WHAT WOULD BE AN ADEQUATE NATIONAL CLIMATE PLAN?

In 2018 the United Nations Intergovernmental Panel on Climate Change (IPCC) reported that in order to avoid catastrophic climate change, the world needs to cut global carbon dioxide emissions by **45% of our 2010 level by 2030. But what does that mean?** It means it will require a very rapid and steep decline from 31 billion tons ("GT" or "gigatons") CO2 emitted in 2010 to **14.5 gigatons CO2 by 2030!** The IPCC has warned us that without such a sharp decline in our emissions, global temperature will pass 1.5°C above preindustrial levels by 2030, and we will face extreme destabilization of our climate. Furthermore, we need to reach net zero by 2050.

So, what can we do to get our governments to step up to this challenge? We have the resources and the knowhow to make this shift, but we need to move from generalities about "having a climate plan" to specifics. The plan must include policies strong and rigorous enough to shift from business as usual in the next 10-12 years, or face massive climate disruption and the environmental, social, economic, and political chaos it will cause.

After much research, I've developed the attached list of specific questions to ask yourself; your circle of friends, family and colleagues; your congressional representatives; and our presidential candidates about what would be a truly effective climate plan. Each question is followed by an example of an adequate response. These answers do not represent my viewpoint but rather were painstakingly gathered and synthesized from the best available sources online and in print (see Appendix).

Sanjen Miedzinski, B.S. Biochemistry, Ph.D. Clinical Psychology
Director, Earth Rising Action Network

For further information or for additional publications, email
info@EarthRisingAction.org

QUESTIONS TO EVALUATE A CLIMATE PLAN

by Sanjen Miedzinski, Ph.D.

GETTING THE BIG PICTURE

Do you agree with the latest IPCC report that we are in a climate crisis, that greenhouse gas emissions primarily from burning fossil fuels is a major cause of this crisis, and that we must act in the next 10-12 years to radically reduce our emissions?

If they don't agree with this one, we've got problems. Best to just inquire into why, what is their reasoning for disagreeing.

What is the level of carbon dioxide in the air as of 2019? What is considered the safe level and the maximum beyond which the global temperature will rise too high to sustain life as we know it?

In June 2019, carbon dioxide was 413.92 parts per million. James Hansen of NASA has stated that 350 parts per million is the maximum to maintain the climate as we know it. The last time concentrations reached the current level was about 3.6 million years ago during the ice-free Pliocene era—i.e. before human beings walked the Earth.

What are the major sources of carbon dioxide in the United States?

Carbon dioxide is released into the air when burning oil, gas or coal by cars, trucks, planes and trains, by utility companies in generating electricity, by industry to run furnaces to create iron, steel and cement, to run factories, to heat and cool homes and other buildings.

What emission reduction targets will you set for the world—and most importantly for the U.S.—to accomplish this rapid decline in greenhouse gas emissions by 2030?

Global:

According to the IPCC 2018 Special Report on keeping warming to no more than 1.5°C over pre-industrial levels, we must cut carbon dioxide emissions by 45% of 2010 levels by 2030. As levels were approximately 31 GT CO2, we would need to be **down to 14.85 GT CO2 in 2030.**

The 2019 UN Emissions Gap Report focused on carbon dioxide equivalents (includes all greenhouse gas emissions), which reached **a record high in** 2017 of **53.5 gigatons (GT) CO2e** (GT is a Billion metric tons; CO2e is carbon dioxide equivalents). They report that to limit global warming to 1.5°C the world needs to cut this amount by 55% to hit **29 GTCO2e in 2030.**

By either measure, this is a very radical, steep and immediate reduction!

It means reducing emissions more each year, starting with peaking (reaching a maximum of CO2e) now or very soon, and turning the graph downward to lower yearly emissions. However, in 2017 there was an increase of 0.7 GTCO2e compared with 2016 and the graph shows no sign of having peaked.

U.S.:

Despite the Trump Administration's "climate hoax" position, our own government in its *U.S. Global Change Research Program Fourth National Climate Assessment* has supported climate science in great detail and also looked at every region of the country and the changes currently happening and expected.

While this author couldn't find mention of a specific emissions target in that report, we know our emissions were at **6.5 GTCO2e** (6,472 million) in 2017 and the best assessment from numerous sources suggest they would need to go down to **3 to 3.6 GTCO2e by 2030**.

Note: The fossil fuel industry is touting a decline of 14% between 2005 and 2016, however this includes the period of the recession and is also related to the switch from using coal to gas as well as some positive changes in energy use. There was also a decline between 2016 and 2017. However it is now climbing, and in any case the amount is far too high to hold to the 1.5°C Limit. Furthermore, Climate Action Tracker reports that the existing U.S. target under the Paris Agreement is "Insufficient", as it is not stringent enough to limit warming even to 2°C, let alone 1.5°C.

Note: There are three measures: C or carbon, CO2 or carbon dioxide, and CO2e or carbon dioxide equivalents, which includes other sources of greenhouse gas emissions. Sometimes CO2e includes "land use" which is important.

Be wary of responses given by candidates of the form *"I would reduce emissions by 25% from the year 2005 by 2030"* which state a target year and a percentage reduction over the amount emitted in a previous year. Unless you know the emissions amount in that earlier year, it sounds good but you don't know what their target actually is. Furthermore what matters is not some impressive percentage figure but rather the maximum amount of gigatons of carbon dioxide equivalents we can add to what is already accumulated in the atmosphere to avert catastrophe. (See Carbon Budget in Appendix.)

To actually meet the required targets in the short amount of time we have will require drastic actions. Sanders and Ocasio-Cortez have introduced H. Con. Resolution 52 expressing the sense of Congress that "there is a climate emergency which demands a massive scale mobilization to halt, reverse and address its consequences and causes." Do you support this resolution and how will the fact of this emergency affect your first 100 days in office?

While solar and wind power are growing and their prices are now cost-competitive, market-based forces cannot act swiftly enough to address the climate crisis we are now in. The new President will need to immediately create national government structures to focus on the climate emergency. In addition they will need to fully engage internationally through the UN Paris Agreement of 2015 and the ongoing meetings of the Conference of Parties.

We will need government intervention to coordinate and fund a national social, industrial, and economic mobilization of the resources and labor of the United States at a massive scale to halt, reverse, mitigate, and prepare for the consequences of the climate emergency, and to restore the climate for further generations.

There are many examples when we Americans have mobilized with government resources to accomplish something specific that seemed almost impossible—building the Erie and Panama Canals, landing on the moon, etc. But the climate crisis calls for the kind of mobilization that was required by World War II.

During this period, American industry was called upon to essentially stop what it had been doing and dedicate everything towards building tanks, planes and armaments for the Allied forces. Domestic auto production ceased, nylon stockings were hard to find and steel was used to make pennies to save precious copper. Everything changed and everyone made sacrifices. America's labor market witnessed tens of millions of workers entering industrial centers from previous service sector or agrarian jobs. Million of students, retirees, housewives and the unemployed moved into the active labor force.

Given that the fossil fuel industry has a stranglehold on our economy and government, how can we build a common movement to combat their immense money, power, and political influence? Do you support the Green New Deal?

We need a movement of movements. The climate crisis exposes a common issue underlying many of our separate concerns. That issue is a form of capitalism based only on profit. It results in pollution and health costs created by the fossil fuel industry but paid for by the public, environmental injustice where the poorest suffer the greatest environmental costs, increasing wealth inequality leaving the poor and middle class in debt with many working multiple jobs to survive, many who need health care but who are not receiving it, people of color exploited and imprisoned, and women devalued and abused.

