

GOLDEN VALLEY ELECTRIC ASSOCIATION

GREEN POWER ADVISORY COMMITTEE

2005 Report to the Board of Directors

March 2006

(revised March 21, 2006)

2005 Report to GVEA Board of Directors on Green Power

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Section 1. Background

EXECUTIVE SUMMARY

In March 2004, the GVEA Green Power Advisory Committee (GPAC) submitted its ‘2004 Report to GVEA Board of Directors on Green Power’. Since 2004, the GPAC has continued to meet with GVEA personnel on a quarterly basis to review progress on the renewable energy programs GVEA has committed to implementing, as well as exploring additional possible options for future development. Progress has been made on several fronts in the intervening 24 months and new issues have come to light. For these reasons, GPAC would like to submit this 2005 report to update the Board of Directors on renewable energy issues as they relate to GVEA.

In the 2004 report the GPAC focused on five areas of priority. These were:

1. A Renewable Energy Pledge
2. Wind Power Generation
3. Enhanced Energy Efficiency and Conservation
4. Small Scale Renewable Generation
5. Funding Option

The GPAC membership has been very pleased to note that the GVEA Board of Directors has acted on each of these five identified priorities. During the past two years GVEA has adopted an ambitious Renewable Energy Pledge, has made significant progress in identifying potential local wind resources and supporting the proposed Fire Island project, and has instituted the SNAP¹ program. This report will review progress on each of these stated priorities, as well as address other areas which were not included in the first report. These include the potential geothermal resource at Chena Hot Springs, the newly formed Renewable Energy Alaska Project (REAP), of which GVEA is a founding member, and a report on fossil energy forecasting for Fairbanks.

The 2004 GPAC Report included substantial sections explaining the formation of the GPAC, the meeting process which culminated in the final recommendations to the board, and background information on each identified area of priority and renewable energy development in general. This report will not repeat that information, rather it is viewed as building on and supplemental to the original report.

EXECUTIVE RECCOMENDATIONS

1. The leading candidate for meeting GVEA’s Renewable Energy Pledge continues to be wind power.
2. GVEA should bring developers up to look at the Eva Creek site to assess the commercial feasibility and produce a time frame for wind energy production.
3. GVEA should continue to monitor the possibilities of developing Fire Island as a wind generation site.

¹ Sustainable Natural Alternative Power.

4. We continue to feel the Conservation Recommendations described in the 2004 Report are important and should be implemented.
5. The situation with respect to energy on earth is critical and will get more serious in the next decade. Support of the energy conservation programs listed above will help to reduce the global risks associated with the use of energy.
6. The work of CCHRC including their efforts with respect to the LEED building standards are important and deserve GVEA's continued support.
7. GVEA has made excellent progress in promoting the SNAP program and should continue its efforts, including development of a method by which battery back-up can be utilized.
8. Major advancements in geothermal energy utilization have been made by Chena Hot Springs Resort. They should be commended for their efforts.
9. Continued involvement with the Renewable Energy Alaska Project (REAP) is necessary.

Section 2. Renewable Energy Pledge

In the 2004 Report, the GPAC recommended that GVEA adopt a plan for obtaining renewable energy as part of its future energy portfolio. This 'Renewable Energy Pledge' that GVEA would adopt would not be a state or regulatory mandate, but rather would reflect the leadership of the board of directors and support for green power by the membership.² This pledge would provide the foundation for all other GPAC recommendations.

In its 2004 Report, the GPAC urged the adoption of an immediate goal of 10% of green power generation by 2014, excluding Bradley Lake. The Renewable Energy Pledge adopted by GVEA went one step further by pledging:

10% of peak demand from renewable energy sources by 2007, and
20% by 2014, including Bradley Lake.

Projected peak demand for GVEA in 2007 is 230MW. 20MW (average) are supplied by Bradley Lake. To meet the goal of supplying 10% of peak demand capacity in 2007, an additional 3MW of renewable generation will need to be brought online. As can be seen in Figure 2.1, increased renewable energy generation requirements are necessary to meet the pledge in future years, taking into account 2.5% growth per year. This graph is not intended to be absolutely accurate and does not take into account future fluctuations in demand caused by changing power requirements from Fort Knox Gold Mine or other large customers. Instead, this graph is meant to illustrate quantitatively what the Renewable Energy Pledge requires in terms of increased generation from renewables to meet the stated milestones for 2007 and 2014.

