



[6450-01-P]

DEPARTMENT OF ENERGY

[EERE-2021-BT-DET-0010]

Analysis Regarding Energy Efficiency Improvements in the 2021 International Energy Conservation Code (IECC)

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of determination.

SUMMARY: The U.S. Department of Energy (DOE) has reviewed the 2021 International Energy Conservation Code (IECC) and determined the updated edition would improve energy efficiency in buildings subject to the code. DOE analysis indicates that buildings meeting the 2021 IECC, as compared with buildings meeting the 2018 IECC, would result in national site energy savings of 9.38 percent, source energy savings of 8.79 percent, and energy cost savings of approximately 8.66 percent of residential building energy consumption. Upon publication of this affirmative determination, each State must certify that it has reviewed the energy efficiency provisions of its residential building code and made a determination whether it is appropriate to revise the code to meet or exceed the updated edition of the IECC. Additionally, this notice provides guidance on State code review processes and associated certifications.

DATES: Certification statements provided by States shall be submitted by **JULY 28, 2023**.

ADDRESSES: A copy of the supporting analysis, as well as links to the Federal docket and public comments received, are available at:

<https://www.energycodes.gov/development/determinations>.

Certification Statements must be addressed to the Building Technologies Office – Building Energy Codes Program Manager, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 1000 Independence Avenue SW., EE-5B, Washington, DC 20585.

FOR FURTHER INFORMATION CONTACT: Jeremiah Williams; U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 1000 Independence Avenue SW., EE-5B, Washington, DC 20585; (202) 441-1288; *Jeremiah.Williams@ee.doe.gov*.

For legal issues, please contact Matthew Ring; U.S. Department of Energy, Office of the General Counsel, 1000 Independence Avenue SW., GC-33, Washington, DC 20585; (202) 586-2555; *Matthew.Ring@hq.doe.gov*.

SUPPLEMENTARY INFORMATION:

I. Background

II. Public Participation

III. Determination Statement

IV. State Certification

I. Background

Title III of the Energy Conservation and Production Act (ECPA), as amended, establishes requirements for building energy conservation standards, which are administered by the DOE Building Energy Codes Program. (42 U.S.C. 6831 *et seq.*) Section 304(a), as amended, of ECPA provides that whenever the 1992 Council of American Building Officials (CABO) Model Energy Code, or any successor to that code, is revised, the Secretary of Energy (Secretary) must make a determination, no later than 12 months after such revision, whether the revised code would improve energy efficiency in residential buildings, and must publish notice of such determination in the *Federal Register*. (42 U.S.C. 6833(a)(5)(A)) If the Secretary determines that the revision of the CABO Model Energy Code, or any successor thereof, improves the level of energy efficiency in residential buildings then, not later than two years after the date of the publication of such affirmative determination, each State is required to certify that it has reviewed its residential building code regarding energy efficiency, and made a determination as to whether it

is appropriate to revise its code to meet or exceed the provisions of the successor code. (42

U.S.C. 6833(a)(5)(B))

The International Energy Conservation Code (IECC) is the contemporary successor to the CABO Model Energy Code specified in ECPA. The IECC is revised every three years through an established code development and consensus process administered by the International Code Council (ICC). As part of the ICC process, any interested party may submit proposals, as well as written comments or suggested changes to any proposal, and make arguments before a committee of experts assembled by the ICC, with the collection of accepted proposals forming the revised edition of the IECC. More information on the ICC code development process is available at <https://www.iccsafe.org/codes-tech-support/codes/code-development-process/code-development-2/>.

In addition, on January 20, 2021, the President issued Executive Order 13990, “Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.” 86 FR 7037 (Jan. 25, 2021). The Executive Order directed DOE to consider publishing for notice and comment a proposed rule suspending, revising, or rescinding the final technical determination regarding the 2018 IECC by May 2021. *Id.* at 86 FR 7038. In response, DOE has reviewed the current 2021 IECC so that DOE’s determination under Section 304(b) of ECPA reflects the most recent version of IECC, and to facilitate State and local adoption of the 2021 IECC, which will improve energy efficiency in the nation’s residential buildings.

