

ENERGY CHALLENGES

ECONOMIC GROWTH

COVID-19

DISPARITY IN WEALTH AND INCOME/POVERTY

DEGROWTH

POLITICAL CHALLENGES/POPULISM

REFUGEES/IMMIGRATION

FINANCIAL REFORM

ENERGY CHALLENGES, ENVIRONMENT & GLOBAL CLIMATE CHANGE

Areas of overlapping concern: energy, environmental pollution, climate change, and national security present a classic:

- **problem for which a precautionary approach may be indicated**
- **(environmental and other) externalities problem,**
- **limits-to-growth problem**
 - **environmental limits**
 - **energy as a source of growth**
 - **employment effects**
- **(global) commons problem**
- **monopoly problem**
- **information asymmetry problem**
- **distributional equity problem**
- **corruption problem**
- **terrorism problem**
- **balance of trade implications**
 - **sovereign wealth funds**
 - **implications of division of labor**

Socioeconomic drivers

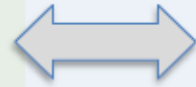
- Demographic change
- Economic growth
- Urbanization
- Science & technology investment
- Inequities

Global environmental changes

- Air pollution
- Land use change
- Biodiversity loss
- Desertification
- Water stress

Climate variability and change

- Extreme weather events
- Heat stress
- Air quality
- Water quality & quantity
- Food supply & safety
- Vector distribution & ecology



Vulnerability and susceptibility

- Political commitment
- Population health status
- Population health status
- Health system capacity & resilience

Socioeconomic conditions
Social infrastructure
Individual factors



Examples of health impacts and risks

- Injuries, fatalities, mental health effects from extreme events and disasters
- Heat-related illness and death, including impacts on pregnancy outcomes and worker productivity
- Exacerbations of asthma & other respiratory diseases; allergies
- Infectious diseases, such as salmonella, dengue fever, Zika virus, Lyme disease, malaria, West Nile virus infection
- Undernutrition
- Physical and mental health effects of violent conflict and migration
- Impacts on healthcare infrastructure

Ways to think about the problem(s):

- supply or demand-side policies?**
- change supply, efficiency, conservation, or consumption?**
- social or industrial changes?**
- increase public awareness or counter-advertise?**
- diffusion and incremental innovation or R&D and radical/disrupting technology?**
- static efficiency or dynamic efficiency?**
- unilateral or multi-lateral approaches?**
- regulatory intervention or economic instruments?**

Energy Independence

World Political Stability

Energy Supply/Use

- **increase sources**
- **efficiency**
- **conservation**
- **consumption**
 - **growth or development?**
 - **products or product-services?**

Environmental/Public Health Consequences

- **global climate change**
- **public health**
- **land diversion → food prices**

Market Solutions

- **market-based instruments**

Non-market Solutions (regulation)

- **non-market-based instruments**

Mixed Instruments

- **cap-and-trade**

Rate (efficiency) limitations → Jevon's Paradox (boomerang)

Use Limitations

Emission Limitations

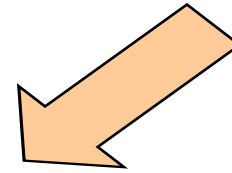
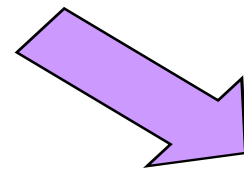
Supply Side

Extraction industries
Manufacturing
Agriculture
Transportation
ENERGY
Services
Housing
ICT

Producer-created demand →

Consumer Consumption
Commercial Consumption
Government Consumption

Demand Side



FINANCE
← Subsidies
← Credit →

SUSTAINABILITY CHALLENGES

Inadequate Supply of, and Access to, Essential Goods & Services

Toxic Pollution

Climate Disruption

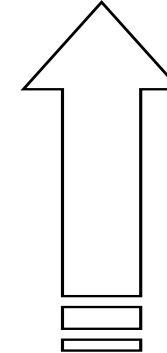
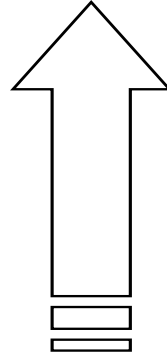
Resource Depletion

