

# NOURISHING OUR NET ZERO FUTURE WITH INDUCTION COOKING

# LEARNING OBJECTIVES

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At the end of this course, participants will be able to:

1. Articulate the culinary benefits of induction appliances
2. Identify the wellness, safety and environmental benefits of induction technology.
3. Discuss challenges and opportunities of incorporating an all-electric kitchen with induction appliances to achieve an NZE project
4. Evaluate the potential of induction technology achieve NZE projects and decarbonization



## **Induction Cooking In The Big Picture**

**Kirstin Weeks, LEED AP, WELL AP, GRP, CEM**, Associate Energy and Building Ecology Specialist, Arup

## **Induction Cooking for Residential and Commercial Food Service**

**Richard Young**, Director of Education, Frontier Energy Food Service Technology Center

**Mark Duesler**, Chef Consultant and Program Advisor, Frontier Energy

## **Induction & Air Quality**

**Woody Delp, PhD**, Mechanical Engineer: Indoor Environment and Sustainable Energy Systems Groups, Lawrence Berkeley National Laboratory

## **Gas vs Induction Cookoff**

**Teresa Jan, AIA, LEED AP, WELL AP**, Senior Associate, Sustainable Design Committee Leader, Gould Evans

## **Q&A**

# Induction Cooking in the Big Picture

Kirstin Weeks, LEED AP, GRP, WELL AP, CEM  
Associate, Energy + Building Ecology, Arup

**Advice from my kids:  
How can we save energy and help the Earth?**



# Advice from my kids: How can we save energy and help the Earth?



"Use tools that aren't electric"

# Advice from my kids: How can we save energy and help the Earth?



"Use tools that aren't electric"

"Stop using gas and use electricity instead"

# Advice from my kids: How can we save energy and help the Earth?

“Ehhhhhhh”



“Use tools that aren’t electric”

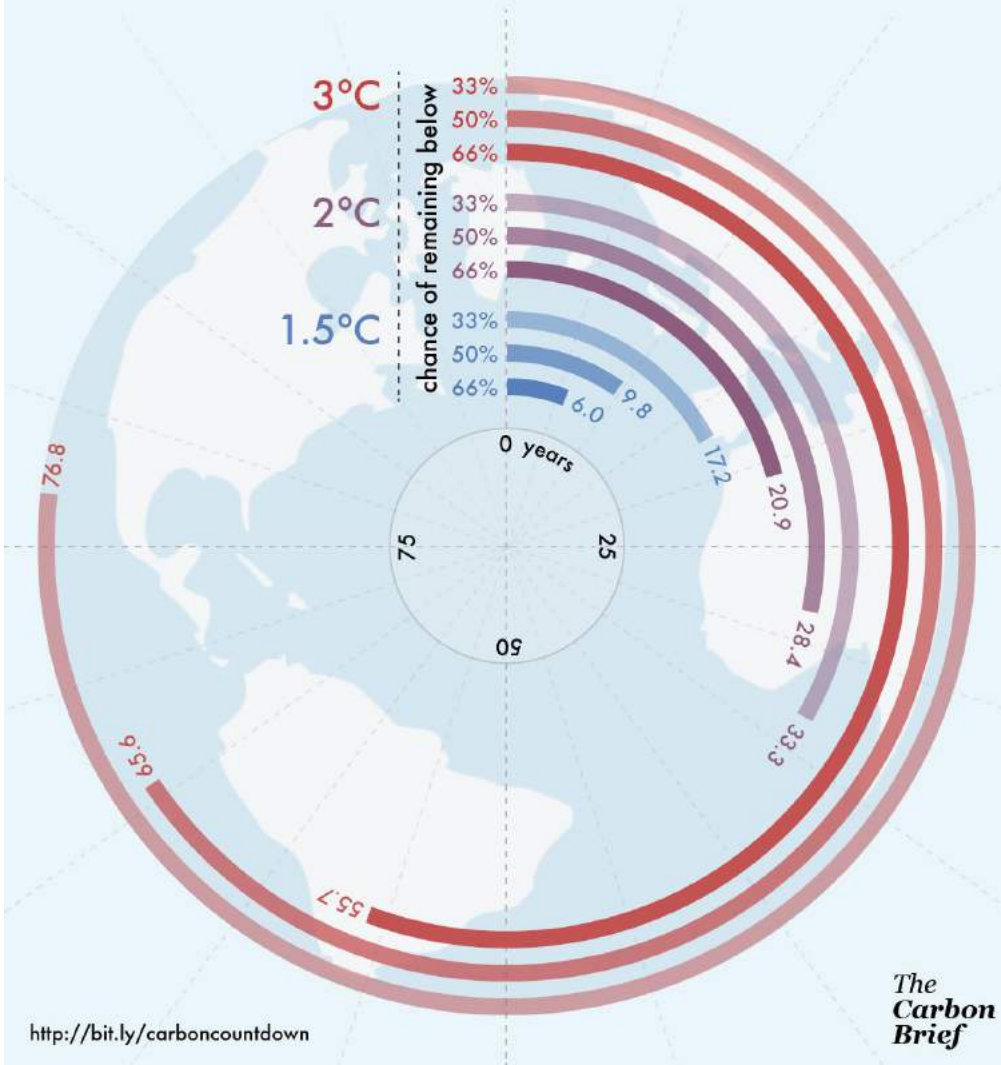
“Stop using gas and use electricity instead”

# Climate – time to act fast!



## Carbon Countdown

How many years of current emissions would use up the IPCC's carbon budgets for different levels of warming?



# Building Energy is a Key Part



## A ROADMAP TO DECARBONIZE CALIFORNIA BUILDINGS **SUMMARY**



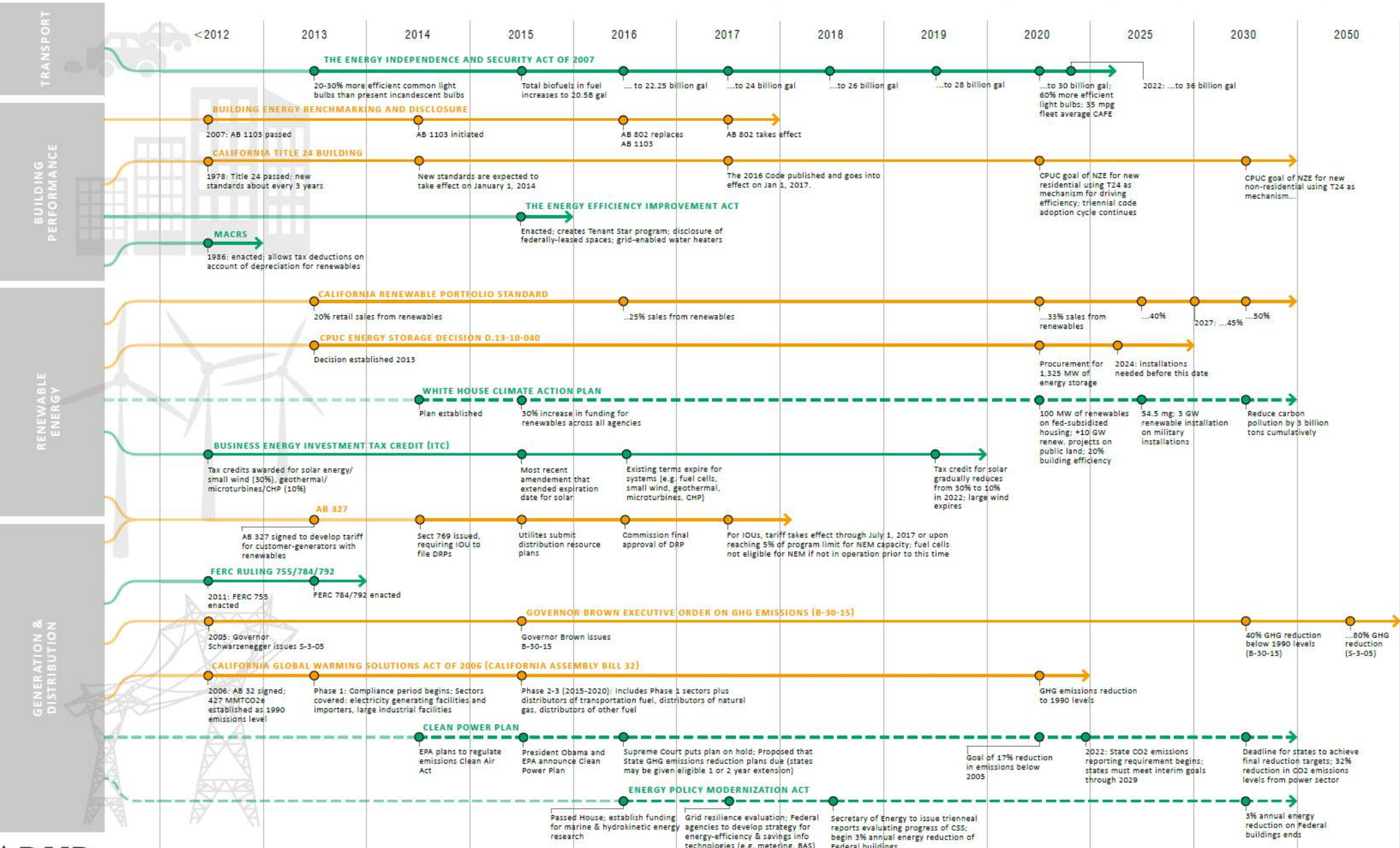
BUILDING  
DECARBONIZATION  
COALITION

~25% of CA  
emissions from  
building energy



ARUP

# ENERGY AND CARBON POLICY TIMELINE | U.S. & CALIFORNIA

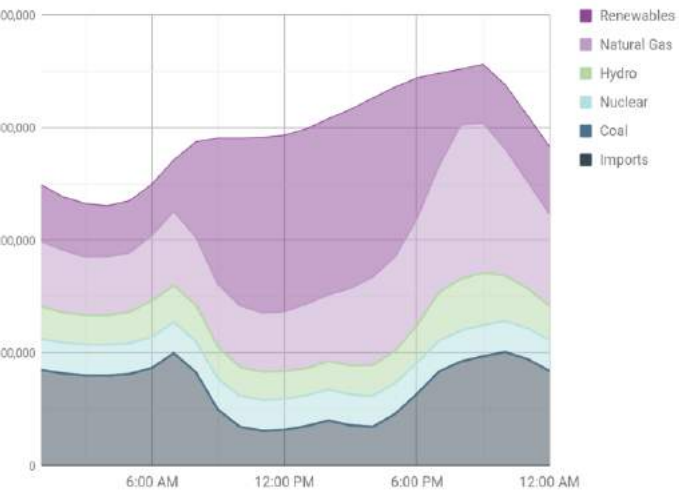




# The California Grid is Decarbonizing. Hooray!



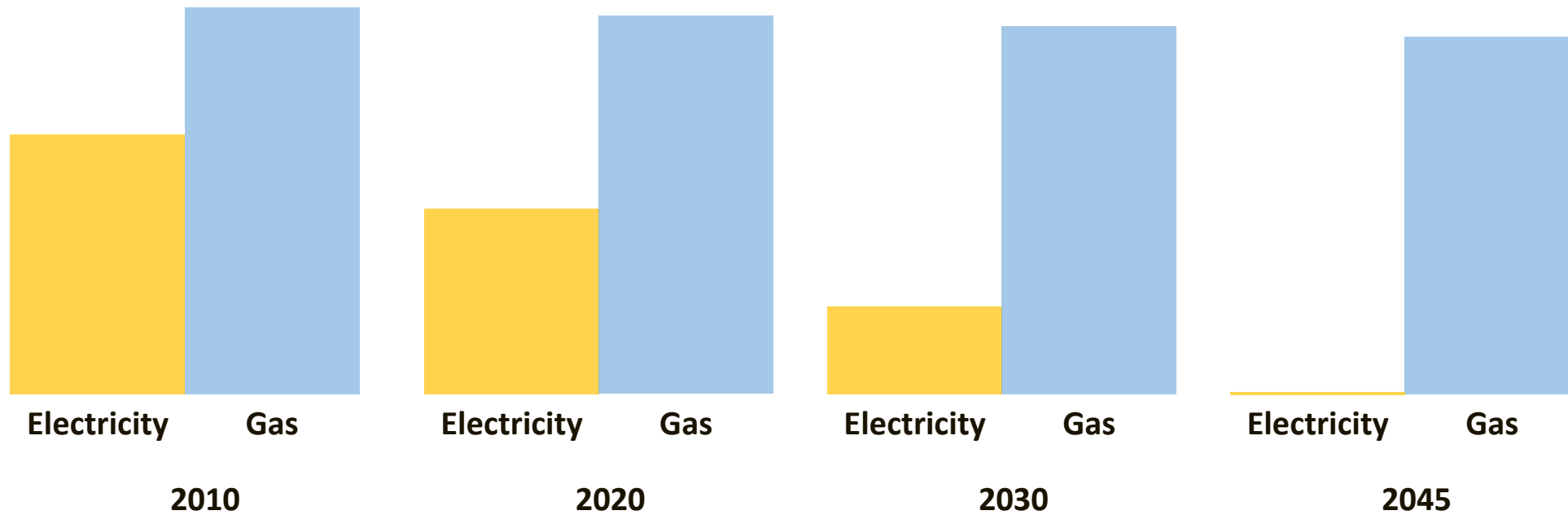
California Energy Supply — April 23, 2018



- California electric grid is going renewable – 31% in 2018 (over 50% carbon free counting hydro and nuclear)
- Target 50% renewable by 2030, 100% by 2045
- ZNE New Residential 2020 New Commercial 2030
- We achieved our 2020 emissions reduction goal early!

