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Memorandum

To: Members of the Peer Review Committee

From: Barton Day

Re: Peer review the analytical methods employed by the U.S. Department of Energy (DOE) in setting “standards regulations” for the performance of buildings and associated equipment and products.

Date: January 8, 2020

On behalf of my client Spire Inc., I am writing to provide written feedback as a follow up to comments I provided on the second day of the November 19-20, 2019 public meeting concerning the National Academies of Sciences, Engineering and Medicine’s peer review of DOE’s methods for regulatory analysis in energy conservation standards rulemaking.

On November 19, 2019, DOE and its contractors provided several presentations, including a presentation outlining the regulatory analysis prepared in support of DOE’s proposed residential furnace standards. On the following day, the Committee raised questions concerning the legal context for DOE standards development, including questions concerning the objectives of DOE’s appliance efficiency program and any legal requirements relevant to regulatory analysis in DOE standards rulemaking. This correspondence provides a brief response to the Committee’s legal questions and then identifies two serious methodological flaws in the analysis prepared in the residential furnace rulemaking.

For a more comprehensive technical critique of DOE’s residential furnace, the Committee is urged to review Spire’s January 1, 2017 comment submission in the residential furnace rulemaking, which includes a 107 page comment document accompanied by six supporting attachments including a 122 page report providing a detailed technical review of DOE’s regulatory analysis.¹

¹ Spire’s comment submission (“Spire’s Residential Furnace Comments”) is identified as Document No. EERE-2014-BT-STD-0031-0309 in in Docket No. EERE-2014-BT-0031. This submission – along with all six attachments – can be accessed at: <https://www.regulations.gov/document?D=EERE-2014-BT-STD-0031-0309>

A. Legal Questions Raised by the Committee

1. Objectives of the Appliance Efficiency Program

DOE's appliance efficiency program is an energy conservation program authorized for the specific purpose achieving *energy conservation through technologically feasible and economically justified improvements in the efficiency of regulated products*. The statutory provisions authorizing this program are codified in the U.S Code as Chapter 77 of Title 42 (entitled "Energy Conservation"), and the authorized purpose of the program is confirmed by an explicit "Congressional statement of purpose" – codified in the statute itself – stating that the relevant purposes of Chapter 77 are:

- to conserve energy supplies through energy conservation programs, and, where necessary, the regulation of certain energy uses;
- to provide for improved energy efficiency of motor vehicles, major appliances, and certain other consumer products; [and]
- to conserve water by improving the water efficiency of certain plumbing products and appliances.²

DOE has considered the environmental impacts of energy conservation standards in determining whether efficiency standards are economically justified, but *the purpose of standards* must be to conserve energy by improving the efficiency of regulated products, not to advance environmental objectives as such.³ The singular nature of this statutory purpose is confirmed by the fact that DOE "may not prescribe" a standard – even a standard that would be technologically feasible and economically justified – if it "will not result in significant conservation of energy."⁴

² 42 U.S.C. § 6201(4), (5) and (8). The full text of 42 U.S.C. § 6201 can be accessed at: <https://www.govinfo.gov/content/pkg/USCODE-2011-title42/html/USCODE-2011-title42-chap77-sec6201.htm>

³ The statute does not require DOE to consider the environmental impacts of standards. However, in determining whether standards are *economically justified*, DOE has treated the environmental impacts of standards as an "other relevant" consideration under 42 U.S.C. §§ 6295(o)(2)(B)(1)(VII) (commercial products) and 6313(a)(6)(B)(ii)(VII) (industrial equipment). The full text of 42 U.S.C. §§ 6295 and 6313 can be accessed at: <https://www.govinfo.gov/content/pkg/USCODE-2010-title42/html/USCODE-2010-title42-chap77-subchapIII-partA-sec6295.htm> and <https://www.govinfo.gov/content/pkg/USCODE-2009-title42/html/USCODE-2009-title42-chap77-subchapIII-partA-1-sec6313.htm>

⁴ 84 Fed. Reg. 3910 at 3921 (February 13, 2019) (quoting 42 U.S.C. § 6295(o)(3)(B)); *see* 42 U.S.C. § 6313(a)(6)(A)(ii)(II) (requiring a "significant *additional* conservation of energy" in the case of industrial equipment standards more stringent than those required under ASHRAE/IES Standard 90.1).

