# GLOBALISATION, ENVIRONMENTAL JUSTICE, AND SUSTAINABLE DEVELOPMENT: THE CASE OF OIL

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*Oil has become so central to modern civilization that language strains to convey its importance; the common metaphors for its role – linchpin, lifeblood, prize- seem tired and inadequate.*[1]

## I INTRODUCTION

As globalisation has taken hold, nearly half of the world's people, over 3 billion men, women and children, live on less than two dollars per day. Furthermore, over twenty-five per cent of the world's species face extinction by 2025. Water scarcity is increasing at an alarming rate while the world's fisheries suffer from over-fishing. Thousands of the world's most respected scientists warn of the devastation to come as the earth's temperature rises. On the other hand, the medical successes of the last century have meant a dramatic increase in the human lifespan. Likewise, global use of pesticides has resulted in unprecedented agricultural production. Human productivity has grown 100-fold since commercial energy use began.[2] People can travel to all parts of the world with ease and comfort. Such travel was unimaginable even 60 years ago. Remarkably, petroleum energy has played a pivotal role in all of these problems and accomplishments.

Oil provides worldwide transportation, heating, cooling, electricity, clothing, communication, crops, and much more. Through oil's energy, the world is no longer a hotchpot of isolated nation states. Globalisation of trade and commerce would not flourish without the accomplishments of oil.[3] Energy production and use

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1 Thomas Prugh, Christopher Flavin and Janet L Sawin, 'Changing the Oil Economy', *State of the World 2005* (2005) 100, 100.

2 Norman Myers and Jennifer Kent, *Perverse Subsidies: How Tax Dollars Can Undercut the Environment and the Economy* (2001) 63.

3 Prugh, Flavin and Sawin, above n 1, 100-101; Myers and Kent, above n 2, 96-7.

is the single biggest human enterprise.[4] On the other hand, oil consumption is responsible for dramatic damage to our environment and society. Power struggles over controlling precious oil resources threaten global security. In many respects, the globalisation of trade and commerce seems to stand at odds with environmental stewardship, global security and social justice. Scholars around the world debate the facts, the law and the solutions, as do politicians and business leaders. This paper discusses the case of oil in the context of the trisection of globalisation, environmental justice, and sustainable development. Oil stands as an essential element to recovery or devastation.

This paper develops the intersection between globalisation, environmental degradation, and social justice by an examination of the world of oil – its development, its consumption and its devastation. The paper focuses on economic policies that nations have used to address the various components of petroleum's use in the modern world. For example, through direct subsidies and tax incentives, nations have encouraged the exploration and development of oil stores. Governments have also implemented 'green taxes' on petroleum in recognition of oil's devastating environmental effects. Often, a country will have conflicting economic incentives and disincentives relating to the use of oil. This kind of schizophrenic policy-making reflects the same conflicts nations face when balancing global trade and commerce with environmental and social problems. Through an analysis of the economic policies affecting petroleum, this paper will shed light on obstacles that prevent a more cohesive approach to addressing global problems. Furthermore, the paper considers whether international solutions in any of these arenas are even possible. For example, the Kyoto Protocol, which attempts to control worldwide carbon emissions (one of the chief byproducts of oil consumption) on a global scale, is viewed as a limited success because the biggest actors, the United States and Australia, failed to adopt it. Finally, the paper offers some thoughts on the future, possible solutions and the role that international law might play in dealing with these problems.

## II BACKGROUND

### A *Globalisation and its Environmental Impacts*

#### 1 *The Role of Oil in Globalisation*

Energy generated from oil has transformed modern life. The abundance of energy defines life in industrial nations and distinguishes life in undeveloped areas of the world.[5] Prior to the world of oil, societies used wood, animal labour and human labour fueled by plants. Once developed, however, fossil fuels dominated the energy budgets of those nations that could exploit them. Per capita and total energy

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4 Myers and Kent, above n 2, 63.

5 Prugh, Flavin and Sawin, above n 1, 100-1.

consumption dramatically grew, particularly with the advent of the automobile and widely available electricity.[6] For undeveloped parts of the world, in contrast, pre-modern energy sources, primarily wood, continue to support their economies. Furthermore, the quest by wealthier countries to secure and extract oil has lead to the destruction and desecration of the rights of indigenous populations and fragile ecosystems.[7] Fossil fuels, for good or ill, exert a dramatic presence globally.

The modern world of fossil fuel based energy began around the turn of the twentieth century when the British Royal Navy began to power its fleet with oil instead of Welsh coal.[8] Ships using oil had greater speed and range than those fueled with coal. With no domestic oil supplies, the British found and exploited dependable supplies in the Middle East. In both World War I and World War II, oil's increasing importance played out with the United States and Russia dominating the world scene, in part, because of their plentiful domestic oil resources.[9]

The significance of the oil reserves in the Persian Gulf also becomes clear in early 1945 as the United States and Saudi Arabia formed a monumental strategic alliance. With oil production on the Saudi side and military protection on the side of the US, this powerful relationship continues today. The balance of power between the two countries changed in 1948, however, when the United States became a net oil importer. With the US now dependent on foreign oil, the Middle East with its vast oil stores emerged onto the world stage as a powerful force where it remains today. Other oil-rich countries, primarily in North Africa and South America, have developed their oil resources while oil importers, such as Europe and the United States have sought to diversify their sources of oil. Unfortunately, most of the known oil reserves sit in politically or economically unstable parts of the world.[10] To the extent that petroleum remains the dominant global energy source, the stability or instability of relationships between those who have and those who want oil will determine global economic, environmental, and social wellbeing.

Oil stands as the most highly prized energy source for many reasons. Oil is easily extracted, flexible, and energy-dense. As the world's largest energy source, oil accounts for about 37 per cent of global energy production.[11] In the transportation sector, oil accounts for nearly all energy consumption. The largest, most profitable companies in the world are oil companies.[12] On an even larger scale, oil's price and availability influences the health, welfare, and security of billions of people and

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6 Ibid 101.
7 Ibid 110.
8 Ibid 108.
9 Ibid.
10 Anthony H Cordesman and Khalid R Al-Rodhan, 'The Changing Risks in Global Oil Supply and Demand: Crisis or Evolving Solutions?' (Report produced for the Center for Strategic and International Studies, 3 October 2005) 7, 33.
11 Prugh, Flavin and Sawin, above n 1, 102.
12 Ibid 103.

their nations. Globalisation expands largely through energy provided by oil. As countries trade vast quantities and varieties of goods and services, people's lives all over the world have dramatically improved.

At the same time, the global economy is threatened by dependence on a commodity controlled by few and destined for extinction. The United States economy, for example, is significantly vulnerable to oil price increases, and US economic disruptions create ripple effects worldwide. Since the 1970s, several dramatic oil price increases sent the global economy into an economic downturn.[13] The global energy market is increasingly unpredictable, and recent oil prices have been high and volatile.[14] Developing countries may be even more at risk of economic shocks in response to oil prices. According to Worldwatch, if the 2004 US$20-per-barrel price increase were sustained, the United States' economic growth would fall by 1 per cent, while undeveloped counties, such as those in Africa, would see a drop of 5.1 per cent in their economies. Such price increases can be particularly devastating in the lives of the poor.[15]

Oil, unfortunately, is a limited resource, and many believe that discoverable oil is on the decline.[16] Although the peak of oil production remains uncertain, China and India's emergence as top oil users in a time when competition for existing oil is intensifying, concerns many policymakers.[17] Many believe that the added pressure on uncertain oil supplies will trigger soaring oil prices and corresponding global economic disaster.[18] Furthermore, many of the largest oil fields in the Persian Gulf are over 30 years old, but independent verification of these oil reserves has not been permitted for decades.[19] Any loss of production, particularly in the Middle East, would have devastating consequences for the entire world economy.[20]

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13 For example, in 2004, a surge in oil prices shook the world's stock markets and the world economy as spare production fell short of demand: ibid 104. Moreover, in the United States, 9 of the 10 recessions since World War II were preceded by oil price increases: ibid 102.

14 Cordesman and Al-Rodhan, above n 10, 7.

15 Prugh, Flavin and Sawin, above n 1, 103. For example, increased costs of transporting food affects impoverished populations, as does higher prices for kerosene which is used for cooking fuel by the poor.

16 Peak oil predictions are very controversial. For example, the US Geological Survey believes that there are sufficient oil stores to last for many decades while others believe that global oil productions may begin to decline as early as 2007. See Prugh, Flavin and Sawin, above n 1, 105-107; Collin J Campbell and Jean H Laherrere, 'The End of Cheap Oil' (1998) 278 (3) *Scientific American* 84; A M Samsam Bakhtiari, 'World Oil Production Capacity Model Suggests Output Peak by 2006-2007' (2004) 102 (16) *Oil and Gas Journal* 18; Robert L Hirsch, Roger Bezdek, Robert Wendling, *Peaking of World Oil Production: Impacts, Mitigation, and Risk Management* (2005).

