QUANTIFYING THE HEALTH BENEFITS OF RESIDENTIAL BUILDING ELECTRIFICATION

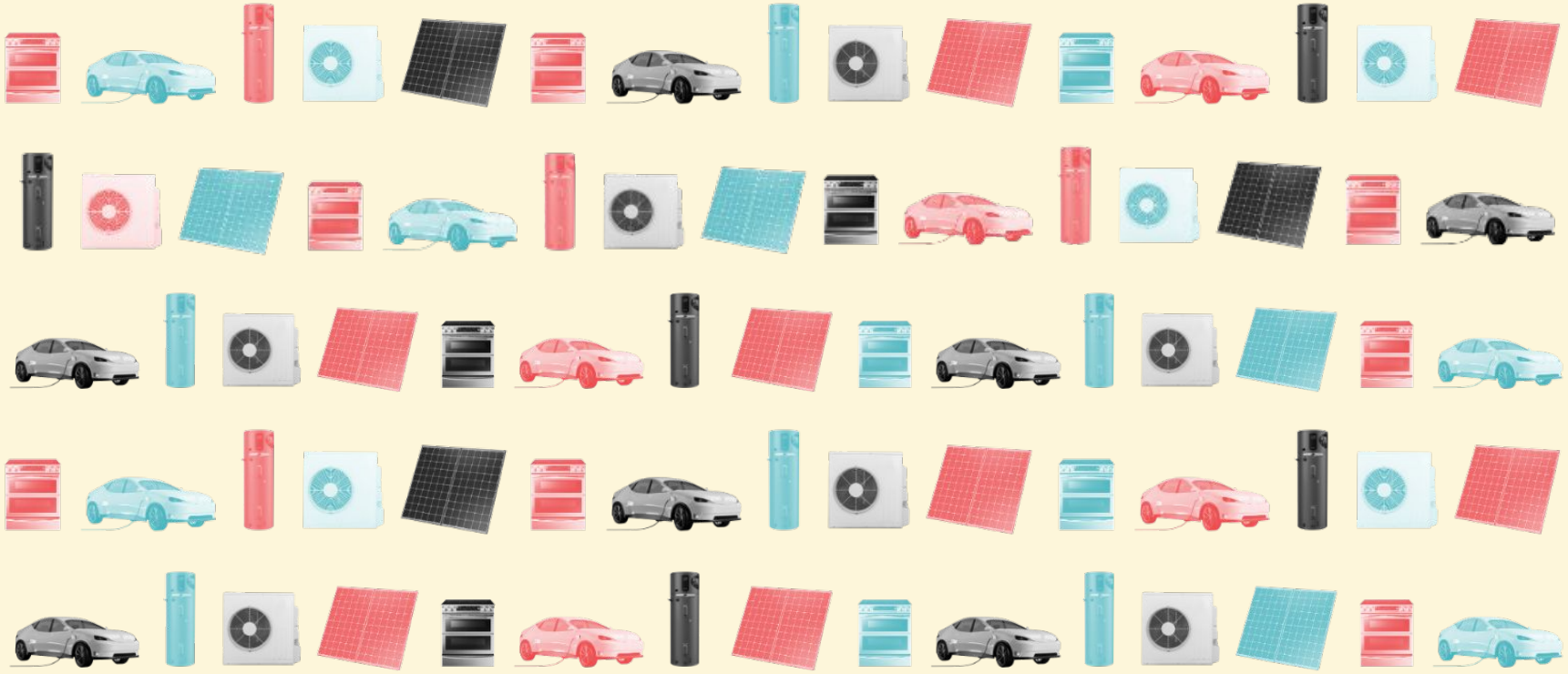
JUNE 2024

REWIRING AMERICA

NETWORK FOR PUBLIC HEALTH LAW

OVERVIEW

- **01** Introduction and Background
- **02** Analysis
- **03** Results



We *must* electrify everything.

42% OF OUR ENERGY-RELATED EMISSIONS COME FROM DECISIONS MADE AROUND THE KITCHEN TABLE.

