Fairbanks Energy

November 2007

Strategic Business Plan

This document contains confidential and proprietary information
belonging exclusively to:

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The best time to plant a tree was 20 years ago. The second best time is today.
-Chinese Proverb-

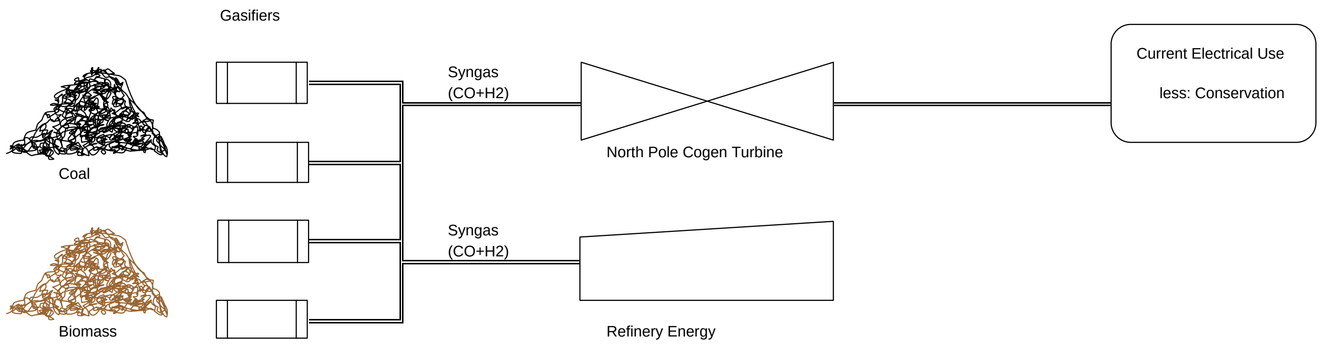
Fairbanks Energy Vision Statement:

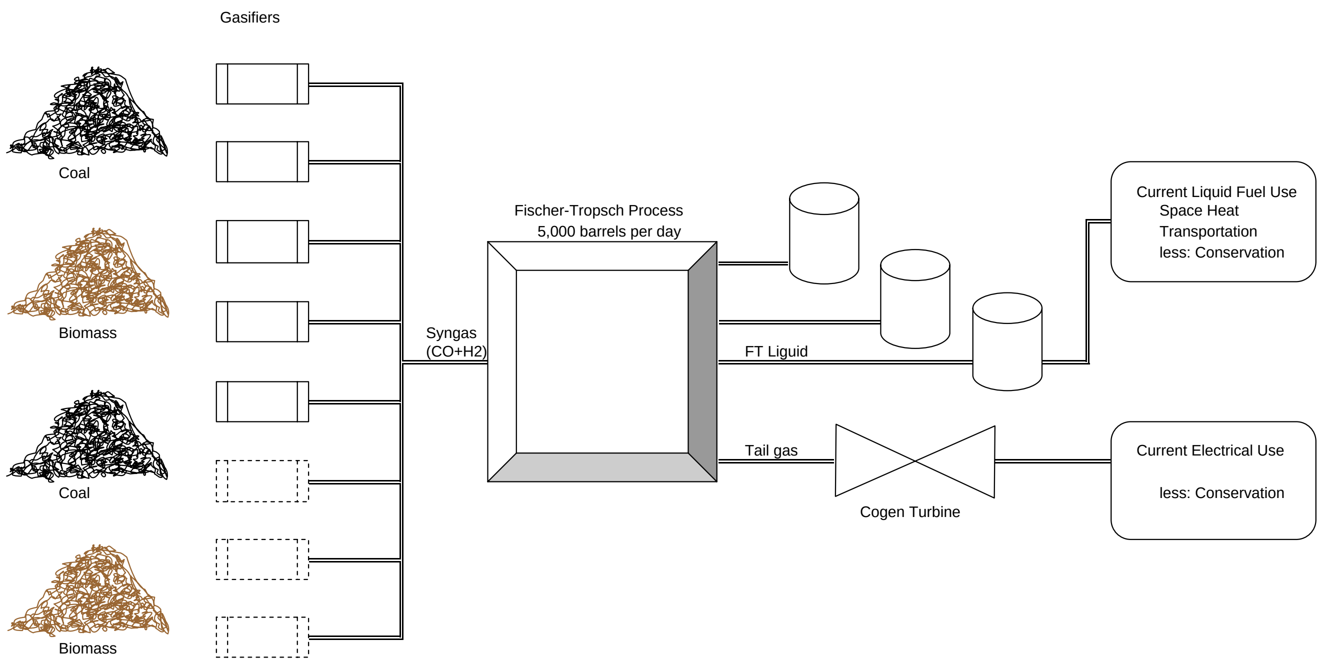
Be the World Leader in Responsible Energy Use and Supply.

Achievable Objectives under the Fairbanks Energy Strategic Business Plan:

1. Be energy self-sufficient.
2. Reduce Interior Alaska yearly energy costs by $100,000,000.
3. Reduce carbon dioxide emissions to zero.
4. Reduce sulfur emissions to near zero.
5. Reduce heavy metal emissions to near zero.
6. Reduce airborne Particulate Matter ($PM_{2.5}$) to near zero.
7. Utilize tainted water from TAPS and municipal wastewater.
8. Replace base load aging electric generation for 100 years plus.
9. Diversify the Alaskan economic base.
10. Create economic energy, but use it wisely.
11. Grow a culture of energy use awareness and responsibility.
12. Create local jobs in both the supply and responsible use of energy.
13. Grow the local economy through construction and beyond.
14. Enhance partnership with UAF research to resolve local energy issues.
15. Build opportunities for the education and wise use of energy.
16. Invest in long term Alaskan infrastructure.
17. Ensure local control of Alaskan energy businesses.
18. Supply energy products for existing homes and vehicles.
19. Retain wealth in Interior Alaska.
20. Increase disposable income.
21. Shift from non-renewable fuels to sustainable local fuels.
22. Use carbon-neutral fuels rather than using sequestration.
23. Provide a robust vision for all plausible futures.
24. Provide a future for our children, grandchildren and great grandchildren.
25. Brand Fairbanks as: “The place to be, for energy”.

Fairbanks Energy Plan





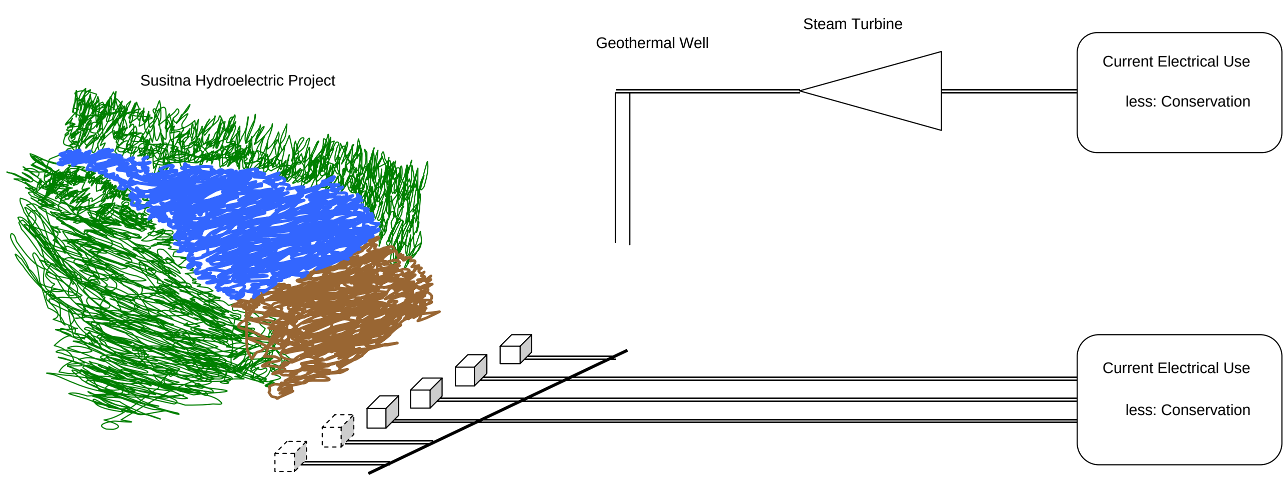


Table of Contents

Fairbanks Energy

Executive Summary

Fairbanks has relied heavily on petroleum as an energy source for electricity, space heating and transportation. The economy of Alaska is being crushed by the increasing cost of crude oil. In 2006, Fairbanks Economic Development Corporation (FEDCO) formed the Interior Issues Council (IIC) to address current local issues. One taskforce that was formed by the IIC was the Cost of Energy Taskforce. The taskforce conducted a screening study to rank energy options based on the total energy consumed in Fairbanks for electric generation, space heating and transportation.

In August 2007 the taskforce was asked to identify energy solutions, which in addition to reducing the cost of energy would reduce $PM_{2.5}$, CO_2 and sulfur emissions. In addition to reduced emissions, several other goals were established, such as use of municipal waste, sustainability, stable priced fuel supply, green energy, economic development and wildfire mitigation. The taskforce conducted a high level financial analysis, which identified significant potential savings from current energy prices.

The significant reduction in energy cost was shown through a combination of conservation and efficiency increases, 600 MW Susitna hydroelectric project, 100 MW Mt. Spurr geothermal, carbon-based fuel gasifiers and a 5,000 barrel per day Fischer-Tropsch (FT) plant. The financial analysis shows an incremental reduction in electrical costs in excess of 50% and in FT diesel in excess of 30%. Using the Fairbanks energy model, the residential energy bill could be reduced by 23%.

Fairbanks' energy future will be secured by leveling the energy playing field by deployment of conservation and efficiency measures in homes and businesses throughout the Borough and by replacing crude oil with FT liquids, Syngas, hydroelectric and geothermal energy sources.

Introduction

Energy and environmental uncertainties are prompting States and our Nation to re-think fundamental policies. Diversity is widely seen as the key to policies for energy security, with diversity of suppliers and in energy-mix for the consumers, and of markets for the producers. But the policy of turning to one energy source to meet new challenges and reduce energy uncertainties can also exacerbate uncertainties or create new ones elsewhere. Amid the uncertainties, there is a fundamental certainty. The State, the Nation, and the World will need more and cleaner energy, used in a more efficient way, accessible and affordable to a larger share of the population. The political challenge lies in creating this energy imperative in a fair and sustainable way, through State and National policies as well as in bilateral, regional and wider global cooperation. More and cleaner energy is moving the world in the direction of natural gas consumption, with carbon dioxide sequestration as a foreseeable trend for coal and oil combustion processes.

Biomass sources, wind power, geothermal, solar and new hydroelectric power projects are also receiving top attention.

As this study was being prepared, the State of Alaska requested proposals for the pipeline delivery of North Slope natural gas to both Alaskan and world markets. All of the alternatives for the natural gas pipeline pass through Fairbanks, and thus, if a pipeline is built, it will offer an additional ample source of fossil fuel for the production of electric power, FT liquids, and home and industrial heating. However, the pricing of the natural gas, while presently unknown, may be competitive with present liquid petroleum fuels, on the one hand, or may be competitive with the more economical energy sources such as hydroelectric and coal which are discussed in this report. It is recognized that the details of a scenario for a Fairbanks natural-gas-fueled economy are not considered in this report, and as the natural gas pipeline plans become more firm, possible scenarios including natural gas need to be formulated.

Concept Statement / Timeline

Conservation and efficiency increases are by far the most effective means of reducing cost, reducing emissions and reducing fuel usage. The beauty of increasing efficiency is we can start today. With available know-how one can immediately start to save money on our utility and home heating bills. There are a multitude of simple measures that range in price and energy savings. Education is key to producing these energy savings, so the casual implementer will know what measure will provide the best bang for their buck. Efficiencies can happen at all levels, from installing compact fluorescent light bulbs to installing the most efficient combined cycle gas turbine. The most significant savings can come from supply-side reductions, not having to install the energy source at all, which saves all capital costs, operation and maintenance costs and fuel costs, after the need has been negated through demand-side conservation or efficiency increases. As cost effective as supply-side reductions are they cannot make up the total energy solution, but are rather one key piece of the energy solution puzzle. Once again, the advantage of conservation and efficiency increases are that they can start immediately, with focused training and substantial initiative.

Secondly, in the mid-term one to two-year window, significant fuel shifting can take place. The installation of gasifiers will provide Syngas from a variety of carbon-based fuels. Little work has been done on the siting of the gasifiers. Traditional siting would indicate the gasifiers be placed close to the fuel source, but with little infrastructure to deliver the Syngas, placement of the gasifiers would likely be near the initial gas usage point in North Pole at the Golden Valley generation site and the Flint Hills refinery. Coal would be the initial fuel source with a shift to locally available biomass to further reduce CO_2 emissions from current petroleum fuels sources.

Thirdly, also in the mid-term one to two year window, additional gasifiers would be installed to provide Syngas to a Fischer-Tropsch plant that could produce zero sulfur FT Diesel, Naphtha, Jet A, electricity and other products. Once again the gasifiers and FT plant should be located near the fuel source. With the existence of a Class I air shed in the Healy area, an alternative site could be considered. Once the coal has been loaded onto rail cars the incremental cost of delivering the coal to Nenana and Fairbanks is very small, so all available sites along the rail system should be considered. If all sites are nearly equivalent, the delivery of the FT product may dictate the appropriate placement of the FT plant.

The development of hydroelectric and geothermal power plants could start very soon, but are not expected to be available for power production for at least 10 years, due to environmental, permitting, design, and construction. The size of these facilities needs further review to ensure the proper sizing of the facilities at initial operation and for generator additions to match electrical needs in future years.

Thought should be given to the use of hydroelectric power as one source of renewable energy for a future hydrogen economy. The renewable energy would be delivered to Fairbanks over electrical transmission lines to power electrolyzers that will generate the hydrogen to power fuel cells for electric, space heating and transportation. Infrastructure and technology need to be developed and available on a commercial basis before the hydrogen economy can become a reality.

Marketing Plan

Simply put, the marketing strategy will be based on a plan to incentivise the Public in the conservation of energy, increases in efficiencies and provide currently used products (electric energy and liquid fuel) at a lower cost. The complete marketing plan will take a significant effort to identify the market and implementation strategy.

SWOT Analysis

Each work group conducted a high level review of the Strengths, Weaknesses, Opportunities and Threats (SWOT) of the energy alternatives, included in the PowerPoint work product. The SWOT analysis can be a useful tool when developing strategic initiatives. Strategic initiatives can be developed that change weaknesses into strengths and threats into opportunities.

Strategic Robustness

It is hard to predict the future with much accuracy. However, one can use the Dow-Shell model that selects several plausible futures and then applies the alternatives to each future to determine the most robust alternative with the aim of attaining a sustainable future.

The four selected futures are as follows:
Rear View Mirror essentially doing what we have always done
Technology hoping technology will provide a solution
Shades of Green going the environmental route
World In Turmoil nobody trusts anybody that globally restrict imports

As an example, in the 80's and 90's it was "Technology would save the day". After 9/11 it was World in Turmoil. Now it is closer to Rear View Mirror, business as usual. Our children will most likely be in Shades of Green. The Taskforce recommendations are more aligned with the Shades of Green but are equally valid in all scenarios suggesting the recommendations provide a robust solution that will work in any of the plausible futures.

For example, evaluating hydroelectric in the Rear View mirror we would see that hydro has been used successfully throughout the world for many hundreds of years. In the Technology future, hydroelectric could improve efficiencies, construction methods and designs or develop fish friendly projects. With Shades of Green, hydro would reduce CO_2 emissions and provide a long-term source for hydrogen. In the World in Turmoil, hydroelectric would negate the importing of fuels, labor or technology.

So, in the case of hydro and gasification of biomass, we would have a very robust answer to all four possible futures.

Services and Products

Energy will be provided as electricity, Syngas ($CO+H^2$) for use in combustion turbines and as a feed stock for the FT plant for the production of zero-sulfur FT Diesel, Jet A and Naphtha. The choice of fuels will be provided to maximize the use of existing infrastructure, such as existing fuel delivery systems and use of FT liquids in home heating systems and vehicles.

A comprehensive energy efficiency program will be developed. It will be comprised of four interdependent subprograms, some of which exist today and others that will need to be developed. The four programs are an outreach and awareness program, an energy evaluation and rating program, a training and certification program and the financial resources program.

Structure and Organization

The taskforce believes that ideal structures for providing Fairbanks with its future fuel and energy supplies would be a low or not-for-profit models, such as a cooperative, Joint Action Agency (JAA) or a Port Authority or other business entity. Electric cooperatives will be limited in sales of fuel, but a JAA would be able to sell electricity and fuel to electric cooperatives, fuel suppliers and industrial users. The Alaska Railbelt Energy Authority (AREA) JAA was formed by the Railbelt electric utilities to provide joint planning and for financing of multi-utility projects. The AREA JAA structure is stated on the website: http://www.alaskanet.com/area . Financing would be secured with pre-construction Power Sales Agreements (PSA).

In the fall of 1999, an initiative was passed by the City of Valdez, the Fairbanks North Star Borough and the North Slope Borough that led to the creation of the All Alaska Gasline Port Authority. One of their goals, "Providing cleaner, more cost effective energy throughout the State", could be realized by first using less energy and providing FT fuels to Alaska. The Authority could also bring the benefits of tax-exempt structure to Alaskan energy picture. Information on the All Alaska Gasline Authority can be found on their website: http://www.allalaskagasline.com .

One structure that was discussed was the formation of a cooperative model that would provide energy efficiency analysis, recommendation on energy saving projects and financing for various improvements in energy efficiency. The member's electric or fuel bill could show the savings and the cost of debt repayment.

Financials

The comparative financials were conducted on an incremental basis using the best available information for capital costs , operations and maintenance expenses, fuel expenses and a small margin component.

All data and assumptions are listed in the model worksheet Renewable Flow 10-07.

600,000 kilowatts	Susitna Hydroelectric Project Output:	$0.0558/kilowatt-hour (62%)
100,000 kilowatts	Mt. Spurr Geothermal Project Output:	$0.0571/kilowatt-hour (61%)
60,000 kilowatts	LM6000 1x1+on Syngas Output:	$0.0720/kilowatt-hour (51%)
	Computed 2007 Electric Equivalent Cost	$0.148/kilowatt-hour

5,000 barrels/day Gasifier/ Fischer-Tropsch Plant Output: $1.86/gallon of FT Diesel (21%)
Current Petroleum Wholesale Diesel Costs $2.37/gallon of Diesel

500 gallon/year savings Conservation/efficiency – new boiler Fuel Savings: $1,400/year at $2.80/gallon

The percentages are the percent saving over the current equivalent price.

A snapshot comparison model was created that quantifies all the energy consumed in Interior Alaska for electric, space heating and highway transportation. The base case model is based on 2005 usages levels with prices adjusted to October 2007 fuel prices, All costs are included in the electrical to show the true cost of electricity and accurately reflect the sunk cost of existing capital investments, which must be paid for whether running or not. Space heating and transportation reflect the cost of fuel only, so a fuel type switch may require capital costs that are not included in the model but not if the switch is from diesel to FT diesel. Two snapshots were developed to test for anticipated cost savings, 1) Mid-term which includes gasification with the Syngas used in the LM6000 turbine for electrical generation and a Fischer-Tropsch process for FT liquid fuels, and 2) Long-term which replaces all liquid-fueled electric generation with energy from Susitna hydroelectric project and Mt. Spur geothermal power plant. The following lists the total yearly cost of energy in Interior Alaska and the total yearly cost per residence. Susitna hydro and Mt Spur will be used as the primary electrical generation in the Railbelt with the aging Railbelt generation placed in standby in the event of a electrical system interruption.

