



2023 Technical Conference

Indoor Air Quality and Cooking with Natural Gas

Frank Johnson, PhD
R&D Manager

Residential Cooking IAQ – The Issue

Growing Concerns of the Safety of Cooking with Natural Gas



FACTSHEET

Gas stoves and asthma in children

indoor pollution healthy home triggers

DONATE

tove, your

DONATE

Why experts are concerned

Opinion

NEWS

As Cities Grow, Concerns About Gas Stoves Increase

THE CONVERSATION

Academic rigor, journalistic flair

COVID-19 Arts + Culture Economy + Business Education Environment + Energy Ethics + Religion Health Politics + Society Science + Technology

Q Search analysis, research, academics...



Gas cooking is associated with worsening asthma in kids. But proper ventilation helps

The Washington Post

How electric stoves are poised to dethrone the mighty gas range

Gas stoves cause indoor air pollution, health risks



Childhood asthma; worse covid outcomes

Residential Cooking IAQ – The Issue

Claims against Cooking with Natural Gas

- Causes 12% of all asthma cases in children
- Causes asthma in women
- Causes allergies in children
- Lowers IQ or causes learning disabilities in children
- Makes COVID symptoms worse
- Releases harmful greenhouse gases
- Larger carbon footprint than electric
- Causes cancer
- Wastes more energy than electric
- Releases harmful PM (particulate matter) that kills 354 persons/year in California



Residential Cooking IAQ – The Issue

Good Morning America: Nov 2, 2021



Residential Cooking IAQ – The Issue

NPR segment *"We need to talk about your gas stove, your health and climate change"*

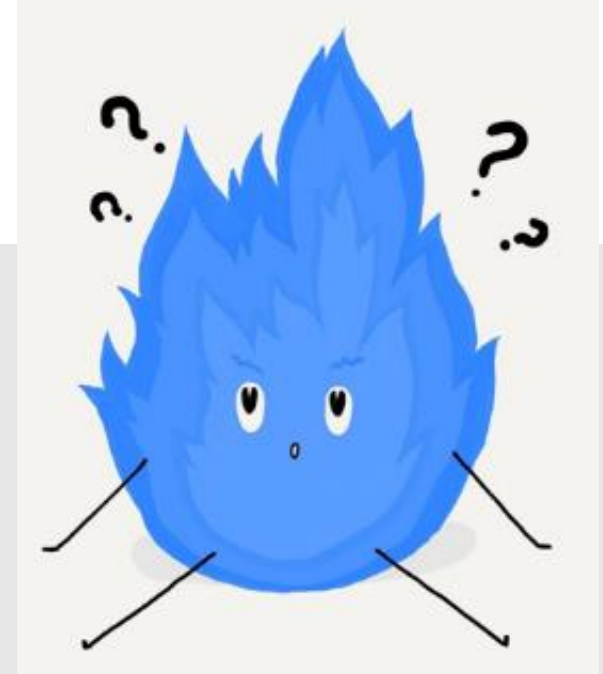
- Tests conducted by a professor of environmental epidemiologist from Drexel University in his own home and using a rented NO₂ monitor
- States that NO₂ levels exceeded World Health Organization guidelines of 106 ppm
 - Instantaneous readings and not time averaged as is conventionally done for IAQ measurements



Q&A: Indoor Air Quality and Cooking with Natural Gas

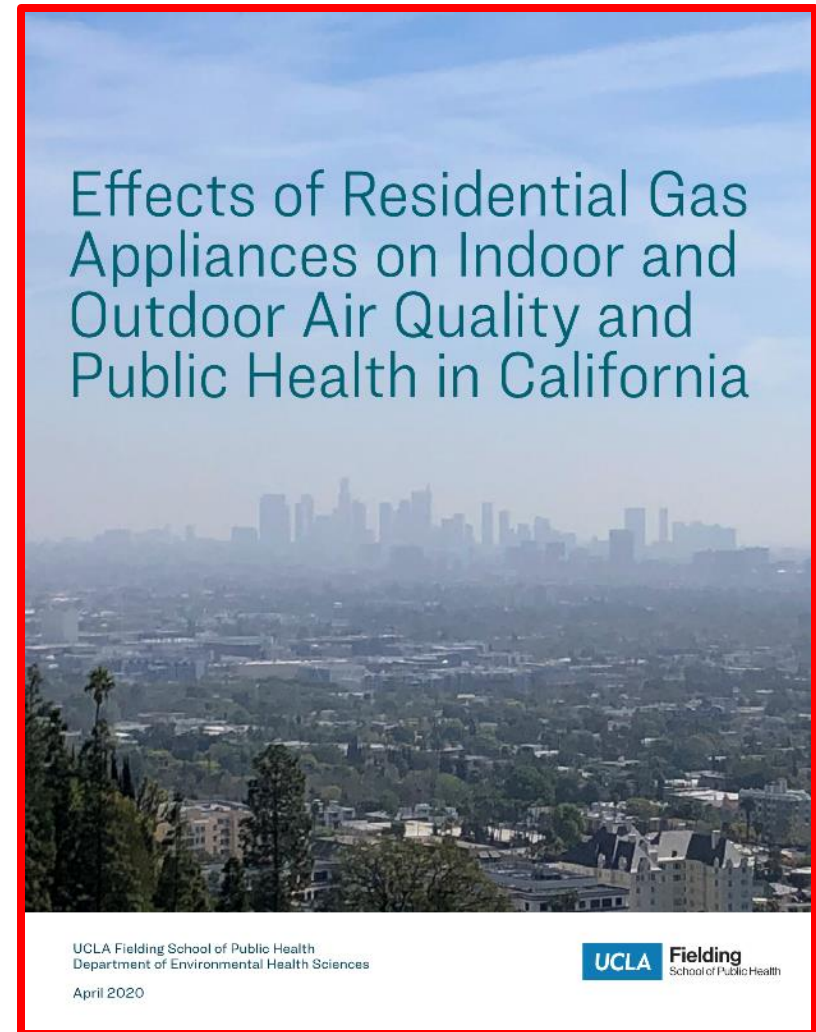
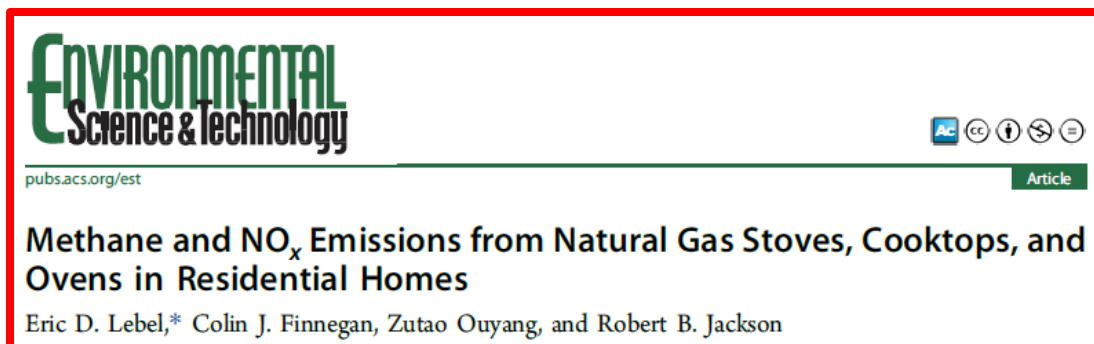
OR

