

**A Summary of  
*Plan B 4.0:  
Mobilizing to Save  
Civilization,*  
a book by  
Lester R. Brown**



**EARTH POLICY INSTITUTE**

# Overview

## A Civilization in Trouble

- Hunger on the Rise
- Soaring Food Prices
- How Did We Get Here?
- Geopolitics of Food Scarcity
- Looming Stresses
- Food: The Weak Link?
- Failing States
- Tipping Points

## Time for Plan B

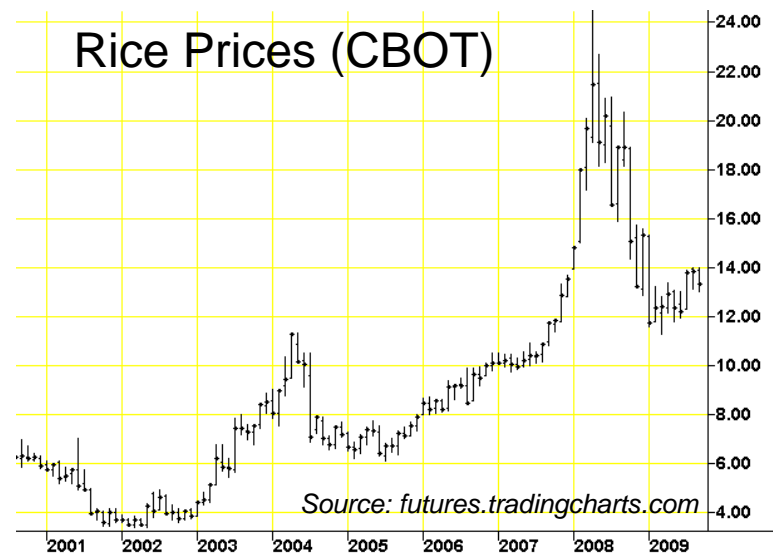
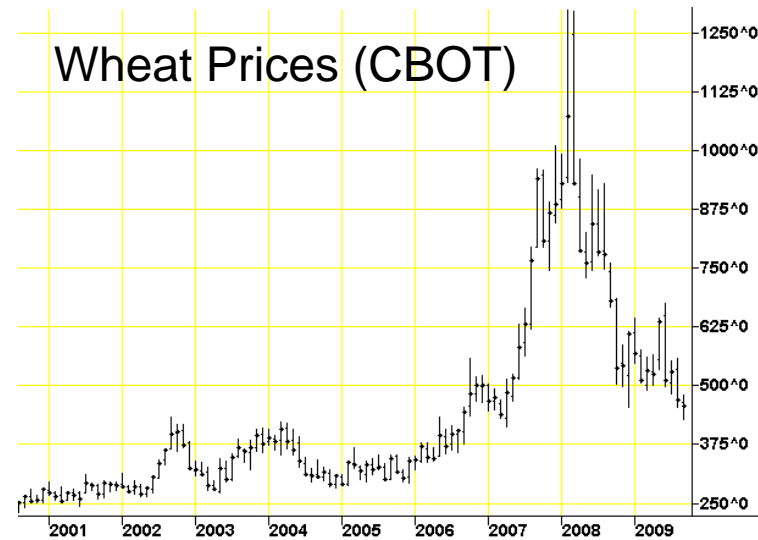
- Plan B: Four Main Goals
- Stabilizing Population and Eradicating Poverty
- Restoring the Earth
- Plan B Budget
- Climate Action Plan
- Putting a Price on Carbon
- A Wartime Mobilization
- Pieces of the Puzzle
- Let's Get to Work

# Hunger on the Rise

World hunger and malnutrition were on the decline for much of the late 20<sup>th</sup> century. But after falling to 825 million in the mid-1990s the number of hungry people began to rise, reaching 915 million in 2008. In 2009 it jumped to over 1 billion. With a business-as-usual approach to agriculture, population, and energy, 1.2 billion or more people will be hungry by 2015.

# Soaring Food Prices

- Mid-2006 to mid-2008: world grain and soybean prices roughly tripled
- Global impact, but the poor were most affected
  - Poorest often spend 50-70% of income on food
  - For low-income people in developing countries buying grain directly, if the price of grain triples, so does their grocery bill
- Took worst economic crisis since Great Depression to ease prices, but they remain well above historical levels



# How Did We Get Here?

- Food price spikes in the past were event-driven, e.g. Indian monsoon failure; prices typically returned to normal with the next harvest
- This one is driven by unresolved long-term trends limiting food supply and increasing demand



# Supply Constraints

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- Little unused arable land, loss of cropland to development and industry
- Overpumped aquifers, falling water tables, and over-allocated rivers limit irrigation expansion
- Slowing growth in crop yields
- Soils eroding, deserts expanding due to overgrazing, overplowing, deforestation