Biodiversity/Ecosystem Integrity

Environmental Injustice

Employment/Purchasing Power

Economic Inequity



SOLUTIONS

Education & Human Resource Development

Industry Initiatives

Government Intervention/Regulation

Stakeholder Involvement

Reform the Financial System

Factors of production: critical challenges

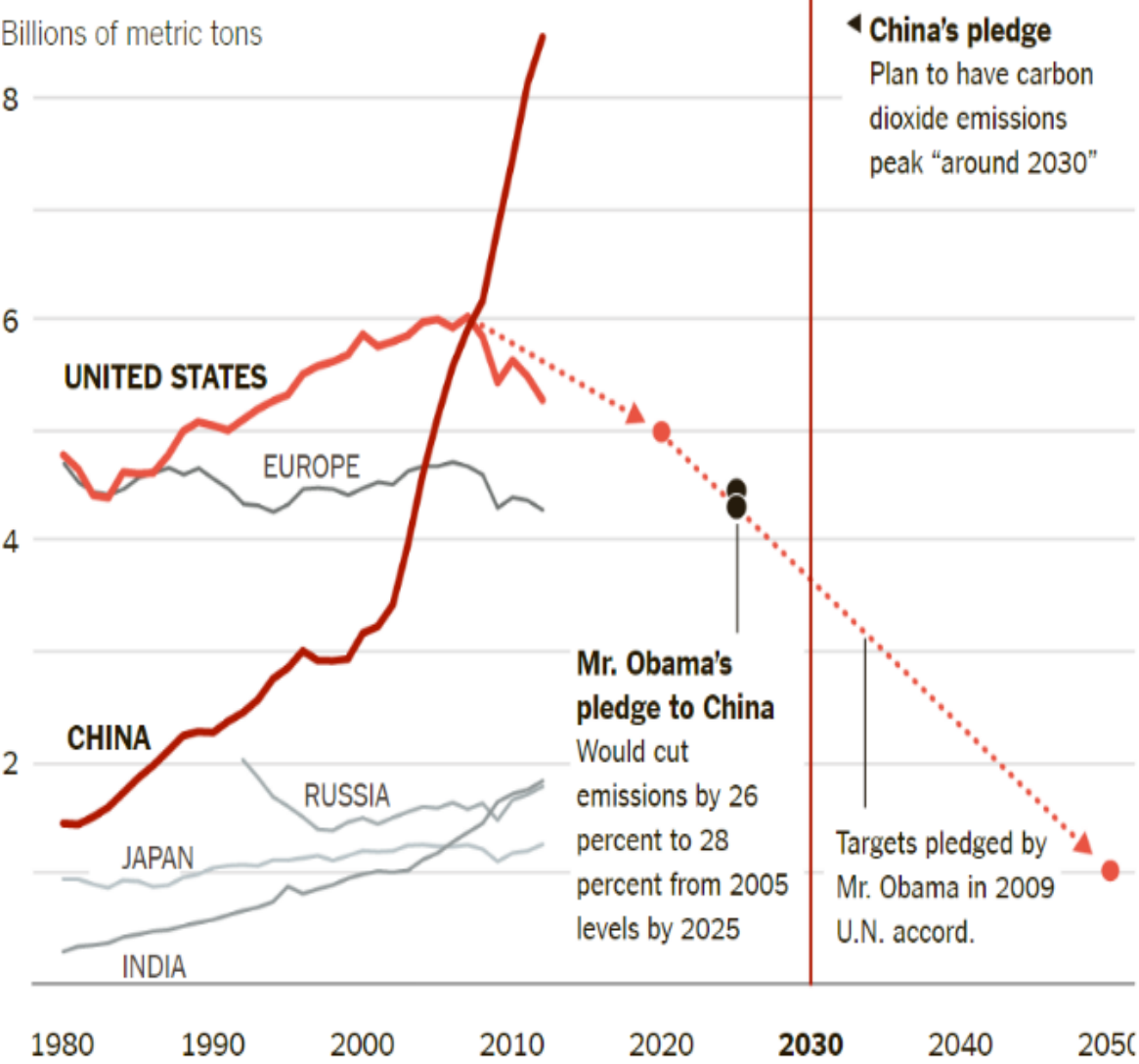
- Factors of production do not reflect their full cost – *failure to internalize negative externalities*
- Volatility in the price of the factors of production, undermines the use of labor

Expanded List of the Factors of Production

- Land
- **Natural and physical capital** (material resources)
- **Energy**
- **Labor** capable of performing physical work
- **Know-how (intellectual human capital)**
- [Innovation systems]
- Built capital (that is, infrastructure, such as railways, bridges, roads, ports, airports, and dams)
- **ICT** (information and communication technology)
- (Health and the environment)
- Structural capital (knowledge and productive routines held by organizations)
- Networks and outsiders (linking organizations, people, and entrepreneurs)
- Social capital (knowledge held by consumers and citizens)