HOW DO I RESPOND TO QUESTIONS
ABOUT IAQ AND COOKING WITH
NATURAL GAS



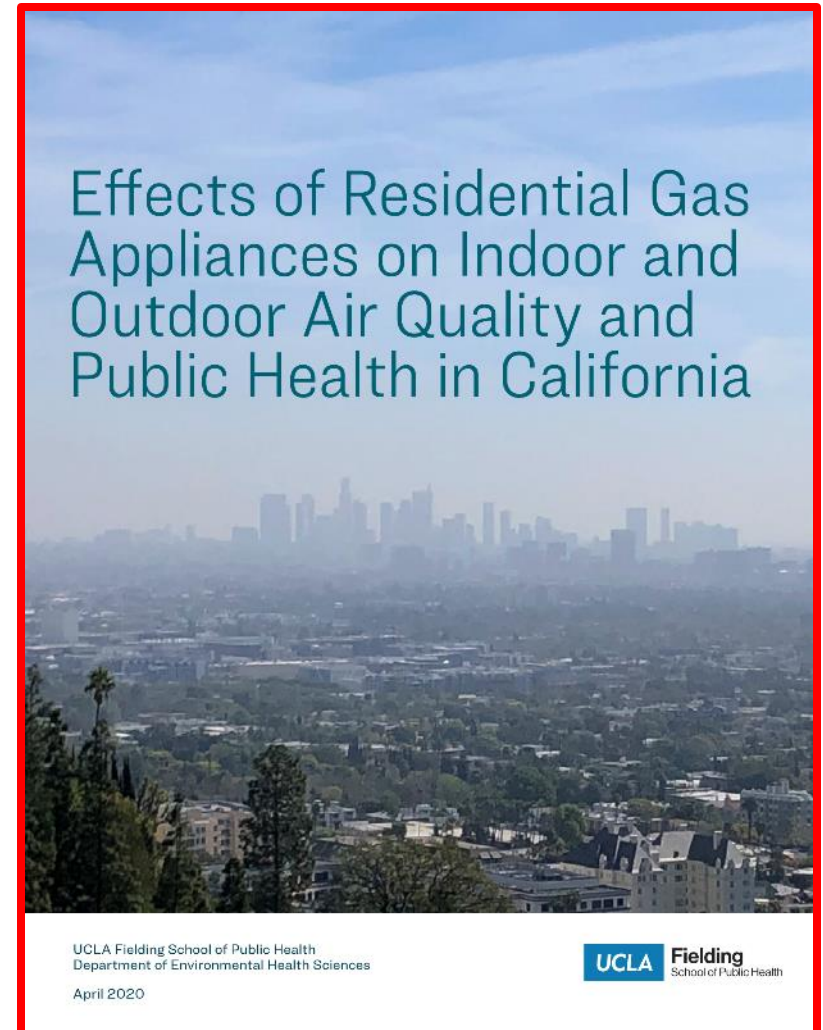
IAQ Q&A

- Question: **With all the sources coming out about the harmful effects of cooking with natural gas, it must be dangerous?**
- Answer:
 - Very little new data
 - UCLA Study
 - Stanford Study



IAQ Q&A

- Question: **What Does the UCLA Study Say?**
- Answer: Critical comments about using natural gas for residential cooking in terms of particulate matter (PM) and NOx
 - Example: Releases harmful PM (particulate matter) that kills 354 persons/year in California
- Question: **Does the data back the claims in the UCLA Study?**
- Answer: **No**



IAQ Q&A

Review by Daniel Tormey and Steve Huntley of Catalyst Environmental Solutions:

- Indoor air modeling results are incorrectly compared to NAAQS and CAAQS
 - Had the UCLA Report made the correct comparisons, it would have concluded that there are no adverse health impacts from indoor use of natural gas appliances.
- Cites several references that conclude that indoor air quality is more a function of what is being cooked, rather than the fuel used for cooking.
- Does not consider consequences of electrification (cost and disproportionate adverse impacts to disadvantaged communities, availability, hazards)
- Results depend upon a sequential series of assumptions, some of which are unsupported by the literature.
- Numerous statements throughout the UCLA Report are not supported by the data provided or the references cited. Because the UCLA Report is built on data in the published literature, this problem indicates a flawed foundation for the findings.

Danish & Kimm

Report: Push to ban gas appliances in California based on faulty science

Cole Lauterbach, The Center Square

October 21, 2021 · 3 min read



IAQ Q&A

- Question: **What Does the Stanford Study Say?**
- Answer: Critical comments about using natural gas for residential cooking in terms of methane leaks and NOx



- Question: **Does the data back the claims in the Stanford Study?**
- Answer: **No**

IAQ Q&A

A review by **Menyae Christopher of Energy In-Depth, Five Facts on PSEHE's New Questionable Indoor Air Quality Study gives the following summary:**

- The author's health claims are unsupported by their findings and methods
 - Compared NO₂ emissions readings over the course of a few minutes to the NAAQS 1-hr outdoor air standard
- The researchers create an unrealistic kitchen environment to achieve their results
 - Kitchens sealed with plastic, prevents natural air flow
- The researchers have made false claims about natural gas in homes
 - Claims of small leaks in homes that are too small to smell (unlikely with odorants)
 - Encourage homeowners to tighten fittings themselves
- The study is affiliated with "Keep it in the Ground" groups
 - PSEHE, Tony Ingraffea, his research is "a form of advocacy"



IAQ Q&A

- Question: **Does cooking with natural gas cause asthma?**
- Answer: Undetermined, more data is needed

Wong et. Al, 2013, Cooking fuels and prevalence of asthma: a global analysis of phase three of the International Study of Asthma and Allergies in Childhood (ISAAC)

- Investigated the association between types of cooking fuels and symptoms of asthma using logistic regression
- Adjustments made for sex, region of the world, language, gross national income, maternal education, parental smoking and six other subject-specific covariates
- Data collected between 1999 and 2004
 - 198,398 children aged 6-7 years from 29 countries
 - 314,309 children aged 13-14 years from 47 countries
- Detected no evidence of an association between the use of gas as a cooking fuel and either asthma symptoms or asthma diagnosis for both age groups

IAQ Q&A

- Question: **Does cooking with natural gas cause asthma?**
- Answer: Undetermined, more data is needed

Jarvis et al, 1998, The association of respiratory symptoms and lung function with the use of gas for cooking. European Community Respiratory Health Survey

- European community respirator health survey
- Over 100,000 respondents
- Conclusion: No relation between the use of gas for cooking and obstructive respiratory symptoms

IAQ Q&A

- Question: **Who is RMI and what information are they presenting?**
- Answer:
 - Rocky Mountain Institute
 - Generate and distribute information and graphics from UCLA and Stanford studies



IAQ Q&A

EXHIBIT 1

Differentiating Pollutants from Cooking Food vs. Gas Fuel

Many factors contribute to which pollutants are generated from the stove and the food being cooked.

