How Can We Minimize the Detrimental Effects of Human Biases on Climate Solution Decisions?

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Co-Founder, Global Solutions and Outreach Programs
Chair, 2023 Climate Solutions Symposium
Leader, Houston Team, Texas Chapter of the Foundation for Climate Restoration
Climate Solutions Liaison, Engineering, Science and Technology Council of Houston
Past Chair, The Climate Solutions Community

How Can We Minimize the Detrimental Effects of Human Biases on Climate Solution Decisions? : Added value of Global Solutions and Outreach Programs

Citizens' Climate Lobby

(Sustainable Energy Corps)

The Climate Solutions Community
An AIChE Initiative

Let's Make Texas Energy Clean and Reliable

Climate Solutions Policy Initiative

Climate Bonds INITIATIVE

(Foundation for Climate Restoration)

Global Solutions and Outreach Programs

Seven levels of climate grief

We're not worried about so-called global warming.

1 – Denial

2 – It's Not Serious

We're worried about global warming and whether it can be fixed.

3 – It's Not Our Fault

4 – We Can't Fix It

5 – We Must Fix It

We're confident the problem can be fixed, but will we survive the solution?

6 – The Adam Smith Mirage

7 – The Wicked Problem Approach

2021 Yale University survey: **Global warming should be a high priority for the next President and Congress**

Grief level 1 – Denial. 50-year temperature trends for greatest denier states? Wyoming (38%, 1.1 F), North Dakota (39%, 1.8 F), West Virginia (39%, 1.7 F), Kentucky (44%, 2.3 F), Oklahoma (45%, 0.8 F).

Grief level 2 – It's Not Serious. 50-year temperature trends for next group? Idaho (46%, 1.3 F), Montana (46%, 1.9 F), Nebraska (46%, 1.0 F), South Dakota (46%, 0.8 F), Arkansas (47%, 0.6 F), Indiana (47%, 1.6 F), Utah (47%, 2.6 F).

Grief level 3 – It's Not Our Fault. Analysis pending. Alabama, Iowa, Kansas, Missouri, Tennessee (48%).

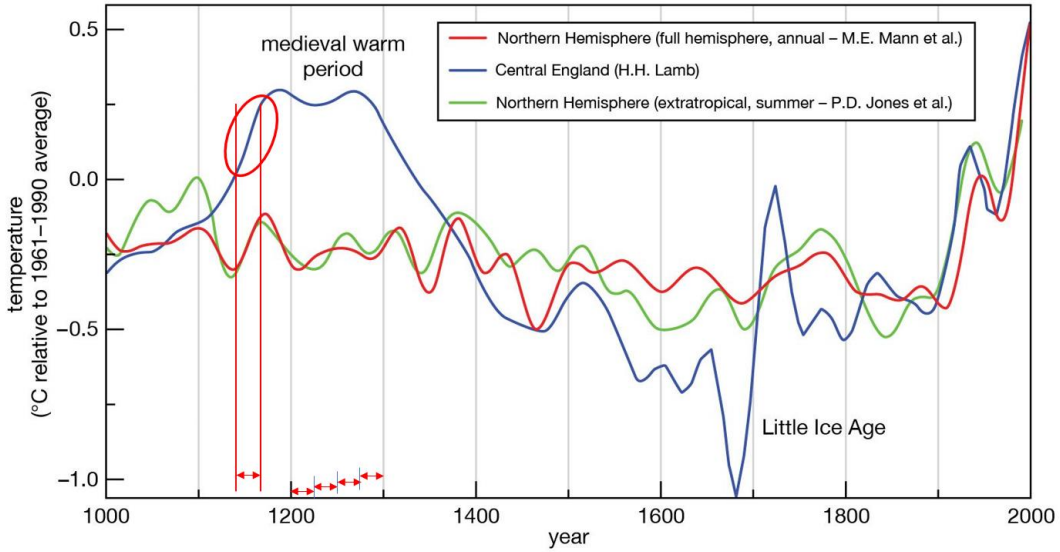
Grief level 4 – We Can't Fix It. Analysis pending. Alaska, Louisiana, Ohio, Wisconsin, Maine, Minnesota, Mississippi, New Hampshire, South Carolina (50-52%).

Grief level 5 – We Must Fix It. Analysis pending. Michigan, Pennsylvania, Arizona, Colorado, Hawaii, North Carolina (53-55%).

Grief level 6 – The Adam Smith Mirage. Analysis pending. Florida, Georgia, Nevada, Oregon, Rhode Island, **Texas (56%, 1.3 F)**, Vermont, Virginia (level at 56-57%).

Grief level 5 – The Wicked Problem Approach. Analysis pending. Delaware, Illinois, New Mexico, Washington, Connecticut, Massachusetts, New Jersey, New York, California, Maryland (58-64%).

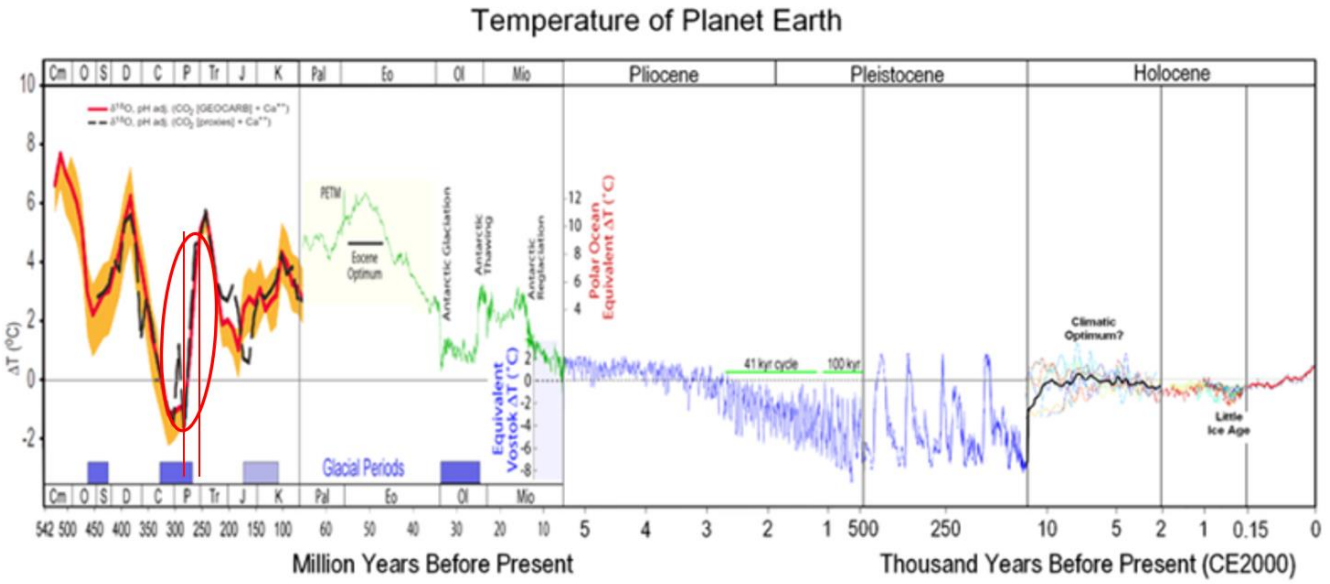
Estimated temperature variations for the Northern Hemisphere and central England (1000–2000 CE)



Sources: M.E. Mann et al., "Northern Hemisphere Temperatures During the Past Millennium: Inferences, Uncertainties, and Limitations," *Geophysical Research Letters*, 26:759–762 (1999); P.D. Jones et al., "High-resolution Palaeoclimatic Records for the Last Millennium: Interpretation, Integration, and Comparison with General Circulation Model Control Run Temperatures," *Holocene*, 8:477–483 (1998); H.H. Lamb, "The Early Medieval Warm Epoch and Its Sequel," *Palaeogeography, Palaeoclimatology, Palaeoecology*, 1:13–37 (1965).

0.9 °F over 50 years

Past 500 million years of climate change



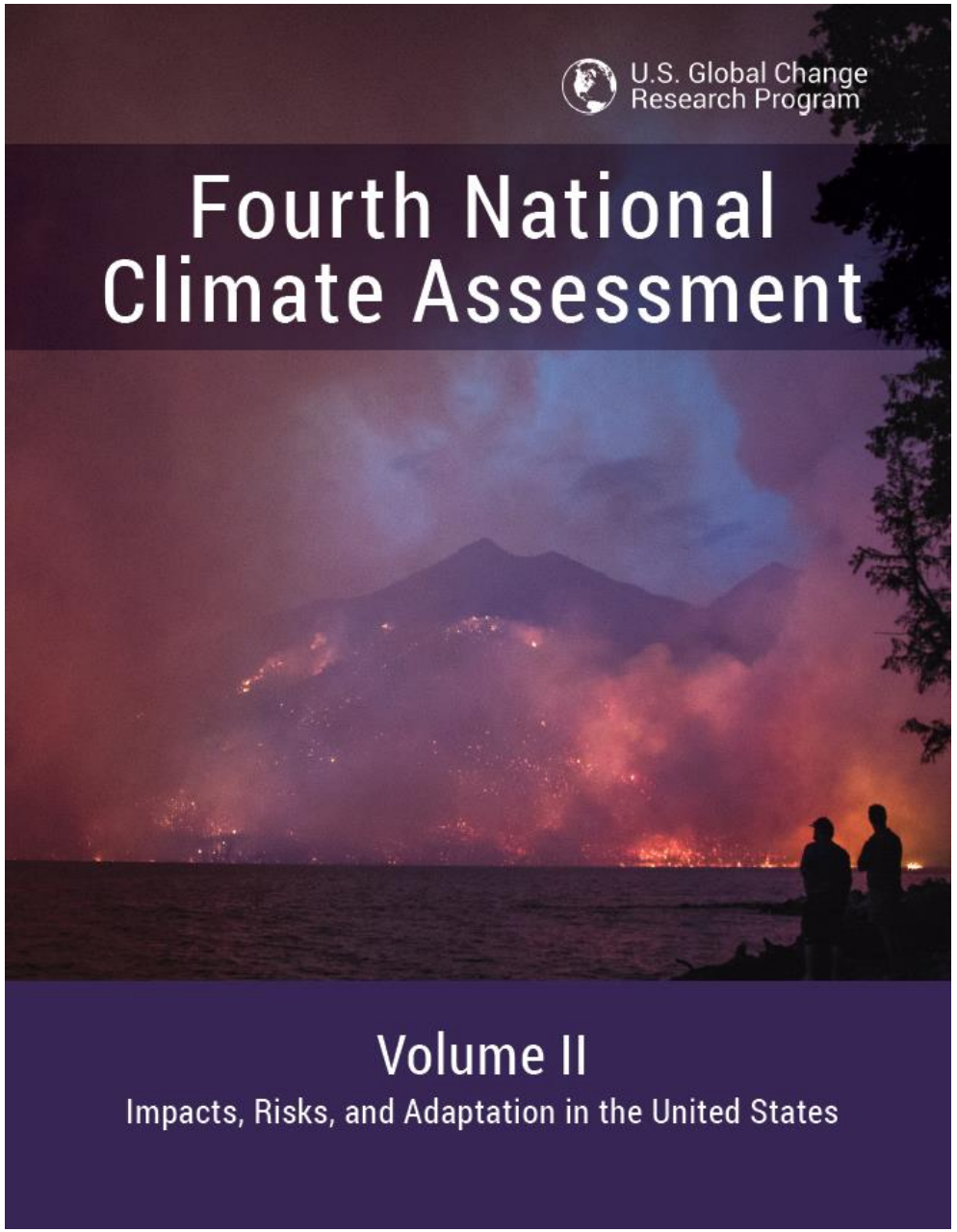
1 °C over 1,000,000 years

How are we doing in the United States?