This is how we heat and cool our homes, cook our food, dry our clothes, and get around.

It's a deeply actionable number.

And *it is our opportunity*.

WHY

WHY GO ELECTRIC AT THE HOUSEHOLD LEVEL?

Almost everyone is really worried about the climate crisis.

But we’re still not seeing the action we need.

WHY

→ Fossil fuel combustion for **space heating, water heating, and cooking** in households accounts for **6 percent** of US greenhouse gas emissions

→ **Household vehicles** account for **17 percent** of US greenhouse gas emissions

→ Transitioning away from natural gas, fuel oil, propane, and gasoline will **improve efficiency and lower bills**

→ Removing fossil fuel combustion from our homes and **improves air quality indoors and out**

Source: https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions

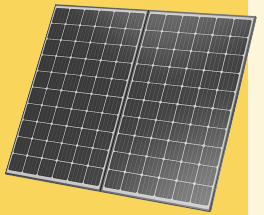
HOW DO WE ELECTRIFY OUR LIVES?

Induction stoves

Air source heat pumps, heat pump water heaters

Heat pump dryers

Electric vehicles



Solar panels

PRIMARY PROJECT GOALS & OUTCOMES

QUANTIFY	ENABLE	PROVIDE
Quantify the avoided health impacts and costs from residential building electrification	Enable community-specific analyses of the health and air quality co-benefits of electrification	Provide partners with data and resources

SCOPE

Air Quality

Indoor air quality:

Most research on the health impacts of fossil fuels in buildings has been done on indoor air quality

No existing regulations on indoor air quality

Indoor air quality does not include full impacts of heat pumps, heat pump water heaters.

Outdoor air quality - *our analysis*:

Knowledge gap around the contribution of buildings to poor outdoor air quality

Demonstrate health impacts at the community scale.

Capture pollution reduction impacts of heat pumps, heat pump water heaters.

SCOPE

To understand how electrification impacts health, we first need to understand the impacts of:

Burning fossil fuels
in the home

Burning fossil fuels in a
power plant for electricity

SCOPE

In the home

Home burns fossil fuels for space heating, water heating, etc.

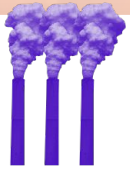
Home emits criteria air pollutants into the outside air.

CAP become concentrated in the air.

...leading to health impacts.

At the plant

Electricity consumption for space heating, water heating, etc.



Power plants emit criteria air pollutants when they burn fossil fuels.

CAP become concentrated in the air.

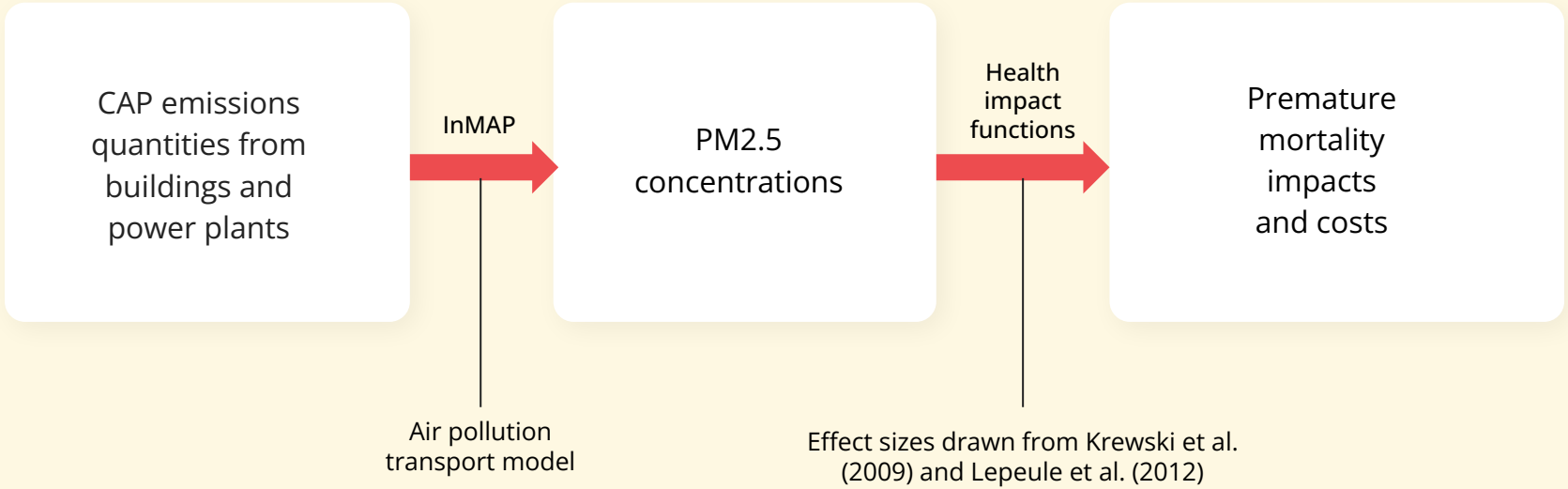
...leading to health impacts.

