Zero Carbon®
Homes and Cars

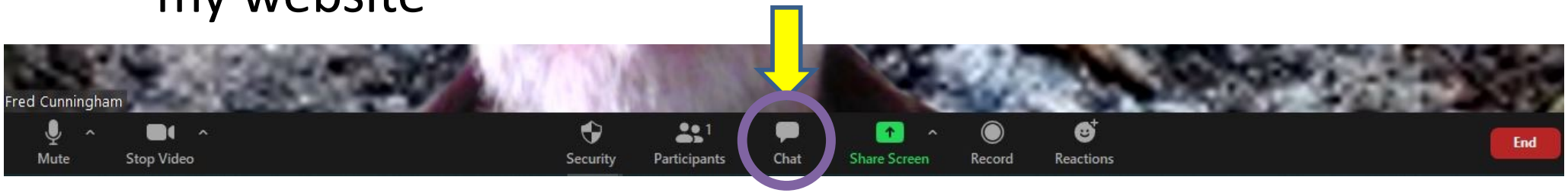
Zero Bills, Zero Carbon
Now includes IRA subsidies and EVs

How to save money by cutting carbon

By someone who has done it: David Green

Today's logistics

- All participants will be muted during the presentation.
- To ask a question or make a comment, please type your question or comment in "chat". The MC will monitor questions and relay them to me. There will be a 5 minute break for Q&A after every section
- At the end we will allow participants to unmute themselves so that you can ask questions live
- I will stay on until the last attendee's question gets answered
- The webinar is being recorded and will be posted on my website



The Conventional Wisdom on Net Zero is all Wrong

- “You can’t do net zero on an existing building”
- “It will never pay for itself”
- “Heat pumps will double your bills”
- “Solar panels reduce the price of your house”
- “Insulation is only for the north”
- “You have to take short showers”
- “EVs are too expensive, and I have range anxiety!”

All wrong. I have done it.

New Green Wisdom

Houses:

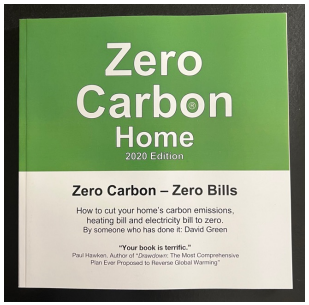
- Most MA homeowners can cut bills 50-100%, save $5-10k pa with 15-20% ROI, cut energy & carbon emissions 50-100%. Work MassSave and the IRA!
- For most MA homeowners a new heating/AC system (heat pump) is free or 80% off with NO INCREASE IN BILLS
- For most MA homeowners, a new heat-pump hot-water tank is either free or 60% off and will cut your bills by about 30%
- For all MA homeowners, insulation and draft sealing are almost free
- For all MA homeowners, solar panels are 40% off and cut your electric bill about 50% with an ROI of 10-15%

EVs:

