Climate Change and Climate Action in MA

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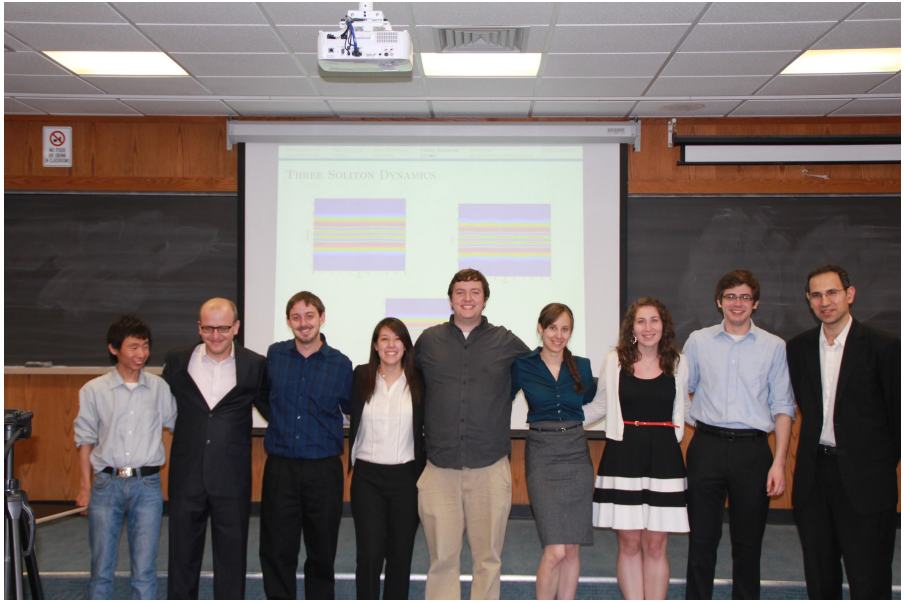
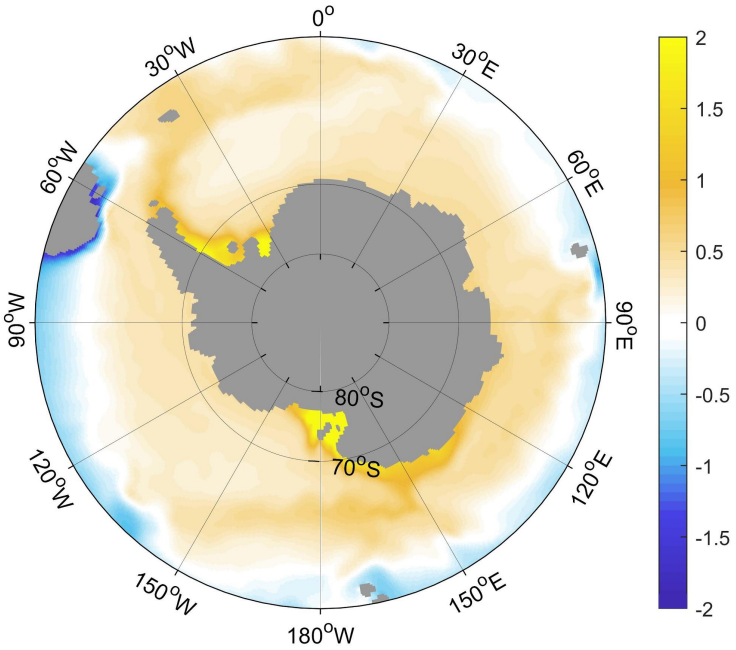
Nice to Meet You All!

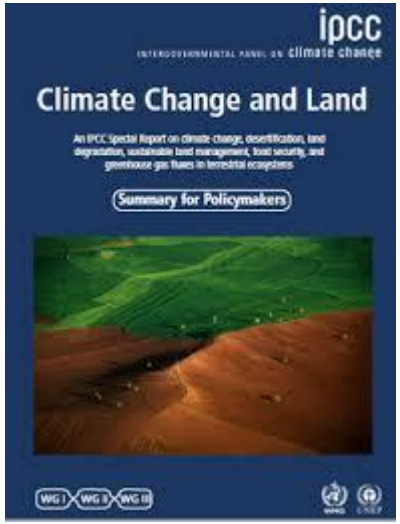
University of Massachusetts Amherst

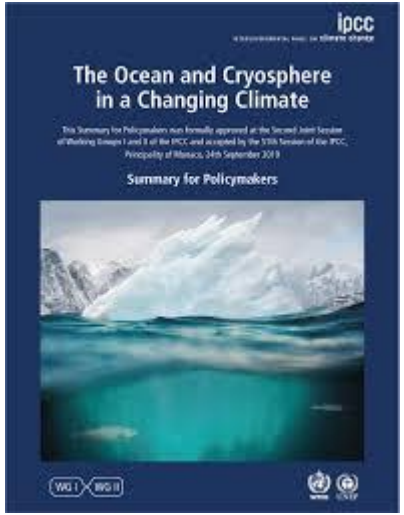




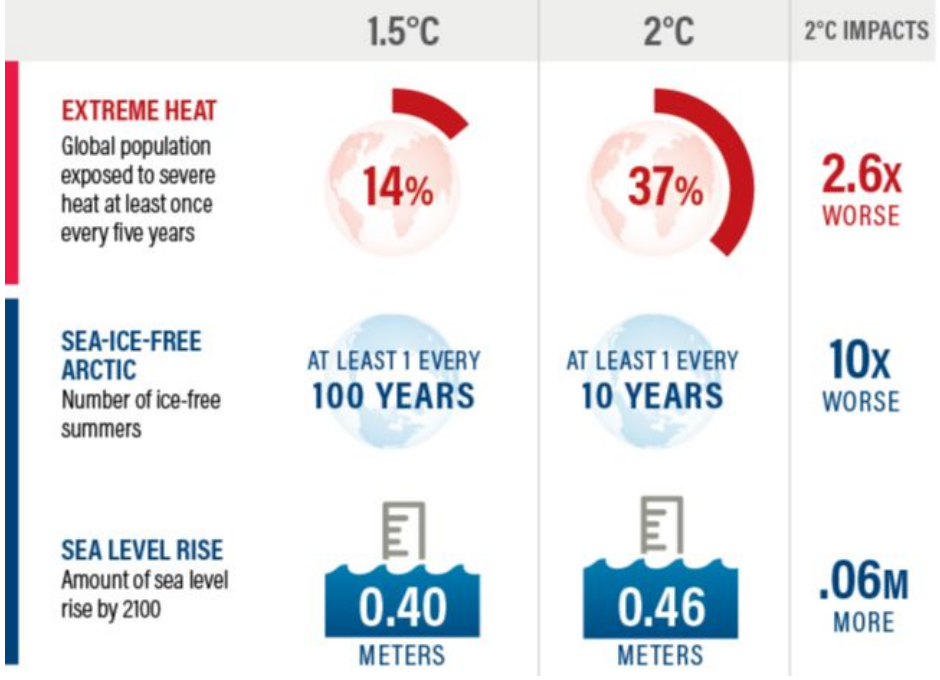
Latest Science- IPCC Special Reports

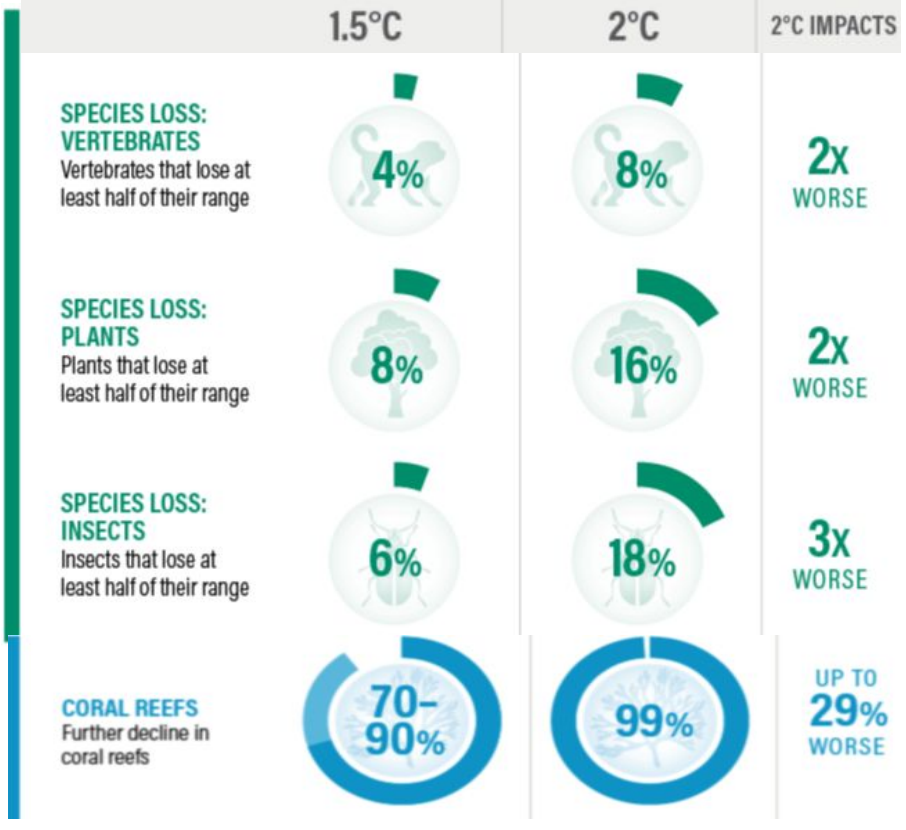
Together these 3 reports paint a picture of a world in crisis, and what is needed to address it.





