

# **BUILDINGENERGY BOSTON**

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## **The Deep Energy Retrofit Controversy Revisited**

**Michael Hindle (Passive to Positive)  
Rachel White (Byggmeister)**

**Curated by Meg Howard (MassCEC)**

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**Northeast Sustainable Energy Association (NESEA) | March 19, 2024**

## Reactions to Keynote

*Can we agree that what we really have is a values problem?*

*Byggmeister's clients are well-meaning progressives that, in reality, like most of us, prioritize spending money on stuff rather than on reducing their carbon footprint.*

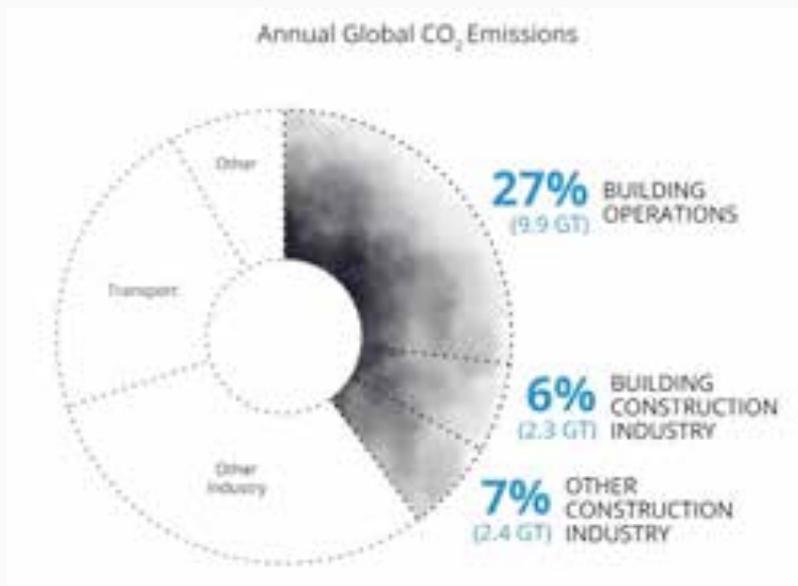
*The keynote elevated a justification for our industry to remain merchants of mediocrity... Conventional ROI thinking – without accounting for the real limits of our planet's boundaries – may be the very root cause of our climate emergency.*

*I felt terribly confused and abandoned. It was as if the leader of the pack had capitulated.*

# Design-Build Remodeling + Energy Retrofit



# Why existing buildings?



In 2040, **2/3 of the global building stock** will be buildings that exist today. Without upgrades, they will still be emitting GHGs.

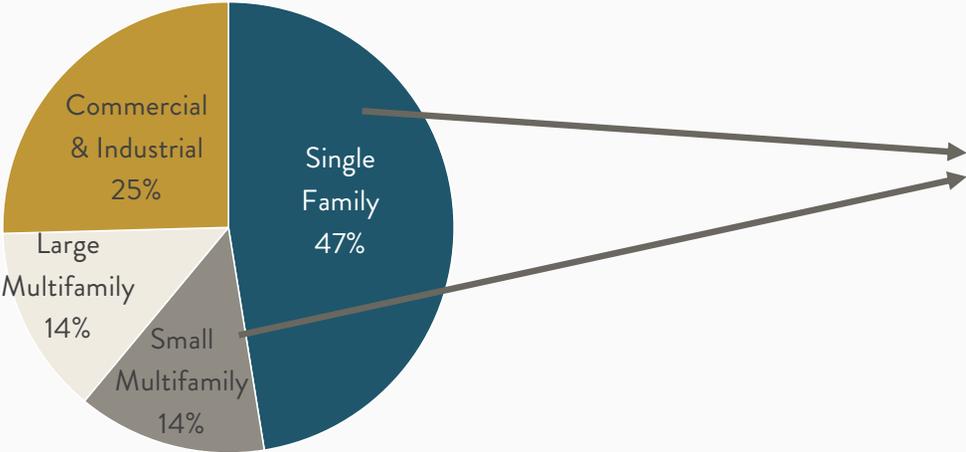


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Data Source: IEA Energy Technology Perspectives 2020, February 2021 Revised Edition

Credit: Architecture 2030

# Why Small Residential?

MA Building Stock by Square Footage as of 2016



60% of emissions

# The DER

Basement slab and wall insulation

Exterior “wrap” above grade walls and roof

Triple-pane windows

Near Passive-house levels of air tightness

Heat pumps

Balanced ventilation



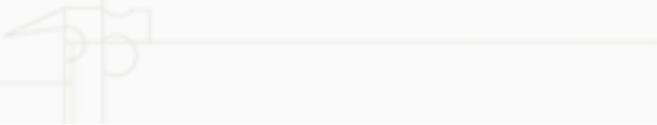
## Byggmeister's DER Journey

- 2008: ZNE Buildings Task Force formed
- 2009: DER Pilot Incentive Programs Launch
- 2010: Our first full DER
- 2014: Our first (and only) net-positive DER
- 2016: National Grid DER Program ends
- 2017: Our last DER (full or partial); Our first all-electric moderate retrofit



## Why We Shifted our Focus

- High Cost & High Waste
- Strategic Electrification
- Upfront Carbon



## The Moderate Retrofit (MER)



- Wall insulation — dense pack cellulose
- Basement wall and roof insulation — minimize foam
- Blower-door guided air-sealing
- Triple-pane windows in renovated spaces only (typ.)
- Plan for whole house electrification and at least partially implement
- Prep for PV
- Exhaust ventilation or ERV for bedrooms

# MER Case Study Project Scope

## Remodeling

- Kitchen, dining room and living room renovation
- Replacement of powder room with full bathroom
- Deck addition

## Envelope

- R49 roof
- R13 or 20 above grade walls
- R13 foundation walls
- No slab insulation
- 40% of windows replaced

## Mechanical & Solar

- 2:1 ducted minisplit heat pumps
- Heat pump water heater
- Continuous exhaust ventilation
- No solar PV

# Hypothetical DER Scenarios

## High Upfront Carbon (High UC)

- 3" spray foam on basement walls (R20)
- Cellulose in wall cavities + 4" polyisocyanurate (R40)
- Triple paned windows
- Cellulose in 10" roof cavities (built-down) + 4" polyiso (R60)
- 2:1 ducted heat pump & ERV

## Low Upfront Carbon (Low UC)

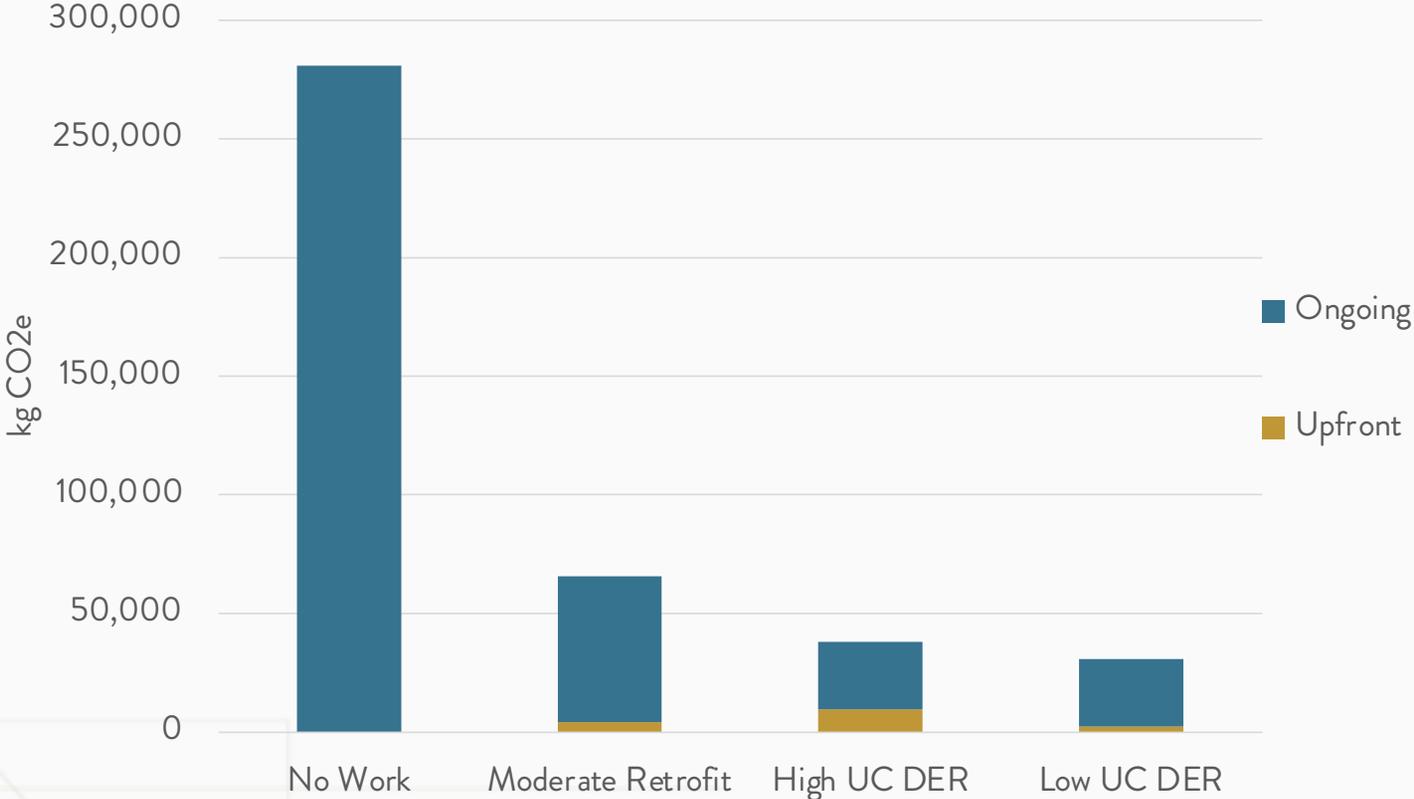
- 3" spray foam on basement walls (R20)
- Cellulose in wall cavities + 7" wood fiberboard (R40)
- Triple paned windows
- Cellulose in 10" roof cavities (built-down) + 7" wood fiber board (R60)
- 2:1 ducted heat pump & ERV

## MER and DER Performance

	Pre-Project (Measured)	Post-Project (Measured)	Hypothetical DER (Modeled)
Air Leakage	13.5 ACH50	4.9 ACH50	1.0 ACH50
Heating Load	67 kbtu/hr	32 kbtu/hr	13 kbtu/hr
Annual Site Energy	195 MMBtu	42 MMBtu	18 MMBtu*
Energy Use Intensity	85 kBtu/sf	18 kBtu/sf	7.9 kBtu/sf*