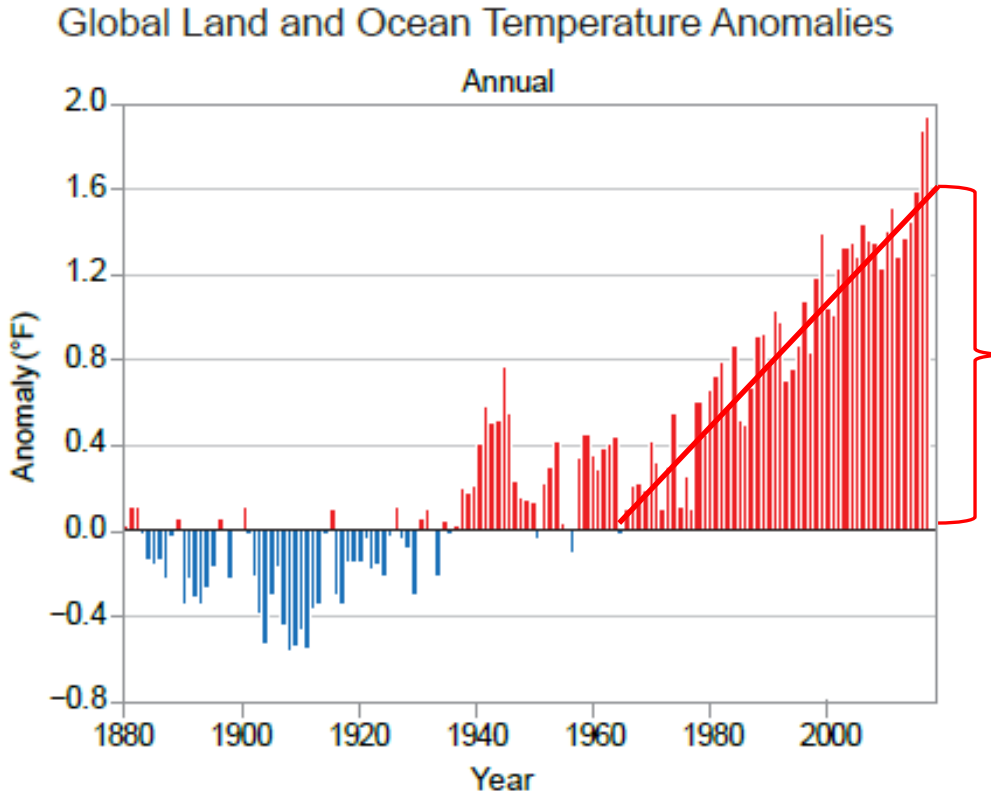
Wyoming, 1.1 °F
North Dakota, 1.8
West Virginia, 1.7
Kentucky, 2.3
Oklahoma, 0.8

Idaho, 1.3 °F
Montana, 1.9
Nebraska, 1.0
South Dakota, 0.8
Arkansas, 0.6
Indiana, 1.6
Utah, 2.6

Texas, 1.3 °F



Volume II, November 2018



~1.6 F rise in 50 years

How are we doing in the United States?

Wyoming, 1.1 °F
North Dakota, 1.8
West Virginia, 1.7
Kentucky, 2.3
Oklahoma, 0.8

Idaho, 1.3 °F
Montana, 1.9
Nebraska, 1.0
South Dakota, 0.8
Arkansas, 0.6
Indiana, 1.6
Utah, 2.6

Texas, 1.3 °F

co2levels.org

GSOP Anytime | 00736: Global Clim... | My WiX account | To Do | computer | Consulting | Home | Politics | Religion | Travel | Bookmarks from M... | AIChE | AAPG | Dropbox | Microsoft account |... | Poll everywhere | SAChE | socrative student -... | Wells Fargo | Wiley Customer Su... | Webcam Toy | Other book

GLOBAL CO_2 LEVELS

Click and drag in the plot area to zoom in

https://www.co2levels.org

Reset zoom

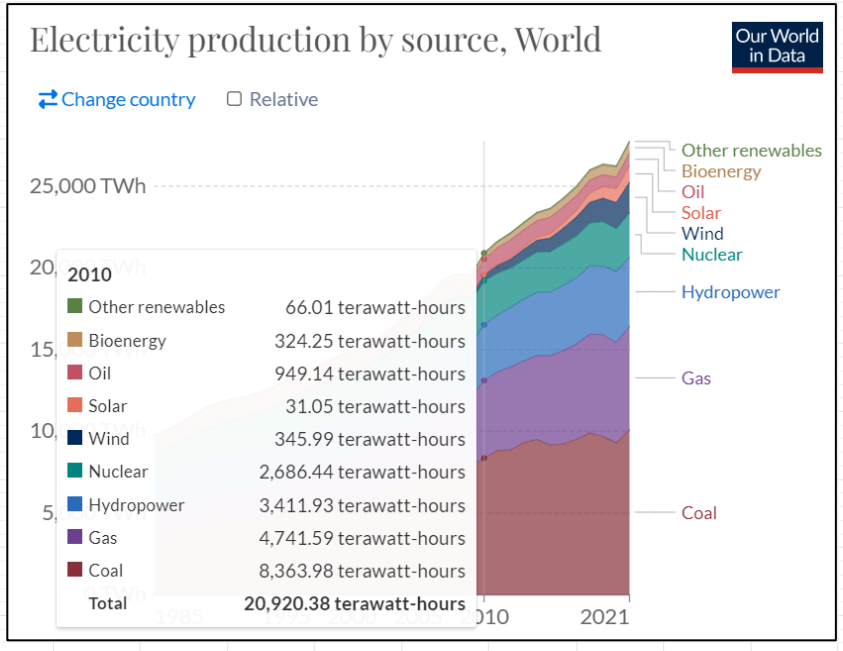
May, 13, 2022
CO_2 PPM: **421.95**
1% higher than today.

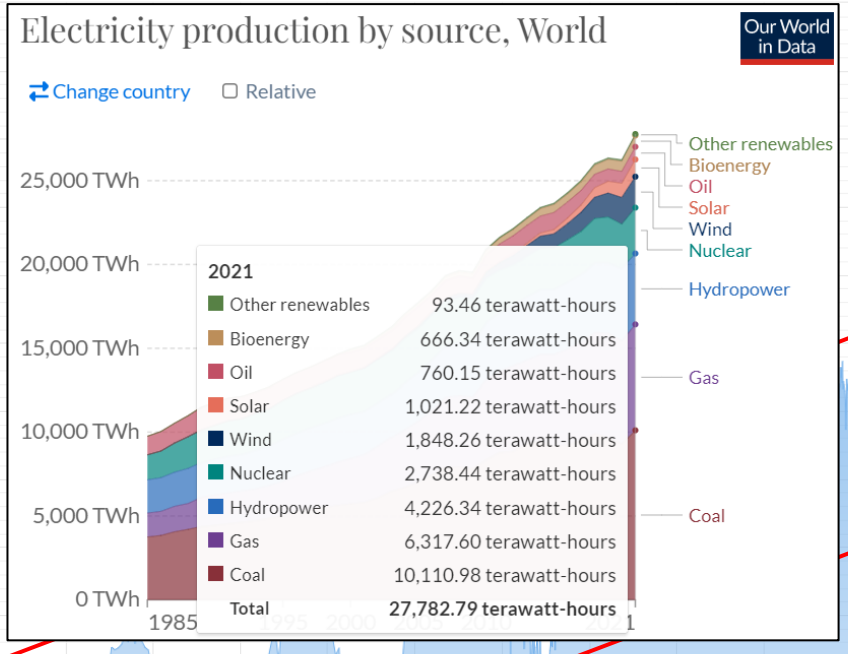
Jul '08 Jan '09 Jul '09 Jan '10 Jul '10 Jan '11 Jul '11 Jan '12 Jul '12 Jan '13 Jul '13 Jan '14 Jul '14 Jan '15 Jul '15 Jan '16 Jul '16 Jan '17 Jul '17 Jan '18 Jul '18 Jan '19 Jul '19 Jan '20 Jul '20 Jan '21 Jul '21 Jan '22 Jul '22