The SNAP program (see section 5.) will add a component of local small scale renewable energy generation. In Chelan County³, the SNAP program typically generates 90,000 kWh. Because this is an important but small component, additional sources will need to be sought to augment Bradley Lake and the SNAP program. The leading candidate is wind power (section 3.).

² As determined by GVEA's 2003 Green Power Survey.

³ Chelan County PUD (Washington) is the originator of the SNAP program in 2001.

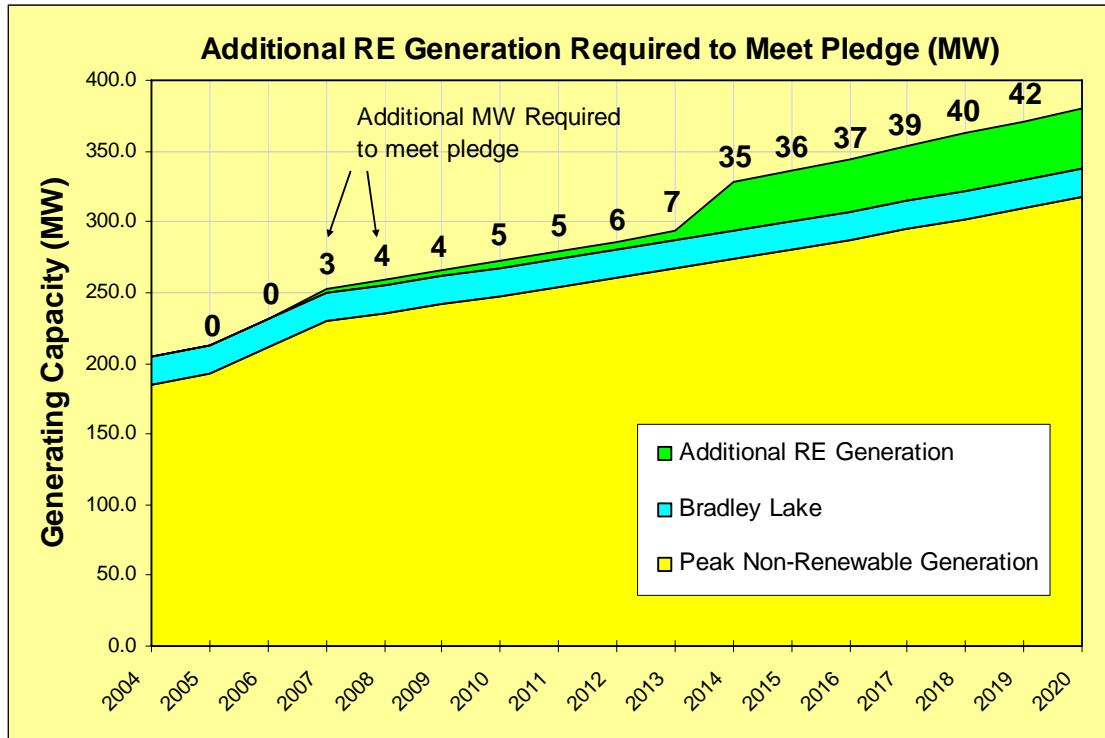


Figure 2.1
GVEA System Demand versus Time

Note: Non renewable capacity retirements and replacements have been ignored in the graph above.

Section 3. Update on Wind Power Generation

In the GPAC Recommendations to the Board of Directors in March 2004, it was stated that:

“It is recommended that GVEA pursue the use of wind turbines to generate electric power. This initially involved GVEA’s participation in the “True Wind” study and will include continuation of these efforts to better quantify the wind resource in Interior Alaska, as well as cooperating with the railbelt utilities that participated in the 2004 Railbelt Energy Study.⁴ The latter may lead to the development of tens of megawatts worth of wind power in the Anchorage area. It is possible that the full development of this wind potential could result in enough megawatts being transmitted north over the Intertie that at least the southern portion of the line may have to be upgraded. Similarly, if sufficient resources exist in the Delta region, the line from Delta to Fairbanks may eventually have to be upgraded. Such issues can only be completely addressed after ongoing studies are completed. If GVEA ultimately produces wind-generated electricity from a region extending all the way from Anchorage to Delta, this geographical diversity could dampen the effects of wind fluctuations in the total wind resource.

