

Yukon Energy Charrette Participant Guide Book

Yukon's
energy future...
let's talk



your needs power what we do



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Project Background and Outcomes/Goals

Welcome to the Yukon Energy Charrette. The Yukon Energy Corporation is pleased you are participating as we talk about Yukon's energy future.

The Yukon Energy Charrette Participant Guidebook has been developed to guide you through the three day charrette. In this guidebook you will find the names and contact information for the Yukon Energy Charrette Planning Team, energy resource information, a report indentifying issues and opportunities which have been gathered through stakeholder interviews and reports from Yukon Energy's community meetings in Mayo, Dawson City and Haines Junction.

This charrette is one way of engaging Yukoners. Yukon Energy recognizes we are all stakeholders and that we need to find the answers together.

Project Background

Yukon Energy's job is to ensure that there is an ongoing and sufficient supply of sustainable energy. Yukon Energy has identified a clean energy deficit by 2014. In response to this predicted shortfall Yukon Energy is currently working on several generation projects. These projects include enhancement of the existing hydroelectric facilities (Whitehorse, Aishihik and Mayo Lake), geothermal, wind and waste to energy. Except for Mayo Lake, which is under construction, the other projects are in the planning and feasibility and phases. Yukon Energy is also working with Yukon Electrical Company Ltd. and Yukon government to develop a demand side management program.

In response to the medium term planning horizons, Yukon energy is guided by the 20–Year Resource Plan, which was prepared in 2006 and is undergoing a major review in 2010-2011. Yukon Energy recognizes the need to create high level energy planning principles which can guide the Corporation's decisions now and into the future. This planning horizon is being considered as a 40 year planning horizon.

In response to Yukon Energy's planning needs and in keeping with the Corporation's 2010-2012 Strategic Plan 'to *engage Yukoners so we can collectively create a clean energy future*', Yukon Energy has identified the charrette planning process as the vehicle to educate, engage and plan with Yukoners.

The Energy Charrette

Charrettes are educational and inspirational; they engage the public and stakeholders through short feedback loops and are unique in educating and achieving feasible solutions with broad public support (National Charrette Institute, 2006). The charrette planning process is a collaborative planning process with three phases.

Phase 1: Research, background information, stakeholder analysis, education and engagement and charrette planning and logistics;

Phase 2: The three-day charrette event; (the phase we are in now); and,

Phase 3: Implementation, which will include the writing of a report that will inform:

- The Resource Plan Review;
- The development of high level energy planning principles; and,
- The way in which Yukoners want Yukon Energy to engage with them in future energy planning and energy decisions;

During the charrette we will be working to achieve the following objectives:

- An understanding of Yukon's energy demand situation and potential opportunities, both near and longer term;
- Input from Yukoners to be used to inform the update of Yukon Energy's 20-Year Resource Plan;
- Decision making tools that consider the principles and tradeoffs Yukoners want Yukon Energy to consider when making energy decisions; and
- The way in which Yukoners want Yukon Energy to engage with them in future energy planning and energy decisions.

In preparation for the three-day charrette, Yukon Energy has been working with national and internationally recognized energy experts who have prepared background energy resource reports which will be presented over the three days of the charrette. A complete package of the presenters and experts' bios is available in the information package you will receive Monday morning at the charrette.

Our key note speaker is Dr. Mark Jaccard, a leading expert in the global energy system, energy-environment planning, policy design and public engagement on energy-

environment issues. He has worked on major energy policy analysis and modeling work for BC, Alberta, and Saskatchewan and most recently for the Northwest Territories. Dr. Jaccard has also done work in Yukon. He is an award winning author and lecturer and is currently working on a book about human cognitive delusions and the likely failure of humanity to address the climate risk in time to avert major ecosystem disruption.

Thank you very much for being a part of Yukon's energy future. We hope you enjoy the experience.

Electricity is a “peculiar product”:

- it is the only product consumed continuously by essentially all customers;
- it is consumed within a tenth of a second of its production; and
- less than a tenth of a second of power can be stored as electrical energy in the system.

The supply of electricity must be continuous and precise in terms of frequency and voltage - electricity producers must supply exactly the amount of electricity customers are demanding at any given point in time. Since a typical customer can instantaneously increase or decrease their demand load without prior warning to the electricity supplier, it falls entirely at the feet of the electricity supplier to accommodate ever-changing demand loads.¹

¹ Adapted from Steven Stoft, *Power System Economics Designing Markets for Electricity*, 2002.

Stakeholder Analysis

To have a contemporary understanding of the electrical energy issues Yukoners are concerned about, approximately 50 interviews were conducted with individuals and representatives from a broad array of organizations, agencies and government departments. The stakeholder interviews were conducted in February and early March of this year. A summary of the issues expressed by the stakeholders during the interviews is grouped by major theme below:

General Comments

- Energy affects everything from economics to foreign policy;
- The key concern is the need to have enough capacity at a reasonable rate for clients;
- Burning diesel is also a tax write off thus lowering government's potential royalty and tax revenues;
- Yukon government's focus is on implementing the Energy Strategy and working on the four priority areas: conserving energy, increasing renewable energy, meeting current and future electricity needs, and managing responsible oil and gas development;
- Given the power supply shortage, resource planning backlog, and increasing but not addressed greenhouse gas emissions, an energy charrette would have been useful years ago;
- A power grid consolidation with B.C. could become a "Trojan Horse" bringing these agreements here and create a situation that would jeopardize energy security and environmental protections in Yukon down the road;
- Yukon may end up under the jurisdiction of trade agreements and their energy related provisions which currently do not apply here, such as TILMA, and the NAFTA Chapter 6 Energy proportional sharing provision;
- Yukon Energy has not made the best energy choices - Mayo B without subsidy would be very expensive power;

- Want to see a 'yes' or 'no' as to waste-to-energy;
- Energy Solution Centre should go back to Yukon Development Corporation; and,
- Frustrated with Yukon Energy and now glad they are finally talking about Demand Side Management rather than about how to generate more power.