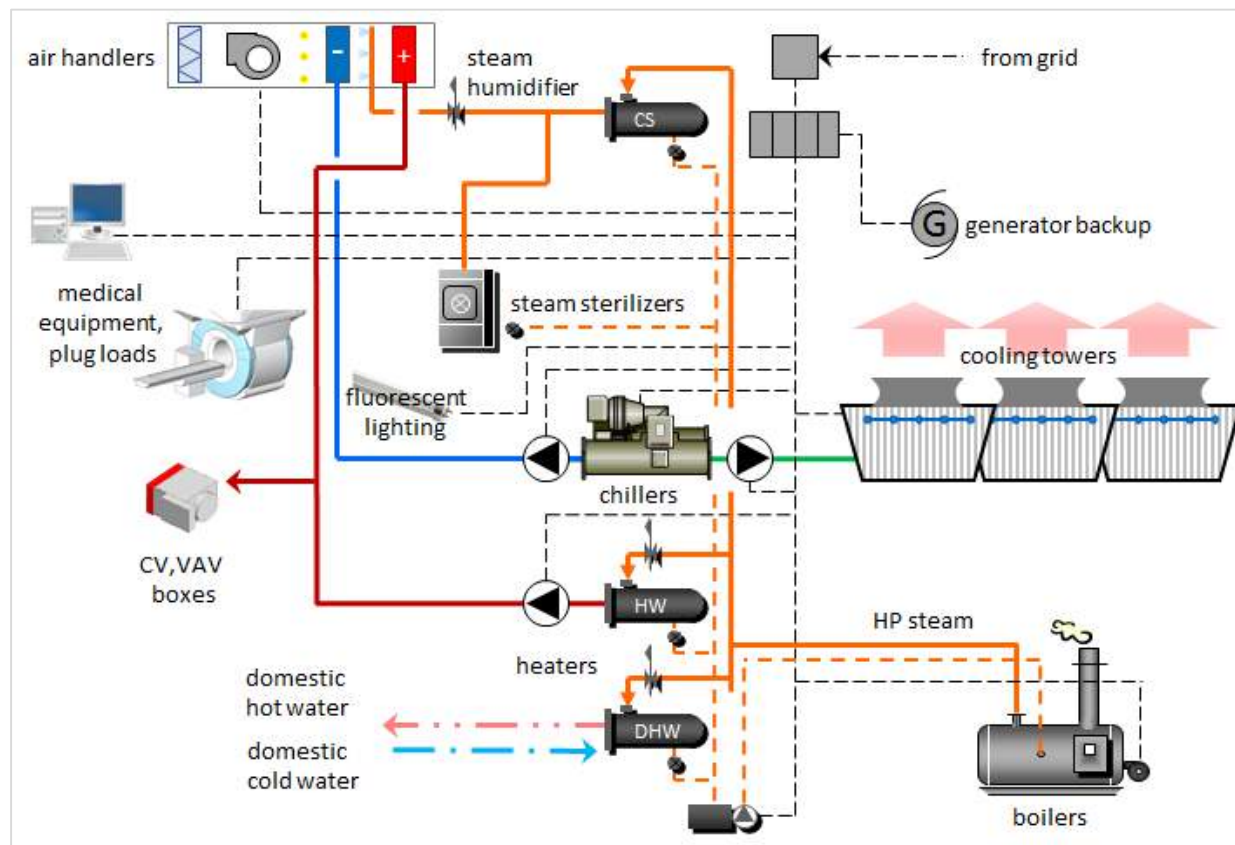


# What's left? Natural gas.

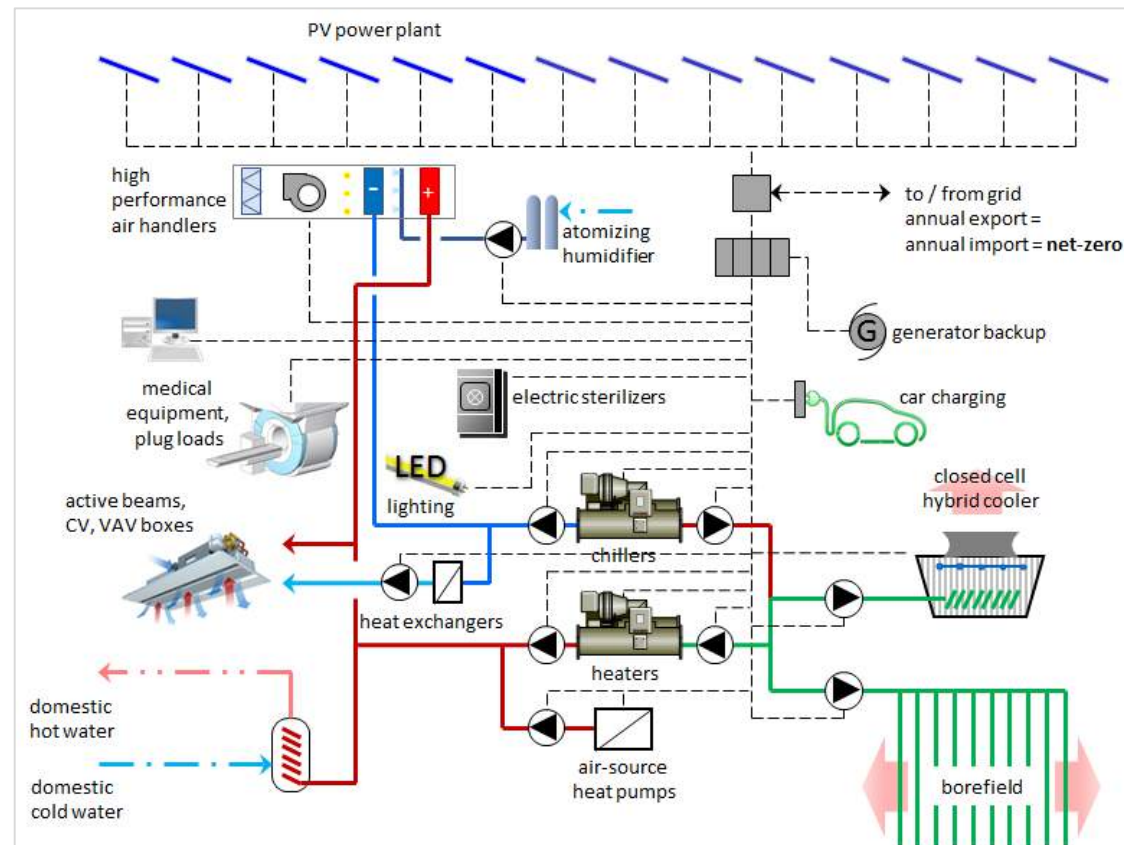


**California Building Operational Emissions**  
(approx. – not to scale)

# Gas systems and their electric alternatives

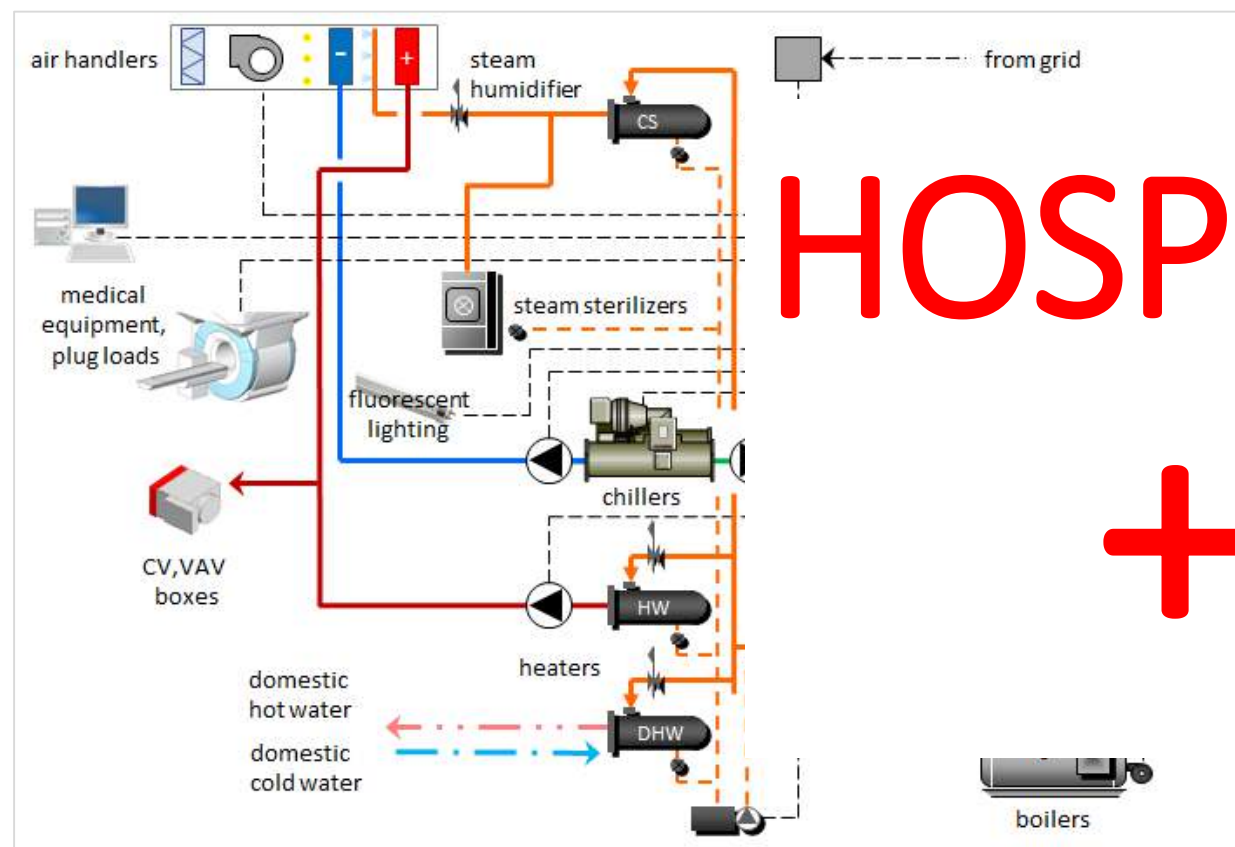


Gas-steam



Renewable-electric

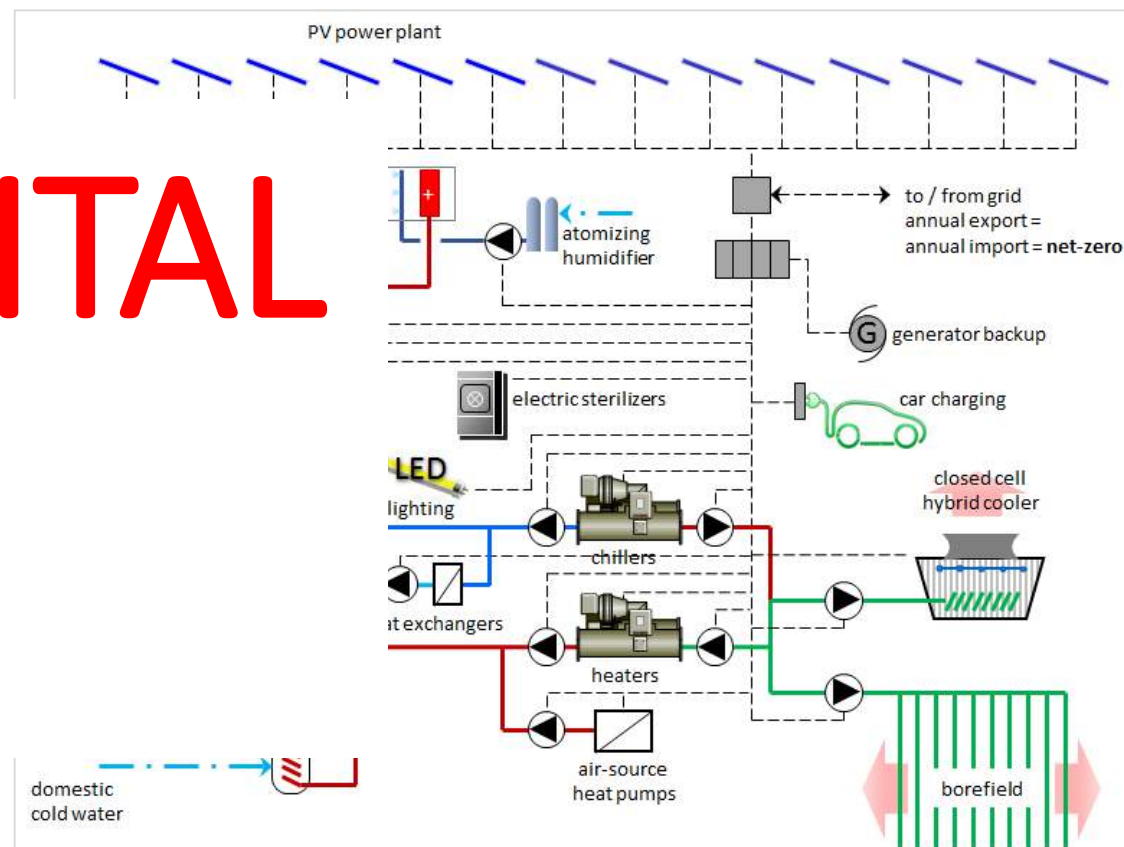
# Gas systems and their electric alternatives



Gas-steam

HOSPITAL

+



Renewable-electric

# Gas systems and their electric alternatives



Dryer



Water  
Heater



Furnace

Stove



Gas Combustion



Heat  
Pumps



Solar Thermal



Induction



Electric Dryer

Electric

ARUP

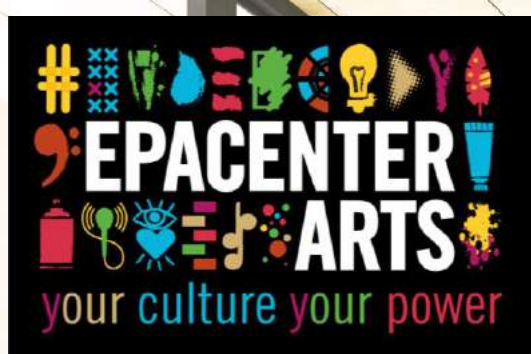
# Multifamily Residential Opportunity

Study by Mithun of Six New All-Electric Multifamily Buildings

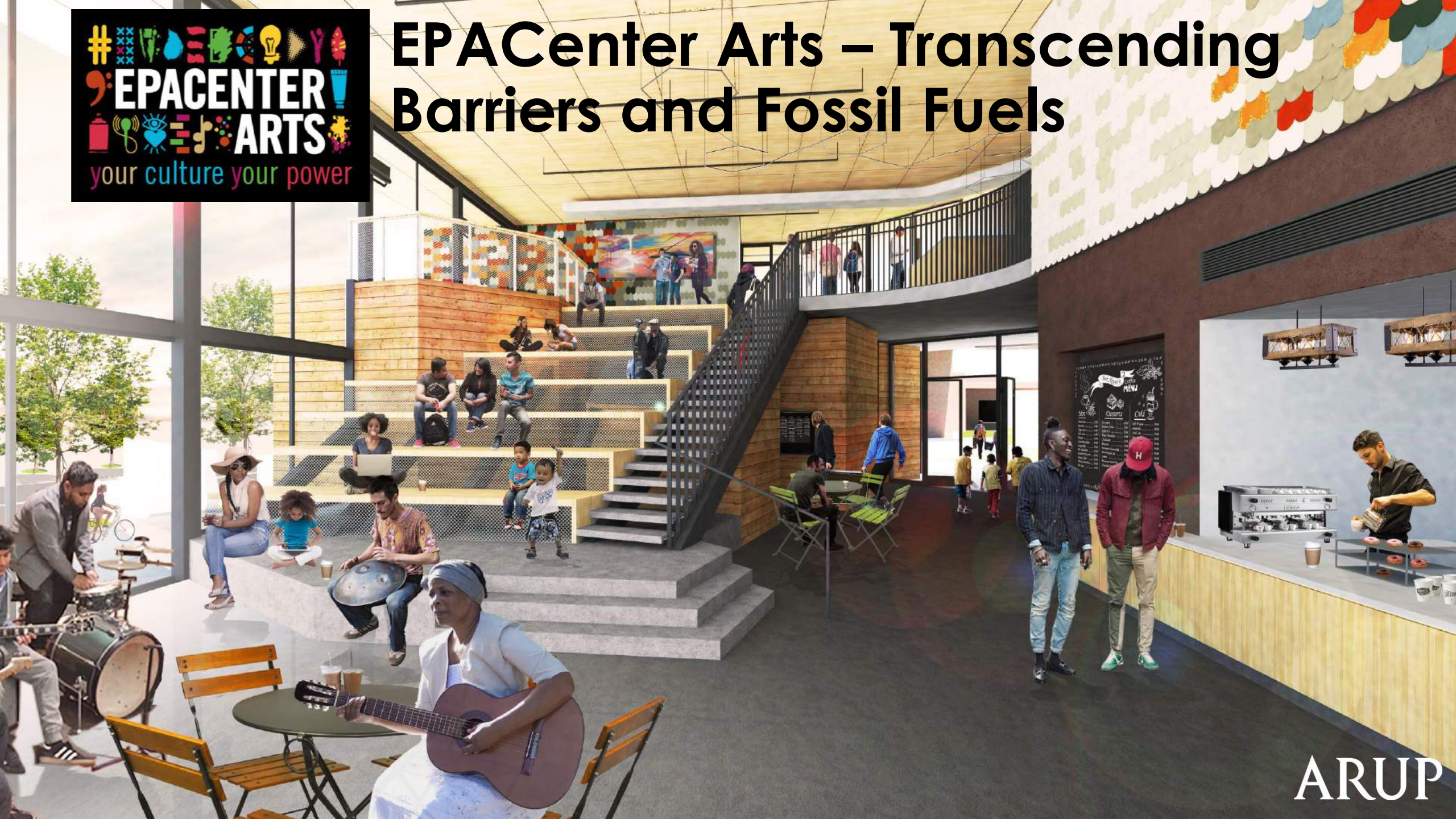
- Cost neutral to cost saving - \$2000+/unit avg savings
- Savings are in natural gas infrastructure – increasing when partial gas offset is attempted through solar hot water
- Co-benefits – resilience, safety, accelerated schedule, reduce leakage

**MITHŪN**

ARUP



# EPACenter Arts – Transcending Barriers and Fossil Fuels



ARUP

# What's next?

- All-electric policy is happening in cities, starting with Berkeley 2020.
