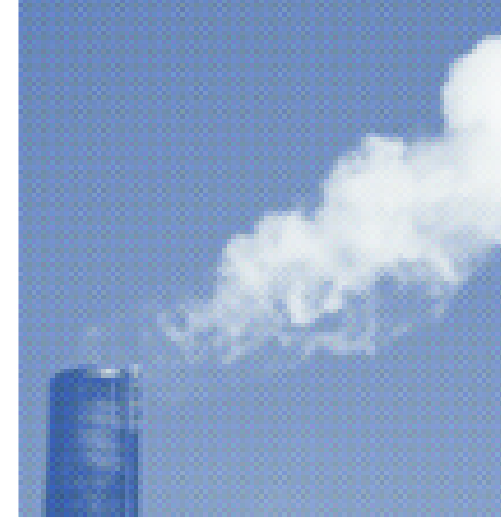


People Planet Property



How Buildings Shape the Environment,
Your Health, and Your Wealth

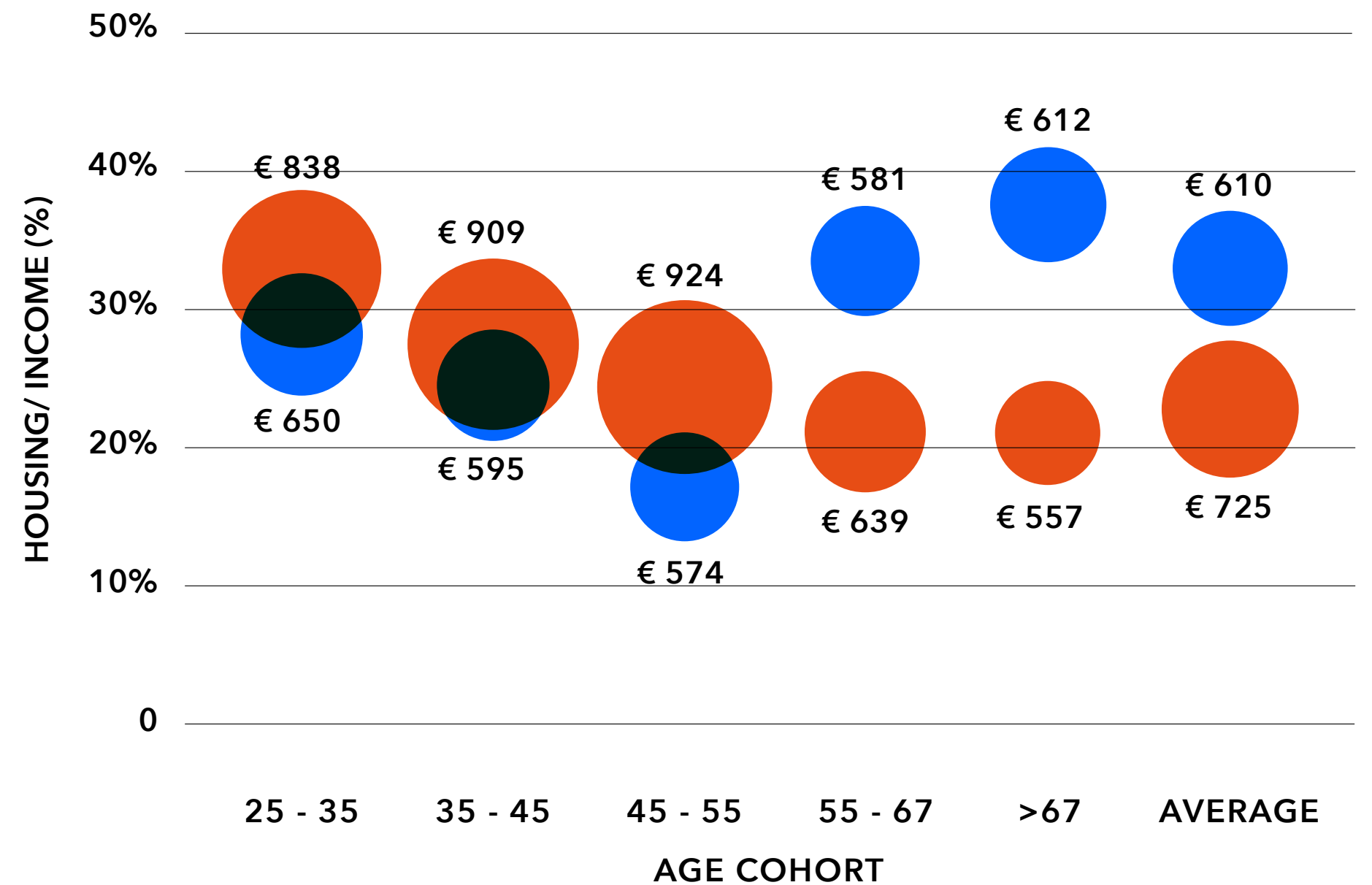


Real estate
is a big part
of your life...



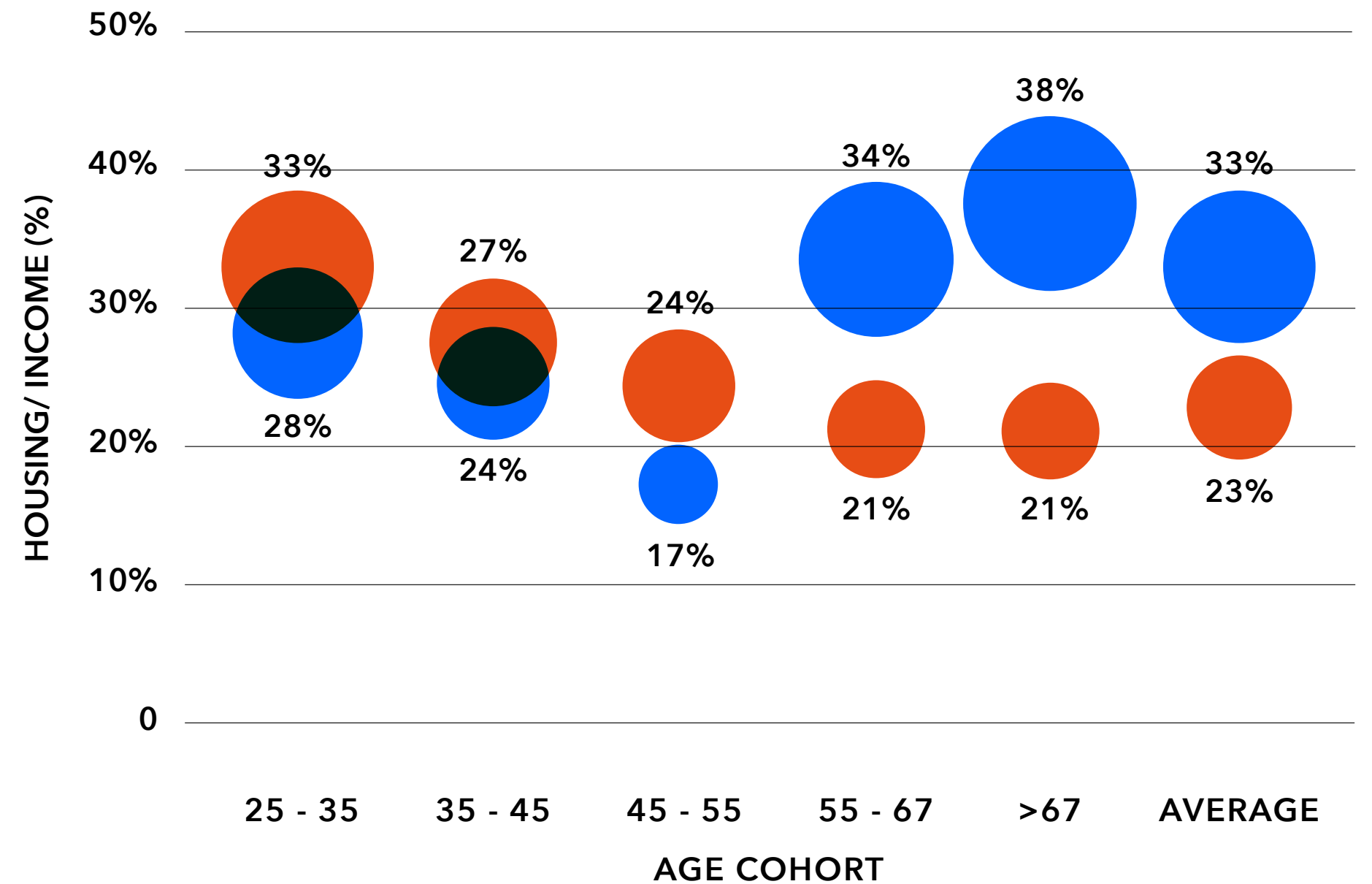
Let's start with your home...

Monthly costs vary by age and tenure



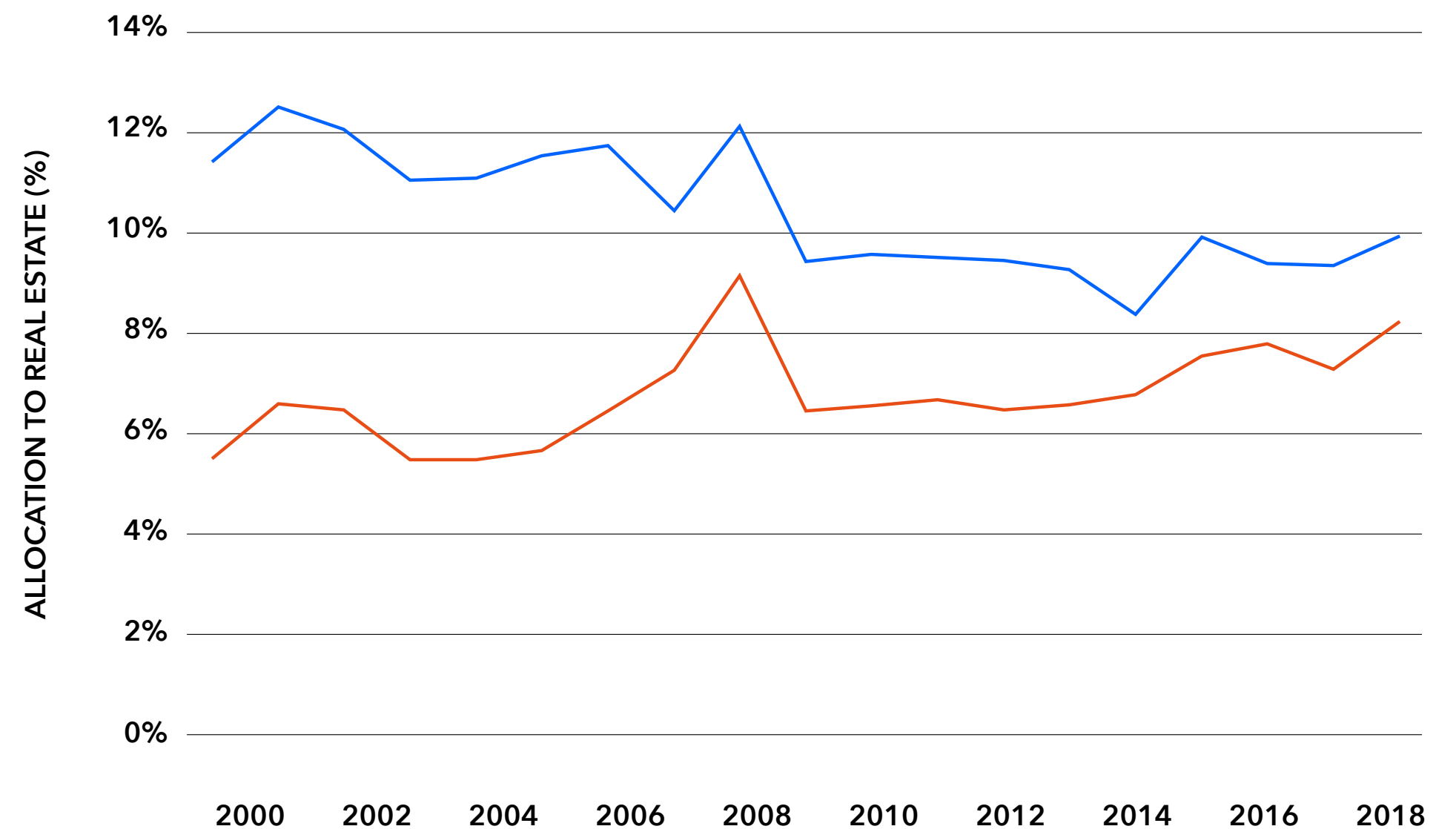
...taking a quarter to a third of income

Young owners and old tenants
have highest "woonquote"



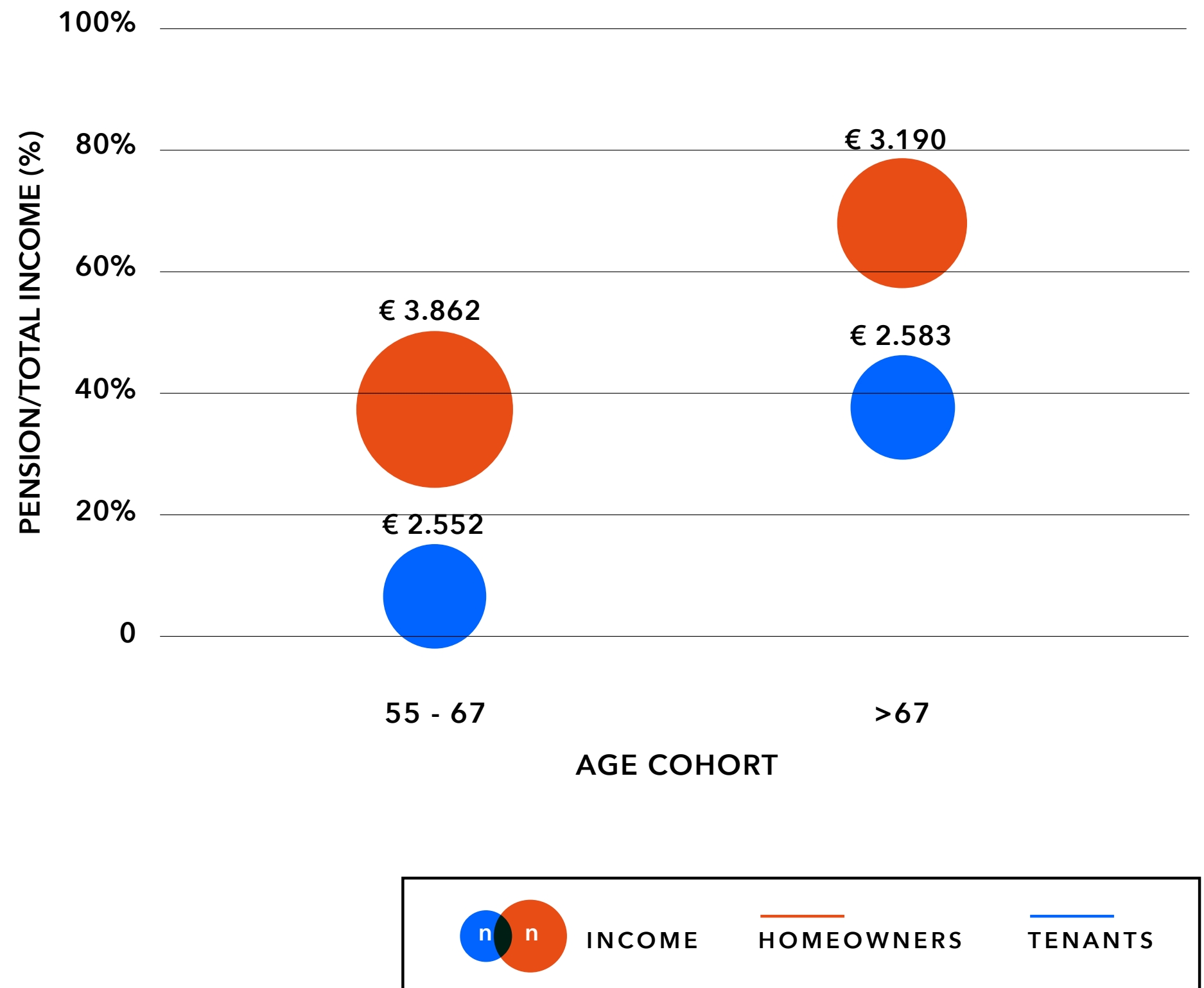
The impact of real estate goes beyond your home

Your pension fund invests in real estate as well



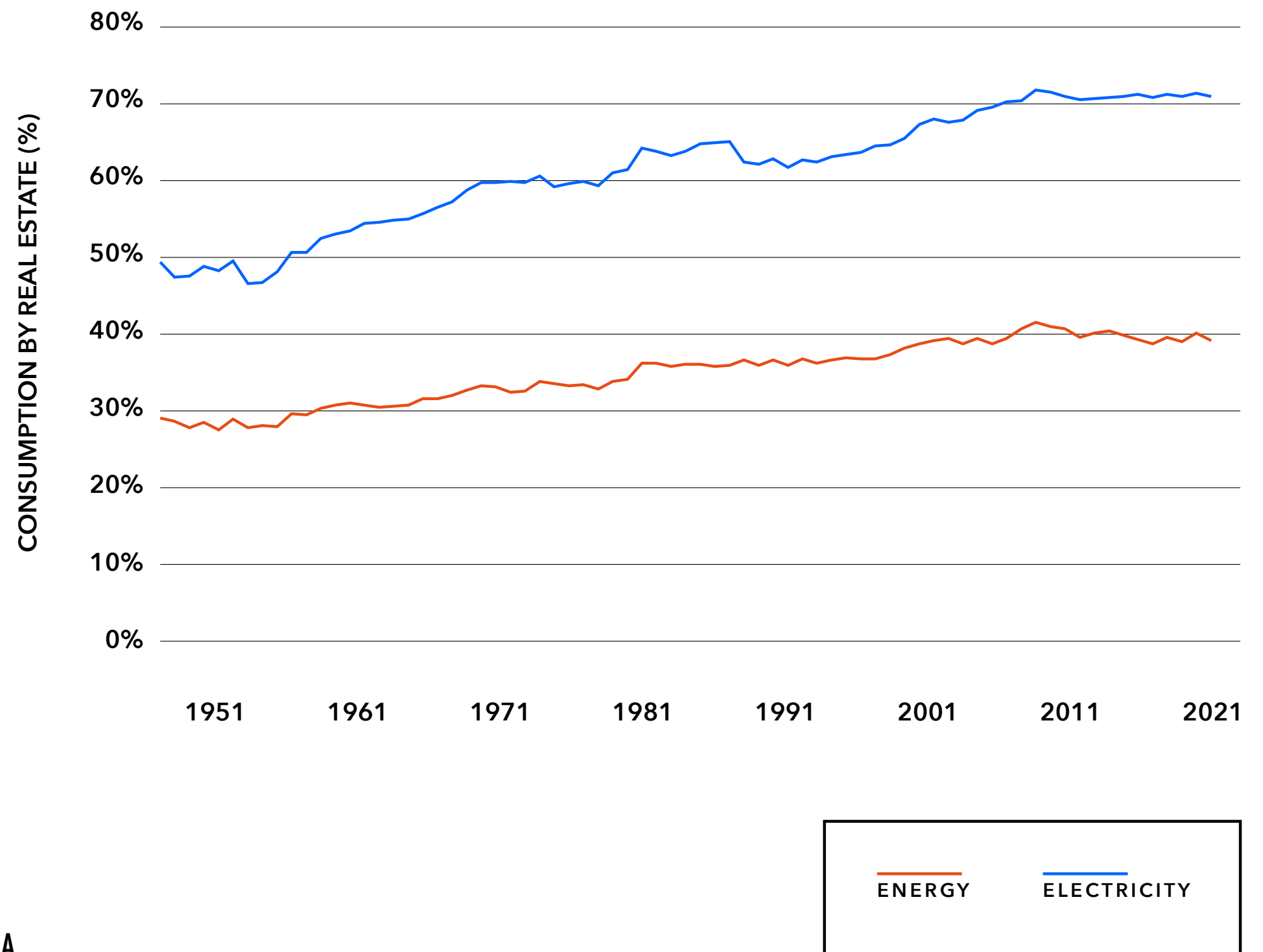
And your pension represents a large chunk of your income (later...)