The Green New Deal is a wonderful beginning in uniting these different agendas. Also a great example is the Canadian values-based plan known as the "Leap Manifesto." Most recently, environmental organizations have come together to produce a Climate Plan that integrates the perspectives of the "Big Greens" (e.g. Sierra Club, Natural Resources Defense Council), as well as the many environmental and social justice organizations. (See Appendix for links to all of the above.)

Once we have consolidated our own movement of movements, we can then reach out to our fellow Americans who hold different perspectives, and find the common ground underlying all of our concerns. The President must model respect by meeting with representatives of opposing perspectives as well as setting up structures to coordinate community meetings in which moderate right and left citizens can listen to and respect each other.

Ultimately we will need to make a "Leap." When faced with a chasm, there is no other option but to leap. We human beings sometimes jump into a whole different worldview and take action even when we can't fully see the outcome. We need a cognitive shift which brings together the values of the left and right, which honors individuality, individual achievement, creativity and enterprise, but broadens it into awareness of the whole human and ecological system in which we are embedded and honors our connections as well as our separate unique capacities.

Our new President must be committed and charismatic enough to catalyze that leap.

What are the broad outlines of a climate plan comprehensive enough to begin to respond to the climate crisis?

Recommit to the Paris 2015 Climate Agreement and work to strengthen our targets as well as those of all other countries so that we meet the 1.5°C limit.

Support and fund programs that enable developing nations with insufficient energy resources to go straight to renewable energy rather than depend on new fossil fuel development.

Switch from fossil fuels—oil, gas and coal—to renewable and clean sources of energy including solar, wind, geothermal, hydro, wave, tidal, and possibly nuclear.

Leave fossil fuel reserves in the ground.

Establish a national carbon tax or carbon cap and trade program or require each state to develop one that meets national standards. Through increasing the price of carbon each year, bring the U.S. down to net zero emissions by 2050.

End fossil fuel subsidies and special tax breaks, loopholes and credits for the industry.

Provide funding and retraining for fossil fuel workers who will need to transition from fossil fuel jobs to renewable energy jobs.

Strengthen the EPA, and mandate that each state develop Renewable Portfolio Standards specifying how much of their electricity will be generated from renewables and by when, as well as Feed-In Tariffs which pay customers for feeding energy from their solar or wind generators into the grid.

Modernize the electrical grid so that energy generation can be less centralized.

Mandate increased energy efficiency in industrial processes, especially in creating clinker for cement, and in the smelting required making steel and iron.

Regulate efficiency in fuels and in design of transportation vehicles.

Regulate efficiency in building construction and in heating and cooling.

Stop methane leaks from fossil fuel extraction, manure and enteric gas from factory animals, landfills, damaging agricultural processes that release it from soil,

metallurgical coke in iron and steel production, and inadequate wastewater treatment of remaining sediment.

Control nitrous oxide and nitrogen dioxide emissions from overuse of nitrogen fertilizers and burning fossil fuels, respectively.

Control emissions and eventually eliminate the use of the extremely potent greenhouse gases: **hydrofluorocarbons and perfluorocarbons** (PFC, HFC, SF6) used in refrigeration, electric insulation, and semiconductor manufacture.

Insure environmental justice as various programs clean up fossil fuel sites and develop new projects, taking into account the needs of the communities in which they are placed.

Support a shift in land use to strengthen natural carbon dioxide removal or carbon "sinks" by working internationally to establish global programs which:

Stop clear-cutting forests for palm oil and cattle grazing, restore forests, and plant new native forests (1 trillion trees),

Create green barriers or "walls" around deserts,

Restore coastal sea grasses, mangroves, and marine sanctuaries,

Shift from increasing meat and dairy production to more plant-based foods,

Adjust agricultural farming processes that deplete soils, and reconstruct soil ecosystems.

GETTING DOWN TO THE DETAILS

Are you accepting donations from fossil fuel companies for your campaign?

No! Or, if they say yes, why?

What existing laws are available to regulate greenhouse gas emissions and other pollutants?

We already have the Clean Air Act, Clean Water Act, Endangered Species Act, and the Environmental Protection Agency to regulate and enforce those acts. In 2007 the Supreme Court ruled that greenhouse gases are an air pollutant that can be regulated under the Clean Air Act.

What policy tools can you use to begin limiting our use of fossil fuels?

In addition to mandating a nationwide reduction in greenhouse gas emissions, we can also do the following:

Stop fossil fuel subsidies. The International Monetary Fund reports that in 2017 $5.2 trillion was spent globally and $649 billion in the U.S. on fossil fuel subsidies. Forbes reports that in 2015, U.S. fossil fuel subsidies were higher than our defense budget

and ten times higher than our education budget. The report further states that fossil fuel subsidies account for 85% of all global subsidies.

Eliminate the many tax loopholes, deductions and credits given to fossil fuel companies. As an example ExxonMobil used all these benefits to pay only 3.7% tax in 2016. Trump's 2017 Tax Cuts and Jobs Act provided $25 billion in direct one-time benefits for 17 American oil and gas companies. It also reduced corporate annual tax from 35% to 21% every year in perpetuity. With all these additional benefits, ExxonMobil's effective tax rate is estimated to be -85.6 percent 2017. In other words, instead of paying taxes, they are receiving money from the U.S. treasury.

Put a price on carbon either through a direct carbon tax or a carbon trading program. This can be a national program or mandating that each state institute a program that meets certain national standards. Currently individuals pay for all the health and environmental costs that result from greenhouse gas emissions. (See more details in next question.)

Stop building new infrastructure. Investments in new coal plants, pipelines, fracking, and refining facilities extend the industry another 50 years.

Keep fossil fuels in the ground. Set dates by which fossil fuel operations must stop altogether—not just net zero but zero fossil fuel extraction. All fossil fuel reserves must stay in the ground as we stop mining, drilling and fracking.

Develop and enforce efficiency standards to lower fossil fuel use. Currently 63.5% of electricity in the U.S. is generated by burning fossil fuels. Therefore, an important way to reduce use of these fuels is to reduce electricity demand by increasing efficiency in energy use—in transportation, agricultural processes, and buildings. In addition, we need to reduce emissions from other processes besides generating electricity, such as direct burning in cement production, flaring of natural gas, and blast furnace heating in various manufacturing processes.

Would you push for a carbon trading program or a carbon tax to accelerate the shift to clean energy, and if so how high should it be? What would you do with the revenue generated from this tax?

An important tool in the shift to clean energy is to set a price on carbon pollution and to have it increase every year. This can be through a market-based carbon trading program (see Appendix) or a direct tax on carbon. The market-based programs are subject to great variability in their effectiveness and can contribute to environmental injustice. A direct carbon tax is a better choice.

The 2018 UN Emissions Gap Report concludes that to limit warming to no more than 1.5°C, one of the tools must be a **minimum price (or fee) paid to release CO_2 in the atmosphere of from $38 to $76/metric ton.** Meanwhile the IPCC 2018 report has stated that the global average price for a ton of CO_2 must reach a minimum of $135/ton by 2030 and could go as high as $5500!

At the moment the U.S. has no such tax. California has a cap and trade program in which the price reached $15.10/ton in March 2018. There is also a Regional Cap and Trade program among the nine Northeastern states in which the price has been well below $5 for much of its history, and the Western Climate Initiative's Cap and Trade program is in the process of forming. The EU has a cap and trade program currently trading at $33 a metric ton.