- Needs reconciliation with Title 24 energy code compliance and organizational policies.
- Needs knowledgeable professionals and owners...



# Induction Cooking for Residential and Commercial Foodservice

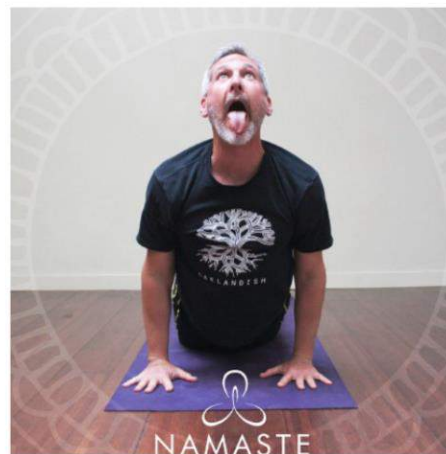
**Richard Young**, Director of Education, Frontier Energy Food Service Technology Center

**Mark Duesler**, Chef Consultant and Program Advisor, Frontier Energy



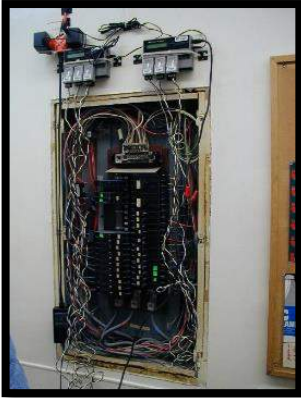
*Presentation by:*  
**Richard Young**  
Director  
ryoung@frontierenergy.com

**FRONTIER**  
energy



# The Food Service Technology Center

## Field Research



## Appliance Test Lab



## Direct Customer



## Workforce Education & Training

# **Benefits of Induction:**

Fast

Flexible

Modular

Efficient

Controllable

Safer

Easier to Clean

Less Heat Released to the  
Kitchen



## **Induction Considerations:**

Higher Initial Cost

Durability

Specific Cookware Needed

# Overcoming Residential Consumer Concerns

## ...with Science!

Research funded by:



Sacramento Municipal Utility District

<https://www.smud.org/-/media/Documents/Corporate/About-Us/Energy-Research-and-Development/Induction-Range-Final-Report---July-2019.ashx>