Clean, Green, Renewable and Sustainable Power

- We must consider how Yukon's energy plan fits with Canada's greenhouse gas targets and UN frameworks;
- Our energy sources need to be as sustainable as possible;
- We must use the highest environmental standards;
- We must consider all aspects before we label projects green power. Hydro is clean but there are environmental impacts. Right now we have huge workloads, need more resources to respond;
- In the short term we need to consider getting off diesel and burning something cleaner;
- Long term we need clean and secure energy. We need to be forward thinking to anticipate future needs and match that with realistic solutions. We need to consider the impacts of the carbon economy and how to benefit from this; and,
- Yukon Energy must provide electricity that is less than the cost of oil and produces the least amount of greenhouse gases.

Energy Management

- Municipalities are interested in offsetting costs or even making money in communities with their own energy projects (small scale);
- Yukon Energy should let municipalities do the smaller energy stuff, free Yukon Energy to do the big projects;
- Small IPPs need fair rates to work on smaller projects;
- Rates should not be subsidized, need a price signal;
- In winter mines could pay more and less in the summer;

- OICs need to be reviewed and cleaned up;
- Metering solutions need to be used;
- Explore the use of batteries;
- Yukon Energy should focus on what it does well and work with others. Does not need to do it all;
- Yukon Energy needs to properly engage with First Nations governments to ensure adequate participation at all appropriate levels, anything that affects the waters systems; and,
- Yukon Energy and YECL need to work together on reliability in the short-term. We need a coordinated approach to planning that listens to the business voice.

Development and Growth

- Tourism industry is interested in reliable, cost effective clean energy. Visitors don't understand outages. The energy should be sustainable / green as much as possible;
- Reacting to mining energy needs should not put tourism attributes and values at risk. Tourism revenue is long term and steady. Tourism marketing features our natural resources. Waterways are important so we must be careful about the choices we make around our wilderness;
- Mining is an industry based on fluctuating commodity markets and must build its business cases around commodity prices that are realistic over the long term. This means labour, transportation and energy cost factor into the overall financial argument. Diesel prices become an issue for this reason; and,
- Plan for long term supply/creating energy security: Yukon's population has increased by 7,000 in the last several years.

Technology

- Natural gas is an option for Yukon. It's scalable. Biomass is not a good source as it costs too much to cut trees;
- Biomass is a good source as it is carbon neutral and renewable;

- Transmission line to BC should be priced and considered;
- Need more work done on the demand side including with industrial clients like mines;
- There are some small hydro opportunities in Yukon but we are limited by precipitation and elevation gradients;
- We could use most of the hydro electricity for residential and commercial use and diesel or other sources less clean for industrial use; and,
- How will we take advantage of technological breakthroughs i.e. coal, LNG or shale gas.

Awareness

- People waste energy;
- We need to better insulate our homes;
- Customers should be shown on their bill the true cost of electricity (e.g. Old Crow is not paying 10 cents a KWh);
- People need to know and understand the true cost of electricity;

We need to consider:

- Increasing housing needs and related electricity needs;
- What will happen if both pipeline projects go ahead;
- The energy price and supply impacts with the affects from mining and population growth;
- What infrastructure is going to be required and what are the related costs to meet demand;
- What is the overall foot print that different energy solutions make. Not just one or two of the factors.
- What are the private investment opportunities;
- What are the FN partnership/investment opportunities;

- What big players exist to deal with industrial load off-grid and for this coal and transmission can't be ruled out;
- If Yukon Energy is obligated to serve, do all Yukoners need to pay;
- We need to investigate the transmission line to B.C. opportunity; and,
- How do we generate enough capacity to sustain new mining projects that might come onto the grid (Victoria Gold, Tagish Lake, Carmacks Copper). Also these mines will bring new people to Yukon and there could end up being population growth which needs to be served (some 600 new jobs are coming);

Opportunities:

To be considered into the future by Yukon and by Yukon Energy:

- Define clean energy;
- Consider how will we enact Chapter 22 so more attention will be paid to related energy opportunities;
- Consider how we will get more energy. We need clear and concise, not general Charrette recommendations;
- Have government invest in infrastructure to encourage economic activity from which taxes and royalties can be pulled;
- Recognize and analyze different pricing and business models for rationalizing projects;
- Consider First Nation Development Corporations and YIDC for investment and partnership;
- Collaborate instead of negotiating or butting heads on issues. Projects that have better results and long term research related to the environment should be considered;
- Develop an understanding of business opportunities;
- Asses the B.C. transmission line connection opportunity;
- Implement an innovative Demand Side Management assessment and program;
- Set an established buy back rate so independent power producers have an incentive to build projects;
- Complete a Yukon Energy First Nation investment/partnership policy;