Powered by the 2 Degrees Institute

GLOBAL CO_2 LEVELS

Click and drag in the plot area to zoom in





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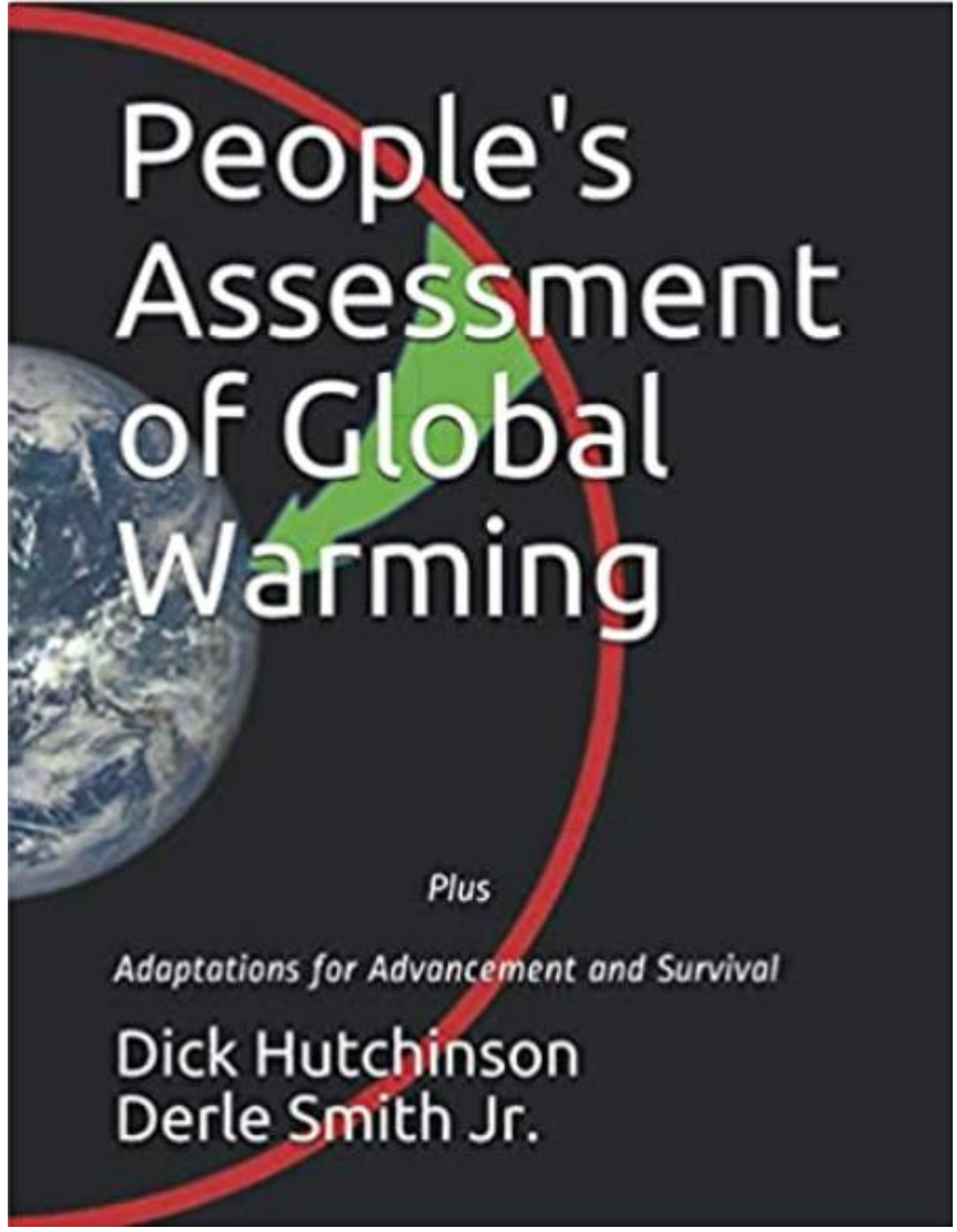
Inhofe Snowball Confusion

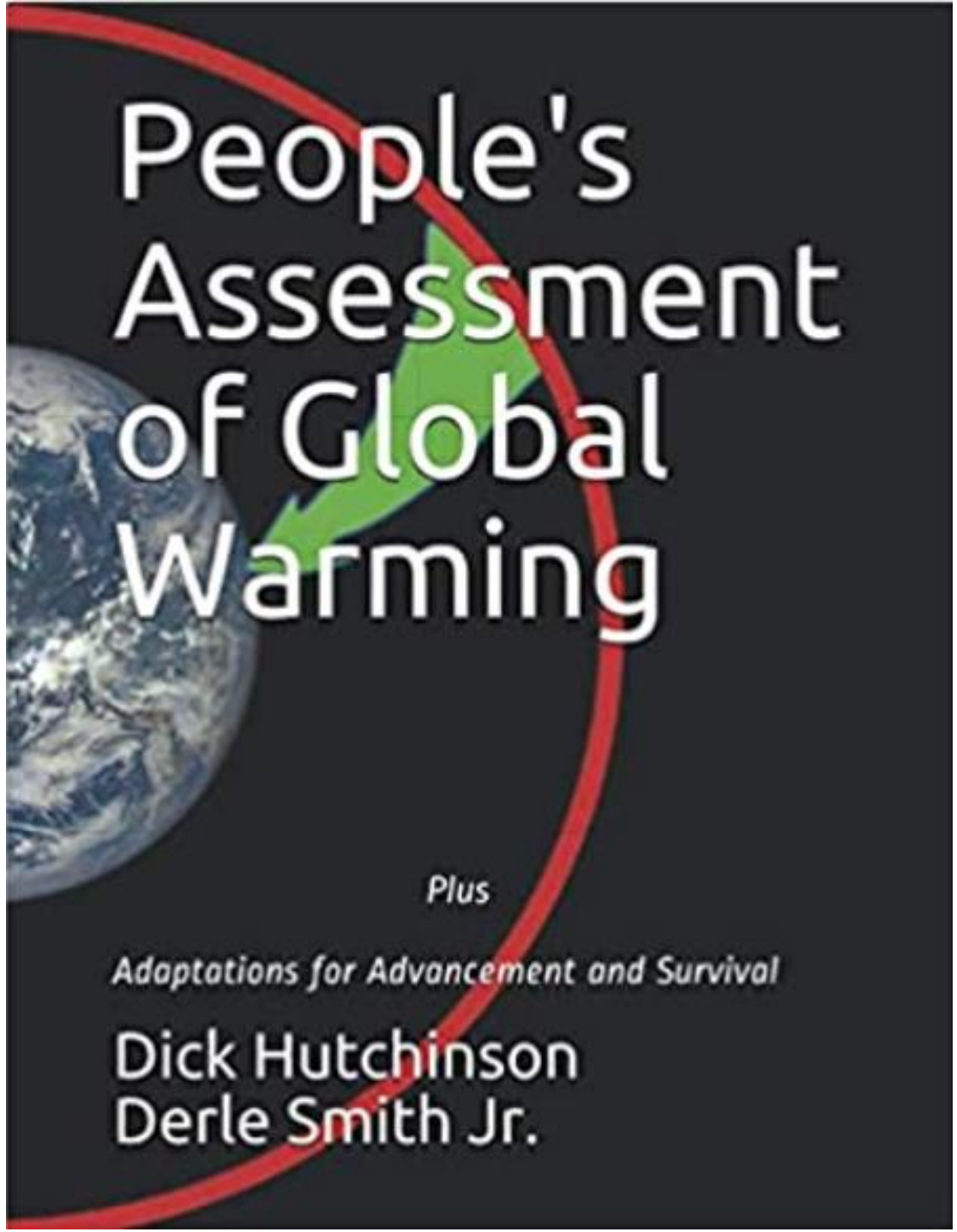
After COP26 in Glasgow, Scotland:

Global Solutions and Outreach Programs

Who is Dick Hutchinson?

- Retired chemical engineer (PhD)
- Career in U.S. Army projects, mostly at the Aberdeen Proving Ground
- U.S. Army work in the 1990s using the Wicked Problem Approach
- Co-founded the Stable Climate Group about ten years ago
- Primary author of the 2019 book *People's Assessment of Global Warming*