ANALYSIS

ELECTRIFY EVERYTHING FOR EVERYONE

ANALYSIS

We first calculated the total health impacts associated with fossil fuel combustion:



ANALYSIS

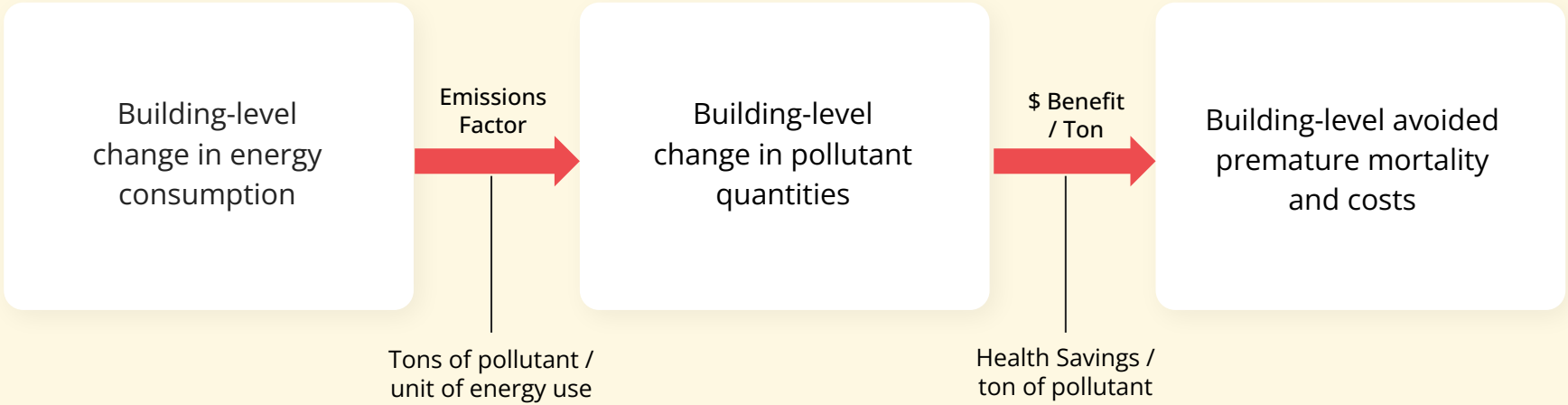
Electrification modeling

High-granularity modeling of energy consumption within the US housing stock, under baseline conditions (e.g. fossil fuel appliances) and electrification (e.g. heat pumps, heat pump water heaters)

Source: https://resstock.nrel.gov/

ANALYSIS

We could then calculate the building-level health impacts:



RESULTS

RESULTS

We quantify the health impacts of electrification upgrades in two ways:

Incidence

How many premature deaths is the reduction in outdoor air pollutions avoiding?

