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December 18, 2020

California Energy Commission  
Docket Office, MS-4  
1516 Ninth Street MS-4  
Sacramento, CA 95814-5512

**Re: Response to Criticisms of Scientific Literature Establishing Relationship Between Gas Stoves and Health Impacts, Docket #19-BSTD-03 (2022 Energy Code Pre-Rulemaking)**

Dear Commissioners and Staff:

Burning fossil fuels in buildings degrades both indoor and outdoor air quality, in addition to posing a clear health risk to the public. In December 2019, the Massachusetts Medical Society recognized the association between gas cooking stoves, household air pollution and asthma.<sup>1</sup> Multiple peer-reviewed studies over the last several decades have demonstrated overwhelming evidence that gas stoves are a source of indoor air pollution, which increases the risk and severity of respiratory illnesses like asthma in children – a health risk much higher in homes with gas stoves than homes with electric stoves.<sup>2,3,4</sup> This is especially concerning in California where the prevalence of pediatric asthma is above the national average.<sup>5</sup> In a recent resolution, the California Air Resources Board (CARB) underscored the dangers of gas stove pollution and the urgency for the state to act to reduce that pollution.<sup>6</sup> The air quality and health experts at CARB found that statewide building codes are not protective enough of public health and described the urgent need for the state to rapidly strengthen building codes to address gas appliance pollution.

Despite the mounting scientific evidence of the health harms from gas stove pollution, several industry groups have submitted comments to the California Energy Commission (CEC), attempting to call that evidence into question. Most notably, the Southern California

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<sup>1</sup> Mass Medical Society Recognizes Link Between Gas Stoves, Indoor Air Pollution and Asthma.

<https://gbpsr.org/wp-content/uploads/sites/11/2020/01/gas-cooking-and-asthma-2019-mms.pdf>

<sup>2</sup> Belanger K et al., *Association of indoor nitrogen dioxide exposure with respiratory symptoms in children with asthma*. AM J RESPIR CRIT CARE MED (2006), available at <https://www.atsjournals.org/doi/full/10.1164/rccm.200408-1123OC>.

<sup>3</sup> J. D. Spengler et al., "Nitrogen Dioxide and Respiratory Illness in Children. Part IV: Effects of Housing and Meteorologic Factors on Indoor Nitrogen Dioxide Concentrations," *Research Report (Health Effects Institute)* 58 (December 1, 1996): 1–29; discussion 31–36, <https://pubmed.ncbi.nlm.nih.gov/9063844/>.

<sup>4</sup> N. A. Mullen et al., "Results of the California Healthy Homes Indoor Air Quality Study of 2011–2013: Impact of Natural Gas Appliances on Air Pollutant Concentrations," *Indoor Air* 26, no. 2 (March 17, 2015): 231–45, <https://doi.org/10.1111/ina.12190>.

<sup>5</sup> California Department of Public Health, "Asthma Prevalence in California: A Surveillance Report," January 2017, [https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/CDPH%20Document%20Library/Asthma\\_Surveillance\\_in\\_CA\\_Report\\_2017.pdf](https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/CDPH%20Document%20Library/Asthma_Surveillance_in_CA_Report_2017.pdf).

<sup>6</sup> California Air Resources Board, *Resolution 20-32*, (November 19, 2020), <https://ww3.arb.ca.gov/board/res/2020/res20-32.pdf>

Gas Company (SoCalGas) submitted comments on October 16, 2020 (hereinafter referred to as “SoCalGas Comments”) that criticize specific findings in the scientific literature.<sup>7</sup> This letter responds to SoCalGas’s comments by addressing the following points:

- 1) As gas stoves release unique pollutants beyond those from electric stoves, ventilation is important but not sufficient to protect health**
- 2) Exposure to nitrogen dioxide causes health impacts both in the short- and long- term**
- 3) A robust body of evidence demonstrates the link between gas stoves and health impacts**
- 4) SoCalGas misrepresents the findings and scope of additional studies, which in fact support a link between gas stoves and asthma.**

### **1) As Gas Stoves Release Unique Pollutants Beyond Those from Electric Stoves, Ventilation Is Important but not Sufficient to Protect Health**

SoCalGas comments attempt to suggest that ventilation alone is enough to reduce the incidents of asthma in children.<sup>8</sup> For example, they assert that “[a]dequate ventilation effectively mitigates emissions from all cooking and does not differentiate between energy sources.”<sup>9</sup> SoCalGas is incorrect. Because gas stoves burn gas anytime the stove is on, they produce unique combustion-based pollutants that cannot be remedied by ventilation alone.