Pension income is especially relevant for homeowners



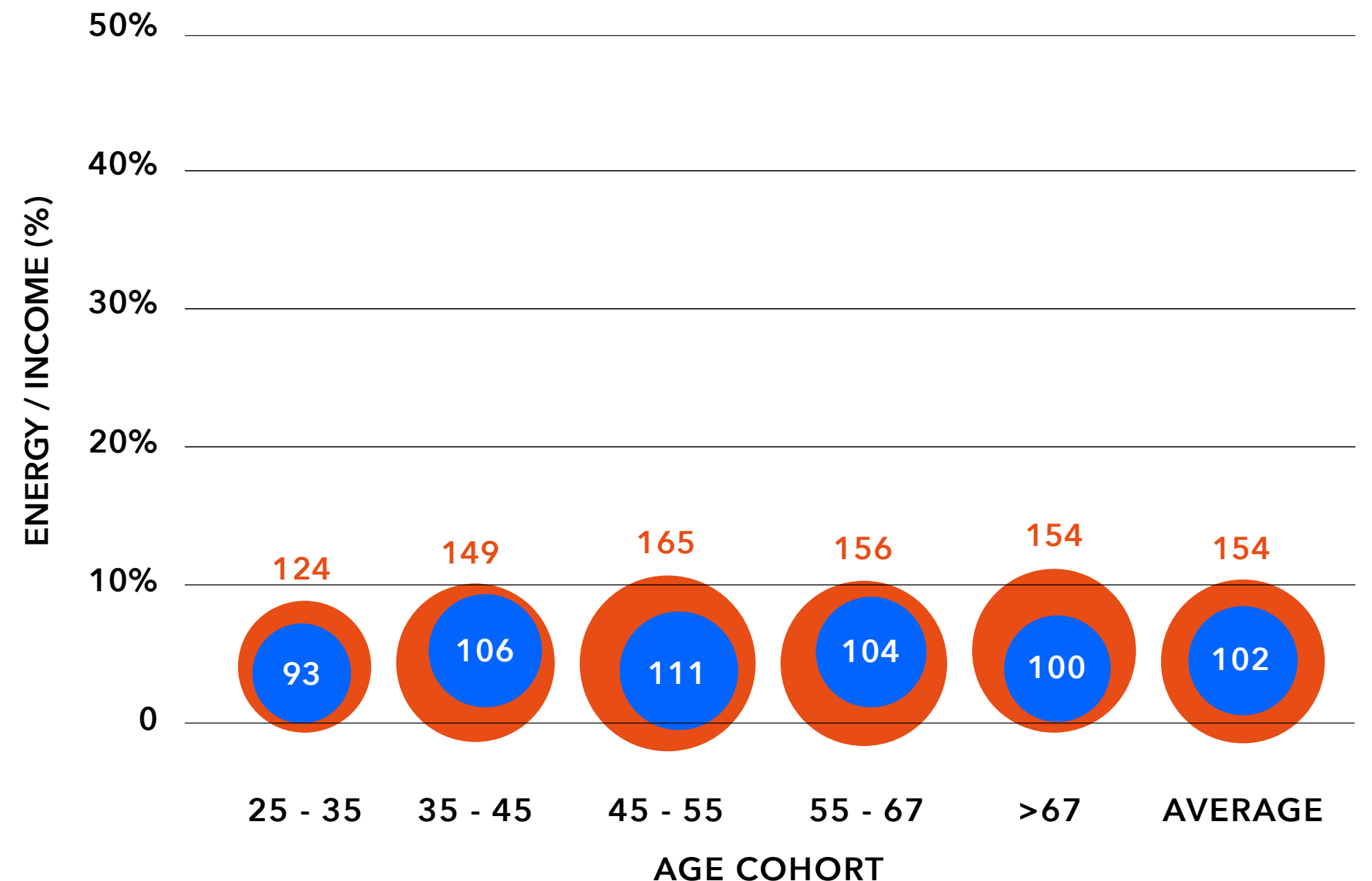
Real estate and the environment are also closely related

71% of total U.S. electricity consumption is in buildings!



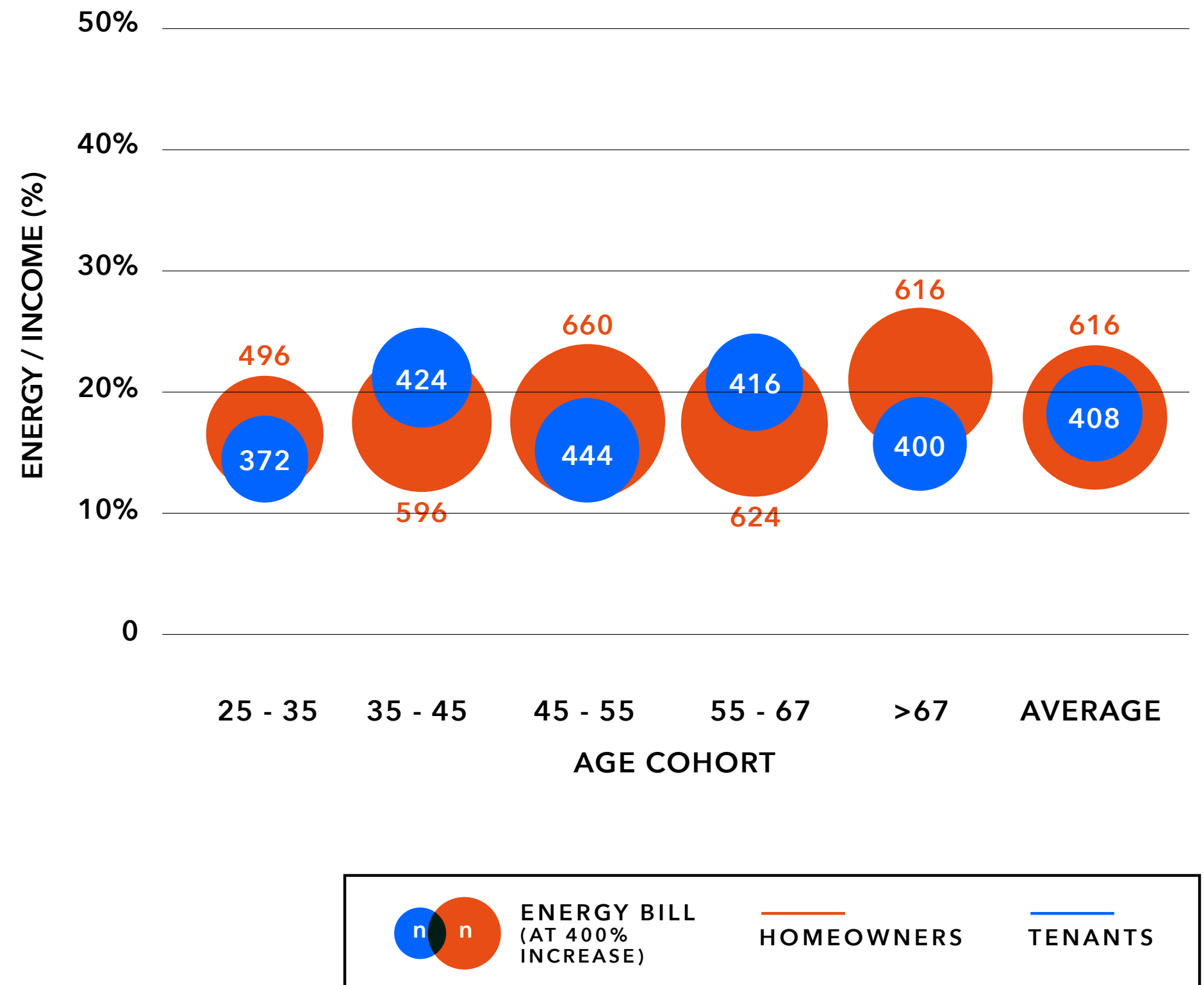
Energy consumption directly affects you

Energy expenditures were about 4-5% of gross income in 2021...



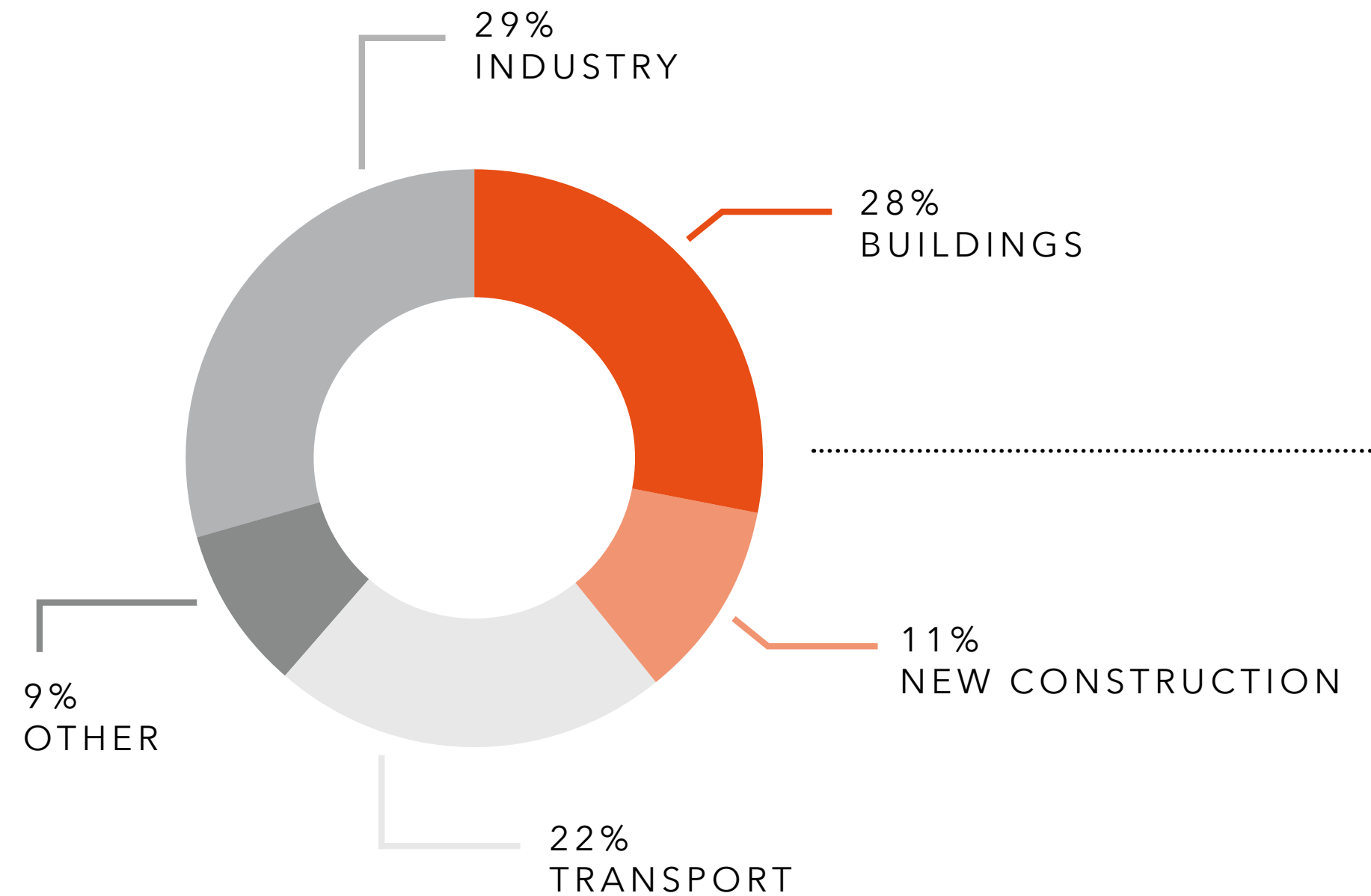
...but the energy bill has started to bite...

15-20% of gross income in 2023
(at a 400% price increase)



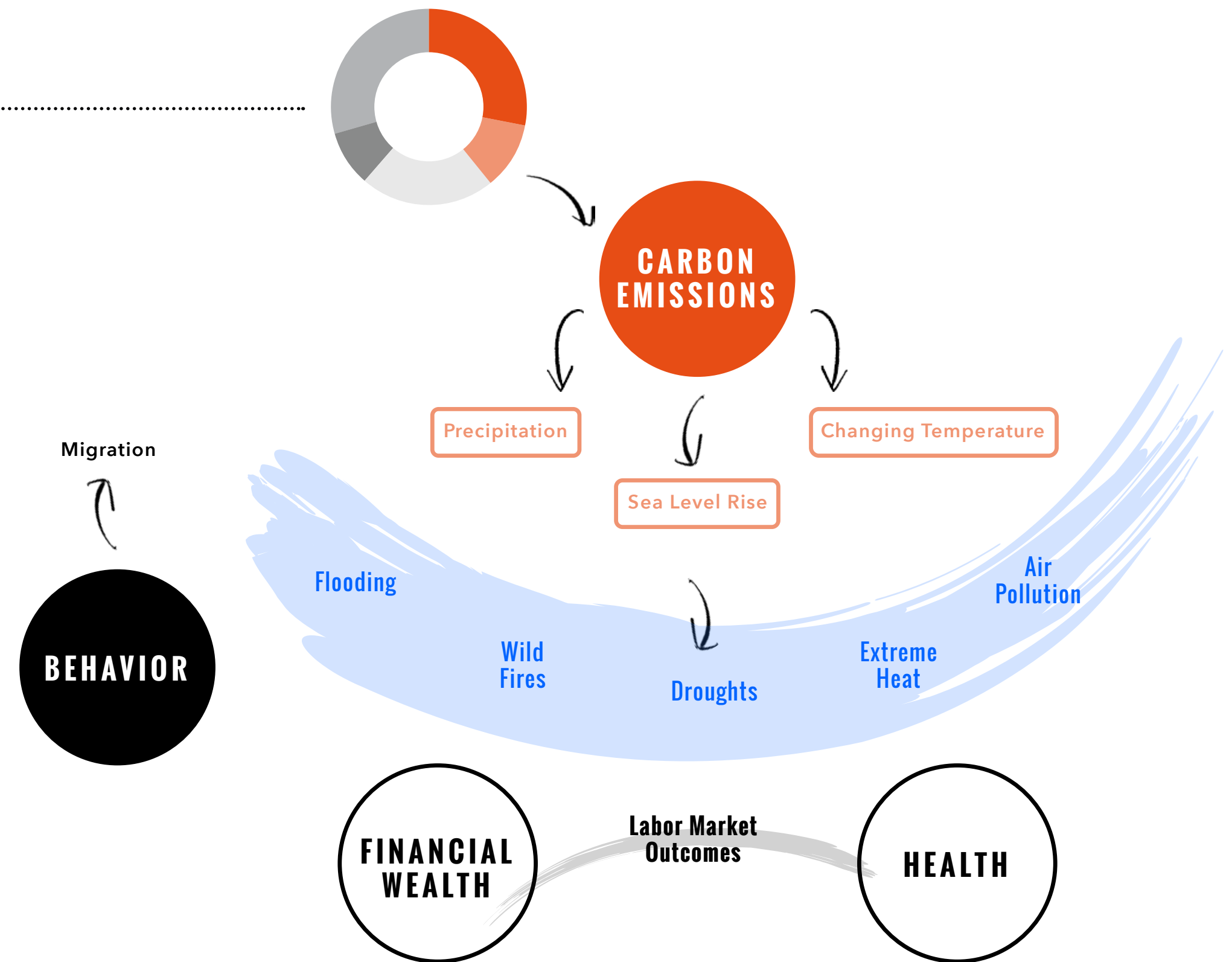
Energy consumption = carbon emissions

Real estate represents 39%
of global CO₂ emissions (2022)