	Total Fairbanks Energy		Residential Energy	
	$/year	Delta%	$/year	Delta %
Base Case	$ 434,700,000		$ 6,353	
Mid-Term	$ 331,500,000	(24%)	$ 4,831	(24%)
Long-term	$ 337,500,000	(22%)	$ 4,877	(23%)

The major components of the yearly energy costs per Residence, not counting efficiency increases or usage reductions, are shown below:

	Base	Mid-Term	Long-Term
Electric	$1,311	$1,096	$1,142
Space Heating	$2,807	$2,073	$2,073
Transportation-Hwy	$2,235	$1,662	$1,662
Total Annual Cost	$6,353	$4,831	$4,877

One would expect the long-term costs to be lower than the mid-term costs. The mid-term solution uses existing generation infrastructure, which is approaching its economic useful life. In the next 10 years, there will be 1,000 megawatts of electrical generation within the Railbelt that will need to be replaced at a cost of $1 –2 billion, which is not included in the mid-term cost. The long-term solution includes the cost of new generation infrastructure and effectively negates the need to replace the aging turbines with similar combustion technology.

Conservation and efficiency increases can drive significant savings and are considered a key piece of the overall energy solution, which should proceed immediately. The cheapest kilowatt is the one you don't have to build or replace. With conservation and energy efficiency increases, we anticipate 20-30% saving from the "low hanging fruit" of building energy use. The conservation programs could be financed from these savings..

State of Alaska Assistance

Several levels of State participation would be helpful such as:

- Sharing project risk
- Back-stopping the debt to achieve a lower interest rate,
- Access to tax-exempt financing
- Use of existing State funds to finance debt at a tax-exempt rate.
- Access and use of State land for the growth and harvesting of biomass

Carbon Management

There is general consensus that the release of carbon dioxide into the atmosphere will be restricted in the near future. There are two general approaches to the management of carbon emissions: Carbon sequestration to capture and store post combustion CO_2; or use of a fuel that is not carbon based or at least carbon neutral. Carbon sequestration is currently not commercially available for either large volume emitters such as power plants or smaller emitters such as home heating systems or vehicles.

Biomass fuels are considered carbon-neutral if they have a short time from release to sequestration back in the biomass source. Willow, aspen and poplar are considered to have a five to seven year carbon life cycle. Carbon neutral fuels are available in Alaska and could become more cost competitive if they were farmed to increase the fuel density and reduce the material handling and processing costs. An economic analysis of carbon sequestration options compared to use of a more expensive carbon-neutral biomass fuel, should be conducted to identify the most environmental and economic option. Carbon taxes could add significant costs for non-renewable carbon based fuel usage, but there are currently no final tax schemes to use in a cost analysis. More work needs to be done on the use of biomass in Alaska to answer questions about summer time harvesting, irrigation, soil depletion, fuel density, risk of reduced biodiversity, etc.

The use of CO_2 sequestration combined with the FT process can include either coal-fired, natural gas fired, or biomass-fired installations. For coal or natural gas feed stocks, CO_2 sequestration makes them carbon neutral, and for biomass feed stocks, biomass re-growth combined with CO_2 sequestration actually causes a NET removal of CO_2 from the atmosphere!

Different fuel sources emit different amounts of CO_2. The following table estimates the pounds of CO_2 per million BTUs:

Fuel Type	Pounds of CO_2/mmBTU of fuel
SynGas*	101.26 #/mmBTU
Natural Gas	116.39 #/mmBTU
Gasoline	154.91 #/mmBTU
Petroleum Diesel	159.66 #/mmBTU
Wood	250.00 #/mmBTU
Coal	211.91 #/mmBTU

* Based on the Wiley gasifier specification.

The Fairbanks energy snapshot model was used to compute the level of CO_2 emissions (in pounds - #) for current, mid-term and long-term fuel source recommendations.

	Base Case	Mid-Term	Long-Term
Electrical	1.875 billion #	1.723 billion #	0.002 billion #
Space Heating	1.242 billion #	1.308 billion #	1.306 billion #
Transportation	1.042 billion #	1.089 billion #	1.089 billion #
Total CO_2 Emissions	4.158 billion #	4.121 billion #	2.397 billion #

The largest shift is from combustion to hydroelectric and/or geothermal, which have near zero carbon emissions. The mid-term Space Heating and Transportation emissions can be greatly reduced through the use of a biomass feedstock, which is considered carbon neutral. The amount of biomass used as feedstock for gasification will be limited by previously mentioned factors that need more research. As it may be possible to operate with 100% biomass, it may not be practical. Shifting to hydro and/or geothermal will place Alaska ahead of all other States and integrating maximum biomass could take Alaska off the carbon map completely.

Many strategies have been developed for carbon dioxide sequestration in the case of conventional fossil-fueled-combustion-based electric generation facilities. Since air is fed into the combustion chamber, the product gas mixture contains a major quantity of nitrogen, as well as carbon dioxide, water vapor, and often sulfur dioxide and nitrogen oxides, along with ash particulates. Hence, separation processes have been created, based upon chemical reactions or physical properties, which separate the carbon dioxide and segregate it. If industrial use of the carbon dioxide is planned, a high purity of carbon dioxide is desired, usually obtained at a higher process cost.

Chemical processes for carbon dioxide selection include the use of amine scrubbing, ammonia, limestone, carbonates, layered double hydroxides, zeolites, metal/organic/framework structures, and membranes. Biological fixation involves photosynthesis in various organisms. Cold separation has been proposed using an integrated cascade chiller.

In the IGCC processes, however, many of the processes involve the prior separation of oxygen from the air. Nitrogen is diverted or released back to the atmosphere after oxygen separation. This simplifies the treatment of the exhaust gases in some cases.

IGCC is a clean coal technology that combines two technologies – coal gasification and combined cycle – to achieve the environmental benefits of gas-fired generation with the thermal performance of a combined-cycle plant.

The oxygen-fed processes include those of Lurgi, BGL, HTW, KBR, Chevron Texaco, Conoco-Phillips, Future Energy, Koppers-Totzek, and Shell SCGP. The Wiley process uses pyrolysis, under a vacuum condition, excluding both nitrogen and oxygen. For all of these processes for the production of synthesis gas, and the use of synthesis gas for firing a gas turbine and for Fischer-Tropsch production of liquid synthetic fuels, the product gases will only contain nitrogen if air is used in the turbine combustion stage. The oxygen-based processes presumably will have oxygen separation equipment which could be sized large enough so that sufficient oxygen would be available for combustion. In that case, the product gases would be carbon dioxide and water, for which simple sequestration options may be considered.

One option which is naturally considered in a cold climate such as Alaska is the integrated cascade chiller, which is a conceptual design proposed by Clodic et al. of Ecole des Mines de Paris, at the Greenhouse Gas Control Technology 6 Conference. Chilling of the gas to $-120^{o}C$ solidifies the water and the carbon dioxide, depending upon the pressure. In an Alaskan application, the storage of such a frost mixture or of a carbon-dioxide-based gas hydrate in an underground cavern could be considered. Of course, the simple separation of the water vapor at modest negative temperatures, followed by injection of carbon dioxide gas into an available porus geological stratum, would be even more economical. Clearly, conceptual research on these possibilities is needed.

Comparative Future Costs of Diesel

When the oil price reached about $60/bbl in 2006, the OPEC leadership expressed concern and began to meet to find ways to put a floor under the price. They were successful, and from July to November 2007, the price rose from $70/bbl to $98/bbl. In early November 2007, the Fairbanks price for heating oil was at $3.00/gallon or $126/bbl, while Alaska North Slope crude was $93.96/bbl, giving a refining margin for diesel of $32/bbl. This compares with average refining margins of $3.50/bbl to $4.00/bbl several years before, across the USA. Considering the years 2011 to 2027 and beyond, when a Fairbanks FT plant could be operating, it is likely that the refining margin of $32/bbl will prevail, if the trans-Alaska oil pipeline is still operating. When the trans-Alaska pipeline no longer delivers North Slope crude oil, refined product from Washington or California will be exported to Alaska at a similar price mark-up.

A forecast of world oil price has been made which includes the effects of the 4%/year exchange rate decrease between the US$ and the Euro; which also allows for the announced plans to increase strategic reserves in the major consuming countries over the next three years, by 2%/year; which allows for an inflationary rise in oil price equal to the increase in world GDP projected at 3.8%/year; and which allows for a 5%/year increase from 2007 until 2020 due to an oil demand/supply shortfall and the construction of many gas-to-liquids and coal-to-liquids plants to attempt to meet the demand for liquid transportation fuels. The following price prediction chart can be made for diesel fuel which is delivered from refineries until the year 2027. Synthetic fuels plants operated by profit-making corporations may be expected to follow this dominant pricing level. The price in 2026 is estimated at $246.49/bbl or $5.87/gallon for diesel fuel/heating oil in Fairbanks, Alaska.

TABLE I. POSSIBLE RANGE FOR WORLD OIL PRICES, 2007-2027 per Barrel.

YEAR	Annual Average Minimum Price[1]	Annual Av Price Incl.GDP Rise[2]	Annual Av Price Incl. Supply Shortfalls[3]	Av Diesel Price[4]
2007	$60.00	$62.28	$67.28	$99.28
2008	$63.60	$66.02	$76.02	$108.02
2009	$67.42	$69.98	$84.98	$116.98
2010	$71.46	$74.18	$94.18	$126.18
2011	$74.32	$77.14	$102.14	$134.14
2012	$77.29	$80.23	$110.23	$142.23
2013	$80.38	$83.43	$118.43	$150.43
2014	$83.60	$86.78	$126.78	$158.78
2015	$86.94	$90.24	$135.24	$167.24
2016	$90.42	$93.86	$143.86	$175.86
2017	$94.04	$97.61	$152.61	$184.61
2018	$97.80	$101.52	$161.52	$193.52
2019	$101.71	$105.57	$170.57	$202.57
2020	$105.78	$109.80	$179.80	$211.80
2021	$110.01	$114.19	$184.19	$216.19
2022	$114.41	$118.76	$188.76	$220.76
2023	$118.99	$123.51	$193.51	$225.51
2024	$123.75	$128.45	$198.45	$230.45
2025	$128.70	$133.59	$203.59	$235.59
2026	$139.20	$144.49	$214.49	$246.49

Notes

1. Assuming a 2%/yr price increase over three years due to increases in strategic reserves, and a 4%/yr increase over twenty years due to exchange rate creep between the Euro and the US$.

2. Assuming an additional 3.8%/yr increase over twenty years due to increase in World GDP.

3. Assuming an additional $5/bbl/year from 2007 to 2014; a continued $5/bbl/year from 2014 to 2019; and no additional per-barrel premium from 2020 to 2027, all due to the shortfall between demand and supply of conventional and tar sand oil until 2020, when gas-to liquids and coal-to-liquids technology is expected to be fully introduced. Risk premium due to war or threat of war, terrorism, labor unrest, major weather events such as hurricanes, major fires in large export terminals, revolutions, anarchy, or changes in governmental leadership policies leading to a dramatic loss of production, are NOT included.

4. Diesel price in US$/bbl, rack price, fob Fairbanks, Alaska, based upon a $32.00/bbl refining margin. Divide by 42 to get $/gallon price.

Contingencies

As a general approach, an approach should be selected that will work and then improve on the approach to achieve our intended results of reducing the cost of energy to Interior residents, reducing carbon and other emissions, and retention of local wealth. For example, gasification could start using coal as a feed stock and as biomass becomes commercially available more and more biomass would be used until 100% biomass feedstock has been achieved or the biomass supply limit has been reached.

Exit Strategy

Market loss can bring considerable risk. The strength of the FT process is that the Syngas can be used to make other products such as hydrogen, ammonium nitrate, or paraffin to allow for a market shift. Market expansion could also be available in the provision of Jet A or naphtha to local markets or export to rural areas.

Gasification – FT Subsection of the Energy Task Force Meeting

Participants: Kate Lamal, William Sackinger, Frank Abegg, Paul Morgan, Dave Hoffman, Paul Park, Cassie Pinkel, Steve Haagenson, Jim Dodson

Gasification – FT Subsection Proposal: Coal to Liquids Plant (CTL)
Consider installing a multi-fuel gasification unit capable of producing enough syngas to feed a 5000 barrels per day (bbld) Fisher Tropsch (FT) synthetic fuel process. Refining process units would be installed downstream of the FT to produce a low pour-point diesel product and naphtha ready for use by local consumers. Waste heat and tail gas from the FT process would be utilized to produce electricity for local sale.

CTL Performance Estimate[1]

Coal Feed	3,825 tons/day
Diesel/Jet A Fuel Output	4,280 bbl/day
Naphtha Output	820 bbl/day
Electric Power Output	52 MW

Discussion:
Tasked with reviewing gasification as part of an energy plan for Fairbanks, the group acknowledged the decline and eventual end of North Slope crude oil in the future. This fuel source reduction is expected to continue to escalate the cost of energy for Transportation, Space Heating, and Electricity in the Fairbanks area. Coal is an abundant resource in Alaska that is currently being utilized for electric power production and a limited amount of district space heating. Gasification technology is advancing to the point where gasification processes fed by biomass, refuse, and blended coal will soon be available commercially. The Syngas produced from the gasification process could be used for electric power production and for creating high value liquid fuel products utilizing the established Fischer Tropsch (FT) process. Feasibility studies have shown a combined CTL (Coal to Liquids) plant that includes power generation capabilities can convert low value coal to Diesel fuel, naphtha, and electricity and compete in price with traditional refined products[1].

Selecting a gasifier unit with capabilities of using coal, biomass, and municipal waste as feed allows renewable fuel sources to be included in the Fairbanks energy plan. Seasonal changes in the fuel blend could be accommodated with 100% coal feed as a reserve. Coal reserves in Alaska are extensive with the Usibelli Coal Mine in Healy having proven reserves of 91 million tons[2]. A 5000 bbld Fisher Tropsch plant would require 1.4 million tons/year of coal as gasifier feed.

The Fisher Tropsch process coupled with refining capabilities would produce ultra-low sulfur diesel and jet fuel. This new source would provide the Fairbanks area and surrounding communities with heating oil and low sulfur highway diesel fuel using the existing fuel distribution infrastructure. Jet A fuel could be marketed at the local airport or to the DOD for

[1] Wyoming Coal/FT Fuels Economic Viability Study, June 2005, Rentech Inc.
[2] Alaskan Coal Gasification Feasibility Studies – Healy Coal-to-Liquids Plant, DOE/NETL-2007/1251, July 2007

military use as an alternative fuel. Excess liquid fuel produced could be shipped by truck or rail for distribution across Alaska or exported by barge. Diesel fuels produced using the FT process typically meet or exceed the EPA 2006 Low Sulfur Fuel requirements. Heating oil meeting these standards would reduce the Fairbanks' area emission levels for PM, NOx, and CO_2. Naphtha product could be exported for further refining, used for gasoline blend stock, or as a fuel supply for existing combined cycle power production. Tail gas from the Fischer Tropsch process would be used as fuel for gas turbine/combined cycle power generation that could be sold to consumers.

Estimates that could impact cost of end product:

- We have assumed a 100% coal feed supply for gasification. The reduced performance and additional handling costs associated with blending biomass fuels are not considered in the financial assessment.
- Performance, capital, and construction cost estimates are based on the Wyoming Coal/FT Fuels Economic Viability study performed in June 2005 employing Rentech technologies.
- Long term maintenance costs for the CTL and process equipment life have not been substantiated.
- A mine-mouth CTL plant location is assumed, no coal transportation costs are included.

Strategies to reduce weaknesses and threats from SWOT analysis

A number of weaknesses and threats were identified as part of the Gasification SWOT analysis. Below are some suggestions for mitigating or eliminating potential issues.

- Include Usibelli in developing the project and obtain a long term commitment on coal pricing and contract terms.
- Select EPC contractor who has previous CTL design and construction experience.
- Don't be short-sighted when comparing initial CTL efficiency upgrades against construction and capital costs.
- Investigate whether existing gasifier and FT installations are "leading edge" technology which can be commercially viable and sustainable in Fairbanks' arctic environment.
- If a gas pipeline is constructed from the North Slope, small communities and villages will still require diesel for heating and electric power generation. The federal government and DOD support development of alternate liquid fuels and could be approached for a long term commitment[3].
- If a gas pipeline is constructed from the North Slope, an alternative gas feed supply for the FT would be available. This alternative fuel source could provide an opportunity to negotiate with fuel suppliers for the best value.
- Fairbanks is protected from liquid fuel shortages and fuel price extremes after the Trans-Alaska Pipeline shuts down.
- The specifications for the Wiley gasifier claim the gasifier emits zero carbon dioxide, and combusting of the resulting syngas produces less carbon dioxide than with natural gas.

[2] Alaskan Coal Gasification Feasibility Studies – Healy Coal-to-Liquids Plant, DOE/NETL-2007/1251, July 2007

[3] NMA Mining Week, Volume 13 Issue 32, August 17, 2007

Recommendations for next steps:

- Determine minimum and maximum Fairbanks diesel requirements on a seasonal basis to verify CTL sizing and tank farm requirements.
- Verify Fischer Tropsch product can be refined to produce diesel that meets established specifications for Jet A.
- Research existing commercial gasifier technology that supports multi-fuel feed.
- Consider impact on local refiners and heating oil prices with a new diesel source.
- Define available markets for summer season diesel sales when heating oil demand is reduced.
- Determine CTL plant location considering labor, permitting, construction, fuel transportation, and end product distribution factors. A Fairbanks location would be a central point for utilizing combustible wastes, harvested biomass, or a gas pipeline connection when the gas pipeline is constructed. Fairbanks fuel distribution infrastructure, tank farms, and rail road infrastructure could be utilized to reduce CTL capital costs. The Golden Valley lines to Healy and the Alaska Intertie could be used to export electric power to Anchorage.
- Develop an RFP for getting formal quotes from the gasifier and FT manufacturers to establish current pricing and expected performance guarantees (efficiencies, emissions, capacity, etc.) on the proposed fuel mix

Biomass Workgroup of the Energy Task Force Meeting

Participants: Gwen Holdmann, William Sackinger, Mark Elliot, Kaarle Strailey, Lena Perkins, Cassie Pinkel, Ryan Colgan, Jeff Werner, Steve Haagenson, Jim Dodson, David Van den Berg

Yearly availability of biomass fuel sources in FNSB
There are four primary potential sources of biomass feedstock available or potentially available in the FNSB. These include:

1. Raw harvested timber as part of wildfire mitigation planning and right-of-way clearing
2. Byproduct of lumber industry (wood residue)
3. Landfill and municipal waste
4. Short rotation woody biomass crop, such as willow or aspen

At this time, there is little demand for biomass as a fuel or processed lumber in Interior Alaska. For this reason, with the exception of municipal waste, there is not an established supply of material which can serve as a feedstock for large scale power generation or heating using biomass material. For this reason, we have considered current land uses and availability when assessing potential biomass available for power generation and heating. The FNSB has a total land area of 4,764,160 acres, of which roughly 1% is water and significant additional sections are wetlands or are areas of low productivity. Assuming an average total biomass per acre of 11 tons[4] in the FNSB and a conservative regrowth rate of 40 to 70 years, it would require just under 7,000,000 acres, harvested on a rotational basis, to generate 200 MW, which would be required to supply all the electric power needed in the Fairbanks area. This is nearly double the land area of the entire borough, and so this is clearly not a feasible solution on its own.

Another alternative would be growing a short rotation woody biomass crop with potentially higher yields. Averaged biomass production of farmed willow coppice has been reported as 3.56 tons/acre/yr in the U.S[5]., 4.23 tons/acre/yr in Canada[6]**,** and 6.23 tons/acre/yr[7] in Sweden[8]**,**. To maximize productivity, above ground biomass is harvested on a multi year rotation, with 3 years being common. This would require somewhere from 309,000 to 540,000 acres to generate the same 200MW, which represents 6.5 to 11.3% of the total land area of the FNSB. The University of Alaska has been conducted preliminary research into a number of varieties of potential biomass crops, however this program will need to be substantially expanded to determine species and cultivation techniques which are effective in our climate and latitude as initial results have not been able to duplicate yields reported from other regions.