RMI’s previous comments submitted on September 28 and October 16 provide additional research and facts to describe the unique risks of gas stoves, which are summarized below.<sup>10,11</sup>

Gas stoves present a unique and dangerous human health threat due to combustion of a methane-based fuel inside buildings. Gas stove combustion produces *additional* particulate matter (PM) beyond that which is emitted from cooking, as well as nitrogen dioxide (NO<sub>2</sub>) and carbon monoxide.<sup>12</sup> Because electric stoves do not combust fuels directly, they emit much lower or zero levels of these pollutants. Plus, unlike other gas appliances that are

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<sup>7</sup> Southern California Gas Company, Southern California Gas Company Comments – Comments on Sept 30, 2020, IAQ Workshop, Docket # 19-BSTD-03, TN#235288 (filed Oct 16, 2020) [hereinafter referred to as “SoCalGas Comments”]. See also, e.g., Association of Home Appliance Manufacturers (AHAM), AHAM Comments for Hearing on Indoor Cooking, Ventilation, and Indoor Air Quality, Docket #19-BSTD-03, TN#235281 (filed Oct 16, 2020) [hereinafter referred to as “AHAM Comments”].

<sup>8</sup> See SoCalGas Comments, p. 3.

<sup>9</sup> *Id.*

<sup>10</sup> Rocky Mountain Institute, RMI, Redwood Energy, Guttman and Blaevoet, Mothers Out Front, NRDC, Sierra Club Response to SoCalGas on Indoor Air Quality, Docket # 19-BSTD-03, TN #234934-1 (filed Sep 28, 2020) [hereinafter referred to as “RMI Sep 28 Comments”].

<sup>11</sup> Rocky Mountain Institute, Sierra Club CA, EHDD Architecture, Rocky Mountain Institute, Sierra Club CA, EHDD Architecture Comments – EHDD Comments on Sept 30, 2020 Indoor Air Quality Workshop, Docket #19-BSTD-03, TN #235287, (filed Oct 16, 2020) [hereinafter referred to as “RMI Oct 16 Comments”].

<sup>12</sup> Peter Strait, California Energy Commission, Sept. 30, 2020 Presentation Slide 11. Link: <https://efiling.energy.ca.gov/GetDocument.aspx?tn=234999&DocumentContentId=67873>

required to vent outside because of known health risks, gas stoves may vent indoors making them even more dangerous.<sup>13</sup>

As the California Air Resources Board (CARB) has articulated, ventilation is *necessary but not sufficient* to address the adverse health effects of gas appliances.<sup>14</sup> While ventilation—and to that effect, more stringent ventilation standards for gas stoves—are absolutely necessary, ventilation alone will not solve the problem of the additional NO<sub>2</sub> pollution from gas stoves. In fact, even the Kile et al study cited by SoCalGas shows that ventilation can improve asthma outcomes, but not fully reduce the risk of asthma while cooking with gas.<sup>15</sup> A notable 2014 study, Paulin et al, conducted a three-armed randomized trial to evaluate the efficacy of interventions to reduce indoor NO<sub>2</sub> concentrations in homes with unvented gas stoves. Their results found that ventilation hood installation alone did not significantly change NO<sub>2</sub> levels. In contrast, replacing gas stoves with electric stoves decreased median NO<sub>2</sub> concentrations by 51% in the kitchen and 42% in the bedroom.<sup>16</sup>

Behavioral factors such as choosing to use ventilation is another issue. Data presented by the Lawrence Berkeley National Laboratory showed that fewer than 40% of people claim to use their range hood “always” or “most of the time.”<sup>17</sup> A follow-up study revealed that people actually use range hoods less than half the time that they say they do, suggesting that fewer than 20% of people consistently use their range hoods.<sup>18</sup>

To this extent, solely relying on human behavior to ensure the safety of our indoor air is a fallible mitigation strategy. Ventilation is not enough. Replacing gas stoves with electric stoves will eliminate unnecessary exposure to NO<sub>2</sub> and other harmful pollutants caused by gas stove combustion.