17 Prugh, Flavin and Sawin, above n 1, 107.

18 On 14 July 2006, the *Wall Street Journal* reported that oil prices were likely to hit US$80 per barrel as a result of increased violence in the Middle East. See Jason Leow, 'Dow Drops 1.5% as Oil Hits High', *The Wall Street Journal* (New York), 14 July 2006, C1.

19 Cordesman and Al-Rodhan, above n 10, 54.

20 Prugh, Flavin and Sawin, above n 1, 109.

Predicting future supplies of oil has proved very difficult. The most recent oil forecast issued by the Energy Information Administration ('EIA') in June 2006, is the first report to consider the implications of long-term oil prices of US$50 per barrel or more.[21] The EIA report indicates that the Middle East producers are projected to supply 38 per cent of the increase in petroleum supplies that will be needed by 2030.[22] Non-OPEC oil producers are projected to supply 62 per cent of the oil supply increases over the same time period. In addition, unconventional resources (biofuels, coal-to-liquids, gas-to-liquids) are expected to jump to 10 per cent of the total world petroleum supply by 2030 as a result of sustained high oil prices.[23] However, the EIA report points out that '[t]rends in end-use sector energy consumption can vary widely.'[24] For example, between 2005 and 2006, the report's prediction for growth in the transportation sector changed significantly. With high oil prices and no competitive alternative fuels in the transportation sector, the EIA reduced its projected growth rate for transportation energy use.[25]

Unfortunately serious oil supply concerns remain unresolved, and global use of oil continues to rapidly increase. In 2004, worldwide use of oil surged by 3.4 per cent, the fastest rate of increase in 16 years.[26] Oil prices hit a record US$55 per barrel as producers struggled to keep up with worldwide demand, estimated at 82.4 million barrels per day.[27] This trend continues as oil prices as recently as 5 July 2006, hit a record US$75 per barrel while demand shows no signs of leveling off as global demand now tops 85 million barrels per day.[28] The United States and China account for the biggest increases in oil consumption with the US using nearly 25 per cent of the total global daily usage.[29] Moreover, during the past four years, oil prices have gone up by about 108 per cent.[30] Oil traders fret over the possibility of supply disruptions because spare production capacity is less than 2 million barrels a day with most of that in Saudi Arabia.[31] Such concern is well warranted as China continues on the heels of the United States in petroleum consumption with approximately one half of its oil coming from imports.[32] The worldwide scramble for oil also creates considerable global tensions.

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21 Energy Information Agency ('EIA'), *International Energy Outlook 2006* (June 2006) 1.
22 Ibid 2.
23 Ibid 2.
24 Ibid 1.
25 Ibid 1.
26 Christopher Flavin, 'Fossil Fuel Use Surges' in *Vital Signs 2005: Trends That Are Shaping Our Future* (2005) 29, 30.
27 Ibid.
28 Brad Foss, 'Oil Prices Climb to Record Above $75' *The Washington Post* (Washington, USA), 5 July 2006 <http://www.washingtonpost.com/wp-dyn/content/article/2006/07/05/AR2006070500209.html> at 19 January 2007.
29 Flavin, above n 26, 30.
30 Cordesman and Al-Rodhan, above n 10, 7.
31 Foss, above n 28. Center for Strategic and International Studies, 'China's Energy Outlook: Securing a Path for Development' *Future Watch* (June 2006) <http://www.csis.org/media/csis/pubs/06_14_06.pdf> at 19 January 2007.
32 Center for Strategic and International Studies, above n 31.

Significant security issues connected to oil's place in the world's economy are likely to exacerbate economic issues associated with increasing demand and declining supplies of oil. The significance of oil in the world cannot be understated as governments seeking to acquire and exploit oil stores have resorted to military force when necessary to accomplish their goals.

The United States recognised over 60 years ago that oil security required a willingness to use military force. According to Worldwatch Institute,

> [f]or at least 30 years the United States has had military contingency plans to seize key Middle Eastern oilfields if necessary to secure the flow of oil – plans stimulated by the Arab oil embargo of 1973-74, which ironically was the first time oil itself was used as a weapon against western interests.[33]

Military strategies are not cheap. One report estimated that the US spent US$49 billion per year between 1993 and 2003 to maintain the US military presence needed to secure oil supplies.[34]

Acts of terrorism in the Middle East are causing increasing threats to oil security. The recent military actions taken by Israel against Lebanon could precipitate Iran blocking the Straits of Hormuz – the threat of which has sent oil price futures soaring.[35] The US stock market reacted to the news of Israel's attack with a sharp decline, and US gasoline prices are predicted to top US$4.00 per gallon.[36] Ironically, if Americans cut their oil use by 1/8$^{th}$, oil imports from the Middle East could be eliminated. This level of efficiency could be achieved by improving gas mileage from 32 kilometers per gallon to 40 kilometers per gallon.[37]

As recent world events make painfully clear, military strategies also have tragic human costs. Military conflicts, however, are not the only security threat posed by the world's unhealthy dependence on oil. As the United States, China, Russia and India vie for oil security, alliances with corrupt and repressive governments perpetuate lives of poverty, persecution, political repression and many other grave human rights violations.[38] The emergence of terrorism against western powers stems in large part from the rejection of western interference in Middle Eastern politics – all due to oil.

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33 Prugh, Flavin and Sawin, above n 1, 109.

34 Prugh, Flavin and Sawin, above n 1, 109; Milton R Copulos, *America's Achilles Heel: The Hidden Costs of Imported Oil* (2003) 36.

35 See Leow, above n 18; National Public Radio, 'NPR News Special Coverage: Lebanon, Israel and Regional Politics', *Talk of The Nation*, 17 July 2006 <http://www.npr.org/programs/totn/transcripts/2006/jul/060717.jenkins.html?sc=emaf>.

36 Ibid.

37 Myers and Kent, above n 2, 103.

38 Prugh, Flavin and Sawin, above n 1, 110.

Military efforts, along with their hefty price tags, divert funds that could counteract much of the inequities that lead to armed conflicts. Scarce financial resources pledged to counter poverty, health epidemics, and environmental degradation, which are the root causes of insecurity, have been reallocated to military purposes. The world's richest countries accounted for 79 per cent of global military expenses in 2004, roughly US$817 billion, while their developmental assistance programs receive only about 1/10$^{th}$ of that amount.[39] Furthermore, when compared to military budgets, investments in developmental assistance are modest at best. For example, the costs to cut world hunger by fifty per cent is estimated at US$24 billion per year, while providing clean water and sewage systems would cost roughly US$37 billion per year.[40] The global thirst for oil has resulted in a perverted sense of priorities.

2 *The Role of Oil in Environment*

Even if oil reserves were limitless and every country owned enough supplies to feed its citizens' oil appetites, the devastating environmental consequences associated with fossil fuel use demand the world's attention. Fossil fuel use results in negative environmental impacts in a number of ways including local and regional air pollution, water pollution, ground pollution, and climate instability. In its 2005 report, the Worldwatch Institute concluded that 'oil threatens climate stability because its use, which is accelerating, accounts for a major share of global greenhouse gas emissions and because its overwhelming dominance of the transportation fuel market makes it difficult to replace.'[41] This section discusses the impact of fossil fuel use on the environment.

The environmental impacts of exploration and extraction are enormous. Some argue that the resulting environmental damage is greater than that of a large oil spill.[42] Once the oil and gas is located, roads, crews and heavy equipment are needed to extract the resource from the ground resulting in

> deforestation, ecosystem destruction, chemical contamination of land and water, long-term harm to animal populations (particularly migratory birds and marine mammals), human health and safety risks for neighboring communities and … industry workers, and displacement of indigenous communities.[43]

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39 Michael Renner, 'Military Expenditures Surge' in *Vital Signs 2005* (2005) 73, 76; Elisabeth Skön, 'Military Expenditure' in United Nations, *Disarmament Forum: Investing in Security* (2004) vol 3, 3-4.

40 Renner, above n 39, 76.

41 Prugh, Flavin and Sawin, above n 1, 100.

42 Dara O'Rourke and Sarah Connolly, 'Just Oil? The Distribution of Environmental and Social Impacts of Oil Production and Consumption' (2003) 28 *The Annual Review of Environment & Resources* 587, 594.