To meet the statutory requirement, and to satisfy the directive issued under Executive Order 13990, DOE issued a preliminary determination and published supporting analysis to quantify the expected energy savings associated with the 2021 IECC relative to the previous 2018 IECC version. Notice of this preliminary analysis was published in the *Federal Register* on May 16, 2021 (86 FR 26710), and is available at: <https://www.regulations.gov/document/EERE-2021-BT-DET-0010-0001>.

II. Public Participation

In a May 16, 2021 *Federal Register* notice, DOE requested public comments on its preliminary analysis of the 2021 IECC. (86 FR 26710) DOE received four public comments, all of which DOE considered in arriving at its final determination. DOE has now issued the final analysis of the expected energy savings associated with the 2021 IECC as compared to the 2018 IECC. A summary of public comments received, and DOE responses, is included in Appendix A of this Notice. The final analysis is available at: <https://www.energycodes.gov/development/determinations>.

III. Determination Statement

Residential buildings meeting the 2021 IECC (compared to the previous 2018 edition) are expected to incur the following savings on a weighted national average basis:

- 9.38 percent *site* energy savings
- 8.79 percent *source* energy savings
- 8.66 percent energy *cost* savings

DOE has rendered the conclusion that the 2021 IECC will improve energy efficiency in residential buildings, and, therefore, receives an affirmative determination under Section 304(a) of ECPA. States can experience significant benefits by updating their codes to reflect current construction standards, a total estimated \$74.61 billion in energy cost savings and 424.20 MMT of avoided CO₂ emissions in residential buildings (cumulative 2010 through 2040), or \$3.24 billion in annual energy cost savings and 18.50 MMT in annual avoided CO₂ emissions (annually by 2030). These benefits, including emissions reductions, are estimated in a revised 2021 interim report addressing building code impacts.¹ Though not quantified in the interim report, there may also be costs to regulated entities as a result of updated residential building codes.

¹ See https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-31437.pdf for the 2021 interim code impact report. Financial benefits are calculated by applying historical and future fuel prices to site energy savings and by discounting future savings to 2020 dollars. Historical and future real fuel prices are obtained through EIA's AEO 2015 report (EIA 2015).

IV. State Certification

Upon publication of this affirmative determination, each State is required to review the provisions of its residential building code regarding energy efficiency, and determine whether it is appropriate for such State to revise its building code to meet or exceed the energy efficiency provisions of the 2021 IECC. (42 U.S.C. 6833(a)(5)(B)) This action must be made not later than two years from the date of publication of a Notice of Determination, unless an extension is provided.

State Review and Update

The State determination must be: (1) made after public notice and hearing; (2) in writing; (3) based upon findings and upon the evidence presented at the hearing; and (4) made available to the public. (42 U.S.C. 6833(a)(2)) States have discretion with regard to the hearing procedures they use, subject to providing an adequate opportunity for members of the public to be heard and to present relevant information. The Department recommends publication of any notice of public hearing through appropriate and prominent media outlets, such as in a newspaper of general circulation. States should also be aware that this determination does not apply to IECC chapters specific to nonresidential buildings, as defined in the IECC. Therefore, States must certify their evaluations of their State building codes for residential buildings with respect to all provisions of the IECC, except for those chapters not affecting residential buildings. DOE determinations regarding earlier editions of the IECC are available on the DOE Building Energy Codes Program website.² Further national and State analysis is also available.³

State Certification Statements

State certifications are to be sent to the address provided in the **ADDRESSES** section, or may be submitted to *BuildingEnergyCodes@ee.doe.gov*, and must be submitted in accordance with the deadline identified in the **DATES** section. If a State makes a determination that it is not

² Available at <https://www.energycodes.gov/regulations/determinations/previous>

³ Available at https://www.energycodes.gov/development/residential/iecc_analysis

appropriate to revise the energy efficiency provisions of its residential building code, the State must submit to the Secretary, in writing, the reasons for this determination, which shall be made available to the public. (42 U.S.C. 6833(a)(4))