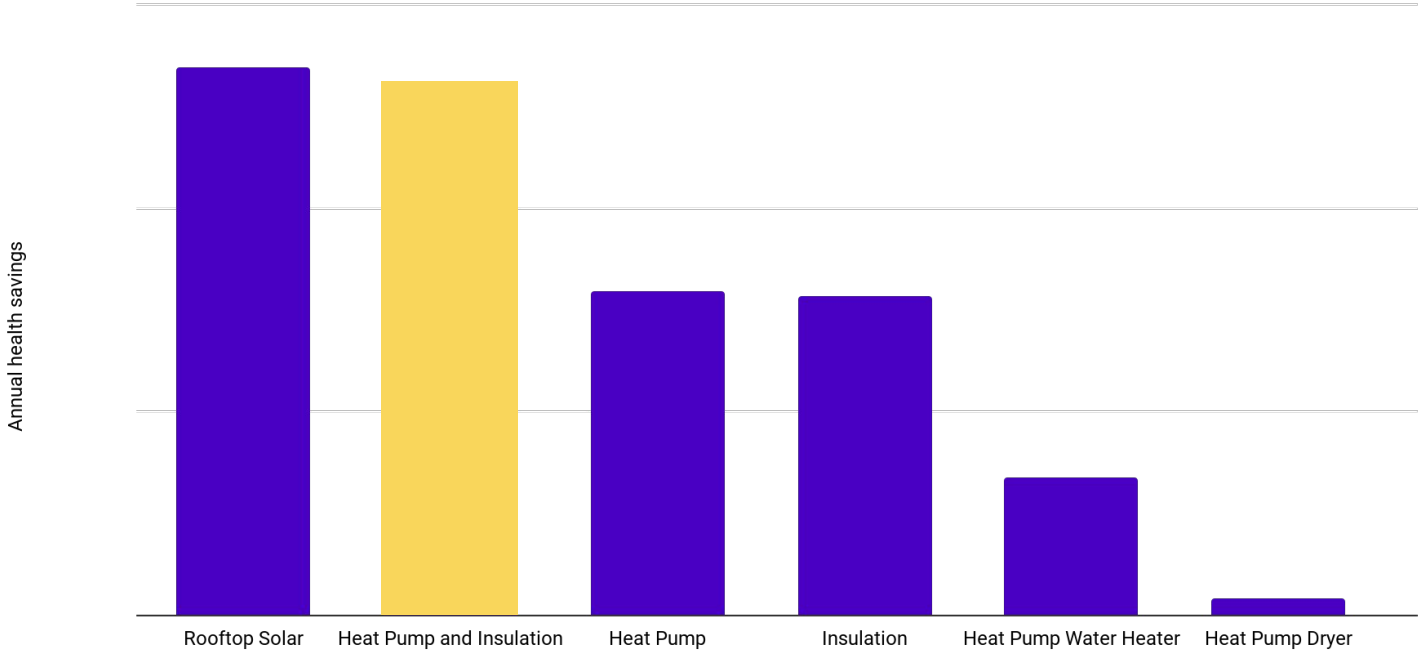
Valuation

The monetary value associated with the avoided deaths, using the value of a statistical life (VSL) from the EPA: ~$11.5 million (2024).

