THE GREAT GREEN DEBATE

The Ongoing Green Energy Debate
Facts, Questions, Testimony, and more

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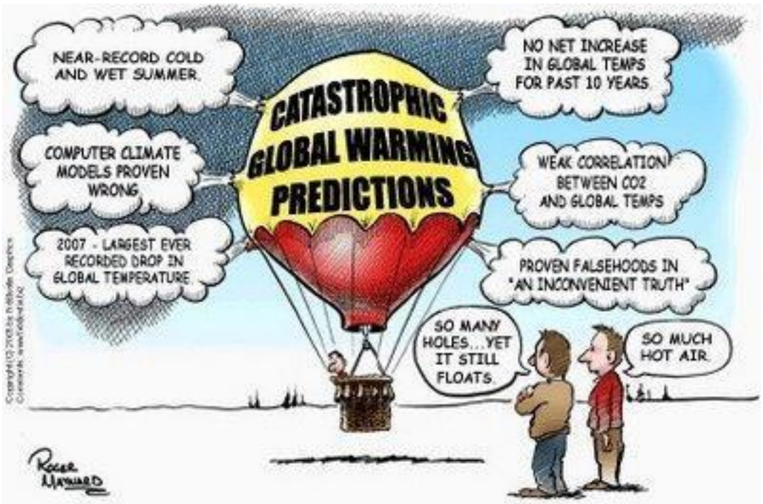

With so many people on both sides of the climate change issue, the public is now unsure of what is real or not.

We have been told for decades to trust the science. "The science is settled." But then health officials told us to trust the science during Covid, most of which was proven wrong later. Now, more and more information is finally being made public, and even the biggest climate activist, Bill Gates, has done an about-face, and now says there is no concern for "humanity's demise."

The following pages will offer just a portion of the information related to the climate change issue, specifically regarding global CO_2 atmospheric concentrations, with some data on temperatures. It's absolutely time for us to start having reasonable debates, without the partisan rancor. For decades, anyone that disagrees with the climate change activists were labeled as climate change deniers and worse. This type of disagreement should be squelched, and calmer heads need to prevail.

We invite everyone to explore this topic on their own. Think of it in the way they score ice skating events: throw out the highest and the lowest score, and look for the average in between. It has been extremely difficult to do any normal research, and find any article or document that isn't extremely slanted to one side. While some of us may have a differing opinion, our goal is not to get everyone say there's no climate change. Quite the opposite. We believe in carbon neutrality and that net zero (while very lofty) is a good goal. But, our concern is how the extremists tend to want to simply throw money at things, even if we don't know if the results would be what's hoped for.

In our own little way, our company offers unique and innovative solutions that will eliminate a variety of waste materials in an eco-friendly manner and generate clean energy. In addition to that, we also believe in the use of solar and wind, just not to count on it as a primary supply of electricity. With the very low return on investment (ROI), and the extreme level of unreliability, wind and solar are not good solutions to replace fossil fuel-generated electricity and are intermittent suppliers, not base-load producers. Please see our document: ***Wind and Solar and Vortex (oh my!).pdf*** that can be found on our website under the Resources tab, and by clicking on Current Activities.

Historic Temperature and Atmospheric CO2 Concentration – 485 Million Years Ago to Present

The Earth is approximately 4.54 billion years old, and dinosaurs lived during the Mesozoic Era, from about 245 to 66 million years ago. The era ended with the Cretaceous-Paleogene extinction event, which wiped out all non-avian dinosaurs.

- **Earth's age**: The best estimate for Earth's age is approximately 4.54 billion years.
- **Dinosaur era**: Dinosaurs lived during the Mesozoic Era, which lasted from about 245 to 66 million years ago.
    - **Early dinosaurs**: The earliest known dinosaur-like reptiles appeared around 240 million years ago.

Scientists now have:

- A new global temperature curve (PhanDA) for the last 485 million years.
- Several large CO_2 compilations for the last 420–540 million years (Royer, Foster & Lunt, Franks et al., and the new Cenozoic CO_2 Proxy Integration Project).

1. How we know: methods & uncertainties

Temperatures (GMST)

For deep time, we can't stick thermometers into rocks, so we use **proxies**:

- **Oxygen isotopes ($\delta^{18}O$) in marine carbonates** – colder water → more ^{18}O in shells.
- **"Clumped" isotopes** in carbonates – temperature-dependent bonding of heavy isotopes.
- **Mg/Ca ratios** in foraminifera – warmer waters → more Mg in shells.
- **Organic proxies** like TEX_{86} from archaeal lipids.

The new **PhanDA** reconstruction (Judd et al., 2024) statistically combines >150,000 proxy data points with climate model simulations for many past continental/CO_2 configurations. It finds that over the last **485 Myr**:

- GMST ranged roughly **11–36 °C** (today ≈ **15 °C**).
- Earth spent **more time in warm "greenhouse" states** than in cold "icehouse" states.

Crucially, the authors emphasize *uncertainty bands* of several degrees for many intervals.

CO_2

Deep-time CO_2 is reconstructed from a mix of:

- **Stomatal density/indices** on fossil leaves (more stomata → lower CO_2).
- **Boron isotopes ($\delta^{11}B$)** in plankton shells (pH → dissolved CO_2).
- **Paleosol (ancient soil) carbonates** and their carbon isotopes.
- **Alkenones and phytoplankton carbon isotopes** (CO_2-dependent fractionation).
- **Carbon-cycle models** (e.g., GEOCARB family) tuned to these proxies.

Key syntheses:

- **Foster, Royer & Lunt 2017**: CO_2 over last **420 Myr** fluctuates from about **200–400 ppm in cold "icehouse" phases** up to roughly **2,000–3,000 ppm during warm "greenhouse" phases**.
- **Franks et al. 2014**: for much of the post-Devonian Phanerozoic, long-term CO_2 lies **mostly between ~200 and 1,000 ppm**, with occasional excursions above 1,000 ppm.
- **CenCO$_2$PIP (Hönisch et al. 2023)**: a detailed **66-Myr CO_2 history**, showing peaks up to **~1,600 ppm** in the early Eocene and values **below 300 ppm during the last 2.6 Myr**; pre-industrial was **≈280 ppm**, 2022 was **419 ppm**.

Again, these are **probability distributions**, not single "true" numbers.

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2. 245 million years of temperature & CO_2 (very approximate timeline)

Anchor point: Modern GMST ≈ **15 °C** and pre-industrial CO_2 ≈ **280 ppm**; current CO_2 ≈ **420+ ppm** and GMST ≈ **+1.1 °C** above late-19th-century.

Below, "GMST" is approximate global mean surface temperature, and "CO_2" is a typical proxy *range*.

Mid–Late Triassic (≈245–201 Ma)
Context: After the end-Permian mass extinction (~252 Ma), the **Triassic** was a long recovery interval with **hot, generally arid "Pangea" climates**.

- **GMST**:
  - PhanDA shows the Triassic mostly in a **warmhouse** state, with GMST roughly **20–25 °C**, probably several degrees warmer than most of the Cenozoic.
- **CO_2**:
  - Late Triassic reconstructions from paleosols and leaf proxies suggest CO_2 often **>1,000 ppm**, with excursions that may reach **~2,000 ppm**, though some models argue for somewhat lower caps (≲1,500 ppm).

Broadly: **hot world, high CO_2, no permanent polar ice**.

Jurassic (201–145 Ma)
The **Jurassic** sees the break-up of Pangea, expansion of shallow seas, and generally warm conditions.

- **GMST**:
  - PhanDA indicates **persistently warm greenhouse conditions**, typically **around 20–24 °C**, warmer than today but not as extreme as later mid-Cretaceous peaks.
- **CO_2**:
  - Syntheses of proxies/geochemical models suggest **~600–1,500 ppm**, with considerable scatter; values **below ~1,000 ppm** may mark relatively cooler, non-glacial intervals.

Net picture: **Warm oceans, little or no ice, elevated CO_2.**

Cretaceous (145–66 Ma)

The **Cretaceous**, especially its middle part, is one of the warmest intervals of the last few hundred million years.

- **GMST**:
  - PhanDA shows a rise into a **hothouse** state, peaking in the **Turonian (~94 Ma)** at GMST up to **~30–36 °C**, i.e., **15–20 °C warmer than today**.
- **CO_2**:
  - Some classic estimates for the **mid-Cretaceous** allowed CO_2 up to **~3,000–4,000 ppm**, but more recent proxy work often finds **~400–1,500 ppm** for much of the interval, depending on the method and time slice.

  - Modeling of the "super-plume" tectonic episode suggests CO_2 **3.7–14.7× pre-industrial**, i.e. **~1,000–4,000+ ppm**, but those are scenario calculations rather than direct measurements.

So for a **ball-park**: mid-Cretaceous GMST ≈ **25–30+ °C**, and CO_2 is very likely in the **high hundreds to low thousands of ppm**.

Paleocene–Eocene (66–34 Ma)

After the dinosaur-killing impact (66 Ma), the **early Cenozoic** remained warm.

- **GMST**:
  - PhanDA and other marine proxies show GMST mostly **5–10 °C warmer than today**, with especially hot conditions during the **Paleocene–Eocene Thermal Maximum (PETM, ~56 Ma)** and the **Early Eocene Climatic Optimum (EECO, ~52–50 Ma)**. PETM warming was about **+5–8 °C** in a few thousand years.
- **CO_2** (CenCO_2PIP):
  - PETM spike: CO_2 probably exceeded **1,000 ppm**.
  - EECO peak: mean CO_2 around **~1,600 ppm**.
  - Middle–late Eocene: gradually falling into roughly **800–1,100 ppm**.

Still essentially a **greenhouse world**, with **no large permanent ice sheets**.

Oligocene (34–23 Ma)

The **Oligocene** marks the transition to the icehouse world we know today.

- **GMST**:
  - PhanDA and $\delta^{18}O$ records show a notable cooling, with GMST dropping toward **~18–20 °C**, closer to, but still warmer than, modern conditions. Antarctic ice sheets appear and grow.
- **CO_2**:
  - CenCO_2PIP shows CO_2 falling from Eocene levels down into the **~400–700 ppm** band (with method differences and uncertainties).

Key shift: **CO_2 crosses a threshold low enough for large polar ice sheets to be stable**, pushing Earth into an **icehouse** regime.

Miocene (23–5.3 Ma)
The **Miocene** has both warm pulses and cooling trends.

- **GMST**:
  - Early–mid Miocene Climatic Optimum (~17–15 Ma) probably **2–4 °C warmer than pre-industrial**; later Miocene cools toward near-modern values.
- **CO_2**:
  - A combination of marine and terrestrial proxies suggests **~400–600 ppm** during the warm Miocene optimum, declining to **~250–400 ppm** later.

We're in an icehouse overall, but with **substantial warm episodes** when CO_2 creeps higher.

Pliocene (5.3–2.6 Ma)
The **mid-Pliocene** is often used as a partial analog for near-future warming.

- **GMST**:
  - Best estimates: **~2–4 °C warmer than pre-industrial**, with reduced ice and much higher sea level.
- **CO_2**:
  - CO_2 generally **~360–400 ppm**, similar to or slightly below present values; sea level was at least **15–25 m higher** than today.

So today's CO_2 levels are roughly **Pliocene-like**, but we haven't yet had time to fully realize the long-term warming and sea-level response.

Pleistocene–Holocene (2.6 Ma–present)
The last couple million years are dominated by **glacial–interglacial cycles** driven by orbital (Milankovitch) forcing, with CO_2 acting as an amplifier.

- **GMST**:
  - Glacial maxima are roughly **4–6 °C colder** than pre-industrial; interglacials are comparable to or slightly warmer than the late-19th-century baseline.
- **CO_2**:
  - Ice-core records show CO_2 swinging between **~180 ppm (glacials)** and **~280 ppm (interglacials)** over the last **800,000 years**.
  - Modern: **>420 ppm**, higher than at any time in at least **2.6 million years**, and likely higher than any time in the **last 14–20 million years** based on multiple proxies.

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3. Putting it together: rough summary table

All numbers below are *approximate ranges* drawn from the reconstructions above. Think of them as **order-of-magnitude guides**, not precise measurements.

