Climate Change: An Existential Challenge

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What I will cover

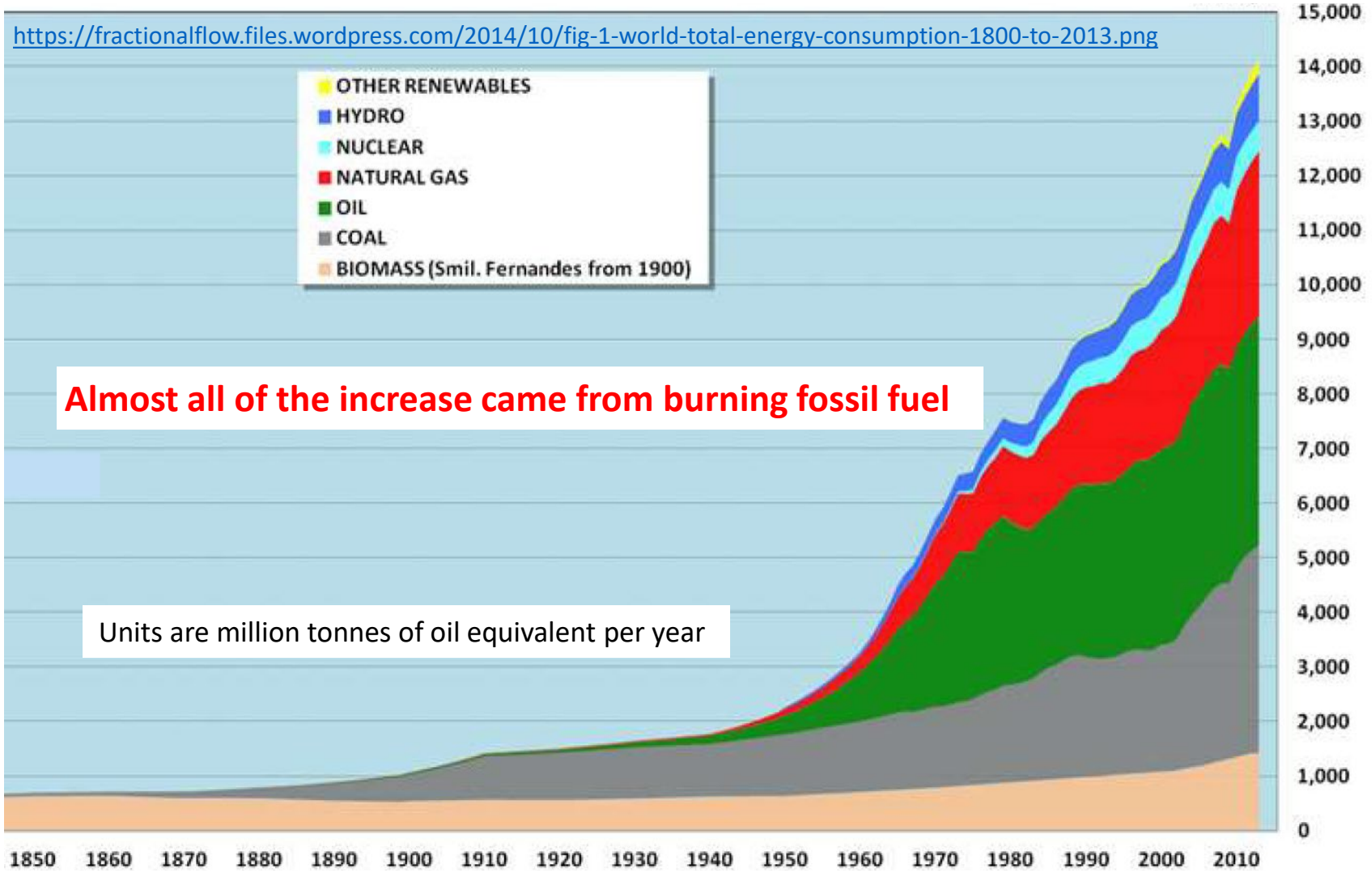
- Brief discussion of climate science (borrowing heavily from John Holdren).
- What makes climate a unique challenge?
- Climate Mitigation and Adaptation.
- Discussion of three key issues.

Fundamentals of Climate Science

- Earth's climate has been changing since about 1900 in ways that cannot be explained by natural influences.
- The reason is emissions of heat-trapping gases from fossil fuel burning and changes in land use patterns.
- About ¼ of CO_2 once emitted remains in the atmosphere for up to 100-200 years. It is referred to as a stock pollutant—as opposed to a flow pollutant. Concentrations build up over time.
- The climate impacts and harm will get worse in the future, no matter what actions we take, because of time lags in the climate system.

