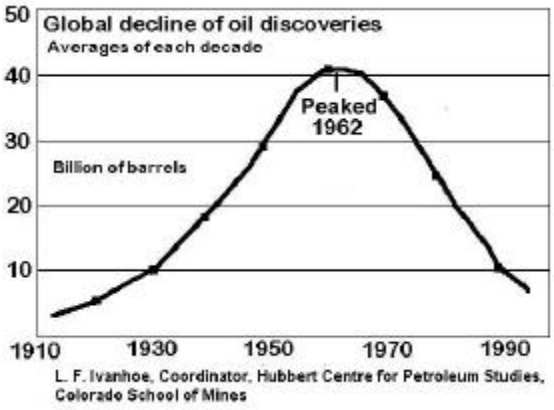
The oil crash and you:

Short explanation	The sources of information
Oil shortages soon **Summary:** This document reveals that within ten years: • Oil extraction from wells will be physically unable to meet global demand (the evidence is from the oil industry itself) • Alternative energy sources like nuclear and natural gas will fall far short of compensating for expected shortages of oil. There is simply not enough time to convert over to them. • Massive disruptions to transportation and the economy are expected around 2010 when the final peak of production of all petroleum liquids (globally) is followed by decline. **Most significant effects:** • Gradual, permanent cut-off of fuel for transport and for industrial machinery. Global trade will greatly decline. • Agriculture (food production) depends heavily on fertilizers and made from oil). • Shortages of 500,000 other goods made from oil. • Therefore, reduction of virtually all business and government activity. **Difficulty of adapting:** A major part of the problem is that existing equipment is designed only for oil fuels. For example, the world's 11,000 airliners cannot run on natural gas, nuclear or coal. **By-products of oil:** Cost and decreasing availability of 500,000 known uses of oil: Fertilisers (farms/food supply), medicines, plastics, insulation, computers, asphalt, inks & toners, paints, glues, solvents, antiseptics, golf balls, CDs trash bags, nail polish, detergents, chewing gum, etc. **Hidden problem:** Not only will the oil supply dwindle, but the shortages and climbing prices will obstruct industry as it attempts to convert society to other forms of energy. **Proof of impending shortages:** Much uninformed literature says oil is plentiful and that better extraction will maintain adequate supply for decades yet. However, this sheet reveals: - misleading reporting of oil inventories, by oil extracting countries. - a clear, forty-year trend of less and less discovery of oil and dwindling outputs from the steadily-emptying wells. **Alternative energy sources will not prevent shortages:** Alternative fuels have been studied. As replacements for oil they are grossly inadequate both in quantity and versatility of use. There is insufficient time to prevent heavy impacts.	
When, and how bad: **Year when global oil supply first fails** to meet global demand: about 2009	**When, and how bad:** **Year when global oil supply first fails** to meet global demand: about 2009. Conventional "easy-to-extract" oil peaks around 2005 but non-conventional will fail about 2009) See International Energy Agency tables at http://208.240.253.224/campbell.htm From Colin J. Campbell and Jean H. Laherrère, at end of 1999. Thay have each worked in the oil industry for more than 40 years. Campbell completing his Ph.D. in geology at the University of Oxford. He worked for Texaco as an exploration geologist and then at Amoco as chief geologist for Ecuador. His decade-long study of global oil-production trends has led to two books and numerous papers.He worked on behalf of Petroconsultants of Geneva, a consultancy whose database is the most comprehensive available for data on oil resources that exists outside of continental North America, and is used as a 'bible' by all international oil companies. The IEA is an international body set up under treaty by OECD including USA to deal specifically with the issue.of oil depletion. A conservative organization, it has however indirectly confirmed Campbell's assessment in its World Energy Outlook 1998. (See "IEA" slide explanation at http://www.hubbertpeak.com/campbell/commons.htm) Laherrère's early work on seismic refraction surveys contributed to the discovery of Africa's largest oil field. At Total, a French oil company, Laherrère supervised exploration techniques worldwide.
Rate of decline of global oil supply: 3% every year from 2009 onward.	**Rate of decline of global oil supply:** from 2009 3% every year (permanently). From an address by Dr. Colin Campbell (see above.) at the British House of Commons on July 7th 1999. Read the address and accompanying PowerPoint slide show at http://www.hubbertpeak.com/campbell/commons.htm

Short explanation	The sources of information
	Also: Dr. William Rees, article in Globe and Mail (Canadian national newspaper), 29 March, 2000 " Several recent studies project world oil production to peak by 2013 or sooner, possibly as soon as 2007. Even the necessarily conservative International Energy Agency in its World Energy Outlook, 1998 concurred for the first time that global output could top out between 2009 and 2012 and decline rapidly thereafter. IEA data project a nearly 20-per-cent shortfall of supply relative to demand by 2020 that will have to be made up of from "unidentified unconventional" sources (i.e.,known oil-sands deposits have already been taken into account)." William E. Rees is an ecological economist and professor in the University of British Columbia's School of Community and Regional Planning.
Duration of decline: Forever. Oil takes millions of years to form, in very special geological conditions.	**Duration of decline:** Forever. Chevron Learning Centre "Geologists generally agree that crude oil was formed over millions of years from the remains of tiny aquatic plants and animals that lived in ancient seas." http://www.chevron.com/explore/science/crude/ Also, "Most North Sea and Middle East Oil was formed 140 million.years ago. Most US Gulf Coast-Mexico-Venezuela 90 million years ago". Dr. Colin Campbell (above), or read about the formation of petroleum at: http://www.hubbertpeak.com/campbell/commons.htm.)
Barrels *consumed* globally per year: more than 22 billion in 1999. (About 2 billion barrels per month)	**Barrels consumed globally per year**: (IEA database, 1999. http://208.240.253.224/campbell.htm Increasing by 1.5% every year. (Campbell http://www.hubbertpeak.com/campbell/commons.htm) "Barrels consuming [you will always run into the problem of what is being measured. Conventional oil only or all liquids] Also with discovery. Excluding deepwater there is long downward trend of discovery to about 6 Gb/a now, save for a spike this year of about 15-20 with the Caspian Kashagan East discovery. With the deepwater (apart from the spike) it is about 11 Gb, with the deepwater trend still rising." (Colin Campbell, private email, June 2000)
Barrels *discovered* globally per year: about 6 billion. (that is, conventional, not including 8 billion of hard-to-get deep sea, oil sand, and other oils.Discovery of oil fluctuates each year, but peaked in the 1960s, and has declined at an average of about 9 billion barrels per year over the past 40 years. We've mostly just been using up huge old oil fields.  **Barrels Discovered Extracted Consumed** **U.S.A.** (15 yr.1977-1991 5 Billion 45 Billion 92 Billion **World** (10yr.1982-91) 91 Billion 221 Billion 221 Billion From http://users.knsi.com/~tbender/ivanhoe.html	**Barrels of new oil *discovered* per year:** 6 billion in 1999, from book: *The Coming Oil Crisis*, p. 52 by Colin Campbell, based on the oil industry's biggest and most respected database. It is described as "The most extensive petroleum database in the world covering E&P contracts, exploratory wells, development drilling, oil and gas fields, geological provinces, geophysical surveys, companies, installations and cultural features". Senior industry geologists' views on Campbell & Laherrere's arguments are summarised in the *Petroleum Review* (Cope 1998). Also, comment by oil depletion researcher, Brian Fleay (refs. below): "There was general acceptance of the substance of their arguments; that the bulk of remaining discovery will be in ever smaller fields within established provinces. But most thought 400 billion barrels might remain to be discovered. However, Campbell points out that it would take 35 years to find their 210 billion barrels at present discovery rates. He says present conventional oil will drive production over the peak - it is too late for these other options to alter the timing of the peak." Fleay was presenting a paper about the coming oil crash at the Chartered Institute of Transport in Australia, National Symposium, Launceston Tasmania 6-7 November 1998.He is **B.J Fleay** B Eng, M Eng Sc, MIEAust, MAWWA Associate of the Institute for Sustainability and Technology Policy Murdoch University, Western Australia The graph and Fleay's paper are at http://wwwistp.murdoch.edu.au/OilFleay/climaxingoil.html#4.2 and Fleay has a Web site at http://www.oilcrisis.com/ showing supporting articles from the Scientific American (March 98), the London Observer (July 98.) "My latest estimate is that there are 151 Gb yet-to-find conventional oil excluding deepwater, polar and NGL" (Colin Campbell, June 2000 in private email.) "Is There a Lot More Undiscovered Oil? 80 per cent of oil being produced today is from fields discovered before 1973. In the 1990's oil discoveries averaged about seven billion barrels of oil a year, only one third of usage. The discovery rate of multi-billion barrel fields has been declining since the 1940's, that of giant (500-million barrel) fields since the 1960's. In 1938, fields with more than 10 million barrels made up 19% of all new discoveries, but by 1948 the proportion had dropped to only 3%. Most oil fields are less than ten million barrels, and ten million barrels will supply the United States with less than a day's worth of energy. Large oil fields make up a disproportionate part of the world's oil supply. The ten largest oil fields contain a fifth of the world's oil reserves; twenty more bring the total to a third. 500 large fields contain two thirds of the world's known oil. The remainder is distributed among 20,000 or more small oil fields. The fact that discoveries of large fields are getting rarer means only one thing: we are running out of new oil to find." From: http://www.uwgb.edu/dutchs/202ovhds/resource.htm Steven Dutch, Professor, College of Environmental Sciences, University of Wisconsin-Green Bay. Resume at http://www.uwgb.edu/dutchs/resume.htm Block graphs of oil field sizes: http://www.uwgb.edu/dutchs/202ovhds/resource.htm **Barrels discovered Extracted Consumed** **U.S.A.** (15 yr.1977-1991 5 Billion 45 Billion 92 Billion **World** (10yr.1982-91) 91 Billion 221 Billion 221 Billion From http://users.knsi.com/~tbender/ivanhoe.html "The US Geological Survey now comes out with absurdly exaggerated claims. They say 724 Gb to be found between 1995-2025. They are already short 100 Gb five years into the study period, but still they say it." Colin Campbell, in private email, June 2000.