Interval (Ma ago)	Geologic slice	Approx GMST (°C)	Approx CO_2 (ppm)	Climate state (broad)
245–201	Mid–late Triassic	~20–25	~1,000–2,000 (spikes possibly higher)	Warm greenhouse, no large ice sheets
201–170	Early–mid Jurassic	~20–24	~600–1,500	Warmhouse
170–145	Late Jurassic	~22–26	~600–1,200	Warmhouse
145–100	Early Cretaceous	~22–28	~500–1,500	Warm greenhouse
100–66	Mid–late Cretaceous (incl. CTM)	~25–30+; Turonian peak up to ~30–36	~600–1,600+ (some models up to ~3,000+)	Hothouse; very warm oceans
66–56	Paleocene	~18–22	~400–800	Warm, cooling slightly from Cretaceous
56	PETM spike	+5–8 above an already-warm baseline → low–mid 20s	>1,000	Short, extreme warming pulse
56–50	Early Eocene Climatic Optimum	~23–28	Peak around ~1,600	Hothouse; no polar ice
50–34	Middle–late Eocene	~18–24	~800–1,100 → trending lower	Gradual cooling toward icehouse
34–23	Oligocene	~18–20	~400–700	First large Antarctic ice sheets
23–15	Early Miocene	~17–19	~350–500	Cool icehouse with warm episodes
17–15	Miocene Climatic Optimum	~17–19 (≈2–4 above pre-industrial)	~400–600	Shorter warm phase within icehouse
15–5.3	Late Miocene	~15–17	~250–400	Gradual cooling
5.3–2.6	Pliocene	~17–19 (≈2–4 above pre-industrial)	~360–400	Warm icehouse; sea level 15–25 m higher
2.6–0.01	Pleistocene	~9–15 (glacial–interglacial range)	~180–280	Glacial cycles, expanding/retreating ice sheets
0.01–0	Holocene to present	~14–16; now ≈1.1°C above 1880s	280 → >420 today	Human-driven warming superimposed on an icehouse world

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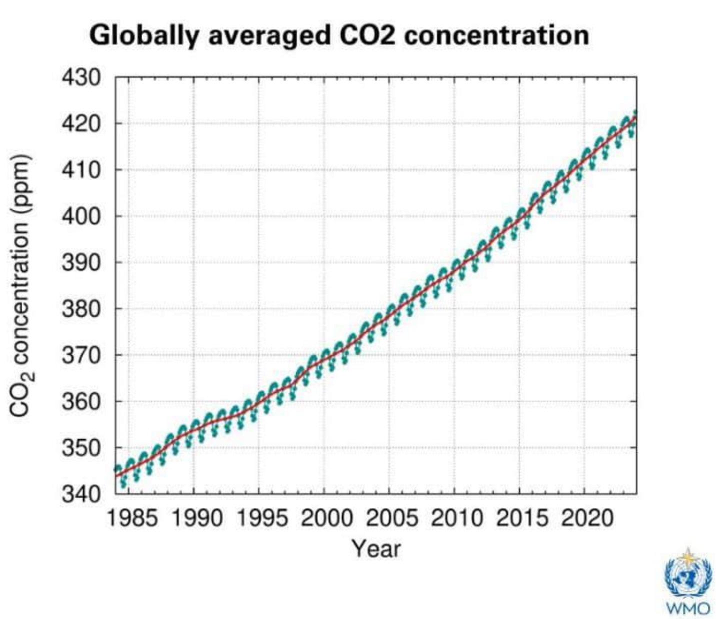
4. Where to get the actual curves

If you'd like to **plot or analyze the full time series**, these are good starting points:

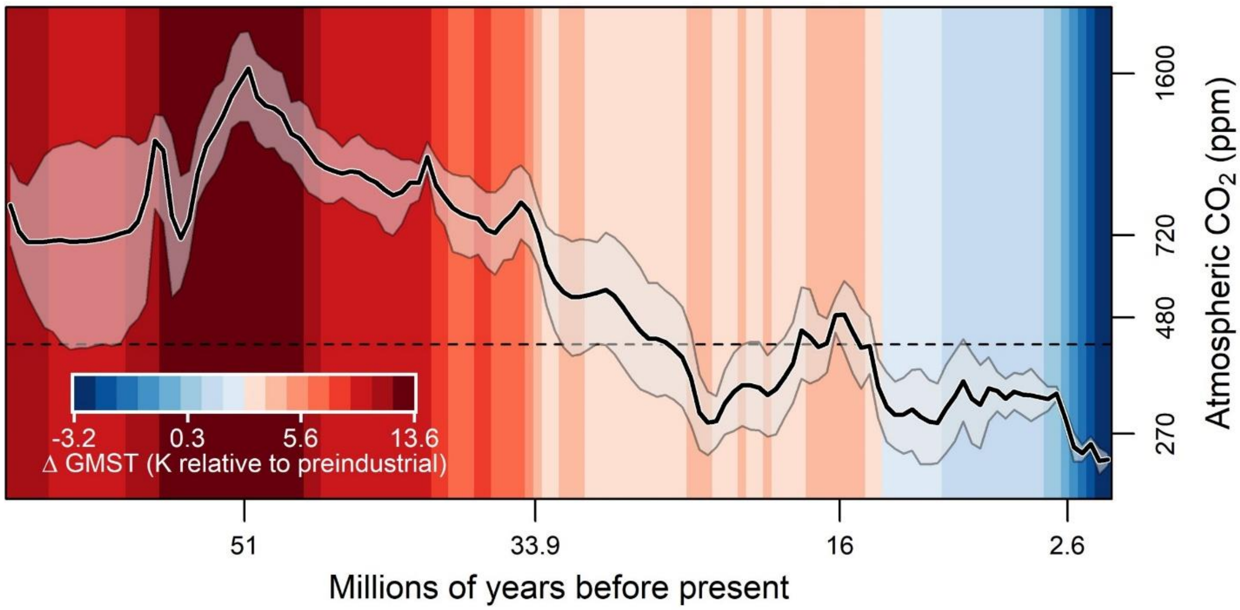
- **Global temperature (GMST)**
    - Judd et al. 2024, *A 485-million-year history of Earth's surface temperature* (PhanDA). Supplementary data provide the GMST time series used in the new reconstructions.
- **CO_2 over 420–540 Myr**
    - Foster, Royer & Lunt 2017, *Future climate forcing potentially without precedent in the last 420 million years* – includes a curated Phanerozoic CO_2 compilation.
    - Royer et al. 2006 data file at NOAA's NCEI with hundreds of Phanerozoic CO_2 proxy points ("royer2006co2.txt").
- **Cenozoic (last 66 Myr) CO_2**
    - CenCO_2PIP (Hönisch et al. 2023), *Toward a Cenozoic history of atmospheric CO_2* – probably the best current summary for 66–0 Ma, with downloadable composite curves.
- **Context on paleoclimate & proxies**
    - NOAA Paleoclimatology "Paleo Perspective on Global Warming."
    - IPCC AR4 Chapter 6 "Palaeoclimate," especially figures summarizing CO_2 and temperature over the last 65 Myr.

One of the biggest issues related to climate change is the fact that the data is all over the place. Public trust in the data began falling rapidly in 2009 with the Climategate exposure. Those wanting to cling to their previous doom and gloom predictions, were actually more upset with the fact that someone hacked the servers at East Anglia University in England, and not about the content. The famous "hockeystick" controversy soon spread globally, and was debunked. Following are some charts to better help us understand the issue of CO_2 atmospheric concentrations.

Short-termed data currently used by most climate activists:



Expanded out a bit further:



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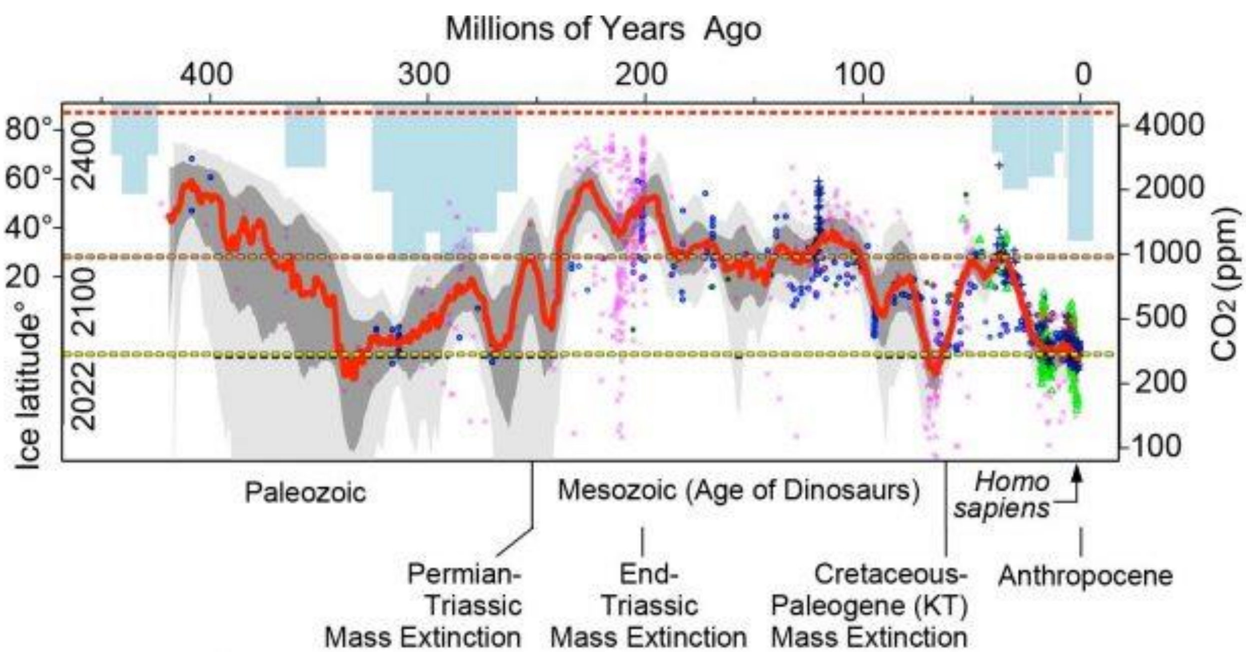

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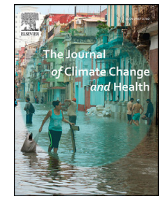

Research article

Present and future sea level rise at the intersection of race and poverty in the Carolinas: A geospatial analysis

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A B S T R A C T

Sea level rise (SLR) has and will continue to impact coastal communities in the coming decades. Despite the widespread availability of data on SLR projections, little is known about the differential impact of SLR on minority or economically disadvantaged populations. In this study, we aim to identify the geographic areas in which low-income and communities of color along the North and South Carolina coastline in the United States will experience the most severe effects of SLR. Geospatial mapping was performed to estimate the total area impacted by 1) SLR, 2) tidal inundation, and 3) low-lying areas separately for three scenarios (0-, 2-, and 4-feet). Findings project that over 2.2 million people and at least 370,000 Black or economically disadvantaged individuals will be impacted by SLR by 2100. Results showed that the most economically deprived and racially segregated communities are already experiencing the effects of SLR, including more frequent tidal inundation and low-lying flooding. Inland flooding is seven times more likely to occur in low-income Black communities compared to high-income white communities. Findings highlight the urgent need for additional resources and adaptive measures that target low-income, black communities who will continue to be disproportionately impacted by SLR in coastal Carolina.

Background

Rising sea levels pose significant threats to coastal communities [1-3]. One of the most obvious effects of SLR is the increased spatial extent of flooding at high tide during normal conditions. For this analysis, we define tidal inundation as the continuous flooding along the receding shoreline, while inland flooding refers to the sporadic flooding of low-lying areas further inland. In the Carolinas, projections indicate that sea levels will rise an estimated 1.3 to 2.4 feet under a moderate emission scenario and up to 2.0 to 3.6 feet under a high emissions scenario by 2100 [2,5]. The combined effects of low-lying topography, subsidence (i.e., sinking of land), and a heavily developed coastline make North and South Carolina in the United States particularly vulnerable to tidal inundation and inland flooding. While the effects of sea-level rise (SLR) will be experienced differently along the coastline [2], few studies have explored the present and future impact on low-income and racially segregated non-Hispanic Black communities in the Carolinas.

Although coastal communities must make difficult decisions to mitigate, adapt, or retreat from receding shorelines [1], there are few state and federal resources that help measure the impacts of SLR and develop targeted adaptation plans. Decisions will be made based on localized impacts and available funds [5], and costs will not be evenly distributed across coastal populations. Developed beach-front property typically has higher property values and more affluent residents, while more disadvantaged populations tend to reside further inland and generally have fewer mitigation options due to poverty and political marginalization [7]. Therefore, SLR's effects are likely to be felt harder in low-income communities or communities of color because they typically don't have the financial means to employ expensive mitigation methods, relocate, or repair home-related damages.