A 2018 report by MIT and the National Renewable Energy Laboratory summarizing multiple studies found the impact of a $50/ton fee with an annual increase of 5% a year could result in a 63% reduction in total U.S. greenhouse gases by 2050. Despite concerns that it would have a serious negative effect on the economy, the report states that its impact would be minor, i.e. -0.4%.

Obviously the higher the tax the more revenues available to support a new clean energy economy. Over ten years a $73/ton fee would generate $3 trillion. As this tax would hit middle and lower income families the hardest through increases in the price of energy and other commodities, its revenues could be used partly to provide a rebate to lower and middle-income families while preserving a portion to fund government efforts to support the development of renewable energy.

This is not just about fossil fuels. What other pollutants add to the global warming problem?

Fluorinated Gases: hydrofluorocarbons and perfluorocarbons (HFC, HCFC, PFC, SF6, nitrogen trifluoride)

These are used in a variety of industrial processes and in refrigeration and are extremely potent greenhouse gases. Some are 7,000 to 9,000 times per molecule as powerful in global warming as a molecule of carbon dioxide. Also, perfluorocarbons have relatively long atmospheric lifetimes (up to 50,000 years).

Methane is a greenhouse gas that is 28 times more potent than carbon dioxide. Natural gas is predominantly methane and while burning it emits less greenhouse gas than oil or coal, it is still a major pollutant. However there are many other ways methane enters the atmosphere. First, there are leaks from oil, gas and coal production. Then manure and gas from digestion are major sources in factory farming, as are damaging agricultural practices such as tilling the soil, as well as methane escaping from landfills and wastewater treatment processes.

Black Carbon is the sooty black material emitted from the incomplete combustion of fossil fuels, biofuel, and biomass. Sources are wildfires, cook stoves, burning wood, gas and diesel engines, coal-fired power plants, and other sources that burn fossil fuel. It is a particulate matter air pollutant. The IPCC estimates that it is the second largest contributor to global warming after CO_2 emissions. This is because it darkens surfaces (such as Arctic ice, mountain glaciers, and clouds), which leads to absorption rather than reflection of heat back into space. It is also a source of health risks including respiratory and cardiovascular disease, cancer, and even birth defects.

Climate model alternatives that limit global warming to 1.5°C with no or limited overshoot involve deep reductions in emissions of methane and black carbon (35% or more of both by 2050 relative to 2010).

Nitrogen Dioxide (NO_2) is released into the atmosphere during the burning of coal, gas or oil. In cities it is mostly due to vehicle exhaust. Other sources are oil and metal refining, electricity generation from coal-fired power stations, other manufacturing industries, and food processing. It contributes to the formation of smog and ground level ozone and has significant impacts on human health.

Nitrous Oxide (N_2O) Nitrogen from fertilizers (manure and synthetic) which is in excess of crop needs leads to soil microbes on farms belching unexpectedly high levels of nitrous oxide, a greenhouse gas with 300 times as much heat-trapping power as carbon dioxide.

Furthermore, it would appear that the relationship between amount of fertilizer and gas produced is not linear but exponential, so a small increase in excess fertilizer leads to a large increase in gas. Furthermore, there may be additional emissions from fertilizer as it erodes from soil and enters streams.

How will you encourage development of wind, solar, geothermal, and other renewable energy?

Research And Development Programs The government should fund universities and think tanks to discover and begin the development of new energy approaches such as building roads which are themselves a form of solar panels, working on better batteries to store more wind or solar energy, developing better airline industry fuels, etc.

Subsidies Where an industry needs support to get off the ground, government can provide funds to help them through the risk period. This is where the recovered $469 billion in fossil fuel subsidies could be re-invested. As an example, the airline industry may need considerable financial support to transform planes with lighter building materials, different fuel, and more efficient designs. Subsidies can support the development of tidal and offshore wind turbine projects. Government funding might be needed for the development of very large infrastructure projects such as massive solar farms or offshore wind farms.

We already know that the price of alternative energy has been steadily decreasing and is now competitive with the price of fossil fuels. As a price is put on carbon pollution, renewable energies will become even more attractive.

Economic Incentives We already have a federal rebate on the purchase of electric vehicles. These should be maintained and other incentives can be offered for increased energy efficiency in industrial and agricultural processes.

Renewable Portfolio Standards (RPS) States can be mandated to develop individual RPSs, much as is currently done in California. An RPS is a regulation that requires companies such as electrical utilities to procure a fixed portion of their generation

from eligible renewable sources—e.g. 25% from solar by 2025. Compliance with the standard is then tracked through a credit system.

Feed-In Tariffs Another important economic policy tool is to mandate that a business or household that generates electricity from a wind turbine, or solar panels, or other renewable source, receives a long-term contract enabling them to feed their extra energy into the grid and receive a fixed payment (the tariff) for that contribution.

Modernize Electrical Grid Overall the U.S. electrical grid is in need of modernization and an important part of that process can include increasing the ways that energy generated locally (i.e. "distributed," including by businesses or households from rooftop solar), can be more readily stored and fed into the U.S. grid.

Encourage the Development of Community Owned Utilities Neighbors wanting to control the source of their power can take control of their own power generation by developing utilities like MCE Community Choice Energy in Marin County, California.

The IPCC Report on holding to 1.5°C states that in addition to greatly reducing fossil fuel use, we need programs to actually take accumulated carbon dioxide out of the air—100-1000 GTCO2e over the course of the 21st century. We need "Negative Emissions Technologies." Two major possibilities are carbon capture and sequestration (CCS), and afforestation—i.e. planting more trees as well as other changes in Agricultural, Forestry and Other Land Use (AFOLU). Which would you prioritize and why?

Carbon Capture and Sequestration (CCS) involves capturing carbon dioxide at its source (power plants, industrial processes) transporting it to storage sites where it is put in non-atmospheric reservoirs (e.g., depleted oil and gas reservoirs, un-mineable coal seams, deep saline formations, deep ocean.

There are currently many CCS pilot projects using different methods to capture, transport and store the carbon dioxide. They have proven to be expensive, as they require high capital and operating costs. The process itself is energy intensive which lowers its overall efficiency. Although some of the CCS technologies have been proven, comprehensive CCS projects involving large-scale capture and storage are not operational.

There are potential dangers with different methods. For example, those that store the gas underground must guard against earthquakes or other shifts that could release massive amounts of carbon dioxide, which can be lethal. There are also the usual dangers associated with transportation by pipeline. Releasing CO_2 into the deep ocean may result in further acidification, a significant issue.

Many environmental organizations, including the Union of Concerned Scientists, see carbon capture as an attempt to allow continued burning of dirty fuels instead of moving to clean renewable energy.

Bioenergy with Carbon Capture and Storage (BECCS) Some argue that Bioenergy with Carbon Capture and Storage is an answer to that concern. It couples burning

plants with capturing the CO_2 emissions. The advantage is that plants are a renewable energy source. There is also the argument that burning plants is carbon neutral in that the plants re-grow and thereby sequester the carbon that has been emitted. The argument against this is that it will require (as does ethanol from corn) the use of arable land and water that could be used to grow food, as well as the energy used in growing, transporting and refining the crop into fuel.

Also there is a question about its technical and economic viability. As of 2018, there is only one BECCS project in the world—ADM's Decatur corn ethanol refinery in the U.S. The argument that it is carbon neutral is deemed spurious as the refinery is powered by fossil fuels and corn is an energy intensive crop. Converting land can displace biodiverse ecosystems, degrade and overharvest forest, and produce emissions from soil. It can also increase the use of nitrogen fertilizers and NO_2 emissions. Finally, it opens the way for more "land grabs" that harm communities.

