Planning in Public: The Story of the 2012 Yukon Energy 20-Year Resource Plan

It's hard to imagine our modern day lives without electricity — it lights our homes (and in some cases also heats them), fuels our industries, and keeps community infrastructure running. Electricity demand in Yukon is expected to increase by about 50 per cent over the next 10 years as a result of economic expansion, population growth and the increased use of, or conversion to, electricity. Yukon Energy's 20-year Resource Plan outlines the steps we propose to take to meet growing demand so that customers will continue to receive affordable, reliable and sustainable electricity.

As you will see in the draft plan, conservation is crucial to close the gap between forecast need and supply. However, future growth in electricity demand cannot be met through conservation alone.

While ensuring electricity will be there in the future when it's needed, we are also mindful of the need to advance actions in a prudent manner to avoid unnecessary risks and keep rates as low as possible.

Background:

In 2006, the last time Yukon Energy developed a 20-year resource plan, our approach with regard to public consultation was fairly conventional. We shared the plan with the public, but only once it was a finished document that had been filed with our regulator, the Yukon Utilities Board.

Since that time, we have made a conscious and fundamental change in our approach to planning. We recognize that the more thoughtful input we receive, the better the end product will be for all of us. The first thing we did in preparing for this latest 20-year resource plan was to seek input from First Nation and other governments, stakeholders and the public - *before* we'd even begun the writing, or determined any of the content.

We call this *planning in public*, and it took the form of meetings, workshops, and a three-day energy planning charrette held in March 2011.

The charrette brought together Yukoners from all walks of life along with nationally and internationally-recognized energy experts. Information and knowledge was shared and the participants provided a great deal of input in terms of what Yukon's energy future should look like.

Dr. Mark Jaccard led off the proceedings by clarifying his experience regarding energy planning and urged participants to thoughtfully consider all of the choices available and to examine the alternatives from the point of view that all options have impacts and risks and all require trade-offs.

Dr. Jaccard also talked to the gathering about how we determine and provide affordable energy:

- What role energy has in economic development
- Future demand and supply
- The need to examine multiple objectives

Along with providing us with a list of potential energy options (in priority order) that required further investigation and analysis, the charrette participants also helped Yukon Energy formulate four principles around which to base future energy decisions. They include:

- Reliability
- Affordability
- Flexibility
- Environmental responsibility

With these four principles as our lens through which we considered all possible energy options, we prepared a draft of a new 20-year resource plan. We are now seeking input from Yukoners on this draft. Note that this is a living document that continues to evolve. This summary tries to incorporate changes that have taken place since the draft document was first written.

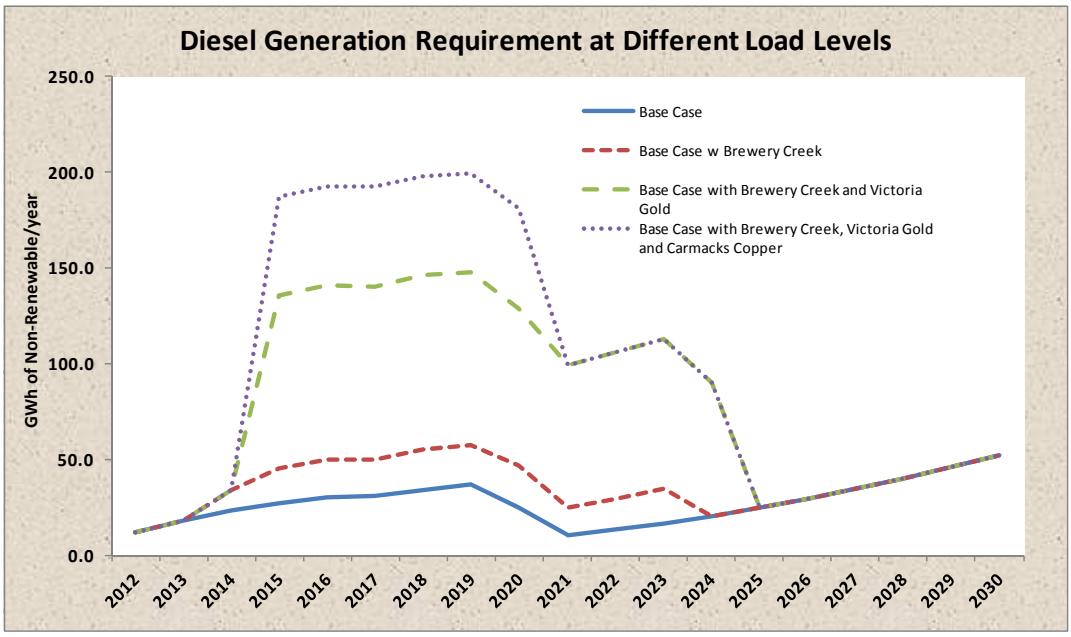
We believe that this resource plan, based on input at every stage from Yukoners from all walks of life, will enable Yukon Energy Corporation to continue to live by our brand promise "your needs power what we do".

