Yukon Energy Sector Assessment 2003

Final report

Prepared

for Yukon Development Corporation

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October 2003

Yukon Development Corporation

Yukon
Energy, Mines and Resources

CONTENTS

INTRODUCTION

Energy is at the centre of the day-to-day lives of all Yukon citizens. It is part of our whole range of daily activities from home heating to transportation, from cooking to leisure pursuits. The continuing and adequate supply of energy in its various forms affects Yukoners of all ages, of all occupations in all communities. In sum, energy matters.

In light of the importance of energy to the Yukon economy and to Yukoners, this research paper has been prepared to enhance the baseline understanding of Yukon energy issues. The paper is built around the framework of a "Yukon Energy Matrix" which was conceived in the course of the project. The matrix looks at the Yukon energy sector from three different perspectives (Table 1), with each perspective captured in a "vector." Vector A describes the Yukon's energy capacity or potential to supply various forms of energy. Vector B examines the markets for energy in the Yukon. Vector C looks at energy from the perspective of energy users.

Table 1. Yukon energy matrix

Vector A Energy capacity	Vector B Energy markets	Vector C Energy uses
non-renewable	**production**	**residential**
oil	natural gas	by type of use
gas	biomass	by form of energy
coal	electricity	
renewable	**consumption**	**commercial/institutional**
water	oil	by type of use
biomass	natural gas	by form of energy
wind	electricity	
geothermal		
solar		
electricity	**infrastructure**	**industrial**
hydro	electricity transmission	by type of use
diesel	pipeline	by form of energy
wind		
energy efficiency	**prices**	**transportation**
non-renewable	non-renewable energy	by type of use
renewable	electrical energy	by form of energy
electricity	comparative prices	

THE YUKON ENERGY MATRIX

VECTOR A. ENERGY CAPACITY

The sources of energy found in Canada are numerous and varied. Non-renewable sources of primary energy are extracted from the earth in the form of crude oil, oil sands, natural gas, coal and uranium. Renewable energy comes from sources which do not require the depletion of resources such as water, biomass, wind, solar and waste stream energy. Electricity is the product of many sources of energy — both non-renewable and renewable — and is, in turn, often regarded as an energy source unto itself.

Sources of energy in the Yukon are also diverse. In terms of non-renewable primary sources, the territory is home to reserves of natural gas, coal and oil. Renewable sources of energy include water, biomass, wind, solar and geothermal. In the Yukon, electricity is produced from oil, water and wind. The major sources of primary energy found in Canada and the Yukon (and the sources of energy used to generate electrical energy) are shown in Table 2.

With increasing evidence of a link between energy use and climate change, attention on energy efficiency measures has become more focused. Energy efficiency measures attempt to produce the same amount of benefit to energy users from reduced amounts of energy. The energy conserved through efficiency measures can then be "spent" on other energy use or set aside for future uses.

VECTOR B. ENERGY MARKETS

The Yukon is home to significant quantities of non-renewable energy in many forms. All energy consumed in the territory which derives from non-renewable sources, however, is imported from southern and Alaskan markets. Thus, notwithstanding that significant reserves of coal, gas and oil have been identified in the Yukon, no fossil-based forms of energy are being extracted from within the Yukon and sold into Yukon energy markets at the present time. While

Table 2. Major sources of primary energy and electricity: Canada and Yukon

	Canada		Yukon	
	energy	electricity	energy	electricity
Non-renewable				
oil/oil sands	•	•	•	•
natural gas (e.g., propane)	•	•	•	
coal	•	•	•	
uranium	•	•		
Renewable				
water	•	•	•	•
biomass (e.g., wood)	•	•	•	
wind	•	•	•	•
geothermal	•		•	
solar	•		•	•

natural gas is extracted from the Kotaneelee field in the southeastern Yukon, all production is exported south.

A defining characteristic of all renewable forms of energy is their "limitless supply." No matter how many wind turbines are hoisted, solar panels laid out or geothermal heat pumps installed, the wind just keeps on blowing, the sun keeps on shining and the earths core keeps emitting heat. While forests may be harvested for fuelwood, replanting can replenish forest stocks. Similarly, unless a water course is altered, water flows year in and year out. As a result, renewable energy resources (water, biomass, wind, geothermal and solar) in their primary forms do not trade in energy markets.

Energy sources derived from renewable energy forms or, secondary forms of renewable energy, do trade in markets. Most notable in the Yukon context is electricity generated from hydro and wind which is sold in a regulated market overseen by the Yukon Utilities Board. Biomass (wood) is also harvested and sold in localized markets in and around Yukon communities. Secondary forms of geothermal and solar energy are not currently consumed in the Yukon in quantities sufficient to allow identification of functioning markets; consumption tends to be specific to individuals, businesses and municipalities.

The near-absence of non-renewable energy production in the Yukon is also evident in the lack of pipeline and rail infrastructure in the territory. With the exception of a short length of pipeline through which the Yukon's Kotaneelee natural gas production is shipped south, there are no operating oil or gas pipelines in the territory. Railway infrastructure is limited to a single narrow gauge track connecting Whitehorse with the Alaskan port of Skagway; the Yukon portion of the track has seen very limited use since 1982.

The Yukon's electricity transmission grid, built largely to service the Faro lead-zinc mine, is fragmented. At the same time as several Yukon communities continue to burn diesel year-round to generate electricity, the Whitehorse-Aishihik-Faro (WAF) grid system has experienced surpluses of hydro-electric capacity since the final closure of the Faro mine in January 1998. In addition, the Yukon electricity generation and distribution system is completely isolated from southern markets.

At the same time as the Yukon is home to an abundant wealth of non-renewable and renewable energy resources, the territory remains reliant on energy sources from outside its borders. All energy products which derive from non-renewable sources including gasoline, diesel and propane, are imported into the territory. As a result, the prices of all fossil fuel-based forms of energy consumed in the Yukon are determined in national and international markets. The resulting price volatility is compounded by the size of the Yukon market and its distance from wholesale distribution points. Electricity prices, in contrast, have remained stable due to utility cost control, avoiding the need for a General Rate Application for seven years thus far, and to bill relief paid out of the Yukon government's Rate Stabilization Fund.

VECTOR C. ENERGY USES

The Yukon's energy situation can also be viewed from the perspective of energy users. This 2003 version of the energy sector assessment introduces a framework which can be filled in over future years as more data becomes available. The framework is adapted from (and is consistent with) the framework developed by Natural Resources Canada's Office of Energy Efficiency. For purposes of this paper, energy uses have been categorized into four groups: 1) residential, 2) commercial/institutional, 3) industrial[1], and 4) transportation. While the availability of data that describe energy uses in the Yukon is limited at the present time, efforts to expand the Yukon energy use knowledge base are underway through a series of surveys and studies.

VECTOR A. ENERGY CAPACITY

NON-RENEWABLE ENERGY CAPACITY

Three forms of non-renewable energy are found in the Yukon: oil and gas, and coal. For each of the three forms, this section looks at their capacity, or reserves.

Vector A Energy capacity	Vector B Energy markets	Vector C Energy uses
non-renewable	production	residential
oil	natural gas	by type of use
gas	biomass	by form of energy
coal	electricity	
renewable	consumption	commercial/institutional
water	oil	by type of use
biomass	natural gas	by form of energy
wind	electricity	
geothermal		
solar		
electricity	infrastructure	industrial
hydro	electricity transmission	by type of use
diesel	pipeline	by form of energy
wind		
energy efficiency	prices	transportation
non-renewable	non-renewable energy	by type of use
renewable	electrical energy	by form of energy
electricity	comparative prices	

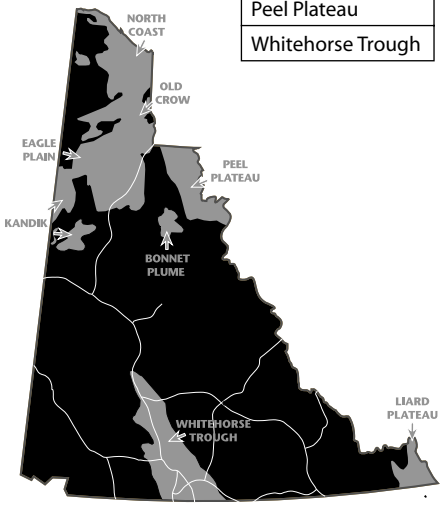
• Oil and gas

The oil and gas potential of the Yukon is largely unexplored and undeveloped. A total of eight distinct sedimentary basins with potential to host oil and gas deposits have been identified (Table 3). Each basin has its own unique geological history and character.

Assessment studies of the petroleum resources of all eight Yukon basins have been undertaken by the Government of Yukon through the National Energy Board and the Geological Survey of Canada. Drilling activity in the Yukon dates back to 1957, with a well drilled in the Eagle Plain region. To date, only 71 wells have been drilled, with most of the wells being located in one of three basins: Liard Plateau, Peel Plateau and Eagle Plain. The remaining five basins (Bonnet Plume, Kandik, Old Crow, Whitehorse Trough and North Coast) remain virtually unexplored.

Table 3. Yukon oil and gas basins

Bonnet Plume
Eagle Plain
Kandik Basin
Liard Plateau
North Coast
Old Crow
Peel Plateau
Whitehorse Trough



Responsibility for the administration of the Yukon's oil and gas resource was formally transferred to the Yukon by the federal government in 1998 with the passage of the *Yukon Oil and Gas Act* and an amendment to the *Yukon Act*. Since the *Yukon Oil and Gas Act* has been in force, four oil and gas rights dispositions, or permits, have been granted.