Direct Air Capture (DAC) involves a cocktail of chemicals that bind to CO_2 but are inert to other gases. As air passes through DAC machines, also known as artificial trees, the CO_2 adheres to the chemicals and is released again when excited by energy, allowing it be captured, stored, and recycled or reused. Additional research is required in this area.

Natural Methods for Carbon Dioxide Removal

Soil carbon sequestration Currently methods such as intensive plowing, crop burning and the application of industrial fertilizers have led to huge amounts of carbon in the soil being oxidized when exposed to the air and entering the atmosphere as CO_2. Soil carbon sequestration uses measures such as modern farming methods, grassland restoration, and creation of wetlands and ponds to reverse past losses of soil carbon and sequester the CO_2.

Biochar Biomass is decomposed using pyrolysis (which is heating in the absence of oxygen) and so does not create carbon dioxide. The result is biochar—concentrated carbon—which is then added to soils where it stays for hundreds or thousands of years. This has the additional effect of improving soil fertility and boosting crop yields. It is also a convenient way of disposing of agricultural wastes.

Building with biomass Use of plant-based materials in construction, storing the carbon and preserving it for as long as the building remains standing. The standard construction materials cement and steel are carbon-intensive to produce.

Blue carbon habitat restoration Conservation and restoration of degraded coastal and marine habitats such as salt marshes, mangroves, and seagrass beds so they continue to draw CO_2 out of the air, which they do even faster than forests, according to studies.

Deforestation and Afforestation

First, we must stop deforestation—clearing forests to plant palm oil trees or graze livestock. Even if we stop these activities, with global warming, we are set to lose trees due to fire and pests.

By contrast with CCS, afforestation (planting more trees) is a natural way to remove carbon dioxide from the air. And scientists report that it is a powerful tool in the arsenal of greenhouse gas-lowering methods. As trees grow they absorb and store carbon dioxide emissions. The latest special report by the Intergovernmental Panel on Climate Change (IPCC) states an increase of 1 billion hectares (about 2.5 billion acres of trees—the size of the U.S.) will be necessary to limit global warming to 1.5°C by 2050.

The Crowther Lab of ETH Zurich, a Swiss university, published a study showing there is enough room (.9 billion ha) in the world's existing parks, forests, and abandoned land to plant 1.2 Trillion additional trees without encroaching on cropland or urban areas. Once matured, these trees could absorb 205 gigatons of carbon, or about 1/3 of the cumulative emissions since the beginning of the industrial age.

Also, the soils underneath the trees can harbor entire ecosystems that themselves absorb carbon.

Nations are now promising to plant more trees, but unfortunately, sometimes the timber industry rules the day and monocultures of fast growing trees are planted with the intention to cut them down when the time is profitable. By contrast, what is needed are native forests which support ecological systems with their biodiverse soils that can sequester even more carbon.

A related project based on using nature's own decarbonizing process is to build green walls or barriers made of native vegetation and planted on the edge of deserts to stop the desertification of the surrounding area. This has been tried only on a limited basis.

The IPCC report has stated that it will be impossible to limit temperature rise to safe levels without fundamentally altering the way the world produces food and manages land. What changes do we need to make to our food production and consumption and the way we use land?

First the U.S. needs policies to curb wasting 30-40% of our food. Imperfect vegetables are sent to the landfill by growers and grocers. Restaurants throw away food prepared but not served. Individuals eat only part of their purchases. Second, as the nations of the world become more prosperous and global population continues to grow, meat and dairy consumption is rising. Land is cleared for grazing, fossil fuel use for factory farming is intensive, and methane in great quantity is generated by manure and enteric digestion. Grain that could be a direct source of food is raised to feed this livestock. We need policies, including subsidies, to encourage a shift toward more plant-based diets. Recently, new research published in the journal *Nature* calls

for a shift to "flexitarian" diets that may include meat but are more balanced. More specifically, it found that in order to keep climate change below even 2 degrees C, the average world citizen needs to eat 75% less beef, 90% less pork and half the number of eggs while tripling consumption of beans and other pulses and quadrupling nuts and seeds.

Finally, good soil is essential both for sequestering carbon and for growing nutritious food. What makes soil fertile and rich is the ecological community that grows within it. Modern industrial agriculture tills the soil killing its ecosystem (microorganisms, fungi, bacteria, as well as the insects, worms, etc.). This practice, followed by planting mono-crops, depletes the soil, which then requires synthetic nitrogen fertilizers. It also releases the carbon sequestered naturally in the soil. We need to use gentler planting methods, natural fertilizers, and crop rotation to enhance the quality of the soil. Furthermore, as the world heads toward a population of 9 billion we may not have enough land to grow our food if it is used to grow grain for an increasing number of cattle and other livestock, to grow biofuels, or for palm oil plantations to make cosmetic and industrial products.

The IPCC has stated that a "share" of nuclear power in electricity generation is part of most models that keep warming to the 1.5°C limit. The issue is very controversial with many environmentalists opposed. What role should nuclear power play in the energy mix of the future?

There are five concerns repeatedly cited by those opposed to nuclear energy: safety, cost, the long time they take to build, difficulty of disposing of radioactive waste, and the increased availability of uranium thereby facilitating the development of nuclear weapons if nuclear power is widely used.

Concerning safety—the specter of Chernobyl, Three Mile Island and the more recent Fukushima have discouraged further development. Some 23 U.S. reactors were built with a GE designed containment housing known as Mark I which is the same design used at Fukushima. While this design has operated safely for more than 40 years, it could not stand up to an earthquake and Tsunami. This highlights the potential for major disasters especially if the plant is near a big city. (Fukushima was some distance from Tokyo.)

Also, nuclear plants are aging. Currently the U.S. has 99 reactors operating at 60 plants. Most were built in the 60s-80s. Thirty-five percent are at risk of early closure or slated to retire.

High cost and the time it takes to build them (10-20 years or more) are additional issues. Nuclear doesn't do well in carbon cap and trade programs in competition with either renewables or gas. Some states have had to develop a zero-emission credit (ZEC) to support their continued operation.

Four new, large-scale nuclear power plants are under construction, helped by federal subsidies. All are being built by Westinghouse and have faced massive cost overruns and delays.

However, there are advocates for building new plants. (See Yale350 article in Appendix.) They argue that nuclear power generates no carbon emissions, and once working can operate at much higher capacity (92.3%, a continuous supply) than renewable energy sources or fossil fuels, thus adding to energy security.

They also cite studies showing that the long term health effects resulting from these three major accidents have had much less impact than we imagined, and compare favorably to toxic chemical accidents such as the Bhopal gas leak where thousands died. Other advocates point out the terrible health records of mining and drilling operations and disasters.

And they point out that contrary to popular belief, nuclear power generally releases less radiation into the environment than any other energy source (e.g. coal ash has more uranium and thorium than nuclear waste and is collected to be used for other purposes, such as concrete production.) This article also argues that we have the technical capacity to recycle 90% of spent fuel and storage problems have been largely solved using deep geological storage.

The environmental groups are quite mixed on this subject. The Union of Concerned Scientists, National Resources Defense Council, and the Environmental Defense Fund all express concern that if we close down nuclear reactors too soon what we will get in their place are more fossil fuel burning plants. They also list many safety, security and performance standards that must be strengthened for any continued operation. However, they see a scaling down of production, as renewables replace nuclear's contribution over time. NRDC suggests 3% nuclear power as the final target.