It is recommended that GVEA investigate the use of advanced energy storage technologies to allow the Interior region to maximize use of the wind resource. GVEA should also pursue the study of low-impact hydropower to complement the wind-generated electricity. As the wind-generated electricity fluctuates, hydro-generated electricity may be well suited to quickly ramp up or down and help stabilize the overall renewable energy production.”

Since then, there have been numerous discussions about the wind potential in both Interior and South Central Alaska as well as the status of efforts to develop a wind farm on Fire Island just south of Anchorage. GPAC has been encouraged by the wind resource potential at Eva Creek north of Healy and concerned about the pace of progress to develop Fire Island (associated with its proximity to Ted Stevens [Anchorage] International Airport). Use of electricity generated by wind turbines at Eva Creek compared with Fire Island could be advantageous for GVEA because of its proximity to Fairbanks. However, having multiple generation sites has the advantage of stabilizing the total resource through geographical diversity. There are also issues involving ease of transport of large wind farm components to Eva Creek versus Fire Island.

Since wind resources are transient, it is important for GVEA to look at the influence of this fluctuating resource on system stability as well as storage issues.

The European Wind Energy Association has reported that wind energy can meet up to 20% of electricity demand on a large electricity network without posing any serious technical or practical problems. In the western Energinet, wind energy covers some 25% of electricity demand in a normal wind year and it is not a technical problem to handle more.⁵

⁵ “Large scale integration of wind energy in the European power supply: analysis, issues and recommendations”, December 2005, www.ewea.org.

GVEA should also consider technologies that may become commercially available in the future such as the use of flow batteries (as costs decline and reliability increases) to store excess wind energy. Such devices convert chemical energy into electrical energy with the electrolyte stored in a separate tank until needed. The process can be reversed to regenerate the electrolyte.

ACTION REQUEST:

- GVEA should bring developers up to look at the Eva Creek site to assess the commercial feasibility and produce a time frame for wind energy production.
- GVEA should continue to participate with other utilities to develop Fire Island as a wind generation site.

Section 4. Enhanced Energy Efficiency and Conservation

In the GPAC Recommendations to the Board of Directors in March 2004, we stated that:

'GVEA should improve upon the EnergySense programs already in place and continue enhancing energy efficiency efforts as outlined in Section 7.1 of the GVEA Administrative Manual (last revised Dec. 16, 2002).

Highlights of Sec. 7.1 include the following:

- a. Develop and maintain an effective load management program.*
- b. Provide conservation information to the membership.*
- c. Monitor energy use in all aspects of operations including facility operation, facility construction, and use of vehicles.*
- d. Maintain an active employee training program.*

Other specific efficiency / conservation recommendations include the following:

- e. Provide energy efficiency information to the membership.*
- f. Include the GVEA motor vehicle pool.*
- g. Increase the penetration and use of energy efficient appliances, such as horizontal axis washing machines and energy miser vending machines.*
- h. Install smart meters, initially in businesses and ultimately in residences, as installed costs decrease. (This will at least allow "time of use" (TOU) pricing programs to be implemented, which will help stabilize demand and reduce utility operating costs.)*

Enhanced energy efficiency and conservation measures should be included in the overall strategy to meet GVEA's renewable energy pledge (REP) goals. Implementing a "system benefits charge" (SBC) to help in the funding of enhanced energy efficiency and conservation programs should be considered. Another funding source could be the United States Department of Energy.'

The Report also discussed how the region GVEA serves differs from other regions in the US with respect to differences in the interconnectedness with other utilities, electric demand profiles, coincidence of renewable resources with the thermal and electric loads, ratio of the thermal to electric loads, and heating degree days (HDD) verses cooling degree days (CDD).

We continue to feel the above recommendations are important and should be implemented.

For example, at one of our meetings during the past year, we have discussed LED Christmas tree lights that use much less energy and last much longer than conventional Christmas lights. One string of 100 conventional mini-lights consumes about 50 watts of power, while the same length of LED lights uses only around 4 watts. If five strings of lights are used eight hours a day, LED lights will save more than \$5 every month at 10-cents/kWh electricity. If one assumes that the typical conventional string of lights is

replaced every two years versus five years for LED, the savings will total \$150 over five seasons.⁶

Besides using appliances and lights that are more efficient when on, we encourage the use of devices that reduce standby losses. For example, the European Commission (EC) estimated that standby losses from external offline power adaptors in the EU will increase from 8 T Wh annually in 1996 to 14 T Wh in 2006. For now, the EC is urging manufacturers to meet minimum offload efficiencies for devices in the 0.3 to 150 W range. It believes that this action can save 5 T Wh annually by 2010 or about 500 Euros.⁷ The California Energy Commission (CEC, www.energy.ca.gov) is requiring as of July, 1, 2006, all single-output ac-ac and ac-dc external power supplies shall meet minimum efficiency criteria at 25%, 50%, 75%, and at full load. The CEC estimated that conservation/efficiency actions could generate energy savings equivalent to 10% of total electricity sales in 2011 at a levelized cost of less than 5 cents per kWh.