## **2) Exposure to Nitrogen Dioxide Causes Health Impacts Both in the Short- and Long-Term**

SoCalGas asserts that using peak emissions exposure levels is an “incorrect comparison to the federal standard.”<sup>19</sup> This is an attempt to cast doubt on the dangers of gas stove pollution by claiming that indoor air quality impacts are exaggerated by looking at peak emissions rather than time-averaged emissions. This claim, also raised in comments

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<sup>13</sup> International Code Council, “2018 INTERNATIONAL FUEL GAS CODE – ICC DIGITAL CODES,” codes.iccsafe.org, August 2017, <https://codes.iccsafe.org/content/IFGC2018>.

<sup>14</sup> California Air Resources Board, “Update to Indoor Air Quality Successes, Continuing Concerns, and Challenges,” CARB, November 19, 2020, <https://ww3.arb.ca.gov/board/books/2020/111920/20-12-4pres.pdf>.

<sup>15</sup> Molly L Kile et al., “A Cross-Sectional Study of the Association between Ventilation of Gas Stoves and Chronic Respiratory Illness in U.S. Children Enrolled in NHANESIII,” *Environmental Health* 13, no. 1 (September 2, 2014), <https://doi.org/10.1186/1476-069x-13-71>.

<sup>16</sup> L. M. Paulin et al., “Home Interventions Are Effective at Decreasing Indoor Nitrogen Dioxide Concentrations,” *Indoor Air* 24, no. 4 (August 1, 2014): 416–424, <https://doi.org/10.1111/ina.12085>.

<sup>17</sup> Brett C. Singer. “Gas Burners, Cooking and Kitchen Ventilation: Presentation to CEC Indoor Cooking and Air Quality Workshop” Lawrence Berkeley National Lab, 2020, <https://efiling.energy.ca.gov/GetDocument.aspx?tn=235047&DocumentContentId=67939>.

<sup>18</sup> Yang Kim, Brennen Less, and Brett Singer, “Ventilation and Indoor Air Quality in New California Homes with Gas Appliances and Mechanical Ventilation,” *Lawrence Berkeley National Laboratory*, March 22, 2019, 28, <https://escholarship.org/content/qt44g399sb/qt44g399sb.pdf>.

<sup>19</sup> See SoCalGas Comments, p.4.

submitted by the Association of Home Appliance Manufacturers on October 16,<sup>20</sup> is unfounded and misleading. Our earlier comments responded to similar arguments in detail, and more information is available in Rocky Mountain Institute's joint comments submitted on September 28 and October 16.<sup>21</sup>

In brief, as described in our earlier comments, gas stoves have been found to frequently produce indoor concentrations of nitrogen dioxide (NO<sub>2</sub>) that exceed health-based standards, not only at a peak level but also at time-averaged levels.<sup>22</sup> Health harms from NO<sub>2</sub> pollution can occur on a range of time scales, not just over the 1-hour time period in the federal outdoor air standards.<sup>23</sup> Both duration and intensity of exposure can exacerbate harm, with both long-term low levels of pollution and repeated spikes (peaks) of high-level pollution adding to risk.<sup>24</sup> Furthermore, repeated short-term exposure can accumulate over time and lead to long-term effects.<sup>25</sup>

As the Environmental Protection Agency (EPA) has stated, "repeated short-term NO<sub>2</sub> exposure could lead to the development of asthma."<sup>26</sup> Studies have also shown that repeated exposures to short-term peaks of NO<sub>2</sub> can be a more important determinant of airway symptoms than total dose or absolute background exposure levels.<sup>27,28,29</sup> In sum, peak emissions can also contribute to health effects. Evidence shows that NO<sub>2</sub> pollution causes health impacts with both short- and long-term exposures.

### **3) A robust body of evidence shows the link between gas stoves and health impacts**

SoCalGas seeks to discredit the peer-reviewed literature that demonstrates the clear link between gas stoves and harms to public health, including their contribution to asthma.<sup>30</sup> However, this critique is misguided. The scientific consensus that gas stoves harm human health is robust and growing ever stronger. The clear relationship between gas stoves, increased NO<sub>2</sub> levels in homes and increased incidence of asthma is thoroughly detailed in

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<sup>20</sup> See AHAM comments, *supra* note 7.

<sup>21</sup> See *generally* RMI Sep 28 Comments, *supra* note 10 and *generally* RMI Oct 16 Comments, *supra* note 11.