Short explanation	The sources of information
Pre-1973-discovered oil in use today: More than 70% of present global supply.	**Pre-1973-discovered oil in use today**: "At least 70% of present global supply was discovered before 1973. These fields are now in terminal decline". Colin Campbell. Also stated as 80% Steven Dutch, Natural and Applied Sciences, University of Wisconsin - Green Bay http://www.uwgb.edu/dutchs/202ovhds/resource.htm
Ratio of oil *consumed* to oil *discovered* each year: Four to one. **Proportion of global energy provided by oil** in developed countries: 40% (1997)	**Ratio of oil consumed to oil discovered** each year. Four to one. Typically six billion barrels discovered, and 23 billion consumed, as indicated above. **Proportion of energy provided by oil** "Oil currently accounts for about 40 percent of world commercial energy supplies" - IEO99, a 1999 report by the US Department of Energy and the International Energy Agency. See: http://www.eia.doe.gov/oiaf/ieo99/oil.html
The "invest more to find it" idea: **Yet-to-be located oil, globally:** After a century of exploration, the earth's geology and oil resources are generally well known. When the fields are emptying, money only helps to scrape out the hard-to-reach remainder. There are 210 billion barrels left to discover and 1000 billion barrels left to extract. This is indicated by the 40 year decline in discovery of oil. No amount of money will create oil that the simply isn't there.	**The "invest more to find it" idea:** **Yet-to-be located oil, globally:** 210 billion barrels left to discover and 1000 billion barrels left to extract. From: http://wwwistp.murdoch.edu.au/OilFleay/04discoverandprodn.html Senior industry geologists' views on Campbell & Laherrere's arguments are summarised in the *Petroleum Review* (Cope 1998). There was general acceptance of the substance of their arguments; that the bulk of remaining discovery will be in ever smaller fields within established provinces. Although most geologists thought 400 billion barrels might remain to be discovered, Campbell points out that it would take 35 years to find their 210 billion barrels at present discovery rates. He says present conventional oil (i.e. easy, not heavy oil, or deep water oil) will drive production over the peak. Then oil scarcity will make the mining of those other options prohibitively energy-costly, and the actual global oil peak date will therefore not be delayed by them). After a century of exploration, the earth's geology and oil resources are generally well known. This is indicated by the 40 year decline in discovery of oil. No amount of money will create oil that the planet does not contain. Forecasts that ignore the influence of oil scarcity on extraction: "For many years geologists and oil companies have published estimates of the total amount of crude oil that will ultimately be recovered from the earth over all time. Remarkably, these assessments of Estimated Ultimately Recoverable (EUR) oil have varied little over the past half century. [Figure 9 lists 41 estimates dating from the early 1950s]. For the past 25 years, with only two exceptions, estimates have ranged from around 1800 billion barrels to around 2400 billion barrels. David Woodward, General Manager of the Abu Dhabi Company for Onshore Oil Operations, also analyzed 40 estimates of ultimately recoverable oil, all published between 1975 and 1993. According to Woodward, "there is a fair degree of consistency among the estimates, with the average value being 2000 billion bbl [barrels] and most [70 percent] falling in the range of 2000 to 2400 billion bbl." " World Resources Institute: http://www.wri.org/wri/climate/finitoil/eur-oil.html
Number of oil wells already in world/USA: More than 500,000. In USA, 80% of the wells now produce less than three barrels a day.	**Number of oil wells in USA, elsewhere:** "By the end of the 19th century there were about 600,000 oil wells in more than 100 countries." The Maguire Energy Institute, at: http://maguireenergy.cox.smu.edu/resources/learning/LCCh12.html "Currently, the U.S. has approximately 600,000 oil wells in operation. Nearly 500,000 of those wells produce less than three barrels a day" from The (US Government) International Trade Resource Center at: http://www.itds.treas.gov/ITDS/ITTA/oilprofile.htm
Percentage of oil recovered from a typical oil well: 20% to 60% . It relates primarily to the density of the oil. You get less from a heavy oil than a light one because it sticks in the reservoir.	Most fields only yield about c, while the best achieve 60%. Brian Fleay http://wwwistp.murdoch.edu.au/OilFleay/climaxingoil.html Brian Fleay BJ Fleay B Eng, M Eng Sc, MIEAust, MAWWA Associate of the Institute for Sustainability and Technology Policy Murdoch University, Western Australia, presenting paper at the: Chartered Institute of Transport in Australia, National Symposium, Launceston Tasmania 6-7 November 1998. Fleay is a retired civil engineer who worked for over 30 years at the Water Authority of W. Australia. He is currently an associate of Murdock University's Institute of Science & Technology Policy and convenor of the Economic Policy Working Group for the Greens WA "Percentage recovery 20-60%. It relates primarily to the density of the oil. You get less from a heavy oil than a light one because it sticks in the reservoir." (Colin Campbell, private email, June 2000.)
"Technology will solve it" idea **Challenge to technology:** To compensate for the expected 3% oil decline (at even today's 22 billion barrels a year), create and install, by year 2009, permanent supplies of portable energy, equivalent to 660 million barrels of oil a year. Then as oil keeps declining forever, increase this new energy it until it replaces 40% of the world's energy supply (22 billion barrels a year) OR… reduce energy demand equivalently as the global population increases by almost a quarter million people every day.	**"Technology will solve it" idea** **Challenge to technology:** (See earlier statements about decline of global oil supply, and increasing global demand for oil.) Population: "Each year, about 81 million people are added to the world's population -- the equivalent of adding a country the size of the United States every three years or one the size of India every ten years. And demographers expect the world's population to continue to grow for at least the next 50 to 100 years.".Union Of Concerned Scientists, at http://www.ucsusa.org/resources/pop.faq.html#1
The "better efficiency" idea Increases in efficiency usually fail to reduce consumption (e.g. more m.p.g. causes people to just travel more and buy two cars) unless the users are personally determined to reduce their consumption.	**The "better efficiency" idea** *Why Energy Conservation Fails* by Herbert Inhaber, 1997. http://info.greenwood.com/books/1567201/1567201202.html