The DOE Building Energy Codes Program tracks and reports State code adoption and certifications.⁴ Once a State has adopted an updated residential code, DOE typically provides software, training, and support for the new code, as long as the new code is based on the national model code (*i.e.*, the 2021 IECC). DOE has issued previous guidance on how it intends to respond to technical assistance requests related to implementation resources, such as building energy code compliance software. (79 FR 15112) DOE is directed to provide incentive funding to States to implement the requirements of Section 304, and to improve and implement State residential and commercial building energy efficiency codes, including increasing and verifying compliance with such codes. (*See* 42 U.S.C. 6833(e)) Some States develop their own codes that are only loosely related to the national model codes, and DOE does not typically provide technical support for those codes. DOE does not prescribe how each State adopts and enforces its energy codes.

Requests for Extensions

Section 304(c) of ECPA requires that the Secretary permit an extension of the deadline for complying with the certification requirements described previously, if a State can demonstrate that it has made a good faith effort to comply with such requirements, and that it has made significant progress toward meeting its certification obligations. (42 U.S.C. 6833(c)) Such demonstrations could include one or both of the following: (1) a substantive plan for response to the requirements stated in Section 304; or (2) a statement that the State has appropriated or requested funds (within State funding procedures) to implement a plan that would respond to the requirements of Section 304 of ECPA. This list is not exhaustive. Requests are to be sent to the

⁴ Available at <https://www.energycodes.gov/adoption/states>

address provided in the **ADDRESSES** section, or may be submitted to

BuildingEnergyCodes@ee.doe.gov.

Appendix A

DOE accepted public comments on the Notice of Preliminary Determination for the 2021 IECC until June 16, 2021, and received submissions from a total of 4 commenters. Responsive public comments and associated DOE answers are described as follows. DOE received comments on its preliminary determination and supporting analysis of the 2021 IECC from the following stakeholders:

- North American Insulation Manufacturers Association (NAIMA)
- Responsible Energy Code Alliance (RECA)
- Edison Electric Institute (EEI)
- Air-Conditioning, Heating and Refrigeration Institute (AHRI)

The comments are summarized as follows and are available

at <https://www.regulations.gov/document/EERE-2021-BT-DET-0010-0001/comment>. DOE responded to all comments received. Several issues raised by commenters are distinct from the energy efficiency analysis DOE has undertaken pursuant to its statutory obligations. These include the social cost of carbon, life-cycle cost, and cost effectiveness; among these issues, social cost of carbon garnered the most attention from commenters and is therefore emphasized in the responses below.

North American Insulation Manufacturers Association (NAIMA)

Comment: NAIMA requested that DOE use the updated climate zone designations in the 2021 IECC and not 2018 IECC. DOE's preliminary analysis appears to leave out impact of the 2021 IECC climate zone designations in numerous counties across the United States. This shortfall could lead to an overestimation of the energy savings associated with the 2021 IECC.

DOE Response: DOE acknowledges that the residential provisions of the 2021 IECC incorporate several administrative changes introduced by the 2013 edition of ASHRAE Standard 169, *Climatic Data for Building Design Standards* (ASHRAE 2013a). ASHRAE 169-2013 redefined climate zones and moisture regimes based on recent weather data. As a result, a number of U.S. counties were reassigned to different zones/regimes, and a new, *extremely hot* Climate Zone 0 was added. (The addition of Climate Zone 0 has no impact on DOE's analysis, since it does not occur in the U.S.) Approximately 400 U.S. counties out of more than 3,000 were reassigned, most to warmer climate zones. However, the reassignment of localities is considered an administrative action, based on long-established definitions of heating degree days and cooling degree days, and is handled consistently with how similar climate zone updates have been handled by previous DOE model energy code determinations. DOE also notes that the reassignment of climate zones is expected to occur in the future, based on updated weather and climate data, and associated updates to ASHRAE Standard 169.

Comment: NAIMA requested that DOE produce the equivalent cost-effectiveness document for the 2021 IECC as rapidly as possible after the publication of the final 2021 IECC determination. Additionally, NAIMA requested that DOE perform this analysis with a variety of down payment amounts to show cost-effectiveness with typical range of loans - a 0% down loan, a 10% down loan, and a 20% down loan.