<sup>22</sup> See RMI Oct 16 Comments, p. 3-4.

<sup>23</sup> See RMI Oct 16 Comments, p 4.

<sup>24</sup> See RMI Oct 16 Comments, p 4.

<sup>25</sup> See RMI Oct 16 Comments, p 4-5.]

<sup>26</sup> U.S. EPA. Integrated Science Assessment (ISA) For Oxides of Nitrogen – Health Criteria (Final Report, 2016). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-15/068, 2016, pg. lxxxv

<sup>27</sup> Peter Franklin et al., "Comparison of Peak and Average Nitrogen Dioxide Concentrations inside Homes," *Atmospheric Environment* 40, no. 38 (December 1, 2006): 7449–7454, <https://doi.org/10.1016/j.atmosenv.2006.06.042>.

<sup>28</sup> D. E. Gardner et al., "Influence of Exposure Mode on the Toxicity of NO<sub>2</sub>," *Environmental Health Perspectives* 30 (June 1, 1979): 23–29, <https://doi.org/10.1289/ehp.793023>.

<sup>29</sup> J. A. Graham et al., "Influence of Exposure Patterns of Nitrogen Dioxide and Modifications by Ozone on Susceptibility to Bacterial Infectious Disease in Mice," *Journal of Toxicology and Environmental Health* 21, no. 1–2 (1987): 113–125, <https://doi.org/10.1080/15287398709531006>.

<sup>30</sup> See SoCalGas Comments, *supra* note 7, p. 5.

peer-reviewed literature.<sup>31,32,33</sup> The specific studies that SoCalGas critiques—namely Lin et al. and Belanger et al.—are peer-reviewed, well-executed, and sound. Furthermore, findings from additional studies are consistent with the conclusions found in Lin et al and Belanger et al.

SoCalGas in their comments focused on the isolated limitations of each individual study, choosing to ignore the fact that the body of research, in aggregate, shows a clear linkage between gas stoves, NO<sub>2</sub> (and other combustion-related pollutants), and harms to public health. Of course, every study has its limitations, and no individual study can comprehensively cover every facet of gas stove pollution. This makes it imperative to review the scientific research in aggregate, as well as pay careful attention to studies that systematically compile the breadth of scientific literature such as the Lin et al.'s meta-analysis and EPA's integrated science assessment.<sup>34, 35</sup> The following is a summary of the key takeaways from major studies that establish a clear link between gas stoves and health impacts: Lin et al; Belanger et al (2006 and 2013); Paulin et al.; two science assessments by Health Canada and the U.S. EPA; and a recent resolution by CARB.

Meta-analyses, such as Lin et al., aggregate multiple studies to provide a more precise estimate of the effect size, or the strength of the relationship between two variables (in this case, gas cooking and asthma). An advantage of the meta-analysis methodology is that it increases the generalizability of the results of individual studies. The results of the Lin et al study support and build upon a previous meta-analysis conducted in 1992 by Hasselblad et al which, at that time, served as the basis for the World Health Organization (WHO) indoor and outdoor NO<sub>2</sub> guideline. Both the Lin and Hasselblad studies conclude that there is a relationship between gas cooking and respiratory effects, like asthma.

Gas cooking is a main predictor of indoor NO<sub>2</sub> concentrations; therefore, it is often used as a proxy for indoor NO<sub>2</sub> exposure.<sup>36</sup> The relationship between NO<sub>2</sub> exposure and childhood asthma is in fact well-documented in recent peer-reviewed literature, with federal agencies contributing to this growing body of research.<sup>37</sup> In 2016, the EPA made the conclusive finding that there is a causal relationship between short-term exposure to NO<sub>2</sub> and respiratory effects such as asthma attacks. They also found there is likely to be a causal relationship between long-term exposure to NO<sub>2</sub> and respiratory effects including the development of asthma. Meanwhile, the 2013 comprehensive Lin meta-analysis reviewed 36 years of research and found that children living in homes with a gas stove are 42% more

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<sup>31</sup> Kathleen Belanger et al., "Household Levels of Nitrogen Dioxide and Pediatric Asthma Severity," *Epidemiology* 24, no. 2 (March 2013): 320–30, <https://doi.org/10.1097/ede.0b013e318280e2ac>.

