the ICC voting members of measures that did achieve the sought-after 30% savings (beyond the 2006 IECC) for both residential and commercial buildings. Some of the more important residential provisions added in 2012 included:

- Mandatory whole-house pressure test aka: Blower Door test must achieve less than 5 air changes/hour at a pressure difference of 50 Pascals (ACH50) in Climate Zones 1 & 2 and less than 3 ACH50 in Climate Zones 1-8;
- Improved duct requirements including a more stringent duct leakage test;
- More efficient insulation requirements in some climate zones and uses;
- Improved fenestration efficiency in most climate zones, resulting in low-e glazing (or equivalent performance) required for all climate zones;
- 75% of lamps in permanently installed fixtures shall be high efficacy lamps; and
- Hot water piping must be insulated to at least R-3, with some exceptions.

In the more recent 2015 IECC code update cycle, most of these gains were preserved despite an aggressive campaign by efficiency opponents seeking to reverse course, based on the assertion that the energy code was "moving too fast."

Model Codes Are Only the First Step – Next is Adoption, Training, Compliance, and Enforcement

[5] http://energyefficientcodes.com/site/wp-content/uploads/2013/09/Highlights-of-The-30-Percent-Solution-2012.fin_.pdf
[6] http://www.advancedbuildings.net/core-performance

As in our earlier, 2010 paper we acknowledge that strengthening the language of the model energy code is necessary but not, by itself, sufficient to assure that new buildings are more energy-efficient. Once updated, the new model code must be adopted by numerous state and local jurisdictions and become widely known, understood, and complied with by designers, builders and construction trades, and the suppliers of building products and equipment. Local governments as well as professional and trade groups have a key role to play in code training, implementation, and enforcement. Moreover, long-term success for continuous code improvement in turn depends on any number of supporting activities and program initiatives by utilities, the private sector, and public agencies to help build market interest and delivery capacity from designers, builders and trades people, product suppliers, lenders – and ultimately, from consumers (new home buyers) themselves.

Although the ultimate outcome depends on all these factors – not just the model code intent, it is important to have a strong and steadily improving model code as the starting point. While some parties to the code process maintain that rapid changes in the model energy code have made adoption and compliance more difficult, we have seen little evidence of this in the experience to date with the 2009 and 2012 codes. In each case, most of the code changes that contributed to the ~15 percent increases in savings were modest adjustments to well-established building practices (added insulation, improved windows, etc.). Two areas that did represent new practice for many residential builders were the requirements to reduce and test air duct leakage (2009), and to reduce and test envelope air leakage (2012). Even here, however, both practices were already being introduced to the market through home energy ratings, utility-sponsored retrofit programs and the requirements of Energy Star Homes.[7]

Historic Adoption Rates of the 2009 IECC Were Aided by Federal Stimulus Funding, But 2012 Adoption Is Also Ahead of Schedule Compared with Past Versions of the IECC

While some efficiency opponents have claimed that the 2012 IECC has a low adoption rate, this is not borne out by reality. For example, the adoption pace of the 2012 IECC is still ahead of past codes, like the 2006 IECC. Because of the unique incentive of federal stimulus funding to states that agreed to adopt the 2009 IECC, it is hardly fair to compare its record-setting adoption rate with that of the 2012 IECC. That said – with almost a quarter of the states and numerous municipalities having already adopted the 2012 IECC (or a roughly equivalent state-developed variant) and several others currently considering the 2012 IECC – its adoption rate is ahead of most code adoption timetables. Ironically, the same opponents who claim that adoption of the 2012 IECC is behind schedule have also been leading efforts to delay its adoption. Some factors to consider related to adoption of the 2012 IECC include:

- Interest groups that oppose building code updates have waged an unprecedented campaign against state and local adoption of the 2012 IECC.

[7] Energy Star new homes represented one-quarter of all homes built in 2010 and 2011, and a lower share (16%) in 2012 due to the introduction of new, tighter criteria and an increase in total housing starts (http://www.eia.gov/todayinenergy/detail.cfm?id=8390; http://www.energystar.gov/index.cfm?fuseaction=qhmi.showhomesmarketindex).

- Due to a change in the ICC's adoption schedule, the 2012 IECC was completed just two years (instead of the customary three years) after completion of the 2009 IECC. As a result, it was published right in the middle of state-by-state adoption of the 2009 IECC – many jurisdictions have waited to take up the 2012 version as a result.
- The 2012 IECC's publishing date was pushed back by appeals filed by efficiency opponents, appeals that were unanimously rejected by the ICC Appeals Board and by the ICC Board of Directors. Opponents then used the filing of their own appeals as "evidence" in state code adoption efforts that the 2012 IECC was "flawed," even though the appeals failed.