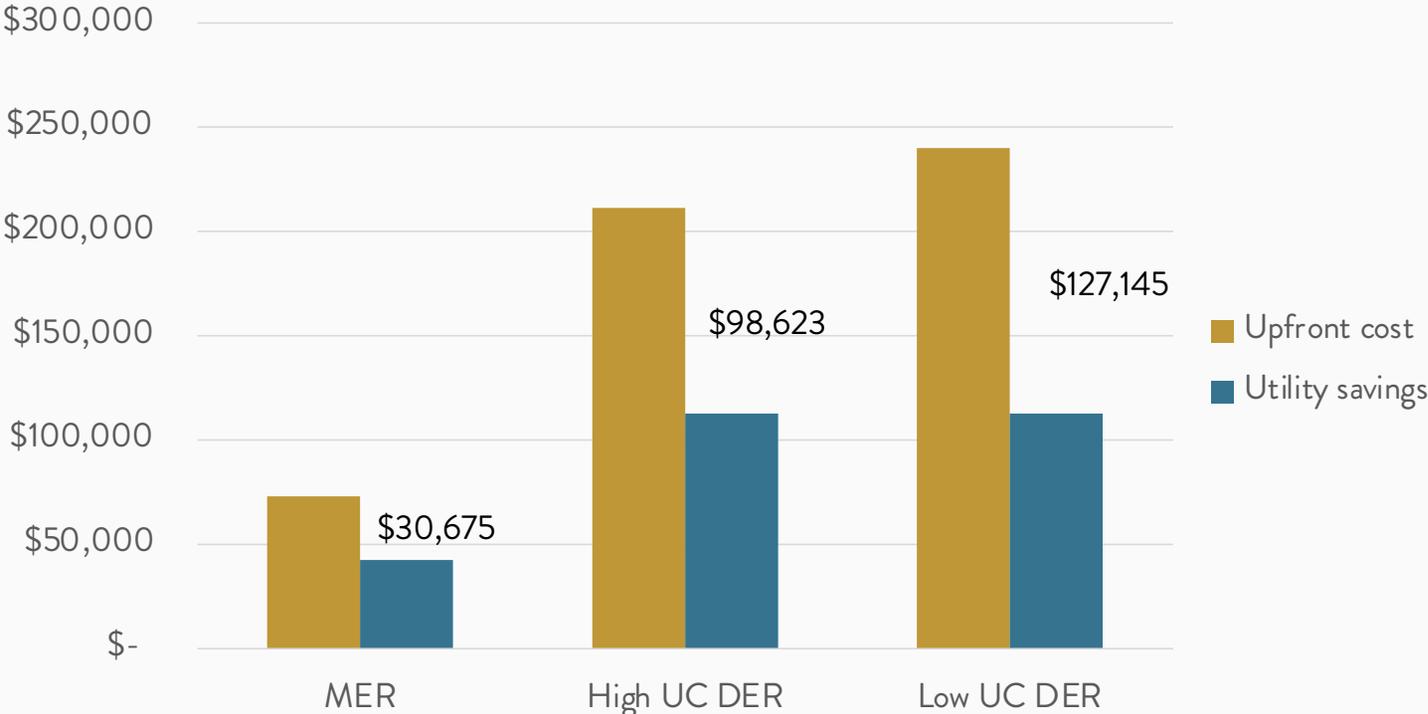
*\*modeled energy use updated*

# Carbon Emissions 2020-2050\*



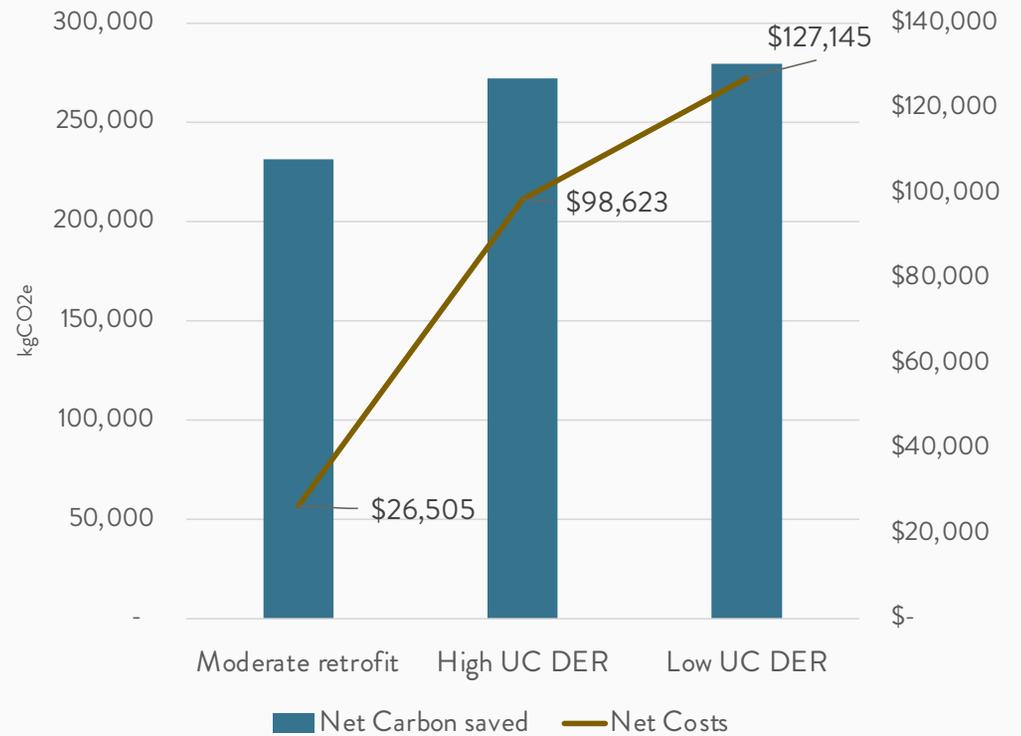
\*DER operating emissions updated

# Net Costs 2020-2050



# MER and DER Decarbonization Cost Effectiveness\*

	Cost per kgCO <sub>2</sub> e saved 2020-2050
Moderate Retrofit	\$.11
High UC DER	\$.36
Low UC DER	\$.45



\*DER operations emissions updated

Deep energy retrofits are not (currently) a cost-effective decarbonization strategy for single-family homes. For now, we think all-electric moderate retrofits are where Byggmeister can have the most impact, but if experience or data indicate otherwise, we stand ready to pivot.

BE23 KEYNOTE CONCLUSION



Passive to **POSITIVE**  
PASSIVE HOUSE AND LOW IMPACT DESIGN

MICHAEL HINDLE, CPHC – Owner, Principal  
[michael@passivetopositive.com](mailto:michael@passivetopositive.com)  
240-431-1281

**HIGH PERFORMANCE LOW CARBON PASSIVE HOUSE NET ZERO NEW RETROFIT**

# A SYSTEMIC CRITIQUE

**RESPONSE TO THE NESEA BE BOSTON 2023 WEDNESDAY  
KEYNOTE, "WHY WE STOPPED DOING DEEP ENERGY  
RETROFITS"**



Michael Hindle





# MATERIAL SELECTION FOR REGENERATIVE IMPACT



# EXTRACTIVE, LINEAR ECONOMICS



A ONE-WAY TRIP

# EXTRACTIVE, LINEAR ECONOMICS



A ONE-WAY TRIP

# WAR

IRAQ WAR COST \$ 1.3 TRILLION TO THE US ALONE



OBSCENE, SPECULATIVE, ECONOMICS FOR BILLIONAIRES



OPULENCE ONLY FOR A FEW



Child Waste picker in Malaysia:JP Getty Images



## ABANDONED POPULATIONS SINKING IN WASTE

The west and rich populations export all negative externalities

# FORMERLY RENEWABLE RESOURCES

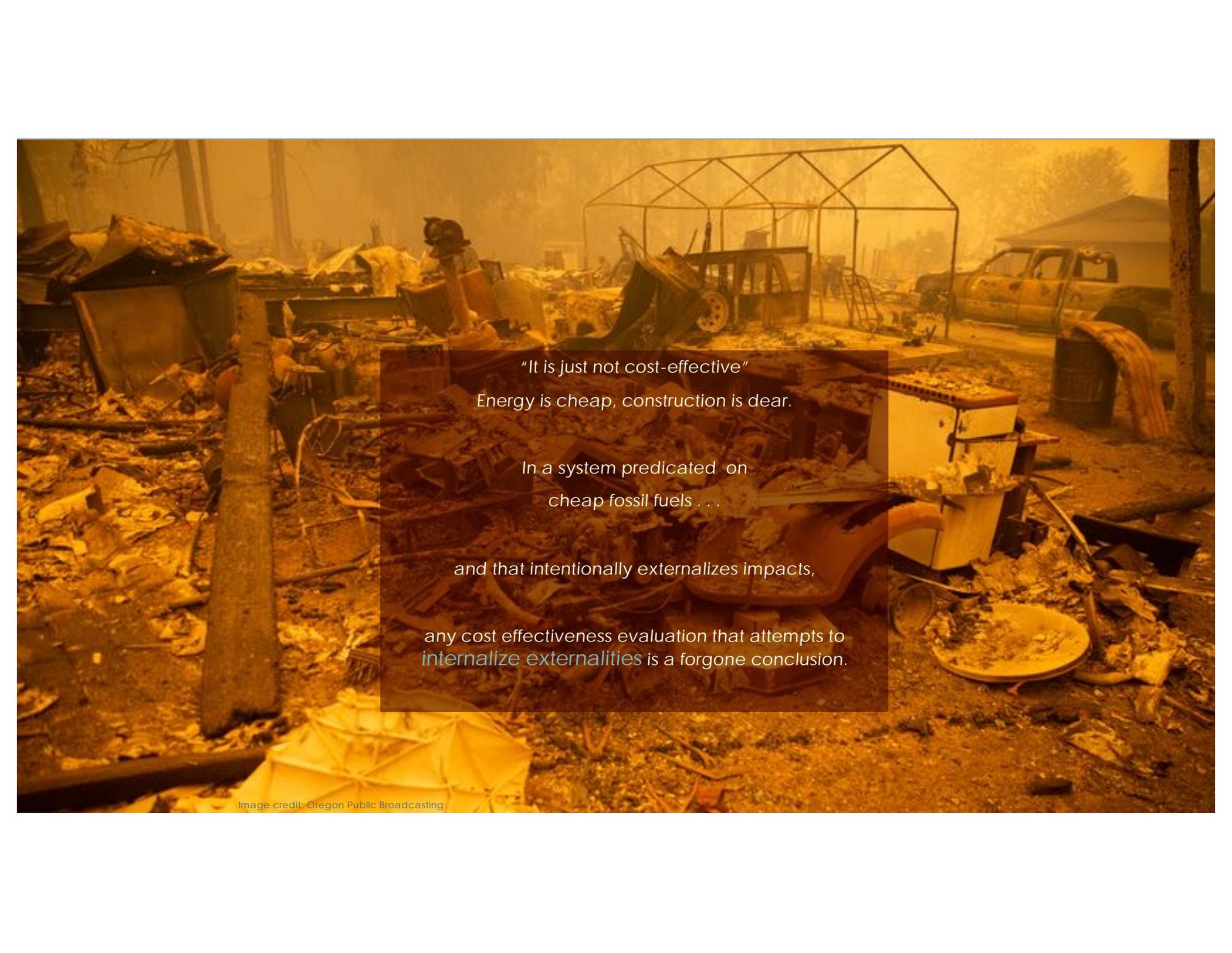
EROSION OF REGENERATIVE CAPACITY



ALL HAVE REGENERATION RATES - SOME ARE ERODABLE  
MAY BE GONE FOREVER (FOR HUMAN TIMESCALE)



Image credit: Oregon Public Broadcasting

A photograph showing the aftermath of a disaster, likely a wildfire, with a semi-transparent text box overlaid. The scene is filled with debris, including a destroyed shed, a metal frame structure, and a damaged vehicle. The lighting is dim and yellowish, suggesting smoke or fire damage.

*"It is just not cost-effective"  
Energy is cheap, construction is dear.*

*In a system predicated on  
cheap fossil fuels . . .*

*and that intentionally externalizes impacts,*

*any cost effectiveness evaluation that attempts to  
internalize externalities is a forgone conclusion.*

A photograph showing the aftermath of a disaster, likely a wildfire. The scene is filled with charred and mangled debris, including twisted metal, wood, and household items. In the center, a metal frame for a greenhouse stands amidst the wreckage. To the right, a dark-colored pickup truck is heavily damaged and partially obscured by debris. The background is hazy and smoky, suggesting a recent fire. The overall color palette is dominated by warm, orange-brown tones, emphasizing the destruction and loss.

WHAT DOES IT COST . . . IF WE FAIL?

Image credit: Oregon Public Broadcasting

A photograph showing the aftermath of a disaster, likely a wildfire. The scene is filled with debris, including charred wood, metal, and twisted metal. In the center, there is a large, empty metal frame structure, possibly a greenhouse or a shed. To the right, a dark-colored vehicle is heavily damaged and partially obscured by debris. The background shows more destruction and a hazy, orange-tinted sky. The overall atmosphere is one of devastation and loss.

PLEASE, SOMEONE, DEFINE  
COST EFFECTIVE  
(MEANINGFULLY !!!)