<sup>32</sup> See RMI comments, *supra* 10.

<sup>33</sup> See RMI comments, *supra* 11.

<sup>34</sup> W. Lin, B. Brunekreef, and U. Gehring, "Meta-Analysis of the Effects of Indoor Nitrogen Dioxide and Gas Cooking on Asthma and Wheeze in Children," *International Journal of Epidemiology* 42, no. 6 (August 20, 2013): 1724–37, <https://doi.org/10.1093/ije/dyt150>.

<sup>35</sup> See EPA, *supra* note 27.

<sup>36</sup> Brett Singer, Lawrence Berkeley National Lab, Sept. 30, 2020 Presentation Slide 7 (citing N.A. Mullen et al., *Results of the California Healthy Homes Indoor Air Quality Study of 2011-13: Impact of Natural Gas Appliances on Air Pollutant Concentrations*, 26 INDOOR AIR 231-245 (2015)).

<sup>37</sup> See EPA, *supra* note 27.



likely to experience asthma symptoms and 24% more likely to be diagnosed with asthma by a doctor compared to those living in homes with electric stoves.

When analyzing existing literature, it is extremely important to include studies that have measured concentrations of NO<sub>2</sub>. Studies without direct NO<sub>2</sub> measurements have a greater risk of measurement error, due to the potential for higher exposure misclassification.<sup>38</sup> None of the studies cited by SoCalGas include actual in-home measurements.<sup>39</sup> In contrast, the studies that incorporate in-home NO<sub>2</sub> measurements consistently find a strong link between NO<sub>2</sub> exposure and respiratory health effects. For example, Belanger et al 2013 is a key epidemiological study, a yearlong large prospectus study of 1,342 asthmatic children including four in-home NO<sub>2</sub> measurement periods. That direct measurement study found that that when asthmatic children were exposed to low levels of NO<sub>2</sub> concentrations (as low as 11 ppb), their asthma got worse.

Health Canada relied on direct NO<sub>2</sub> measurement studies, including this Belanger study, in their 2015 residential indoor air quality science assessment. The Health Canada report highlighted the strengths of the Belanger study including methodology, relatively large sample size, exposure characterizations, monitoring in two rooms and in multiple seasons, and use of the asthma severity score which reduces confounding factors.<sup>40</sup> In Health Canada's overall assessment of indoor NO<sub>2</sub>, Belanger et al and two other studies provided the strongest basis for determining the exposure level at which adverse respiratory health effects can be observed.<sup>41</sup>

Studies with asthmatic children are also critical to include in a literature review, as children with asthma are one of the populations most susceptible to gas stove pollution. Belanger's prior 2006 study of 728 children with physician-diagnosed asthma found evidence supporting statistically significant associations between high indoor NO<sub>2</sub> concentrations and increased respiratory symptoms.<sup>42</sup> The study included 728 children with active asthma and adjusted for age, ethnicity, humidity, mold, medication use, and season of sampling. The study found significant associations between NO<sub>2</sub> and the likelihood as well as the recurrence of wheeze and chest tightness. Additionally, measured mean NO<sub>2</sub> concentrations in homes with electric stoves were significantly lower than those with gas stoves. Health Canada's assessment of indoor NO<sub>2</sub> studies noted that this study was robust

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<sup>38</sup> Health Canada (2015) Residential Indoor Air Quality Guideline Science Assessment Document NITROGEN DIOXIDE, p. 11.

<sup>39</sup> Kile, Wong, Norback, Svendsen, Huang all used survey methods and did not include actual in-home measurements.

<sup>40</sup> "The Belanger et al. (2013) study methodology is generally stronger compared to other studies investigating health effects of NO<sub>2</sub> exposure in children. The study size is relatively large and only children with active asthma were included. Exposure to NO<sub>2</sub> in the home was better characterized as compared to other studies, as the measurement of NO<sub>2</sub> was carried out in two rooms over a month-long period, for each season of the year. Children's symptoms were recorded daily throughout the year as well, so that seasonal variations were represented in the reporting. Finally, the authors underlined the importance of the use of an asthma severity score as a health outcome, which includes the extent of the use of medication, to reduce confounding by socioeconomic status." See Health Canada (2015) Residential Indoor Air Quality Guideline Science Assessment Document NITROGEN DIOXIDE, p 52

<sup>41</sup> See Health Canada, *supra* note 33, p. 72.