Similar to other climate change threats, SLR acts as a "risk-amplifier" for health impacts by exacerbating existing environmental, socio-economic, and health disparities. Increased coastal flooding and storms from SLR create greater health-related challenges for low-income and minority communities including food security [4,6], availability of safe, reliable drinking water, loss of infrastructure and income, and adverse effects on mental health and disease transmission [8–10] Climate change in addition to race and poverty have been cited as important social determinants of population health that influence individual and community-level vulnerability to climate drivers (e.g., SLR) [11].

Although SLR has been widely studied, there has been considerably less research examining the societal impacts, particularly

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through the lens of poverty and race, at the regional level. The objective of this study was to quantify the present and future spatial extent of SLR in coastal North and South Carolina, while capturing the number of individuals living in extreme poverty and/or racially-segregated communities that will likely be impacted by future SLR throughout the century.

Methods

Study area

Our study area consisted of the entire coastline for both North and South Carolina in the United States (Fig. 1). The area was selected based on the region's susceptibility to tidal inundation and inland flooding, a heavily developed coastline, and stark contrasts of socioeconomic status among coastal communities. Like other southern states, NC and SC experience higher poverty rates than the national average (10.5%), with 13.6% of NC residents and 13.8% of SC residents living in poverty [19]. In NC the most common minorities are Black (22.2%) followed by Hispanic (9.8%), whereas SC has a higher Black population (27%) and smaller Hispanic population (6.0%) [19].

North Carolina's (NC) coastline can be divided into two provinces which exhibit distinct geology and very different coastal zones. The Northern province is classified by gentle gradients and low-lying slopes, a broad coastal plain and long barrier islands, while the Southern province exhibits rocky, steep slopes and short barrier islands [2].

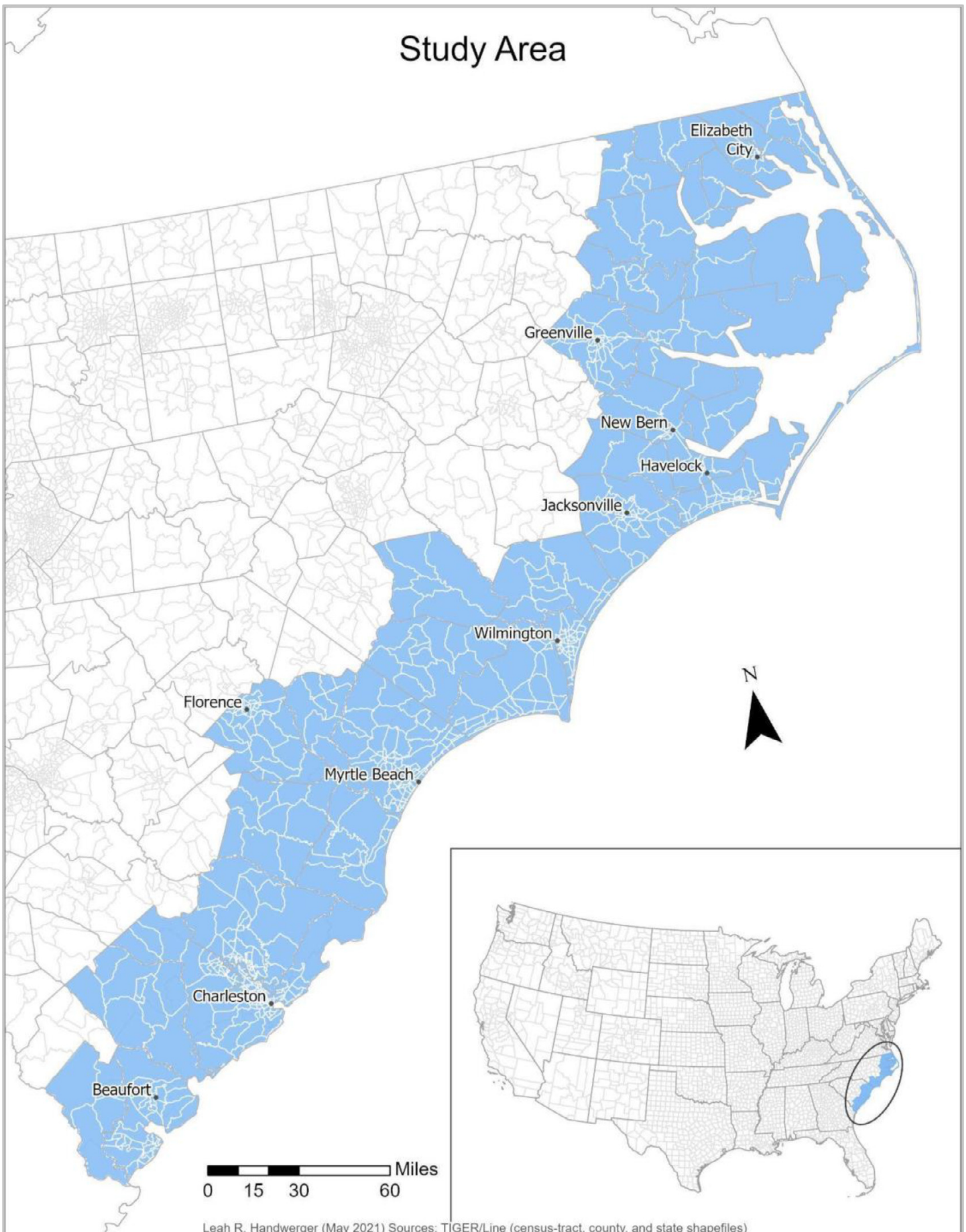

Fig. 1. Study area of the coastline of North and South Carolina.

The Northern province experiences subsidence of approximately 4 inches per century, and the Southern province exhibits an uplift of about 1 inch per century [2]. South Carolina's (SC) coastline gradually shifts from rocky topography to a large estuarine system with gentler slopes and short and thick barrier islands [14]. Particularly in the southern half of SC, which includes the heavily-developed metropolitan area of Charleston, exhibits subsidence as much as 1 inch every twenty years [15]. SC's sea level has risen 10 inches since 1950, and in the last ten years has risen 1 inch every two years [11].

Sea level rise

Inundation is the most expensive and deadly effect of SLR [16], and areas that are heavily developed with high population density are most vulnerable [17]. To measure the severity of inundation and inland flooding, we used the NOAA SLR Database [18], which contains shapefiles for current 0-ft SLR conditions and 1-foot increments of projected SLR above current Mean Higher High Water conditions. These files were constructed by NOAA utilizing Digital Elevation Models of the area and a tidal surface model that represents spatial tidal variability [18].

Index of concentration at the extremes

American Community Survey (ACS) 5-year (2015-2019) estimates for census-tracts were used to calculate the Index of Concentration at the Extremes (ICE), which quantifies the concentrations of top versus bottom distributions for racial segregation, income disparities, and combined racial segregation and income disparities [12,13]. ICE takes the total population from the most privileged and deprived extremes to calculate a value that ranges from -1 and 1, where -1 indicates 100% of the population was concentrated in the most deprived group, Quintile 1 [13]. Unlike other indices that quantify racial and income inequalities (e.g., the Gini Index, Index of Dissimilarity), ICE is praised for its effectiveness for analyzing societal distributions across both small and large spatial scales [13].

In addition to ICE, data on socioeconomic variables were compiled to estimate the present and future impacts of SLR on social determinants of health in coastal communities [19]. We pulled census variables that are known to influence vulnerability to exposure and adaptive responses to climate hazards, such as: poverty status, percent of Black and Hispanic populations, female-headed households, percentage of children and aging populations (over 65), percentage of populations with low English proficiency, percent without health insurance, educational attainment with high school or less, percentage of disabled population, and percentage of rented households [20]. These variables were imported into ArcGIS Pro and joined with SLR shapefiles for each increment of SLR (0-, 2-, and 4-ft). Files were clipped using the Clip tool to only display tracts that were impacted at each increment of SLR.

Risk mapping

Inundation and low-lying shapefiles were used to calculate the total area that is expected to be flooded at 0-feet, 2-feet, and 4-feet SLR scenarios. These increments were selected to represent 1) current SLR impacts at 0-feet, 2) impacts of SLR as it progresses throughout the century at 2-feet, and 3) maximum expected SLR impacts by 2100 at 4-feet. We used ACS 5-year estimates to calculate quintiles for the three ICE metrics in Microsoft Excel, displaying areas with the highest concentration of racial segregation, income disparities, and combined racial segregation/income disparities (e.g., Quintile 1 = most deprived and Quintile 5 = least deprived). Using the Clip tool in ArcGIS [21], we calculated the total extent of inundation within each ICE quintile. Area calculations of tidal inundation and low-lying areas were performed separately to determine which plays a larger role within vulnerable communities. This was an iterative process that required high processing power due to the large size of each SLR shapefile. We also calculated the number of residents anticipated to be affected by inundation and low-lying flooding, highlighting locations where SLR will be most impactful for vulnerable populations.

Results

Present level of SLR

Calculations at 0-feet represent the present level of SLR and the NC and SC populations that are currently being impacted (Supplemental Fig. 1). For the entire study area, nearly 2040 square miles (mi^2) ($5283.576km^2$) are already feeling the effects of SLR, with $1922mi^2$ ($4978km^2$) resulting from tidal inundation and $117.5mi^2$ ($304.3km^2$) due to flooding of low-lying areas (Table 1). This translates to over 2 million Carolina residents currently being impacted by SLR, with at least 326,000 individuals in the most vulnerable quintile. Vulnerability based on racial segregation shows that roughly the same amount of area is affected for both the lowest and highest quintiles (approximately $500mi^2/1295km^2$), while the two metrics for income disparities and combined racial segregation/income disparities revealed Quintile 5 (Q5) (i.e., most privileged) exceeding Quintile 1 (Q1) (i.e., least privileged) by at least $100mi^2/259km^2$. Flooding of low-lying areas alone affected the most vulnerable population (Q1) by at least twice the rate of the most privileged group (Q5).

2-feet of SLR throughout 21st century

Inundation at 2-feet illustrates the projected impacts of SLR as it progresses throughout the century (Supplemental Fig. 2). Area calculations demonstrated a total of $3880mi^2$ ($10049\ km^2$) affected by SLR, with $3385mi^2$ ($8767\ km^2$) as a result of tidal inundation and nearly $500mi^2$ ($1294\ km^2$) due to flooding of low-lying areas. We estimated that over 2.1 million Carolina residents will be affected, with at least 340,000 individuals in the most vulnerable quintile (Q1) for all three ICE metrics (Tables 2.1–2.3). Vulnerability based on racial segregation revealed that more area will be covered in least vulnerable census-tracts (Q5) ($924mi^2/2393\ km^2$) compared to the most vulnerable (Q1) ($809mi^2/2095\ km^2$). However, the combined racial segregation/income disparities metric showed Q1 exceeding Q5 by $200mi^2/518\ km^2$, and Q1 surpassed Q5 by nearly two-fold when examining income disparities alone ($1097mi^2/2841\ km^2$ and $556mi^2/1440\ km^2$, respectively). For all three ICE metrics, lowland flooding impacted vulnerable populations at a much higher rate than tidal inundation, where Q1 exceeded Q5 by as much as seven times.

4-feet of SLR by 2100

Inundation at 4-feet displays the potential extent of SLR for the study area by 2100 (Supplemental Fig. 3). Our calculations revealed that SLR could impact a total of $5147mi^2/13330\ km^2$, with approximately $4464mi^2/11562\ km^2$ as a result of tidal inundation and $683mi^2$ $/1769\ km^2$ due to flooding of low-lying areas. By 2100, we can expect to see over 2.2 million Carolina residents affected by SLR, and at least 370,000 individuals affected in the least privileged quintile (Q1) (Tables 2.1–2.3). Vulnerability based on racial segregation estimates that more area will be covered in least vulnerable census-tracts ($1264mi^2/3273\ km^2$) compared to the most vulnerable ($985mi^2/2551\ km^2$). However, both metrics for income disparities and combined racial segregation/income disparities revealed Q1 to be most affected, with over $1500mi^2/3885\ km^2$ for income disparities alone, and over $1000mi^2/2590\ km^2$ for combined racial segregation/income disparities. Flooding of low-lying areas across all three metrics will most severely impact less privileged tracts by as much as $300mi^2/777\ km^2$.