Short explanation	The sources of information
What about nuclear power? Nuclear is **currently being abandoned globally:** (IEA 1999). Its ability to soften the oil crash is very problematic: - Past **accidents**. Risk of more, and **terrorism**. - **Many more reactors would be needed.** Tons of radioactive materials to **transport through populations** - Nuclear **waste disposal** still the major, unresolved problem, especially **breeder reactors producing plutonium** a nuclear weapon/terrorist raw material, half-life contamination is 24,000 years. All abandoned reactors are radioactive for decades or millenia. - **Nuclear is not directly suitable for aircraft and vehicles**, and adapting nuclear to make hydrogen or other fuels would be a huge. - **Nuclear fusion** is still not available, after 40 years' research and billions of dollars invested.	**What about nuclear power?** "Nuclear electricity generation remains flat in the IEO99 reference case, representing a declining share of the world's total electricity consumption. Net reductions in nuclear capacity are projected for most industrialized nations." http://www.eia.doe.gov/oiaf/ieo99/nuclear.html Nuclear's ability to soften the oil crash is very problematic. "The United Nations Development Programme (UNDP), in its document Energy After Rio (Ref 2) does not suggest a role for nuclear power except in the most doubtful of terms. The Swedish parliament's February 1997 law beginning the phaseout of nuclear power is entitled Government Bill on a Sustainable Energy Supply." (From the Uranium Institute's, International Symposium,1997. They try also to defend nuclear energy there.) http://www.uilondon.org/sym/1997/bourd.htm Nuclear **waste disposal** is the major, still unresolved problem, especially **breeder reactors producing plutonium** a nuclear weapon/terrorist raw material, **contaminating for 24,000 years** ABC News, Feb 1999: "…nearly 40,000 tons of highly radioactive used reactor fuel now http://www.abcnews.go.com/sections/science/DailyNews/yuccawaste990225.html **Half-Life of Plutonium-239**: The Physics Factbook © 1998-2000 by Glenn Elert http://hypertextbook.com/facts/JaniceChing.shtml **Abandoned reactor**: "Megadose of Radioactivity. Although it no longer contains its uranium fuel, the Trojan reactor vessel contains 15 times as much radioactivity as those objects, according to state officials. It was shut down in 1993, two decades earlier than planned, after a series of problems including a faulty safety system that drew federal fines, an accidental release of radioactive gases and cracked steam tubes.Nearly 800 spent but highly radioactive uranium fuel rod assemblies removed from the reactor over the years remain in storage at the Trojan site. http://www.abcnews.go.com/sections/science/DailyNews/reactor990808.html **Past accidents**. Risk of more, and terrorism.(over 360 accidents at: http://www.greenpeace.org/~comms/nukes/chernob/rep02.html) **Many more reactors would be needed.** Tons of radioactive materials would be transported through populated areas: Dean Edwin Abrahamson *The Challenge of Global Warming*, http://www.islandpress.org/books/Detail.tpl?cart=30593902472653&SKU=0-933280-86-6 p. 27 says: "The nuclear weapons proliferation risk which would accompany the replacement of fossil fuel with nuclear fission is staggering ….[That] would require between 7,000 and 8,000 large nuclear power plants, each of which [if breeders] would produce about 1,000 kg. of plutonium annually. Between 7 and 98 million kg of plutonium would therefore be produced per year and would be shipped hither and yon between the various facilities which constitute the nuclear power fuel cycle. The commercialization of plutonium would create major hazards because of its incredible toxicity and its potential use in weapons…A typical shipment would contain 250 kg – so there would be about 40,000 shipments annually. About 10 kg. of plutonium is needed t construct an atomic bomb." **Nuclear is not directly suitable for aircraft and vehicles**, and adapting nuclear to make hydrogen or other fuels would be a huge.project. **Nuclear fusion** is still not available, after 40 years' research and billions of dollars invested. Magnetic Confinement Fusion spending: http://plasma.ep.wisc.edu/ufa/News/enews_021499.html "On Feb. 1, the Department of Energy released it's proposed **budget** for FY 2000. Overall, DOE's budget is proposed to go from $17.4 billion in FY 99 to $18.1 billion in FY 2000. DOE's Office of Science (the new home of the Fusion Energy Science program) is proposed to go from $2.698 billion in FY 1999 to $2.835 billion in FY 2000 - a $137 million increase.". **Fusion history**: Extrapolating from STARPOWER the claim that tokamak hot fusion has been ongoing since 1950 with never any beneficial surprises along the way and having spent 25 billion dollars worldwide. The laser inertial confinement fusion program has been ongoing since 1970 with never any beneficial surprises along the way and having spent 10 billion dollars worldwide. . http://www.newphys.se/elektromagnum/physics/LudwigPlutonium/File135.html **Fusion prospects**: Richard E. Rowberg, Resources, Science, and Industry Division April 6, 2000: The National Council For Science And The Environment cnie@cnie.org and http://www.cnie.org/nle/eng-22.html Brief for Congress: "Successful development of a fusion power plant, however, is proving to be one of the most difficult scientific and technological challenges. Although progress has been steady, it may be at least 35 to 50 years before an operating power plant is built."