43 Ibid.

In addition, the US oil and gas industry 'creates more solid and liquid waste than all other categories of municipal, agricultural, mining and industrial wastes combined.'[44]

Oil extraction is also a significant source of both water depletion and pollution. Coal gasification and shale oil extraction plants, both highly water-intensive in their processes, have a tremendous impact on already water-impoverished areas.[45] Coalbed methane extraction, widely popular in the United States, requires removal of large quantities of water from coal aquifers releasing the methane and allowing it to move to the ground surface where it can be captured.[46] Oil from spills or underground storage can also leak into and contaminate underground aquifers. [47] Further the oil industry generates a by-product known as 'produced water'. Produced water is drawn from the ground with the oil and then reinjected into wells under high pressure forcing more oil to the surface. The water that is not reinjected is discharged into surface waters, resulting in a toxic medley of ingredients, such as benzene, toluene, barium, arsenic, cadmium and mercury, to name a few.[48] Produced water, in some cases, is more radioactive than water discharged from a nuclear power plant.[49]

An oil field might produce oil for a decade or even a century.[50] During that time, oil spills, polluting emissions and explosions are a daily occurrence.[51]Aside from death and injury to workers, these incidents destroy wildlife, pollute the air and wreak havoc on local watersheds.[52] Before oil and gas reaches consumers and their vehicles, it must be transported, often over great distances. Typically, supertankers, pipelines, trucks and barges are the delivery mechanism of choice. Today, the oil and gas pipelines travel more miles than railroads worldwide, and oil constitutes a full 50 per cent of global sea cargo tonnage.[53] Corroded or overused pipelines leaked as much as 67 million gallons of crude oil into the United States' land and waters in the last decade.[54] Large spills from cargo vessels occur one to three times per year and dump as much as ten million gallons of oil or more each time into the

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44 Ibid.

45 See James Griffin, 'Environmental Quality and Rising Energy Needs: A Collision Course?' in Gerard Marion Brannon (ed), *Studies in Energy Tax Policy* (1975) 253, 263-64.

46 Kathleen C Zimmerman et al, *Preserving Our Public Lands: A Citizen's Guide to Understanding and participating in Oil and Gas Decisions Affecting our Public Lands* (2001) ii.

47 International Center for Technology Assessment, 'The Real Price of Gasoline', Report No 3: *An Analysis of the Hidden External Costs Consumers Pay to Fuel Their Automobiles* (1998) 23.

48 O'Rourke, above n 42, 594.

49 Ibid.

50 Zimmerman, above n 46, 8.

51 Ibid.

52 Ibid 9.

53 O'Rourke, above n 42, 598.

54 Ibid 601.

world's oceans.[55] Smaller spills, which occur frequently, contribute another 10 million gallons of oil into global waters every year.[56]

Oil must be 'separated, converted, and refined into useful products such as gasoline' in order to maximise its benefits.[57] This process involves heating and pressurising the oil, then capturing the distilled by-products like gasoline.[58] The 'crude oil constituents' that are not captured are released into the environment resulting in 'toxic air and water emissions, accidental releases of chemicals, hazardous waste disposal, thermal pollution and noise pollution.'[59] Although these emissions and discharges are regulated by environmental laws in the US, oil refineries have consistently committed serious violations of those laws. The problem got so bad that the US Environmental Protection Agency focused on oil refineries as their top enforcement priority in the 1990s.[60]

After the environmental damage caused by locating, extracting and transporting fossil fuels from their place of origin to the refinery, the consumption of oil and gas causes a tremendously detrimental impact on human health, air and water quality, wildlife and wilderness areas, and even agricultural productivity. Worldwide, approximately 531 million passenger cars provide transportation, with about 11 million new vehicles added to the global fleet every year.[61] Americans own approximately 25 per cent of that global fleet and drive more miles than all other industrial nations combined, although China plans to expand its fleet to 22 million by 2010.[62] As early as the 1950s, growing awareness of air pollution problems prompted the US Congress to study the issue.[63] Although significant evidence pointed to the automobile as a source of contaminants, these early studies did not emphasise any particular form or source of air pollution.[64] The study did not specifically implicate the automobile because of concern over negative consumer reaction if they learned that the reports identified the auto as a major source of pollutants.[65]

Today, established scientific research points to motor vehicles as the single greatest source of air pollution in the United States.[66] Aside from the 'aesthetic' problems of

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55 Ibid 599.
56 Ibid 600.
57 Ibid 603.
58 Ibid.
59 Ibid.
60 Ibid.
61 Janet L Sawin, 'Making Better Energy Choices' in *State of the World 2004* (2004) 24, 28.
62 Ibid.
63 Richard B Mancke, *The Failure of US Energy Policy* (1974) 37. Congress responded by passing the *Air Pollution Control Act* of 1955, Pub L No 84-159, 69 Stat 322 (1955), which authorised research into the issue of air pollution.
64 Ibid.
65 Ibid 37-38.
66 Ashley Morris Bale, 'The Newest Frontier in Motor Vehicle Emission Control: The Clean Fuel Vehicle' (1995-6) 15 *Virginia Environmental Law Journal* 213, 215-6 (citing Henry A

air pollution (ie reduced visibility and discoloration of otherwise panoramic vistas), motor vehicle emissions[67] are now linked to such deleterious effects as 'human illness and mortality, global warming, ozone depletion, crop damage … deterioration of buildings, and acid rain.'[68]

In terms of human health costs, probably the most significant are the illnesses and deaths related to air pollution. For example, scientific studies have linked a number of human carcinogens to the components of gasoline and gasoline by-products.[69] Cardiopulmonary and respiratory diseases, like emphysema and asthma, as well as incidental effects like 'eye irritation, poisoning from gasoline ingestion, and injuries caused by explosions, gas spillage and fires…' are associated with automobile pollution.[70] In Los Angeles, airborne carcinogens are 426 times higher than is considered safe, even though the city has the toughest emissions standards in the United States.[71]

Perhaps lesser known of the air pollution costs include the impacts on crops and building deterioration. Components of air pollution, like ozone, nitrogen oxide and acid rain, damage crops and 'stunt agricultural productivity' causing as much as US$2 to US$4 billion in crop damage each year.[72] Acid rain also increases the rate of building deterioration and related materials breakdown, often threatening culturally significant historic buildings and statues.[73] In addition to the oil spills and contamination of underground aquifers discussed above, a number of other oil-related sources indirectly impact on water quality. Automobiles and the extensive network of paved roads in the United States also detrimentally impact on waterways, such as wetlands, streams, rivers and shorelines.[74] Roads, built to facilitate car use, cut waterways off from their water sources.[75] Motor vehicles leak oil and oil-related fluids that are absorbed into the ground. During rainy periods, roads increase the concentration of run-off, contributing to flooding and streambed erosion.[76] Roadway de-icing pollutes water by increasing salt levels to ground and surface water which negatively impacts on fish populations and the ability of plants and trees to grow and flourish.

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Waxman, Gregory S Wetstone and Philip S Barnett, *Cars, Fuels and Clean Air: A Review of Title II of the Clean Air Act Amendments of 1990* (1991) 21 *Environmental Law* 1947, 1949)

67 Ibid 216. Motor vehicle emissions include harmful chemicals such as nitrogen oxides, hydrocarbons, carbon monoxide, particulate matter, carbon dioxide, and sulfur dioxide.

68 International Center for Technology Assessment, above n 47, 19; Myer and Kent above n 2, 81-3.

69 International Center for Technology Assessment, above n 47, 20.

70 Ibid.

71 Myers and Kent, above n 2, 95.

72 International Center for Technology Assessment, above n 47, 21.

73 Ibid 22.

74 International Center for Technology Assessment, above n 47, 24.

75 Ibid.

76 Ibid.

In addition to pollution, scientists more recently discovered that the carbon dioxide released when fossil fuels are burned is building up in the earth's atmosphere. Greenhouse gases exist naturally in the earth's atmosphere and are credited with trapping heat near the earth's surface keeping our planet a warm and hospitable place to live.[77] Under normal circumstances, natural processes maintain an equilibrium of the amount of gases in the atmosphere, but human influence can disrupt that balance increasing the ozone layer and causing the atmosphere to warm.[78] The primary culprit is carbon dioxide, or $CO_2$, generated primarily from fuel combustion. For every gallon of gasoline burned, 28 pounds of $CO_2$ is released into the atmosphere.[79]

Carbon dioxide levels in the earth's atmosphere have dramatically increased since the industrial age began, and scientific evidence supports the conclusion that these dramatic carbon dioxide increases are causing the global temperature to rise at unprecedented levels.[80] Since 1976, the rate of global temperature increase is three times faster than the rate of temperature change for the entire twentieth century. Between 1990 and 2005, scientists recorded the ten warmest years since they began collecting temperature data.[81] NASA's Goddard Institute for Space Studies recorded 2005 as the hottest single year on record.[82]

Climate experts are observing mounting evidence of the impact that the temperature increases and $CO_2$ concentrations are having on the earth. Scientists have linked increased global temperatures with species decline and displacement, melting glaciers and rising sea levels, unprecedented storms, floods and droughts, and a myriad of other changes to the earth's ecosystems and plant and animal populations.[83] Because scientists believe that carbon emissions from fossil fuels are the primary culprit for increased $CO_2$ concentrations and global temperatures,[84] reducing fossil fuel use must be a worldwide priority. Oil combustion makes up approximately 42 per cent of carbon dioxide emissions - the primary human-caused greenhouse gas.[85] And yet, the IEA estimates that over the next 25 years, world primary energy demand will increase by approximately 60 per cent, with 85 per

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77 Surface Transportation Policy Project, *Transportation and Climate Change*, <http://www.transact.org/library/factsheets/climate.asp> 30 June 2004.