Table 1
Total Sea Level Rise, Inundation, and Flooding of Low-lying Areas for each of the Index of Concentration of Extreme Metrics: Racial Segregation, Income Disparities, and Racial Segregation & Income Disparities for North and South Carolina (Square Miles). Final column represents the level of disproportionate impacts between Q1 (least privileged) and Q5 (most privileged) by subtracting Q1 from Q5.

Sea Level Rise: Total Inundation and Flooding of Low-lying Areas (Sq Mile)							
	Total	Quintile 1 (least privileged)	Quintile 2	Quintile 3 (moderate)	Quintile 4	Quintile 5 (most privileged)	Disproportionate Impacts: Q1-Q5
RACE							
0ft	2,039.9	521.0	501.4	172.2	220.7	546.0	-25.0
2ft	3,879.5	809.1	1352.9	285.2	409.3	923.8	-114.8
4ft	5,147.1	986.0	1898.0	365.5	523.0	1264.3	-278.3
INCOME							
0ft	2,039.9	336.2	359.8	520.5	296.5	439.5	-103.3
2ft	3,879.5	1096.6	628.1	985.4	482.2	555.6	541.0
4ft	5,147.1	1559.4	821.8	1336.7	653.1	660.5	898.9
RACE + INCOME							
0ft	2,039.9	336.2	534.4	276.8	328.1	481.4	-145.1
2ft	3,879.5	808.0	1164.8	531.0	706.9	604.9	203.1
4ft	5147.1	1094.7	1516.0	692.7	1017.2	707.6	387.1
Inundation (Sq Mile)							
	Total	**Quintile 1 (least privileged)**	**Quintile 2**	**Quintile 3 (moderate)**	**Quintile 4**	**Quintile 5 (most privileged)**	**Disproportionate Impacts: Q1-Q5**
RACE							
0ft	1922.4	492.1	438.5	166.8	216.4	530.6	-38.5
2ft	3384.7	734.0	1076.9	262.7	383.8	834.7	-100.6
4ft	4464.4	871.5	1556.7	323.1	478.6	1134.9	-263.3
INCOME							
0ft	1922.4	294.5	336.3	491.6	290.6	431.5	-137.0
2ft	3384.7	853.4	555.7	883.7	446.3	522.6	330.7
4ft	4464.4	1259.0	712.9	1199.0	595.2	598.6	660.4
RACE + INCOME							
0ft	1922.4	310.6	482.1	260.3	314.9	474.1	-163.5
2ft	3384.7	696.0	950.6	480.2	626.6	576.0	120.1
4ft	4464.4	931.0	1257.7	618.0	902.1	653.0	278.0
Flooding of Low-Lying areas (Sq Mile)							
	Total	**Quintile 1 (least privileged)**	**Quintile 2**	**Quintile 3 (moderate)**	**Quintile 4**	**Quintile 5 (most privileged)**	**Disproportionate Impacts: Q1-Q5**
RACE							
0ft	117.5	28.9	62.9	5.4	4.3	15.4	13.5
2ft	494.9	75.1	276.0	22.5	25.5	89.2	-14.1
4ft	682.6	114.4	341.3	42.4	44.5	129.4	-15.0
INCOME							
0ft	117.5	48.4	23.5	28.9	5.9	8.0	40.4
2ft	494.9	243.2	72.4	101.7	35.9	33.0	210.2
4ft	682.6	300.3	108.9	137.7	58.0	61.8	238.5
RACE + INCOME							
0ft	117.5	25.6	52.3	16.5	13.2	7.3	18.4
2ft	494.9	111.9	214.2	50.8	80.3	28.9	83.0
4ft	682.6	163.7	258.3	74.7	115.1	54.7	109.1

Table 2.1
Total population and least and most privileged populations (Q1, Q5) affected by 0-, 2- and 4-feet of Sea Level Rise for the Index of Concentration of Extreme Metrics: Racial Segregation. *Q1= most privileged; Q5=least privileged

Total Populations Affected by 0-ft SLR				Total Populations Affected by 2-ft SLR			Total Populations Affected by 4-ft SLR		
	Total Impact	Q1 (least privileged)	Q5 (most privileged)	Total Impact	Q1 (least privileged)	Q5 (most privileged)	Total Impact	Q1 (least privileged)	Q5 (most privileged)
Total Census-tracts	**477**	102	116	**502**	106	121	**524**	113	122
Total Population:	**2,049,906**	343,591	403,663	**2,164,117**	357,555	416,777	**2,277,089**	398,772	428,972
Total Population: Under 5 Years	**114,527**	20,466	17,496	**121,562**	21,525	17,832	**127,624**	24,412	17,832
Total Population: Under 18	**414,909**	74,747	71,533	**438,355**	78,854	72,637	**461,559**	89,504	72,929
Total Population: Over 65	**389,758**	59,398	110,908	**413,090**	60,808	115,863	**435,730**	65,445	125,482
Total Population: Black or African American Alone	**443,021**	191,002	8,692	**463,193**	198,508	8,920	**493,973**	216,793	9,259
Total Population: Hispanic or Latino	**130,909**	23,817	11,418	**139,376**	25,411	11,877	**150,955**	32,130	12,010
Low English Proficiency	**89,619**	18,672	8,044	**96,979**	20,122	8,529	**110,495**	27,658	8,925
Total Rented Population	**617,159**	137,615	76,243	**658,783**	145,541	79,974	**705,033**	169,772	80,517
Total Population: Poverty Status	**280,999**	80,698	29,081	**299,270**	84,557	29,977	**319,082**	95,137	30,429
No Health Insurance Coverage	**211,692**	48,553	28,876	**227,248**	51,800	30,159	**242,703**	60,208	30,597
Female-Headed Household	**94,153**	27,112	11,226	**99,532**	28,272	11,618	**106,302**	31,751	11,834
Education: High School or Less	**480,664**	116,625	66,704	**509,514**	121,138	69,958	**536,424**	133,251	72,163
Total Population: With Disability	**290,781**	57,653	51,640	**309,054**	59,423	54,162	**325,124**	64,324	57,481

Table 2.2
Total population and least and most privileged populations (Q1, Q5) affected by 0-, 2- and 4-feet of Sea Level Rise for the Index of Concentration of Extreme Metrics: Income Disparities. *Q1= most privileged; Q5=least privileged

Total Populations Affected by 0-ft SLR				Total Populations Affected by 2-ft SLR			Total Populations Affected by 4-ft SLR		
	Total Impact	Q1 (least privileged)	Q5 (most privileged)	Total Impact	Q1 (least privileged)	Q5 (most privileged)	Total Impact	Q1 (least privileged)	Q5 (most privileged)
Total Census-tracts	**477**	84	104	**502**	89	110	**524**	97	113
Total Population:	**2,049,906**	326,055	492,783	**2,164,117**	344,130	524,179	**2,277,089**	379,958	535,382
Total Population: Under 5 Years	**114,527**	17,281	25,140	**121,562**	18,299	27,341	**127,624**	20,911	27,859
Total Population: Under 18	**414,909**	65,149	96,909	**438,355**	68,922	103,744	**461,559**	77,503	106,213
Total Population: Over 65	**389,758**	54,415	109,195	**413,090**	58,761	113,626	**435,730**	63,039	115,353
Total Population: Black or African American Alone	**443,021**	145,161	35,772	**463,193**	151,460	41,733	**493,973**	165,659	43,242
Total Population: Hispanic or Latino	**130,909**	25,702	19,416	**139,376**	27,435	21,385	**150,955**	32,350	22,157
Low English Proficiency	**89,619**	18,027	12,025	**96,979**	19,441	14,027	**110,495**	24,843	15,410
Total Rented Population	**617,159**	144,470	92,427	**658,783**	153,763	99,081	**705,033**	176,178	101,441
Total Population: Poverty Status	**280,999**	86,683	26,236	**299,270**	91,770	28,133	**319,082**	102,572	28,848
No Health Insurance Coverage	**211,692**	44,121	29,404	**227,248**	48,015	32,176	**242,703**	54,285	32,915
Female-Headed Household	**94,153**	23,543	12,911	**99,532**	24,852	13,724	**106,302**	27,629	14,003
Education: High School or Less	**480,664**	100,560	66,681	**509,514**	106,411	71,473	**536,424**	115,680	73,343
Total Population: With Disability	**290,781**	53,180	48,585	**309,054**	56,196	51,825	**325,124**	60,766	53,202

Table 2.3
Total population and least and most privileged populations (Q1, Q5) affected by 0-, 2- and 4-feet of Sea Level Rise for the Index of Concentration of Extreme Metrics: Combined Racial Segregation & Income Disparities. *Q1= most privileged; Q5=least privileged

Total Populations Affected by 0-ft SLR				Total Populations Affected by 2-ft SLR			Total Populations Affected by 4-ft SLR		
	Total Impact	Q1 (least privileged)	Q5 (most privileged)	Total Impact	Q1 (least privileged)	Q5 (most privileged)	Total Impact	Q1 (least privileged)	Q5 (most privileged)
Total Census-tracts	**477**	82	110	**502**	85	114	**524**	91	117
Total Population:	**2,049,906**	333,964	473,953	**2,164,117**	343,721	483,364	**2,277,089**	373,867	502,008
Total Population: Under 5 Years	**114,527**	19,562	22,589	**121,562**	20,231	22,925	**127,624**	22,731	23,119
Total Population: Under 18	**414,909**	72,533	89,503	**438,355**	75,337	90,492	**461,559**	83,708	92,271
Total Population: Over 65	**389,758**	56,436	115,745	**413,090**	57,471	118,625	**435,730**	61,141	129,285
Total Population: Black or African American Alone	**443,021**	175,833	25,894	**463,193**	181,901	26,065	**493,973**	195,081	27,282
Total Population: Hispanic or Latino	**130,909**	22,616	17,081	**139,376**	23,661	17,426	**150,955**	28,424	17,799
Low English Proficiency	**89,619**	16,883	11,538	**96,979**	17,997	12,003	**110,495**	23,357	12,524
Total Rented Population	**617,159**	146,538	89,328	**658,783**	152,892	92,151	**705,033**	172,685	93,181
Total Population: Poverty Status	**280,999**	88,224	27,930	**299,270**	91,402	28,405	**319,082**	100,539	29,178
No Health Insurance Coverage	**211,692**	47,533	27,763	**227,248**	50,189	28,680	**242,703**	56,229	29,410
Female-Headed Household	**94,153**	27,093	12,264	**99,532**	27,996	12,500	**106,302**	30,684	12,828
Education: High School or Less	**480,664**	110,738	63,746	**509,514**	114,192	65,693	**536,424**	123,104	68,944
Total Population: With Disability	**290,781**	56,734	48,888	**309,054**	57,928	50,303	**325,124**	61,949	54,511

Social determinants of health

In general, when looking across the three separate SLR scenarios, results showed that a higher proportion of vulnerable residents (e.g., Black, Hispanic, limited English proficiency, financially poor, uninsured, in rental housing, high school or less education, female-headed households) were in the most vulnerable quintiles. Not surprisingly, results revealed communities in the least privileged quintile (Q1) exceeded the most privileged (Q5) by as much as nearly four times for Black and Hispanic/Latino populations, low English proficiency, individuals living in poverty, and female-headed households (Tables 2.1-2.3).

