ROBERT CRAWFORD

CLIMATE ACTION HANDBOOK

FOR DESIGN PROFESSIONALS

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PREFACE

"Some scientists continue to believe the problem of (climate change) denialism can be solved through ever more data and greater public education. ... Instead of accusing ... climate denialists of irrationality, Latour ... (notes) we would be in a much better situation ... if (scientists) stopped pretending that ... the climate change deniers — 'are the ones engaged in politics and that (scientists) are engaged only in science.'"

-Bruno Latour, as described by Ava Kofman[1]

"'I have no power as an architect, none whatsoever. I can't even go on to a building site and tell people what to do.' Advocacy, he says, is the only power an architect ever has."

-Norman Foster, as captured by Rowan Moore[2]

PREFACE

Norman Foster, I suspect, doesn't literally believe architects, engineers, and designers have no power outside of advocacy. His assertion, though, that our greatest power as designers and citizens to shape the built environment is as advocates is something that has become increasingly evident to me through compiling this manual.

The impetus for this project came from hearing elected officials struggle to make informed decisions about which progressive reach building codes and policies to adopt while ensuring the longterm economic health of their constituents as many representatives don't have a full picture of the impact not adopting such measures would entail.

The primary goal of this handbook is to empower design professionals and the broader community with a collection of information and case studies related to the built environments' impact on emissions as well as environmental policies' impact on economies. A secondary goal is to provide tips to ensure practitioners can succinctly disseminate that information to parties who might have alternative views.

Latour's contention that we are all political actors whether we acknowledge it or not might seem a pedantic splitting of hairs or even to give air to junk science and "alternative facts;" however, understanding the nuance is key to the effective diffusion of information. Today and historically, the veracity of the content of a statement alone is not the most impactful way to ensure being heard or shifting others' views.

Said differently, misinformation can take root quickly when uttered intentionally or unintentionally by reputable institutions in a palatable manner. Conversely, accurate information might be tuned out by those with differing viewpoints, especially if delivered in a righteous tone.

A greater acknowledgment and understanding of how misinformation is established will help us counter it, if we hope for the information we consider to be the best available to be inculcated by city council members, building departments, legislators, and the voting public.

PREFACE

This handbook is a call to action, a call to advocacy.

It provides fodder and tools for design professionals to build political will for climate action related to the built environment.

Top 5 Reasons Why

1. Our voice, grounded by experiences in our field, is stronger than we realize as working professionals
2. Exemplary projects, voluntary initiatives, and sustainable rating systems have made strides at reducing emissions; however, the continual improvement of energy and green building codes holds the greatest potential to reduce building sector emissions
3. Codes related to improving buildings' operational energy demand have reduced emissions, but a gap exists with respect to the legislation of buildings' embodied carbon emissions
4. Global warming has exacerbated economic inequality
5. Inaction today compounds the frequency of climate related disasters and the challenge of mitigating warming to IPCC targets

Top 5 Actions

1. Adopt statewide building codes where none presently exist
2. Adopt a timeframe of 3 years for state building codes to be continually improved where less frequent timeframes or no timeframe exists
3. To the extent possible, building energy codes should focus on desired outcomes and performance, not prescriptive codes or specific technologies
4. Decouple utility companies' revenues and sales while ensuring their financial health and incentive to improve with small annual adjustments in rates where decoupling policies have not been adopted
5. Push for codes related to buildings' embodied carbon footrpints to be adopted (not just improvements in operational energy)

01
INTRODUCTION

Despite increased support for policies on the environment and new technologies continuing to show “that a low-carbon future is within reach and perhaps as cheap as or cheaper than a high-carbon one,” there has been sporadic progress in the US at reducing greenhouse gas emissions over the past 30 years at the rate needed to limit warming to 1.5°C above preindustrial (1850-1900) levels by 2100.[3, 4, 5]

Why the disconnect?

(between US sentiment and its regulatory environment)

How can we close the gap?

Why the disconnect?
- Language
- Engagement

There are no doubt numerous reasons for the growing majority support in the US for policies on the environment, on the one hand, and the increasing polarization around government environmental action and inconsistent progress at realizing greenhouse gas reductions, on the other.

I believe part of the disconnect which is often overlooked and actionable is language.

I am guilty of using doomsday language used by many in favor of stricter environmental policies as a way to convey the gravity of the situation, but this may alienate those we are trying to sway.

Pragmatic Optimism
This is not to downplay the urgency of action needed, but an appeal to elevate language about solutions, engage and listen to opposing viewpoints, and reframe dialogues around common ground policies which save money, reduce energy and conserve water.

“Sustainability?
I assume the word
has been poll-tested
somewhere, but I don’t
think people react to it the
same way as they do to the
word conservation.”

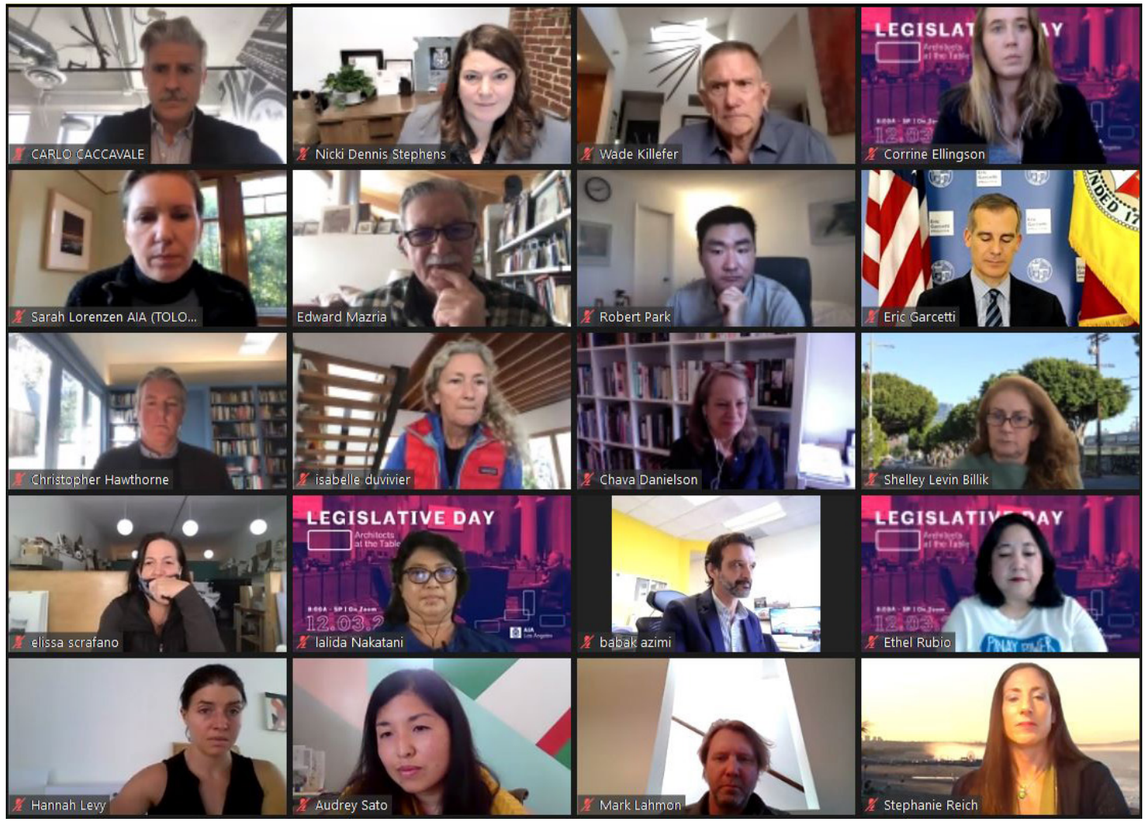
Annise Parker, former Mayor of Houston, as quoted by Brantley Hargrove[6]

How can we close the gap?
- Participatory Action
- Political Action
- Professional Action

This guidebook will focus on political actions design professionals can take to reduce greenhouse gas emissions.

Subsequent sections will cover key information, lessons learned from case studies on the scale of corporations to countries, how to engage in advocacy, rhetoric, and recommendations.

I hope this sparks others to develop their own positions and advocate for them in their localities and beyond.

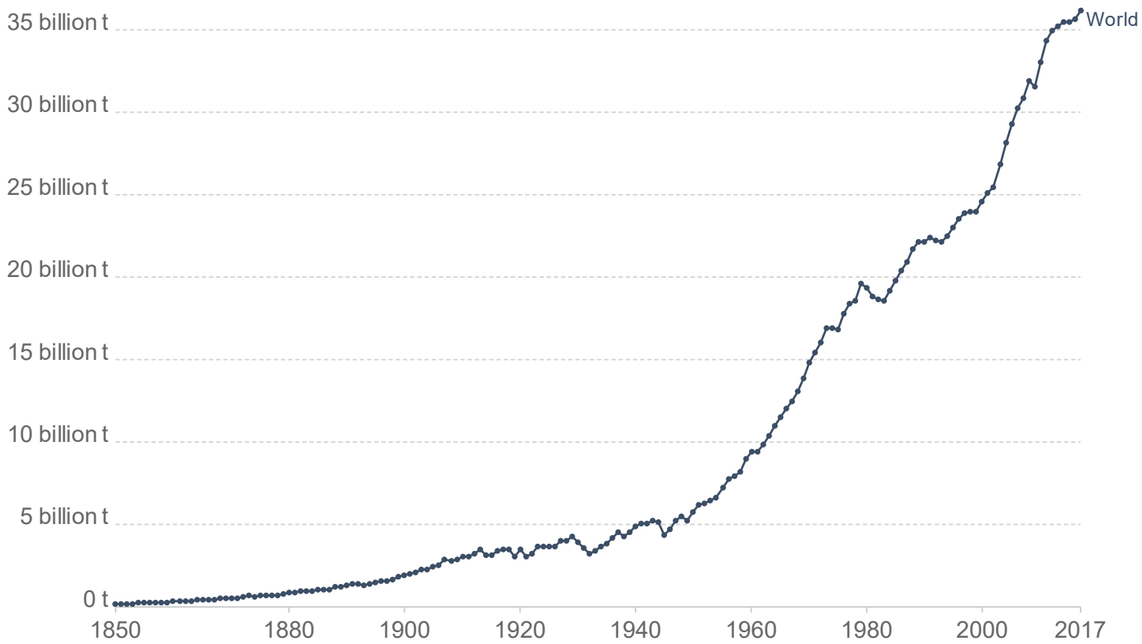


2020.12.10 - As part of the AIA LA's virtual Legislative Day events Architecture 2030's CEO, Edward Mazria, advocated to Mayor Eric Garcetti for the City of Los Angeles to adopt the 2022 Zero Code for California as a reach code in 2021.

02
KEY INFO

This section provides information related to greenhouse gas emissions globally, the USA, and the building and design sectors.

World annual CO_2 emissions



This graph from Our World in Data shows the growth of global CO_2 emissions over time from the burning of fossil fuels for energy and cement production. It does not account for land use change. The underlying data for the chart is primarily from the Global Carbon Project and the Carbon Dioxide Information Analysis Centre.[7]

How have global carbon dioxide (CO_2) emissions changed over time?

1950 saw levels at just over 5 billion tonnes of CO_2 which quadrupled to 22 billion by 1990.

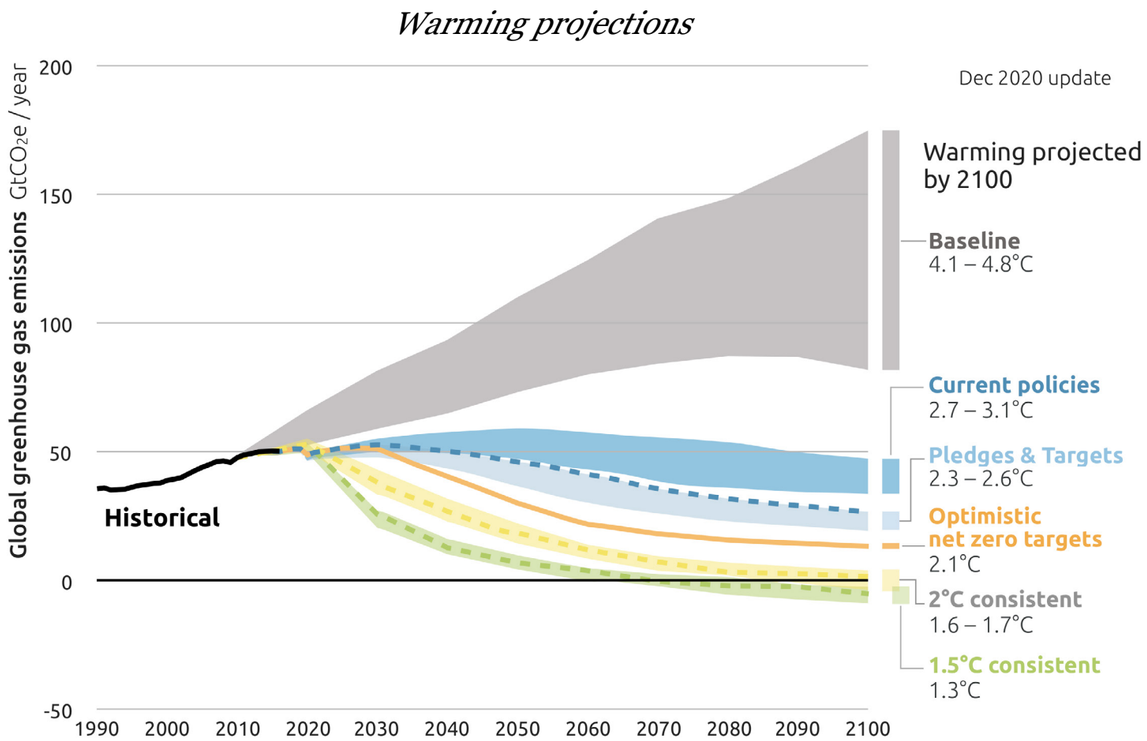
Emissions have slowed recently, but they have not yet reached their peak.

How long does CO_2 stay in the atmosphere?

After an initial pulse of CO_2 is emitted, 40% will remain in the atmosphere for 100 years, 20% for 1,000 years, and 10% after 10,000 years.[8]

"If emissions were to peak and drop to zero immediately, CO_2 concentrations and temperatures would continue to increase."

Hal Harvey describes the impact of how the effects of gases emitted today continue to be felt for thousands of years.[9]



Climate Action Tracker's chart maps out potential greenhouse gas emissions scenarios moving forward.[10]

What are the forecast outcomes if action is or is not taken?

Climate Action Tracker projects global warming would reach +4.1°C to 4.8°C above pre-industrial levels by 2100 without environmental policies in place.