78 Ibid.

79 Ibid. Nineteen pounds is emitted from the tailpipe while the remaining nine pounds comes from 'upstream' activities such as refining and transportation of fuels.

80 Janet L Sawin, 'Climate Change Indicators in the Rise' in *Vital Signs 2005* (2005) 29, 40.

81 Ibid.

82 Kristin Choo, 'Feeling The Heat: The Growing Debate Over Climate Change Takes On Legal Overtones' (2006) 92(7) *ABA Journal* 28, 29, 31.

83 Camille Parmesan and Hector Galbraith, 'Observed Impacts of Global Climate Change in the US' (Report prepared for the Pew Center on Global Climate Change, November 2004); Sawin, 'Climate Change Indicators in the Rise', above n 80, 40; Choo, above n 82, 29, 31.

84 Joint Science Academies, 'Statement: Global Response to Climate Change' (7 June 2005) 1.

85 Prugh, Flavin and Sawin, above n 1, 102. 'Oil alone accounts for over two fifths of total emissions of carbon dioxide, the chief human-caused greenhouse gas.': Ibid 111.

cent of this projected increase coming from fossil fuels (primarily oil).[86] Such predictions solidify concerns over the impact of environmental degradations and global warming. As the environmental fallout of global warming increases, global poverty will increase as peoples' homes and livelihoods are subjected to environmental stressors such as drought and disease. Economic development will likely suffer, disproportionately impacting upon poorer nations.[87] In turn, global political instability will likely increase, reducing the possibility that governments will shift their budgets from military spending to developmental assistance.[88]

One other aspect of climate change deserves mention; many scientists attribute the increasing incidents of severe storms, such as Hurricane Katrina that devastated the Louisiana coastline in August 2005, to climate change.[89] These 'natural disasters' often disrupt supply and distribution of petroleum and other fuels. After Hurricanes Katrina and Rita, the United States had to shut down most of its refineries on the US Gulf of Mexico, forcing the US to release oil from the Strategic Petroleum Reserve.[90] Natural disasters can also lead to and intensify conflict in regions that are politically unstable.[91] These same regions are often dealing with economic struggles that are exacerbated by damage wrought by natural disasters. Furthermore, disasters ravage the lives of the poor to a far greater degree because the poor have no capacity to contend with a loss of resources.[92] These scenarios make it vital for nations to act now. 'Poverty must be reduced through sustainable development so that people can better cope with the changes wrought by global warming. Renewable energy must play a major role on this front, because it can help to alleviate poverty and reduce the risk of conflicts over nonrenewable energy.'[93]

At the 2005 G8 Summit, scientists from around the world issued a plea to world's governments:

> The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. . . . The task of devising and implementing strategies to

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86 Joint Science Academies, above n 84, 1; IEA, *World Energy Outlook 2004* (2004) 57.

87 Joint Science Academies, above n 84, 1.

88 Prugh, Flavin and Sawin, above n 1, 112.

89 Myers and Kent, above n 2, 33. In September 2005, meteorologists reported an 80 percent increase in the most powerful cyclones over the last 35 years. Michael Renner and Zoë Chafe, 'Turning Disasters in to Peacemaking Opportunities' in *State of the World 2006* (2006) 115, 118.

90 Cordesman and Al-Rodhan, above n 10, 8.

91 Renner and Chafe, above n 89, 120-1. For example, Darfur and Somalia both suffered from extreme drought situations that when combined with unstable governments, lead to violent conflict.

92 Ibid 121.

93 Prugh, Flavin and Sawin, above n 1, 112-3.

> adapt to the consequences of climate change will require worldwide collaborative inputs from a wide range of experts….[94]

The role of governments and international cooperation will be pivotal to any successful strategy to eliminate world dependence on fossil fuels and alleviate the impact of climate change. Governments must create the incentive structures to encourage the investment needed to overhaul the oil economy.

## B *Sustainable Development*

### 1 *Can Oil Be Part of Sustainable Development?*

Oil must be part of sustainable development – at least for the foreseeable future. Today, we have no available oil substitute to satiate the world appetite for energy, and yet, the global energy economy must break its dependence on oil. Sustainable development will involve reducing dependence on oil through a mix of strategies. Such strategies should include: demand management, renewable energy, energy efficiency initiatives, the use of a greater variety of energy technologies and fuels, and diversification of energy sources.[95]

The Joint Science Academies' Statement during the 2006 G8 Summit stated that

> providing for global energy sustainability and security will require many vigorous actions at national levels, and considerable international cooperation. These actions and cooperative steps will need to be based on widespread public support, especially in exploring avenues for increased efficiency of energy use.[96]

For example, Americans use six times more energy than the worldwide average and seventy times more energy than a Bangladeshi. If Americans increased their energy efficiency to that of the Western Europeans and Japanese, energy costs would drop by US$100-US$200 billion per year.[97] Moreover, if the US eliminated fossil fuel subsidies, $CO_2$ emissions would decline to 16 per cent below 1990 levels by 2010, surpassing the Kyoto target by a sizable margin.[98]

Furthermore, countries should diversify energy supply and demand with oil as part of an energy mix. The Joint Science Academies also urged the international community to develop a global energy infrastructure with attention to its resilience; promote clean and affordable energy sources; promote cost-effective economic

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94 Choo, above n 82, 31; The Royal Society, *Clear Science Demands Prompt Action on Climate Change Say G8 Science Academies* (7 June 2005) <http://www.royalsoc.ac.uk/news.asp?id=3226> at 26 November 2006.

95 Prugh, Flavin and Sawin, above n 1, 114.

96 Joint Science Academies, 'Statement: Energy Sustainability and Security' (14 June 2006) 1.

97 Myers and Kent, above n 2, 63.

98 Ibid 70.

instruments targeting greenhouse gas reductions; and address the critical needs of the world's poor who have no access to modern energy.[99]

Although some steps have been taken to address the threat of global warming, the one binding international agreement, the Kyoto Protocol,[100] sets only modest goals for emissions reductions.[101] For example, some climate models predict that if temperatures rise 2 degrees Celsius above pre-industrial levels major environmental change will be triggered.[102] Based on this prediction, worldwide greenhouse gas emissions need to be reduced to about one half of 1990 levels by the year 2050. The Kyoto Protocol sets emissions reductions to about 5 per cent of 1990 levels by the year 2012 for developed countries. The United States, the biggest emitter of greenhouse gases, refused to ratify the protocol, along with other significant industrial nations, such as Australia. In addition, the protocol exempts China and India, two developing countries with dramatic emissions increases, from the mandatory emissions reductions. Without the participation of the United States and no significant national plan to reduce greenhouse gases ('GHG'), emissions are predicted to increase, not decline, by 2050.[103] On the other hand, countries including Germany, Spain, Japan, and the Philippines have enacted strong policies designed to shift from fossil fuels to renewable energy technologies.[104] China has also taken steps to include renewable energy as a significant part of its future energy needs, and the European Union began operating the world's first international emissions trading program in January 2005.[105]

### C *The Economic Development of Oil*

#### 1 *Use of Fiscal Instruments*

Given the overwhelming reasons to move away from fossil fuel dependence, it might seem surprising that the world continues to be so wedded to fossil fuels. Considering the regulatory and policy environment that has supported the fossil fuel industry with enormous subsidies for nearly a century, however, it is not surprising that nations face huge challenges in changing to a sustainable energy regime. These subsidies include not only direct investment in the fossil fuel industry, but also in the infrastructure to support the industry and fossil fuel uses such as centralised

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99 Joint Science Academies, above n 96, 2.

100 The Kyoto Protocol is officially known as the *United Nations Framework Convention on Climate Change* ('UNFCCC') and has been ratified by 163 countries. Most notably absent from ratification are the United States and Australia. The protocol sets emissions reductions target at 5.2 per cent of 1990 levels by 2012.

101 Choo, above n 82, 31.

102 Ibid 31.

103 Ibid.

104 Sawin, above n 80, 40.

105 Ibid; Stuart Penson, 'EU Launches Pioneering Emissions Trading Scheme', *Reuters News Service* (London, UK), 4 January 2005.

generating facilities, hydroelectric dams, and national highway systems.[106] Dismantling the oil economy will require governments to eliminate current subsidies for fossil fuels and shift those investments into renewable energy technologies and infrastructure. The Organisation for Economic Cooperation and Development ('OECD') recently stated

> [r]eform of subsidies to the energy sector should focus on support provided to the use of fossil fuels, particularly coal and oil. Support to the increased use of these fuels poses greater threats to the environment than, say, subsidies that support the use of energy-saving devices or the development of renewable energy. At the same time, there are often significant social objectives that need to be considered when assessing energy policy, together with the general equilibrium effects of altered patterns of energy production and consumption that may be generated by subsidy reform.[107]

In its report the OECD outlined three primary factors that policymakers need to identify in order to determine the detrimental consequences of subsidies. First, analysts need to determine how much the incentive reduces other competition or alternatives. Second, analysts need to compare the environmental effect of the subsidised sector with the environmental effect of alternatives that are discouraged because of the subsidy. Third, the analysts must determine how much the environment will improve if the measure is removed.[108] This section discusses the massive economic machinery that governments have built around oil through their financial investments. The paper analyses the types of oil subsidies and the impact of eliminating them. This section also discusses financial instruments that governments are using to stimulate alternative energy use. As the oil economy declines, as it must, subsidies to renewable energy can overcome some of the obstacles faced as new technologies enter the market.