- Be forward thinking and strategic to solve the problems. Start long term. Look backwards and solve the problem;
- Look for opportunities to fund new infrastructure with mining customers to provide Yukon legacy power. The question is what type of project works for mining and for Yukon (natural gas, hydro, transmission?);
- Buy power to help make projects feasible for both itself and new mines. This may also be an opportunity to develop Yukon's natural gas reserves;
- Consider becoming an energy exporter if there is a resource to export;
- Recognize the long term energy impacts that come from mining cycles and the response we give them. It can affect people, business and environment;
- Focus on increased storage for the immediate needs with wind energy. Long term solutions could include a hydro expansion or some other big energy project. Work must be done to consider implications of climate change targets and caps;
- Take advantage of our own energy sources and reduce the use of diesel. Gas is a good option and complements the future when the Alaska Highway pipeline comes on stream. Enough natural gas for 40 MW plant to run for 2,000 years;
- Take a coordinated approach to our energy future. Charrette should provide some clarity around what are the realistic options. The energy suppliers' role is to look at the variety of realistic solutions that are cleaner than diesel options along with those that are truly clean and green;
- Consider solutions like green energy that would contribute towards limiting the most prevalent green house gas, CO₂, to 350 parts per million.
- Consider international developments that imply a new urgency to expand energy that is not only affordable now and becoming cheaper but at the same time has expansive potential, is secure, domestic, democratic energy. The energy upgrade in Yukon must happen while Canada is economically strong enough. Energy security in Yukon must be improved while conventional sources like diesel, gas and natural gas are sufficiently available to move, manufacture, procure and adapt what is necessary in order to build a significantly more sustainable energy production;
- Consider electric grid load balancing, smart grid capacities and modern transmission technologies all of which need intelligent planning now together with a new level of decisiveness;

- Continue to work on Net Metering, IPP, DSM and Bio-energy and northern gas development;
- Consider technological advances;
- Assist others in changing the building bylaws to require 'super green';
- Provide loans/incentives for homeowners to build super green;
- Create a working group that would work on implementing the ideas from the charrette and other energy ideas; and
- Find and use energy sources that are local, e.g., not trucking diesel up the highway.

Reports from Community Meetings

Members of the Charrette Planning Team travelled to three Yukon communities (Mayo, Dawson City and Haines Junction) in February 2011 to learn about electrical energy concerns at the community level. What was heard in each of the three communities is presented below so that it may inform the planning work at the charrette.

Mayo Community Meeting: February 22nd, 7:00 p.m. at the Mayo Community Center

The following is a list of the issues and the opportunities as presented by the community residents. Twelve local residents attended the meeting, including representation from the Village of Mayo and the First Nation of the Na-cho Nyak Dun.

Issues:

- Reliability; there are too many power outages;
- The mines are causing the reliability and load issues;
- The mines should be helping to solve the energy issues;
- What is the timing for the Victoria Gold Mine project?
- Yukoners need to understand what the loads are that we need to plan for;
- Without the mining of the past Mayo would not have hydro generated energy;
- Hook up to the B.C. Transmission Line;
- Examine the costs spent on new energy over the past ten years and compare that to the costs to hook up to the BC grid;

- Why are the loads increasing – where is the growth coming from?
- Independent Power Producers (IPP) will ‘cut into’ Yukon Energy’s profits;
- Energy savings technologies in buildings are too complicated;
- The village considered heat pumps for their new municipal complex but found the payback was too long;
- Solar cannot add to the grid when the demand (winter) is higher;
- Energy is not an issue in Mayo; and
- How much of a risk is Yukon Energy willing to take?

Opportunities:

- Mines have the resources to help;
- Support micro-energy projects;
- Examine the waste to energy options for the Village of Mayo as Mayo operates as a regional landfill that serves Minto and the Alexco Mines?
- Rates should reflect consumption ‘if you use you pay’;
- Develop and deliver education programs around energy conservation and budgeting;
- Hold training workshops in the communities for energy saving technology education;
- Has Yukon Energy assessed the potential of Fraser Falls for a large hydro project?
- Transmission connection to B.C. allows Yukon Energy to consider export opportunities;
- Yukon Energy should develop partnerships with those that need energy, e.g. the mines and B.C.;
- Need to examine methods to recover more energy (e.g. recover heat from the diesel engines);
- Consider combined heat and power (co-generation);
- Educate Yukoners about the true costs of energy; and
- Consider incentives, liked the hot water heater blanket program.

Dawson City Community Meeting: February 23nd, 7:00 p.m. at the Dänojà Zho Cultural Centre

The following is a list of the issues and the opportunities as presented by the community residents. Eight local residents attended the meeting.

Issues:

- Dealing with the demand off grid;
- Knowing how much energy Yukon needs;
- Need to design a resilient system;
- The Mayo – Dawson transmission line was built so Dawson did not need to burn diesel however, since Alexco was hooked up Dawson is burning diesel for electricity;
- Consumer demand is rising;
- Does Yukon Energy need to provide energy to every mine that comes onto the grid?
- Can we manage the amount of mines coming onto the grid?
- The Town of Dawson's water and sewer system requires a lot of energy, (both heat and electricity);
- There is a lack of education around energy;
- The true cost of energy is not considered by consumers;
- Builders are forced by the codes to build inefficient buildings (e.g. heat exchangers/air handling units);
- Government buildings suck energy;
- Government overdue with carrying out energy educate;
- Need modern wiring systems in buildings;
- Energy conservation programs do not often come out of Whitehorse.