DOE Response: In making its determination, DOE's directive under ECPA is to assess whether updated editions of the 2021 IECC would improve *energy efficiency* in residential buildings. Concepts such as life-cycle cost and cost effectiveness represent economic analysis and are therefore unique from energy efficiency analysis. However, DOE recognizes the value of such analysis in informing State and local decisions surrounding code review and update processes, as well as design decisions associated with specific buildings and systems. Distinct from its

determination directive under ECPA, DOE provides a variety of additional analysis, including cost-effectiveness analysis. The established DOE methodology is currently designed around a single typical home mortgage scenario, and not multiple down payment scenarios, as requested by NAIMA. However, DOE will consider expanding its analysis in the future to further study a range of financing scenarios, including those experienced by low and moderate income (LMI) households.

Responsible Energy Codes Alliance (RECA)

Comment: RECA's first comment recommended that the DOE take actions to encourage, and provide additional support for, States and cities to adopt and implement the 2021 IECC in the months and years ahead.

DOE response: DOE is directed under ECPA to provide technical assistance supporting the implementation of building energy codes. Consistent with this directive, DOE intends to continue providing robust technical assistance supporting State and local implementation of buildings energy codes. DOE recognizes the importance of supporting the States and local governments who ultimately adopt and implement codes, as well as the wide range of industry stakeholders who rely upon energy codes and strive to achieve compliance in practice.

Comment: RECA's second comment stated that RECA agrees with and supports the methodology and conclusion in the preliminary analysis.

DOE response: DOE appreciates the support.

Comment: RECA's third comment recommended that DOE should implement the 2021 IECC into REScheck.

DOE response: DOE intends to support the implementation of the 2021 IECC into REScheck in the future.

Comment: RECA's fourth comment recommended that DOE remove pre-2015 IECC versions from REScheck.

DOE response: In maintaining its compliance resources, such as the REScheck software⁵, DOE typically supports the three most recent editions of the model codes. (79 FR 15112) Following the current determination, this is anticipated to include the 2021, 2018 and 2015 editions of the IECC. DOE intends to maintain consistency with this approach.

Comment: RECA's fifth comment recommended that DOE provide cost-effectiveness analysis.

DOE response: As outlined in previous responses, DOE notes that the current determination is focused on whether the 2021 IECC would improve *energy efficiency* in residential buildings. However, DOE recognizes the value of additional forms of technical analysis supporting building energy codes, and intends to continue to provide both national and State-level cost-effectiveness analysis of the 2021 IECC in the future.

Comment: RECA's sixth comment recommended that DOE provide *State-level* energy and cost analyses.

⁵ REScheck is a software tool developed and maintained by DOE for the purpose of verifying compliance in residential buildings. See <https://www.energycodes.gov/rescheck>.

DOE response: Consistent with the previous comment response, DOE intends to provide State-level energy and cost analyses in the future.

Comment: RECA's seventh comment recommended that DOE provide implementation support for the 2021 IECC.

DOE response: Consistent with previous comment responses, DOE intends to continue providing robust support for States and local governments implementing building energy codes. DOE intends to provide additional resources supporting the 2021 IECC implementation in the future.

Edison Electric Institute (EEI)

Comment: EEI's first comment stated that the EPA greenhouse gas equivalencies calculator overstates the emissions impact.

DOE response: As outlined in previous responses, DOE notes that the current determination is focused solely on whether the revised Standard would improve energy efficiency in residential buildings, and CO₂ savings were not considered as part of DOE's ultimate determination of whether the revised Standard will improve energy efficiency. DOE is reporting estimated CO₂ savings only because it recognizes the value of additional forms of technical analysis supporting State implementation of building energy codes, including emissions analyses. DOE relies on greenhouse gas emission coefficients established by the Environmental Protection Agency (EPA) in estimating current year CO₂ savings. EPA's emission coefficients are designed to reflect marginal CO₂ savings from electricity savings occurring on the building site, which DOE

considers appropriate for estimating and communicating the carbon savings stemming from an improved energy code. This approach is consistent with how DOE has performed similar calculations in previous determinations.