People's Assessment of Global Warming
Plus
Adaptations for Advancement and Survival
Dick Hutchinson
Derle Smith Jr.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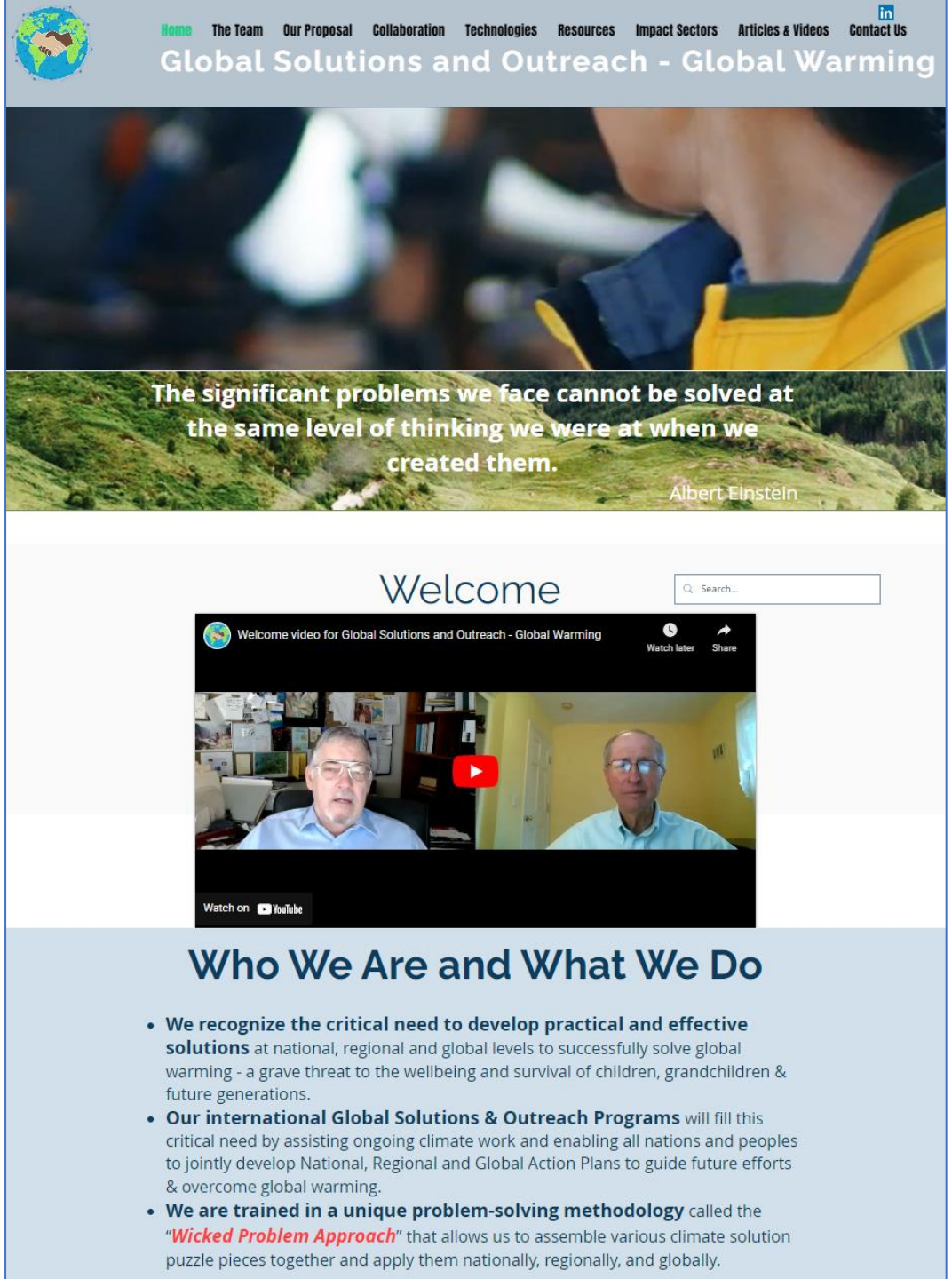
Home
The Team
Our Proposal
Collaboration
Technologies
Resources
Impact Sectors
Articles & Videos
Contact Us
Global Solutions and Outreach - Global Warming
The significant problems we face cannot be solved at the same level of thinking we were at when we created them.
Albert Einstein
Welcome
Search...
Welcome video for Global Solutions and Outreach - Global Warming
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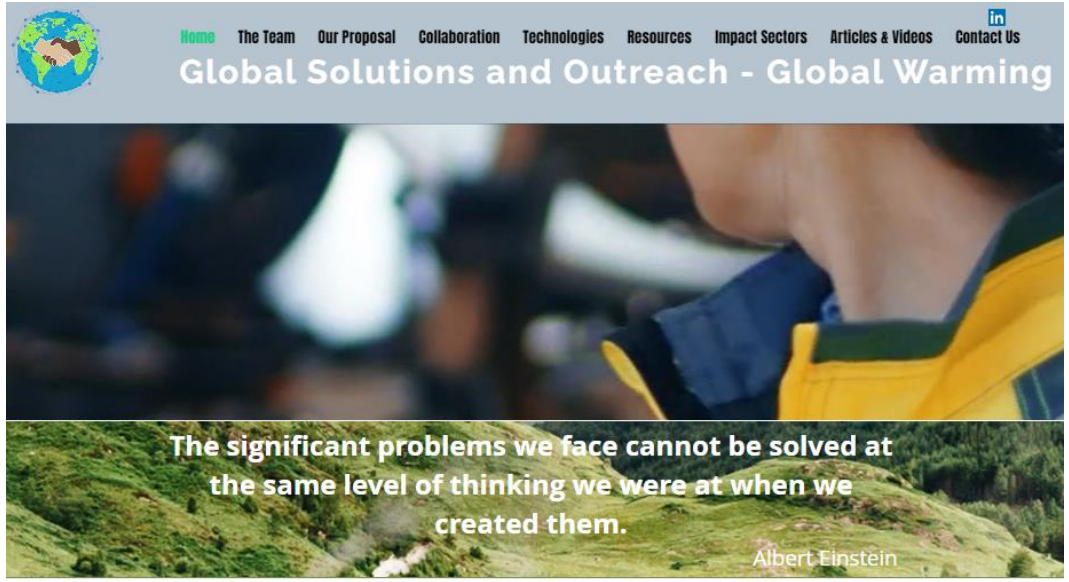
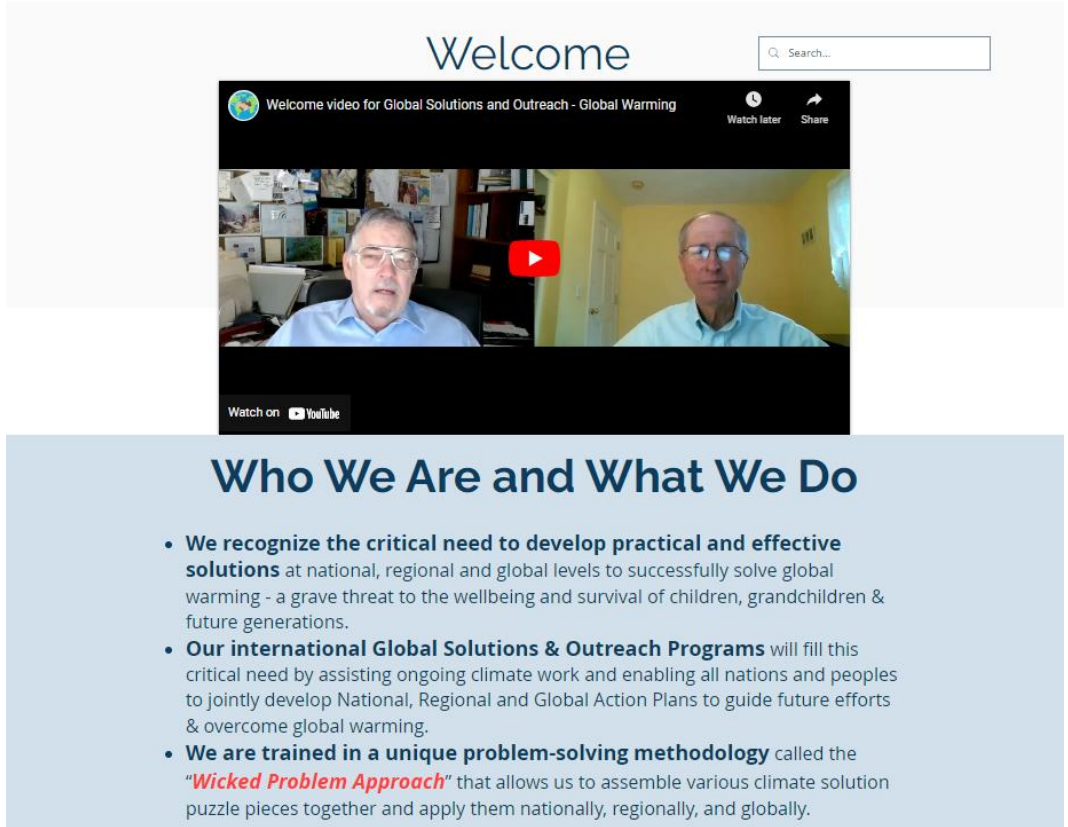
Share
Watch on YouTube
Who We Are and What We Do
We recognize the critical need to develop practical and effective solutions at national, regional and global levels to successfully solve global warming - a grave threat to the wellbeing and survival of children, grandchildren & future generations.
Our international Global Solutions & Outreach Programs will fill this critical need by assisting ongoing climate work and enabling all nations and peoples to jointly develop National, Regional and Global Action Plans to guide future efforts & overcome global warming.
We are trained in a unique problem-solving methodology called the "Wicked Problem Approach" that allows us to assemble various climate solution puzzle pieces together and apply them nationally, regionally, and globally.





Who We Are and What We Do

- **We recognize the critical need to develop practical and effective solutions** at national, regional and global levels to successfully solve global warming – a grave threat to the wellbeing and survival of children, grandchildren and future generations.
- **Our international Global Solutions and Outreach Programs** will fill this critical need by assisting ongoing climate work and enabling all nations and peoples to jointly develop National, Regional and Global Action Plans to guide future efforts and overcome global warming.
- **We are trained in a unique problem-solving methodology** called the "***Wicked Problem Approach***" that allows us to assemble various climate solution puzzle pieces together and apply them nationally, regionally, and globally.

Rehm: In my view, decisions made on climate solutions are too heavily influenced by public passions, vested interests (careers and corporate) and political agendas. If we continue down this path, we will spend our global economic resources without solving our planetary problem. (The Team Page)

https://www.climate-collaboration.com/

Global Climate Collaboration Flagship Project

Global Solutions and Outreach Programs

January 2022 snapshot

Development Committee

13 Chemical Engineers
2 Mechanical Engineers
2 Physicists
1 Civil Engineer
1 Computer Graphics
1 Chemist
1 Electrical Engineer
1 Engineering Geoscientist
1 Environmental Engineer
1 Environmental Scientist
1 Industrial Engineer
1 Marketing
1 Nuclear Engineer
1 Organic Geochemist
1 Systems Engineer
1 Sustainable Scientist

Marketing Plans now under development for these impact sectors

Governments
Insurance Industry
Philanthropies
Climate Action Organizations

Other impact sectors

Agriculture
Large Corporations
Private Equity Organizations
Faith-based Organizations
Finance Industry
Foundations
Institutes
Military
Oceans (Ocean health, relating to food)
Trade Associations
Universities

Global Climate Collaboration Flagship Project

Global Solutions and Outreach Programs

August 2022 snapshot

Development Committee

13 Chemical Engineers
2 Mechanical Engineers
2 Physicists
1 Civil Engineer
1 Computer Graphics
1 Chemist
1 Electrical Engineer
1 Engineering Geoscientist
1 Environmental Engineer
1 Environmental Scientist
1 Industrial Engineer
1 Marketing
1 Nuclear Engineer
1 Organic Geochemist
1 Systems Engineer
1 Sustainable Scientist
… plus about 30 others

Marketing Plans now under development for these impact sectors

Governments
Insurance and Finance
Philanthropies
Climate Action Organizations

Soil and Ocean Health
Faith-based Organizations
Universities
Large Corporations

Other impact sectors

~~Agriculture~~
~~Large Corporations~~
~~Private Equity Organizations~~ (part of "Insurance and Finance" impact sector)
~~Faith-based Organizations~~
~~Finance Industry~~
~~Foundations~~ (part of "Philanthropies" impact sector)
Institutes
Military
~~Oceans (Ocean health, relating to food)~~
Trade Associations
~~Universities~~

How are we doing on solving our planetary problem?

- Project Drawdown
- Deep Decarbonization Pathways Project
- A Harvard review of 40 decarbonization studies

Project Drawdown (https://drawdown.org/)

SOLUTIONS LIBRARY

- SOLUTION
- Abandoned Farmland Restoration
- Alternative Cement
- Alternative Refrigerants
- Bamboo Production
- Bicycle Infrastructure
- Biochar Production
- Biogas for Cooking
- Biomass Power
- Bioplastics
- Building Automation Systems
- Building Retrofitting
- Carpooling
- Clean Cooking
- Coastal Wetland Protection
- Coastal Wetland Restoration
- Composting
- Concentrated Solar Power
- Conservation Agriculture
- Distributed Energy Storage
- District Heating
- Dynamic Glass
- Efficient Aviation
- Efficient Ocean Shipping
- Efficient Trucks
- Electric Bicycles
- Electric Cars
- Electric Trains
- Family Planning and Education
- Farm Irrigation Efficiency
- Forest Protection
- Geothermal Power
- Grassland Protection
- Green and Cool Roofs
- Grid Flexibility
- High-Efficiency Heat Pumps
- High-Performance Glass
- High-Speed Rail
- Hybrid Cars
- Improved Aquaculture
- Improved Cattle Feed
- Improved Fisheries
- Improved Manure Management
- Improved Rice Production
- Indigenous Peoples' Forest Tenure
- Insulation
- Landfill Methane Capture
- LED Lighting
- Low-Flow Fixtures
- Macroalgae Protection and Restoration
- Managed Grazing
- Methane Digesters
- Methane Leak Management
- Micro Wind Turbines
- Microgrids
- Multistrata Agroforestry

... and 37 more!

Project Drawdown (https://drawdown.org/)

NUCLEAR POWER

Nuclear power is slow to build, expensive, and risky, and it creates radioactive waste. However, it also can avoid emissions produced by generating electricity from fossil fuels.

Methodology

This analysis models the adoption of nuclear fission as used in pressurized water reactors, the current most prevalent form of nuclear energy. Advanced reactors such as thorium-based reactors, gas-cooled reactors, pebble bed reactors, and other technologies in the pre-commercialization phases are out of the scope of this analysis.

Project Drawdown (https://drawdown.org/)

NUCLEAR POWER

Nuclear power is slow to build, expensive, and risky, and it creates radioactive waste. However, it also can avoid emissions produced by generating electricity from fossil fuels.

Methodology

"… advanced reactors … are out of the scope of this analysis."

