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An Energy Policy for the 21st Century

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AN ENERGY POLICY FOR THE 21ST CENTURY

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INTRODUCTION

Thank you very much. I met Davis Robinson a few weeks ago and we had a chance to get to know each other over a very pleasant dinner. Henry and Davis are powerful reasons for me to be here today!

I had the same dilemma that Davis had; I had a difficult time deciding on what to say. It is hard enough to move in the direction of a coherent energy policy at home, let alone one that embraces both of our nations. Since the debate on US energy policy has become rancorous, I decided I would try to broaden our perspective by looking at what is happening in the energy sector worldwide. I would like to focus on the global role of the United States and Canada, as two leading nations in the G-8 and as leaders in the International Energy Agency and in the Asia/Pacific Economic Community, and avoid getting into the pros and cons of US or Canadian national energy policy.

GLOBAL ENERGY CHALLENGES

There are some new dimensions on the global energy scene. Once again (this time due to September 11th), energy security has come to center stage, and joined markets, technology and the environment as important driving forces. In thinking about the future, we need to engage in the strategic planning exercise pioneered by Shell: to think the unthinkable, to anticipate the unknowable, to think outside the box. Only such thinking will produce coherent energy policies for the United States, Canada and the world.

Ideally, we would all like to accelerate worldwide economic growth, deliver secure and reliable energy services, eradicate global poverty and stabilize greenhouse gas concentrations. Indeed, one might say that these are the overarching goals of an enlightened energy policy. Let us look at how

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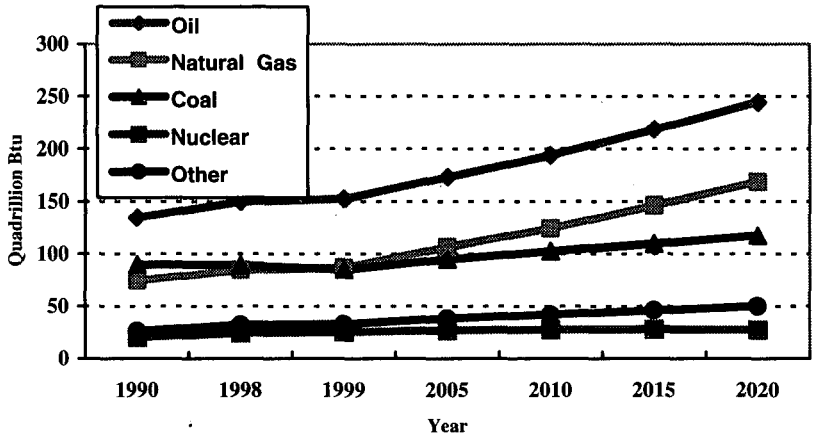
global energy patterns may evolve over the next twenty-five years, and whether such goals are likely to be realized.[1]

Consumption Patterns

Figure 1. World Energy Consumption, 1990-2020



World energy consumption is expanding rapidly, and there is no sign that we are going to be consuming less oil and gas for the near future. *See* Figure 1. In fact, oil and gas are likely to dominate the supply mix throughout the next 20 years.[2] These projections are based on work done by the International Energy Agency, the Energy Information Agency, and the U.S. Government. However, I want to warn you that projections about today's consumption habits made 25 years ago, as we did in the United States after the 1973 oil embargo, were wrong; predictions then were that we would be using about 50 percent more energy than we currently use. Projections were that we would have over 1000 nuclear plants (we have only about 100); that we would have a similar number of coal plants (wrong); that we would have massive synthetic fuels facilities (wrong again) and that the price of oil would be, in today's dollars, around $100 per barrel (the current world oil

[1] Since this speech was given, the International Energy Agency published the "World Energy Outlook 2002" in September 2002, which contains updated global and regional energy production and consumption projections. *See* INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 2002 (2002), *available at* http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2002).pdf [hereinafter ENERGY OUTLOOK].