2. Legal Requirements Applicable to DOE's Regulatory Analysis in Standards Rulemaking

The legal framework for DOE standards rulemaking requires significantly more rigorous economic analysis than would be required simply for purposes of compliance with Executive Orders 12866 and 13563. The key considerations are as follows.

- The economic analysis required in standards rulemaking is not conducted simply as a matter of good regulatory practice. Instead, the analysis is both *legally required* and *determinative of regulatory outcomes*, because (with limited exception) DOE generally cannot adopt a standard without making the determination that it is economically justified.⁵
- DOE's determination that a standard is economically justified *must be supported by substantial evidence*.⁶
- DOE's obligation to economically justify energy conservation standards is *subject to notice and comment rulemaking procedures*.⁷ For notice and comment to be legally sufficient under general principles of administrative law, interested parties must have the opportunity to review and comment on all of the key evidence and analysis DOE relies upon to support its determination that a standard is economically justified.⁸ This means that all of the key evidence required to justify the adoption of a standard – including actual technical data, studies, and staff reports⁹ – must be made available for review by interested parties and thus “exposed to refutation” during the rulemaking process.¹⁰
- DOE's analysis must address considerations identified as relevant by statute, including the results of lifecycle cost (“LCC”) and “payback” analyses that require direct

⁵ 42 U.S.C. §§ 6295(o)(2) (commercial products) and 6313(a)(6)(A)(ii)(II) (industrial equipment). The exception applies only when DOE is adopting requirements of ASHRAE/IES Standard 90.1 pursuant to 42 U.S.C. § 6313(a)(6)(A)(ii)(I).

⁶ 42 U.S.C. § 6306(b)(2). “Clear and convincing” evidence is required to justify industrial equipment standards more stringent than those applicable under ASHRAE/IES Standard 90.1. *See* 42 U.S.C. § 6313(a)(6)(A)(ii)(II). The full text of 42 U.S.C. § 6306 can be accessed at: <https://www.govinfo.gov/content/pkg/USCODE-1996-title42/html/USCODE-1996-title42-chap76-subchapIII-partA-sec6306.htm>

⁷ 42 U.S.C. §§ 6295(p)(1)-(2) and 6306(a)(1). The more general notice and comment requirements of the Administrative Procedure Act (5 U.S.C. § 553) also apply.

⁸ *See Chamber of Commerce v. SEC*, 443 F.3d 890, 900-02 (D.C. Cir. 2006); *Ass'n of Data Processing Service Orgs. v. Bd. of Governors*, 745 F.2d 677, 684 (D.C. Cir. 1984).

⁹ *American Radio Relay League, Inc. v. FCC*, 524 F.3d 227 (D.C. Cir. 2008).

¹⁰ *Owner-Operator Indep. Drivers Ass'n v. FMCSA*, 494 F.3d 188, 209 (D.C. Cir. 2007) (*quoting Ass'n of Data Processing Service Orgs. v. Bd. of Governors*, 745 F.2d 677, 684 (D.C. Cir. 1984)).

comparison of the incremental cost of required efficiency improvements and the operating cost savings those required efficiency improvements would provide.¹¹

3. Methodological Implications

The legal considerations outlined above have the important methodological implications outlined below.

a. Actual evidence is required.

DOE must have credible evidence to support every necessary part of its analysis. To the extent such evidence is not immediately available, DOE must gather the evidence it needs rather than substituting baseless assumptions or “estimates” for which it provides no articulable basis. For example, DOE cannot (as it routinely does) assume that the percentage of products *sold* with particular features is the same as the percentage of *available models* with those features, because there is no factual basis for such an assumption. The methodological implication is that DOE’s analytical approach must be designed to avoid the need for information that cannot be obtained through diligent data collection efforts.

b. DOE cannot rely on key information that is not documented on the record for public review and comment.