DISTRIBUTED SOLAR PHOTOVOLTAICS

Whether grid-connected or part of stand-alone systems, rooftop solar panels and other distributed solar photovoltaic systems offer hyper-local, clean electricity generation.

Impact

We assume that distributed solar photovoltaics can grow from 180 terawatt-hours of electricity generation to 6,010.21–9,786.80 terawatt-hours by 2050. This large range is due to the many possibilities for future renewable technologies and the extent of electrification. That growth can avoid 26.65–64.86 gigatons of greenhouse gas emissions. With implementation costs declining by the day, increased adoption of distributed solar photovoltaics could save US$7.61–13.14 trillion in operation, maintenance, and fuel costs over fossil fuel–based electricity generation.

Project Drawdown (https://drawdown.org/)

NUCLEAR POWER

Nuclear power is slow to build, expensive, and risky, and it creates radioactive waste. However, it also can avoid emissions produced by generating electricity from fossil fuels.

Methodology

"… advanced reactors … are out of the scope of this analysis."

ONSHORE WIND TURBINES

Onshore wind turbines generate electricity at a utility scale, comparable to power plants. They replace fossil fuels with emissions-free electricity.

Impact

Onshore wind turbines are rapidly being incorporated into electricity infrastructure around the world. An increase from 4.4 percent of world electricity generation to 20–27 percent by 2050 could reduce emissions by 46.95–143.56 gigatons of carbon dioxide equivalent greenhouse gases. Net first costs to implement are US$0.92–1.89 trillion with lifetime net operational savings of US$3.77–9.83 trillion. These are conservative estimates, however. Costs are falling, technology is improving, and capacity is increasing to generate more electricity at the same or lower cost.

Deep Decarbonization Pathways Project (DDPP), 2015

The Deep Decarbonization Pathways Project (DDPP) is convened under the auspices of the Institute for Sustainable Development and International Relations (IDDRI) and the Sustainable Development Solutions Network (SDSN).

The project is led by:

***Teresa Ribera**, Director, IDDRI*

***Jeffrey Sachs**, Director, SDSN*

***Michel Colombier**, Scientific Director, IDDRI*

***Guido Schmidt-Traub**, Executive Director, SDSN*

***Henri Waisman**, DDPP Director, IDDRI*

***Jim Williams**, DDPP Director, SDSN*

***Laura Segafredo**, Senior DDPP Manager, SDSN*

***Chris Bataille**, Associate Researcher, IDDRI*

***Roberta Pierfederici**, DDPP Manager, IDDRI*

Deep Decarbonization Pathways Project (DDPP), 2015

https://ddpinitiative.org/

The Deep Decarbonization Pathways Project (DDPP) is convened under the auspices of the Institute for Sustainable Development and International Relations (IDDRI) and the Sustainable Development Solutions Network (SDSN).

- Teresa Ribera, Director, IDDRI, Assistant professor in public law in the Universidad Autónoma de Madrid
- Jeffrey Sachs, Director, SDSN, PhD Economics
- Michel Colombier, Scientific Director, IDDRI, Engineer, Economist
- Guido Schmidt-Traub, Executive Director, SDSN, PhD Economics, MS Physical Chemistry
- Henri Waisman, DDPP Director, IDDRI, PhD Economics, MS Physics
- Jim Williams, DDPP Director, SDSN, PhD Energy Resources, BS Physics
- Laura Segafredo, Senior DDPP Manager, SDSN, PhD Economics
- Chris Bataille, Associate Researcher, IDDRI, PhD Resource and Economic Management, BA Economics and Political Science
- Roberta Pierfederici, DDPP Manager, IDDRI, MS Economic Modeling and Statistics

Current DDPP Director:

Henri WAISMAN · 3rd

Senior Researcher at IDDRI - Coordinator of Deep Decarbonization Pathways Project

2023 will be a landmark year for climate ambition. Many countries must still develop ambitious and actionable plans, countries and other actors must start taking concrete measures without delay and international processes such as the Global Stocktake must deliver concrete progress on international cooperation. Based on our experience, our strengths and the legitimacy we have built over the years, we will have a key role to play in all these streams and many partners count on us! (2022 DDPP Annual Report)

EHESS - Ecole des Hautes Etudes en Sciences Sociales
Doctor of Philosophy (PhD), Economie de l'environnement
2005 - 2012

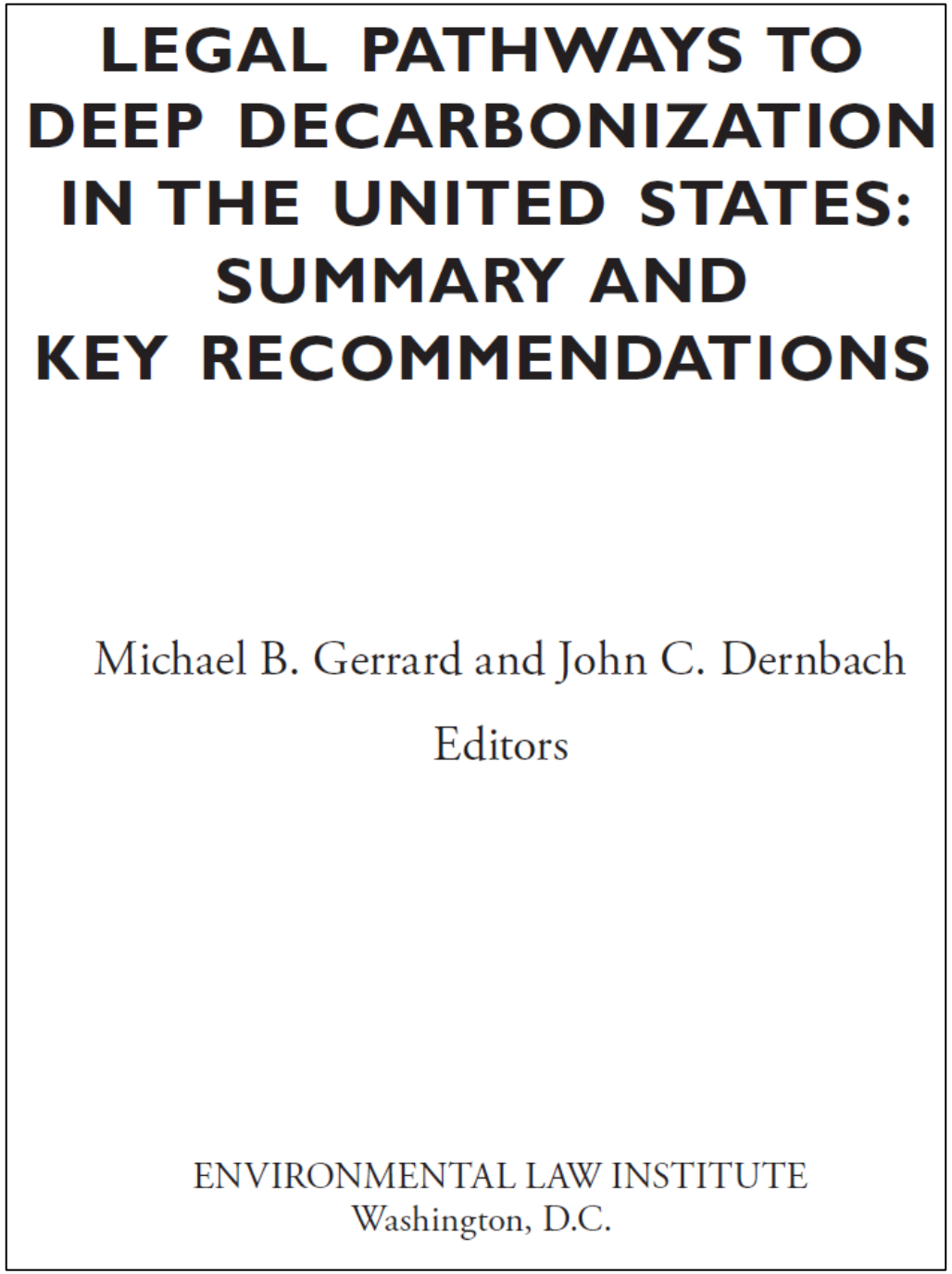
EHESS - Ecole des Hautes Etudes en Sciences Sociales
Master's degree (Economie of the Environment and Natural Resources), Economics
2004 - 2005

École normale supérieure de Lyon
Agrégation de Physique-Chimie; Master's degree in Physics, Physics
2000 - 2004

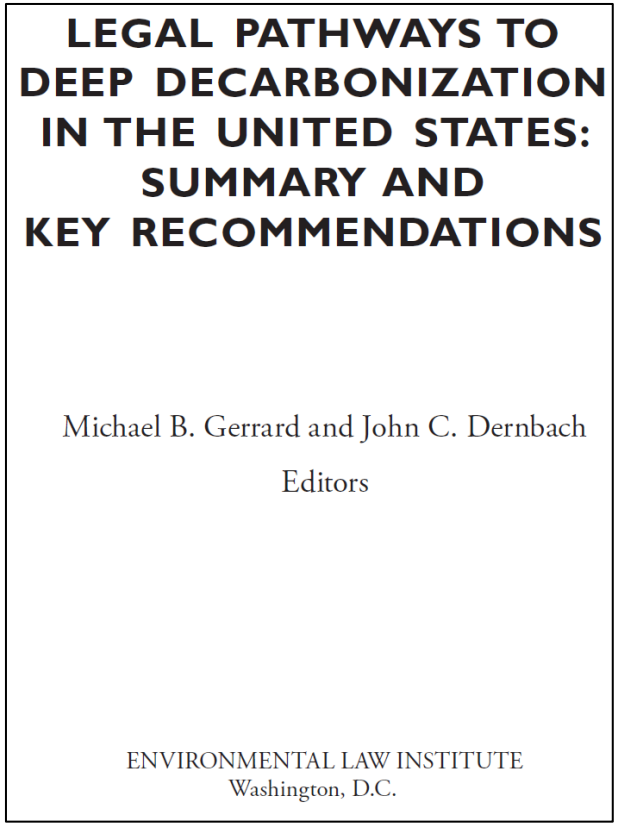
Lycée Louis-le-Grand
1994 - 2000

Lycée, Classes Préparatoires aux Grandes Ecoles

2018 Publication based on the 2015 DDPP report:



2018 Publication based on the 2015 DDPP report:



Widener Law Commonwealth

November 2018

Widener University Commonwealth Law School Legal Studies Research Paper Series no. 18-12

The Dozen Types of Legal Tools in the Deep Decarbonization Toolbox

John C. Dernbach
Widener University Commonwealth Law School

I. INTRODUCTION

This article provides a description and analysis of the types of legal tools that are available to reduce U.S. greenhouse gas (GHG) emissions by at least 80% from 1990 levels by 2050. The "80 by 50" target and similarly aggressive carbon abatement goals are often referred to as "deep decarbonization," a term that signals the need for systemic changes to the energy economy.[1] This article builds on, but is different from, a book that Michael Gerrard and I have edited, entitled *Legal Pathways to Deep Decarbonization in the United States* ("*Legal Pathways*"), which is a "playbook" for achieving the "80 by 50" target.[2] In North American football, a playbook describes all of the plays that a team could run; some of the plays will be used, and some will not be used, in any given game. Coaches will decide what

December 19, 2018,

Getting to Zero Carbon Emissions in the Electric Power Sector

Jesse D. Jenkins,[1,*] Max Luke,[2] and Samuel Thernstrom[3]

Jesse D. Jenkins is a postdoctoral Environmental Fellow at the Harvard Kennedy School and the Harvard University Center for the Environment. His research harnesses methods from operations research, power systems engineering, and applied economics to improve regulation, policy, and practice in the rapidly evolving electricity sector. He earned a PhD in Engi-

The electric power sector is widely expected to be the linchpin of efforts to reduce greenhouse gas (GHG) emissions. Virtually all credible pathways to climate stabilization entail twin challenges for the electricity sector: cutting emissions nearly to zero (or even net negative emissions) by mid-century, while expanding to electrify and consequently decarbonize a much greater share of global energy use.[1,2] In light of this fact, a flurry of recent studies has outlined and explored pathways to "deep decarbonization" of the power sector, defined here as an 80%–100% reduction in carbon dioxide (CO_2) emissions from current levels. Here we review and distill

Reviewed 40 deep decarbonization studies from 2014 to 2018.