Current Challenges and Opportunities:

In preparing this resource plan, there are certain realities Yukon Energy needed to take into account. Many of them were identified and discussed during the charrette process.

- We expect unprecedented growth in Yukon over the next decade in all our customer classes. We must move quickly to meet electricity needs that are emerging today, while continuing to plan for longer-term energy sources. We currently have approximately 400 gigawatt hours of renewable electricity available to us. Demand could grow to more than 600 gigawatt hours by 2015.

- Yukon Energy has developed load growth scenarios that will as close as possible set out the anticipated system energy requirements. These load forecast scenarios will help inform the development of strategies to meet the expected new loads over time. The following figure and table illustrate the various load scenarios Yukon Energy considers to be relevant at this point in time.

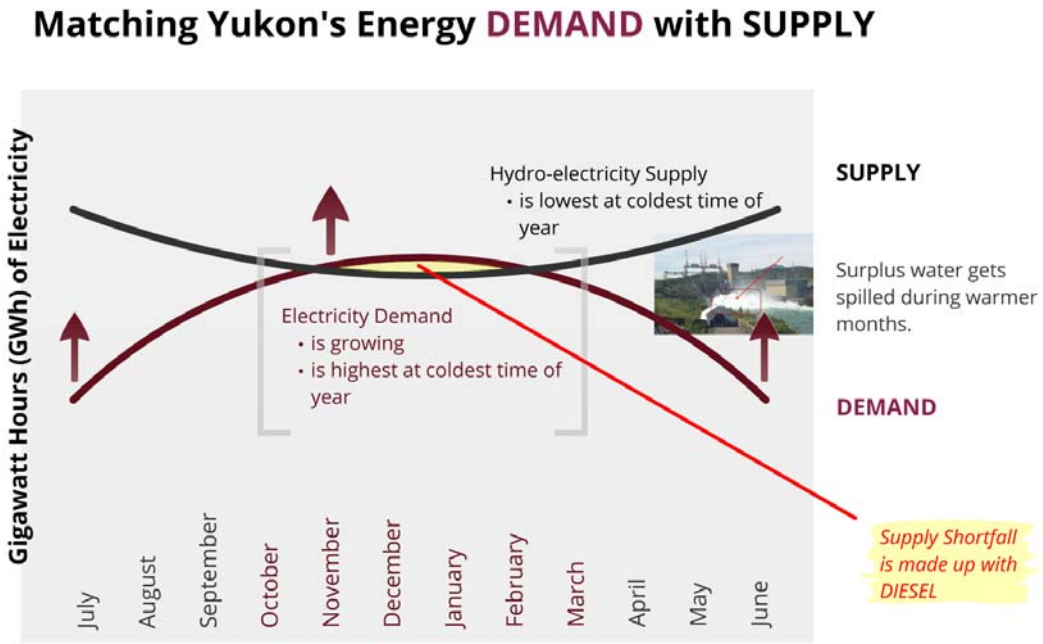


Diesel Energy Requirement (GWh)	2012	2015	2020	2025	2030
Base Case	11.5	27.0	24.4	24.5	51.9
Base Case with Brewery Creek	11.5	45.5	47.1	24.5	51.9
Base Case with Brewery Creek and Victoria Gold	11.5	135.2	128.8	24.5	51.9
Base Case with Brewery Creek, Victoria Gold and Carmacks Copper	11.5	187.1	181.0	24.5	51.9

Notes:

1. The numbers are based on updated load for 2012-2030.
2. Diesel requirement numbers are long-term average diesel.
3. Model run with Aishihik 10-year rolling average rule; Mayo Lake assumed in-service 2014.