These are examples that could be used to expand and enhance the EnergySense audit programs.

We feel that the situation with respect to energy on earth is critical and will get more serious in the next decade. Support of the energy conservation programs listed above will help to reduce the global risks associated with the use of energy.

We feel the work of CCHRC, including their efforts with respect to the LEED building standards, are important and deserve GVEA's continued support.

⁶ Report published Nov 11, 2003, available at: <http://www.greenstarinc.org/enews/enewsv4n11.htm>.

⁷ From the website www.edn-europe.com.

Section 5. Small Scale Renewable Energy (SNAP Program)

In March of 2004, GPAC recommended to the GVEA Board of Directors that:

“GVEA should adopt a policy and program that encourages members to invest in small-scale, grid-tied renewable energy systems.”

In August of 2005, GVEA initiated a SNAP program to accomplish this task. SNAP has been well received as is indicated by the 300 plus members who have signed to become “purchasers” in the program. Unfortunately there have been no “producers” generating power so far. This is mostly due to the fact that the ground froze not long after the program started, and those interested were not able to break ground and install the service equipment needed. We expect to see the first SNAP systems producing power this summer.

GVEA has done a great job getting the word out to members. SNAP has been advertised in print and on radio. Presentations on SNAP have been given in several interior communities. Last month there was a Renewable Energy Clinic at UAF sponsored in part by GVEA. This covered both on and off grid RE systems and was very well attended.

To further increase public awareness, GVEA should consider placing an image of an RE power system, and/or the SNAP logo, on the GVEA home page. These images could be used to link to the SNAP information available on the GVEA website. GVEA should add a link to www.alaskasun.org from the GVEA website.

There should also be a link to information on the federal tax credits available for the installation of photovoltaic systems as well as credits for energy conservation. <http://www.dsireusa.org> contains a database of state and federal incentives for renewable energy.

GVEA should also consider deleting the following sentence from www.gvea.com/memserv/snap/producer.php

“SNAP is not for members who want to install renewable energy sources for back-up power generation at their home or business.”

This discourages people who already have battery based systems from applying to become SNAP producers. There is no reason to disallow grid-tied renewable energy systems with battery back up from participating in the SNAP program. As long as the system can not sell power back to the utility grid during an outage, it should be allowed. This can be accomplished easily by the installation of an automatic transfer switch. GVEA should explore other options as well.

Section 6. Funding Options for Projects

GPAC will continue to explore funding opportunities for the programs discussed in this report.

Section 7. Chena Hot Springs Geothermal System

Chena Hot Springs Resort has been an active participant of GPAC since May 2005. At that time GVEA President and CEO Steve Haagenson signed a letter of support for a grant application to DOE⁸ for exploration of the larger geothermal resource at Chena. Chena was awarded the grant with the goal of determining whether the deep resource at Chena (4000+ feet) could support large scale geothermal power generation on a scale which would interest GVEA. The first phase of the project is being concluded right now; Phase II and III, which include drilling into the reservoir and testing it, have been put on hold due to funding cuts for the DOE Geothermal Program. While reservoir temperatures have been projected to be ~250°F at depth, it is not yet known how large the reservoir is or what its recharge rate might be.

Chena has been active in pursuing renewable energy development at the resort and has been involved in numerous cutting edge projects. Chena uses its geothermal water in a district heating system, which includes all the buildings onsite in addition to three greenhouses which operate year-round. Chena also uses geothermal water in an absorption chilling cycle to cool the Aurora Ice Museum. As the first unit of its kind in operation, it has won awards on a national level.

Chena Hot Springs will be the site of the first geothermal power plant in Alaska, which will be installed and operating in May 2006. The plant will be a 400kW ORC (Organic Rankine Cycle) geothermal power plant, designed and built by United Technologies.