# Growing Demand

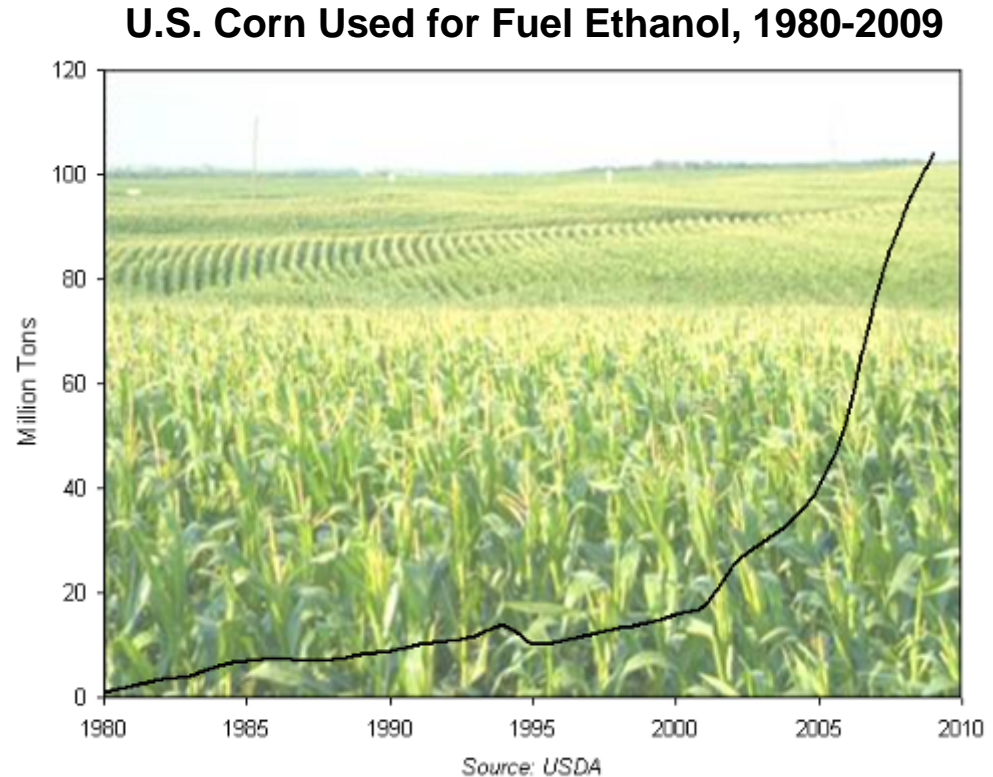
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- World population is increasing by 79 million annually
- Some 3 billion people desire to move up the food chain and eat more grain-intensive livestock products
- Food vs. Fuel: Expanding biofuel production means that cars and people compete for crops

# Food vs. Fuel

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- Rising price of oil has made it profitable to turn grain into fuel
- U.S. ethanol euphoria quickly doubled annual growth in global grain demand, raising food prices worldwide



*The grain needed to fill an SUV's 25-gallon tank with ethanol once could feed one person for an entire year.*



# Geopolitics of Food Scarcity

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- Late 2007: Food prices spiked even higher as grain exporters, including major players such as Viet Nam, limited or banned exports, further tightening the world market
- Climbing prices provoked riots and unrest in dozens of countries
- Contributed to the fall of Haiti's government
- Affluent food importers began buying or leasing large swaths of land abroad to grow food for themselves

# A New Response: Farming Abroad

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- Libya plans to farm wheat on 100,000 hectares (250,000 acres) in Ukraine
- South Korea signed deals to grow wheat on 690,000 hectares in Sudan
- Chinese firm secured 2.8 million hectares in Democratic Republic of the Congo for palm oil
- In all, some 50 large agreements worth \$20-30 billion are being pursued

# Potential for Conflict

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- Land often acquired in impoverished, hungry countries, e.g. Sudan and Ethiopia
- Deals lack transparency; local farmers left out
- Some countries plan to bring foreign farm workers, may fuel public outrage further
- Even these attempts to secure food supplies may prove futile unless the world addresses the long-term trends and looming stresses threatening food security



# Looming Stresses

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...foreshadow further food production constraints, price rises, and increased political unrest unless dealt with.



# Peak Oil

- The 20 largest oil fields were discovered between 1917 and 1979
- Since 1981, oil extraction has exceeded new discoveries by a widening margin
- Most of the easily recovered oil is already pumped

*Once oil production turns downward, countries will compete for a shrinking supply. It will be far more difficult to expand energy-intensive agricultural production when the price of oil is rising and the supply is declining.*

# Water Shortages

- Between 1950 and 2000, world water use tripled
- Some 70% of water use is for irrigation
- Overextraction is leading to disappearing lakes and rivers failing to reach the sea
- Aquifer depletion is causing water tables to fall and wells to go dry
- 175 million Indians, 130 million Chinese are fed with grain produced by overpumping

*Since the overpumping of aquifers is occurring in many countries more or less simultaneously, the depletion of aquifers and the resulting harvest cutbacks could come at roughly the same time, creating potentially unmanageable food scarcity.*



# A Dramatic Example: Saudi Arabia

- Saudi Arabia has heavily subsidized wheat production and as a result has been self-sufficient for more than 20 years
- Used oil-drilling technology to tap a non-replenishable aquifer to irrigate the desert
- In early 2008, announced the aquifer was largely depleted and wheat production would be phased out entirely by 2016
- Will be importing nearly all the grain needed to feed its 30 million people

*Saudi Arabia is the first country to publicly project how overpumping will shrink its grain harvest.*