Health Impact $ = Reduced incidence x VSL

RESULTS

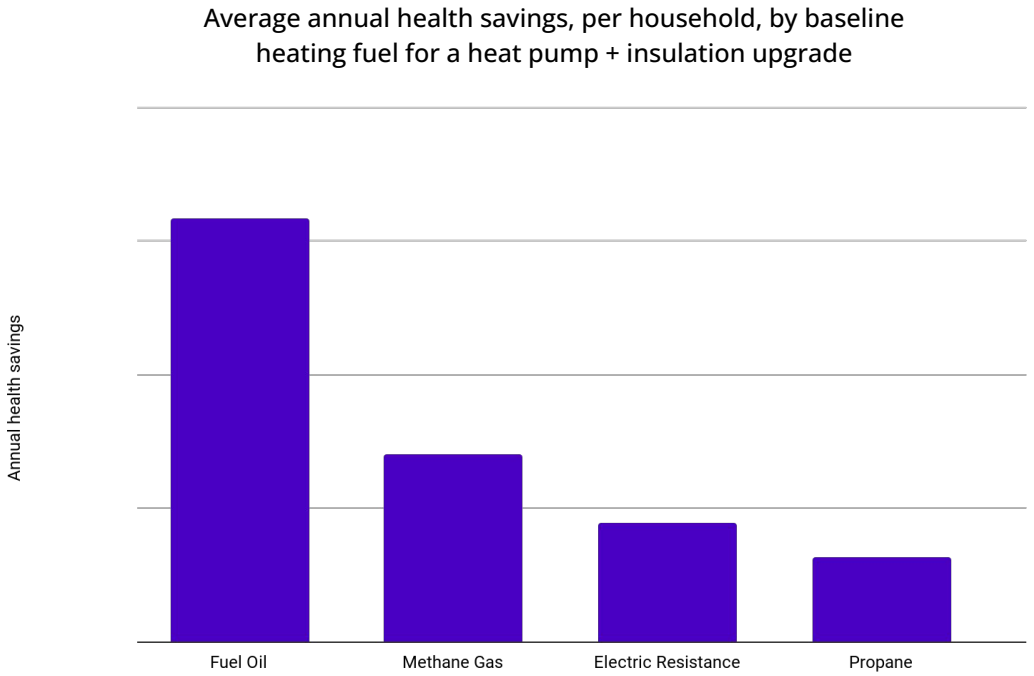
Average annual health savings, per household for different electrification and efficiency upgrades



RESULTS

Some fuels are more harmful than others.

Electrification of fuel oil homes can be particularly impactful in reducing premature mortality.

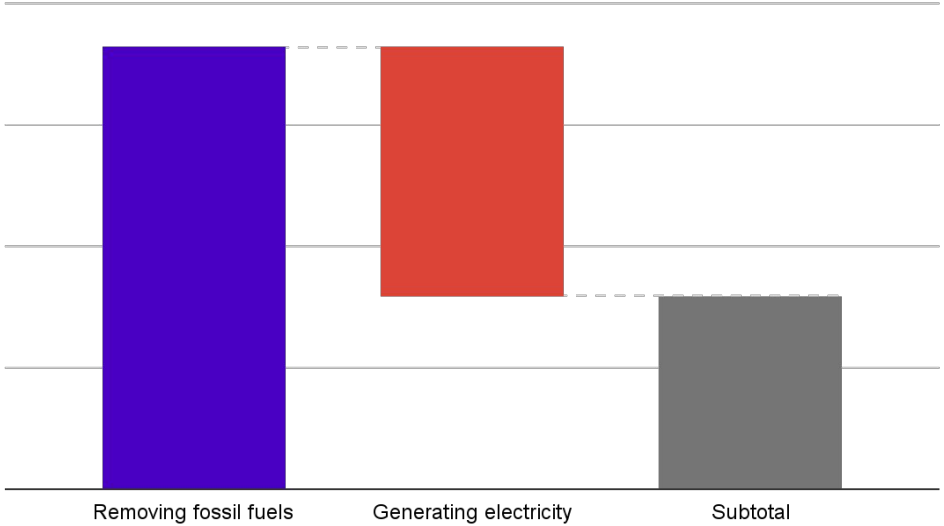


RESULTS

What about the grid?

Even accounting for burning some fossil fuels to generate electricity over the next 15 years, electrification still wins out.