<sup>42</sup> Belanger K et al., *Association of indoor nitrogen dioxide exposure with respiratory symptoms in children with asthma*. AM J RESPIR CRIT CARE MED (2006), available at <https://www.atsjournals.org/doi/full/10.1164/rccm.200408-1123OC>.

in supporting an association between higher indoor NO<sub>2</sub> concentrations and increased respiratory symptoms in children.<sup>43</sup>

Most recently, on November 19, 2020, CARB unanimously passed Resolution 20-32, which cites the link between gas appliance pollution and health impacts as a key basis for taking stronger action to reduce indoor air pollution from appliances. It states, “studies have linked exposure to high levels of NO<sub>2</sub> and other nitrogen species (NO<sub>x</sub>) emitted from gas appliances with asthma and exacerbation of other respiratory symptoms.”<sup>44</sup>

Peer-reviewed science unequivocally links gas stoves and negative health impacts. Any claims of the contrary are misinformed, misguided, and misleading.

#### **4) SoCalGas Mischaracterizes the Findings of Additional Health Studies**

SoCalGas attempts to cast doubt on the research establishing a clear link between gas stoves and health effects by selectively citing other studies and trying to claim inconsistency. These arguments fall flat. Contrary to the arguments by SoCalGas, nearly every study they cite offers evidence that there is an association between gas cooking and asthma plus other health effects.

SoCalGas attempts to deflect from these significant findings by often conflating wheeze symptoms with asthma. SoCalGas’ selective focus on the mixed evidence on the relationship between gas stoves and wheeze is problematic because it ignores the consistent and robust finding that gas stoves increase the likelihood of doctor-diagnosed asthma. In cases where associations with gas cooking and asthma are found, but wheeze is not, SoCalGas fails to account for use of asthma medication, which is well known to reduce wheeze symptoms.<sup>45</sup>

SoCalGas’s comments suffer from other weaknesses, as well. In many cases, SoCalGas misrepresents the main findings and purpose of studies. To the extent that SoCalGas’s cited studies do diverge from the scientific consensus that gas stoves contribute to respiratory harm, those findings are questionable. Unlike the Belanger or Paulin research, none of SoCalGas’s cited studies measured concentrations of NO<sub>2</sub> in the home—they were based on survey data alone. Additionally, data on type of cooking fuel (e.g., natural gas or propane) is often either lacking or unspecified.

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<sup>43</sup> See Health Canada, *supra* note 33, p. 71.

<sup>44</sup> See California Air Resources Board, *supra* note 6.

<sup>45</sup> One of the studies that SoCalGas cites—Huang et al.—acknowledges the point that asthma medication may mask a relationship between gas stoves and wheeze. Huang et al. notes it is possible that children who have asthma or rhinitis (stuffy nose) may take medicine that controls associated wheeze. They suggest this is a likely plausible as China has historically overused antibiotics, with as many as half of all outpatients receiving prescriptions. Shaodan Huang et al., “Home Environmental and Lifestyle Factors Associated with Asthma, Rhinitis and Wheeze in Children in Beijing, China,” *Environmental Pollution (Barking, Essex: 1987)* 256 (January 1, 2020): 113426, <https://doi.org/10.1016/j.envpol.2019.113426>.



The major takeaway is that nearly every study that SoCalGas cites actually confirms the link between gas stoves and asthma. Kile et al is a nationally representative sample which shows that children living in homes that use gas for cooking and heating have the highest likelihood of asthma.<sup>46</sup> Svendsen et al. found that “cooking with gas stoves” was “associated with both allergy and asthma prevalence” and that children in homes with gas stoves with or without pilot lights had decreased pulmonary function.<sup>47</sup> Similarly, Huang et al. reported a two-fold statistically significant increased risk of current asthma in children who used gas stoves for cooking in China in a study with a large sample size of 2,214 children.<sup>48</sup>

In arguing that Norback et al. found no association between asthma and gas cooking, SoCalGas mischaracterizes the purpose of that study. The study did not look at asthma, but instead examined the prevalence, onset and remission of wheeze and rhinitis among children across China.<sup>49</sup> Much like comparing apples to oranges, examining the occurrence of wheeze and rhinitis in children is not comparable to doing so for asthma in children and should not be used as authority on such. For what it is worth, Norback et al. found that gas cooking was associated with the onset of rhinitis. Their data also shows that having an electric stove is more protective for wheeze as compared to having a gas stove.<sup>50</sup> In the concluding recommendation section, the authors state there is a need to improve the home environment, including “encouraging the use of electricity for cooking.”<sup>51</sup>