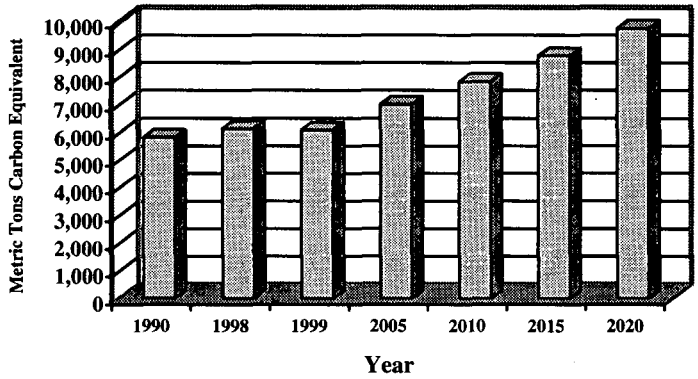
[2] *See, e.g., id.* at 40 (noting that expected trends of moderate oil prices should facilitate growth in U.S. demand for the next 20 years).

price is about $30 per barrel). What was roughly correct was the projection regarding oil consumption in the United States. I say this only as a general caveat concerning predictions of future energy consumption.

Explosive Growth of Consumption in Asia

For the first time in history, the developing countries, as a group, will equal the industrialized countries in their energy demands. This will happen around 2010 – or even sooner. Much of this growth is due to the rapidly growing energy needs of India and China. Between now and 2020, the growth in industrialized countries will be far less than the growth of developing countries. This will be reflected in the increase of worldwide carbon dioxide emissions, which show no sign of abatement. *See* Figure 2.

Figure 2. Carbon Dioxide Emissions, 1990-2020



As a result of this rapid growth, with an anticipated doubling of energy consumption in Asia, carbon dioxide emissions will also increase. *See* Figure 3, Table 1.

Figure 3. World Carbon Emissions by Region

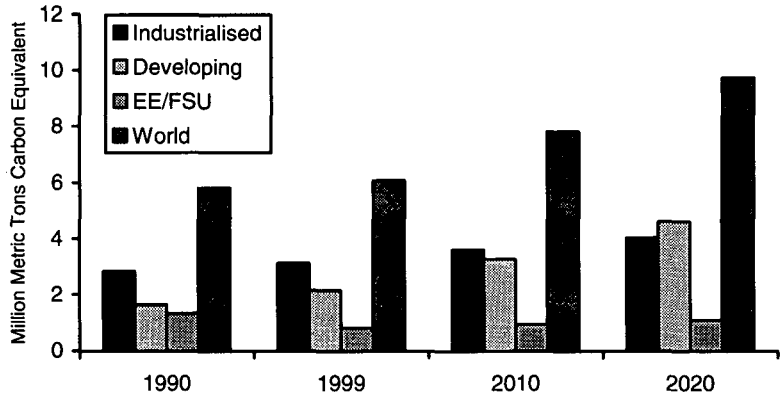


Table 1. Energy Consumption and CO_2 Emissions by Region, 1990-2020

	Energy Consumption (Quadrillion Btu)				Carbon Dioxide Emissions Million Metric Tons Carbon			
Region	**1990**	**1999**	**2010**	**2020**	**1990**	**1999**	**2010**	**2020**
Industralized Countries	182.4	209.6	243.4	270.4	2,842	3,122	3,619	4,043
EE/FSU	76.3	50.5	60.3	72.3	1,337	810	940	1,094
Developing								
Asia	51.0	70.9	113.4	162.2	1,053	1,361	2,137	3,013
Middle East	13.1	19.3	26.9	37.2	231	330	451	627
Africa	9.3	11.8	16.1	20.8	179	218	294	373
Central and South America	13.7	19.8	29.6	44.1	178	249	394	611
Developing Total	87.2	121.8	186.1	264.4	1,641	2,158	3,276	4,624
Total	**346.0**	**381.8**	**489.7**	**607.1**	**5,821**	**6,091**	**7,835**	**9,762**

Where is all of the oil and gas going to come from? Saudi Arabia and Iraq have proven reserves of about 300 billion barrels each. Russia also has sizable reserves of gas; she is, in fact, the "Saudi Arabia of natural gas." Although the Middle East also has large reserves of natural gas – about a third of the world's proven reserves – the former Soviet Union has about 40 percent. *See* Table 2.

Table 2. Proven World Oil and Natural Gas Reserves, Jan. 2000

Region	Crude Oil (Billion Barrels)	Natural Gas (Trillion Cubic Feet)
North America	55.1	261.3
Central & South America	89.5	222.7
Western Europe	18.8	159.5
EE/FSU	58.9	1,999.20
Middle East	675.6	1,749.20
Africa	74.9	394.2
Far East & Oceania	44	363.5
World Total	1,016.80	5,149.60

The problem in the transportation energy sector is going to haunt us. See Table 3. North America, from now to 2020, will have about a 50 percent increase in transportation demand. Today, North Americans consume around 15 million barrels; in the year 2020, consumption will rise to about 23 million barrels. However, this growth rate pales in comparison to what is likely to happen in Asia, wherein the transportation energy demand will almost triple in the same amount of time. Even then there will still be far fewer vehicles per capita than we have here. The transport energy demand of Asia and other countries is driving oil demand and global oil security policy today.