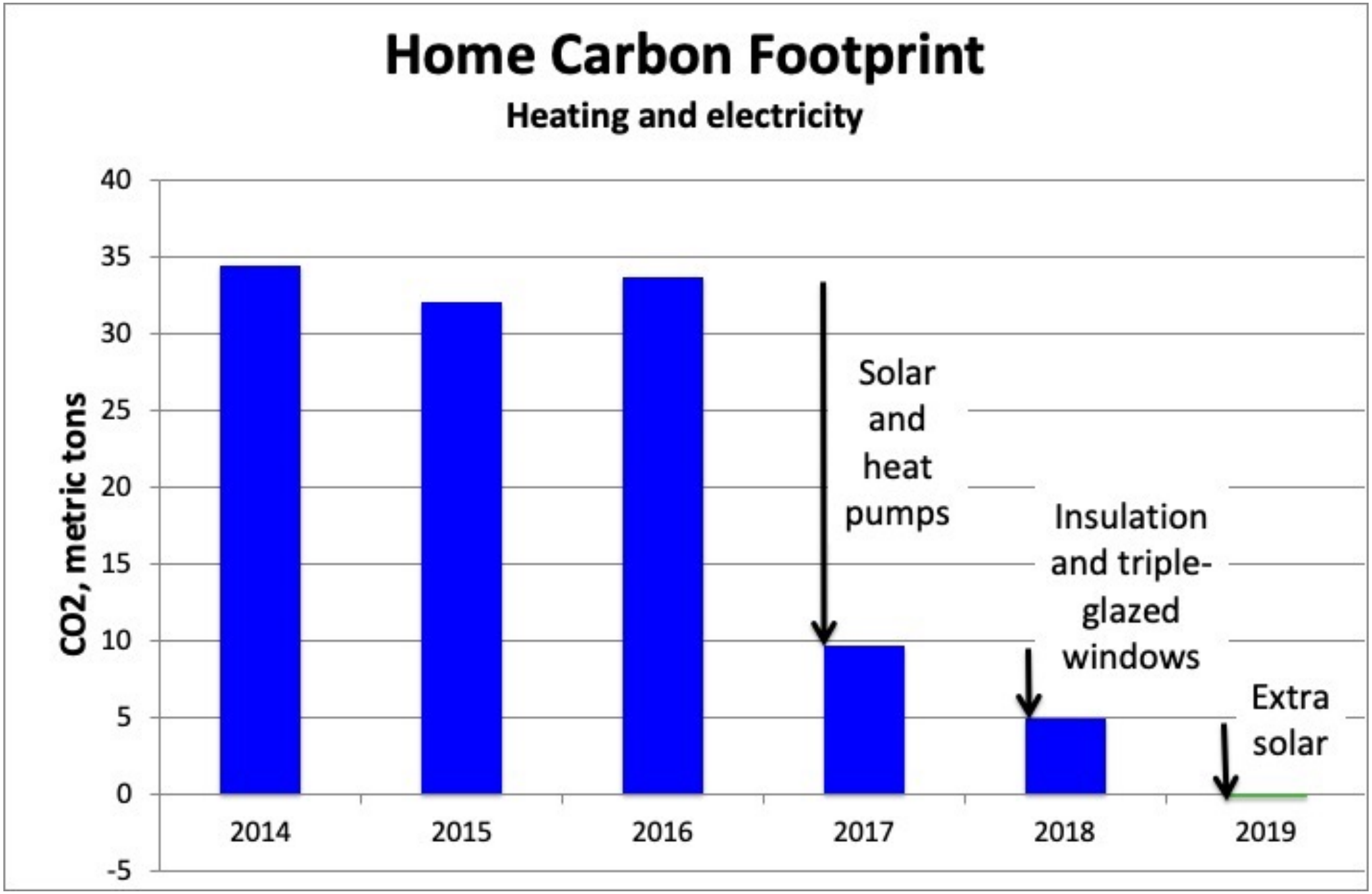
- With IRA and MA subsidies, EVs are cheaper to buy, run and maintain than gas-powered vehicles
- Save about $1,000 per year with an EV on utility electricity and $2,500 per year on solar panels
- No range anxiety on Tesla network: Tesla/GM/Ford/Kia/Hyundai/BMW
- V2H is cheaper than a battery or back-up generator: F150/Nissan Leaf