Today's current policies reduce that to +2.7°C to 3.1°C.

The pledges and targets governments have made brings this to +2.3°C to 2.6°C.

The "optimistic" target of +2.1°C incorporates the effect of net zero emissions targets that are adopted or under discussion in 127 countries. It should be acknowledged historically there has been a gap between what governments pledged and the actions taken.

Achieving +2 or 1.5°C target pathways will likely require carbon dioxide removal (CDR). "All CDR methods are at different stages of development and some are more conceptual than others, as they have not been tested at scale."[11]

“In the last four decades, the frequency of natural disasters recorded in the Emergency Events Data-base has increased almost three-fold, from over 1,300 events in 1975–1984 to over 3,900 in 2005–2014.”

Excerpt from the Asian Development Bank’s Global Increase in Climate-Related Disasters report.[12]

What is the impact of global warming on the frequency of climate related disasters?

The goal of limiting warming to 1.5°C above preindustrial levels by 2100 represents more wildfires, storms, and floods than today’s levels.

The severity and level of frequency we see today has increased significantly over the past half century.

Most peer-reviewed studies by scientists have concluded the increase in frequency of climate related disasters is directly linked to climate change which is largely the result of human activities.[13]

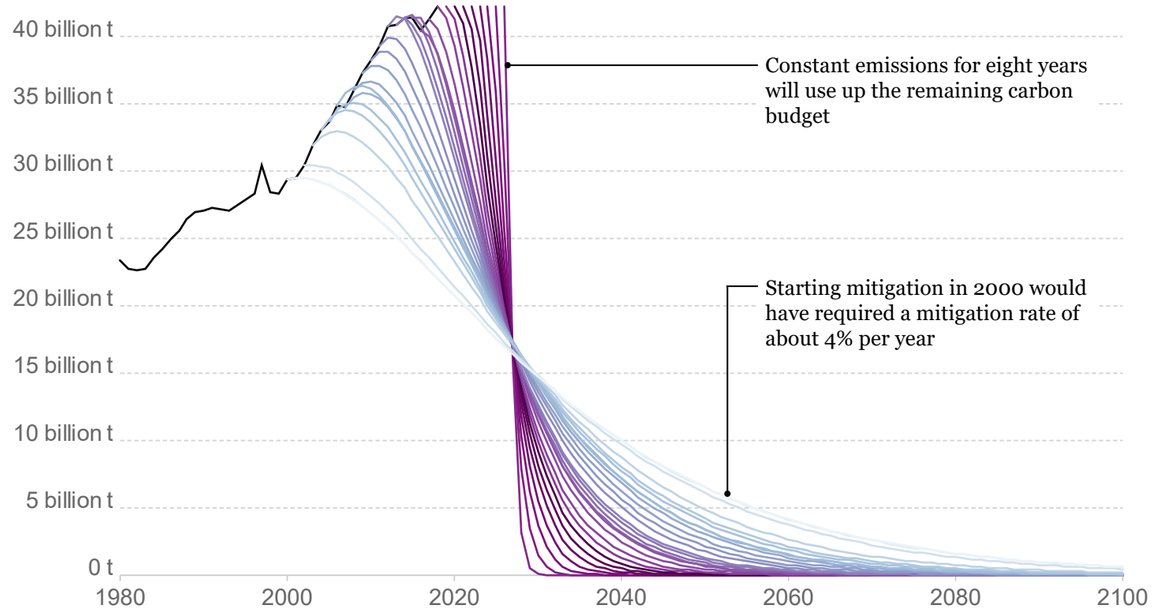
What is the impact of waiting to act?

If emissions had peaked in the year 2000, the 1.5°C warming limit target by 2100 would only have required reductions of around 4% per year.

If emissions had peaked in 2019, without net-negative emissions, a 15% cut each year through 2040 would be required.[14]

Technological optimism might delay some from action, but it is clear inaction now will make meeting the target exponentially more difficult.

CO_2 mitigation curves: 1.5°C



This graph from Our World in Data visualizes Robbie Andrew's mitigation curves and highlight the increasing difficulty of meeting the 1.5°C target by waiting to act.[15, 16]

World = 1.75 Earths

According to the Global Footprint Network there were "12.2 billion hectares of biologically productive land and water on Earth in 2019. Dividing that by the number of people alive in that year (7.7 billion) gives 1.6 global hectares per person." A global hectare is a biologically productive hectare with world average biological productivity for a given year. The current world average ecological footprint is 2.75 global hectares (gha) per person which means 1.75 Earths per year are needed to fuel our present way of life.[17] Illustration by Robert Crawford.

Will there be enough resources for the anticipated global population in 2100?

There is a lot to unpack in this question. Carbon footprint and ecological footprint are inextricably linked. Let's start with, what is the anticipated growth of the global population?

The UN anticipates a population of 10.9 billion in 2100.[18] The Wittgenstein Centre expects the end of global population growth around the year 2070 at near 10 billion, and to then fall to under 9 billion by 2100.[19]

Are there enough resources for 10 billion people?

Presently he world's population of 7.7 billion is using resources 1.75 times faster than the Earth is able to regenerate them; however, E.O. Wilson estimates that "if everyone agreed to become vegetarian (among other resource reducing measures)... the present 1.4 billion hectares of arable land would support about 10 billion people."[20]

USA = 5 Earths

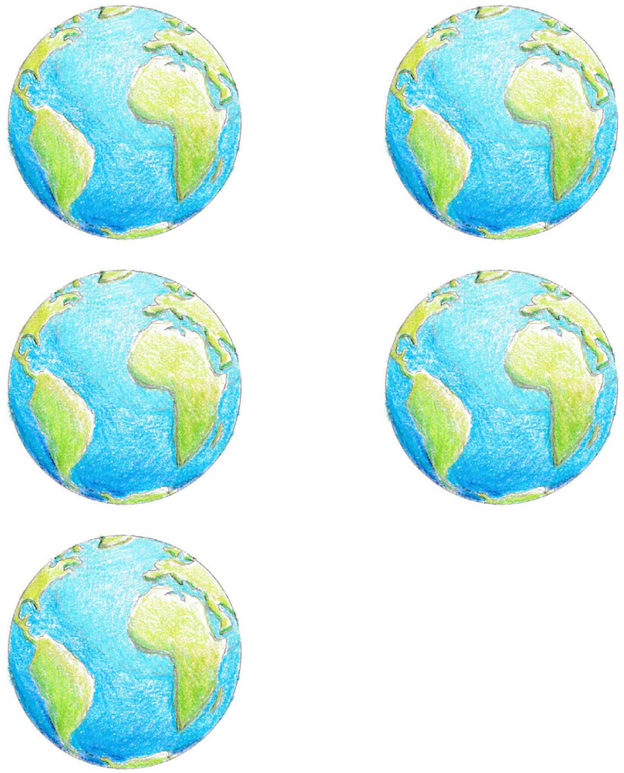
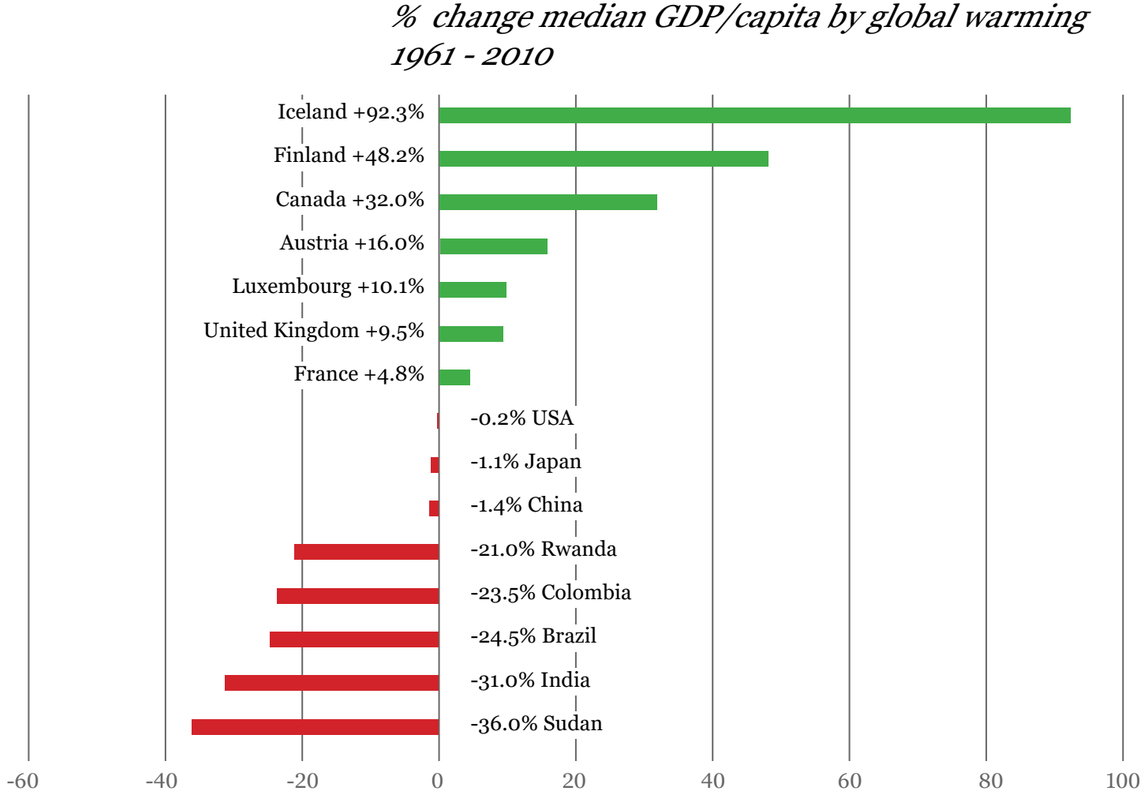


Illustration by Robert Crawford.

How many global hectares per person are needed to fuel the American standard of living?

The average American uses around 8.0 global hectares or said differently if everyone on the planet lived the same way Americans do, we would need about 5 Earths to support those habits.[21]



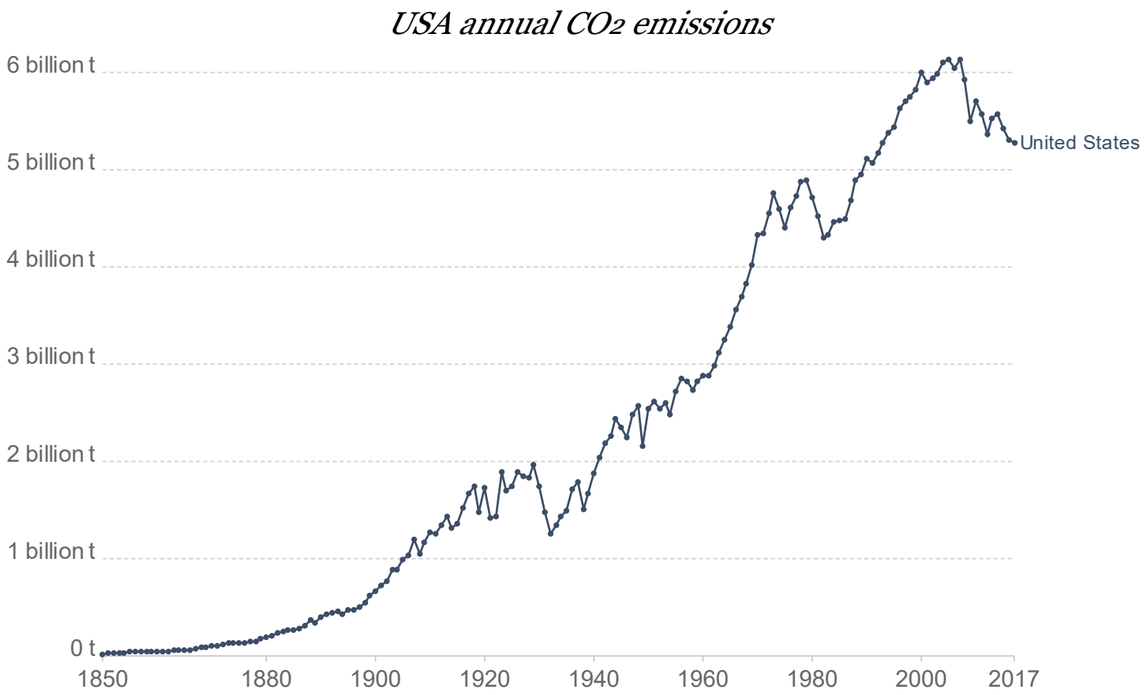
Visual representation of data from Diffenbaugh and Burke's study highlighting the extent to which countries have been helped or hindered by global warming.[22]

What is the impact of climate change on global economic inequality?

It has exacerbated it.

While economic inequality between countries has decreased in recent decades, a peer-reviewed study estimates the gap between the economic output of the world's richest and poorest countries is 25% larger today than it would have been without global warming.[23]

Crops and people are healthier and more productive when temperatures are not overly hot or cold. "This means that in cold countries, a little bit of warming can help. The opposite is true in places that are already hot."[24]



This graph from Our World in Data shows the USA's CO_2 emissions over time from 'production' (i.e. emissions from the burning of fossil fuels for energy and cement production within its borders). It does not account for 'consumption' emissions. The underlying data for the chart is primarily from the Global Carbon Project and the Carbon Dioxide Information Analysis Centre.[25]

How have American carbon dioxide (CO_2) emissions changed over time?