Short explanation	The sources of information
Natural gas **Proportion of global energy provided by gas:** 20% of global energy supply (1997). **As a replacement for oil:** Gas itself will start running out from 2020 on. Demand for natural gas in North America is already outstripping supply, especially as power utilities take the remaining gas to generate electricity. Gas is not suited for existing jet aircraft, ships, vehicles, and equipment for agriculture and other products. Conversion consumes large amounts of energy as well as money. Natural gas also does not provide the huge array of chemical by-products that we are also dependent on.	**Natural gas** **Proportion of global energy provided by gas** IEO99, a 1999 report by the US Department of Energy and the International Energy Agency. See: http://www.eia.doe.gov/oiaf/ieo99/oil.html **As a replacement for oil:** Gas also will start running out from 2020 on. Demand for natural gas in Nth America outstripping supply, especially as power utilities take the remaining gas to generate electricity. Gas is not suited for existing jet aircraft, ship, vehicles, and equipment for agriculture and other products. "In late 1987 Toledo was the first government entity in the State of Ohio (and one of the first cities nationally) to implement a consortium use of transport natural gas resulting in additional savings of $200,000 to $300,000 annually." http://www.climate.org/programs/cities/sec2/Toledo.html.. Gulf News Online, 29 May, 2000: Economides: US gas price spikes expected "US natural gas prices "definitely" will climb to $4/Mcf this fall, with world oil prices escalating to $40/bbl probably within a year, unless producers dramatically increase spending to offset depletion and to supply growing demand, a University of Houston professor told reporters at the Offshore Technology Conference Monday in Houston. But that's nothing compared with what will happen when the real gas Shortage hits North America within 2 or 3 years, says Michael J. Economides, coauthor of "The Color of Oil," a book about the economics of the oil and gas industry." http://www.gulf-news.co.ae/16052000/BUSINESS/business16.htm Canada: "Production per new well in the western basin has slipped from a 1986 peak, and decline rates are up. As a result, Canada will have excess pipeline capacity of about 1.5 to 2 billion cubic feet per day this year and will be "long" pipe until 2005, Mr. Frank predicts. TransCanada faces "significant" capacity turnback in 2002 and 2003, he says." (Brian Frank, vice president BP Amoco Gas & Power Canada at The North American Gas Strategies Conference Monday, April 17, 2000) http://news.ft.com/ft/gx.cgi/ftc?pagename=View&c=Article&cid=FT3PN4PC67C&live=true&tagid=ZZZGEKAOD0C&Co Colin Campbell, May 2000 in private email: "Problem with gas is that it has a different depletion profile with a long plateau defined by market and pipeline. When the plateau ends it ends abruptly. I think the US is now on the edge of this cliff." "Gas will peak in 2020" Colin Campbell, private email June 2000. Brian Fleay, at http://www.hubbertpeak.com/gas/ "The two largest resources not yet in production are in the Sahara and Niger Delta. It can be supposed that gas pipelines will be built soon from the Middle East to Europe and the Indian subcontinent, so that production will rise in steps as the linkages are made. If one assumes a 1% increase over the next 5 years followed by a 4% increase thereafter as oil becomes expensive, the midpoint of depletion (more or less the gas "Hubbert Peak") would come around 2018 at about 120 Tcf/annum Gas reserves are much more difficult to assess than oil, and much more susceptible to economic factors, the most important of which is transport (pipelines/LNG). The USA is more depleted than anywhere else. Any proposal to use natural gas as the primary substitute for oil in the transportation sector represents at best a temporary solution, and at worst a distraction of human industrial resources (consuming time and capital, while oil and gas remain economic, to produce a fleet which will then soon become obsolete, rather than using the remaining economic reserves to create a lasting solution), as well as a waste of natural resources of great potential value to future generations." Brian J. Fleay: B Eng, M Eng Sc, MIEAust, MAWWA, Associate of the Institute for Sustainability and Technology Policy, Murdoch University, Western Australia, presenting paper at the: Chartered Institute of Transport in Australia, National Symposium, Launceston Tasmania 6-7 November 1998. Fleay is a retired civil engineer who worked for over 30 years at the Water Authority of Western Australia. He is currently an associate of Murdock University's Institute of Science and Technology Policy and convenor of the Economic Policy Working Group for the Greens WA.

Short explanation	The sources of information
Hydro-electric **Present use:** 2.3% of global energy supply (1997). http://www.eia.doe.gov/oiaf/ieo99/oil.html **As a replacement for oil:** Very small compared with 40% provided at present by oil. Unsuitable for aircraft and present 722 million existing vehicles.	**Hydro-electric** **Present use:** 2.3% of global energy supply (1997). http://www.eia.doe.gov/oiaf/ieo99/oil.html **As a replacement for oil:** Very small compared with 40% provided at present by oil. Unsuitable for aircraft and present 722 million existing vehicles. Electricity Not an Adequate Substitute for oil. It is important to note that the end product of many alternative energy sources such as nuclear, hydro-electric power, wind, solar, geothermal, and tides is electricity, which is not a replacement for oil and natural gas in their important roles as raw material for a host of products ranging from paints and plastics, to medicines, and inks. But probably the most vital of all uses is to make the chemicals which are the basis for modern agriculture. Electricity is no substitute. Walter Youngquist, Consulting Geologist http://www.ecotopia.com/apollo2/ The world vehicle fleet is assessed at 730 million vehicles: (Donella Meadows, adjunct professor, Dartmouth College, and director of the Sustainability Institute in Hartland, Vermont, speaking on Earth Day, 2000) http://www.overpopulation.org/whyPopMatters.html
Coal **Current global use:** 24% of global energy supply. **As a replacement for oil:** Is 50% to 200% heavier than oil per energy unit. Bulky and dirty. Would require expansion of coal mining, leading to land ruin and increase in greenhouse gas emissions. Hard to fine-control the rate of burn (oil/gas is easy), therefore is used in power stations to make electricity, wasting half of its energy content. A single station can produce a million tons of solid waste each year. Present coal-mining machinery and transportation does runs not on coal, but runs on oil-based fuels. Burning coal in homes pollutes air with acrid smog containing acid gases and particles. **Large pollution & environmental problems:** (Smog, greenhouse gases, and acid rain). Wastes 1 unit of energy to produce 8 units. **Liquid fuels from coal:** Major pollution, very inefficient, and huge amounts of water required.	**Coal** **Current global use:** 24% of global energy supply. http://www.eia.doe.gov/oiaf/ieo99/oil.html **As a replacement for oil:** About 50% to 200% heavier than oil per energy unit: Dr. Thomas Meyer - Professor of Physics and Computer Science , California State University, in class notes. **Liquid fuels from coal:** It has large pollution and environmental problems, an EPR of less than eight, [consumes one unit of energy to produce eight] and would require a massive expansion of coal mining to replace oil leading to a dramatic increase in greenhouse gas emissions. "Conventional oil rapidly displaced the direct use of coal as an industrial and transport fuel because of its ease of storage and transport, the fine control possible in its various uses and its high power-weight ratio. Oil is the most economically effective of all the fuels, especially for transport. Contemporary industries and services using coal, gas and electricity require petroleum powered transport to be economically effective and viable. The availability of cheap oil is the most critical factor for the future of our contemporary world. Not all fuel types are economically equivalent. For the USA oil and gas produce 1.3 to 2.45 times the dollar value in the economy than does the direct use of coal, with oil probably superior to gas (Hall et al. 1986, p. 55). Coal converted to electricity produces 2.6 to 14.3 times the dollar value in the US economy than does the direct use of coal (Gever et al. 1991, p. 269). That is why we burn coal in power stations to produce electricity even though half the heat energy is wasted to the environment." http://wwwistp.murdoch.edu.au/OilFleay/07alternatives.html **Large pollution & environmental problems:** http://wwwistp.murdoch.edu.au/OilFleay/climaxingoil.html#4.2 Coal burning produces a great deal of solid waste (5-20%) of original volume. A single coal-fired electric plant can produce >1 million tons of solid waste a year. (100 X 100 x 100 m) http://www.mines.utah.edu/~wmep/LE_136/Lectureout/LE13609.html "…coal-fired generating stations are major sources of the particulates and ozone that make up smog, acid rain, greenhouse gases and persistent toxins such as mercury. The Ministry of Environment has indicated that the current levels of particulates in Ontario's air are associated with 1800 premature deaths and 1400 cardiac and respiratory hospital admissions in Ontario each year." Dr. Sheela V. Basrur, Medical Officer of Health, City of Toronto http://www.city.toronto.on.ca/legdocs/1999/agendas/committees/hl/hl990406/it002.htm "Particulates penetrate deep into lungs. Prolonged inhalation causes a range of respiratory and cardiovascular problems, such as emphysema, asthma, bronchitis, lung cancer, and heart disease." Seth Dunn, research associate at the Worldwatch Institute. http://www.wvhighlands.org/VoiceSep99/CoalPartI.WW.Sept99Voice.htm "Coal-burning power plants are a major source of carbon dioxide, a greenhouse gas, and are the leading cause of acid rain. Coal-burning power plants have a Clean Air Act incentive to clean up their act. Taxpayers should not be funding a $2.4 billion Clean Coal program or additional coal research and development programs" http://www.house.gov/science/aurilio_4-9.html at House Science Subcommittee On Energy And Environment, April 9, 1997 **Liquid fuels from coal:** Steve Morningthunder Instituto de Física, Universidad Nacional Autónoma de México quoting "Energy Strategies: Toward a Solar Future"; Union of Concerned Scientists, 1980; Ballinger; Cambridge, Mass. pg 10 & 75. http://208.240.253.224/page143.htm