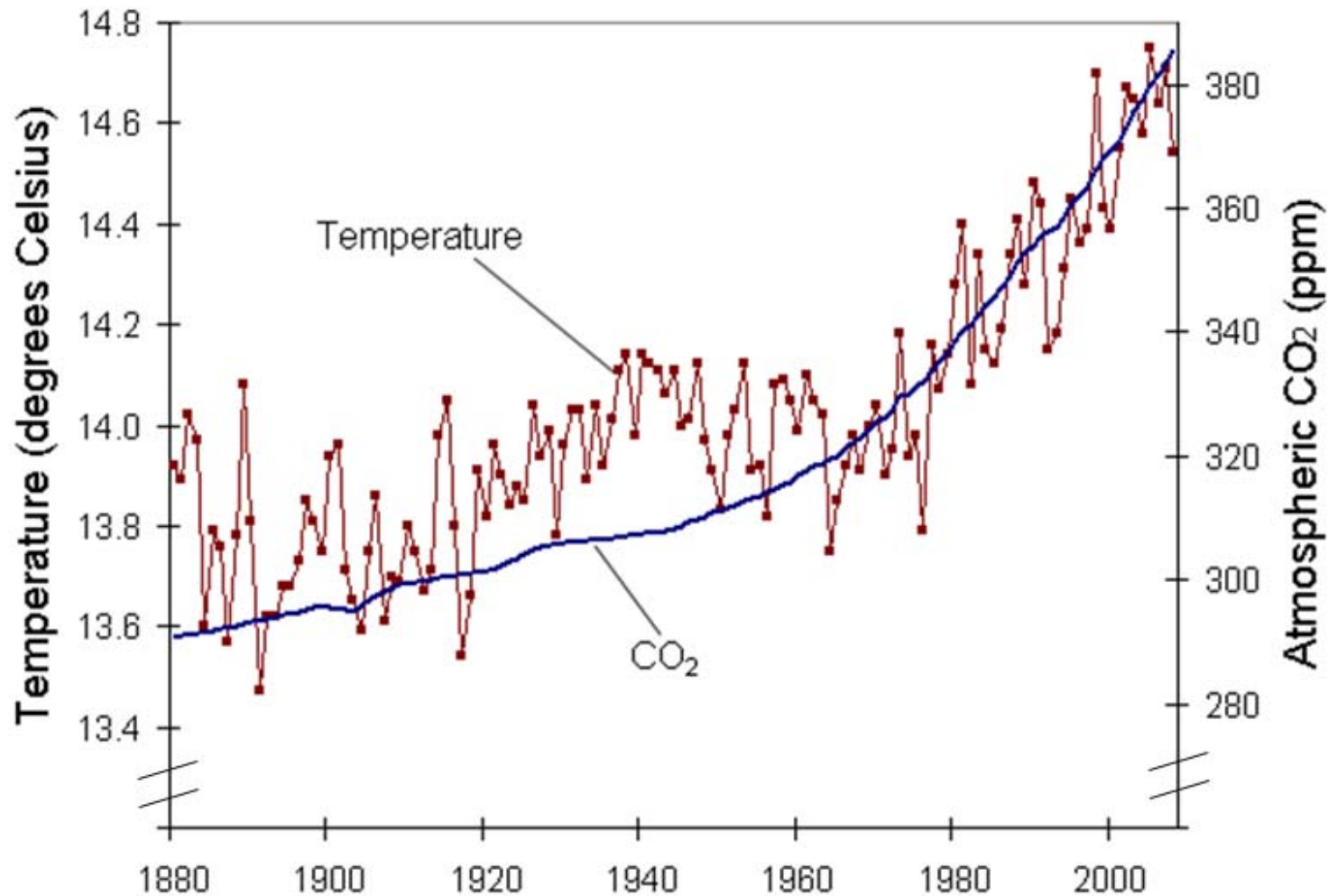
# Climate Change

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- Since start of Industrial Revolution, carbon dioxide (CO<sub>2</sub>) in the atmosphere has risen from 277 parts per million to 387 parts per million
- In 2008, 7.9 billion tons of carbon were emitted from burning fossil fuels – coal, oil, natural gas
- Emissions from deforestation totaled 1.5 billion tons of carbon that year
- Electricity generation and transportation are the largest sources of CO<sub>2</sub> emissions, with coal-fired power plants the biggest culprit
- As CO<sub>2</sub> accumulates, global temperature rises

# Average Global Temperature and Atmospheric Carbon Dioxide Concentrations, 1880-2008

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Source: NASA GISS and NOAA/ESRL



# Climate Change

- The earth has warmed an average 0.6°C (1.0°F) since 1970
- Rising temperatures fuel stronger storms and increase crop-withering heat waves
- The Intergovernmental Panel on Climate Change (IPCC) projects earth's average temperature will rise 1.1 - 6.4°C (2.0 - 11.5°F) during this century
- Current trajectory is already outpacing projections

*For every 1°C rise in temperature above the norm during the growing season, yields of wheat, rice, and corn drop 10 percent.*

# Ice Melting

- Losing our Reservoirs in the Sky
  - Mountain glaciers rapidly disappearing worldwide
  - Himalayan and Tibetan-Qinghai Plateau glaciers sustain the major rivers of Asia during the dry season, providing critical irrigation water for agriculture
  - If melting continues at current rates, rivers like the Yellow, Yangtze, Ganges, and Indus could become seasonal, causing wheat and rice harvests to plummet

# Ice Melting

- Rising Seas

- Massive Greenland and West Antarctic ice sheets are melting at accelerating rates
- Together hold enough water to raise sea level 12 meters (39 feet)
- A 10-meter rise in sea level today would inundate coastal areas home to more than 600 million people

*The risk is that climate change could spiral out of control, making it impossible to arrest trends such as rising temperatures, ice melting, and rising seas, threatening food security and creating hundreds of millions of climate refugees.*

# Food: The Weak Link?

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- Food shortages led to collapse of Sumerian, Mayan, and many other early civilizations
- Could food be the weak link for our 21<sup>st</sup> century global civilization?
- We are failing to reverse trends undermining food security while adding new stresses
- Accumulating problems and their consequences may overwhelm more and more governments, accelerating spread of state failure



# Failing States

- States fail when governments lose control of part or all of their territory and can no longer ensure their people's security
- Rapidly growing populations, rising hunger and poverty, resource depletion, and political stresses are pushing more countries such as Afghanistan, Haiti, and Sudan toward state failure each year, decreasing stability

*How many failing states before our global civilization begins to unravel?*

# Tipping Points

- Can we address the root causes of rising food insecurity and state failure in time to avoid global political instability?
- Can we halt deforestation before the Amazon rainforest dries out, becoming vulnerable to fire?
- Can we close coal-fired power plants fast enough to avoid losing the Greenland and West Antarctic ice sheets?
- Can we cut carbon emissions quickly enough to keep temperature from spiraling out of control?