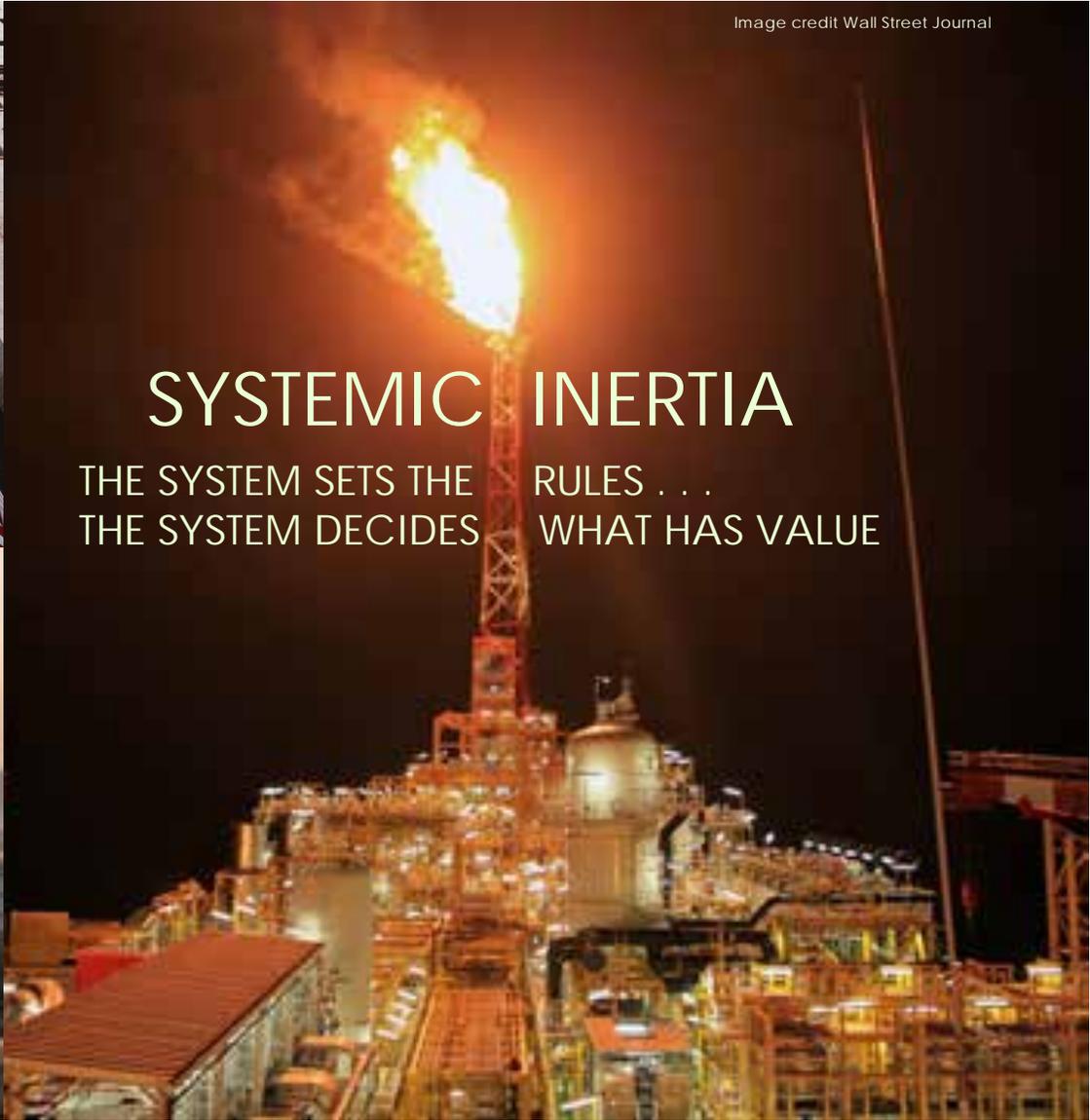


Image credit Wall Street Journal

# SYSTEMIC INERTIA

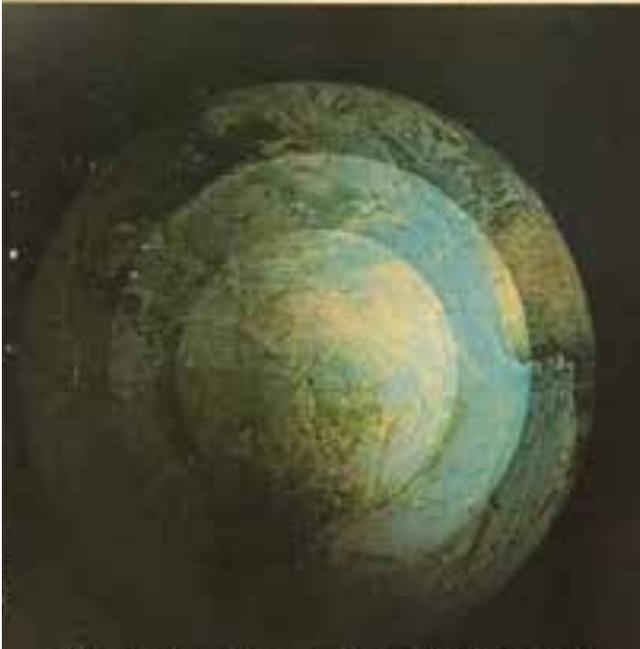
THE SYSTEM SETS THE  
THE SYSTEM DECIDES

RULES . . .  
WHAT HAS VALUE

SIGNET • 451 W5767 • \$2.50

# THE LIMITS TO GROWTH

The headline-making report on the imminent global disaster facing humanity—and what we can do about it before time runs out. "One of the most important documents of our age!" —Anthony Lewis, *The New York Times*



DONELLA H. MEADOWS/DENNIS L. MEADOWS  
JØRGEN RANDERS/WILLIAM W. BEHRENS III  
A POTOMAC ASSOCIATES BOOK

SYSTEMIC THINKING

SYSTEMIC ACTION



HOW DO WE GAIN PURCHASE WITHIN THE SYSTEM?

WHAT IS THE GOAL?

The background of the slide is an aerial photograph of a vast agricultural landscape, showing a grid of fields and roads. A bright sun flare is visible in the upper right quadrant, creating a lens flare effect across the sky. The title 'BOUNDED RATIONALITY' is positioned in the top right corner, with 'BOUNDED' in white and 'RATIONALITY' in orange.

# BOUNDED RATIONALITY

Most actors are behaving rationally within the confines of a defined set of boundaries with access to certain (limited) information, even if their behaviors seem irrational or are cumulatively destructive when viewed from a larger context.

# THE ULTIMATE BOUNDED RATIONALITY



## PERPETUAL **GROWTH**

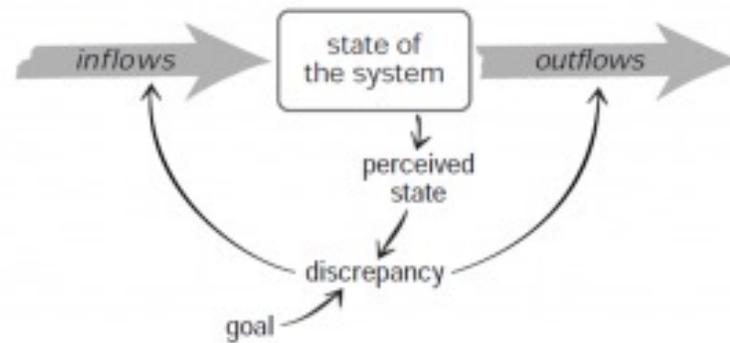
### WHAT'S NOT TO **LOVE?**

Most actors are behaving rationally within the confines of a defined set of boundaries with access to certain (limited) information, even if their behaviors seem irrational or are cumulatively destructive when viewed from a larger context.

# REINFORCING OR RESTRAINING FEEDBACK LOOPS

Desertification exacerbates the drought in California's central valley

## WHAT IS THE MARKET SIGNAL?



Market signal demands higher yield → intensive mono-crop commodity production → causes soil erosion → less organic matter in soil → depletion of soil biome + less moisture in soil → higher use of fertilizer and pesticide + more irrigation → less robust plants more erosion → circle back to higher use of fertilizer and pesticide = runaway, self reinforcing feedback loop.



# OBVIOUSLY INSANE AND YET EVERY BEHAVIOR WAS ENTIRELY RATIONAL

JUNE 8, 2015 | 10 MIN READ

## Use It or Lose It Laws Worsen Western U.S. Water Woes

ProPublica's "Killing the Colorado" series examines a 139-year-old water law that pushes ranchers to use as much water as they possibly can, even during a drought

BY ANTHONY CUCIAGLIA & PROPUBLICA

# BOUNDED RATIONALITY

IF PUBLICLY TRADED TIMBER COMPANY HAS THE IMMEDIATE PRESSURE TO MAXIMIZE EARNINGS

A CLEAR-CUT YIELDS A HIGH, SHORT-TERM YIELD OF ONE COMMODITY BUT DECIMATES THE ECOSYSTEM

INDIGENOUSLY MANAGED FORESTS LIMIT SHORT TERM YIELD, INCREASE YIELDS YEAR ON YEAR AND REMAIN HEALTHY





BUT WHY?

FINANCE!  
THE TAIL THAT WAGS THE  
DOG

INFORMED BY ECONOMIC  
ORTHODOXY

# BLINDNESS OF THE MARKETS



The efficient-market hypothesis (EMH) is a hypothesis in financial economics that states that asset prices reflect all available information.

**Markets live in denial of limits. They are essentially blind to non-linear impacts, and work on incomplete information with numerous distortions and delays of feedback.**

**Paraphrased from "Limits to Growth"**

# ECONOMIC ORTHODOXY



## RATIONAL ECONOMIC MAN

- ALL SEING (MONEY)
- SELF INTERESTED
- TOTALLY RATIONAL
- HAS AGENCY

CREATED EXPICITLY TO UNLEASH THE POWER OF  
MATHEMATICAL MODELING

HOMOECONOMICUS (**RIDICULOUS**)

# ECONOMIC ORTHODOXY



THERE WAS ALWAYS EVIDENCE THAT HE WAS A **FALLACY**



**HOMOECONOMICUS (RIDICULOUS)**

# ECONOMIC ORTHODOXY



THERE WAS ALWAYS EVIDENCE THAT HE WAS A **FALLACY**



SURE - GO AHEAD AND TRY TO MAKE A RATIONAL ECONOMIC DECISION ABOUT HEALTH CARE

# ECONOMIC ORTHODOXY



**NEVERTHELESS, HE WENT  
FROM:  
A MODELING TOOL FOR  
CALCULATIONS →**

**TO A THEORETICAL  
ORTHODOXY →**

**TO A CULTURAL A MODEL  
OF "CORRECT" BEHAVIOR**



**HOMOECONOMICUS (RIDICULOUS)**

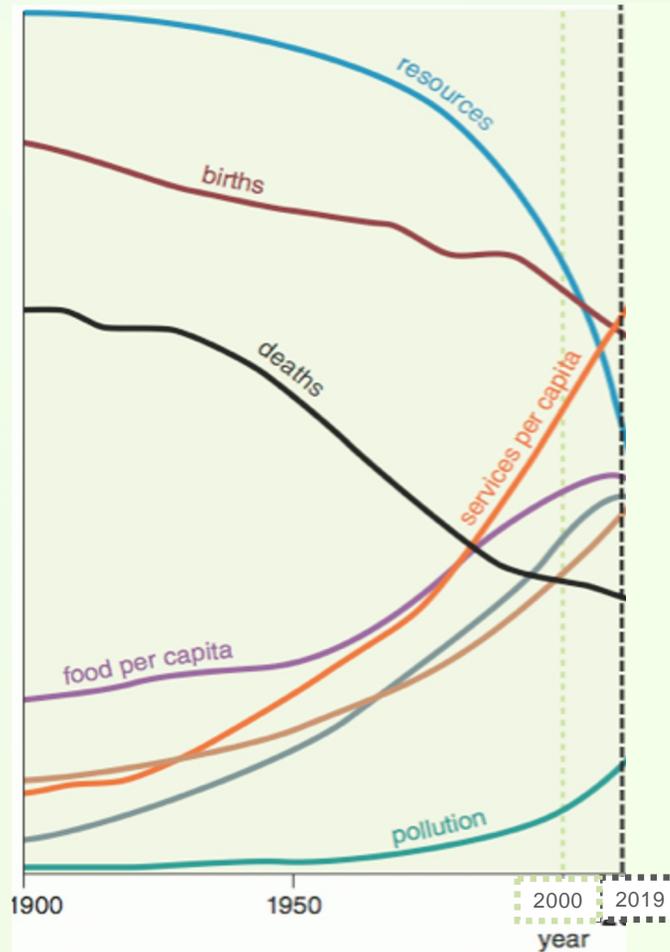
# DOOMSDAY MACHINE



**OUR ECONOMIC MYTHOLOGY AND MARKET MECHANISMS  
HAVE US TRAPPED IN DELUSIONAL BEHAVIOR**

# THE PREVAILING PARADIGM OF GROWTH

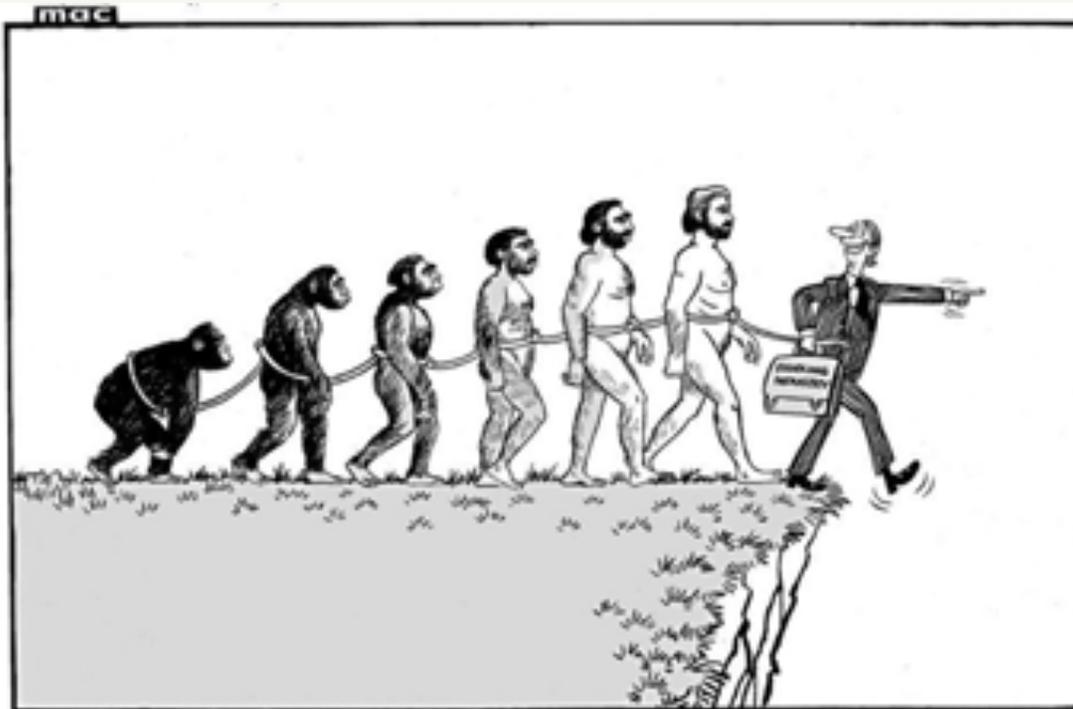
ECONOMISTS'  
ABSURD  
CONFIRMATION  
BIAS