Short explanation	The sources of information
Solar and wind **Global solar use:** About 0.006% of global energy supply. Energy varies constantly with weather or day/night. Not storable or portable energy like oil or natural gas, so unsuited for present vehicles and industry. Batteries bulky, expensive, wear out in 5-10 years. Photovoltaic solar equipment (US$4/watt) are about 15% efficient, giving about 100 watts of the 1 kW per square metre exposed to bright sunshine (enough for one light bulb). A typical solar water panel array can deliver 50% to 85% of a home's hot water though. Using some of our precious remaining crude oil as fuel for manufacturing solar & wind equipment may be wise. **Global wind power use:** 0.07% of 1990 global energy supply. As with solar, energy varies greatly with weather, and is not portable or storable like oil and gas. Each wind turbine from Denmark produced of 698 kW averaged over a year.	**Solar and wind** "This surge in solar sales comes as current data shows solar energy makes up less than one percent of global power supplies. Presently, about 800 megawatts of solar power capacity is in place globally, enough to meet yearly energy needs for 200,000 U.S. homes." WorldWatch Institute, July 1998 http://www.worldwatch.org/alerts/pr98716.html "The new wind turbines added in 1998 have pushed overall wind generating capacity worldwide to 9,600 megawatts at the end of this year--double the capacity in place three years earlier….These wind turbines will generate roughly 21 billion kilowatt-hours of electricity in 1999--enough for 3.5 million suburban homes. Wind power is now the world's fastest growing energy source.." http://www.worldwatch.org/alerts/pr98716.html Total global energy use: 13.7 terrawatts in 1990 (terrawatt is a million megawatts. Paul R.Ehrlich and Anne H. Ehrlich http://www.npg.org/forums/ehrlich.htm Paul Ehrlich is Professor of Population Studies, Stanford University, Anne Howland Ehrlich is a senior research associate in biology and associate director of the Center for Conservation Biology at Stanford. Photovoltaic solar panels: US$4 per watt, average wholesale price for solar module in 1995. Profs.Stefan K. Estreicher and Mark Holtz http://jupiter.phys.ttu.edu/corner/1998/jan98.html Solar water heaters: Florida Solar Energy Centre: http://www.fsec.ucf.edu/Solar/APPS/SDHW/EN5.HTM Cumulative generating capacity worldwide topped 10000 Megawatts (MW) in 1998. Manufacturers installed more than 2400 MW of wind-generating capacity worldwide last year and expect to install another 2000 MW in 1999. Investment in wind generating capacity exceeded US$3 billion in 1998 for the first time. http://www.chelseagreen.com/Wind/articles/Overview.htm Average size of wind turbine in 1998 from Denmark Wind Turbine Manufacturers Association: 698 kW. http://www.windpower.dk/stat/tab03.htm
Hydrogen **Current global use:** US (only) 1998 consumption is 0.01% of energy supply. **As a replacement for oil:** Hydrogen is currently manufactured from methane gas. It takes more energy to create it than the hydrogen actually provides. It is therefore an energy "carrier" not a source. Liquid hydrogen occupies four to eleven times the bulk of equivalent gasoline or diesel. Existing vehicles and aircraft and existing distribution systems are not suited to it. Solar hydrogen might be an option in hot countries.	**Hydrogen** Current global use: 23 billion cu. ft a day in 1998.(Was quoted at the news site http://buscom.com/editors/RC-219.html) Conversion calculator at http://www.hionsolar.com/n-heq1.html (1 cu. ft = 0.0000466 barrrel of crude oil.) **As a replacement for oil:** Existing vehicles and aircraft and existing distribution systems are not suited to it. "Hydrogen , while very abundant on earth , almost never exists as a free gas, so other hydrogen compounds need to be treated in order to make hydrogen gas. Currently the treatment of methane with steam is used to produce the hydrogen gas *(CH*4 (g) + H2O = 3H2 (g) + CO (g)) (Zumdahl,1997) but this reaction requires a lot of energy to make the hydrogen gas . It is currently more economical to simply burn the methane instead of using it to get the hydrogen used for fuel. In addition, this method of achieving hydrogen endorses a reliance upon natural gas as well as producing Carbon Monoxide as a byproduct." http://darwin.bio.uci.edu/~sustain/global/sensem/Forrest98.htm Liquid hydrogen occupies eleven times the space of equivalent gasoline or diesel: http://www.energy.ca.gov/afvs/vehicles.html#500 David Pimental states on pg 212 of Food, Energy, and Society, revised edition "that the volume of hydrogen fuel is about 4 times greater for the same energy content of gasoline (8000 kcal/liter versus 2030 kcal/liter)." Also, "A 15 gallon automobile gasoline tank contains 90 pounds of gasoline. The corresponding hydrogen tank would be 60 gallons, but the hydrogen would weigh only 34 pounds." http://www-formal.stanford.edu/pub/jmc/progress/hydrogen.html
Other sources of energy **Options:** Shale, tar sand, coalbed methane, ethanol, biomass (from vegetation), etc. **Effectiveness as replacements for oil:** Huge investment in research and infrastructure to exploit them, plus large amounts of now-expiring oil supply. 6% of US gas is from non-conventional generation. The major problem is that they cannot be exploited before the oil shocks cripple attempts to bring them on line, and the rate of extraction is far too slow to meet the huge global energy demand.	**Other sources of energy** **Options:** Shale, tar sand, coalbed methane, ethanol, biomass (from vegetation), etc. **Effectiveness as replacements for oil**: Huge investment in research and infrastructure to exploit them, plus large amounts of now-expiring oil supply. 6% of US gas is from non-conventional generation. The major problem is that they cannot be exploited before the oil shocks cripple attempts to bring them on line, and the rate of extraction is far too slow to meet the huge global energy demand.. Example, Canadian oil sands: "I think the problem with extracting tar sands etc is not exactly economics. It is just such a very slow process so it cannot deliver nearly enough to compensate. Canada would be black with dump trucks." (Colin Campbell, June 2000 in private email.) Also, http://hubbert.mines.edu : Shale Oil - The Elusive Energy by Walter L. Youngquist. There is no oil in so-called shale oil. The organic material is a precursor to oil and is short of hydrogen. After hundreds of millions of dollars attempting to exploit shale, thirteen companies, including big oil corporations, have given up their shale interests.

Short explanation	The sources of information

How it will affect us

Food production & delivery depends on oil

Grain production: Food grains now contain between 4 and 10 calories of fossil fuel for every 1 calorie of solar energy. Four percent of US energy budget is used to grow food, while 10 to 13 percent is needed to put it onto our plates. The worsening oil shortages will make production increasingly expensive. Putting food production closer to city consumers will be vital.
Percentage of US grain used to feed cattle: 70%
Efficiency: Meat feeds 1/5 as many people as the grain could.
Number of cats & dogs in USA: 112 million
Food given to pets: The North American pet food and supply industry is worth $30 billion annually, and growing.
"Future food" being consumed by using gasoline in vehicles: Gasoline consumed 'now' will deprive future agriculture of energy for producing food. Below are examples of how much "future food" a 30 mile-per-gallon vehicle is "eating" now. Also shown is the heavy physical labour humans will have to do in future when gasoline is unavailable for farm/industrial/office/home machinery:
Bread, 1 kg loaf = 6 miles= one slice per 422 yards
That gasoline = human heavy farm labour for 23 hrs
Beef, 1 kg = consumed by driving 76.2 miles
That gasoline = human heavy farm labour 300 hrs
Canned corn 1 kg= consumed by driving 5.4 miles
That gasoline = human heavy farm labour 20 hrs

Oil for transportation

Automobiles, globally: 800 million
Automobiles, USA: 132 million (1997)
Trucks (all types, in USA): 1.5 million
Buses: (all types, in USA): 654,000, in 1974.
Locomotives: (USA) 26,000
World aircraft fleet: 11,000 aircraft more than 100 passengers. All of these are designed for oil-based fuel
World shipping: 85,000 ships in world.
Decked fishing boats in the world: 1.2 million
Globalization: Will end because of fuel costs & scarcity.
.