Net annual health savings from heat pump + insulation upgrade

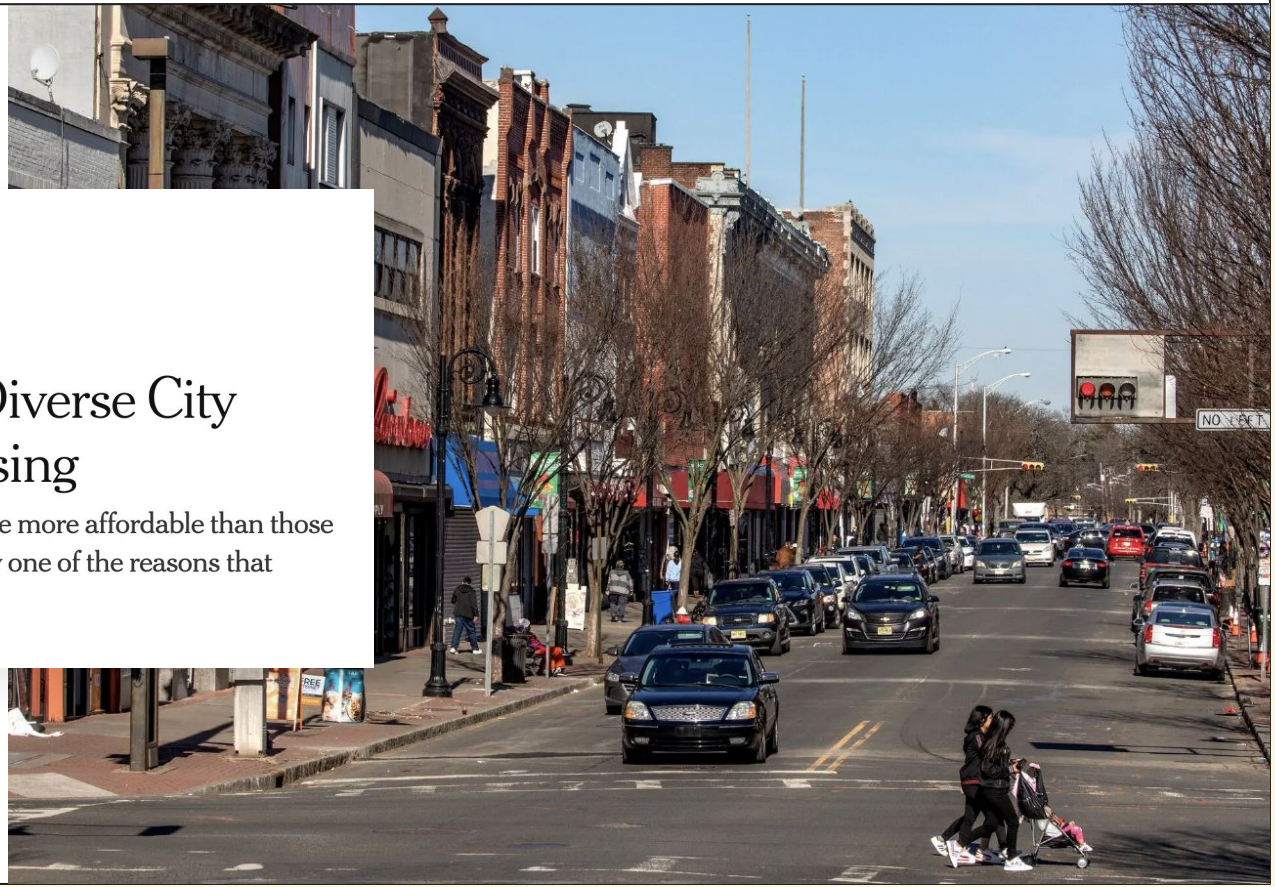


RESULTS

Our local analysis incorporates:

- Baseline health and mortality rates
- Household characteristics (ResStock)
- Electric grid mix
- Local climate and geography (ResStock)
- Population density

RESULTS



The New York Times

MARCH 2, 2022

Plainfield, N.J.: A Diverse City With Historic Housing

The city's ornate Victorian homes are more affordable than those in surrounding areas. But that's only one of the reasons that people move here.

RESULTS

~$500

Avg health savings from heat pump and insulating a household in **Plainfield, NJ**

$7,500

Over the course of the appliance's lifetime (15 years)

>$100M

For all 16,000 households in the city*

We can measure health impacts for the average household, over the lifetime of the appliance, for an entire city.