1.5℃ versus 2℃- the difference sounds small but the impacts are large





WRI

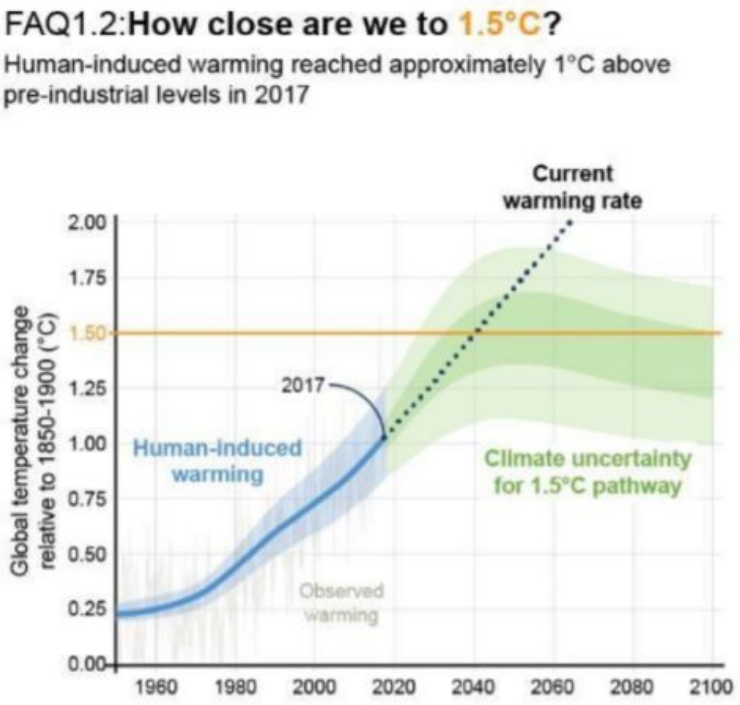
Where do we stand today?

The temperatures are discussed as *global mean surface temps*. Regional variations can be significant.

We are currently at around 1°C (likely between 0.8°C and 1.2°C) above pre-industrial (1850-1900 average)

Warming is increasing at 0.2°C (likely between 0.1°C and 0.3°C) per decade

This leaves little time to mitigate emissions enough to prevent 1.5°C, but with action on a massive scale this is still possible.



FAQ1.2, Figure 1: Human-induced warming reached approximately 1°C above pre-industrial levels in 2017. At the present rate, global temperatures would reach 1.5°C around 2040.

There is No Safe Level of Warming

> “Many impacts take time to observe, and because of the warming trend, impacts over the past 20 years were associated with a level of human-induced warming that was, on average, 0.1°C–0.23°C colder than its present level.”

Our current emissions will persist for centuries to millennia.

They will continue to cause warming into the future. Warming will lead to sea level rise, increased storm intensity, and more continuing into the future.

However, emissions up to this point are likely insufficient to cause 1.5℃.

There is still time to prevent it, but how can we go about that?

SR15

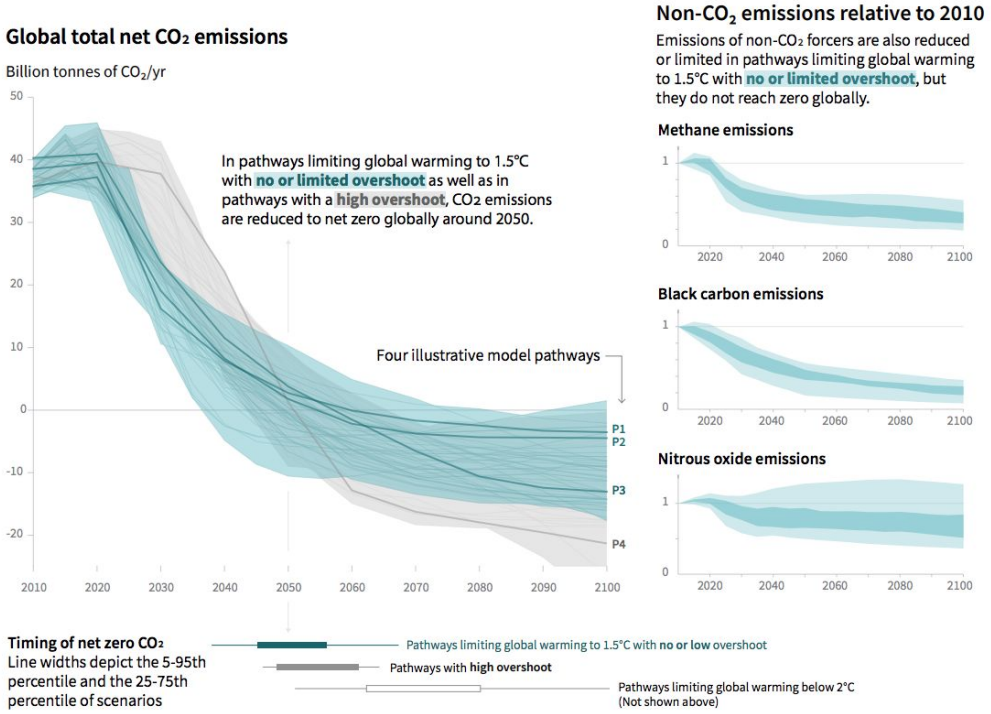
Emissions Reductions Are Needed Fast

For CO2 emissions reductions of 45% below 2010 levels by 2030 to limit warming to 1.5°C without overshoot. **This is where the '12 years' number comes from.**

Emissions have increased since 2010. They increased again in 2018 (by ~3%). The percentage decrease needed below current levels is >55%

CO2 emissions must reach net zero by 2050 for 1.5°C future pathways with and without overshoot.

Non-CO2 GHGs must decline steeply as well



To stay below 2°C emissions must decline by 20% below 2010 levels by 2030 and reach net zero by 2075.

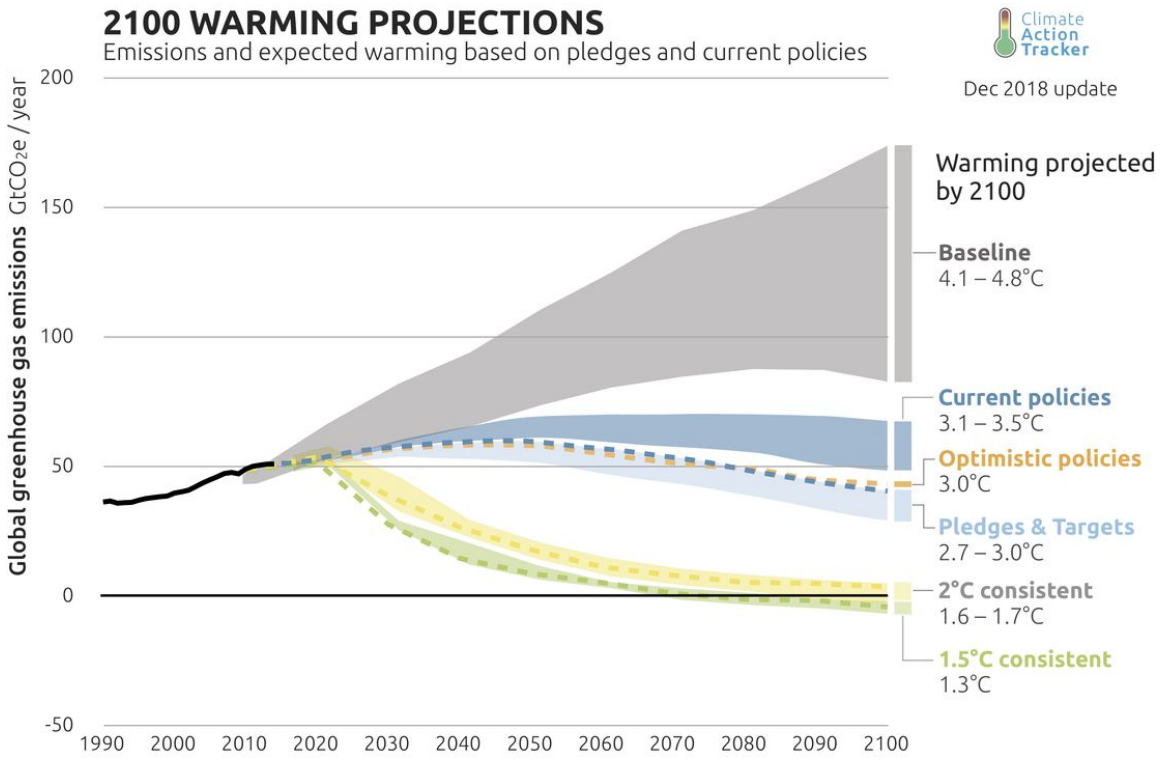
What is needed to reach the goal?

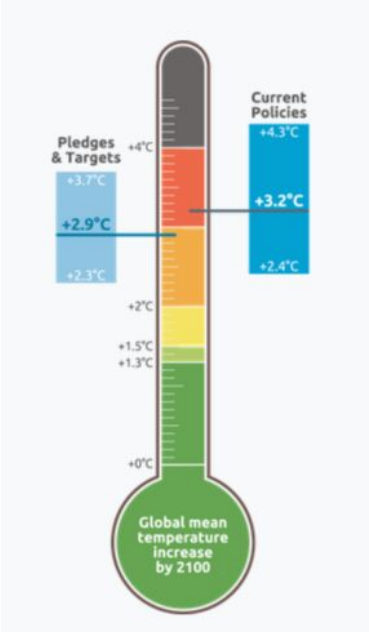
- Complete phase out of coal
- Steep declines in fossil fuel use over the next decade, dropping to zero by mid century
- Increase in the share of energy from renewables
- 75-90% reductions in industrial emissions by 2050 from 2010 levels
- Ecosystem restoration and transitions to less energy intensive diets
- Adaptation alongside mitigation

“1.5°C implies very ambitious, internationally cooperative policy environments that transform both supply and demand”

Necessary emissions reductions will be steep. The biggest challenges are not technological, they are political and economic.