- We must recognize that new options will come at a higher cost than our existing legacy hydro.
- Working with Yukon Electrical Company Limited and the Yukon government, we must have a robust and effective energy conservation/efficiency plan and programs in place as soon as possible.
- We must factor in environmental, social and economic impacts of all new electrical generation.
- We must ensure there is an acceptable level of risk for new investments for the small number of Yukon electrical customers.
- Public investment will be more difficult to secure given we are in an era of government restraint; we must find new business partners.
- We must continue to invest in our aging infrastructure to keep it efficient, up-to-date and safe for Yukoners.
- A significant percentage of new energy demand will come in sharp increments as new mines wish to connect to our grid.
- It is vital that we continue to engage with governments, stakeholders and the Yukon public as we move forward with planning and projects.
- We must recognize that there is a widely varying seasonal demand for electricity. The chart below shows that winter is the time of greatest electricity need, which is also when Yukon Energy's current Whitehorse hydro supply is most constrained.



Summary of the Options:

Please note: the 20-year plan is meant as a living document; as such you will notice differences between the options in the plan and overview, and this more recently-written options summary.

At the back of this document are two charts that shows all the options considered, how each ranked in terms of the four principles, and expected output, construction costs and costs per kilowatt hour. In brief, they include:

Near-term options (potentially available to start construction by 2015)

- Energy Conservation/Efficiencies: up to 8.5 gigawatt hours per year by 2015 (including up to 3.5 gigawatt hours per year for internal energy efficiencies). Energy conservation is a crucial element in helping to meet Yukon's growing electricity needs. In August 2011 Yukon Energy created an Energy Conservation department to work with Yukon Electrical Company Limited, the Yukon government, and other stakeholders to develop a territory-wide energy conservation and efficiency plan.

- Hydro enhancements – Mayo Lake Storage (4 gigawatt hours per year), Southern Lakes Enhanced Storage (6.4 gigawatt hours per year), and Gladstone Diversion (36.6 gigawatt hours per year). There is recognition that it is important to enhance Yukon Energy's existing assets before building brand new projects. These enhancements offer relatively low cost options, although each is subject to timing uncertainties related to regulatory and permitting processes.

- Wood biomass: original plan of up to 25 megawatts has been scaled back to approximately two to three megawatts (16 to 24 gigawatt hours per year) based on feedback from Yukon public. Yukon Energy is currently working with the Champagne and Aishihik First Nations, the Dakwakada Development Corporation, the Yukon Cold Climate Innovation Centre and the Village of Haines Junction on the potential for a small biomass plant in the Haines Junction area.

- Liquefied natural gas from a B.C. or Alberta gas source (in the future, adequate Yukon gas resources may also become available): LNG is less expensive than diesel. Consideration is being given to using LNG as a fuel to displace diesel while we continue to search for and develop new clean and preferably renewable sources of cost effective energy.

- Wind – Tehcho (formerly Ferry Hill) or Mount Sumanik: up to 21 megawatts or 56 gigawatt hours per year. In 2011 Yukon Energy installed state-of-the-art wind monitoring equipment that will help confirm if a wind farm is viable in the Tehcho area.

- Default diesel – potentially an unlimited supply but concerns are high costs and high GHG emissions.