PERPETUAL **GROWTH**

WHAT'S NOT TO **LOVE?**

# ECONOMIC ORTHODOXY



Evolution stops here

I ONLY CONSIDER THE  
COST TO ME

FIRST COST IS  
PARAMOUNT

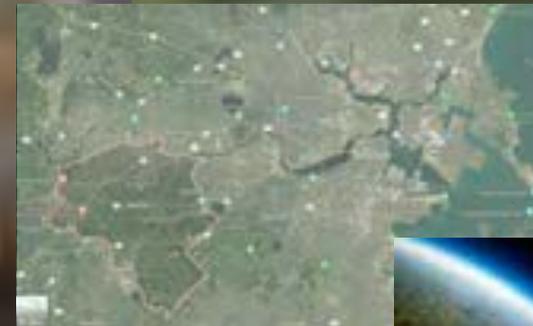
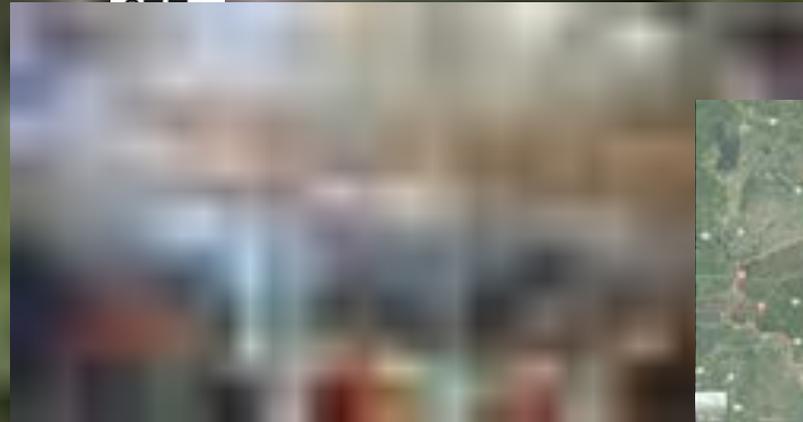
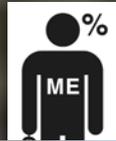
(VERY) SHORT TIME  
HORIZON

IF IT IS NOT ON MY PRO-  
FORMA IT MUST NOT  
EXIST

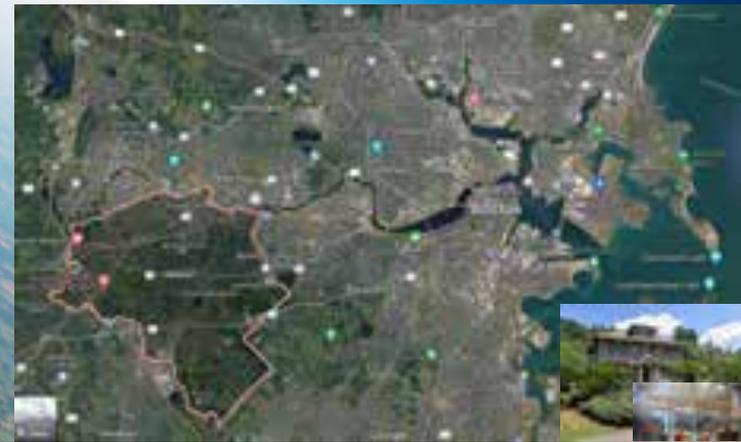
EXTERNALIZE LIABILITIES

WE ARE BEING COST BENEFITED TO DEATH

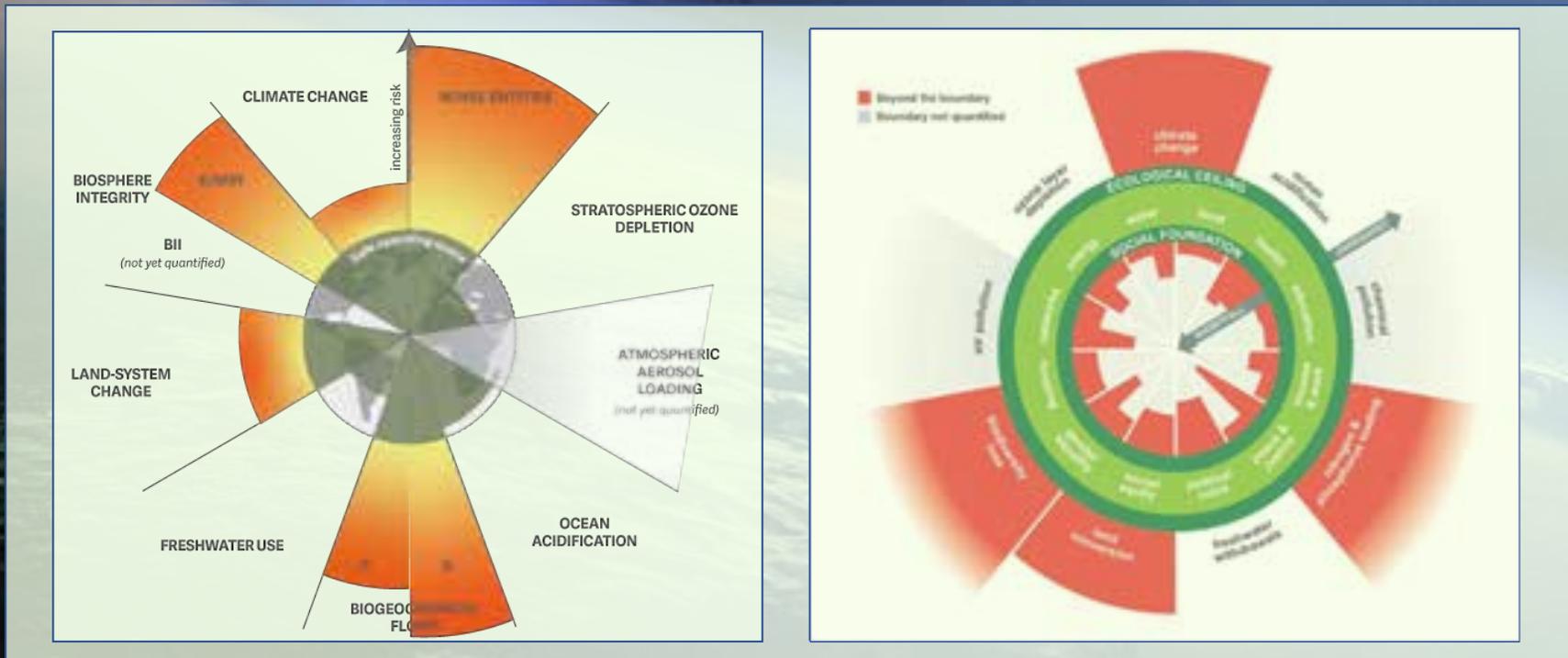
# CHANGE YOUR SYSTEMS ANALYSIS BOUNDARIES



# CHANGE YOUR SYSTEMS ANALYSIS BOUNDARIES

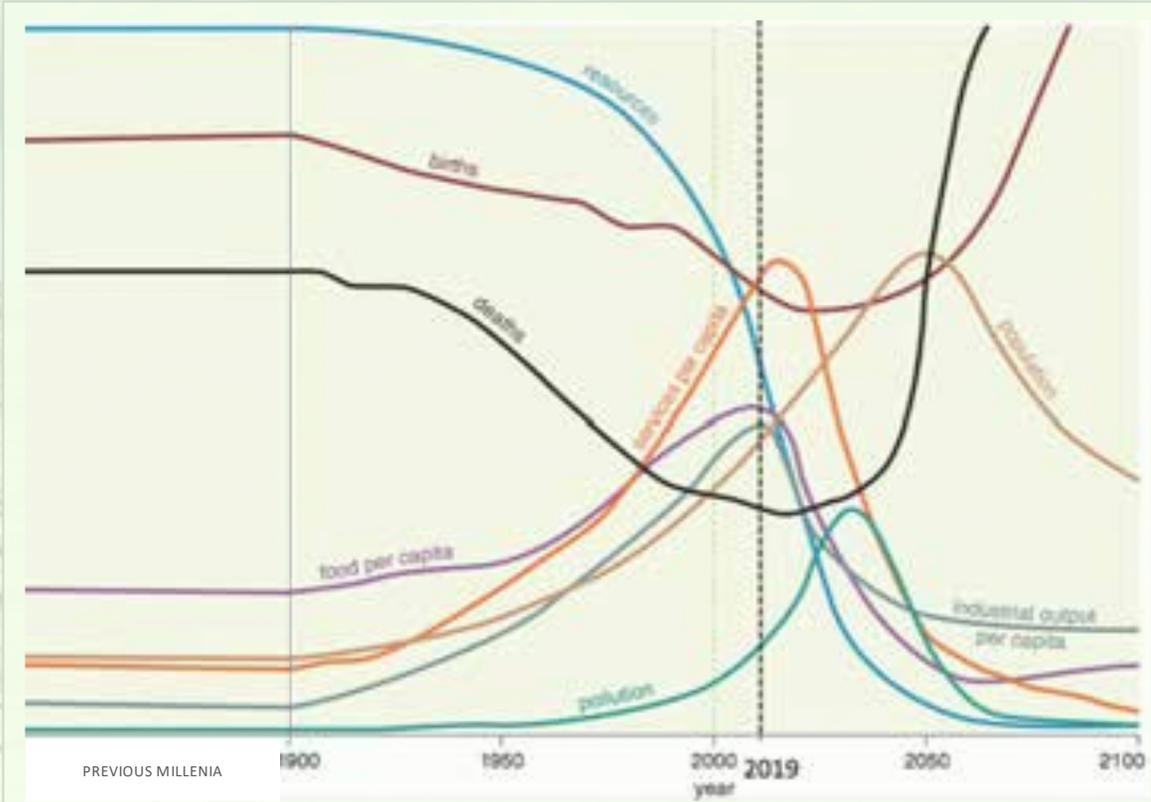


# WE NEED THREE PLANETS



OVERSHOOT + COLLAPSE

# THE NON-DELUSIONAL VIEW



**EXPONENTIAL, NON-LINEAR VARIABLES**

**DELAYED FEEDBACK**

**EXTRACTION AND DESTRUCTION OF RESOURCES**

**LAYERED LIMITS**

**OVERSHOOT AND COLLAPSE**



Number of Bays  
temperature map images: U.S. Global Change Research Program

A photograph showing the aftermath of a disaster, likely a wildfire. The scene is filled with a vast amount of debris, including charred wood, twisted metal, and unrecognizable household items. In the center, a metal frame for a greenhouse stands amidst the wreckage. To the right, a dark-colored pickup truck is partially visible, appearing heavily damaged. The background is hazy and smoky, suggesting a recent fire. The overall color palette is dominated by warm, orange-brown tones, emphasizing the destruction and desolation.

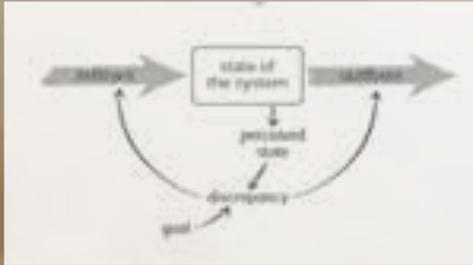
WHAT DOES IT COST . . . IF WE FAIL?