[4] From Department of Forestry ‘Analysis of Wood Volume Available from Hazardous Fuel Reduction Program and Development of Wood Residue Markets in the Fairbanks Area’, Douglas Hanson, 2007
[5] Kopp, RF; White, EH; Abranhamson, LP; Nowak, CA; Zsuffa, L and Burns, KF ‘Willow biomass trials in Central New York State’. 1993. Biomass and Bioenergy 5:2, pages 179-187.
[6] Roberston, A. ‘Willow plantations in Agroforestry’. Span. 1984, 27: 1, pages 32-34
[7] Beale, CV. and Heywood, MJ. ‘Productivity of commercial crops of short rotation coppice at six sites in southern England’. Aspects of Applied Biology No.49, pages 181-188
[8] Hytonen, J. ‘Effects of fertilizer application rate on nutrient status and biomass production in short rotation plantations of willows on cut away peatland areas’. Suo. 1994 45: 3, pages 65-77

When considering supplying biomass as a feedstock to produce a more modest 20MW of electric power generation[9], the land requirements are reduced to 31,000 to 54,000 acres of willow biomass, 680,000 acres of harvested wood from forest lands, or 105,000 tons of municipal waste. This takes rotation into effect to allow for a sustainable yield. Alaska currently has 900,000 designated as farmland, however this includes large tracts used for Reindeer herding on the Seward Peninsula and other grazing lands. Actual traditional croplands currently in production is estimated at 30,000 for the entire state, of which approximately half is located in the Tanana Valley. There are an additional 28,000+ acres in the Delta area, which are listed in the Conservation Reserve Program (CRP) and not in current production.

There is an effort being made to remove much of this land from the CRP program, which, coupled with USDA incentives to farmers for growing bio-energy crops, may encourage local farmers to consider willow and other short rotation woody biomass crops provided there is an established market. It is further estimated that the average crop value on currently farmed land is $300/acre, which would equate to a short rotation woody biomass crop value exceeding $84 per ton at the lower end of productivity, and $49 at the high end, in order to displace other crops. However displacing local agriculture is not a desired effect and for this reason the biomass subsection focused on assessing existing fallow farm fields which are currently part of the CRP program. Additionally, the thousands of acres of existing and planned fire breaks around communities could be used to grow biomass crops, and other land such as acreage located in the Tanana River Floodplain or within the flood control project would be ideal for this type of crop. In fact, the flood control project is periodically mowed to reduce growth and as such has a negative value to the local economy at this time. There are additional consequences, which should be assessed, including stream bank stabilization potential on the positive side and potential discharge of fertilizer into local waterways on the negative side, although some research indicates fertilizing does not increase total biomass production anyway[10].

The Borough also has 10,500 acres of allowable harvest from State lands that is not currently being utilized in any quantities. The ideal and lowest cost way of obtaining biomass from this acreage would be to encourage the growth of sustainable local timber harvest and use residue from that harvest as an inexpensive fuel stock. Additionally, the FNSB Landfill Eielson waste paper program collected 1500 tons per year of waste paper and cardboard until the program was discontinued in 2006. Estimates of total recoverable paper and cardboard are 14,000 tons based on national averages. Presumably any fuel diverted from the landfill would have a zero or negative fuel cost associated with it. Processing and transportation costs are TBD. While a mixed source of feedstock is expected, priority should be given as follows based on lowest cost and impact to the environment and community:

1. Landfill and Municipal Waste
2. Wood residue or wood harvested as a byproduct of other beneficial activity
3. Short rotation wood biomass crops
4. Raw lumbered harvested solely for the purpose of use as a biomass feedstock

[9] Assuming 30% efficiency

Cost of producing fuel and energy content (delivered):
All biomass sources will require some transportation, processing, and storage of fuel or inventory maintenance to manage a uniform continual feed. Expenses vary based on distance to market and degree of processing or separation (in the case of municipal waste) required. For harvested wood, a good first order estimate can be obtained from the Department of Forestry Report issued in 2007[1]. In this report, a value of $51.51/ton is estimated for green biomass from fire mitigation program in Fairbanks area, assuming biomass production of 7500 tons/year. For willow biomass, $25-50 per ton is the delivered fuel cost estimate based on other projects. Both of these values represent minimal processing, such as size reduction and drying, which may be necessary to prepare a feedstock for certain uses such as co-firing and pelletizing for heating.

Process efficiencies that could impact cost of end product:
- We have assumed a total efficiency of 30-35% for gasification to power (e=70% for gasification, e=50% for gas turbine)
- We have assumed total efficiency of 20% for boiler (heat) to power (e=85% for boiler, e=24% for power cycle)
- We have assumed a capacity factor of 85% for a biomass CHP plant

Strategies to reduce weaknesses and threats from SWOT analysis
A number of weaknesses and threats were identified as part of the biomass SWOT analysis. Below are some suggestions for mitigating or eliminating potential issues.
- Use farming to control distances (fuel source to end use)
- Export techniques and equipment design to other parts of state
- Use waste heat in process applications (drying feedstock)
- Low density fuel and high handling costs increases job opportunities, particularly in winter months
- Use modular approach to mitigate chicken and egg problem
- Tap large land owners as project participants
- Use diversified crop strategy
- Long term power sales contract to stabilize fuel cost
- Encourage devolvement of fallow farmland (CRP land) through incentives
- Include Usibelli by tapping them as a potential biomass producer on remediated lands

Recommendations for next steps:
It is evident that a multi-fuel approach must be taken for any large scale project, as any single fuel source is inadequate for a larger scale project (20+ MW). Additionally, near term uses for biomass, which can drive development of a future supply include:
1. Co-firing in existing power plants
2. Support the installation of small, privately owned CHP biomass systems
3. Support the growth of a sustainable harvest lumber industry in the interior

In particular, the co-firing of a biomass fuel in existing coal plants in the interior was identified as a low cost option for building a market for biomass fuels and should be further assessed. This has already been done in the past at the University of Alaska and the Eielson Air Force Base coal fired plants. Both programs were discontinued when the feedstock (densified paper-based municipal waste) was discontinued. In order to be able to use biomass as a co-fired fuel, a coal plant must operate as traveling grate boiler or fluidized bed. For this reason, biomass cannot be co-fired at either power plant in Healy (Clean coal or Healy 1).

Any biomass to electric power installation must be coupled with an industrial or residential use for low grade rejected heat. This could boost overall CHP cycle efficiency to as high as 80% and greatly improve project economics. Biomass industries could support one another, for example heat produced as a byproduct of biomass combustion in a CHP system could be used to dry pellets which in turn could be used for space heating.

Finally, a technology option review should be completed and biomass should be considered as a potential feedstock for any future combustion or gasification systems designed for use in the FNSB. Also an assessment of potential air quality issues, including $PM_{2.5}$, would need to be completed for the Fairbanks vicinity.

Hydroelectric Subsection of the Energy Task Force

Participants: John Davies, Mike Wright, Karl Monetti, Dave Van Den Berg

Hydroelectric Workgroup Proposal
Consider the installation of a 600-megawatt Susitna Hydroelectric project that would supply the electrical needs of the Railbelt. Construction of multiple transmission lines to Fairbanks and Anchorage would also be required for the reliable "firm" delivery of the Susitna energy.

Delivery of electrical power from Susitna to rural Alaska would likely not be economic, but Susitna energy could augment or power the production of Fischer-Tropsch liquid fuels for delivery to rural Alaska that would be used in existing infrastructure.

In the long-term, a 20 to 50-year timeframe, once the technology is commercially available, electricity from Susitna could be used to power electrolyzers for the creation of hydrogen. Hydrogen would be delivered locally for use in home fuel cells for heat and electric cogeneration and car fuel cells for transportation. This is idealistic; zero-emission renewable energy used in a technology that only produces energy and distilled water.

Discussion
Hydroelectric power has been an important source of electrical power throughout the World for decades. Regions have developed and grown from the construction of hydro projects, many of which were constructed with Federal governmental support.

Hydroelectric projects typically have very high initial capital costs to construct the original dams and generators. The operations and maintenance costs that typically are predictable with increases linked to inflation. The predictability of the very stable hydroelectric costs, over 100-year plus project lives, has coined the phrase "flat power".

In the 1930's through the 1950's, when most of the large federal projects were built, the National Environmental Policy Act (NEPA) was not in existence. The goal of these projects was to provide jobs, abundant and cheap power to regions for economic growth. After the passage of NEPA, the rules governing the evaluation of projects and their effects on the environment were developed and clarified into the current day, Environmental Impact Statement (EIS).

All the legacy combustion turbines in the Railbelt are over thirty years old, and will need to be replaced within the next ten years. The cost of replacing these aging electric generators is approximated to be in the range of $1.5 billion to $2.5 billion. The general approach to the aging generation situation will be the replacement of the combustion turbines with new more efficient combustion turbines or with low cost fuel options such as coal power plants. Financially, once the new turbines have been installed and the investment has been made the turbines are expected to be operated and emit some level of pollutants and carbon dioxide for their economic life of about thirty years. Fuel switching or changing to hydroelectric is a only viable option before commitment to the construction of the replacement turbines. Environmentally, the carbon-based power plants will emit varying amounts of oxides of sulfur, oxides of nitrogen, particulate matter and carbon dioxide. Hydroelectric generation will provide a renewable alternative to combustion technology that will emit near zero emission. Hydroelectric emissions are considered near zero rather than zero due to recent discussions of methane released from submerged biomass due decomposition from the creation of the lake behind the dam. There is little data on this topic in northern regions but it is suspected that the potential release of the quantity of methane released would have much less impact as a green house gas than the carbon dioxide release from even the most efficient combustion turbine using natural gas as a fuel. In addition, logging and clearing the area to be inundated prior to filling the reservoir can greatly reduce the quantities of methane released after the reservoir is completed.

Cost of hydroelectric Construction and Operation

The capital cost of a 600,000-kilowatt Susitna project was estimated at $5,000/kilowatt for a hydroelectric capital cost of $3,000,000,000. The electrical transmission lines for inclusion were 20 miles and 300 miles if line at a cost of $1,000,000 and $1,500,000., respectively, for a total transmission line cost of $470,000.

The State of Alaska provided a September 13, 2005 memo on an update of the cost estimate for the Susitna project, from the 1984 Update Study adjusted to 2005, at a cost of $10.5 billion. The reason for this 3 fold increase in price are not known, but needs to be examined and evaluated. The scope of this project is not known and needs to be verified to ensure the proper cost estimate. The full 1,600-kilowatt project was referenced in the FERC application but in the later stages of the project there were discussions of a reduced scope Susitna Project. More research needs to be conducted on the project scope. A former Alaska Power Authority employee involved in the project estimated the Watana dam to be 4/5 of the project costs.

Operation and maintenance cost were estimated at $0.008/kWh, based on a DOE Large Hydro report.

Recommendations for next steps:

Analysis should be done on the appropriate sizing of the dam to power both the mid-term and long-term energy of the Railbelt.

The hydrological design should be reviewed once the sizing has been completed.

System security should also be analyzed to ensure power supplies in the Railbelt would continue following any common mode failure or natural disaster. Peaking units could be maintained at each load center to ensure continuity of energy supply if the hydroelectric was unavailable. The existing aging generators may provide many years of emergency power at a realistic price. Delivery of the electric energy of high-voltage transmission lines can be secured through multiple transmission lines, which are separated by distance to reduce one cause removing multiple lines from service.

The timing of permitting and licensing should be reviewed to identify the effect of re-filing the existing FERC license for Susitna, or modifying the dam design, which may require additional environmental field studies.

Geothermal Workgroup of the Energy Task Force Meeting

Participants: Chair: Dan White, Gwen Holdmann, Bill Sackinger, Doug Goering, Amanda Kolker.

Two types of geothermal plants are candidates for development in Alaska. One is a large power plant that may or may not be connected to a grid. In the case where it is not connected, the plant is located at a port where it can serve as a power plant for manufacturing, refining of minerals, or separation of liquids. The example for a large, grid connected power plant is the potential Mt. Spurr prospect that would serve the railbelt grid. In the case of large power plants we chose a 100 MW plant. The second type of geothermal plant would supply power to a small grid, such as the Chena Hot Springs Resort. In this case the plant would more likely be a lower temperature resource binary system geothermal development.

1. Write a short section for the business plan that identifies and cites the source of data and assumptions that were used in the cost model.

The data that was used by the geothermal group were derived principally from Hance, 2005, as well as costs developed by Amanda Kolker in her work with the AEA and Gwen Holdmann from the Chena Hot Springs Resort.

According to Hance, 2005, capital costs can be broken down according to Figure 1. The capital costs in Hance, 2005, ranged from $3000 - $3900/kW (in 2007 dollars) including all elements of development as shown in Figure 1.

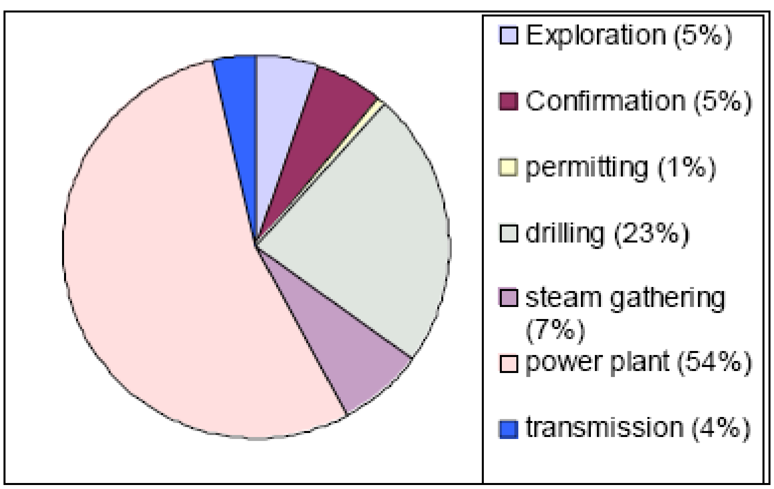


Figure 1. Distribution of capital costs for geothermal power plants (Hance, 2005).

Here, transmission is only 4% of the total cost of the project, or $120-$156/kw. For Mt. Spurr, there would be roughly 30 miles of transmission line built. According to Hance, 2005, the cost of transmission is $400,000 - $500,000 per mile. The 230 kilovolt Northern Intertie was recently constructed at a capital cost of $1,000,000 per mile. For a 100 MW plant at Mt.

Spurr therefore, the capital cost would be approximately $350,000,000 of which $20M would be for transmission.

An equation was included in Hance, 2005, to generate costs for geothermal plants on a size basis. The equation suggests that a power plant at 10 MW would cost roughly 26% more on a per kW basis than a 100 MW. As such, a cost of 4410/kW was used for the CHSR model.

Operating and maintenance costs for geothermal are estimated to cost between $15 and $30/MW in 2007 dollars. In our estimates we assumed $25/MW for both the large and small plants.

2. Rank the available options for inclusion in the presentation final short, mid, and long-term recommendations

Recommendations for the short term include: 1) evaluation of small grid, large grid and point of use applications in the state, 2) develop a resource research plan. Before selling leases or private investment, regional or state agencies should evaluate the geothermal resource potential.

Recommendations for the midterm include: 1) Implementation of resource evaluation and cost structures for leasing the resource, and construction/operation of the power plant. In the mid-term, exploration should begin on small and large scale plants.

Recommendations for the long term include: 1) Construction and operation of plants, 2) study the potential opportunities to convert geothermal power into a mobile fuel source (e.g. hydrogen).

3. Develop a socioeconomic model of alternatives that show relationships of alternatives and their externalities.

Henry??

Hance, C., (2005), Factors affecting costs of geothermal power development, Geothermal Energy Association, Washington DC.

Distributed Generation Workgroup of the Energy Task Force

Distributed Generation. Chair: Jack Hebert. **Members:** Gwen Holdmann, Karl Monetti, Seth Danielson

Distributed Generation Workgroup Proposal
Develop a campaign to increase participation in Golden Valley Electric's Sustainable Natural Alternative Power (SNAP) program for both contributions and generation. The growth in contributions is critical in maintaining a healthy market that will attract additional generators.

Consider launching an entirely new program under a different name dedicated to distributed generation and green energy. SNAP could be integrated into new program that would aggressively fund viable & fiscally sound green energy by offering GVEA customers the option to pay 5-10-20% more for "renewable energy". To recognize those committed to green energy this program could have bumper stickers, lawn signs, & even window signs for businesses along with other promotional tactics could also be employed Work with Golden Valley Electric's Green Power Advisory Committee (GPAC) to develop a "green premium" for the renewable electric generation sold to Golden Valley.

Work with the Railbelt utilities in the development of Interconnection Standards.

Initiate a public education campaign that outlines the costs and paybacks of installing various systems that use renewable energy for small scale electric production to homes and businesses.

Discussion

Golden Valley has developed the SNAP program to encourage the generation of distributed generation resources. As explained on the www.gvea.com website the SNAP program places a willing seller with a willing buyer, with Golden Valley acting as a broker. Contributions to the SNAP program are made by GVEA members on their electric bill and placed into the SNAP account. Each year the available funds are distributed to the SNAP generators based on the kilowatt-hour of SNAP energy generated. There is a $1.50/kWh cap on the amount that will be paid to producers under the SNAP program. Excess funds stay on the SNAP account for pay out in future years. There is not cost to GVEA members who do not want to participate in the SNAP program.

The $1.50/kWh cap should not be assumed as the payout amount for any economic analysis. As larger SNAP producers come online, the kWh production will increase and the payment per kWh will decrease unless more funds are contributed to the SNAP program. If the contributions stay constant and the generators increase production, the SNAP payments will decrease. The decrease will continue until producers determine that additional SNAP generation is uneconomic or until additional contributions are made to sustain the program at an economic level for the producers. Ideally, a new generator would not only add new generation but would bring additional contributions to the SNAP program to maintain the amount per kWh paid to the producers.

The GVEA Board has asked the GPAC to investigate a "green premium" that would be an additional payment under a power sales agreement to generators for the production of renewable energy.

The Energy Policy Act and FERC directed each State to evaluate several issues, one being Interconnection Standards. The Regulatory Commission of Alaska has recently opened a docket to investigate these standards and has conducted a workshop with utilities to hear proposals for the interconnection of generators to the electric system.

The proposal will have the effect on the following 'looming issues.'
Reduce the cost of energy for Interior residents – SNAP is cost neutral, Green premium will have a minor increase for the renewable generation. After initial investment in a system is recovered cost of electricity becomes minimal and potential net positive revenue is possible. In addition if distributed generation continues to grow then it can also lead to a more robust grid, which can also result in lower energy costs.

New generation capacity/fuel source moved to production – Small capacity additions are expected under the SNAP program.

Aging Generation - Distributed generation – as through the SNAP program – adds increments of new generation capacity.

PM 2.5 Standards – Slightly lowered use of fuels from fossil fuels will result in slightly lower emissions.

Waste stream use – Wood and paper waste can be used as a fuel source for clean burning combination heat and power units (CHPs) if they prove practical.

Economic development – Funds will be paid to local SNAP generators. Should stimulate growth of renewable energy companies that install and distribute systems.

Sustainability – SNAP is sustainable

Global warming – Reduction in greenhouse gas emissions from use of green technologies. Distributed generation also means less transmission losses, which means higher energy effectiveness, also lowering net greenhouse gas emissions.

Meeting Renewable Portfolio Standards (RPS) – SNAP generation can be included in the Existing GVEA RPS.

Wildfire mitigation – If combined heat and power generation systems (CHPs) develop and are viable using woody biomass as a fuel source, a significant resource in renewable and carbon neutral clearing waste created by maintaining area wide fire breaks will be available.

Joint Utility Planning – Development of a system-wide Interconnect Standard will aid in determining the rules of the road for distributed generators throughout the State of Alaska.

Recommendations for Next Steps

Evaluate new technologies for use in distributed generation that will decrease capital or production costs.

Assist the GPAC in their evaluation of a “green premium” for renewable electric energy.