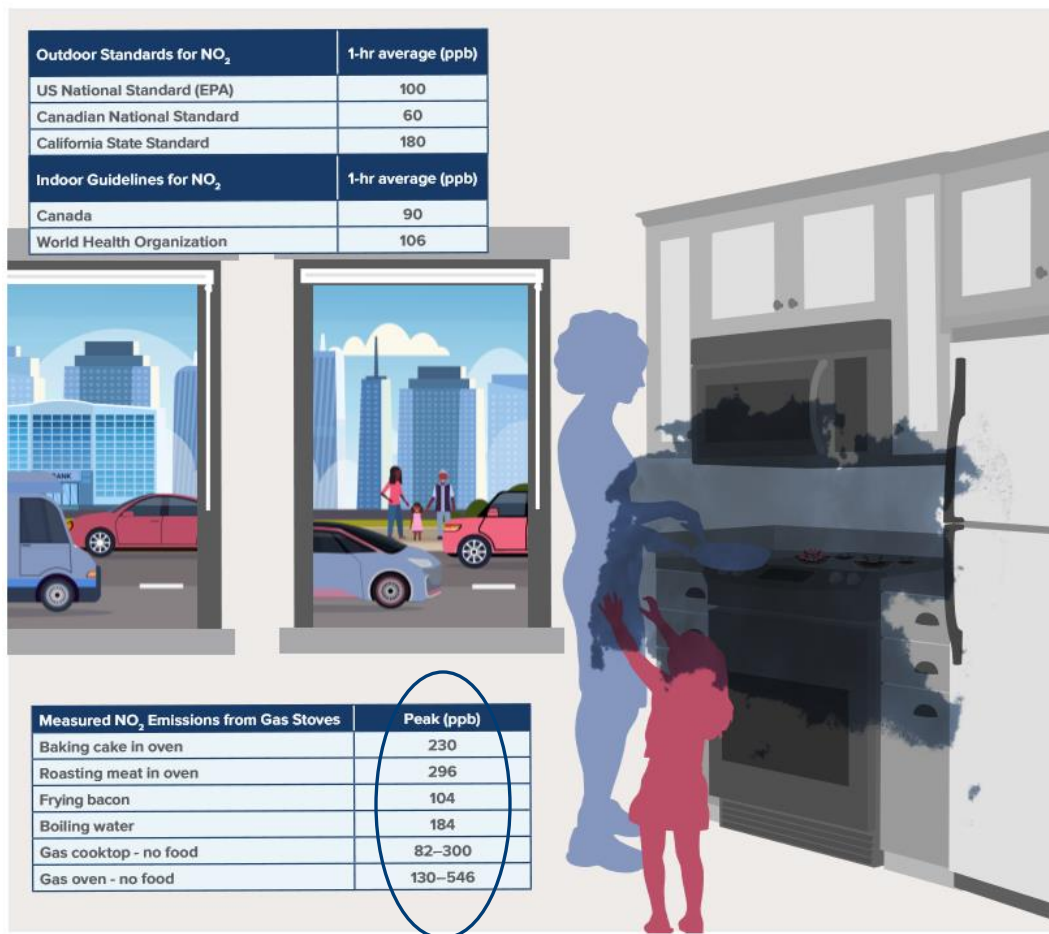
Pollutants Generated from Cooking Food (regardless of stove type)	Pollutants Associated With Gas Stoves
Particulate Matter (PM₁₀) Small particles with a diameter less than 10 micrometers. Commonly measured in cooking activities like frying or broiling with the highest emissions levels found during the oven self-cleaning cycle. ¹⁷	Particulate Matter (PM_{2.5}) Unlike electric stoves, gas stoves emit PM _{2.5} in the absence of cooking food (i.e., from the flames). Although cooking food emits PM _{2.5} , tests show PM _{2.5} emissions from gas stoves can be two times higher than from electric stoves. ¹⁸
Particulate Matter (PM_{2.5}) Small particles with a diameter less than 2.5 micrometers. PM _{2.5} can penetrate deep into the lungs and even enter the bloodstream. ¹⁹ Stove tests show emissions are dependent on a number of factors such as the type of food cooked, cooking temperature, type of oil used, and type of fuel/stove used. ²⁰	Nitrogen Oxides (NO_x) When nitrogen and oxygen react to each other, especially at high temperatures, they produce several toxic gases. NO ₂ and NO are the principal gases associated with combustion sources (collectively known as NO _x). ^{21,22} *A 2001 laboratory study showed no rise in NO _x when using an electric stove. ²³ *A study published in 2016 showed that after subtracting outdoor contribution, all-electric homes had NO _x levels close to zero. ²⁴
Ultrafine Particles (UFP) These tiny particles are less than 100 nanometers (nm) in diameter and are hazardous to health. Cooking is the main source of UFP in homes, particularly those with gas stoves. ²⁵ Gas stoves and electric coil resistance stoves emit high quantities of UFP, particularly smaller than 10 nm in diameter. ²⁶	Nitrogen Dioxide (NO₂) Nitric Oxide is oxidized in the air to form NO ₂ . More data exists on NO ₂ than NO. NO ₂ is regulated by the EPA and thus is the component most studied and considered by the EPA in terms of health effects. ²⁷

18. Tianchao Hu, Brett C Singer, Jennifer M Logue, *Compilation of Published PM_{2.5} Emission Rates for Cooking, Candles and Incense for Use in Modeling Exposures in Residences*, Ernest Orlando Lawrence Berkeley National Laboratory, 2012, p. 11, <https://www.osti.gov/servlets/purl/1172959>.

Some studies compared different types of stoves to see if stove fuel type influenced particle emission rates. Zhang et al performed repeated cooking experiments frying chicken on gas and electric types of ranges. The results showed that emissions from the use of the gas stove were a factor of 2 higher than an electric stove for the same cooking method. Buonanno et al. found that gas stoves generate more particles than electric when grilling. This result reflects the fact that indoor combustion, i.e. gas stove flames, is an important sources of particulate matter in the absence of cooking emissions. Gas stoves are also an important source of pollutants such as CO and NO_x and can result in acute exposures at harmful concentrations.

EXHIBIT 3

Gas Stoves Can Emit Elevated Indoor Nitrogen Dioxide (NO₂) Levels Often Exceeding Indoor Guidelines and Outdoor Standards⁶



Brett C. Singer et al, *Pollutant Concentrations and Emission Rates from Scripted Natural Gas Cooking Burner Use in Nine Northern Californian Homes*, Lawrence Berkeley National Laboratory, 2016, p.

observed in those homes. Four of the nine homes had kitchen levels exceed the national ambient air quality standard threshold of 100 ppb NO₂ over 1h, and two others had 1h NO₂ concentrations of at least half this value. Three of the nine homes had bedroom NO₂ levels exceed 50 ppb. This suggests significant exposures may occur for anyone at home when natural gas burners are used for even a single, substantial cooking event.

5 Recommendations

Based on the findings of this field study and the related, prior work referenced herein, the authors offer the following policy recommendations.

Efforts should be made to increase awareness (a) that natural gas cooking burners are a source of air pollutant emissions into homes, and (b) that these pollutants can be controlled with an appropriately-sized venting range hood or other kitchen exhaust ventilation. Since cooking with electric burners also produces pollutants, kitchen exhaust ventilation should be available in all homes, and operated as a precaution whenever cooking occurs. Since the performance of most hoods is much better when cooking is done on the back cooktop burners, this practice should be encouraged to improve safety. Gas utilities could play a valuable role in publicizing these messages.

Building standards should require that range hoods have airflows of at least 95 L/s and cover front burners or preferably demonstrate performance through a standard test. Such a test is currently under development by ASTM.

IAQ Q&A

EXHIBIT 4

Three Main Factors Why Children Are More Susceptible to Illnesses Associated with Air Pollution than Adults^b

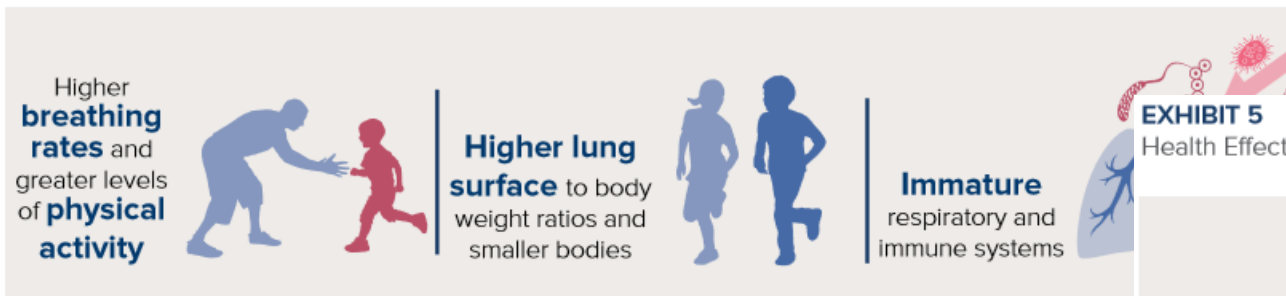
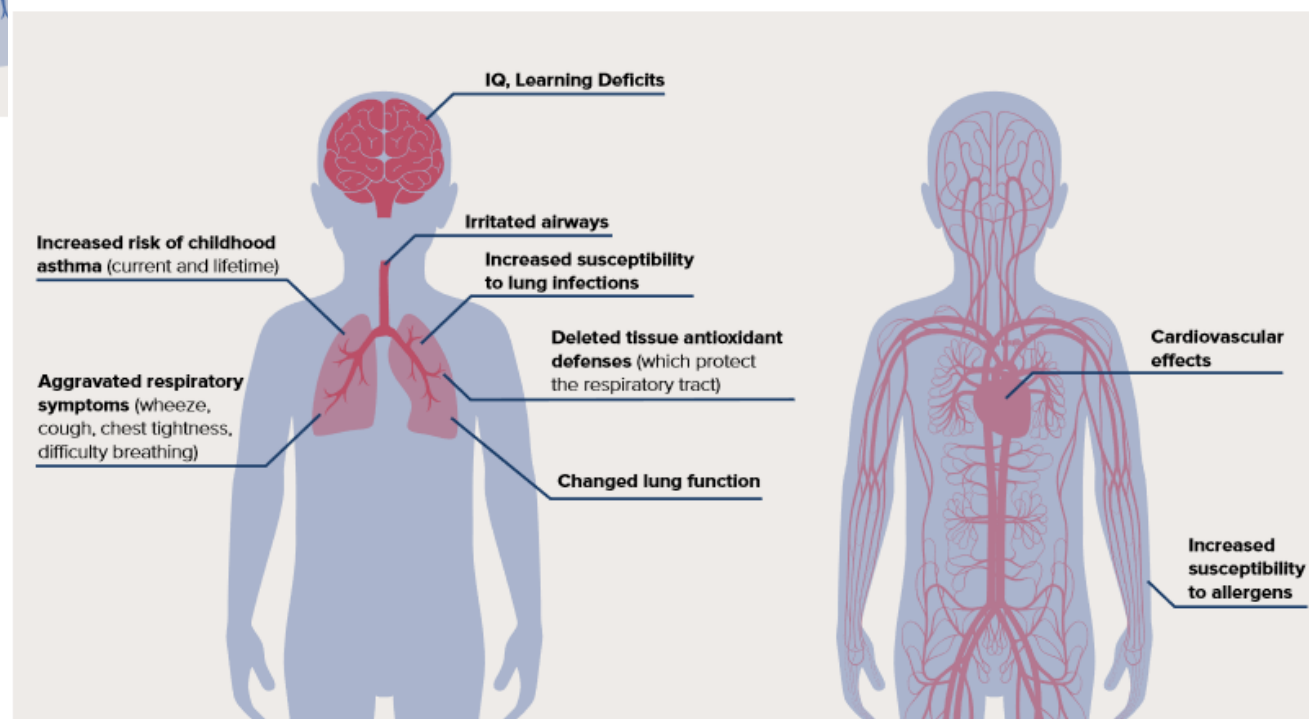