Opportunities:

- Look at multiple solutions...not just hydro in order to not burn diesel;
- Consider a turbine in the river to create electricity as in Eagle;
- We need to flatten the demand curve (seasonal variations);
- Consider the potential for new hydro at Coal Creek, 12 Mile, North Fork;

- Consider new technology e.g. lowhead hydro which is environmentally better, (see project at Laval, Quebec);
- Information needs to go where people are;
- Create a 'sexier' message;
- Use artwork – use the students at KIAC to bring importance to energy;
- Remember the 3 R's (best to reduce);
- Government needs to educate;
- Government needs to develop energy codes;
- Yukoners need to reduce consumption;
- Government needs to support engineering solutions designed in the north;
- Consider developing and carrying out training and workshops in regards to operating energy efficient buildings;
- Yukon Energy should work with the City of Dawson regarding water use;
- IPP's that are good for the ratepayer should be considered;
- Net metering should be available;
- Consider biomass for energy opportunities; plants are becoming more scalable and could be considered as an option for off grid;
- Fuel harvesting can create economic development opportunities;
- The public information from Yukon Energy has really improved; the website is good;
- Need 'eyeball to eyeball' programs;
- Use the internet – 'short, snappy, easy to read, little items';
- Liked the recent survey;
- Develop an educational campaign around conservation; and
- Make a film – use art to connect with Yukoners around energy and conservation.

Haines Junction Community Meeting: February 28nd, 7:00 p.m. at the St. Elias Convention Center

The following is a list of the issues and the opportunities as presented by those in attendance. The meeting was attended by local residents, representatives of the Champagne and Aishihik First Nations, the Kluane First Nation, the Village of Haines Junction, Yukon Electrical Company Ltd., and Yukon Energy Corporation. There were twelve people at the meeting.

Issues:

- Need to be careful planning long term energy requirements for short term mines;
- Planning for 50 years is good but this also needs to consider changes and development in technology, which is quickly changing;
- Wind is not reliable – sun is reliable;
- Hydro development needs to consider the full environmental costs including the releasing of methane during construction and decommissioning of hydro facilities;
- Need to define clean energy;
- Carbon credits and offsets need to be examined for all future energy choices;
- Yukon Energy should better explain the Victoria Gold Power Purchase Agreement;
- Supplying all new industrial customers with energy is not sustainable;
- What is the obligation that Yukon Energy must supply the mines?
- Review non-industrial growth rate.

Opportunities:

- Reducing the demand is an option;
- Examine the use of solar panels;
- The Village of Haines Junction is studying the waste-to-energy technology (WTEC) for disposal of municipal solid waste and options for biomass to create heat and electrical energy;
- Consider users as partners – e.g., Yukon Energy support the purchase of solar panels for residences;
- Re-insulate and better insulate homes and buildings;

- Include First Nations as partners in the development of the 20-Year Resource Plan and development of energy resources;
- Participation rather than consultation;
- Consider time of day metering;
- The coal deposit between Haines Junction and Whitehorse – is it a clean option?
- Government can legislate industry to develop their own green power;
- The charrette can highlight new energy policy the Yukon government needs to consider (e.g. put a higher priority on energy conservation) ;
- There are opportunities for the utilization of biomass and management of the spruce bark beetle;
- There are economic opportunities of using local biomass – building a pellet plant; and,
- Yukon Energy needs to consider combined heat and power.

Gladstone Diversion Project

- Consider Gladstone Lake as a new project and not an enhancement project;
- The detailed science, with detailed traditional knowledge needs to be presented together and then let people decide;
- There is a high risk of uncertainty that there will be no significant cultural and environmental impacts;
- The Champagne and Aishihik people have a history of experiencing change when told there would be no change;
- The Champagne and Aishihik people have cultural ties to Gladstone Lake and the area, the nature of this project to divert some water “changes the place”;
- The Champagne and Aishihik First Nations are gathering information to better understand the cultural significance of the Gladstone area and to examine if the cultural impacts can be mitigated;
- The following issues were identified: mercury methylation (see James Bay experience), flooding, changing climate, the impacts on Kluane Creek.

The Yukon's Electrical Energy Context

Yukon's electricity generation and transmission system is defined by three key features: its very small size in terms of its installed capacity and generation, its isolation from electricity transmission grids located outside of Yukon and, almost all of its electricity is generated from renewable hydro sources (94 percent in 2009).

Installed Capacity and Generation

Electricity is generated by two utilities in Yukon, both regulated by the Yukon Utilities Board. Yukon Energy Corporation, owned by the Government of Yukon, is the primary generator and transmitter of electricity in the territory. The Yukon Electrical Company Limited, a private utility owned by ATCO Electric Limited, is Yukon's primary distributor of electricity. Both utilities generate electricity from hydro and diesel combustion sources. Yukon Energy also produces a small amount of electricity from wind. The table below outlines the utility-owned installed electricity generation capacity in Yukon in 2010.