While the geothermal resource at Chena is very site-specific, it is important to note that all of the applications being used onsite could operate off a waste heat resource instead of low temperature geothermal.

⁸ Department of Energy.

Section 8. Renewable Energy Alaska Project (REAP)

Golden Valley Electric Association is a founding member of the Renewable Energy Alaska Project (REAP). REAP is a coalition of urban and rural Alaska utilities, businesses, conservation and consumer groups, and Alaska Natives with an interest in developing Alaska's vast renewable energy resources. REAP's goal is to increase the production of renewable energy in Alaska through five primary strategies:

- To advocate for the construction of viable renewable energy projects proposed for Alaska;
- To help develop and implement policies that will lead to increased production of renewable energy;
- To build a market for renewable energy in Alaska;
- To foster and demonstrate stakeholder unity in support of renewable energy; and
- To promote energy efficiency.

REAP has been an active supporter of the Fire Island wind project and has actively supported the four new renewable energy bills currently in the state legislature: HB 335, HB 445, SB 270, and SB 283. REAP has also been instrumental in making green tags available for sale in Alaska through a partnership with the Bonneville Foundation. REAP hosted the first Renewable Energy Fair in Alaska in August 2005 on the Park Strip in Anchorage. GVEA had a booth at the event and over a thousand people attended. This will become an annual event.

ACTION REQUEST:

Continue to support 2006 RE Fair, to be held August 12, 2006 on the Park Strip in Anchorage.

Section 9. Fossil Energy Forecasting for Fairbanks Electric Power Generation

Since the discovery of crude oil in Pennsylvania, the price of oil has been sensitive to the availability of the oil supply. In Figure 9.1 (below), the price of crude oil shows a first peak in 1864 when it was learned that it could replace oils of animal origin. Discovery of oil fields near Oil City, Pennsylvania, caused a drop in price in 1874, and the drop in 1880 came from the discovery of the Bradford Field. Depletion caused increases in 1895 and discovery of Texas oil in 1901 caused a low price until 1921. Secondary recovery began and the oil price fluctuated until 1948 when the Saudi Arabian oil fields came into the world market. In Figure 9.2, the oil price from 1947 to 2004 is shown and the average price for world oil was \$22.86 over that period. Increases due to political events (Arab Oil Embargo, Iranian Revolution, Iran/Iraq War, Gulf War, PDVSA Strike, 9/11 Attack, Iraq War) are shown in that figure. One can see that price increases in the order of \$10 to \$30 per barrel are caused by major political events and these occur every several years.