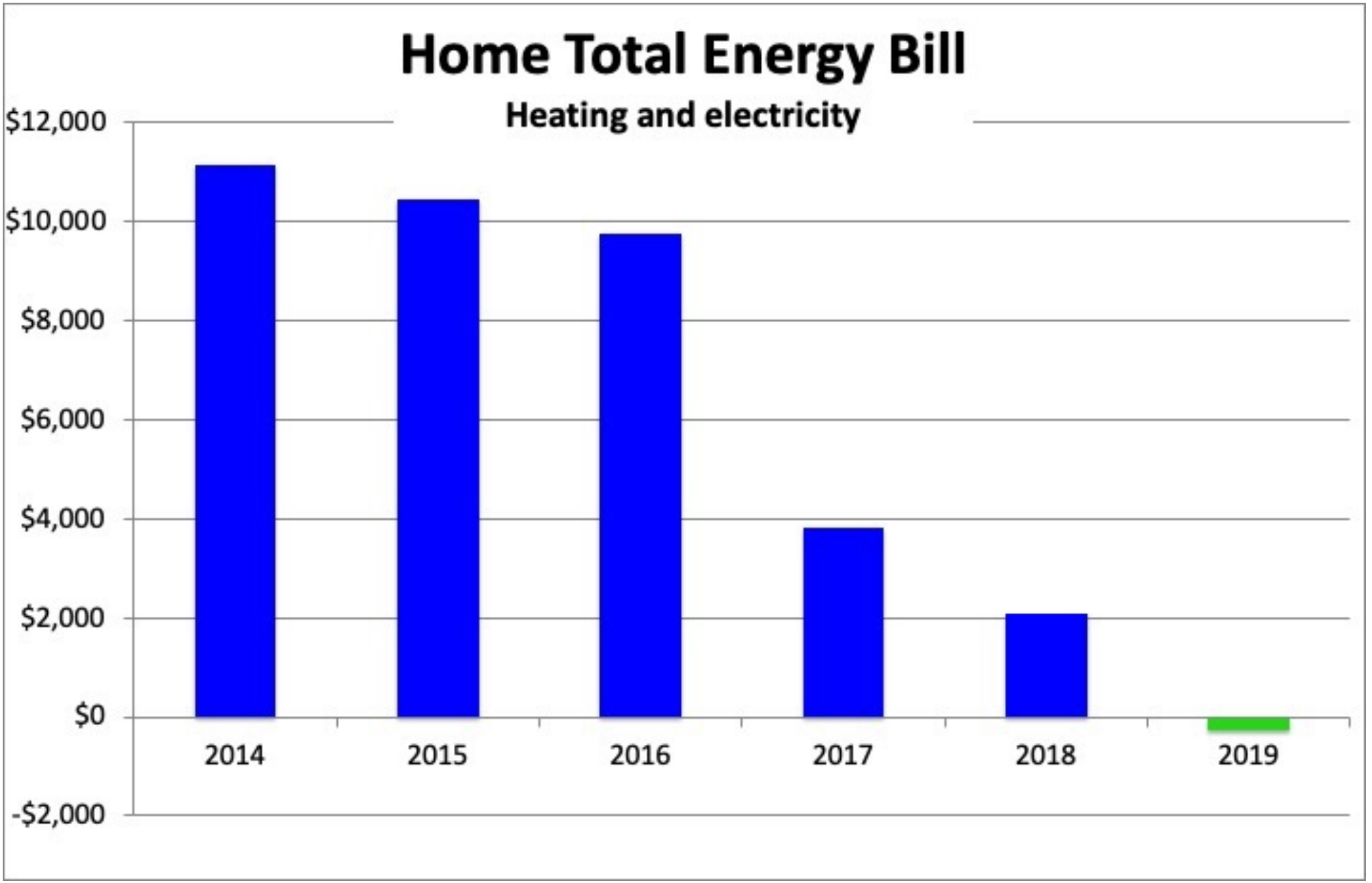
You can "save a lot of green by going green!"

About David Green:



- BA physics (Oxford), MBA (HBS)
  - Did things that made **both** energy **and** financial sense
  - HITS: heat pumps, insulation, triple-pane windows and solar panels
  - Not HITS: geothermal, solar hot water, wall insulation or super-tight building envelope
  - Worked on my house and 35 others
- Science based, financially sound, independent
- Free book Zero Carbon Home and free webinar. Thousands have seen. 74% do it. $99 report.
- I am not going to tell you to eat vegan, lower lower your thermostat, bike to work, have fewer children or vote for Al Gore.





The Fab Four:
HITS - Heat Pumps

Results for Heat Pumps

Effect on	Impact
Carbon Footprint	Cut 47% (20 tons)
Money saved per year	$2,888
Investment (net)	$26,250
Years to pay for itself	9.1
Return on investment	9% (after tax)

An October 2020 article in the journal Nature Energy reported a 4-7% price premium for houses with heat pumps compared to similar houses without heat pumps. On an average house, this translates to a premium of $10,000 to $17,000, or roughly what heat pumps would cost. This means you no longer have to wait for the payback period to get your money back on heat pumps – you get it back as soon as you sell your house. BlocPower leases heat pumps, if the upfront cost is too high for you.

Our heat pumps replaced our AC units, but both heat and cool the house

Heat pumps heat with 2.5x the efficiency of a furnace or boiler and cool with the same efficiency as an AC unit

HITS - Heat Pumps

- For most MA homeowners a new heating/AC system (heat pump) is free or 80% off with NO INCREASE IN BILLS
  - MassSave rebate on ASHP is up to $10,000
  - IRA Part A tax credit is $2,000 (each year) for any income level
  - IRA Part B Electrification Rebate up to $8,000 (varies by income level)
  - IRA Part C Energy-Efficiency Rebate $4,000 to $8,000 (varies by income)
- Keep your furnace/boiler and use when below about freezing
  - Ensures no increase in bills
- Heat pumps are electric heating which is R3 rate
  - About 1.5c/kWh (6%) lower than Basic Rate. Just call and ask! Also, NexAmp is 100% solar, 100% MA for 12.5% off Basic Rate
  - Or add solar at 8c/kWh vs Eversource at 30c/kWh
- A heat-pump hot-water tank is free or 60% off
  - Will lower bills vs. even natural gas
- Get multiple quotes. Any questions so far?