### Residential Cooktop Performance and Energy Comparison Study

Frontier Energy Report # 501318071-R0  
July 2019

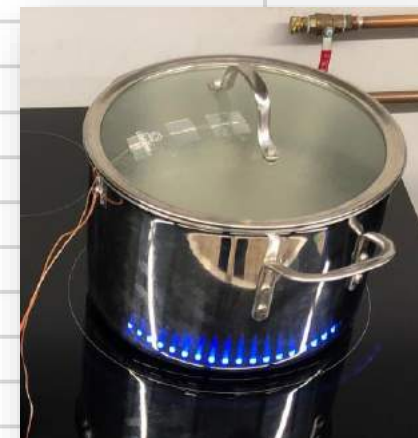
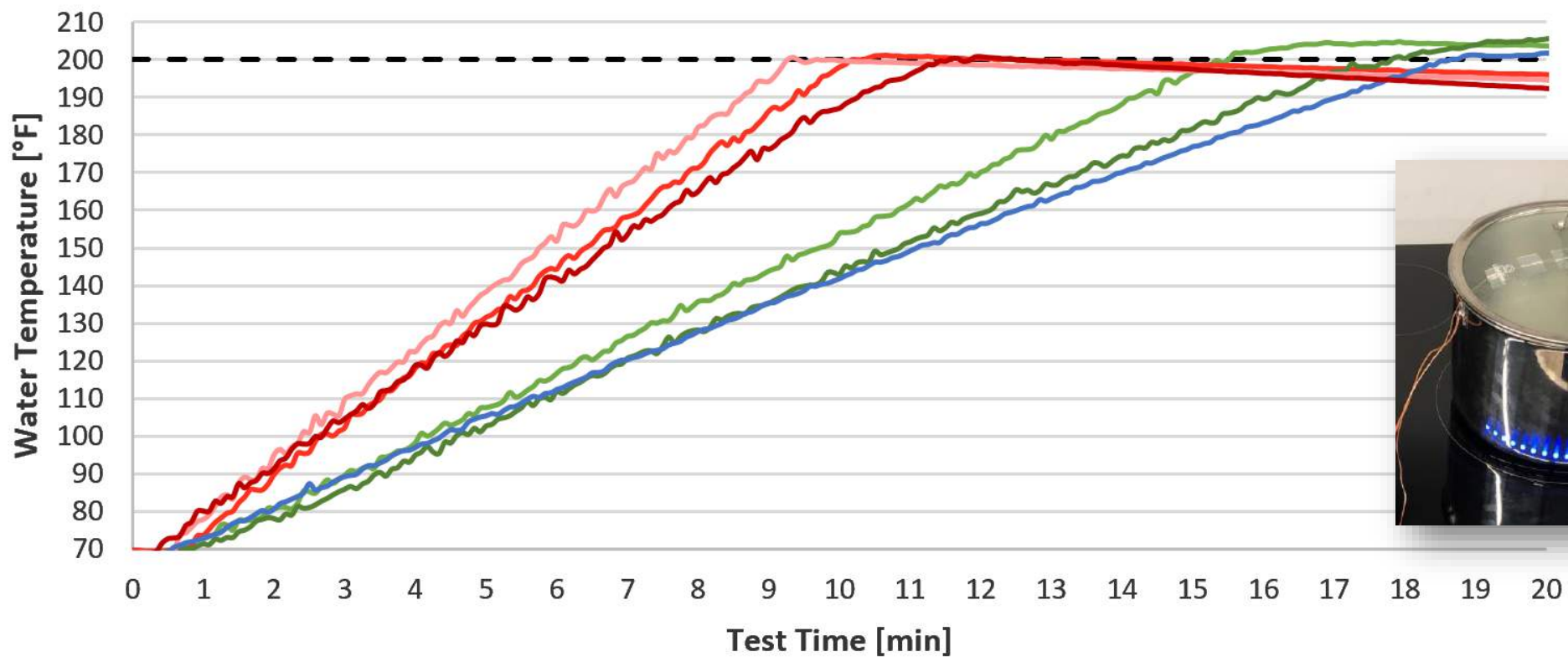
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The information generated in this report is based on data generated at the Food Service Technology Center (FSTC)

## Water Heat-Up Rate\*



- - - Threshold
- Induction A (Frigidaire)
- Induction B (GE)
- Induction C (Samsung)

- Resistance Coil (Frigidaire)
- Resistance Ceramic (Whirlpool)
- Gas Burner (Samsung)

# **Induction In Commercial Foodservice**

# Case Study: Salt Craft





Gas = \$1,000  
Elec = \$1,000

# Induction vs. Gas Range Summary:


Similar Performance, Production, and Cost to Operate



Lower Capital Cost  
Indestructible



Safer  
Easy to Clean  
Less Heat to the Kitchen



Gas = \$350  
Elec = \$1,700

Gas = \$600  
Elec = \$1,730



# **The Tools to Get it Done**



## LOVE IT BEFORE YOU LIVE WITH IT

Try out new high-performance kitchen equipment at the FSTC. Our Chef Consultant Mark Duesler has a wide array of equipment available for you to test drive.

- STEP 1. Visit [fishnick.com/demos](https://fishnick.com/demos)**
- STEP 2. Schedule your hands on Demo**  
*(For more information contact Mark Duesler at — [mduesler@fishnick.com](mailto:mduesler@fishnick.com) or 925.866.5960)*
- STEP 3. See the equipment in action and bring your menu items to life!**

Looking for a new fryer or need to replace that old broken oven?

**SCHEDULE YOUR DEMO TODAY!**



**Mark Duesler**

*Chef Consultant*

With 20 years in the food service industry and 15 years in the kitchen, Mark will share his expertise and help you find a solution for your operation.

# Hands-On Changes Hearts and Minds

‘After the presentation and testing some of the equipment, I am confident that they are just as good or better than conventional cooking equipment.

I am and would be a “Happy Chef” with using more energy efficient appliances.

Green Light for me.’

# Induction & Air Quality

Woody Delp, PhD

Lawrence Berkeley National Laboratory

Woody Delp, PhD

Lawrence Berkeley National Laboratory, Sustainable Energy and Environmental Systems Department



Worked in a  
variety of  
places



Airflow inside of  
buildings guy



Uber-geek xkcd  
makes perfect sense



Woody Delp, PhD

Lawrence Berkeley National Laboratory, Sustainable Energy and Environmental Systems Department



Be careful inviting  
me to diner



# Outdoor Criteria Pollutants



- Ozone
- Particulate Matter
- Sulfur Dioxide
- Nitrogen Dioxide
- Lead
- Carbon Monoxide

Used for regulatory purposes

Local example, spare-the-air day

# Outdoor Criteria Pollutants

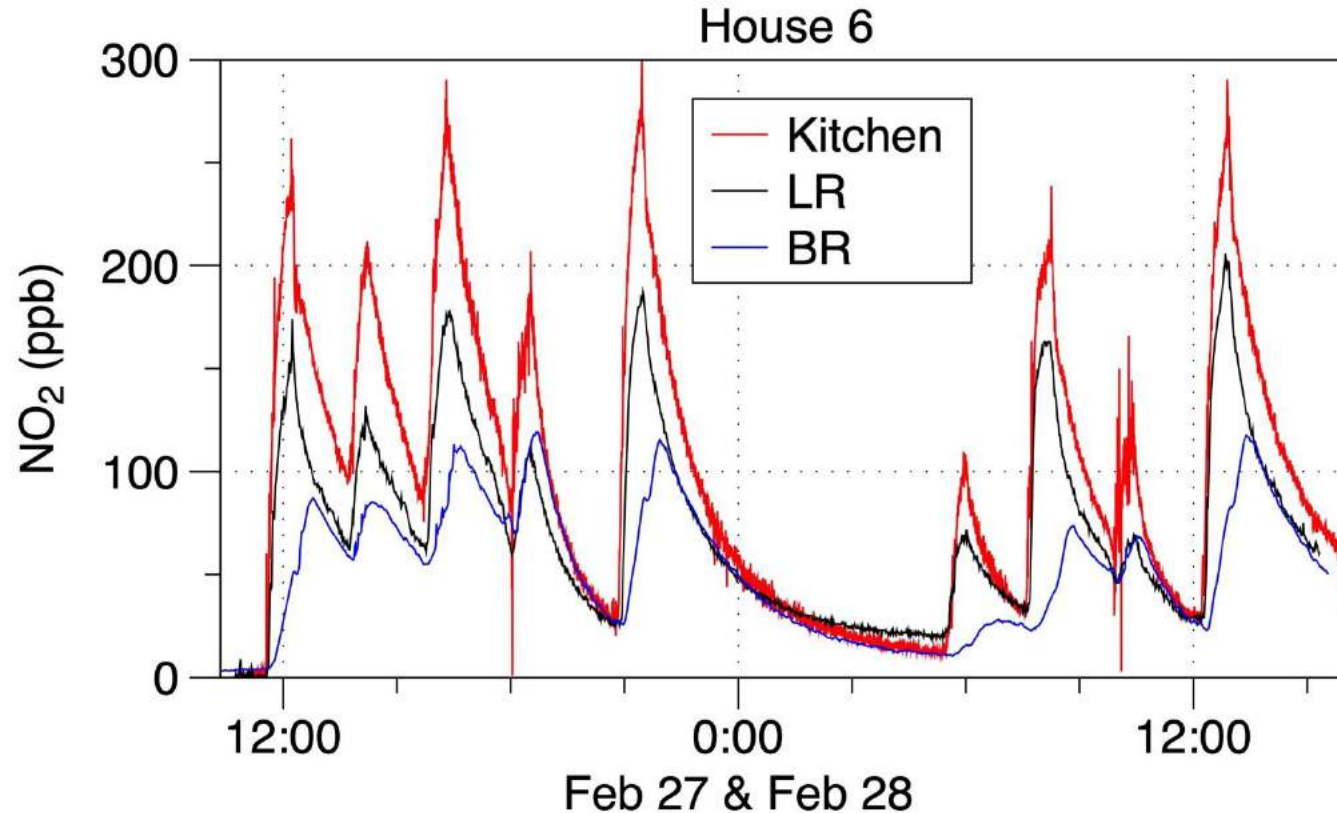


- Ozone
- Particulate Matter
- Sulfur Dioxide
- Nitrogen Dioxide
- Lead
- Carbon Monoxide