Institutionalizing Multiyear Targets for Continuous Improvements

Unfortunately, the general acceptance of the 30% savings goal during the 2012 code cycle has not been accompanied by success at the federal level with the longer-term goal of institutionalizing the process of setting and pursuing multiyear targets to continuously improve the model energy code. At the same time, continuous code improvement has had some success at the state and local levels. To cite three notable examples:

- Beginning in 2004, the California Energy Commission and the California Public Utilities adopted policies to regularly update the California Title 24 building standards every three years in order to achieve net-zero-energy performance in new residential buildings by 2020 and in new commercial buildings by 2030. The strategy for continuous improvement in Title 24 was most recently enunciated in an energy codes action plan (CEC/CPUC 2014).
- In 2009, Massachusetts adopted an optional "stretch" code for consideration by local governments, based on the New Building Institute's "Core Performance" guide for new commercial buildings. As of October 2013, 134 municipalities had adopted this stretch code,[8] which was then largely incorporated in the 2012 update – while regular updates aim at maintaining a stretch code that is 20% more stringent than the base energy code.[9]
- Oregon also adopted a stretch ("reach") code in 2011, with plans to update it every three years as part of the regular update cycle.[10]

Both California and Massachusetts have explicitly set an ultimate target for successive improvements in the energy code: "net-zero" energy (NZE, i.e., a building that uses no more energy in a year than can be produced on-site in one year). The number one recommendation of a report by the Massachusetts NZE Task Force was:

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[8] http://www.mass.gov/eea/docs/doer/green-communities/grant-program/stretch-code-towns-adoption-by-community-map-and-list.pdf
[9] http://www.neep.org/Assets/uploads/files/public-policy/building-energy-codes/Massachusetts%20Stretch%20Code.pdf
[10] http://www.bcd.oregon.gov/notices/Adopted_Rules/2011/070111_ReachCode_pr.pdf.

> "…that Massachusetts adopt minimum energy performance standards for buildings that, over time, drive continuous improvement in energy efficiency by using the market to identify the most cost-effective methods of meeting those standards. Massachusetts should systematically raise these standards over the next 20 years until they reach zero net energy for all new construction and major renovation projects in the commercial and residential sector, and move within five years to begin establishing performance standards for existing buildings in the commercial sector." (Massachusetts 2009)

New Dimensions for Energy Efficiency in Building Codes – Opportunities for Further Progress, Threats of Rollbacks

While the potential options for future efficiency gains are nearly endless, we present two significant proposals from the 2015 IECC code development process as examples, first, of opportunities for further efficiency gains and second, to convey the concern that new, untested approaches to energy code compliance might lead unexpectedly to bad outcomes. Both examples start with a minimum prescriptive requirement for the new home's envelope.

The first is EECC's "Builder Flex Beyond the 2012 IECC," which was not approved in the final voting on the 2015 IECC, but could become a potential framework for putting future updates of the IECC on a glide path of steady, incremental efficiency gains that would eventually lead the nation to net-zero energy construction.

Similarly, the 2015 IECC provision for a new compliance path based on an Energy Rating Index could also lead to net-zero construction with a steady tightening of ERI scores. But while this approach (which also requires builders to meet the 2009 IECC's prescriptive requirements for certain aspects of the building envelope and the mandatory provisions of the IECC) presents significant opportunities for improvement, it also could become an avenue for weakening rollbacks in the process of state and local adoption. Both concepts are described and discussed further below.

"Builder Flex beyond the 2012 IECC"

EECC's "Builder Flex Beyond the 2012 IECC" is an innovative concept offering builders a menu of options to improve a home's efficiency by a set percentage *after they have met the prescriptive or performance requirements of the 2012 IECC.*[11] The concept, based on the examples of the Oregon and Washington State codes, is aimed at ensuring a strong building envelope (the longest lasting and most difficult and expensive efficiency feature to retrofit) but then giving builders flexibility to choose additional efficiency measures that add up to a targeted performance level. This concept also recognized that future development should not just be linear (lower and lower levels of annual energy use), but extend to some important new territory for residential and commercial model energy codes, such as:

[11] http://energyefficientcodes.com/site/wp-content/uploads/2013/09/EECC-Public-Comment-in-Support-of-RE-186-Bldr-Flex-Beyond-the-2012-as-modified.pdf

- Giving builders eight different buckets of options to choose from, including reductions in total envelope heat-loss (UA), reductions in glazed area-weighted average Solar Heat Gain (SHGC), reducing air leakage rates with energy- or heat-recovery ventilation (ERV or HRV), improvements to duct heating or cooling distribution systems, and improving the efficiency of pipe distribution systems for hot water.
- Setting an efficiency goal that can be flexibly met (or exceeded), and then simply be increased from one code cycle to the next, e.g. EECC's goal for its 2015 IECC proposal was a 5% boost beyond the 2012 prescriptive requirements, so the goal for the 2018 might be 7-10%.

