BIRCH POINT
Consulting

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Doug,

Please find below my comments on the draft 1 criteria for the ENERGY STAR® Version 7.0 Windows, Doors, and Skylights program. I want to offer my observations and expertise on the technical issues, and will leave any comments on market, cost, and implementation issues to others. Note that these are solely my personal opinions, not on behalf of any specific client or interest.

First, I commend you and your team at LBNL and D&R on the strong, comprehensive analysis. I also appreciate the transparency of EPA in providing the technical documents, modeling assumptions, and spreadsheets. The proposed criteria are well justified, and I am in ***strong support*** of this significant advancement for the program.

Regarding some of the technical issues, it seems that most of the discussion has focused on the north. My observations on these are as follows:

IECC Climate Zone 5 and the Energy Star North / North-Central Zones

Some are asking that IECC climate zone 5 be combined in with the Energy Star North-Central zone. When this question was asked as part of the discussion guide in 2019, I suggested you "follow the science" to see what was justified by the analysis. With the comprehensive analysis that has now been completed, the results are clear that window performance is very different in zone 5 than in zone 4 (Energy Star North-Central) in terms of U, SHGC, and energy savings. It would be a significant weakening and loss of energy savings to move zone 5 (including large population areas like Chicago, Denver, Salt Lake City, Detroit, and Cleveland) into the North-Central with weaker U-factor requirements and a cap on SHGC that can actually harm energy efficiency as shown in Table 12 of the analysis report. If this move is even considered, you would conversely need to examine applying the more stringent U-factors from the North to the North-Central as well as removing the SHGC cap. However, that may not be right for the zone 4 cities also under the North-Central. The simplest solution – and the one justified by the technical analysis – is to just leave IECC zone 5 in with the Northern Zone.

Warming Trends and Climate Zones

Related to the above, many have correctly cited how climate change is resulting in a long-term warming trend for many locations, including in the north. Some are incorrectly implying that this justifies using less stringent U-factors in zone 5, moving zone 5 into the North Central, or

removing the minimum SHGC and SHGC trade-offs in the North. However, this is misunderstanding how the climate zones are established and defined … climate zones do *not* change, just *where* they are changes. ASHRAE 169 (and PNNL in earlier years) define each climate zone based on certain heating and cooling characteristics, which do not change. Zone 1 is Zone 1, and Zone 5 is Zone 5 … whether it is 1985 or 2025. What changes is the updated analysis of the weather station data to see where the boundaries of each zone lie, and yes, we do see those creeping north. This resulted in an update to the climate zone maps in ASHRAE 90.1-2016 and the 2021 IECC, where the boundaries move slightly and several counties on the boundaries change zones … climate change in the building codes! For example, Norfolk VA moved from zone 4 to zone 3. But that doesn't mean the criteria necessarily change for zone 4 or 3, just where they apply, and Norfolk will follow the zone 3 criteria in future codes.

I should point out that there is a new 2020 edition of ASHRAE 169 with the latest changes in the zone boundaries, but it's not dramatic. EPA can examine this if they like, but the change in zone boundaries is minimal in the north. The bigger change is in the boundary between zone 2 and 3 which is Energy Star South, but again nothing crazy, with the largest changes in TX and LA. However, since this new map has not been adopted in the energy codes yet, it makes sense to stick with the current proposed map for consistency with the energy codes.

Northern SHGC

I appreciate the detailed and updated analysis EPA and LBNL did for the north. As we've seen in previous analyses, higher SHGC saves more overall energy in this zone – it's not rocket science that the sun is our friend here in Wisconsin and other northern states. Some have claimed this effect is only applicable in homes designed with special passive solar features, but that is not true. There are no special assumptions about passive solar design in the analysis, and the new orientation sensitivity analysis looked at both optimal and worst-case conditions. The analysis supports what EPA is proposing regarding both a baseline minimum SHGC and optional SHGC trade-offs. I support both aspects.

The minimum SHGC is set low enough that it does not preclude homeowners from purchasing a solar control window when needed for special exposures or summer comfort reasons, but it does prevent ultra-low SHGC products that are inappropriate for the north from using the Energy Star label when it is not in the best interest of consumers and harms the Energy Star brand. We need to move beyond the days of one-product-fits-all, where the same window is sold with the Energy Star label in Phoenix and in Duluth when the energy efficiency needs are clearly different. The energy analysis shows a steady linear decrease in energy savings in zone 5 as SHGC is decreased from 0.35 to 0.17, and the effect will be more pronounced in zones 6-7. While I would have chosen a minimum SHGC a bit higher around 0.20-0.23, setting the minimum at 0.17 is a reasonable starting point.

The optional SHGC trade-offs also provide additional flexibility to manufacturers. Some will likely question the metrics involved in determining the trade-off numbers, and it is a good discussion. It may be helpful for EPA to clarify if the equivalent energy analysis used site energy, or if source energy conversion factors were considered (although the source factor for electricity is rapidly changing downward as more renewable energy comes online). Either way, it is useful to see the energy cost $ savings and payback also included as a metric, showing that while the trade-offs

were established using equivalent energy, they also provide cost effectiveness and reduced paybacks. And of course, the trade-offs are purely optional to provide additional flexibility; manufacturers don't have to use them if they don't want to. I'd like to also point out one additional metric and benefit to the trade-offs … carbon and greenhouse gas emissions. These SHGC trade-offs preferentially reduce heating use, which not only is beneficial in cold climates, but specifically also helps EPA's long term goals of reduced fossil fuel use, electrification, and decarbonization.

It has been pointed out that there may be a difference in the latest Energy Plus version that could impact the cooling energy results. I agree that it is important for EPA and LBNL to investigate this question, perhaps by comparing the results in a few sample locations. However, since cooling is a smaller portion of energy use in the north, it may not change the conclusions at all, or it may only lead to small modifications (e.g. from a U to SHGC trade-off ratio of 5:1 to something different like 4:1). I don't expect it to make major change in direction, but it is worthwhile taking a closer look.

In conclusion, I am very encouraged to see EPA propose a strong advancement for Energy Star which will ultimately be good for both the industry and general public, and I am very much in support of it.

Thank you and best regards,

Thomas D. Culp, Ph.D.