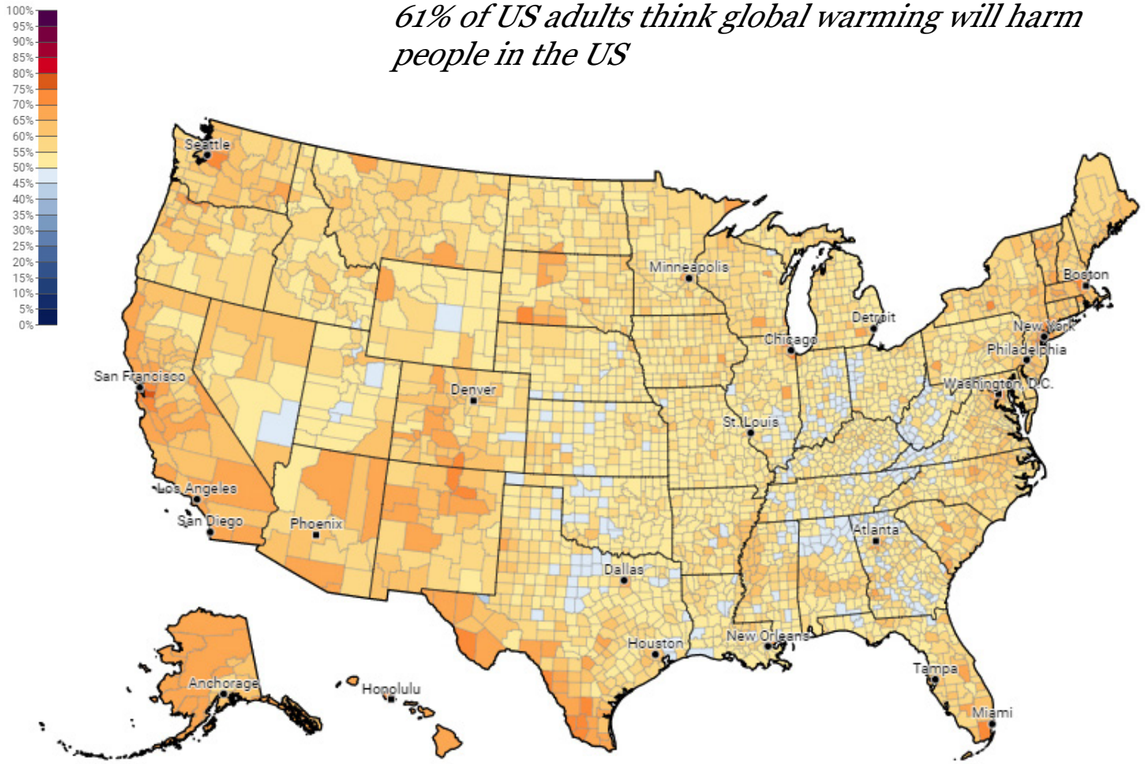
They are down since the peak in 2007, but they grew considerably over the 20th century.

To give the numbers more context, if we look at cumulative historic emissions to date the US has emitted the most at 25%, followed by the EU at 22% and then China at 13%.

In 2017 US emissions accounted for 15% of the global total. China accounted for 27% and the EU-28 for 10%.

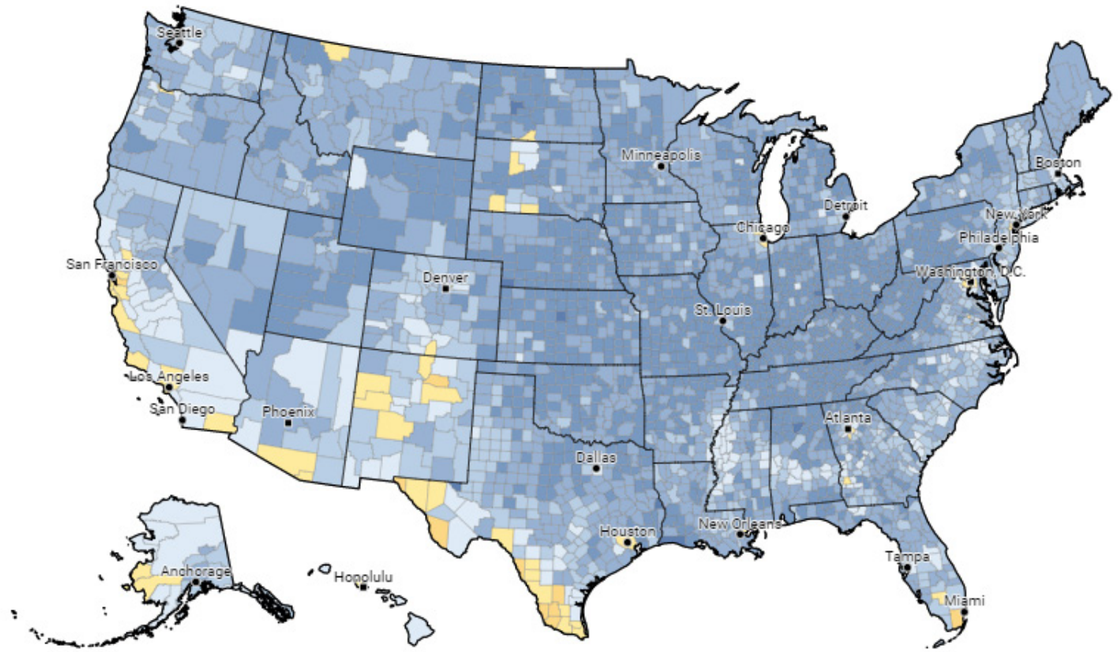
Looking at emissions per capita in 2017, the US averages 16.21 tonnes (t) of CO_2 where as China averages 6.92 t and the EU-28 averages 6.89 t. The world average is 4.79 t.[26]

61% of US adults think global warming will harm people in the US



These 2020 Yale Climate Opinion Maps show how Americans' perceive the risks of climate change.[27]

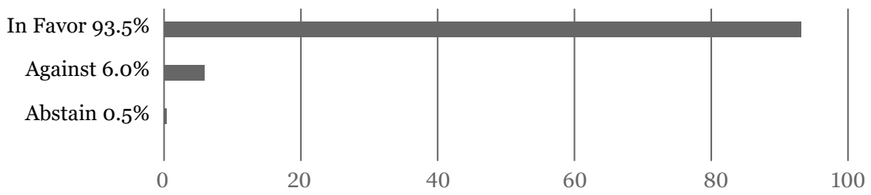
43% of US adults think global warming will harm them personally



How does optimism bias impact views on climate change?

The majority of adults believe climate change will harm Americans, but don't believe it will harm them.

Voting results of AIA Resolution 19-11

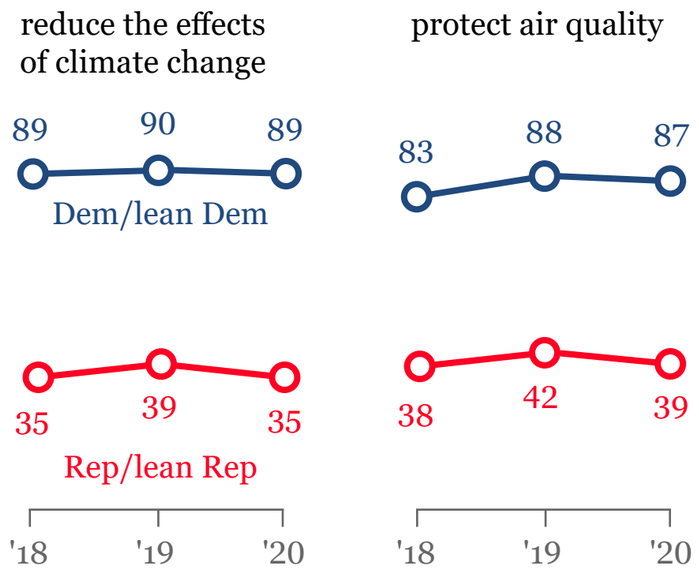


Where does the AIA stand on climate action?

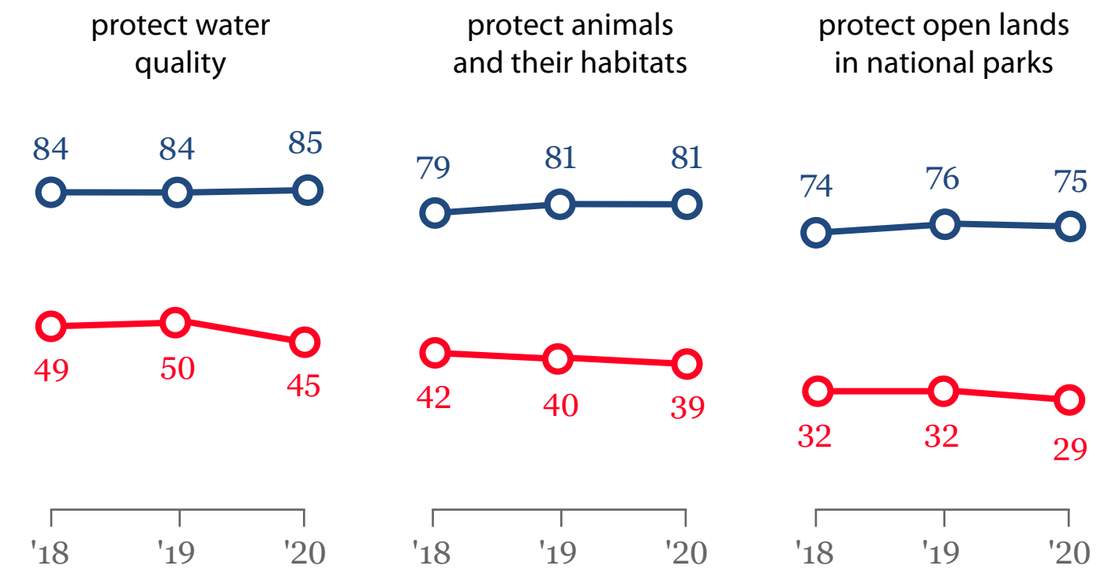
In 2019 the 19-11: Resolution for Urgent and Sustained Climate Action was overwhelmingly supported at the AIA's 162nd Annual Meeting.

"The new piece of business proposed that AIA prioritize and support urgent climate action to exponentially accelerate the “decarbonization” of buildings, the building sector, and the built environment. In addition to calling for revisions to AIA Public Policies and Position Statements, the resolution advocated that the Institute engage its full membership, clients, lawmakers, and communities in a multi-year education, practice, and advocacy strategy."[28]

% of U.S. adults who say the federal government is doing too little to ...



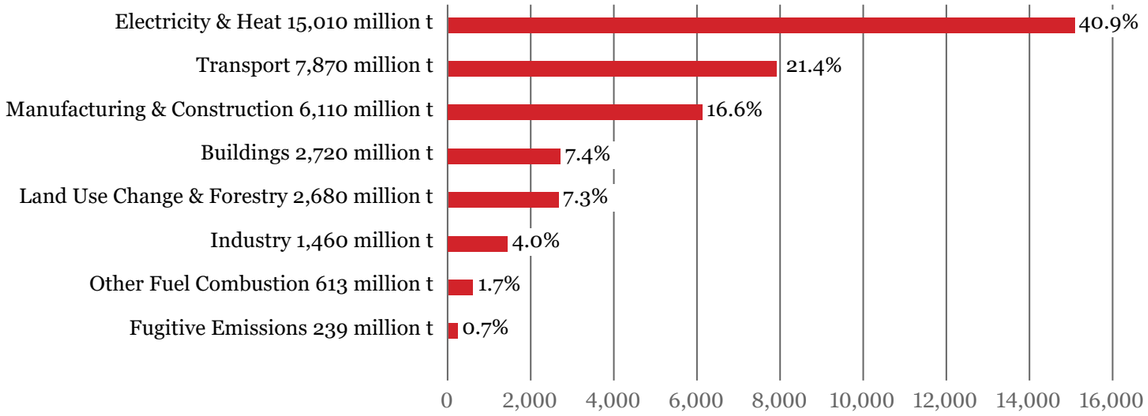
Results from a Pew Research Center survey.[29]



Where do Americans stand on government environmental action?

Americans have become more likely to say protecting the environment should be a top priority, but partisan divide is increasing over government environmental action.

2016 World annual CO_2 emissions by sector



This bar chart showing the world's CO_2 emissions by sector was produced with data from Our World in Data and underlying data from Climate Watch.[30]

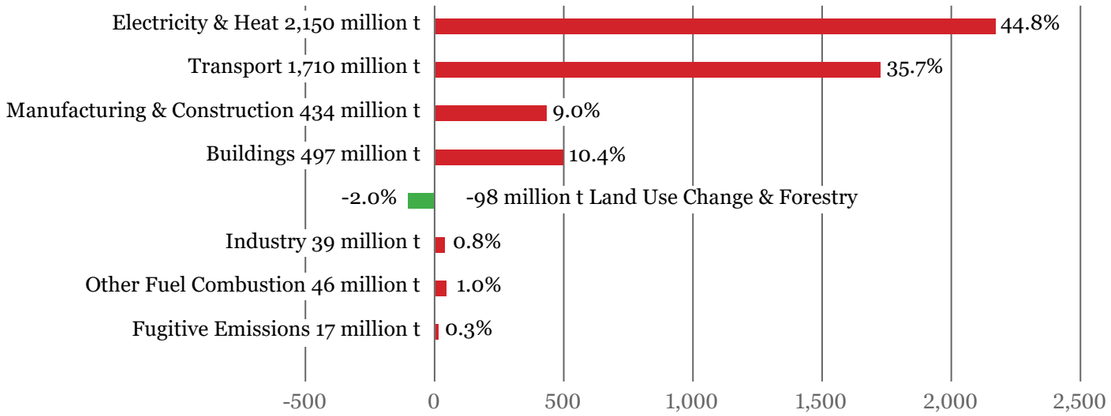
Of global CO_2 emissions, what amount is attributable to the building sector?

In 2016 globally the building sector was responsible for 2.7 billion tonnes of CO_2 or approximately 7% of annual emissions; however, it should be noted emissions from the electricity and heat, manufacturing and construction, and industry sectors among others include emissions that are attributable to building construction and building operations.

Factoring in the emissions from these other sectors related to buildings the Global Alliance for Buildings and Construction estimates that building and construction are responsible for nearly 40% of total direct and indirect CO_2 emissions, with construction accounting for 11% and building operations 28%.[31]

"Energy demand from buildings and buildings construction continues to rise, driven by improved access to energy in developing countries, greater ownership and use of energy-consuming devices, and rapid growth in global buildings floor area."[32]

2016 USA annual CO_2 emissions by sector



This bar chart showing the USA's CO_2 emissions by sector was produced with data from Our World in Data and underlying data from Climate Watch. Note land can be a carbon sink and here shows up as a negative source of emissions.[33]

Of USA CO_2 emissions, what amount is attributable to the building sector?

In 2016 the USA building sector was responsible for 497 million tonnes of CO_2 or approximately 10%* of annual emissions.