Longer-term options (potentially available before or by 2021)

- New hydro projects – up to 70 gigawatt hours of small (less than 10 megawatts) of hydro, more than 2,070 gigawatt hours of medium (11-60 megawatts) hydro, and more than 4,700 gigawatt hours of large (more than 60 megawatts) hydro
- Yukon energy is currently doing preliminary work on the Hoole Canyon option which has potential for 275 gigawatt hours (40.4 megawatts).
- Geothermal – needs further exploration and assessment of cost benefits potential
- Solar – needs cost-effective proven technology for Yukon market conditions
- Pipeline/natural gas – needs commitments by others re: Alaska Highway Pipeline and/or potential Eagle Plain gas development
- Grid connection to B.C. or Alaska – needs commitments by others

Yukon Energy's Next Steps:

Based on the research and analysis done in preparing this draft of the 20-year resource plan, we would propose the following action items:

Near-term

- Complete and implement a cost-effective energy conservation program in 2013.
- Complete feasibility assessments and cost benefit models that would determine the feasibility of an LNG generating plant located in Whitehorse to be in operation as soon as is feasible before the end of 2014 with sufficient capacity to displace grid diesel generation under current load forecasts. *In the current Resource Plan model, LNG would be used instead of diesel. At the same time, Yukon Energy would continue to pursue new longer-term renewable, cost effective energy options.*
- Work with the residents of Marsh Lake and Tagish to complete the environmental baseline studies, engineering, remediation options and costing models for the Southern Lakes Winter Enhancement Concept and determine whether this option should be implemented.
- Within the next 12 months, determine whether Gladstone Diversion is feasible to pursue further, based on discussions with local First Nations and regulators.
- Pursue with Champagne and Aishihik First Nations, Dakwakada Development Corporation, Village of Haines Junction and the Yukon Cold Climate Innovation Centre opportunities for a small-scale (two to three megawatts) wood biomass pilot project, potentially with existing wood operations at Haines Junction, and seek funding support for this pilot project.

Future development

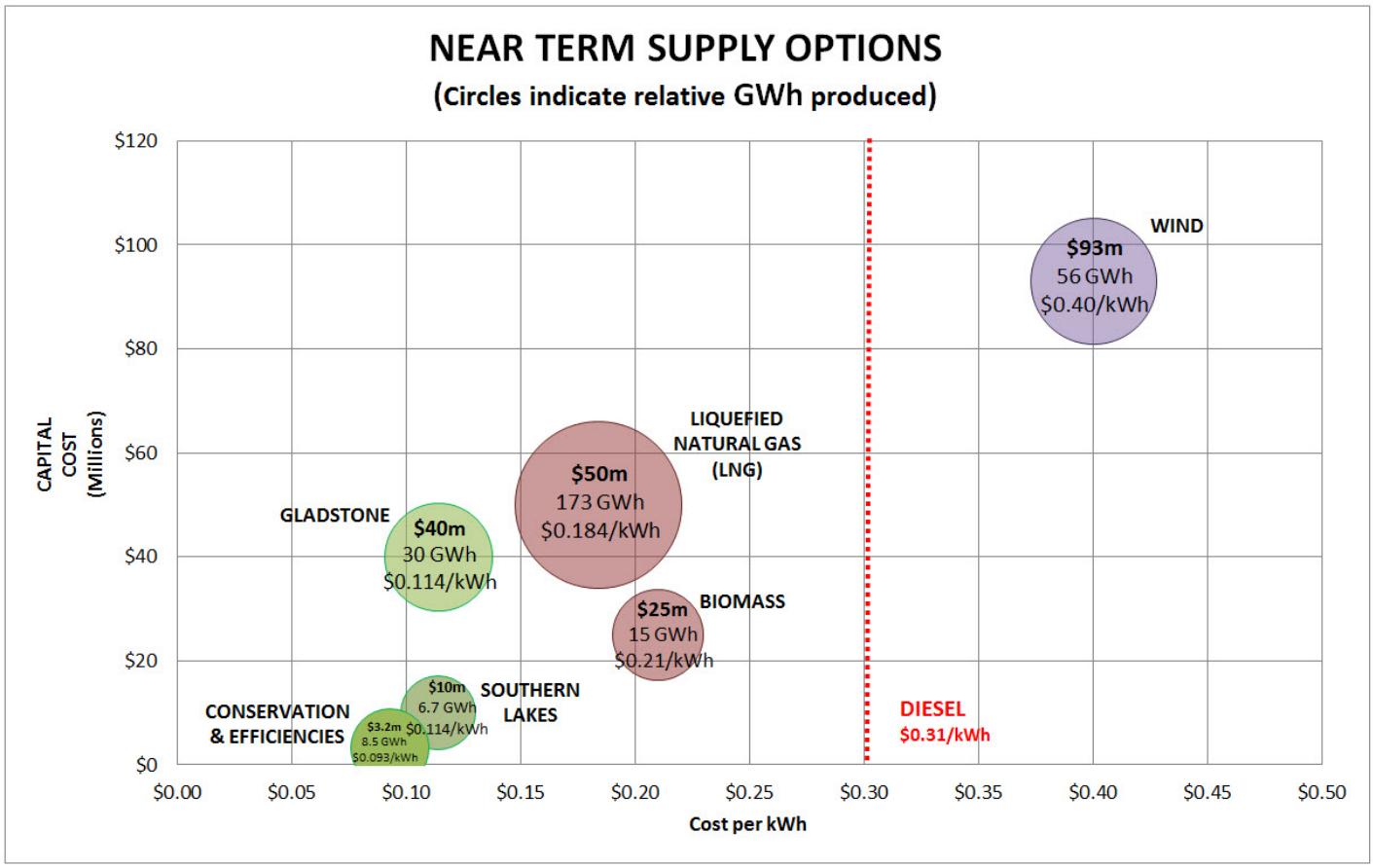
- Finish current Tehcho (Ferry Hill) wind monitoring to have this project shelf-ready for a time when this project would be cost-effective to implement. Continue to examine the feasibility of smaller wind projects in the range of 10 megawatts.
- Continue to identify and plan new priority hydro projects including Hoole and Finlayson sites and seek support for these activities.