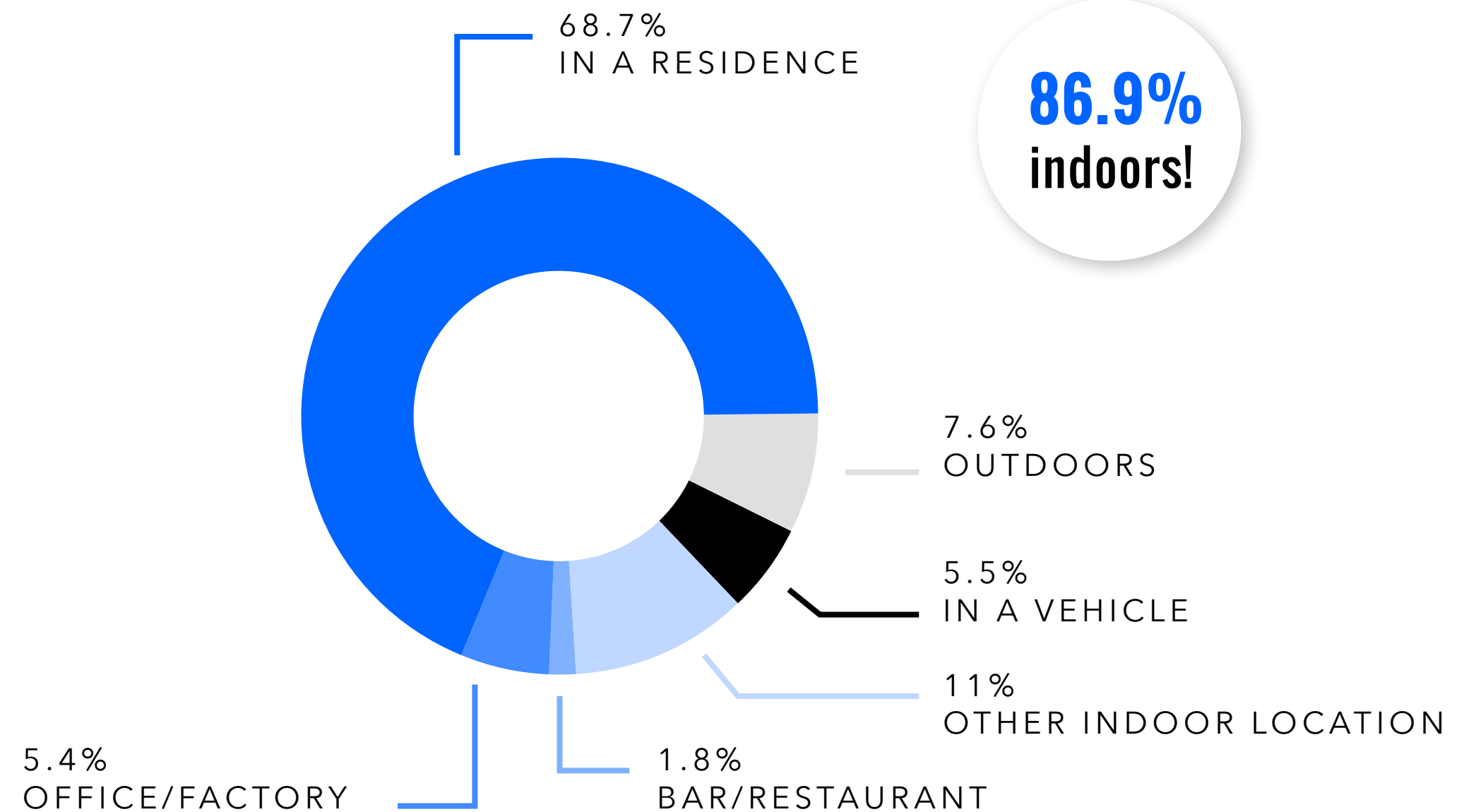
CO₂ emissions also affect you, ultimately

A plethora of channels...



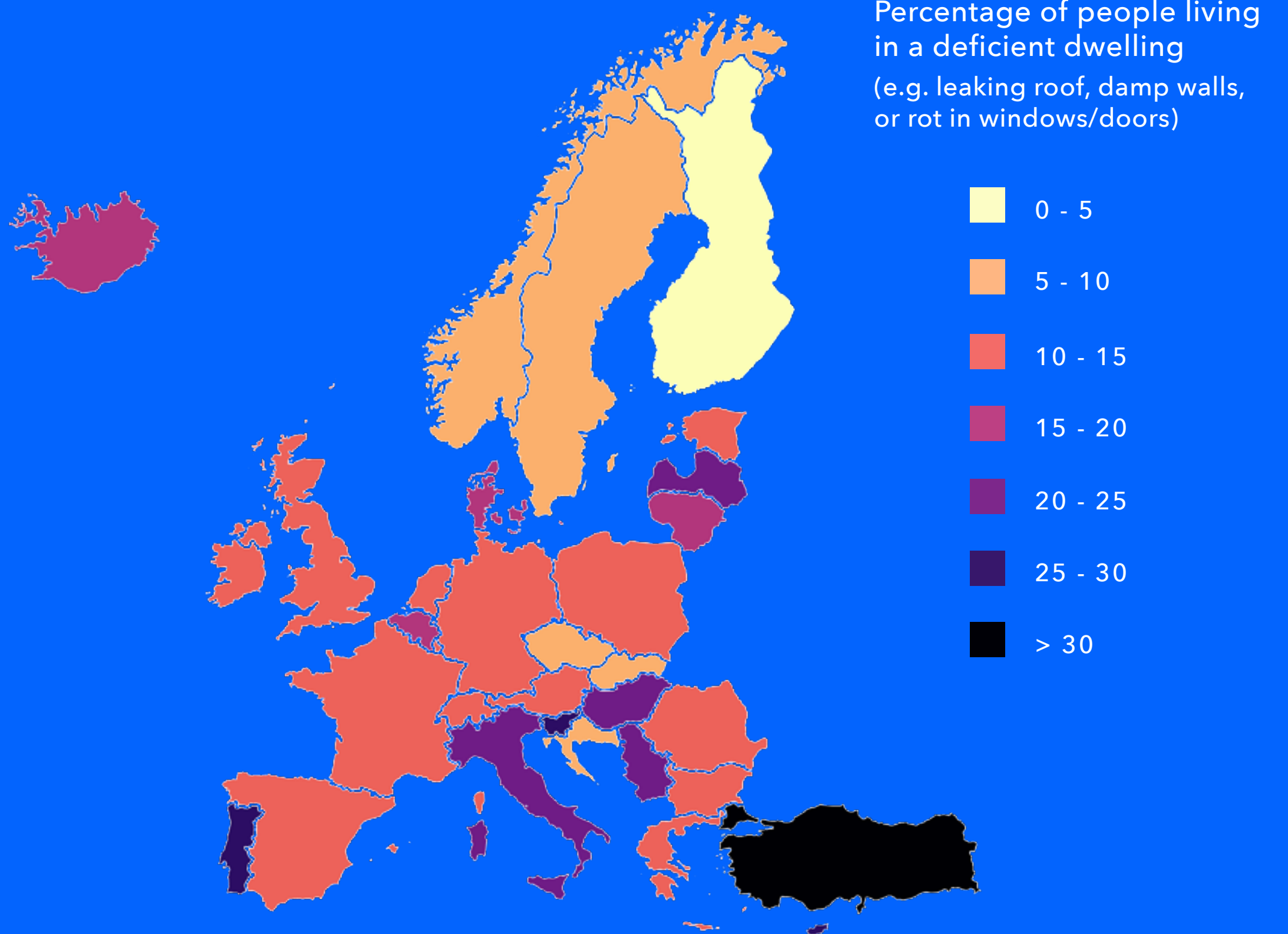
Real estate may also affect you in a different way

Think about where you spend your time...



...and “indoor” isn’t always so great

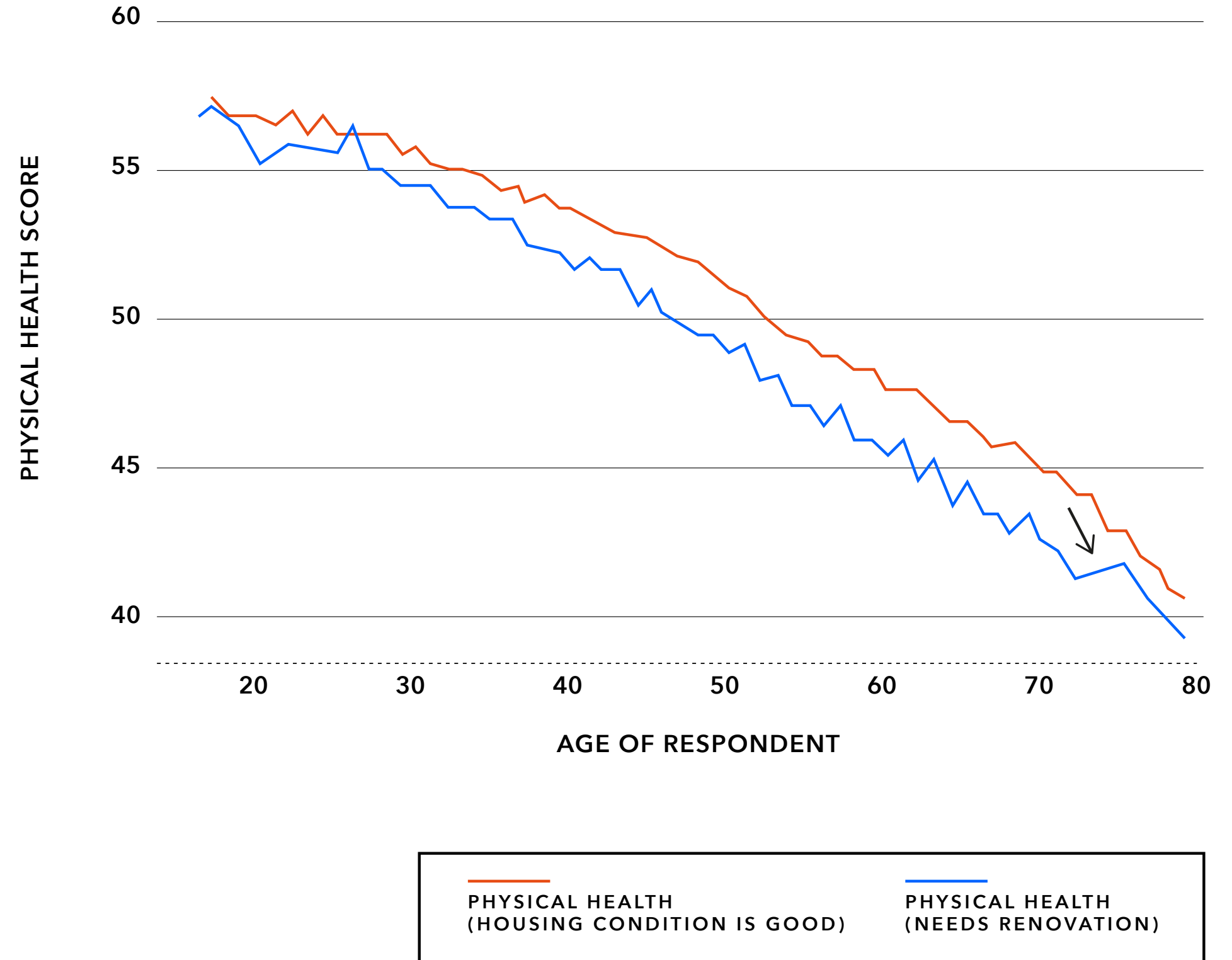
The state of home maintenance
in Europe is worse than you think



Home quality affects your physical health...

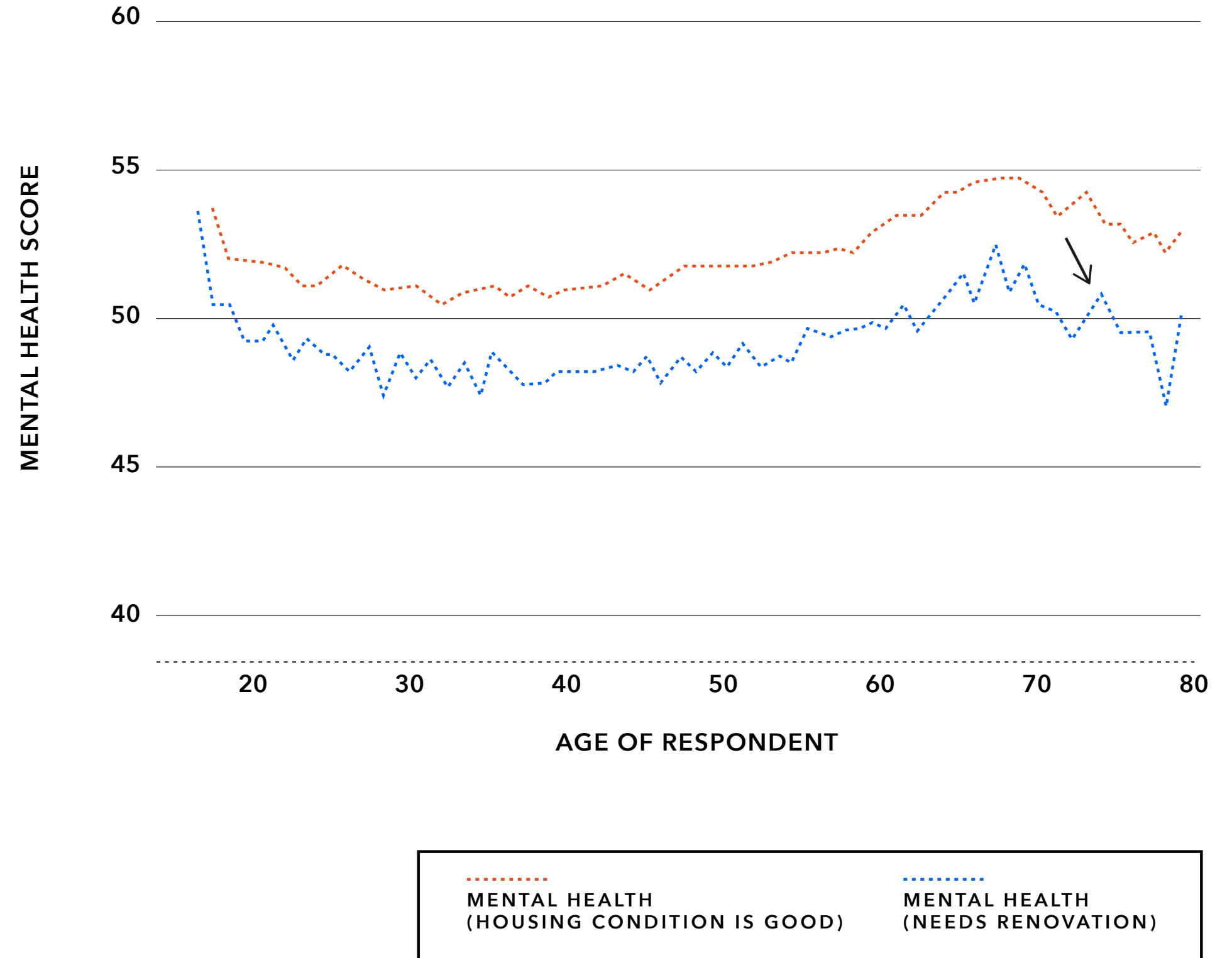
Self-reported health status in German homes is lower for poorly maintained homes

11%
more
doctor
visits!



