



CLIMATE SECURITY INDEX

Bernard I. Finel and Christine Bartolf



Changes in the Earth's climate are more evident every day, but the United States has failed to act, alone or with allies, to avoid disaster.

MISSION

The American Security Project is organized around the belief that honest public discussion of national security requires a better-informed citizenry — one that understands the dangers and opportunities of the twenty-first century and the spectrum of available policy responses.

Security is a fundamental responsibility of government. In the new millennium, however, U.S. national security policy has not kept pace with rapidly changing threats to American interests. Globalization has quickened, but the United States has not built alliances or institutions to protect and advance American security. Terrorists have expanded their reach and lethality, but the moral authority of the United States is at an all-time low.

Changes in the Earth's climate are more evident every day, but the United States has failed to act, alone or with allies, to avoid disaster.

America needs a new national security vision for this new era and a dialogue at home that is as robust as it is realistic. Yet the quality of our discussion on national security has been diminished. Fear has trumped conversation. Artificial differences have been created and real differences have been left unexamined. The character of our national dialogue has grown increasingly shrill while the need for honest discussion has grown more urgent.

Only by developing real analysis and thoughtful answers can a genuine foreign policy consensus be rebuilt for a dangerous and decisive age. Only then will America again marshal all her resources — military, diplomatic, economic, and moral — to meet the challenges of a complex world.

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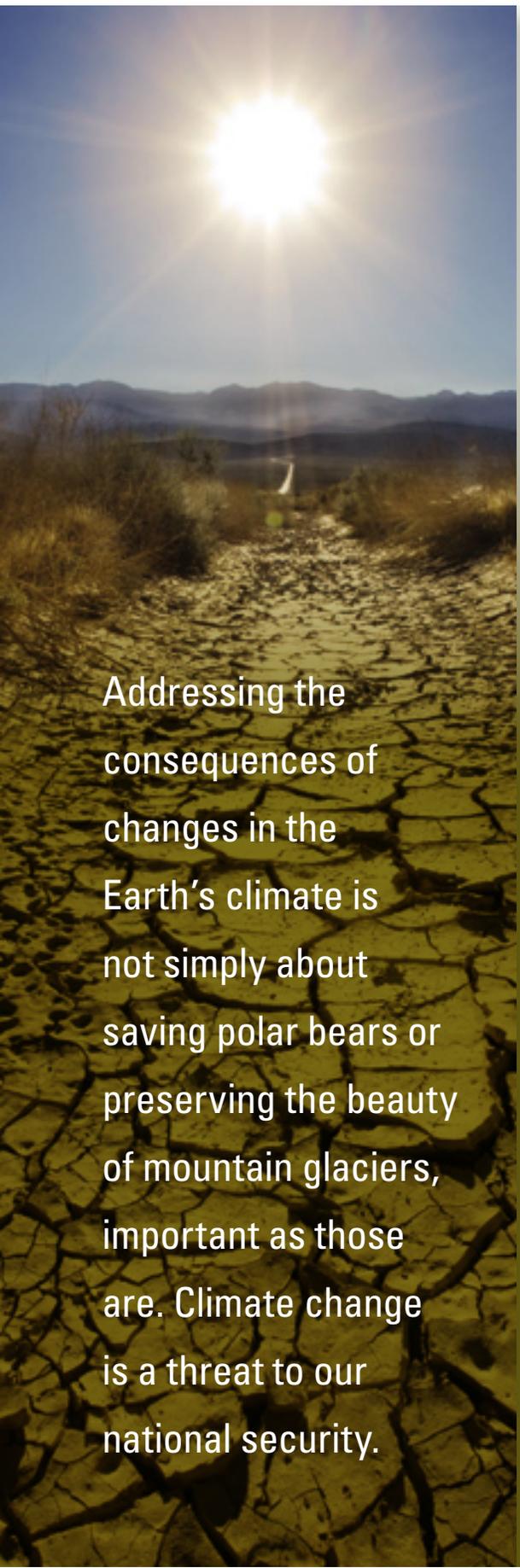
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Addressing the consequences of changes in the Earth's climate is not simply about saving polar bears or preserving the beauty of mountain glaciers, important as those are. Climate change is a threat to our national security.

INTRODUCTION

VICE ADMIRAL LEE GUNN

(U.S. Navy, Retired)

President, American Security Project

I spent 35 years in uniform serving our nation around the world in the United States Navy. I entered the Navy during the Vietnam War and retired after the Berlin Wall fell. I helped evacuate UN forces from Somalia, weathered enormous storms at sea, oversaw many billions of dollars of the Navy budget, and I have seen threats materialize from crowds that, the moment before, looked like peaceful civilians.

I have also seen the incredible power of the United States military, and I have been humbled by the challenges we've faced, even with that mighty military, in dealing with complex emergencies, whether they are caused by corrupt leaders or nature's fury.

So it is with this perspective that I write to introduce this report from the American Security Project. The scientific community is warning us about a new threat to our security — a threat I believe is still misunderstood and underappreciated — but a threat to which we must respond. The threat is climate change.

This examination of the national security implications of climate change adds an important piece to the public debate — a piece that has been missing for too long. Addressing the consequences of changes in the Earth's climate is not simply about saving polar bears or preserving the beauty of mountain glaciers, important as those are. Climate change is a threat to our national security. Taking it head on is about preserving our way of life.

The consequences of climate change will be found, and are being found now around the world. New climate conditions will drive human beings to move in ever larger numbers, seeking food, water, shelter and work. No region will be immune. Climate refugees will increasingly cross our own borders. The stress of changes in the environment will further weaken marginal states. Failing states will incubate extremism. In South Asia, the melting of Himalayan glaciers jeopardizes fresh water supplies for more than one billion human beings. In North America, agriculture could be disrupted by increases in temperatures and shifting weather patterns that limit rainfall. Globally, major urban centers could be threatened by rising sea levels. Malaria and other tropical diseases are moving into new areas, and outbreaks are increasing in frequency as

the planet warms and weather patterns change. All of this is just the foretaste of a bitter cup from which we can expect to drink should we fail to address, urgently, the threats posed by climate change to our national security.

A changing and uncertain climate will demand we adapt to new conditions affecting:

- Why we apply our nation's power (in all its forms), around the world,
- How and where specifically our military is likely to have to fight,
- The issues driving alliance relationships (and whom are we likely to find on our side on the battlefield).

WHY WE APPLY POWER

Climate change will force changes in "why" the United States gives aid, supports governments, provides assistance, and anticipates natural and manmade disasters, or goes to war.

It will do so because **climate change threatens unrest and extremism as competition for dwindling resources, especially water, spreads**. Weak or poorly functioning governments will lose credibility and the support of their citizens. Under these conditions, extremists will increasingly find willing recruits. In particular, climate change will certainly expand the number of humanitarian relief and disaster assistance operations facing the international community.

America's men and women in uniform will be called on increasingly to help in these operations directly and to support the work of legitimate governments and non-governmental organizations alike.

HOW WE FIGHT

Climate change will force changes in how we operate our forces around the world; changes will effect ground operations and logistics as well as operations at sea and in the air. Sea level rise threatens large investments in U.S. facilities around the world. Desertification and shifts in the availability of water can change logistic patterns drastically for all our forces. The flexibility of America's military will be tested, with our forces rendering aid, supporting peaceful solutions to tough problems, and pivoting to combat if and when necessary.

These challenges are not insurmountable. But they will be expensive to address and have to be thought through carefully lest a profusion of missions impact readiness. In any case, confronting changes in the military's operating environment and mission set may lead to somewhat different decisions about U.S. force structure. Consider that it takes 20 or more years to build a new aircraft for the U.S. Air Force or Navy

and that Navy ships are designed to last 30 to 50 years. With these extended time-frames, a basing structure secure from threats posed by climate as well as more traditional foes is a real national security consideration. **We must anticipate new and revised missions for our military forces and factor those into our calculations of the consequences of climate change for America's national security.**

ALLIANCES

The Arctic is a prime example of how alliances will be forced to adapt to the realities of climate change. Just a few years ago, the scientific community was predicting that the Arctic wouldn't be ice-free until the middle of this century. Now the predictions put that date at 2013; just four years from now.

In the Arctic, the loss of sea-ice has caused concern in the U.S. Navy for nearly a decade. What naval planners know is that loss of sea-ice at the North Pole has the potential to increase commercial and military activity by other powers. As if we needed any evidence of this, look no further than the 2007 expedition by Russia to plant its flag in the sea-bed at the North Pole. Not surprisingly, Canada, Norway, Denmark, and the United States — all nations bordering on the arctic — responded critically to Russia's actions. Undeterred, Russia recently declared her intention to parachute troops into the vicinity of the Pole as an exercise.

New climate conditions, new geographic realities, changes in economic and commercial circumstances, and pressures of migrating populations; all will test old alliances. Some changes may create new international friendships that will depend on America's ability to help smooth the turmoil associated with those changes. Supporting other nations' successes will continue to be an important part of our military's role in U.S. national security.

Climate change poses a clear and present danger to the United States of America. But if we respond appropriately, I believe we will enhance our security, not simply by averting the worst climate change impacts, but by spurring a new energy revolution.

The report that follows seeks to document both some of the core evidence for the reality of climate change and many of the likely security implications. It highlights the fundamental problem of reliance on fossil fuels to power our economy. And it provides a compelling call to action and an outline of some of the most promising potential responses. If, after reading this report, you feel as compelled to act as I do, I hope you will join us at the American Security Project to chart a new course to ensure our nation remains prosperous and secure.



Even when climates changed slowly, in response to gradual centuries- or millennia-long cycles, species died out and civilizations collapsed.



CLIMATE CHANGE AND CONSEQUENCES

The overwhelming consensus of climate scientists is that increased greenhouse gases in the atmosphere — particularly carbon dioxide (CO₂) — are transforming global climate. While it is true that CO₂ levels have varied over time, there is compelling evidence that current trends are both unprecedented and man-made.

Scientists have been able to reconstruct several millennia worth of atmospheric records by examining ice cores drawn from miles-deep ice sheets.¹ These records show a constant fluctuation of CO₂ levels, ranging from roughly 200 parts per million (PPM) to roughly 300 PPM. Over an ice core record of 800,000 years, scientists have never found any levels significantly higher than 300 (PPM) — until now. In the 1950s, CO₂ levels were recorded above 300 PPM. They have risen consistently since, and are now approaching 400 PPM.²

Total carbon dioxide emissions doubled between 1900 and 1950. They increased nearly four-fold between 1950 and 2000. Today, human activity is responsible for producing nearly 20 billion tons of carbon dioxide annually.³ Roughly forty-five percent of that total remains trapped in the atmosphere, while the remaining fifty-five percent is absorbed by plants, land, and oceans.⁴ **There is no doubt that this increased level of carbon dioxide emissions is responsible for the dramatic increase in atmospheric carbon above levels recorded over the past million years.**

The connection between carbon dioxide levels in the atmosphere — as well as the increase in other “greenhouse” gases which only exist due to industrial activity — and climate change is also increasingly a matter of settled scientific fact.⁵ Greenhouse gases trap heat in the atmosphere. This causes temperatures to rise globally, with the most extreme temperature increases at the poles. High temperatures reduce the extent of seasonal ice. In the northern hemisphere, the Northwest Passage from the Atlantic to the Pacific was ice free in 2006 for the first time in centuries.⁶ In the southern hemisphere, huge chunks of the Antarctic ice shelf have broken up and floated away over the past decade and there is increasing concern over the status of the massive West Antarctic ice sheet.⁷ Less ice results in less sunlight reflected back into space and more sunlight absorbed by now ice-free expanses of land and sea.⁸ This promotes further warming. At this point, global warming is

a self-reinforcing process, a vicious cycle that threatens to transform the earth’s climate dramatically.