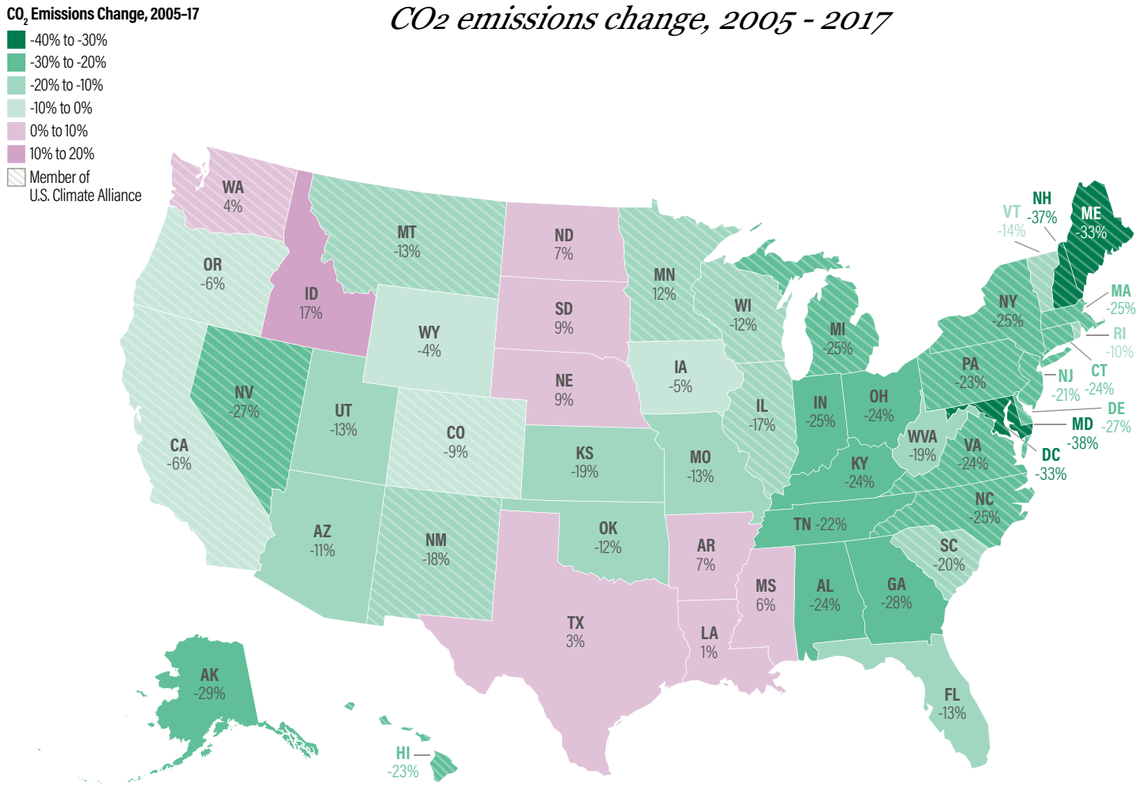
As aforementioned the emissions from electricity and heat, manufacturing and construction, and industry include emissions that can be attributed to building and construction. To my knowledge there has not been an estimation of the % which construction and building operations account for of US CO_2 emissions.

What is noteworthy comparing this chart to the world's emissions by sector is the USA's building sector accounts for a greater % of its total emissions.

As buildings in America and globally become increasingly energy efficient, the impact of emissions related to building products and construction, aka embodied carbon, will become an increasingly significant portion of total new construction emissions.

* Please note, a percentage is useful for ease of understanding impact, but is not the most accurate metric to understand this data as the land use change and forestry sector acted as a carbon sink resulting in negative emissions or approximately -2% and thus the other sectors total 102%.

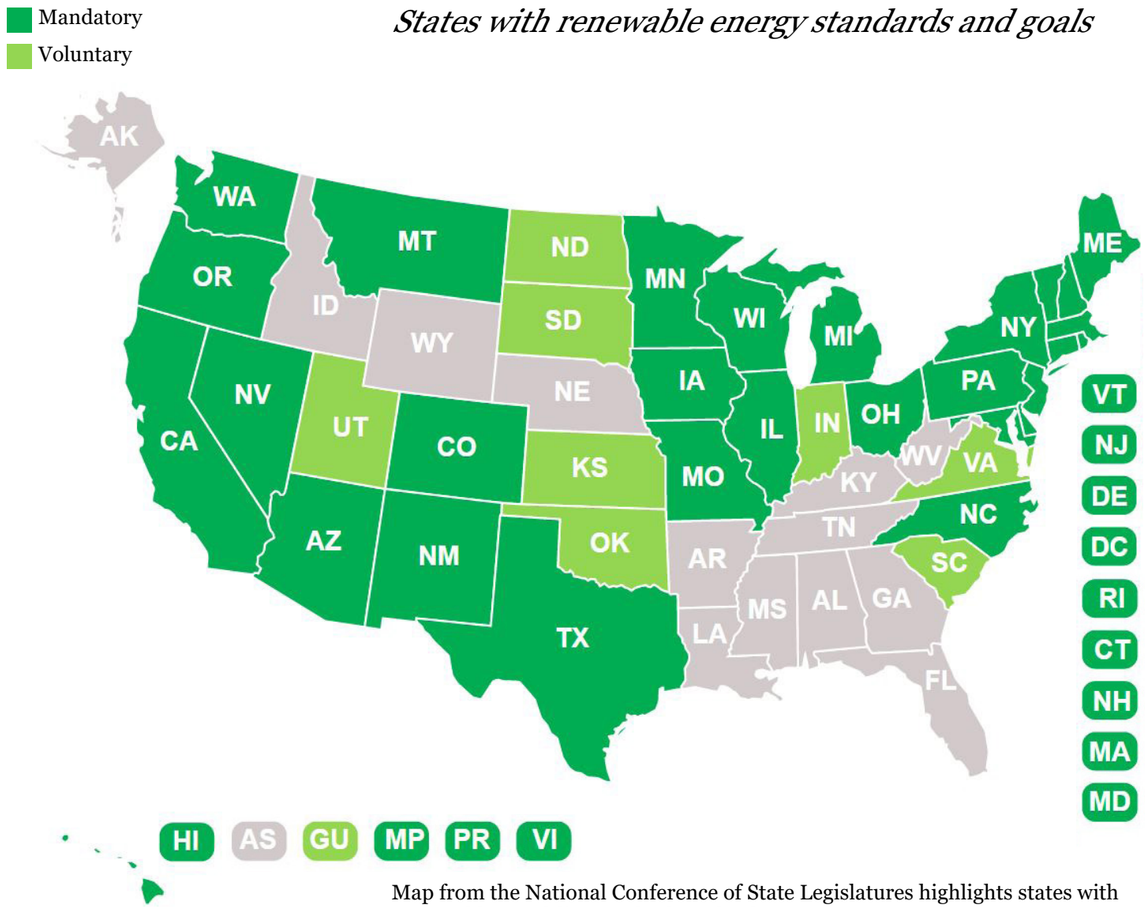
CO2 emissions change, 2005 - 2017



Map from the World Resources Institute identifying the % reduction of CO2 emissions by state from 2005 to 2017 produced with underlying data from the U.S. Energy Information Administration.[34]

Of the states which have recently seen significant reductions in their emissions, what were the reasons for these improvements?

"In most states that reduced their emissions, the dominant reason was a decrease in the carbon intensity of the energy sources they used to generate electricity — with substitution of gas for coal playing a major role. For a few states such as Alaska, Massachusetts and Kentucky, the decline came mostly from improvements in energy intensity, as a result of energy efficiency in buildings and industries, and of states moving away from heavy manufacturing to less carbon-intensive service economies."[35]



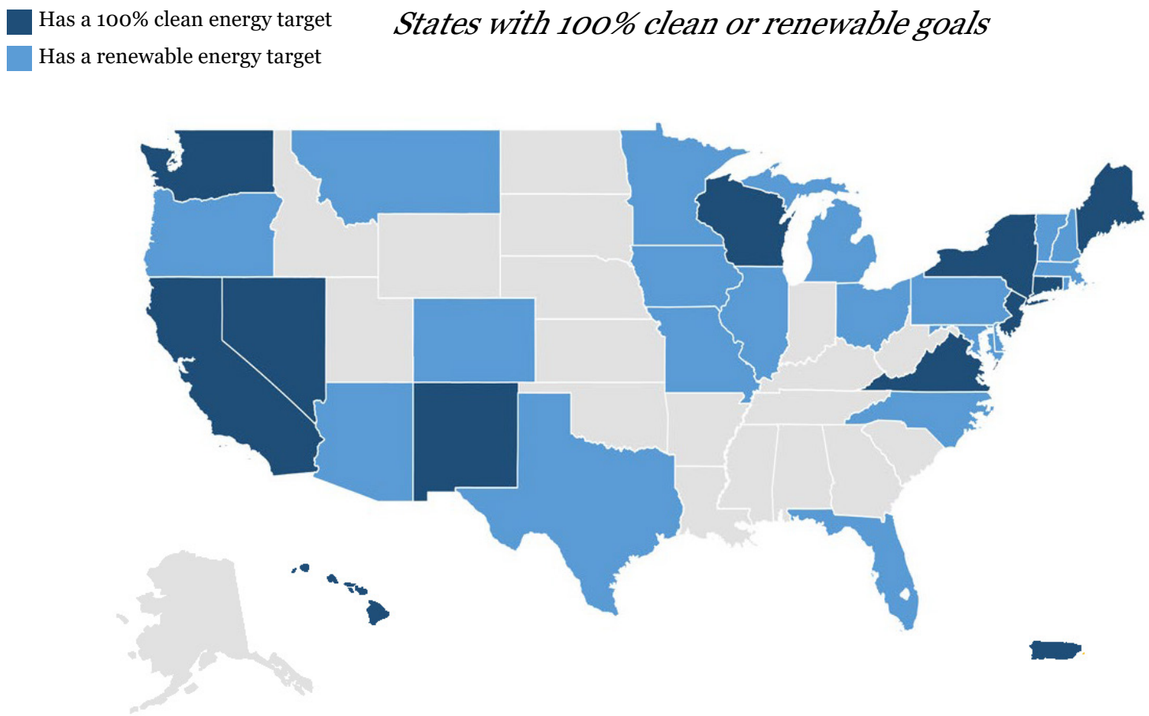
Map from the National Conference of State Legislatures highlights states with Renewable Portfolio Standards and voluntary energy standards or targets.[36]

How many states have clean or renewable energy standards and goals?

30 states, the District of Columbia, and 3 territories have adopted Renewable Portfolio Standards (RPS).

An RPS "is a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation."[37]

Iowa was the first state to establish and RPS in 1983.



States with 100% clean or renewable goals

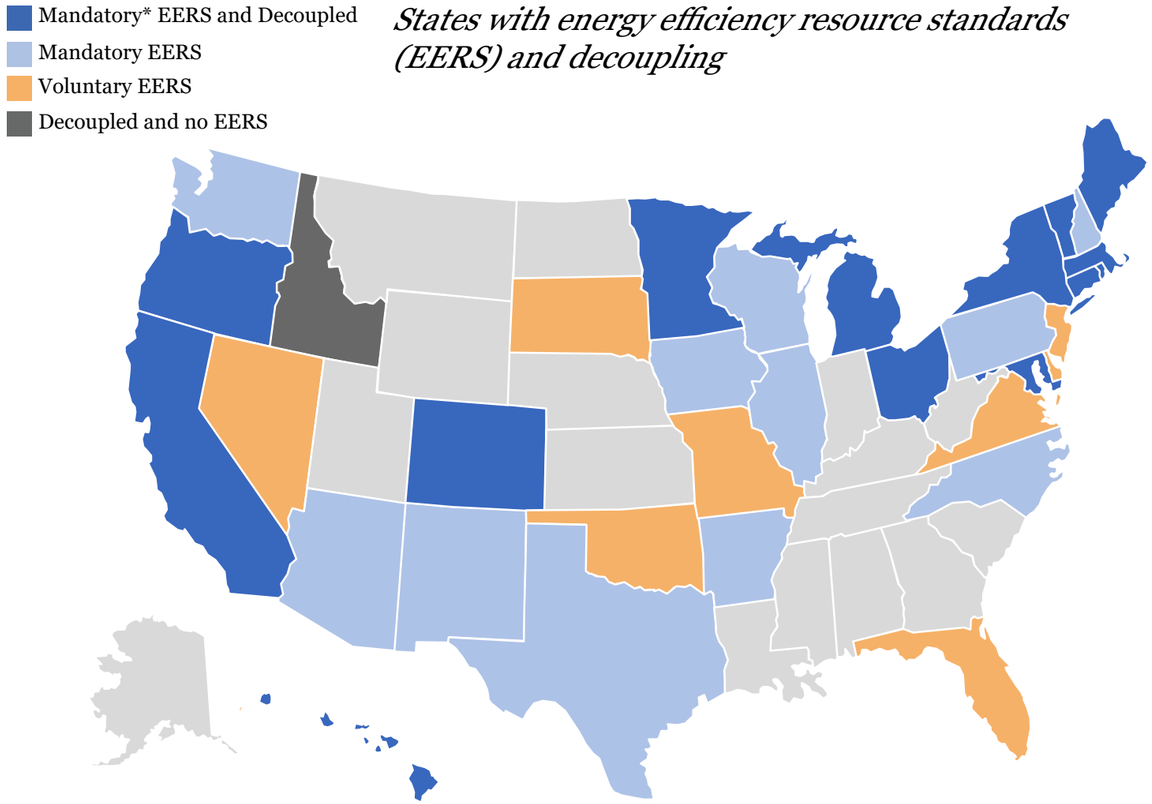
Map from the UCLA Luskin Center for Innovation highlighting states which have passed 100% clean energy policies or other renewable energy targets.[38]

How many states have 100% clean or renewable energy goals?

11 states have adopted laws or issued executive orders with 100% clean energy targets, a 2019 UCLA Luskin Center for Innovation report shows.

Hawaii was the first state to pass a law mandating a transition to 100% renewable energy.

A number of other states, districts, cities and territories have taken some action, but not yet established a 100% clean energy target.



States with energy efficiency resource standards (EERS) and decoupling

Map from the Advanced Energy Economy.[39]

* Or 3rd party administered

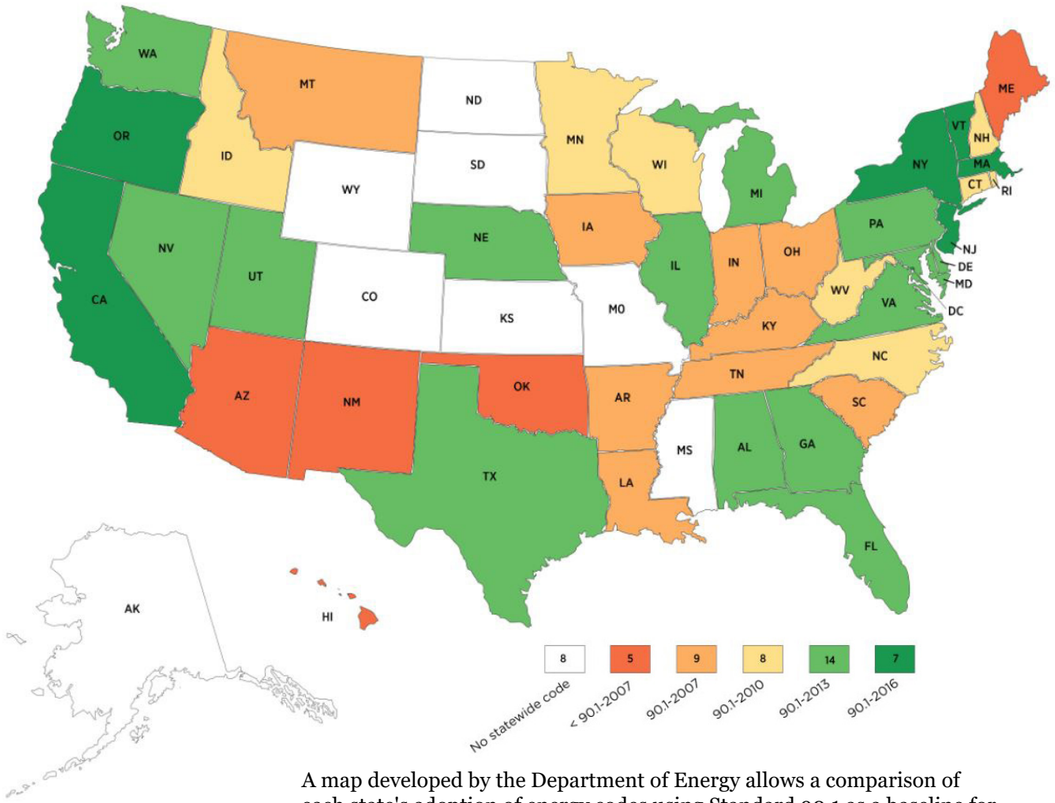
How many states have energy efficiency resource standards and/or decoupling?