Image credit: Oregon Public Broadcasting

LONG LIVE THE DER



# WHAT IF WE PROVIDE A MARKET SIGNAL?



## REGEN NETWORK

### Platform for a Thriving Planet

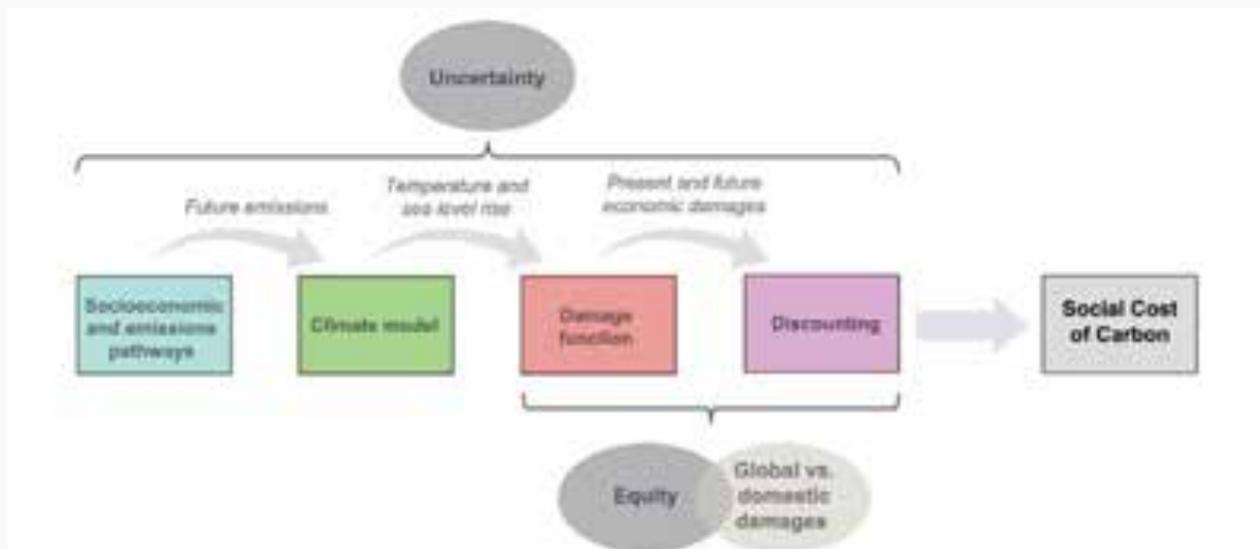
### Science Team Deep Dive

### 1/22/2021

Regen Network Science Team  
Gisel Booman  
Sam Bennetts  
Sophia Leiker

Satellite Carbon monitoring in soil pays farmers to engage in regenerative agriculture

# Social Cost Carbon



*Calculating the Social Cost of Carbon: What Are We Already Spending, Climate Change Fork*

Cost of Future Damages

vs.

Cost of Mitigation

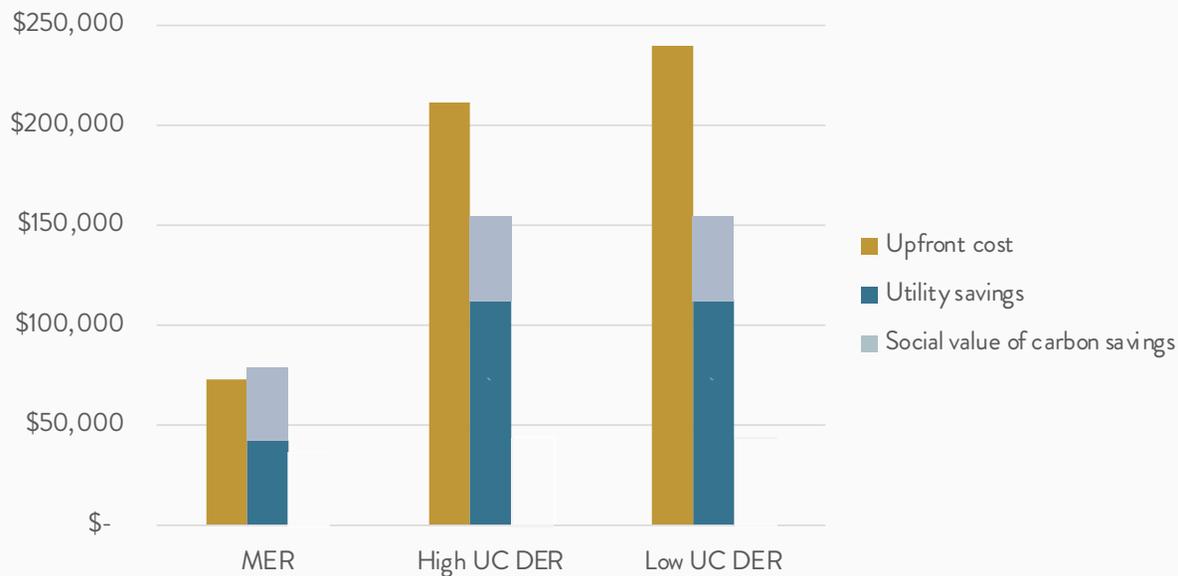
To Determine “Optimal” Policy

## Mass Save 2022-2024 Plan

*For the first time ever, this plan assigns a social cost of carbon value to greenhouse gas emissions to measure climate impacts—and the damages avoided through avoided CO2 emissions.*

<https://www.massave.com/about/news-and-events/news/the-sponsors-of-mass-save-submit-three-year-electric-and-natural-gas-energy-efficiency-plan>

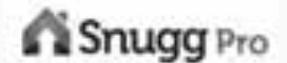
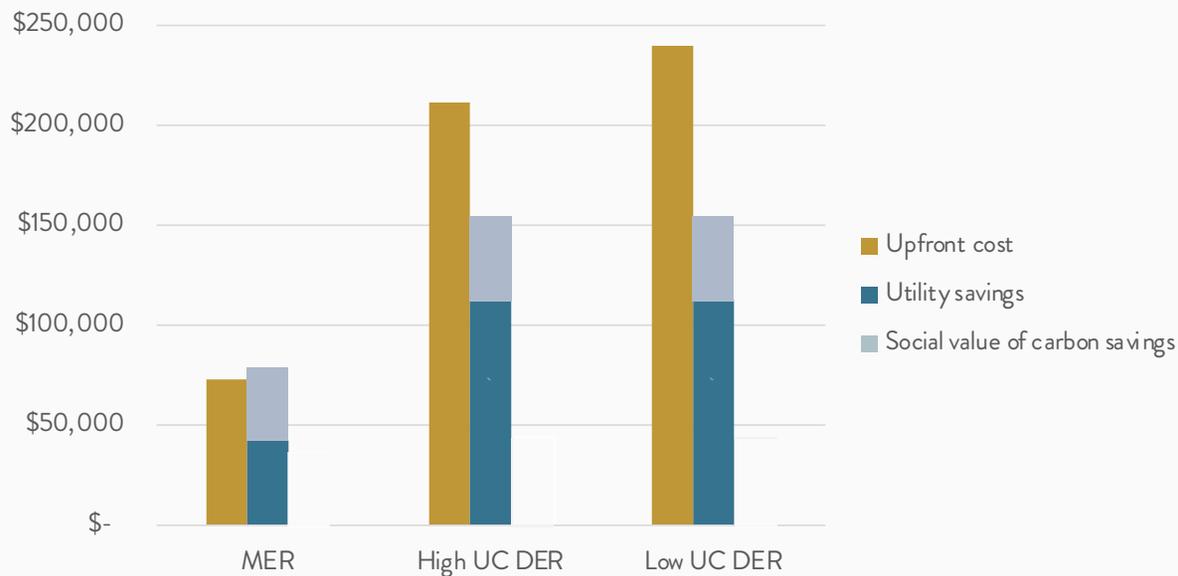
## Net Costs 2020-2050 Revisited: Include Social Value of Carbon\*



	Net Cost (Savings) 2020-2050
Moderate Retrofit	\$(4,881)
High UC DER	\$56,574
Low UC DER	\$84,180

\*Mass Save SCC \$128/ton

# Home MVP Pilot Program



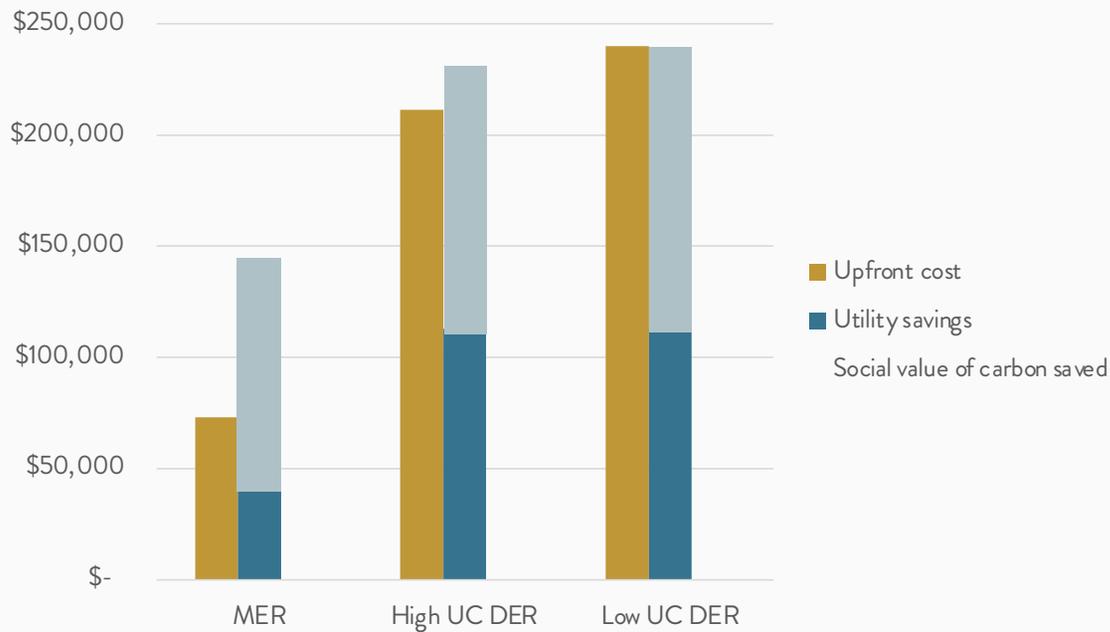
Based on the current list of recommendations, the project may qualify for an estimated incentive of

**\$ 24,535.00**

	WDR	CDR	SDR	SAVED %
Whole House MBTU (including new PE)	226	88	148	29
AMOUNT SAVED BY TIER - A/RATING				
1st Tier - % Savings of Base (20% - 29%)		88	125	\$ 1,625.00
2nd Tier - % Savings of Base (30% - 49%)		88	160	\$ 4,750.00
3rd Tier - % Savings of Base (50% - 69%)		16	160	\$ 12,760.00
New Solar PE Incent		0	10	\$ 0
<b>Grand Total Incentive</b>				<b>\$ 24,535.00</b>

\*Mass Save SCC \$128/ton

# Net Costs 2020-2050 Revisited Again: Include Higher Social Value of Carbon\*



	Net Cost (Savings) 2020-2050
Moderate Retrofit	\$(72,654)
High UC DER	\$(23,379)
Low UC DER	\$2,173

\*SCC \$393/ton

## MER and DER Decarbonization Cost Effectiveness Revisited\*

	Cost per kgCO <sub>2</sub> e saved No SCC	Cost (Savings) per kgCO <sub>2</sub> e saved SCC \$128/ton	Cost (Savings) per kgCO <sub>2</sub> e saved SCC \$393/ton
Moderate Retrofit	\$.11	(\$0.02)	(\$0.31)
High UC DER	\$.36	\$.21	(\$0.09)
Low UC DER	\$.45	\$.30	\$.01

\*DER operations emissions updated



Best Case Design (low refrigerant) + PV + 10 years of operation

1375 metric tons CO<sub>2</sub> emissions avoided

- at \$128/ton = \$91,284 (Mass Save)
- At \$190/ton = \$135,501 (Biden EPA @2% discount)
- At \$393/ton = \$280,272 (Mass Save high end – rejected)
- At \$1000/ton = \$713,162 (Pure Hypothetical)

Best Case Design (low refrigerant) + PV + 10 years of operation  
+ CARBON STORAGE IN TIMBER

1375 metric tons CO<sub>2</sub> emissions avoided

- at \$128/ton = \$206,120 (Mass Save)
- At \$190/ton = \$305,960 (Biden EPA @2% discount)
- At \$393/ton = \$632,854 (Mass Save high end – rejected)
- At \$1000/ton = \$1,610,316 (Pure Hypothetical)

## WHAT IF WE PUT A VALUE ON CARBON?

Conclusion:

*it all depends on the value of carbon – with lower values it appears we are no where near there.*

SO HOW DO WE VALUE CARBON?

PROBLEM #1

IAM's = INTEGRATED ASSESSMENT MODELS  
**ARE NOT APPROPRIATELY TARGETED**

MODELS' SCC's ARE CONSISTENTLY TOO LOW TO SUPPORT THE COST  
OF MITIGATION

MOST SET PARAMETERS THAT WOULD YIELD 3-4° C  
TEMPURATURE RISE

SO HOW DO WE VALUE CARBON?