Discussion

In this study, we identified low-income and communities of color along the Carolina coastline that are expected to experience the most severe effects of SLR-related tidal inundation and inland flooding. Health impacts of sea level rise include increased risk for flood-related drowning, injury, indoor mold outbreak and respiratory illnesses, relocation and housing instability, disruptions to critical infrastructure and adverse pregnancy (e.g., low birth weight) and mental health impacts, and post-event disease transmission (e.g., waterborne, vectorborne) [22]. Low-income communities with a greater proportion of residents who are Black or Hispanice, un(der)insured, unemployed, and reside in flood prone and substandard housing developments will continue to experience greater vulnerability to SLR. While present tidal inundation (0-ft) affects high-income, white communities and low-income, Black communities roughly equally, as SLR progresses throughout the century, impacts grow increasingly disproportionate by as much as two-fold for low-income alone and low-income Black coastal communities at 2- and 4-ft of SLR (Fig. 2). The disparate impact of SLR on economically disadvantaged and racially segregated Black communities becomes even more dramatic when examining flooding of low-lying areas. In the near term, by around mid-century, results showed that 2-ft of SLR is expected to increase 700% for low-lying flooding in the most economically disadvantaged, Black communities compared to economically advantaged, white communities. While there are some risk-mapping tools currently available, none to date allow for the examination of community-level SLR impacts at the intersection of extreme racialized and economic segregation. To our knowledge, this is the first geospatial analysis to examine the impacts of SLR through an equity lens that sheds light on how the low-income and racially segregated, Black communities along the Carolina coast are particularly vulnerable to SLR in the form of tidal inundation and inland flooding. The most vulnerable subgroups included Black, Hispanic, or limited English proficiency residents,

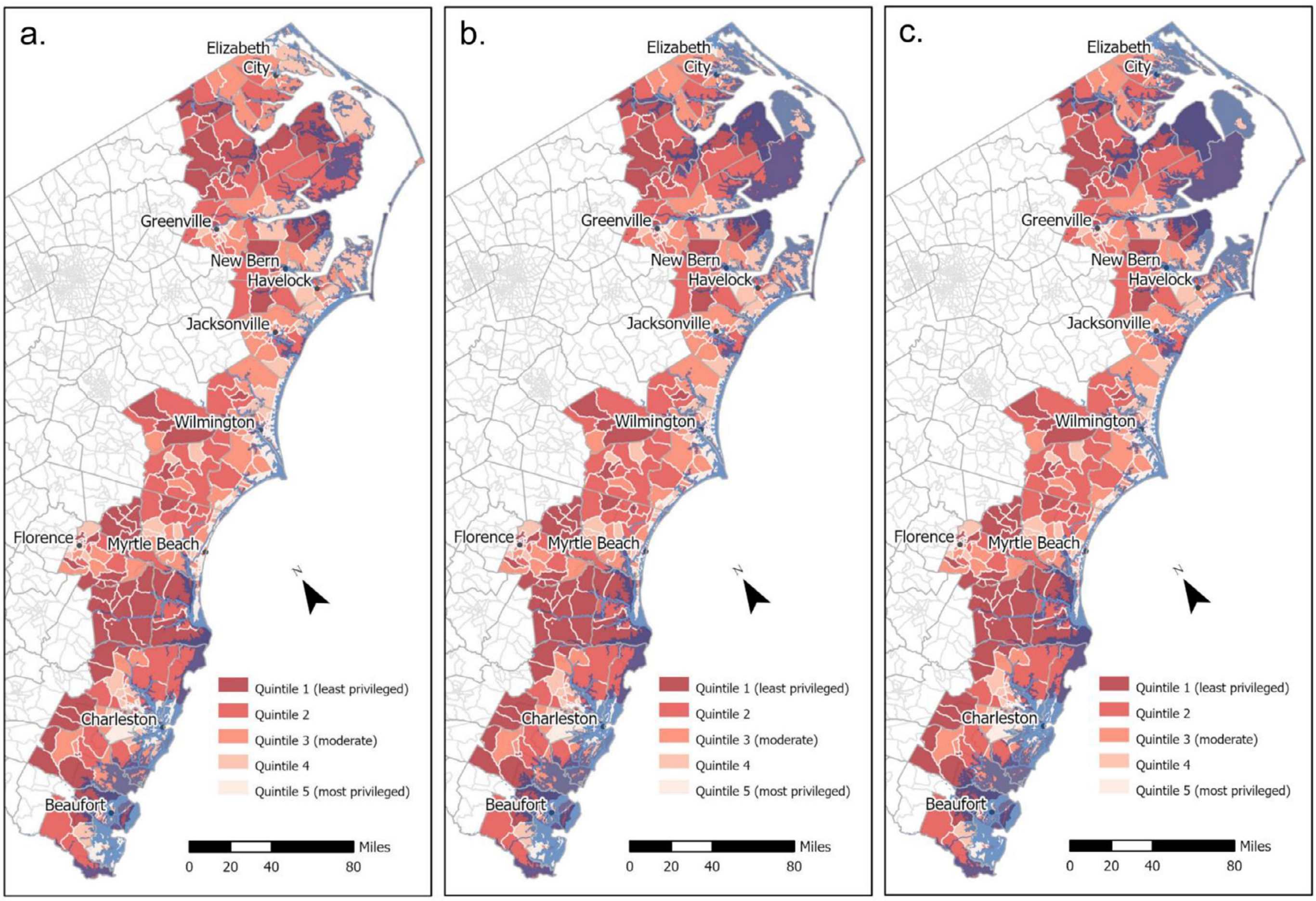

Fig. 2. Spatial vulnerability for least privileged (Q1) verses most privileged (Q5) for the Index of Concentration at the Extremes of Racial Segregation and Income Disparities at the census tract for a.) 0-feet b.) 2-feet and c.) 4-feet of Sea Level Rise.

as well as the financially poor, uninsured, those in need of affordable housing, and female-headed households.

Confirming our hypothesis, inland flooding impacts the most racially segregated and economically disadvantaged communities. Prior research has shown that more disadvantaged groups are typically located further inland, outside of cities and tourist destinations [e.g., 7]. A few studies have examined the compounding social and physical stressors behind increased vulnerability to SLR [4,23], but too few have narrowed in on the structural causes, like residential segregation (a proxy for structural racism [24]) behind the inequitable impacts of SLR. Local adaptive responses to rising sea levels can no longer remain colorblind and must acknowledge the racialized history behind coastal formation and the historical and present systemic causes of differential vulnerability and structuring of racial inequality [25]. Racial and economic segregation are two important drivers that independently and jointly contributed to the disproportionate impact of SLR in coastal Carolina communities.

We identified the northernmost counties in NC and southern half of SC as the most at-risk communities (Supplemental Figs. 4 and 5). These areas exhibited high potential for the most extensive impacts of SLR, as well as high rates of both racial segregation and income inequalities. It is likely many communities in these locations will suffer mitigation challenges as a result of geographic isolation and political marginalization. Conversely, the heavily developed coastline contains high population density with stark socioeconomic contrasts across the metropolitan area. These contrasts highlight how the cost of SLR will not be evenly distributed across coastal communities. Total expenses in SC could exceed $22 billion by 2100 for building over 3,000 miles of seawalls, and NC has estimated $34 billion for 5,320 miles of seawalls along the coastline [26]. Dare County, NC, which contains the Outer Banks tourist destination and consistently ranked in high privilege quintiles for all three ICE metrics, estimates a needed $5.4 billion for coastal protection [26]. Meanwhile, Tyrrell County, NC, which consistently ranked in the most deprived quintiles for all three ICE metrics will also be severely impacted by SLR with the estimated cost of SLR mitigation projected to be approximately $1 billion. The stark contrast in costs between the most and least privileged coastal communities highlights how SLR protection will not be equally distributed in low-income communities and communities of color. It is important to note that these estimates only consider coastline protection and do not fully account for all anticipated expenses in protecting communities from SLR such as elevating buildings, insurance, utilities, healthcare and community preparedness, telecommunications, transportation, environmental protection and remediation, and water and wastewater [26]. These additional expenses will likely further exacerbate the inequalities in exposure to SLR among affluent and disadvantaged communities in the Carolinas [27].

Strengths and Limitations

There were some limitations with this study. SLR shapefiles were extremely large and required high processing power which may have resulted in a small margin of error in area calculations. ACS census data also contains margins of error, and therefore, our population totals were estimates and should not be interpreted as a precise level of impact. Moreover, population estimates were pulled from current ACS data, and do not account for anticipated population changes that will occur throughout the century. It is likely that there will be substantial changes to our estimations of the populations affected by SLR at 2- and 4-ft. Additionally, shapefiles did not show depth of inundation, so we were unable to determine the severity of inundation. Future studies should consider examining inundation depth in order to more accurately assess how inhabitable some of these coastal areas may become. Nevertheless, our results highlight the disproportionate impact of SLR on historically underserved communities, and addresses the need to target mitigation plans towards the most vulnerable and economically-disadvantaged communities.

Conclusion

SLR will inevitably continue to impact the Carolina coastline. Our analysis showed that many low-income and primarily Black communities are already being affected by SLR and will continue to experience more severe effects in the future. Poverty and residential segregation were two important drivers that independently and jointly contributed to the disproportionate impact of current and future SLR on vulnerable populations in coastal Carolina communities. In order to effectively address climate injustice, more work is needed to ensure that all communities' voices are being represented and elevated in the decision-making and planning process to achieve equitable and holistic climate change resilience in coastal communities. Results demonstrated the disproportionate exposure to SLR in some economically-disadvantaged and Black communities, and identified high-risk areas along the coast of North and South Carolina in need of more targeted mitigation plans. Findings highlight the urgent need for additional resources and adaptive measures that target low-income, black communities who already are and will continue to be disproportionately impacted by SLR in coastal Carolina.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.joclim.2021.100028.

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New Scientist

By Michael Le Page

16 May 2007

See all climate myths in our special feature. /article/dn11462-climate-change-a-guide-for-the-perplexed

Truth is the first casualty of war. As the political battle over climate change has heated up, so has the propaganda campaign. On one side, green activists sometimes exaggerate claims about the possible consequences of global warming. On the other, sceptics seize upon anything that appears to suggest that climate change is not happening, is not due to human emissions, or will not be a problem.

The media tend to give both of these extremes rather more column inches and airtime than they do to the mainstream scientific position.

The first questions to ask about any claim are who is making it, and on the basis of what evidence? Does the claim come from a scientist whose career is dedicated to studying the complexities of the climate or is it the pet theory of one of the many amateurs who think they know more than the experts after a few hours surfing the web http://www.realclimate.org/index.php/archives/2006/11/cuckoo-science/? Is the claim mere opinion or backed by publications in a peer-reviewed scientific journal?

While scientific papers are more trustworthy than most sources, they are not always correct. Many scientific papers that get published turn out to have major flaws. There can be systematic errors in measurements, mistakes in calculations and, occasionally, outright fraud. Peer reviewers spot some problems but not all. The point of publishing papers is to allow other scientists to assess the work and to try to repeat it. What really matters is whether later studies back a finding or demolish it.

Global swindle?

Take the repeated claims that recent global warming is mostly or all due to solar changes. In 1991, for instance, a paper in *Science* http://dx.doi.org/10.1126/science.254.5032.698 claimed there was a striking correlation between variations in the solar cycle length and temperature between 1880 and 1980, suggesting greenhouse gases have not played as big a role as thought mg13217962.900. However, the correlation has not held up after 1980

Despite being discredited, this graph is still being presented as evidence against human-induced global warming today (see *The Great Global Warming Swindle* http://en.wikipedia.org/wiki/The_Great_Global_Warming_Swindle entry in Wikipedia).

Similarly, studies suggesting that the lower atmosphere dn11660 and the oceans dn11664 are cooling, contrary to what climate models predict, have turned out to be wrong. Later studies have shown the apparent coolings to be a result of errors in equipment or calibration (See *Sceptics forced into climate climb-down* mg18725134.400).

By contrast, the famous "hockey stick" graph has been the subject of a determined campaign to discredit it (see *The hockey stick graph has been proven to be wrong* /article/dn11646-climate-myths-the-hockey-stick-graph-has-been-proven-wrong). Yet later temperature reconstructions and other evidence back the key conclusions of the original hockey stick study (See *Climate: The great hockey stick debate* /article/mg18925431-400-climate-the-great-hockey-stick-debate.)

Of course, few people have the time to wade through the scientific literature weighing up the evidence and trying to work out which findings have or have not stood up to scrutiny. Fortunately, when it comes to climate change, there is an organisation that does exactly this for us: the Intergovernmental Panel on Climate Change http://www.ipcc.ch/ (IPCC).

Whatever some sceptics may claim, its reports are a fairly good summary of the huge mass of scientific evidence relating to climate change. If anything, some scientists think it is too conservative, understating the possible risks (see *Climate report 'was watered down'* /article/mg19325943-900-climate-report-was-watered-down).

The Tribune-Democrat
Monday, November 17, 2025 | E-PAPER

How clean is green energy? Despite advances, technology's manufacturing still produces CO2, health risks

By Carson Gerber
CNHI News Service

Clean energy – such as solar, wind and batteries – is often considered a zero-emission technology that doesn't generate any climate-change-inducing carbon dioxide when it produces electricity.

But manufacturing the solar panels, wind turbines and battery cells for those energy sources is anything but clean.

Most production facilities require large amounts of electricity from emission-spewing coal and gas plants to make them, said Sergey Paltsev, deputy director of the Massachusetts Institute of Technology's Center for Sustainability Science and Strategy.