*Business as usual is not working – It's time for Plan B.*

# Plan B: Four Main Goals

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1. Stabilizing Population
2. Eradicating Poverty
3. Restoring the Earth's Natural Support Systems
4. Stabilizing Climate

# Stabilizing Population and Eradicating Poverty

- Universal primary education
- Eradication of adult illiteracy
- School lunch programs for 44 poorest countries
- Assistance to preschool children and pregnant women in 44 poorest countries
- Reproductive health care and family planning services

Total Additional Annual Cost = \$77 billion



# Restoring the Earth

- Protecting and restoring forests
- Conserving and rebuilding soils
- Protecting biodiversity
- Restoring fisheries
- Stabilizing water tables
- Planting trees to sequester carbon

Total Additional Annual Cost = \$110 billion

# Plan B Budget

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Additional Global Annual Expenditure Needed:

Basic Social Goals      \$77 billion

Restoring the Earth      \$110 billion

Total Plan B Budget      \$187 billion

Perspective: This equals just *one eighth* of annual world military spending.

# Climate Action Plan

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Cut Global Net CO<sub>2</sub> Emissions 80% by 2020

Three components:

1. Raising energy efficiency and restructuring transportation
2. Replacing fossil fuels with renewables
3. Ending net deforestation and planting trees to sequester carbon

...to prevent global atmospheric CO<sub>2</sub> concentrations from exceeding 400 parts per million, minimizing future temperature rise.



# Raising Energy Efficiency

- Buildings
  - Retrofits with better insulation and more efficient appliances can cut energy use 20-50%
- Lighting
  - A worldwide switch to highly-efficient home, office, industrial, and street lighting would cut electricity use 12%, equivalent to closing 705 of the world's 2,670 coal-fired power plants
- Appliances
  - Japan's Top Runner Program uses today's most efficient appliances to set tomorrow's standards; e.g. helped boost computer efficiency by 99%