Greenpeace and the Sierra Club are both completely opposed to the use of nuclear energy. Greenpeace commissioned some of the world's leading experts on nuclear waste to produce an overview of the current status of nuclear waste across the world. They found that no government has yet resolved how to safely manage these wastes. (See Appendix.) The Sierra Club remains "unequivocally opposed" to nuclear as an energy source. They point out all the issues and risks and argue that renewables avoid all such risks.

Ambivalence about nuclear energy is also evident in the European Union. Overall the EU depends on it for about a quarter of its electricity needs, with France supplying half of that. However, several countries are phasing it out (Germany, Italy, Sweden and Belgium). As one of their EU parliament members stated: "It is not a clean fuel but a 'dirty' fuel." The issue continues to be whether fossil fuels will replace nuclear in countries that phase it out. Meanwhile other EU countries such as the UK are planning to renew or expand their nuclear power infrastructure.

GEOENGINEERING: CONTROVERSIAL ALTERNATIVES

Some scientists argue that in order to survive the climate crisis we may have to take radical measures such as seeding the stratosphere with sulfate particles mimicking volcanic ash to block the sun, or fertilizing the ocean with iron so that carbon dioxide absorbing phytoplankton will proliferate. Many environmentalists see this as an unnecessary and risky distraction from switching entirely to renewable energy. What do you think of pursuing geoengineering and what do you see as its possibilities for success and its dangers?

Solar Radiation Modification (SRM) measures are not included in any of the pathways proposed by the IPCC to keep warming to 1.5°C. "Although some SRM measures may be theoretically effective in reducing an overshoot, they face large uncertainties and knowledge gaps as well as substantial risks and institutional and social constraints to deployment related to governance, ethics, and impacts on sustainable development

Aerosols in the Stratosphere Blocking the Sun One proposed method is to send trace amounts of aerosol containing compounds like sulfate into the Earth's stratosphere, roughly 20 km high. This can reflect incoming sunlight and reduce global temperatures. It essentially mimics the ash plume from a volcanic eruption and like an ash plume, once injected into the lower stratosphere, the aerosol will quickly spread out, thus affecting large areas of the planet. Unfortunately it may result in cooling one part of the Earth while triggering extreme weather events on other parts. Unfortunately, research has found that billions of people could suffer both worse droughts and floods.

A Giant Parasol to Block the Sun Another plan is to manage the amount of solar radiation hitting Earth by putting a giant parasol consisting of a thin, wide sheet of carbon fiber—the Huge Space Shield—into a Lagrange Point where the gravitational pulls between the Earth, moon, and sun are relatively balanced. The sheet would block a small portion of solar radiation, but it could be enough to drop global temperatures below the 1.5°C limit.

Stimulating Cloud Formation Others want to block the sun by stimulating cloud formation, a process known as cloud seeding. Rain is formed when water droplets nucleate around dust particles, pollen, sea salt, and even bacteria but scientists have confirmed that compounds like silver iodide or dry ice can work just as well. The plan is to inject the atmosphere above drought-prone areas with these substances, thus increasing cloud cover and rainfall.

Ideas Not Involving Solar Radiation Modification:

Alkalizing Clouds and Ocean Alternatively there is a plan to increase the alkalinity of clouds or the ocean to enhance their ability to dissolve CO_2 in water and thereby remove it from the air. Adding strong alkali (56m tonnes of potassium hydroxide across .4% of the Earth's surface) to clouds will create alkali rain that washes CO_2 out of the atmosphere. Adding lime or calcium oxide to the ocean would increase its

capacity to absorb CO_2 while also partially offsetting ocean acidification. It would need to be spread over a wide area.

Ocean Fertilization Rather than working on cooling the planet, another plan seeks to remove CO_2 from the atmosphere by fertilizing the oceans either with iron or nitrogen. This would then stimulate the growth of phytoplankton (tiny plants), which would photosynthesize using CO_2 dissolved in the surface layer of the ocean, thereby locking up the carbon into their tissues which would become sediment on the ocean floor when they die sequestering the carbon for hundreds or thousands of years.

Enhancing Weathering Normally rock is weathered as slightly acidic rain falls on it forming bicarbonate from the CO_2 in the atmosphere and eventually it is washed into the ocean. The plan is to pulverize rock speeding up the weathering action and spread it over large areas of agricultural land or on the ocean surface to speed up the bicarbonate formation process.

The question is, of course, do we really know enough to engage in geoengineering of any kind? What if large-scale cloud seeding, for example, alters the jet stream and delays the monsoon season across Southeast Asia? What would this do to rice crops? In 2008, 191 countries approved a UN ban on ocean seeding out of fears of unknown side effects, such as altering the food chain or creating regions of low oxygen concentration.

The truth is we don't understand the complexity of these geological systems and changing one part of a system without understanding the whole is akin to squeezing a balloon—as one part contracts, another bulges out.

DIGGING DOWN INTO RESPONSIBILITY AND LEGALITIES

How will you support efforts to hold fossil fuel companies responsible for the climate crisis we are in?

Legislators and candidates for office should not accept campaign donations from fossil fuel companies. A constitutional amendment to overturn the Supreme Court's Citizens United decision should be introduced and ratified, thereby controlling the ability of fossil fuel and other corporate actors to promote the candidates of their choice. Lawsuits to hold fossil fuel companies responsible for deliberately concealing the dangers of climate change should be supported. Likewise lawsuits by youth, such as Our Children's Trust, which seek to hold governments responsible for inaction on climate change, should be supported. If one chooses to be an investor and therefore a shareholder within a fossil fuel based company, one can act from within and tie resolutions to carbon reduction goals. Universities and other institutions, as well as individuals through banking and investment choices, can divest from fossil fuels.

Who is liable for climate change?

There are four levels: the countries who emit the most, the industries that produce fossil fuels, the industries that are the source of the emissions, and all of us for our individual energy decisions.

Approximately twenty developed countries have over time produced the accumulation of carbon dioxide that is now heating the planet.

The fossil fuel industry is the major driver of greenhouse gas emissions and the irony is that as early as 1977 their own scientists knew the danger of what they were putting into the atmosphere.

However, across all industries, we have been feeling flush with energy, addicted to "black gold" and ignoring energy use efficiency—in transportation, agriculture, building, and manufacturing.

Finally, as private citizens in the top twenty Western countries, we have been bingeing on fossil fuel energy through our food, transportation, home heating, cooling, and lighting choices.

What does the U.S. owe the world?

We are the home of the fossil fuel industry. We are the second largest greenhouse gas producer in the world, responsible for 15% of the global emissions this year. In 2014, U.S. citizens emitted approximately 20 tons of greenhouse gases per person a year as compared to Europe's citizens at 7.5 and India at 2.5.

Furthermore we have been burning fossil fuels far longer than the rest of the world and with just over 4% of the world's population we are responsible for almost a third of the excess carbon dioxide that has accumulated and is heating the planet.

In a period of transition from fossil fuels to renewables, it is our country and our citizens that can afford to cut back on our energy use to make some room for the very energy poor countries to build their energy resources.

In the Conference of Parties Paris 2015 agreement it was acknowledged that the U.S. as well as other Western countries would need to provide funding to help the less developed countries move into energy sufficiency by leap-frogging over fossil fuels and investing in solar, wind, geothermal, and tidal energy. A Green Climate Fund was established to which the U.S. and the other developed countries pledged to donate a total of $100 billion per year. So far, neither the U.S. nor the other developed countries have donated what they pledged.