Mining the minerals needed for solar panels and batteries also requires huge amounts of mostly dirty energy and can also pollute the environment and endanger the health of local residents.

"Low-carbon sources are lower, but they're not zero," Paltsev said. "We definitely need to educate both decision-makers and the general public on making sure that we are not making claims which are not realistic."

It all begs the question: How clean, really, is green energy, and do the potential benefits offset the negative impacts?

'A big difference'

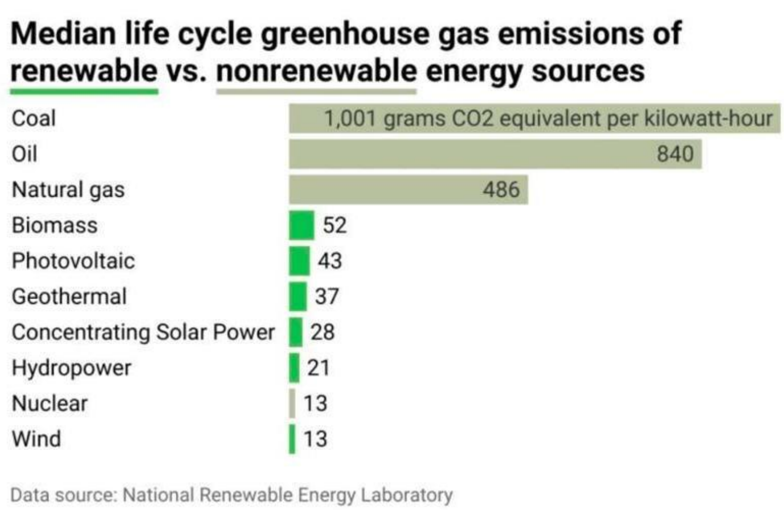
Manufacturing wind, solar and batteries can come with a significant up-front carbon footprint. But nearly all research agrees that those energy sources produce far fewer greenhouse gas emissions than coal or gas over their entire lifecycle.

Coal plants, on average, generate 1,000 grams of carbon dioxide, or CO2, for every kilowatt hour of energy produced, according to an analysis by the U.S. Department of Energy's National Renewable Energy Laboratory.

Wind generates just 13 grams per kilowatt hour, solar produces 28 grams, and lithium-ion batteries generate 33 grams, according to the analysis.

The Energy Department's research, published in 2021, determined the average carbon emission rate based on a review of hundreds of independent studies.

"When you are comparing around 10 grams versus 1,000, that's a big difference," Paltsev said. "We need to keep that scale in perspective."



To put those numbers in perspective, solar panels only need to operate for four to eight months to offset their manufacturing emissions; wind turbines need around three months to two years; and lithium batteries take one to three years.

Fossil fuels also generate huge amounts of toxic air pollution that killed more than 8 million people worldwide in 2018, according to a Harvard University study released in 2021.

While manufacturing of solar, wind and other clean energy sources produces some air pollution, the technology is completely clean once operational.

Reducing air pollution through clean energy sources could help save 400,000 American lives by 2050, according to Princeton University's 2021 Net Zero America study.

"Coal is really out there in terms of the bad impacts," Paltsev said. "So at this point, even though wind and solar isn't at zero emissions, it's still better."

Getting green clean

But even with clean energy's clear track record of producing less pollution and earth-warming gases, its downside shouldn't be ignored, argued Dustin Mulvaney, an environmental studies professor at San Jose State University.

Today, many solar panels and batteries contain toxic chemicals that could be hazardous to human health, but still slip under the regulatory radar.

A case in point: The U.S. Environmental Protection Agency in December banned the use of trichloroethylene, which increases risks of certain cancers, in nearly every industry. Battery manufacturers, however, don't have to phase out their use for 20 years.

"Here's a hazardous chemical that's in the battery supply chain that is not necessarily being adequately addressed," said Mulvaney. "The EPA is putting this green halo on batteries, saying we forgive all of the bad sides to this."

Mining lithium for electric-vehicle batteries is also notoriously bad for the environment, using vast amounts of water in sometimes arid locations while employing heavy machinery that generates tons of emissions.

A sign at a proposed lithium mine in Nevada.
Associated Press | Rick Bowmer

Silicon mining for solar panels also poses major health risks to workers, who face permanent and sometimes fatal lung diseases by inhaling toxic silica dust. Mining can also pollute groundwater and degrade soil.

Most solar panels, wind turbines and some batteries also end up in landfills at the end of their lifecycle, which negatively impacts the environment.

Although the research is clear that clean energy produces less carbon emissions than fossil fuels, there currently is no metric measuring the overall, life-to-death environmental impact of green technologies, Paltsev said.

Mulvaney argued that although it's imperative to reduce the impacts of climate change through green energy, the people who do deal with its negative side effects, such as polluted groundwater or increased health risks, shouldn't be ignored.

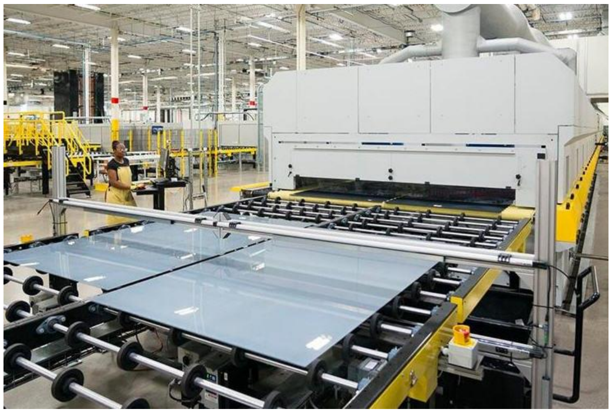
"I think it's dangerous to dismiss these impacts," he said. "Even if 7 billion people benefit and only 20 people suffer on the planet, I think those 20 people deserve attention."

Approaching zero

But new technology and improved manufacturing processes for clean energy sources are quickly diminishing those adverse impacts.

Companies such as Arizona-based First Solar have developed a panel that doesn't use silicon, greatly reducing its carbon footprint and water usage compared to traditional arrays.

The publicly traded company with facilities in four countries also started the first global solar recycling program, and today recovers 90% of the materials in each module it produces.



A non-silicone solar panel comes of the production line at a First Solar facility. Photo provided by First Solar

The American Battery Technology Co. is innovating ways to recycle lithium batteries and extract the rare metals inside to sell back into the battery supply chain. The system reduces the need for mining and produces American-sourced metals with less environmental impact, according to the company.

Even China, where around 80% of all solar panels are manufactured, has since 2011 halved the CO2 produced through its manufacturing processes, according to the International Energy Agency. Still, total emissions from solar manufacturing there have almost quadrupled in the same time as production skyrockets.

Paltsev said how quickly green energy can move toward net-zero emissions in the U.S. really depends on policymakers and the economic incentives that they can provide.

That matters, he argued, because reduced emissions from clean energy won't be enough to curb climate change in the long run. Greenhouse gases are also coming from non-energy sources such as agriculture and deforestation, Paltsev noted.

Until zero emissions are reached across the globe, temperatures will continue to rise and contribute to a surge in catastrophic weather events around the world.

"At some point, I think there will be a huge demand for much more aggressive actions, because when you see things which are destroying your way of life, you will start asking more and more loudly that policymakers do something," he said.

The Great Green Debate

CNHI and The Tribune-Democrat are offering a five-part series looking at green energy in the United States as part of The Great Green Debate.

Amid a growing need for energy access across the nation, more options are coming online, while old standbys are also being boosted.

Secretary Kerry Climate Discussion

Former Secretary of State John Kerry and Kentucky Representative Thomas Massie

[0:00 - 0:33] ***Representative Massie:*** Secretary Kerry, I want to read part of your statement back to you. Instead of convening a kangaroo court, the president might want to talk with the educated adults he wants trusted to fill his top national security positions. It sounds like you're questioning the credentials of the president's advisors currently, but I don't think we should question your credentials today. Isn't it true you have a science degree from Yale? What's that? Is it a political science degree? Yes, political science.

[0:34 - 0:40] ***Representative Massie:*** So how do you get a Bachelor of Arts in a science?

[0:40 - 0:41] **Secretary Kerry:** Bachelor of Arts degree. Well, it's liberal arts education and degree.

[0:42 - 0:56] ***Representative Massie:*** It's a Bachelor. Okay, so it's not really science. So I think it's somewhat appropriate that somebody with a pseudoscience degree is here pushing pseudoscience in front of our committee today. I want to ask you.

[0:56 - 0:58] ***Secretary Kerry:*** Are you serious? I mean, this is really serious happening here.

[0:58 - 1:05] Representative Massie: You know what? It is serious you're calling the president's cabinet a kangaroo court. Is that serious?

[1:06 - 1:13] ***Secretary Kerry:*** I'm not calling his cabinet a kangaroo court. I'm calling this committee that he's putting together, a kangaroo committee.

[1:13 - 1:15] ***Representative Massie:*** Are you saying that he doesn't have educated adults there now?

[1:16 - 1:16] ***Secretary Kerry:*** I don't know who it has yet because it's secret.

[1:16 - 1:19] ***Representative Massie:*** Well, you said it in your testimony.

[1:19 - 1:24] ***Secretary Kerry:*** Why would he have to have a secret analysis of climate change? Let me ask you. Why does the president need to keep it secret?

[1:25 - 1:26] ***Representative Massie:*** Let's get back to the science of it.

[1:27 - 1:30] **Secretary Kerry:** But it's not science. You're not quoting science.

[1:31 - 1:48] ***Representative Massie:*** Well, you're the science expert. You got the political science degree. Look, let me ask you this. What's the consensus on parts per million of CO_2 in the atmosphere?

[1:48 - 1:50] ***Secretary Kerry:*** About 406, 406 today. 350 being the level that scientists have said is danger.

[1:51 - 2:01] ***Representative Massie:*** Okay. Are you aware? Yes. 350 is dangerous. Wow. **Are you aware that since mammals have walked the planet, the average has been over 1,000 parts per million?**

[2:02 - 2:18] ***Secretary Kerry:*** **Yeah, but we weren't walking the planet. Let me just share with you that we now know that definitively at no point during at least the past 800,000 years has atmospheric CO_2 been as high as it is today.**

[2:18 - 2:30] ***Secretary Kerry:*** When I was in the South Pole, when I was in McBurdo, We couldn't get to the South Pole because of the weather, but I was given a vial of air which said on it, cleanest air in the world.

[2:30 - 2:38] ***Secretary Kerry:*** It was 401.6 parts per million. That is 50 parts per million already over what scientists say.

[2:38 - 2:50] ***Representative Massie:*** **The reason you chose 800,000 years ago is because for 200 million years before that, it was greater than it is today.**

[2:50 - 2:54] ***Secretary Kerry:*** **Yeah, but there weren't human beings. I mean, there was a different world, folks. We didn't have 7 billion people.**

[2:55 - 2:58] ***Representative Massie:*** **So how did it get to 2,000 parts per million if we humans weren't here?**

[2:58 - 3:02] ***Secretary Kerry:*** **Because there were all kinds of geologic events happening on Earth which spewed up.**

[3:02 - 3:06] ***Representative Massie:*** **Did geology stop when we got on the planet?**

[3:08 - 3:12] ***Secretary Kerry:*** Representative Massie, this is just not a serious conversation.

[3:12 - 3:25] ***Representative Massie:*** Your testimony is not serious. I agree. When you can't answer the question, that's the best answer you got. I submit for the record an article called the CO2 deficit.

[3:25 – 3:27] ***Secretary Kerry:*** I did answer.

[3:27 - 3:43] ***Representative Massie:*** Thank you. Secretary Kerry, what is your – you avoided my colleague's question about how do you pay for it, but I want to ask what is your solution to comply with the Paris Accord requirements? Like what would you do? I –

[3:43 - 3:53] ***Secretary Kerry:*** I did not avoid the question. I said there are many ways to pay for it. He just asked for one. I did. I talked about the carbon pricing is one way to pay for change.

[3:54 - 4:11] ***Secretary Kerry:*** There are all kinds of other things we could do. One would be to not give a trillion dollars worth of tax benefits to the top 1% of Americans. I'm one of them. I didn't deserve to get that tax cut. Nobody did in this country at the expense of average folks who can't make ends meet. So that would be a fair way to start.

[4:11 - 4:16] ***Representative Massie:*** You don't want to politicize this, but you just played the 1% card.