The oil and gas permits were issued through three calls for bids issued in November 1999, March 2001 and November 2001. Three of the permits are located in the Eagle Plain basin and the fourth in the Peel Plateau basin. Anderson Resources Ltd. (now owned by Devon Energy Corp.) was the successful bidder for the three Eagle Plain permits. The Hunt Oil Company of Canada won the bid for Peel Plateau. All four permits were issued for six years. Table 4 describes the permits issued by the Government of Yukon after gaining administrative authority for oil and gas resources in 1998.

The fourth oil and gas disposition to be held under authority of the *Yukon Oil and Gas Act* is currently at Step Two in the five step disposition process which ends with a call for bids. Step Two consists of consultations between the Government of Yukon and each First Nation government which has traditional territory within the proposed disposition area.

Table 4. Yukon oil and gas dispositions.

Source: Government of Yukon, Department of Energy, Mines and Resources

Permit no.	Region	Bid ($ millions)	Permit owner	Permit expiry
001	Eagle Plain	8.2	Devon ARL	November 2005
002	Eagle Plain	12.2	Devon ARL	November 2005
003	Eagle Plain	2.9	Devon ARL	March 2007
004	Peel Plateau	1.2	Hunt Oil Canada	January 2008

In addition to the permits issued under the *Yukon Oil and Gas Act*, there are two different types of oil and gas dispositions that have been grandfathered under the new regime. Two exploration licences on the Yukon's North Coast are currently held largely by Phillips Petroleum and BP Canada. Northern Cross is the major player in three significant discovery licences in the Eagle Plain area. Encana Corp., Nexen Inc. and Devon Energy Canada hold a significant discovery licence in the La Biche area in the Liard Basin.

• Coal

The Yukon is also home to significant reserves of a third form of non-renewable energy — coal. While coal is currently not being extracted, there are over 100 known occurrences of coal in the territory. Coal has been used on a small scale since the early 1900s in applications including domestic space heating, electricity generation, powering riverboats and concentrate drying at the Faro and Elsa mines.

Major coal reserves in the Yukon have been identified at Division Mountain (near Braeburn), Whitehorse Coal (near Whitehorse), Bonnet Plume (northern Yukon) and Rock River (southeast Yukon). The full span of Yukon coal potential is described the publication, *Yukon Coal Inventory.* Though as yet untapped, coalbed methane potential has been identified in the Bonnet Plume, Whitehorse Trough and Liard Plateau regions.

As with all resource commodities, future Yukon coal production is highly dependent on price. Yukon coal also faces the added challenges of being located far from market. Much of the coal found in the Yukon has a high ash content. This makes it unsuitable for use as coking coal, which is used to make steel, and, as a result, fetches a premium price on world markets. Because of its large volume to weight ratio, coal is typically transported by rail. The economic extraction of Yukon coal for export would likely require the reintroduction and/or expansion of rail service into the territory.

RENEWABLE ENERGY CAPACITY

Five forms of renewable energy are found in the Yukon: hydro, biomass (wood), wind, solar and geothermal. For each of the five forms, this section looks at their capacity (reserves).

• Hydro

The Yukon's hydro potential is significant. Out of the Yukon's total land base of 483,450 km^2, five primary river basins drain an area of 418,000 km^2. The volume of water flowing through Yukon river systems is limited, however, by three key factors: a semi-arid climate, long, sub-zero winters and glacier melt.

First, a semi-arid climate simply means relatively little rain or snow falls over the course of a year relative to other jurisdictions. Second, water flows are restricted in the winter since surface water in a frozen state cannot join water running

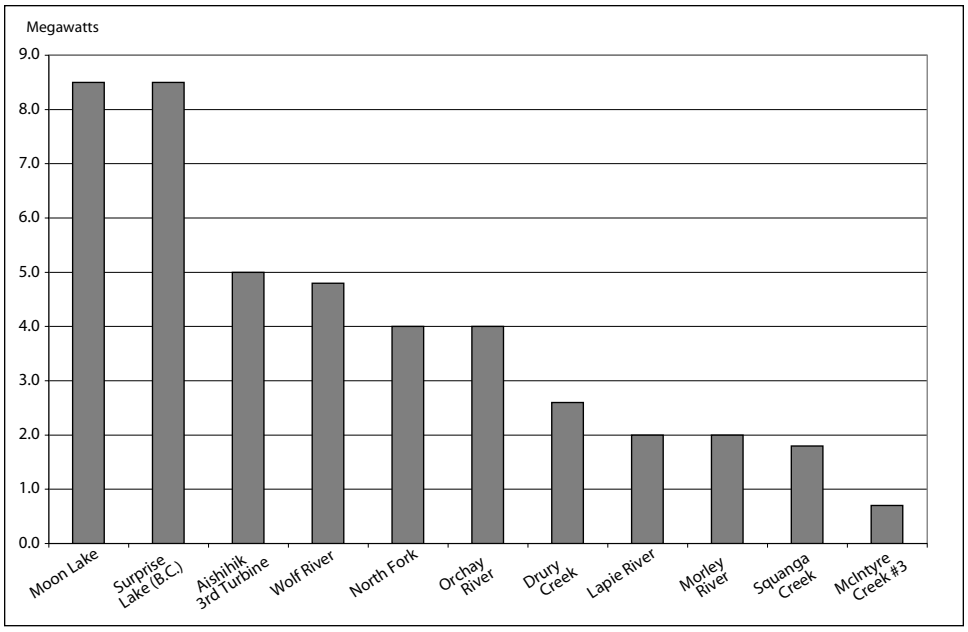


Chart 1. Examples of potential Yukon hydro-electric capacity (< 20 MW). *Source: Yukon Energy Corporation*

under ice. In addition, while hydro potential is effectively stored in the form of snow and ice, the rapid release of that energy during times of melt makes it difficult to effectively capture the hydro energy. In the context of electricity generation, the long cold Yukon winters also means that hydro-electric potential is lowest in winter when demand for electrical energy is at its highest. Third, the volume of water available for hydro-electric generation in a given watershed is significantly higher if glacial melt contributes to water flows. For example, generation potential at the Aishihik Lake hydro-electric facility, which is not glacier-fed, is much more dependent on rainfall than the Whitehorse hydro-electric facility which benefits from glacier melt in the Atlin area.

With regard to future hydro-electric potential, far more hydro capacity exists than is currently being harnessed. Both Northern Canada Power Commission (NCPC) and Yukon Energy Corporation have identified and studied a large number of potential hydro sites in the Yukon and northern BC. The NCPC studies identified 82 potential sites. Of the 82, 32 have potential of generating greater than 100 MW, 17 are in the 20 to 100 MW range and 33 are under 20 MW. Those sites under 20 MW were considered the most economically viable alternative to diesel generation. From 1988 to 1992, Yukon Energy Corporation undertook further investigations of potential hydro sites in the Yukon and northern BC and most viable options were included in the corporation's 1992 capital plan. The 11 options are shown in Chart 1. Additional small hydro (less than 20 megawatts) assessment work is underway on a region-by-region basis as part of the Small Hydro Resource Assessment Program, a five-year initiative now in its second year.

• Biomass

The Yukon's biomass energy potential is also significant. Energy from biomass, or bioenergy, can be produced from a variety of sources including wood, wood waste, methane gas from land fill and sewage waste as well as pulping liquor from

pulp and paper production. In the Yukon context, biomass means cordwood and wood waste from sawmilling activities.

Energy has been extracted from wood by many, many generations of Yukon people for space heating and cooking purposes. Energy from cordwood was also crucial in the Yukon's transportation industry in the years before highways when wood-fuelled steam-driven riverboats plied Yukon waterways. More recently, wood chips and pellets have been used in institutional and residential space heating applications.

While information which accurately describes the biomass energy potential of the Yukon is not available, the Yukon's fuelwood capacity far exceeds current demand. The Yukon's estimated annual consumption of fuelwood of 22,000 cords represents less than five percent of the Yukon's average annual firekill.[2]

• Wind

While the total wind energy potential of the Yukon is largely unknown and undeveloped, wind power has been used to generate electricity in small-scale applications as early as the 1940s. Since the early 1980s, studies have been undertaken with the purpose of identifying prime locations for wind-generated electricity at a variety of sites such as Destruction Bay, Dawson City, Haines Junction, Tagish and Whitehorse. While analysis has been hampered by data deficiencies due to rime icing of wind speed monitoring instruments, three locations suitable for wind farming have been identified in the Whitehorse area: Haeckel Hill, Mount Sumanik and Flat Mountain. Winds at the three wind farm-suitable sites blow predominately from the southeast, south and southwest.

Site assessments around the territory are continuing. Sites are selected annually for monitoring through the YDC-funded Community Wind Resource Assessment Program. Wind assessment locations in 2002/2003 included Aishihik Lake, Haines Junction, Silver City, Annie Lake Road, Faro, Fish Lake, Lake Laberge. Wind monitoring was also undertaken at Stewart Crossing and Old Crow in 2002/03.

• Solar

While our long winter nights might suggest that solar power is of limited application in the Yukon, the territory actually receives close to the same amount of sunshine, on an annual basis, as do many regions in Canada. Whitehorse receives 35 percent less sunshine than Canada's sunniest community, Estevan, Saskatchewan and it receives only about 10 percent less sunshine that Victoria, British Columbia. The reflective nature of snow also contributes to the Yukon's solar capacity.