The earth’s climate has undergone several major transformations in its history. But for the most part, change has been gradual enough for the planet’s creatures to adapt over time. Animals migrated to more welcoming climates and plants adapted and spread as the environment changed. But even these broad adaptations were marked by tremendous destruction. Climate change throughout history has been a significant force in the expansion and extinction of species.⁹ **Noting that the climate has changed in the past is not a source of comfort, but rather a warning about the fragility of our reliance on an interconnected web of climate-constrained habitats.**



Indeed, even within the historical record, there are numerous instances of climate change leading to massive political upheaval.¹⁰ Many scholars attribute the movement of the Huns and the Mongols to changes in the climate of the Eurasian steppes. The Mayan civilization collapsed under the stress of climate change, as did Native American civilizations in the American Southwest.¹¹

Even when climates changed slowly, in response to gradual centuries- or millennia-long cycles, species died out and civilizations collapsed.

But now we live in a world of rapid climate change due to human activity. And we live in a world with more people than ever. The consequences of the best case assumptions are dire, of the worst, they are catastrophic.

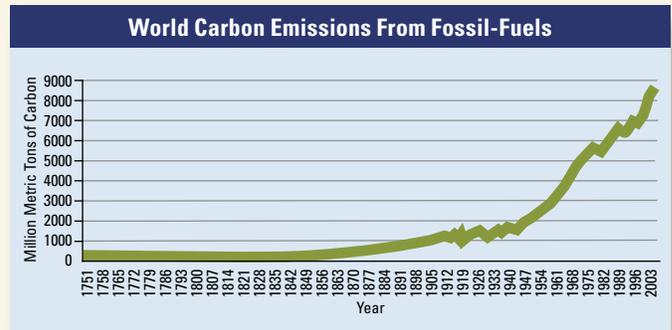


GREENHOUSE GAS EMISSIONS

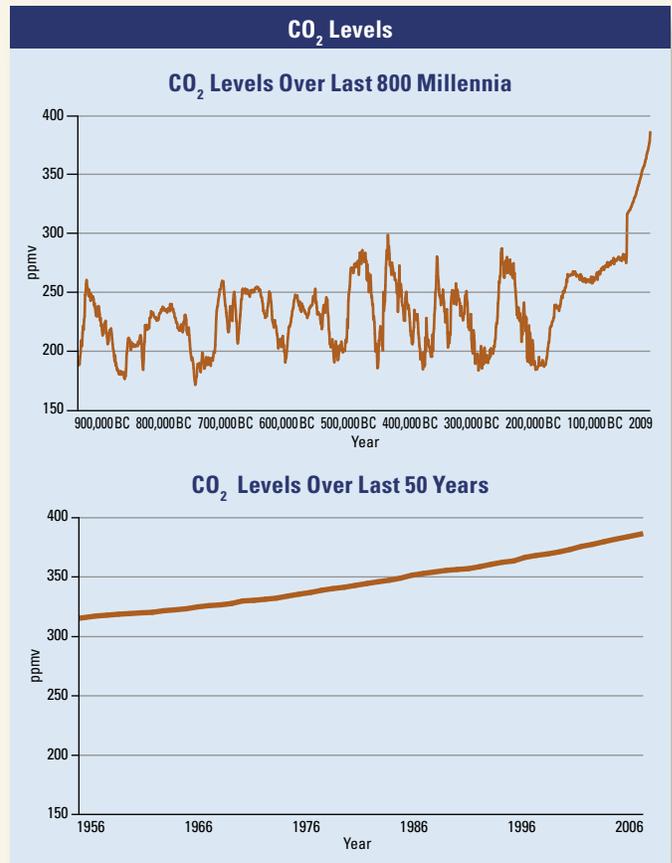
Greenhouse gases such as carbon dioxide are a major cause of climate change. Carbon dioxide levels in the atmosphere are currently 30% higher than at any point in the past million years and are projected to increase.

The Intergovernmental Panel on Climate Change (IPCC) has determined that greenhouse gas emissions are very likely to have caused modern climate change occurring since the 1950s.¹² Specifically, emissions increase greenhouse gas concentrations in the atmosphere, which cause temperature levels to increase by trapping heat. The increase in temperature creates other climate changes including sea level increases, changes in precipitation patterns, desertification, flooding, and extreme weather discussed in other sections of this report. **Looking at greenhouse gas emissions is therefore essential when considering climate change, its impacts, and ways to mitigate it.**

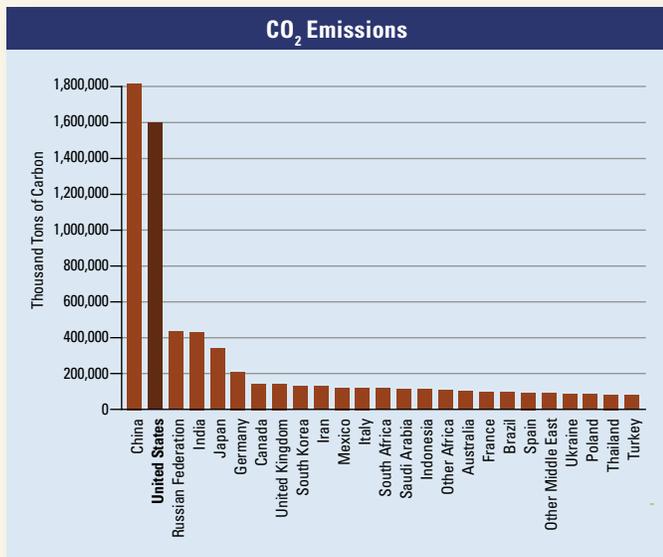
CO₂ makes up 70% of total greenhouse gas emissions and thus is the primary contributor to climate change.¹³ The majority of CO₂ comes from the combustion of fossil fuels for electricity generation and transportation. CO₂ levels in the atmosphere have spiked to levels significantly higher than any measured over the last 800 millennia. Globally, CO₂ levels have risen sharply since the mid-nineteenth century as a consequence of the Industrial Revolution.



SOURCE: http://cdiac.ornl.gov/trends/emis/tre_glob.html



SOURCE: Marland, G., T.A. Boden, and R.J. Andres. 2008. Global, Regional, and National Fossil Fuel CO₂ Emissions. In *Trends: A Compendium of Data on Global Change*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A.



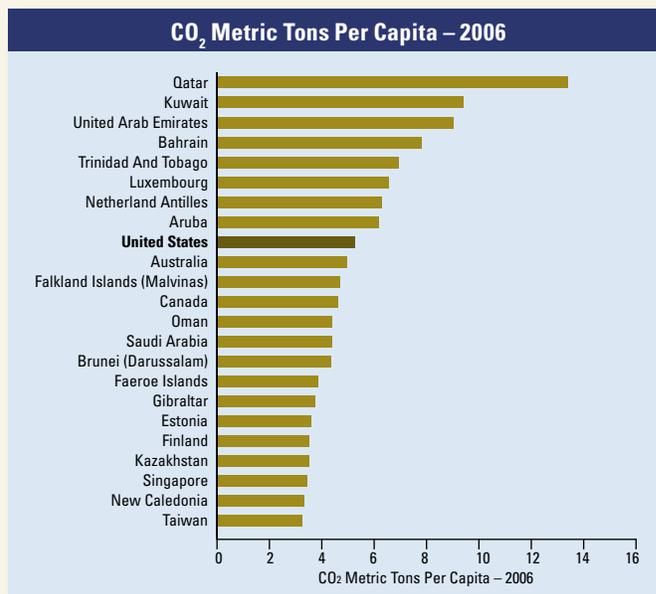
SOURCE: Carbon Dioxide Information Analysis Center (CDIAC)

China and the United States are the highest emitters of CO₂. Each contributes well over three times the global CO₂ emissions of Russia, the next largest emitter. However, when CO₂ emissions are measured per capita, the United States ranks 9th and China 82nd.¹⁴ Wealthy oil nations make up four of the five top emitters per capita with Qatar nearly producing more than double America’s emissions on a per capita basis. These countries typically have relatively small populations and hydrocarbon intensive economies focusing on the extraction of petroleum. They also have high energy needs due to their climates. Several European states with high population density also emit significant amounts of CO₂ on a per capita basis.

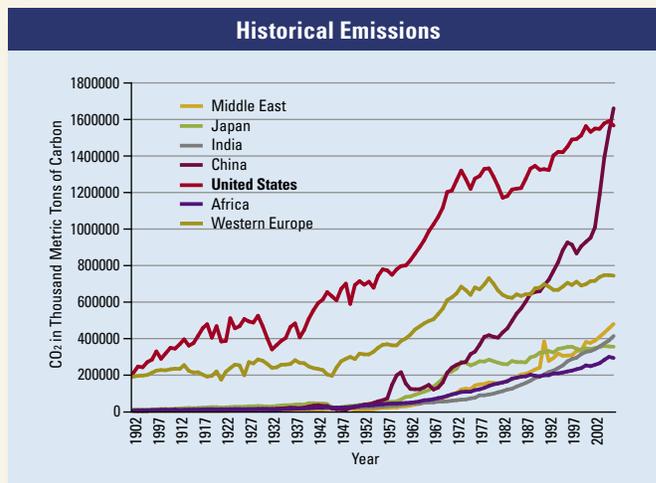
CO₂ emissions increased consistently around the world between the 1960s and 1980s. A brief dip in emissions associated with the recession of the early 1980s and increased emphasis on fuel economy following the 1970s oil shocks was followed by steady renewed growth in the 1990s.¹⁵ Western Europe has for the most part stabilized its CO₂ emission rate, while China recently overtook the United States.

In addition to CO₂, methane also is a significant contributor to climate change, making up an estimated 24% of total greenhouse gas emissions.¹⁶ Slightly over half of methane emissions come from human activity, typically from the extraction of natural gas fields. But methane also comes from more mundane things, such as decaying trash in solid waste landfills. While methane makes up a significantly lower

percentage of overall emissions, it is 21 times more powerful at warming the atmosphere than CO₂. Additionally, methane dissipates from the atmosphere in 12 years. In comparison, CO₂ takes nearly one hundred years to dissipate.¹⁷ As a consequence, policies to control or harness methane emissions could have a significant short-term impact, but in the long-run addressing carbon emissions will be a crucial element of managing climate change. International debate over measures to reduce CO₂ will reflect these statistics and play an important role in shaping the positions of individual governments in the debate.



SOURCE: International Energy Annual 2006



SOURCE: Carbon Dioxide Information Analysis Center (CDIAC)



CLIMATE CHANGE

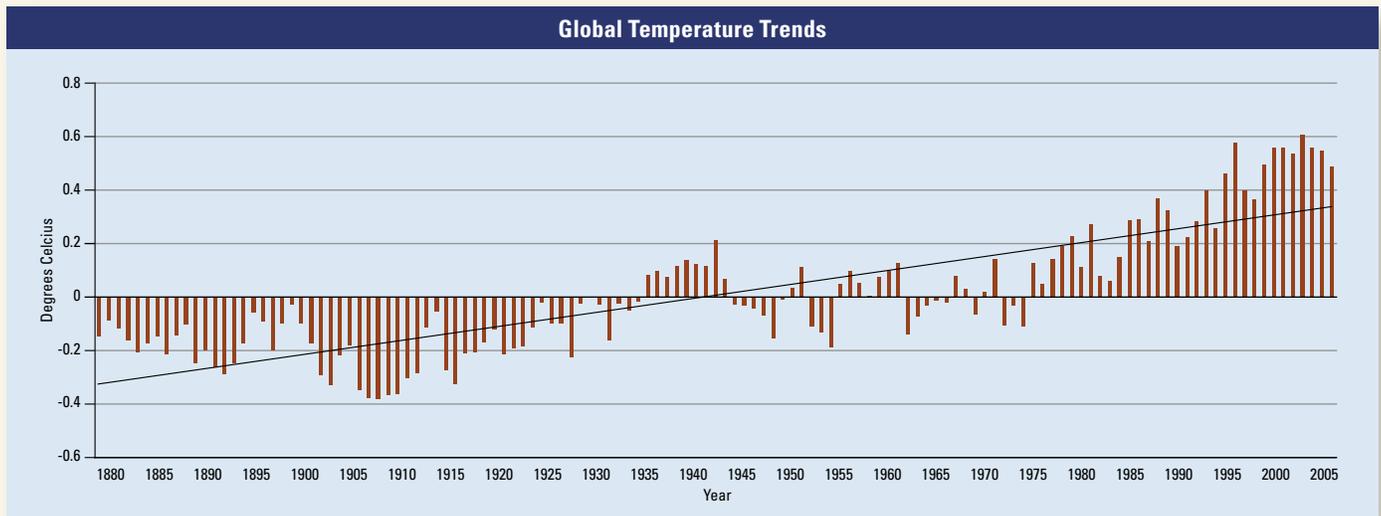
Climate change over the past century has resulted in higher global temperatures and increased sea levels. In the future we can expect significant disruptions in rainfall patterns and access to fresh water.