Comment: EEI's second comment recommended that DOE's determination should take into account the commitments utilities have made to reduce carbon emissions.

DOE response: As outlined in previous responses, DOE notes that the current determination is focused solely on whether the revised Standard would improve energy efficiency in residential buildings, and CO₂ savings were not considered as part of DOE's ultimate determination of whether the revised Standard will improve energy efficiency. DOE is reporting estimated CO₂ savings only because it recognizes the value of additional forms of technical analysis supporting State implementation of building energy codes, including emissions analyses. DOE's analysis is based on several metrics; energy cost, site energy, and source energy. In addition, DOE reports carbon emissions on a first-year basis. DOE recognizes the progress being made by utilities in decarbonizing the electric grid, and emphasizes that estimates provided in the supporting technical analysis are based on current emission levels and are subject to change in the future.

Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

Comment: AHRI, p. 2-5. AHRI commented that historically DOE did not estimate emission reductions or apply a value to emission reductions as part of the results and basis for the determination. They further stated that including emission reductions or their value, including the SC-CO₂, as part of the basis for determination was outside DOE's authority to consider (42 U.S.C. 6833(a)(5)), because EPCA is an energy conservation statute and excludes environmental objectives (see 42 U.S.C. 6312 which excludes environmental objectives), and that DOE does

not have the statutory authority to consider greenhouse gas estimates in determination of residential building codes. AHRI opined that the SC-CO₂ should only be included for rulemakings where DOE has clear statutory authority to do so and stated that it lacks such statutory authority as to building energy codes.

DOE response: In making its determination, DOE's directive under ECPA is to assess whether updated editions of the IECC would improve *energy efficiency* in residential buildings. 42 U.S.C. 6833(b)(2)(A) DOE emphasizes that the estimates pertaining to CO₂ are provided as supplemental information only and were not considered as part of DOE's final determination, which is based on energy efficiency as required under 42 U.S.C. 6833(5)(A). Climate benefits associated with the expected CO₂ emissions reductions are monetized using estimates of the social cost of carbon presented in the *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990* (IWG 2021). DOE is reporting estimates related to CO₂ only because information on the carbon emissions associated with buildings are valued by many stakeholders, including States and local governments who ultimately implement building codes, and who have expressed a need for this information. These estimates are not considered as part of DOE's ultimate determination of whether the updated IECC will improve energy efficiency.

Comment: AHRI, p. 2, 5. AHRI stated that DOE is ignoring clear congressional intent in including emissions in the narrowly scoped building energy code review defined in the statutory text (42 U.S.C. 6833(b)(1)). AHRI further stated that congress could have added global climate change into a variable to weigh in the determination, but did not do so and so DOE should not include this in the determination.

DOE Response: See response to previous AHRI comment.

Comment: AHRI, p. 2. AHRI requested that DOE remove carbon emissions from the determination for building energy codes, including the 2021 IECC.

DOE Response: See response to previous AHRI comment.

Comment: AHRI p. 2. Irrespective of the authority consideration, AHRI requested that DOE must act to remedy inaccurate assumptions and conclusions on the social cost of carbon benefits analysis. AHRI opined that the benefits claimed from full fuel cycle and global impact of emissions and SC-CO₂ are speculative and tangential and that these are calculated over a time period (100 years) that greatly exceeds that used to measure economic costs.

DOE Response: In making its determination, DOE's directive under ECPA is to assess whether updated editions of the IECC would improve *energy efficiency* in residential buildings. 42 U.S.C. 6833(b)(2)(A) DOE emphasizes that the estimates pertaining to CO₂ are provided only as supplemental information and are not considered as part of the final determination, which is based on energy efficiency as required under 42 U.S.C. 6833(b)(2)(A).

In calculating related CO₂ impacts, DOE used the estimates for the SC-CO₂ from the most recent update of the Interagency Working Group on Social Cost of Greenhouse Gases, United States Government (IWG), from "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990." (February 2021 TSD). DOE has determined that the estimates from the February 2021 TSD, as described more below, are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of CO₂ related to the reductions of emissions from updating the IECC to the 2021 edition.