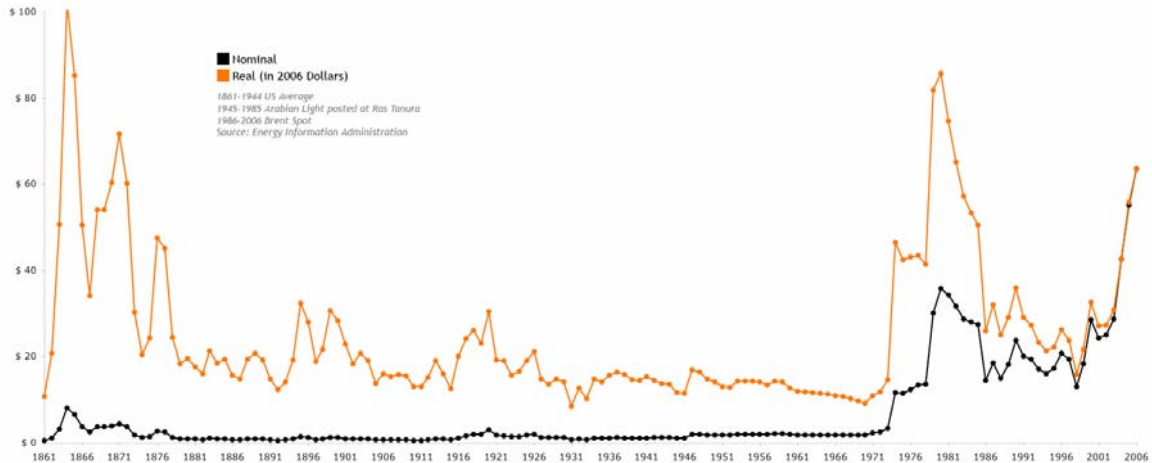


Figure 9.1. Worldwide price of crude oil

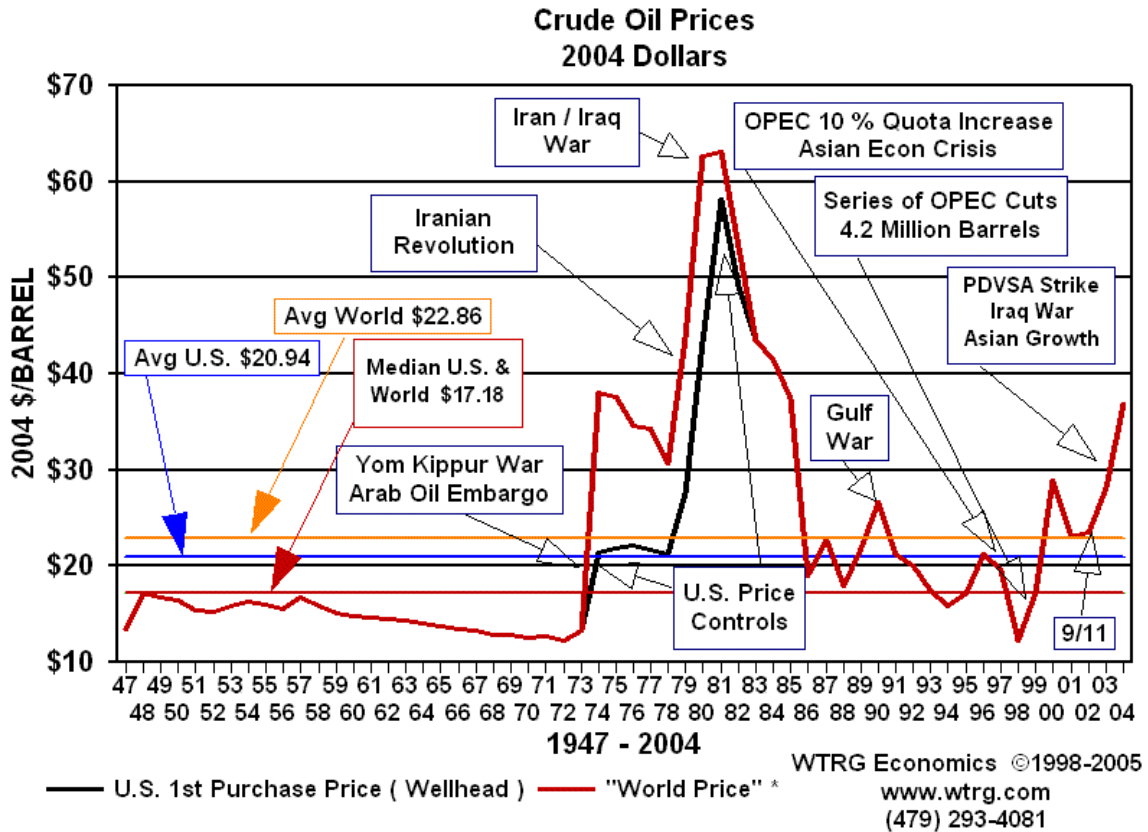


Figure 9.2. Crude oil price fluctuations due to instability in oil producing regions

Figures 9.3. and 9.4. show that there has been a rise in oil price beginning in about 2002 (\$18/bbl) until 2005 (\$70/bbl) which seems to be a major trend, a demand growth rate of about 2% per year. This trend was forecasted as early as 1998 and is related to the major demographic factors of population increase in China, India, Indonesia, and other Asian countries. It was augmented by their rapid industrialization, export of a multitude of consumer goods, and the expectation of the newly-emerging middle class for an automobile as a major means of transportation. Economists in both the demand side and the supply side of the petroleum industry are consistently using the 2%/yr demand growth assumption, over the next 25 years, as it is tied to demographics and to the existence of persons who are already alive.

When this oil price rise was taking place, from \$20/bbl to \$60/bbl, there were only mild complaints from the consumers of the developed countries. Today, the demand for oil in the developed countries remains strong and the demand growth in the newly-emerging countries remains at 2% with some predicting values as high as 5%.