The IECC residential energy committee's stated reason[12] for recommending disapproval of "Builder Flex" shows that they mistook the proposal as a "beyond code" program, similar to the NAHB's "National Green Building Standard" (ICC-700).[13] Builder Flex is neither a "green" nor an "above-code" program. Rather it is an efficiency requirement in addition to the base code requirements that offers a choice among a number of compliance options. The IECC commercial provisions already have a similar approach (see section C406). For many builders, there would be no cost increase whatsoever, since many of the Flex Points options are commonly installed – such as improved HVAC equipment or ducts located in conditioned space – and can satisfy all 5 flex points (or more). The Builder Flex measures in most cases are not appropriate to require prescriptively in the code at this time, either because of federal preemption issues or a lack of market penetration for new efficient products. While the proposal will likely require some modifications in the future, the concept and approach present an important opportunity to improve the efficiency of the code in future development cycles.

The 2015 IECC's New Energy Rating Index (ERI) Compliance Path

In Atlantic City last October, the ICC adopted a proposal to allow builders to comply with the 2015 IECC if they: 1) meet the prescriptive envelope requirements of the 2009 IECC, 2) meet the mandatory requirements of the 2015 IECC, and 3) receive an Energy Rating Index (such as a Home Energy Rating Score, or HERS) that meets or exceeds a maximum ERI between 51 and 55 depending on the climate zone.[14]

Many stakeholders claim that meeting ERI scores at these levels would generally result in a home that would also meet or exceed the requirements of the 2012 IECC (Fairey 2013). If that is true, the advantage of the ERI could be enhanced compliance, an argument presented in Public Comment Hearing testimony by the trade association representing U.S. production builders (who account for approximately two-fifths of the nation's new home starts). Enhanced compliance could be expected because of the added inspections and potential quality control by qualified

[12] "Committee Reason: The point system in ICC-700 is simple, and workable, but there is no justification that the stringency of this code is achieved. ICC-700 can be used as an above code program now, with appropriate analysis." 2013 ICC Public Comment Agenda - IECC Residential
[13] www.nahb.org/page.aspx/generic/sectionID=2510.
[14] The ERI index is set so that a score of 100 represents a home meeting the 2006 IECC requirements, and a score of 0 represents a net-zero energy loss.

HERS raters and the marketing advantage some builders will seek by achieving a HERS rating even better (i.e., a lower number) than required by code. Moreover, if the flexibility inherent in the new ERI path helps with the adoption of the 2015 IECC, that would provide additional collateral benefits. As might be expected with a new, untested approach to energy code compliance, however, there are several areas of concern with the new ERI path:

- Several home features that count toward a home energy rating are not currently allowed as trade-off features under other IECC compliance paths. Using the proposed home energy rating method, for example, it appears that builders may take credit for upgraded equipment, appliances, lighting and other measures for trade-off purposes (such as a setback thermostat). This could potentially lead to homes built with less-efficient thermal envelopes and more efficient, short-lived products.
- The potential for opponents during local code adoption to successfully weaken required ERI numbers or other requirements instead of using the un-amended code language and code values.
- Potential for confusion over comparisons between ERI and other IECC compliance paths. First, the baseline for ERI rating is the 2006 IECC not the 2015 IECC. Making a fair comparison is also difficult (or impossible) because of the additional measures that can be counted as part of an ERI (or HERS) rating, as already discussed. Moreover, the energy rating counter-intuitively tends to improve as the size of the home increases, unlike the IECC, which is neutral as to home size.
- The potential misuse of the existence of a new ERI path by efficiency opponents as justification for modifying or delaying a jurisdiction's normal code adoption cycles. For example, in anticipation of this new compliance path, some opponents of energy codes have already urged local jurisdictions not to adopt the 2012 IECC, but instead to wait until the 2015 IECC is published and vetted by DOE – yet these stakeholders also acknowledge that they intend to oppose the 2015 IECC as well.

    - General concerns that since the HERS rating system is the best established and most obvious choice for meeting the ERI requirement, the process for revising the HERS index and rating system does not have the same history or participation level of the ICC model code process.
    - Maintaining quality of the home rating process: Even though RESNET, the organization responsible for the HERS rating scheme, is taking steps to maintain and improve the skills and practices of HERS-certified raters, as the ERI compliance path becomes an option in thousands of local jurisdictions around the country it may be difficult to expand the number of qualified raters quickly and to maintain quality assurance in the process. Moreover, there is no guarantee that local jurisdictions will insist on HERS-certified raters rather than other third-party raters performing the home rating needed for ERI-based code compliance.

In our view, the ERI should only be adopted as part of an adoption of the 2015 IECC, since it has been integrated into that code and not earlier codes. In future code development cycles, additional refinement of this approach should be pursued along with increases in required performance.

Approaches like "Builder Flex" offer considerable opportunities for future code advancement by offering flexibility along with gradual improvements in energy efficiency may have the potential to win over an increasing share of the building community. At the same time, it will be important to continuously confront efforts to roll back current code efficiency. Engaging homeowners and homebuyers (who polls show as increasingly willing to pay more for permanent efficiency features), promoting the macro- and micro-economic benefits of improving the efficiency of all new and renovated homes, increasing utility support for code requirements, and a greater recognition of the 70-, 80-, even 100-year impacts of building construction must all unite if we are to put the nation on a glide path of energy-saving improvements that lead eventually to net-zero buildings.

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