*(a) Government Supports for the Petroleum Industry*

The petroleum industry has developed over the last 100 years supported by significant government subsidies. Governments offer many different types of subsidies, and analysts may disagree as to the definition of a subsidy or how to measure its value. For the purposes of this article, the following definitions of subsidy will suffice, because our focus is on the environmental impact of subsidies on the targeted sector of the economy – here, energy.[109] One accepted definition of energy subsidy includes 'any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy

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106 Myers and Kent, above n 2, 64: Oil accounts for 97 per cent of all fuel used in transportation which also receives huge subsidies.

107 Organisation for Economic Cooperation and Development ('OECD'), *Environmentally Harmful Subsidies: Challenges for Reform* (2005) 9.

108 Ibid 33.

109 In the 2005 OECD report on harmful subsidies, issues connected to defining a subsidy for purposes of accurate measurement and analysis are discussed. Ibid 7-8.

producers or lowers the price paid by energy consumers.'[110] Another definition states

> [a] subsidy is a form of government support extended to an economic sector (or institution, business, or individual), generally with the aim or promoting an activity that the government considers beneficial to the economy overall and to society at large…. A subsidy can be supplied in the form of a monetary payment of other transfer or through relief of an opportunity cost.[111]

Nations use many different types of energy subsidies, such as tax exemptions, direct grant or loan programs, market price supports, or indirect subsidies, such as road and infrastructure subsidies and funding for research and development to stimulate the energy sector. When analysing the environmental impact of financial supports, a number of interdependent variables must be considered. The type of energy source, the amount of the support, the form or type of the support, the energy system circumstances, policy considerations and general equilibrium effects can affect the environmental impact of the particular subsidy.[112]

The impact of government subsidies to the fossil fuel industry have resulted in artificially low prices of oil and gas for many decades. Studies show that these subsidies have resulted in increased exploitation and consumption of fossil fuels as well as increased resource allocations to the industry.[113] For example, US petroleum companies are taxed, on average, at an effective rate of 11 per cent while non-oil industry businesses are taxed at an average rate of 19 per cent.[114] The exploitation and consumption of petroleum resources, as already discussed, has led to supply and security issues in importing countries, and environmental degradation across the board.[115] In most cases, if the energy source causes more harm to the environment than an alternative energy source, the subsidy should be eliminated.[116]

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110 IEA, Economic Analysis Division, 'Carrots and Sticks: Taxing and Subsidising Energy' (2006) 1: In a 1987 World Resources Institute report, the author considered 'economic subsidies' for fossil fuels and defined the term as 'the difference between world oil market prices and domestic ones….Financial or budgetary subsidies are what a government pays out to cover these operating costs; they do not include the opportunity costs of foregoing transactions at higher market prices.': Mark Kosmo, *Money to Burn? The High Costs of Energy Subsidies* (1987) 7.

111 Myers and Kent, above n 2, 5; see also OECD, above n 107, 16-17 (citing the World Trade Organisation ('WTO') definition of subsidy in the *WTO Agreement on Subsidies and Countervailing Measures*).

112 OECD, above n 107, 48.

113 Kosmo, above n 110, 8; Myers and Kent, above n 2, 65.

114 Suzanne C Hunt, Janet L Sawin and Peter Stair, 'Cultivating Renewable Alternatives to Oil' in *State of the World 2006* (2006) 61, 76.

115 In most circumstances, cost estimates of a given fossil fuel subsidy are generally inaccurate because the environmental costs are left out. For example, the costs of environmental externalities such as pollution, ecosystem damage and climate change, discussed above, are not quantified. See Myers and Kent, above n 2, 26-31. Obviously, if quantified, the true costs of fossil fuel subsidies are much greater and their impact can not be eliminated for a long time.

116 OECD, above n 107, 48.

Thus, fossil fuel subsidies need to be eliminated.[117] However, the world's economy will continue to depend heavily on fossil fuels for many years, and the impact of subsidy removal may result in economic hardship, particularly to the poor who have no access to alternative fuel sources.[118]

A transitional approach with phased-out fossil fuels subsidies and, perhaps, short-term subsidies for the development of marginal petroleum resources could help to prevent dramatic economic shifts as new energy sources are developed. Likewise, incentives to develop new energy sources will be instrumental, at least for the short term.

Many types of interventions distort the market towards particular fuels,[119] and estimating the amount of support to the petroleum industry is very difficult.[120] One recent OECD report estimated the energy production subsidies to OECD countries ranged from US$20 billion per year to US$80 billion per year.[121] Non-OECD countries provide energy consumption subsidies of approximately US$160 billion per year.[122] Fossil fuels (coal, gas, and oil) receive the overwhelming bulk of these subsidies, approximately two-thirds of the total while renewable energy receives less than 4 per cent of total subsidies.

Ironically, the fossil fuel industry, which recorded in 2005 its most profitable year ever, is the third most heavily subsidised economic sector in the world, after road transportation (which also benefits petroleum) and agriculture.[123] Moreover, these figures drastically under-represent the true costs associated with oil. Because oil amounts to 97 per cent of all fuel used in road transportation, the subsidies associated with oil's use in road transportation must be added into the analysis.[124] Direct subsidies to oil and gas on the consumption side include government funding of infrastructure, services, research and development, tax incentives, foreign tax credits, accelerated depreciation on machinery and equipment, low sales taxes on gasoline and other income tax deductions and credits.[125]

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117 Kosmo, above n 110, 1; Myers and Kent, above n 2, 87; OECD, above n 107, 9.

118 Myers and Kent, above n 2, 9-10.

119 OECD, above n 107, 27.

120 Another recent comprehensive study on subsidies concluded that data on fossil fuel subsidies worldwide was lacking. They found that data was uneven in quantity and poor in quality. Furthermore, the available data was often contradictory. Myers and Kent, above n 2, 67.

121 OECD, above n 107, 26-7.

122 Cees van Beers and André de Moor, *Public Subsidies and Policy Failures* (2001) 49-50.

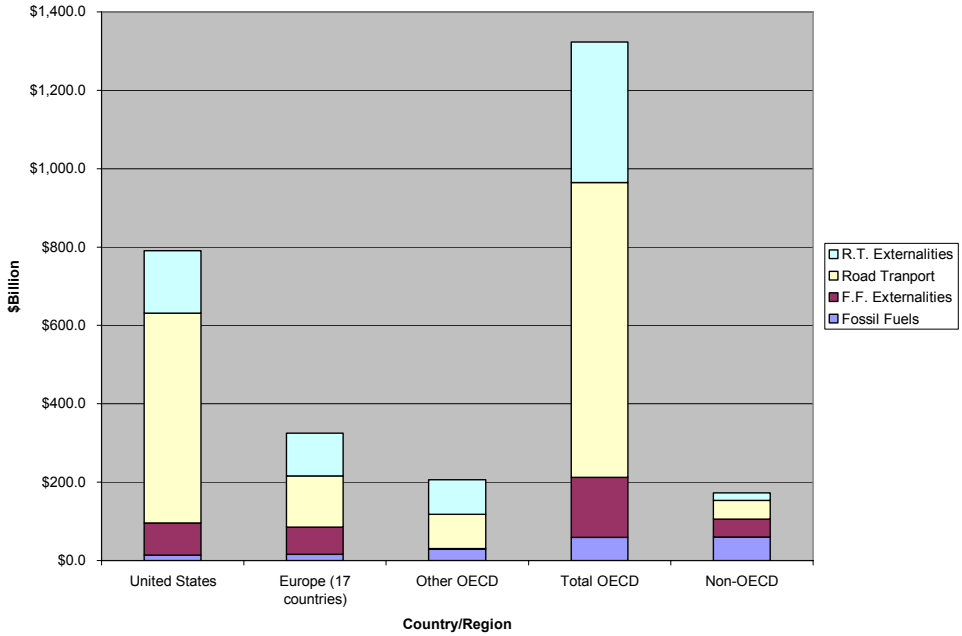
123 Myers and Kent, above n 2, 66; Simon Romero and Edmund L Andrews, 'At Exxon Mobil, A Record Profit But No Fanfare', *New York Times* (New York), 31 January 2006, A1; Robert Pirog, *Oil Industry Profit Review 2005* (Congressional Research Service ('CRS') Report for Congress, 18 April 2006).