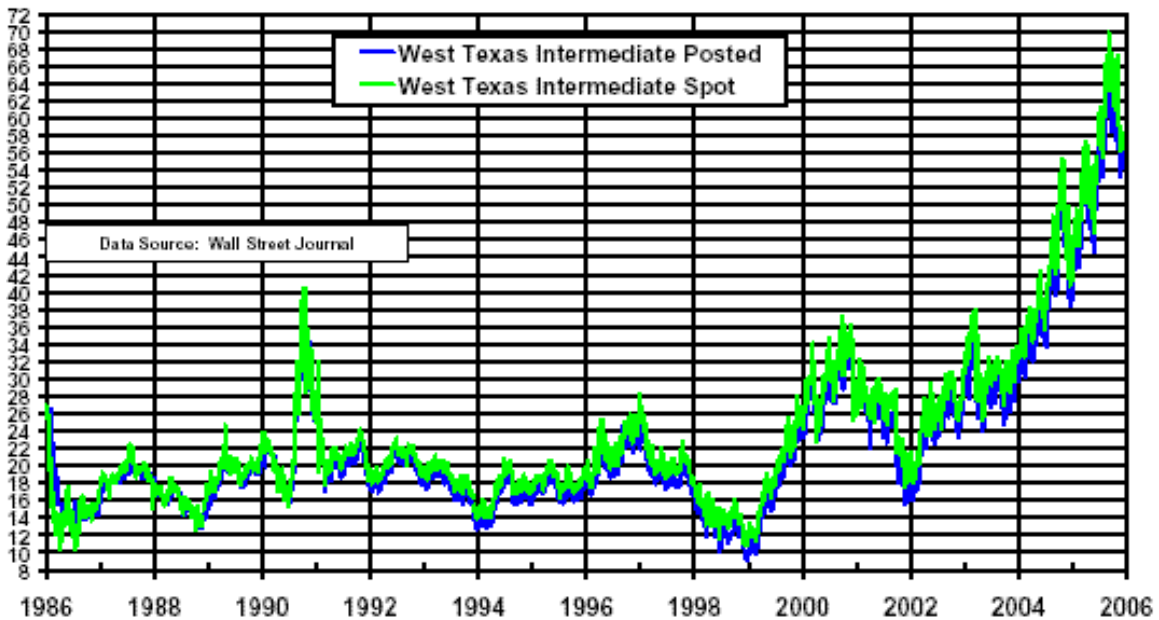


Figure 9.3. Rise in oil price beginning in 2002

On the supply side, the spare capacity of the global oil industry has been diminished to the point where demand and supply are closely matched. The International Energy Agency (IEA) member consuming countries have strategic petroleum reserves in the range of 90 to 120 days in each country. Those countries thus are cushioned against the interruption of one or more of the major oil supply chains through acts of terrorism, or through the vagaries of political decisions in certain unstable oil-producing countries. However, a demand growth rate of 2% implies that about 1.7 million barrels/day of new supply must come on-stream each year, along with the additional 5.6 million barrels/day of new supply which is needed to offset the depletion of the world's oil fields each year. To add 7.3 million bbl/d of production each year globally, means completion of the equivalent of 7 new pipelines of the 48-inch size each year, or the installation of equivalent offshore capacity. This is not happening. The expansion of the pumping capacity of the Middle Eastern oil fields through new drilling and completions, is now fully active, and this will only possibly help the industry oil supply stay even with demand. One can see that a gradual oil price rise has taken place although this approach has been taken for the past two years, as shown in Figure 4.

One can consider the extraction of synthetic oil from the tar sands and from the synthetic fuel conversion of natural gas, both using technologies which are active now and have a production cost of only about \$14 - \$18/bbl. These methods are available, but each installation is typically of 50,000 bbl/d capacity, and there are perhaps 6 such installations being started each year. This will only give an annual augmentation in the order of 0.3 million bbl/d over the next decade.

Future Prospects

The prospects for an oil price below \$50/bbl are very remote at any time in the future. On the other hand, the prospects of an oil price in the range \$70 to \$100/bbl are quite real.

As this may affect the electricity price to Fairbanks consumers, it means that the present fuel surcharge (\$0.02631/kwh), which is associated with the oil price differential of \$20/bbl to \$50/bbl, can get larger and may reach \$0.06/kwh within the next three years. The consumer may be paying \$0.156/kwh in Fairbanks.