Global Action is Currently Insufficient



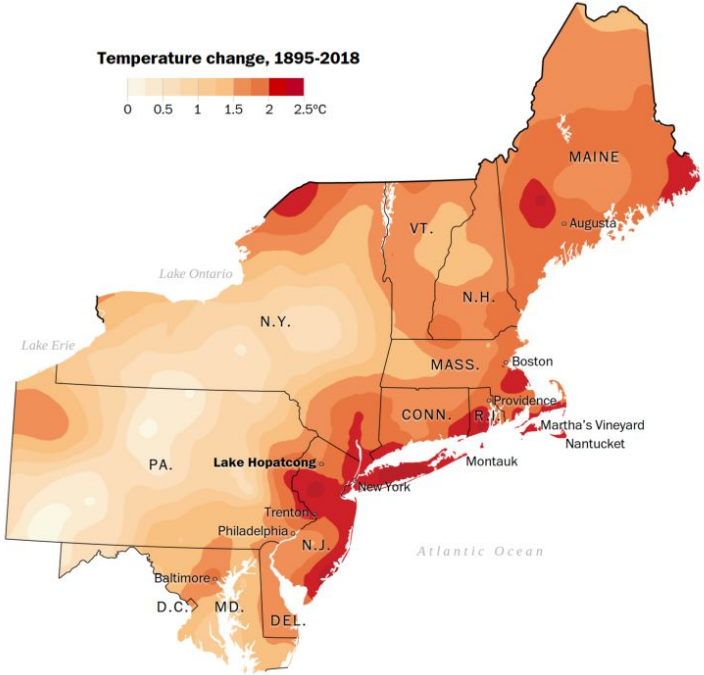


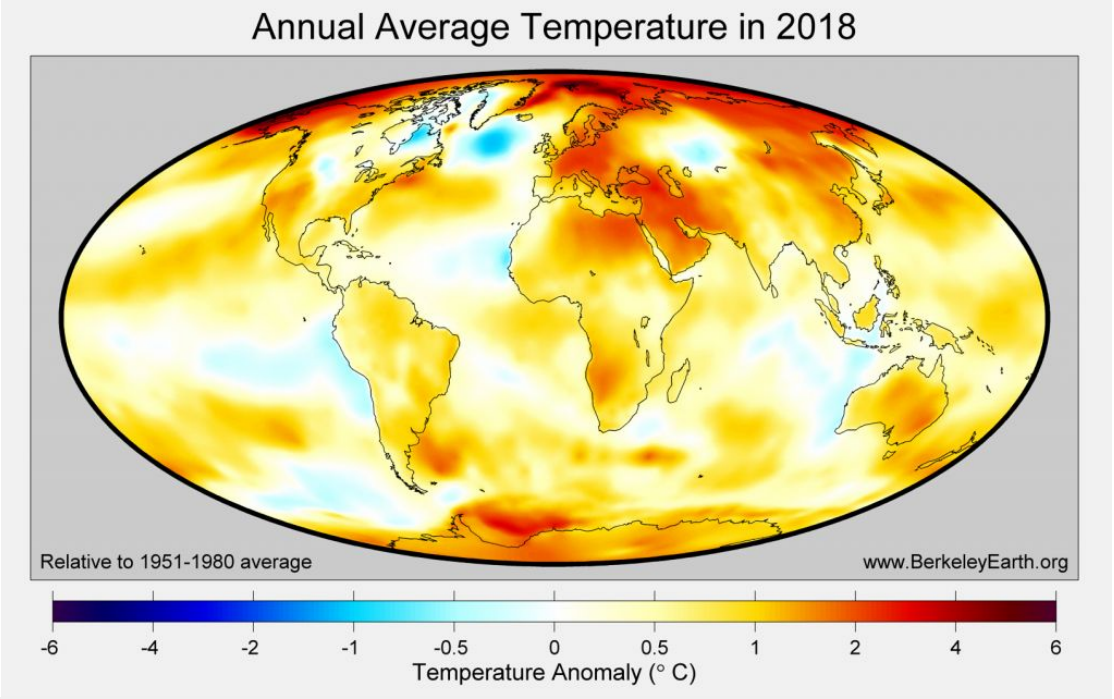
Climate Action Tracker and the Ecofys / Climate Analytics / NewClimate

Implications for

Massachusetts

Impacts Will Vary Regionally

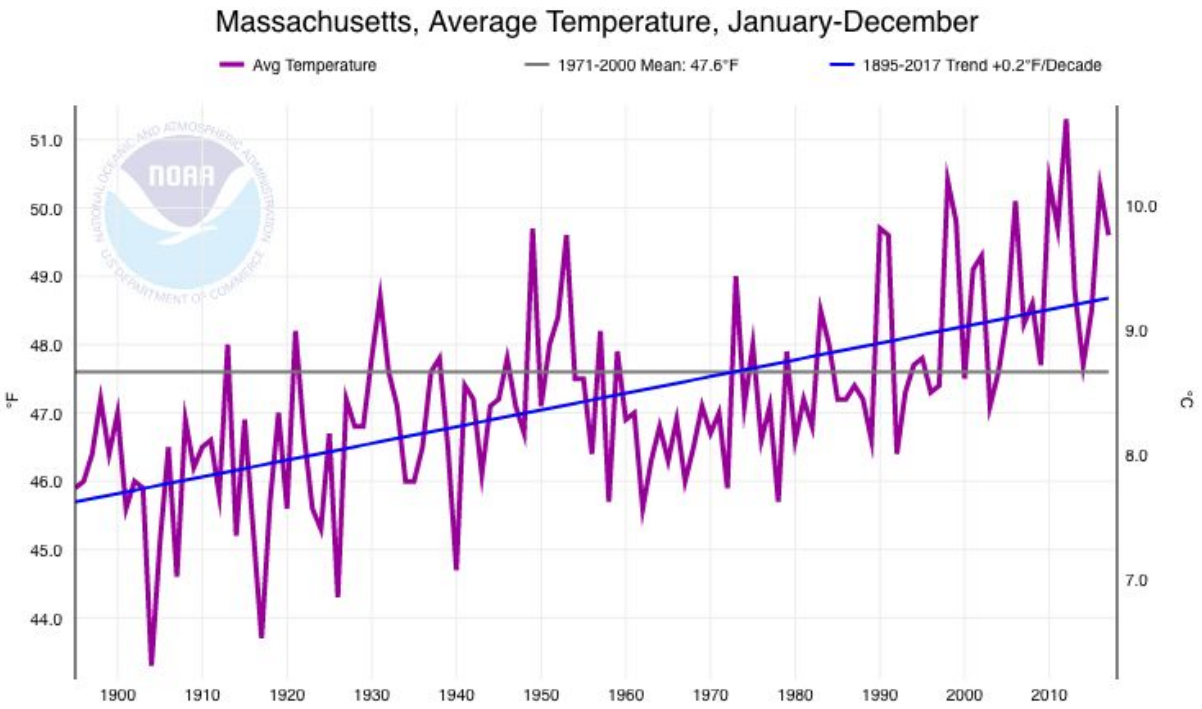




Left- NOAA Climate Divisional Database (nClimDiv), analyzed by Washington Post, Right- Berkley Earth

Temperature Trends in Massachusetts

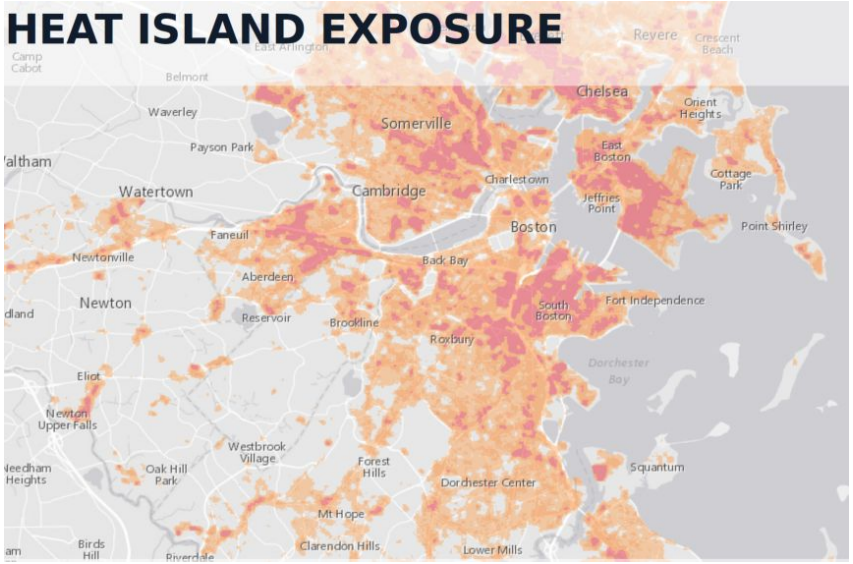
Mean annual temperature in MA has increased by about 2.4ºF (1.3ºC) since 1895 – faster than the rise in global mean temperature (1ºC)