These SC-CO₂ estimates are interim values developed under Executive Order (E.O.) 13990 for use until an improved estimate of the impacts of climate change can be developed based on the best available science and economics. The SC-CO₂ estimates used in this analysis were developed over many years, using a transparent process, peer-reviewed methodologies, the best science available at the time of that process, and with input from the public. Specifically, an interagency working group (IWG) that included the EPA and other executive branch agencies and offices used three integrated assessment models (IAMs) to develop the SC-CO₂ estimates and recommended four global values for use in regulatory analyses. The SC-CO₂ estimates were first released in February 2010 and updated in 2013 using new versions of each IAM. In 2015, as part of the response to public comments received to a 2013 solicitation for comments on the SC-CO₂ estimates, the IWG announced a National Academies of Sciences, Engineering, and Medicine review of the SC-CO₂ estimates to offer advice on how to approach future updates to ensure that the estimates continue to reflect the best available science and methodologies. In January 2017, the National Academies released their final report, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*, and recommended specific criteria for future updates to the SC-CO₂ estimates, a modeling framework to satisfy the specified criteria, and both near-term updates and longer term research needs pertaining to various components of the estimation process (National Academies 2017). On January 20, 2021, President Biden issued Executive Order 13990, which directed the IWG to ensure that the U.S. Government's (USG) estimates of the social cost of carbon and other greenhouse gases reflect the best available science and the recommendations of the National Academies (2017). The IWG was tasked with first reviewing the estimates currently used by the USG and publishing interim estimates within 30 days of E.O. 13990 that reflect the full impact of GHG emissions, including taking global damages into account.⁶ The interim SC-CO₂ estimates published in February 2021 are used here to estimate the climate benefits associated with this determination.

⁶ The E.O. instructs the IWG to undertake a fuller update of the SC-GHG estimates by January 2022.

DOE acknowledges that there are a number of challenges in attempting to assess the incremental economic impacts of CO₂ emissions. The science and economic understanding of climate change and its impacts is improving over time; research focused on the assessment of climate damages and socioeconomic emissions projections is particularly important for reducing uncertainty in the calculation of the social cost of greenhouse gases (SC-GHG)⁷, as is quantifying and being transparent about where key uncertainties in the models remain. But contrary to AHRI's suggestion that uncertainty should cause DOE to discount or abandon monetization of the social benefits of reducing CO₂ emissions, as IWG has stated, due to a number of sources of uncertainty, there is a likelihood that the SC- CO₂ is an underestimate of the true social cost of emissions.⁸ Despite the limits of both quantification and monetization, SC- CO₂ estimates can be useful in estimating the social benefits of reducing CO₂ emissions. As a result, DOE has used the IWG's SC-CO₂ estimates in monetizing the social benefits of reducing CO₂ emissions. However, as discussed in previous comments, DOE's SC-CO₂ analysis using these estimates was not considered in DOE's ultimate determination of whether the 2021 IECC Standard will improve energy efficiency.

Comment: AHRI p. 2,3. As part of the rationale for not including SC-CO₂, AHRI further commented that DOE has acknowledged the uncertainty of SC-CO₂ estimates and stated that these are both provisional and revisable. Further, they noted that the interagency working group developing the SC-CO₂ noted that the underlying models were imperfect and incomplete and

⁷ The social cost of greenhouse gases (SC-GHG) is the monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year and, therefore, should reflect the societal value of reducing emissions of the gas in question by one metric ton. The marginal estimate of social costs will differ by the type of greenhouse gas (such as carbon dioxide, methane, and nitrous oxide) and by the year in which the emissions change occurs. The estimates of the social cost of carbon (SC-CO₂), social cost of methane (SC-CH₄), and social cost of nitrous oxide (SC-N₂O) published in the February 2021 TSD allow agencies to understand the social benefits of reducing emissions of each of these greenhouse gases, or the social costs of increasing such emissions, in the policy making process. Collectively, these values are referenced as the “social cost of greenhouse gases” (SC-GHG).

⁸ See Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide. Interim Estimates Under Executive Order 13990*, Washington, D.C., February 2021.

notes that the intergovernmental panel on climate change (IPCC) which the IWG relied on also stated in 2013 that no best estimate for equilibrium climate sensitivity could then be given because of the lack of agreement on values across assessed lines of evidence and studies.