How it will affect us

Food production & delivery depends on oil

Grain production: "Food grains produced with modern, high-yield methods (including packaging and delivery) now contain between four and ten calories of fossil fuel for every calorie of solar energy. It has been estimated that about four percent of the nation's energy budget is used to grow food, while about 10 to 13 percent is needed to put it on our plates. In other words, a staggering total of 17 percent of America's energy budget is consumed by agriculture! " p. 172, BEYOND OIL, Gever et al.; Univ. Pr. Colorado 1991.
Percentage of grain consumed by cattle: 70% (U.S. Department of Agriculture Economic Research Service) A given quantity of grain eaten directly will feed 5 times as many people as it will if it is first fed to livestock and then is eaten indirectly by humans in the form of livestock products (M.E. Ensminger, PH.D., internationally recognized animal agriculture specialist) http://www.mcspotlight.org/media/reports/beyond.html#5
"If the fertilizers, partial irrigation [in part provided by oil energy], and pesticides were withdrawn, corn yields, for example, would drop from 130 bushels per acre to about 30 bushels.": http://dieoff.com/page185.htm Note, that drastic drop would only affect a minority of US agriculture: http://dieoff.org/page40.htm states:" In the United States, surface water supplies about 60% of the water used in irrigation, with the remainder coming from ground water supplies."
Number of cats & dogs in USA: 112 million http://www.avma.org/pubinfo/pidemosb.htm
Food given to pets: The North American pet food and supply industry is worth $30 billion annually http://canada.internet.com/can-news/article/0,1087,141_24611,00.html
Future food being consumed by using gasoline in vehicles:
Number of miles a 30 m.p.g vehicle drives to consume 1 kg of foods:
Bread, 1 Kg = 6 miles = is one slice per 422 yards
Equivalent to human doing heavy labour 1 hour
Beef, 1 Kg = consumed by driving 76.2 miles
Equivalent to human doing heavy labour 300 hrs
Canned corn = consumed by driving 5.4 miles
Equivalent to human doing heavy labour 20 hrs
Based on data of David Pimentel, College of Agriculture and Life Sciences and Division of Nutritional Sciences, Cornelll University, Ithaca, New York, USA, in his book "Food, Energy http://www.unu.edu/unupress/food/8F072e/8F072E06.htm This data was calculated by Steve Morningthunder (of Instituto de Física, Universidad Nacional Autónoma de México) as follows:
30 mpg = 12.66 kms per liter @ 1.6 km per mile. Human can work at rate of 0.075 kW
Automobile is 20% efficient in converting gasoline heat energy into mechanical work..
Gals gasoline equivalent per kg beef = 2.54, bread=0.20 gal/kg, canned corn=0.18 gal/kg
2.54 * 30mpg =76.2 **miles per kg** beef, bread=6 miles/kg, canned corn=5.4 miles/kg
1000 g per kg / 76.2 = 13.12 **g per mile** beef, bread=166.7g/mile, canned corn=185.2g/mile
76.2 * 1.6 = 122 **km per kg** beef, bread=9.6 km/kg, canned corn=8.64km/kg
1000 gms per kg/ 122 = 8.2 **g per km** beef, bread=104 g/km, canned corn=115 g/km
117.3 hours human sweat labour per gallon/30 mph = 3.91/1.6=244 **sweat hrs/km.**
Human sweat hours/kg is therefore 122 km/kg*244=298, bread=23 hrs, canned corn=20hrs

Oil for transportation

Automobiles, globally: "During the past three decades the annual growth rate in the world vehicle fleet has been 3%, leading to a total of nearly 800 million vehicles in 1995" World Health Organization (1997) *Health and Environment in Sustainable Development*, p. 75
Automobiles, USA: 132 million in USA 1997:
http://www.fhwa.dot.gov/ohim/hs98/tables/mv1.pdf
Buses: Of the total bus population of 654 ,000 vehicles in 1994, 71 percent were school buses, 24 percent were transit buses, and 5 percent were intercity buses
http://www.ota.fhwa.dot.gov/hcas/final/two.htm
Trains: "Today the nation's railroads employ 192,000 people who maintain and operate just under 200,000 miles of track. 26,000 locomotives pull 1.6 million freight and passenger cars." California State Railroad Museum http://www.csrmf.org/history.html
Trucks (all types) in USA 1997, 77 million:
http://www.fhwa.dot.gov/ohim/hs98/tables/mv9.pdf
World aircraft fleet: "The number of aircraft in the world designed for scheduled and charter traffic, with space for more than 100 passengers, currently totals some 11,000.":
http://www.ctt.se/Company_overview/Market/market.htm
World shipping: 85,000 ships in the world. David Aldwinckle, manager of Lloyd's Register Ship Emergency Response Service, March 1999. http://www.lr.org/news/pr/9917.html
"Between 1970 and '92, the last year for which figures are available, the number of decked fishing boats in the world doubled, from 581,000 to 1.2 million." Pulitzer Prize winner writer, John McQuaid. http://www.pulitzer.org/year/1997/public-service/works/1-2/
World War 2 Rationing described at
http://www.batavia.k12.il.us/bps/HistWeb/TXTIMG/96prjcts/ww2bat/reports/hmfront/rationin/hoke2.htm
Aircraft fuel capacity and range figures. For a 777-300 the capacity is 45,220 gallons (US), the range is 5,960 nautical miles, with up to 550 passengers. Boeing web site for the 777 is:
http://www.boeing.com/commercial/777-300/product.html