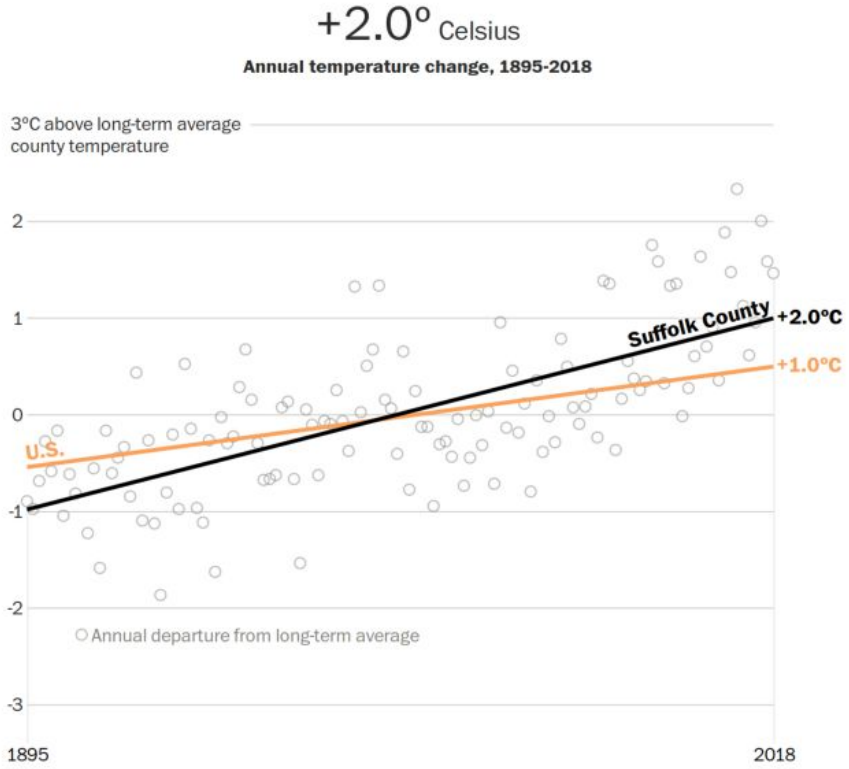


Observed temperature 1895-2017 via NOAA

Temperature Trends for Suffolk County

The temperature change has been higher in Suffolk County than the MA or US averages

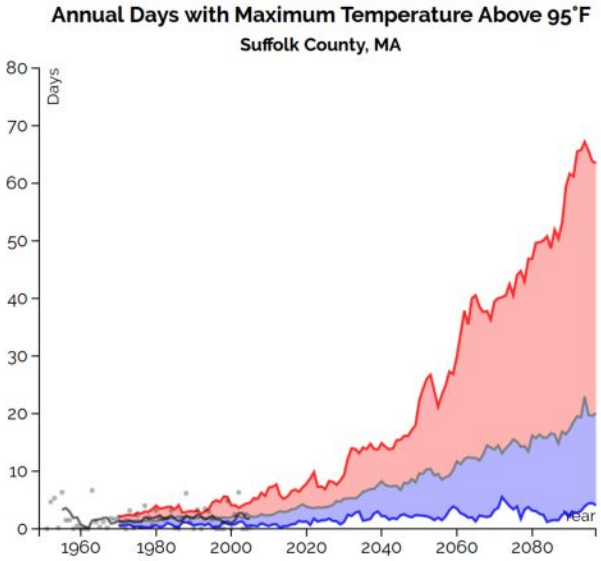




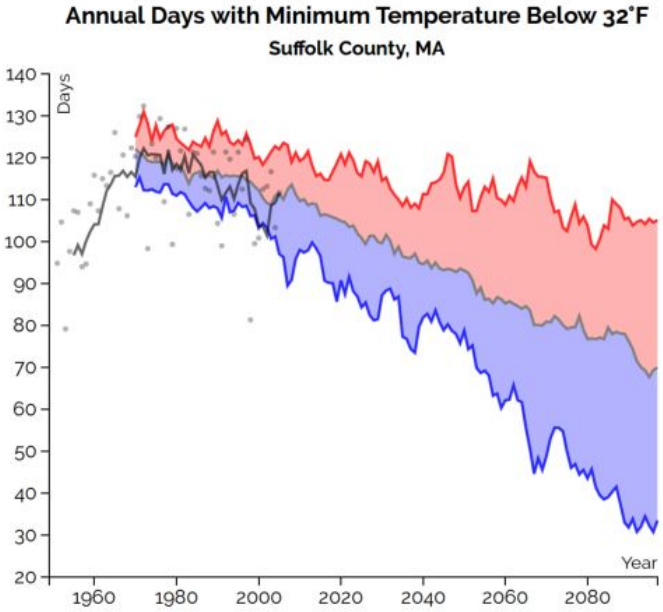
Left- Climate Ready Boston, Right- NOAA Climate Divisional Database (nClimDiv), analyzed by Washington Post

Temperature Extremes

resilient MA



Observed	days
5-yr Mean	
Modeled days	
Max	
Median	
Min	
Changes from 1971-2000 for:	
2020 - 2049	4.40 days
2040 - 2069	7.88 days
2060 - 2089	12.76 days
2080 - 2097	15.08 days



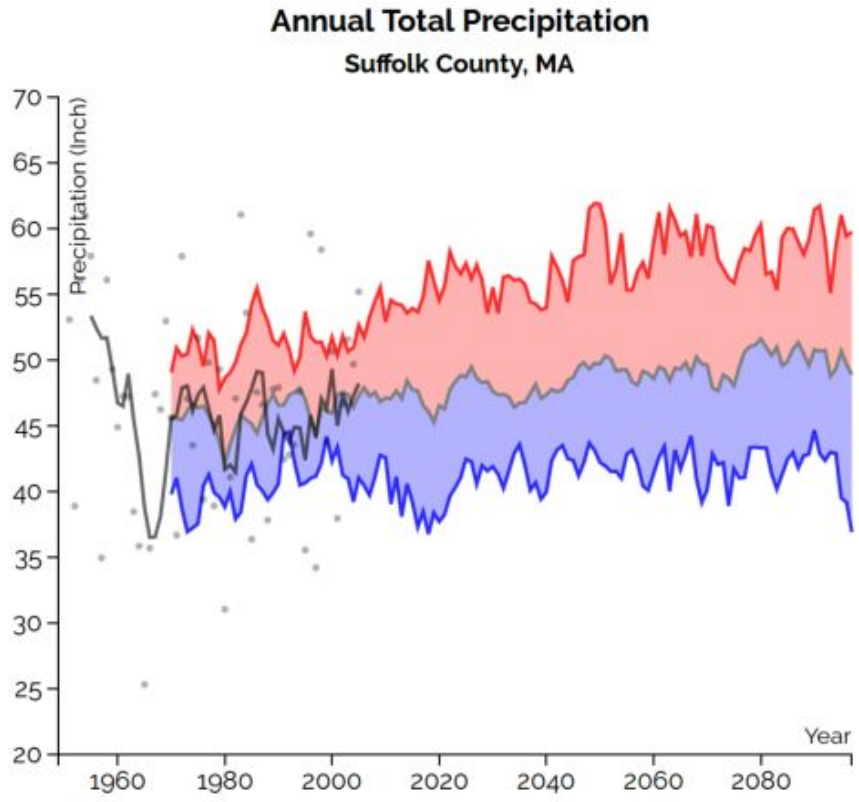
Observed	days
5-yr Mean	
Modeled days	
Max	
Median	
Min	
Changes from 1971-2000 for:	
2020 - 2049	-22.72days
2040 - 2069	-32.67days
2060 - 2089	-39.79days
2080 - 2097	-43.09days

CLIMATE SYSTEM RESEARCH CENTER

Precipitation Boston MA

Precipitation trends are towards increased precipitation, though interspersed with periods of drought.

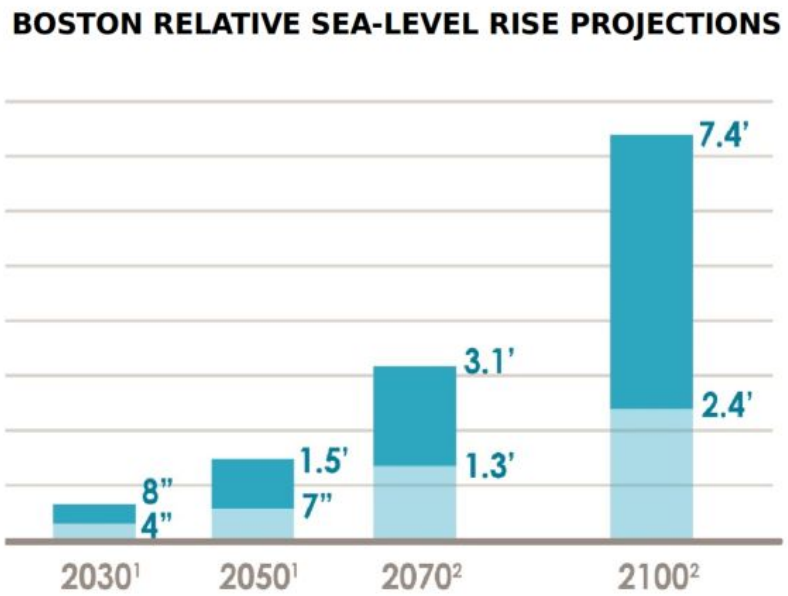
Winter precip will be more likely to be rain than snow.



Observed	Inches
5-yr Mean	
Modeled Inches	
Max	
Median	
Min	
Changes from 1971-2000 for:	
2020 - 2049	0.94"
2040 - 2069	2.42"
2060 - 2089	2.78"
2080 - 2097	3.76"

Sea Level Rise

Sea Level Rise is another climate impact that will vary regionally. Massachusetts coastlines will need to adapt to the changing coasts. Plans have been released for Boston and surrounding regions.



Climate Ready Boston

Action

Steps

Climate Solutions

Solving climate change requires shifting the economy away from fossil fuels and towards renewable energy.

It also requires changes to the agricultural system and human diets, forest conservation, innovation in building materials, and more.

We need as many solutions as we can find at all levels.

Molly Crabapple

Individual vs. systemic action is a false dichotomy.

Systemic change is driven by collective action. What you do matters and who you align with politically matters.