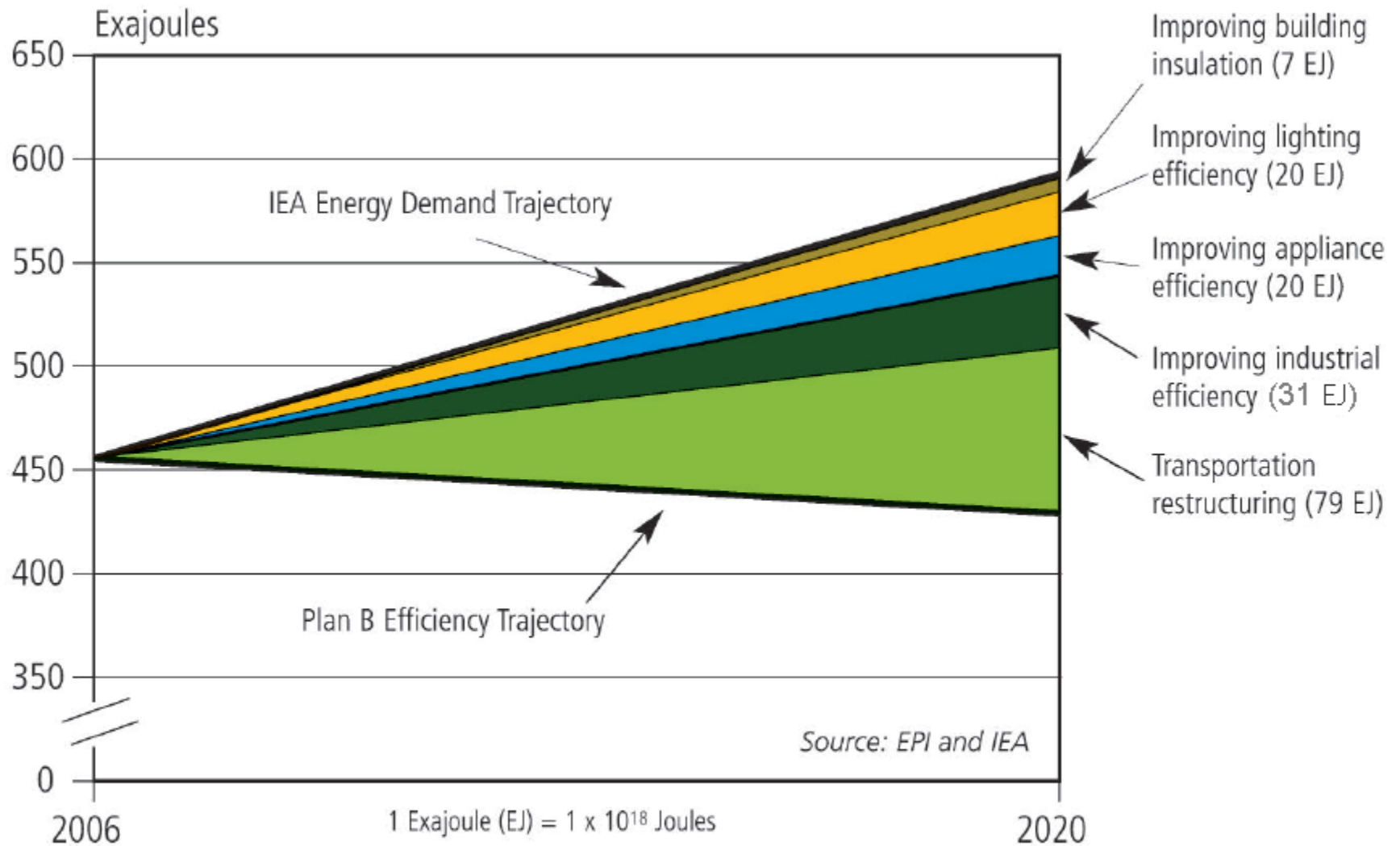
# Raising Energy Efficiency

- Industry
  - Improving manufacturing efficiency for carbon emissions heavyweights (chemicals, petrochemicals, steel, and cement) offers major opportunities to curb energy demand
- Transportation
  - Restructuring transport to emphasize rail, light rail, and bus rapid transit would save energy while making walking and cycling safer
  - Moving from oil to electricity reaps big gains

# A New Automotive Economy

- Plug-in hybrid electric vehicles (PHEVs) running primarily on emissions-free electricity generated by the wind and the sun would allow for low-carbon commuting, grocery shopping, and other short-distance travel
- Combining a shift to PHEVs with widespread wind farm construction would allow drivers to recharge batteries at a cost equivalent of less than \$1 per gallon of gasoline

# Plan B Energy Efficiency Measures



# Replacing Fossil Fuels with Renewables

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- Wind
- Solar
- Geothermal
- Other: Small-scale Hydro, Tidal and Wave Power, Biomass



*Photo Credit: iStockPhoto / Gary Milner*

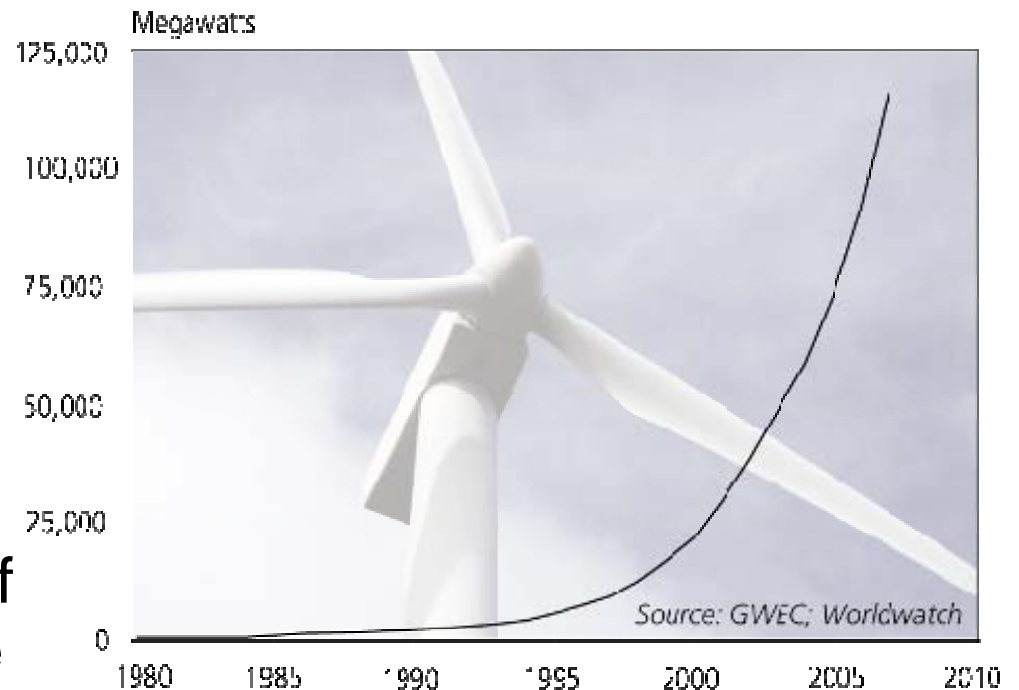


# Harnessing the Wind

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- Centerpiece of Plan B energy economy
- Abundant – North Dakota, Kansas, and Texas alone could satisfy U.S. energy needs
- Widespread – in every country
- Increasingly inexpensive
- Plan B goal: 3 million MW of installed capacity worldwide by 2020
- Need 1.5 million 2-MW turbines installed by 2020