[4:16 - 4:24] ***Secretary Kerry:*** No, I actually played a moral judgment about what is appropriate in building a civil society.

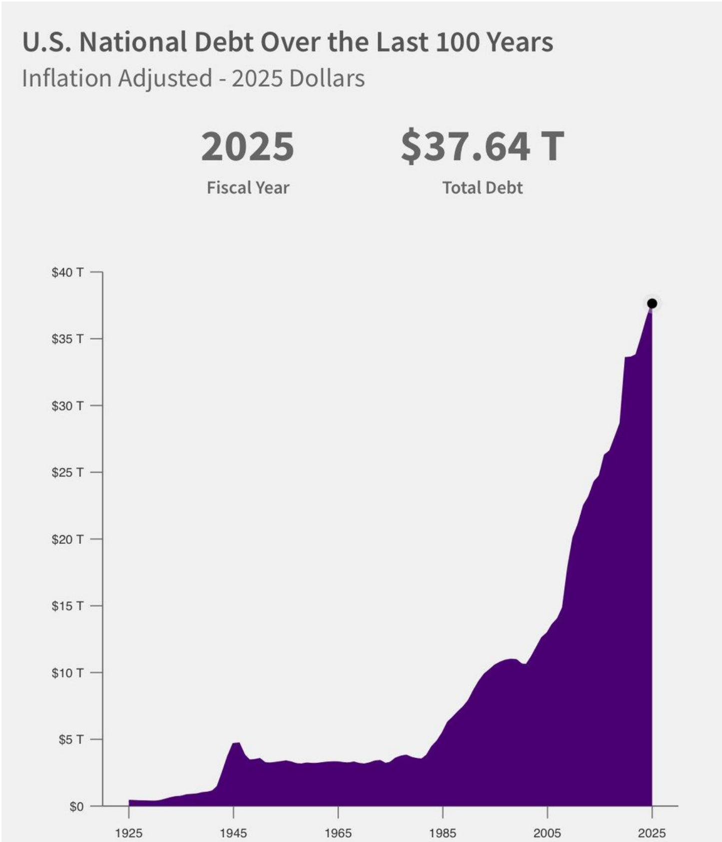
[4:24 - 4:38] ***Representative Massie:*** Well, what my colleague Mr. Comer of Kentucky knows is that this will fall on the poorest of the poor. It's regressive when you're paying the price of energy in Kentucky or Massachusetts or Pennsylvania or France or wherever, whichever house you're staying in.

[4:38 - 5:15] ***Secretary Kerry:*** That is absolutely incorrect that it would fall on the poorest people because if you do it right, which hasn't been done here for a little while, if you look at the tax legislation, there are all kinds of ways to make sure that people at the bottom end, people struggling to get into the middle class, can be rewarded. And that's not what's happened. If you look at the distribution, we have the most unequal distribution of income in America that we've had since the 1920s when we didn't have an income tax. We have a country in which 51% of America's income is going to 1% of Americans. That is not a sustainable political equation.

Note: The **green bold text** is the important part of this exchange. Climate alarmists and activists for decades have decried that the high concentrations of CO_2 are caused by humans, and yet Secretary Kerry claims that during the period ***before*** humans, extremely high concentrations of CO2 were caused by geological events. So, how can that be? Did geological events stop when humans started walking the earth? Scientists are now coming forward to reject the old notion that humans were the largest source of atmospheric CO_2. Even previous climate activists like Bill Gates are now reversing their extreme positions.

We aren’t claiming that there is climate change, but when you look at the entire history of the planet, and not just the last 100,200, or any number they usually pick, we are actually in a period of

What Difference Will $50 Trillion Make to Global Temperatures?



Climate alarmists want to spend more than $50 trillion to reach carbon neutrality by 2050. Even the experts admit that it won't reduce global temperatures but will actually see them increase by 1.5°C (2.7°F).

About this report

(Net Zero by 2050 A Roadmap for the Global Energy Sector)

The number of countries announcing pledges to achieve net zero emissions over the coming decades continues to grow. But the pledges by governments to date – even if fully achieved – fall well short of what is required to bring global energy-related carbon dioxide emissions to net zero by 2050 and give the world an even chance of limiting the global temperature rise to 1.5 °C. This special report is the world's first comprehensive study of how to transition to a net zero energy system by 2050 while ensuring stable and affordable energy supplies, providing universal energy access, and enabling robust economic growth. It sets out a cost-effective and economically productive pathway, resulting in a clean, dynamic and resilient energy economy dominated by renewables like solar and wind instead of fossil fuels. The report also examines key uncertainties, such as the roles of bioenergy, carbon capture and behavioral changes in reaching net zero.

Average global temperatures have increased by approximately 1.1°C to 1.5°C (1.9°F to 2.7°F) since 1970. This is a significant acceleration in warming with some analyses indicating a rise of about 0.9°C (1.6°F) to 1.1°C (2°F) specifically since 1970, while others report figures close to 1.5°C (2.7°F) since the 1940s. The rate of warming has been faster since 1970 than in any other 50-year period in at least the last 2,000 years.

The $50 Trillion Carbon Neutral Plan That Experts Admit Won't Work

During a Senate testimony, climate experts admit that the nation's climate efforts may not impact global temperatures at all.

by Brittany Raymer

Former Digital Writer & Editor

February 16, 2023

At a recent Senate hearing, climate experts claimed it would cost $50 trillion to make the country carbon neutral—and then admitted that it may not even work. Though the U.S. could sink trillions and trillions into green initiatives, it may not move the needle at all when it comes to temperatures.

There's nothing wrong with wanting to keep the planet in the healthiest state that we can. From recycling and forest and ocean management to responsible fishing, hunting and farming, all play a role in keeping food on the table and the global economy rolling. But certain climate activists want to take it further.

In order to avoid what they believe could be a catastrophic outcome, climate activists testifying before the Senate want the country to essentially bankrupt itself by spending an additional $50 trillion, when the country already has a ballooning debt of $31 trillion, to try and achieve the seemingly mythical carbon neutral status by 2050.

However, when pressed about the success of this method during a Climate-Related Economic Risks and Their Costs to the Federal Budget and the Global Economy committee hearing by Senator John Kennedy of Louisiana, they all admitted that the United States could financially destroy itself with no impact on global temperatures **at all**.

Senator Kennedy begins by questioning Dr. Douglas Holtz-Eakin, president of the American Action Forum, a center-right policy think tank that advocates for a "50-52 percent economy-wide reduction of net greenhouse gas emissions below 2005 levels by 2030," about the cost of the potential move towards carbon neutrality and the possibility of success.

"If we spend $50 trillion to make the United States of America carbon neutral by 2050, how much will that lower world temperatures," Senator Kennedy asks.

Dr. Holtz-Eakin pauses and shakes his head before responding, "I can't answer because it will depend on what China and India and the globe has done."

“Have you heard from anybody in the Biden administration say how much it will lower world temperatures?” Senator Kennedy pressed again.

Dr. Holtz-Eakin takes another long pause, before answering simply, “No.”

“Does anybody know how much it will lower world temperatures,” Senator Kennedy asks. When Dr. Holtz-Eakin doesn’t respond, so Kennedy answers himself, “No.”

“No one can know for sure,” Dr. Holtz-Eakin finally answers.

Kennedy moves on to another witness, asking, “If we spend $50 trillion or however much it takes to make the United States carbon neutral by 2050, how much will it lower world temperatures?”

Dr. Robert Litterman, Chair of the Climate-Related Market Risk Subcommittee U.S. Commodity Futures Trading Commission, responded, “Senator, that depends on the rest of the world. We have to work with the rest of the world, we’re in this together. It’s one world, we can’t build a wall around the United States…”

“What if we spend $50 trillion, Europe cooperates, most Western democracies cooperate, but India and China don’t. How much will our $50 trillion lower world temperatures?” Senator Kennedy asked again.

“We’re in this together, Senator, we have to get the world to work together,” Dr. Litterman responds.

“I get that.”

“Okay.”

“How much will it lower world temperatures?”

“If China and India do not help?” Dr. Litterman clarifies.

“Yes.”

“I don’t know.”

This exchange is a great example of how some demand action, change and billions if not trillions of dollars, without knowing if any of it will be effective. And if the United States makes itself weaker on the international stage with a foolhardy, untested and reckless plan, how can we hope to ever encourage China and India to follow our lead?

It’s obvious that any aggressive action towards carbon neutrality should be tempered with the global realities of our limited role in reigning in other countries, beyond our allies in Europe.

Similar questions could be posed to Gov. Cooper when it comes to some of his green initiatives.

Will a massive wind turbine farm off the coast of North Carolina damage tourism while producing no noticeable additional power to the electrical grid? Will adding solar panel farms result in more failures after a hurricane, as the sun exposure is limited and the technology breaks under the impact of hurricane force winds? Will forcing most North Carolinians to purchase electric cars result in an overloaded electrical grid that consistently fails during the coldest and hottest days of the year? And despite increasing energy costs and working towards a carbon neural state, will all of this effort and money fail to have any kind of real result on the environment and temperatures?

That’s what people should be asking Gov. Cooper and any politician advocating for massive change in pursuit of the carbon neutral dream that may be as fanciful as searching for El Dorado. A pointless effort that causes infinitely more damage that it ever addressed.

UNITED STATES SENATE COMMITTEE ON THE BUDGET

Agenda

There will be a Hearing of the Committee on the Budget

On: Wednesday, February 15, 2023, 10:00 AM

In: Room SD-106. Members of the Committee may participate in person or by video conference technology.

To consider: "Climate-Related Economic Risks and Their Costs to the Federal Budget and the Global Economy"

See below for opening statements from Chairman Sheldon Whitehouse and Ranking Member Chuck Grassley.

Opening Statement of Chairman Sheldon Whitehouse
Senate Committee on the Budget
"Climate-Related Economic Risks and Their Costs to the Federal Budget and the Global Economy"
February 15, 2023

Ranking Member Grassley, colleagues, particularly our new members, let me welcome you to what I hope will be a busy, revived, impactful and lively Budget Committee. I want this to be your surprise favorite committee. We have important work to do on bipartisan health care reforms, on reforming this Committee's process to fit the basic arithmetic of the budget, and on issues important to each of you as members.

We'll begin with a series of hearings on the looming costs and economic risks of climate upheaval. Almost exactly five years ago, I sent around this binder to all of my Senate colleagues, in which I compiled some of the most compelling warnings about the economic risks associated with climate change. Last week, I sent your staffs an updated version of this binder. Here it is. As you can see, the warnings keep piling up. Have fun with the light reading.

These warnings come from central bankers, economists, asset managers, insurance companies, investment banks, credit rating agencies, and leading management consultants — folks with a lot of credibility when it comes to economics, finance, corporate risk, and their effect on government spending and revenues. These will be our witnesses — economists, scientists, business leaders, and other financial and risk experts, many of whose work is included in this binder.

I've said that science provides the headlights for society; that it's scientists who illuminate the way for us to navigate into the future. Think of the economists and scientists we'll hear from as the headlights for the United States Congress as this committee helps navigate our long-term budget and fiscal priorities.

Look at our national debt. One thing that stands out is how much of it was incurred as a result of exogenous shocks to the economy. Consider the 2008 financial crisis, which blew up the financial security of families and businesses across the country, and reduced government revenues for a decade. Two years after the recession, CBO found that projected revenues fell by $4.4 trillion and projected spending rose by $800 billion to spur the recovery.

Consider the pandemic. The Committee for a Responsible Federal Budget estimates that the federal response to the pandemic, which brought Covid under control, protected families, and jump-started our economic recovery, will add $5.5 trillion to our deficits. That doesn't factor in lost revenue, or lost economic activity, so the total economic cost is much higher.

We came through both, but together those two exogenous shocks contributed $10 trillion to the federal debt — more than 40% of the total; proof of how catastrophic events can and do affect the federal budget and the economy. And how life has a way of upsetting best-laid plans—and 10-year budget baselines.

Headlights, and better attention to what they illuminated, could have helped. Plenty of financial experts saw the 2008 mortgage mess coming. Plenty of epidemiologists warned that the country was woefully unprepared for a pandemic.

Now we have all these warnings. Warnings of crashes in coastal property values as rising seas and more powerful storms hit the 30-year mortgage horizon. Warnings of insurance collapse from more frequent, intense and unpredictable wildfires. A dangerous interplay between the insurance and mortgage markets hitting real estate markets across the country. Inflation from decreased agricultural yields. Massive infrastructure demand. Trouble in municipal bond markets. Stranded assets, and a "carbon bubble." The most dangerous risks are called "systemic," meaning that they will cascade out into the broader economy, as the mortgage problem did in 2008. And it's big: Deloitte predicts the differential between being responsible and reckless about climate could sum to more than 220 trillion dollars between now and 2070.