The Fab Four:
HITS - Insulation

Results for Insulation

Effect on	Impact
Carbon Footprint	Cut 16% (7 tons)
Money saved per year	$2,923
Investment (net)	$1,000
Years to pay for itself	0.3
Return on investment	100% (after tax)

Insulation: what we did

Our flat roof

10” fiberglass plus 4” ISO board – R50 total.
MA code minimum is now R49

Our basement ceiling

12” fiberglass – R38 total.
MA code minimum is now R37

Insulation - Subsidies

- MassSave will pay 75% of the cost of insulation up to $2,000 and 100% of the cost of draft sealing.
  - They will not pay for spray foam.
- IRA tax credit up to $1,200 per year for all income levels.
  - Additional up to $1,600 based on income.
  - Additional up to $8,000 based on energy savings and income.

Insulation is the lowest hanging ripest fruit in the garden. Pick it!

HITS - Insulation

Insulation and draft sealing are heavily subsidized, will cut your bills and carbon emissions substantially and often have a return on investment of over 100% pa (beats my 401k!)

- For which type of insulation to put where in your house, occasions to insulate walls profitably, and how much of it to install, see Chapter 1 in Zero Carbon® Home.
- I do not recommend taking off your siding, adding insulation and replacing your siding. It will cut your carbon footprint, but it is far too expensive compared to insulating your roof and basement.
- It is not necessary to get to Passive House levels of drafts (0.6 ACH50) to get to zero carbon. My house is 4.6.
- Any questions on insulation and air sealing?

The Fab Four:
HITS - Triple-Pane Windows

Results for Triple-Pane Windows

Effect on	Impact
Carbon Footprint	Cut 5% (2 tons)
Money saved per year	$974
Investment (net)	$4,500
Years to pay for itself	4.6
Return on investment	19% (after tax)

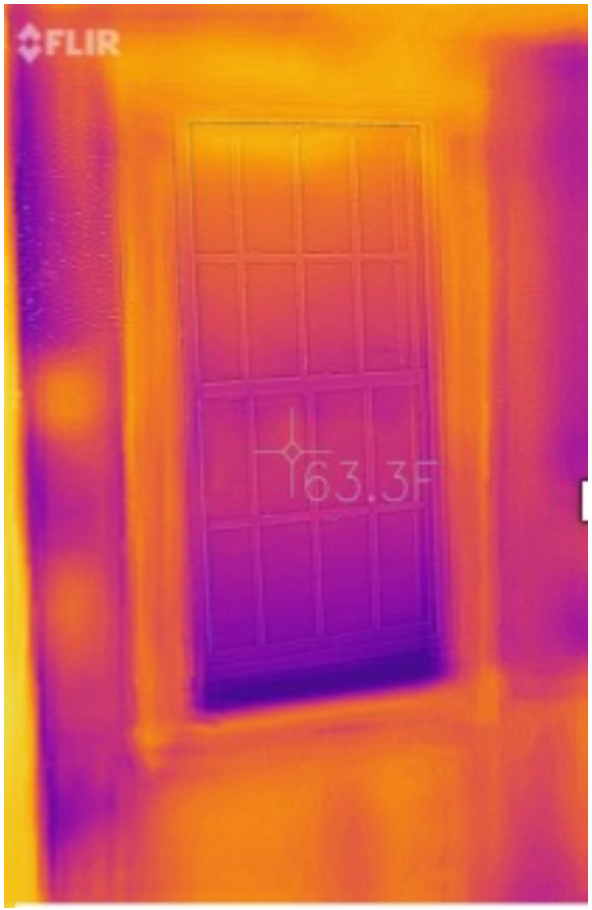
Note: the investment and cost savings are the additional cost above that for double-glazed equivalents. I only recommend you install triple-pane windows when you are replacing your windows for other reasons like they are rotting or leaking. Replacing windows, any windows, will not usually pay for themselves from the utility bill savings. Unless you use “fit-from-the-inside” triple-pane windows. A recent client can get to net zero with only double-pane windows.