Provide input to the RCA or Golden Valley on the proposed Interconnection Standards.
Support research on clean burning wood fired CHPs for the Tanana Valley.

Conservation & Efficiency Workgroup of the Energy Task Force

Conservation and Efficiency Workgroup: Chair: Rich Seifert. **Members:** Mike Musick, Becky Warren, Lori Hanemann, Karl Monetti, David van den Berg, Ryan Colgan.

Conservation & Efficiency Workgroup Proposal
Consider the immediate formation of an efficiency business that will identify and support the most productive means to reduce energy usage in homes in Interior Alaska. The business would provide home evaluations, identify the best energy saving alternative, provide funding options for the retrofit and document the savings to the homeowner. Utilize local workforce to provide the energy evaluation,

As a longer-term strategy, develop an applied science Energy Efficiency Education program in the local school districts. The program would start at the lower grades with basic concepts and continue through high school. Qualified high school students could work as energy raters as summer employment. It is likely that each student will at some time in their life either build or buy a home. The understanding of energy usage and efficiency will allow them to make an educated informed decision.

Discussion
Conservation and efficiency increases are by far the most effective means of reducing cost to the individual, reducing emissions and reducing fuel usage. The beauty of increasing efficiency is we can start today. With available know-how one can immediately start to save money on our utility and home heating bills. There are a multitude of simple measures that range in price and energy savings. Education is key to producing these energy savings, so the casual implementer will know what measure will provide the best bang for their buck. Efficiencies can happen at all levels, from installing compact fluorescent light bulbs to installing the most efficient combined cycle gas turbine. After the future need has been reduced through demand-side conservation or efficiency increases , the most significant savings can come from the reduced need for future supply side increases,not having to install the energy source at all, which saves all capital costs, operation and maintenance costs and fuel costs. As cost effective as conservation and efficiency efforts that reduce the need for supply-side increases are, they cannot make up the total energy solution, but are rather one key piece of the energy solution puzzle. Once again, the advantage of conservation and efficiency increases are that they can start immediately, with focused training and substantial initiative.

No matter what type of energy is used, its cost to consumers is a function of its unit of energy times the price per unit. When energy is expensive the user has limited choices; pay the high price, switch to a lower cost energy source or reduce energy costs by using less energy. The cheapest unit of energy is the one not used.

For most families, their home is their primary investment and a prime determinant of quality of life. Public policy and financial practices should reward investment in homes (including rental properties) that minimize energy usage.

The overwhelming strength of conservation and efficiency is that the technology and know-how currently exists to immediately save mostFairbanksan money on their utility and home heating bills. Yet these measures are underutilized. Demand for conservation and efficiency measures in new and existing buildings has lagged; supply of conservation and efficiency incentives exist but appear neither coordinated nor attractive. Despite numerous programs [1], most commercial and residential buildings are grossly inefficient. There are at least two preconditions to making the build environment more efficient: a high cost of energy, and both sticks and carrots to encourage demand for conservation/efficiency measures.
There are many areas, which could be developed to encourage the wise and efficient use of energy in businesses and homes. We recommend each be evaluated to ascertain how they can be deployed to provide a world leadership culture of smart energy use in Interior Alaska.

Lenders: Enable more Borough residents to qualify for energy efficiency/conservation upgrades or retrofit grants and low interest loans. (As an example of a simple upgrade, it is estimated that replacing an older low efficiency boiler with a high efficiency boiler could save a Fairbanks resident or homeowner 500 gallons a year for a net savings of approximately $1050/year.)

1. Increase funding for Low Income Weatherization program. In 2007, Interior Weatherization aims to serve127 households, or four-tenths of one percent of the Borough's 29,777 households. http://www.fedstats.gov/qf/states/02/02090.html
2. Extend AHFC's Energy Efficiency Interest Rate Reduction package to Borough residents, increase the allowable loan, and make available more funds for the program.
3. Extend AHFC'S Small Building Material Loan to Fairbanks residents, extend these loans to non-owner occupied buildings, and increase loan limits.
4. Establish loan program to encourage renewable energy installations in households and businesses (AHFC or other).

Lenders and Appraisers: Educate lenders and appraisers of the value that efficiency/conservation measures add to new or retrofitted homes and commercial buildings, especially as these measures relate to the operating costs of building, which relate in turn to a borrower's ability to repay the debt.

Borough: The Borough should encourage energy retrofits by not including the improvements in the tax assessment. Also, because conservation programs and awareness are having a positive effect on consumer choices of home lighting, the Borough needs to take used compact fluorescent bulbs as part of their hazardous waste disposal program.

GVEA: Consider utility rate structures that promote energy conservation. Continue to promote the SNAP program.

CCHRC: Fulfill their BEEEP plan, which is attached to this committee report.

Hutchison Career Center: Via the 'Alaska Works' program and other statewide vocational curriculum create a workforce trained in conservation and efficiency building practices.

The proposal will have the effect on the following 'looming issues.'
Reduce the cost of energy for Interior residents - No matter what type of energy is used, its cost to consumers is a function of its unit of energy times the price per unit. The easiest variable to control is personal energy use rates. Using less energy – at any price, but especially at present prices – necessarily reduces the cost to Interior residents.

Aging Generation - Conservation and efficiency do not by themselves obviate the need to replace increments of aging generating capacity. Distributed generation – as through the SNAP program – adds increments of new generation capacity. The cheapest kilowatt is the kilowatt you don't need to replace.

PM 2.5 Standards – Lowered use of fuels from any source, and fossil fuels in particular, will result in lower emissions overall. Conservation and efficiency may have a positive effect on Fairbanks' ability to meet PM2.5 standards.

Waste stream use – With widespread retrofit campaign, salvage of existing building materials is possible, creating secondary market for building stock and reducing space requirements at Borough landfill.

Economic development – Funds made available by lending institutions create employment. The impact on economic development can be substantial if we assume the workforce and materials for retrofits will be locally supplied and that households realizing cost savings will re-allocate their discretionary spending. Finally, the workforce, products and services developed in the course of the retrofits may well be a service headquartered in Fairbanks for export throughout the state.

Sustainability – Reduced reliance on fossil fuels can lower operating costs for families and for the community thereby increasing their sustainability. Simplifying infrastructure rather than elaborating it leads to sustainability.

Global warming – Since most power generation and home heating in Fairbanks relies on fossil fuels, we can directly reduce greenhouse gas emissions by conserving household energy and making our homes more efficient.

Meeting renewable portfolio standards - Using less energy, however, reduces the scale of generation capacity needed. Smaller loads can be met by smaller units. Potential renewable energy projects could look better in light of meeting smaller loads.

Wildfire mitigation – no effect.

Joint Utility Planning – Conservation/efficiency programs and expansion of distributed generation – or campaigns to that effect – would be helped greatly by joint utility planning.

Recommendations for Next Steps
Identify an organization to start the Energy Efficiency business.

Work with the FNSB School District staff to implement existing applied science energy curriculum.

Verify impediments to conservation and efficiency.

Determine what city and borough ordinances and policy and what state policies and legislation would create a favorable environment for energy conservation and efficiency.

Determine realistic near-term and mid-term activities to create demand for conservation/renewable measures. (Determine communications plan.)

Consolidate conservation/efficiency programs under an overall program addressing green building, to include new construction, energy rating, retrofits, weatherization, distributed generation, education, regulations, state and national policy.

Correlate Fairbanks Energy with Borough Resolution 2007-40, which commits the Borough to list opportunities and vulnerabilities related to climate change and to create an action plan to adapt and mitigate for climate change.

Correlate Fairbanks Energy with Mayor Whitaker's FLEX Energy Plan, especially the Non-fossil Fuel Energy Analysis.

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(1) Programs to Encourage Conservation and Efficiency in households:

- Energy Efficiency Interest Rate Reduction Program, AHFC
- Small Building Material Loan, AHFC
- Homeowners Association Loan Program, AHFC
- Alaska Building Energy Code – to qualify for AHFC loans for new construction, purchase of existing homes, or retrofit, these must be met.
- Golden Valley Electric Ass'n. - Builder $ense
- Golden Valley Electric Ass'n. – Home $ense
- Golden Valley Electric Ass'n. – home energy audit
- Golden Valley Electric Ass'n. - SNAP program
- Federal tax credits and exemptions
- Low Income Weatherization programs
- Technical assistance from UAF Cooperative Extension Commercial

- Golden Valley Electric Association - Business $ense Government/Public
- Energy Standards for Public Buildings
- Appliance/Equipment Efficiency Standards

(2) Adapted from Rich Seifert, Professor of Energy and Housing, and UAF Cooperative Extension Officer, http://www.uaf.edu/ces/faculty/seifert/energy.html

(3) Page 4, Tackling Climate Change in the US: Potential Carbon Emissions Reductions from Energy Efficiency and Renewable Energy by 2030.)

A Summary of the Built Environment Energy Efficiency Program (BEEEP)

Developed by the Cold Climate Housing Research Center

Program Benefits

Economic

- Employ new energy raters (approximately 9 @ $40,000 per year).
- Create work for those with retrofit capabilities (approximately 12 workers @ $40k – 50k).
- Enable residents to save money over time by spending less on energy efficiency measures than they would on energy (payback periods ranging from approximately 2 mo. to 10 yrs).
- Dollars saved will circulate in the community.

Environmental

- Reduce the amount of greenhouse gases and particulate emissions generated in the FNSB.

Program Energy Evaluation and Retrofit Outcomes

The CCHRC estimates the following number of energy evaluations and retrofits will occur during the first three years of the program:

- Approximately 4,000 homes in the FNSB will undergo a comprehensive energy evaluation.
- Approximately 1,500 homes will undergo significant retrofit.

Program Cost

Approximately $275,000 per year for three years is unfunded. This figure assumes that all other identified funding sources fully fund the program.

Overview

CCHRC developed a comprehensive energy efficiency program concept which will lead to a built environment market transformation in the Fairbanks North Star Borough (FNSB).

The program is comprised of four interdependent subprograms, some of which exist to some degree today and others which will be developed. The four subprograms are the Outreach and Awareness Program, the Energy Evaluation and Rating Program, the Training and Certification Program, and the Financial Resources for Energy Efficiency Program.

The subprograms work seamlessly to first make the consumer aware of the economic and environmental efficacy of creating a more energy efficient built environment, the steps that can be taken, and the resources available to complete the steps. The programs will encourage consumers to participate in an energy evaluation and rating which will provide the consumer with a list of recommendations to make their home more energy efficient.

The program will assist consumers by providing information about suppliers and contractors able to provide the products and services consumers choose to pursue. The program will also provide consumers information relating to financial resources including existing low interest loans and tax incentives.

Parallel to working with consumers, the program will offer training and certification services to contractors and other professionals involved in the built environment to ensure that the local professionals are able to perform the work necessary to meet consumer demand.

The program will incorporate existing energy efficiency programs under one umbrella, including Golden Valley Electric Association's (GVEA) Home $ense program, and Alaska Housing Finance Corporation's (AHFC) energy rating and low interest loan programs. Other program components will be developed to complete the range of services herein described.

Outreach and Education Sub-Program

The Outreach Program will encourage and educate the public of the availability, benefits, installation and use of high efficiency products, renewable energy and CHP technology that will result in lower energy costs and lower emissions of greenhouse gases and particulates.

A focus of this program will be to provide "one-stop shopping" for consumers for the help needed to make informed decisions. The Program will provide a centralized means of obtaining the information they need to make their homes and buildings more energy efficient via our website, library, informational materials, classes, tours, personal consultations, individual home evaluations, presentations, and demonstrations.

Energy Evaluation and Rating Sub-Program

The primary objective of the Energy Evaluation and Rating Program is to coordinate and enhance the existing Home $ense program administered by the GVEA and the Energy Rater program provided by the AHFC to provide more comprehensive evaluations of existing buildings. The Evaluation Program will provide information and help to consumers who want to make their homes as energy efficient as possible but don't necessarily know what to do or how to do it. The cost of an evaluation will be subsidized at an affordable rate which takes into account the purpose of the program, the level of service offered and the longevity of the program.

The Energy Evaluator will give the consumer a detailed list of potential energy saving measures for their home and the associated cost and payback time for each of the measures. The Evaluators will also provide information packets compiled through the Outreach Program (described in previous section above) on topics such as product information, lists of contractors, and financing options.

If the homeowner needs further information, they can set up an appointment with the Project Manager who will review the intake form, inspection notes, list of recommendations and information given and will give additional materials and advice to the homeowner.

Training and Certification Sub-Program

The Training and Certification Program's primary objective is to train a cadre of contractors to do the work needed to make homes and buildings more energy efficient. The Training and Certification Program (hereafter, the Training Program) will serve to encourage the adoption of energy efficient design, technologies, and practices in new construction and retrofits to achieve energy efficient goals in residential and other buildings.

The Training Program will organize workshops and training opportunities to improve knowledge and understanding of energy efficient construction techniques and renewable energy standards, policies, products and materials for contractors, builders, architects, engineers, and other professionals.

The Training Program will coordinate certification training to increase the number of professionals needed in "niche" areas such as renewable energy system installers, energy inspections, data control technology, waste water treatment, building and installing masonry heaters, etc. This will build regional and local technical capacity and create new jobs.

CCHRC is collaborating with experts in building and energy sciences from the University of Alaska Fairbanks (UAF), Josyln Castle Institute for Sustainable Communities (JCISC) and Siemens Communication/ Education Department to develop and integrate new educational curriculum into schools and universities. The curriculum will build awareness of sustainability issues and will encourage students to pursue careers such as facilities management, construction management, engineering, etc.

Financial Resources for Energy Efficiency Sub-Program

The primary objective of Financial Resources for Energy Efficiency (FREE) Program (hereafter, the Finance Program) is to provide financial information to consumers and to expand the availability of financial services from lenders and other financial institutions.

There are a few resources currently available to help finance energy efficient upgrades. AHFC presently offers a low-interest loan program in rural Alaska for energy efficiency upgrades. We propose to work with AHFC, the Alaska State Legislature, the Fairbanks North Star Borough, and private lenders, to make such loans available in Fairbanks as well. CCHRC has had conversations with key personnel in all of these entities and they are interested in seeing this program become a reality.

The Finance Program will help consumers to understand the range of options including AHFC and other available energy efficiency lending programs. The energy efficiency loan is a home improvement loan from participating lenders where the homeowner qualifies for the loan based on their projected increased cash flow gained from having a more energy efficient house. If these loans can be guaranteed by a government agency, private lenders can offer very low interest rates. The Project Manager will supervise this program and the Outreach and Training Coordinator will implement it.

Interior Issues Council
Cost-of-Energy Taskforce

- Fairbanks pulling together and asking the tough questions to find an energy solution.
- Partnering with: FEDCO, utility, industry, environmental community, University of Alaska – Fairbanks, CCHRC, government
- Finding common ground in a diverse group.

Energy Taskforce Process

- Recharge Existing Taskforce and add new impassioned members
- Identify Issues to be addressed
- Form workgroups
- Create Business Plan

IIC Energy Taskforce Members

Chair: Steven Haagenson

Frank Abegg
Henry Cole
Ryan Colgan
John Davies
Jim Dodson
Mark Elliot
Hugh Fate
Lori Fickus
Jack Hebert
Dave Hoffman
Gwen Holdman
Sue Hull
Bernie Karl
Kate Lamal
Carol Lewis
Eric Lidji
Karl Monetti
Paul Morgan
Mike Musick
Paul Parks
Lena Perkins
Cassie Pinkel
William Sackinger
Rick Solie
Jomo Stewart
David Van Den Berg
Jeff Werner
Dan Wells
Dan White

Issues to be Resolved

Issue	
PM2.5	Particulate matter under 2.5 microns
Municipal Waste	Paper, plastics, tires, wood and metals
Cost of Energy	Our original goal: “Reduce the cost of energy”
Sustainability	Fuel for the 100 year plus timeframe
Global Warming	CO2 reduction
Green Energy	Helping ourselves and others meet an RPS
Economic Development	Local jobs, economic diversification and growth
Wildfire Mitigation	Fire buffers around populated areas
Compatible Products	Use FT fuels in existing infrastructure
Fuel Supply	Fuel that is vertically integrated, economic, long-term stable priced and sustainable

Looming Energy Issues

Scenario	Issue
TAPS	Pipeline could shut down by 2014 – low volume
Anchorage Gas Supply	Anchorage could run out of gas by 2011
Bullet Line	Line not built till 2011
Natural Gas Pipeline	Line not built till 2017-2022
Kenai gas supply	No additional gas found
Aging Generation	1,000 MW to be replaced in next 10 years
Cost of crude oil	Crushing the economy throughout Alaska
Joint Utility Planning	Multiple directions and goals

Workgroups

ALTERNATIVE	**Chair**
Waste-to-Energy	Ryan Colgen
Biomass	Gwen Holdmann
Gasification	Dave Hoffman
Fischer-Tropsch	Paul Park
Hydroelectric	John Davies
Geothermal	Dan White
Distributed Generation	Jack Hebert
Conservation/ Efficiencies	Rich Seifert
Modeling	Henry Cole

Strategic Business Planning

Business Plan Components	Status
Executive Summary	Need one page abstract
Marketing Plan	Lower cost of total energy strategy
SWOT Analysis	Completed in draft
Services and Products	Syngas, electricity, FT fuels
Structure and Organization	Non-profit or low profit
Financials	High level to verify lower costs
Contingencies	Alternative uses for Syngas
Exit Strategy	Alternative markets

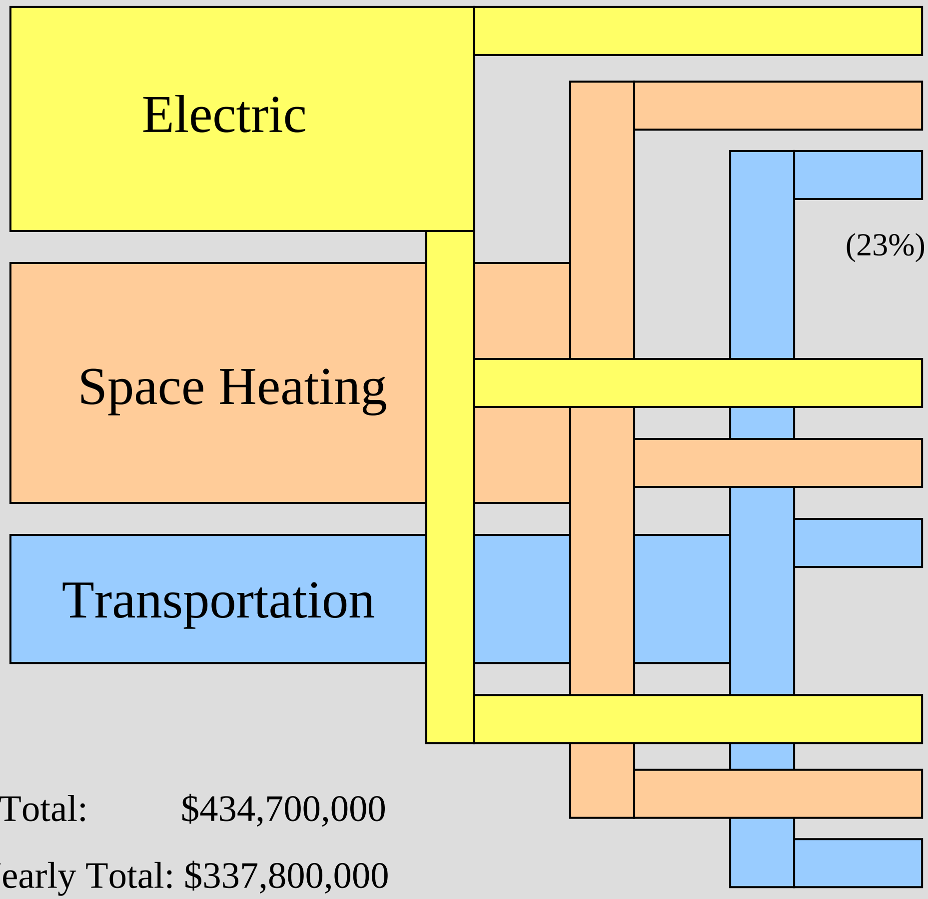
Energy Flow Model

	Residential Base	Residential Long-term
	$ 1,311	$1,142
	$2,807	$2,073
	$2,235	$1,662
(23%)	$6,353	$4,877