December 19, 2018,

Getting to Zero Carbon Emissions in the Electric Power Sector

Jesse D. Jenkins,[1,*] Max Luke,[2] and Samuel Thernstrom[3]

As this review indicates, several obstacles must be overcome to cost-effectively decarbonize electricity regardless of whether wind and solar are expected to deliver the vast majority of electricity or we pursue a more diverse portfolio of resources. We cannot assume that public opposition and siting challenges for new, continent-spanning transmission networks can be overcome; that flexible demand will be unlocked at sufficient scale; that wind and solar PV will continue deep and sustained cost declines; or that order-of-magnitude cheaper "seasonal" storage technologies will become widely scalable. Any one of these things may well happen, but it is far less likely all will be simultaneously achieved.

would raise the chance of success of at least one affordable pathway to decarbonize electricity to 97% (using the hypothetical odds given above).

These examples are purely illustrative, but the logic is critical. Eschewing the development of firm low-carbon technologies because they face challenges today would amount to betting the planet on the assumption that *all* of the conditions needed for an affordable wind and solar-centered path to decarbonize electricity will fall into place. Supporting an expanded and diversified portfolio of clean energy options that can substitute for one another hedges the risk of technology failure and substantially improves the

Simon Michaux: "Minerals Blindness"

https://www.thegreatsimplification.com/episode/19-simon-michaux

0:00 1:19:20 FOLLOW SHARE

Episode 19
May 18, 2022

(Conversation Recorded on March 29, 2022.)

On this episode, we meet with Associate Professor of Geometallurgy at the Geological Survey of Finland, Simon Michaux.

Why do humans ignore important mineral and material limits that will effect human futures? Michaux reveals how we are "minerals blind" – and the consequences of this myopia.

To shed light on the effects of our minerals blindness, Michaux explores the disconnect between experts in renewable energy and economic and government leaders.

Michaux offers individual strategies for us to overcome our energy and minerals blindness. How can we learn to adapt in order to overcome the coming challenges?

Simon Michaux
Associate Professor of Geometallurgy

About Simon Michaux

Simon Michaux is an Associate Professor of Geometallurgy at the Geological Survey of Finland. He has a PhD in mining engineering. Dr. Michaux's long-term work is on the development and transformation toward a circular economy.

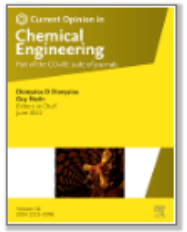
From https://www.washingtonpost.com/business/energy/net-zero-isnt-possible-without-nuclear/2022/12/28/bc87056a-86b8-11ed-b5ac-411280b122ef_story.html

Net Zero Isn't Possible Without Nuclear

Analysis by The Editors | Bloomberg

December 30, 2022 at 12:02 a.m. EST

Current Opinion in Chemical Engineering
Volume 39, March 2023, 100878



Advanced nuclear energy: the safest and most renewable clean energy

Thomas E Rehm [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]*

1 American Institute of Chemical Engineers (AIChE), USA
2 The Climate Solutions Community (TCSC), AIChE Institute for Sustainability, USA
3 Sustainable Energy Corps (SEC), AIChE, USA
4 Climate Solutions Policy Initiative (CSPI), AIChE, USA
5 Global Solutions and Outreach Programs (GSOP), USA
6 Foundation for Climate Restoration (F4CR), USA
7 Engineering, Science and Technology Council of Houston (ECH), Climate Solutions Liaison, USA
8 American Nuclear Society (ANS), USA
9 Citizens Climate Lobby (CCL), USA
10 American Society of Testing and Materials (ASTM), USA
11 The Future of Energy Initiative (FOEI), USA

Available online 28 November 2022, Version of Record 28 November 2022.

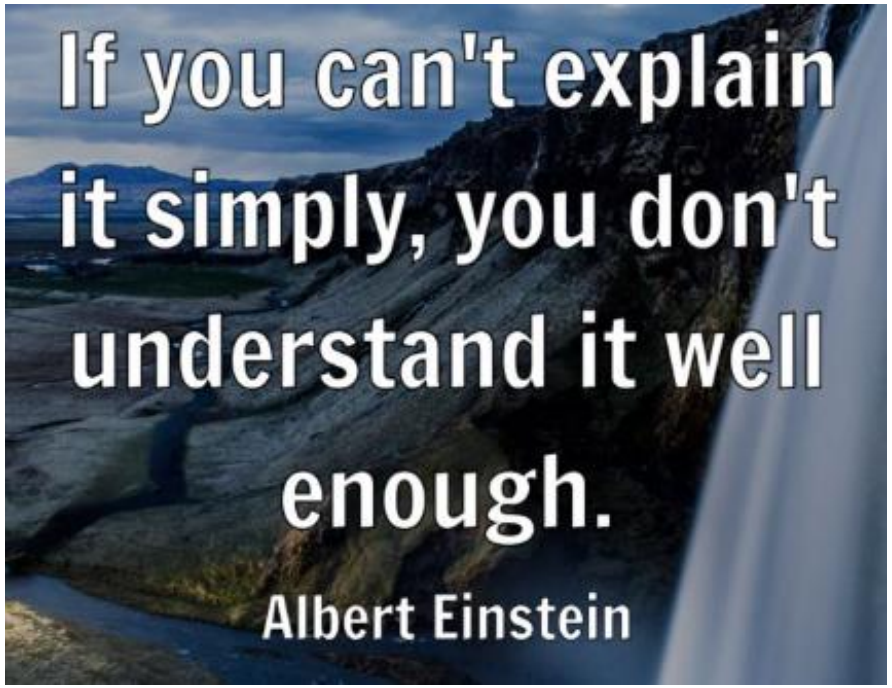
Advanced nuclear energy: the safest and most renewable clean energy

Introduction
Advanced nuclear technology
Are solar and wind renewable?
Advanced nuclear technology is truly renewable
Advantages of Small Modular Reactors (SMRs)
Uranium and thorium reserves
Replacing crude oil: Large-scale nuclear biorefineries
Conclusion

For a preprint, tom@tomrehm.com

For the article,
https://www.sciencedirect.com/search.
Search “Thomas E Rehm” and “2023”.

Some of my colleagues tell me, “There are few opportunities for chemical engineers in nuclear.” I disagree. Opportunities include design and operation of high-temperature (550-750 °C) plants involving molten salts, liquid metal, and helium; application of this high-temperature capability for industrial process heating; recycling legacy nuclear “waste” to provide fuel for advanced reactors; integration of the hydrogen economy into nuclear plant design and operation; improvement in moving pebble bed advanced reactor technology; mining improvements for uranium and thorium, including mining uranium from seawater; molten salt storage systems for improving load following functionality and to provide process heat functionality; and retrofitting existing oil-and-gas based refineries to operate as nuclear biorefineries.



Concern for man and his fate must always form the chief interest of all technical endeavors. Never forget this in the midst of your diagrams and equations.

Albert Einstein

Problem: Global Warming
Solution Path Underway Now: Wishful thinking and national promises
Major Impediments: Corporate and career vested interests, public passions, and political agendas (trusting in Adam Smith's invisible hand, i.e., business-as-usual)

Only Viable Solution: Undertake international analyses to figure out best national and regional action plans, and then implement them.

Global Climate Collaboration Flagship Project

Global Solutions and Outreach Programs

Development Committee

13 Chemical Engineers
2 Mechanical Engineers
2 Physicists
1 Civil Engineer
1 Computer Graphics
1 Chemist
1 Electrical Engineer
1 Engineering Geoscientist
1 Environmental Engineer
1 Environmental Scientist
1 Industrial Engineer
1 Marketing
1 Nuclear Engineer
1 Organic Geochemist
1 Systems Engineer
1 Sustainable Scientist
… plus about 40 others