As the presentations provided during the public meeting of November 18, 2019 explained, DOE’s regulatory analysis relies heavily on information obtained by DOE’s consultants through “tear-down” analyses and manufacturer interviews. Unfortunately, there is typically no meaningful information in the public record concerning such analyses or interviews; DOE simply states that some of its critical conclusions are based upon (or supported by) information obtained through such analyses or interviews. In the residential furnace rulemaking, a DOE official responded to repeated requests for an explanation of the basis for such conclusions by indicating that DOE did not have any explanation to provide, because all DOE obtains from its consultants is a set of input parameter values on a spreadsheet. This is substantive problem, because it leaves DOE with no *evidence* to support critical elements of its analysis. It is also a basic violation of DOE’s notice and comment obligations, because it leaves interested parties with no opportunity to assess the representativeness or validity of the information on which DOE’s conclusions are based or to understand how that information was interpreted or why it was interpreted in the way that it was. This was especially problematic in the residential furnace rulemaking, in which the results of DOE’s inordinately complex methodology for estimating product and installation costs had produced results grossly at odds with available market data.¹²

¹¹ 42 U.S.C. §§ 6295(o)(2)(B)(i)(II) and (o)(2)(B)(iii) (commercial products); 6313(a)(6)(B)(ii)(II) (industrial equipment).

¹² See Spire’s January 1, 2017 comments in the residential furnace rulemaking, identified as Document No. EERE-2014-BT-STD-0031-0309 in in Docket No. EERE-2014-BT-0031 (“Spire’s Residential Furnace Comments”) at pp. 71-73 and 91-94. These comments and their supporting attachments can be accessed at <https://www.regulations.gov/document?D=EERE-2014-BT-STD-0031-0309>

The methodological implication is that DOE's analytical approach should be designed to minimize DOE's need to rely on non-public information. Confidential or proprietary information can be used as appropriate to enhance DOE's understanding of the relevant issues but DOE may not rely on undisclosed information as the primary basis for conclusions material to the outcome of its analysis. To the extent it is necessary for DOE to rely on confidential business information or other non-public information (such as the results of manufacturer interviews or "tear-down" analyses), DOE must prepare documentation for the public record that provides a sufficient basis to enable interested parties to provide meaningful comment on the representativeness and validity of that information and DOE's interpretation of it.

- c. DOE's analysis must be consistent with relevant statutory requirements and purposes.

DOE's regulatory analysis must be designed to ensure that statutorily relevant issues are addressed in a manner that is consistent with specific statutory direction and with the fundamental statutory purpose of achieving energy conservation through improvements in the efficiency of regulated products. It may not – as it did in the residential furnace rulemaking – substitute an alternative analysis designed to justify standards on a fundamentally different basis than that specified by statute. This issue is discussed in detail in Section B.2. below

B. Major Methodological Issues in the Residential Furnace Rulemaking

DOE's proposed standards for residential furnaces are highly controversial, and DOE's attempt to justify those standards has been challenged for numerous legal and technical reasons.¹³ While this correspondence focuses on two specific methodological problems with DOE's analysis, there was a third problem that exacerbated the practical impact of both: in the residential furnace rulemaking, DOE sought to justify efficiency standards that would leave many consumers without replacement options suitable for most standard gas furnace installations. Specifically, DOE:

- Proposed standards that can be achieved only by furnaces that are incompatible with the atmospheric venting systems built into most of the existing homes in which gas furnaces are installed, thereby making it impossible for many consumers to replace their existing furnaces without the need to modify their homes as necessary to permit the installation of products they were not designed to accommodate;¹⁴ and
- Treated the costs imposed by the unavailability of atmospherically-vented gas furnaces (which in some cases include the cost of scrapping existing atmospheric venting systems and scrapping and replacing other commonly-vented products, such as water heaters) as part of the "installation cost" *of the new furnace*.