Table 3. Transportation Energy Use By Region, 1990-2020

Region	Transportation Energy Consumption (Million Barrels of Oil per Day)				Average Annual Percent Change	
	1990	1999	2010	2020	1990 - 1999	1999 - 2000
Industrialized	21	25	31	35	2	1.6
North America	13	15	19	23	2.1	2
Western Europe	6	7	8	9	1.8	1
Industrialized Asia	2	3	3	3	2.4	1
EE/FSU	3	2	3	4	-5	2.8
Developing	7	11	18	29	5.2	4.8
Asia	3	6	10	16	6.8	5.1
Middle East	1	2	3	5	4.1	4.8
Africa	1	1	2	2	3.4	3
Central & South America	2	2	4	6	3.4	4.6
Total World	31	38	51	68	2.2	2.8

Table 3 shows world oil resources used for transport in the Year 2000. About half of the oil is used for transport and for vehicles.

Table 4, *infra*, shows a similar trend in the electricity sector in China and India, as they are likely to triple their electricity use over a 20-year period.

Table 4. World Net Electricity Consumption by Region, 1990-2020 (in billions of kilowatt-hours)

Region	History		Projections				
	1990	1999	2005	2010	2015	2020	Annual percent change
Industrialized	**6,385**	**7,515**	**8,580**	**9,352**	**10,112**	**10,888**	**1.8**
United states	2,817	3,236	3,761	4,147	4,484	4,804	1.9
EE/FSU	**1,906**	**1,452**	**1,622**	**1,760**	**1,972**	**2,138**	**1.9**
Developing Countries	**2,258**	**3,863**	**4,988**	**6,191**	**7,615**	**9,203**	**4.2**
Developing Asia	1,259	2,319	3,088	3,883	4,815	5,856	4.5
China	551	1,084	1,533	2,035	2,635	3,331	5.5
India	257	424	545	656	798	949	3.9
South Korea	93	233	294	333	386	437	3.0
Other Developing Asia	357	578	716	858	996	1,139	3.3
Central & South America	**449**	**684**	**844**	**1,035**	**1,268**	**1,552**	**4.0**
Total World	**10,549**	**12,833**	**15,190**	**17,303**	**19,699**	**22,230**	**2.7**

What have we learned from this? Electricity and transport energy demand is growing most rapidly in Asia; the highest energy growth rates are in India and China, and the lowest in the former Soviet Union. A new phenomenon is emerging: Asia as a whole, and India and China in particular, will become heavily dependent on oil imports from the Middle East in the next two decades, driven largely by transport.

The cities of India and China suffer from traffic congestion, polluted air, and serious health problems from the use of leaded gasoline. The thought of having three or 400 hundred million new vehicles of all kinds over the next two decades based on current technology is just unthinkable, but that is the projection.

Energy Security

History

After the 1973 oil embargo, the United States, seriously considered becoming nationally self-sufficient in energy through programs such as Project Independence;[3] that is simply never going to happen. Every now and then, there are proposals to reduce our oil imports to zero,[4] but those are

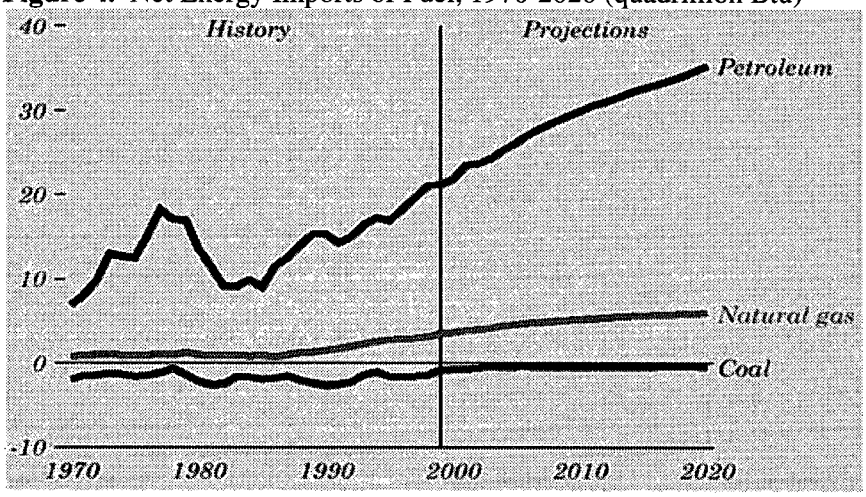
[3] The goal of Project Independence, first started by President Richard Nixon in 1973 after the oil embargo, was to achieve energy self-sufficiency by 1980. *See Department of Energy: About Us*, *at* http://energy.gov/aboutus/history/timeline79.html (last visited July 11, 2002).