Installed Electricity Generation Capacity – Yukon (Megawatts)

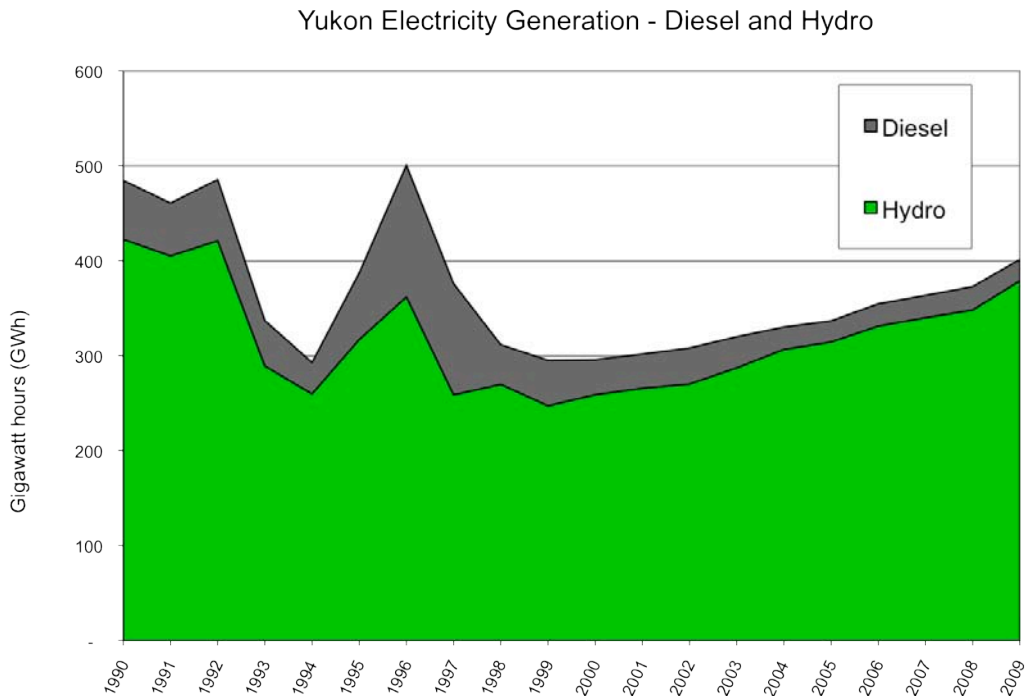
Yukon Energy Corporation		The Yukon Electrical Company Ltd.	
Hydro		Hydro	
Whitehorse	40.0	Fish Lake	1.3
Aishihik*	30.0	Diesel	
Mayo**	5.0	Carmacks	1.3
Total	75.0	Haines Junction	1.3
Diesel		Teslin	1.3
Whitehorse	25.0	Ross River	1.0
Faro	10.4	Watson Lake	5.0
Dawson	4.3	Beaver Creek	0.9
Mayo	2.0	Destruction Bay	0.9
Total	41.7	Old Crow	0.7
Wind		Pelly Crossing	0.7
Haeckel Hill	0.8	Stewart Crossing	0.3
		Swift River	0.3
		Total	13.7
Total Yukon Energy Corporation Capacity		117.5	
Total Yukon Electrical Company Ltd. Capacity		15.0	
Total Yukon (YEC and YECL) Capacity		132.5	
Total Yukon (YEC and YECL) Hydro Capacity – Summer		76.3	
Total Yukon (YEC and YECL) Hydro Capacity – Winter		60.0	
Total Yukon (YEC and YECL) Diesel Capacity		55.4	
Total Yukon (YEC) Wind Capacity		0.8	
Source: Yukon Energy Corporation.			
* An additional 7MW of installed capacity will be available when the third turbine is brought on line at the Aishihik Hydro Facility. ** An additional 10MW of installed capacity will be available upon completion of the Mayo B project.			

The chart below illustrates electricity generation from diesel and hydro sources in Yukon by both utilities over the period 1990 to 2010. Electricity generation reached its peak during that period in 1996 when 501 GWh of electricity was produced. Electricity production fell off sharply after closures at the Faro mine in 1992 and 1996. The Faro mine closed for the last time in 1998.

MW = megawatt, a measure of capacity to generate electricity.

GWh = gigawatt hour, a measure of the amount of electricity generated; one GWh of electricity is roughly how much electricity is consumed by 100 homes in one year.

A total of 402 GWh of electricity was generated in the Yukon in 2009 (Yukon Bureau of Statistics, *Yukon Energy Facts*). By way of comparison, 575,200 GWh of electricity was generated in Canada in 2009 (Statistics Canada, *Survey 2151*, 2010). Thus, Yukon's share of total Canadian electricity generation was 0.1 percent (one tenth of one percent) in 2009.