The Center for Climate and Energy Solutions notes in "the United States there are currently 22 states with mandatory EERS and 4 states with a voluntary EERS (non-binding). 2 states have combined their EERS with their Renewable Portfolio Standards (RPS)."

An EERS is similar in concept to renewable portfolio standards (RPS) and alternate energy portfolio standards (AEPS). The RPS or AEPS requires that utilities generate a certain percentage of electricity from renewable sources. An EERS requires that they achieve a percentage of electricity and/or natural gas reduction in energy sales from energy efficiency measures."[40]

Decoupling removes the link between a utility's profits and financial health and their electricity and natural gas sales. "At present, 24 states and the District of Columbia have decoupling policies in place. Of these, 12 states offer decoupling for electric and gas utilities, 7 states and the District of Columbia (have) it (for) only electric utilities, and 5 states (have) it (for) only gas utilities."[41]

State energy code adoption map for commercial buildings comparison relative to the Standard 90.1 as a baseline

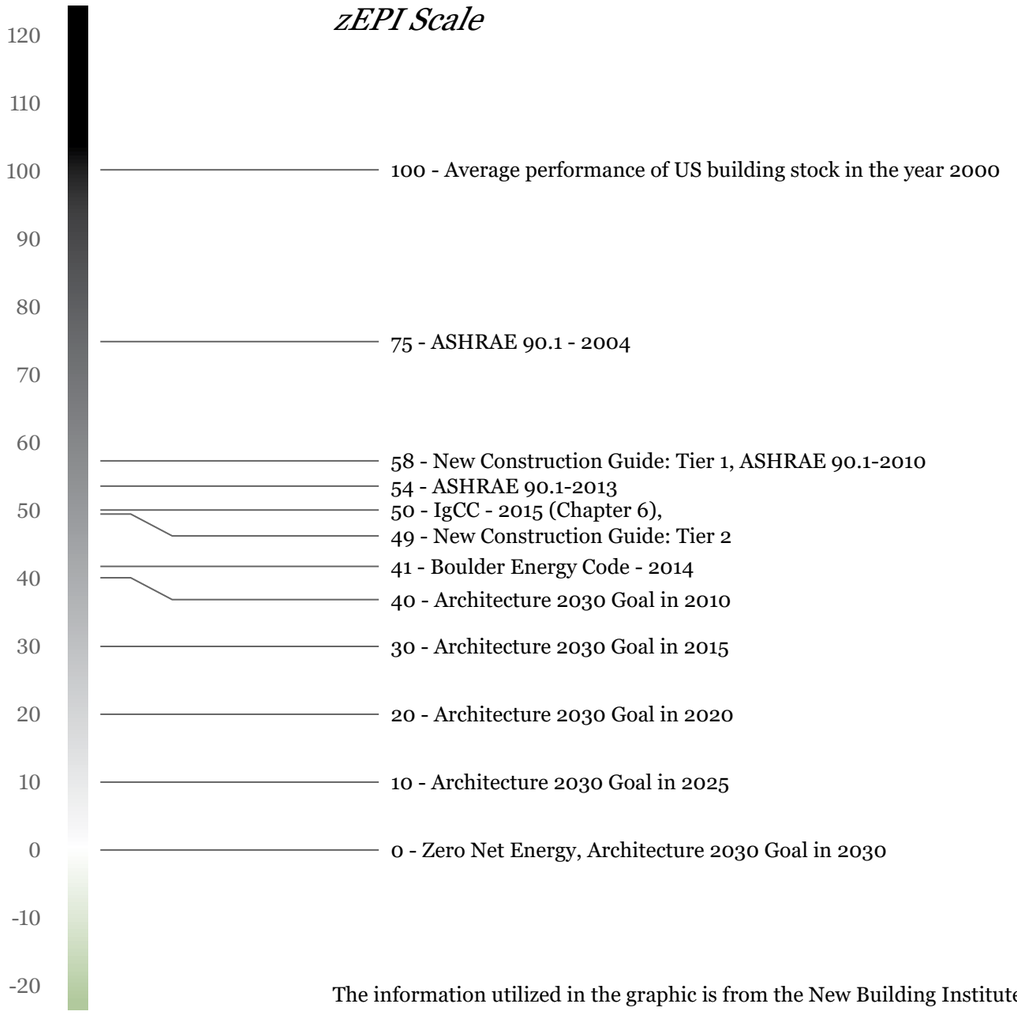


A map developed by the Department of Energy allows a comparison of each state's adoption of energy codes using Standard 90.1 as a baseline for commercial buildings (pictured) and the 2006 IECC for residential buildings (not pictured). Many states listed as "no-statewide code" are home rule.[42]

How do the states' presently adopted building related energy codes compare? What is their impact?

As the map to the left highlights, there is a wide range of model energy code years (or their energy savings equivalent) adopted by different states.

Most states do not update building codes every three years which results in missed energy savings opportunities. A Pacific Northwest National Laboratory (PNNL) report found that the current model energy codes for residential and commercial buildings are projected to save $126 billion dollars in consumer cost and 841 million tonnes CO2 (equivalent to 245 coal power plants) cumulatively from 2010 through 2040.[43]



The information utilized in the graphic is from the New Building Institute.[44]

Where do various building energy codes and initiatives rank relative net zero energy? Which codes have integrated zEPI?

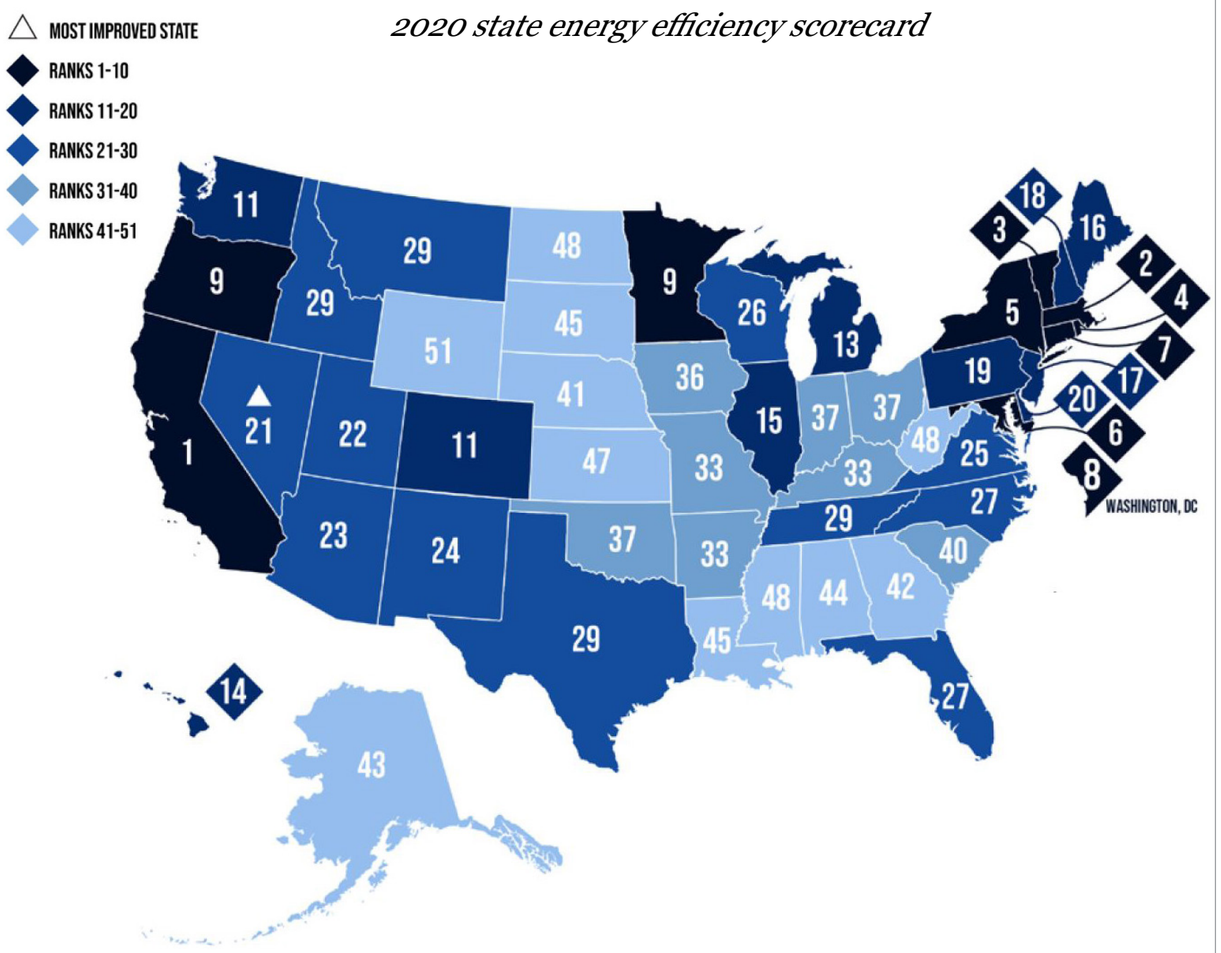
The Zero Energy Performance Index (zEPI)"is an absolute scale with two key points:

- A building with energy use equal to that of an average building in the year 2000 receives a score of 100.
- A building with net zero energy use receives a score of 0.

The zEPI scale extends in a linear fashion between, above, and below those two points."[45]

The graphic to the left highlights where key codes, standards, and initiative goals rank on the scale.

zEPI was incorporated into the 2015 IgCC. The Edison Electric Institute opposes the concept of source energy codes and successfully prevented zEPI's inclusion in the 2017 ASHRAE Standard 189.1 and 2018 IgCC (which wholly incorporated 189.1). zEPI will be part of the 2020 189.1 which will become part of the 2021 IgCC and is also referenced in the Zero Code 2.0.



2020 state energy efficiency scorecard

The map is from "The 2020 State Energy Efficiency Scorecard" report by the American Council for an Energy-Efficient Economy (ACEEE).[46]

Looking broadly at policy areas related to energy, where do states rank on energy efficiency?

Top 5:
- California
- Massachusetts
- Vermont
- Rhode Island
- New York

These rankings are from a 2020 report produced by the American Council for an Energy-Efficient Economy (ACEEE). Their scoring methodology incorporates building energy efficiency codes using the zEPI scale, utility policies, transportation policies, state government-led initiatives around energy efficiency and appliance and equipment standards.[47]

03
CASE STUDIES

The section looks at what can be learned from SmithGroup, Houston, California and the EU with respect to reducing carbon emissions.

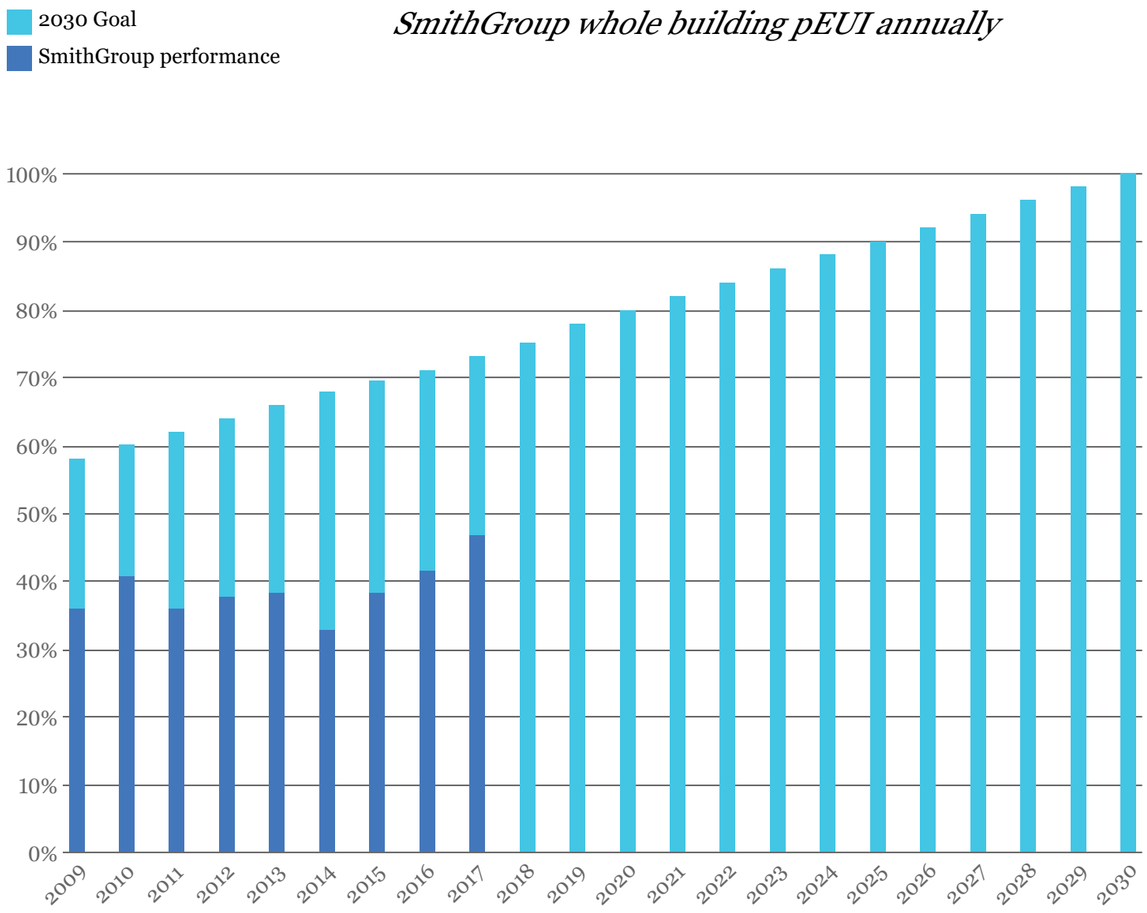


Chart shows SmithGroup's whole building predicted energy use intensity (pEUI).