HITS - Triple-Pane Windows

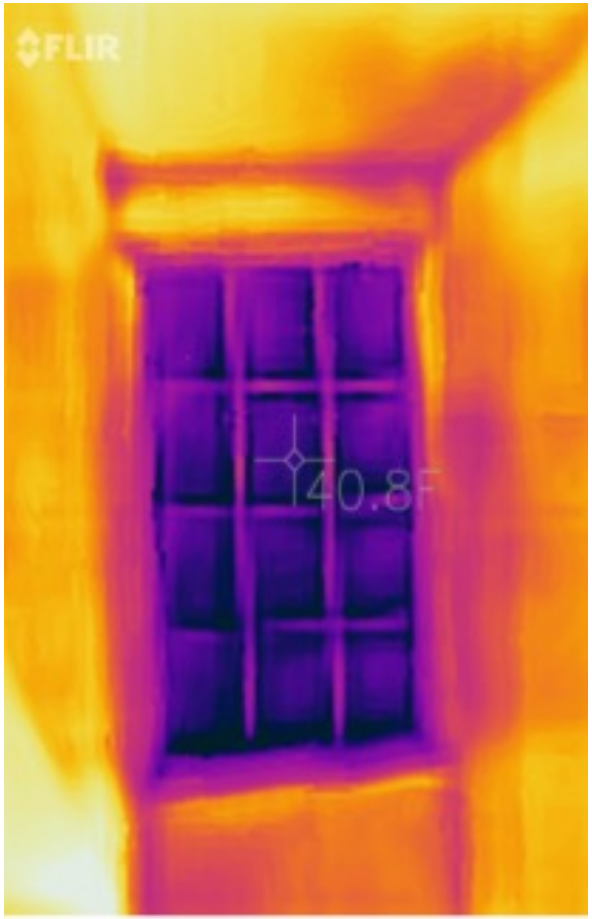
In addition to cutting our carbon footprint and saving us money, our new wood-framed, triple-pane windows have transformed the look and feel of our house – and we can see the garden! We now have Christmas in the living room.

Low Cost, “fit-from-the-inside” Window Inserts

Window insert in single-pane window.



Window insert in single-pane window – 63F. Cost $75-$200, payback is 2-5 years.



Single-pane window, no insert – 40F

HITS - Triple-pane Windows

Please see Chapter 4 in Zero Carbon® Home for details on how to:

- Shop for triple-pane windows
- Which types of low-E glass I recommend for which locations; my evaluation of different window inserts
- I do not recommend the stretchy film, except as poor-man's triple-pane windows

Any questions on triple-pane windows?

HITS - Solar Panels

Results for Solar Panels

Effect on:	Impact:
Carbon Footprint	Cut 32% (14 tons)
Money saved per year	$5,572
Investment (net)	$42,791
Years to pay for itself	7.2
Return on investment	13% (after tax)
Electricity cost (LCOE)	5-8c/kWh (ES 30c)

In addition, the DOE/Appraisal Journal estimates (based on analysis of 49,000 houses with Census Bureau data over 5 years) that our house value has increased by $111,000 (7%) from installing the solar panels. That is more than double our net investment in solar panels and more than our net investment in all the Fab Four. At current prices and subsidies our solar panels would earn a 12% ROI (after tax), payback in 9 years with a LCOE of about 10c/kWh.

HITS - Solar Panels

- Most homes in MA need 15-25kW to go zero after heat pumps:
  - With IRA and MA subsidies, solar panels are 40% off and reduce your electric bill about 50% with an ROI of 10-15%
  - Solar saves money even on roofs in part shade (like my garage), or roofs facing east or west, or flat roofs (like ours)
  - Solar panels increase the price of your house 4-7%
- Get multiple quotes, use EnergySage.com. Financing with a loan is usually better than leasing (there are loan sharks in leasing!)
- V2H (using an EV as backup) is usually cheaper than a home battery
- If your roof cannot do solar, try NexAmp (or other community-source solar) which is 100% solar, 100% MA for 12.5% off Basic Rate – even tenants can do this. Get the R4 rate for heat pumps.
- Add 3kW (8 panels) for an EV and 1kW (3 panels) for a HPHWT

Any questions on solar panels?