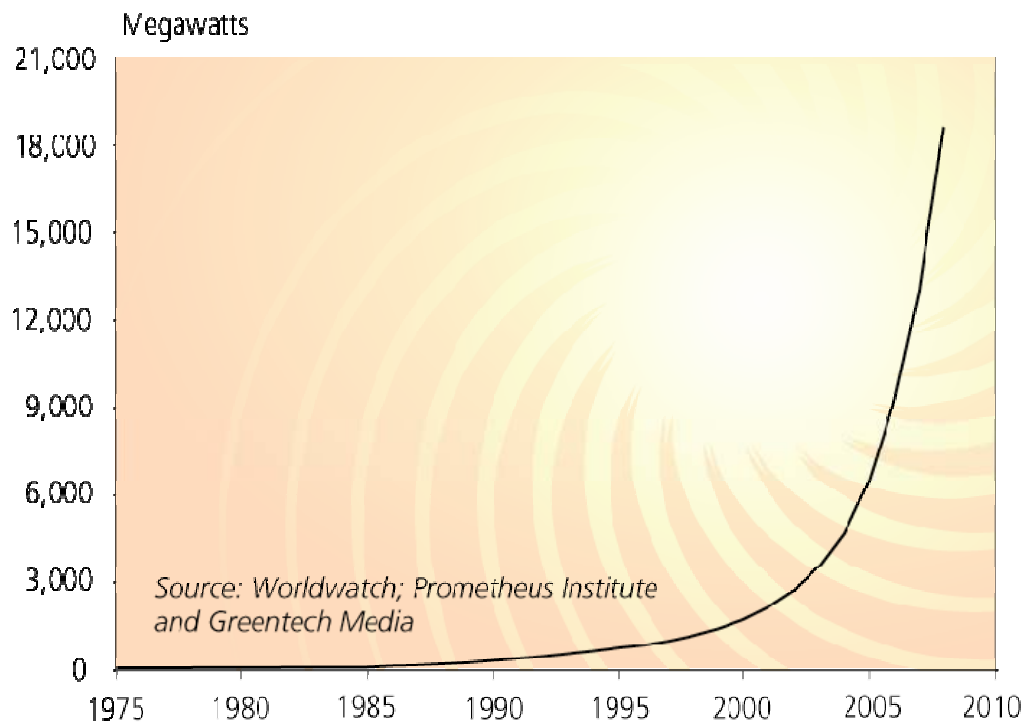
World Cumulative Installed Wind Power Capacity, 1980-2008



# The Power of the Sun

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**World Cumulative Photovoltaics Production, 1975-2008**



- Technologies include photovoltaics (PV), solar thermal power plants, solar hot water and space heaters
- Sunlight hitting the earth in 1 hour could power global economy for 1 year
- Plan B goal: Solar heating and electricity each exceed 1 million MW installed capacity by 2020

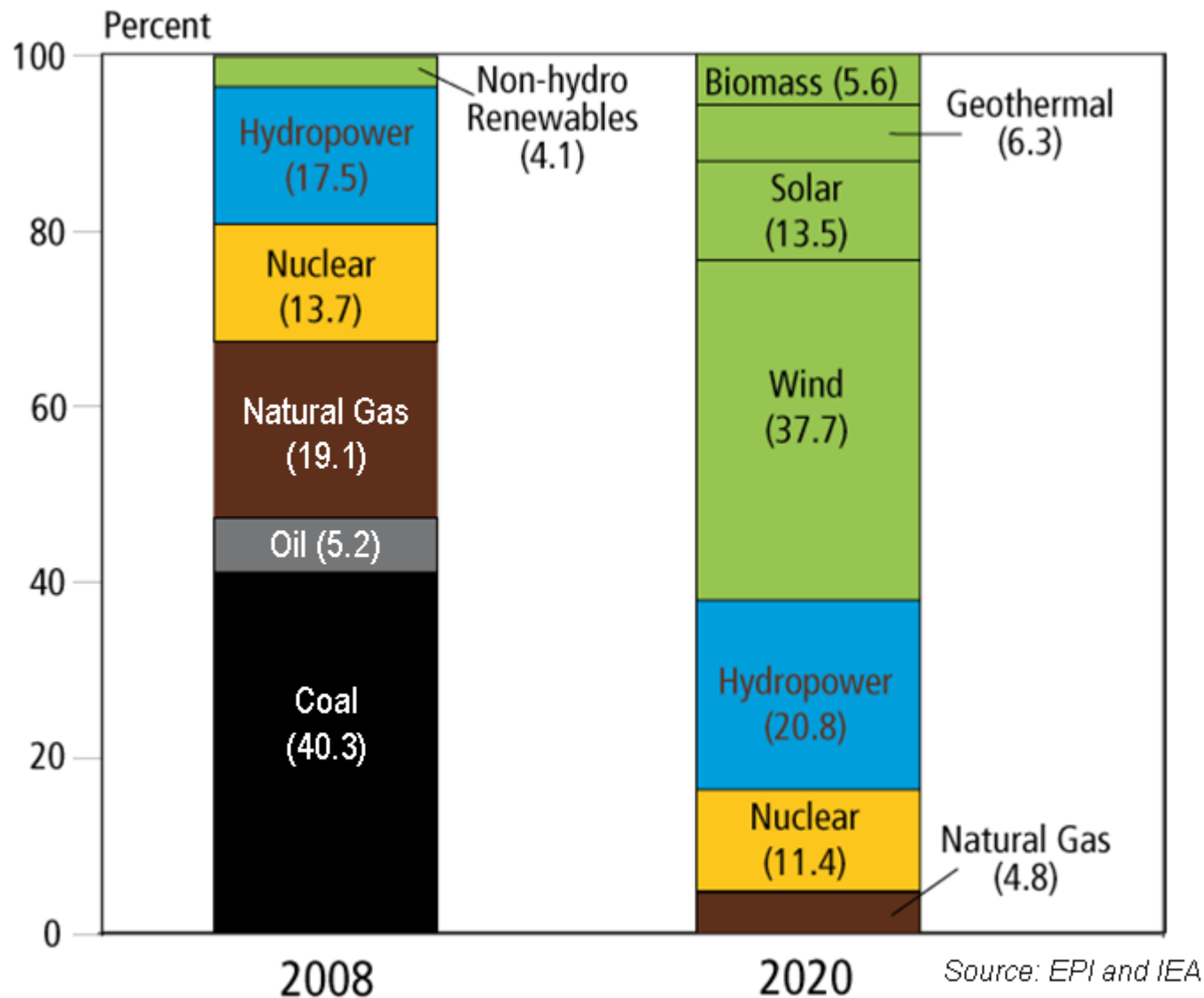
# Geothermal: Energy from the Earth

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- Heat in the upper 6 miles of earth's crust contains 50,000 times the energy found in global oil and gas reserves
- Plan B goal: increase geothermal heating 5-fold to 500,000 thermal MW and geothermal electricity production 20-fold to 200,000 MW by 2020