124 Myers and Kent, above n 2, 64.

125 Ibid 99.

In addition, revenues generated from sources other than transportation (such as gasoline excise taxes) that fund the costs of road building are also considered a direct subsidy to road transport. Indirect costs associated with road transport include free parking, lost productivity associated with road congestion, accidents, injuries and deaths on the road, military costs associated with safeguarding oil supplies, and environmental costs associated with air, water, and noise pollution.[126] In the United States, alone, these costs are conservatively estimated to be approximately US$695 billion per year.[127]

TABLE 1 – FOSSIL FUEL SUBSIDIES AND ROAD TRANSPORTATION SUBSIDIES WORLDWIDE[128]




With increasing concern over harmful subsidies to the fossil fuel industry, policymakers, economists, and academics have analysed existing oil and gas subsidies for their harmful impacts on the environment and society and concluded that both the environment and the economy will improve if subsidies are abolished.[129] Countries must reduce and eliminate harmful subsidies by removing (1) producer grants and price supports; (2) consumer subsidies and sales tax

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126 Ibid 100-4.

127 Ibid 104. The US$695 billion includes US$150 billion for oil and car industry and road building and infrastructure; US$150 billion for free vehicle parking; US$100 billion for congestion; US$110 billion for accidents, injuries, deaths; US$25 billion for military safeguards; and US$160 billion for environmental externalities. Ibid 105; see also Hunt, Sawin and Stair, above n 114, 76-7.

128 See Myers and Kent, above n 2, 85 and 113 (data combined to create chart).

129 See van Beers and de Moor, above n 122, 52-4.

exemptions; and (3) tax and trade barriers.[130] Gradually, subsidy reform initiatives are growing, particularly in OECD countries.[131]

The impact of subsidy reform depends on the type of subsidy being addressed. The 2005 OECD report on subsidy reform categorised subsidies based on the type of government intervention and its influence on the energy market.[132] As market interventions, subsidies are typically designed to achieve one of the following: lower the costs of energy production, lower energy prices, lower the costs of energy consumption, or raise energy prices. The table reproduced below indicates the impact of various instrument types.

TABLE 2 – ENVIRONMENTAL EFFECTS OF VARIOUS TYPES OF ENERGY SUBSIDY[133]

| | | How the subsidy usually works | | | |
|---|---|---|---|---|---|
| Government Intervention | Example | Lowers cost of energy production | Lowers energy prices | Lowers cost of energy consumption | Raises energy prices |
| Direct financial transfers and preferential lending | Grants to producers | • | ? | | |
| | Grants to consumers | | | • | |
| | Low-interest or preferential loans to producers | • | ? | | |
| Preferential income tax treatment | Rebates or exemptions on royalties, duties, producer levies and tariffs | • | ? | | |
| | Tax credit | • | ? | • | |
| | Accelerated depreciation allowances on energy supply equipment | • | ? | | |
| Differentiated energy sales taxes | Below-standard value added taxes ('VATs') | | • | | |
| | Excise taxes | | | | • |

130 Myers and Kent, above n 2, 87.
131 OECD, above n 107, 49.
132 Ibid 49.
133 Ibid 50, Copyright OECD.

| | | | | |
|---|---|---|---|---|
| Trade restrictions | Quotas, technical restrictions and trade embargoes | | | • |
| Energy-related services provided directly by government at less than full cost | Direct investment in energy infrastructure | • | ? | |
| | Public research and development | • | ? | |
| | Preferential tariffs provided by state-owned energy companies | | • | |
| Regulation of the energy sector | Demand guarantees and mandated deployment rates | • | ? | • |
| | Price controls | | • | |
| | Market-access restrictions | | | • |

| | |
|---|---|
| • | direct effect |
| ? | indirect effect, varying in terms of degree and timing |

When considering the impact of reform, most developed countries currently use subsidies to lower the cost of production.[134] The impact of eliminating production subsidies will depend on the producers' reactions. For example, some producers may absorb the additional costs associated with the lost subsidy. Others may pass the cost increase on to consumers or be priced out of the market. The OECD stated in its recent report that 'reforming production-cost subsidies would not be likely to alter prices much in the short term.'[135] Over the long term, however, significant shifts in fuel competition would result. The goal of decreasing dependence on oil and increasing the market for renewable technologies is therefore facilitated by eliminating subsidies for petroleum and other fossil fuels. Despite the significant information regarding the benefits of subsidy reform, governments have been slow in their reforms. Since 1990, Western Europe has spent over US$80 billion on fossil fuel subsidies and only US$1.5 billion on renewable energy and US$3.2 billion on energy conservations measures.[136] The chart reproduced below estimates for non-

134 Ibid 49.
135 Ibid 50.
136 Myers and Kent, above n 2, 87-88.

OECD countries the benefits to the environment and national economies of eliminating fossil fuel subsidies.

| TABLE 3 – THE BENEFITS OF FULL-COST PRICING OF ENERGY[137] | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | Effects of Subsidy Removal | |
| | Population (Million) | Average Subsidy (% of Ref. Price) | Cost of Subsidy ($ Bil) | Economic Efficiency Gain (% of GDP) | Reduction in Energy Consumption | Reduction in $CO_2$ Emissions |
| | | | | | | |
| China | 1,254 | 10.9 | 3.6 | 0.4 | 9% | 13% |
| Russia | 147 | 32.5 | 6.7 | 1.5 | 18% | 17% |
| India | 987 | 14.2 | 1.5 | 0.3 | 7% | 14% |
| Indonesia | 212 | 27.5 | 0.5 | 0.2 | 7% | 11% |
| Iran | 66 | 80.4 | 3.6 | 2.2 | 48% | 49% |
| South Africa | 43 | 6.4 | 0.08 | 0.1 | 6% | 8% |
| Venezuela | 24 | 57.6 | 1.1 | 1.2 | 25% | 26% |
| Kazakhstan | 15 | 18.2 | 0.3 | 1.0 | 19% | 23% |
| **TOTAL** | 2,748 | 21.1 | 17.2 | 0.7 | 13% | 16% |
| **WORLDWIDE** | | | | | 3.5% | 4.6% |

As the chart illustrates, removing subsides for fossil fuels and providing incentives for the development of renewable fuels will improve the negative environmental consequences of fossil fuel use to a significant extent. However, economists agree that the most efficient method of reducing the harmful impacts of fossil fuel use is to directly reform pricing policies so that fossil fuel prices include externalities.[138] Many economists support either gasoline taxes that reflect environmental costs or carbon taxes that directly tax $CO_2$ emissions as the best market mechanisms to deal with the environmental fallout from fossil fuel use.

Energy taxes can achieve a number of benefits. For oil importers, they can reduce dependence on foreign oil improving domestic security and minimising the impact of supply disruptions.[139] Energy taxes can also be set to reflect the cost of environmental degradation exacted by fossil fuel use, and the revenue they generate can be used to offset inequality created by energy price increases to poorer

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137 Ibid 77.

138 See Table 1 above; OECD, *Environmentally Related Taxes in OECD Countries: Issues and Strategies* (2001) 36 (citing a 1993 study that showed that pollution taxes are significantly more efficient than pollution subsidies).

139 Kosmo, above n 110, 7.

consumers.[140] However, to date, such measures are under-utilised, often due to competitiveness concerns.[141] In the United States, for example, suggesting gasoline taxes is the equivalent of political suicide. In order to increase fuel efficiency in US cars by about one third, the price of gasoline would have to double.[142] 'And doubling the price of gasoline is only slightly less tractable politically than outlawing the flag.'[143] However, a modest energy tax could prove extremely beneficial if the entire proceeds went to fund energy efficiency and renewable energy technologies.[144]

*(b) Incentives for Alternative and Renewable Energy*

Non-polluting and renewable energy sources provide many benefits – economic, environmental, political, security, social and ethical benefits.[145] However, without government help to get these technologies established in the market, they might never be competitive with fossil fuels because of the size of the fossil fuel infrastructure and existing government support. While economists generally prefer environmental taxes (as discussed above) or economic instruments such as marketable permits (like emissions trading schemes), these instruments may not always be politically or technologically feasible leaving environmental subsidies as the more realistic option.[146] Unlike subsidies for fossil fuels, subsidies for renewable energy are considered beneficial for the environment and the economy.[147] Such subsidies can help to correct existing market failures. For example, with fuel prices and road transportation historically priced artificially low, a subsidy for public transportation is necessary to encourage its use and to prevent increased road transport and pollution.[148] This section discusses incentives that subsidise and promote energy efficiency and alternative or renewable fuels.