Current global climate change effects include increased global surface temperatures, a rise in global sea levels, altered precipitation patterns, and thawing of sea ice and glaciers. Assessments of climate change are most reliable for the past fifty years — during which accurate data has been systematically gathered all over the globe and throughout the upper atmosphere.¹⁸ For data on the climate in the distant past, scientists rely on a variety of sophisticated methods including using coral reefs, pollen samples drawn from lake beds, and arctic glaciers to ascertain climate conditions.

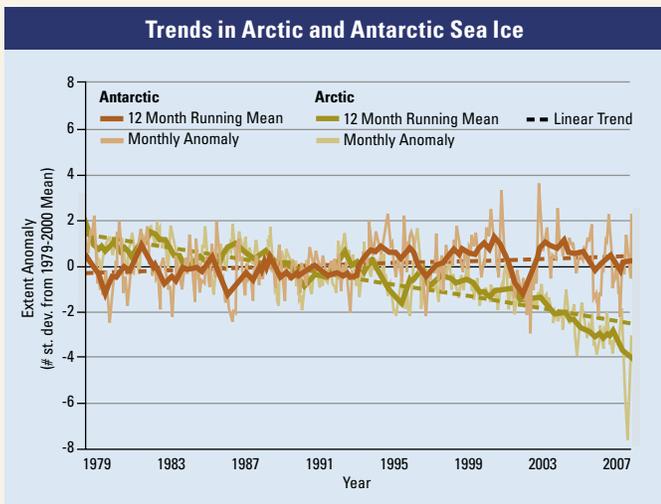
While temperatures around the world have risen, it is important to note that temperature changes have not been uniform. **Some areas will and are getting colder, but trends in the mean land and ocean temperature have increased by 1° C, nearly 2° F in the past hundred years.**¹⁹ While seemingly minor, warming of 3° F is enough to reduce crop yields significantly. Projected temperature increases in tropical areas would reduce important calorie rich staple crops by 20-40%, a reduction that would dramatically increase malnutrition levels in many of the world’s poorest countries.²⁰ Areas around the equator will be particularly hard hit by climate



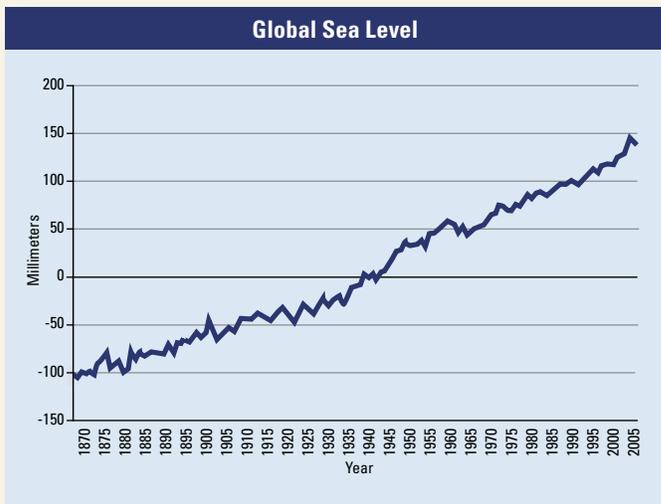
change. Regions such as the Middle East and Northern Africa are predicted to see their temperatures increase by over 6° F by the end of the century.²¹ These increased temperatures will affect everything from sea levels, to fresh water availability, to sanitation, to the spread of disease.



SOURCE: National Climate Data Center — U.S. Department of Commerce



SOURCE: National Ice Center, 2000



SOURCE: Church and White Global Mean Sea Level Reconstruction — Proudman Oceanographic Laboratory



The increase in temperatures has caused sea ice to melt beyond seasonal thaws and glaciers to shrink.

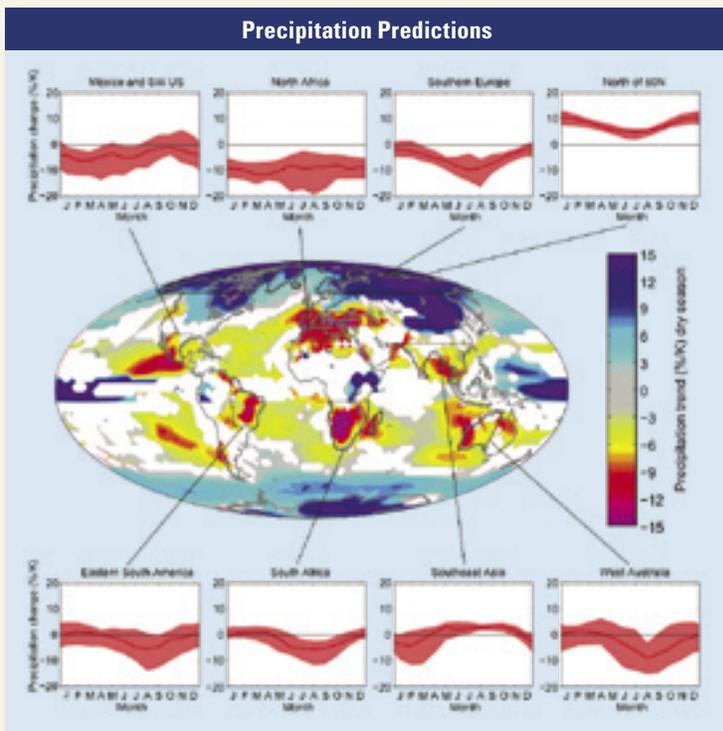
The Arctic is particularly affected by the increase in temperature and its melting ice contributes to climate change.

Scientists looking at long-term trends believe

that sea ice is declining by 3.3% per decade, or 15,500 square miles each year.²² Arctic sea ice reflects sunlight and helps moderate the global climate. As it melts, it produces a vicious cycle of increased warming leading to further reductions in sea ice.

Ice on land surfaces also melts as temperatures warm. The melting ice will increase sea levels and coastal erosion, which also contributes to further erosion of continental ice shelves. Similar to global temperatures, global sea levels have risen, although not uniformly, by roughly eight inches in the past 100 years.²³

Rising sea levels in combination with expected changes in precipitation will affect access to fresh water. As temperature increases, demand for fresh water to irrigate crops will



SOURCE: Solomon, Susan; Plattner, Gian-Kasper; Knutti, Reto; Friedlingstein, Pierre. "Irreversible climate change due to carbon dioxide emissions." *PNAS* 106, no 6, 2009: 1707.

increase and place further stress on limited fresh-water sources. As a result, the salinity of water will increase, threatening its suitability for irrigation or human consumption. This frequently results in migration to areas already environmentally stressed, where the cycle is then repeated — highlighting the fact that climate change often begets further climate change.



SECURITY IMPACTS OF CLIMATE CHANGE

The security consequences from climate change include worsening poverty, political instability, and risk of conflict. These are already affecting large portions of the globe.

The regions most at risk from climate change are also those regions with the highest incidents of interstate conflict, radicalism, and terrorism. These regions include South Asia, North Africa, Sub-Saharan Africa, and Central America. Climate change will further exacerbate regional tensions, increasing the risk of conflict, mass migration, and humanitarian emergencies that will jeopardize U.S. national interests and — if history is a guide — force U.S. intervention. Even if climate change does not result in more numerous American military operations, it will affect the stability and capabilities of numerous friends and allies. Climate change will, in a fundamental sense, be a key element in defining threats to American national security in the future.



Coastline Erosion



Disease



Conflict



Extreme Weather



Desertification



Refugees/Mass Migration



Political Instability



Increased Radicalism



Water Shortage

CENTRAL AMERICA



Projected climate change will affect the security of North America primarily through the second-order impact of migration from Central and South America into the United States. The result will be continued stress on the United States' southern border, which is already a conduit for drug trafficking, human smuggling and gang violence. Climate change poses a significant risk to Mexico which is already vulnerable to political instability due to its rapid population growth, poverty, and government corruption.²⁴

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SUB-SAHARAN AFRICA



Projected climate change will have a devastating impact on Sub-Saharan Africa. Already home to the most vulnerable populations in the world, climate change will exacerbate poverty, increase the spread of disease, and overwhelm the limited governance capacity of many Sub-Saharan African states. State collapse, massive refugee flows, and increased conflict — both between countries and within them — will be more common.²⁵

massive refugee flows, and increased conflict — both between countries and within them — will be more common.²⁵

Africa may witness some classic “resource” conflicts, particularly over water. But a more significant risk is violence stemming from either state collapse or inter-communal disputes. Studies have shown, for instance, that the Rwandan genocide was most severe precisely in those districts where population growth and soil erosion had reduced farm sizes to below subsistence levels. Climate change will bring stresses such as this throughout Sub-Saharan Africa.²⁶



NORTH AFRICA



Projected climate change will have a significant impact on North Africa and the Middle East primarily as a consequence of diminished access to fresh water. The region is already very vulner-

able to water shortages and droughts. Poor subsistence farmers will be hardest hit, but for countries already struggling with rapidly rising populations and lagging economic growth, the broader impact will be significant.²⁷ Projected sea level rise could also displace millions in the Nile river delta.²⁸ Water scarcity could provoke mass-migration from North Africa to southern Europe, resulting in increased social tensions within European states.

North Africa is already home to large, powerful, and sometimes violent radical movements. Corrupt and illegitimate governments face a great deal of public discontent. Climate change will exacerbate these dynamics, making the region even more prone to violence and increase the risk of the development of radical groups willing to use terrorism to pursue their interests. The nexus between authoritarian regimes, radicalism, violence, and climate change will play an important role in politics in the region over the coming years.

SOUTH ASIA



Projected climate change could have serious and destabilizing impacts on Asia. The expected rise in sea level will likely cause coastal flooding that would displace one million people in South

and Southeast Asia, as well as increasing the incidents of cholera, malaria, and other diseases. The effects of climate change may jeopardize the development and stability of parts of Asia. Tensions among states over water, especially in South Asia, are probable. The Himalayan glacier — the Earth's third largest ice sheet — is expected to continue melting, resulting in a dramatic reduction in the supply of fresh water to much of Asia, especially Pakistan, and large parts of China and India.²⁹ South Asia is already a dangerous region. India and Pakistan remain locked in a decades long confrontation, and both sides continue to build up their nuclear arsenals. Violence by extremists in India, Pakistan, and Afghanistan could destabilize the region and all three states are among the top-ten countries surveyed by the U.S. Marine Corps for instability and potential conflict.³⁰



For the United States, energy is also a more narrow security issue.

Reliance on foreign energy is a major U.S. vulnerability.



ENERGY SECURITY

Climate change is inextricably linked to energy use patterns. Carbon emissions are largely a function of industrial activity and transportation. Nonetheless, controlling carbon requires addressing patterns of energy production and consumption.

For the United States, energy is also a more narrow security issue. Reliance on foreign energy is a major U.S. vulnerability. Ensuring access to foreign energy sources is costly, both militarily and politically.

In 1973 and 1979, developments in the Middle East and Persian Gulf caused energy prices to spike. The resultant economic disruptions caused trillions of dollars in cumulative lost economic growth.¹ In 1991, the United States went to war in the Persian Gulf to prevent Saddam Hussein from controlling forty percent of proven global oil reserves when he invaded Kuwait. Eighteen years later, the United States — following a second war with Hussein — is still fighting to stabilize Iraq. Annually, the cost of buying foreign oil adds to American trade deficits.