[4] John Harwood, *Bush Maintains Wartime Support With 82% Approval Rating in Poll*,

simply not realistic. Rather, we should plan for a long-term global transition to a post-petroleum energy system, where all nations share the benefits of such a transition.

The concept of energy security has evolved to place less emphasis on "Fortress America," "Fortress India," or "Fortress China," and, instead, to place more importance on the interdependence of countries, good relationships among producers, consumers and suppliers, open and competitive markets, and private investment supplanting government investment.

Figure 4. Net Energy Imports of Fuel, 1970-2020 (quadrillion Btu)



After the embargo, energy security and oil security were synonymous. However, over the years, gas and electrical supply networks have joined oil as an important part of the energy security equation, as we have seen in the California energy situation. The environment has also become part of the energy security mix. Indeed, the question of environmental constraints has become a very important consideration; if these constraints place certain energy options at risk, you are not going to be able to develop them.

WALL ST. J., Jan. 24, 2002, at A20, *available at* 2002 WL-WSJ 3383881 (announcing that House Minority Leader Richard Gephardt would give a speech on a plan to attain energy independence by 2010). *See also* Paul Georgia, *Eliminating U.S. Dependence Isn't Advisable...or Possible*, TIMES UNION (Albany, NY), Oct. 14, 2001, at B1, *available at* 2001 WL 24814888.

Ongoing Concerns

Here are some issues that the U.S. and Canada will have to contend with, considering that energy, economic, environment and political security are interwoven and linked.

Political and Economic Stability of Energy-Exporting Nations

Global security is becoming increasingly dependent on the political stability of energy-producing regions, such as the Middle East, Nigeria, Colombia, in the Caspian, and in the Caucasus. There is an effort in the U.S. administration to view Russian oil production as a future alternative to OPEC. However, Russia simply does not have the oil reserves for this to be a viable long-term strategy. In contrast, Russia certainly has the gas reserves to be a dominant player in Asia and Western Europe. However, there are serious capital investment problems, and major changes in the legal and regulatory environment are required to mobilize domestic and foreign investment on the scale necessary.[5] The latest figures show that the Russians need to attract about USD$500-700 billion of capital to the oil and gas sector in the next 20 years.[6]

Instead of a mutually hostile standoff between producers and consumers, the U.S. and Canada, along with the G-8, have embraced the need for more dialogue between producers and consumers in the oil market. For the first time, two years ago, the U.S. sent a cabinet secretary to a producer-consumer dialogue. This is the right direction to go, given the fact that complete energy independence is a fiction. For the U.S., the 55 percent of our energy needs coming from imports is predicted to rise to two-thirds in 2020.[7]

Greater Appetite for Energy

This same picture will be repeated in other parts of the world. India, a country of 1.1 billion people,[8] is becoming very dependent on the Middle East for oil, and the same thing is happening in China. China is projected to

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[5] *See generally Russia: Energy Sector Restructuring*, *at* http://www.eia.doe.gov/emeu/cabs/russrest.html.