Marketing Plans now under development for these impact sectors

Governments
Insurance and Finance
Philanthropies
Climate Action Organizations

Soil and Ocean Health
Faith-based Organizations
Universities
Large Corporations

Other potential impact sectors

Institutes
Military
Trade Associations

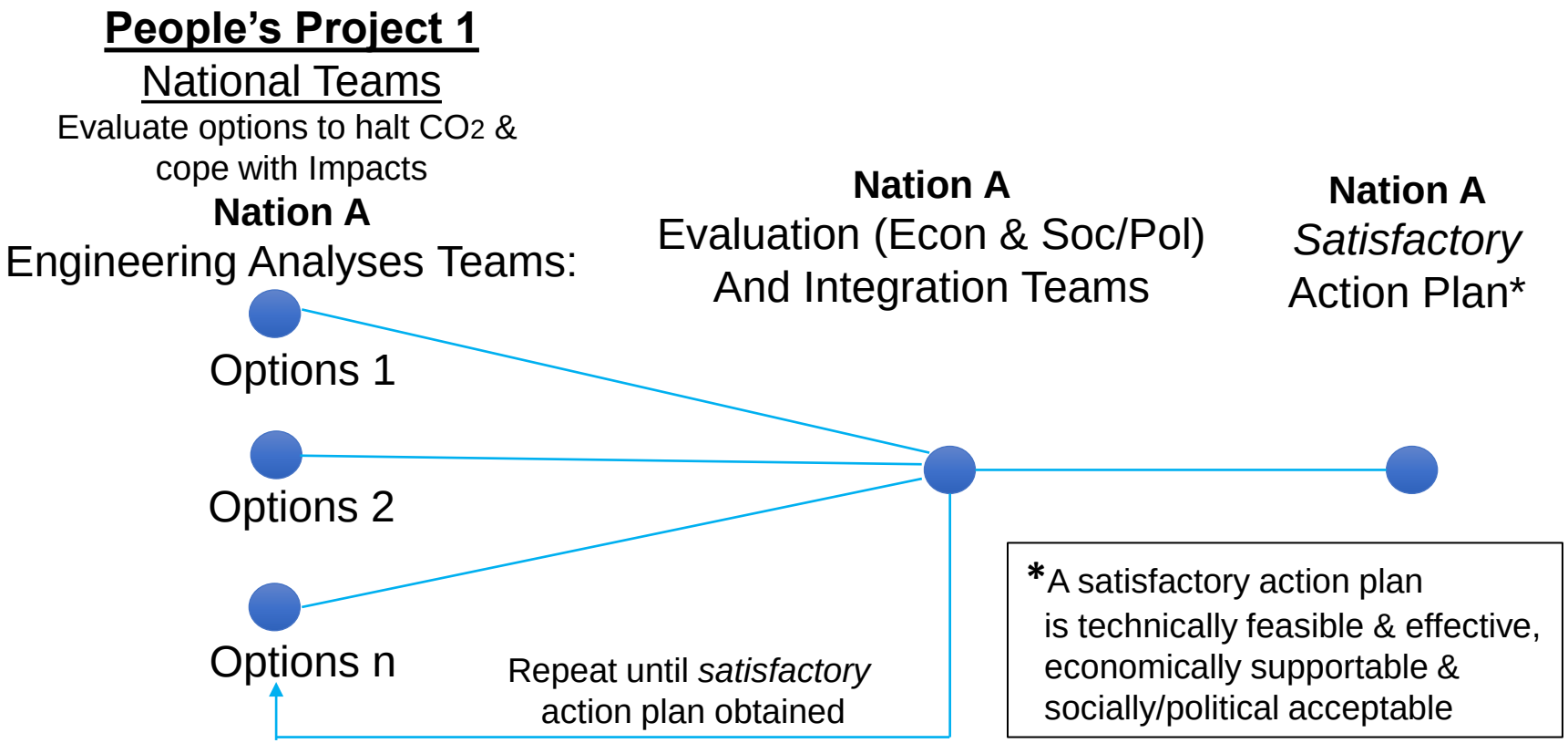
Dick Hutchinson: Three People's Projects

Project 1 focuses on halting CO2 release and adapting to ongoing climate impacts.

Project 2 will evaluate ways to stabilize and adjust the Earth's energy balance and to address ocean acidification and other problems.

Project 3 will focus on climate monitoring, modeling and future projects, particularly the Earth's energy and CO2 balances.

People's Project 1

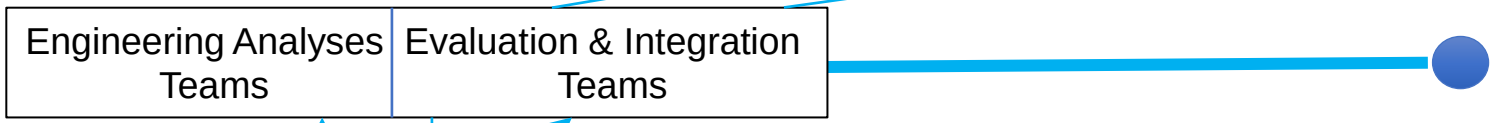


People's Projects 1, 2, and 3

People's Project 1
National Teams
Evaluate Options to
Halt CO_2 & Cope With Impacts
Nation A

People's Project 2
International Teams
Evaluate Options to
Stabilize & adjust
Earth's Energy Balance
Nation A Participates

People's Project 3
International Teams
Evaluate new technologies to
Meet Projects 1 & 2 objectives
Nation A Participates



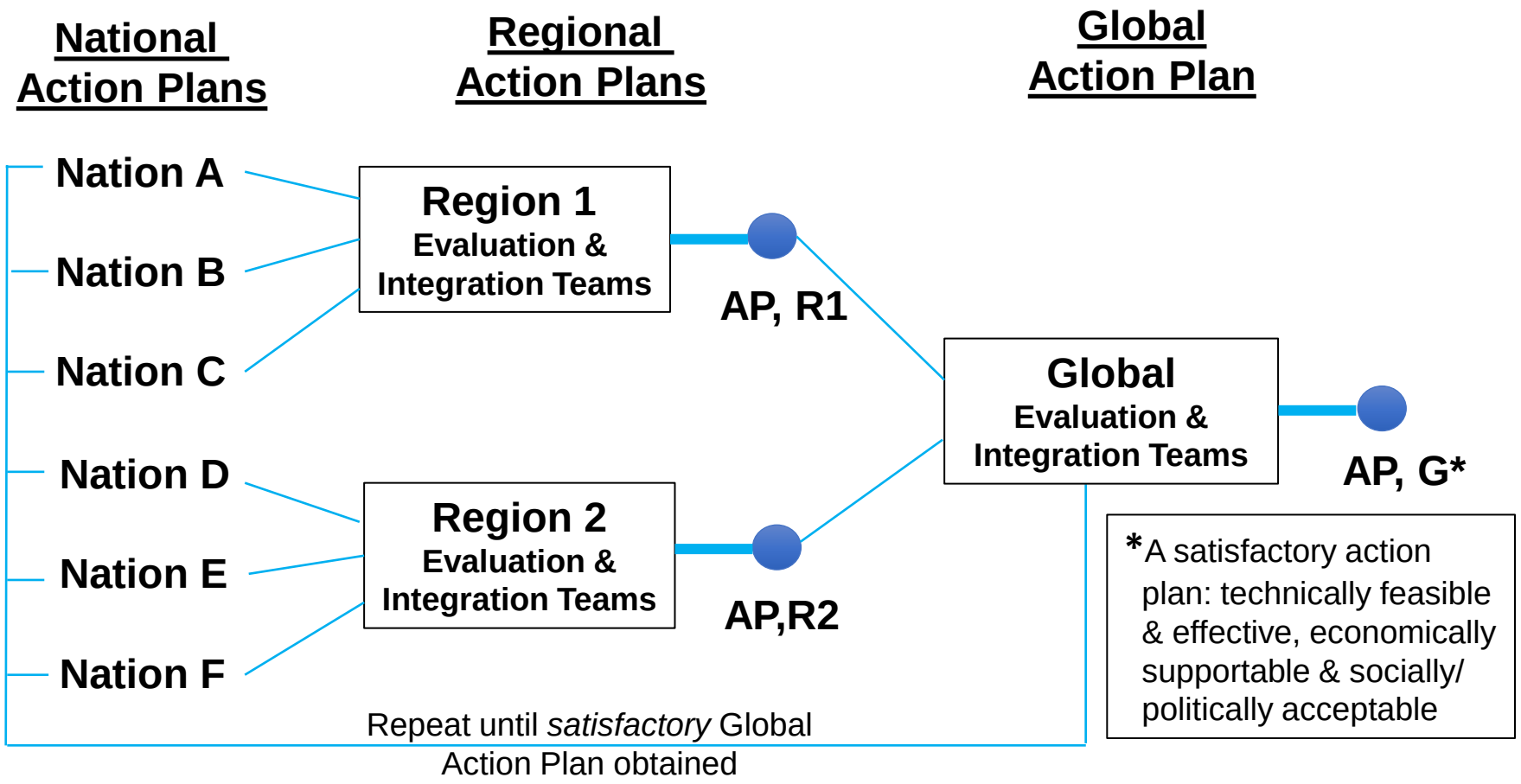
Nation A
Satisfactory
Action Plan*

Exchange results, good ideas, social/political evaluations, pilot testing

Outreach Program
National Teams in each State
Engineering support to
States, local communities & industry
Taking action on global warming
Nation A

*A satisfactory action plan is technically feasible & effective, economically supportable & socially/political acceptable

National, Regional & Global Action Plans



Global Solutions and Outreach Programs – the U.S. Budget

Three-year costs for GSOP work in the United States:

Global Solutions Program
- $245 M
- 270 full-time
- 1,960 part-time – 4 hours/week

Outreach Program
- $105 M
- 110 full-time
- 1,000 part-time – 4 hours/week

Total GSOP Personnel: 380 full-time, 2,960 part-time
Total 3-year costs for US: $350 M

McKinsey: Net-zero transition will cost $275 trillion globally by 2050
January 24, 2022

https://www.thenationalnews.com/Business/UK/2022/01/25/mckinsey-net-zero-transition-will-cost-275-trillion-globally-by-2050/

* Costs based on average US chemical engineer salary ($121K/year + 40% overhead)
https://www.climate-collaboration.com/personnel-plan

Conclusions

1. Global warming is occurring at an accelerating rate.
2. Climate solutions now are built on too much wishful thinking.
3. Understandable human biases are detrimental to decisions on solutions.
   - Vested corporate interests
   - Vested career interests
   - Public passions
   - Political agendas
4. Minimum expectation – mitigate the effect of human biases as much as possible.
5. Best course of action – determine national and regional action plans and implement them → **Global Solutions and Outreach Programs**

Questions?

Action Requested: Register for a GSOP Briefing at https://www.climate-collaboration.com/bimonthly-briefing-registration

2023 Climate Solutions Symposium

Texas, the Energy Capital of the Planet, Can *and Should* Lead

April 22, University of Houston Student Center

1-4pm, symposium proper, Student Center Theater

- Montgomery (Monty) Alger, Sustainable Energy Corps (SEC)
- Joel Yu, Improved Texas Grid Reliability through Natural Gas Microgrids
- Eugene (Gene) Preston, Solutions for moving ERCOT off fossil fuel dependency improving reliability and keeping energy costs low
- Caleb Tomlin, Nuclear in support of industrial applications and grid reliability
- Richard (Dick) Hutchinson, Global Solutions and Outreach Programs (GSOP)