Worse, our dollars help fund many of our adversaries.

We buy oil from Russia, a country that has become increasingly authoritarian in the last decade while it has also helped Iran develop nuclear technology that some suspect is really intended to produce nuclear weapons. Our dollars help fund Hugo Chavez in Venezuela who bitterly condemns the United States and is seeking to foment revolutionary politics in the Western hemisphere. And in the Middle East, American dollars have served to fund some of our bitterest enemies. Muammar Qaddafi in Libya, Saddam Hussein in Iraq, the Islamists regimes in Sudan and Iran, and even Saudi supporters of Osama bin Laden have all benefitted from our reliance on foreign oil.

The global energy infrastructure is tremendously vulnerable to disruptions. Oil transits through a large number of naval choke points, several of which have been disrupted by conflict over the past few decades. The Persian Gulf facilities were targeted during the Iran-Iraq War (1980-1988). The Suez Canal shut between 1967 and 1975 as a result of the Arab-Israeli conflict. In any confrontation with Iran, it is likely that traffic through the Strait of Hormuz would be disrupted. Piracy in and around the Strait of Malacca and off the Somali coast also impacts seaborne transit of oil.² Most oil refineries are located on coastal sites and many have been damaged by powerful storms — which are predicted to worsen as the climate continues to change.³

Access to oil and natural gas also raises security concerns because of the vulnerability of pipelines to terrorist attack. The reconstruction of Iraq, for instance, has been dramatically affected by hundreds of attacks on Iraq's pipeline infrastructure.⁴

Energy, in fact, has two security implications. One, reliance on the harvesting and transportation of fossil fuels creates national vulnerabilities and thus is a direct security challenge. Two, burning fossil fuels contributes to climate change which has its own security implications.

Energy, climate change, and security, as a consequence, create a powerful nexus that must be addressed and resolved together.



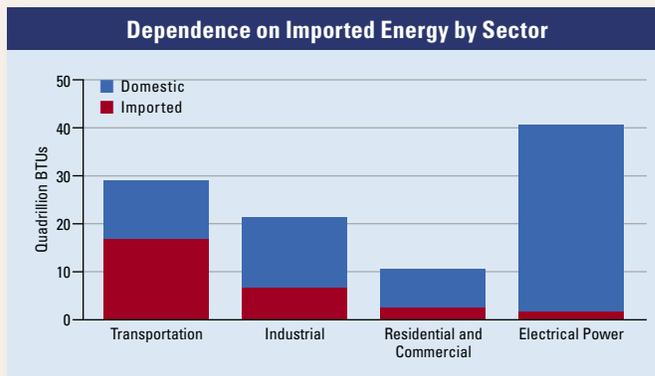
AMERICAN ENERGY DEPENDENCE

The United States meets the majority of its energy needs from domestic sources, but remains vulnerable to disruptions in oil supply.

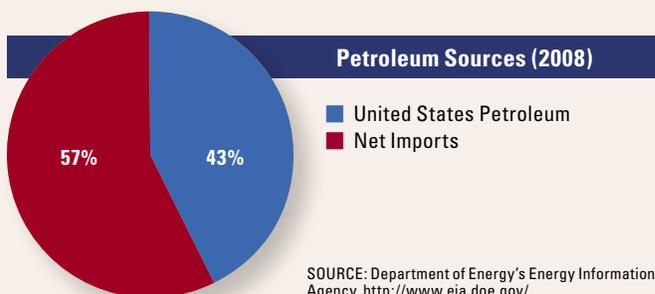
The United States produces about 74% of its energy requirements domestically; however, certain key sectors of the U.S. economy are heavily dependent on imported energy.⁵ Nevertheless, the United States possesses vast, and often underappreciated, resources.

Approximately 22% of U.S. energy comes from the burning of coal, virtually all of which is mined domestically. In fact, the United States is a net exporter of coal. Similarly, 23% of U.S. energy comes from natural gas, of which 83% is produced domestically.⁶ Nuclear energy contributes significantly to electricity production and makes up 8% of total energy use, while renewable energy sources, taken together, provide for 7% of U.S. energy needs.⁷

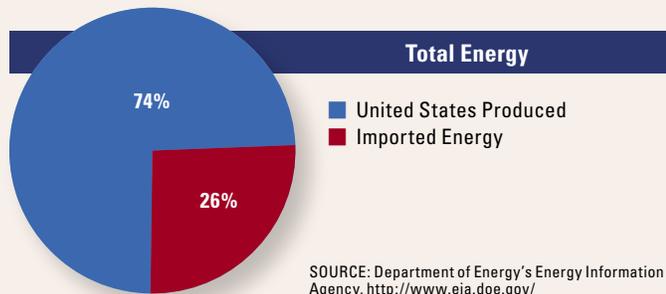
The United States remains significantly reliant on imported petroleum, however. Petroleum helps fulfill 39% of U.S. energy needs and only 43% of U.S. petroleum requirements are met from domestic sources. **As a consequence, self-sufficiency in petroleum is almost certainly unachievable.**⁸ According to the CIA *World Factbook*, the United States has less than 2% of the world's proven oil reserves.⁹ Increased



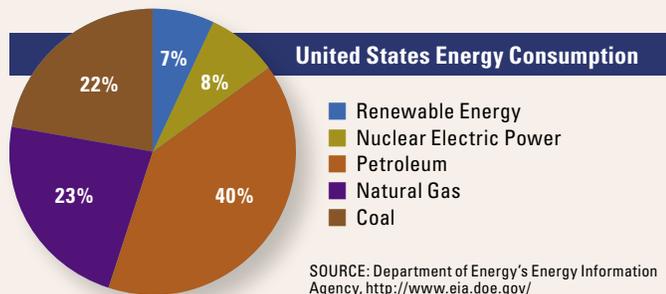
SOURCE: Department of Energy's Energy Information Agency, <http://www.eia.doe.gov>



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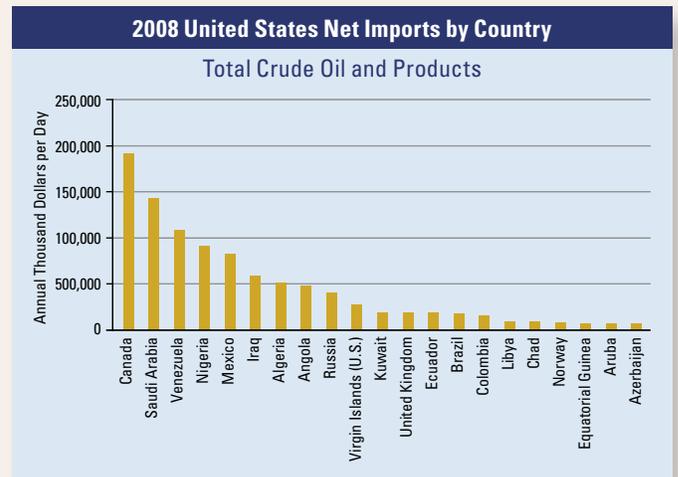
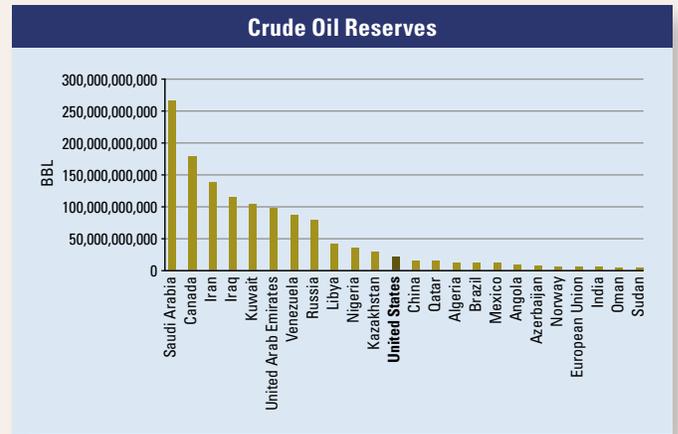
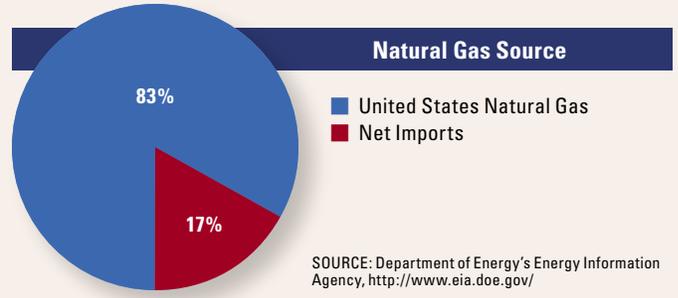
SOURCE: Department of Energy's Energy Information Agency, <http://www.eia.doe.gov>





drilling — whether offshore or in protected wildlife areas — is, at best, a temporary stop-gap measure to alleviate American reliance on foreign petroleum.

Petroleum contributes a small amount to domestic electricity production, but is the overwhelming source of energy for America’s transportation sector — and that has its own security implications.¹⁰ The U.S. economy is tremendously complex and interrelated. It depends on advances in supply-chain management, the wide-spread adoption of “just-in-time” logistics, and a tremendous amount of specialization and trade. In other words, the entire American economy is stitched together by the cheap and reliable transportation of goods. With 58% of the U.S. transportation sector dependent on foreign energy,¹¹ **America’s economic security is tremendously susceptible to disruptions in the oil markets.**



Greater energy independence, therefore, will require dramatic changes in America’s transportation infrastructure, including a greater reliance on mass transit, high-speed rail, and ultimately hydrogen-powered or advanced electric cars and trucks.



RELIABILITY OF FOREIGN ENERGY SOURCES

The vast majority of American oil imports come from countries rated as “high risk” or “very high risk” for political instability.

America’s reliance on foreign oil jeopardizes key national security interests. Most oil consumed in the United States comes from regimes at high risk of political instability. In addition, several major suppliers pursue international objectives strongly at odds with American interests. Finally, there is compelling evidence that the dollars we spend on foreign oil impede democratization and further entrench oppressive authoritarian governments around the world.¹²

Canada, which is the United States’ single largest supplier of oil, is a stable, democratic and friendly neighbor. The next eight largest suppliers of oil to the United States are rated by the *Economist* as either at “high risk” or “very high risk” of political instability.¹³ In fact, 68% of U.S. petroleum imports come from countries in those two categories, **making the United States strikingly vulnerable to potential oil supply shocks** arising from domestic disturbances or broader

regional conflicts affecting just one of the major oil exporters.