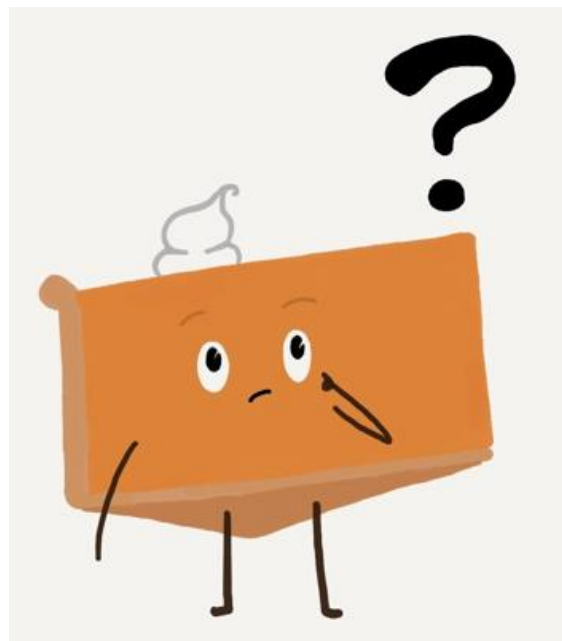
EXHIBIT 5

Health Effects of Nitrogen Dioxide (NO₂) in Children May include^c



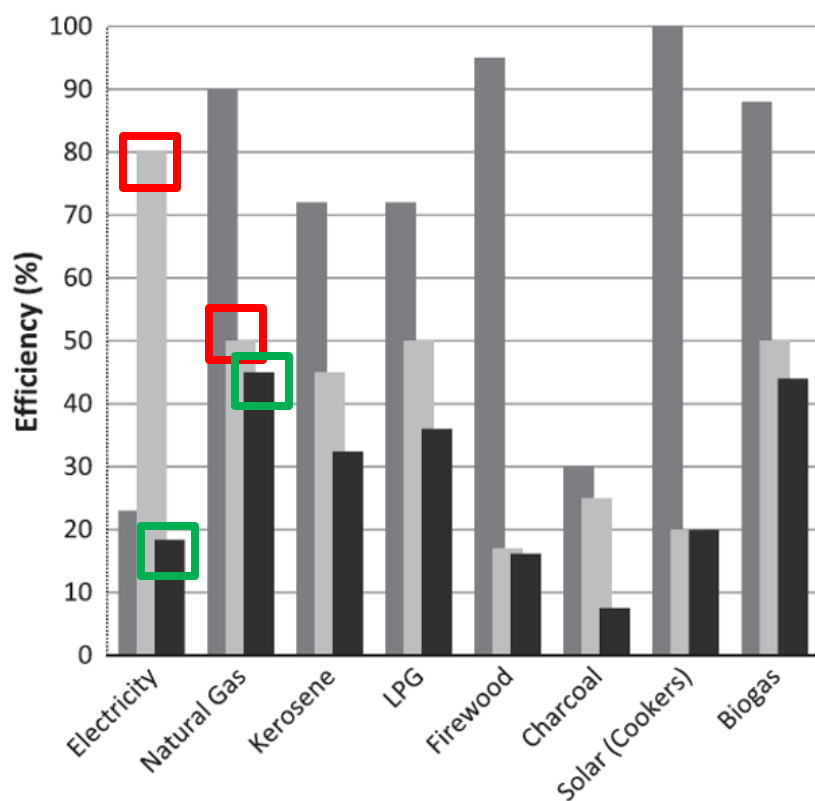
IAQ Q&A

- Question: **Should I switch to electric for cooking since it is more efficient or uses less energy than natural gas?**
- Answer: **No**, because it's not



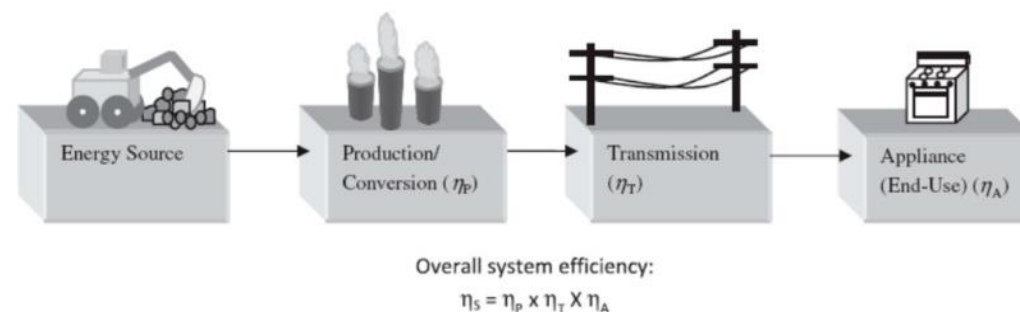
The Myth of Gas vs. Electric Cooking Efficiency

- Energy sources for cooking with conversion and transport efficiencies, end-use efficiency, and total system efficiencies



Key Results

- End Use Efficiency
- System Efficiency
 - Electric is ~18%
 - Natural Gas is ~45%



Source: Ramanathan, R., Ganesh, L.S., 1994. A multiobjective analysis of cooking-energy alternatives. Energy 19, 469-478.


IAQ Q&A

- Question: **Should I switch to electric for cooking because it is better for the environment than natural gas?**
- Answer: **No**, because it's not in most states



Commercial Foodservice Decarbonization

- CFS Build Restaurant Tool at <http://cfscalculator.gastechnology.org/BuildRes.aspx>


GTI ENERGY
solutions that transform

Commercial Food Service Equipment Calculator

Welcome, fjohnson@gti.energy
Log Off

[Home](#)
[Build Restaurant](#)
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Build Your Own Restaurant

Project

Project: 1 - Frank's Cooking with Gas Cafe
Save Restaurant Name ⓘ

Restaurant Name: Frank's Cooking with Gas Cafe
Create New Project ⓘ

Description: Good food, better energy
Download PDF Results ⓘ

Delete Current Project ⓘ

User Input

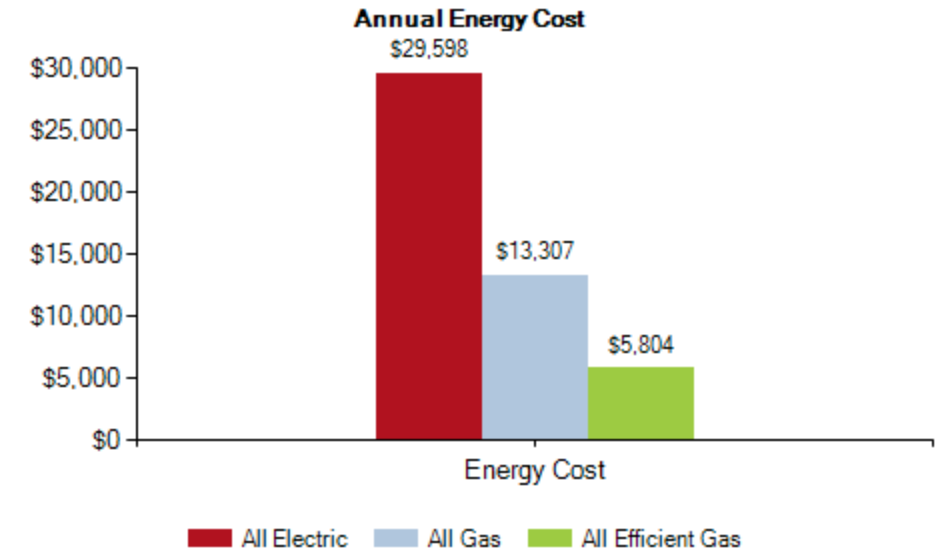
Life Time Period: 12 Years
Geographic Area*: California
* The different area affects the electric source energy consumption, emissions, and energy cost.