These two are regularly produced indoors

# Nitrogen Dioxide – NO<sub>2</sub>

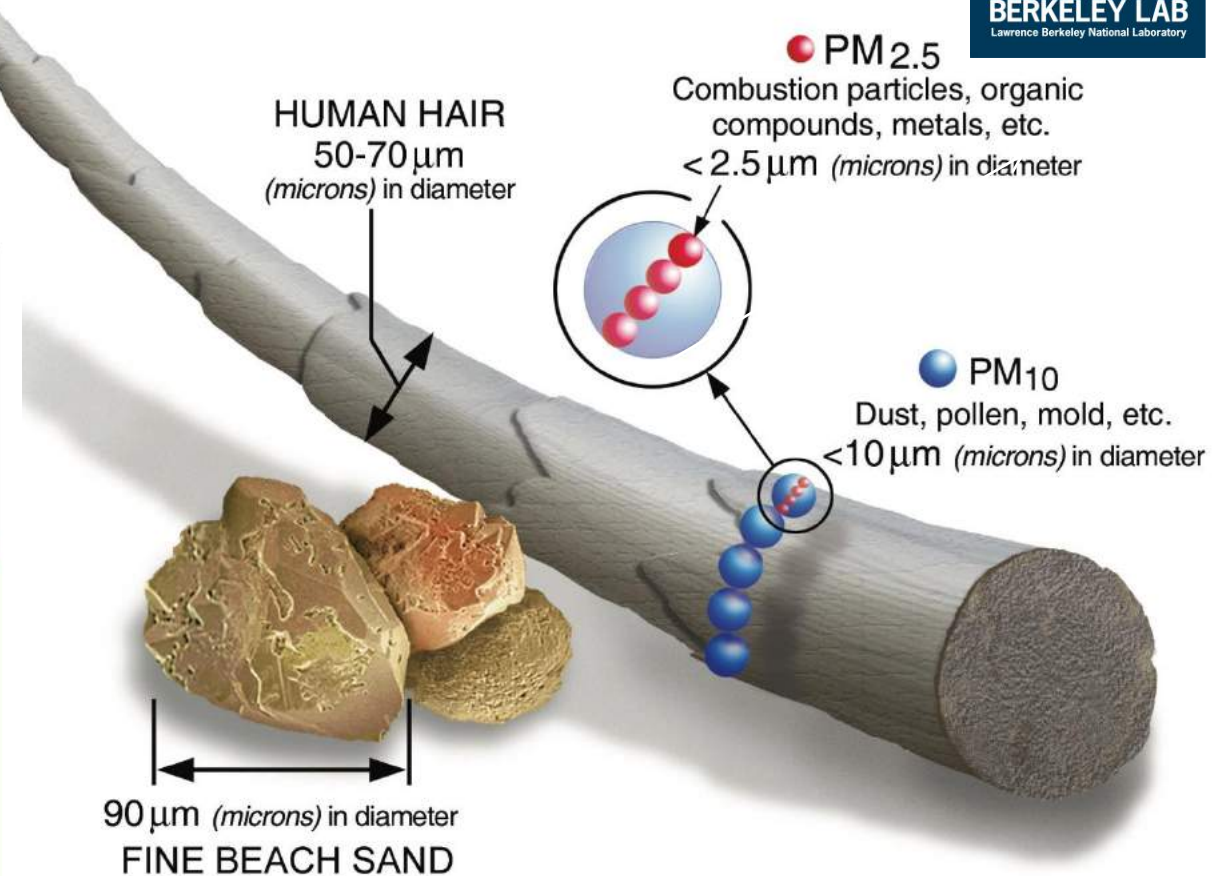
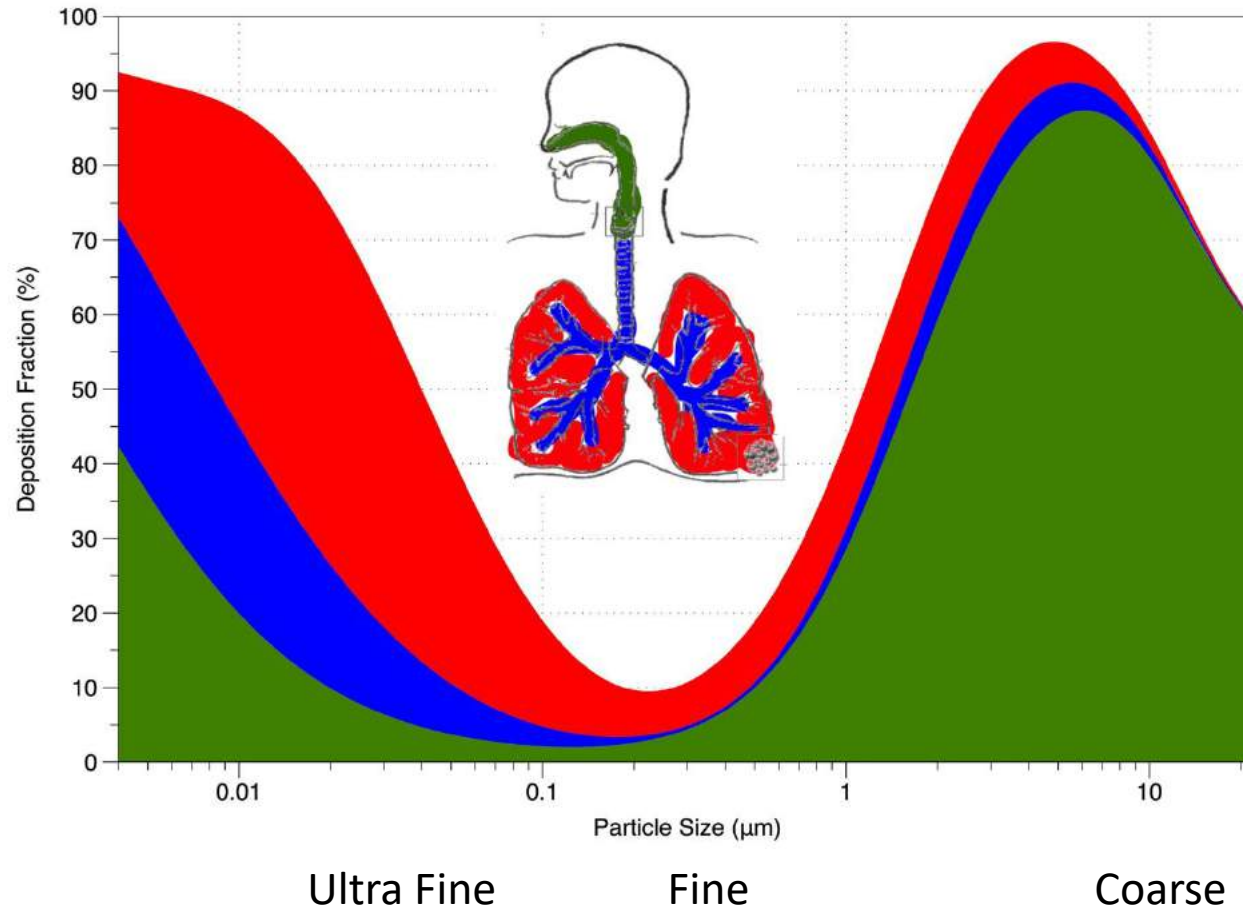
- Powerful lung irritant
- Byproduct of combustion
- 1hr outdoor action level 100ppb



# Particulate Matter – PM

## Size Matters

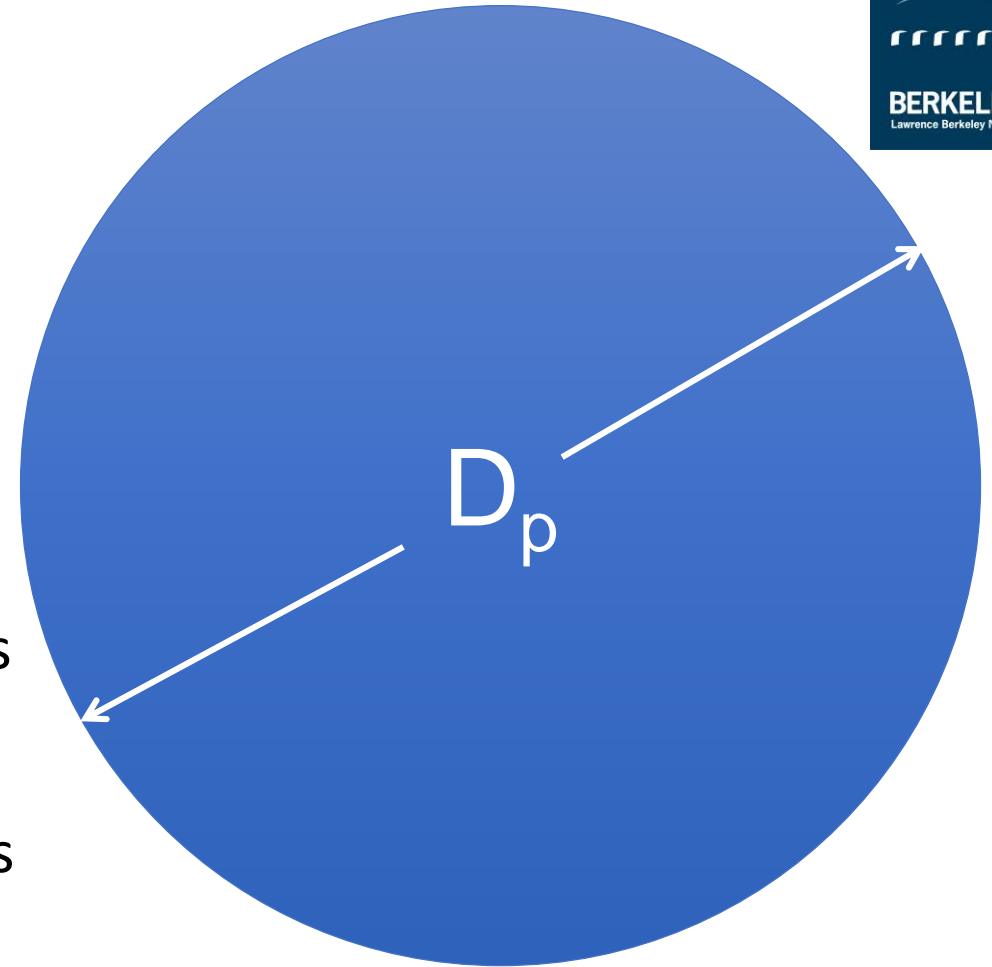
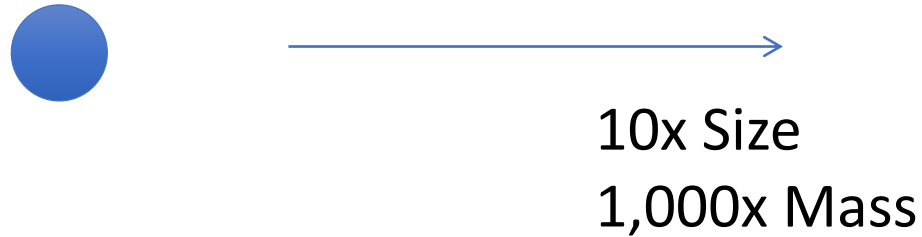
- PM<sub>2.5</sub> mass smaller than  $2.5\mu\text{m}$
- EPA / WHO action levels  $35\mu\text{g}/\text{m}^3$



# Particulate Matter – PM

Particle numbers are dominated by small sizes

But the mass changes as dia. cubed



Cooking can generate a wide range of particle sizes

Direct combustion produces sizes ~10x's nm

Many types of cooking makes particles well into the  $\mu\text{m}$  range

# Cooking comparison — Breakfast



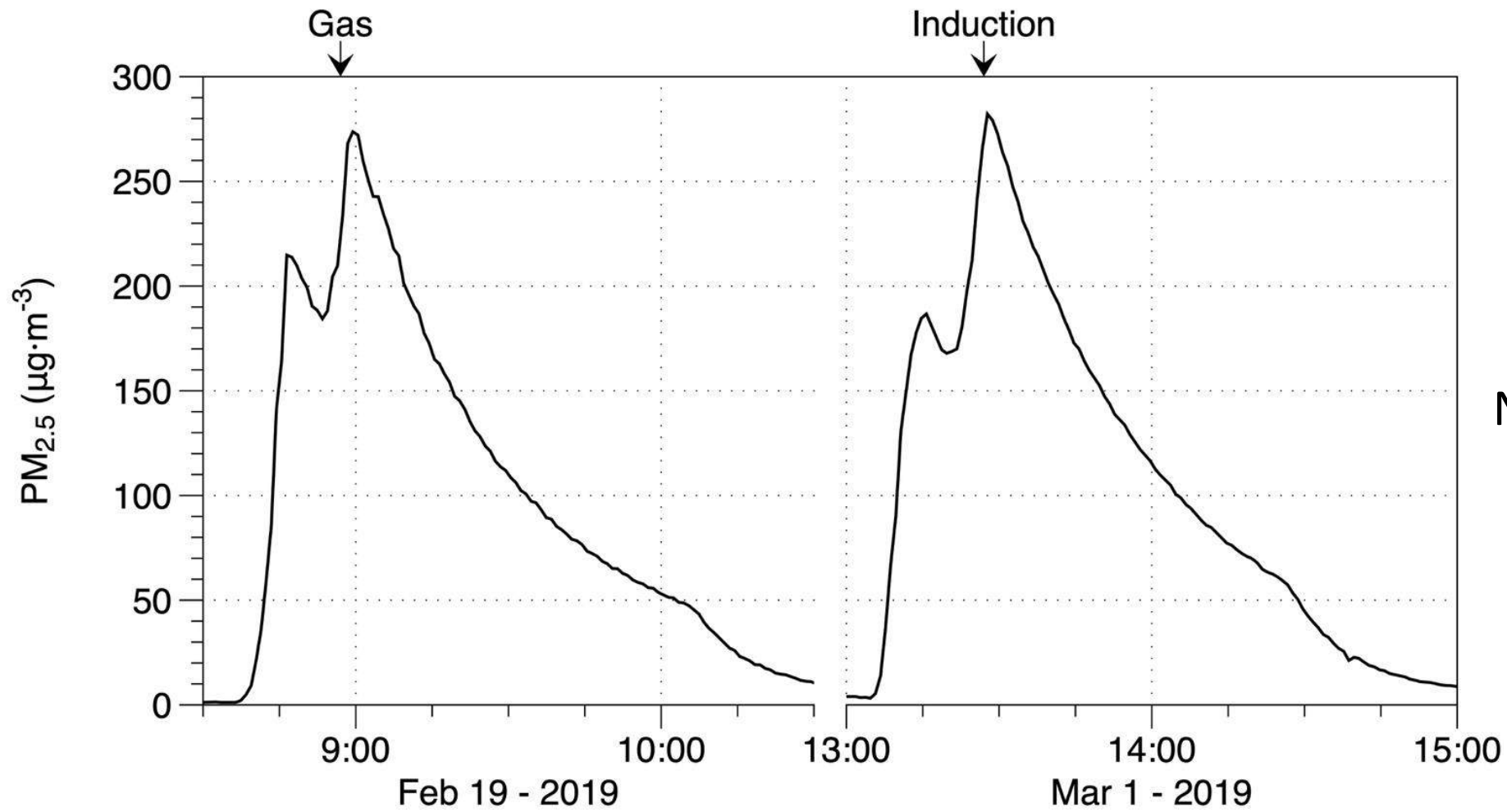
## Breakfast Cooking Details - PARALLEL

Time (min)	Activity	Gas (lpm)
0	<b>Start front left burner on medium (2 lpm)</b> for hash browns	->
0:15	<b>Start front right burner on medium (+2 lpm; Total 4 lpm)</b> - <b>bacon in pan (cook 12 min)</b> ; remain to watch oil	->4.04
1.5	<b>Add 2 hash browns to small skillet (cook 9 min)</b> ; remain	
2	flip bacon and adjust in pan; remain	
3.5	Press hash browns 5s each; remain	
4	Flip bacon and adjust in pan; remain	
5.5	Flip hash browns; press 5s each; remain	3.99
6	Flip bacon and adjust in pan; remain	
7	Flip bacon and adjust in pan; remain	3.97
8	Press hash browns 5s each; remain	3.96
8-12	Flip bacon every 30s	
10	Return; flip hash browns; press	3.94
10:30	<b>Stop front left burner</b> ; remove hash browns to plate with paper towel; place skillet on back left burner.	->2.02
12	<b>Stop front right burner</b> ; remove bacon to plate; move pan to rear burner; leave uncovered	0
12.5	Place non-stick pan with butter on <b>front left burner, start and adjust to medium (2 lpm)</b>	->2.04
14	<b>Add eggs to non-stick pan (cook 4 min)</b> ; remain	2.05
17	Flip eggs	2.05
18	<b>Stop front left burner</b> ; remove eggs to plate; place pan on front right burner	->0
48	Remove skillets and fry pan from cooktop	