4:00-5:30pm, meet-and-greet, Ballroom

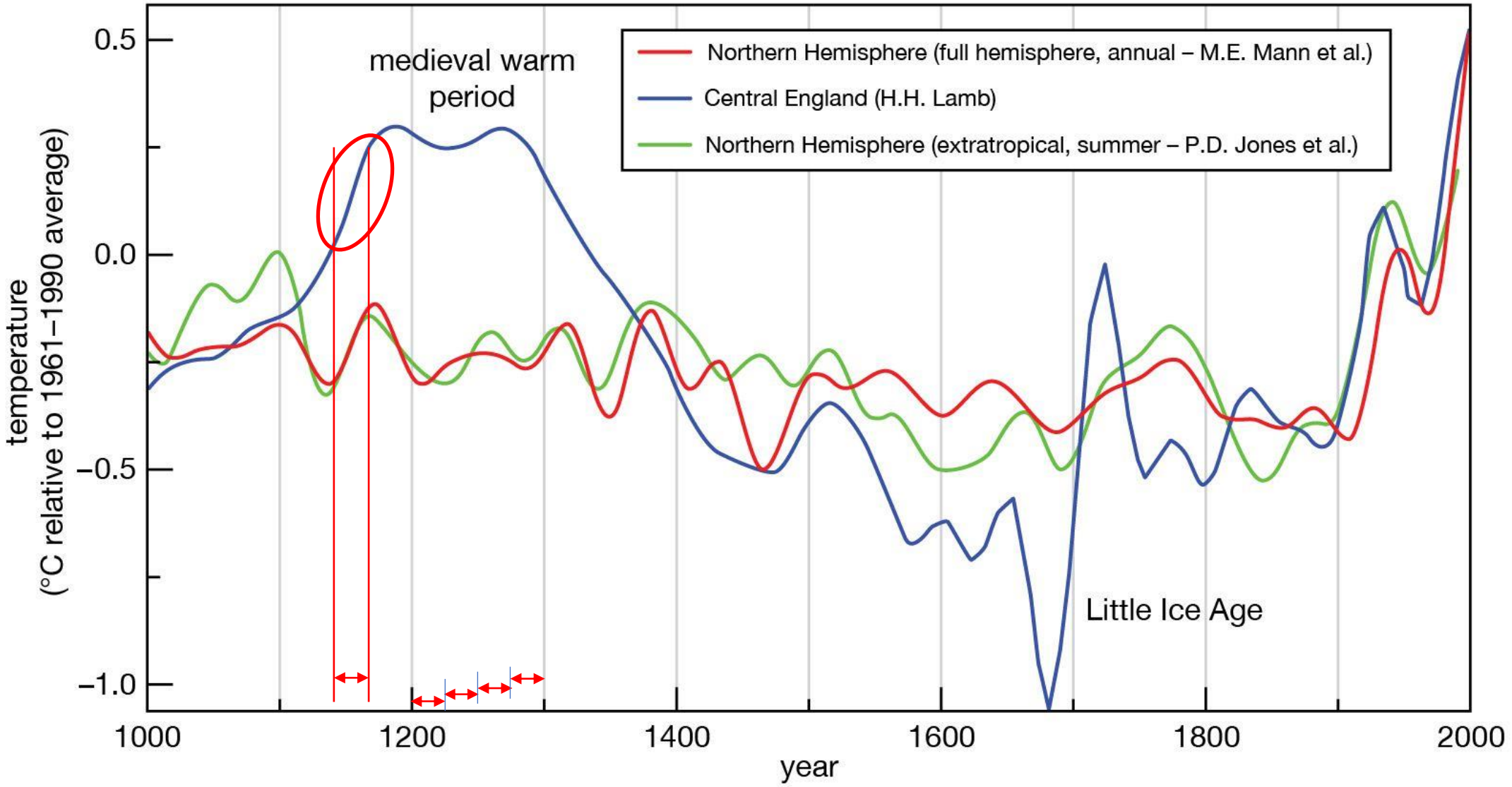
Global Solutions and Outreach Programs (GSOP)

https://www.climate-collaboration.com/

Richard (Dick) Hutchinson, Ph.D. ChE, retired

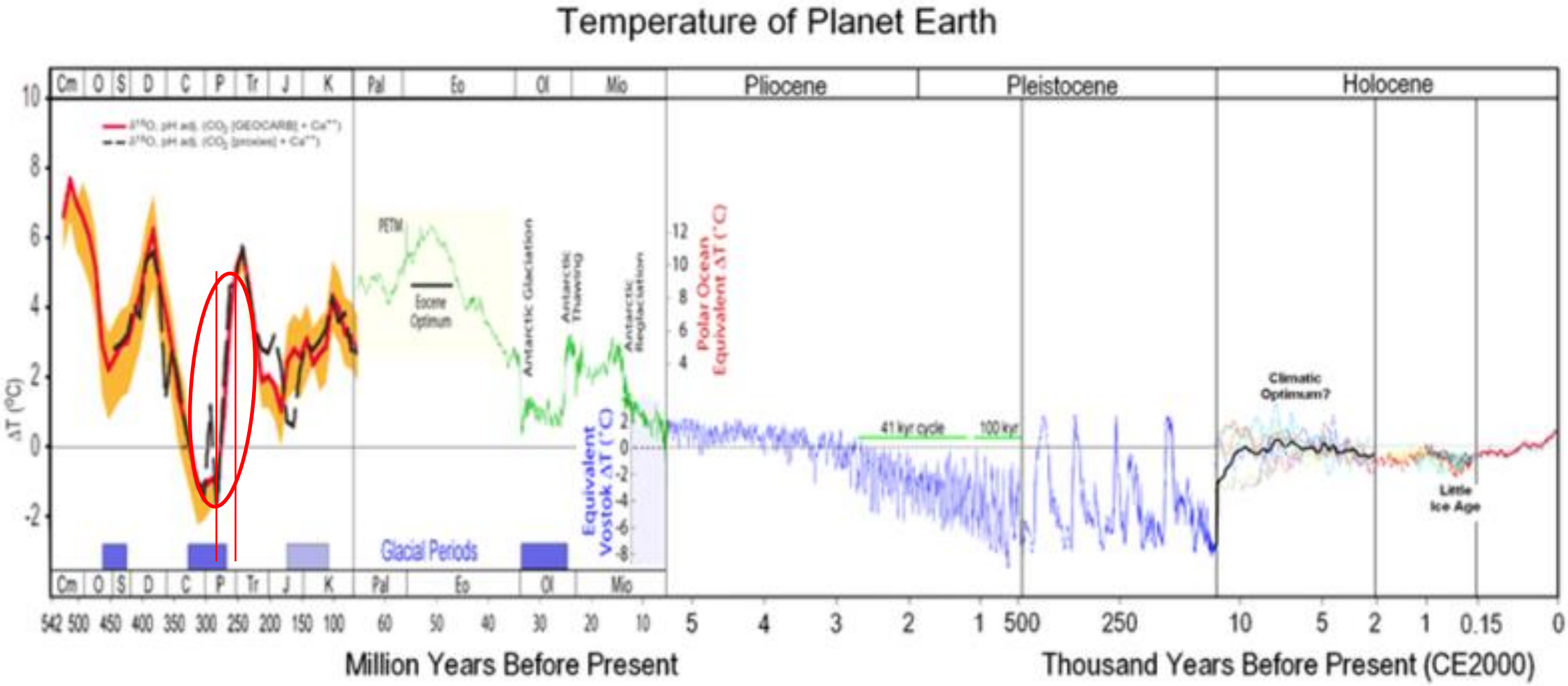
- Career in U.S. Army projects, mostly at the Aberdeen Proving Ground
- U.S. Army work in the 1990s using the Wicked Problem Approach
- Co-founded the Stable Climate Group about ten years ago
- Primary author of the 2019 book People's Assessment of Global Warming

Estimated temperature variations for the Northern Hemisphere and central England (1000–2000 CE)

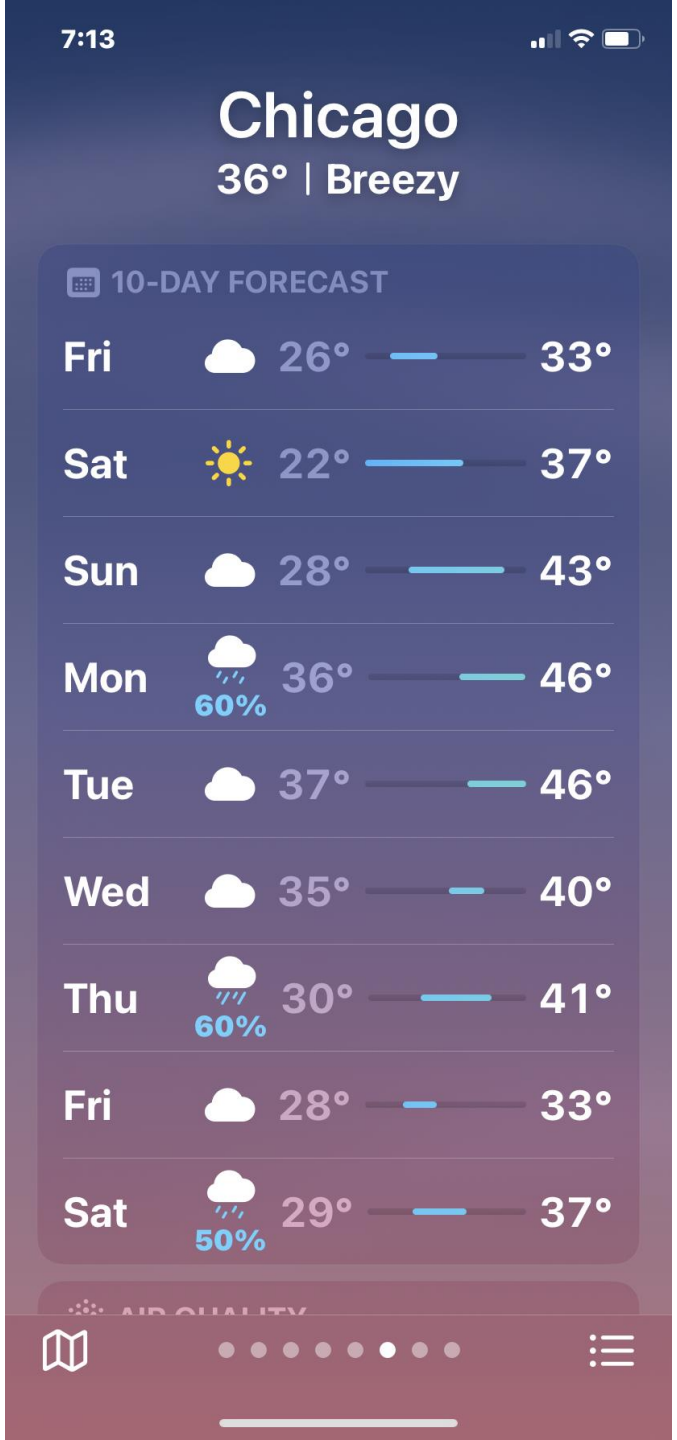


Sources: M.E. Mann et al., "Northern Hemisphere Temperatures During the Past Millennium: Inferences, Uncertainties, and Limitations," *Geophysical Research Letters*, 26:759–762 (1999); P.D. Jones et al., "High-resolution Palaeoclimatic Records for the Last Millennium: Interpretation, Integration, and Comparison with General Circulation Model Control Run Temperatures," *Holocene*, 8:477–483 (1998); H.H. Lamb, "The Early Medieval Warm Epoch and Its Sequel," *Palaeogeography, Palaeoclimatology, Palaeoecology*, 1:13–37 (1965).

Past 500 million years of climate change



January 12, 2023



Rehm golf anecdote – February, ~1990