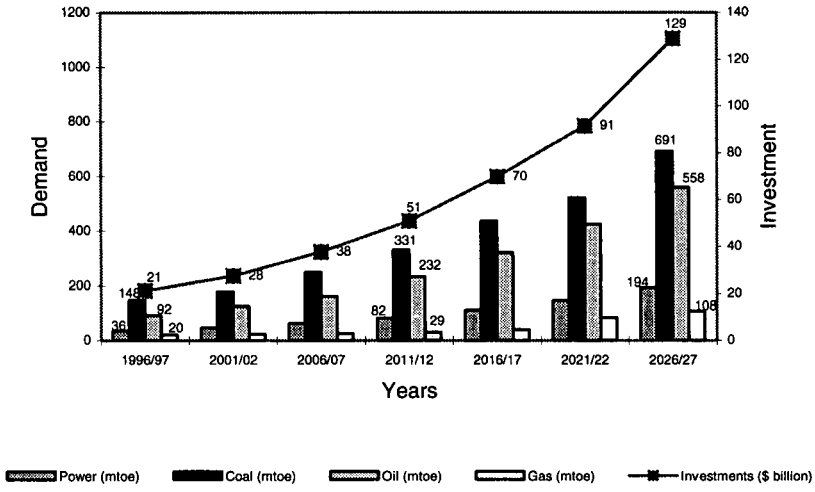
[6] *See, e.g.*, INTERNATIONAL ENERGY AGENCY, RUSSIA ENERGY SURVEY (2002); *EU-Russia Energy Partnership*, *at* http://europa.eu.int/comm/energy_transport/en/lpi_en_3.html (stating that new capital investments totaling between $460 and $600 billion will need to be made by 2020)

[7] *See* ENERGY INFORMATION ADMINISTRATION, INTERNATIONAL ENERGY OUTLOOK 1998 136, 175 (1998).

[8] *India*, *in* CENTRAL INTELLIGENCE AGENCY, THE WORLD FACTBOOK (2001), *available at* http://www.cia.gov/cia/publications/factbook/index.html.

import around 8 million barrels a day in 2015,[9] just 13 years from now. This is essentially adding two U.S.-sized countries to the world in terms of oil imports.

Figure 5. Energy Demand (mtoe) and Additional Investment Requirements (in billions of dollars)



[9] China is expected to consume around 10.5 million barrels per day by 2020. *See* ENERGY OUTLOOK, *supra* note 1, at 29.

Figure 6. Energy Imports, 1996-2027

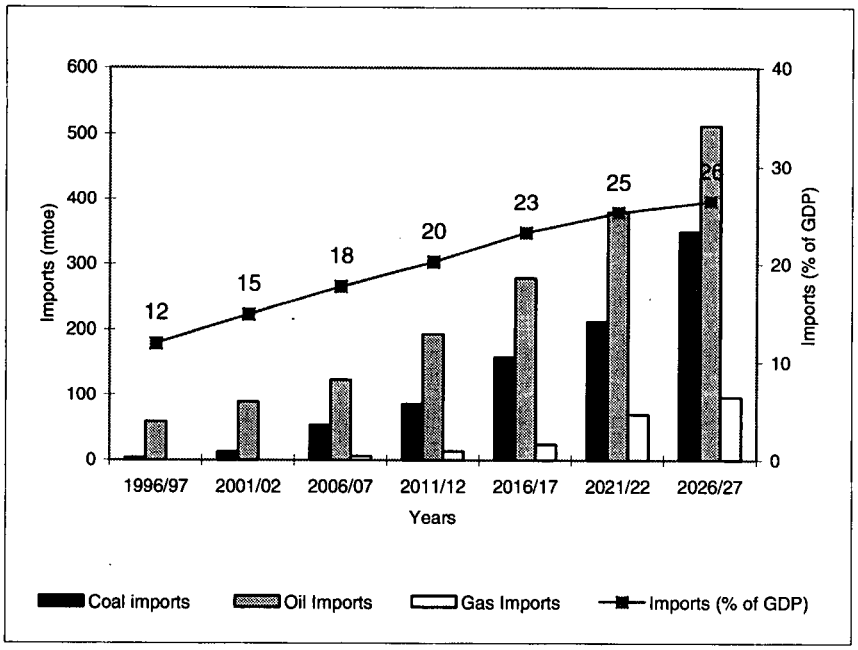
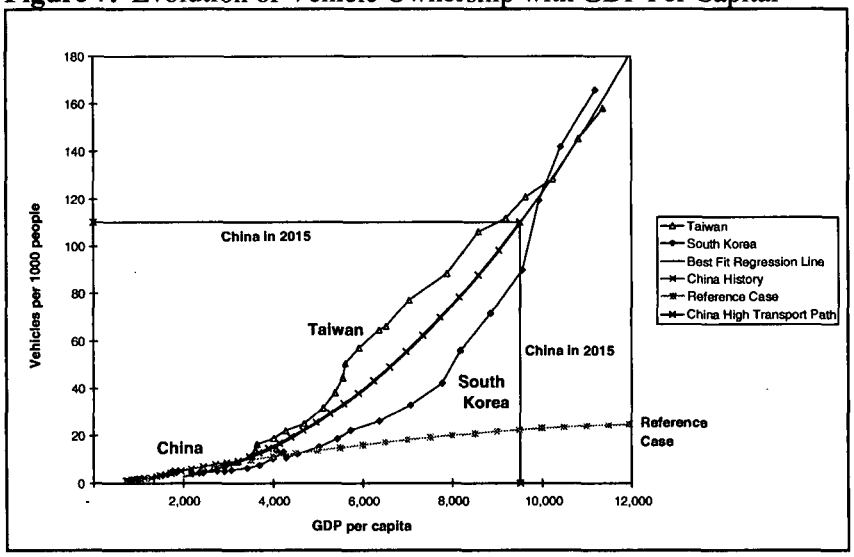