The Key to Going Zero is To Do All of the Fab Four

- Cut your building's energy use so much you can generate it all from solar panels on the roof
  - Cut energy use with insulation and draft sealing
  - Cut energy use with triple-pane low-E windows
  - Cut energy use with heat pumps
  - Generate energy with solar panels

Fab Four Summary - HITS

	Total money invested (after subsidies and tax credits)	Total Money Saved	Years to pay for itself	Return on Investment (after tax)	Total carbon footprint reduction (CO2 per year)
Heat pumps	$26,250	$2,888	9.1	9%	20 Tons
Insulation	$1,000	$2,923	0.3	100%	7 Tons
Triple windows	$4,500	$974	4.6	19%	2 Tons
Solar panels	$42,791	$5,572	7.7	13%	14 Tons
Total	$74,541	$12,358	6.0	15%	43 Tons

Free "Zero Carbon, Zero Bills" Stuff:

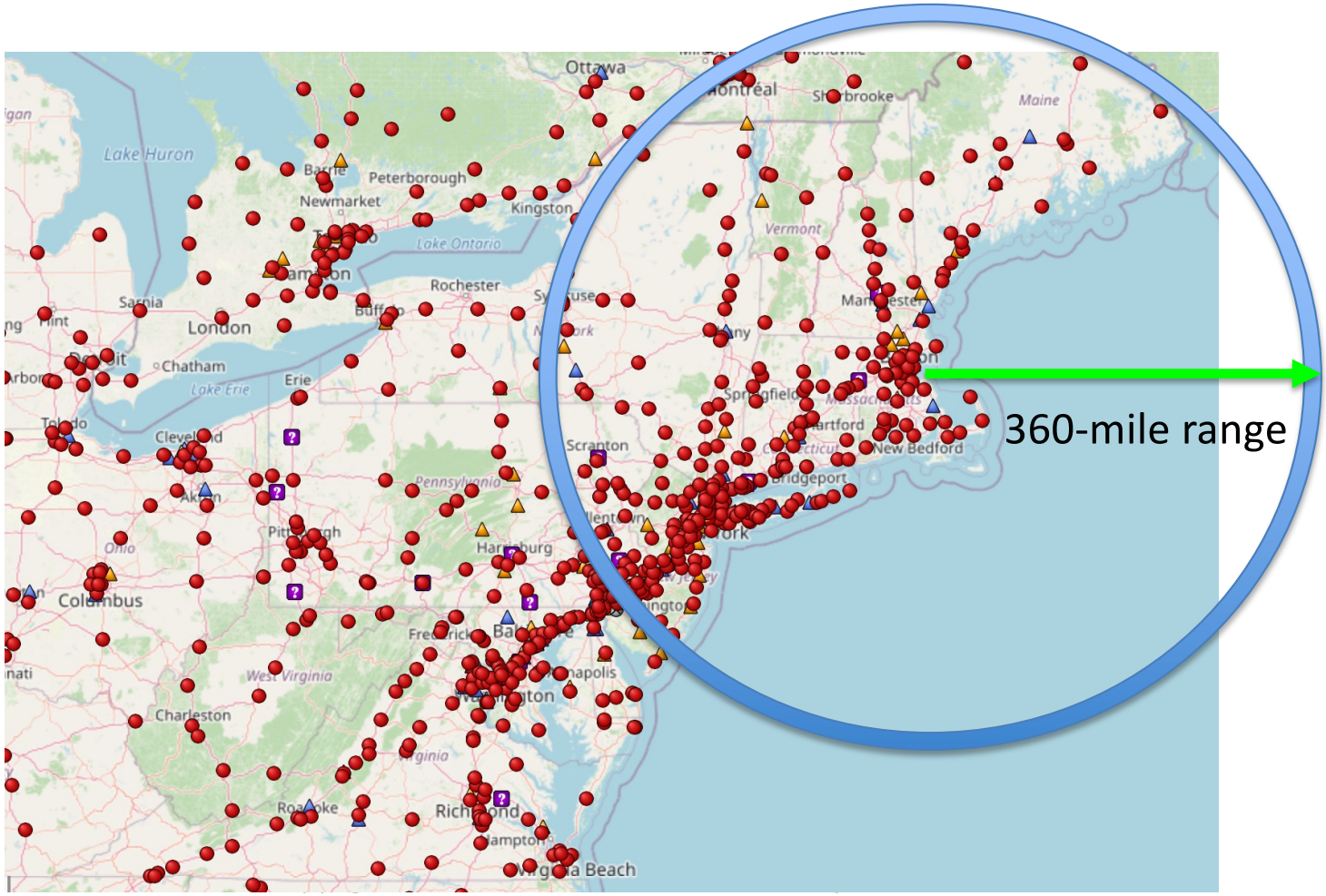
A pdf file of the slides for this webinar,
A YouTube recording of a previous webinar,
Searchable, written Q&A (300) from previous webinars,
And the free book are all available at:
www.greenzerocarbonhome.com
For the free iPad / Kindle copy of Zero Carbon Home,
visit my website, order the book and use the code UCCA24.
If this does not work, email me!
Heat Smart Alliance does volunteer consulting on heat pumps.
$150 paid consulting service (not mine, mostly on heat pumps):
https://abodeem.com/homeowners/paid-consulting-service/
For $99 analysis and recommendations report (used to cost $1-2k) to get your house to net zero in the most profitable way (includes a plan to exploit the IRA), email me your address and type of heating fuel:
My email address: dgreen@greenzerocarbon.com
Only for MA. Only for detached homes.
And for the encore…