The current administration has sponsored relentless attacks on science and scientists. What will you do to stop this?

It is important to develop legislation to safeguard scientific integrity and hold federal agencies accountable for ensuring that science isn't sidelined from the process of protecting public health, safety, and the environment. Strong congressional oversight is needed to ensure these actions.

WORKING WITH OUR CURRENT CHALLENGES

While our goal is reducing emissions and averting the most catastrophic climate change, we are already facing many climate crises. What will you do to address the repeated damage to health and property currently happening as sea level rises in coastal cities, storms become more extreme, and extreme drought and wildfires occur throughout the U.S.? How we will mitigate and adapt to severe climate change?

To respond adequately to this climate emergency we will need very resolute and strong leadership from the President but also from newly created collaborative federal, state and local government agencies aligned with businesses and NGOs.

We may need to create a cabinet-level position and coordinating committee to handle the climate crisis, which will work with the heads of our U.S. agencies—especially Homeland Security, FEMA, EPA, USDA, CDC, Interior and Energy agencies.

The recent report: *Adapting to Climate Change: A Call for Leadership,* by the Center for Climate and Energy Solutions, offers a beginning roadmap.

We will need to develop a Strategic Planning Initiative to provide the overarching goals, objectives, and priorities for a climate program. It would include the development of federal agency adaptation plans and work to integrate both sector and state level planning processes into a national climate change adaptation strategy. It can draw upon the 2018 United States Government National Climate Assessment, which evaluates the risks for each part of the country, and it will work with city, county and state governments to strengthen mitigation plans for local action.

We may also need a National Climate Service to provide stakeholders with much-needed information on climate change impacts and adaptation options. All levels of government, the private sector, and other stakeholders will need information on climate change impacts on a time and geographic scale useful to them, as well as decision tools to aid in analyzing adaptation options.

Finally, there must be an Adaptation Research Program to ensure that appropriate emphasis is placed on adaptation research as part of the larger federal climate research effort.

We can be reassured that there are many technologies already available to help us respond to the coming challenges. There are actions such as restoring wetlands that form a barrier to flooding, creating or reinforcing sea walls, rebuilding dams and levees, moving businesses, homes, and military bases back from the coast, strengthening roads, bridges and power lines, strengthening the electrical grid, and much more.

Congress must recognize and fund these combined mitigation efforts.

What will you do to help the U.S. prepare for a more chaotic world? And what will you do to help other countries and international institutions prepare?

The U.S. military has called climate change a "threat multiplier" that will increase the odds of disasters, mass migrations, and shortages of food, water, and arable land, all leading to armed conflict around the world. Obviously issues concerning migration today are only the tip of the iceberg compared to what can happen when whole countries and continents become unlivable.

Clearly agreements such as COP Paris 2016 are necessary in order to bring down greenhouse gases quickly enough. We must recommit fully to this agreement and greatly increase our INDC (Intended Nationally Determined Contributions, the amount that we are pledging to lower our U.S. emissions, which is currently far too low). We must also keep our commitment to contribute our part ($3 billion) of the $100 billion a year pledged to the UN's Green Climate Fund so that developing countries can increase their energy consumption through renewable rather than fossil fuel energy.

But much more than this, there is great need for international collaboration in preparing for and responding to the crises that are coming. The UN has currently outlined 17 sustainable developmental goals and holds a yearly Climate Action Summit.

We must support, strengthen and go beyond the current UN efforts to combat climate change. This calls for strong and committed leadership by the U.S. Clearly we need to create the laws and the structures that will enable the world to collaborate equitably and justly on food, water, agricultural land, and all the other natural resources, or we will enter into a period of devastating conflict. Finally, unless we agree together to preserve the forests, soils, and the oceans we will have neither air, water, nor marine life to sustain us.

FACING THE REALLY TOUGH QUESTIONS

(As yet no one seems to be wiling to look squarely at these.)

Many conservatives have expressed the concern that the costs of shifting away from fossil fuels will be far too high and will bring down the economy.

It is true that we are facing what could be a rocky transition. Fossil fuels are used in virtually everything we do. Many people and many industries will need financial support to make the transition into renewable energy. Many fossil fuel workers will lose their jobs and need financial support and retraining. We will quickly need to build massive wind and solar farms, transmission lines, and storage facilities. We will need to redesign and retool our transportation, agricultural, and manufacturing industries to greatly increase renewable use and energy efficiency.

On the other hand, if we ignore this emergency, business as usual will result in financial and ecological devastation. Current analyses predict that under business as

usual, global temperature is predicted to rise between 3 to 5°C (5.4-9.0° Fahrenheit) over pre-industrial times by 2100.

The Fourth National Climate Assessment released by the U.S. government (despite Trump) on November 23, 2018 states that "heat waves, wildfires, extreme weather events and rising sea levels could cost the country hundreds of billions of dollars in lost labor, reduced crop yields, health programs, and crumbling infrastructure." The report was authored by hundreds of U.S. climate scientists from 13 federal agencies. It predicts that the U.S. economy will shrink by as much as 10 percent.

Nicolas Stern, a leading economist, published a massive review in 2006 on the impact of climate change on the world's economy. In over 500 pages, the review makes the case that investing in alternative energy sources and bringing down carbon emissions will save enormous costs in the future while actually adding revenues from investments in the alternative energy industry. (See Appendix.)

A final thought: This discussion around the costs of the transition is a strange one. It resolves down to "can we afford to save ourselves?"

As well as climate change, there are many other socially responsible programs that are important to fund, such as expanding health care to include a Medicare for all option, a higher minimum wage for all government workers, and funding education and training (especially for early childhood programs and displaced workers). Where will we get all this money?

There are many ways that money leaks out of the hands of our governments. Here's a beginning look at where the money could come from each year, globally:

Ending fossil fuel subsidies: $775 billion

Creating a financial transaction tax: $650 billion

Raising income tax on the wealthiest and corporations: $45 billion

A progressive carbon tax at $50/metric ton CO_2: $450 billion

25% cut of the top ten military budgets: $325 billion

But this avoids discussing a rather major reality. When the government needs money for a project of national security, we switch from a "classical" market-based economy to a Keynesian government intervention policy.

The U.S. government was willing to spend as much money as needed to win World War II. And these expenditures were said to have resulted in a great increase in the GNP and to have brought the Great Depression to a close.

When we need money these days, our government "prints" as much money as needed, or more accurately, simply creates the money digitally. And while this is surprising to most people, there is no gold or cash or any other reserves to back up this money—this money is created "out of thin air" and only the good word of the government is behind it.

Beginning with the financial crisis of 2008 when we decided the banks needed our support or the economy would crash, there was both a direct payment of $700 billion to the banks (TARP), and also the Federal Reserve issued a series of "quantitative easings" over the next six years by which a total of **$4 trillion dollars** were injected into the economy through the purchase of mortgage-backed securities and bonds. And while this definitely increased the national debt by trillions, it was done to rescue the economy, which it appears to have done at least in the short term.

We are facing the most devastating national security threat we have ever confronted. Why not use the tools we already have?

Our entire economy is based on a model of growth. We watch the various indices such as the Dow, the SP, the Nasdaq, as well as indicators such as the rate of growth of the economy as a whole, the number of jobs, etc. Even our key measure of national "success," the GDP, is focused on growth and measures money spent on all our activities including even negative ones such as weapons, building more prisons, and recovering from climate disasters. However, we are living on a finite planet. What are your thoughts about this problem?