Gas Cost per Therm **: 0.95 \$/Therm
Electric Cost per kWh **: 17.53 cent/kWh
** The default gas and electric utility price per EIA 2020 state commercial annual average data.

☐ User-Specified Cost Data

Build-up Restaurant

Appliance	# of Units	Operating Hours per Day (hrs/day/unit)	Operating Days per Year (days/year/unit)	Pounds of Food Cooked per Day (lbs/day/unit)
Fryer	2	14	365	150
Combi Oven	1	12	365	250
Convection Oven	2	12	365	100
Griddle (3 ft)	2	12	365	100
Steamer	1	12	365	100



Commercial Foodservice Decarbonization

- CFS Build Restaurant Tool at <http://cfscalculator.gastechnology.org/BuildRes.aspx>

GTI ENERGY Commercial Food Service Equipment Calculator
solutions that transform

Welcome, fjohnson@gti.energy [Log Off](#)

[Home](#) [Build Restaurant](#) [Tools & Calculators](#) [Rebate Programs](#) [Equipment Demonstration](#) [Contact](#)

Build Your Own Restaurant

Project

Project: [Save Restaurant Name](#) ⓘ

Restaurant Name: [Create New Project](#) ⓘ

Description: [Download PDF Results](#) ⓘ

[Delete Current Project](#) ⓘ

User Input

Life Time Period: Years

Geographic Area*: * The different area affects the electric source energy consumption, emissions, and energy cost.

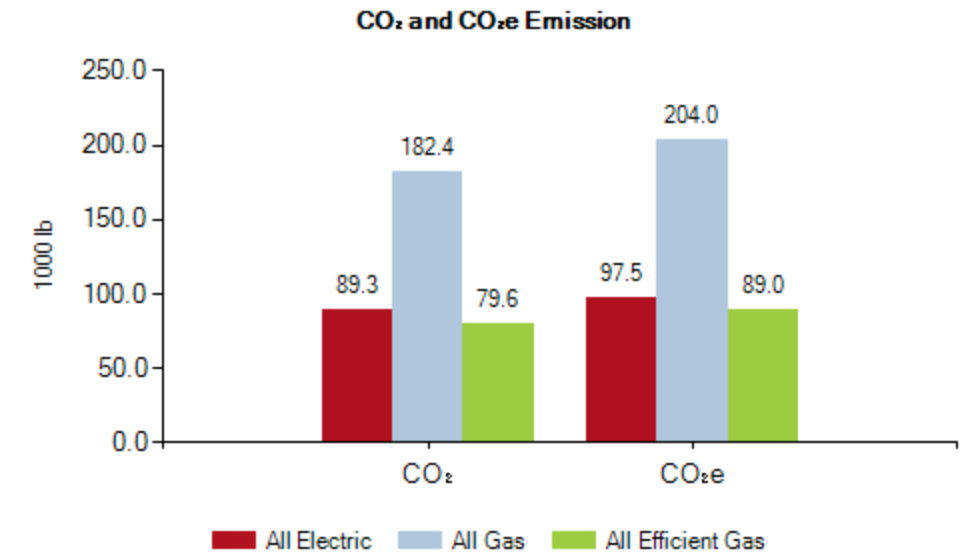
Gas Cost per Therm **: \$/Therm

Electric Cost per kWh **: cent/kWh

☐ User-Specified Cost Data ** The default gas and electric utility price per EIA 2020 state commercial annual average data.

Build-up Restaurant

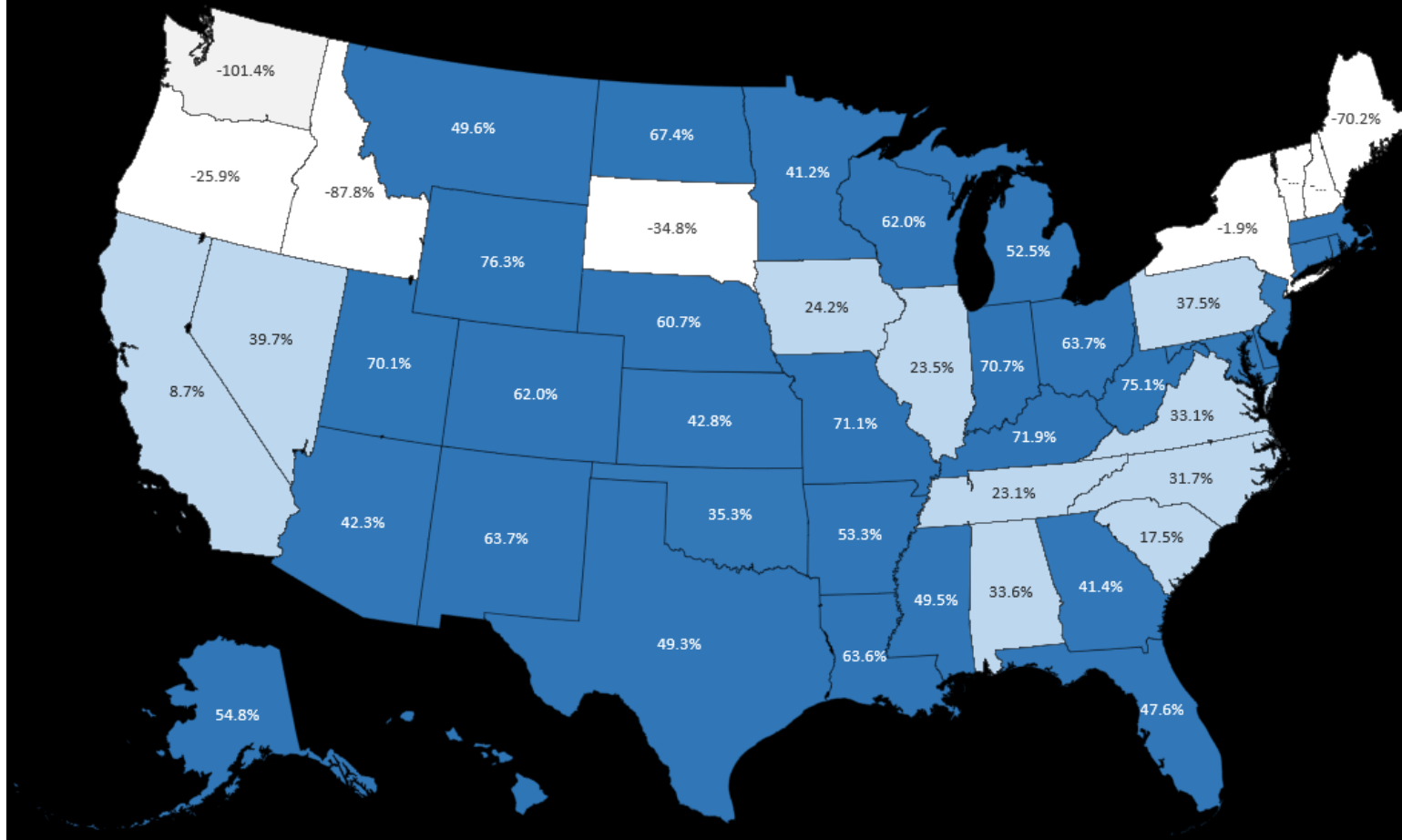
Appliance	# of Units	Operating Hours per Day (hrs/day/unit)	Operating Days per Year (days/year/unit)	Pounds of Food Cooked per Day (lbs/day/unit)
Fryer	<input type="text" value="2"/>	14	365	150
Combi Oven	<input type="text" value="1"/>	12	365	250
Convection Oven	<input type="text" value="2"/>	12	365	100
Griddle (3 ft)	<input type="text" value="2"/>	12	365	100
Steamer	<input type="text" value="1"/>	12	365	100



Note: All Emission calculations are based on [Source Energy and Emission Analysis Tool](#) developed by GTI Energy.