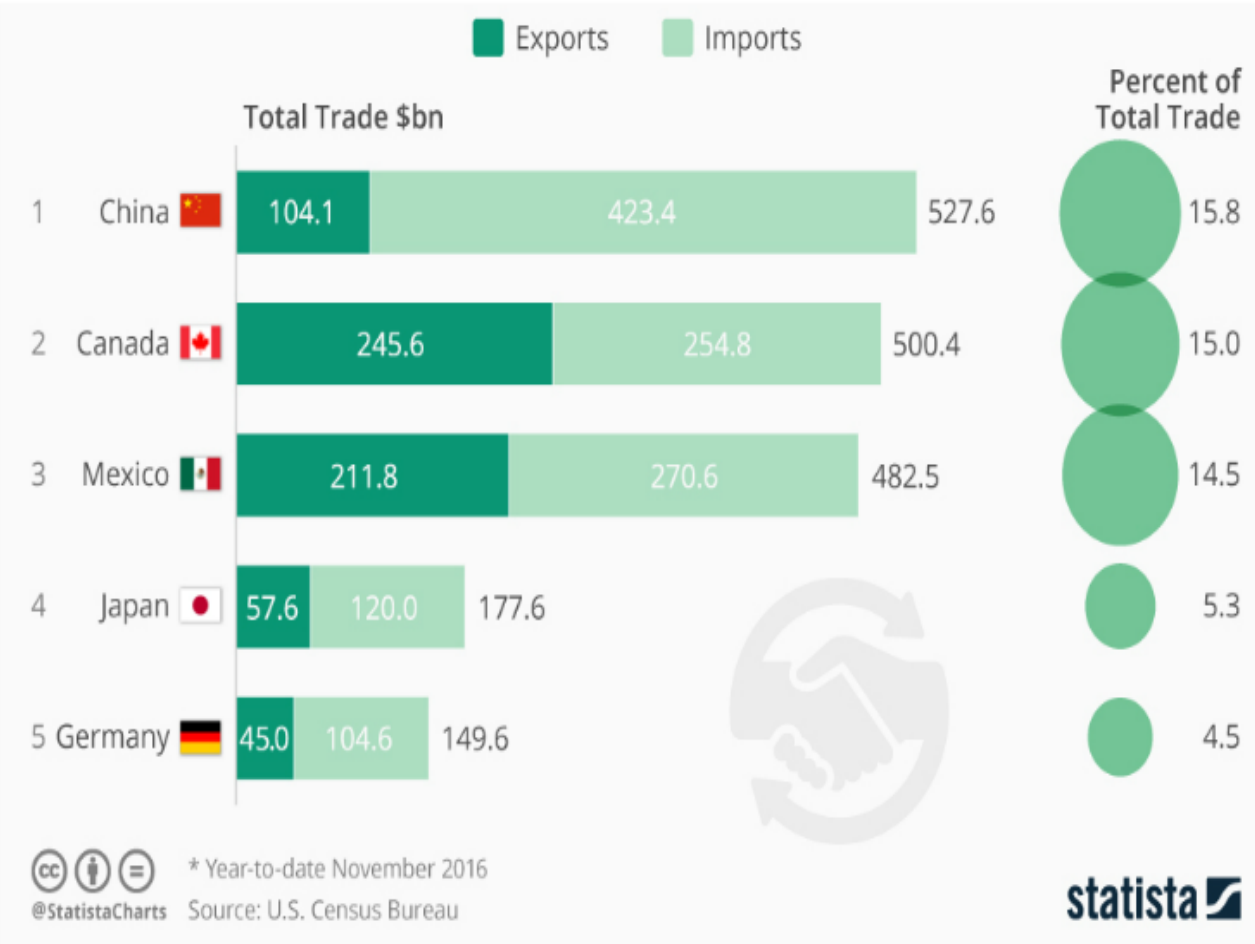
Climate Goals Pledged by China and the U.S.