Building Codes' Impact

In 2003 Edward Mazria introduced the Architecture 2030 Challenge to pursue increasingly stringent energy targets for all new buildings, developments, and major renovations to achieve carbon neutrality by 2030.

SmithGroup was an early adopter, committing to the challenge in 2007. The firm saw its first net-zero energy building certification in 2013 with completion of the Phoenix regional office for DPR Construction. Architect magazine ranked SmithGroup 5th in its top 50 sustainability firms in 2019. As a SmithGroup employee the firm's passion and commitment to designing a better future is evident, though our aspirations have not yet translated to meeting our 2030 commitments.

SmithGroup's 46.7%pEUI in 2017 was its highest to date, but it is estimated that just meeting code would result in a pEUI of 42.5%.

This highlights the importance of advocating for the adoption of increasingly progressive building codes.

Houston is home to one of the largest manufacturing centers of petrochemicals in a state which grants minimal authority to municipalities to enforce the state's Clean Air Act. Houston created its own local version of the Texas Clean Air Act in 2007 which "was struck down by the Texas Supreme Court in 2016 after a prolonged legal fight."[48]

How then had the growing[49] city of Houston with many refineries which fall just outside of its jurisdiction already managed to reduce greenhouse gas emissions by 32% from 2007 to 2014?

“(The Port of Houston) represents Parker's other constituency ... and ... she can't ever hope to exercise control over it. (It) makes her achievements all the more remarkable.”

Excerpt from an NRDC article highlighting Annise Parker's approach to addressing environmental issues in Houston.[50]

Collecting Local Data on Externalities

Instead of relying on state environmental regulators to monitor emissions, one of former mayor Annise Parker's strategies was to invest "$9 million in its own air-monitoring equipment, installing monitors at strategic points near municipal borders "so that we could create our own record of violation and then try to work directly with the plants.""[51]

Increasingly ambitious building energy codes are vital to ensuring a minimum level of progress on reducing emissions. Parker, though, shows us how in the absence of greater legal authority to penalize bad actors open dialogue and leading by example are efficient and effective ways to encourage mutually beneficial behavior when externalities are made clear. Her approach is worth emulating even in regions which have greater legal authority.

The Houston skyline is visible beyond the refineries in the foreground of the Port of Houston accessed by a 50 mile long shipping channel. Image by United States Coast Guard.[52]

That 24% would have been 1,200 million metric tons of carbon emissions or the equivalent to over 10 million barrels of oil consumed. Keep in mind simultaneous to this reduction in emissions from 1975 to 2016 California quadrupled their GDP while the rest of the US had only tripled theirs.

What was unique about the regulatory environment in California over the past 30 or 40 years which allowed for those progressive measures to be adopted?
Especially considering those measures were adopted without that data or precedents to have confidence they would work.

"Had the other 49 states reduced fossil fuel use relative to economic activity at the same pace as California, nationwide carbon emissions would have been lower in 2016 by ... 24%."

A finding in the NRDC's report California Stars: Lighting the Way to a Clean Energy Future.[53]

Key policies adopted

Earl Warren	1947 – 1st State to enact air pollution control statute
Pat Brown	1964 – Nation's (and world's) 1st emissions standards for pollutants from motor vehicles
Ronald Regan	1974 – The Warren-Alquist Act established the California Energy Commission to respond to the energy crisis of the early 1970s and the state's unsustainable growing demand for energy resources.
Jerry Brown	1977 – Nation's 1st energy efficiency standards for appliances
Jerry Brown	1979 – Adopted the 1st state energy-efficient building code
Jerry Brown	1982 – California 1st state "to introduce "decoupling," which incentivized utilities to meet the state's energy needs through efficiency and conservation measures rather than building new power plants.
Arnold Schwarzenegger	2006 – "California passed the most ambitious climate change legislation ever enacted in North America. The Global Warming Solutions Act required California to reduce its greenhouse gas (GHG) emissions to 1990 levels by 2020"
Jerry Brown	2016 – Legislation enacted in 2016 "strengthen this mandated, requiring GHG emissions to decline 40% below their 1990 levels by 2030."

Examples listed from David Vogel's California Greenin color coded to show political party affiliations of the Governor's who signed these into law.[54]

Jerry Brown

Perhaps like me you thought those policies were all legislated in a bastion of liberalism, but I had a Eureka moment when I discovered these regulations were enacted by both liberal and conservative governors.

This changed my thinking.
California is progressive, YES
But radical? NO.

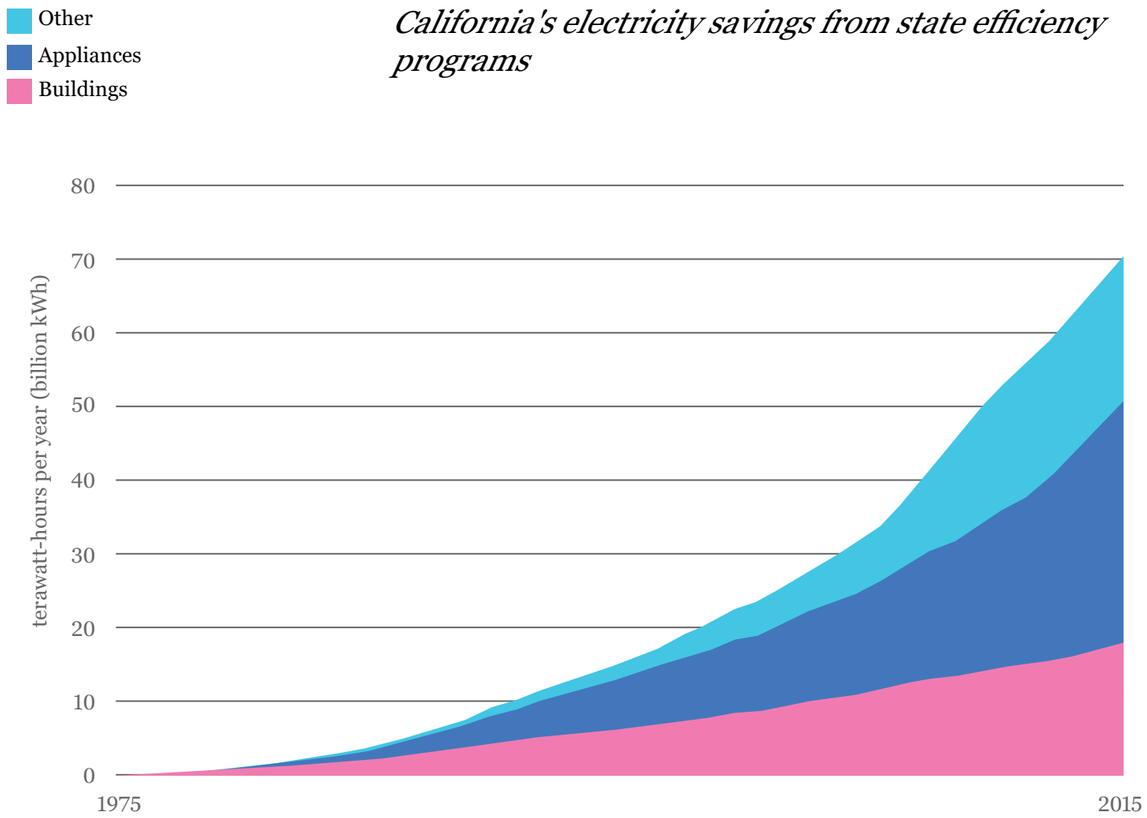
A History of Destruction Curbed -
“Necessity is the mother of invention.” That sums up California’s history. David Vogel’s book California Greenin’ describes rampant destruction necessitating regulatory intervention. Hydraulic gold mining in the 19th century left farmlands covered in toxic sludge The late 19th and early 20th centuries saw a 1/4 of all mature redwoods cut down. By 1972 California’s energy consumption was on pace to need to construct 130 new power plants by 2002.

All of these potential disasters have been avoided because at key moments California enacted public policies that addressed them.

California is a microcosm for where the US is headed.

So which of the policies were most impactful? I posit:
- Performance Standards
- Decoupling

Date Unknown - Title: Among the Redwoods. Ericson Photograph Collection, Humboldt State University Library.[55]



California's electricity savings from state efficiency programs

This graph highlights the cumulative electricity savings in terawatt-hours per year over time from California's state efficiency programs related to buildings, appliances, and other energy policies produced with information from the NRDC's report California Stars: Lighting the Way to a Clean Energy Future and underlying data sourced from the California Energy Commission. [56]

Performance Standards

"They have a bad rep from an age-old and completely upside-down debate about "command-and-control" policy. But we use performance standards all the time, and they work really well. Our buildings don't burn down very much; they used to burn down all the time. Our meat's not poisoned; it used to be poisoned, or you couldn't tell. And so forth. If you just tell somebody, this is the minimum performance required, guess what? Engineers are really good at meeting it cost-effectively.

When you design performance standards, there are a few characteristics that make them work really well. The first, which I emphasize again and again, is continuous improvement. Don't set a quantitative target, set a rate of improvement. It's the gift that keeps on giving. It tells manufacturers, you gotta get better and better and better. It helps them structure their R&D. Maybe most importantly, it uses political bandwidth once and delivers the goods forever.

California's building code gets tighter every three years. It only took one law, in the 1970s, to make that happen."[57]

Decoupling

As mentioned earlier, California was the first state to introduce decoupling in 1982 as part of an ongoing response to avoid building more power plants to meet growing consumer demand.

Prior to this the financial health of gas and electricity companies was tied directly to sales. Decoupling removed that link.

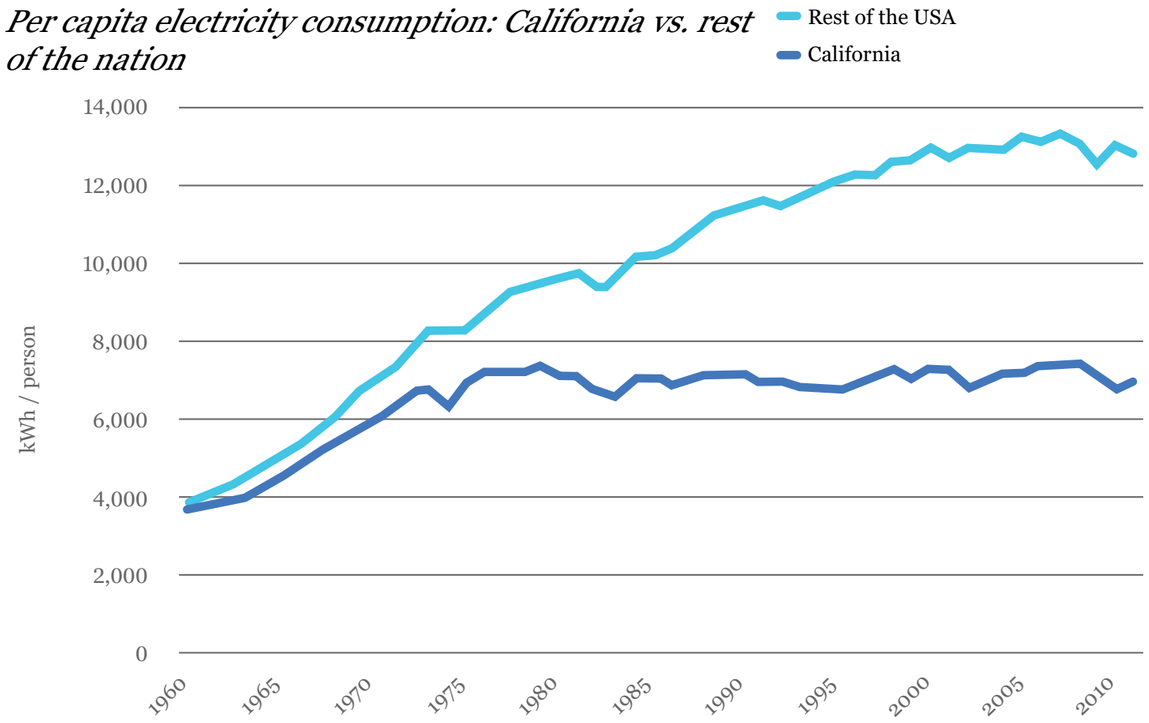
There are two ways to do this:
1. charge for electricity independent of use
2. small annual adjustments in rates which wash out the fluctuation of sales

The first all-you-can-eat rate wouldn't incentivize efficient use of energy by consumers. The second is what California adopted. While it is not a complete solution it addressed the conflict of interest which had stymied progress on incentivizing efficiency in energy production and use.*

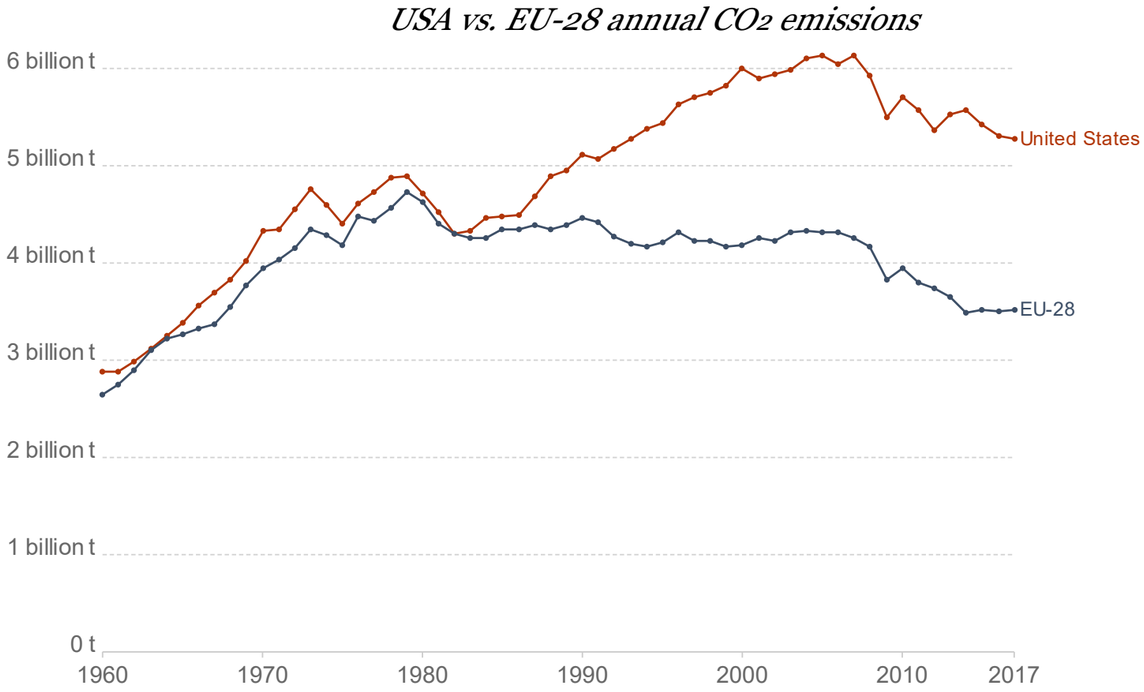
Performance standards in conjunction with decoupling has helped California outpace the rest of the country in its electricity consumption per capita.