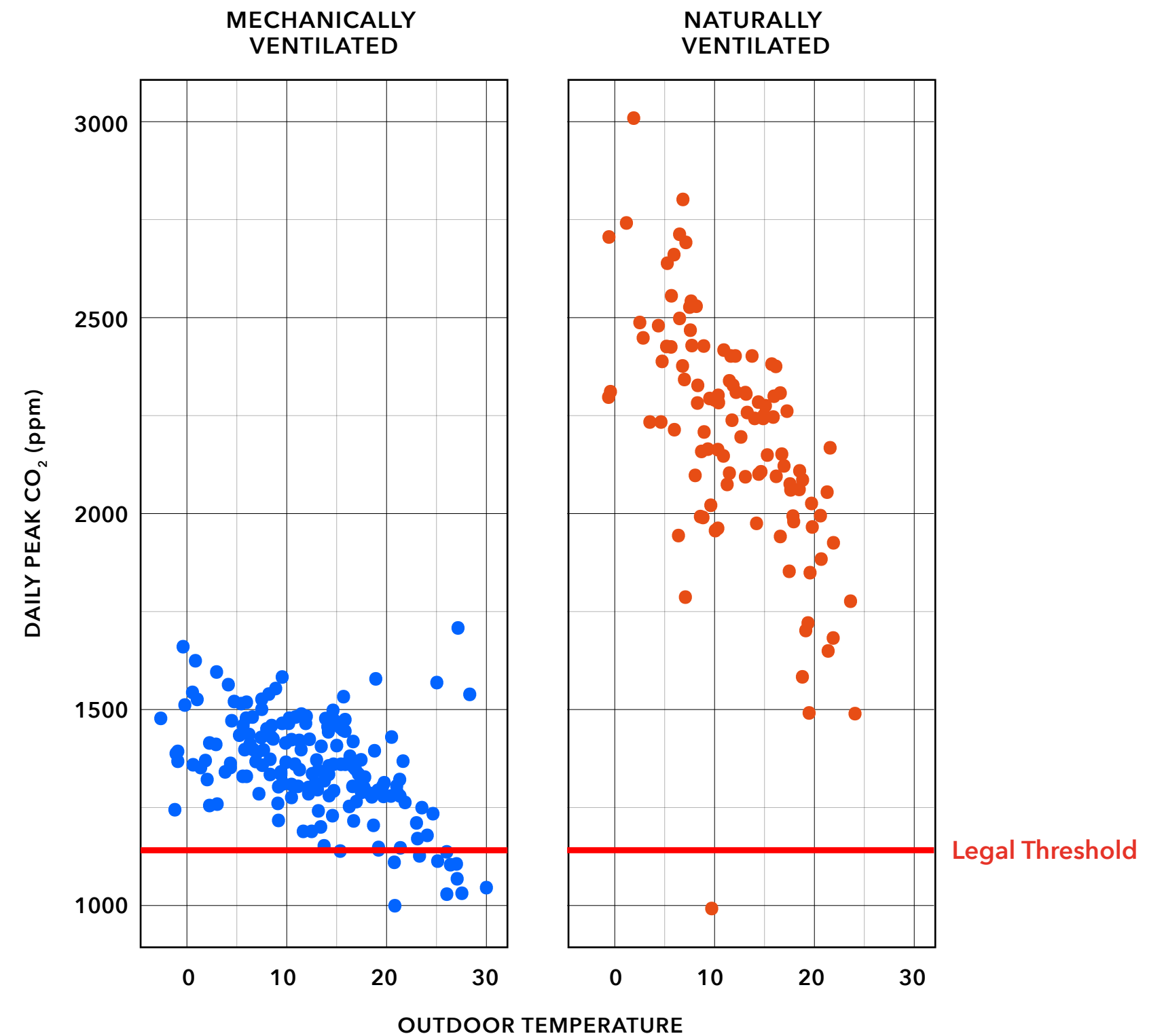
...and your mental health

Health status also lower in poorly
maintained homes



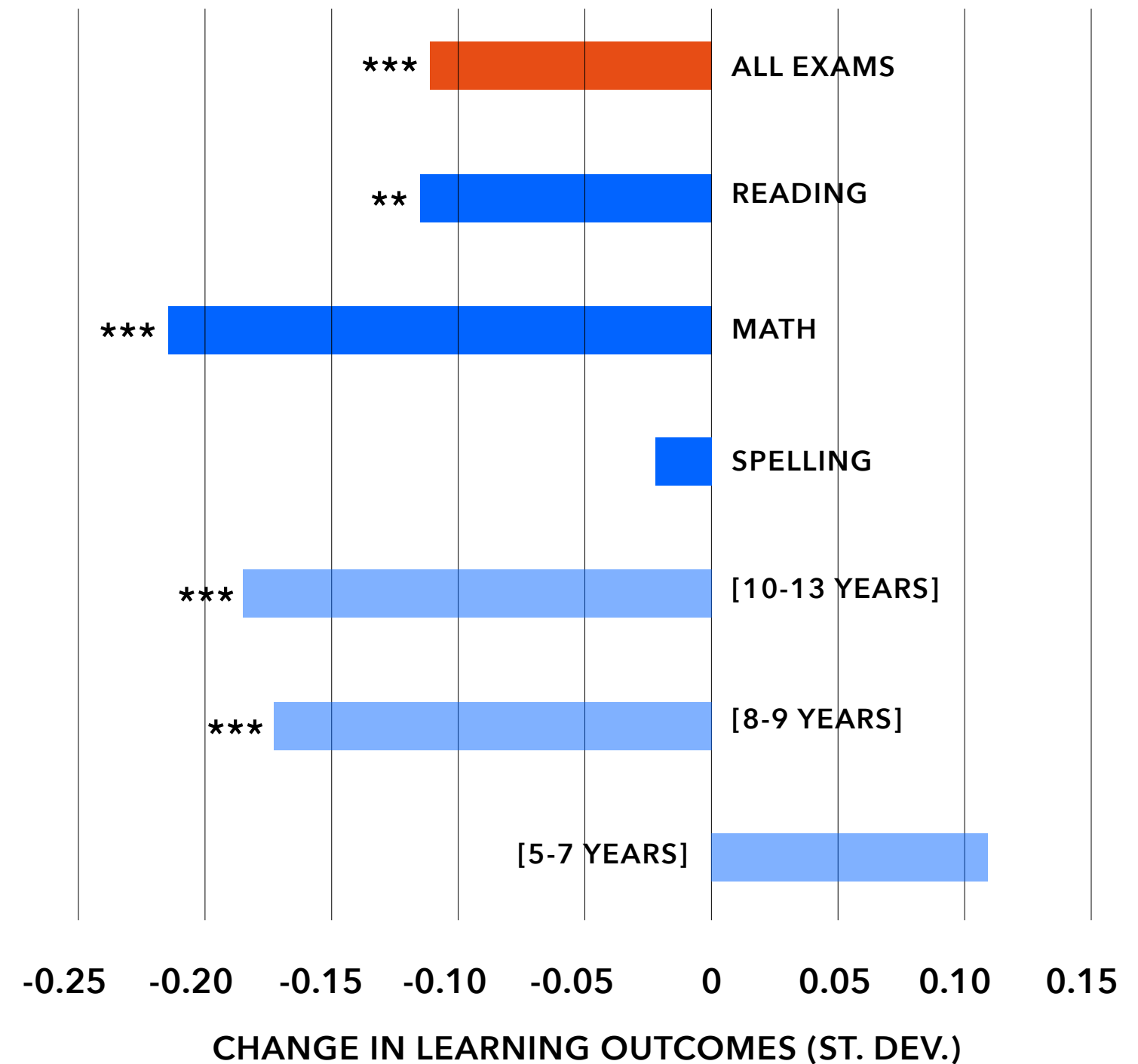
Diving deeper: air quality *in* buildings

Peak CO₂ levels across 300
Dutch classrooms



High levels of CO₂ make you dumb(er)

Doubling of CO₂ level decreases test scores by 20 percent!



/ SIGNIFICANT AT 5/1 PERCENT LEVEL

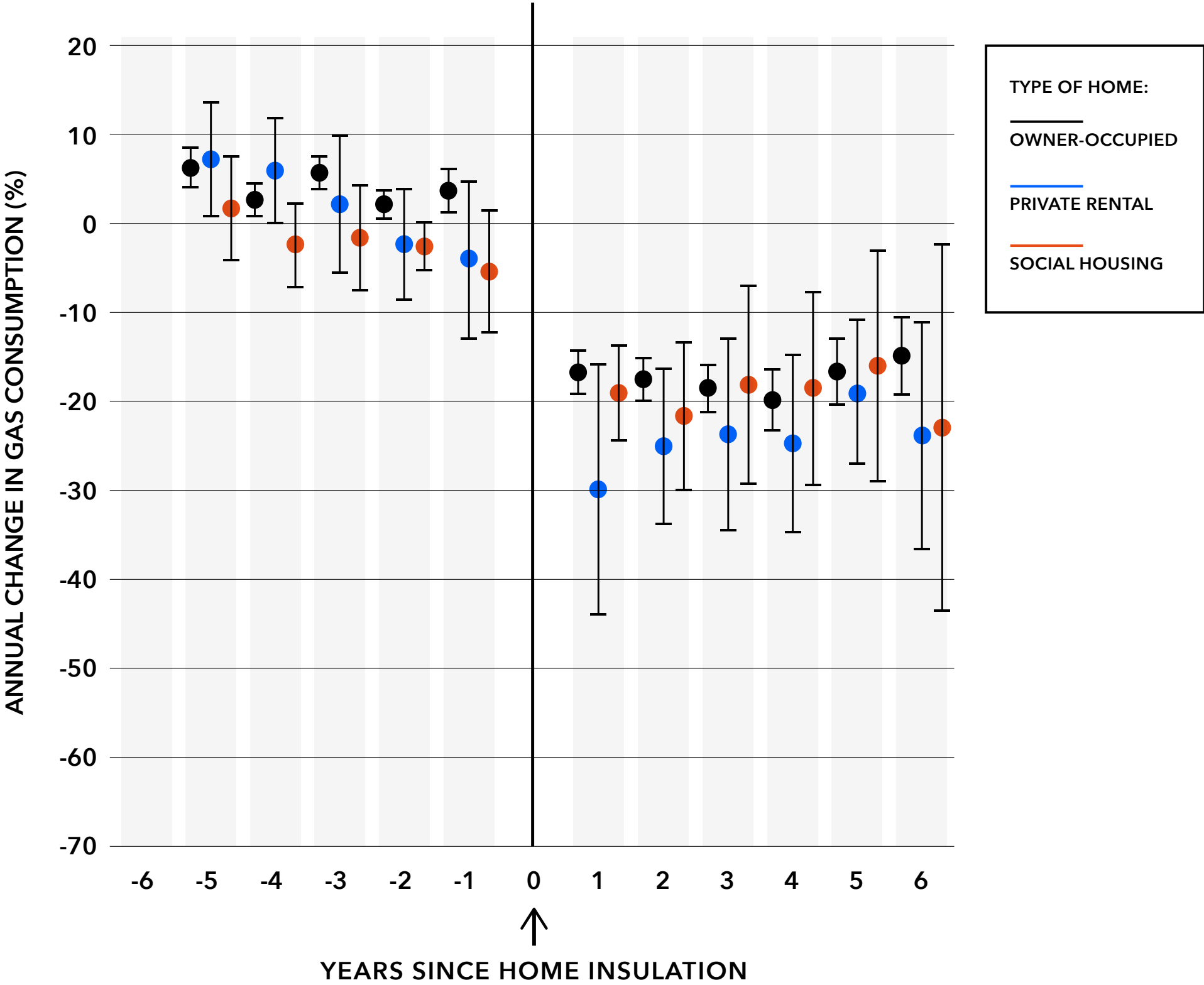
Source: Duran, Eichholtz, Kok & Palacios (2022)

**But,
real estate
can also be
a force
for “good”**

**Let's start
with the environment**

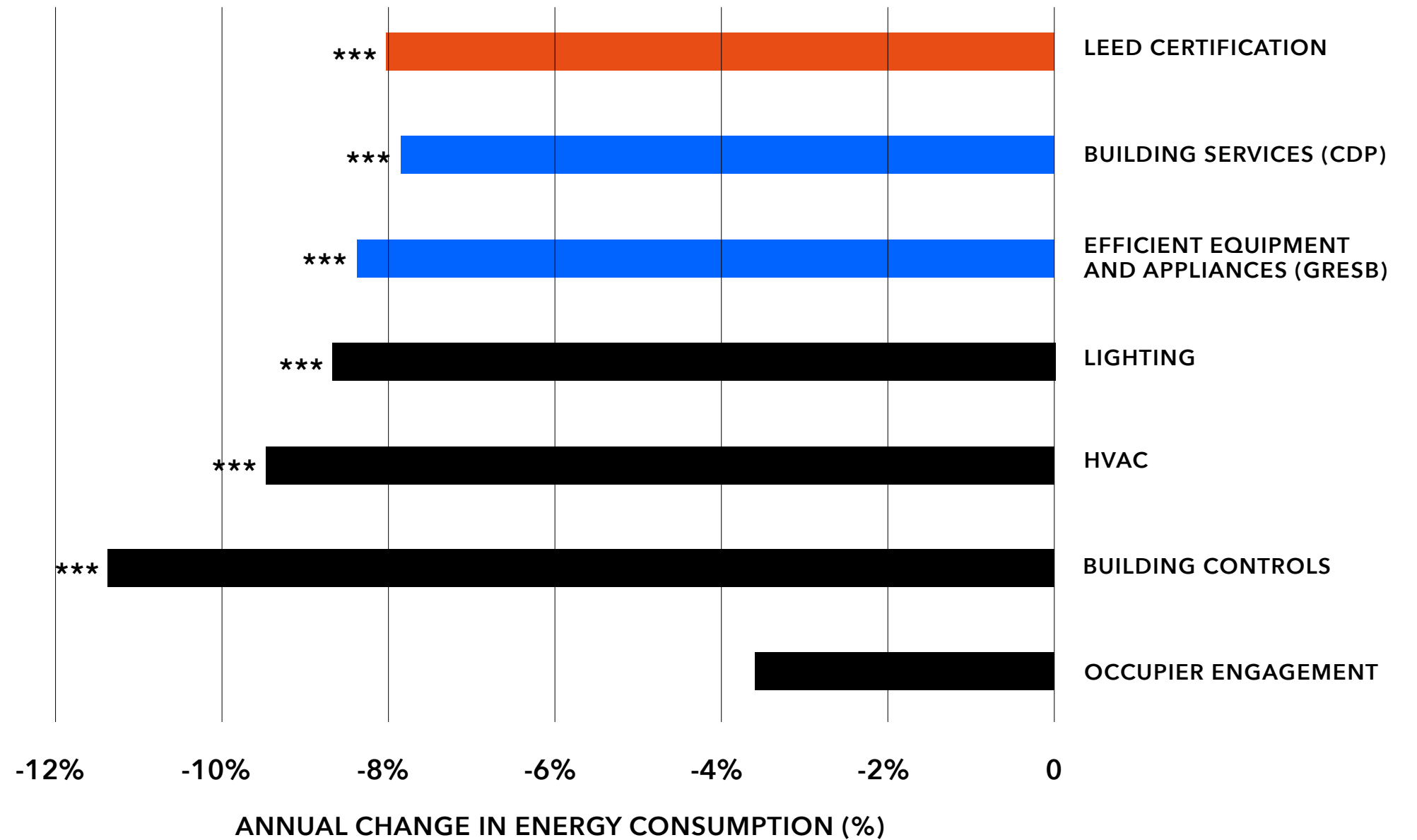
First things first: home insulation

Energy savings of 20%, for all
types of homes



Energy efficiency measures in commercial buildings

Smaller, but significant energy savings



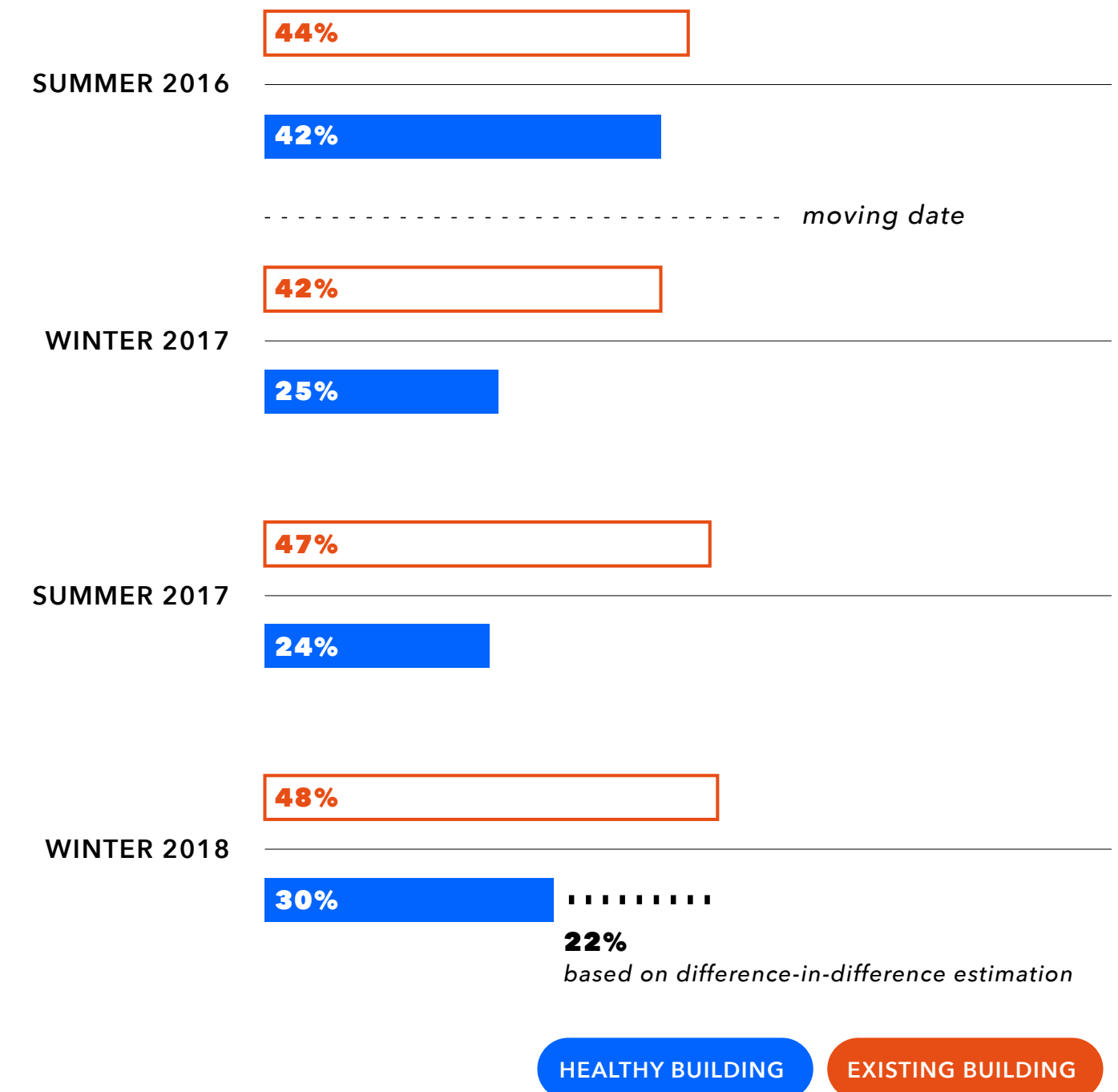
/ SIGNIFICANT AT 5/1 PERCENT LEVEL

The effects of "green" building go beyond energy

Occupants feel healthier, are sick less often

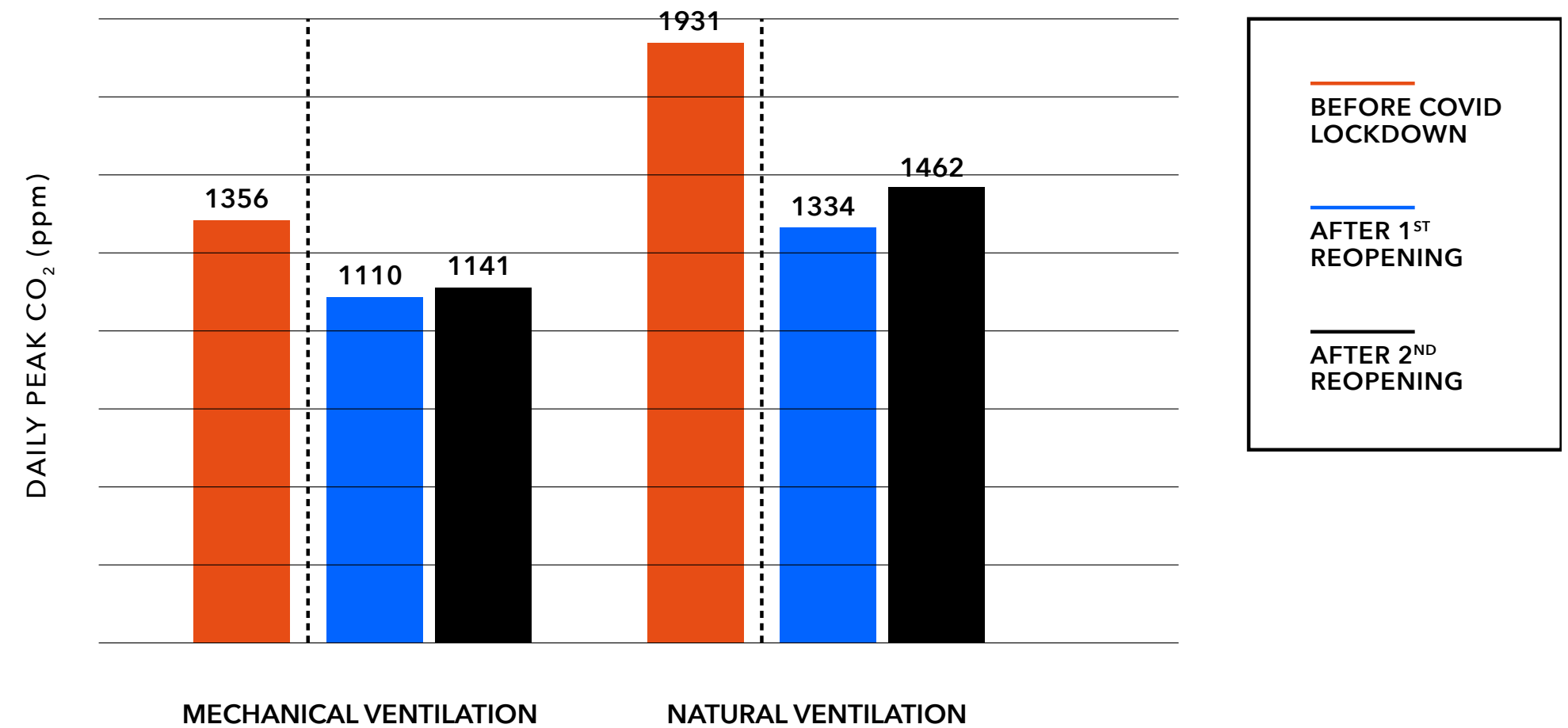


% of respondents with sick building syndroms



Simple interventions can (also) improve air quality

Post-lockdown changes in school ventilation protocols



Importantly, you can do “well” by doing “good”