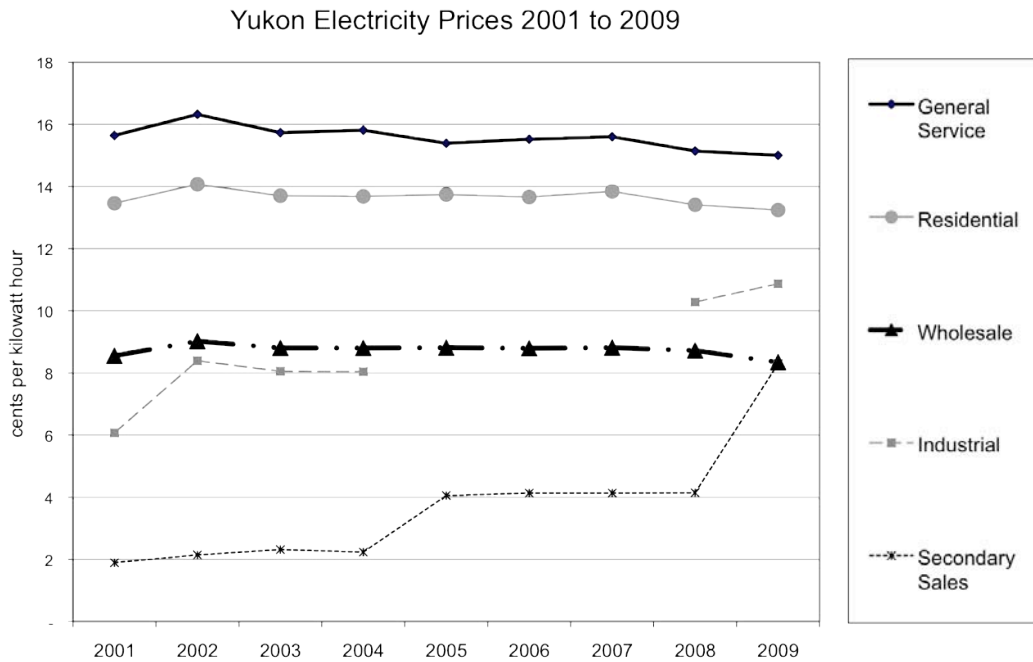
Source: Yukon Bureau of Statistics, *Yukon Energy Facts*.

As can be seen from the chart, demand for electricity has been steadily increasing since 2000. As noted earlier, Yukon Energy Corporation has identified a shortfall in the supply of clean energy to the grid by 2014. The Yukon Energy Charrette has been convened in

part to allow Yukon Energy to work together with Yukoners to understand how to choose the best options for addressing the coming generation shortfall.

Electricity Rates

Notwithstanding the isolation of Yukon’s electrical system from transmission grids in other jurisdictions, Yukon ratepayers have enjoyed stable and relatively low prices for electricity over the last decade. As shown in the chart on the following page, rates for residential customers have been in the range of 13 cents to 14 cents per kilowatt hour over the period 2001 to 2009. Rates for general service category customers, which includes commercial customers, ranged between 15 cents and 16 cents per kilowatt hour. Residential and commercial customers have received government-funded bill subsidies during the same time period, which slightly reduced actual bill costs for those customers.



Source: Yukon Energy Corporation, *Yukon Energy Corporation Annual Reports*.
 Note: Prices shown for the general service category are weighted averages of the prices charged to commercial, municipal and government (federal and territorial) customers.

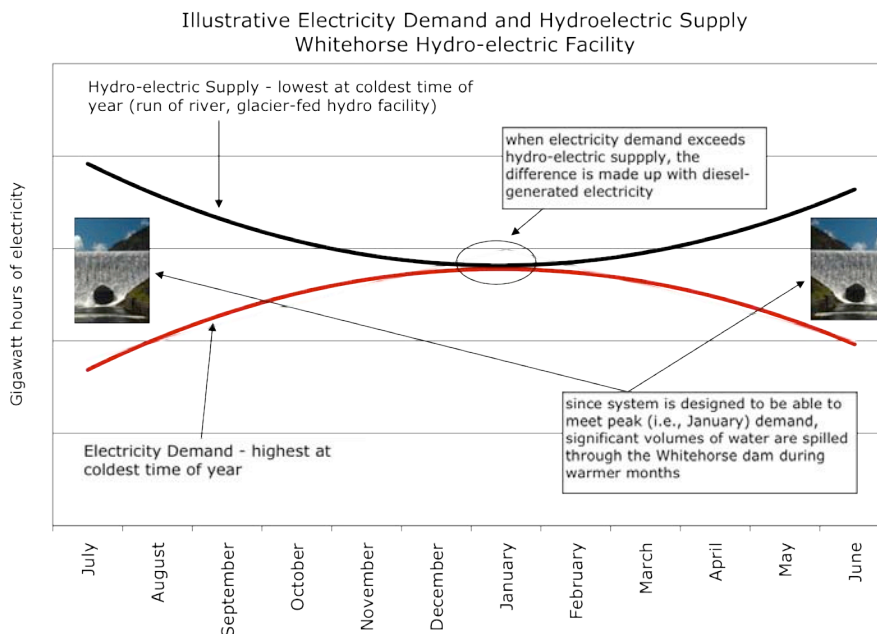
The relatively stable and low electricity rates enjoyed by Yukon ratepayers have been a consequence of legacy hydro-electric infrastructure constructed between 1952 and 1985. While the Yukon Energy Corporation currently has a number of generation-enhancement projects underway, or in the planning stages, new electricity generation

facilities will need to be built in the medium to longer term to fulfill demand from both non-industrial and industrial (including mining) customers.

The installation of new generation capacity holds significant potential for electricity prices to increase. On an isolated and regulated electrical system, planning and capital costs must necessarily be borne by ratepayers. It is not possible to “over build” to bring capital costs down and then sell surplus electricity into a larger grid nor are all planned projects constructed (notwithstanding that planning costs are typically in the order of 10 percent of capital costs). The Yukon Energy Charrette has been convened in part to allow the Yukon Energy Corporation to work together with Yukoners to understand how cost-effective supply choices can be made.