Commercial Foodservice Decarbonization

Percent Difference in Annual CO₂e Emissions (Efficient Gas compared to Electric)



- If all CFS kitchens were all-electric
 - Only 7 states would have a smaller carbon footprint
 - Only 11% of the population would have a smaller carbon footprint
- 6% without New York

Staff Proposal: Phase Out of Natural Gas EE Incentives

A.22-02-005: Aug. 2 Ruling Workshop – 8/26/22

Travis Holtby

**Today's meeting will be recorded*

Policy Context

- CA has set GHG reduction and decarbonization as a priority
 - AB 3232, SB 100, 2021 IEPR, etc.
- CPUC has signaled our emphasis on decarbonization
 - 2021 EE Potential and Goals, BUILD, TECH, etc.

- ### EXHIBIT 1
- Differentiating Pollutants from Cooking Food vs. Gas Fuel

Pollutants Generated from Cooking Food (regardless of stove type)	Pollutants Associated With Gas Stoves
<p>Particulate Matter (PM₁₀)</p> <p>Small particles with a diameter less than 10 micrometers. Commonly measured in cooking activities like frying or broiling with the highest emissions levels found during the oven self-cleaning cycle.¹⁷</p>	<p>Particulate Matter (PM_{2.5})</p> <p>Unlike electric stoves, gas stoves emit PM_{2.5} in the absence of cooking food (i.e., from the flames). Although cooking food emits PM_{2.5}, tests show PM_{2.5} emissions from gas stoves can be two times higher than from electric stoves.¹⁸</p>
<p>Particulate Matter (PM_{2.5})</p> <p>Small particles with a diameter less than 2.5 micrometers. PM_{2.5} can penetrate deep into the lungs and even enter the bloodstream.¹⁹ Stove tests show emissions are dependent on a number of factors such as the type of food cooked, cooking temperature, type of oil used, and type of fuel/stove used.²⁰</p>	<p>Nitrogen Oxides (NO_x)</p> <p>When nitrogen and oxygen react to each other, especially at high temperatures, they produce several toxic gases. NO₂ and NO are the principal gases associated with combustion sources (collectively known as NO_x).^{21,22}</p> <p>*A 2001 laboratory study showed no rise in NO_x when using an electric stove.²³</p> <p>*A study published in 2016 showed that after subtracting outdoor contribution, all-electric homes had NO_x levels close to zero.²⁴</p>
<p>Ultrafine Particles (UFP)</p> <p>These tiny particles are less than 100 nanometers (nm) in diameter and are hazardous to health. Cooking is the main source of UFP in homes, particularly those with gas stoves.²⁵ Gas stoves and electric coil resistance stoves emit high quantities of UFP, particularly smaller than 10 nm in diameter.²⁶</p>	<p>Nitrogen Dioxide (NO₂)</p> <p>Nitric Oxide is oxidized in the air to form NO₂. More data exists on NO₂ than NO. NO₂ is regulated by the EPA and thus is the component most studied and considered by the EPA in terms of health effects.²⁷</p>



VS



Residential Cooking IAQ – The Research

- **Cooking Emissions testing of residential ranges**
 - Measure and compare cooking emissions with natural gas and electric residential ranges
 - Cooking emissions = only emissions generated from food



Residential Cooking IAQ – The Research

Cooking Emissions Tests: Setup

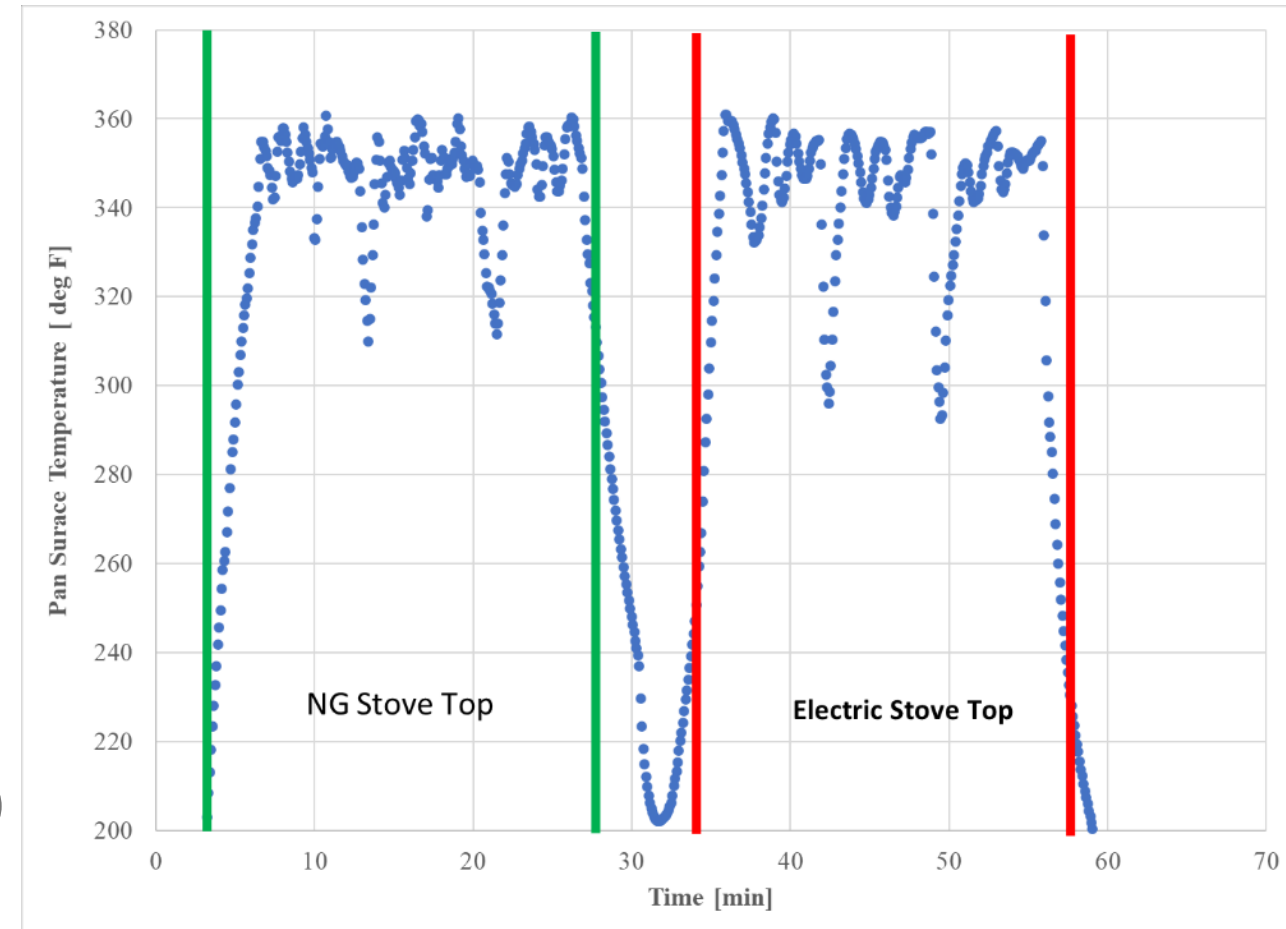
- Based on ASTM F1521-12
 - 80/20 hamburgers
 - Thermocouple welded to pan surface
 - 350 °F
- Particulate capture method from Gerstler et al (1998) University of Minnesota
 - ASHRAE RP-745



Residential Cooking IAQ – The Research

Cooking Emissions Tests: Results

- Measured weight gain per volume (mg/m^3)
 - Electric: 15.2 to 26.4 mg/m^3
 - Natural Gas: 7.1 to 8.2 mg/m^3
 - Propane: 4.7 to 5.9 mg/m^3
- Other factors
 - Consistency of product
 - Age of product
 - Temperature Control (Standard Deviation)
 - Natural gas: 5.8 °F
 - Electric: 9.7 °F



Residential Cooking IAQ – The Research

Cooking Emissions Tests: Conclusions

- Cooking emissions as a function of the fuel source are not well understood and require additional testing and evaluations with other range designs and food types to make definitive conclusions
- Ventilation is the best solution for improving indoor air quality
 - Turn it on
 - Better capture efficiency
- More research is needed



Residential Cooking IAQ Special Report: Cooking Emissions for Natural Gas, Propane and Electric Range Tops

By: Frank Johnson, PhD – GTI Energy

Summary

Recent reports and information presented by some universities, media outlets and other research organizations have raised questions about using natural gas or propane as the primary energy source for residential cooking in terms of safety and environmental issues. Many of these sources conclude that more research is needed to draw definitive conclusions for the claims being made. GTI Energy tested one claim that electric ranges have lower cooking emissions than natural gas¹. For this study, cooking emissions is defined as only the emissions from the food during the cooking process and not the combustion emissions from the heat source. Based on the range top cook test developed by GTI Energy, and the tests conducted with natural gas, propane and electric range tops; a conclusion that one energy source generates more cooking emissions than the others cannot be made despite GTI Energy's results showing electric ranges emitted more cooking emission than natural gas or propane. Results showed cooking emissions were more a function of the cooking vessel and food product cooked than energy source. The results varied with different boxes of same food product and with the age of the food. The temperature control and temperature distribution of the pan's cooking surface was also shown to affect the cooking emissions generated. In the tests conducted by GTI Energy, the temperature varied more for the electric range and was more difficult to control than natural gas or propane.