Petroleum
Coal
Nat. Gas
Hydro

Petroleum
Coal
Nat. Gas
Wood
Electric

Petroleum



Commercial

Industrial

Base Yearly Total: $434,700,000

Long-term Yearly Total: $337,800,000

ELECTRIC

Units	Measure		Gross BTU's (billions)	efficiency %	Net BTU's (billions)
		PETROLEUM:			
-	gal	HAGO	-	30%	-
73,000	gal	LAGO	14	18%	2
-	gal	Diesel	-	38%	-
22,616,683	gal	Naphtha	2,594	48%	1,247
215,000	tons	COAL: HLP	2,580	27%	707
146,500	tons	AE	2,051	27%	562
-	tons	UAF	-	27%	-
		NATURAL GAS/SynGas:			
4,100,000	mcf	N Anchorage Basin	4,100	36%	1,473
-	mcf	S North Slope: Frame 7	-	30%	-
-	mcf	S North Slope: LM6000	-	48%	-
		HYDROELECTRIC:			
62,250,000	kwh	Bradley Lake	224	95%	212
-	kwh	Susitna	-	95%	-
-	kwh	GEOTHERMAL:	-	90%	-
			11,563		4,204

4204

SPACE HEATING

Units	Measure		Gross BTU's (billions)	Combustion efficiency %	Insulation efficiency %	Net BTU's (billions)
		PETROLEUM:				
49,000,000	gal	Heating Fuel	6,762	85%	100%	5,748
-	gal	FT Heating Fuel	-	85%	100%	-
		NATURAL GAS:				
700,000	mcf	Anchorage: LNG	700	85%	100%	595
	mcf	North Slope: LNG	-	85%	100%	-
	gal	Propane	-	85%	100%	-
25,000	ton	COAL: AE	350	30%	100%	105
-	ton	UAF	-	30%	100%	-
1,000	cord	WOOD:	17		100%	-
3,600,000	kwh	ELECTRIC:	12	100%	100%	12
6,343			7,842			6,460

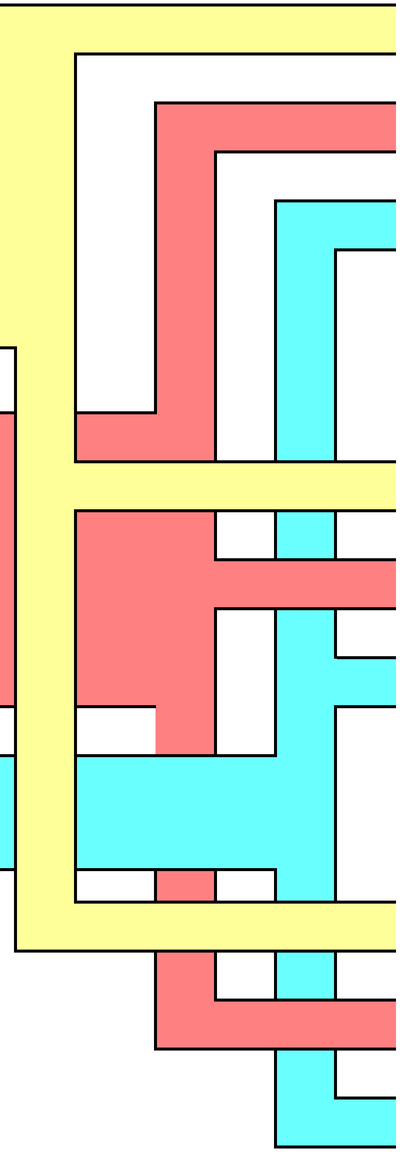
6460

TRANSPORTATION

Units	Measure		Gross BTU's (billions)	efficiency %	Net BTU's (billions)
		PETROLEUM:			
18,000,000	gal	Diesel	2,484	43%	1,068
33,500,000	gal	Gasoline	4,164	25%	1,041
-	gal	FT Diesel	-	43%	-
-	gal	FT Gasoline	-	25%	-
			6,648		2,109

2109

26,053



	Net BTU's (Billions)	% of Source
RESIDENTIAL		
	1,086	27%
	4,638	72%
	1,097	52%
	6,821	54%
COMMERCIAL		
	1,588	40%
	1,215	19%
	479	23%
	3,282	26%
INDUSTRIAL		
	1,331	33%
	607	9%
	533	25%
	2,471	20%
	12,574	100%

Cost per unit	Unit	Measure		Total Dollars	Costs per mmmBTU
			PETROLEUM:		
$ 2.10	-	gal	HAGO	$ -	
$ 2.37	73,000	gal	LAGO	$ 173,010	$ 12,343.91
$ 2.37	-	gal	Diesel	$ -	
$ 1.96	22,616,683	gal	Naphtha	$ 44,328,699	$ 17,088.06
$ 23.00	215,000	tons	COAL: HLP	$ 4,945,000	$ 1,916.67
$ 20.00	146,500	tons	AE	$ 2,930,000	$ 1,428.57
$ 30.00	-	tons	UAF		
			NATURAL GAS:		
$ 6.25	4,100,000	mcf	N Anchorage Basin	$ 25,625,000	$ 6,250.00
$ 6.21	-	mcf	S North Slope: Frame 7	$ -	
$ 6.21	-	mcf	S North Slope: LM6000	$ -	
			HYDROELECTRIC:		
$ 0.042	62,250,000	kwh	Bradley Lake	$ 2,614,500	$ 11,690.59
$ 0.0558	-	kwh	Susitna	$ -	
$ 0.0571	-	kwh	GEOTHERMAL:	$ -	
				$ 80,616,209	

ELECTRIC
includes O&M and I&D

Capital Cost: $ 120,000,000
Interest: 6%
Life (years): 35
Int. & Depr.: $ 10,628,571
Ops. & Maint.: $ -

Cost per unit	Unit	Measure		Total Dollars	Costs per mmmBTU
			PETROLEUM:		
$ 2.71	49,000,000	gal	Heating Fuel	$ 132,790,000	$ 19,637.68
$ 1.66	-	gal	FT Heating Fuel	$ -	
			NATURAL GAS:		
$ 6.25	700,000	mcf	Anchorage: LNG	$ 4,375,000	$ 6,250.00
$ 7.00	-	mcf	North Slope: LNG	$ -	
	-	gal	Propane	$ -	
$ 20.00	25,000	ton	COAL: AE	$ 500,000	$ 1,428.57
	-	ton	UAF		
$ 125.00	1,000	cord	WOOD:	$ 125,000	$ 7,183.91
$ 0.136	3,600,000	kwh	ELECTRIC:	$ 489,600	$ 39,847.64
				$ 138,279,600	

SPACE HEATING

Capital Cost: $ -
Interest: 6%
Life (years): 35
Int. & Depr.: $ -
Ops. & Maint.: $ -

Cost per unit	Unit	Measure		Total Dollars	Costs per mmmBTU
			PETROLEUM:		
$ 3.03	18,000,000	gal	Diesel	$ 54,540,000	$ 21,956.52
$ 2.91	33,500,000	gal	Gasoline	$ 97,451,500	$ 23,403.06
$ 1.86	-	gal	FT Diesel	$ -	
$ 1.80	-	gal	FT Gasoline	$ -	
				$ 151,991,500	

TRANSPORTATION

	Total Fuel Costs	% of total	35,371 Households	35,371 Households BASE CASE	% change
RESIDENTIAL					
	$ 46,383,040	27%	$ 1,311	$ 1,311	0.0%
	$ 99,277,662	72%	$ 2,807	$ 2,807	0.0%
	$ 79,062,989	52%	$ 2,235	$ 2,235	0.0%
	$ 224,723,691	52%	$ 6,353	$ 6,353	0.0%
COMMERCIAL			6,295 business	6,295 business BASE CASE	
	$ 58,393,701	40%	$ 9,276	$ 9,276	0.0%
	$ 26,001,292	19%	$ 4,130	$ 4,130	0.0%
	$ 34,539,943	23%	$ 5,487	$ 5,487	0.0%
	$ 118,934,937	27%	$ 18,894	$ 18,894	0.0%
INDUSTRIAL			4 business	4 business BASE CASE	
	$ 39,645,645	33%	$ 9,911,411.24	$ 9,911,411.62	0.0%
	$ 13,000,646	9%	$ 3,250,161.54	$ 3,250,161.54	0.0%
	$ 38,388,567	25%	$ 9,597,141.84	$ 9,597,141.84	0.0%
	$ 91,034,858	21%	$ 22,758,714.62	$ 22,758,714.99	0.0%
	$ 434,693,486	100%	Yearly Savings	$ 5	

$ 370,887,309

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
		PETROLEUM:			
-	gal	HAGO	-	159,660	-
73,000	gal	LAGO	14	159,660	2,237,765
-	gal	Diesel	-	159,660	-
22,616,683	gal	Naphtha	2,594	159,660	414,179,361
-					
215,000	tons	COAL: HLP	2,580	211,910	546,727,800
146,500	tons	AE	2,051	211,910	434,627,410
-	tons	UAF	-	211,910	-
-					
-		NATURAL GAS/SynGas:			
4,100,000	mcf	N Anchorage Basin	4,100	116,390	477,199,000
-	mcf	S North Slope: Frame 7	-	101,259	-
-	mcf	S North Slope: LM6000	-	101,259	-
-					
-		HYDROELECTRIC:			
62,250,000	kwh	Bradley Lake	212	0	-
-		Susitna	-	0	-
-					
-	kwh	GEOTHERMAL:	-	0	-
-					
			11,552		1,874,971,336

ELECTRIC

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
		PETROLEUM:			
49,000,000	gal	Heating Fuel	6,762	159,660	1,079,620,920
-		FT Heating Fuel	-	159,660	-
-					
-					
-		NATURAL GAS:			
700,000	mcf	Anchorage: LNG	700	116,390	81,473,000
-	mcf	North Slope: LNG	-	116,390	-
-	gal	Propane	-	138,750	-
-					
25,000	ton	COAL: AE	350	211,910	74,168,500
-	ton	UAF	-	211,910	-
-					
1,000	cord	WOOD:	17	250,000	4,350,000
-					
-					
3,600,000	kwh	ELECTRIC:	12	162,313	1,994,302
			7,842		1,241,606,722

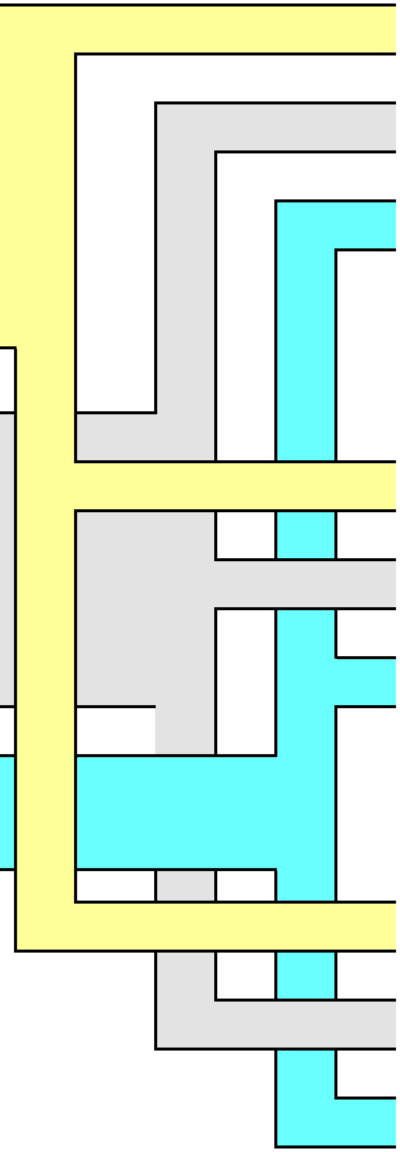
SPACE HEATING

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
		PETROLEUM:			
18,000,000	gal	Diesel	2,484	159,660	396,595,440
33,500,000	gal	Gasoline	4,164	154,910	645,052,986
	gal	FT Diesel	-	159,660	-
	gal	FT Gasoline	-	154,910	-
			6,648		1,041,648,426

TRANSPORTATION

Excludes:
- Fuel used at the refineries
- Military fuel usage
- Aviation fuel usage.

			26,041		4,158,226,484



	Total pounds of CO2	% of Source
RESIDENTIAL		
	508,304,233	27%
	891,409,954	72%
	640,037,003	61%
	2,039,751,190	49%
COMMERCIAL		
	743,600,802	40%
	233,464,512	19%
	190,890,825	18%
	1,167,956,139	28%
INDUSTRIAL		
	623,066,302	33%
	116,732,256	9%
	210,720,597	20%
	950,519,155	23%
	4,158,226,484	100%

Fairbanks Mid-term

Units	Measure		Gross BTU's (billions)	efficiency %	Net BTU's (billions)
		PETROLEUM:			
-	gal	HAGO	-	30%	-
73,000	gal	LAGO	14	18%	2
-	gal	Diesel	-	38%	-
-	gal	Naphtha	-	48%	-
215,000	tons	COAL: HLP	2,580	27%	707
146,500	tons	AE	2,051	27%	562
-	tons	UAF	-	27%	-
		NATURAL GAS/SynGas:			
4,100,000	mcf	N Anchorage Basin	4,100	36%	1,473
-	mcf	S North Slope: Frame 7	-	30%	-
2,594,134	mcf	S North Slope: LM6000	2,594	48%	1,247
		HYDROELECTRIC:			
62,250,000	kwh	Bradley Lake	224	95%	212
-	kwh	Susitna	-	95%	-
-	kwh	GEOTHERMAL:	-	90%	-
			11,563		4,204

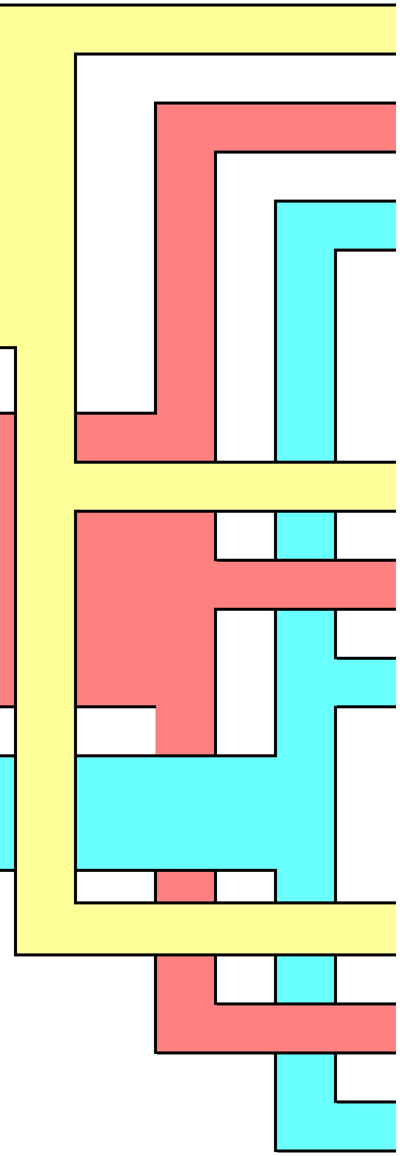
ELECTRIC 4204

Units	Measure		Gross BTU's (billions)	Combustion efficiency %	Insulation efficiency %	Net BTU's (billions)
		PETROLEUM:				
-	gal	Heating Fuel	-	85%	100%	-
52,015,385	gal	FT Heating Fuel	6,762	85%	100%	5,748
		NATURAL GAS:				
700,000	mcf	Anchorage: LNG	700	85%	100%	595
	mcf	North Slope: LNG	-	85%	100%	-
	gal	Propane	-	85%	100%	-
25,000	ton	COAL: AE	350	30%	100%	105
-	ton	UAF	-	30%	100%	-
1,000	cord	WOOD:	17		100%	-
3,600,000	kwh	ELECTRIC:	12	100%	100%	12
595			7,842			6,460

SPACE HEATING 6460

Units	Measure		Gross BTU's (billions)	efficiency %	Net BTU's (billions)
		PETROLEUM:			
-	gal	Diesel	-	43%	-
-	gal	Gasoline	-	25%	-
19,107,692	gal	FT Diesel	2,484	43%	1,068
34,700,417	gal	FT Gasoline	4,164	25%	1,041
			6,648		2,109

TRANSPORTATION 2109



	Net BTU's (Billions)	% of Source
RESIDENTIAL		
	1,086	27%
	4,638	72%
	-	0%
	5,724	55%
COMMERCIAL		
	1,588	40%
	1,215	19%
	-	0%
	2,803	27%
INDUSTRIAL		
	1,331	33%
	607	9%
	-	0%
	1,938	19%
	10,465	100%

Fairbanks Mid-term

26,053

Fairbanks Mid-term

Cost per unit	Unit	Measure		Total Dollars	Costs per mmmBTU
			PETROLEUM:		
$ 2.10	-	gal	HAGO	$ -	
$ 2.37	73,000	gal	LAGO	$ 173,010	$ 12,343.91
$ 2.37	-	gal	Diesel	$ -	
$ 1.96	-	gal	Naphtha	$ -	
	-				
$ 23.00	215,000	tons	COAL: HLP	$ 4,945,000	$ 1,916.67
$ 20.00	146,500	tons	AE	$ 2,930,000	$ 1,428.57
$ 30.00	-	tons	UAF		
	-				
	-		NATURAL GAS:		
$ 6.25	4,100,000	mcf	N Anchorage Basin	$ 25,625,000	$ 6,250.00
$ 6.25	-	mcf	S North Slope: Frame 7	$ -	
$ 6.25	2,594,134	mcf	S North Slope: LM6000	$ 16,202,407	$ 6,245.79
	-				
	-		HYDROELECTRIC:		
$ 0.042	62,250,000	kwh	Bradley Lake	$ 2,614,500	$ 11,690.59
$ 0.0558	-	kwh	Susitna	$ -	
	-				
$ 0.0584	-	kwh	GEOTHERMAL:	$ -	
	-			$ 52,489,917	

Capital Cost: $ 120,000,000
Interest: 6%
Life (years): 35
Int. & Depr.: $ 10,628,571
Ops. & Maint.: $ -

ELECTRIC
includes O&M and I&D

Cost per unit	Units	Measure		Total Dollars	Costs per mmmBTU
	-		PETROLEUM:		
$ 2.71	-	gal	Heating Fuel	$ -	
$ 1.86	52,015,385	gal	FT Heating Fuel	$ 96,639,506	$ 14,291.56
	-				
	-				
	-		NATURAL GAS:		
$ 6.25	700,000	mcf	Anchorage: LNG	$ 4,375,000	$ 6,250.00
$ 7.00	-	mcf	North Slope: LNG	$ -	
	-	gal	Propane	$ -	
	-				
$ 20.00	25,000	ton	COAL: AE	$ 500,000	$ 1,428.57
	-	ton	UAF		
	-				
$ 125.00	1,000	cord	WOOD:	$ 125,000	$ 7,183.91
	-				
	-				
$ 0.136	3,600,000	kwh	ELECTRIC:	$ 489,600	$ 39,847.64
	-				
	595			$ 102,129,106	

Capital Cost: $ -
Interest: 6%
Life (years): 35
Int. & Depr.: $ -
Ops. & Maint.: $ -