Key fundamentals

Growth of population & prosperity from 1850 to the present increased world energy use by over 20-fold



In 2020, coal, oil, & natural gas still supply about 80% of world energy consumption and two-thirds of electricity generation.

What's ahead

Absent big emission cuts, we can expect…

- Large further increases in heat waves
- Big expansion in area burned by wildfires
- Bigger torrential downpours & more flooding
- Destruction of most of the world's coral reefs
- Wider disruption of marine food webs & fisheries
- Bigger thunderstorms, hailstorms, and tornadoes
- More Cat 3-5 hurricanes/typhoons making landfall
- Further increases in frequency & intensity of droughts
- Accelerating sea-level rise, reaching 1 m (3.3 ft) by 2100
- Falling agricultural yields for corn, wheat, rice, soybeans
- More sickness & death from heat stress, tropical diseases

And, as a result, much bigger flows of environmental refugees

If the problem is so serious–why so little urgency?

- Problem has historically always been in the future.
- The pollutant is invisible.
- The impacts are uncertain—both temporally and in scope.
- The impacts are likely to be unevenly dispersed across geographical regions—among countries, but more importantly within countries.
- Climate is a classic global commons issue—hence, the possibility for countries to free ride on the actions of other countries is large.
- Most of the man-made GHGs in the atmosphere were emitted by developed countries, but much of the future impacts will be felt by developing countries that had little to do with causing the problem.

Three Options

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- Suffering—societal disruptions that mitigation and adaptation fail to avoid.

Mitigation

Mitigation will require:

- 3-4 times greater investment in renewables.
- Much greater electrification of heating and passenger vehicles.
- Much smarter buildings, electricity grids, and vehicles.
- Advances in longer term storage.
- 2-7 times more mining and processing capacity for strategic metals.
- Major investments in energy efficiency.

Challenges of Mitigation

- Investment in clean technologies will have to increase by 50%—where will this money come from?
- Restructuring the electricity grid.
- Approximately 75% of the technologies that we will need to reach net zero will need to be developed over the next 15 years.
- Increasing the energy efficiency of buildings, transportation, and industry by 50%.
- Who will pay for mitigation investment in developing countries who are wrestling with poverty, unemployment, poor health care, and educational opportunities?

Climate Adaptation

- Adaptation alone will not work because adaptation measures get costlier and less effective as the impacts of climate change grow larger.
- Adaptation is basically a form of environmental risk management, but harder to implement, since the value of the risks avoided depend on assumptions about the rate of climate change, the rate of future economic growth, and the geographical dispersion of impacts.
- Hence, calculating the return on investment for climate adaptation investments very difficult.

Why local governments must play a role

- Equity concerns—affordability limits the ability of many individuals and communities to invest in resilience. Governments will need to fill this gap.
- Investment in public goods—such as sea walls or artificial wetlands.
- Zoning, public safety, building codes and urban transit are often local or subnational responsibilities

If there is a role for local governments– why have many invested little in climate resilience?

- Lack of financial capability.
- Legacy budgetary demands.
- Uncertainty about impacts of climate disruptions—and their impact on the rate and scope of future economic and population growth.

Three major issues relating to the energy transition.

- Stranded assets and social justice
- Governance
- Siting

Stranded Assets and Social Justice

- Countries have built a fossil-fuel infrastructure over the past century. Included are the facilities to produce, refine, transport, and consume fossil fuels. This infrastructure is worth many trillions of dollars. (Oil and gas sales will exceed $3 trillion in 2022.)
- In addition, there are millions of people who are employed, and receive their healthcare and pensions, from companies who earn revenues directly or indirectly from fossil fuels.
- Any energy transition must incorporate concerns around social justice.

Governance

- Over the last century, governments have built up structures in which responsibilities for infrastructure crosses multiple agencies—horizontal stove-piped structures.
- Further, the relationship between national and subnational governance often remains poorly coordinated.
- To manage climate impacts will require agencies to coordinate and cooperate at levels that rarely exist. Climate will become the ultimate interagency issue.

Siting

- In the next three decades, governments will have to site 3-4 times more infrastructure assets than we site today.
- Do governments have the capacity to review the thousands of permit requests?
- How will we make the trade-offs inherent in most siting decisions between the need for the new infrastructure on the one hand and environmental, social-justice, and economic concerns on the other?
- Examples—electrifying transport, industry, and heating.

Thank you