• Geothermal

The Yukon is part of the so-called Pacific Ring of Fire region which encircles the Pacific Ocean. Geothermal energy consists of heat emanating from within the earth and occurs in nature in two forms. The first, groundwater, includes

hot springs, steam geysers, hot water and steam. Heat energy from warm, hot or vaporized water extracted from the earth is transferred to another medium above ground (known as open loop systems). The second, groundsource, consists of hot and warm earth from which heat can be transferred to liquids flowing through pipes placed in the earth (known as closed loop systems).

Using heat energy from a geothermal resource is practical only if the geothermal occurrence and the energy need are located in close proximity. Thus, the development of geothermal applications in the Yukon will first occur where geothermal resources are found close to populated areas. A major well registry, mapping and resource analysis project is presently underway which will assemble the existing and available information on the groundwater and groundsource heat potential in all Yukon communities.

Known geothermal resources in the Yukon are too low in temperature to produce steam that could be used to generate electricity on a cost-competitive basis. While geothermal temperatures in the range of 100°C to 180°C are required, Yukon geothermal resources have so far been identified in only the 15°C to 55°C range. As a result, the Yukon's geothermal resources are best suited for heat energy applications such as space or district heating.[3]

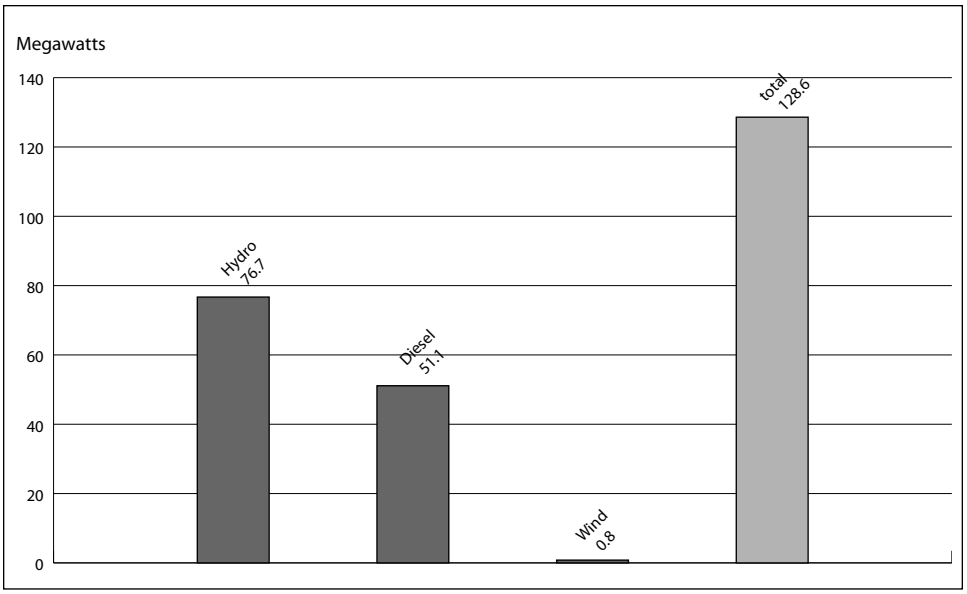
ELECTRICITY

Strictly speaking, electricity is not a form of either non-renewable or renewable energy but is a tertiary form of energy produced from primary energy sources. Because of its prevalence and versatility, however, it is often thought of as a source of energy unto itself. For this reason, electrical energy capacity is discussed in this section, separate from the earlier discussion about non-renewable and renewable forms of energy.

There are two electrical utilities in the Yukon — the Yukon Energy Corporation (YEC) and The Yukon Electrical Company Limited (YECL). The Yukon Energy Corporation is a public utility owned by the Government of Yukon through the Yukon Development Corporation. The primary generator of electricity in the territory, YEC owns the hydro facilities at Whitehorse, Aishihik and Mayo, as well as diesel generators in Whitehorse, Faro, Dawson, and Mayo. Total electricity generation capacity owned by YEC was estimated at 114.6 megawatts in 2002.

The Yukon Electrical Company Limited is a private utility owned by ATCO Electric Limited. Primarily a distributor of electricity at the retail level, YECL owns the small-hydro facility at Fish Lake, and the diesel generators in Carmacks, Haines Junction, Teslin, Ross River, Watson Lake, Beaver Creek, Destruction Bay, Old Crow, Pelly Crossing, Stewart Crossing and Swift River. Total electricity generation capacity owned by YECL was approximately 15.8 megawatts in 2002.

Chart 2. Total Yukon electricity generation capacity (megawatts).



The total current capacity of existing plants in the Yukon is summarized in Chart 2. A more detailed breakdown by form of generation appears in the following sections.

• Hydro generation

The Yukon's two electrical utilities operate a total of four hydro facilities at locations around the territory (Table 5). Three of the facilities are owned by the Yukon Energy Corporation and account for 98 percent of the territory's utility-supplied hydro-electric capacity from operations in Whitehorse, Aishihik Lake and Mayo Lake. The remaining 2 percent of utility-supplied hydro-electric capacity is supplied by The Yukon Electrical Utility Company Limited from its Fish Lake facility.

Table 5 also demonstrates the effect of the Yukon's winter climate on hydro-electric generation capacity. The reduction in water flows during the winter months is most pronounced at the Whitehorse facility where winter capacity is 40 percent less than summer capacity. Territory-wide, hydro-electric capacity is reduced by 21 percent in the winter period.

In addition to electricity generated at the YEC and YECL hydro-electric facilities, there are several non-utility micro hydro facilities operating in the Yukon as well as one at Fraser in northern BC. The Fraser facility has a capacity of 250 kW. A facility at Rancheria was built to supply a highway lodge and has a summer capacity of 155 kW. Other micro hydro setups supply individual residences.

More recently, a new mini micro-hydro submersible generator was installed for seasonal use at the Fort Selkirk historic site on the Yukon River near the mouth of the Pelly River. Unlike other forms of hydro-

Table 5. Yukon utility-supplied hydro-electric capacity. *Source: Yukon Economic Development and Yukon Energy Corporation*

Facility	Utility	Capacity (MW) Summer	Winter
Whitehorse	Yukon Energy	40	24
Aishihik Lake	Yukon Energy	30	30
Mayo Lake	Yukon Energy	5.5	5.5
Fish Lake	The Yukon Electrical Company Limited	1.3	0.7
Total capacity		**76.8**	**60.2**

Note: Capacity at the Aishihik Lake facility will increase by 1.5 MW in each of the next two years (2003 and 2004) as a result of an electrical generator rewinding program.

electric generation found in the Yukon, the submersible unit requires no head of water, no turbines, no dams and no pipes. In a nine-mile-per-hour current, the unit can produce enough electricity to supply about a quarter of the needs of an average suburban home.

• Diesel generation

In combination, the Yukon Energy Corporation and The Yukon Electrical Company Limited have diesel electrical generating facilities installed in nearly every Yukon community. The capacity of these generators, some of which are used only for back-up purposes, is summarized in Chart 3.

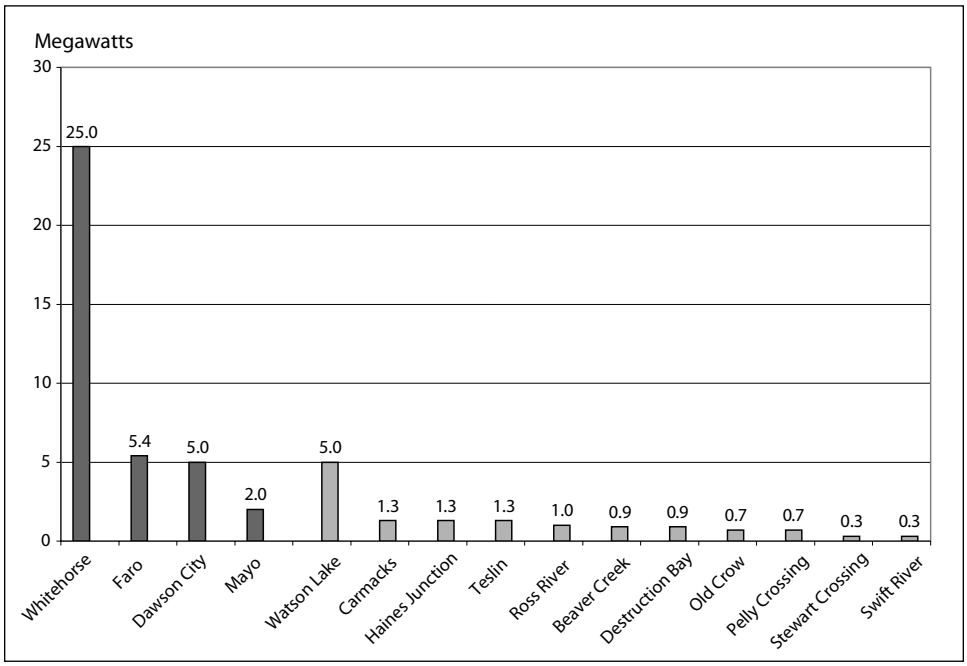


Chart 3. Total Yukon diesel-electric capacity. *Sources: Yukon Energy Corporation and The Yukon Electrical Company Limited*

• Wind generation

The Yukon Energy Corporation operates two wind turbines on Haeckel Hill near Whitehorse (Table 6). The first turbine, a 0.15 MW unit manufactured by Bonus Energy was installed in July 1993 at a cost of $1 million. The second wind turbine, a Vestas V47-660, was installed in the fall of 2000 at a cost of $2 million. The Vestas unit has a capacity of 0.66 MW. Approximately eight micro-scale turbines are in operation in the territory and supply electricity to buildings not connected to an electrical transmission grid.