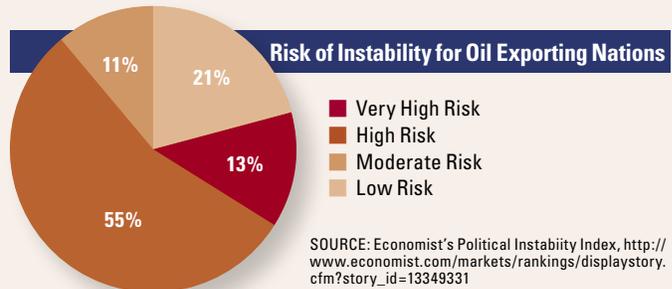
Some of our key suppliers include Iraq (5% of total imports), a nation still in the midst of severe domestic conflict and at risk of splintering along ethnic and sectarian lines; Angola (4%), a corrupt, quasi-democracy that only recently emerged from a decades-long civil war; Nigeria (8%), another quasi-democracy with a long history of



Risk of Instability		
COUNTRY	INDEX SCORE	RISK INCREASE/DECREASE
Canada	2.8	Low Risk
Saudi Arabia	6.1	High Risk
Venezuela	7.3	High Risk
Nigeria	7.0	High Risk
Mexico	6.1	High Risk
Iraq	7.9	Very High Risk
Algeria	6.6	High Risk
Angola	7.6	Very High Risk
Russia	6.5	High Risk

■ Very High Risk ■ High Risk ■ Moderate Risk ■ Low Risk

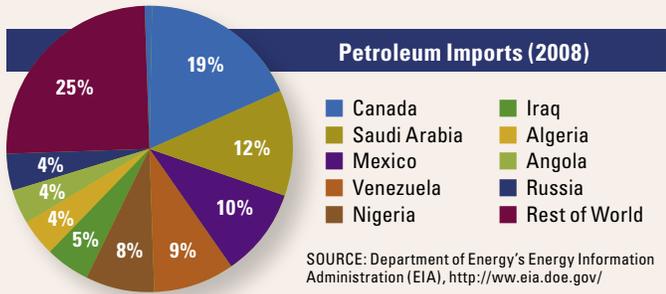
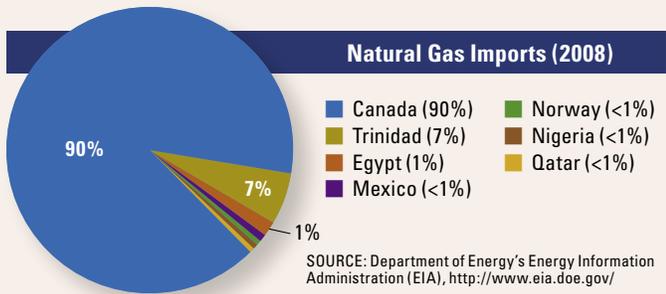
SOURCE: Economist’s Political Instability Index, http://www.economist.com/markets/rankings/displaystory.cfm?story_id=1334



SOURCE: Economist’s Political Instability Index, http://www.economist.com/markets/rankings/displaystory.cfm?story_id=13349331

military rule and governmental corruption; and Algeria (4%), a country that within the past 15 years suffered a civil war that resulted in over 160,000 deaths.

In addition to the risk of instability, several large suppliers are actively hostile to American interests. American oil dollars fund Venezuelan President Hugo Chavez who has gradually eroded democracy in Venezuela and has sought to export his unique brand of authoritarianism and anti-American demagoguery throughout the Western Hemisphere. Oil dollars also fund an increasingly authoritarian Russia that seeks to reassert some control over former Soviet Republics and may be threatening U.S. efforts to contain nuclear proliferation, particularly acting as a *de facto* protector of Iran’s nuclear



ambitions. Even Saudi Arabia, a nominal U.S. ally, is a significant cause of concern for American interests. Saudi Arabia has dramatically curtailed aid to radical Islamist terror organizations since 9/11, but continues to fund schools, charities, and severe interpretations of Islam that serve as incubators for violent extremists.

More generally, the massive amounts we spend on oil serve to undermine America's interest in promoting the spread of democracy. Oil money allows authoritarian governments to maintain power without popular consent. It creates a tremendous incentive toward corruption and the establishment of kleptocracies. Oil money encourages unnecessary arms races and promotes regional conflict.¹⁴

U.S. dependence on foreign oil increases the risks faced by the nation and significantly jeopardizes core U.S. national security interests in democratization and regional stability. The imperatives of climate change as well as traditional U.S. national security calculations both support greater energy independence and an overall reduction in our reliance on petroleum.

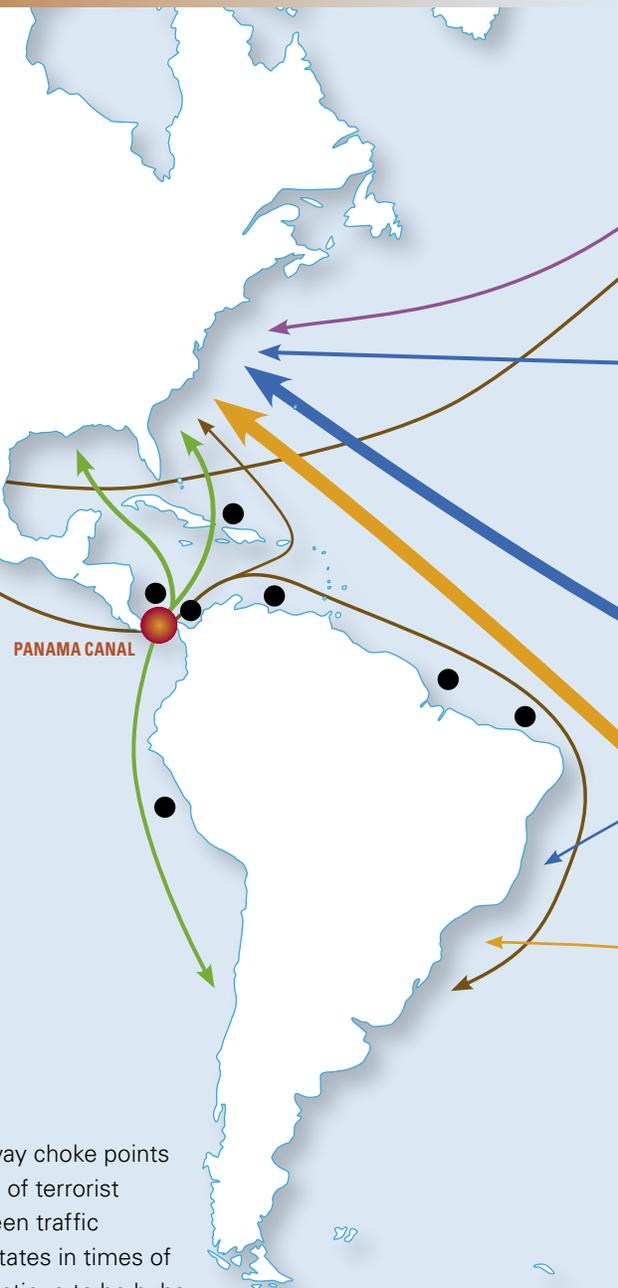




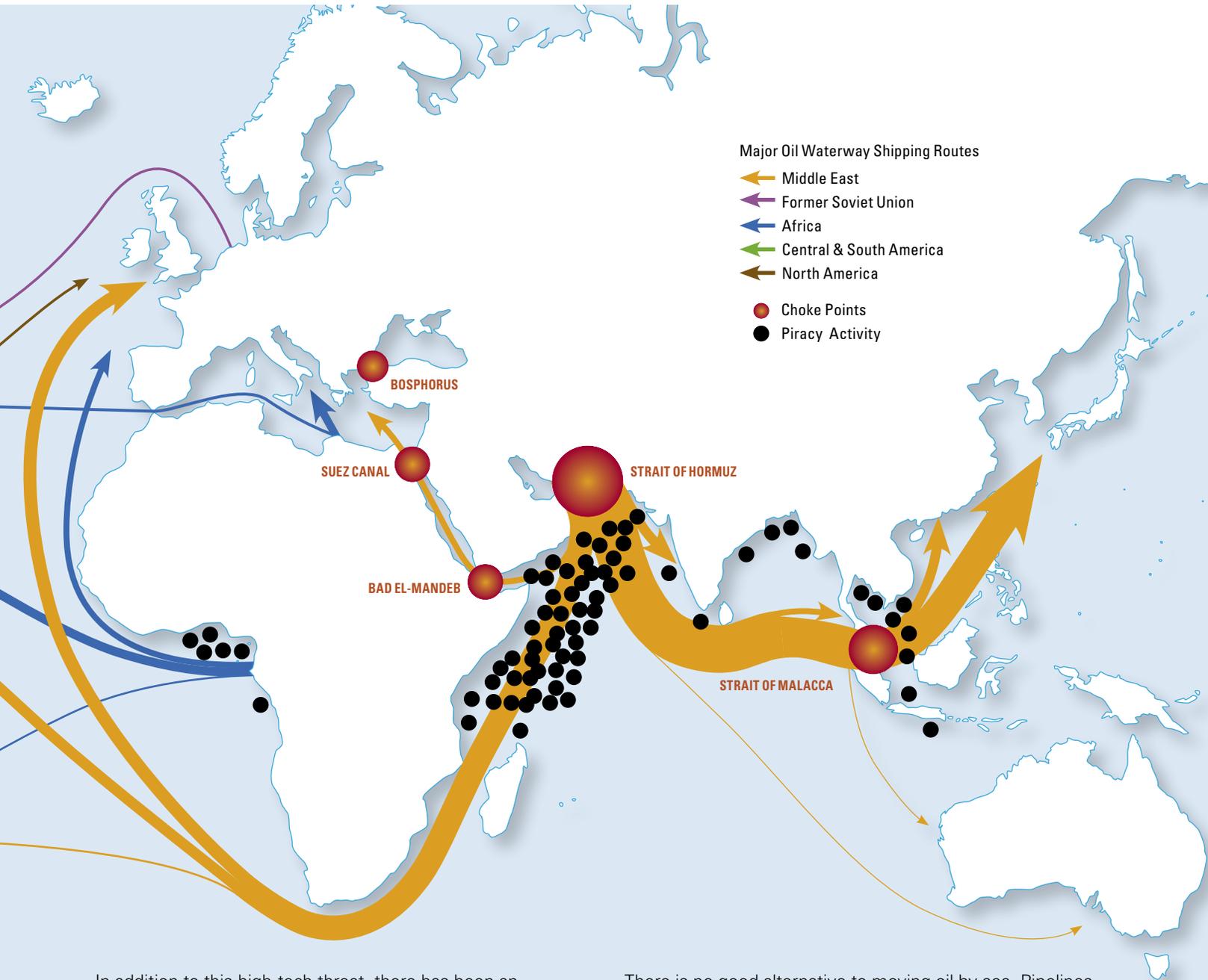
GEOGRAPHIC CHOKE POINTS

International energy flows — particularly oil — pass through a relatively small number of chokepoints and are highly vulnerable to disruption due to regional conflicts, terrorism, and piracy.

World oil supplies are not just threatened by political instability. **The infrastructure required to move massive amounts of oil is both vast and highly vulnerable.** There are three principle risks to oil transportation. First, much of the world's oil transits through relatively constricted passages that can be closed to traffic by states and others with a desire to do so. Second, tankers travelling in large numbers along predictable routes are vulnerable to the rapidly growing threat of piracy. Third, oil pipelines, the major alternative to seaborne shipment of oil, are also susceptible to attack.



Existing waterway choke points are easy targets of terrorist attacks, have seen traffic disruptions by states in times of conflict, and continue to be hubs of piracy. The threat from state actors is severe. Over 50 countries possess significant inventories of anti-ship missiles.¹⁵ And in 2006, Lebanese Hezbollah used anti-ship missiles against Israeli vessels.¹⁶ Nearly twenty percent of the world's oil flows through the Strait of Hormuz, a 21 mile-wide body of water vulnerable to Iranian anti-ship missiles.¹⁷ Nearly the same amount of oil transits the 1.7 mile-wide Strait of Malacca between Malaysia and Indonesia.



In addition to this high-tech threat, there has been an increasing amount of piracy reported globally. **Total attacks by pirates doubled from 2007 to 2008, and thus far in 2009 are on pace to double again.**¹⁸ Remarkably, even the largest ships are vulnerable, as evidenced by the November 2008 seizure of the *Sirius Star* off the coast of Somalia. In this case, small bands of pirates seized control of a 350,000 ton, 1000 foot-long ship.¹⁹ Most of the attacks have occurred near three key sea lanes for oil tankers: off the Somali coast at the exit to the Persian Gulf and Red Sea; in proximity to the Strait of Malacca; and in the Caribbean where oil transits to the American Gulf Coast. With more than 2,600 tankers transporting oil globally, there is no shortage of attractive targets.²⁰

There is no good alternative to moving oil by sea. Pipelines cannot cross oceans, and even those constructed to move oil from inland drilling sites to sea coasts for shipment are expensive to construct and maintain. Pipelines are also highly vulnerable. The Iraq Pipeline Watch, for instance, documented over 450 attacks on Iraqi pipelines and oil facilities from 2003 to 2008.²¹

The costs of safeguarding this oil infrastructure is massive. Some analysts believe that "total [U.S.] military expenditures related to oil now total \$132.7 billion annually,"²² though other analysts place the figure closer to \$50 billion annually.²³ Regardless, the expense is a massive addition to the other costs — climate and security related — of oil dependence.