¹³ See, e.g., Spire's Residential Furnace Comments.

¹⁴ In proposing such standards DOE disregarded clear statutory direction that standards may not be adopted if they would result in the unavailability of products suitable for standard home installations. DOE has since recognized that this was a mistake it should correct going forward. See 84 Fed. Reg. 33011, 33020-21 (July 11, 2019).

As a result, “installation costs” (and thus the initial cost of products meeting the new standard) would vary dramatically depending on the installation scenario involved and DOE recognized that there would be a significant number of cases in which consumers facing substantial “installation” challenges would decline to invest in high-efficiency gas furnaces even if a standard were imposed.

With this background, there are two major methodological issues that warrant close attention.

1. DOE’s Failure to Consider Baseline Purchasing Behavior

A basic premise of efficiency regulation is that market failures can cause purchasers to forego economically beneficial investments in higher-efficiency products, and that – where the net economic impact of all declined investments in such products would be positive – efficiency standards would be economically beneficial for consumers. DOE routinely justifies standards on this basis, claiming that its standards will provide substantial net economic benefits for consumers in the form of utility bill savings. However, in the residential furnace rulemaking *DOE’s methodological approach did not provide a basis to conclude that such claims are true.*

The November 19, 2019 presentation describing DOE’s residential furnace rulemaking suggests that “DOE identified market failures to justify” the standards in the supplemental proposed rule DOE issues in 2016.¹⁵ In fact, DOE merely cited general literature as a basis to assert the existence of market failures; it made no effort to determine the extent to which market failures actually cause purchasers to forego economically beneficial investments in higher-efficiency furnaces.

In the residential furnace rulemaking DOE recognized that:

- Furnaces meeting the efficiency standards under consideration are already available and have captured a significant percentage of the market; and
- The economic consequences of such investments depend on the installation involved, to the extent that operating cost savings would significantly exceed initial costs in some installations while initial costs would significantly exceed operating cost savings in others.

In these circumstances, the economic impact of a standard depends upon the extent to which purchases made in the absence of regulation reflect a preference for economically advantageous efficiency investments or an aversion to economically disadvantageous investments. To the extent they do, the distribution of economic outcomes would be different for “base case” efficiency investments (*i.e.*, investments that would be made in the absence of a new standard) than it would be for “rule outcome” efficiency investments (*i.e.*, investments that would be made only if a standard were imposed), with base case efficiency investments being more likely to

¹⁵ See Slide 7 of the “Furnaces” presentation (“Furnaces Presentation”), which can be accessed through the “Furnaces” link at: <https://www8.nationalacademies.org/pa/projectview.aspx?key=51775>

have favorable economic outcomes and “rule outcome” investments being more likely to have unfavorable economic outcomes.

Regional data strongly suggests that purchases of residential furnaces are significantly influenced by economic considerations, because high-efficiency furnaces have captured a higher percentage of the market in areas where heating demand (and thus the value of efficiency improvements) is relatively high and a lower percentage of the market in areas where heating demand (and thus the value of efficiency improvements) is relatively low.¹⁶ DOE also recognized that the range of economic outcomes for investments in high-efficiency furnaces is particularly large due – in large part – to the venting requirements for high-efficiency furnaces.¹⁷ Nevertheless, DOE made no effort to determine the extent to which baseline purchasing behavior reflects any statistically significant preference for favorable economic outcomes or aversion to unfavorable economic outcomes or the impact such preferences would have on the distribution of different economic outcomes in “rule outcome” efficiency investments. Instead, DOE’s modeling assumed that that investments in high-efficiency furnaces made in the absence of regulation *do not reflect any statistically significant preference for economically favorable efficiency investments or aversion to economically unfavorable investments*. The mechanism involved is as follows:

- DOE’s modeling uses ten thousand “trial cases” to represent the range of installation scenarios expected to be encountered in the real world;
- DOE’s model is designed to use an algorithm to assign “base-case” product efficiencies in way that would reasonably represent purchasing behavior in the absence of regulation;
- Instead of using an algorithm to produce a base case that reflects actual purchasing behavior, DOE used a random distribution function to assign baseline efficiencies as though purchasers acting in the absence of regulation never consider the economics of their purchases, no matter how extreme the economic outcome.