Scientists have protocols not recipes

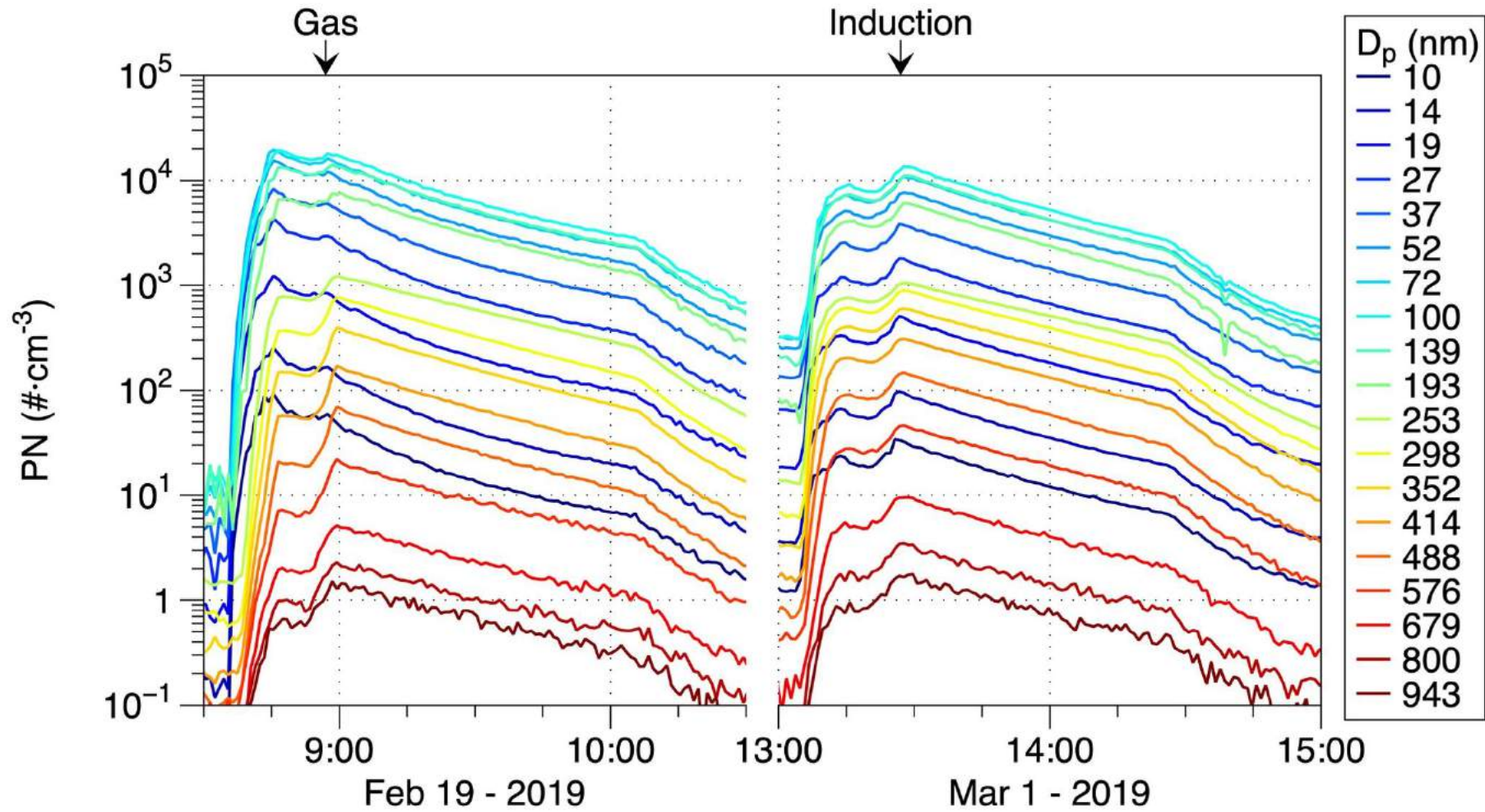


Gas —vs— Induction



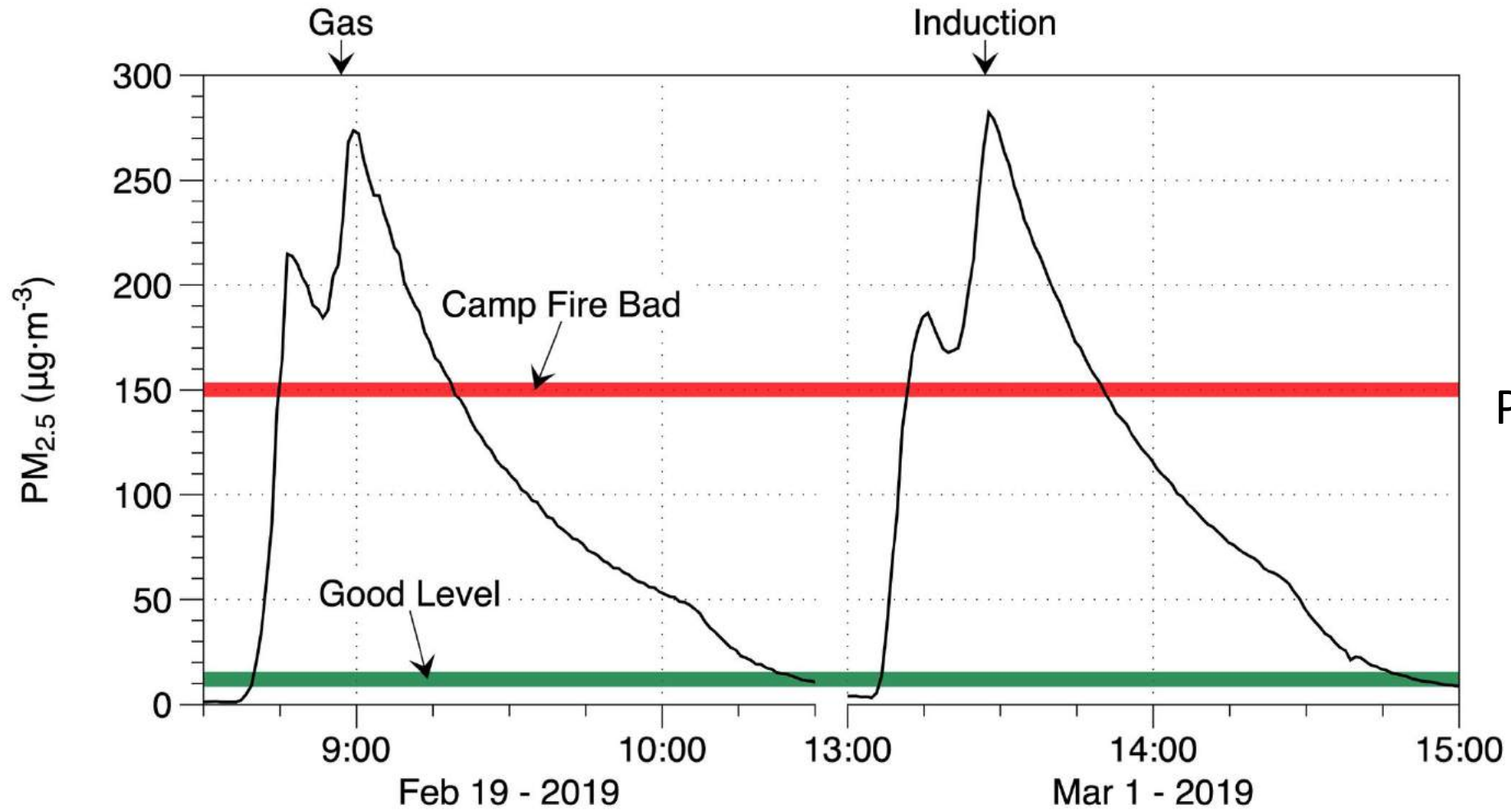
No real difference!?!?





Difference in UFPs  
(smaller than 100nm)





Perspective!!!!

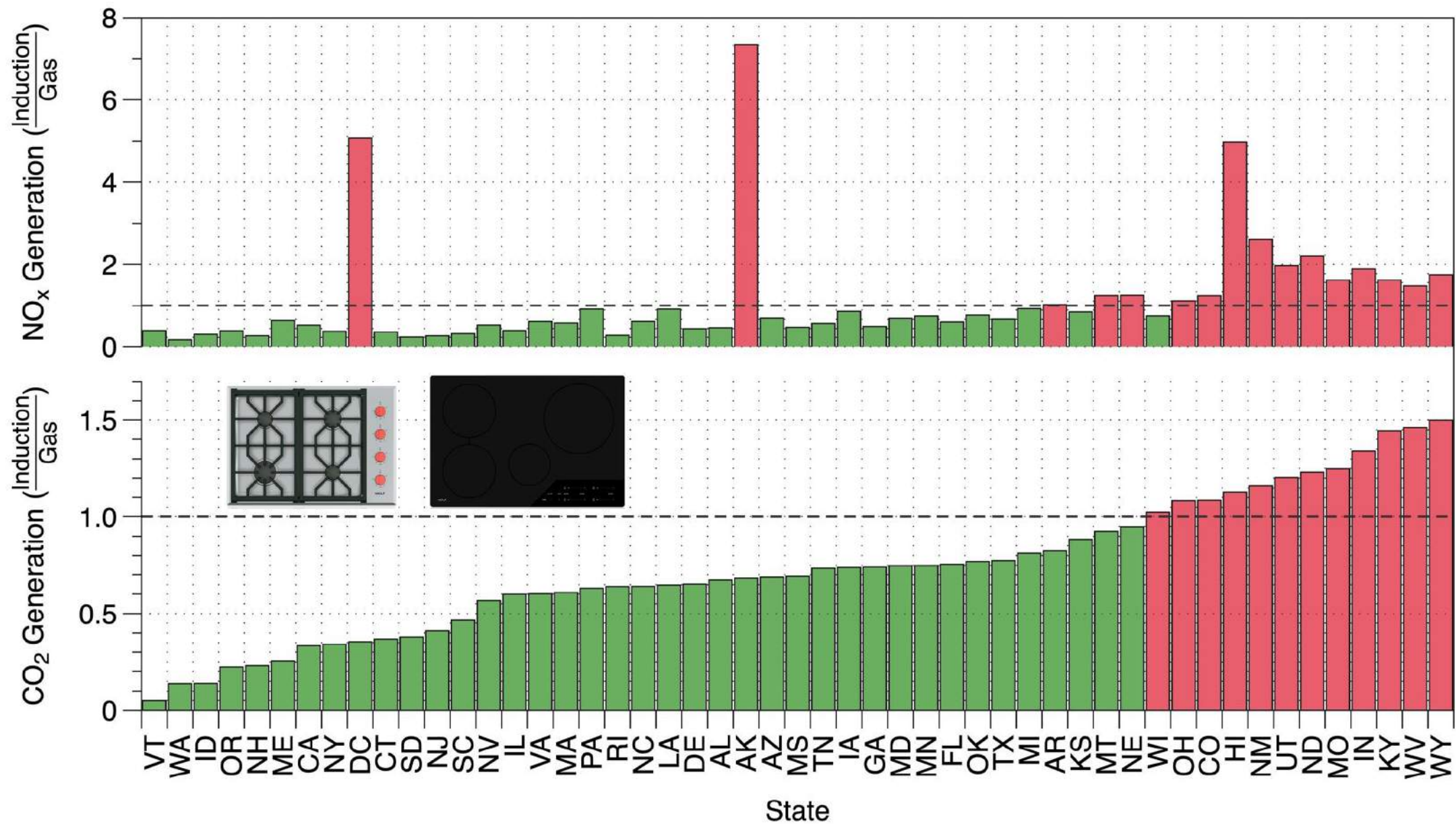


# Cooking comparison — Breakfast, Summary



NO<sub>2</sub> would be zero with induction

Particles are still generated (use a hood)