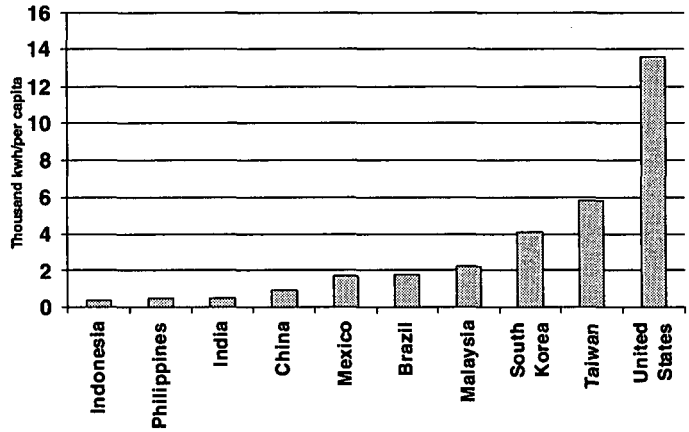
Figure 7 shows a rather remarkable scenario: if China were to follow the path of Taiwan and South Korea, there will be 110 vehicles per thousand people in China in 2015. That number is lower in Taiwan and South Korea today, and is equivalent to what the U.S. and Canada used 80 years ago. Even at that relatively low level, the demand for transport fuels will exceed 8 million barrels a day.

Figure 7. Evolution of Vehicle Ownership with GDP Per Capital



The same thing is happening in the electricity sector. Today, the United States and Canada use about 13,000 kilowatt-hours per capita. India and China, with 2.2 billion people between them, have a long way to go, and they aspire to achieve North American levels of consumption. *See* Figure 8.

Figure 8. Per Capita Energy Consumption, 1995



SOLUTIONS

Renewable Energy Sources

Many have called for accelerating development and commercialization of renewable energy resources. There is also talk about developing advanced fossil fuel technologies that are less carbon-intensive. In fact, the Shell long-term energy scenarios, which look out 50 years, present options to stabilize greenhouse gas emissions to less than 550 parts per million relying on renewables, natural gas, and less-carbon intensive options.[10]

Figure 9.

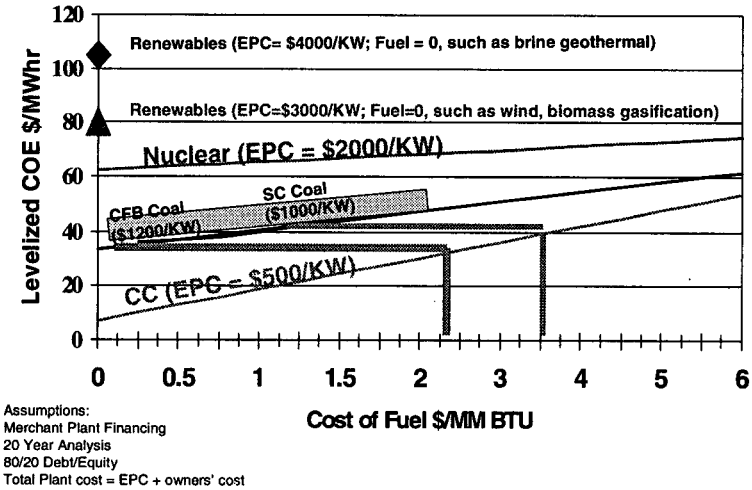


Figure 9 shows that, for the time being, some renewable technologies options are not competitive with conventional options. This could change dramatically if there were huge markets for renewables or if markets were aggregated in a manner similar to ordering aircraft. If instead of small, boutique-size projects, one develops a mass procurement approach, prices for renewables would decline substantially.