In effect, this approach produces a purported assessment of rule impacts that is *based on the economics of a randomly selected universe of all potential efficiency investments rather than on the economics of the efficiency investments that would occur only if a standard were imposed*.¹⁸ In practice, the impact of this difference is enormous, because the results of DOE’s analyses are heavily influenced by a small percentage of product purchases that have extreme economic

¹⁶ See the Furnaces Presentation at slides 43-44. In fact, DOE’s data indicates that high-efficiency furnaces have already captured over 90% of the market in areas where the savings high-efficiency furnaces provide would generally be greatest. See Spire’s Residential Furnace Comments at 58-59.

¹⁷ See the Furnaces Presentation at slides 31-32, 35. DOE’s assessment of the seriousness and cost impacts of the installation issues grossly understated the magnitude of the installed cost of high-efficiency furnaces, and the suggestion Canadian experience suggests otherwise has been thoroughly discredited. See Spire’s Residential Furnace Comments at pp. 11-18 and 91-94.

¹⁸ See Spire’s Residential Furnace Comments at pp. 4-6 and 58-61; Gas Technology Institute Technical Analysis of DOE Supplemental Notice of Proposed Rulemaking on Residential Furnace Minimum Efficiencies (January 4, 2017) (Attachment C to Spire’s Residential Furnace Comments) at pp. 18-24.

outcomes, and these are the types of cases in which economic considerations are most likely to influence purchasing decisions made in the absence of a new standard.¹⁹

DOE has suggested that its assignment of baseline efficiencies is not *entirely* random because it did consider regional differences in market share.²⁰ However – as the presentation during the November 19, 2019 meeting shows – DOE is referring only to its market share analysis: its analysis of how many rule outcome purchases would be expected to occur in each region. These regional differences reflect differences in heating demand (and thus the value of efficiency improvements) but does not provide any consideration of individual economic outcomes, which are often driven by installation costs and venting requirements. As a result, DOE accounts for differences in market share, but – within each region – it still “assigns” trial cases to the base case or rule outcome case randomly, as though purchases made in the absence of a new standard reflect no statistically significant preference for economically beneficial efficiency investments and no aversion to economically unfavorable efficiency investments.²¹

DOE’s analysis expressly recognizes that purchases of residential furnaces are influenced by economic considerations; it simply ignores that fact until – in the context of its fuel-switching analysis – it employs a “consumer choice” model that assumes that purchasing decisions are *always* influenced by economic considerations.²² Unfortunately, by that point DOE’s analysis is based on a universe of purported “rule outcome” trial cases that – rather than being designed to represent actual rule outcome purchases – consists of a randomly-selected universe of trial cases. As a result, DOE’s analysis does not actually provide an assessment of the economic impact of the proposed standard.

2. DOE’s improper use of a fuel switching analysis in lifecycle cost and payback analysis

As already stated, the statutory purpose of the appliance efficiency program is to achieve energy conservation through economically justified efficiency improvements. In determining whether required efficiency improvements are economically justified, DOE must consider whether the cost of those efficiency improvements is justified by the benefits those efficiency improvements would provide. Accordingly, the statute specifically requires that DOE prepare and consider both “payback” and life-cycle cost (“LCC”) analyses in determining whether required efficiency improvements are economically justified. Specifically, DOE must consider:

¹⁹ Indeed, a review of DOE’s analysis in the residential furnace rulemaking found that more than half of the total claimed economic benefits of the proposed standard were attributable to installations in which high-efficiency furnaces would have *lower initial costs* and would provide operating cost savings from day one. See Spire’s Residential Furnace Comments at pp. 60-61 and Attachment C to Spire’s Residential Furnace Comments at p. 23.

²⁰ 81 Fed. Reg. 65720 at 65789 (September 23, 2016).