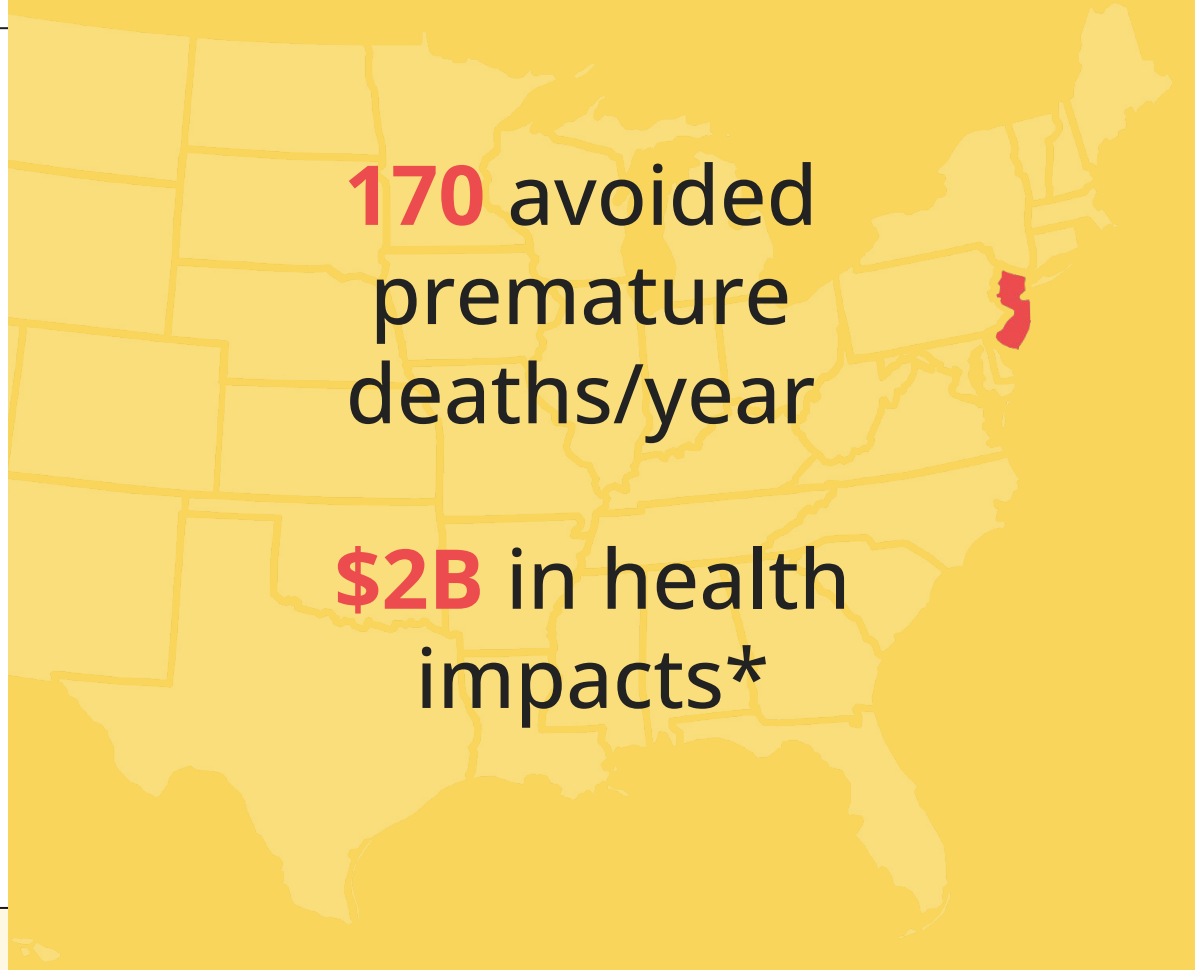
*Preliminary results based on current modeling

RESULTS

Or for a whole state.

Upgrading every home in New Jersey with a heat pump + insulation could save hundreds of lives and billions of dollars each year.

*Preliminary results based on current modeling



170 avoided premature deaths/year

$2B in health impacts*

TAKEAWAY

Burning fossil fuels is unhealthy.

Electrification is essential.

REWIRING AMERICA

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