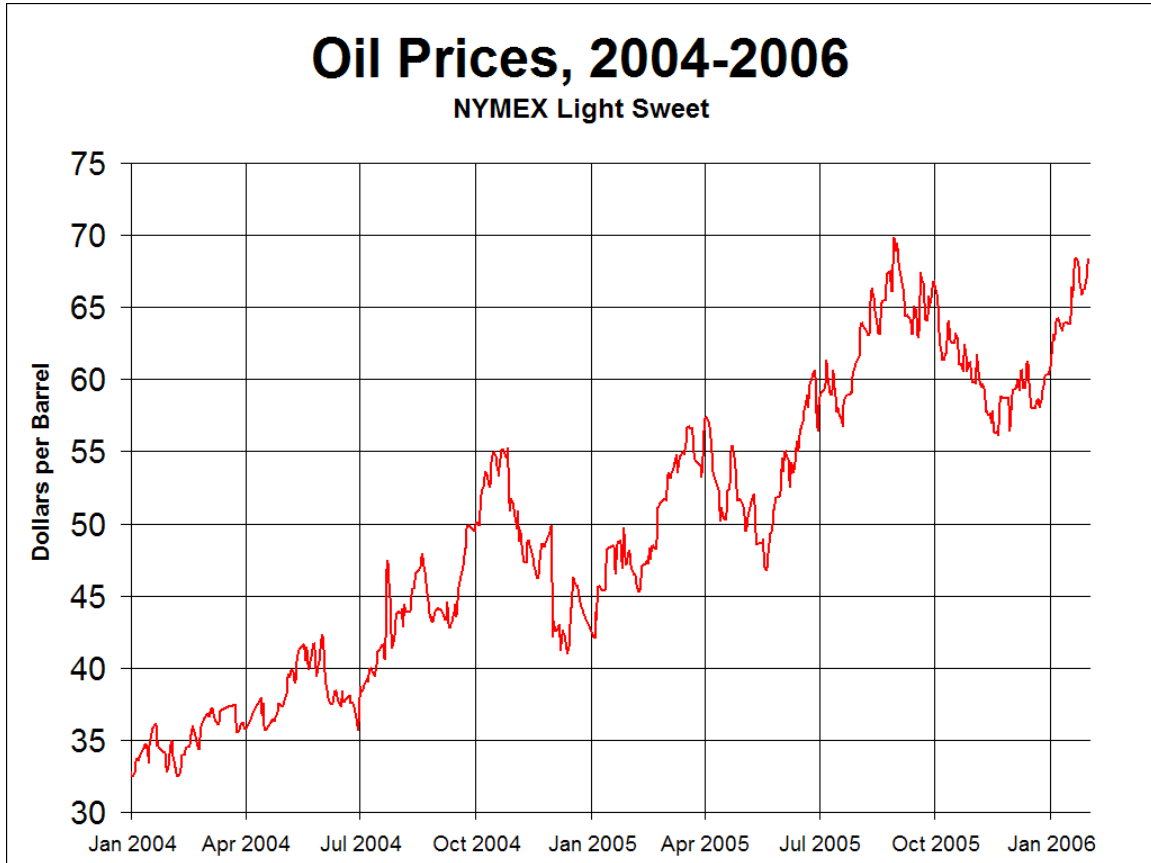


Figure 9.4.

This is a global effect and makes the price of electricity generated from oil and gas to be comparable to the price of electricity generated from wind power (currently about \$0.14/kWh to \$0.05/kWh depending mainly on the system size and the wind resource). Therefore, wind power generation will experience a rapid growth in the next few years. The economic reasons for it to happen in Fairbanks are the same as in the rest of the world; wind power capitalizes the cost of electricity over the life of the wind generator, making that part of the electric power generation mix to be independent of the price of petroleum.

Some might argue that a gas pipeline coming to Fairbanks may reduce the cost of fossil energy. Actually, natural gas has become a fungible commodity in the USA and the gas costs are comparable, on an energy basis, with the oil costs. Pipeline tariffs are set based

upon cost of construction and regulated profit margins and the final profit on gas production is apparent at the wellhead price of gas. Both the private sector owners and the public sector royalty owners of Alaskan gas are dedicated to maximizing the price of Alaskan gas. One must expect that the average price of natural gas in Fairbanks, in the perspective of five decades in the future, will be close to the energy equivalent price of oil over that time.

Since Alaska has such a significant coal resource, coal will continue to play a role in electric generation for GVEA. However, the price of coal should be expected to inflate as the prices of oil and gas inflate, hopefully at a slower inflation rate.

Recommendation

Therefore, it is recommended that wind generation of electricity become part of the Fairbanks electric generation strategy in the immediate future.