# Gas vs Induction Cook Off

Teresa Jan AIA, LEED AP, WELL AP,  
Senior Associate, SF Sustainable Design Committee Leader

Teresa Jan, AIA, LEED AP, WELL AP  
Gould Evans, SF Sustainability Committee Leader

Mom of two little monkeys



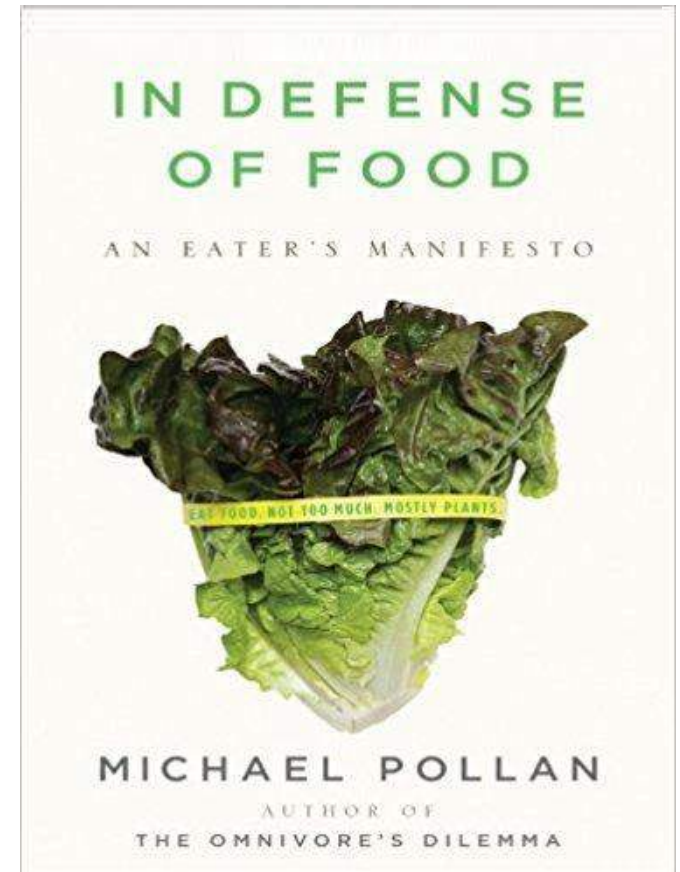
Berry oatmeal cupcake for Jude's 1<sup>st</sup> birthday

Instant Pot Sautee Mode Fan



We are What we eat!

Hero and Inspiration



# BUILDING ELECTRIFICATION @ Gould Evans



**Commercial Kitchen**  
SFUSD EED Kitchen at McAteer  
9,000 sq ft



**K-6 School**  
Oceanview Elementary School  
25,000 sq ft



**Higher Education Dormitory & Mixed Use**  
SFSU Holloway Avenue Student Housing  
239,000 sq ft

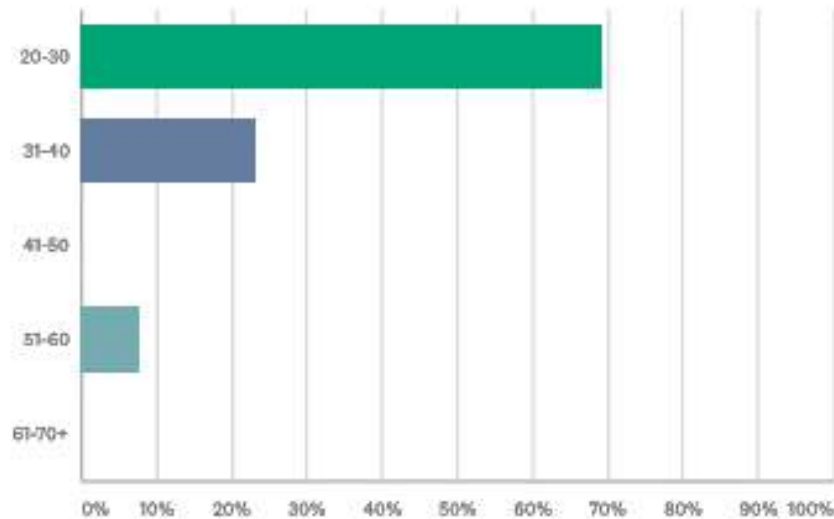


# INDUCTION VS GAS COOK-OFF SURVEY

## Demographics

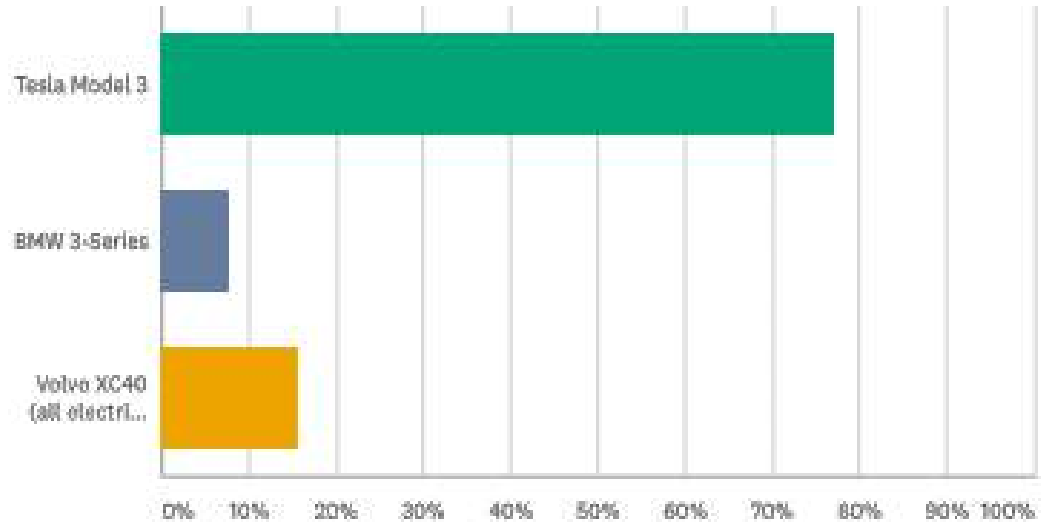
Q1

What's your age group?



Q2

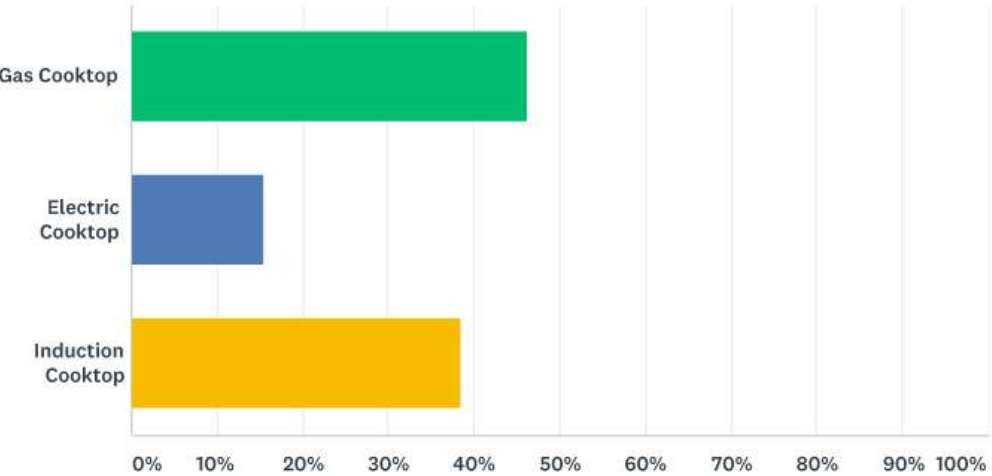
If you were to win any car of your choice, which of the following would you most likely choose?



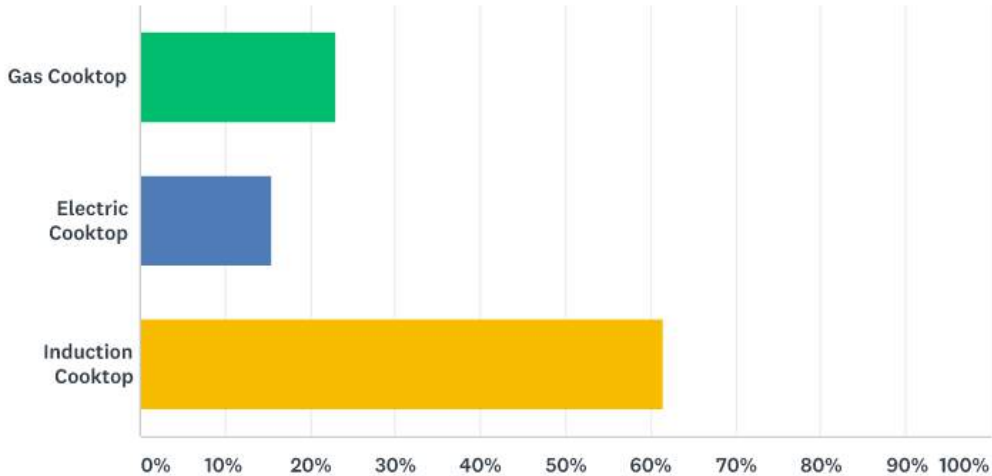
# INDUCTION VS GAS COOK-OFF SURVEY

Q6

Which type of cooktop do you believe would boil water the fastest?