Results showed that cooking emissions as a function of the fuel source are not well understood and require additional testing and evaluations with other range designs and food types to make definitive conclusions.

Cooking Emission Collection System and Test Design

The cook tests were conducted in the Residential Kitchen Ventilation test lab at GTI Energy using a gas range and an electric range. The gas range was chosen based on its typical design and popularity and the electric range was chosen based on it being the closest equivalent to the gas model in terms of cost and cooking compatibility.

A test plan was developed based on an updated standard being developed by Frontier Energy for ASTM F26 (<https://www.astm.org/COMMITTEE/F26.htm>). ASTM F1521-12 defines the pan, cooking procedures and food product to use during the testing, including 80% lean / 20% fat ¼ pound hamburgers. The biggest issue with measuring cooking emissions was developing a method to collect

- Are 12% of asthma cases in US caused by cooking with natural gas?
- Answer: **No**



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Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States

by  Talor Gruenwald ^{1,†},  Brady A. Seals ^{1,*} ,  Luke D. Knibbs ^{2,3} and  H. Dean Hosgood III ⁴ 

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² Faculty of Medicine and Health, Sydney School of Public Health, The University of Sydney, Sydney, NSW 2006, Australia

³ Public Health Unit, Sydney Local Health District, Camperdown, NSW 2050, Australia

⁴ Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx, NY 10461, USA

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† Current address: Rewiring America, Washington, DC 20036, USA.

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Received: 4 November 2022 / Revised: 12 December 2022 / Accepted: 14 December 2022 /

Published: 21 December 2022

IK

The Washington Post
Democracy Dies in Darkness

THE CLIMATE 202

Gas stove pollution causes 12.7% of childhood asthma, study finds

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by [Vanessa Montalbano](#)

m. EST

U.S. Consumer Product Safety Commissioner Richard Trumka Jr.his agency plans to take action to address the pollutants, which have been linked to asthma and other respiratory issues.

IAQ Q&A

- Are 12% of asthma cases in US caused by cooking with natural gas?
- Response: Pushback

January 10, 2023



AGA Statement on the International Journal of Environmental Research and Public Health Report

Washington, D.C. – A December 2022 report in the International Journal of Environmental Research and Public Health linking natural gas cooking with asthma is not substantiated by sound science. Any discussion or perpetuation of the allegations in this report which is funded by non-governmental organizations to advance their agenda to remove consumer energy choice and the option of natural gas is reckless. The authors conducted no measurements or tests based on real-life appliance usage, and ignored literature, including one study of data collected from more than 500,000 children in 47 countries that “detected no evidence of an association between the use of gas as a cooking fuel and either asthma symptoms or asthma diagnosis. Any allegation that gas stoves exceed standards set by the Environmental Protection Agency and the World Health Organization is patently false. Regulators, like the Consumer Products Safety Commission, should rely on real data and science not unsubstantiated claims of advocates. Attempts to generate consumer fears with baseless allegations to justify the banning of natural gas is a misguided agenda that will not improve the environment or the health of consumers and would saddle vulnerable populations with significant costs.

IAQ Q&A

- Are 12% of asthma cases in US caused by cooking with natural gas?
- Answer: **No**

Heating up: Bipartisan duo Manchin and Cruz pitch bill to defend gas stoves

The powerful senators will roll out the Gas Stove Protection and Freedom Act, which would bar the Consumer Product Safety Commission from using federal funding to ban new or existing gas stoves.



“

[The study published in the *International Journal of Environmental Research and Public Health*] does not assume or estimate a causal relationship between childhood asthma and natural gas stoves.

Brady Seals, Rocky Mountain Institute
Washington Examiner, 1/11/2023

“

The President does not support banning gas stoves - and the Consumer Product Safety Commission, which is independent, is not banning gas stoves.

White House spokesperson, 01/11/2023



IAQ Q&A


- Question: **Will residential gas ranges be banned?**
- Answer: **Not likely**
 - Regulated, not banned



“Products that can’t be made safe can be banned,” CPSC Commissioner Richard Trumka Jr.

IAQ Q&A

- Question: **Will residential gas ranges be banned?**
- Answer: **Not likely**
 - Regulated, not banned



United States
Consumer Product Safety Commission

OS 1

This document has been electronically
approved and signed.

Ballot Vote Sheet

TO: The Commission
Alberta E. Mills, Secretary

THROUGH: Austin C. Schlick, General Counsel
Jason K. Levine, Executive Director

FROM: Daniel R. Vice, Assistant General Counsel,
Regulatory Affairs
David M. DiMatteo, Attorney, Regulatory Affairs

SUBJECT: Draft Federal Register Notice: "Request for information on chronic hazards associated with gas ranges and proposed solutions"

DATE: February 22, 2023



BALLOT VOTE DUE: Tuesday, February 28, 2023

As directed in the Commission's Operating Plan for Fiscal Year 2023, staff is proposing, and the Office of the General Counsel has prepared for the Commission's consideration, a draft *Federal Register* notice seeking public input on chronic hazards associated with gas stoves and proposed solutions to those hazards. The draft notice would invite commenters to provide relevant information to the Commission on the public record. It would not initiate a rulemaking proceeding or set in motion any other regulatory action.

Ballot Review

- Request for information
 - Public input on chronic hazards associated with gas stoves
 - Proposed solutions to those hazards
 - Relevant information to the Commission


- Question: **Do residential “gas stove makers have a pollution solution” that they have “hidden” for 40 years?**
- Answer: **No**



CLIMATE

Gas stove makers have a pollution solution. They're just not using it

February 4, 2023 • 7:00 AM ET
Heard on Weekend Edition Saturday

JEFF BRADY

“technology has never been fully developed into a working range burner”

....Frank Johnson, GTI Energy

"I'm sure the cost of that burner was probably significantly more than the existing technology," says Frank Johnson, research and development manager at GTI Energy in Des Plaines, Ill. The non-profit organization used to be called the Gas Technology Institute and is a research group closely tied to the gas industry.

IAQ Q&A

- Question: **Is it safe to cook with Natural Gas?**
- Answer: **Yes**
 - There are potential IAQ issues with cooking both gas and electric due to the generation of cooking emissions (moisture, heat, particulates, VOCs)
 - The consensus best solution to improve IAQ is to use proper ventilation
 - Always turn on the hood
 - Keep the filter clean
 - Captures cooking emissions and combustion emissions



- Question: **Is it safe to cook with Natural Gas?**
- Answer: **Yes**
 - The Effects of Cooking on Residential Indoor Air Quality: A Critical Review of the Literature with an Emphasis on the Use of Natural Gas Appliances
 - By Daniel Tormey and Steve Huntley ([Link](#))
 - Review of dozens of peer-reviewed studies

The Effects of Cooking on Residential Indoor Air Quality: A Critical Review of the Literature with an Emphasis on the Use of Natural Gas Appliances

Daniel Tormey, Ph.D., P.G., Steve Huntley
March 2, 2023



IAQ Q&A

- The Effects of Cooking on Residential Indoor Air Quality: A Critical Review of the Literature with an Emphasis on the Use of Natural Gas Appliances
- Key Findings:
 - The type of appliance – natural gas or electric – used to cook food indoors is **not a significant determinant of residential indoor air quality**.
 - Indoor air quality is impacted **far more by the act of cooking than the fuel you use to cook it**, and the most effective method to protect health is to provide proper ventilation during cooking.
 - Many **additional factors influence the nature and extent of emissions** during cooking, including the type of food, the oils used in cooking, cooking temperatures and time, and proper ventilation.
 - Reports linking gas cooking to negative health outcomes often rely on analyses that **do not make that connection**.
 - The International Study of Asthma and Allergies in Childhood (ISAAC), historically the largest collaborative worldwide epidemiologic project focused on the possible association between gas stove use and asthma ever undertaken, found in their 2013 Phase 3 Report that for a cohort of 512,707 primary and secondary school children from 47 countries there was **“no evidence of an association between the use of gas as a cooking fuel and either asthma symptoms or asthma diagnosis.”**
 - There is often a **mismatch between study results and media coverage**

The Effects of Cooking on Residential Indoor Air Quality: A Critical Review of the Literature with an Emphasis on the Use of Natural Gas Appliances

Daniel Tormey, Ph.D., P.G., Steve Huntley
March 2, 2023



Residential Cooking IAQ – The Research

“Products that can’t be made safe can be banned,” CPSC Commissioner Richard Trumka Jr.