Other longer term resource planning

- Carry out scaled down geothermal investigations and look for funding support for further exploration and studies.
- Continue to explore opportunities to extend the grid within Yukon, and to connect Yukon grid to B.C. or Alaska (including Skagway).
- Continue to follow briefs with regard to solar and pipeline/Yukon sources of natural gas.

NEAR TERM RESOURCE SUPPLY OPTIONS

OPTIONS	**Reliability** Winter Peak Capacity; Development Timing & Cost	**Affordability** Potential lifecycle cost per kWh if fully used	**Flexibility** Ratepayer Risk re: Mine Load Reductions	**Environmental Responsibility** Env. Mitigation; GHG Emission Reduction
Southern Lakes (Marsh Lake) Hydro Enhancement	**Medium**	**High**	**Medium**	**High**
Gladstone Diversion Hydro Enhancement	**Medium**	**High**	**Medium**	**High**
Conservation / Efficiencies	**Medium**	**High**	**Medium**	**High**
Biomass	**High**	**Medium**	**Low**	**High**
Liquefied Natural Gas	**High**	**Medium-High**	**High**	**Medium**
Wind	**Low**	**Medium**	**Low**	**High**
Diesel	**High**	**Low**	**High**	**Low**


NEAR TERM SUPPLY OPTIONS
(Circles indicate relative GWh produced)
CAPITAL COST (Millions)
$120
$100
$80
$60
$40
$20
$0
$0.00
$0.05
$0.10
$0.15
$0.20
$0.25
$0.30
$0.35
$0.40
$0.45
$0.50
Cost per kWh
WIND
$93m
56 GWh
$0.40/kWh
LIQUEFIED NATURAL GAS (LNG)
$50m
173 GWh
$0.184/kWh
GLADSTONE
$40m
30 GWh
$0.114/kWh
BIOMASS
$25m
15 GWh
$0.21/kWh
$10m
6.7 GWh
$0.114/kWh
SOUTHERN LAKES
CONSERVATION & EFFICIENCIES
$3.2m
8.5 GWh
$0.093/kWh
DIESEL
$0.31/kWh