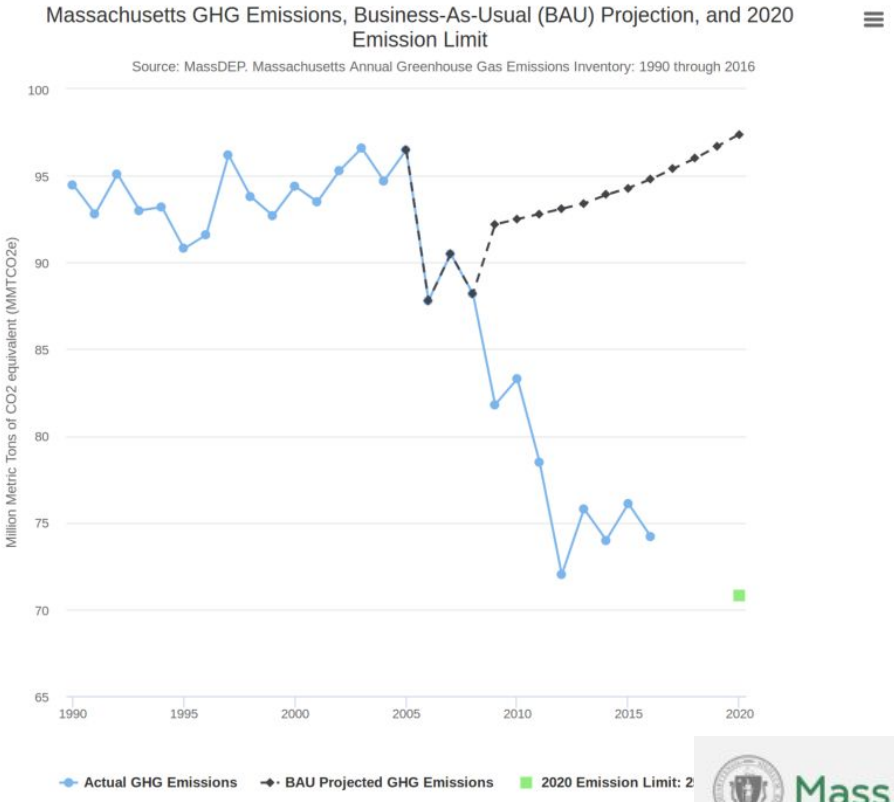
Progress in Massachusetts

MA is 3% of the U.S. economy and 1.2% of the nation's greenhouse gas emissions

Global Warming Solutions Act of 2008- reduce emissions by 25% below 1990 levels by 2020, on the way toward an 80% reduction in emissions by 2050

A 21% reduction occured between 1990-2016.

However these reductions have been accomplished by expanding natural gas.



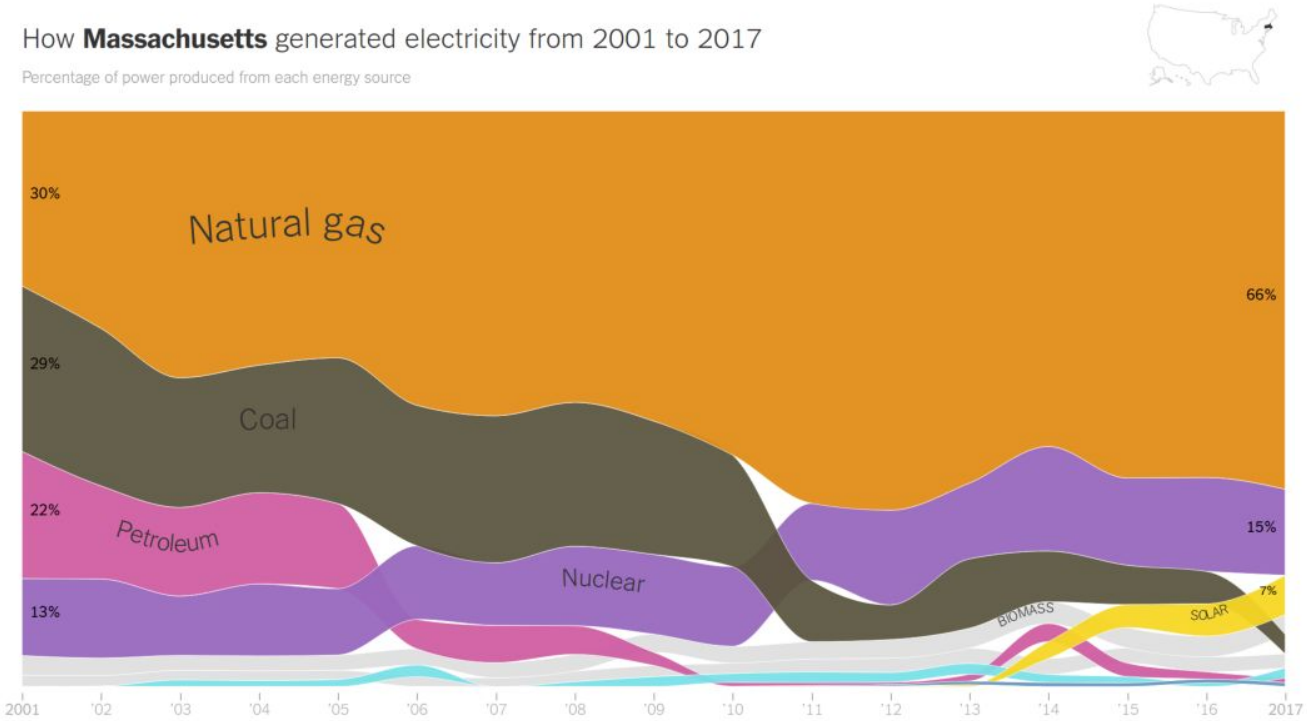
Mass.gov

Emissions in Massachusetts

Most electricity in MA is from natural gas

Bill H.4857 signed last year would expand the share of renewables to 35% 2030.

2050 Roadmap Bill (H.3983) will amend GWSA to set new goal of carbon neutrality by 2050



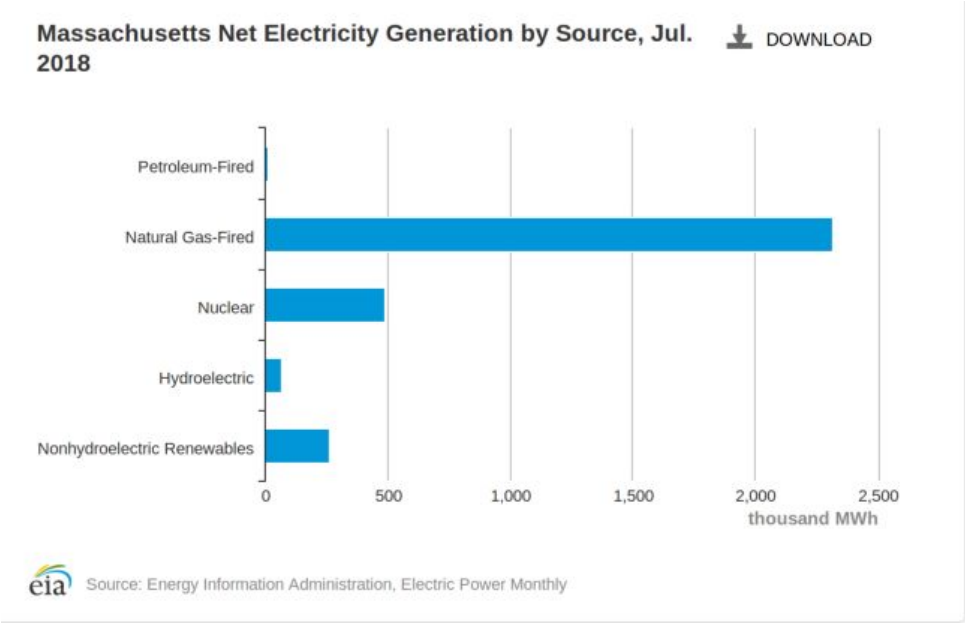
NYT

Energy

In MA decarbonizing the energy sector is now a question of natural gas use.

It is terrible for the climate and, as we saw in Merrimack Valley, it is dangerous. However, it is cheap.

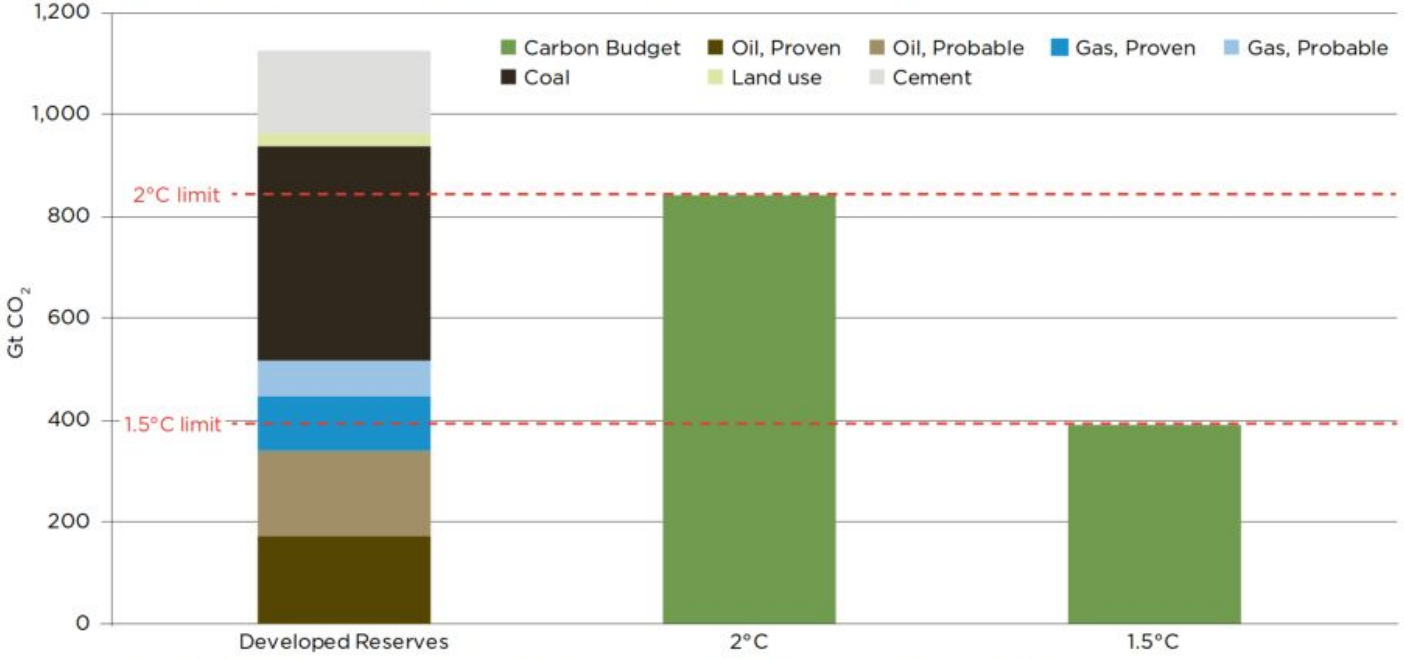
Investments in fossil fuel infrastructure lock in emissions.