Investment decisions in a
(simple) finance framework

$$NPV = -I + \frac{CF_1}{1+R} + \frac{CF_2}{(1+R)^2} + \frac{CF_3}{(1+R)^3} + \dots + \frac{CF_n}{(1+R)^n}$$

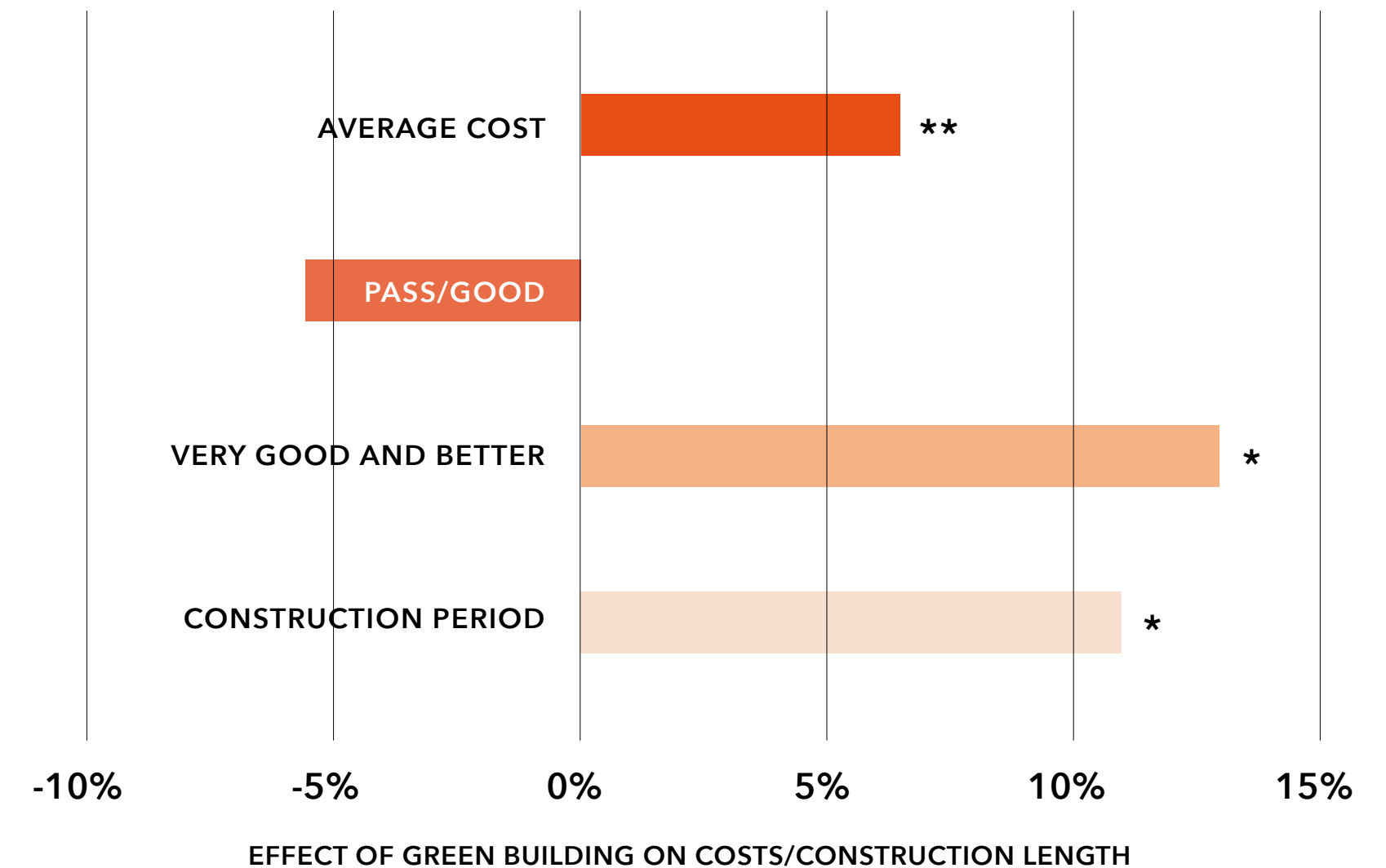
Direct return to home insulation beats...anything

	(1) All interventions	(2) Wall insulation	(3) Floor insulation	(4) Roof insulation	ACTUAL PRICES
Yearly savings	€300	€299	€164	€301	
Investment	€1,640	€1,656	€1,437	€2,055	
Annual return	18.3%	18.1%	11.4%	14.6%	
Payback period	5.5	5.5	8.8	6.8	
	(5) All interventions	(6) Wall insulation	(7) Floor insulation	(8) Roof insulation	2022 PRICES
Yearly savings	€866	€857	€460	€847	
Investment	€2,084	€2,104	€1,825	€2,610	
Annual return	41.6%	40.7%	25.2%	32.5%	
Payback period	2.4	2.5	4.0	3.1	

Investment	Annual Return (1991-2018)
All Assets	7.0 %
Stocks	8.1 %
Bonds	5.0 %
Infrastructure	10.1 %
Real Estate	7.7 %
Private Equity	12.6 %
Hedge Funds	4.2 %

What about the return to “green” building?

Cost estimates are scant, we know a lot about the benefits



*/** SIGNIFICANT AT 10/5 PERCENT LEVEL

What about the return to “green” building?

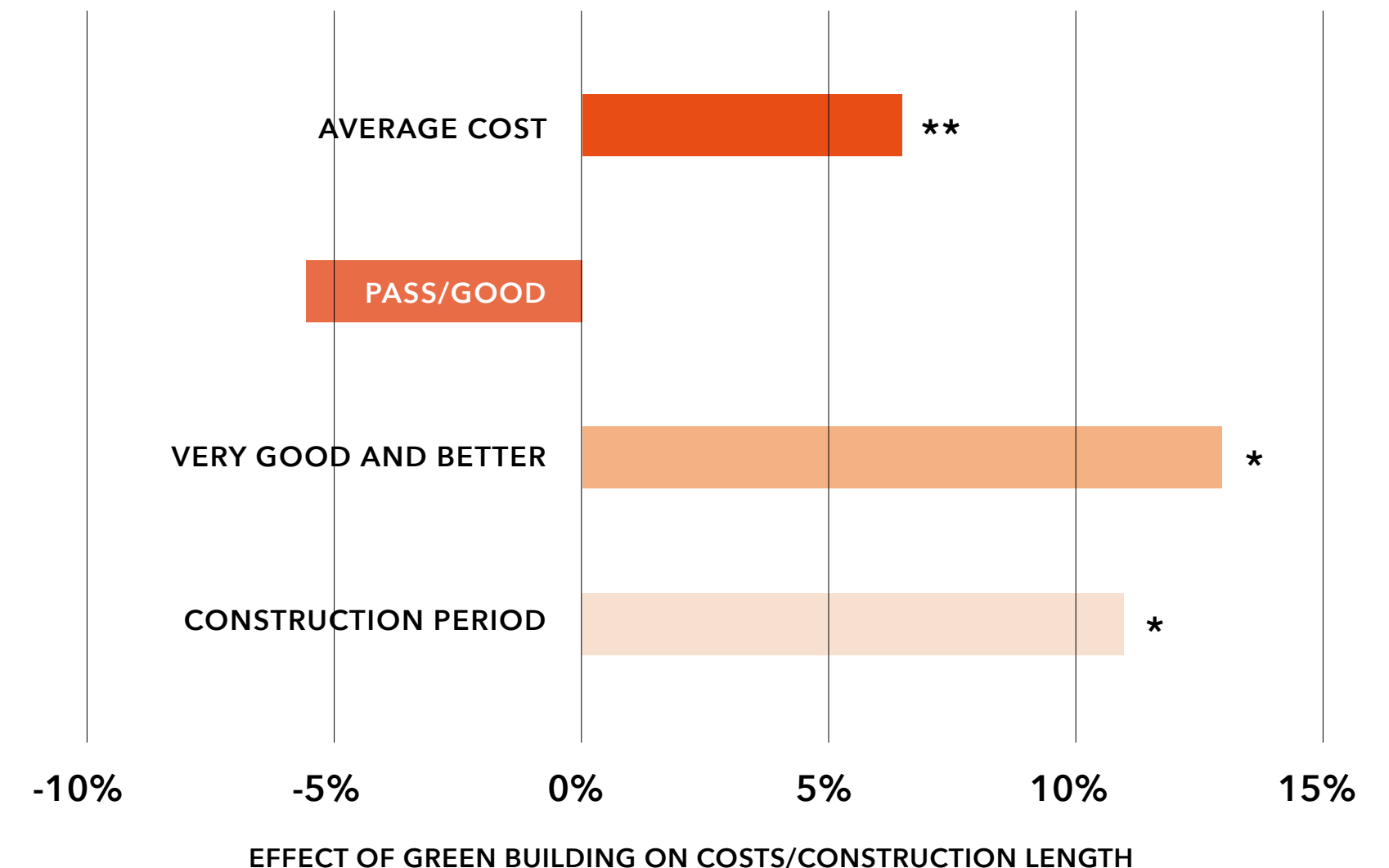
Cost estimates are scant, we know a lot about the benefits

ENERGY EFFICIENCY CAPITALIZED INTO RENTS, PRICES

+3%
rent

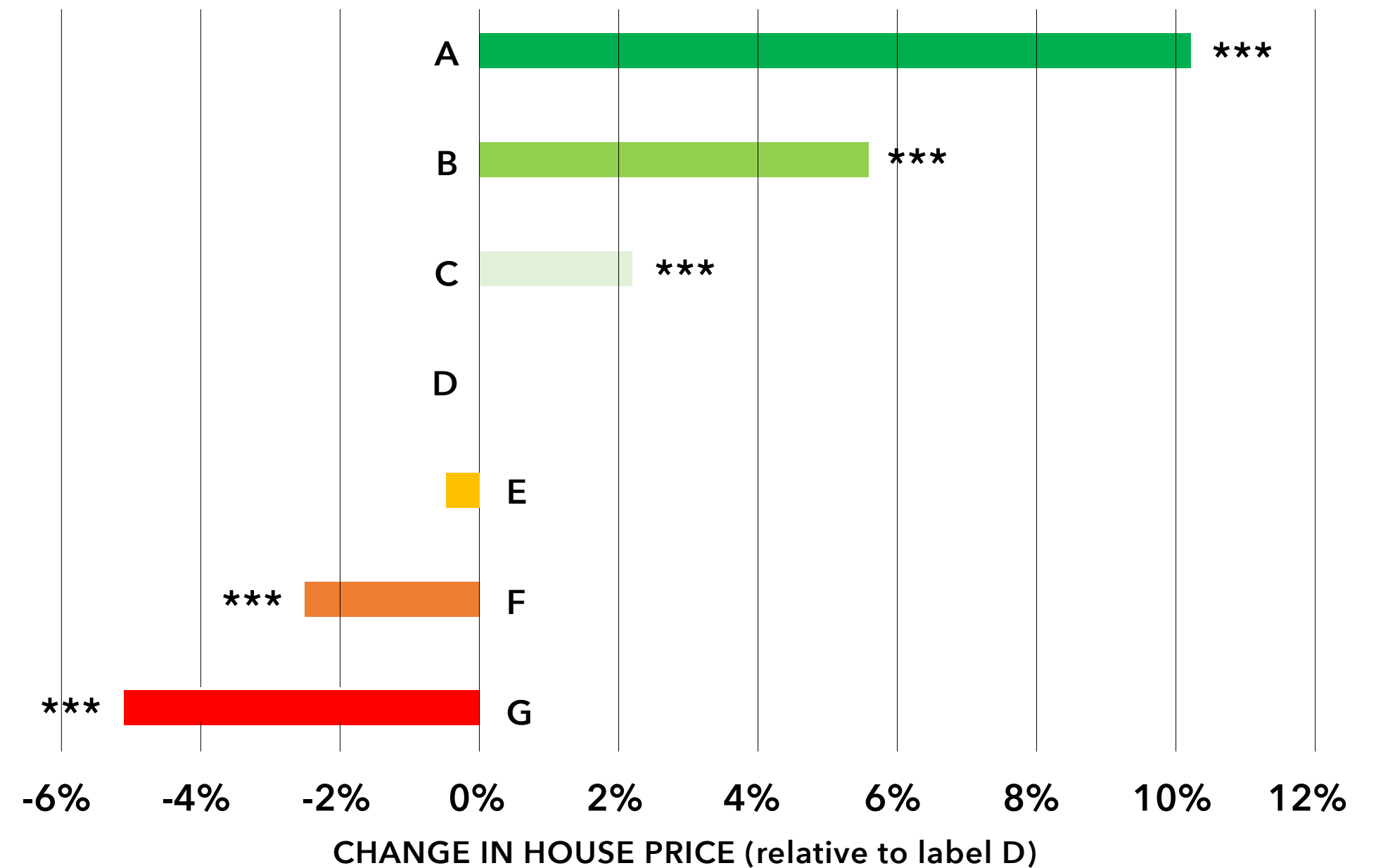
+7%
cash flow

+13%
price



*/** SIGNIFICANT AT 10/5 PERCENT LEVEL

And energy efficiency in homes, more broadly?



*** SIGNIFICANT AT 1 PERCENT LEVEL

And energy efficiency in homes, more broadly?

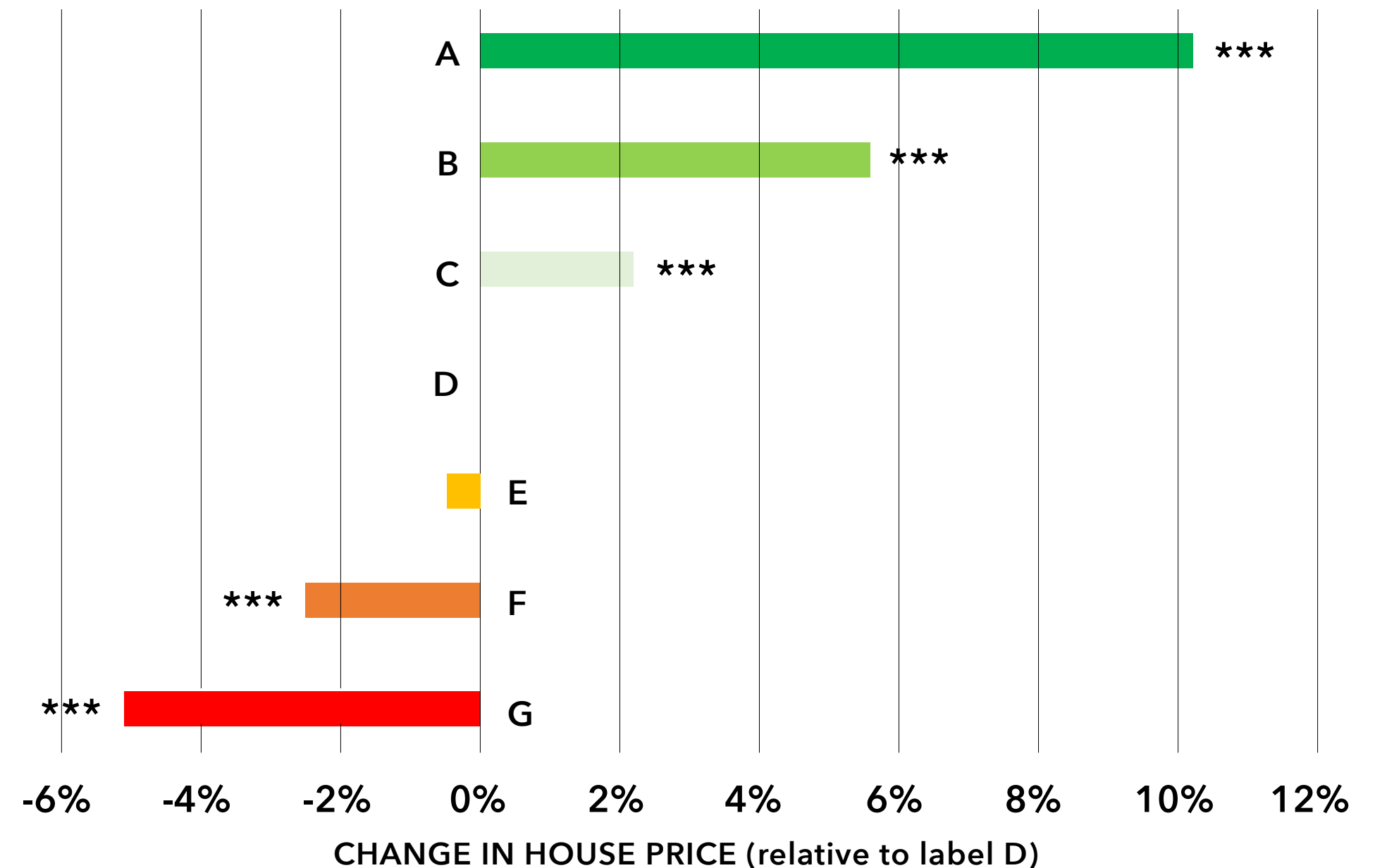
Marginal cost of improving energy efficiency:
€4,000 per grade (EPC label)

Marginal benefits:
2-15% (relative to label G)

At the median home price (€400,000)
G → C transition:

Cost €16,000

Benefit €29,000



*** SIGNIFICANT AT 1 PERCENT LEVEL

Investing in health also yields a return...