DOE Response: In making its determination, DOE's directive under ECPA is to assess whether updated editions of the IECC would improve *energy efficiency* in residential buildings. 42 U.S.C. 6833(b)(2)(A) DOE emphasizes that the estimates pertaining to CO₂ are provided only as supplemental information and are not considered as part of the final determination, which is based on energy efficiency as required under 42 U.S.C. 6833(b)(2)(A).

As noted above, DOE determined that the estimates from the February 2021 TSD are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of CO₂ related to the reductions of emissions from updating the 90.1 Standard to the 2019 edition. As explained in the February 2021 TSD and while the IWG works to assess how best to incorporate the latest, peer reviewed science to develop an updated set of SC-GHG estimates, the IWG has determined that it is appropriate for agencies to revert to the same set of four values drawn from the SC-GHG distributions based on three discount rates as were used in regulatory analyses between 2010 and 2016 and subject to public comment. For each discount rate, the IWG combined the distributions across models and socioeconomic emissions scenarios (applying equal weight to each) and then selected a set of four values for use in benefit-cost analyses: an average value resulting from the model runs for each of three discount rates (2.5%, 3%, and 5%), plus a fourth value, selected as the 95th percentile of estimates based on a 3 percent discount rate. The fourth value was included to provide information on potentially higher-than-expected economic impacts from climate change, conditional on the 3% estimate of the discount rate. As explained in the February 2021 TSD, this update reflects the immediate need to have an operational SC-GHG for use in regulatory benefit-cost analyses and other applications that was developed using a transparent process, peer-reviewed methodologies, and the science available at

the time of that process. Those estimates were subject to public comment in the context of dozens of proposed rulemakings as well as in a dedicated public comment period in 2013. However, as discussed in previous comments, DOE's SC-CO₂ analysis using these estimates was not considered in DOE's ultimate determination of whether the 2021 IECC Standard will improve energy efficiency.

Comment: AHRI, p. 3,5. AHRI commented that EPCA's focus is on benefits accruing with this nation, hence incorporation of SC-CO₂ at the global level is beyond the scope and authority of DOE. See 42 U.S.C. 6833(a)(1-5). They further noted that EPCA originally arose out of the 1970's oil embargo and that nothing in the subsequent amendments suggests a different statutory focus other than improving the energy economic within the United States. AHRI notes that DOE analyzes expected national [domestic] energy savings, but does not scale back reported SC-CO₂ calculations to reflect domestic impacts only.

DOE Response: In making its determination, DOE's directive under ECPA is to assess whether updated editions of the IECC would improve *energy efficiency* in residential buildings. 42 U.S.C. 6833(b)(2)(A) DOE emphasizes that the estimates pertaining to CO₂ are provided only as supplemental information and are not considered as part of the final determination, which is based on energy efficiency as required under 42 U.S.C. 6833(b)(2)(A).

As to the use of a SC-CO₂ value that includes impacts outside the boundaries of the United States, the February 2021 TSD provides a complete discussion of the IWG's initial review conducted under E.O. 13990. In particular, the IWG found that a global perspective is essential for SC-GHG estimates because climate impacts occurring outside U.S. borders can directly (and indirectly affect the welfare of U.S. citizens and residents. Thus, U.S. interests are affected by the climate impacts that occur outside U.S. borders. Examples of affected interests include: direct effects on U.S. citizens and assets located abroad, international trade, and tourism, and spillover

pathways such as economic and political destabilization and global migration. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other countries, as those international mitigation actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents. Therefore, in this analysis DOE centers attention on a global measure of SC-GHG.

As noted above, DOE determined that the estimates from the February 2021 TSD are based upon sound analysis, and therefore, in analyzing the impacts of CO₂ related to the reductions of emissions from updating the 90.1 Standard to the 2019 edition, DOE has focused on a global measure of SC-CO₂. As noted in the February 2021 TSD, the IWG will continue to review developments in the literature, including more robust methodologies for estimating SC-GHG values based on purely domestic damages, and explore ways to better inform the public of the full range of carbon impacts, both global and domestic. As a member of the IWG, DOE will likewise continue to follow developments in the literature pertaining to this issue. However, as discussed in previous comments, DOE's SC-CO₂ analysis using these estimates was not considered in DOE's ultimate determination of whether the 2021 IECC Standard will improve energy efficiency.