For a forward thinking climate stable future we cannot build new fossil fuel infrastructure.

Current Fossil Fuel Reserves Already Surpass the Carbon Budget

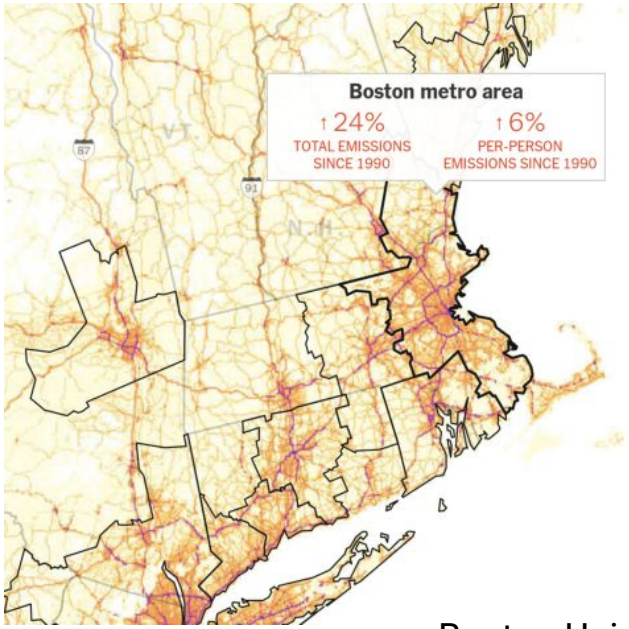
Figure ES-1: Emissions from Developed Fossil Fuel Reserves, Plus Projected Land Use and Cement Manufacture

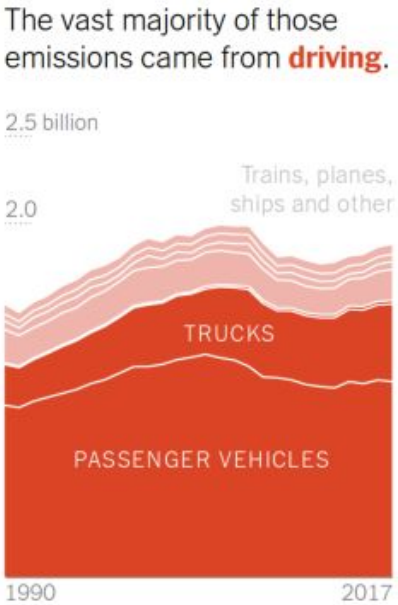


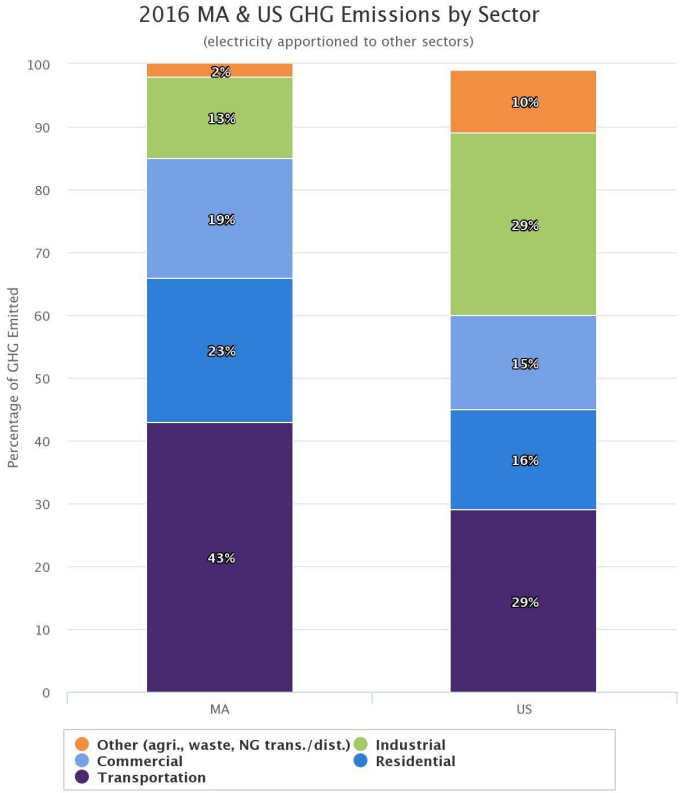
Sources: Rystad Energy, International Energy Agency (IEA), World Energy Council, Intergovernmental Panel on Climate Change (IPCC)

Emissions in Massachusetts

In MA, by sector, most of our GHGs are from the transportation sector (43%), much higher than the US average. And they are rising. Most of this is from cars.







Boston University study, NYT graphics

Mass.gov

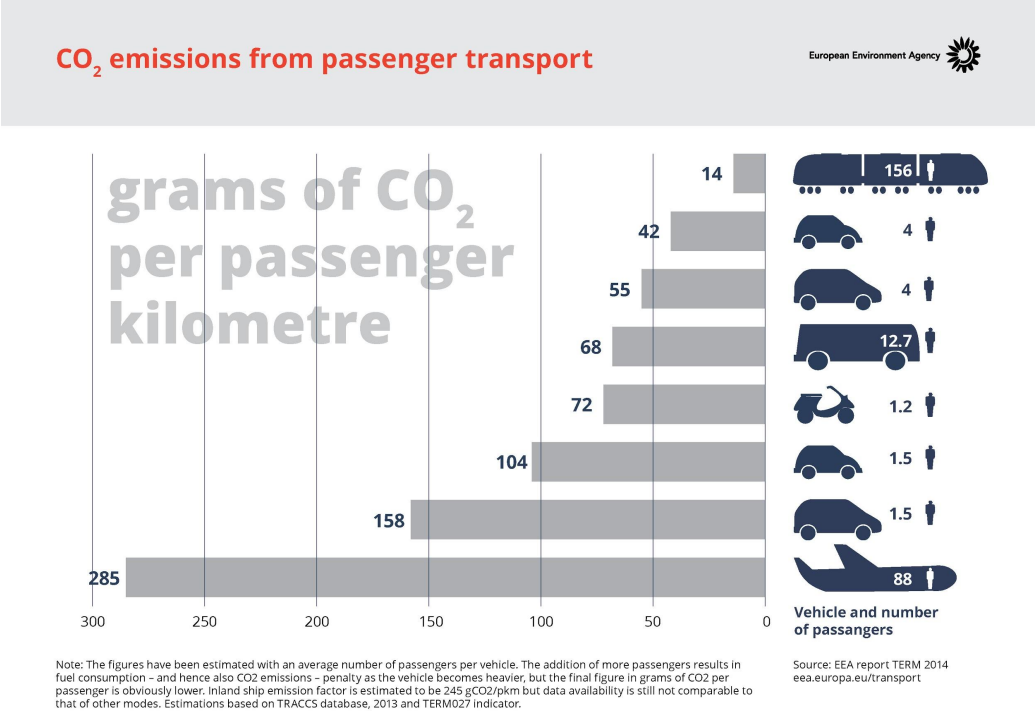
Transportation Options

Emissions vary widely by transport type

How does infrastructure impact how we travel? Are cities designed for cars vs. bikes or people?

Who has access to public transportation? And what is the quality of the public transportation options?

When do we really need to travel? Normalizing working from home in certain industries and utilizing remote access technologies is needed.



TRANSPORTATION & CLIMATE INITIATIVE
Of the Northeast and Mid-Atlantic States

Communication Disconnect on Effectiveness of Solutions

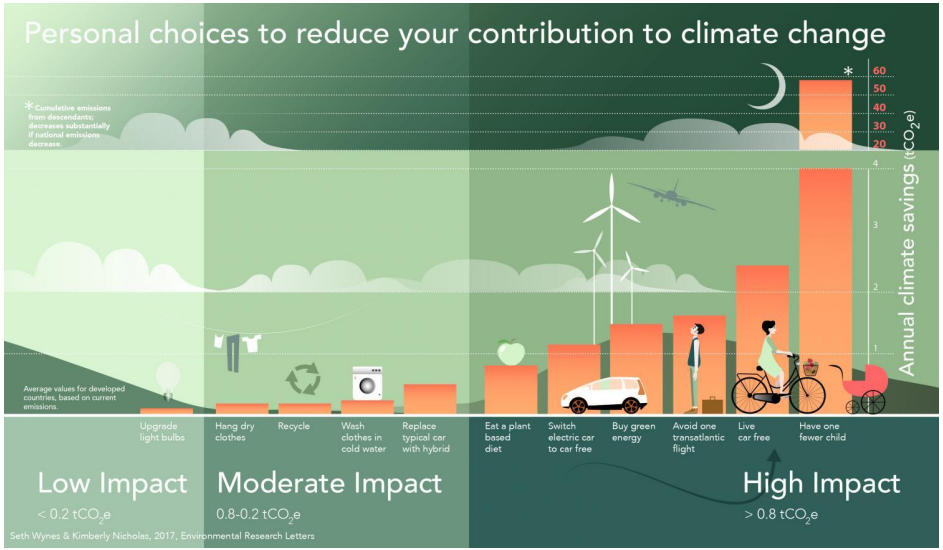
???