* Much of this text is paraphrased from Ralph Cavanagh speaking on a panel discussion at the Bryson Symposium on Climate and Energy Policy in 2018.[58]

Per capita electricity consumption: California vs. rest of the nation



Arthur Rosenfeld, former commissioner of the California Energy Commission, championed causes related to energy efficiency. This graph, often referred to as the "Rosenfeld Curve," depicts electricity use per capita in California has been near flat from 1973 to 2010, whereas use in the rest of the US has risen 50%. The chart was produced with information from the NRDC and underlying data sourced from the EIA, US Census Bureau.[59]



This graph from Our World in Data shows the USA's and EU's CO_2 emissions over time from 'production' (i.e. emissions from the burning of fossil fuels for energy and cement production within its borders). From 1960 to the mid 1980s the two tracked together, but from there forward the EU was able to more consistently make reductions. This graph does not account for 'consumption' emissions. The underlying data for the chart is primarily from the Global Carbon Project and the Carbon Dioxide Information Analysis Centre.[60]

From 2007 to 2017 the EU and US saw similar reductions in CO_2 emissions, 17% and 14% respectively. Yet, when we look at levels in 2017 relative to 1990, we see the EU realized a 21% reduction while the US experienced a 3% increase.

What underlies the EU's sustained success compared to the US?

It is contended this is in no small part due to a stronger adoption of ecological modernization policies.[61]

Ecological modernization, which shares many tenants with sustainable development, is an analytical approach and policy strategy centered around the tenant that the economy benefits from moves towards environmentalism when viewed long-term.

It is worth acknowledging "critics argue that ecological modernization will fail to protect the environment and does nothing to alter the impulses within the capitalist economic mode of production that inevitably lead to environmental degradation."[62]

Irrespective of the existence of altruism, I would counter unenlightened self interest will result in situations worse for all, but enlightened self interest can often be aligned with the common good.[63]

William Forster Lloyd captured the crux of the problem of unenlightened self interest in an 1833 pamphlet using a hypothetical example of over-use of a common resource.

If cattle herders shared "a common parcel of land on which they were each entitled to let their cows graze, ... he postulated that if a herder put more than (their) allotted number of cattle on the common, overgrazing could result. For each additional animal, a herder could receive additional benefits, while the whole group shared the resulting damage to the commons. If all herders made this individually rational economic decision, the common could be"[64] destroyed leaving nothing for grazing for years. A far worse outcome than if they collectively agreed to and followed equitable regulations about grazing resulting in greater and sustained prosperity long-term for all.

I am not suggesting preemptive adoption of regulations where none are seemingly needed to ensure an equitable and sustainable functioning economy, but where unsustainable and unjust externalities benefit a select few to the detriment of many it behooves us all to adopt policies at the broadest scale possible which help ensure our successes are able to be continued.

The EU's Emissions Trading Systems (EU ETS) represents one such attempt in keeping with the principles of ecological modernization.

Carbon pricing is the price for avoided release of CO_2 or CO_2-equivalent emissions. It captures the external costs of emissions, such as "damage to crops, health care costs from heat waves and droughts, and loss of property due to sea level rise."[65]

There are two main types of carbon pricing:

- Emissions trading systems (ETS), also referred to as cap-and-trade
- Carbon taxes

The carbon pricing scheme of Australia provides a cautionary tale. After being introduced in 2012 it was abolished in 2014, "demonstrating that a carbon price design that meets equity and efficiency goals alone is not sufficient, ... politics and political communication are of crucial importance."[66]

There is no one size fits all solution for different political climates. Australia provides a cautionary tale.* Yet, it is apparent that in addition to many "bottom-up" initiatives that exist in the US, success in reducing emissions would be expedited with the adoption of stronger "top-down" ecological modernization policies at the national level which capture the external "costs" of emissions.

* After being introduced in 2012 the Australian carbon pricing scheme was abolished in 2014, "demonstrating that a carbon price design that meets equity and efficiency goals alone is not sufficient, ... politics and political communication are of crucial importance."[67]

Presently 12 states in the US have adopted carbon pricing policies as part of a regional initiative or on their own.[68]

04
RECOMMENDATIONS

Reducing greenhouse gas emissions is a broad and complex topic. This section is not exhaustive, but presents a few recommendations and resources as examples in hopes that it encourages others to develop their own positions and put those into practice and advocate for them.

"Persuading these grocers to divert their garbage has cost Houston nothing, but it will yield a massive environmental dividend."

An excerpt from an NRDC article describing how the City of Houston "helped convince major grocers — including Costco, Sam's Club, and Walmart—to stop sending their food waste to a local landfill and to send it instead to a composting facility equipped to capture the methane this waste gives off as it decomposes."[69]

Methane is second only to carbon dioxide in the amount of warming it is responsible for. Anaerobic digesters are capable of taking organic materials such as food waste and outputting biogas which can be used for heat, cooking, or to create electricity. The digester's biproduct can be used as fertilizer.

Pick low hanging fruit

Addressing climate change will not be easy.

Yet, even today, there are simple actions many people could take which they are not presently. For example, reducing food waste is one of the most impactful ways to reduce greenhouse gas emissions.

Check out Project Drawdown's table of solutions: https://drawdown.org/solutions/table-of-solutions

The solutions can be ordered by their potential impact at reducing emissions or by their related sector. Click on them for additional details. Some of the solutions might jump out to you as something that could be incorporated into your daily habits or work.

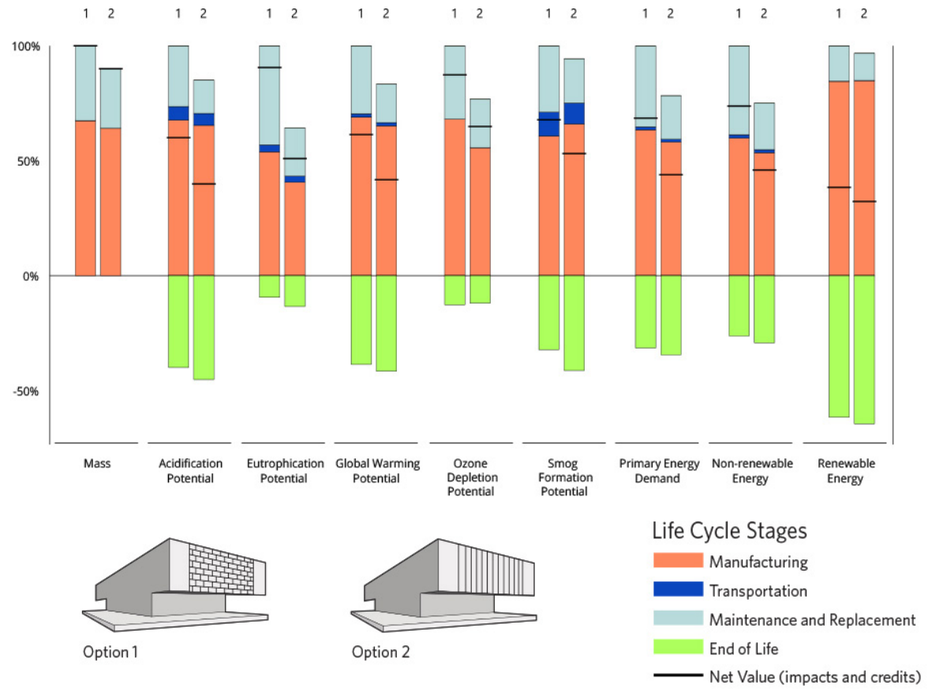
Gamify your design's performance

Identify a target baseline Energy Use Intensity (EUI) based on your project's climate and function.

Model your project's pEUI or Lighting Power Density (LPD) early and often. Play around with different design moves to understand their impact on energy use. Can you beat the target baseline?

Don't stop with a building's energy consumption. Look at the whole picture. Keep in mind a net-zero energy building still has an embodied carbon footprint. It is expected "embodied carbon will be responsible for nearly half of total new construction emissions between now and 2050."[70]

Do a Life Cycle Assessment (LCA) of your project to calculate its environmental impacts. This includes more than just its carbon footprint. Can you reduce your project's energy usage and GHG emissions while balancing budgetary, functional, social, and other constraints and aspirations? For example, if the project site is near a responsibly managed forest would utilizing a mass timber structure be a viable way to reduce emissions and save cost?



KieranTimberlake teamed up with Autodesk to create Tally. This Revit plugin "allows Revit users to imbue their BIM with the complete information about building materials ... their structures will ultimately contain."[71] It allows users to run comparative analyses of different design options' embodied environmental impacts allowing designers and their clients to make more informed decisions at key moments. One Click LCA and the Carbon Leadership Forum's free Embodied Carbon in Construction Calculator (EC3) are examples of other such tools available to design professionals.

Architecture 2030's Achieving Zero website has a collection of policy precedents related to reducing building sector emissions, including 5 specific to embodied carbon.[72]

Push the envelope

Sustainable rating systems and building code advances have done a great job focusing building operators', owners', designers', and builders' attentions on how much energy buildings consume operationally. There still exists a large disconnect, however, when it comes to standards for carbon emissions related to the construction of buildings, production of materials and their transportation. Further research, code and policy development are needed in this vein to encourage positive behaviors here.

Over a million people in Los Angeles live within 500 feet of a freeway, considered to be high-pollution zones. The Bing aerial image shows such an example of residential areas near the 105 and 405 freeways.[73]

"The population near Los Angeles freeways is growing faster than elsewhere in the city as planners push developers to concentrate new housing near transportation hubs."[74] Increasing urban density with viable public transport will help reduce greenhouse gas emissions on the whole, but many minorities and low-income communities "are exposed to substantially more air pollution from cars, trucks and buses than other demographic groups in California."[75] Living near traffic pollution is more likely to result in pre-term births, higher rates of asthma, heart attacks, strokes, and lung cancer.[76]

Be mindful of equity and emissions

There is a mismatch between many countries' greenhouse gas emissions and the burden those countries bear due to collective global emissions.[77] As aforementioned, global warming has exacerbated economic inequality.[78]

This inequality has also been baked into our cities at a granular level. When considering policy implementation make sure to engage your local community to avoid unwittingly perpetuating inequality. Climate policies should consciously strive for and be informed by specific community goals for equity.

Build political will

Though political will for climate action is on the rise in the USA, we saw earlier there is simultaneously a widening gap along party lines.[79]

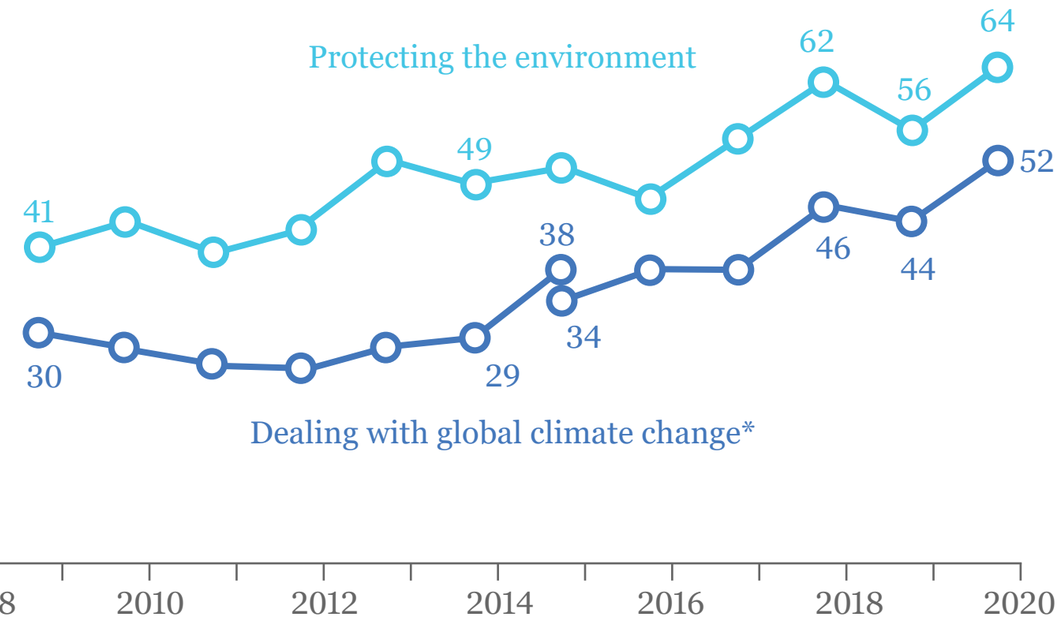
The USA's inconsistent progress at reducing emissions relative to the EU is likely a reflection of that widening gap.

To narrow it proponents of environmental action need to incorporate lessons from linguistics. Doomsday language and moral imperatives are likely to be viewed as tone deaf by those with opposing views.

Although sustainable policies and ecological modernization strategies are seen as a "win-win" for the environment and the economy longterm compared to less progressive measures, "sustainability" has the reputation of being expensive and anti-market in many places.[80, 81]

To increase political will the narrative needs to be reframed around positive solutions which save energy, save resources, and save money.

% U.S. adults who say ____ should be a top priority for the president and Congress



A Pew Center report shows increased support for policies on the environment and climate change since 2011.[82]

* "In 2014 and earlier, respondents were asked about dealing with "global warming." In 2015 half the sample was asked about either "global warming" or "global climate change"; 34% called "global climate change" a top priority while 38% said this about "global warming." Underlying source: Survey of U.S. adults conducted Jan. 8-13, 2020. "As Economic Concerns Recede, Environmental Protection Rises on the Public's Policy Agenda.""[83]

05
TAKE ACTION

This section delves into how to engage in advocacy.
It's easier than you might think.

What is advocacy?

Advocacy is an activity by an individual or group that aims to influence decisions with political, economic, and social institutions.

What sort of activities?