Through operation of wind turbines on Haeckel Hill, Yukon Energy is demonstrating that wind power has promise in northern locations such as the Yukon. Progress has been achieved in overcoming some of the technical difficulties associated with operating turbines in the cold climates, such as rime icing. Placing more wind turbines in the Yukon will now depend on the average winds at a location and whether the benefits of clean and renewable power (including a stable fuel price) outweigh the costs

Table 6. Yukon utility-supplied wind capacity. *Source: Yukon Energy Corporation*

Facility	Utility	Capacity (MW)
Haeckel Hill (Bonus)	Yukon Energy Corporation	0.15
Haeckel Hill (Vestas)	Yukon Energy Corporation	0.66
Total capacity		**0.81**

of production. In the short term, the most likely locations for additional wind turbines are off the main Whitehorse-Aishihik-Faro grid where their output will directly displace diesel rather than surplus hydro. Wind turbines may also prove feasible if located in close proximity to existing electricity transmission infrastructure.

ENERGY EFFICIENCY

By definition, energy efficiency measures strive to produce the same level of benefits to energy users from reduced amounts of energy. Conversely, energy efficiency may also be defined as an increase or enhancement in the benefits derived from a fixed amount of energy. In more mathematical terms, energy efficiency occurs when an increased amount of energy output results from the same amount of an energy input or when the same amount of energy output results from a reduced amount of energy input.

Thus, in the context of energy capacity, energy efficiency is a relative concept. Energy efficiency measures the volume of inputs relative to outputs (or vice versa). In contrast, absolute measures of energy capacity are used to describe the volume of non-renewable, renewable and electrical forms of energy available for use. Note that because energy efficiency is a relative concept, it allows for comparisons between different uses of energy. The meaning of energy efficiency and its relative nature are illustrated in the three examples below.

• Non-renewable

Roger and Cam each own a gasoline-powered Ford Taurus station wagon. Roger's wagon is a 1995 model and Cam's is the 2003 version. Both vehicles have gas tanks with a capacity of 40 litres. According to Natural Resources Canada, the rated highway fuel consumption (or, energy efficiency) for a 1995 Ford Taurus wagon is 7.3 l/100 kilometres (litres per 100 kilometres). The rated highway fuel consumption for the 2003 Ford Taurus wagon is 8.4 l/100 kilometres.

Suppose the lads take a trip to Dawson City, each driving their own Taurus wagon with similar amounts of gear, and that they fill their gas tanks full (i.e., to 40 litres) in downtown Whitehorse before heading up the Klondike highway. If they both drive at the posted speed limit all 536 kilometres to Dawson, only one of them will make it to Dawson without needing to refuel. Which one?

A: Roger. With a rated fuel consumption of 7.3 l/100 kilometres, Roger's Taurus will need 39.1 litres of fuel to get to Dawson (7.3 x 5.36). In comparison, Cam's Taurus will need 45.0 litres of fuel to go the same distance (8.4 x 5.36). Thus, Roger's wagon is more fuel efficient since it requires a smaller input volume (5.9 litres less) to achieve the same output (arrival in Dawson).

• Renewable

Suppose for the purposes of illustration that the Yukon Energy Corporation is experimenting with a new design for the Number 4 turbine at the Whitehorse Rapids Dam hydro facility. With 12 hours of maximum water flow through the intake, the existing turbine produces the equivalent of 240 megawatt hours of electricity. The new turbine, designed with the assistance of computer simulations, produces 270 megawatt hours of electricity with 12 hours of maximum water flow. The new turbine is more energy efficient since an additional 30 megawatt hours of electricity (i.e., output) are produced for an equivalent amount of input (12 hours maximum water flow).

• Electricity

Helen and Gail are neighbours. Each drives a 2002 Toyota Echo. During the winter season, both Helen and Gail use block heaters to be sure that their cars will start when they leave for work in the morning at 7:00 am. The block heaters are each rated at 750 watts. Helen uses a timer which turns on the block heater in her car at 3:00 am while Gail plugs her car in when she arrives home from work each day at 5:00 pm. Since at typical winter time temperatures, a 750-watt block heater needs only four hours to reach maximum warming capacity, Helen's use of a timer is energy efficient. The engine temperatures of both cars will be the same at 7:00 am (i.e., the same output), with Helen having consumed 3 kilowatt hours of electricity while Gail has consumed 10.5 kilowatt hours of electricity.

Note that the renewable and electricity examples illustrate another dimension of energy efficiency — the difference between energy efficiency at the primary and secondary level[4]:

- energy efficiency at the primary level (e.g., the hypothetical new No. 4 turbine) concerns the efficient conversion of primary forms of energy into secondary forms of energy;
- energy efficiency at the secondary level (e.g., a successful car start with less electricity consumption) involves the efficient use of secondary forms of energy.

Thus, an important feature of energy efficiency is that it is additive. Energy efficiency gains made at the production stage of secondary energy can be combined with the efficient consumption of secondary forms of energy. It also bears noting that multiple energy efficiency solutions can be applied to the same energy use. Consider, for example, the residential use of energy for space heating. The installation of a higher efficiency burner on an oil furnace could be combined with the installation of low-emissivity windows which retain heat, to result in a constant room temperature with a decrease in fuel oil consumption.

VECTOR B. ENERGY MARKETS

Vector A Energy capacity	Vector B Energy markets	Vector C Energy uses
non-renewable oil gas coal	production natural gas biomass electricity	residential by type of use by form of energy
renewable water biomass wind geothermal solar	consumption oil natural gas electricity	commercial/institutional by type of use by form of energy
electricity hydro diesel wind	infrastructure electricity transmission pipeline	industrial by type of use by form of energy
energy efficiency non-renewable renewable electricity	prices non-renewable energy electrical energy comparative prices	transportation by type of use by form of energy

PRODUCTION

• Natural gas

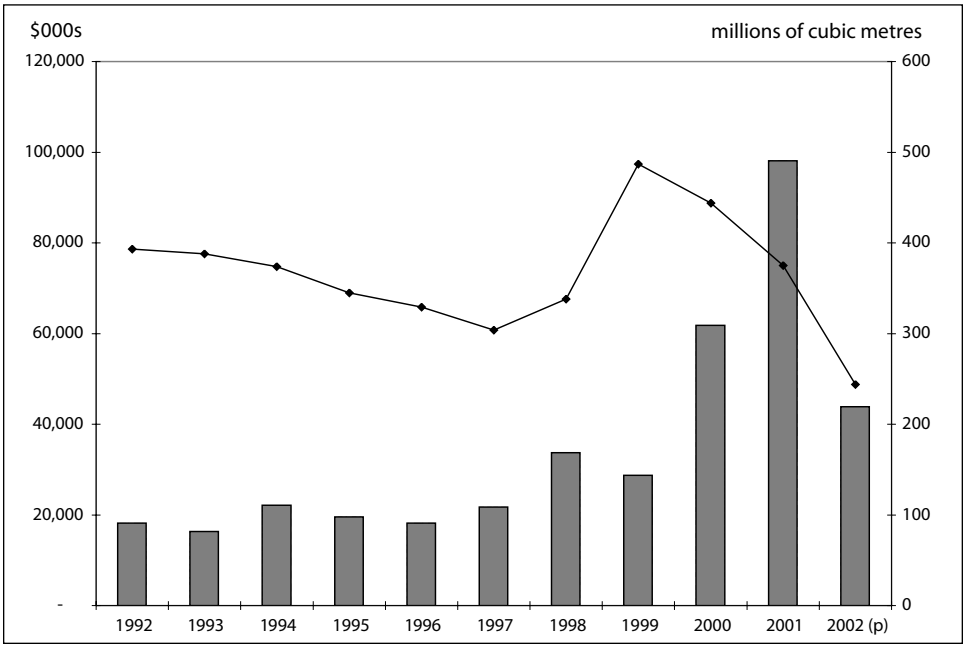
Natural gas is the only form of non-renewable energy currently being extracted in the Yukon; exploitation of the Yukon's oil and coal resources is not occurring at the present time. All natural gas production is taking place at the Kotaneelee field in the Liard Basin (in the southeast Yukon) where two wells produced significant amounts of natural gas in 1979 and 1980, and from 1991 to the present. All production from the Kotaneelee wells has been exported south. Chart 4 shows the volume and value of the Yukon's natural gas production between 1992 and 2002.

• Renewable energy

Cordwood is still extensively used in the territory as an energy source for space heating. According to Statistics Canada's 2001 Survey of Household Spending, 21 percent of Yukon households use wood as their principal heating fuel. The same survey shows that, in comparison, only 4.4 percent of Canadians use wood as their principal heating fuel. Chart 5 shows the production of fuel wood in the Yukon over the period 1982/83 to 1999/00.