# World Electricity Generation by Source in 2008 and in the Plan B Economy of 2020



# Ending Net Deforestation, Planting Trees

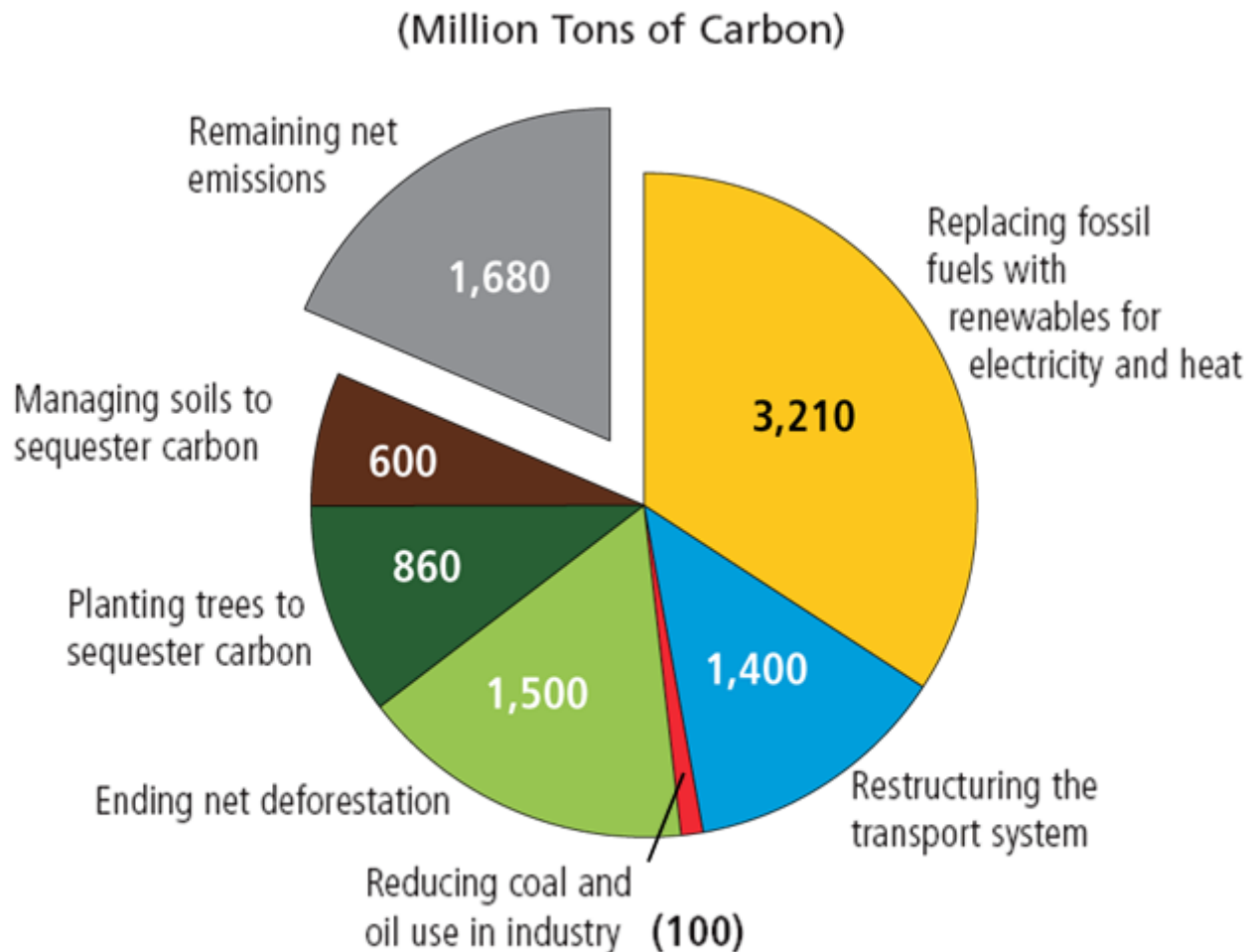
- Ending net deforestation by 2020 will reduce annual CO<sub>2</sub> emissions by 1.5 billion tons of carbon
- Planting trees and adopting less-intensive farming and land management practices can stabilize soils and sequester carbon

*Adding these measures to our renewable energy goals will allow us to reduce net CO<sub>2</sub> emissions 80% by 2020.*



# Plan B Carbon Dioxide Emissions Reduction Goals for 2020

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Baseline Emissions (2006) = 9,350 Million Tons of Carbon

Source: EPI

# Putting a Price on Carbon

- Problem: Price of fossil fuels does not reflect costs of climate change, markets not telling ecological truth
- Solution: Tax restructuring
  - Plan B proposal: Raise tax on carbon emissions by \$20 per ton each year, to reach \$200 per ton of carbon by 2020
  - Offset carbon tax with reduction in income tax

An aerial photograph of a vast aircraft manufacturing plant, likely during World War II. The ground is filled with hundreds of aircraft in various stages of production, from fuselages to complete planes. The scene is a testament to large-scale industrial mobilization.