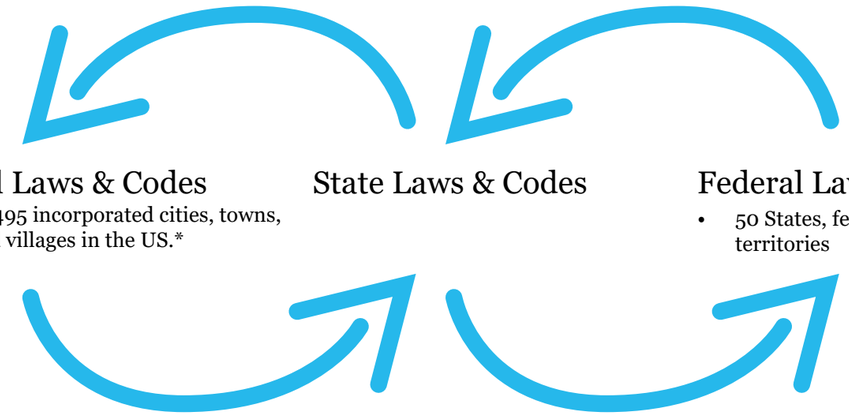
These can include public speaking, public education, research, meeting with elected officials, community leaders, policymakers, and lobbying.*

Why advocacy?

- It is empowering to push for the change one desires to see.
- As a professional you have an important perspective grounded by experiences in your field.
- Citizens have more influence than they realize, and many policies, ordinances, and regulations are legislated at the local level.
- It can be eye opening to engage community stakeholders who might hold different views than you.

* " While all lobbying is advocacy, not all advocacy is lobbying."[84] City's and state's typically require lobbyists to register such as with an ethics commission and its definition often includes compensation. Please note, this handbook is not providing legal advice and an attorney should be consulted for legal counsel.

Diagram of Mutual Influence



* 14,768 of these have populations less than 5,000.
** Federal laws and regulations apply throughout the United States (in every state). Examples of federal laws include patent and copyright laws as well as anti-discrimination, and civil rights laws.

Local reach codes often influence state codes and policies which in turn may influence national policies and laws.

This is in essence the birth story of the California Green Building Standards Code (Title 24 Part 11). It was adopted as mandatory in 2011 due largely to dozens of local governments adopting planning and building code amendments requiring derivatives of LEED or GreenPoint Rated systems.

The 2016 version of T24 required low-rise residential to be "solar ready," but the cities of Santa Monica, Sebastopol, and San Francisco were early adopters of additional solar requirements. Other localities followed, and no doubt played a role in the 2019 T24 requiring low-rise residential to install photovoltaics.

Energy efficiency standards for appliances and requirements that cars be equipped with two-way catalytic converters are examples of innovative California regulations subsequently adopted by the federal government. California's vehicle emissions standards even had international influence. They spurred Germany to support the adoption of similar standards by the European Economic Community.[85]

Developing an Advocacy Plan*:

What issues are important to you?

What is you vision?
(what you want to see in the future)

What is your mission?
(what needs to be done now to achieve the vision)

Who are the stakeholders?

Draft a problem statement.

What is your proposed solution?
(doesn't have to be fully baked)

Is further research on the topic needed?

What is the benefit of your proposal?

What are its drawbacks?

Who are your partners who can help you?
(many industry groups such as the AIA have local advocacy liaisons and government relations teams who might share a common goal with you)

Which groups might hold counter viewpoints?

What are their concerns? How will you address them?

Is there a specific official or agency you are targeting? If elected, are they up for reelection soon?
(City Council, Mayor, State Representative, State Senator, Governor, etc.)
https://www.commoncause.org/find-your-representative/addr/

Who are their constituents?

What related views have they espoused publicly or policies have they supported or opposed?

How will you advocate?
(letter, email, phone call, virtual or in person meeting (advocacy or legislative days are common, city council meeting or planning commission meeting, etc.), social media, public speaking, research, public education, or engaging community groups)

The AIA has made taking action easy.
https://www.aia.org/takeaction
You can push for policies to support energy efficiency, resilience, and other pressing issues. If you click on a topic and input your address your representatives' emails will auto populate. Feel free to modify the AIA's suggested template letters to make them your own.

What is your action plan?

How will you measure your success?

* This advocacy plan referenced many of the suggestions made in the AIA California's publication "The Only Architect in the Room"[86] and the AIA "Citizen Architect Handbook."[87]

Example questions to get the wheels turning:

- Does my city / state utilize decoupling?
- Does my city / state have a climate action plan?
- Does my state have carbon pricing?
- Does my state have renewable portfolio standards (RPS)?
- Does my state have an energy efficiency code? If so, what is it?
- Does my local AHJ / state have a set schedule of code adoptions? Is it intermittent or every 3 years?
- Are there reach codes being deliberated for inclusion in the next code cycle?
- Are there groups tracking decarbonization measures in my state?
- What reach codes make sense for my state or locality to adopt?
- Does my locality have a history of adopting reach codes?
- What are the legal requirements for my locality to adopt a reach code? What is the process for development and adoption?

Though geared towards California this website highlights the general steps: https://www.bayrencodes.org/reachcodes/process-for-reach-code-development-adoption/

This may vary between localities, but typically they must be at least as stringent as the statewide code and shown to be cost effective. Here is such a cost effectiveness study by the city of Palo Alto for example: http://cityofpaloalto.org/civicax/filebank/documents/66742

Approved zero emission building codes in California

Jurisdiction	Approach				Systems			Buildling Types								Add-Ons	
	Natural Gas Infrastructure Moratorium	All-Electric Reach	Electric-Preferred		Whole Building	Water Heating	Space Heating	Low Rise Residential	City-Owned Properties	High Rise Residential	Hotel	Retail	Office	Restaurant	Life Sciences	Additional Solar	Electric Vehicles
Alameda	X			X	X				X								
Berkeley**	X		X	X			X	X	X	X	X	X	X	X	X	X	X
Brisbane		X			X	X	X	X	X	X	X	X	X	X			X
Burlingame		X		X	X	X	X	X	X	X	X	X		X			X
Campbell		X			X	X	X										X
Carlsbad	X	X			X		X									X	X
Cupertino*		X		X			X	X	X	X	X	X	X				X
Davis			X	X			X										
East Palo Alto		X		X			X	X	X	X	X	X		X			X
Hayward		X	X	X			X	X	X	X	X	X	X	X	X	X	X
Healdsburg		X			X	X	X	X	X	X	X	X	X	X			
Los Altos*		X		X	X	X	X	X	X	X	X	X					X
Los Altos Hills		X			X	X	X	X	X	X	X	X	X				
Los Gatos		X		X			X										X
Marin County			X	X			X	X	X	X	X	X	X	X			X
Menlo Park*		X			X	X	X	X	X	X	X	X	X			X	X
Millbrae		X			X	X	X	X	X	X	X	X	X	X			X
Mill Valley			X	X			X			X							X
Milpitas			X	X			X	X	X	X	X	X	X	X			X
Morgan Hill	X			X			X	X	X	X	X	X	X	X			
Mountain View*		X		X			X	X	X	X	X	X	X			X	X
Oakland		X		X			X	X	X	X	X	X	X	X			
Ojai		X		X			X	X	X	X	X	X		X			
Pacifica		X			X	X	X	X	X	X	X	X	X			X	X
Palo Alto*		X	X	X			X	X	X	X	X	X	X	X			X
Piedmont		X		X			X									X	
Redwood City*		X		X			X	X	X	X	X	X					X
Richmond		X		X	X	X	X	X	X	X	X	X					X
San Anselmo			X	X			X	X	X	X	X	X	X	X			
San Francisco**	X		X	X			X	X	X	X	X	X	X	X		X	X
San Jose**	X			X			X	X	X	X	X	X	X	X		X	X
San Luis Obispo			X	X			X	X	X	X	X	X	X	X		X	
San Mateo**		X		X			X		X			X				X	X
San Mateo County		X		X			X	X	X	X	X	X	X				X
Santa Cruz	X			X			X	X	X	X	X	X		X			
Santa Monica			X	X			X	X	X	X	X	X	X	X		X	X
Santa Rosa		X		X			X										
Saratoga		X			X	X	X	X	X	X	X	X	X	X			X
Sunnyvale*		X		X			X	X	X	X	X	X	X	X			X
Windsor		X		X			X										

* Council went beyond staff recommendation
** Multiple ordinances passed to strengthen/expand scope

BUILDING DECARBONIZATION COALITION

This matrix from the Building Decarbonization Coalition tracks local zero code amendments which have been adopted in California.[88] Look to see if there are groups tracking decarbonization efforts in your state.

Tips for engaging policymakers and legislative staff:

DO:

Introduce yourself.
Don't assume they know you. Let them know about your expertise in the field.

Be courteous.
We are often asking something from legislators, thank them for their work.

Be specific.
When you do ask for something don't be vague. Make specific requests about a policy or bill.

Be concise.
You will likely have a few minutes to pitch max, boil it down to 1 or 2 requests.

Be flexible.
Policymakers' schedules often have to change frequently.

Listen.
If you are stuck thinking about what you will say next you might miss a key insight. Pay special attention to counter viewpoints and take them in fully before responding.

DON'T:

Feel slighted.
Your conversation might be rushed. You may meet only with a staff member. Don't fret, many times key staff members do the real work on pushing policies through. Seize the opportunities presented.

Feel the need to know everything
Don't make up answers on the spot. If you don't know something you can acknowledge that and offer to research or consult with others to fine tune your request.

Discuss Money
Keep campaign and fundraising conversations separate from your advocacy.

Be dry.
Don't just read from a script. Weave in your story.*

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* These tips are adapted from the AIA California's publication "The Only Architect in the Room."[89]

GLOSSARY

Carbon capture and sequestration (CCS)
Carbon capture and sequestration is a set of technologies aimed at sequestering carbon and thereby reducing its potential to warm temperatures. It is a 3 step process which includes capture of carbon usually from large point source emitters such as power plants or cement factories, transport of the captured carbon, and lastly sequestration which is typically done through injection into deep geological formations or in the form of mineral carbonates.

Carbon cycle
The term used to describe the flow of carbon in various forms through the atmosphere, terrestrial biosphere, oceans, and the lithosphere.

Carbon dioxide (CO_2)
Carbon dioxide is a gas which occurs naturally, and a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal human caused greenhouse gas which affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and thus has a GWP of 1.

Carbon footprint
The total amount of greenhouse gases emitted into the atmosphere each year by a person's or entity's activities.

Carbon price
The price for avoided release of CO_2 or CO_2-equivalent emissions. This may refer to the rate of a carbon tax, or the price of emission permits.

Carbon sequestration
Carbon sequestration or carbon dioxide removal (CDR) refers to the storage of carbon which would otherwise be released into the atmosphere. Terrestrial, or biologic, carbon sequestration is the process by which trees and plants absorb carbon dioxide, release the oxygen, and store the carbon. In addition to carbon sinks such as oceans, forests, and soils there are technologies aimed at capturing and sequestering carbon, see CCS.

Climate
The usual weather conditions prevailing in an area. The conventional period for averaging weather variability is over a 30-year period.

Climate change
Climate change refers to a change in the state of the climate that persist for an extended period, typically decades or longer. Climate change may be due to natural processes or anthropogenic changes. Often the term is used to describe changes to the climate attributed directly or indirectly to human activities.

Decarbonization
Reducing carbon is a literal reading of the term. In the context of addressing global warming, the term is used to describe the process by which entities or individuals aim to achieve a low-carbon or CO_2-free economy.

Decoupling
In the context of energy markets, decoupling is a regulatory mechanism that removes the pressures on utilities to sell as much energy as possible by eliminating the relationship between revenues and sales volume. Under this system, revenues are “decoupled” from sales and are instead allowed to adjust so that utilities receive fair compensation regardless of fluctuations in sales.*

* Sometimes in the context of climate change decoupling is described as when economic growth is no longer linked with the consumption of fossil fuels. I encourage that in such usage of the term sufficient context is provided to avoid oversimplifications about the implied cause or correlation of increasing or decreasing economic growth or fossil fuel usage.

Ecological modernization
Ecological modernization is the school of thought that argues the economy benefits from moves towards environmentalism.

Embodied carbon
In the context of the building industry this is the total GHG related to the mining, manufacturing, transport, and installation of building materials.

Energy use intensity (EUI)
Energy use intensity is an indicator of the energy efficiency of a building's design and/or operations. EUI is calculated by dividing the total energy use in one year by a building by its gross floor area.

Externality
In economics, an externality is the cost or benefit that is imposed by one or several parties on a third party who did not agree to incur that cost or benefit.

Global warming
Global warming refers to the gradual increase in global surface temperature. Often "global warming" is used to reference the warming which is the result of increased emissions from human activities.

Global warming potential (GWP)
An index measure of the total energy that a gas absorbs over a period (typically 100 years), relative to that of carbon dioxide.

Greenhouse effect
The process that occurs when gases in the Earth's atmosphere trap the Sun's heat. The process makes Earth much warmer than it would be without an atmosphere. Often "greenhouse effect" may be used to refer to the greenhouse effect in the absence of human activities or the increased greenhouse effect because of human activities.

Greenhouse gas (GHG)
Gases in the atmosphere which absorb and emit radiation. Water vapor, carbon dioxide, nitrous oxide, methane, and ozone are the primary gases in the Earth's atmosphere.

Life cycle assessment (LCA)
A life cycle assessment is a methodology for assessing environmental impacts associated with all stages of the life-cycle of a commercial product, process, or service.

Negative emissions
The term "negative emissions" connotes the opposite of emissions. It is used to describe removing carbon dioxide from the atmosphere and sequestering it, typically through biological "sinks" and CCS technologies.

Net zero emissions
Net zero emissions are achieved when GHG emissions from human activities are balanced globally by anthropogenic removals over a specified period.

Renewable energy
Renewable energy, often referred to as clean energy, comes from natural sources or processes that are replenished. Solar, wind, hydroelectric, tidal, biomass, and geothermal are examples of types of renewable energy sources.

Renewable energy certificate (RECs)
Renewable energy certificates are a market-based instrument that certifies the bearer owns one megawatt-hour (MWh) of electricity generated from a renewable energy resource.

Resilience
The capacity of social, economic, and environmental systems to anticipate, prepare for, reorganize or respond to a hazardous event or significant threat in ways that maintain their essential function and capacity for adaptation, learning, and transformation.

Triple bottom line (TBL)
The triple bottom line is an accounting framework which posits that instead of one bottom line there should be 3: profit, people, and planet. The framework seeks to gauge corporations' social, environmental (or ecological) and financial performances.*

This section referenced information from the EPA[90], AIA California[91, 92], USGCRP[93], IPCC[94], C2ES[95], NRDC[96], Investopedia[97], and Wikipedia[98, 99] to compile this glossary of terms.

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