Biomass in the form of wood chips and pellets has been used as a source of energy for space heating by both the territorial government and Yukon First Nations. Examples include Elijah Smith School (Whitehorse) and Eliza Van Bibber School (Pelly Crossing), as well as administration buildings operated by

Chart 4. Value and volume of Yukon natural gas production. *Source: Statistics Canada Cat. No. 26-202*



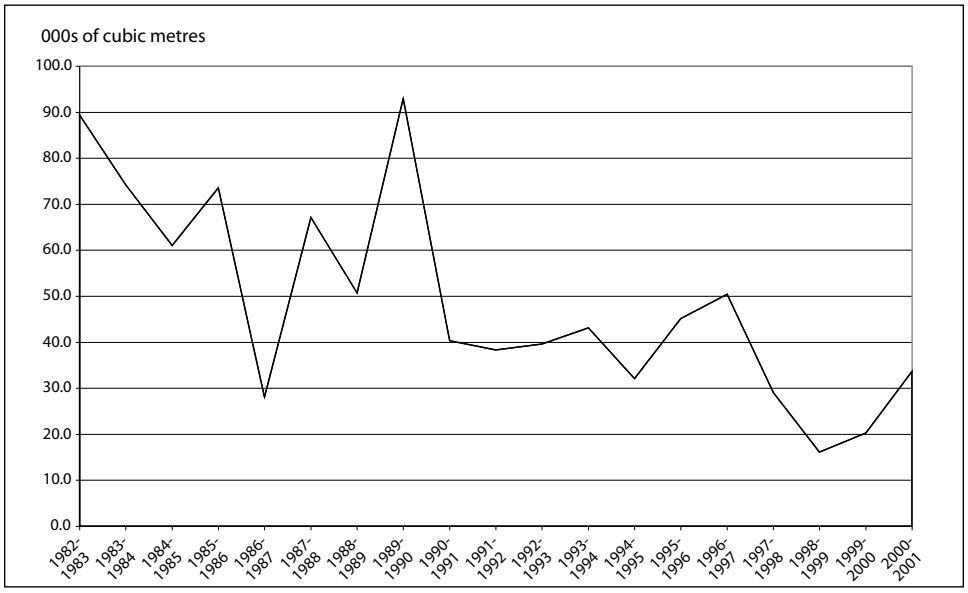


Chart 5. Yukon fuel wood production, 1982/83 to 2000/01. *Source: Yukon Bureau of Statisitics - 2001 Yukon Statistical Review*

the Champagne and Aishihik First Nations (Haines Junction) and Kluane First Nation (Burwash Landing). The high degree of handling and transport which accompanies wood-chip use often makes it difficult for wood chips to compete on a cost basis with diesel.

Enough sunshine is received in the Yukon to make solar energy a viable source of electricity for about eight months of the year in small-scale applications. Similar to hydro energy, however, the peak supply of solar energy is mismatched with peak demand for electricity. Solar energy's unlimited supply, however, coupled with a twenty-fold decrease in the cost of the photo-voltaic technology used to convert sunlight to electricity since 1970, points to an increasingly brighter future for solar energy in the Yukon.

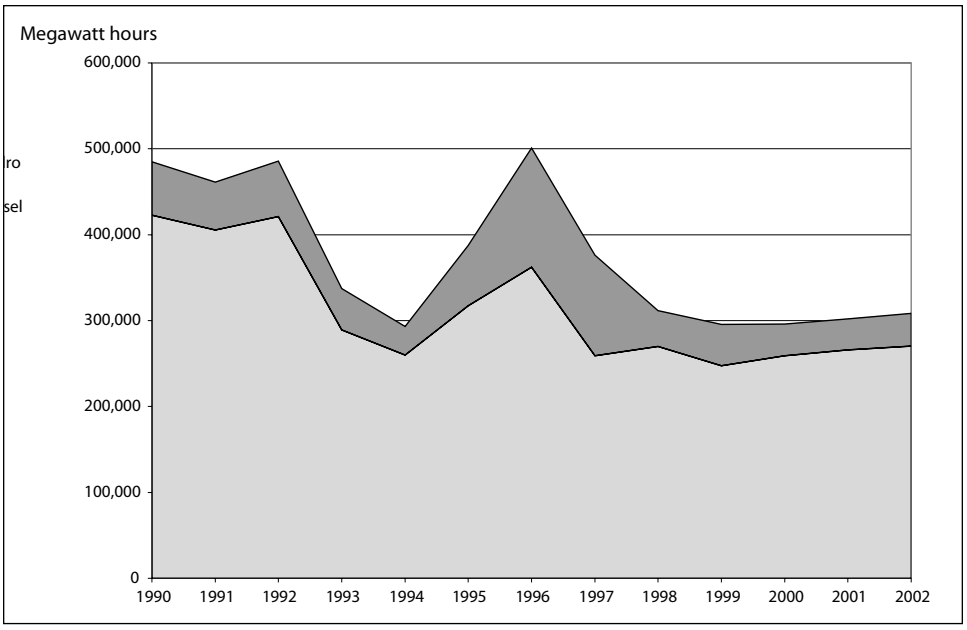
With regard to the consumption of geothermal energy use, two municipalities, Whitehorse and Mayo, use geothermal energy in the form of lukewarm ground water to prevent water systems from freezing during the winter and spring months. Other "consumers" include the Takhini Hot Springs which continues to operate its outdoor geothermal-fed swimming pool facility, and the Whitehorse Fish Hatchery which makes use of a heat pump which draws energy from the warm water aquifer located underneath the Riverdale subdivision.

The feasibility of using geothermal energy to heat a high school in the Riverdale area of Whitehorse is currently being investigated. If the flow rates associated with the September 2002 discovery of 15.5°C drinking well water in Haines Junction prove stable, the water may be used to heat several village-owned buildings.

• Electricity

The most significant consumer of renewable energy resources is likely the Yukon's hydro-electric industry which generated 270,359 megawatt-hours (MWh) of electricity from hydro sources in 2002. While the electrical generating capacity within a given jurisdiction usually provides a dependable proxy of how

Chart 6. Yukon electricity generation — hydro and diesel. *Source: Yukon Bureau of Statistics*



much electricity is actually produced, such a rule of thumb does not apply to the current Yukon situation. Much of the electrical generation capacity in the territory was installed to meet the power requirements of the Faro mine. With the indefinite closure of the Faro mine in 1997, overall demand for electricity in the Yukon has fallen by approximately 40 percent. Chart 6 shows the volume of electricity produced by both Yukon electricity utilities from hydro and diesel sources over the period 1990 to 2002. The chart also demonstrates the effect of the Faro mine closure on demand for electricity.

In southern Canada, a drop in local demand for electricity would typically have little impact over electricity production over the longer term. Deregulation has led to the interconnection of electricity distribution systems and electricity generated from surplus capacity is usually sold into markets outside the local sales area. In the Yukon, however, electricity is generated from a system isolated from the rest of the North American distribution grid. Thus, the Yukon is in the unique position of having available large amounts of surplus electricity generating capacity on the Whitehorse-Aishihik-Faro grid system.[5] That position is made even more unique by the fact that significant amounts of the surplus capacity is in the form of hydro.

With the installation of a second and larger capacity wind turbine on Haeckel Hill, the volume of wind generated electricity in the Yukon has also increased. Chart 7 shows the volume of electricity generated by wind turbines since the Bonus turbine was installed in 1993. The steep increase in electricity generation seen between 2000 and 2001 is due to the installation of the Vestas wind turbine in October 2000. The two Haeckel Hill wind turbines generate enough electrical energy to annually supply 150 homes.

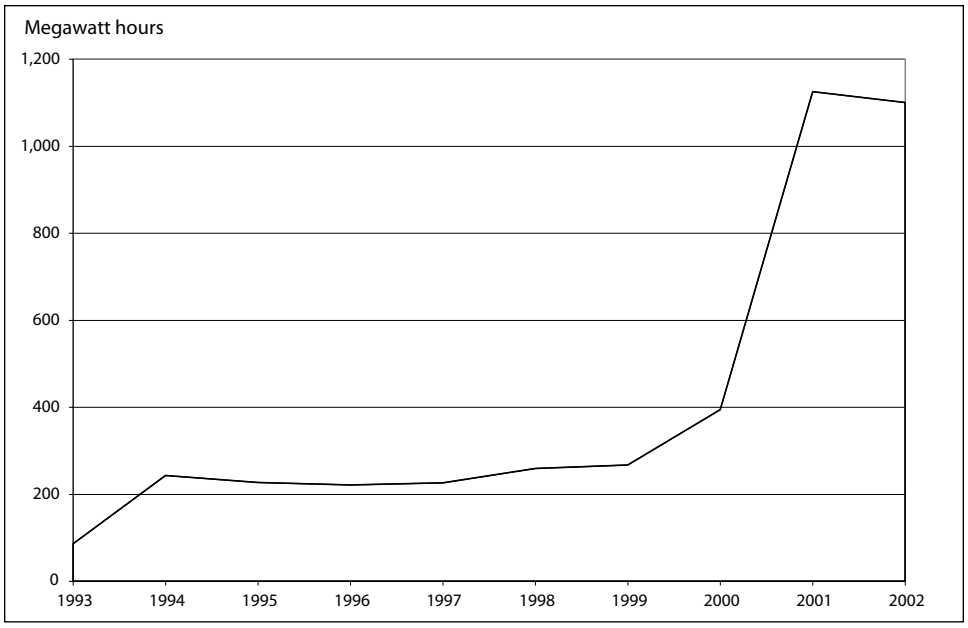


Chart 7. Yukon wind-generated electricity.
Source: Yukon Bureau of Statistics and Yukon Energy Corporation

CONSUMPTION

• Oil

Energy derived from two primary forms of non-renewable energy resources, oil and natural gas, is commonly consumed in the Yukon. Each form of non-renewable energy is familiar to consumers as a variety of product types rather than as oil or natural gas. For example, consumers do not fuel their cars and trucks with oil at their local service stations — they purchase gasoline or diesel. Similarly, natural gas is not available for sale at local retailers to fuel backyard barbeques but propane is.[6] Table 7 shows the general product types which are refined from crude oil and natural gas.