Incentives that target improved energy efficiency attempt to get 'more bang for the buck' with existing fuels and energy technologies. For example, increasing vehicle fuel efficiency does not encourage renewable energy, but attempts to decrease gasoline demand through increased miles per gallon. Therefore, a subsidy for the purchase of a more fuel efficient vehicle can lower its cost relative to less fuel

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140 Ibid 7; OECD, *Environmentally Related Taxes,* above n 138, 29; Craig Hanson and David Sandalow, 'Greening the Tax Code' *Tax Reform, Energy and the Environment, Policy Brief* (2006) 4.

141 See OECD, *Environmentally Related Taxes,* above n 138, 27; Hanson and Sandalow, above n 140, 2.

142 Myer and Kent, above n 2, 118, citing H Harvey.

143 Ibid, citing Harvey.

144 Ibid, citing Harvey.

145 Ibid 10.

146 Lynn Price et al, *Tax and Fiscal Policies for Promotion of Industrial Energy Efficiency: A Survey of International Experience* (2005) 5 <http://ies.lbl.gov/iespubs/s8128.pdf> at 27 November 2006; Andrew J Green, 'You Can't Pay Them Enough: Subsidies, Environmental Law and Social Norms' (2006) 30 *Harvard Environmental Law Review* 407, 426.

147 OECD, *Environmentally Harmful Subsidies*, above n 107, 49.

148 Ibid 15.

efficient vehicles, increasing the odds that a consumer will purchase the fuel efficient car regardless of that person's environmental awareness.[149] Countries have used many mechanisms to encourage energy efficiency including rebates, efficiency labeling, building standards, loan programs and tax incentives.[150] Tax incentives for energy efficient technologies include tax exemptions, tax reductions and accelerated depreciation.

At least twenty-three countries and several states in the United States provide tax incentives for purchases of energy efficient property.[151] Typically, the government will identify a list of technologies eligible for the special tax treatment allowing for flexibility as technologies change. For example, Canada allows for accelerated write-off for investments in co-generation and specified waste-fueled electrical generation systems, active solar systems, wind energy conversion systems and other renewable electricity systems.[152] Japan permits an accelerated depreciation deduction of 30 per cent on investments in heat pumps, floor heaters, combined heat and power ('CHP') systems, high efficiency electric trains, and other energy saving technologies.[153] In the United States, investments in similar energy efficiency technologies are permitted a tax credit.[154]

Several disadvantages are associated with tax incentives for energy efficiency. Such incentives often need to be significant to induce the desired investment; tax incentives do not encourage conservation; and 'free rider' problems can occur with investors who would have purchased the technology without the incentive.[155] Free rider problems can be avoided through targeting incentives toward cutting-edge (and not yet profitable) technologies. Furthermore, by cutting the cost of energy efficient investments, subsidies can alleviate liquidity restraints and accelerate purchasing decisions. Despite disadvantages, one recent study concluded that, because decisions regarding the purchase of energy efficient equipment primarily focused on cost, tax relief for energy efficient technology 'may be more efficient than taxing energy per se.'[156]

Incentives are also used to stimulate alternative and renewable fuel development and demand. To replace oil use, particularly in transportation, alternatives such as electric propulsion and power train systems; hydrogen fuel-cell propulsion systems;

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149 Green, above n 146, 428.

150 Price et al, above n 146, 4, 18.

151 Ibid. At the federal level, the United States only adopted the use of tax incentives for energy efficient technology in 2005.

152 Ibid.

153 Ibid 30.

154 Steven Nadel, *The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts,* Report No E053 (2005) 2-9.

155 Price et al, above n 146, 32.

156 Ibid.

and biofuels with near-zero emissions are considered most important to develop.[157] Currently, ethanol and biodiesel provide only 2 per cent of the global transportation fuels.[158] The remainder comes from fossil fuels. However, Brazil, the world's leader in ethanol production, has demonstrated ethanol's viability with 40 per cent of its non-diesel motor fuel coming from ethanol produced from sugarcane.[159] With soaring gasoline prices and limited alternative transportation fuels, biofuels are quickly becoming the alternative fuel of choice.

The use of ethanol as an alternative to petroleum-fueled transportation is growing worldwide. Since 2000, global production of ethanol has doubled while production of biodiesel has tripled.[160] The United States, the world's second largest ethanol producer, expects more than a doubling of the US ethanol market by 2012.[161] However, ethanol fuels present both positive and negative environmental consequences, and therefore, should not be viewed, just yet, as the solution to petroleum dependence. Nonetheless, tax incentives have and will continue to be critical in supporting the ethanol industry as the next generation of ethanol, produced from less costly and less polluting materials, is developed.

When ethanol is mixed with gasoline, it reduces the amount of air pollution from carbon monoxide and ozone. In the United States, E10, a mixture of 10 per cent ethanol and gasoline accounted for ninety-nine per cent of ethanol consumed. The other one per cent came from purer ethanol mixtures, such as E85 used in specifically designed vehicles.[162] Until 2005, without tax incentives, no market for ethanol would have existed because ethanol was more expensive, and it is less efficient than gasoline.[163]

While ethanol has the potential to help with increasing the fuel demand, on the environmental front, current ethanol production does not fare as well. For example, because most ethanol in the United States is produced from corn, when the overall fuel-cycle is considered, ethanol does not provide much environmental benefit or reduce dependence on oil imports. This results because fossil fuels are used in the fertiliser needed to grow corn and the ethanol plants that process the corn.[164] Furthermore, ethanol production competes with food production so growth of ethanol is limited as worldwide food needs also continue to grow. However, the use

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157 IEA, *Energy Technology for a Sustainable Future: Transport* (IEA Technology Briefs 2004) 10.

158 Hunt, Sawin and Stair, above n 114, 61.

159 Ibid 62.

160 Ibid 61.

161 Brent Yacobucci, *Fuel Ethanol: Background and Public Policy Issues* (CRS Report for Congress, 3 March 2006) CRS-6.

162 Ibid CRS-7.

163 Ibid CRS-10. However, with the current high cost of oil, ethanol is now competitive with gasoline. When oil prices reach US$55/bbl, ethanol is price competitive without subsidies. Hunt, Sawin and Stair, above n 114, 65.

164 Yacobucci, above n 161, CRS-14-CRS-15; Hunt, Sawin and Stair, above n 114, 68-69.

of purer ethanol fuels, such as E85 produced from cellulosic feedstocks,[165] has the potential to reduce fossil fuel energy consumption by approximately 70 per cent.[166] Currently, vehicles that can run on E85 are more expensive than conventional vehicles; the fuel continues to be more expensive than gasoline, and very few refueling stations exist.[167]

For ethanol fuels to make a significant contribution in reducing petroleum dependence and greenhouse gas emissions, investment in ethanol's purer forms, the second-generation fuels, will be required. Because tax incentives have been critical in formation of the ethanol industry, continued use of such subsidies should be tailored to encourage fuels like E85 and the vehicles and infrastructure necessary to make ethanol a 'true' alternative fuel.

## III PROBLEMS AND CHALLENGES

Many barriers face those in the international community seeking to reform the oil economy. Challenges to change existing subsidies and governmental benefits often stem from the political power of special interest groups and the lack of political leadership on the issue. Benefits of subsidies tend to be highly concentrated in the hands of specific groups, while their costs are spread widely across taxpayers (and sometimes consumers).[168] For example, the oil industry tends to get the most support and trade protection.[169] Furthermore, as a politically powerful industry, the petroleum industry has come to expect subsidies, so eliminating them presents difficult political and economic challenges.[170] For example, between 1993 and 1996, the US petroleum industry gave US$10.3 million to political campaigns and received tax subsidies of about US$4 billion.[171]

From an international perspective, nations may fear losing competitiveness if they act while other countries do not.[172] Regional concerns prevent reforms as well, because subsidy reform inevitably entails some interests losing benefits. These problems can be difficult to overcome because demonstrating the economic and environmental costs of subsidies can be difficult. Lack of transparency regarding

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165 Cellulosic materials such as plant stalks and leaves are being used to produce ethanol from non-edible biomass. Research worldwide is focusing on converting waste materials into biofuels. Hunt, Sawin and Stair, above n 114, 67.

166 Yacobucci, above n 161, CRS-15; IEA, *Energy Technologies for a Sustainable Future*, above n 157, 12.

167 Yacobucci, above n 161, CRS-9: In the US, there are only sixty E85 refueling stations in the 10 states along the east and west coasts, where population is higher.

168 OECD, *Environmentally Harmful Subsidies*, above n 107, 60.

169 Ibid 9-10.

170 Ibid 10.

171 Myers and Kent, above n 2, 12.

172 Van Beers and de Moor, above n 122, 72 (discussing lock-in mechanisms and subsidy addiction); OECD, *Environmentally Harmful Subsidies,* above n 107, 10.

the size of subsidies, subsidy beneficiaries, and the economic, environmental and social effects of subsidies contribute to the difficulties in subsidy reform.[173]

Another aspect of economic reform that is difficult to measure, particularly in the international arena, is the effect of cultural and social norms in influencing what laws will get enacted and how individuals and businesses will respond to the changes.[174] For example, successfully addressing climate issues will require great changes on the part of individuals and industry. The magnitude of the change needed will call not only for technological innovation but also a new set of environmental values. Governments that eliminate harmful subsidies and enact policies that are environmentally and economically beneficial can communicate environmental values to its citizens.[175] Changing values, particularly in the industrialised consuming giants, will be critical for long term success.