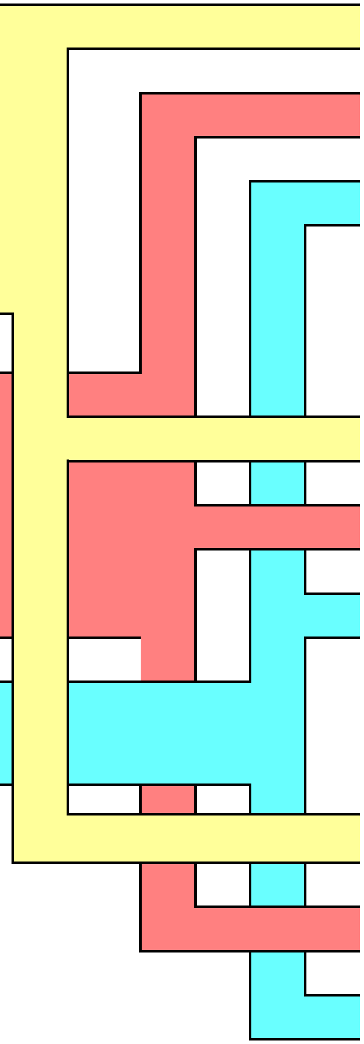
SPACE HEATING

Cost per unit	Units	Measure		Total Dollars	Costs per mmmBTU
	-				
	-				
	-		PETROLEUM:		
$ 3.03	-	gal	Diesel	$ -	
$ 2.91	-	gal	Gasoline	$ -	
$ 2.18	19,107,692	gal	FT Diesel	$ 41,614,687	$ 16,753.09
$ 2.06	34,700,417	gal	FT Gasoline	$ 71,410,070	$ 17,149.19
				$ 113,024,757	

TRANSPORTATION

Fairbanks Mid-term

$ 267,643,780



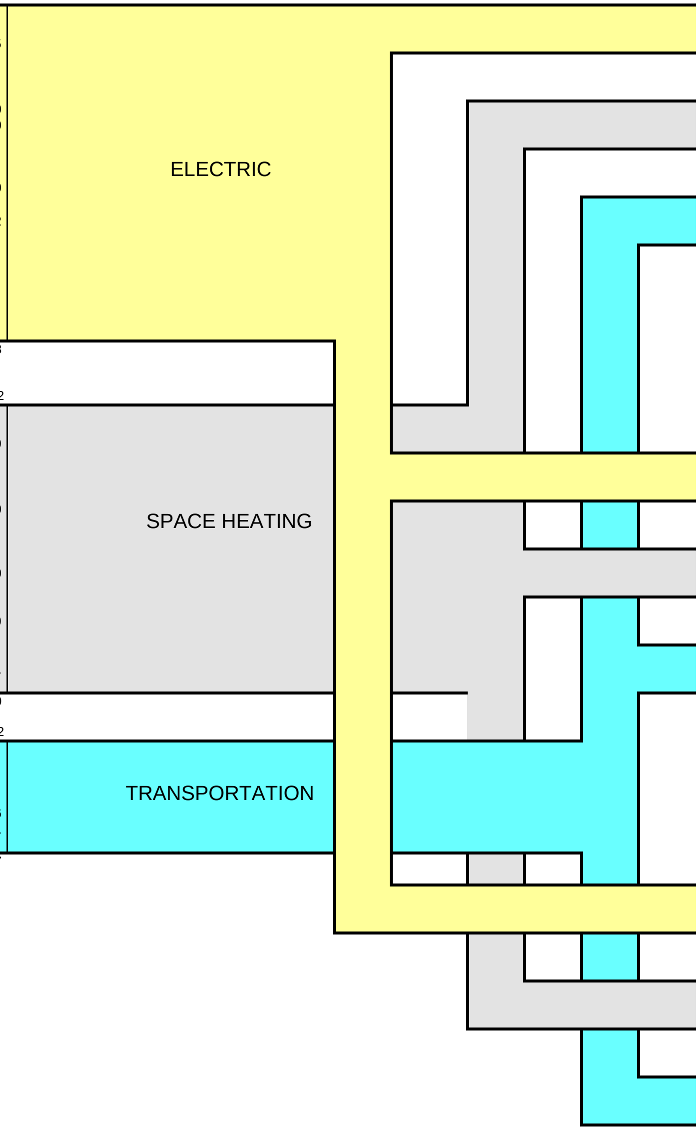
	Total Fuel Costs	% of total	35,371 Households	35,371 Households BASE CASE	% change
RESIDENTIAL					
	$ 38,758,010	27%	$ 1,096	$ 1,311	-16.4%
	$ 73,323,461	72%	$ 2,073	$ 2,807	-26.1%
	$ 58,793,256	52%	$ 1,662	$ 2,235	-25.6%
	$ 170,874,726	52%	$ 4,831	$ 6,353	-24.0%
COMMERCIAL			6,295 business	6,295 business BASE CASE	
	$ 47,239,007	40%	$ 7,504	$ 9,276	-19.1%
	$ 19,203,764	19%	$ 3,051	$ 4,130	-26.1%
	$ 25,684,783	23%	$ 4,080	$ 5,487	-25.6%
	$ 92,127,553	28%	$ 14,635	$ 18,894	-22.5%
INDUSTRIAL			4 business	4 business BASE CASE	
	$ 30,299,079	33%	$ 7,574,769.63	$ 9,911,411.62	-23.6%
	$ 9,601,882	9%	$ 2,400,470.44	$ 3,250,161.54	-26.1%
	$ 28,546,718	25%	$ 7,136,679.50	$ 9,597,141.84	-25.6%
	$ 68,447,678	21%	$ 17,111,919.57	$ 22,758,714.99	-24.8%
	$ 331,449,958	100%	Yearly Savings	$ 103,243,533	

Fairbanks Mid-term

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
		PETROLEUM:			
-	gal	HAGO	-	159,660	-
73,000	gal	LAGO	14	159,660	2,237,765
-	gal	Diesel	-	159,660	-
-	gal	Naphtha	-	159,660	-
-					
215,000	tons	COAL: HLP	2,580	211,910	546,727,800
146,500	tons	AE	2,051	211,910	434,627,410
-	tons	UAF	-	211,910	-
-					
-		NATURAL GAS/SynGas:			
4,100,000	mcf	N Anchorage Basin	4,100	116,390	477,199,000
-	mcf	S North Slope: Frame 7	-	101,259	-
2,594,134	mcf	S North Slope: LM6000	2,594	101,259	262,680,142
-					
-		HYDROELECTRIC:			
62,250,000	kwh	Bradley Lake	212	0	-
-		Susitna	-	0	-
-					
-	kwh	GEOTHERMAL:	-	0	-
-					
-			11,552		1,723,472,118
-					
-					
-					

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
-		PETROLEUM:			
-	gal	Heating Fuel	-	159,660	-
52,015,385		FT Heating Fuel	7,178	159,660	1,146,059,139
-					
-					
-		NATURAL GAS:			
700,000	mcf	Anchorage: LNG	700	116,390	81,473,000
-	mcf	North Slope: LNG	-	116,390	-
-	gal	Propane	-	138,750	-
-					
25,000	ton	COAL: AE	350	211,910	74,168,500
-	ton	UAF	-	211,910	-
-					
1,000	cord	WOOD:	17	250,000	4,350,000
-					
-					
3,600,000	kwh	ELECTRIC:	12	149,198	1,833,161
-					
595			8,258		1,307,883,800
-					

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
-					
-		PETROLEUM:			
-	gal	Diesel	-	159,660	-
-	gal	Gasoline	-	154,910	-
19,107,692	gal	FT Diesel	2,637	159,660	421,001,306
34,700,417	gal	FT Gasoline	4,313	154,910	668,167,391
-					
			6,950		1,089,168,697
			26,760		4,120,524,615



	Total pounds of CO2	% of Source
RESIDENTIAL		
	467,232,835	27%
	938,993,497	72%
	-	0%
	1,406,226,332	46%
COMMERCIAL		
	683,517,248	40%
	245,926,868	19%
	-	0%
	929,444,117	31%
INDUSTRIAL		
	572,722,035	33%
	122,963,434	9%
	-	0%
	695,685,469	23%
	3,031,355,918	100%

Excludes:
- Fuel used at the refineries
- Military fuel usage
- Aviation fuel usage.

Fairbanks Long-term

Units	Measure		Gross BTU's (billions)	efficiency %	Net BTU's (billions)	
		PETROLEUM:				
-	gal	HAGO	-	30%	-	
73,000	gal	LAGO	14	18%	2	
-	gal	Diesel	-	38%	-	
-	gal	Naphtha	-	48%	-	
-	tons	COAL: HLP	-	27%	-	
-	tons	AE	-	27%	-	
-	tons	UAF	-	27%	-	
		NATURAL GAS/SynGas:				
-	mcf	N Anchorage Basin	-	36%	-	
-	mcf	S North Slope: Frame 7	-	30%	-	
-	mcf	S North Slope: LM6000	-	48%	-	
		HYDROELECTRIC:				
62,250,000	kwh	Bradley Lake	224	95%	212	
1,002,976,236	kwh	Susitna	3,423	95%	3,252	
240,000,000	kwh	GEOTHERMAL:	819	90%	737	
			4,480		4,204	4204

ELECTRIC

Units	Measure		Gross BTU's (billions)	Combustion efficiency %	Insulation efficiency %	Net BTU's (billions)	
		PETROLEUM:					
-	gal	Heating Fuel	-	85%	100%	-	
52,015,385	gal	FT Heating Fuel	6,762	85%	100%	5,748	
		NATURAL GAS:					
700,000	mcf	Anchorage: LNG	700	85%	100%	595	
	mcf	North Slope: LNG	-	85%	100%	-	
	gal	Propane	-	85%	100%	-	
25,000	ton	COAL: AE	350	30%	100%	105	
-	ton	UAF	-	30%	100%	-	
1,000	cord	WOOD:	17		100%	-	
3,600,000	kwh	ELECTRIC:	12	100%	100%	12	
595			7,842			6,460	6460

SPACE HEATING

Units	Measure		Gross BTU's (billions)	efficiency %	Net BTU's (billions)	
		PETROLEUM:				
-	gal	Diesel	-	43%	-	
-	gal	Gasoline	-	25%	-	
19,107,692	gal	FT Diesel	2,484	43%	1,068	
34,700,417	gal	FT Gasoline	4,164	25%	1,041	
			6,648		2,109	2109

TRANSPORTATION

Fairbanks Long-term

18,970

	Net BTU's (Billions)	% of Source
RESIDENTIAL		
	1,086	27%
	4,638	72%
	-	0%
	5,724	55%
COMMERCIAL		
	1,588	40%
	1,215	19%
	-	0%
	2,803	27%
INDUSTRIAL		
	1,331	33%
	607	9%
	-	0%
	1,938	19%
	10,465	100%

Fairbanks Long-term

Cost per unit	Unit	Measure		Total Dollars	Costs per mmmBTU
			PETROLEUM:		
$ 2.10	-	gal	HAGO	$ -	
$ 2.37	73,000	gal	LAGO	$ 173,010	$ 12,343.91
$ 2.37	-	gal	Diesel	$ -	
$ 1.96	-	gal	Naphtha	$ -	
	-				
$ 23.00	-	tons	COAL: HLP	$ -	
$ 20.00	-	tons	AE	$ -	
$ 30.00	-	tons	UAF		
	-				
	-		NATURAL GAS/SynGas:		
$ 6.25	-	mcf	N Anchorage Basin	$ -	
$ 6.25	-	mcf	S North Slope: Frame 7	$ -	
$ 6.25	-	mcf	S North Slope: LM6000	$ -	
	-				
	-		HYDROELECTRIC:		
$ 0.042	62,250,000	kwh	Bradley Lake	$ 2,614,500	$ 11,690.59
$ 0.0558	###########	kwh	Susitna	$ 56,004,025	$ 16,360.34
	-				
$ 0.0584	240,000,000	kwh	GEOTHERMAL:	$ 14,007,616	$ 17,100.81
	-				
	-			$ 72,799,151	
	-				
	-				

Capital Cost: $ 120,000,000
Interest: 6%
Life (years): 35
Int. & Depr.: $ 10,628,571
Ops. & Maint.: $ -

ELECTRIC
includes O&M and I&D

Cost per unit	Units	Measure		Total Dollars	Costs per mmmBTU
	-		PETROLEUM:		
$ 2.71	-	gal	Heating Fuel	$ -	
$ 1.86	52,015,385	gal	FT Heating Fuel	$ 96,639,506	$ 14,291.56
	-				
	-				
	-		NATURAL GAS:		
$ 6.25	700,000	mcf	Anchorage: LNG	$ 4,375,000	$ 6,250.00
$ 7.00	-	mcf	North Slope: LNG	$ -	
	-	gal	Propane	$ -	
	-				
$ 20.00	25,000	ton	COAL: AE	$ 500,000	$ 1,428.57
	-	ton	UAF		
	-				
$ 125.00	1,000	cord	WOOD:	$ 125,000	$ 7,183.91
	-				
	-				
$ 0.136	3,600,000	kwh	ELECTRIC:	$ 489,600	$ 39,847.64
	-				
	595			$ 102,129,106	
	-				

Capital Cost: $ -
Interest: 6%
Life (years): 35
Int. & Depr.: $ -
Ops. & Maint.: $ -

SPACE HEATING

Cost per unit	Units	Measure		Total Dollars	Costs per mmmBTU
	-				
	-		PETROLEUM:		
$ 3.03	-	gal	Diesel	$ -	
$ 2.91	-	gal	Gasoline	$ -	
$ 2.18	19,107,692	gal	FT Diesel	$ 41,614,687	$ 16,753.09
$ 2.06	34,700,417	gal	FT Gasoline	$ 71,410,070	$ 17,149.19
				$ 113,024,757	

TRANSPORTATION

Fairbanks Long-term

	Total Fuel Costs	% of total	35,371 Households	35,371 Households BASE CASE	% change
RESIDENTIAL					
	$ 44,263,837	27%	$ 1,251	$ 1,311	-4.6%
	$ 73,323,461	72%	$ 2,073	$ 2,807	-26.1%
	$ 58,793,256	52%	$ 1,662	$ 2,235	-25.6%
	$ 176,380,554	50%	$ 4,987	$ 6,353	-21.5%
COMMERCIAL			6,295 business	6,295 business BASE CASE	
	$ 55,293,510	40%	$ 8,784	$ 9,276	-5.3%
	$ 19,203,764	19%	$ 3,051	$ 4,130	-26.1%
	$ 25,684,783	23%	$ 4,080	$ 5,487	-25.6%
	$ 100,182,056	28%	$ 15,915	$ 18,894	-15.8%
INDUSTRIAL			4 business	4 business BASE CASE	
	$ 37,047,981	33%	$ 9,261,995.25	$ 9,911,411.62	-6.6%
	$ 9,601,882	9%	$ 2,400,470.44	$ 3,250,161.54	-26.1%
	$ 28,546,718	25%	$ 7,136,679.50	$ 9,597,141.84	-25.6%
	$ 75,196,581	21%	$ 18,799,145.19	$ 22,758,714.99	-17.4%
	$ 351,759,191	100%	Yearly Savings	$ 82,934,300	

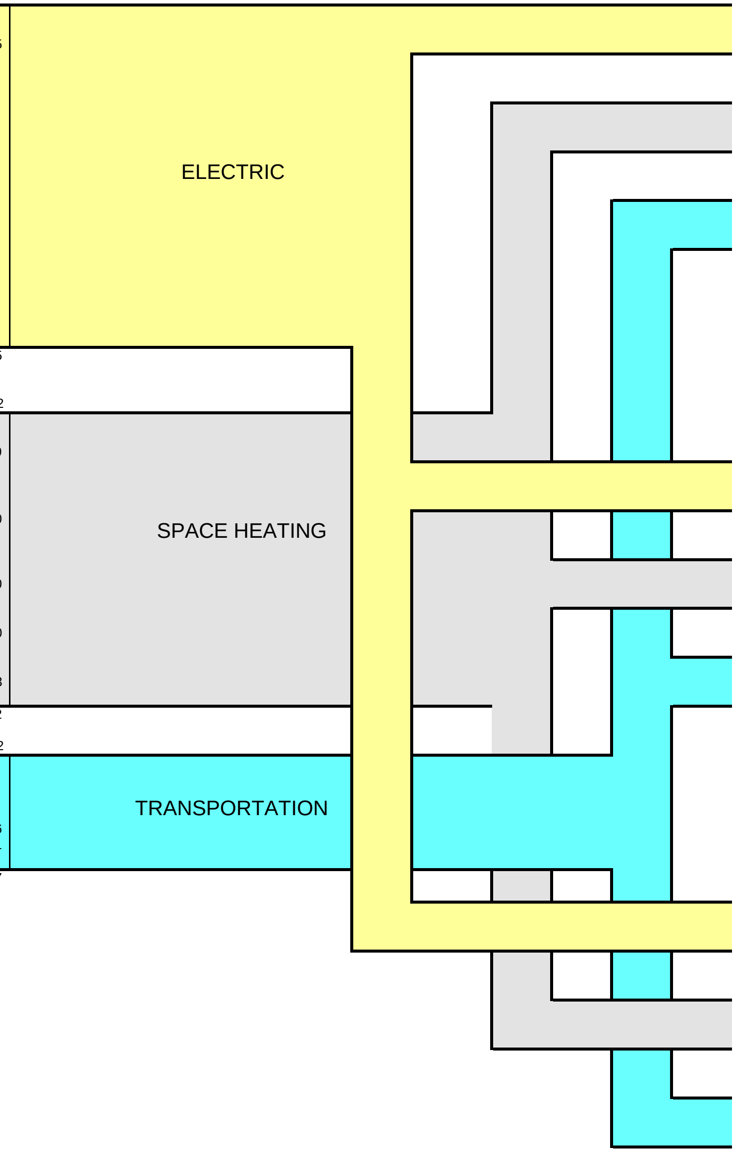
$ 287,953,013

Fairbanks Long-term

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
		PETROLEUM:			
-	gal	HAGO	-	159,660	-
73,000	gal	LAGO	14	159,660	2,237,765
-	gal	Diesel	-	159,660	-
-	gal	Naphtha	-	159,660	-
-					
-	tons	COAL: HLP	-	211,910	-
-	tons	AE	-	211,910	-
-	tons	UAF	-	211,910	-
-					
-		NATURAL GAS/SynGas:			
-	mcf	N Anchorage Basin	-	116,390	-
-	mcf	S North Slope: Frame 7	-	101,259	-
-	mcf	S North Slope: LM6000	-	101,259	-
-					
-		HYDROELECTRIC:			
62,250,000	kwh	Bradley Lake	212	0	-
1,002,976,236		Susitna	3,423	0	-
-					
240,000,000	kwh	GEOTHERMAL:	819	0	-
-					
-			4,469		2,237,765
-					
-					
-					

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
-		PETROLEUM:			
-	gal	Heating Fuel	-	159,660	-
52,015,385		FT Heating Fuel	7,178	159,660	1,146,059,139
-					
-					
-		NATURAL GAS:			
700,000	mcf	Anchorage: LNG	700	116,390	81,473,000
-	mcf	North Slope: LNG	-	116,390	-
-	gal	Propane	-	138,750	-
-					
25,000	ton	COAL: AE	350	211,910	74,168,500
-	ton	UAF	-	211,910	-
-					
1,000	cord	WOOD:	17	250,000	4,350,000
-					
-					
3,600,000	kwh	ELECTRIC:	12	501	6,153
-					
595			8,258		1,306,056,792
-					

Units	Measure		Gross BTU's (billions)	pounds per mmmBTU	Total pounds of CO2
-					
-		PETROLEUM:			
-	gal	Diesel	-	159,660	-
-	gal	Gasoline	-	154,910	-
19,107,692	gal	FT Diesel	2,637	159,660	421,001,306
34,700,417	gal	FT Gasoline	4,313	154,910	668,167,391
-					
			6,950		1,089,168,697
			19,677		2,397,463,254



	Total pounds of CO2	% of Source
RESIDENTIAL		
	606,658	27%
	937,681,799	72%
	-	0%
	938,288,457	72%
COMMERCIAL		
	887,482	40%
	245,583,328	19%
	-	0%
	246,470,811	19%
INDUSTRIAL		
	743,625	33%
	122,791,664	9%
	-	0%
	123,535,290	9%
	1,308,294,557	100%

Excludes:
- Fuel used at the refineries
- Military fuel usage
- Aviation fuel usage.