Electricity Supply from Renewable Sources

As noted earlier, most of the electricity produced in Yukon is generated from hydro-electric sources. While electricity generated from hydro-electric sources is preferred because it is renewable energy, generating electricity from water in a northern climate does present a challenge for the Yukon Energy Corporation. The supply of hydro-electricity from Yukon Energy’s hydro-electric facilities is lowest in the cold winter months at the same time as when electricity demand is at its highest. The problem is illustrated in the figure below. Optimal electrical energy choices will include supply options that contribute steady electricity supply during winter months.



The Yukon Energy Charrette has been convened in part to allow the Yukon Energy Corporation to work together with Yukoners to understand how to continue to maintain a high level of electricity supply from renewable sources.

Resource Expert Background Papers

Energy planning is a complex endeavor. To help educate and engage charrette participants, a team of eleven resource experts was assembled in advance of the charrette. The areas of energy expertise, and the resource experts include:

1. Hydro – Forest Pearson, P. Eng.
2. Thermal – Cam Osler, M.A.
3. Wind – Mark Green, B. Sc.
4. Waste-to-Energy – Don McCallum, P. Eng.
5. Geothermal – Tim Sadlier-Brown, P. Geo.
6. Solar – Gordon Howell, P. Eng.
7. Bioenergy – Dr. Fernando Preto
8. Nuclear – Dr. Chary Rangacharyulu
9. Natural Gas – David Dunn, P. Eng.
10. Storage and Transmission – Bruce Ledger, P. Eng.
11. Demand Side Management – Team: Ivano Labricciosa, P. Eng.;
Bev Van Ruyven, B.A; Krista Roske, MPA

Each resource expert was asked to prepare a background paper examining a variety of Yukon-specific factors including:

Resource capacity – how much of energy source exists or has been discovered in Yukon.

Potential for electricity production – how much electricity could potentially be produced from the energy source in Yukon.

*Electricity cost*¹ – typical cost ranges for electricity generated from the energy source.

¹ Costs can also refer to the potential for “shutdown hangover”, the situation where the demand load from a large consumer stops suddenly and before capital costs for generation infrastructure are adequately paid off.

Complementary applications – whether electricity generated from the energy source typically has any complementary applications (e.g., combined heat and power).

Time to market – an estimate of how long it might take to bring the electricity into production given current technologies.

Probability to market – the probability that available technologies can actually produce electricity in Yukon on time and on budget.

Regulatory issues – the nature and potential scale of regulatory issues specific to the type of energy being considered.

Environmental issues – an indication of the possible effects on the environment from use of the type of energy being considered.

Seasonality – whether there are any seasonal factors that make electricity generated from the energy source more or less attractive.

Copies of the eleven background papers will be available for participants to read and consider at the charrette.

Possible Options for Consideration

A variety of options to address the coming renewable electricity generation shortfall will be discussed and considered at the charrette. A sampling of the options, in no particular order include:

Hydro Enhancements – Atlin

Increase the amount of water available for use at the Whitehorse dam during the winter months by using a weir to slow the outflow of water from Atlin Lake into Tagish and Marsh Lakes.

Hydro Enhancements – Gladstone

Divert water from Gladstone Lake into the Aishihik Lake and Canyon Lake systems to increase winter electricity generation at the Aishihik hydroelectric facility.

Hydro Enhancements – Marsh Lake

Alter the operation of the existing Marsh Lake control structure to slow the outflow of water from Marsh Lake for electricity generation at the existing Whitehorse dam during winter months.

Wind – Ferry Hill

Build a small wind farm atop Ferry Hill (at Stewart Crossing, Yukon).

Liquid Natural Gas - Conversion

Replace major use of Yukon Energy's existing diesel engines with natural gas reciprocating engines or gas turbines, initially using trucked-in liquefied natural gas (LNG).

Liquid Natural Gas – Onsite Generation

Use gas turbines to generate electricity at remote off-grid locations using trucked-in liquefied natural gas (LNG).

Coal – Minesite Generation

Use coal to generate electricity at Division Mountain Coal minesite.

New Hydro – Small Scale

Construct new small-scale (less than 10MW capacity) hydro-electric project.

New Hydro – Medium Scale

Construct a medium-scale (10 to 100MW capacity) hydro-electric project.

New Hydro – Large Scale

Construct a large-scale (100MW+ capacity) hydro-electric project.

Geothermal Electricity

Construct a geo-thermal electricity generation plant.

Micro Nuclear Electricity

Construct a micro-nuclear electricity generation facility.

Solar

Construct a grid-connected photovoltaic (PV) system.

Biomass

Construct a distributed cogeneration plant that produces both electricity and heat to displace diesel-generated electricity.

Waste-To-Energy

Construct a waste-to-energy facility that incinerates municipal solid waste to produce both electricity and heat.

Electricity Storage – Spinning Reserve

Implement a short-term energy storage technology (e.g., diesel rotary uninterruptible power supply unit) to improve reliability of electrical system operations.

Electricity Storage – Long Term

Implement a long-term energy storage technology such as pumped storage where water is pumped to a higher elevation at times of low electricity demand and released during periods of high electricity demand.

Electricity Transmission

Connect the Whitehorse-Aishihik-Faro transmission grid to the planned Northwest Transmission Grid in B.C.

Demand Side Management – Customer Programs and Education

Implement a series of initiatives that encourage electricity consumers to reduce overall consumption and influence how and when electricity is used.

Demand Side Management – Conservation Rates

Alter the electricity rate structure to reward consumers for consuming electricity when it is least expensive to generate.

Demand Side Management – Codes and Standards

Amend building codes and standards to require more energy efficient design and construction.