Difficulties can also stem from technological factors.[176] For example, the US transportation system does not have a ready substitute for gas-powered cars, so subsidy reforms that might cause a dramatic increase in gasoline or vehicle costs would find no government support. Another challenge to reform stems from lack of transparency in many subsidy programs as to their cost, beneficiaries, and impacts.[177] In most countries, environmental regulation is subject to 'regulatory impact assessments' while subsidies, like tax incentives or exemptions are not. As a result, environmental problems associated with subsidies receive little political attention. These difficulties in economic environmental reform have prompted various responses.

The United States experience in formulating environmental policy illustrates the difficulty in reform. To date, the US federal government has declined to participate in the Kyoto Protocol, and done little to formulate a national standard for GHG emissions reductions. In the US, states are filling in the federal regulatory gap by enacting their own sets of GHG emissions regulations and efficiency programs and incentives. These state plans are being challenged by the automotive industry in federal courts.[178] With no clear national policy, US companies are following various paths; some are financing efforts to kill global warming initiatives while others are developing their own set of voluntary emissions initiatives planning for the day when a federal government decides to act.[179]

The Kyoto Protocol may impact US companies with operations abroad, but probably will not prompt companies with domestic operations to reduce GHGs. For

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173 OECD, *Environmentally Harmful Subsidies*, above n 107, 61.
174 Green, above n 146, 409
175 Ibid.
176 OECD, *Environmentally Harmful Subsidies*, above n 107, 10.
177 Ibid.
178 Sarah Kellogg, 'Confronting Global Warming' (2005) 19(9) *Washington Lawyer* 22, 23.
179 Ibid.

US companies with overseas operations in countries under the Kyoto Protocol, they will have to bring these operations into line with new emissions requirements. These companies may also be encouraged to change their technology in their US plants. However, US companies with only US operations, will have little incentive to make changes, 'since those who go first down that path rarely get the credit they deserve or the financial breaks in the long run for taking the risk.'[180]

## IV MODEL FOR CHANGE

With the myriad of obstacles facing any subsidy reform attempts, a multi-faceted approach will provide the best possible opportunities for success. Subsidies, while effective if properly structured, are often inefficient in accomplishing policy objectives. To transform the oil economy, many tools and alternatives are available and will be necessary to meet societal goals. As subsidy reform receives increased attention and the costs associated with fossil fuel use are added to its price, nations and individuals will be more willing to invest in new technologies and renewable energy.

Reforming the oil economy will involve more than reform of fossil fuel subsidies. A comprehensive evaluation of energy policy priorities must accompany subsidy reform initiatives. The OECD suggests evaluating whether replacement policies are necessary to carry out goals developed under old subsidy regimes and whether new policies are needed to deal with climate change and other environmental goals.[181] Governments need to consider potentially competing concerns, such as energy security, employment, regional economic development, energy diversification and environmental considerations, when evaluating subsidy reform.[182] Policy makers should consider coordination with other policy reform initiatives and the budgetary impact of such proposals. The OECD has developed a checklist that will assist governments in identifying subsidies that harm the environment.[183] The checklist is designed to consider the impact of removing these subsidies on consumers and producers. In the OECD's test of the checklist, it concluded that there is significant scope for reducing environmentally harmful subsidies in most sectors.[184]

Requirements for subsidy reform include: diffusion of innovative schemes; better targeting of existing subsidies to improve efficiency and minimise environmental impact; and improved subsidy design for measures targeting alternative energy and energy efficiency. Unlike environmental taxes which generate revenue, subsidies cost money. The level of subsidy needed to encourage the targeted environmental investment can often be substantial initially as new technologies often face significant cost barriers to market entry. As a result, governments may be reluctant

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180 Ibid 26.
181 OECD, *Environmentally Harmful Subsidies*, above n 107, 52
182 Ibid.
183 Ibid 67f.
184 Ibid 8.

to pay large subsidies or they may provide lower subsidies which fail to induce the sought after changes.[185] In addition, designing effective incentives requires information, not only to determine the level of the subsidy, but also about the advantages and disadvantages of different technologies in order to induce individuals and businesses to make the desired choice.[186] On the other hand, individuals often have very little information about environmentally friendly investments, and government incentives can direct consumers towards these new technologies.[187] Furthermore, subsidies have the potential to bring about significant change without initially changing everyone's choices. Individuals lacking information may follow the actions of those they believe have more information. For example, as more people buy hybrid vehicles, others will follow potentially inducing larger scale shifts in behavior.[188] Finally, such government actions send a message to individuals and businesses that environmental problems must be taken seriously.

Realistically, eliminating subsidies to the petroleum industry will also require transitional measures. Fossil fuel use needs to be scaled down while alternative energy technologies are developed, brought to market and integrated into the economy's infrastructure. The international community must work together on these initiatives.[189] International initiatives tend to reduce regional influence of special interest groups.

Political concerns must be addressed and economic opportunities seized. For example, to the extent that changes can precipitate a crisis, reform measures can be enacted with more careful consideration and prevent reactionary rulemaking. Such careful consideration also requires that subsidy mechanisms have increased transparency. For example, in the United States, the tax expenditure budget, which quantifies tax exemptions that deviate from the normative tax base, has highlighted tax provisions that often inure to the benefit of special interest groups.[190]

For a successful transition, governments must also ensure that renewable energy technologies have access to the energy markets.[191] Economic policies, such as pricing laws that guarantee minimum prices for electricity and require utilities to provide renewable technologies access to power grids, are also effective. Quota

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185 Green, above n 146, 426; Susan Gouchoe, Valerie Everette and Rusty Haynes, *Case Studies on the Effectiveness of State Financial Incentives for Renewable Energy* (2002) 33 <http://www.osti.gov/bridge> 28 November 2006.

186 Green, above n 146, 427-8.

187 Ibid 428-9.

188 Ibid 430; Cass Sunstein refers to the phenomena as 'informational cascades': Cass R Sunstein, 'Group Dynamics' (2000) 12 *Cardozo Studies in Law and Literature* 129, 133-4.

189 André de Moor, 'A Recipe for Success: Subsidy Reform Deals to Jump-Start Global Sustainability', *the Courier ACP-EU* (July-August 2002) 44.

190 Joint Committee on Taxation, *Estimate of Federal Tax Expenditures for Fiscal Years 2006-2010* (25 August 2006) 2 (describing the concept of tax expenditures).

191 Prugh, Flavin and Sawin, above n 1, 118.

systems, such as renewable portfolio standards, also guarantee a market for renewable energy.[192]

Another priority to achieve a successful shift in energy requires governments, public interest groups and industry to disseminate information about renewable technologies and available incentives to investors and consumers.[193] When governments include the public in policy-making and project development and ownership, political support and successful project outcomes are increased. Therefore, in developing strategies to reduce oil dependence and increase renewable energy, public participation is critical. Finally, governments must take precautions to prevent inferior products from reaching investors and consumers. For example, industry standards, permit requirements, and building codes can be used to boost confidence in new technologies.[194]

## V CONCLUSION

The challenge of breaking world dependence on oil is formidable, but imperative. The global energy market is complex, making analysis and prediction difficult. The only certainty is that the energy market is unpredictable and that oil prices are high and volatile.[195] Governments' first priority must be economic reform, primarily overhauling subsidy policies away from oil and into renewable energy. The best data on when oil supplies will permanently begin to decline and rising prices will make oil unaffordable suggest an upper limit of about 30 years from now. To replace the world's existing oil infrastructure is estimated to take about 30-40 years and will cost about US$16 trillion.[196] Nations must act now. Globalisation has been built on oil over the last 100 years, but it will take a move away from oil in a much shorter timeframe to achieve sustainable development and social and environmental justice. To date, binding international agreements, such as the Kyoto Protocol, have had limited success. Nations must work harder to achieve international cooperation, including legally binding covenants with enforcement and adjudicative powers. Lastly, in order to succeed in reducing carbon dioxide emissions, the global community must assist developing countries improve living standards and reduce oil's influence on the world's economy.

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192 Several states in the United States have enacted Renewable Portfolio Standards ('RPS') requiring a minimum share of generation or capacity be dedicated to renewable energy. Although advocated by many renewable energy advocates, the US federal government failed to include RPS in its most recent energy legislation. See Nadel, above n 154, 14.

193 Gouchoe, Everette and Haynes, above n 185.

194 Prugh, Flavin and Sawin, above n 1, 118.

195 Cordesman and Al-Rodhan, above n 10, 7.

196 Prugh, Flavin and Sawin, above n 1, 118.