**Marginal investment:
€3.4 million**

Investing in health also yields a return...

In offices (back to Venlo)

Marginal benefit in building management and exploitation:

€17 million

Marginal benefit in sick leave reduction:

- Wages: €54 million/year (800FTE)
- 43% of FTEs sick at least once/year
- Average sick leave: 5 days
- 2% reduction in sick leave yields savings of €25,000/year

€2.5 million capitalized



**Marginal investment:
€3.4 million**

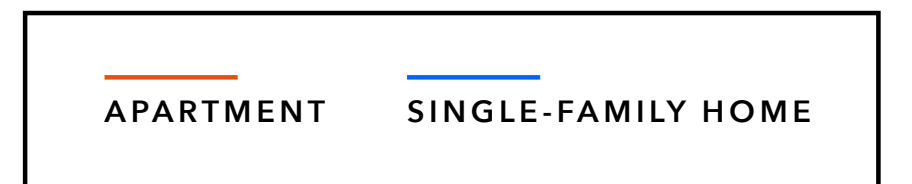
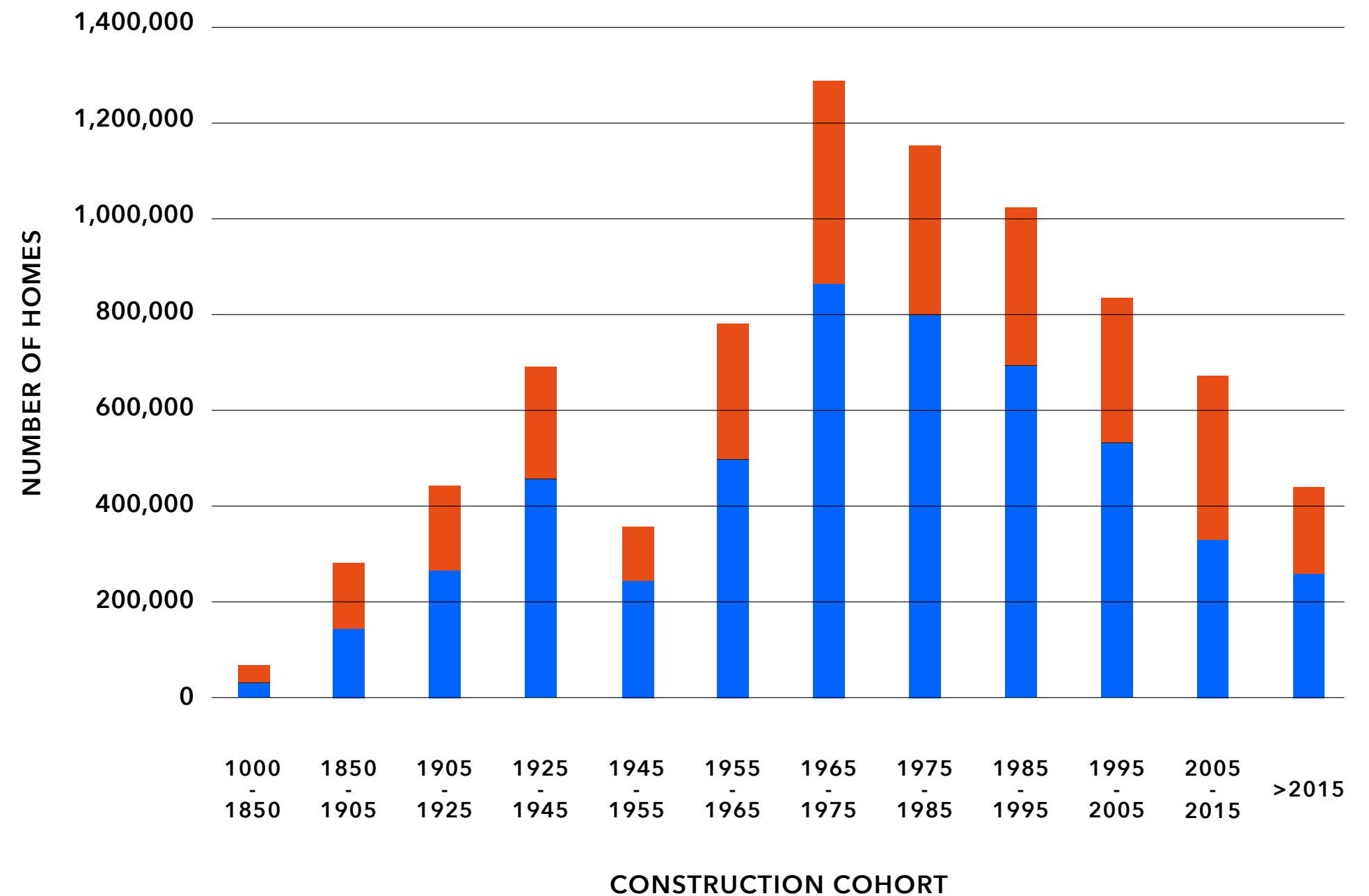
**So, why aren't
all buildings
“green” and “healthy”?**





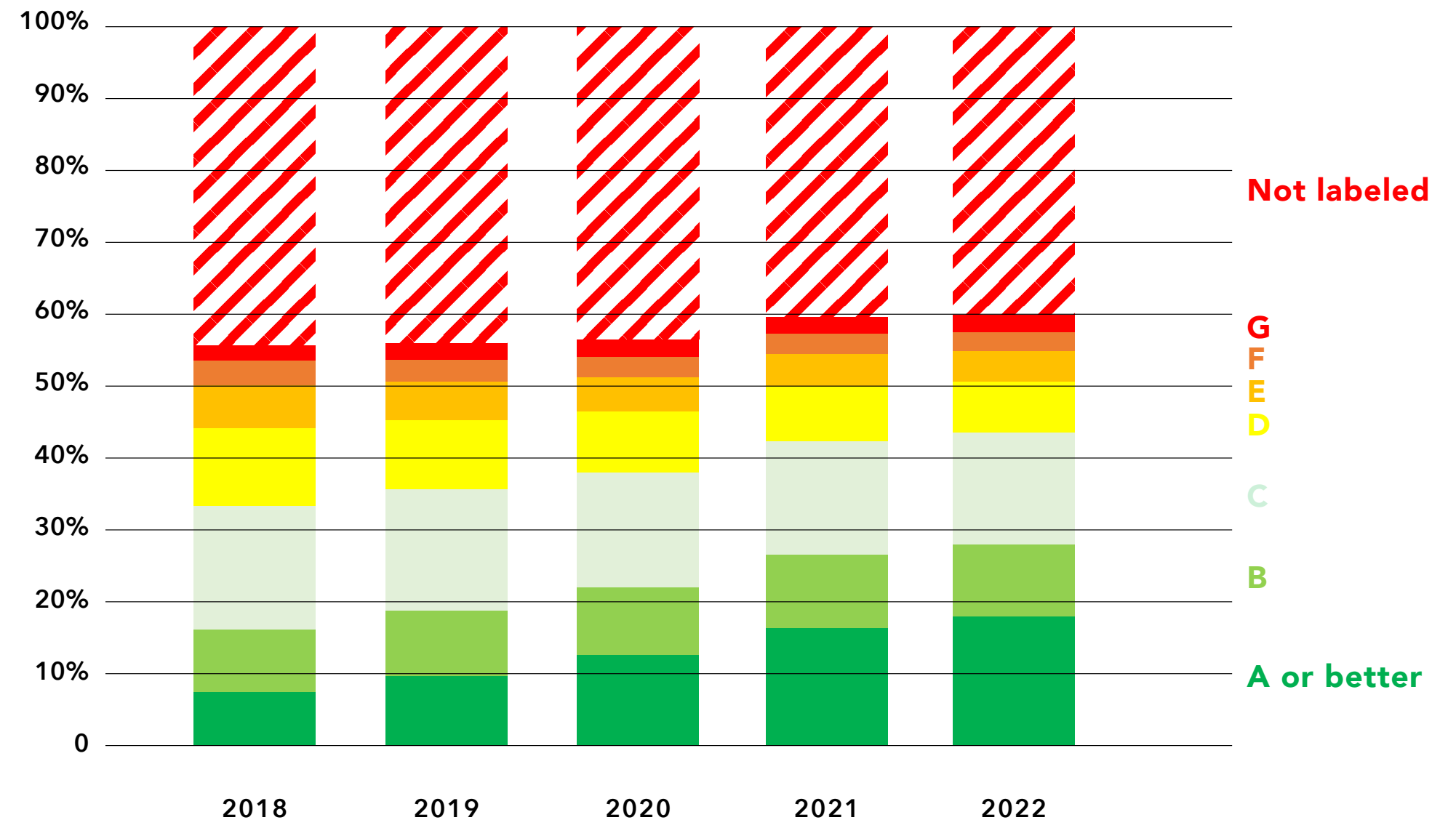
The age distribution of the Dutch housing stock

About 50% of the Dutch stock is more than 50 years old!



...which is also reflected in energy efficiency

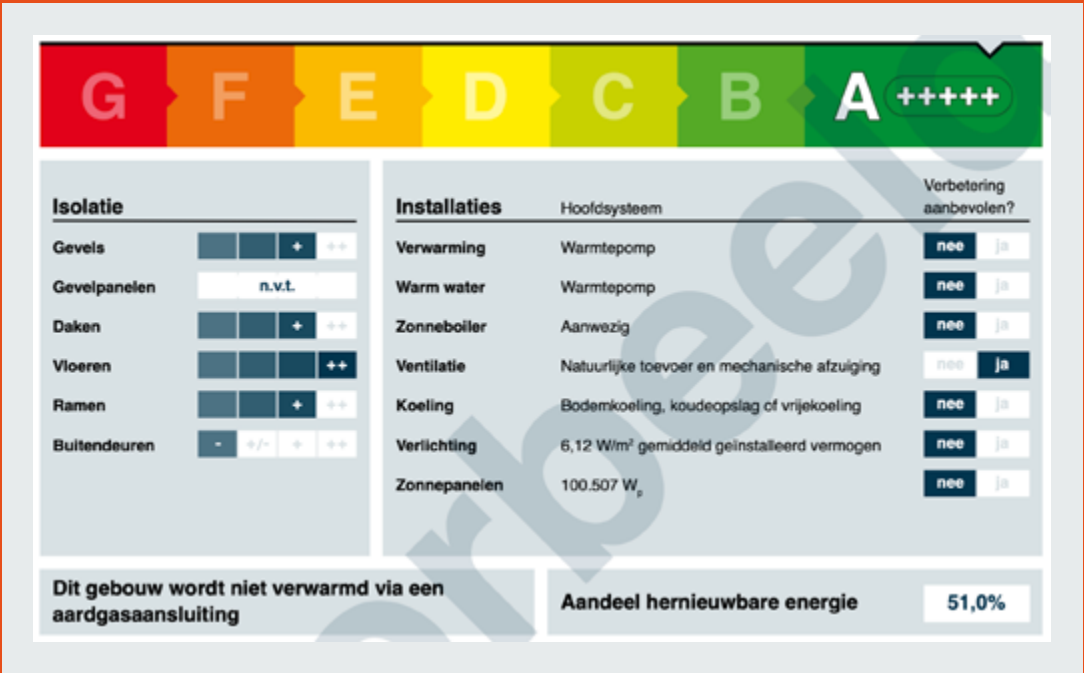
Less than 50% of homes are label C or better (42% is not labeled)



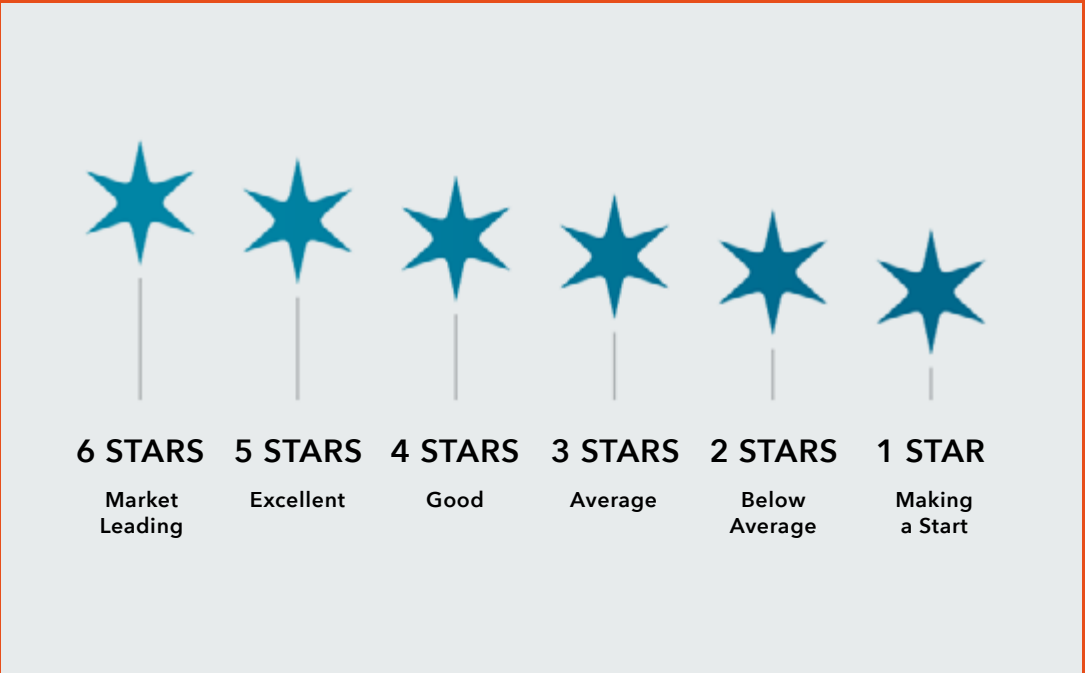
So, what do we need to do?

1. Clear information based on “clean” measures of actual performance...

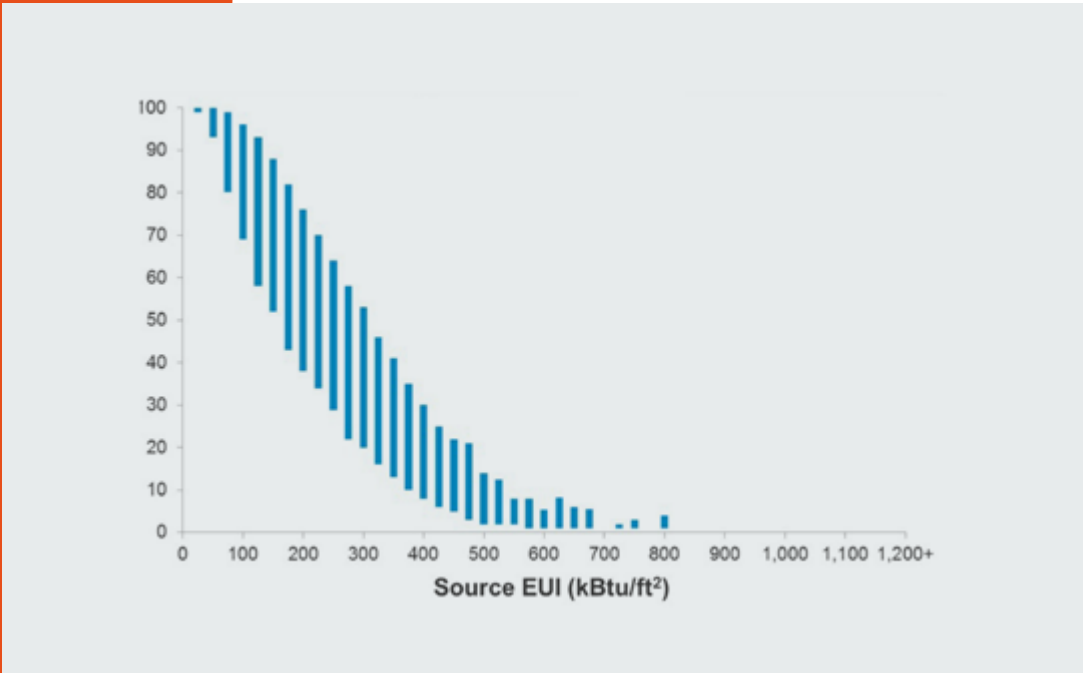
■ Design-based benchmarking —————> ■ EUI-based benchmarking