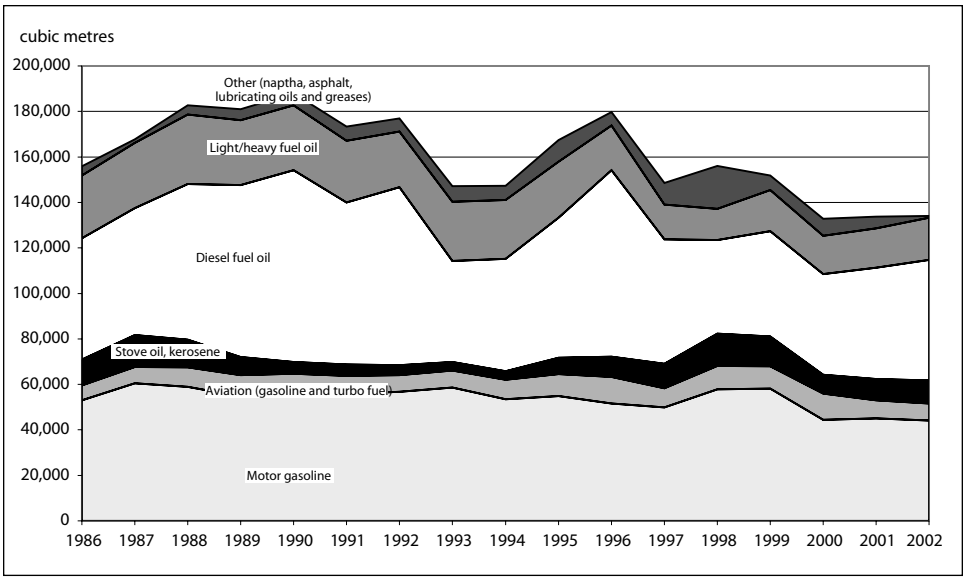
	Source form of energy	
	Oil	**Natural gas**
refined product	naphtha	methane
	gasoline	ethane
	kerosene	propane
	diesel	butane
	asphalt	

Table 7: Oil and gas refined product types

More energy is produced every year from the two Kotaneelee natural gas wells than is consumed on an annual basis in the Yukon. Notwithstanding this fact, all quantities of products derived from oil and natural gas consumed in the Yukon are imported from outside the territory. Oil and natural gas products are shipped into the territory from Alberta, British Columbia and Alaska.

In terms of the consumption of oil products in the Yukon, a total of 134,053 cubic metres of petroleum products were consumed in the Yukon in 2002, up 0.3% from 133,678 cubic metres in 2001. Among the various product types, diesel fuel oil (all grades of distillate fuel sold for diesel engine use) accounted for the largest share of consumption. A total of 52,990 cubic metres of diesel fuel oil were consumed in the Yukon in 2002, representing 40 percent of total oil product consumption. Motor gasoline was the second most popular oil product in the territory in terms of volume consumed accounting for

Chart 8. Yukon consumption of oil products, by type. *Source: Statisitics Canada Cat. No. 45-004*



44,052 cubic metres, or 33 percent of total oil product consumption. Chart 8 shows the pattern of oil product consumption in the Yukon over the period 1986 to 2002.

• Gas

Figures for the consumption of natural gas products, which are mainly in the form of propane, are not available due to confidentiality considerations. Propane suppliers in the Yukon are too few in number to allow the reporting of sales figures at the territorial level.

• Electricity

Electricity is produced on an as-needed basis, with allowance for peaking demand. As a result, electric energy consumption patterns tend to be similar to generation patterns. The difference between the amount of electricity generated and the amount consumed by customers is referred to as "producer consumption."

Chart 9 also shows the consumption of electricity in the Yukon by major type of consumer. As was seen in Chart 6, the generation of electricity in the Yukon has fluctuated widely in concert with the fortunes of the Faro lead-zinc mine. The same is true of electricity consumption patterns. While consumption by consumers in the residential and commercial/institutional markets has been relatively stable on an annual basis since 1988, mining sector consumption has been highly variable. Over the 1988 to 2000 time period, mining sector consumption has ranged between a high of 184,623 MWh in 1992 to a low of 5,249 MWh in 1999. Consumption data for 2001 and 2002 are not yet available.

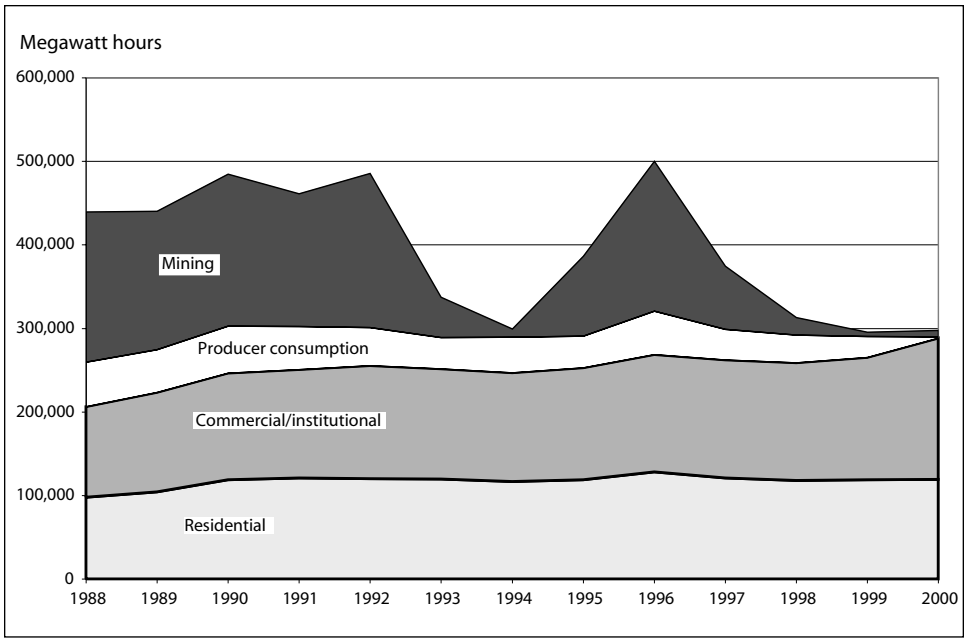


Chart 9. Yukon annual disposal of electric power. *Source: Statistics Canada Cat. No. 57-202*

INFRASTRUCTURE

• Oil and gas pipelines

Natural gas from the Kotaneelee wells, located near the intersection of the British Columbia, Northwest Territories and Yukon borders, is transported via a 20-inch pipeline connected to the Westcoast Transmission system in British Columbia. This short stretch of pipeline is the sum total of the Yukon operating pipeline system. For the Yukon to further advance the development of its own oil and gas reserves, additional pipelines will need to be built.

Interest in transporting northern natural gas from Prudhoe Bay, Alaska and from the Mackenzie Delta, NWT to southern markets was sparked by the sharp increase in natural gas prices seen in 2000. While efforts to bring NWT gas resources to southern markets are continuing, interest in the building of an Alaska Highway pipeline to transport Alaskan natural gas appears to have again shifted to the longer term.

• Electricity transmission

Similar to the situation for the generation of electricity in the Yukon, both The Yukon Electrical Company Limited and Yukon Energy Corporation are involved in the "transportation" of electricity from generation source to end user. The high voltage transmission of electricity is undertaken exclusively by Yukon Energy Corporation which owned approximately 500 kilometres of transmission line at the end of 2002. The YEC transmission network was extended by 230 kilometres in September 2003 with the commissioning of the Mayo to Dawson City transmission line. The 69-kilovolt intertie project displaces diesel-generated electricity in Dawson City and Stewart Crossing with hydro-electric power from the Wareham Dam at Mayo.

The distribution of electricity to residential, institutional and commercial customers is handled by both utilities, with YECL playing a larger role relative to YEC. In terms of direct sales to end users, YEC was serving approximately 1,900 electricity consumers out of the total number of 14,900 electricity consumers territory-wide in 2002. Consumers served by YEC are located mainly in the communities of Dawson City, Faro, Mayo and Champagne. The remaining 13,000 electricity consumers are served by YECL in the communities of Beaver Creek, Carmacks, Destruction Bay, Haines Junction, Old Crow, Pelly Crossing, Ross River, Stewart Crossing, Swift River, Teslin, Watson Lake and Whitehorse.

PRICES

• Non-renewable energy

Prices in the Yukon for products derived from non-renewable sources are largely determined in competitive markets located outside the territory and, indeed, outside of Canada. As a result, consumers of oil and natural gas products in the Yukon are price takers. Similarly, go-ahead decisions regarding future production of the Yukon's oil and gas resources will be based on factors at play in markets outside the territory.

The average annual price for West Texas intermediate crude oil[7] was $US 26.09/barrel in 2002. Crude oil prices started the year much higher, averaging $US 34.03 in the first quarter of 2003 in response to disruptions in Venezuelan oil production and Iraq war fears. The price of oil has settled back down into the $US 31.00 range with a monthly price of $US 30.75 in July and $US 31.65 in August 2003. The price of oil for 2003 has been forecast on an annual basis by the TD Bank at $US 30.63/barrel.