PROBLEM #1

IAM'S DO NOT ACCOUNT FOR UNCERTAINTY OF RISK

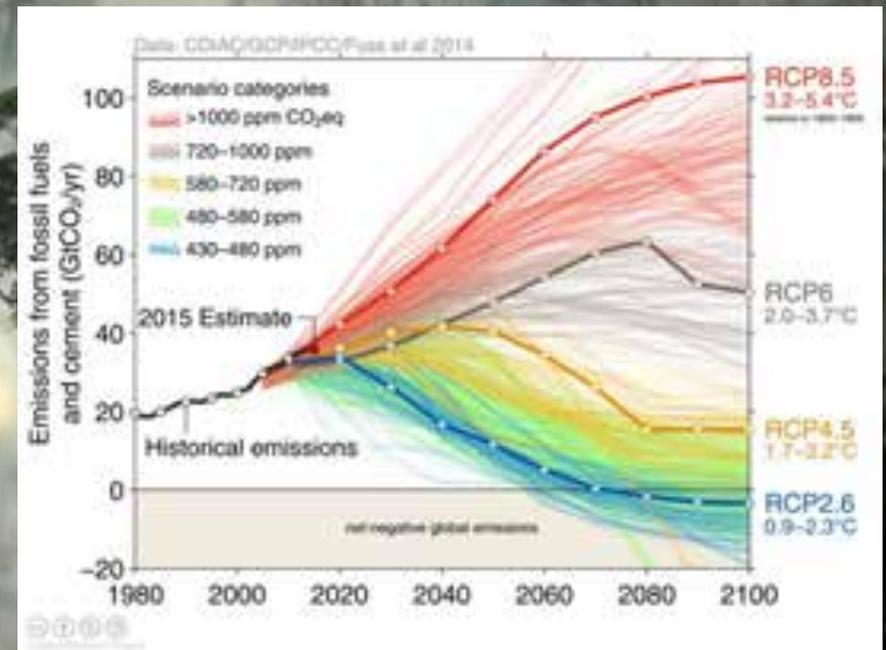
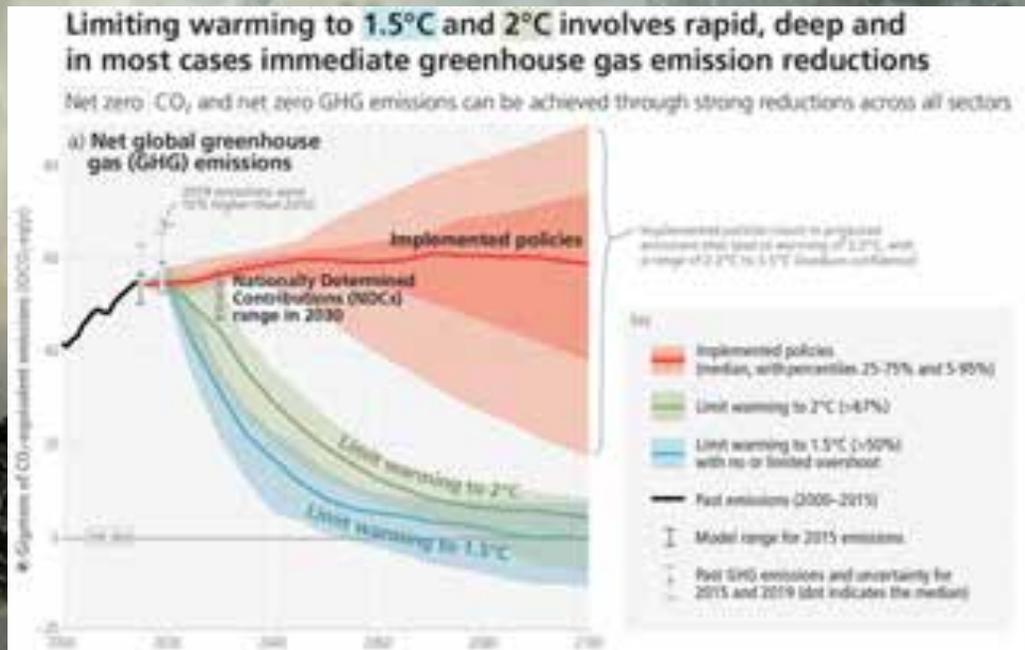


UNKNOWN UNKNOWNNS

MARGIN OF ERROR IN  
ESTIMATES GOES UP WITH  
INCREASE IN TEMPERATURE

# SO HOW DO WE VALUE CARBON? PROBLEM #1

THE HIGHER WE LET THE TEMPERATURE RISE,  
THE WIDER THE UNCERTAINTY



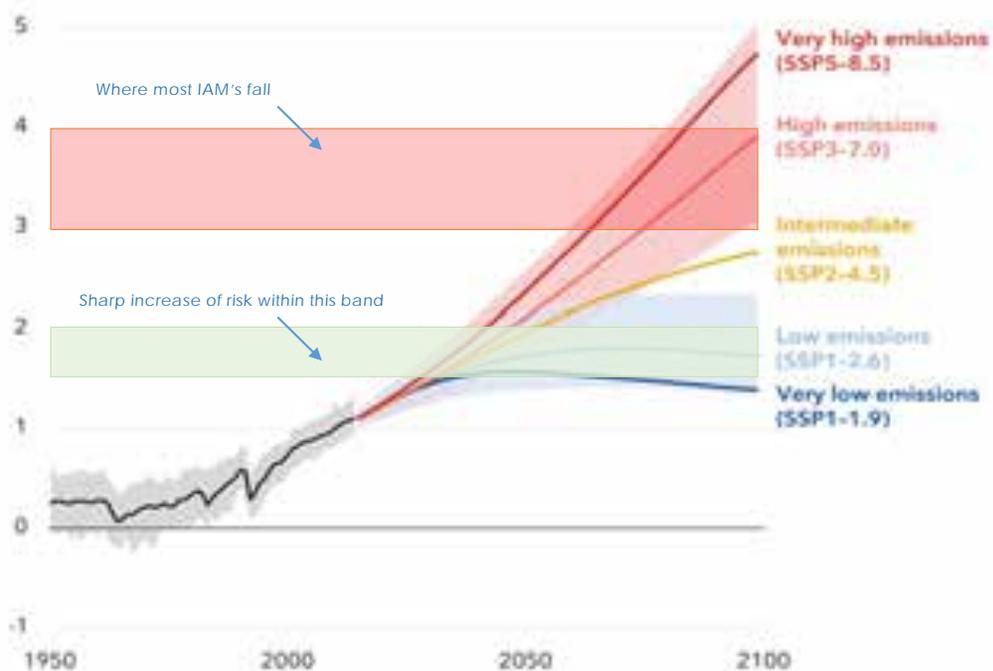
# SO HOW DO WE VALUE CARBON?

# PROBLEM #1

## Uncertain future

There is significant uncertainty about the trajectory of global emissions and as a result global warming.

(temperature change in °C, scenarios used by the IPCC)



Source: IPCC, 2021 Summary for Policymakers.

Note: Global surface temperature change relative to the period 1850-1900.

IMF

THE HIGHER WE LET THE TEMPERATURE RISE,  
THE WIDER THE UNCERTAINTY

SHARP INCREASE OF RISK OF  
SERIOUS DISLOCATION AND  
LARGE-SCALE LOSS OF LIFE  
BETWEEN 1.5° + 2°C

THIS IS WITHIN THE MARGIN OF ERROR FOR OPTIMISTIC SCENARIOS

HOW DO WE VALUE CARBON?

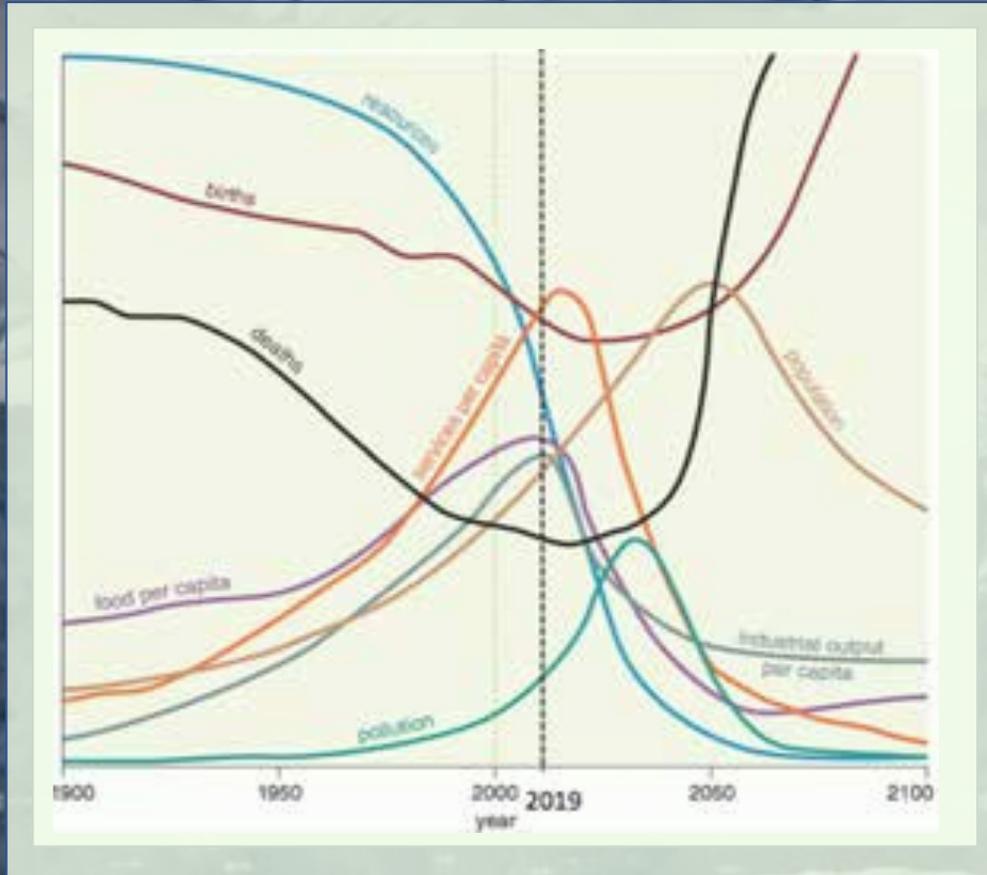
PROBLEM #1

COMPLEX NON-LINEAR RELATIONSHIPS  
+ TIPPING POINTS

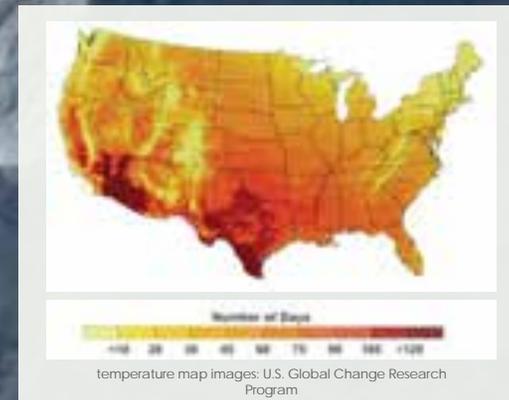


# HOW DO WE VALUE CARBON?

# PROBLEM #1



COMPLEX NON-LINEAR RELATIONSHIPS  
TIPPING POINTS AND SYSTEMIC  
COLLAPSE



OVERSHOOT + COLLAPSE

DERIVED FROM "A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL" + LIMITS TO GROWTH 30 YEAR UPDATE

# HOW DO WE VALUE CARBON?

## PROBLEM #2

IN MANY IAM MODELS, **GROWTH IS EXOGENOUS**

- PREDETERMINED AND CONSTANT

- COMPLETELY IGNORES LASTING IMPACT ON CAPITAL AND GROWTH (?!?!?!?!)

HOW DO WE VALUE CARBON?

PROBLEM #2

DOES NOT CAPTURE THE POTENTIAL MARKET GROWTH OF CLIMATE SOLUTIONS

OVERSHOOT+

DERIVED FROM "A SOCIAL COST OF CARBON CONSISTENT WITH A NET-ZERO CLIMATE GOAL" BY NICHOLAS STERN, JOSEPH STIGLITZ, KRISTINA KARLSSON + CHARLOTTE TAYLOR | 01/2022

HOW DO WE VALUE CARBON?

PROBLEM #4

TO DETERMINE "OPTIMAL" POLICY

OPTIMAL FOR WHAT? - COST? HEALTH? HAPPINESS?  
EQUITY? SURVIVAL?

AND WHO ARE WE ASKING?

HOW DO WE VALUE CARBON?

PROBLEM #4



IAM'S IGNORE INEQUALITY  
OF IMPACTS . . .  
. . . AND RESPONSIBILITY

# HOW DO WE VALUE CARBON?

## PROBLEM #4

### EMPIRICAL DATA

Climate change is costing the world

\$16 million per hour

World Economic FORUM

“ . . . our headline number of \$140bn is a significant understatement,” Noy explained, noting that heat wave data on human deaths was only available in Europe. “We have no idea how many people died from heatwaves in all of sub-Saharan Africa.”