²¹ DOE has also suggested that baseline efficiencies are “allocated to specific buildings based on the existing furnace being replaced.” 84 Fed. Reg. 33011 at 33018 (July 11, 2019). However, DOE’s model randomly assigns the efficiencies of the existing furnaces being replaced, with the result that efficiency assignments based on those efficiencies are also random.

²² See Furnaces Presentation at slides 46-49.

- Whether “the additional cost to the consumer of purchasing a product complying with an energy conservation standard level will be less than three times the value of the energy . . . savings during the first year that the consumer will receive as a result of the standard” (*i.e.*, a payback analysis);²³ and
- The “savings in operating costs throughout the estimated average life of the covered product . . . compared to any increase in the price of, or in the initial charges for, or maintenance expenses of” the product “likely to result from the imposition of the standard (*i.e.*, a life cycle cost analysis).²⁴

As already discussed, DOE’s failure to consider baseline purchasing behavior fatally undermined its payback and LCC analyses. However, DOE also employed a methodology that does more to confound than to address the fundamental question of whether the cost of required efficiency improvements would be justified by the value of the energy savings those efficiency improvements would provide. In short – having identified “rule outcome” trial cases on a basis that assumed that consumers never consider the economics of their efficiency investments – DOE then selectively revised the economic outcomes of these purported “rule outcome” trial cases by assuming that consumers facing economically unattractive gas furnace investments would choose alternative products instead. Specifically, DOE:

- Assumed that consumers facing economically unattractive gas furnace options as a result of the proposed standard would substitute electric alternatives for furnaces with the required efficiency improvements, and – on that basis – preferentially excluded “rule outcome” trial cases with bad economic outcomes from its analysis; and
- Made unduly optimistic assumptions about the economics of the electric products consumers would choose instead and substituted the costs and benefits of the electric alternatives for the economics of the gas furnace investments it had excluded from its analysis.²⁵

The problem with this approach is that the resulting analyses do not address the specific question DOE is required to consider. By statute, required “*efficiency improvements*” must be “technologically feasible and economically justified.”²⁶ In view of the methodology employed, DOE’s payback and LCC analyses do not address the economics of the *required efficiency improvements*. Instead these analyses redefine economic justification in a way that would allow *economically unjustified* efficiency improvements to be justified on the basis of the economics of investments in alternative products that unacceptable costs would force consumers to choose

²³ 42 U.S.C. § 6295(o)(2)(B)(iii).

²⁴ 42 U.S.C. § 6295(o)(2)(B)(i)(II).

²⁵ See Furnaces Presentation at slides 46-49.

²⁶ 42 U.S.C. § 6295(o)(2)(A) (emphasis added). Similarly, it is impacts on “consumers of products subject to” a standard – not consumers of alternative products – that must be considered in determining whether standards are economically justified. 42 U.S.C. § 6295(o)(2)(B)(i)(I).

instead. This kind of economic justification is irreconcilable with the statutory purpose of the appliance efficiency program, which is to promote energy conservation through *economically justified improvements in the efficiency of regulated products*. Moreover – by treating fuel switching as an appropriate outcome of efficiency regulation rather than as evidence that required efficiency improvements are economically unjustified – DOE’s analytical approach ignores the fact that the replacement of gas furnaces with electric alternatives is likely to increase overall energy consumption, thereby frustrating the core purpose of the appliance efficiency program.²⁷ The methodological problem is clear: DOE’s LCC and payback analyses are not designed to address the specific questions it has a statutory obligation to consider, and is designed to defeat rather than promote the statutory purpose of achieving *energy conservation through economically justified improvements in the efficiency of regulated products*.

I appreciate the opportunity to provide feedback for the peer review process and hope that the members of the peer review Committee find it helpful. I understand that the Committee will not be providing any response the feedback it receives but would be pleased to respond to any questions the Committee might have in relation to the information I’ve provided.

²⁷ See Spire’s Residential Furnace Comments at pp. 20-28.