Focusing on economic growth reveals a lack of recognition that the economy is embedded in the Sociosphere (our social world), which is embedded in the Biosphere (all living things), which is supported by the planet. The economy doesn't exist on its own. We need to re-define a "natural capitalism" which includes the understanding that we use Natural Capital (nature's resources) to create Industrial Capital (stuff) that usually ends up as Waste polluting the environment.

There is only so much air, water, land, fish, timber, minerals, etc. we can use and only so many gigatons of greenhouse gases (not to mention trash and toxins) that we can dump into the environment. The Global Footprint Network has told us that since the 1970s humanity has been in ecological overshoot with annual demand on resources exceeding what Earth can regenerate each year. They report that today humanity uses the equivalent of 1.7 Earths to provide the resources we use and absorb our waste. This figure is expected to rise to two Earths by 2030 based on current trends. There is currently a growing and active community of economists laying out the principles of a "steady-state" economy that can work within the natural constraints of our planet. They offer many extremely important ideas on how to do this.

While we can clearly do a great deal to control and gradually eliminate greenhouse gas emissions and keep our planet's temperature from soaring out of control, as long as our population keeps increasing we will keep needing yet more energy and more and more natural resources—water, land, minerals, air, etc. What shall we do about this?

The world population as of July 24, 2019 at 11:43 a.m. was 7,710,842,579 and increasing every second. Experts believe it will reach 11 billion by 2088. (See: **https://www.worldometers.info/world-population/.)** We are living on a finite world.

At a minimum we need to support family planning clinics and the education of girls, which tends to postpone family rearing and reduce family size. More realistically, we may need to confront religious beliefs and as a matter of national security and safety, legislate a limit to the number of children each mother can have.

What are the most powerful things we as individuals can do to reduce greenhouse gas emissions? What have you done in this regard?

Each American, on average, generates 20 tons of carbon dioxide a year as compared to a European at 7.5, and much of the world's people at under 5. Each of us needs to do an analysis of our carbon footprint and create our own carbon budget. We need to:

Reduce the amount of meat and dairy we consume by shifting to a "flexitarian" diet with more plant-based foods. Minimize food waste.

Cut back on using fossil fuel driven transportation including cars, trucks, cruise ships and planes and shift to hybrid or entirely electric vehicles.

Do an energy retrofit to increase energy efficiency in our homes and businesses, including switching to electricity for lighting, heating, and cooling rather than fossil fuels, and powering this electricity from wind, solar, geothermal or hydro sources.

Buy energy efficient appliances and use LED lighting.

Move our money from banks that fund fossil fuels and from stocks and mutual funds that include fossil fuel companies, and invest in green and socially responsible projects.

APPENDIX

Understanding Greenhouse Gas Emission Targets

Measurements are given in C (carbon), CO_2 (carbon dioxide), or CO_2e (carbon dioxide equivalents which includes other major greenhouse gases). In addition the figure given may or may not include LULUCF (Land Use, Land-Use Change, and Forestry, also referred to as Forestry and Other Land Use (FOLU)) emissions (emissions can increase from land use such as tilling the soil and releasing methane or cutting forests). To convert weights of C to CO_2, simply multiply by 3.67.

Different measures:

The weight of greenhouse gases is expressed in "tonnes," which refers to metric tons. Scientific reports use the metric number. One tonne equals 1.102 U.S. tons ("short" tons), or 2,200 U.S. pounds.

Measurements are given in MT (million tonnes) or GT (gigatons, or billion tonnes).

1 degree Centigrade of warming equals 1.8 degrees Fahrenheit. Most targets are given in Centigrade but U.S. citizens think in terms of Fahrenheit.

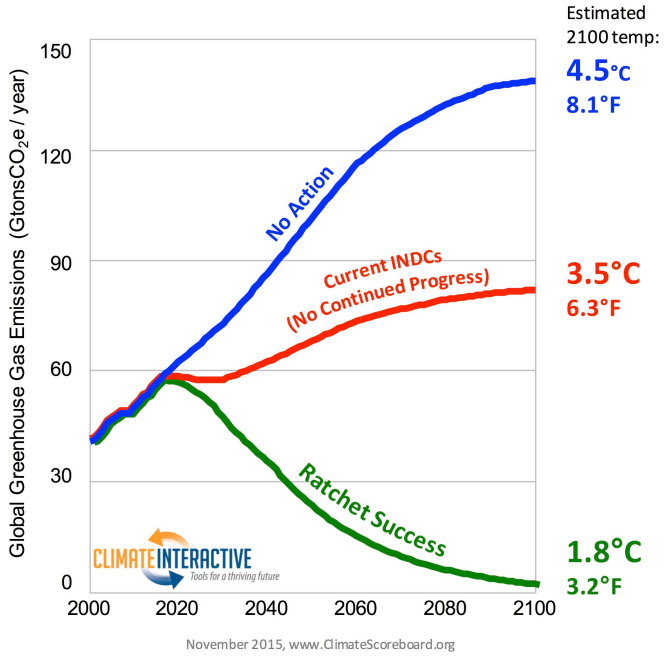
The 1.5 degree limit is equal to a rise in temperature of 2.7 degrees Fahrenheit.

Sharpening Your Understanding of Targets:

You will hear statements such as "I will lower emissions to 25% of 2005 levels by 2030." You have to know what the emissions were in 2005 to know what is actually being proposed. And, you also need to know whether the decline is fast enough to avoid a certain additional amount of global warming. So ask questions!

To just get a visual sense of how much we need to bend the curve of emissions, see below:

Where We Are Heading and Where We Need to Go



Currently the IPCC has recommended net zero by 2050, so this graph is not as steep as is actually needed, but it shows the comparative routes we are on.

("INDCs" refer to the pledges each country made following the Paris Agreement of 2015 to reduce their emissions. They are clearly inadequate.)

The Budget:

Another way to look at how much we need to cut our emissions is the idea that we are on a "carbon budget." Carbon dioxide accumulates in the air and there is an amount past which it causes an increase in global temperature beyond 1.5° Centigrade above pre-industrial levels. The IPCC has determined that to have a 66% likelihood of keeping warming to no more than the 1.5°C, we have about **420-570 GT CO_2** remaining in our "budget." At the rate we are set to emit under business as usual conditions, that gives us until 2030 before we run out of allowable emissions.

To get a sense of how fast we are using up that "allowance," pay attention to the number of gigatons emitted globally each year and just add them up!

(Bear in mind this is a conservative estimate because it doesn't include the other greenhouse gases—it is CO_2 not CO_2e.)

Just How Radical Will the Changes Need to Be to Meet this Deadline?

The Washington Post, 10/7/18 in a review of the 2018 IPCC report has emphasized the magnitude of the changes required to keep to a 1.5°C rise in global temperature since pre-industrial times:

> Overall reductions in emissions in the next decade would probably need to be more than 1 billion tons per year, larger than the current emissions of all but a few of the very largest emitting countries. By 2050, the report calls for a total or near-total phase-out of the burning of coal.
>
> "It's like a deafening, piercing smoke alarm going off in the kitchen. We have to put out the fire," said Erik Solheim, executive director of the UN Environment Program. He added that the need to either stop emissions entirely by 2050 or find some way to remove as much carbon dioxide from the air as humans put there "means net zero must be the new global mantra."
>
> The radical transformation also would mean that, in a world projected to have more than 2 billion additional people by 2050, large swaths of land currently used to produce food would instead have to be converted to growing trees that store carbon and crops designated for energy use. …
>
> In barely more than 10 years, the world's percentage of electricity from renewables such as solar and wind power would have to jump from the current 24 percent to something more like 50 or 60 percent. Coal and gas plants that remain in operation would need to be equipped with technologies, collectively called carbon capture and storage (CCS), that prevent them from emitting carbon dioxide into the air and instead funnel it to be buried underground.
>
> Cars and other forms of transportation, meanwhile, would need to be shifting strongly toward being electrified, powered by these same renewable energy sources. At present, transportation is far behind the power sector in the shift to low-carbon fuel sources. Right now, according to the International Energy Agency, only 4 percent of road transportation is powered by renewable fuels, and the agency has projected only a 1 percent increase by 2022."
>
> "There is no documented historic precedent" for the sweeping change to energy, transportation and other systems required to reach 1.5° Celsius, the UN Intergovernmental Panel on Climate Change (IPCC) wrote in a report requested as part of the 2015 Paris climate agreement.