A 2017 study by Wynes and Nicholas found that the most helpful climate mitigation steps for individuals were the ones that got discussed the least. They found the most effective steps were:

- Flying less
- Living car free
- Not eating meat and dairy

However the ones discussed the most were things like recycling or changing light bulbs. These are still beneficial, but not the most effective.

But who has access?



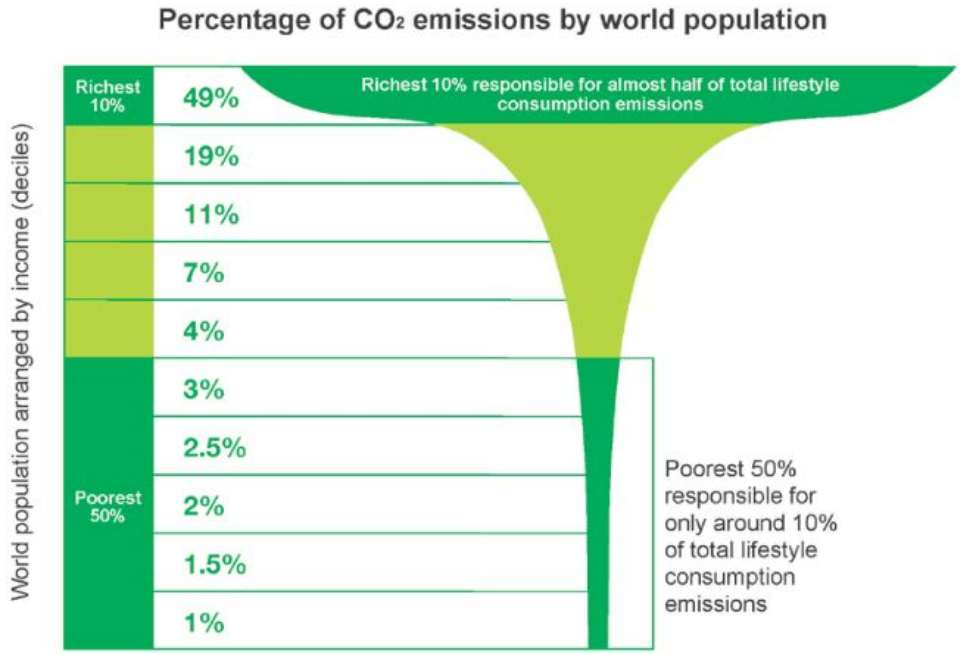
Population?

The issue isn't the population size, it is wealth inequality and access to education and birth control.

With regards to wealth inequality we can think about individual GHG footprints.

Under a 2C emissions scenario per capita footprints should be ~2 tCO2/person. In the US the average is 17 tCO2/person, though this also varies across social status. For billionaires it is near 50 tCO2/person.

Figure 1: Global income deciles and associated lifestyle consumption emissions

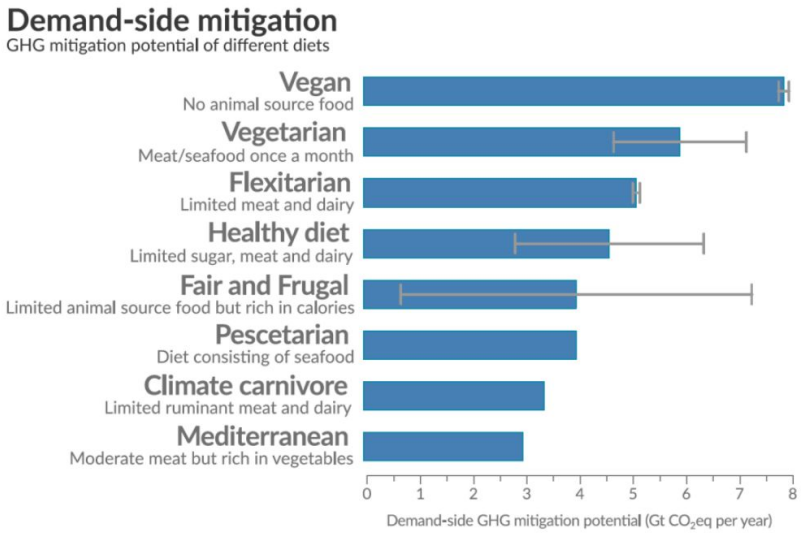


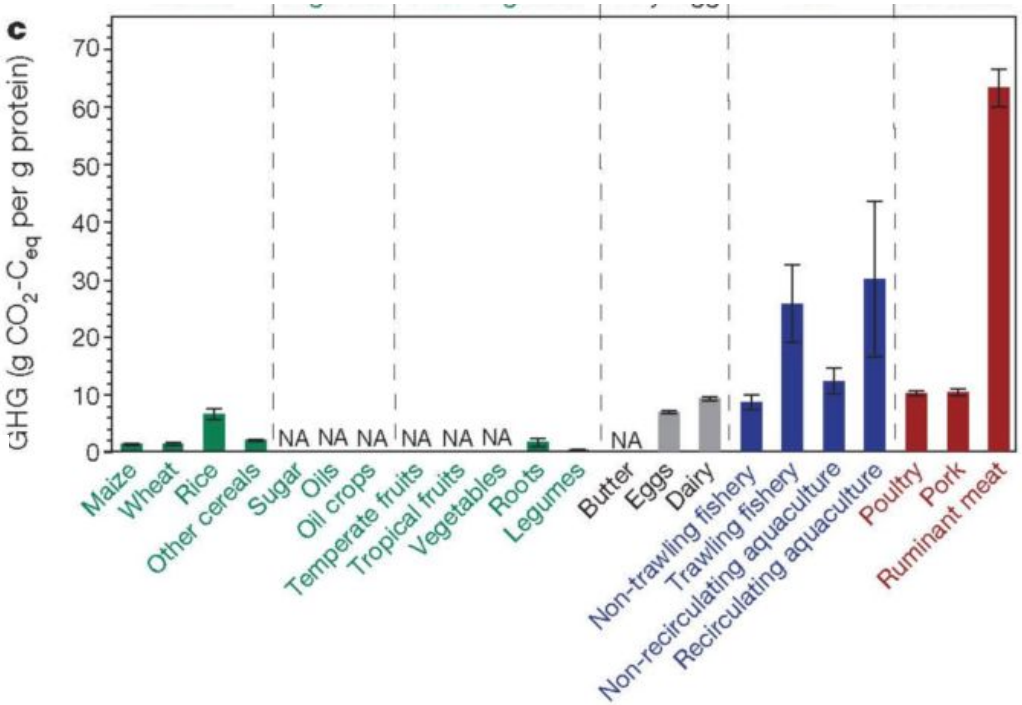
Source: Oxfam

The top 10% of emitters on this chart includes 70% of the US population.

Food

Land use and agriculture are ~23% of global emissions. Large scale shifts towards plant based diets are needed, and a large decrease in food waste.





If global trends toward increased meat, dairy, oil, and sugar continue we cannot meet temperature targets.

Left- IPCC SRCCL, Right- Tilman and Clark

Food

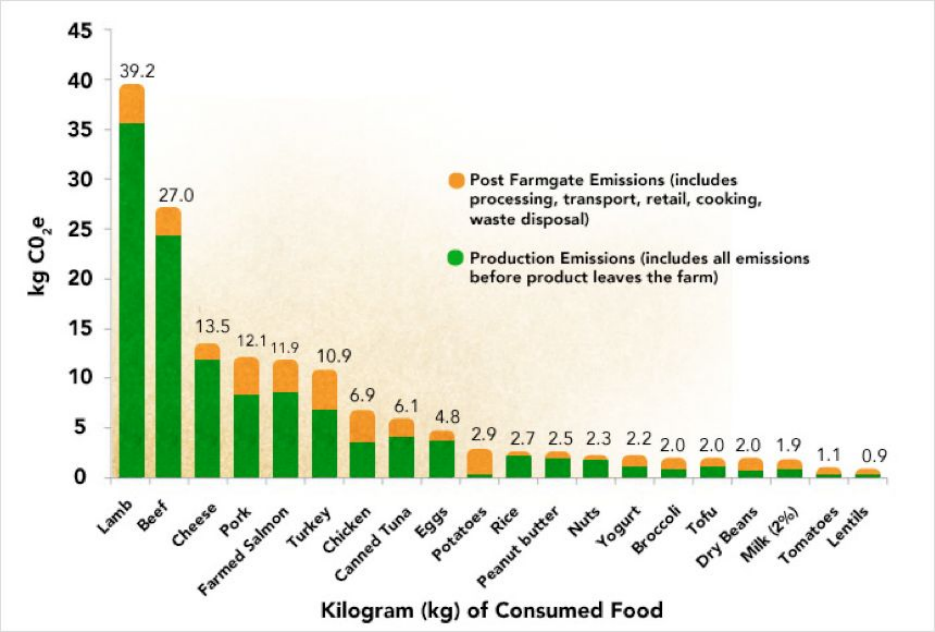
The type of food generally matters much more than where it is from.