Further, authors Noy and Rebecca Newman . . . wrote . . . that there are also immeasurable effects from extreme weather, such as trauma, loss of educational access, and job loss that would further increase the costs

. . . WE ARE NOT GETTING THE COSTS RIGHT  
. . . WE ARE NOT EVEN GETTING THEM ON THE LEDGER.-  
BRANDON TERRY, HARVARD POLITICAL THEORIST



CURRENT MARKET RESPONSE

THERE IS A MARKET SIGNAL

# CURRENT MARKET RESPONSE

CUT AND RUN



... WHAT WOULD IT MEAN TO CAPTURE THAT VALUE IN THIS MARKET SIGNAL



THERE IS A MARKET SIGNAL

# CURRENT MARKET RESPONSE

The screenshot displays the Carbon Credits website interface. At the top, the navigation bar includes 'CARBON CREDITS', 'CARBON PRICES', 'STOCKS', 'NEWS', 'EDUCATION', and 'FEATURED'. Below the navigation, there are three market indicators: KCCA at 30.63 (+0.33, +0.76%), SMOG at 88.61 (+1.34, +1.38%), and CR2N at 175.99 (+1.45, +0.83%). The main heading is 'Live Carbon Prices Today'. A 'Trending Right Now' box highlights 'Singapore's Carbon Credit Market Surging At 21% CAGR' and 'Spectaire Holdings's Innovative Tech Helps Truckers Generate Carbon Credits'. The central table, titled 'Live Carbon Prices', lists various markets with their last price, change, and YTD performance. To the right, there are two promotional boxes: '100+ CHALLENGES PROPOSED BY SINGAPORE' and 'Top 4 Carbon Stocks To Watch In 2024', followed by 'CARBON CRYPTOS KLIMA DAO, CARBON NFTs, & CARBON TOKENS' and 'Carbon Crypto Guide 2024: KlimaDAO, Carbon NFTs, and Carbon Tokens'. A footer note states 'CarbonCredits.com Real-time Pricing' and provides a link to learn how carbon credits are priced.

Market	Last	Change	YTD
<b>Compliance Markets</b>			
European Union	€24.21	-0.26%	-10.24%
UK	€24.60	-1.11%	-20.24%
California	\$28.94	-	5.09%
Australia (NZES)	\$24.75	+0.90%	+8.75%
New Zealand (NZES)	\$24.29	-0.24%	-1.08%
South Korea	\$1.85	-	-1.83%
China	\$11.21	-0.20%	-0.21%
<b>Voluntary Markets</b>			
Avalon Industry Offset	\$1.45	-	+0.68%
Nature Based Offset	\$1.30	+0.00%	+0.11%
Tech Based Offset	\$1.45	-	+10.17%

BUT ACCESS IS ONLY FOR CORPORATIONS AND THE RICH

# SO HOW DO WE VALUE CARBON?

We need a "A Social Cost of Carbon Consistent with a Net-Zero Climate Goal,"  
This refocuses our attention on getting it done – whatever the cost.

*Equitably!!*



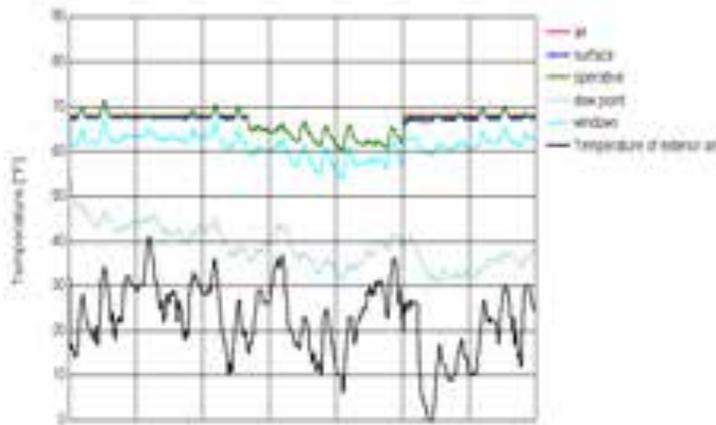
# ADDITIONAL VALUE – ENERGYRESILIENCY

BEGINS WITH PASSIVE SURVIVABILITY

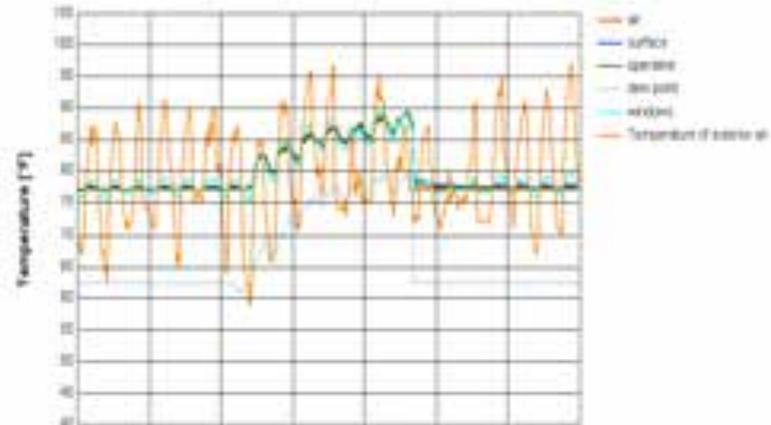


# ADDITIONAL VALUE – ENERGYRESILIENCY

BEGINS WITH PASSIVE SURVIVABILITY



WEINBERG COMMONS JANUARY OUTAGE



WEINBERG COMMONS JULY OUTAGE

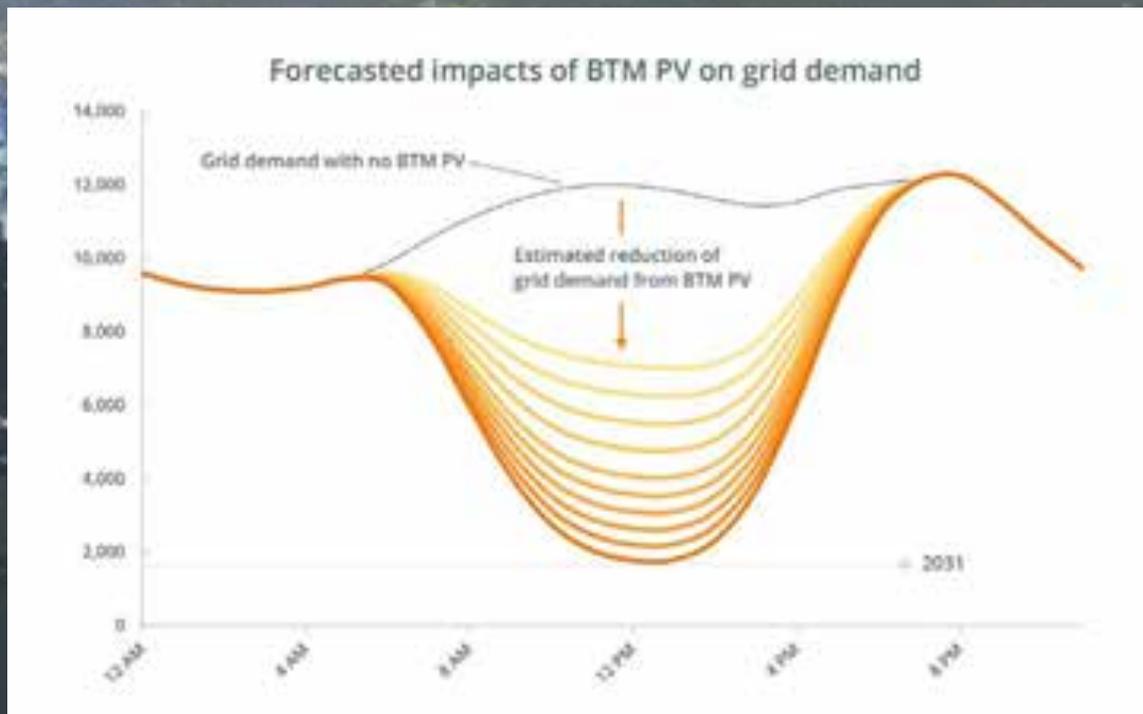
## ONE WEEK POWER OUTAGE IN JANUARY AND JULY:

HIGH PERFORMANCE ENVELOPE MAINTAINS COMFORT AND SAFETY IN WINTER

SOLAR PROVIDES ADEQUATE POWER IN SUMMER

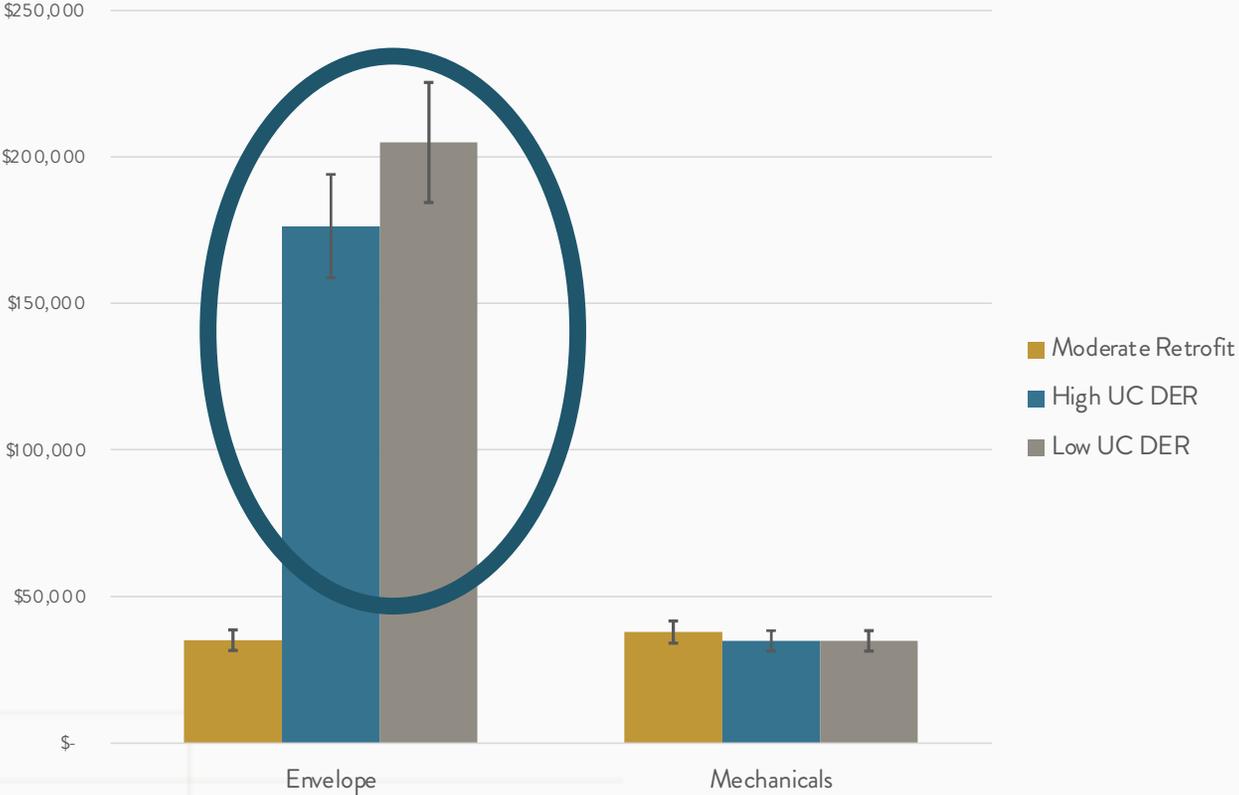
# GRID CAPACITY AND RESILIENCE

Efficiency (and storage) Reduces Peak Load Ramp and Stress on the Grid



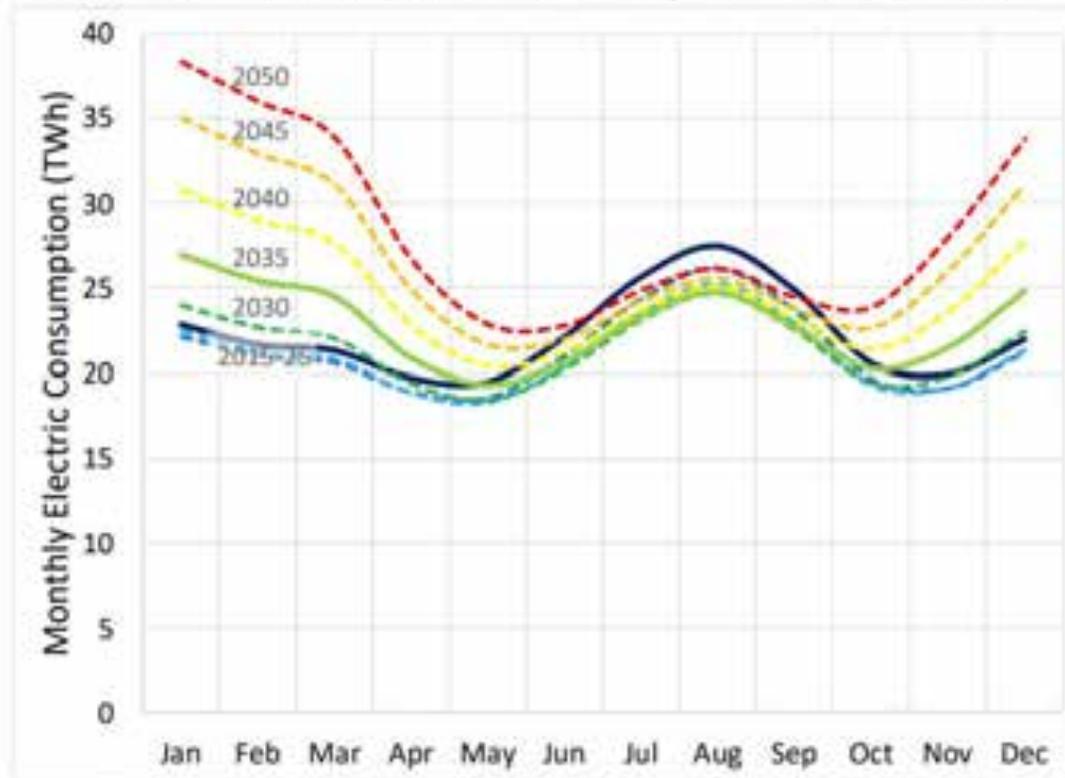
UTILITY DEMAND RESPONSE AND CURTAILMENT INCENTIVES

# Where's the Next Best Dollar Spent?

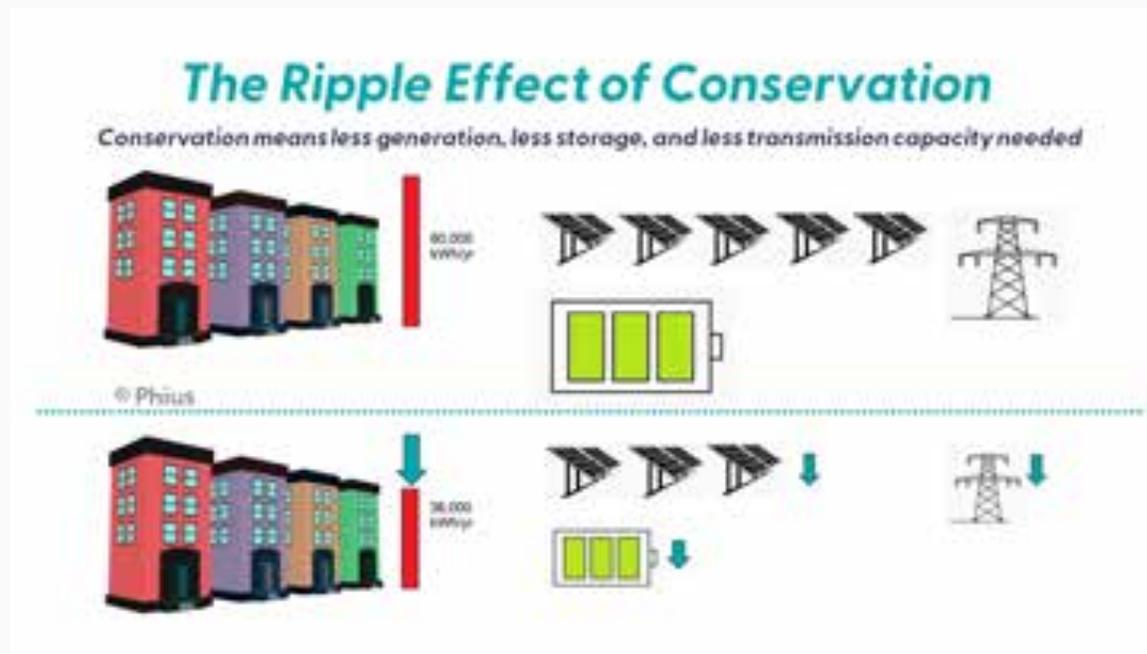


# Grid Capacity

Figure 3. Monthly Northeastern electric energy demand under a "plausibly optimistic" electrification scenario to achieve approximately 80 percent greenhouse gas emission reductions by 2050



# The More We Spend on Efficiency, the Less We Need to Spend on the Grid



An aerial photograph of a vast agricultural landscape, showing a grid of fields and roads. A bright, diagonal light flare or lens flare effect runs across the sky from the top left towards the bottom right, creating a strong contrast and a sense of depth. The text "OK, SO WHAT SHOULD WE DO ?" is overlaid on the image, centered horizontally and slightly above the vertical center.

OK, SO WHAT SHOULD WE DO ?

# LEVERAGE POINTS

## PLACES TO INTERVENE IN A SYSTEM

(in increasing order of effectiveness)

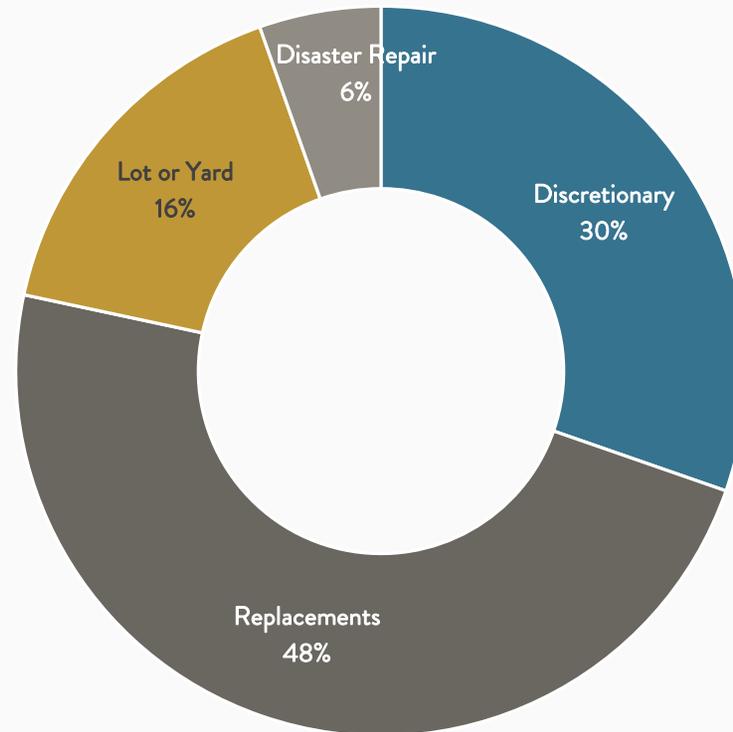
9. Constants, parameters, numbers  
(subsidies, taxes, standards).
8. Regulating negative feedback loops.
7. Driving positive feedback loops.
6. Material flows and nodes of material intersection.
5. Information flows.
4. The rules of the system (incentives, punishments, constraints).
3. The distribution of power over the rules of the system.
2. The goals of the system.
1. The mindset or paradigm out of which the system – its goals, power structure, rules, its culture – arises.

## How To Leverage Renovations for Decarbonization

- Do holistic performance assessments, ideally on every project
- Put decarbonization opportunities on the table early on
- Proactively assist clients in taking advantage of incentive money
- Seek out simplest/least-cost solutions to functional needs (so there's more to spend on decarbonization)
- Plan ahead for the next steps in the home's decarbonization journey

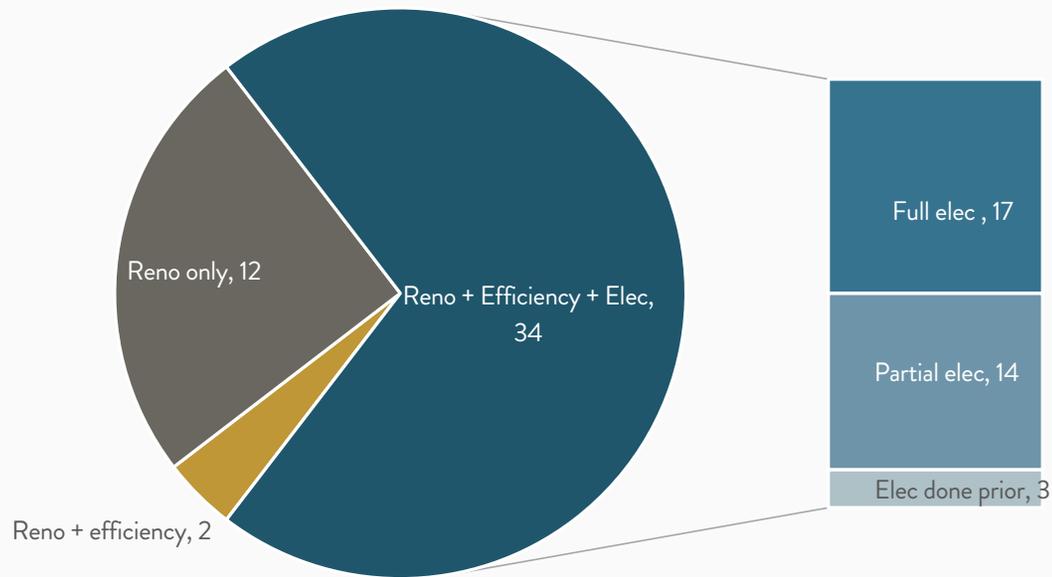


# Nationwide Remodeling Expenditures 2021



*Improving America's Housing 2023*, Joint Center for Housing Studies

# Byggmeister Projects Completed 2020-2023



An aerial photograph of a vast agricultural landscape, showing a grid of fields and roads. A bright sun flare is visible in the upper right quadrant, creating a diagonal line of light across the image. The sky is a clear, bright blue.

# 1. CHANGE YOUR MENTAL FRAME

ASSUME IT MUST BE DONE AND LOOK FOR OPPORTUNITY

An aerial photograph of a vast agricultural landscape, showing a grid of green fields and brown roads. A bright sun flare streaks across the sky from the top left towards the bottom right, creating a lens flare effect. The sky transitions from a pale blue near the horizon to a deeper blue at the top.

## 2. PROVIDE INFORMATION

START WITH A HOLISTIC ASSESSMENT TO REVEAL OPPORTUNITIES

SHOW THE IMPACTS AND SOLUTIONS

WHEN PRESENTED WITH ABSTRACTIONS CLIENTS TEND TO DEFAULT TO SKEPTICISM AND ASSUME ADDITIONAL COST

WHEN WE SHOW THEM A COMPARISON OF BASIS OF DESIGN TO AN IMPROVED CASE THEY GET INTERESTED

An aerial photograph of a vast agricultural landscape, showing a grid of fields and roads. The sky is bright blue with a prominent sun flare or lens flare effect that creates a diagonal streak of light across the upper portion of the image. The overall tone is bright and clear.

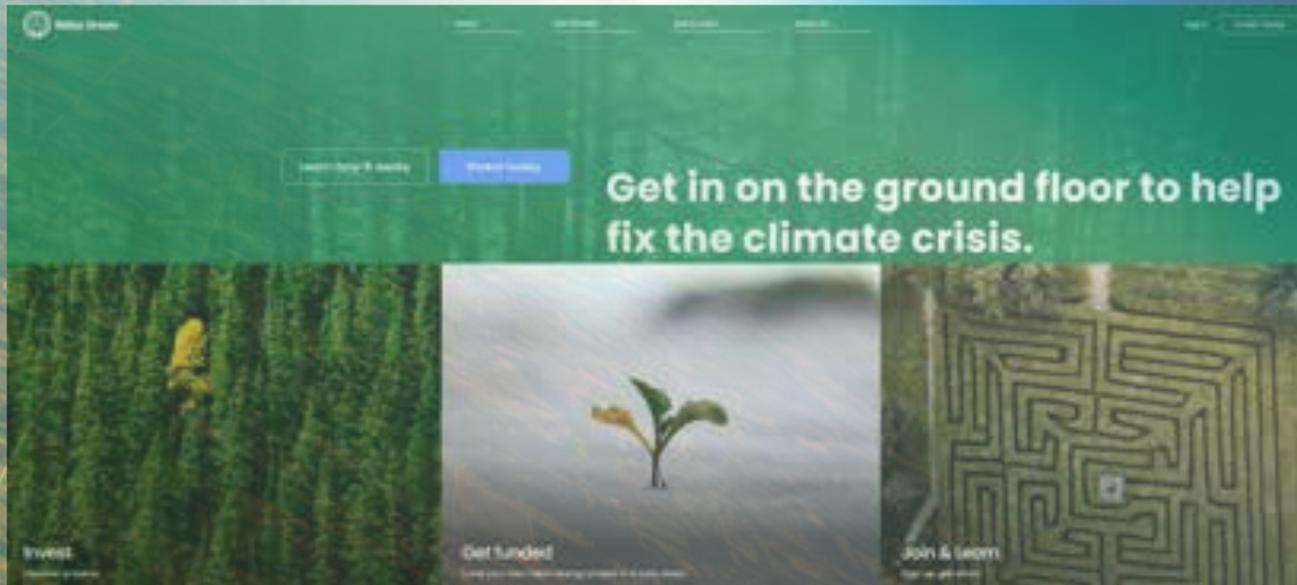
## 2. PROVIDE INFORMATION

SHOW A SOCIAL COST OF CARBON TO YOUR PRO-FORMA  
+ COST EFFECTIVENESS CALCULATIONS (EVEN IF YOU CAN NOT  
CLAIM IT YET)

OUR CLIENTS GET TO CHOOSE, BUT THEY SHOULD BE INFORMED

### 3. COME TOGETHER

DEMAND EQUITABLE, COMMUNITY-BASED ACCESS TO CARBON VALUE THROUGH AGGREGATION COOPERATIVES AND IMPACT FUNDS





## 5. DO IT YOURSELF



Thank you!

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[michael@passivetopositive.com](mailto:michael@passivetopositive.com)

Passive to **POSITIVE**  
PASSIVE HOUSE AND LOW IMPACT DESIGN

BYGGMEISTER  
DESIGN | BUILD