While there is a solid — and growing — consensus in the United States that climate change is both real and a consequence of human activity, there remain significant challenges.

POLICY ALTERNATIVES

Addressing the security implications of climate change is simple in concept and difficult in execution. The policy responses are straightforward. **The United States would be more secure if we reduced our carbon emissions and persuaded others to do the same.** The best way to do so would be to invest in a dramatic expansion of alternative energy production capacity — notably, wind, solar, and nuclear — combined with a massive investment in shifting our transportation infrastructure from its reliance on internal combustion engines fueled by gasoline to electric and hydrogen-powered vehicles. Translating this concept into action is hampered by two sets of factors — public opinion and the state of existing technology.



The state of existing technology is also a challenge. Transitioning to alternative energy on a mass scale would be tremendously costly, and in the case of some economic sectors essentially impossible at the present time. There is a great deal of uncertainty about the future costs. Optimists argue that greater investment in alternative energy would generate economies of scale and more rapid innovation. Pessimists argue that much of the science of alternative energy is mature and that transformational developments are unlikely. Nuclear energy also raises a special set of concerns as memories of Three Mile Island and Chernobyl linger in the public consciousness.

While there is a solid — and growing — consensus in the United States that climate change is both real and a consequence of human activity, there remain significant challenges. First, a large percentage of the public remains skeptical of the science despite the overwhelming evidence. Some of these skeptics are professional contrarians, but many are simply poorly informed individuals. The public education challenge remains significant. Second, many are concerned about the capacity of the federal government to address climate change fairly and effectively, and prefer not to enact policies that would expand the reach and power of Washington. Finally, there are many Americans who consider climate change a pressing issue, but who are worried about supporting a vigorous effort to address climate security because of the potential and real costs to themselves, their communities, and the nation.

As a practical matter, a dramatic shift away from the use of coal for electricity production would require a significant investment in nuclear power. But nuclear plants are large and expensive, raising challenges of both power transmission and financing. Nuclear plants also produce hazardous waste that must be safely stored for many centuries.

Transforming the transportation infrastructure could be even more daunting. There are over 250,000,000 motor vehicles on American roads.¹ Replacing or converting even a significant percentage of them would be a massive undertaking. Investing in additional electricity generation for battery-powered vehicles, or in a hydrogen distribution system would be even more expensive. As a consequence, changes are likely to be made at the margins over a period of decades, ensuring that unless we begin charting a new course immediately, our actions could occur too late to mitigate the worst consequence of climate change.



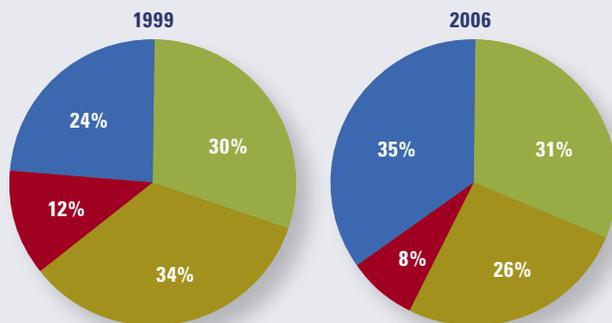
PUBLIC OPINION

The American public strongly support efforts to address climate change, even if measures to do so increase the cost of energy domestically.

American public opinion is important when considering climate change action and viable energy alternatives. Public understanding of the phenomenon and its implications are important considerations as voters choose policy makers and policy makers choose courses of action to enact preventative measures and deal with the ramifications of climate change.

Public attitude surveys yield three major findings. The first is that Americans see climate change as a problem. The second is that the American public wants to see political action on climate change. The third is that Americans are willing to pay to do something about climate change.

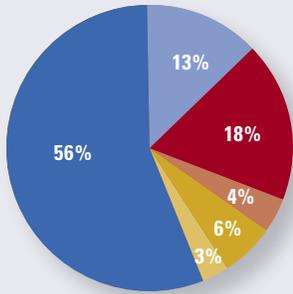
According to a poll conducted by NBC News and the *Wall Street Journal* in 2006, 66% of Americans believed climate change was occurring and required action. This was up 12% from when the question was asked in 1999. In addition, 35% were concerned enough to state that immediate action is needed. In 1999, only 24% of respondents said the same.² Similar polling as recent as April 2009, suggests that the trend has not reversed despite the downturn in the economy.³ 55% of Americans according to an American Security Project poll believe climate change is a threat to national security.⁴ Data suggests that growing numbers of



From what you know about global climate change or global warming, which one of the following statements comes closest to your opinion?

- Global climate change has been established as a serious problem, and immediate action is necessary
- There is enough evidence that climate change is taking place and some action should be taken
- We don't know enough about global climate change, and more research is necessary before we take any actions
- Concern about global climate change is unwarranted

SOURCE: HartMcInturff/The Wall Street Journal/NBC News
Methodology: Telephone interviews with 1,002 American adults, conducted from June 9-12, 2006, Margin of error is 3.1 percent.



Do you favor or oppose the United States taking action to reduce the carbon pollution that causes climate change?

- Favor, strongly
- Favor, not so strongly
- Oppose, strongly
- Oppose, not so strongly
- Undecided
- No opinion/don't know

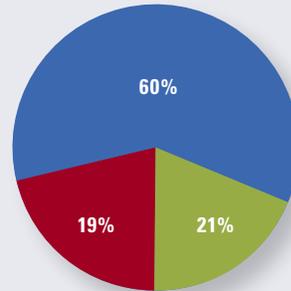
SOURCE: American Security Project National Survey, August 2009

Americans believe climate change is a real issue and fewer Americans believe that we should wait for additional information before taking action.

A large majority of Americans also feel the government should do more to deal with climate change. Nearly three fourths of those polled, 72%, think the government should do more now to deal with the effects of climate change. Only 7% of those feel the government should be doing less. In our poll conducted in August of 2009, 60% of Americans strongly supported the government taking action to reduce carbon pollution. In an earlier poll conducted in July of 2009, 58% of Americans believe that climate change should be a higher government priority than it is today.⁵ The American public clearly wants action to meet the climate change challenge.

Some Americans worry about the risk to America's economic competitiveness if the United States takes action alone to reduce carbon emissions while India and China do not. However, 60% of Americans believe the United States should take action even if China and India *don't* implement similar measures.⁶

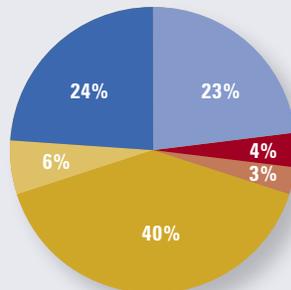
While Americans seem ready to do something about climate change, economic factors matter. According to Rasmussen Reports, 21% of Americans are willing to pay \$100 more per year for cleaner energy, but only 14% are willing to pay more.⁷ In a similar poll, 56% of people were willing to support a cap and trade program that significantly lowered greenhouse gases, but raised monthly electrical bills by \$10. Of note, respondents supporting a cap and trade program dropped to 44% when the cost was raised to \$25 per month.⁸ The percentage of those supporting cap and trade programs, also slightly decreased from 2007 to 2008, suggesting that the price people are willing to pay is elastic and sensitive to economic downturns.



Do you think the United States should take action on global warming only if other major industrial countries such as China and India agree to do equally effective things, that the United States should take action even if these other countries do less, or that the United States should not take action on this at all?

- Take action even if other countries do less
- Take action only if other countries do
- Should not take action at all

SOURCE: ABC News/Washington Post Poll, June 18-21, 2009



If the United States took action to reduce the carbon pollution that causes climate change, would it make the United States more secure, less secure or would it have no effect on the security of the United States?

- Much more secure
- Somewhat more secure
- Much less secure
- Somewhat less secure
- No affect
- No opinion/don't know

SOURCE: American Security Project National Survey, August 2009

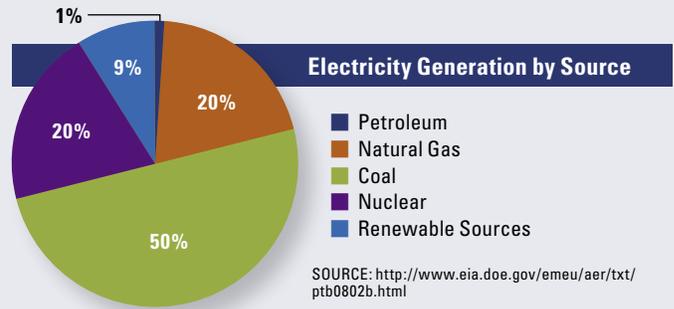


ENERGY CONSUMPTION BY SECTOR

Replacing coal with nuclear, solar, and wind for electricity generation and increasing the fuel efficiency of American vehicles are the most effective ways to reduce American carbon dioxide emissions and reduce dependence on foreign oil.

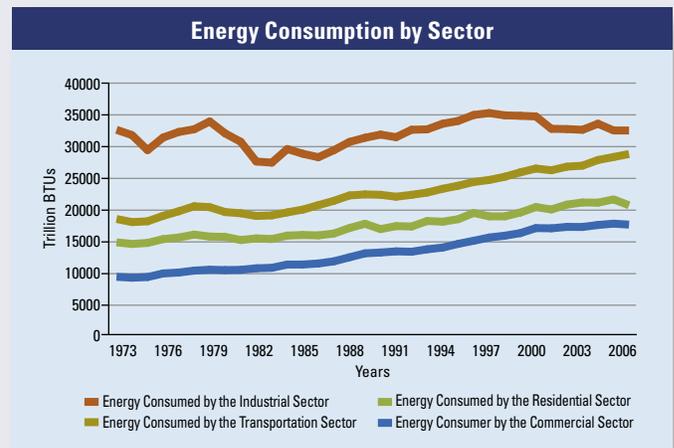
Transportation and electricity generation are the two greatest practical challenges to America's desire to address climate change. The challenges these sectors pose are quite different and difficult to resolve.

The generation of electricity in the United States is heavily reliant on coal. Roughly 50% of all electricity consumed in the United States comes from coal-fired power plants. With the introduction of better emissions controls, coal plants have



managed to significantly reduce the level of pollutants they emit, but nevertheless continue to produce CO₂ at alarming rates. Technology to capture and sequester carbon emission remains in its infancy. No coal-fired power plant captures any significant amount of its carbon emissions at present.⁹ There are also tremendous logistical problems with sequestering massive amounts of carbon even if it were captured. **Reducing the number of coal-fired plants is a necessary step to address CO₂ emissions**, but doing so would require a significant investment in an alternative infrastructure to produce and efficiently distribute electricity.

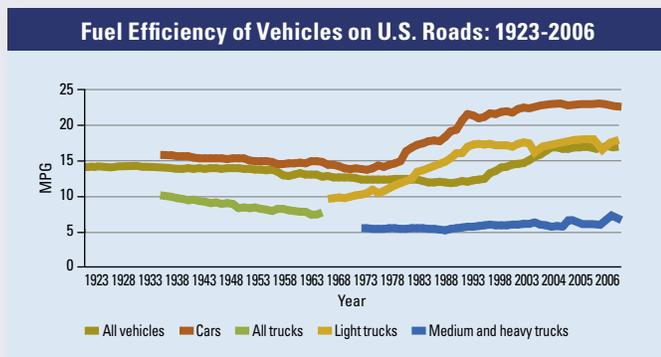
In comparison, the transportation sector has the fastest energy demand growth rate and it is also most reliant on the most problematic energy source — imported petroleum.