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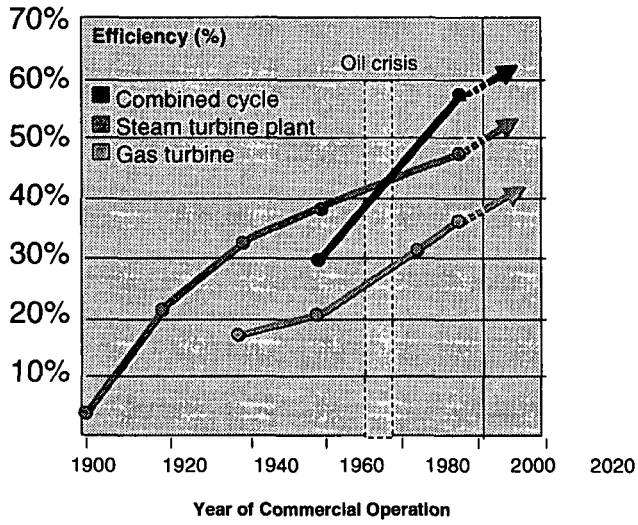
[10] SHELL INTERNATIONAL, ENERGY NEEDS, CHOICES AND POSSIBILITIES: SCENARIOS TO 2050 58 (2001), *available at* http://www2.shell.com//home/media-en/downloads/scenarios.pdf [hereinafter SHELL SCENARIOS].

Advanced Conventional Generation Technologies

Conventional technologies have greatly improved. Figure 10 shows the tremendous increase in efficiency of power generation. Both the US and Canadian governments need the private sector to play a dominant role in international technological innovation. Two-thirds of the R&D in the U.S. – two-thirds or more of energy technology flow from north to south and about 85 to 90 percent of the capital flows – are occurring through the private sector.

Figure 10. Increases in Fossil Fuel Electricity Production Plants



A business-as-usual energy future could be disastrous. Projecting over the next hundred years, energy demand could quadruple and atmospheric CO_2 could triple. Furthermore, there will be a greatly increased potential for oil-related conflict. Rapid technological innovation will be needed to lower the energy intensity of economic activity and the carbon intensity of energy services.

Worldwide Energy Policy Cooperation

I believe that our two nations should play a leadership role in striving to implement global energy solutions. Achieving the objectives of global security, poverty reduction and economic development, and a sustainable environment will require unprecedented technological innovation and commercialization. Also, competitive and diversified energy markets are

better for consumers and the energy industry, so long as the appropriate regulatory framework is in place.

For short-term oil security, I would recommend strategic oil stockpiling for Asia similar to what occurs in the OECD countries.[11] For the first time, India and China are seriously considering an "IEA-like" system for Asia to guard against oil shocks and to reduce vulnerability.

CONCLUSION

For long-term security, our two nations must make a transition to a technologically-advanced and electrified future with alternative transport fuels and technologies. Some of these technologies include gas-to-liquids and hydrogen from fossil and non-fossil sources. The Shell scenarios are based on a gradual transition to a hydrogen economy using a modified natural gas infrastructure. Looking ahead 20 or 25 years, technological innovation with transforming or "disruptive" technologies seems to be a way to reconcile security, environment and economic growth.

The Shell Company has pioneered a unique way of looking at the future, which was to avoid mere extrapolation of present trends and "think" out of the box" in terms of anticipating the unknowable and thinking the unthinkable.[12] Figure 10, *supra*, shows that, since the Nineteenth Century, we have made huge strides in technological advancement. The pace of future technological innovation is well within the range of what has already occurred. We have moved through energy technology discontinuities, embracing steam engines, electric dynamos, internal combustion engines, nuclear and natural gas.

The energy future could see a large increase in natural gas, hydrogen and electrification, with a gradual reduction in petroleum dependence. Such a future could enhance energy security, stabilize climate change, and provide a vigorous level of economic growth for ten billion people. An energy policy for the twenty-first century will have to look out 50 or 100 years. Technological innovation is the key to achieving the energy security that currently eludes us. Thank you, again.

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[11] *See, e.g.*, Yone Sugita, *Oil Can Grease the Wheels of Asian Cooperation*, ASIA TIMES, Apr. 21, 2001, *available at* http://www.atimes.com/japan-econ/CD21Dh02.html.

[12] SHELL SCENARIOS, *supra* note 10, at 6.