Animal products locally will still have generally higher emissions than plant foods from far away.

Eating what is in season are important for reducing transport emissions.

Animal products have high production emissions which far outweigh the transportation emissions.

Buying local matters more for plant foods since they have very low production emissions.



Harvard Extension School

Climate Change is More Than Emissions To Solve It We Need To Understand the Causes

The way things are now grew out of the past. It is important to keep in mind history of colonialism, impacts of capitalism, and to always consider social justice. The current global rise of fascism is an enormous threat to people's safety and to climate stability.

Impacts will be felt disproportionately. Center frontline and vulnerable populations. Do work in our own communities.

This work requires social justice action, economic action, political action.

Why Is Action Not Happening Nationally?

- Lobbying/Consulting
- Campaign finance regulations favor corporations/industry groups
- Political advocacy groups and think tanks allow corporate reps and politicians to write legislation together; also fund & distribute denialism
- Denialism is an industry funded business strategy
- Revolving door between lobbyists, industry, government
- Fossil fuel subsidies ($20.5 billion annually just in US) keep fossil fuels dominant and could be better spent on funding decarbonisation
- Rise of fascism

The Role of the Fossil Fuel Companies

#ExxonKnew #ShellKnew

Support efforts to hold them responsible. Support lawsuit like Our Children's Trust and AG Healey's new suit.

The fossil fuel industry agenda is evolving. Increasing plastic production and pushing for negative emissions technologies are new strategies for protecting their business model in the face of climate action.

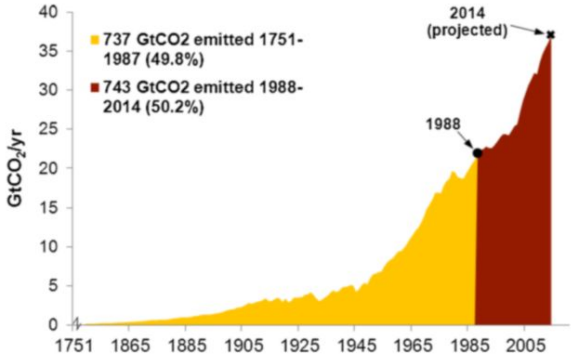


Fig. 3 More than half of global CO_2 emissions (1751–2014) have been released since 1988. Data sources: Boden et al. (2013). Le Quéré et al. (2014)

Heede, Climatic Change (2013)

PS- that 71% of emissions traced to 90 companies statistic is important but almost always misused and taken out of context. It is FF production emissions, not total emissions.

We Need a Better Future for All

Climate change presents us with a bleak future, but our response to it can lead to a better future for all.

We must act quickly, but in well thought out ways to build a more just and equitable future.

Our responses need to be based in science and social justice to ensure that they are both effective and equitable. Keep in mind the goal- net zero emissions- and what is at stake. Do what you can, within your means.

We need to radically care about each other and our collective future.

Keep Up with MA Legislation

Podcasts on MA legislation:

- Beacon Hill in 5
- Statehouse Takeout from the Statehouse News Service

Keep Up with Climate News and Research

Follow climate on social media. Share and talk about what you learn and join in the conversation.

- IPCC
- Inside Climate News
- Carbon Brief
- Climate Central
- DeSmog
- Union of Concerned Scientists

CLIMATE CENTRAL

inside climate news

Union of Concerned Scientists
Science for a healthy planet and safer world

DESMOG
CLEARING THE PR POLLUTION THAT CLOUDS CLIMATE SCIENCE

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ResilientMA.org and Climate Ready Boston

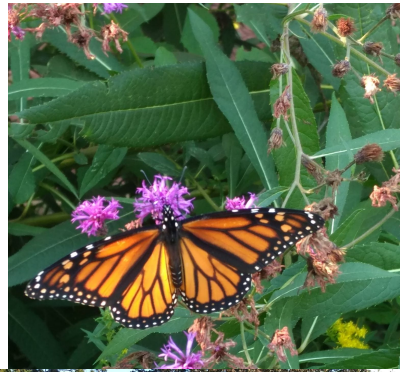
World Resources Institute

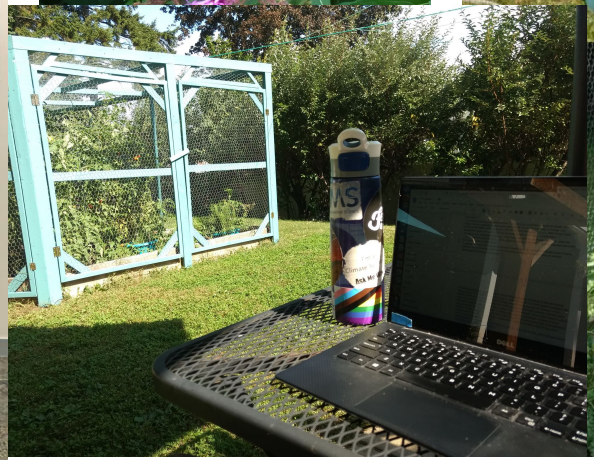
ClimateActionTracker.org

mass.gov/service-details/ma-ghg-emission-trends

Ambarish Karmalkar

How I Keep It Together Doing This Job



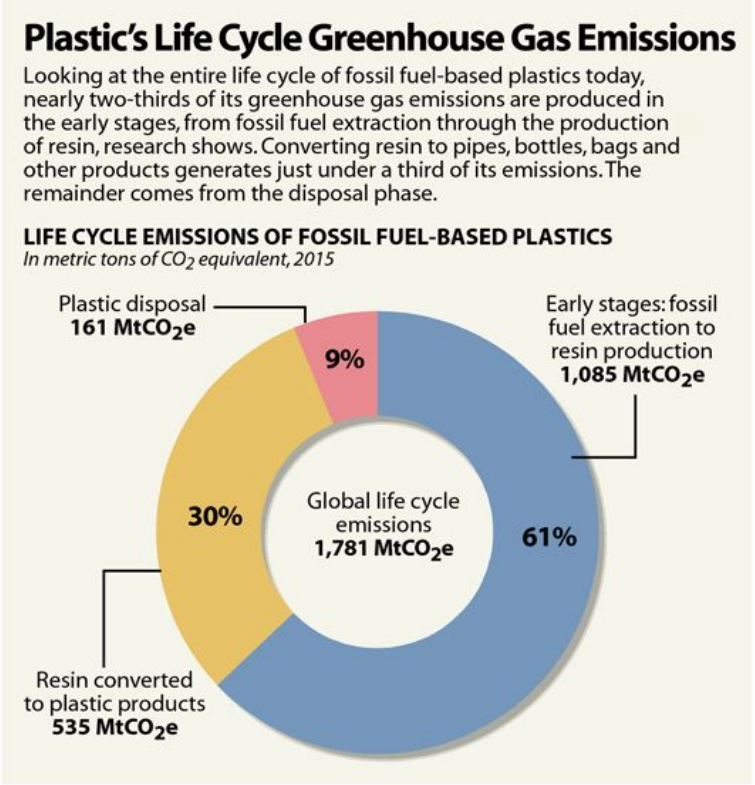


The Question of Plastic

As the fossil fuel companies see climate action coming their business models are adapting. Part of this is ramping up plastic production.

Plastic has more downsides then just emissions, but it is basically impossible to avoid using.

"The strategies that we tested are anywhere between unrealistic to ridiculous, to be honest. What we realized as a result of the study was the magnitude of the challenge that we are facing really requires an unprecedented level of effort to mitigate greenhouse gas emissions." -Sangwon Suh



Strengthening the Global Response

Systemic change is needed across all sectors- energy, industry, transportation, agriculture.

Responses must include mitigation as well as adaptation. Mitigation is needed on both supply & demand sides.

Mitigation

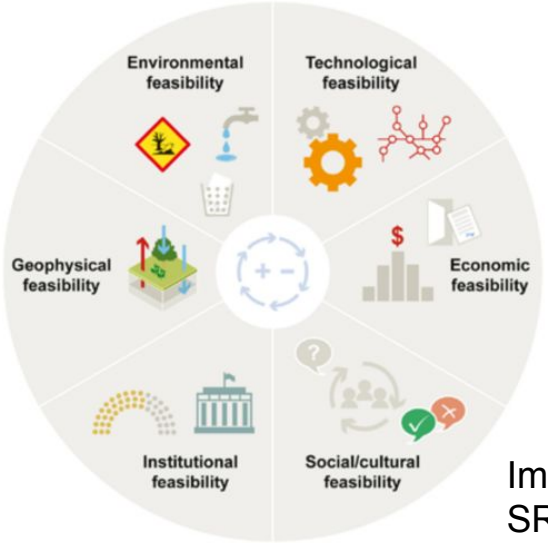
- Solar and wind installations
- Decreased industrial emissions and cement use
- Mass transit, a move away from air travel
- Energy efficient heating cooling, appliances
- Walking, cycling, electric vehicles, public transport
- Plant based diets

Adaptation

- Heat protection
- Flood protection
- Urban parks to combat heat islands
- Forest protection
- Wetland restoration

FAQ4.1: **The different feasibility dimensions towards limiting warming to 1.5°C**

Assessing the feasibility of different adaptation and mitigation options/actions requires consideration across six dimensions.



Images: SR15

Action Needed in the US- Looking to 2020

- Legislation moving towards net zero emissions by 2050
- Expansion of public transportation
- No new pipelines or fossil fuel infrastructure
- Expansion of renewable energy
- Support for inquiries into Exxon, Shell, and others
- No political candidates should take money from the fossil fuel industry
- End subsidies for the fossil fuel industry
- And much more...

Molly Crabapple