Short explanation	The sources of information
Oil for industry **Industry, example: Construction industry example**: Energy to build an energy-efficient home is equivalent to 6,500 gallons of gasoline. **Number of by-products of oil:** Over 500,000 including fertilisers (they are the most vital), medicines, lubricants, plastics (computers, phones, shower curtains, disposables, toys, etc.), asphalt (roading and roofs), insulation, glues/paints/ caulking, rubber tires and boots, carpets, synthetic fabrics/clothing, stockings, insect repellent..	**Oil for industry** **Industry, example**: **Construction industry example**: Energy to build an energy-efficient home is equivalent to 6,500 gallons of gasoline. The total life cycle energy of an Energy Efficient Home is 5,653 GJ (equal to 927 barrels of oil). Raw material extraction & production & construction (pre-use) phase energy is 905 GJ (16.0%), use phase energy is 4,714 GJ (83.4%) and end-of-life phase energy is 34 GJ (0.6%). EEH life cycle energy consumption is 9,802 GJ less than the Standard Home, which is a reduction of 63% (or 1,598 barrels of oil). Figure 3-7 graphically illustrates the percentage of pre-use, use, and end-of-life phase energy in both SH and EEH. http://www.umich.edu/~nppcpub/research/lcahome/homelca3.html A GJ is a Gigajoule, and is equivalent to 7.28 gallons of gasoline (Conversions calculator at http://www.hionsolar.com/n-heq1.html) **By-products of oil:** "It is important to note that the end product of many alternative energy sources such as nuclear, hydro-electric power, wind, solar, geothermal, and tides is electricity, which is not a replacement for oil and natural gas in their important roles as raw material for a host of products ranging from paints and plastics, to medicines, and inks. But probably the most vital of all uses is to make the chemicals which are the basis for modern agriculture.." Walter Youngquist, Consulting Geologist http://hv.greenspun.com/bboard/q-and-a-fetch-msg.tcl?msg_id=003rfc "Most people have no idea of the tremendous number of common items produced from crude oil. Many people associate gasoline or diesel fuel with crude oil, but not the huge number of products that are used everyday. The items produced from crude oil are astounding and number in the thousands. Scientists have identified at least 500,000 different uses of oil." Examples: Saccharine, artificial sweetener) roofing paper aspirin hair coloring heart valves crayons parachutes telephones bras transparent tape antiseptics purses deodorant panty hose air conditioners shower curtains shoes volleyballs electrician's tape floor wax lipstick sweaters running shoes bubble gum car bodies tires house paint hair dryers guitar strings pens ammonia eyeglasses contacts life jackets insect repellent fertilizers hair coloring movie film ice chests loudspeakers basketballs footballs combs/brushes linoleum fishing rods rubber boots water pipes vitamin capsules motorcycle helmets fishing lures petroleum jelly lip balm antihistamines golf balls dice insulation glycerin typewriter/computer ribbons trash bags rubber cement cold cream umbrellas ink of all types wax paper paint brushes hearing aids compact discs mops bandages artificial turf cameras glue shoe polish caulking tape recorders stereos plywood adhesives TV cabinets toilet seats car batteries candles refrigerator seals carpet cortisone vaporizers solvents nail polish denture adhesives balloons boats dresses shirts (non-cotton) perfumes toothpaste roller-skate wheels plastic forks tennis rackets hair curlers plastic cups electric blankets oil filters floor wax ping pong paddles cassette tapes dishwashing liquid water skis upholstery chewing gum thermos bottles plastic chairs transparencies plastic wrap rubber bands computers gasoline diesel fuel kerosene heating oil asphalt motor oil jet fuel marine diesel butane " Dr. Gary L. Stringer Northeast Louisiana University Also, Maguire Energy Institute lists products made from oil, at: http://maguireenergy.cox.smu.edu/resources/learning/LCCh1.html The chemical industry relies on the petroleum industry for over 90% of the source material for the thousands of chemicals it produces: http://www.mineralswa.asn.au/~cmepet/page8.html
City drinking water, government services **Number of cities in the world:** over 55,000 **Services to consider:** Water supply pumping, sewage disposal, garbage disposal, street/park maintenance, hospitals & health systems, police, fire services. National defense (land, sea, air). Possibility of wars over remaining oil.	**Number of cities in the world:** over 55,000 Weather forecasts are available for each of them, from AccuWeather(tm) at http://www.thetrip.com/information/partners/resources/0,1401,1-24,00.html **Paper on effects of scarcity:** http://www.theatlantic.com/issues/97dec/democ.htm
Economy and employment **International oil import costs:** Sharp rises (increasing global competition for dwindling oil available from five Middle-Eastern countries and former Soviet Union.). International tensions. Military also obstructed by oil shortages. **National debt, inflation:** Money goes out of country to oil producers. Money becomes scarce. Interest/mortgage rise up. Government prints more money to pay overseas energy bills. Money devalues. Prices rise. **Poverty:** Public, and businesses become poorer paying higher energy costs. Less spending, less sales. Layoffs. **Welfare payments, taxes:** Taxes up. Pensions for aging/disabled population reduced or discontinued.	"Each year the United States, one of the world's largest producers of fossil fuels, imports an estimated additional US $50 billion worth of oil to satisfy domestic demand for energy." http://www.climate.org/programs/cities/sec3/Phoenix.html

Short explanation	The sources of information
Other serious quality-of-life aspects **Heating and cooling:** In cold regions oil heats buildings (burned as fuel in homes or in oil-fired electric power stations. In hot areas oil power provides air conditioning. As natural gas is substituted for oil, the gas price itself will rise. **Smog:** Energy price and shortages will increase wood burning in homes Wood and coal smoke increase city smog.	"The cost of operating heating and cooling equipment represents about 60% of the total utility bill for the typical Louisiana resident." Louisiana Department of Natural Resources: http://www.google.com/search?q=cache:www.leeric.lsu.edu/energy/hvac/+%22energy+demand%22+%22air+conditioning%22&hl=en&client=googlet The EPA estimates that the lifetime cancer risk from wood stove smoke is twelve times greater than that from an equal volume of second hand tobacco smoke. (The Health Effects of Wood Smoke, Washington State Department of Ecology); (b)"Burning two cords of wood produces the same amount of mutagenic particles as: Driving 13 gasoline powered cars 10,000 miles each at 20 miles/gallon or driving 2 diesel powered cars 10,000 miles each @ 30 miles/gallon. These figures indicate that the worst contribution that an individual is likely to make to the mutagenicity of the air is using a wood stove for heating, follower by driving a diesel car. (Dr. Joellen Lewtas, Contribution of Source Emissions of the Mutagenicity of Ambient Urban Air Particles, U.S. EPA, #91-131.6, 1991) http://www.webcom.com/~bi/fact-sheet.htm "…coal-fired generating stations are major sources of the particulates and ozone that make up smog, acid rain, greenhouse gases and persistent toxins such as mercury. The Ministry of Environment has indicated that the current levels of particulates in Ontario's air are associated with 1800 premature deaths and 1400 cardiac and respiratory hospital admissions in Ontario each year." Dr. Sheela V. Basrur, Medical Officer of Health, City of Toronto http://www.city.toronto.on.ca/legdocs/1999/agendas/committees/hl/hl990406/it002.htm

Short explanation

Why public warning is so late

For business and political reasons, there have been very misleading reports of sizes of stocks of oil:

(a) By firstly understating discoveries, and then later overstating discoveries, oil companies have given the false, but pleasing impression of an increasing discovery trend. Investors respond accordingly, and finance more exploration.

(b) The seven major oil-extracting countries have for years reported unchanged reserves (even though they were extracting and selling billions of barrels of oil, and that the reserves would therefore be less each year). See table of "spurious reserve revisions".

(c) In 1988 five of those countries claimed they each had about twice as much reserve oil as in 1987.See table below, which is displayed at
http://www.hubbertpeak.com/campbell/images/com12.gif

(d) We, the public have enjoyed using up the gasoline, heating oil, plastics, and countless other oil products for decades.The oil kept flowing generously. We "looked on the bright side" and mostly ignored warnings by environmentalists that fossil fuels would run out. Media constantly announced new oil discoveries, and increasing stocks of oil. Emptying wells seemed decades in the future. Nobody planned for it. Now they really are running empty.

OPEC countries depend on income from exports:
OPEC countries need to earn as much oil revenue as possible to support rapidly growing populations where the public health care, education and other services are traditionally provided free, from oil revenues, rather than from taxes.

The sources of information

Why public warning is so late

Very misleading reports of actual stocks of oil:
"The industry systematically understated the size of discovery (in past to meet strict SEC rules). [US Securities and Exchange Commission]. It prefers to see the reserves be revised upwards over time. It has misled analysts into thinking that more is being found than is the case, which in turn exaggerates the trend into the future…Seventy countries in 1999 reported unchanged reserves to the Oil & Gas Journal despite production, which is implausible. Some haven't changed their estimates for years." private email from Colin Campbell, June 2000.
Publicity about false reporting of reserves: http://www.hubbertpeak.com/debate/resref.htm
View (below the graph) the table of actual numbers from which this graph was made. The table itself is found at: http://www.hubbertpeak.com/campbell/images/com12.gif

The Gulf states, Bahrain and Saudi Arabia in particular, suffer from a combination of high expectations, rapid population growth and falling oil revenues: a potentially-explosive combination. In the 1970s, the rapid inflow of oil wealth led all the Gulf states to create extensive welfare systems. Governments provided health care, education, and other services for free to all citizens, and any citizen with an advanced degree was entitled to a lucrative government job. Since the early 1980s, however, the price of oil has fallen dramatically - with disastrous results for the budgets of regional governments.
http://www.biu.ac.il/SOC/besa/meria/journal/1999/issue3/jv3n3a3.html

The table's green areas show where countries reported that their oil stocks were "not declining", even though oil was being taken out, steadily emptying the wells.