RESOURCES

Note: Links that are longer than one line often don't work in pdf files so click on the shorter web address below them where indicated.

For Inspiration:

To see and hear the wonderful young Swedish Activist:
https://www.ted.com/speakers/greta_thunberg

To experience Alexandra Ocasio-Cortez, the wonderful new congressional representative:
https://mashable.com/video/knock-down-the-house-trailer/

To read The Leap Manifesto, the Canadian plan to unite progressive action:
https://leapmanifesto.org/en/the-leap-manifesto/

A climate plan to unite environmental organizations:
https://ajustclimate.org

To Evaluate Climate Plans:

Greenpeace's Scorecard on Presidential Candidates:
https://www.greenpeace.org/usa/climate2020/

Jay Inslee, Governor of Washington State, and presidential candidate's very detailed climate plan:
https://www.jayinslee.com/issues/freedom-from-fossil-fuels

Full text of the Green New Deal:

https://www.congress.gov/bill/116th-congress/house-resolution/109/text

The Latest Reports:

The UN IPCC Report on Holding Global Warming to 1.5°C:
https://www.ipcc.ch/sr15/

The UN report on climate change and land use:
https://www.ipcc.ch/report/srccl/

UN Gap Report summarizing how far we are from our goals:
https://www.unenvironment.org/resources/emissions-gap-report-2018

UN Climate Change Organizations and Programs:
https://www.unenvironment.org/explore-topics/climate-change

U.S. Government National Climate Assessment:
https://nca2018.globalchange.gov/

The house bill calling for the declaration of a climate emergency:
https://www.govtrack.us/congress/bills/116/hconres52/text/ih

More Analysis by Think Tanks/Scientific Journals:

http://www.lse.ac.uk/Granthaminstitute/publication/the-economics-of-climate-change-the-stern-review/
Click here: https://bit.ly/2YXwB07

https://www.wri.org/blog/2018/10/according-new-ipcc-report-world-track-exceed-its-carbon-budget-12-years
Click here: https://bit.ly/2H4SFvE

https://interactive.carbonbrief.org/impacts-climate-change-one-point-five-degrees-two-degrees
Click here: https://bit.ly/2Z6U5fc

https://www.scientificamerican.com/article/ice-free-arctic-in-pliocene-last-time-co2-levels-above-400ppm/
Click here: https://bit.ly/2Twz6Bj

https://www.encyclopedia.com/education/news-and-education-magazines/world-war-ii-mobilization-1939-1943
Click here: https://bit.ly/2SoMcDp

Deepening the Discussion About Ways to Respond to Climate Change:

https://www.c2es.org/document/adapting-to-climate-change-a-call-for-federal-leadership/
Click here: https://bit.ly/2Mfn4vf

https://www.c2es.org/document/u-s-domestic-response-to-climate-change/

https://www.wri.org/blog/2019/08/7-things-know-about-ipcc-special-report-land-and-climate
Click here: https://bit.ly/2ZFWf6F

https://www.theguardian.com/environment/2019/jan/19/could-flexitarianism-save-the-planet
Click here: https://bit.ly/2W4ktWH

https://www.ipcc.ch/report/srccl/ (IPCC report on land use)

https://www.scientificamerican.com/article/massive-forest-restoration-could-greatly-slow-global-warming/
Click here: https://bit.ly/2YGzxe1

https://e360.yale.edu/features/why-nuclear-power-must-be-part-of-the-energy-solution-environmentalists-climate
Click here: https://bit.ly/2uH6wlq

https://www.ucsusa.org/nuclear-power/cost-nuclear-power/retirements

https://www.carbonbrief.org/explainer-10-ways-negative-emissions-could-slow-climate-change
Click here: https://bit.ly/2ekNPgR

https://www.world-nuclear.org/information-library/current-and-future-generation/the-nuclear-debate.aspx
Click here: https://bit.ly/2HlgNu7

http://www.nuclear-transparency-watch.eu/documentation/relevant-studies/new-report-by-greenpeace-the-global-crisis-of-nuclear-waste.html
Click here: https://bit.ly/2KMTDO4

http://www.geoengineeringmonitor.org/2018/05/bio-energy-with-carbon-capture-and-storage-beccs/
Click here: https://bit.ly/2Qi5yol

https://www.biofuelwatch.org.uk/about/

About the Author

Sanjen Miedzinski, B.S. Biochemistry, Ph.D. Clinical Psychology (formerly Susan Schneier) is a systems thinker, deeply interested in how different areas of knowledge shed light on each other. She graduated from Pennsylvania State University with a B.S. in Biochemistry and minors in mathematics and biophysics and worked as a biochemist at the National Institute of Health in Bethesda, Maryland. Upon moving to NYC she worked first as the news editor for the Association for Computing Machinery, then as a computer technical writer, and finally as publications and marketing manager for a cutting-edge software company.

At the same time her attentions were turning inward, and she completed her coursework for a Ph.D. in Clinical Psychology from the City University of New York and moved to San Francisco.

There she received her Ph.D. long-distance while she worked with individuals and couples, and also as Journal editor and writer for the California Child, Youth and Family Coalition as well as several other social justice organizations. She covered the current situation regarding poverty, juvenile delinquency, and mental health programs in California, and their relationship to our economic and social policies. During this period, arising from her deep interest in group and organizational dynamics, she also led retreats for non-profits and created and led *Groundswell*--a conference exploring the relationship between personal and social change.

More recently her life-long interest in spiritual experience and its relationship to psychological experience led her to develop graduate courses for therapists in the latest theories concerning their interaction. This eventually led her to become Director of the master's degree program in Transpersonal Counseling Psychology at John F. Kennedy's Graduate School of Consciousness Studies in Orinda, California as well as Acting Dean of that School.

Moving on from JFK, she combined her interest in the arts as a means of healing and a bridge between the psychological and spiritual, and co-created the Expressive Arts Counseling Psychology MFT M.A. program at the California Institute of Integral Studies in San Francisco and served as core faculty there for 20 years.

However as the threat of global warming became increasingly more evident, she retired and turned her attention to understanding the what, how, and why of this crisis and what to do about it, drawing upon her background in science as well as in social justice. Currently, she is director of the Earth Rising Action Network.

Additional Publications Include:

Citizen's Guide to Climate Change And What To Do About It

Take Your Economic Power

What You Can Do To Meet The Climate Challenge

To request a copy of the above or for further Information:
info@EarthRisingAction.org

Earth Rising Action Network is a group of spiritually oriented individuals with deep concern for the state of our environment. We are not focused on one particular set of beliefs or religions but honor the many experiences of meaning and depth or the sacred that naturally arise in our human experience. We seek to collaborate with others in a respectful way to meet the challenge of this climate emergency.