George Martin – the 5th Beatle!

HITS+ EVs – The Fab Five!

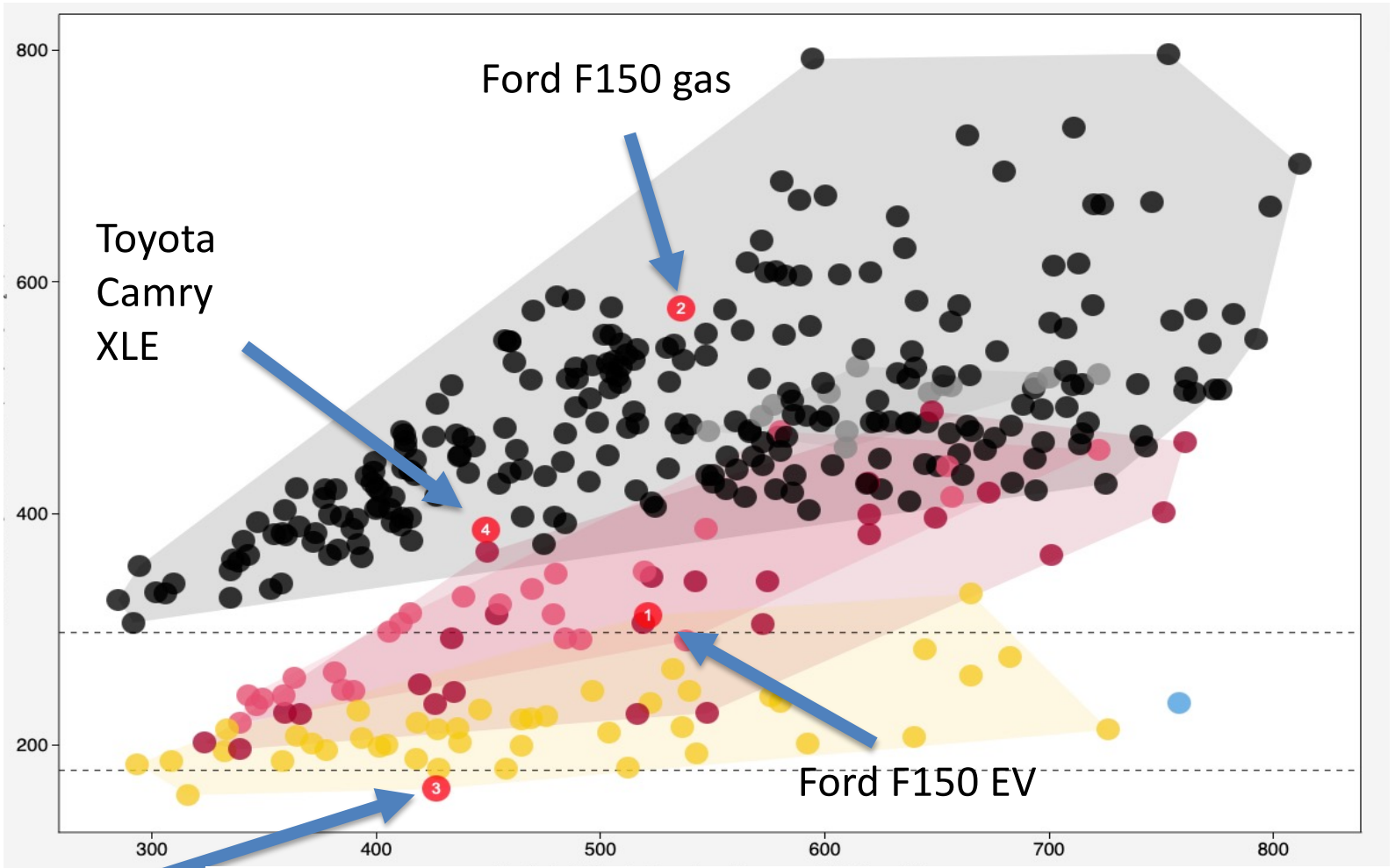
No Range Anxiety!