Carbon emissions from energy consumption



Source: <https://www.nytimes.com/interactive/2014/11/12/world/asia/climate-goals-pledged-by-us-and-china-2.html>

Top 5 U.S. Trading Partners for Goods (2016) (\$ billions and % of total trade)



Source: https://infographic.statista.com/normal/chartoftheday_7749_most_important_trading_partners_of_the_united_states_n.jpg

THE NEED TO ABANDON QUESTIONABLE ASSUMPTIONS IN ENERGY POLICY (1)

- **Myth #1: It is possible to realize mutual gains in industrial competitiveness, reduction of GHGs, and employment**
- **Myth #2: Technological innovation in products and services is essential to achieving deep decarbonization. Europe is suffering from an “innovation deficit”.**
- **Myth #3: Innovation per se fuels the industrial state and creates jobs.**
- **Myth #4: Governments cannot pick winners. Winners pick governments.**

THE NEED TO ABANDON QUESTIONABLE ASSUMPTIONS IN ENERGY POLICY (2)

- **Myth #5 Industrial policy is synonymous with innovation policy.**
- **Myth #6: Regulation inhibits beneficial innovation.**
- **Myth #7: Carbon leakage presents a practical disincentive and limits to what regulation can achieve in terms of decarbonization.**
- **Myth #8: Trade in non-energy-related goods and services is a win-win proposition for all parties to trade.**
- **Myth #9: Nations can “go it alone.”**

CHANGE AGENTS

Corporations [energy producers; users]

Non-corporate business/firms

Individual entrepreneurs/inventors

Government

- executive

- legislature

- the courts

Universities

The Military

NGOs

The Church

Unions

International

- OECD

- Paris

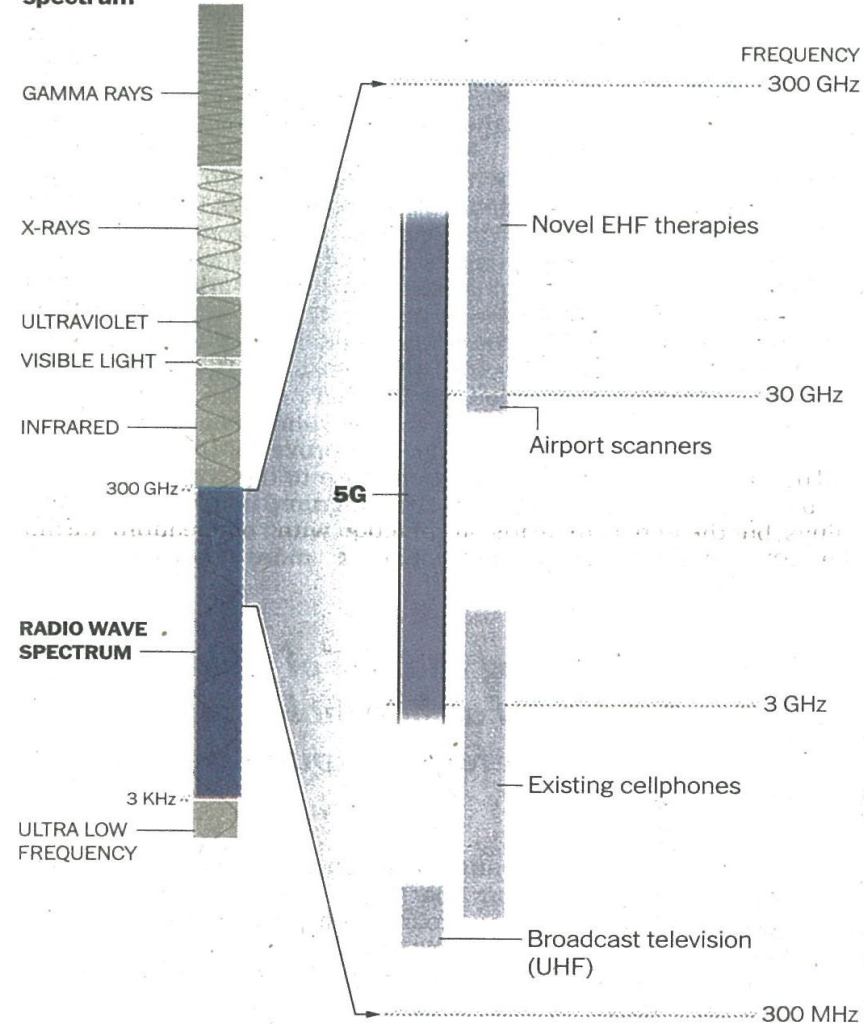
The Press

The Electorate

5G's Place in the Spectrum

The newest generation of cellphones, 5G, will operate near the highest frequencies of the radio wave spectrum. Its range overlaps with other devices — including a novel class of health therapies used in Russia and China.

Electromagnetic spectrum



Sources: National Aeronautics and Space Administration, National Academies of Sciences, National Institute of Environmental Health Sciences, Congressional Research Service, Institute of Electrical and Electronics Engineers