EU Energy Label

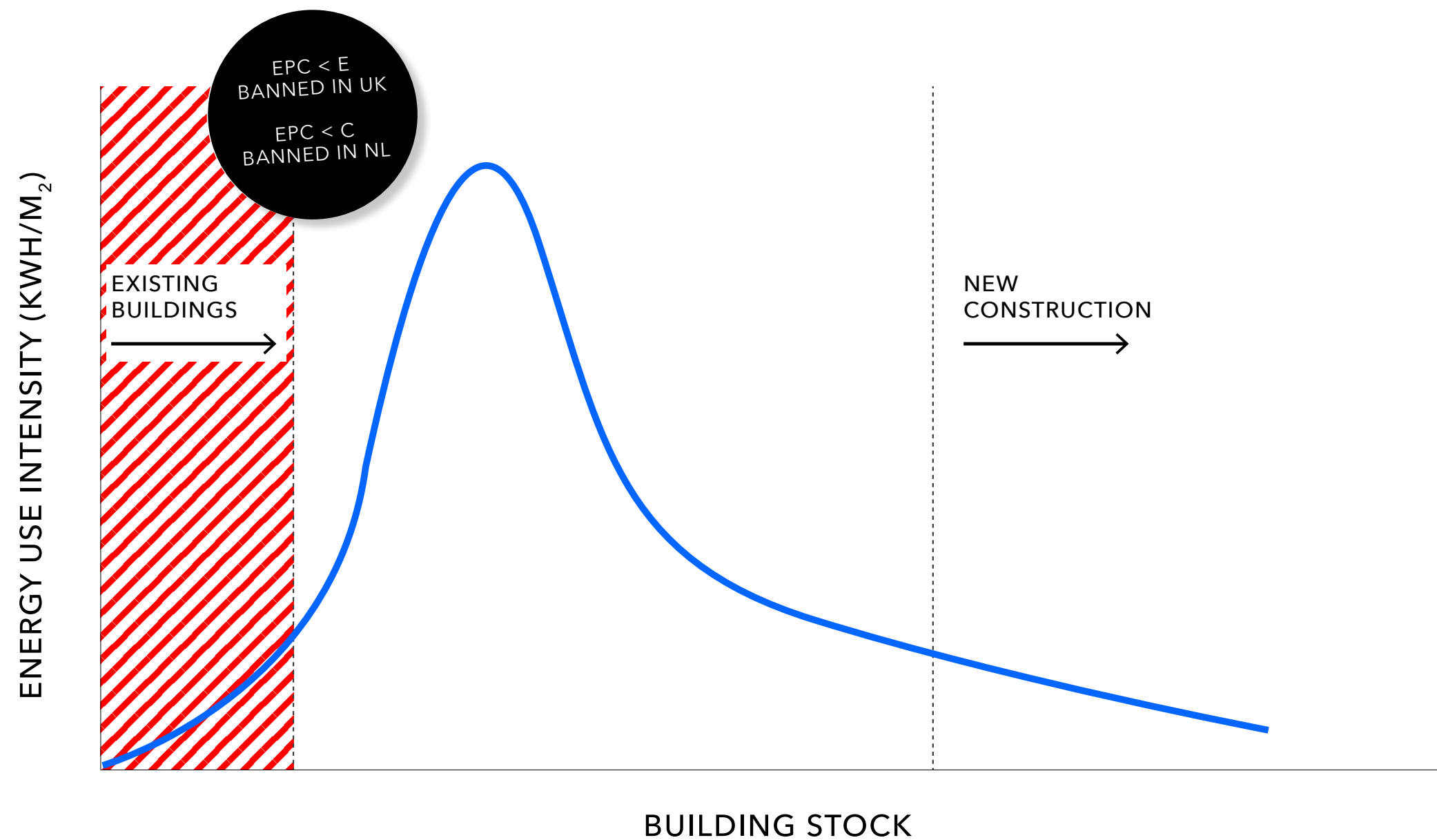


NABERS (Australia and UK)



Energy Star (US and Canada)

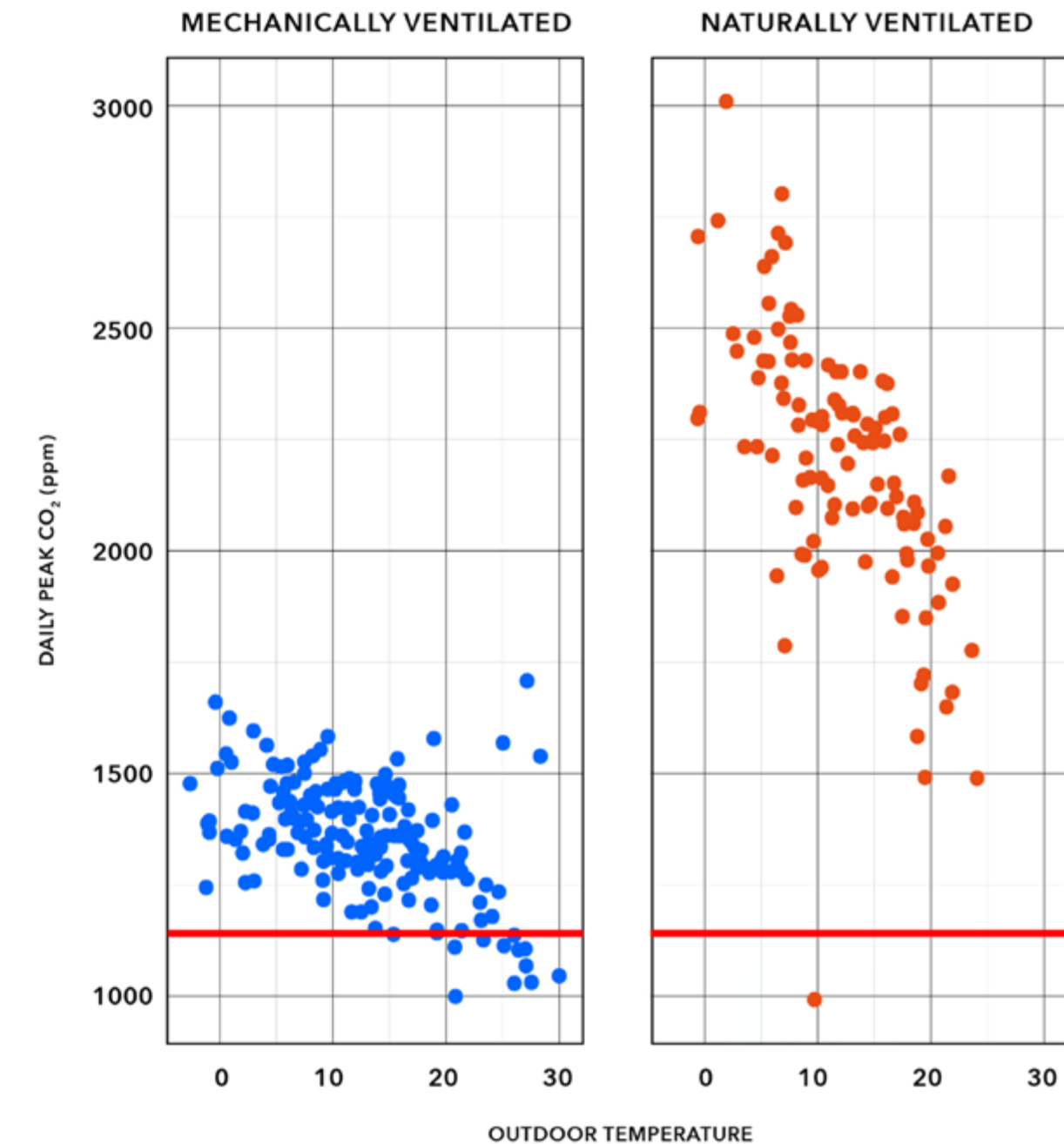
...in combination
with forward-looking
regulation...



The same holds for indoor air quality

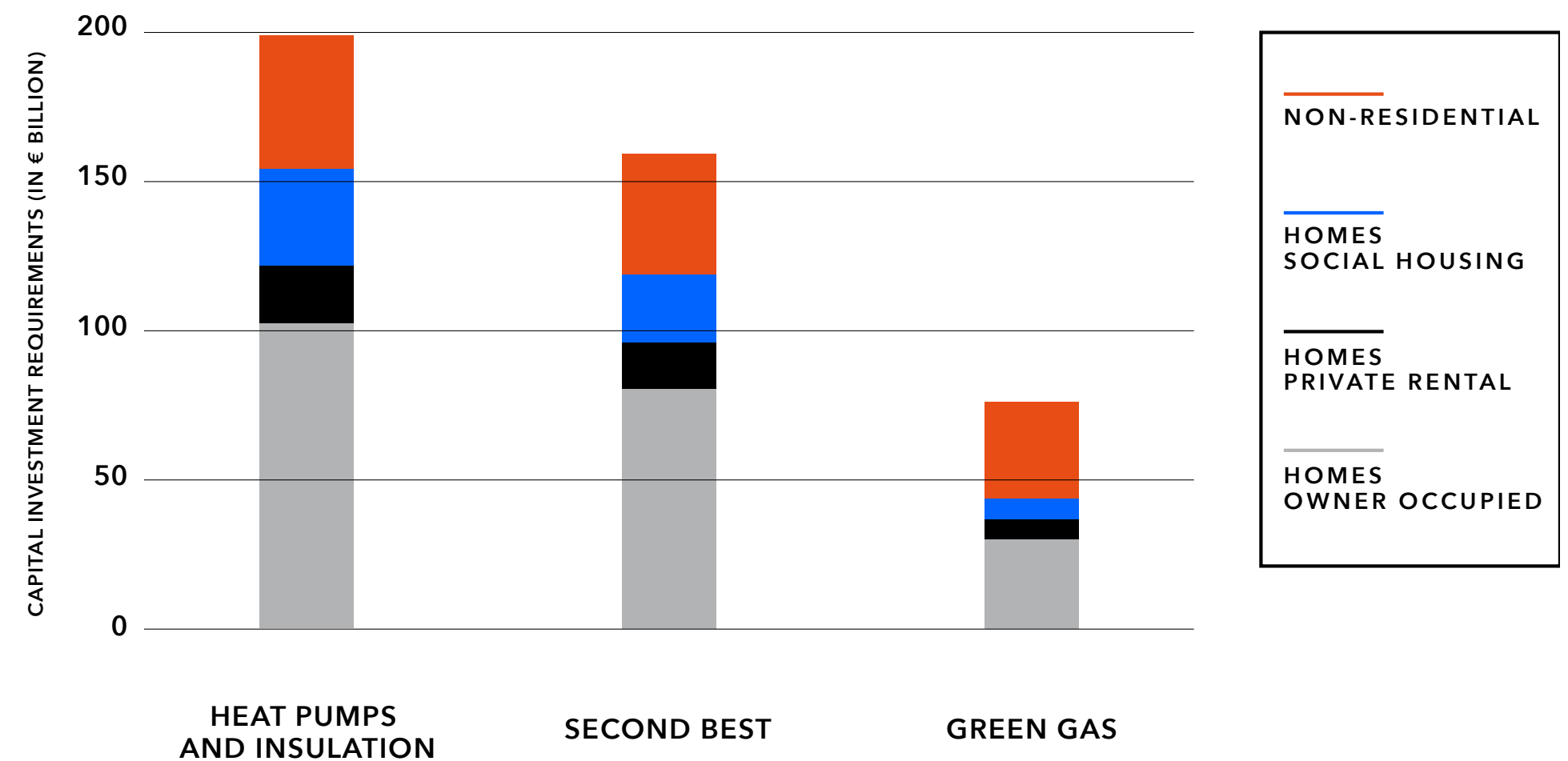
Design-based regulation → Performance-based regulation

Gebruiksfunctie	Bouwbesluit 2003 (verblijfsruimten)					(Concept) Bouwbesluit 2012
	Bezettingsgraadklasse	Opp _{min} [m ²]	Opp _{max} [m ²]	V _{min1} /p.p. [m ³ /h/p.p.]	V _{min2} /p.p. [m ³ /h/p.p.]	V _{min} /p.p. [m ³ /h/p.p.]
Kantoor	B1	-	-	-	-	-
	B2	-	-	-	-	-
	B3	> 5	12	> 18	43,2	23,4
	B4	-	-	-	-	-
	B5	-	-	-	-	-
Winkel	B1	> 0,8	2	> 10,9	27,4	14,4
	B2	2	5	10,8	27,0	14,4
	B3	> 5	12	> 10,8	25,9	14,4
	B4	> 12	30	> 17,3	43,2	14,4
	B5	> 30	-	> 43,2	-	14,4
Sport	B1	> 0,8	2	> 18,4	46,1	23,4
	B2	2	5	18	45,0	23,4
	B3	> 5	12	> 18	43,2	23,4
	B4	> 12	30	> 17,3	43,2	23,4
	B5	> 30	-	> 43,2	-	23,4



Next stop: capital!

€200 billion in the Netherlands alone (just for heat pumps and insulation)

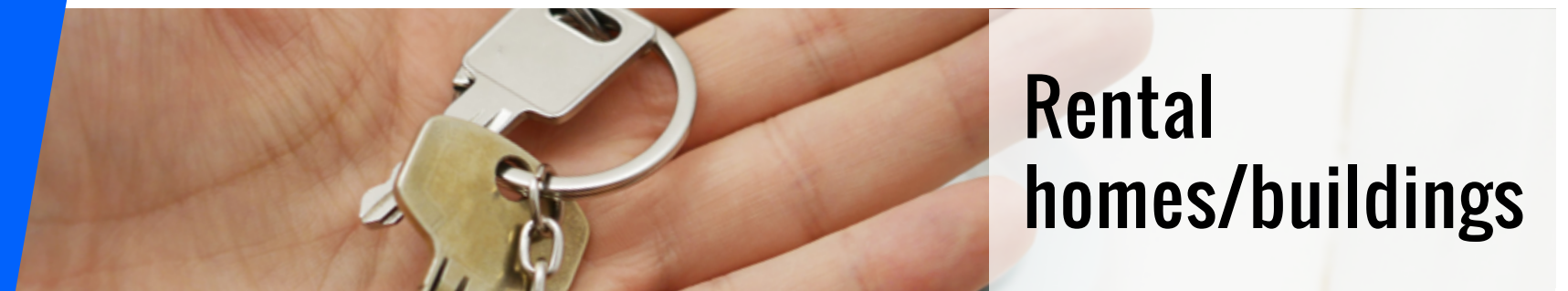


Capital provision has its complexities...

Owner-occupied homes are "easy", rentals are hard



- Budget neutral (savings-to-cost > 1)
- Capitalized into home values
- Energy efficiency allowance → mortgage top-up
- Debt fund w/govt support for low-income households
- Track with ex-post EPC assessment



- Split incentive → regulation for owner, but also for tenant!
- Energy efficiency investment → service charge (savings-to-cost > 1)
- Track with ex-post EPC assessment + smart metering

- Financing

- VVEs → new product (debt fund w/govt support)
- Commercial investors → mortgage top-up
- Housing corporations → new product (debt fund w/govt support) or EIB/BNG