Financial Model

Fuel Sources
Municipal Waste
Coal: $1.92/mmBTU
Biomass: $4.17/mmBTU

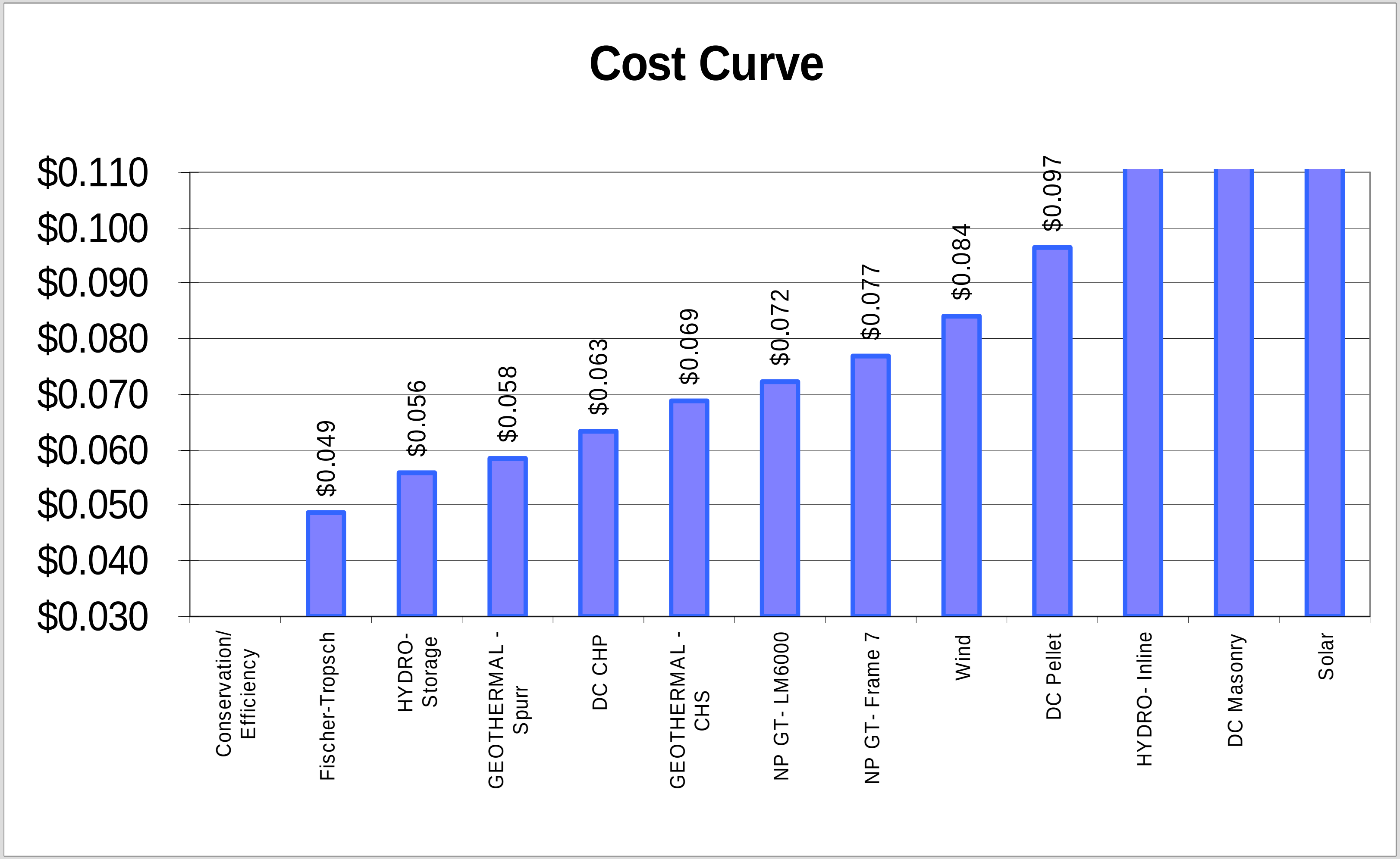
→ **Gasification** $6.25/mmBTU

→ **Fischer-Tropsch** ★ $14.29/mmBTU $1.86/gallon
Jet A
Naphtha
FT Diesel

→ **Combustion Gas Turbine** ★
Electric kWh
$0.072/kWh

Natural Gas	$9.00/mmBTU		
Diesel	$20.90/mmBTU		
Solar	$204.25/mmBTU		$0.6971/kWh
Direct Combustion- CHP	$18.56/mmBTU		$0.0633/kWh
Wind	$24.61/mmBTU		$0.0840/kWh
Geothermal	$17.10/mmBTU	★	$0.0584/kWh
Hydroelectric:	$16.36/mmBTU	★	$0.0558/kWh
Conservation/ efficiency improvements	$(5.93)/mmBTU	★	($0.0203)/kWh

Options Sorted by Price



Energy Cost Model

Active

Renewable Flow 10-07

Fuel supply

	Yearly available volumes per year		Fuel $ per		Heat content		Total BTU/year (mmBTU/year)	Fuel $/mmBTU
LANDFILL WASTE	80,300	ton	$ (25.00)	/ton	11,730,000	BTU	941,919	$ (2.13)
LANDFILL Brush	2,700	ton	$ (25.00)	/ton	10,000,000	BTU	27,000	$ (2.50)
COAL- Waste	657,000	ton	$ 15.00	/ton	12,200,000	BTU	8,015,400	$ 1.23
TIRES	365	ton	$ 19.70	/ton	28,000,000	BTU	10,220	$ 0.70
LUMBER WASTE	4,015	ton	$ 37.04	/ton	13,000,000	BTU	52,195	$ 2.85
COAL- ROM	1,012,177	ton	$ 30.00	/ton	15,600,000	BTU	15,789,965	$ 1.92
BIOMASS- Aspen/Willow		ton	$ 37.50	/ton	9,000,000	BTU	-	$ 4.17
BIOMASS- Harveste	200,000	ton	$ 51.51	/ton	9,000,000	BTU	1,800,000	$ 5.72
							26,636,699	$ 1.82
NATURAL GAS	3,172,000	mcf	$ 9.00	/mcf	1,000,000	BTU	3,172,000	$ 9.00
#2 DIESEL		gallons	$ 2.80	/gallon	134,000	BTU	-	$ 20.90

NATURAL GAS: $ 9.00
#2 DIESEL: $ 20.90

Gasifier

24,809,699 mmBTU

8.71 Number of Gasifier units required

GASIFIER - 1 unit

Net Output	1,992,900 mmBTU/yr	
Capex	$ 46,000,000	
Debt	30 years	
Interest	6.0%	
	Per Annum	$/mmBTU
Fuel	$ 5,178,944	$ 2.60
I&D	$ 3,341,850	$ 1.68
O&M	$ 3,550,000	$ 1.78
Margin	$ 334,185	$ 0.17
Total	$ 12,404,979	$ 6.22
Efficiency		70%

0.98 number of units

4,899 bbl/day

Biomass for FT only (7 year): 1,244,922 acres

14,939,060 mmBTU

Biomass for Electric only (7 year): 202,311 acres

2,427,730 mmBTU

FISCHER-TROPSCH 5,000 bbl/day

9,964,500

Net Output	11,687,053.26 mmBTU/yr	
Capex	$ 299,000,000	
Debt	30 years	
Interest	7.0%	
	Per Annum	$/mmBTU
Fuel	$ 94,898,092	$ 8.12
I&D	$ 24,095,335	$ 2.06
O&M	$ 45,300,000	$ 3.88
Margin	$ 2,409,533	$ 0.21
Total	$ 166,702,960	$ 14.26
Efficiency		77%

Efficiency:Input/Output BTUs

59670000000	
32019324000	54%
	11687053.26

11,452,000 mmBTU

bbld			
820	$	1.82	/gal FT Naphtha
	$	1.91	/gal FT Jet A
4,280	$	1.85	/gal FT Diesel
52,000 kW	$	0.0487	/kWh
1,505 FT Export	$	-	

GAS TURBINE- 1 LM6000

Net Output	1,766,016 mmBTU/yr	
Capex	$ 120,000,000	
Debt	30 years	
Interest	6.0%	
	Per Annum	$/mmBTU
Fuel	$ 22,901,500	$ 12.97
I&D	$ 8,717,869	$ 4.94
O&M	$ 4,800,000	$ 2.72
Margin	$ 871,787	$ 0.49
Total	$ 37,291,157	$ 21.12
Efficiency		48%

Interim

LM6000 on Syngas $ 0.0721 /kWh

1,165,310 mmBTU

GAS TURBINE- 2 Frame 6

Net Output	2,838,240 mmBTU/yr	
Capex	$ 2,000,000	
Debt	30 years	
Interest	6.0%	
	Per Annum	$/mmBTU
Fuel	$ 58,889,572	$ 20.75
I&D	$ 145,298	$ 0.05
O&M	$ 4,800,000	$ 1.69
Margin	$ 14,530	$ 0.01
Total	$ 63,849,400	$ 22.50
Efficiency		30%

gas retrofit

$ 0.0768 /kWh

Renewables

Source	Size	Unit	Parameter	Value	Output	Unit	Capacity Factor
Solar	5	kW	Capex/ tax credit	$ 35,000			
			Debt	25 years	15	mmBTU/yr	10%
			Interest	7.0%			
Direct Combustion Pellet	100,000	BTU/hr	Capex	$ 10,000	Efficiency		90%
			Debt	20 years	99	mmBTU/yr	13%
			Interest	7.0%			
Direct Combustion masonry-cord wood	100,000	BTU/hr	Capex	$ 20,000	Efficiency		90%
			Debt	50 years	99	mmBTU/yr	13%
			Interest	7.0%			
Industrial Direct Combustion CHP	2,000,000	BTU/hr	Capex	$ 2,000,000	Efficiency		90%
			Debt	20 years	13,403	mmBTU/yr	85%
	400	kW	Interest	7.0%	9,149	mmBTU/yr	85%
Wind	30,000	kW	Capex	$ 60,000,000			
			Debt	20 years	287,020	mmBTU/yr	32%
			Interest	7.0%			
GEOTHERMAL - Sp	100,000	kW	Capex	$ 350,000,000			
Mt Spurr Model	20		Debt	30 years	2,929,992	mmBTU/yr	98%
			Interest	7.0%			
GEOTHERMAL - CH	10,000	kW	Capex	$ 44,000,000			
CHS Model			Debt	30 years	284,030	mmBTU/yr	95%
			Interest	7.0%			
HYDRO- Inline	2,000	kW	Capex	$ 10,000,000			
			Debt	30 years	29,898	mmBTU/yr	50%
			Interest	7.0%			
HYDRO- Storage	600,000	kW	Capex	$ 3,470,000,000			
	20.0		Debt	50 years	17,938,728	mmBTU/yr	100%
	300.0		Interest	7.0%			
Conservation/ Efficiency			Capex	$ 10,000			
save 500 gallons/year			Debt	20 years	60	mmBTU/yr	100%
			Interest	7.0%			

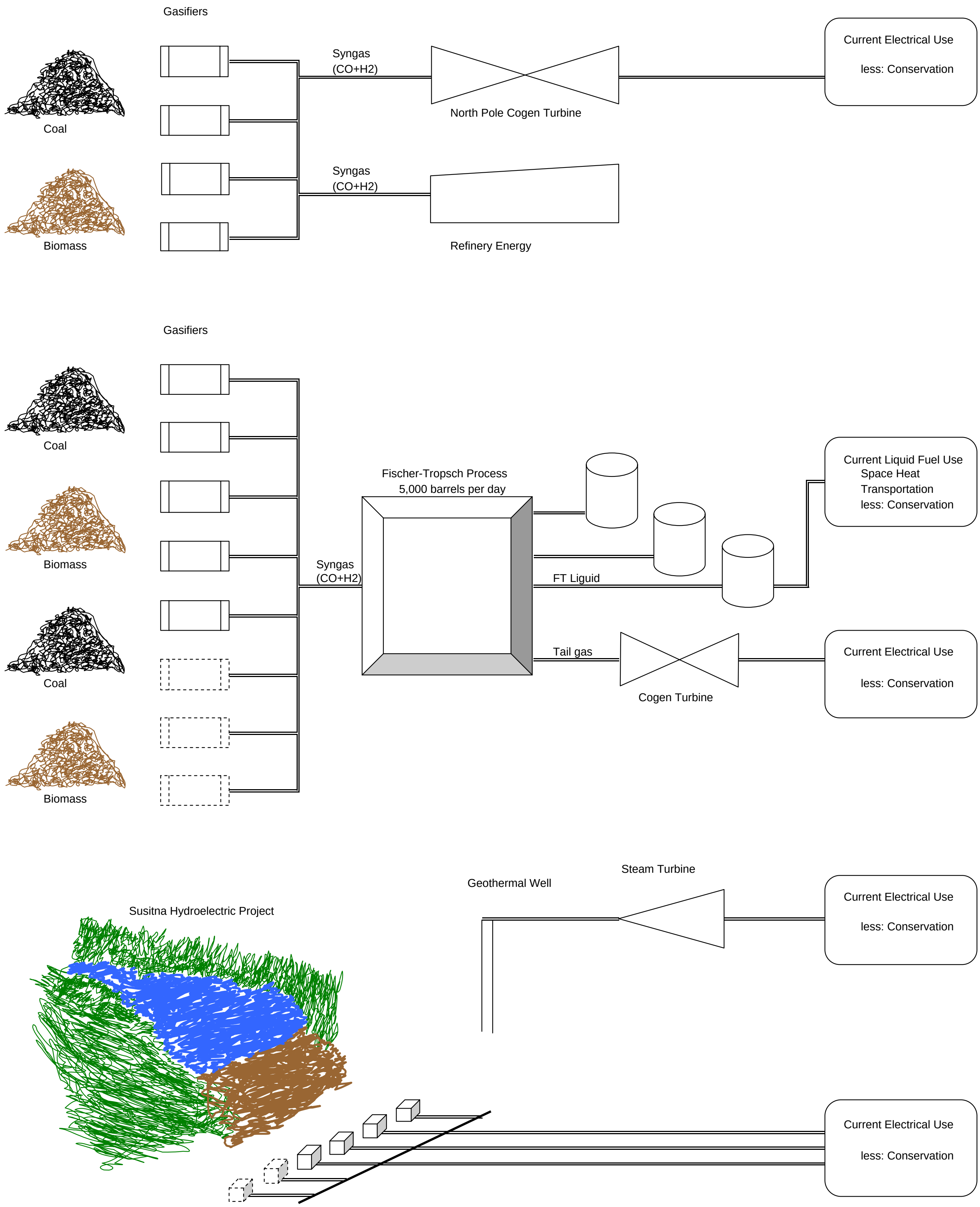
Source	Item	Per Annum	$/mmBTU
Solar	I&D	$ 3,003	$ 200.91
	O&M	$ 50	$ 3.34
	Total	$ 3,053	$ 204.25
Direct Combustion Pellet	Fuel	$ 1,478	$ 15.00
	I&D	$ 944	$ 9.58
	O&M	$ 365	$ 3.70
	Total	$ 1,309	$ 28.28
Direct Combustion masonry-cord wood	Fuel	$ 1,684	$ 17.09
	I&D	$ 1,449	$ 14.71
	O&M	$ 456	$ 4.63
	Total	$ 1,905	$ 36.42
Industrial Direct Combustion CHP	Fuel	$ 110,547	$ 4.90
	I&D	$ 188,786	$ 8.37
	O&M	$ 119,136	$ 5.28
	Total	$ 307,922	$ 18.56
Wind	I&D	$ 5,663,576	$ 19.73
	O&M	$ 1,400,000	$ 4.88
	Total	$ 7,063,576	$ 24.61
GEOTHERMAL - Sp	I&D	$ 28,205,241	$ 9.63
	O&M	$ 21,900,000	$ 7.47
	Total	$ 50,105,241	$ 17.10
GEOTHERMAL - CH	I&D	$ 3,545,802	$ 12.48
	O&M	$ 2,190,000	$ 7.71
	Total	$ 5,735,802	$ 20.19
HYDRO- Inline	I&D	$ 805,864	$ 26.95
	O&M	$ 175,200	$ 5.86
	Total	$ 981,064	$ 32.81
HYDRO- Storage	I&D	$ 251,435,678	$ 14.02
	O&M	$ 42,048,000	$ 2.34
	Total	$ 293,483,678	$ 16.36
Conservation/ Efficiency	Fuel	$ (1,400)	$ (23.33)
	I&D	$ 944	$ 15.73
	O&M	$ 100	$ 1.67
	Total	$ (356)	$ (5.93)

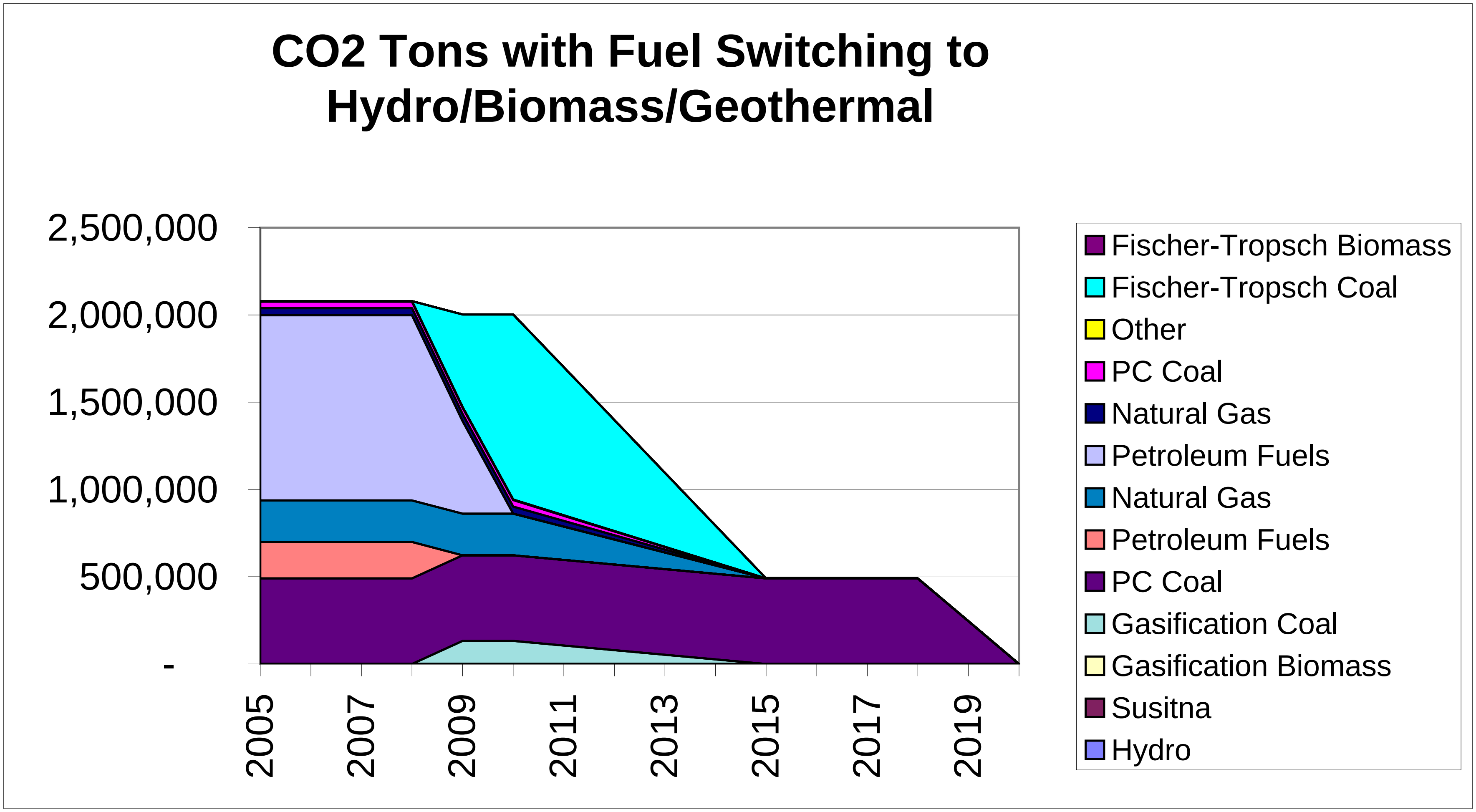
Note	Output		Cost	Unit
	Solar	$	0.6971	/kWh
Heat	DC Pellet	$	0.0965	/kWh
Heat	DC Masonry	$	0.1243	/kWh
Cogen Heat+Electricity	DC CHP	$	0.0633	/kWh
	Wind	$	0.0840	/kWh
	GEOTHERMAL - Spurr	$	0.0584	/kWh
	GEOTHERMAL - CHS	$	0.0689	/kWh
	HYDRO- Inline	$	0.1120	/kWh
600 MW Susitna	HYDRO- Storage	$	0.0558	/kWh
Energy usage reduction	Conservation/ Efficiency	$	(0.0203)	/kWh

Draft Recommendations:
Short, Mid, & Long Term

Short-term	Conservation of energy through weatherization and efficiency increases
Mid-term	Gasification for existing Gas Turbines 5,000 bpd Fischer-Tropsch Plant
Long-term	600 MW Susitna Hydro Project + Interties 100 MW Mt. Spurr Geothermal Project

Fairbanks Energy Plan




CO2 Tons with Fuel Switching to Hydro/Biomass/Geothermal
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
2005
2007
2009
2011
2013
2015
2017
2019
Fischer-Tropsch Biomass
Fischer-Tropsch Coal
Other
PC Coal
Natural Gas
Petroleum Fuels
Natural Gas
Petroleum Fuels
PC Coal
Gasification Coal
Gasification Biomass
Susitna
Hydro

Does this plan achieve our goals?