Active Research at GTI Energy:

- Evaluating residential ventilation systems
 - Effectiveness at capturing and exhausting heat and airborne particles
- Reviewing of publications about residential cooking and IAQ
 - Gas vs. Electric
 - NOx and particulate emissions (PM)
- Testing of residential ranges
 - Determine the volumes of pollutants generated by cooking with natural gas and electric, including NOx, ultrafine particles and moisture/heat
 - Identify a new burner design to improve efficiency and emissions for a residential range



Ventilation is Key

Develop High Performance Residential Range Hood

- Modify current hood design:
 - CFS technology
 - Streamlined geometry
 - Optimized fans and filters



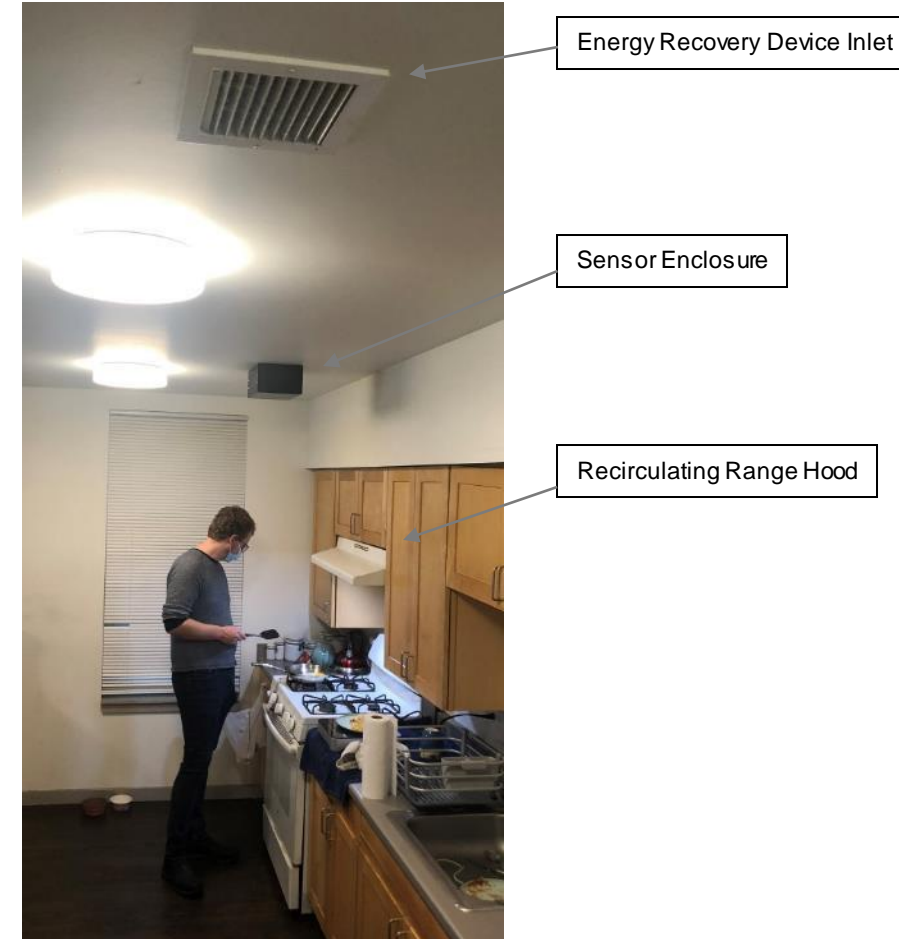
Previous Testing of Residential Hoods – Phase 1

- Shadow graph system to measure capture effectiveness
 - Back burners: ~100%
 - Front burners: Range of 40 – 70%
 - Results specific to equipment tested and conditions
- Modifications to hood design had little improvement

Field Evaluation of Indoor Air Quality in Residential Kitchens

Interim Results: Field Measurements – Tierra Linda

- Completed 12 installations of sensor enclosures:
 - CO₂, NO₂, CO, RH, TEMP; TVOC, PM_{2.5} and Formaldehyde
 - Currently analyzing NO₂ data
- Completed 12 installations of range location sensors
- Analyzing 1-minute data
 - IAQ / Power
- Controlled-cooking events in Phius and Energy Star buildings



Field Evaluation of Indoor Air Quality in Residential Kitchens

Interim Results: Field Measurements – Cooking

- Cooked a variety of foods including bacon, eggs, pasta, and chicken nuggets
- Analyze data for emission trends, peak and time-weighted averages during cooking and non-cooking conditions
- Comparing direct venting in Energy Star units with Energy Recovery Ventilator in Phius unit
 - Fan on/off
 - Gas range top/induction hob
 - IAQ particulates and gasses





Residential Cooking IAQ – Future Research



- Room for Improvement
 - Cooking Efficiency
 - CO & NOx Emissions

New Technology


- Focus on new burner technologies to increase efficiency and reduce emissions



CLIMATE

Gas stove makers have a pollution solution. They're just not using it

February 4, 2023 · 7:00 AM ET
Heard on Weekend Edition Saturday

JEFF BRADY

"I'm sure the cost of that burner was probably significantly more than the existing technology," says Frank Johnson, research and development manager at GTI Energy in Des Plaines, Ill. The non-profit organization used to be called the Gas Technology Institute and is a research group closely tied to the gas industry.

"technology has never been fully developed into a working range burner."

Why Research is Needed



United States
Consumer Product Safety Commission

Record of Commission Action
Commissioners Voting by Ballot*

Commissioners Voting: Chair Alexander D. Hoehn-Saric
Commissioner Peter A. Feldman
Commissioner Richard Trumka Jr.
Commissioner Mary T. Boyle

ITEM:

Draft Federal Register Notice: "Request for information on chronic hazards associated with gas ranges and proposed solutions"
(Ballot vote package dated February 22, 2023)

DECISION:

The Commission voted (3-1) to approve publication of a *Federal Register* notice as drafted, to seek public input on chronic hazards associated with gas stoves and proposed solutions to those hazards. The draft notice would invite commenters to provide relevant information to the Commission on the public record but not initiate a rulemaking proceeding or set in motion any other regulatory action

Chair Hoehn-Saric, Commissioners Trumka and Boyle voted to approve publication of the notice as drafted. Commissioner Feldman voted to not approve publication of the notice.



UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MD 20814

COMMISSIONER RICH TRUMKA JR.

CPSC APPROVES REQUEST FOR INFORMATION ON GAS STOVE
HAZARDS AND **POTENTIAL SOLUTIONS**

Why Cooking with Gas?

- Question: Why are there so many claims against cooking with natural gas?
 - Causes 12% of all asthma cases in children
 - Causes asthma in women
 - Causes allergies in children
 - Lowers IQ or causes learning disabilities in children
 - Makes COVID symptoms worse
 - Releases harmful greenhouse gases
 - Larger carbon footprint than electric
 - Causes cancer
 - Wastes more energy than electric
 - Releases harmful PM (particulate matter) that kills 354 persons/year in California

Answer:



Questions, Feedback or Requests

- Need More Information*: Contact me at fjohnson@gti.energy
 - This presentation
 - White Papers
 - List Resources
 - Used as basis for Q&A
 - More details