After falling below $US3.00/million British thermal units (MMBtu) in the first half of 2002, the price of natural gas picked up sharply in the later part of the year averaging $US4.32/MMBtu in the fourth quarter of 2002. So far in 2003, the increase in price which began in 2002 has continued strongly. The TD Bank's September 19, 2003 price forecast for natural gas to the end of 2003 is $US5.51/MMBtu. Prices in excess of $US5.00/MMBtu should lead to renewed interest in natural gas exploration activity in the Yukon. Chart 10 presents historical and forecast prices for oil and natural gas over the period 1992 to 2003.

Chart 11 shows posted retail motor fuel and residential heating fuel prices for Whitehorse from the first quarter of 1999 to the second quarter of 2003.

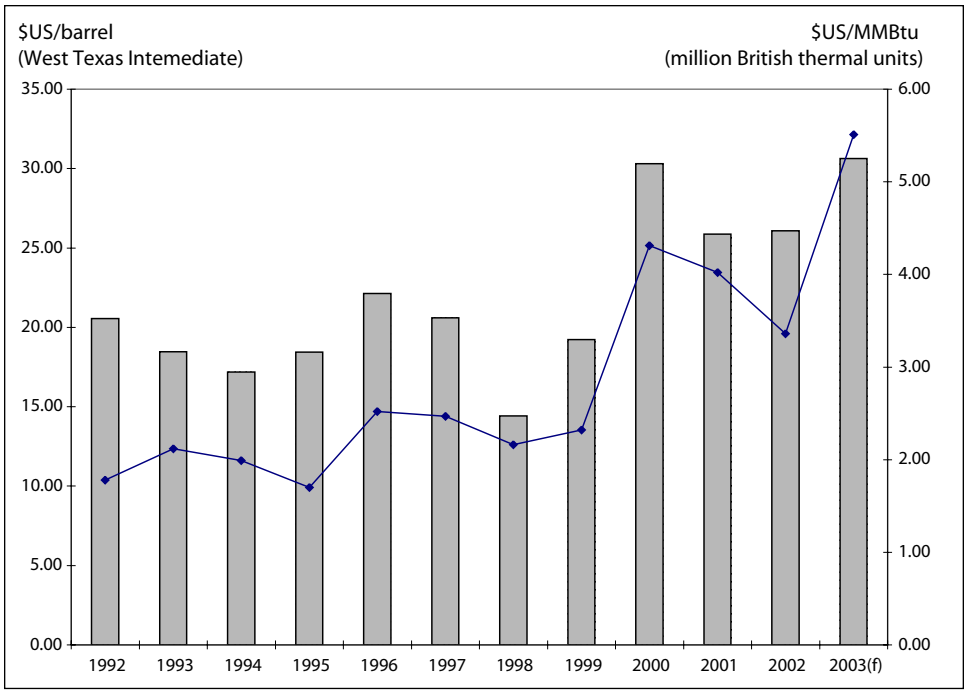


Chart 10. Oil and natural gas prices.
Source: TD Commodity Price Report, September 19, 2003

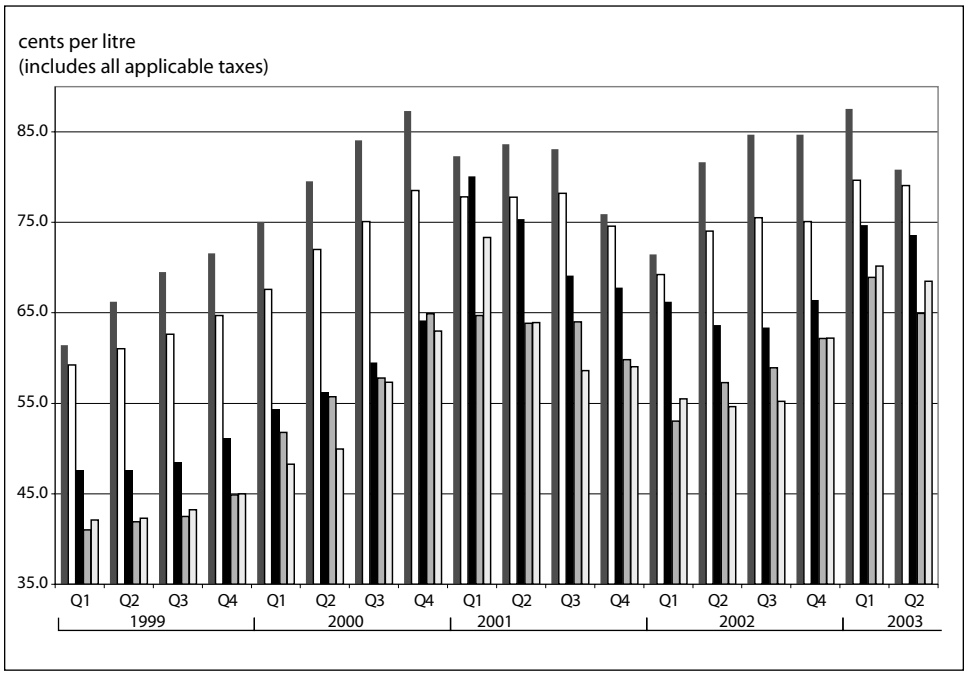


Chart 11. Retail motor fuel and residential heating fuel prices - Whitehorse.
Source: Yukon Bureau of Statistics

• Electrical energy

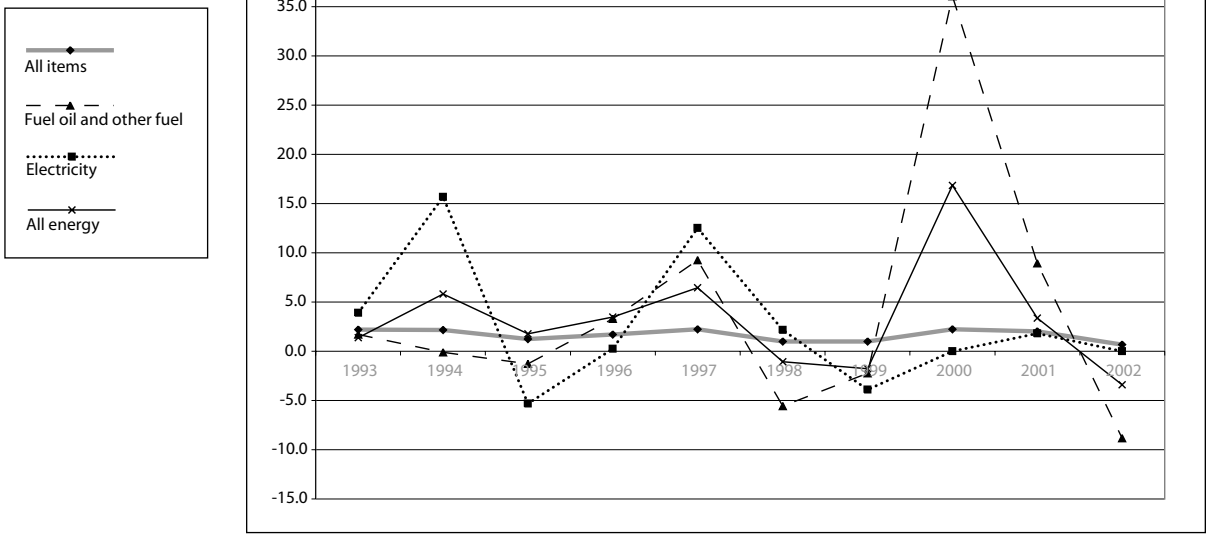
The Yukon electricity generation system has not been deregulated and operates in isolation from the greater North American electricity distribution system. As a result, electricity prices in the Yukon are not determined in a competitive market but instead are prescribed by the Yukon Utilities Board. In theory, the pricing of electricity in the Yukon might be expected to be relatively simple. A combination of a variety of historical and Yukon-specific factors, however, result in a complex system of production-type cross-subsidies, consumer class cross-subsidies, rate riders, rate relief and income tax rebates.

Notwithstanding the complexity of rate-setting, electricity rates in the Yukon have been stable in recent years. The stability has resulted from low variation in demand for electricity (the Faro mine has remained closed), utility cost control avoiding the need for a General Rate Application for seven years thus far, and bill relief paid out of the Yukon government's Rate Stabilization Fund. As of October, 2002, the price of electricity for residential consumers was 9.48 cents/kWh for the first 1000 kWh of consumption and 13.65 cents/kWh for consumption in excess of 1000 kWh.

• Comparative prices

While electricity prices in the Yukon have remained stable in recent years, other energy prices have demonstrated much variability. Chart 12 shows that while Whitehorse has enjoyed very low and stable inflation rates on the basis of the "all items" version of the consumer price index, prices for fuel oil and other fuel have been much less stable. The year-to-year increase in the consumer price index for all items has ranged between 2.2 percent and 0.7 percent over the last ten years. The year-to-year change in the "all energy" component of the consumer price index has been much more volatile over the same period ranging between an increase of 16.9 percent between 1999 and 2000 and a decrease of 3.4 percent between 2001 and 2002. Before 1998, prices for both electricity and fuels were behind the variation in the "all energy" index. Since 1997, changes in the "all energy" index have been driven mainly by fuel price changes.