Comment: AHRI, p.3,4. AHRI stated that DOE wrongly assumes that SC-CO₂ values increase over time in real dollars and states that this is contrary to “historical experience and to economic development science” and that the more economic development that occurs, the more adaptation and mitigation efforts a population living in a growing economy can afford to undertake (AHRI cites the IWG indicating that developed countries can eliminate 90% of the economic impacts and developing countries could eventually eliminate 50% of the economic impacts of climate change). They comment that they see no indication that DOE considered this separately.

DOE Response: In making its determination, DOE's directive under ECPA is to assess whether updated editions of Standard 90.1 would improve *energy efficiency* in commercial buildings. 42 U.S.C. 6833(b)(2)(A) DOE emphasizes that the estimates pertaining to CO₂ are provided only as supplemental information and are not considered as part of the final determination, which is based on energy efficiency as required under 42 U.S.C. 6833(b)(2)(A).

The model scenarios reported by the IWG demonstrate that the damage assessments and corresponding valuation (SC-CO₂), adjusted for inflation, increase through time. As explained in the February 2021 TSD, "[t]he SC-[CO₂] estimates increase over time within the models – i.e., the societal harm from one metric ton emitted in 2030 is higher than the harm caused by one metric ton emitted in 2025 – because future emissions produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change, and because GDP is growing over time and many damage categories are modeled as proportional to GDP. As noted above, DOE determined that the estimates from the February 2021 TSD are based upon sound analysis and provide well founded estimates for DOE's analysis of the impacts of CO₂ related to the reductions of emissions from updating the 90.1 Standard to the 2019 edition in its building codes impact analysis. Accordingly, DOE incorporated the IWG's consideration in its analysis. However, as discussed in previous comments, DOE's SC-CO₂ analysis using these estimates was not considered in DOE's ultimate determination of whether the 2021 IECC Standard will improve energy efficiency.

Comment: AHRI, p. 4. AHRI argued that it is arbitrary and capricious to use different timeframes and assumptions for costs and benefits and notes that DOE must clarify precisely why and how it believes it has statutory authority under 42 U.S.C. 6833(a) to consider SC-CO₂ issues and cites why such action is legally arbitrary without sufficient documented reason for treating similar situations differently. AHRI notes that DOE, in clarifying why it believes it has such authority, can establish how it is acting consistently in terms of the analysis of benefits.

DOE Response: See previous response to AHRI comment on the issue of authority. On the issue of costs and benefits, DOE reemphasizes that its determination analysis is not assessing the costs and benefits associated with the updated 2021 IECC, that the determination is solely based on energy efficiency, and that the reported carbon emissions are reported only as supplemental information for the benefit of interested parties and in support of the directives of Executive Order 12866. To clarify the issue of timeframe, the emission estimates are based on one year (i.e., the annual energy consumption estimated via the energy efficiency analysis). However, the step of projecting the associated CO₂ impacts captures the longer-term impact of those single-year emissions, as they persist in the atmosphere (and drive the damage impacts over the time they persist), which is then discounted to present value for the year when the emissions occur. DOE does not find an economic inconsistency in this approach to reporting emission benefits. Such a calculation is similar to life-cycle analysis, for instance, which is performed in a similar fashion, where a single year event occurs (e.g., a purchase of more efficient equipment), but the energy savings are calculated over the time they exist (e.g., the life of the equipment), and discounted back to the present value to reflect an overall life-cycle cost. DOE's reporting here of discounted damage impacts is consistent with that general approach.

Signing Authority

This document of the Department of Energy was signed on July 19, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon

publication in the *Federal Register*.

Signed in Washington, DC, on July 22, 2021.

Treena V. Garrett,
Federal Register Liaison Officer,
U.S. Department of Energy.

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