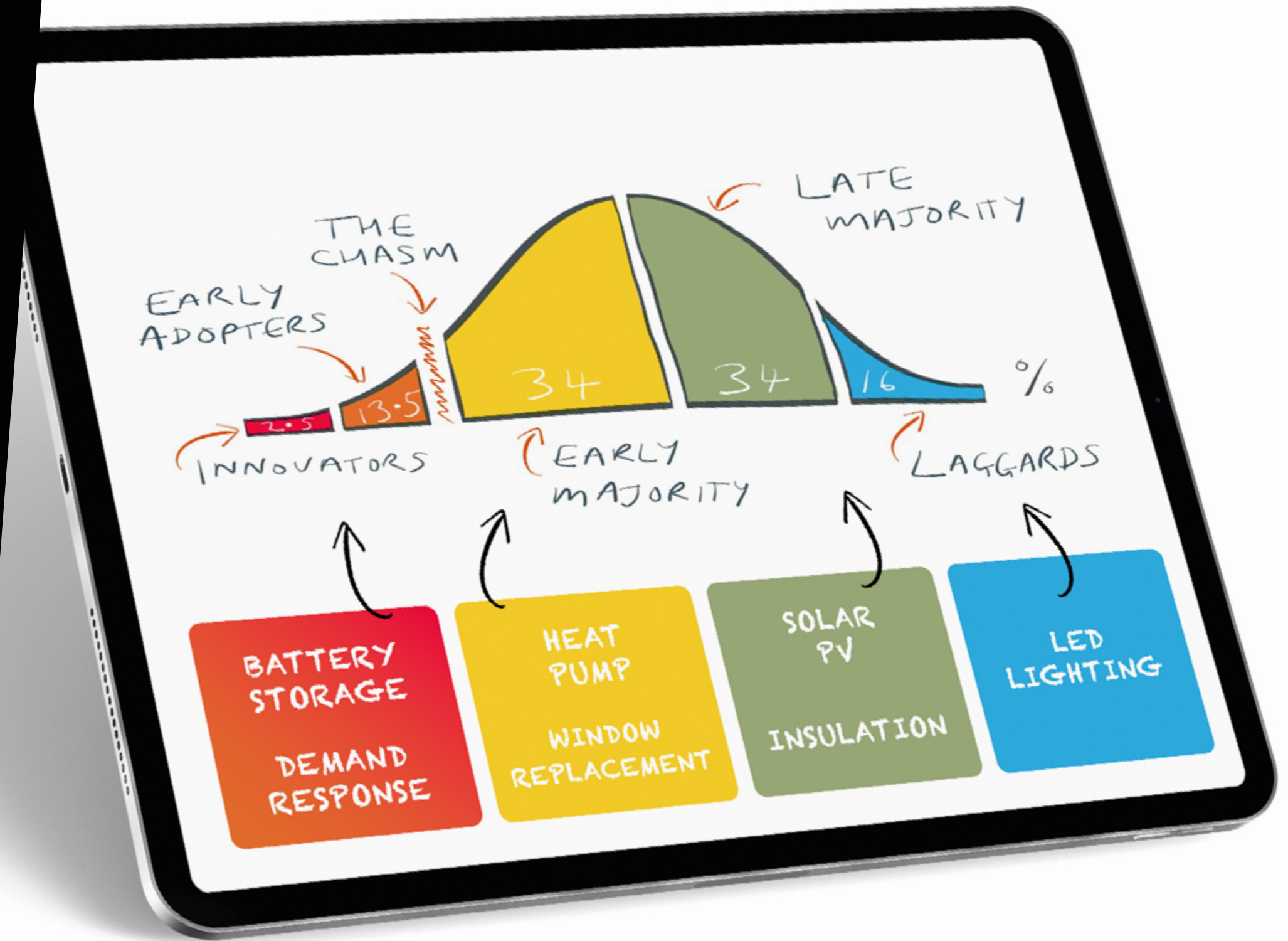
...and capital needs guidance

The equity market is eager to get in, but needs clarity and product



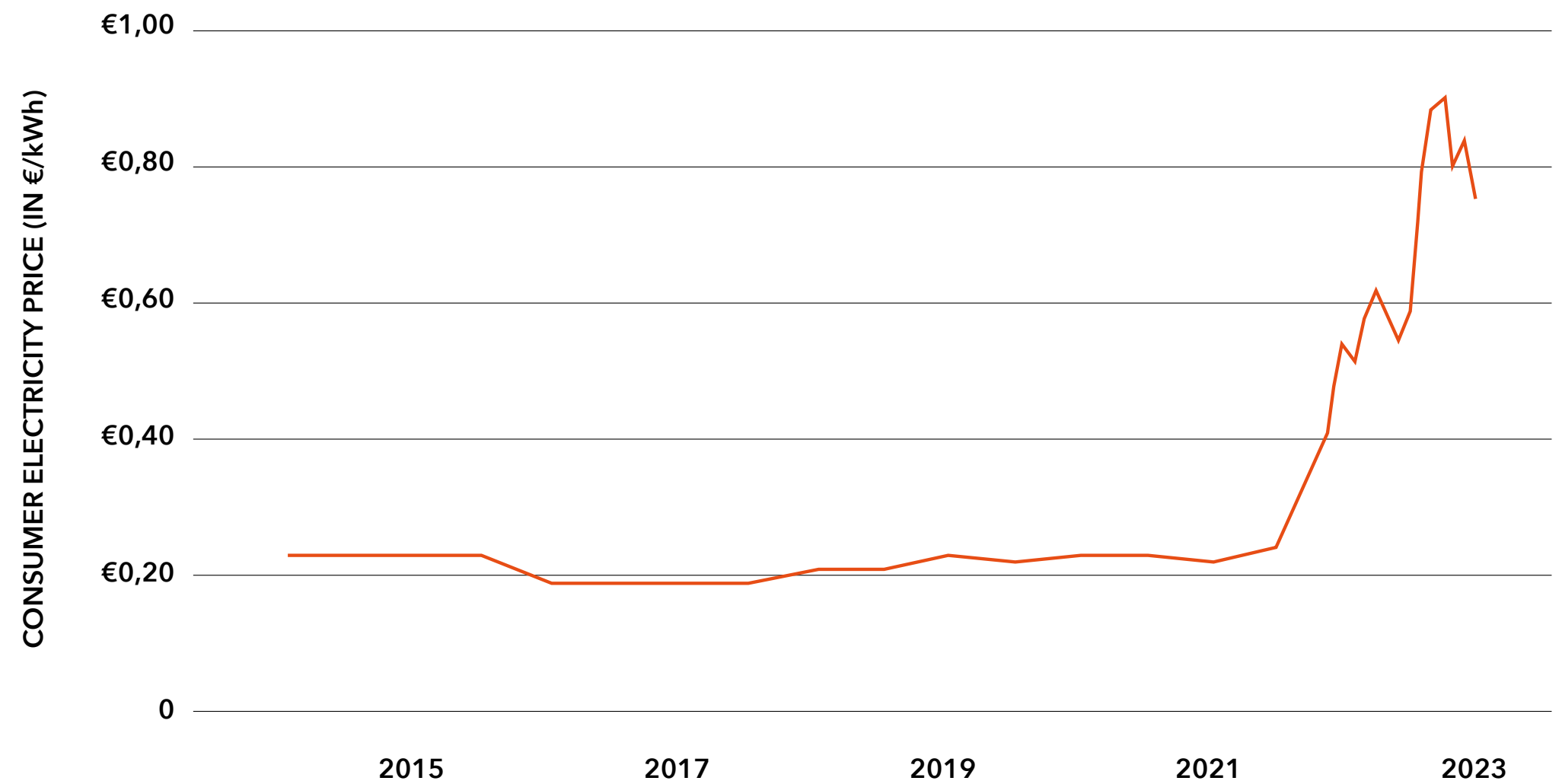
What about subsidies?

Only subsidize the bleeding edge
(heat pumps, battery storage)



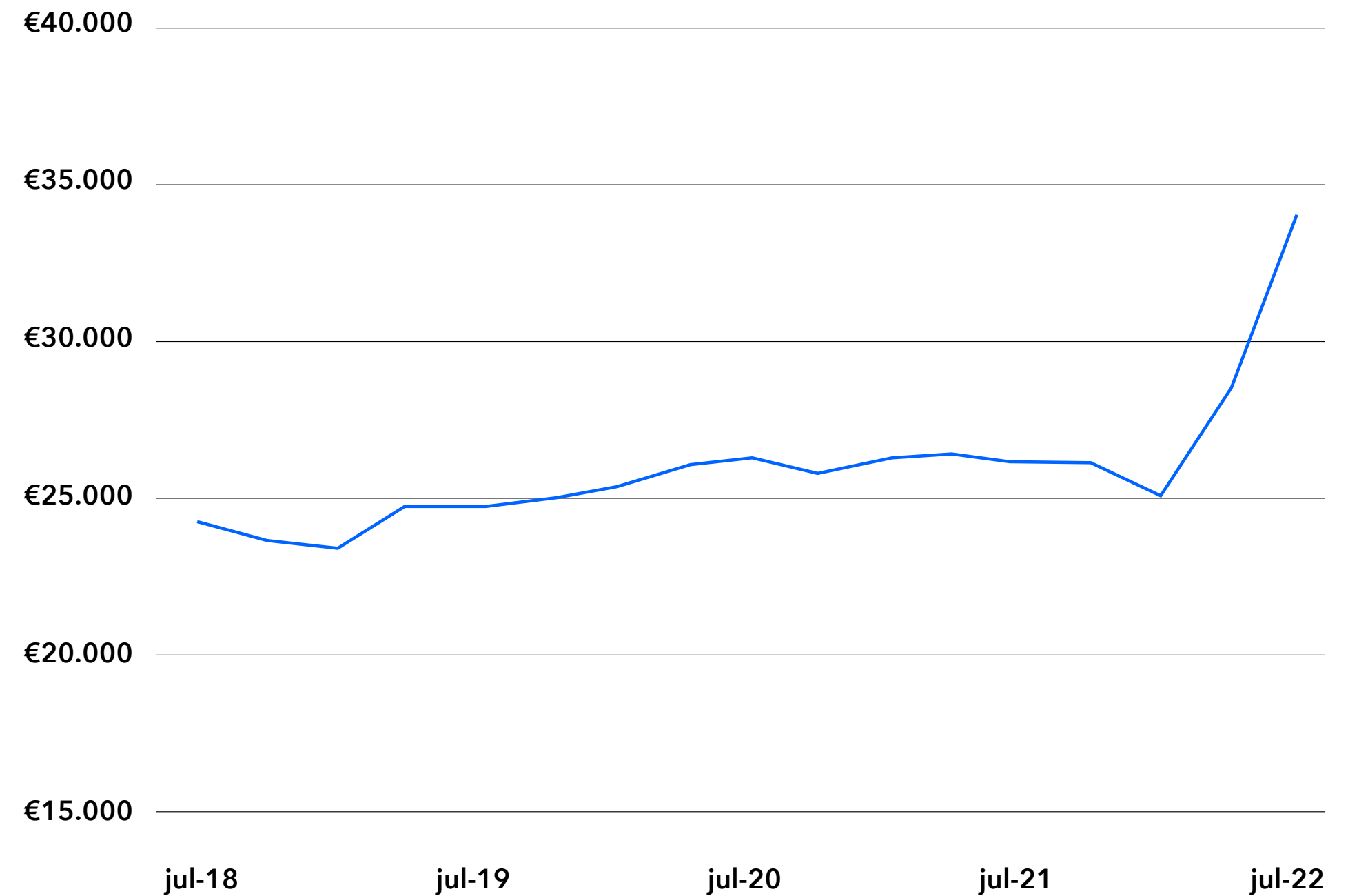
What will the future bring?

Fundamentals for energy
efficiency have shifted...



That means further bifurcation in the resi market...

You Ain't Seen Nothing Yet



AVERAGE DIFFERENCE
BETWEEN LABEL G AND LABEL C

Fundamentals for space demand are different

At the extensive margin...



KASTLE BACK TO WORK BAROMETER

Weekly Occupancy Report from Kastle Access Control System Data

OCCUPANCY OVER TIME - MARCH 4, 2020 TO JANUARY 4, 2023



*On March 22, 2021, Kastle moved from daily to weekly data reporting to provide a more robust and comprehensive picture of office occupancy. We have also recalculated data back to the start of the time series for consistency. This has only a marginal impact on most cities and the national average.



The world has woken up, at last!

The Economist

Modern workers do not just seek luxury, however. They also want to sal
consciences. As a result, green buildings are increasingly popular. For l
these have the twin advantages of attracting higher rents and hedging a
obsolescence, as countries look to meet their net-zero carbon goals. New
efficiency requirements for buildings in England and Wales mean that r
half of London's office stock could be unusable by 2027. In Europe build
be required to source roughly half their energy from renewable sources
Among the newer breed of offices, clean air, minimal carbon emissions a
insulation are commonplace. One Manhattan West, another tower in the
development, is powered entirely by renewable energy. Like many
owner, Brookfield, is aiming to achieve net-zero

CNBC

SUSTAINABLE
FUTURE

INVESTMENT | RESPONSIBILITY | TECHNOLOGY

**'Green' offices in
London are over
25% more
expensive. But a
modern workforce
now expects it**

PUBLISHED MON, JAN 16 2023

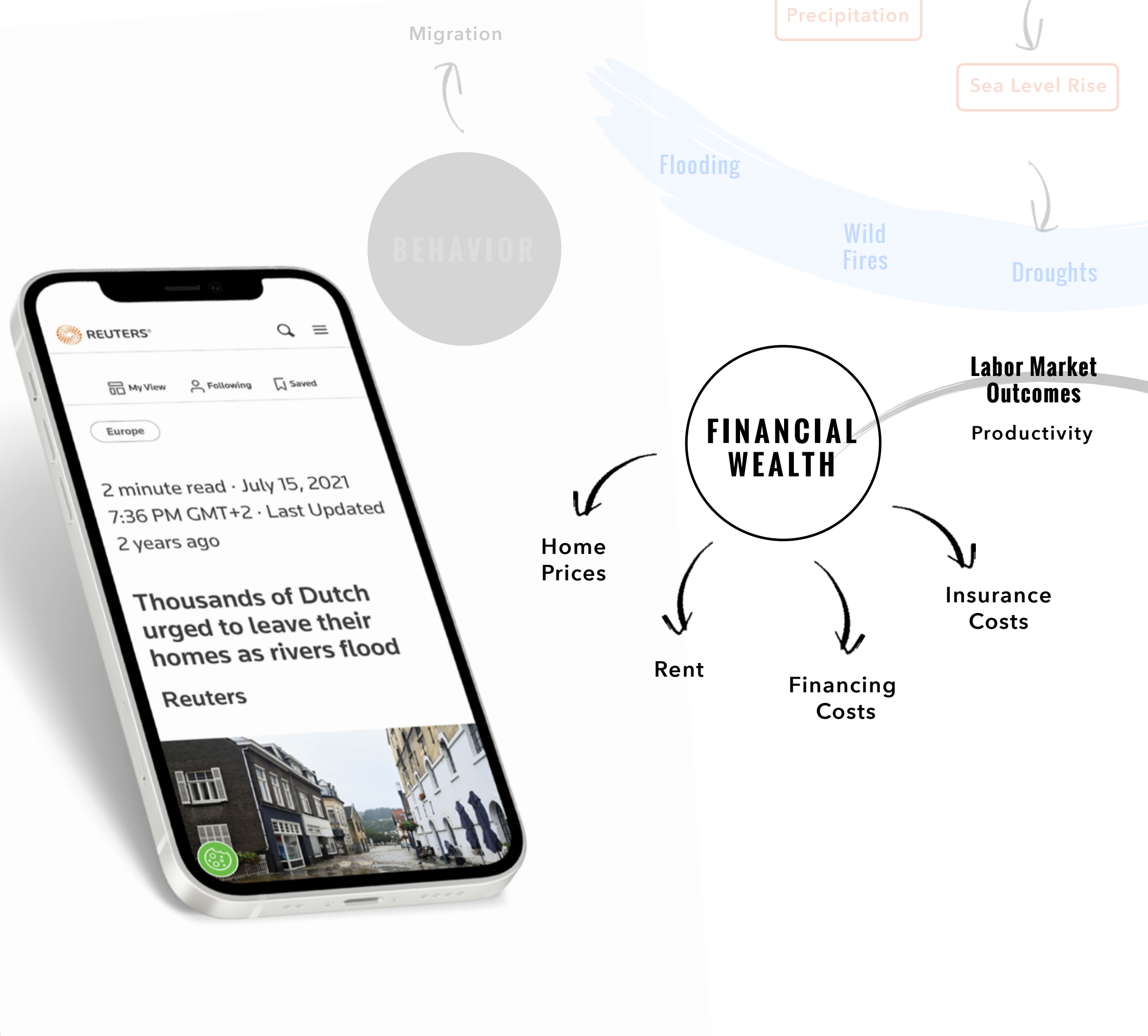
UPDATED THU, JAN 19 2023

Hannah Ward-Glenton
@HANNAH5WG

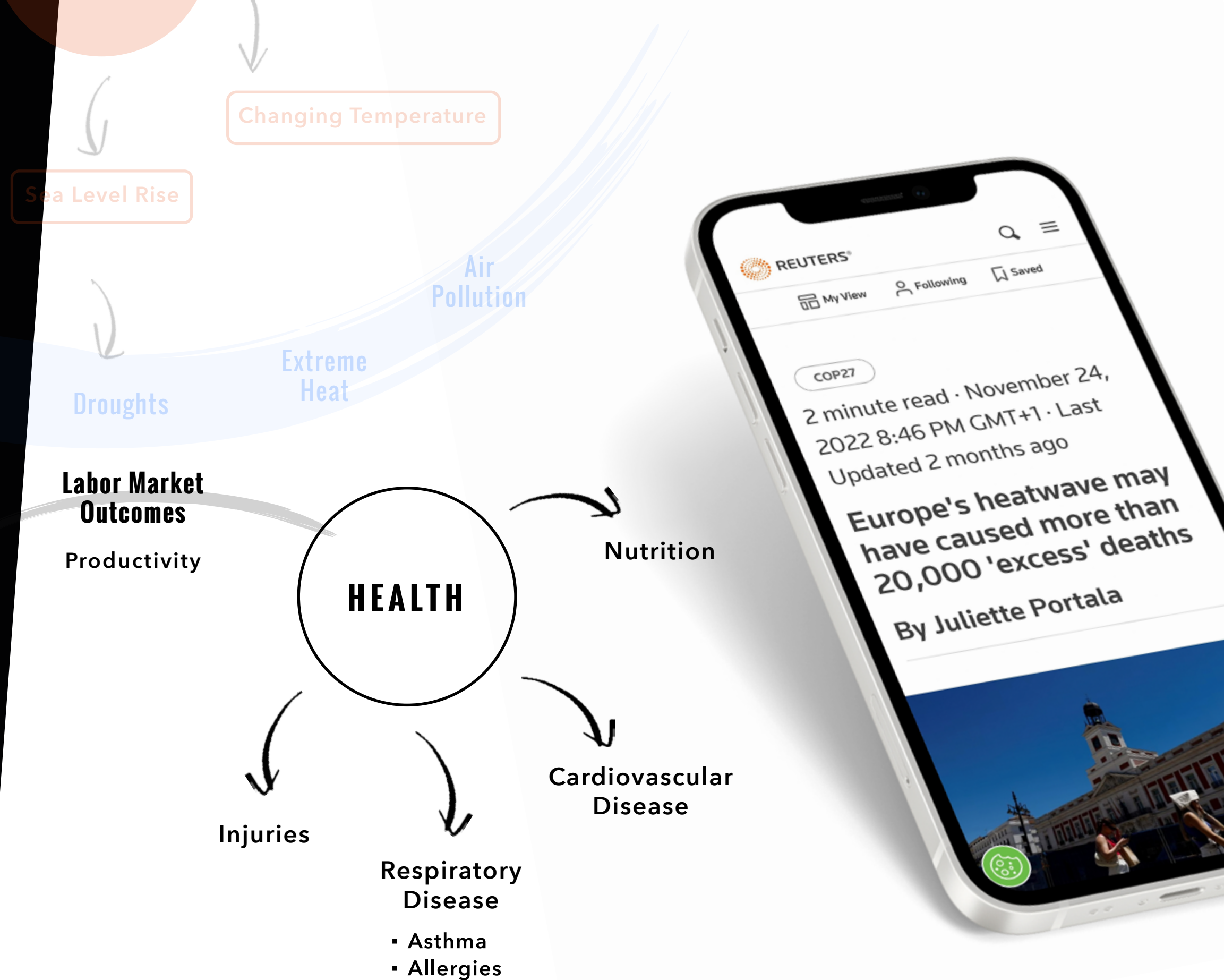
WATCH LIVE

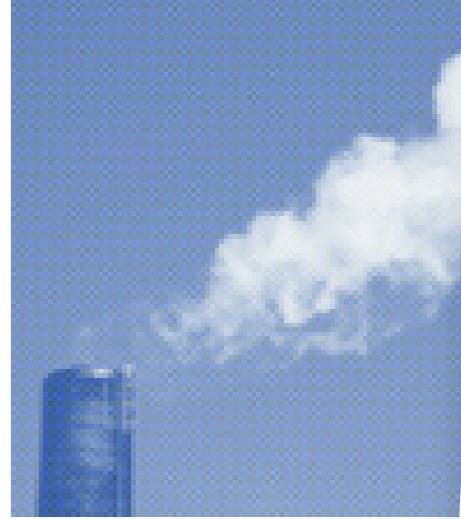
All of this ignores physical climate risk

Capitalization & health outcomes...



...and the building as a “shelter”





People Planet Property



How Buildings Shape the Environment,
Your Health, and Your Wealth