The red areas show where countries spectacularly increased the reported quantities of oil in stock, so that OPEC would recognize them as bigger suppliers and allow them to export more, increasing revenues. They were desperately competing with each other to make up their revenue by having a bigger slice of market share, because the price per barrel had plunged to about $12 per barrel. The history graph of the prices is at
http://www.eia.doe.gov/emeu/cabs/chron.html

They seem especially frightened of alternative energy sources, even though when examined closely, those alternative sources are drastically too small to compensate for oil. "As a group of fossil fuel exporters, OPEC stands to lose more than most from any proposals that threatens to cut oil consumption," - Rilwanu Lukmanhe, Secretary General of OPEC, speaking at the 16th World Petroleum Congress, 2000. (Globe & Mail Newspaper, June 5, 2000)

SPURIOUS RESERVE REVISIONS

	Abu Dhabi	Dubai	Iran	Iraq	Kuwait	Neutral Zone	Saudi Arabia	Venezuela
1980	28.0	1.4	58.0	31.0	65.4	6.1	163.4	17.9
1981	29.0	1.4	57.5	30.0	65.9	6.0	165.0	18.0
1982	30.6	1.3	57.0	29.7	64.5	5.9	164.6	20.3
1983	30.5	1.4	55.3	41.0	64.2	5.7	162.4	21.5
1984	30.4	1.4	51.0	43.0	63.9	5.6	166.0	24.9
1985	30.5	1.4	48.5	44.5	90.0	5.4	169.0	25.9
1986	30.0	1.4	47.9	44.1	89.8	5.4	168.8	25.6
1987	31.0	1.4	48.8	47.1	91.9	5.3	166.6	25.0
1988	92.2	4.0	92.9	100.0	91.9	5.2	167.0	56.3
1989	92.2	4.0	92.9	100.0	91.9	5.2	170.0	58.1
1990	92.2	4.0	92.9	100.0	91.9	5.0	257.5	59.1
1991	92.2	4.0	92.9	100.0	94.5	5.0	257.5	59.1
1992	92.2	4.0	92.9	100.0	94.0	5.0	257.9	62.7
1993	92.2	4.0	92.9	100.0	94.0	5.0	258.7	63.3
1994	92.2	4.3	89.3	100.0	94.0	5.0	258.7	64.5
1995	92.2	4.3	88.2	100.0	94.0	5.0	258.7	64.9
1996	92.2	4.0	93.0	112.0	94.0	5.0	259.0	64.9
1997	92.2	4.0	93.0	112.5	94.0	5.0	259.0	71.7
1998	92.2	4.0	89.7	112.5	94.0	5.0	259.0	72.6
	P50 Estimates by Petroconsultants							
1996	57.7	1.0	64.7	77.4	52.0	8.2	222.6	27.4

Short explanation

What you can do

Personal preparations: Reduce energy dependence of family, home, lifestyle. The less fuels and goods you consume, the less the impacts will be.

Workplace: 'Same.

Work on it with friends: Workmates, neighbourhood, city, governments. The ideal use for remaining oil and mineral reserves is into industries that create inexhaustible alternative energy equipment like windmills, solar water heaters, biomass (vegetation that creates fuels), etc.

Share your feeling with others:. Try to stay positive and active rather than ignore it or blame people for it. Where there's life there's hope, esp. if we collaborate and are creative. "It's not that new". Humans have always faced hardships, and many among us do so constantly now. Learn from them.

Possible emergency measures to consider:
- Alert the entire public so people will accept preparations for the oil shortages and will participate in finding/implementing solutions
- Relocate food production nearer to cities
- Relocate workplaces nearer to homes or homes nearer to workplaces
- Prepare for conserving and rationing of dwindling oil/other resources that are created using oil
- Population control to protect children being born into the extremely harsh conditions that seem likely, and to conserve resources for those already born.
- General re-localize, to reverse now-futile globalization
- Strengthen the police to deal with likely social chaos and to control distribution of vital supplies.
- Alert the national leaders to cooperate against this major threat that faces us all.

Note: "The USA has the exceptional position as the largest and a growing importer. US imports deny somebody else access to oil. For example, starving Africans result. Tax on gasoline is lower in the USA than in other countries by a large factor. So the US could easily curb its excess. In fact it has no option. The worst thing the US can do is press OPEC to increase production, which will simply make the peak higher and the decline steeper. It is just digging itself into a bigger hole, morality apart." Colin Campbell, in private email, June 2000.

More information

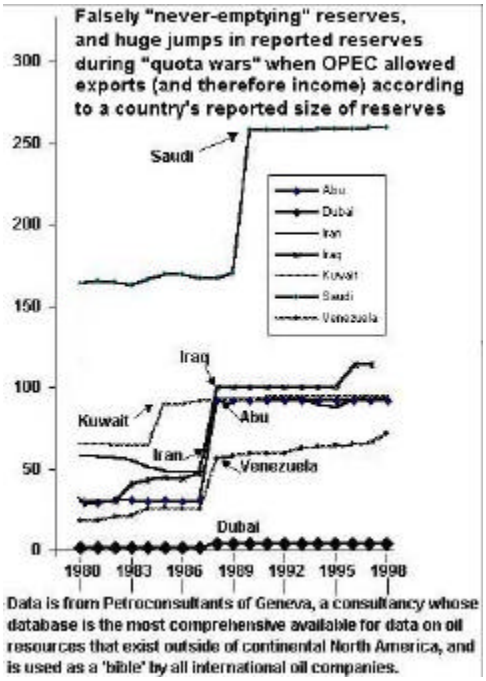
Documented evidence:
All references and authorities for this information are easily available in the "longer" version which you can download by temporarily joining the RunningOnEmpty internet forum mentioned below. It is in the *Files* section.
Also the oil die-off is described at www.hubbertpeak.com and www.dieoff.org
a very large, keyword-searchable web site with scientific and oil industry literature about this topic. It is heavily annotated with authoritative references.
Discussion forum - Technical/scientific research:
www.egroups.com/group/energyresources
Discussion forum-Implications, preparationss, action:
www.egroups.com/group/RunningOnEmpty

Author: Bruce Thomson, moderator of RunningOnEmpty forum at www.egroups.com/group/RunningOnEmpty

COPY THIS ITEM FREELY TO OTHERS

The sources of information

Economics error: Illusion that money can replace physically exhausted resources.
http://dieoff.com/page185.htm
According to Philip K. Verleger, Jr.: "No person has had a greater influence on the thinking of experts who have become government regulators of the world's oil and gas industries than Morry Adelman." [[23]] If Verleger is right, then government regulators all over the world are going to be in big trouble soon because according to economist Adelman: "Minerals are inexhaustible and will never be depleted. A stream of investment creates additions to proved reserves, a very large in-ground inventory, constantly renewed as it is extracted… How much was in the ground at the start and how much will be left at the end are unknown and irrelevant." [[24]] The quote is on page xi of his book, *The Economics of Petroleum Supply*, published 1993.) This absolute confidence in money ignores the fact that oil is a physical reality and that oil can be, and is being exhausted. To illustrate: If Mr. Adelman were sealed in a wooden crate with a one loaf of bread and briefcase full of money for two months, money would not replace the bread once he had eaten it. It is easy to lose sight of physical realities when dealing mainly with theoretical ideas.



More information

Documented evidence
This sheet, and all references and authorities for this information are available for download by temporarily joining the RunningOnEmpty internet forum mentioned below. In MyGroups page, click the *Files* section. It is among the first files.
Web sites
The oil die-off is explained in up-to-date detail at www.hubbertpeak.com, and www.dieoff.org Both sites are keyword-searchable, with scientific and oil industry literature about this topic. It is heavily annotated with authoritative references.
Discussion forum - Technical/scientific: www.egroups.com/group/energyresources
Discussion forum-Implications, action: www.egroups.com/group/RunningOnEmpty
Author of this sheet: Bruce Thomson (moderator of RunningOnEmpty forum at www.egroups.com/group/RunningOnEmpty**)** and helped by members of those groups.

COPY THIS ITEM FREELY TO OTHERS