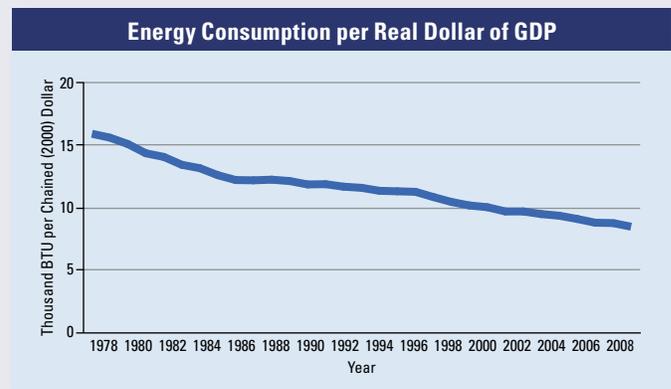
The United States lags behind many industrialized nations in mass transportation and inter-city connectors like high-speed rail. Going from London to Paris by rail — a distance of slightly more than 200 miles — takes two-and-a-quarter hours.¹⁰ Amtrak from New York to Boston — roughly the same distance — takes three-and-a-half hours, literally 50% longer.¹¹ Because the United States is so large and spread-out, compared to many other industrialized nations, we face unique challenges in the transportation sector.

Nonetheless, total vehicle fuel efficiency has barely improved in over 20 years, even as the number of vehicles on the road has continued to increase dramatically.¹² **New fuel economy standards announced by the Obama administration in May of 2009 will hopefully lead to improvements.** Progress on this front would significantly reduce both America’s carbon emissions and reliance on foreign oil.

In the past 20 years, energy consumption per real dollar of GDP has declined by approximately 50%.¹³ Interestingly, cost savings measures and greater efficiency in American industry have resulted comparatively in less energy consumption growth than in other major sectors of the U.S. economy. This demonstrates that economic incentives can drive significant improvements in energy efficiency.



SOURCE: Sivak, M. and Tsimhoni, O. (2009). Fuel Efficiency of Vehicles on US Roads: 1923–2006, *Energy Policy*, vol. 37, pp. 3168-3170



SOURCE: <http://www.eia.doe.gov/emeu/aer/txt/ptb0105.html>



ALTERNATIVE ENERGY

Future increases in electricity demand can easily be met by investment in renewable energy. Alternative energy technologies also create fewer strategic vulnerabilities for the United States.

Greater energy independence is possible. Increased efficiency is projected to reduce the rate of growth of electricity demand in the United States. In the future, the price of renewable energy is projected to drop, while the price of non-renewables will remain static, and may, in fact increase if requirements for carbon capture are implemented.¹⁴ Nonetheless, for at least a generation, higher priced alternative energy will have to compete with lower cost coal and natural gas by promoting its small carbon footprint. Nuclear energy, less expensive than renewable, but

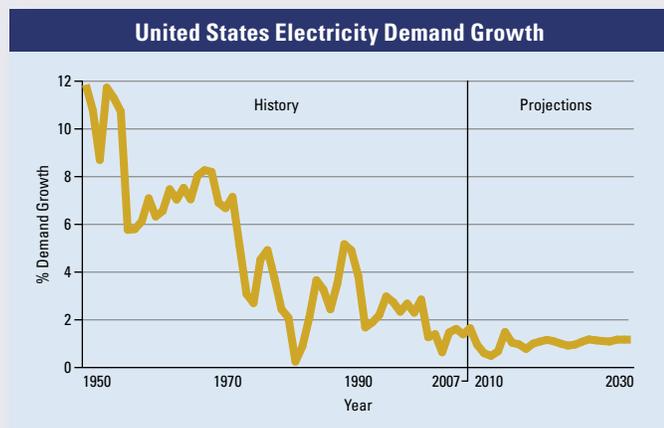
still more expensive than coal and natural gas, will need to serve as a bridge until clean, renewable energy sources and technologies mature

Renewable energy — notably solar, wind, and hydro-electric — usually suffer from high, up-front construction costs, but benefit from low fuel and maintenance costs.

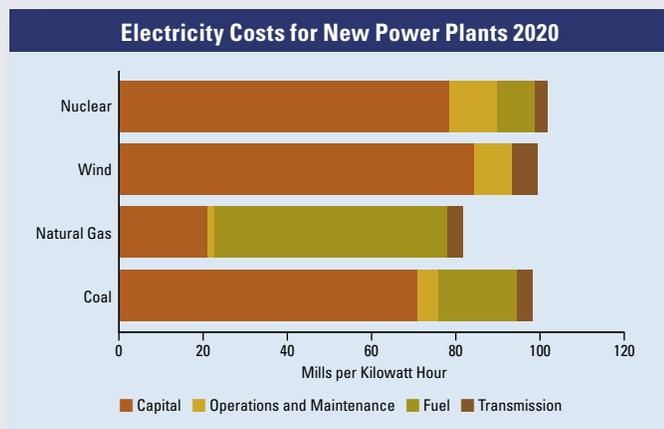
Because they do not produce carbon, their contribution to climate change is negligible. Additionally, alternative energy technologies create fewer strategic vulnerabilities. They do not rely on imports and are less vulnerable to disruption due to political disturbances. Because of the unfortunately high cost of some of these energy sources, however, it is clear that the short-term alternative is increased reliance on nuclear energy.

In order for nuclear power to have an impact on emissions, it would need to make up a higher percentage of the United States' overall electricity production. In the past, however, growth of nuclear power has been stymied by concerns over safety and the risk of proliferation. France already uses nuclear power to supply over 75% of its electricity while the United States only uses nuclear power to supply around 20% of its electricity.¹⁵ Without some mechanism to penalize carbon emissions — such as a carbon tax or a cap-and-trade system, nuclear power will remain more expensive than coal and natural gas due primarily to higher capital costs, particularly for construction.¹⁶

Nuclear energy is, like other non-renewable energy, dependent on resource availability. The Massachusetts Institute of Technology (MIT) conservatively estimates that at least an 80 year global supply of nuclear fuel exists for 800 reactors (there are nearly 440 commercial reactors operating world-wide today) and specifically states that, “the world-wide supply of uranium ore is sufficient to fuel the deployment of 1000 reactors over the next half century”.¹⁷

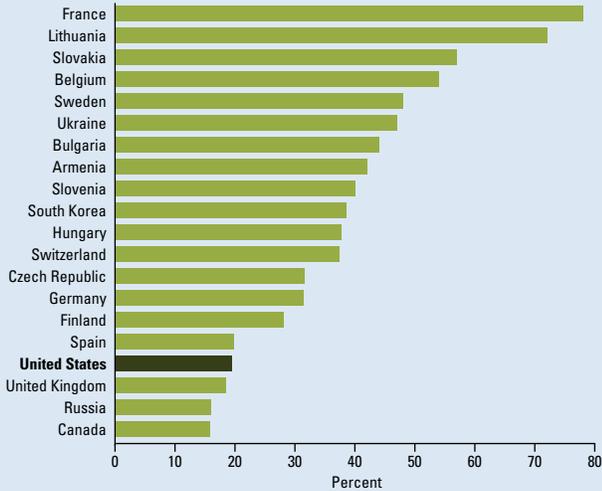


SOURCE: DOE/EIA-0383(2009) <http://www.eia.doe.gov/oiaf/aeo/electricity.html>



SOURCE: <http://www.eia.doe.gov/oiaf/aeo/electricity.html>

Electricity Supplied by Nuclear Power Reactors in 2006

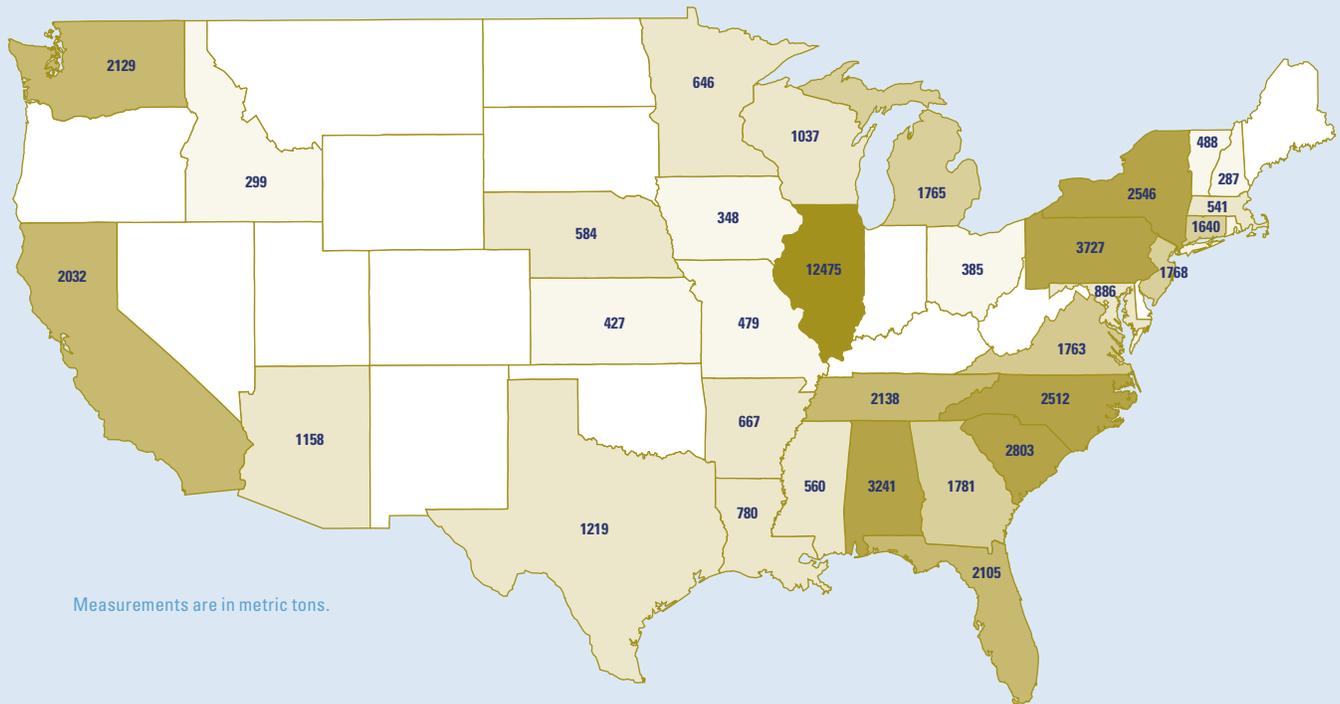


SOURCE: IAEA, http://www-pub.iaea.org/MTCD/publications/PDF/RDS1-27_web.pdf

Americans continue to worry about the safety of nuclear reactors and fear reactor accidents and the effects of nuclear waste. However, the Nuclear Regulatory Commission’s safety standards are rigorous. There is a strong scientific consensus that nuclear reactors can be built and operated safely.¹⁸

The issue of nuclear waste remains unresolved. Yucca Mountain, originally intended to store nuclear waste, is no longer a politically viable option and does not have the capacity needed now for America’s nuclear waste. Since the United States has not come up with a long-term waste management solution, nuclear plants currently store their waste on site. As a result, with over one hundred reactors operating in thirty one states, there are waste storage sites scattered all over the country with few problems or protests.¹⁹ **These factors highlight the fact that nuclear energy could serve as a bridge technology between today’s reliance on fossil fuels and a future economy powered by renewable energy sources such as solar and wind.**

Spent Nuclear Fuel Storage



SOURCE: Andrews, Anthony. “Spent Nuclear Fuel Storage Locations and Inventory.” CRS Report for Congress, Washington DC, 2004

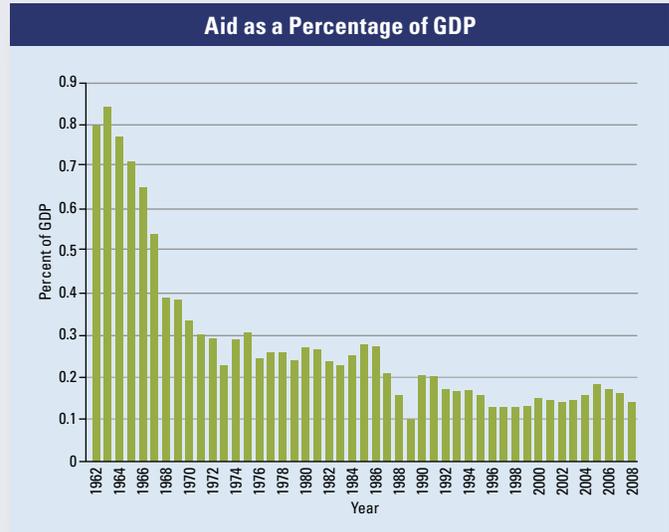


AMERICAN GOVERNMENT CAPABILITY AND RESPONSES

Climate change and its impacts will stress the U.S. government's ability to respond at home and abroad.