Wong et al. is the single study cited by SoCalGas that did not find an association between gas cooking and asthma.<sup>52</sup> This study is based on a self-reported global survey in which the respondents were children aged 13-14 and parents of kids aged 6-7.<sup>53</sup> A main factor that could mask an association between gas cooking and asthma is that Wong et al. combined 31 countries in the study. By combining data from 31 countries, the differences across countries in housing characteristics, ambient temperatures, and ventilation may mask the association between gas cooking and asthma. Additionally, without better isolation between geographies and types of housing and associated ventilation, it is problematic to assume the global findings are applicable to California or the United

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<sup>46</sup> See Kile et al, *supra* note 15.

<sup>47</sup> Erik R. Svendsen, Melissa Gonzales, and Adwoa Commodore, “The Role of the Indoor Environment: Residential Determinants of Allergy, Asthma and Pulmonary Function in Children from a US-Mexico Border Community,” *Science of The Total Environment* 616–617 (March 1, 2018): 1513–1523, <https://doi.org/10.1016/j.scitotenv.2017.10.162>. p. 1516 – 1517.

SoCalGas claimed that Svendsen et al. reported a 22% decrease in lifetime asthma in children who lived in homes with gas stoves versus electric stoves. This trend would be contrary to the trend of the rest of the literature, however that statistic is not reported anywhere by the authors in the study.

<sup>48</sup> See Huang, *supra* note 47, p 5, 7.

<sup>49</sup> “Norback et al. reported no association between gas cooking and current asthma.” Dan Norbäck et al., “Onset and Remission of Childhood Wheeze and Rhinitis across China - Associations with Early Life Indoor and Outdoor Air Pollution,” *Environment International* 123 (February 1, 2019): 61–69, <https://doi.org/10.1016/j.envint.2018.11.033>.

<sup>50</sup> See Norbäck, *supra* note 45, p. 66. In table it shows that having an electric stove is protective for wheeze compared to gas stoves, but it wasn’t statistically significant .91 (.075, 1.10).

<sup>51</sup> See Norbäck at 45, p. 68.

<sup>52</sup> See SoCalGas Comments, *supra* note 7.

<sup>53</sup> Gary WK Wong et al., “Cooking Fuels and Prevalence of Asthma: A Global Analysis of Phase Three of the International Study of Asthma and Allergies in Childhood (ISAAC),” *The Lancet Respiratory Medicine* 1, no. 5 (July 2013): 386–94, [https://doi.org/10.1016/s2213-2600\(13\)70073-0](https://doi.org/10.1016/s2213-2600(13)70073-0).

States.<sup>54</sup> In short, one cross-sectional study not specific to the U.S. does not call into question an entire body of scientific literature that has established a clear relationship between gas stoves and respiratory health effects.

## **CONCLUSION**

Ensuring that Californians are able to breathe clean air inside our buildings is crucial to our well-being, and never has this been clearer than in 2020, when respiratory health has come into sharp focus. SoCalGas and allies have misrepresented the findings of several studies, citing not only research that has been completely taken out of context but more dangerously misrepresents the current scientific understanding of public health threats. The scientific evidence is clear that unlike electric appliances, gas appliances in buildings are responsible for poor air quality and its associated health impacts. Health risks from indoor air pollution are not adequately addressed by current regulation. Implementing more rigorous policies that reduce household gas stove pollution will help California reduce the risk of childhood asthma, asthma symptoms and asthma-related emergency department visits. The time is right for the CEC to take strong action in protecting the health of all Californians.

Respectfully submitted,

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**Rocky Mountain Institute**

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<sup>54</sup> For example, the study does not control for ventilation or ambient temperature (i.e., living in warmer climates where windows may be open can lead to decreased emissions concentrations and affect personal exposure). A study from Lawrence Berkeley National Laboratory, particular to the California climate, clearly shows that NO<sub>2</sub> levels are highest in the winter when windows are closed. Jennifer M. Logue et al., "Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California," www.osti.gov, June 1, 2014, <https://www.osti.gov/servlets/purl/1163745>.