Supply Side Enhancements

Implement measures to reduce the costs of production and transmission of electricity on the utility side of the customer’s meter.

Charrette Integrators

To ensure that the discussion and input from charrette participants is carried forward in the Yukon Energy Corporation planning process (including the 20-Year Resource Plan), a team of “Charrette Integrators” has been assembled. The Integrators will work with the Charrette Planning Team to synthesize, by the end of the charrette on March 9, the discussion and input from the charrette participants into *an array of engagement-tested options for future electrical energy development in the Yukon*. The Integrators are:

Mark Jaccard

Professor, School of Resource and Environmental Management
Simon Fraser University

Pierre Guimond

President and Chief Executive Officer
Canadian Electricity Association

Stuart Hickox

President, One Change

John Streicker, P.Eng

Climate Change Specialist

Thank you! We look forward to seeing all charrette participants, resource experts and integrators at the Yukon Energy Charrette!

Charrette Agenda

Day 1

- 8:00** Registration
- 8:30** Welcome and Blessing from Kwanlin Dün First Nation
- 8:35** Introductions and presentation of charrette “road map” for the three days
- 8:45** Opening remarks: Yukon Energy Chair Piers McDonald and Yukon Energy President and CEO David Morrison
- 9:05** Keynote speaker: Dr. Mark Jaccard: Clean energy systems, goals and how to get there.
- 10:05** Break
- 10:25** Yukon energy planning context: Paul Kishchuk, Vector Research
- 10:45** Solar: Gordon Howell, Howell-Mayhew Engineering Ltd.
- 11:05** Wind: Mark Green, Natural Power
- 11:25** Waste to Energy: Don McCallum, Morrison Hershfield Environmental Engineering
- 11:45** Yukon Government Climate Change Action Plan: Eric Schroff, Climate Change Secretariat
- 12:00** **LUNCH: SERVED ON SITE**
- 1:00** Energy Policy: successes and failures from around the world; ideas for Yukon: Dr. Mark Jaccard
- 1:50** Yukon’s energy load / scenario forecasts and the role of diesel for generating electricity in Yukon: Cam Osler, Intergroup Consultants Ltd.
- 2:10** Stakeholder issues and community meeting reports: Darielle Talarico, Tipping Point Strategies
- 2:20** Issues, opportunities, scenarios and solutions
- Group work
 - Scenario descriptions and related assumptions, issue / opportunities identification, solutions from stakeholders existing perspectives
- Break as desired
- 3:45** Share results
- 4:30** Closing remarks
- 7:00** **Public meeting**



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Charrette Agenda

Day 2

- 8:00** Coffee and networking
- 8:30** Day 2 goals: energy choices
- 8:35** Opening remarks: Dr. Mark Jaccard reflection on Day 1 and an overview of definitions and future implications (clean, sustainable, renewable, green, technology advancements)
- 9:00** The future of the Canadian electricity sector: Pierre Guimond, Canadian Electrical Association
- Discussion of Energy Resources**
- 9:30** Demand Side Management: Ivano Labricciosa, Toronto Hydro-Electric System
- 9:50** Hydro: Forest Pearson, AECOM Canada Ltd.
- 10:10** Break
- 10:30** Natural gas: David Dunn, Fekete Associates Inc.
- 10:50** Geothermal: Timothy Sadlier-Brown, Sadlier-Brown Consulting Ltd.
- 11:10** Bio-energy: Dr. Fernando Preto, CanmetENERGY Technology Centre
- 11:30** Nuclear: Dr. Chary Rangacharyulu, Department of Physics and Engineering Physics, University of Saskatchewan
- 11:50** Energy storage and transmission: Bruce Ledger, BBA Engineering
- 12:10** **LUNCH: SERVED ON SITE**
- 1:15** Coal / thermal: Cam Osler, Intergroup Consulting Ltd.
- 1:30** Energy strategy for Yukon: Manon Morcan, Energy, Mines and Resources
- 1:45** Group work: Yukon Energy game
- Comments from Day 1 public meeting will be presented and considered
 - Play with scenarios, different load forecasts, energy resources and game changers
- Break as desired
- 3:45** Share results
- 4:30** Prepare presentation of Day 2 work for public meeting
- 7:00** **Public meeting**



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Charrette Agenda

Day 3

- 8:00** Coffee and networking
- 8:30** Day 3 goals: development of energy planning principles and a way forward; reconfirm charrette planning outcomes
- 8:35** Presentation of the public comments from evening session
- 8:45** Opening remarks: Dr. Mark Jaccard: keynote reflection on Day 2 and overview of “commonalities” and implications.
- 9:15** Demand Side Management and B.C.’s Power Smart program: Bev Van Ruyven, BC Hydro
- 10:15** Break
- 10:45** Climate change / carbon economy / impact on our Yukon decisions: John Streicker, climate change expert
- 11:10** Yukon First Nations perspective / business and land choices (interests and opportunities)
- 11:30** The constraints and opportunities of a regulated utility: John Landry, Davis and Company
- 12:00** **LUNCH: SERVED ON SITE**
- 1:15** Group work
- Development of energy planning principles and decision making criteria
 - How should Yukon Energy Corporation move forward?
- 3:00** Break
- 3:20** Share results
- 4:15** Closing remarks: David Morrison, Yukon Energy Corporation
- 7:00** **Public meeting**



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