Climate change will affect human life and security. Because it is unlikely that even concerted action will wholly prevent all negative climate change consequences, the United States will need to take steps to mitigate the effects. As a result, we must consider how well prepared the United States is to deal with some of the predicted security ramifications of climate change such as humanitarian emergencies, military conflict, and the spread of disease.

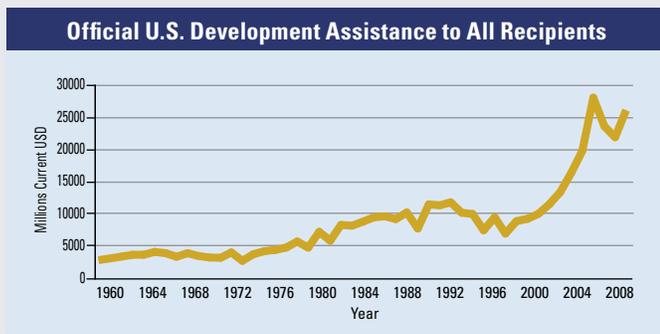
Climate change will increase global poverty and cause humanitarian emergencies. The United States will need to fund a generous program of foreign assistance. U.S. capacity to alleviate global poverty is at a low ebb. The U.S. Agency for International Development shed a great deal of expertise over the past two decades, and now serves largely as a contracting instrument rather than an effective instrument of U.S. policy. Furthermore, even with increases in foreign assistance under President George W. Bush, American foreign assistance has



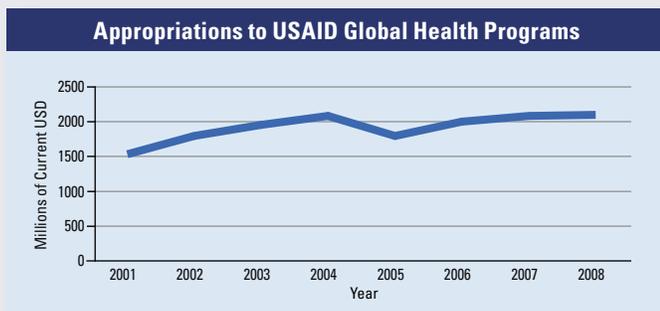
SOURCE: Budget of the United States Government: Historical Tables <http://www.gpoaccess.gov/usbudget/fy10/hist.html>

been declining as a percentage of GDP for nearly 50 years.²⁰ Increasing poverty will mean a higher likelihood of famine, economic migration, and conflict.

According to current predictions, climate change will also lead to an increase in communicable diseases including malaria and dengue fever, and, indirectly — due to human migrations — HIV/AIDS. As a result, the United States will need to focus on efforts to eradicate and contain these diseases abroad as well as establish effective monitoring and rapid response measures at home. In 2002, the World Health Organization documented the effects of climate change on global health. The authors examined ten major risks, including: temperature extremes; weather disasters; disease vectors; food- and water-borne illnesses; smaller harvests; diseases affecting plants and animals; fresh-water scarcity; air pollution; and armed conflict. These developments — essentially climate change and its effects — were responsible for 2.4% of the world's cases of diarrhea, 6% of malaria cases in some middle-income countries, and 7% of the cases of dengue fever in some industrialized countries.²¹ **By one estimate, climate change contributes to 300,000 deaths annually.**²² Under President Bush, the United States dramatically increased global



SOURCE: Organization for Economic Cooperation and Development <http://stats.oecd.org/qwids/>



SOURCE: Salaam-Blyther, Tiaji, "Global Health: Appropriations to USAID Programs from FY2001 through FY2008", CRS Report for Congress. Washington, DC: 2008. http://pdf.usaid.gov/pdf_docs/PCCAAB934.pdf

Potential Water Conflicts



The Indus River system, originating in India and running through Kashmir into Pakistan, is shared through the Indus River Treaty. The treaty has thus far survived two wars between the nations; but increased irrigation needs, allegations that India is misappropriating water, continued low-level conflict in the area, and the melting of the Siachen Glacier (the source of the river system) due to climate change, threaten the agreement and peace in the region.



Few water agreements that govern the division of surface and groundwater resources in the Middle East region exist. The majority of countries have significant populations highly dependent on agriculture and desperate for scarce water. Access to water resources continues to play a large role in territorial disputes including the Golan Heights and the Palestinian Territories.

health expenditures, notably under the President’s Emergency Plan for AIDS Relief (PEPFAR) and the President’s Malaria Initiative (PMI).²³ These expenditures will need to continue to increase in the future.

The U.S. government will also need to take a leadership role in establishing principles for the equitable sharing of increasingly scarce resources — particularly water — beginning in North America.²⁴ Establishing a North American water agreement may require a contentious revision of the 1922 Colorado River Compact, but doing so would show the world that the United States is working seriously to alleviate the worst impacts of climate change — despite domestic political pressure.²⁵ Such an agreement would also serve as a useful model to the world of how states can peacefully negotiate sustainable solutions to the impacts of climate change.



The Nile Basin is shared between ten African countries with Egypt dominating water usage. Allocation of the water resources continues to be a contentious issue dealt with for the most part successfully under the Nile Basin Initiative. Egypt has in the past indicated that it was willing to use force to guarantee its access to the Nile—a growing concern as populations continue to rise in the area.

In order to cope with these and other consequences of climate change, the US military will need the ability to respond to famines, epidemics, interstate conflict, mass migrations, and resource scarcity. **While the United States military already has significant capacity for humanitarian intervention, our allies have lagged in developing similar capabilities.**²⁶



The Zambezi river basin and river system is severely exploited. Disputes within and between the countries bordering the river will likely escalate as farmers intensify irrigation, national governments institute water transfers from the river to distant areas with drought, individual countries go through with plans for wide-scale water withdrawal, and conflicts over areas of land continue.

Nonetheless, with US forces committed to a large, open-ended deployment to Afghanistan, it seems unlikely that the United States will be in a position to respond quickly to any but the most extreme crises. Darfur, for instance, has languished in the shadow of Iraq and Afghanistan. There is little reason to assume that the United States will be able or willing to do more in the future than it has done there. American leaders will face a multitude of tough choices as climate-induced national security threats begin to compete with and crowd out our ability to respond to traditional threats such as terrorism, rogue states, and the rise of peer competitors.



Although Thailand and Laos share the bulk of the Mekong River Basin, China is able to strongly influence distribution of water resources due to its political clout and geographic position upstream. Countries diverging interests in the river including cheap hydropower, fisheries, and irrigation for agriculture are mediated by the Mekong River Commission, without China’s participation. China continues to build dams increasing the rate of environmental degradation and putting the livelihoods of countries downriver at stake.



CONCLUSION

Climate change is real and human activity is contributing to it.

The United States is confronted by the related threats of climate change and energy insecurity, which place in jeopardy lives, property, our economic health, and — potentially — our very way of life. As such, they constitute a clear and present danger to the national security of the United States.

Climate change is real and human activity is contributing to it. Atmospheric CO₂ concentrations are now at unprecedented levels due to industrial activity and the burning of fossil fuels. As a result, the planet's atmosphere and seas are getting warmer. The cascading consequences of continued warming are sobering to consider: insufficient water supplies, shifting rainfall patterns, disruptions to agriculture, human migrations, more failing states, increased extremism, and even resource

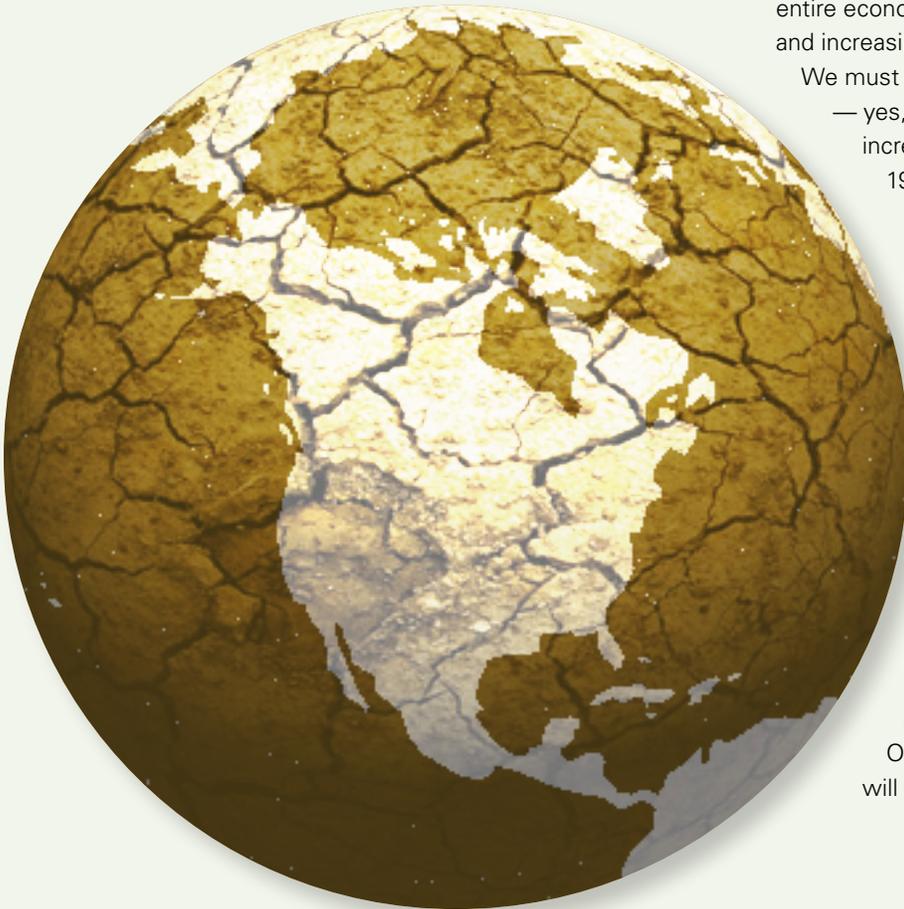
wars. These predictable consequences will strain the capacity of the United States and its allies to adapt and meet the challenges of the coming century.

We face a troubling climate future because of our dependence on fossil fuels — coal, petroleum, and natural gas. Imported petroleum makes us doubly vulnerable. Not only do we do further damage to the climate with its use, but we also make ourselves — and our economy — susceptible to disruptions in global oil supplies and subject to the whims of authoritarian despots who undermine our interests and values around the world financed with the money we spend on oil.

To meet these threats, we must harness a new American revolution in energy — becoming more efficient across our entire economy, investing in renewable energy technologies, and increasing our use of safe and reliable nuclear power.

We must leverage the inventiveness of American industry — yes, the same industry that produced dramatic increases in vehicle fuel efficiency from the mid-1970s to the late-1980s and allowed American wealth to rise while reducing the cost of energy used in manufacturing.

The economic opportunities of the twenty-first century will be found in developing solutions to meet the challenges of climate change and energy dependence. If we ignore the warnings of scientists and national security leaders, we will only deepen our addiction to imported oil, hamstringing our economy, and weaken our country. But if we heed those warnings, the United States will lead the world in a new wave of profitable, green technology, reduce our dependence on foreign energy supplies, and reduce our contribution to global warming. Our economic strength and our national security will grow in tandem.





ENDNOTES

The endnotes in this online file are updated from the printed report to correct for an error in the numbering of the notes.

CLIMATE CHANGE AND CONSEQUENCES

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