Issue	
PM2.5	Significantly reduced due to ultra-low sulfur FT fuel
Municipal Waste	Resolved waste-to-energy by gasification
Cost of Energy	Significant reduction
Sustainability	Long-term with coal, sustainable with aspen/willows
Global Warming	Zero from hydro, carbon neutral with aspen/willows
Green Energy	Yes with hydro, geothermal and aspen/willows
Economic Development	Yes, local jobs, economic diversification and growth, increase in disposable income
Wildfire Mitigation	Yes, with strategically harvested aspen/willows
Fuel Supply	Fuel that is vertically integrated, economic, long-term stable-priced and sustainable

Planning to reduce the impact

Scenario	Results
TAPS	Shutdown would not impact energy costs
Anchorage Gas Supply	No impact to energy costs in Fairbanks
Bullet Line	No impact to energy costs in Fairbanks
Natural Gas Pipeline	No impact to energy costs in Fairbanks
Kenai gas supply	No impact to energy costs in Fairbanks
Aging Generation	Resolved, hydroelectric has a 100+ year life
Cost of crude oil	No impact to energy costs in Fairbanks
Joint Utility Planning	All Railbelt utilities purchase from hydro project
Unified System Operation	Utilities have no issues to disagree on.

Dreaming together to Power Alaska

- Fuel delivery to rural Alaska
- Return Ballast
- Freight
- People

Questions ???

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Waste-to-Energy

STRENGTHS

- Waste to Energy is an accepted technology.
- Large waste stream w/ support for doing something with waste stream other than landfill.
- Stable pricing for up to 5 MW.
- Some portion is carbon neutral.
- Human resources (Henrick Wessel, etc.)

OPPORTUNITIES

- Landfill lasts longer / does not expand as rapidly.
- Waste will likely increase over time.
- May create jobs.
- Ability to utilize existing infrastructure.
- Large producers of waste may be able to utilize waste in their own facilities (University, City, School District, etc.)
- Landfill mining and reclamation.
- Combine with recycling or other projects which utilize waste stream.
- Most people in this community care about the environment and will encourage these efforts

WEAKNESSES

- Economies of Scale
- Not separating the waste stream raises the question of how what happens to hazardous materials mixed in with regular waste.

THREATS

- Questions relating to air quality / emissions need answers.
- Questions relating to what happens when hazardous materials (batteries etc) are combusted need answers.
- Answers to other questions relating to environmental impact.
- May cost more than existing landfill operation.

Conservation

STRENGTHS

- Immediate action possible
- Technology available
- Fairbanks community full of creativity
- Fairbanks community has an understanding of conservation
- Informed and educated small groups
  - builders
- GVEA promotion
- Lower PM 2.5
  - pollution
  - gas
  - emissions

OPPORTUNITIES

- Retro-fit
- Energy Star products
- Re-market and re-phrase
- Conservation
- “green” subdivision on college road
- Educate community on “next best steps”
- Spawn businesses
  - energy audits
  - engineers with understanding
  - ARDOR program
- State funding
- 5 star appliances (buck for buck)
- Before and after audits
- Federal Farm Bill grants
- AEA/ AIDEA/ AHFC programs
  - financing
- Get politicians to pitch conservation as a positive
- Palin promotion
  - florescent lights
- Scalable to demand
- Energy Audits

Messages on bills- “You could save $__ by …”

WEAKNESSES

- No architectural school
- Knowledgeable community
- No codes/mandates for bldg. (UPC)
- Hard sell
- Not enough contractors
  - skill base for retro fit
- Lack of infrastructure
- Traps comm. members might get sucked into without being informed properly
- Large shift needed to see difference
- Not working in general population

THREATS

- Low interest loans
  - financing
- Cost vs. Payback
- Low cost of energy
- Population increase
  - educate more
- Fast growth

Gasification

STRENGTHS	OPPORTUNITIES

• Abundant local feedstock in Fairbanks
  o coal
  o biomass (willow, lumber waste, paper waste)
  o tires
• Minimal environmental impact; reduce emissions. No sulfur or mercury
• Proven technology w/ coal, oil and NG
• Potential CO2 offset (reduction)
• Use waste stream that is a lower cost fuel source
• Meet various needs of fuel type
• Go GREEN
• Front end to existing plant
• Low onsite construction
• Off market of volatility
• IGCC creates less ash, less CO2 and is more efficient than direct-fired coal combustion
• Combining electrical generation and liquid fuel production provides flexibility for electrical load following
• Continuous or plug type process
• Reduced PM 2.5
	• Liquid fuels from SYN gas
	• Lower cost, emerging technologies (mcf-$7.00) utilize biomass
	• Get rid of waste
	  o all streams
	• $$$ from FEDs for CO2 reduction to support
	• Better combustion efficiency
	• Lower fuel and energy cost
	• Utilize non-0normal fuels to create gas
	• Creation of low sulfur fuels
	• Make diesel fuel locally from low sulfur fuels
	• Utilize existing infrastructure
	  o trucks
	  o roads
	  o turbines
	  o boilers
	  o rail transportation system?
	• Various types of fuel can be produced to consider utilizing
	• Ethanol and methanol
	• 30,000(10,000 bbld more realistic) barrels a day (output). Modular technology can start small and expand
	• Burn waste coal
	• Landfill waste
	• Need variable plant size for BA plan; build to fit
	• SYN gas from coal (known tech.)
	• Reduce CO2
	  o global warming
	• Create higher value product; can you compete with oil?
	• Space to grow
	• Portable plant (??)
	• Low grade heat (district home heating?)
	  o Purchase Syngas from owner of gas plant, avoid capital costs
	• TAPS could provide routs for future coal to liquids export

Gasification Continued

WEAKNESSES	THREATS

• Ash
• Multiple materials handling/collecting
• Large real estate needed
• Continuous flow—can it load follow?
• Does it operate at a high enough temp to result with methane and no DiSulfate
• Blended fuel stock
  o don't switch
  o costly
  o maintain sustainability
• Internal
  o volume of feedstock
• Economies of scale
• Catalyst use: high cost
• Proprietary technology
  o consumables
• Weakness in SYN gas (110btu), lower value of SYN gas
• Tapping AK's resources
• Won't affect transportation unless you make fuel out of it.
• Load following capability
• Turbine tripping flare of excess gas
	• Coal
	• High heat rate
	• Energy input = to energy output
	• Cost
	• Utilize existing infrastructure
	  o capital upgrades
	  o depends on return
	• High cost of conversion/use of infrastructure
	• Can't meet feedstock
	• PM 2.5 etc. created to gather fuel
	  o material handling
	• Burning biomass
	  o competition
	• Plant construction cost
	• Permission to utilize certain fuel sources
	• CO2 emission
	  o coal level
	  o scrubbers
	• Gas line
	• Changing economics: potentially lower cost supply
	  o Long lead time for design, procurement, and construction
	  o Public perception of using coal and new technology (HCCP)

Biomass Overall/Gasification

STRENGTHS	OPPORTUNITIES
• Plentiful local fuel sources • Plentiful land • Sustainable harvest conducive to healthy forests & habitat management • Carbon neutral • Successful short rotation crops grown elsewhere in similar climate • Community development through employment opportunities • Capture biomass from municipal waste stream • Power generation facility could be modular to spread out infrastructure costs and match facility with available fuel • Can successfully be co-fire in existing coal plants • Would help remove methane produced from dead trees in forests • Global Warming could make 'silvaculture' easier • Energy ratios are favorable (14:1	• Could make use of biomass harvested during power line maintenance • Fire mitigation and reducing fuel load of burned standing trees could provide near-term fuel source • Potential for carbon sequestration associated with willow production • Cost of energy high and climbing • Fairbanks could export technology/expertise to rural communities, developing industry locally • Potential for collaboration between UA and industry in addressing challenges • Opportunity to demonstrate sustainable husbandry • Re-distribution of farm subsidies • Potential to engage Usibelli (could willows be grown on their re-vegation plots?) • Willows could be used for phytoremidiation of urban wastewaters, landfill leachate, industrial wastewaters and sewage sludge • Develops local economy and potentially raises land values in areas suitable for willow crop production • Waste heat from biomass power production can spawns other business opportunities (cooling, drying) • Increased employment (new; revive local farming) • Specialized equipment might need to be developed which could be done locally and exported to other parts of the state • Expertise could be exported • Modular plants could be built located near fuel sources • Ash byproduct could be used for fertilizer • There are existing models existing to draw from (Europe, NY) • New funding sources are available (State, Federal) • Qualifies for Green Tags sales • New opportunities for revenue (carbon trading)

Biomass Overall/Gasification Continued

WEAKNESSES	THREATS
• Gathering/transportation of fuels – dispersed resource • Specialized equipment needed for harvest/collection • Green biomass has high moisture content – may require drying • Farm subsidies may discourage biomass crops • Materials handling – relatively low energy content per pound • High particulates (potentially) • May not be economical/profitable • High infrastructure costs • Chicken and egg scenario – need power plant and fuel • Green power can't be purchased at a premium locally	• Land ownership may be an issue – large tracks could be needed • Single crop biomass farming may be susceptibility to pests • High particulates (potentially) • Biomass undercut by other cheap fuel sources such as NG (timing) • Subsidies that encourage fallow fields • Corps of Engineers could be resistant to farming if wetlands are involved • Could hurt Usibelli

Biomass Extraction

STRENGTHS	OPPORTUNITIES
• Could be used in new GVEA turbine in North Pole (19,000 acres in production could meet fuel requirements for turbine) • Clean • Renewable • Carbon neutral	• Could convert Fairbanks vehicles to ethanol • Potential for 'no' sulfur fuel, range of fuel production • Need to do demonstrate pilot project • Military could be customer and source of energy for modular biomass plant • Now is the right time • Opportunity to coordinate with other players worldwide • Funding is available for viable projects • Re-evaluate currently discounted crops in Alaska for biomass fuel potential rather than feedstock • Jack Spafford/Dr Posner
WEAKNESSES	**THREATS**
• Alaskan biomass is lower quality in terms of oil content • Undemonstrated technology • Byproduct associated with production • Local ambient temps could pose challenges • Competing w/ NG (cheaper), economics?	• Need to be aware of biomass 'charlatans' tooting unproven technology • Cost of labor increases (NG Pipeline?) may change economics

Geothermal

STRENGTHS	OPPORTUNITIES
• Distributed power • Significant potential in Aleutians • Non green-house gas producing • Nearly all of resource undeveloped • Wide range of opportunity scales • Much off-the-shelf technology available • Good cooling resources in Alaska • Could take advantage of popularity • Statewide distribution of resource	• Convert geothermal into alternative fuels • Co-locate with minerals extraction • Power for refining minerals Red Dog mine ore refining • Ground source heat pumps • Volcanoes offer opportunities • Opportunities for heating (local/district) • Mt. Spur as a source nearby Beluga • Geothermal for refrigeration
WEAKNESSES	**THREATS**
• Limited knowledge of resource • Source not near urban centers, • Not transportable • Hazards/volcanoes • Lack of performance data • No documented super-sized source • Issues with transmission of power	• Potential for transience, natural events • Sustainability • Potential for depletion • Public and policy inertia • Land ownership • Permitting

Hydroelectric- Run of River

STRENGTHS (internal)	OPPORTUNITIES (external)
•Low to moderate capital required •No fossil fuel •Moderately abundant resource •Source for rural homes/villages •Resource available across Railbelt •Possible ties into grid •Ease of remote construction •Short development time	•Tanana, Yukon, Susitna, Nenana. etc. •Many communities along these rivers •Eagle project funded by Denali Commission •Local industry potential •High cost of fossil fuels •Global warming issue •Possibly portable, or mass produced •New ARRC bridge over the Tanana River •Previously State purchased Harbin turbines
WEAKNESSES (internal)	**THREATS (external)**
•Limited capacity •Limited season? •Variable output, existing generation must be maintained •Potential for damage by ice/silt/trees •Requires some distribution lines •Possible channel changes (loss of current)	•Fish issues (spawning areas) •Navigation impacts •Flooding

Hydroelectric-Storage: Chakachamna

STRENGTHS (internal)	OPPORTUNITIES (external)
• Some design and EIS work done (Chris Rose, REAP, Beluga Triangle – hydro, wind, tidal) • Relatively low environmental impact • Abundant power (order of 100s of MW) • Located centrally within the Railbelt	• High cost of fossil fuels • High level of concern about global warming • Good fit with wind systems • Hydrogen production potential
WEAKNESSES (internal)	**THREATS (external)**
• Cost to connect to grid • Environmental impacts • Large capital needs ($1 billion) • Long lead time for construction • Potential for lake to fill with silt • Need for EIS	• Negative public opinion about large dams • Seismic, volcanic potential of region • Fish impacts? • Concern over loss of habitat, recreational areas, or historical sites • TDX has applied for the FERC site license

Hydroelectric-Storage: Susitna

STRENGTHS (internal)	OPPORTUNITIES (external)
• Lots of design and EIS work done • Relatively low environmental impact compared to present alternatives • Abundant power (order of 500s of MW) • Located centrally within the Railbelt • Production of hydrogen possible • Long life time (100 yrs)	• High cost of fossil fuels • High level of concern about global warming • Good fit with wind systems • Creation of recreation areas • Possible benign industry (data center, hydrogen production, etc.)
WEAKNESSES (internal)	**THREATS (external)**
• Cost to connect to grid • Environmental impacts • Large capital needs ($5-10 billion) • Long lead time for construction • Potential for lake to fill with silt	• Negative public opinion about large dams • Seismic potential of region • Fish impacts • Concern over loss of habitat, recreational areas, or historical sites • Possible large industry impacts

Hydroelectric- Tidal

STRENGTHS (internal)

- Regular tides, predictable generation
- High capacity
- Located in Railbelt
- Second highest tidal range in world

OPPORTUNITIES (external)

- Co-locate with wind sites
- Located in Railbelt
- Coastal villages
- Attach to bridges, platforms

WEAKNESSES (internal)

- Immature technology
- Impact of ice/silt?
- Interconnection costs high
- Slack tide – need two sites?
- High maintenance costs
- Electrical system operating impacts from cyclic generation

THREATS (external)

- Shipping (low)
- Fish, whale issues
- Seismic design issues

Distributed Generation

STRENGTHS	OPPORTUNITIES
• Produce energy greater than use; Ideal • Net zero energy use; Practical • Sustainable building systems and infrastructure • Environmentally friendly • Long term cost savings • Increase disposable income by reducing bills generates greater economic growth in community • Incremental approach one step at a time, one house at a time. Using a community wide approach	• Turn weaknesses into strengths by education of public: o Cost analysis of different energy reduction options available. o Easy access to cost analysis information web-sites. • Reduce cost of energy • Reduce amount of energy use in homes • Reduce the detrimental effects of wasted energy on the environment • Provide positive long term effects from green building • Reduce reliance on fossil fuels from unstable countries (and underdeveloped wilderness areas). • Reduce / Eliminate greenhouse gas emissions • Not add to Global Warming • Lesson need for new power plants from any source by using energy more efficiently and producing energy cleanly • Incentives: tax breaks, direct rebates, snap program • Energy detectives, kilowatts (devices used to show how much energy is being used in total or by a single appliance at any given moment). Could be used to educate public • Education in schools at all levels on energy production and green building • Demonstration projects • National funding for projects • EPA PM 2.5 reduction • Change out programs could be used for specific types of appliances or light bulbs • Local focus in media: newspaper, TV, other press • Public Service Announcements about energy saving options • Reality show / energy retrofit one house a month for 1 year • 30 sec. spots on news, energy tip of the week • Replace street lights with LEDs. • Energy tip of the month on GVEA bill - savings per month and savings per year so consumers can see.

Distributed Generation Continued

WEAKNESSES	THREATS
• Initial cost investment is higher • Lack of public education / awareness / lack of perception of benefits • Overcoming the desire for the familiar and making a change	• Non tangible • Lack of commitment on the part of the public and lending institutions that finance buildings

2006 Sorted Overall Ranking (Best=0, Worst=90)

Evaluation Matrix Sorted by Ranking	Overall Rank	Energy Service	Success Hurdles	Start-up Date	Capital Needed	Cost Reduction	Monthly Bill	Uncer-tainty	Natural Systems	Alaskan Citizens
Truck North Slope Gas	10	0.0	2	0	0	0	0	3	2	3
Enriched Gas Pipeline*	24	0	6	6	2	0	0	7	2	1
Bullet Gas Pipeline	24	0	5	3	10	0	0	3	2	1
Spur Gas Pipeline**	27	0	9	10	0	0	0	5	2	1
Other AK Gas	28	0	7	8	1	0	0	7	2	3
Conservation	32	8	1	0	1	9	8.6	2	1	2
Wind Power	38	6	2	3	0	9.2	9.7	2	2	4
Coal Bed Methane	39	0	8	6	3	0	0	8	7	7
Coal Power Production	42	5	4	1	2	8.3	9.2	5	5	3
Solar	43	9.9	2	1	0	10	10	4	2	4
Biomass – Combustion	46	9.7	3	3	0	9.7	9.9	3	4	3
Public Transportation	46	9.9	5	2	0	9.2	9.2	7	1	3
Biomass – Extraction	48	9.7	4	4	0	10	9.4	4	4	3
Geothermal	53	9.9	5	4	0	9.8	10	7	2	5
Hydro – Instream	55	9.9	5	5	0	9.8	9.9	8	2	5
Hydro – Storage	55	6	6	6	6	8.8	9.4	6	4	3
Coal Gasification	57	9	8	4	2	9.9	10	8	4	3
Bike Paths & Lanes	58	9.9	8	8	1	9.6	9.7	7	1	4
Nuclear	60	6	9	5	1	8.6	9.3	9	8	5


WAIT! STOP! BUILD IT BACK UP!
NUCLEAR POWER
HIGH FOSSIL FUEL PRICES