# A Wartime Mobilization

- Upon entering World War II, the U.S. mobilized resources and completely restructured its economy within months
- Saving civilization will require action equal in urgency but much larger in scale
- We have the technologies necessary to implement Plan B – what is needed now is the political will to do so

# Pieces of the Puzzle



Countries and cities around the world give a sense of what is possible:

- In Copenhagen, 36% of commuters bike to work
- Iran cut its rapid population growth rate from 4.2% in the early 1980s to 1.3% in 2006 through national literacy, health, and family planning programs
- China has 27 million rooftop solar water heaters harnessing energy equal to the output of 49 coal-fired power plants
- Japan's high-speed rail system moves hundreds of thousands of passengers each day, measuring delays in seconds

# Pieces of the Puzzle

- Once almost treeless, South Korea has reforested 65% of its land
- In the Philippines, 19 million people get electricity from geothermal power plants
- Over the last quarter-century the United States reduced soil erosion 40% by retiring cropland and practicing conservation tillage, while increasing the grain harvest 20%
- In Germany, a systematic shift of taxes from labor to energy reduced annual CO<sub>2</sub> emissions by 20 million tons and created 250,000 jobs between 1999 and 2003
- Denmark gets more than 20% of its electricity from wind and is aiming for 50%
- Proposals for more than 100 coal-fired power plants in the United States have been shelved since 2001



# Let's Get to Work

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*Saving civilization is not a spectator sport.*

Lester R. Brown

- What You Can Do
  - Educate yourself on environmental issues
  - Spread the word: letters to the editor, op-eds, internet
  - Get politically involved: let elected officials know what's important
  - Take action in an area that excites you, such as closing coal-fired power plants, tax restructuring, or ending biofuel mandates that raise food prices



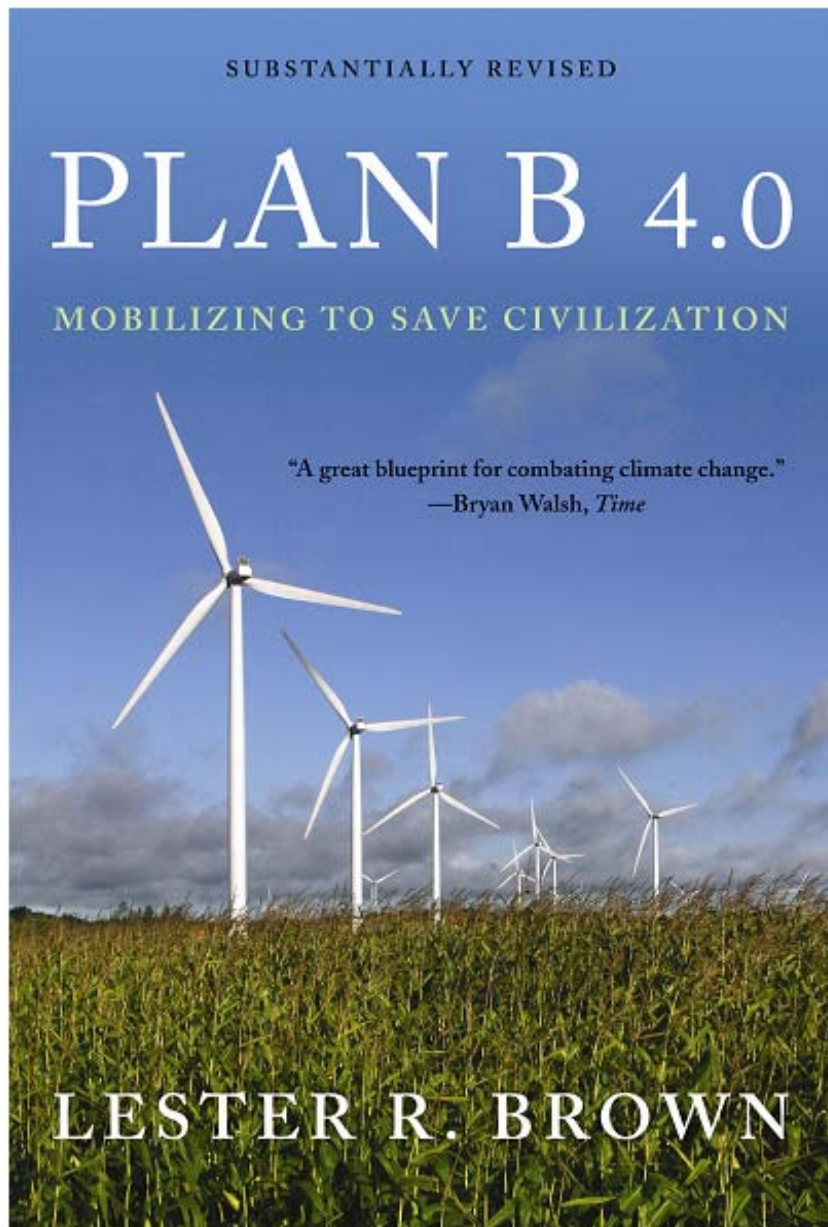
# The Choice is Ours

- Will we stay with business as usual and preside over an economy that continues to destroy its natural support systems until it destroys itself?

*or*

- Will we adopt Plan B and be the generation that changes direction, moving the world onto a path of sustained progress?

*The choice is ours. It will be made by our generation, but it will affect life on earth for all generations to come.*



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