There are over 500 Tesla Superchargers within my 360-mile range. They are fast, convenient and reliable. 20 mins charging adds 100 miles of range.
GM/Ford/Kia/Hyundai/BMW all will have access to the Tesla Supercharger network in ’24. Toyota in ’25. Need NACS adapter.
I have a Tesla Model S with over 70,000 miles in 4 years & a new Ford F150 Lightning



EVs are Cheaper than Gas

Black = gas, red = hybrid, yellow = EV



Source: CARbon Counter, Trancik Lab at MIT

EVs are Cheaper than Gas

	----------Sedans----------			----------SUVs----------			---------Trucks---------	
	Tesla Model 3	Toyota Camry XLE	BMW 3 Series	Tesla Model Y RWD	Lincoln Corsair	Acura RDX	Ford F150 Lightning Pro	Ford F150 Supercab (gas)
List price (Kelly's Blue Book)	$39,000	$31,000	$44,500	$43,990	$38,830	$44,350	$49,000	$43,000
Cost of level 2 home charger	$2,000			$2,000			$2,000	
IRA tax credit	$0	$0	$0	$7,500	$0	$0	$7,500	$0
MA MOREV rebate	$3,500	$0	$0	$3,500	$0	$0	$7,500	$0
Net cost	$37,500	$31,000	$44,500	$34,990	$38,830	$44,350	$36,000	$43,000
5-year maintenance	$1,115	$1,168	$7,074	$1,449	$2,942	$2,556	$3,433	$4,506
Cost per mile ($4/gal, 30c/kWh)	$0.08	$0.14	$0.13	$0.08	$0.15	$0.17	$0.15	$0.20
Cost per year to drive 12,000 miles	$900	$1,714	$1,548	$900	$1,846	$2,000	$1,800	$2,400
Cost per mile (solar @ 8c/kWh)	$0.02	$0.14	$0.13	$0.02	$0.15	$0.17	$0.04	$0.20
Cost per year to drive 12,000 miles	$240	$1,714	$1,548	$240	$1,846	$2,000	$480	$2,400

I can drive to NYC and back for $8 in my Tesla! The Greyhound costs $26!!

Lease a Toyota bZ4X for $129/month. Average US cable bill is $129/month!

My Awesome F150 Lightning

Seats 5 adults, more comfortable than BMW X5

Interior 120V AC socket (x2) plus USB A and USB C (x2)

Can carry 4 kayaks or 2 cu yds of wood chips

Massive “frunk” with 4 x 120V AC sockets.
Lockable, waterproof storage!

4 x 120V AC sockets
(plus USB A and C) in frunk

4 x 120V AC sockets in bed of truck
with 1 x 240V/30A AC V2H outlet

My F150 Lightning Powering my House During the Grid Outage in March

EVs – V2H

- V2H (vehicle-to-home) uses your EV as a back-up generator
- V2H is on Nissan Leaf (with charge station) and Ford F150 Lightning.
  - will be on Teslas in 2025, all GM EVs in 2026, Kia EV9 in 2024
- My Ford F-150 Lightning has 130kWh of storage (9x a Tesla Powerwall!), it has 2 x 120V outlets in the cab, 4 in the frunk, 4 more truck bed: circular saws, lights, refrigerator, microwave, espresso – awesome tailgating/movies! Plus 240V/30A for V2H.
- It will run my house for 3 days (without the heat pumps, stove or tumble dryer), a Powerwall would run it for 8 hours.
- My F150 Lightning (Lariat) cost $61k after subsidies, Pro is $36k
  - 9 Powerwalls (130kWh) = $128k
- It is a huge battery / party on 4 wheels. It is also a very nice truck!
- Don’t get a house battery or new generator – get V2H!

New Green Wisdom

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