Some of these warned-of risks are already upon us. Already, climate-related natural disasters increase federal spending on disaster assistance, flood insurance, crop insurance, and other programs we fund. But this is just the beginning. It will certainly get worse — much worse, particularly if warming exceeds 1.5 degrees. We are on a bad trajectory. It's time for us all to wake up and face the problem, before coastal cities flood with water or Southwest cities can't get water. I hope we can fend that off, with action, if we snap into focus on the danger.

We are all familiar with the "tragedy of the commons." In 2015, our opening witness Dr. Carney gave a speech entitled "the tragedy of the horizon," because some the gravest dangers of climate change, which we could head off today, come to pass years or decades out. Rhode Island's coastline will be gone, reshaped into an archipelago by 2100, you say? Who cares, that's an eternity!

Well, almost exactly a year ago, I became a grandfather for the first time. Baby Vera, God willing, will be alive in 2100. When I look at her, I am looking at that future. Walk by any elementary school. The faces you see on the playground, God willing, will be alive in 2100. How will those little ones remember our Less-than-Greatest Generation? We owe it to kids on playgrounds all across America to pay attention, to get this right.

By the end of this series of hearings, if we hear these expert witnesses, if we treat their testimony as our headlights, then our path will be clear. Thank you, and let's get to work.

Prepared Statement by U.S. Senator Chuck Grassley (R-Iowa)
Ranking Member, Senate Budget Committee
Hearing on Climate-Related Economic Risks and Their Costs to the Federal Budget and the Global Economy
Wednesday, February 15, 2023
VIDEO

Mr. Chairman, I'm pleased to be here with you for our inaugural hearing as Chair and Ranking Member of the Budget Committee. Despite our political differences, I know we can find common areas of agreement to work on together.

One area of agreement must be that our budget and appropriations process is broken. This sentiment isn't new, nor is it particularly partisan. No person could look at last year's process and say things are working.

For the fiscal year 2023 cycle, Congress didn't adopt a budget resolution. The Senate Appropriations Committee didn't markup a single bill. And, not one of the 12 individual appropriations bills was debated on the Senate floor. Instead, we were presented with a $1.7 trillion omnibus just days before Christmas.

Things need to change.

I applaud Senators Murray and Collins for publicly announcing their commitment to regular order– including debating appropriations bills on the Senate floor. We need to do our part to make that happen.

We should also agree that our nation's fiscal outlook is dire.

The Congressional Budget Office will release updated budget projections this afternoon. Every indication is that their new projections will be as bad as – or worse than - last summer's projections.

What did they tell us last summer?

Within 10 years, public debt as a share of our economy will exceed World War II record highs. However, unlike after World War II – when spending and debt subsided – our public debt is projected to climb ever higher.

Our public debt will reach 110 percent of our economy in 2032 and grow to 185 percent by 2052.

Trillion dollar annual deficits will be replaced by $2 trillion deficits within a few years.

Simply servicing the debt will lead to record-breaking annual costs of more than $1 trillion within ten years.

Mr. Chairman, your immediate predecessor refused to bring in CBO to discuss the overall budget outlook. This was a mistake. I urge you to hold a hearing with CBO on the latest outlook. Nobody benefits from us burying our heads in the sand.

I acknowledge that a changing climate is a historical and scientific fact. I also recognize that most scientists agree manmade emissions contribute to climate change. Throughout my career, I have advocated for renewable and alternative energy solutions.

This being said, even if the entire U.S. stopped emitting greenhouse gases tomorrow, projected temperatures would only be 0.3 degrees Fahrenheit lower come 2100.

Even in this unrealistic scenario, the U.S. would still need major polluters, like China and India, to pull their weight.

As we look to address climate and energy issues, the nation must also address its fiscal health.

There's plenty of blame to go around for how we got into our current situation. For decades, Congress turned a blind eye as our nation walked toward a fiscal cliff. But, Democrats turned that walk into a sprint.

In March of 2021, Democrats took advantage of an emergency situation to pass a $2 trillion partisan spending bill—even as our economy showed strong signs of recovery.

Then, as inflation soared to 40-year highs, they doubled down; spending trillions more on their liberal wish list. They pushed through omnibus appropriations bills with "take it or leave it" mantras for two years—each time growing the size of government. When not using fast-tracked procedures or a government shutdown as leverage, the Administration drove up deficits through unilateral actions like student loan giveaways that could cost taxpayers $1 trillion.

Congress needs a fiscal reality check. This reality check should start with this Committee getting back to performing its core functions. This includes holding hearings on federal fiscal matters; examining programs and authorizations that have been on autopilot for decades; and performing robust oversight of agency spending—no government entity should be exempt.

Finally, I welcome the opportunity to work with you on budget process reform. Mr. Chairman, you are a well-established leader on the issue. I appreciate your stated interest in working with me on this issue starting from where you left off with Senator Enzi in 2019. It was a bipartisan process then and I think we can build to get it over the finish line this Congress.

Needless to say, we have our work cut out for us to get our fiscal house in order. To paraphrase former Fed Chairman Paul Volcker, cutting spending may be painful, but the pain for all of us will be much greater if it isn't accomplished.

I look forward to the witnesses' testimonies and a discussion of the challenges and risks facing our nation.

Carbon Neutrality Cost and Temperature Impact

May 3, 2023

Senator Kennedy questions David Turk, Dep. Secretary U.S. Dept. of Energy

[0:00 - 0:19] ***Senator Kennedy:*** Dep. Secretary Turk, thanks for being here. I want to tap your expertise for a moment. Give me your best estimate, just an estimate I know, of how soon you think the United States of America will be carbon neutral.

[0:20 - 0:20] ***Dep. Secretary Turk:*** So

[0:22 - 0:23] ***Senator Kennedy:*** I think...

[0:23 - 0:35] ***Dep. Secretary Turk:*** According to the climate scientists around the world and certainly the cutting-edge scientists that we need to rely on here in the U.S., we've got to get carbon neutral by 2050. And I'm very comfortable with that target. And I think that's the appropriate target.

[0:36 - 0:36] ***Senator Kennedy:*** By 2050.

[0:36 - 0:39] ***Dep. Secretary Turk:*** Which is only 27 years. That is not a long time away.

[0:39 - 0:40] ***Senator Kennedy:*** And how much will that cost?

[0:40 - 0:46] ***Dep. Secretary Turk:*** So the cost that I focus on even more is all the costs that are going to happen if we don't get our act together.

[0:46 - 0:48] ***Senator Kennedy:*** How much will it cost to get us carbon neutral?

[0:48 - 0:52] ***Dep. Secretary Turk:*** It's going to cost trillions of dollars, and it'll cost tens of trillions of dollars if we don't get our act together.

[0:52 - 0:53] ***Senator Kennedy:*** How many trillions?

[0:54 - 1:02] ***Dep. Secretary Turk:*** I don't have the estimate or the numbers in front of me. I've seen a variety of different estimates, but it's a large amount. Fundamentally transforming our energy economy is a big deal.

[1:02 - 1:04] ***Senator Kennedy:*** Tell me the estimates that you've seen.

[1:04 - 1:05] ***Dep. Secretary Turk:*** I don't have those numbers right on hand.

[1:06 - 1:11] ***Senator Kennedy:*** So you're advocating that we become carbon neutral, but you don't know how much it's going to cost?

[1:11 - 1:14] ***Dep. Secretary Turk:*** So there's an awful lot of estimates out there. It depends on technology.

[1:14 - 1:20] ***Senator Kennedy:*** You're the expert.

[1:20 - 1:21] ***Dep. Secretary Turk:*** I know. I know.

[1:21 - 1:22] ***Senator Kennedy:*** How much is going to cost?

[1:22 - 1:30] ***Dep. Secretary Turk:*** I know with the certainty of all the experts I've spoken about, it's cheaper to get our act together than it is to not get our act together on climate change.

[1:30 - 1:35] ***Senator Kennedy:*** Then tell me the cost.

[1:35 - 1:39] ***Dep. Secretary Turk:*** Orders of magnitude. The cost that we don't do it. I think it's orders of magnitude different.

[1:40 - 1:48] ***Senator Kennedy:*** I know that. But you don't have a cost? You want us to get there, but you can't tell the American taxpayer how much it's going to cost? Is that your testimony?

[1:48 - 1:55] ***Dep. Secretary Turk:*** It's going to save us money, and there's a lot of jobs. Well, how do we know if you don't know how much it's going to cost?

[1:55 - 1:58] ***Dep. Secretary Turk:*** I'd be happy to pull up the latest numbers that I've seen.

[1:58 - 2:00] ***Senator Kennedy:*** How about $50 trillion? Is that right?

[2:00 - 2:03] ***Dep. Secretary Turk:*** It's going to cost trillions of dollars. There's no doubt about it.

[2:03 - 2:18] ***Senator Kennedy:*** Okay. If we spend trillions of dollars and we achieve... Some of your colleagues estimate 53, and it disappoints me that you're not willing to give the estimates.

[2:20 - 2:47] ***Senator Kennedy:*** I hope you're not telling me you have no idea how much it's going to cost. That creates a whole new host of problems. But if it costs $50 trillion, as some of your colleagues have testified, to become carbon neutral by 2050, and I'm all for carbon neutrality, by the way, how much is that going to lower world temperatures? Or how much is that going to reduce the increase in world temperatures?

[2:47 - 2:52] ***Dep. Secretary Turk:*** So every country around the world needs to get its act together. Our emissions are about 13% of global emissions right now.

[2:52 - 3:11] ***Senator Kennedy:*** Yeah, but if you could answer my question. If we spend $50 trillion to become carbon neutral in the United States of America by 2050, you're the Deputy Secretary of Energy. Give me your estimate of how much that is going to reduce world temperatures.

[3:11 - 3:20] ***Dep. Secretary Turk:*** So first of all, it's a net cost. It's what benefits we're having from getting our act together and reducing all of those climate benefits.

[3:20 - 3:34] ***Senator Kennedy:*** Let me ask you again. Maybe I'm not being clear. If we spent $50 trillion to become carbon neutral by 2050 in the United States of America, how... How much is that going to reduce world temperatures?

[3:34 - 3:39] ***Dep. Secretary Turk:*** This is a global problem. So we need to reduce our emissions and we need to do everything we can.

[3:39 - 3:41] ***Senator Kennedy:*** How much,if we do our part, is it going to reduce world temperatures?

[3:41 - 3:43] ***Dep. Secretary Turk:*** So we're 13% of global emissions.

[3:43 - 3:46] ***Senator Kennedy:*** You don't know, do you? You don't know, do you?

[3:46 - 3:48] ***Dep. Secretary Turk:*** You can do the math.

[3:48 - 3:52] ***Senator Kennedy:*** You don't know, do you, Dep. Secretary Turk?

[3:52 - 3:52] ***Dep. Secretary Turk:*** So we're 13% of global emissions.

[3:52 - 3:53] ***Senator Kennedy:*** If you know, why won't you tell me?

[3:53 - 3:55] ***Dep. Secretary Turk:*** If we went to zero, that would be 13%.

[3:55 - 4:23] ***Senator Kennedy:*** You don't know, do you? You just want us to spend $50 trillion. And you don't have the slightest idea whether it's going to reduce world temperatures. Now, I'm all for carbon neutrality, but you're the Deputy Secretary of the Department of Energy, and you're advocating we spend trillions of dollars to seek carbon neutrality, and this isn't your money and my money. It's taxpayer money. And you can't tell me how much it's going to lower world temperatures?

[4:24 - 4:26] ***Senator Kennedy:*** Or you won't tell me? You know, but you won't?

[4:26 - 4:32] ***Dep. Secretary Turk:*** In my heart of hearts, there is no way the world gets its act together on climate change unless the U.S. leads.

[4:32 - 4:39] ***Senator Kennedy:*** Tell me how much it's going to reduce. You can't tell me. Either that or you won't.

[4:40 - 4:41] ***Dep. Secretary Turk:*** And that's the president of the United States needs.

[4:41 - 5:03] ***Senator Kennedy:*** I've still got a few seconds. I've got 22 seconds. I'm going to use them a different way. Dep. Secretary Turk, shame on you for not answering my questions.