Chart 12. Whitehorse price inflation, all items and energy components, 1992=100. *Source: Statistics Canada CANSIM II Table 326-0002*



VECTOR C. YUKON ENERGY USES

The Yukon's energy situation can also be viewed from the perspective of energy users. The Yukon energy use framework outlined in the Yukon energy matrix is adapted from (and is consistent with) energy use framework developed by Natural Resources Canada and presented in their publication Energy Use Data Handbook, 1990 and 1995 to 2001.

Vector A Energy capacity	Vector B Energy markets	Vector C Energy uses
non-renewable oil gas coal	production natural gas biomass electricity	residential by type of use by form of energy
renewable water biomass wind geothermal solar	consumption oil natural gas electricity	commercial/institutional by type of use by form of energy
electricity hydro diesel wind	infrastructure electricity transmission pipeline	industrial by type of use by form of energy
energy efficiency non-renewable renewable electricity	prices non-renewable energy electrical energy comparative prices	transportation by type of use by form of energy

In the Yukon energy matrix, uses are categorized into four sectors:

- residential;
- commercial/institutional;
- industrial; and
- transportation.

Energy use in each of the four sectors may be described from two separate perspectives. The first perspective, energy use by type, considers the purposes for which energy is used. For example, in the residential sector, energy is used for space heating, space cooling, appliances, lighting and water heating. The second perspective, energy use by form of energy, describes the amount of each form of energy used within the sector. For example, energy is used in the residential sector in the form of electricity, propane, heating oil, and wood.

While the availability of data that describe energy uses in the Yukon is limited at the present time, efforts to expand the Yukon energy use knowledge base are underway. The energy use vector will be filled in as data from a variety of surveys and studies are compiled and analysed. The surveys and studies include:

- **Yukon Community Housing Survey**: Conducted by the Yukon Housing Corporation, a face-to-face survey of householders in 13 Yukon communities which gathered data on dwelling adequacy, affordability, suitability and home ownership access. The focus of the survey was on the condition of housing in the Yukon at the community level; limited energy-related information was sought through this survey.
- **Household Energy End Use Survey**: Funded by the Yukon Development Corporation and conducted by the Yukon Bureau of Statistics, a statistically valid randomly sampled telephone survey of households in all Yukon communities. This survey gathered data on housing characteristics, heating equipment, appliances, lighting, hot water heating and vehicle plug-ins.

- **Survey of Household Spending**: An annual national survey conducted by Statistics Canada which collects detailed information about household spending during the previous calendar year. Information is also collected about dwelling characteristics and household appliances including heating equipment.
- **Off-Grid Energy Survey**: Funded by the Yukon Development Corporation, Natural Resources Canada and the Energy Solutions Centre, and carried out by the Yukon Bureau of Statistics, a telephone survey of householders with dwellings (houses, cabins) located off the electrical grid. This survey collected data on space heating, lighting, appliances and small-scale electricity generation (generators, solar, wind and micro-hydro).
- **Yukon Business Survey**: Undertaken by the Yukon Bureau of Statistics, the Yukon Business Survey is a census of business owners in the Yukon. The 2003 version of the survey included a question funded by the Yukon Development Corporation which asked business owners to indicate their total energy expenditures and to identify energy use by form of energy. The underlying structure of the survey will allow further allocation of energy consumption according to industry classification.
- **Energy Performance Standards for Yukon Buildings**: Carried out under contract to the Energy Solutions Centre, this study included a survey of commercial buildings constructed, or renovated at a cost of more than $100,000, over the 1992 to 2001 time period. Based on a representative sample of buildings, the survey assessed the energy efficiency practices employed in the commercial construction and renovation industry relative to national standards. Greenhouse gas implications were also considered.

Energy use data at the national level is much more complete than at the Yukon level. For purposes of illustration, Table 8 shows the patterns of energy use in Canada by both type of use and by form of energy for each of the four sectors.

Table 8. Energy use in Canada by a) Type of energy and b) form of energy, 2001. *Source: adapted from Energy Use Data Handbook, 1990 and 1995 to 2001, Natural Resources Canada, 2003*

	by type of use			by form of energy	
SECTOR	**Volume (PJ)**	**Share (%)**	**SECTOR**	**Volume (PJ)**	**Share (%)**
residential					
space heating	775.9	58.0	electricity	504.8	37.8
space cooling	16.5	1.2	natural gas	601.0	45.0
appliances	185.9	13.9	heating oil	121.1	9.1
lighting	62.4	4.7	propane	11.3	0.8
water heating	296.0	22.1	wood	97.2	7.3
			other	1.3	0.1
Total	**1,336.7**	**100.0**		**1,336.7**	**100.0**
commercial/industrial					
space heating	565.8	53.7	electricity	444.6	42.2
space cooling	55.4	5.3	natural gas	481.7	45.7
water heating	70.4	6.7	light fuel oil and kerosene	63.6	6.0
auxiliary equipment	79.2	7.5	heavy fuel oil	26.8	2.5
auxiliary motors	121.2	11.5	propane	36.4	3.5
lighting (including street)	161.7	15.3	other	0.6	0.1
Total	**1,053.7**	**100.0**		**1,053.7**	**100.0**
industrial					
mining	521.6	17.0	electricity	803.8	26.2
pulp and paper	880.1	28.7	natural gas	851.5	27.8
iron and steel	224.5	7.3	light/diesel fuel oil and kerosene	138.6	4.5
smelting/refining	246.1	8.0	heavy fuel oil	143.9	4.7
cement	63.5	2.1	still gas and petroleum coke	378.5	12.4
chemicals	201.3	6.6	LPG and gas plant NGL	39.8	1.3
petroleum refining	311.3	10.2	coal, coke/coke oven gas	176.7	5.8
other manufacturing	549.1	17.9	wood waste/pulping liquor	491.2	16.0
forestry	18.3	0.6	other	39.6	1.3
construction	47.8	1.6			
Total	**3,063.6**	**100.0**		**3,063.6**	**100.0**
transportation					
small cars	315.7	13.9	electricity	3.1	0.14
large cars	295.3	13.0	natural gas	2.4	0.11
passenger light trucks	417.6	18.3	motor gasoline	1,308.7	57.47
freight light trucks	169.7	7.5	diesel fuel oil	650.5	28.56
medium trucks	164.1	7.2	light fuel oil and kerosene	–	–
heavy trucks	342.1	15.0	heavy fuel oil	77.5	3.40
motorcycles	2.0	0.1	aviation gasoline	3.5	0.15
school bus	15.2	0.7	aviation turbo fuel	215.1	9.45
urban transit	42.9	1.9	propane	16.5	0.72
inter-city bus	6.1	0.3	other	–	–
air	218.7	9.6			
passenger rail	3.0	0.1			
freight rail	78.7	3.5			
marine	123.2	5.4			
off-road	83.1	3.6			
Total	**2,277.4**	**100.0**		**2,277.3**	**100.0**

Notes
(1) Table does not include energy use in the agriculture or electricity generation sectors.
(2) PJ = Petajoule; 1 Petajoule = 1 x 1015 joules; 1 joule = the energy produced by a power of one watt flowing for one second.

ENERGY MATRIX OVERLAY: GREENHOUSE GAS EMISSIONS

The burning of fossil fuels over the past 200 years is now generally accepted as resulting in higher levels of carbon dioxide and other greenhouse gases in the atmosphere. The increase in carbon dioxide has in turn resulted in an increase in overall global temperatures and temperatures are expected to keep rising. A substantial rise in global temperatures (as much as two to four degrees Celsius) in a relatively short period is expected to result in large changes in climate.

Most of the Yukon's electrical generation requirements are being met through renewable sources (e.g., hydro, wind) which do not emit greenhouse gases. As a result, the Yukon is a relatively "green" jurisdiction. Electricity generation notwithstanding, however, Yukoners are high intensity energy consumers. While partly the result of local consumption habits, the higher relative consumption levels are also the result of geographic factors. For example, our northern latitude brings colder winter temperatures and shorter days, which translates into higher demand for energy used for space heating and lighting. Similarly, long distances between communities and from southern sources of supply of food and dry goods means relatively higher motor fuel consumption levels.

The impacts of climate change are more concentrated at northern latitudes. As a result, the Yukon is expected to be on the receiving end of a disproportionate share of the impacts of climate change. Thus, between our predilection for high intensity energy use and our geographic lot in life, a thorough understanding of the greenhouse gas emissions for all vectors of the Yukon energy matrix is becoming increasingly important. Readers are referred to the Yukon Development Corporation's 2003 *Progress Report for Canada's Climate Change Voluntary Challenge and Registry Program* which contains several energy-related examples of the greenhouse gas emission calculations in a Yukon setting.

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FOOTNOTES

[1] Includes the agricultural sector.

[2] The Lure and Lore of Wood, Yukon Development Corporation (2002), page 1.

[3] Adapted from Yukon Energy Resources: Alternatives (Yukon Economic Development, 1997).

[4] Energy at the primary level includes crude oil, natural gas and electricity at the generation stage. Secondary energy is energy refined from primary energy sources such as gasoline, propane and electricity distributed to individual homes. Secondary energy is used to heat and cool homes and workplaces, operate appliances, vehicles and factories.

[5] A similar situation has existed in the Mayo area since 1989 when United Keno Hill Mines ceased mining operations and the bulk of electricity capacity at the Wareham Dam became surplus.

[6] While natural gas is consumed in its raw form in most other parts of Canada, only refined natural gas products are available for purchase in the Yukon.

[7] Oil and gas price figures and forecasts in this section were found in the TD Commodity Price Report for September 19, 2003.