Pre-cook off

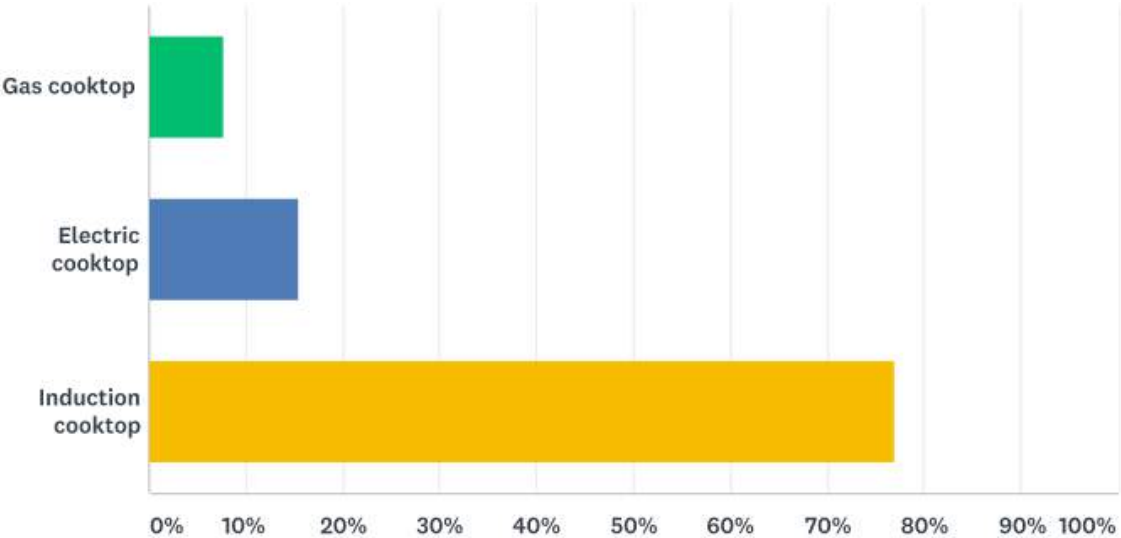


Post-cook off

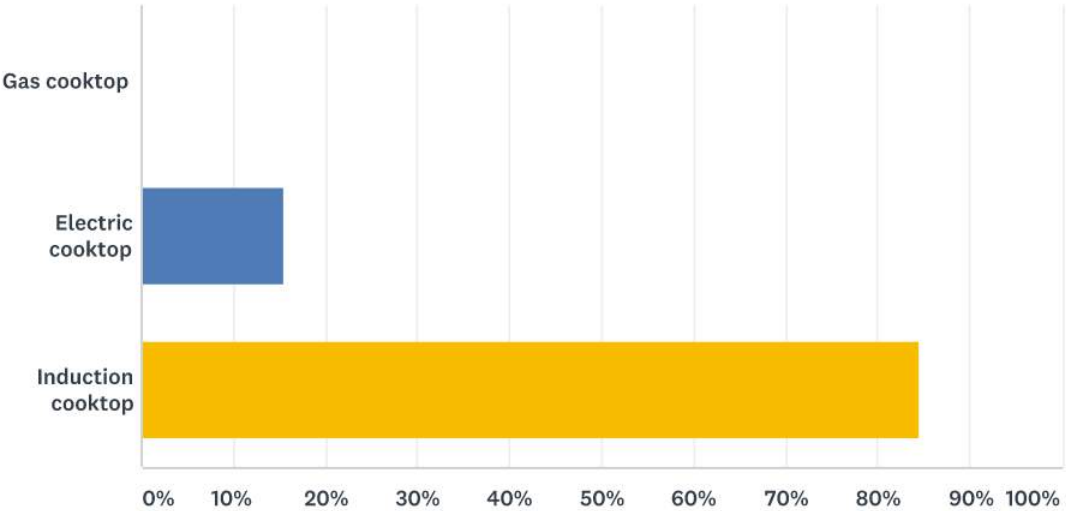
# INDUCTION VS GAS COOK-OFF SURVEY

Q7

In terms of safety, which type of appliance/cooktop would you feel most comfortable purchasing for a home with younger children or an old relative?



Pre-cook off

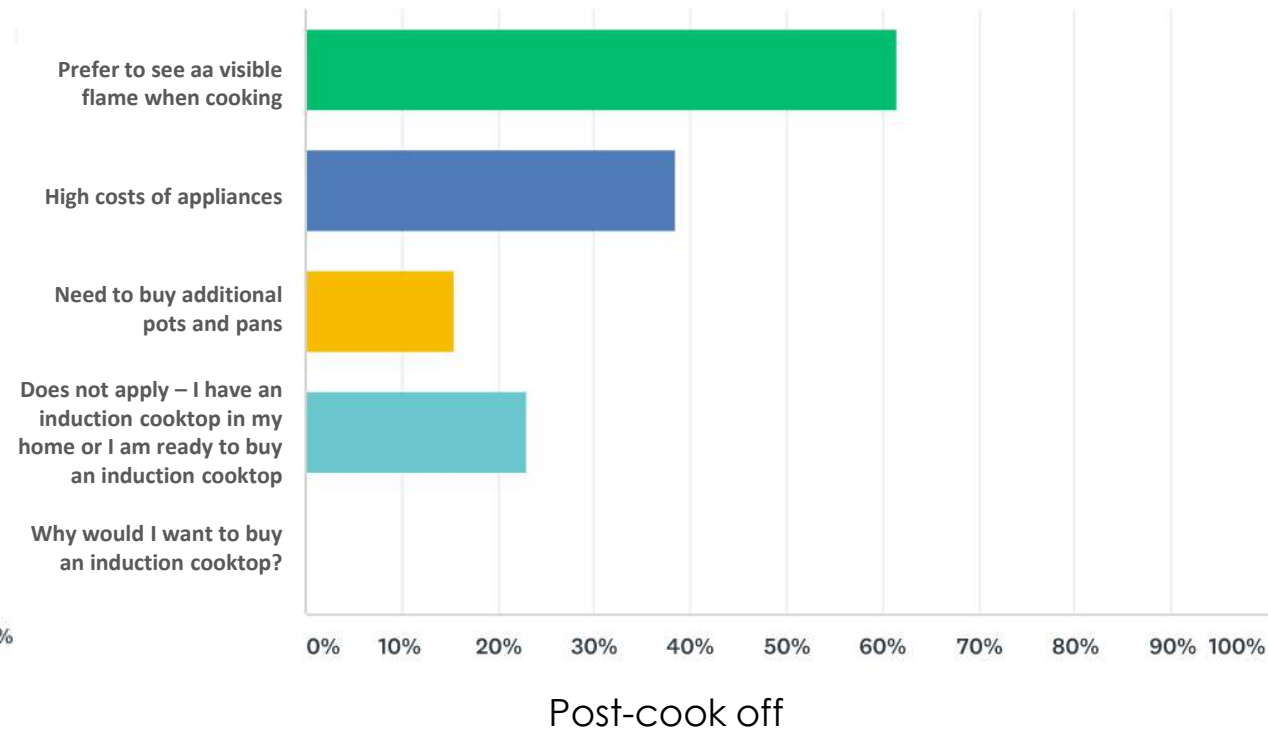
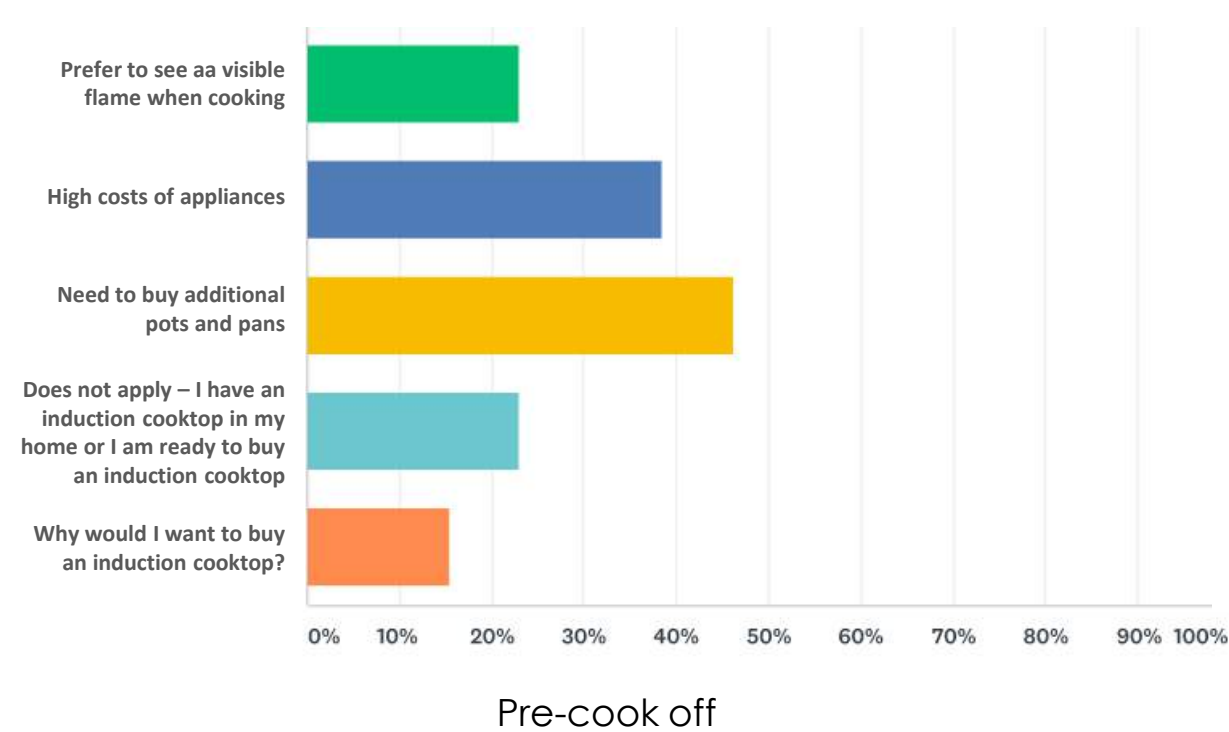


Post-cook off

# INDUCTION VS GAS COOK-OFF SURVEY

Q8

If you do not currently use/own induction cooking appliances, what are some of the factors that may explain why you may not (check all that apply);



# ALL CRUISE KITCHENS - ALL ELECTRIC!



**"All electric kitchens place no limitation on maritime food experience: NCL runs 28 restaurants, up to 50 a la carte dishes in addition to buffets, which both have fixed menus as well as seasonal changes. An electrical smoking cabinet with wood chips allows us to enhance the flavor of our signature ribs at Q Texas Smokehouse."**

**-- Christian Pratsch, Director of Culinary Development & Operation, Norwegian Cruise Line**

# INDUCTION – REDEFINING THE KITCHEN

Induction range



Induction off the wall



<http://www.adrianodesign.it/project/ordine/>

Induction Worktop



<http://www.tpbarselona.com/en/tpb-tech.html>

# INDUCTION – REDEFINING WOK COOKING

Wok designed for Induction



<https://www.electrolux.com.au/cooking/accessories/eiwt01/>

Induction wok (concave)



[https://nuwavenow.com/NuWaveWok?ref\\_version=DIRECT  
&TM=1569828912425](https://nuwavenow.com/NuWaveWok?ref_version=DIRECT&TM=1569828912425)

Adaptable Induction cooktop



<https://www.behance.net/gallery/49291561/Amphi>

**“Mastering heat and waterflow control for traditional wok cooking is extremely difficult. Concave Wok cooking that provides even heat requires much less time/skill to master.”**  
-- Paul Bohbot/ NG Associates

# INDUCTION – REDEFINING GATHERING OVER FOOD

Induction Korean BBQ



Induction hotpot



Mobil Induction Station



<https://www.newyorker.com/magazine/2019/04/15/hot-pot-for-the-type-a-personality-at-on>

<http://www.induplus.eu/en/trolleys/new-2018-cookboy>

“Once past the appetizers, you’ll find a minute-by-minute schedule of how your meal will unfold if you opt into the main event,. .....This is hot pot for the type-A personality, cooked before you on the barely noticeable state-of-the-art induction plate built into each tabletop, but requiring no participation beyond spooning the finished product into your mouth.”

Hanna Goldfield, *Hot Pot for the type A personality at O:n°*, The New Yorkers

# INDUCTION FOR THE FUTURE GENERATION



MasterChef  
JUNIOR

# INDUCTION FOR THE FUTURE GENERATION



MasterChef  
JUNIOR

# RESOURCES

## Residential Cooktop Performance and Energy Comparison Study

by Frontier Energy | SMUD

<https://www.smud.org/-/media/Documents/Corporate/About-Us/Energy-Research-and-Development/Induction-Range-Final-Report---July-2019.ashx>

## Induction vs Gas Cook off Video

by Gould Evans

<https://vimeo.com/gouldevans/netzero>

<https://www.gouldevans.com/firm>

## Factsheet Induction Cooking

by Energy & Environmental Transformation | Berkeley Ecology Center

<https://ecologycenter.org/wp-content/uploads/2019/09/EC-Induction-Cooking-Factsheet.pdf>

## An Electrification Guide for Large Commercial Buildings and Campus A Zero Emissions All-Electric Multifamily Construction Guide

by Redwood Energy

<https://www.redwoodenergy.tech/research/>



### Residential Cooktop Performance and Energy Comparison Study

Frontier Energy Report #10-131821-1-01  
July 2019

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The information generated in this report is based on data generated at the Post Service Technology Center (PSTC).



# PROGRAMS

**Try before you Buy, Food Service Technology Center, San Ramon**

<https://fishnick.com/equipment/demos/>

**Taste Drive, Riggs Showroom, Burlingame**

<https://www.riggsdistributing.com/event/events-riggs-showroom/>



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