Yukon Energy Strategy
Renewable Energy Target Options Identification

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1. Background and purpose

With the public consultation phase for the draft Yukon Energy Strategy now complete, Yukon Energy, Mines and Resources is working to prepare the final version of the strategy. In response to consultation input, Yukon Energy, Mines and Resources would like to investigate options for a renewable energy target. The target is intended signal the Yukon Government's commitment to increasing the supply and use of renewable energy in the Yukon without severely limiting the options for meeting energy needs in the future. The target is also intended to be consistent with the 2020 efficiency and conservation target recently announced by the Council of the Federation. Accordingly, the purpose of this project was to identify options for a renewable energy target for possible inclusion in the Yukon Energy Strategy. Our research findings follow below.

2. Design parameters

The renewable energy options were developed with the design parameters below in mind.

1. The Yukon is highly dependent on imports of refined petroleum products. With the exception of electricity and energy from renewable sources (e.g., wood space heating), all energy consumed in Yukon is derived from imported refined petroleum products (primarily diesel, gasoline and propane).
2. The potential for large swings in resource extraction activity is great in the Yukon. A long-term target will need to recognize that the economic mix even five years out may be very different than the mix of today. The corresponding patterns of energy supply and consumption may also be very different.
3. Very limited data that describe renewable energy supply and consumption are available for the Yukon.
4. Renewable energy does not automatically mean "good" energy. From a public policy perspective, a shift from non-renewable to renewable energy sources should minimize:
    - "greenhouse gas emissions;
    - local or regional air quality impacts;
    - significant community impacts;
    - impacts on watersheds, landscapes and biological diversity; and,
    - contributions to toxic waste buildup."[1]

3. Renewable energy options

In 1999, the Pembina Institute for Appropriate Development prepared a discussion paper entitled *Economic Development from Renewable Energy: Yukon Opportunities.* The paper identifies several renewable energy options that could have application in the Yukon including:

- Solar water heating for homes, offices, or other buildings, during the spring, summer, and fall;
- Solar space heating for homes or offices through passive solar building design techniques;
- Biomass space and water heating for homes, offices, other buildings with individual wood boilers/stoves, or entire communities through district heating systems;

[1] Barbara Campbell and Andrew Pape, (1999), *Economic Development from Renewable Energy: Yukon Opportunities* Pembina Institute for Appropriate Development, page 1.

- Hydro, wind, and biomass systems to provide electricity for off-grid communities, working in tandem with existing diesel generators and reducing overall diesel consumption;
- Hydro, wind, biomass, and solar PV systems to provide electricity into the utility grid, thus reducing overall diesel consumption during winter peaking periods; and,
- Hydro, wind, and solar PV electrical systems to provide power for remote applications (e.g., homes, cottages, tourism lodges, camps, communications sites, parks offices, or other electricity uses), providing power into previously un-powered areas, or reducing the consumption of fuel with existing diesel generators.[2]

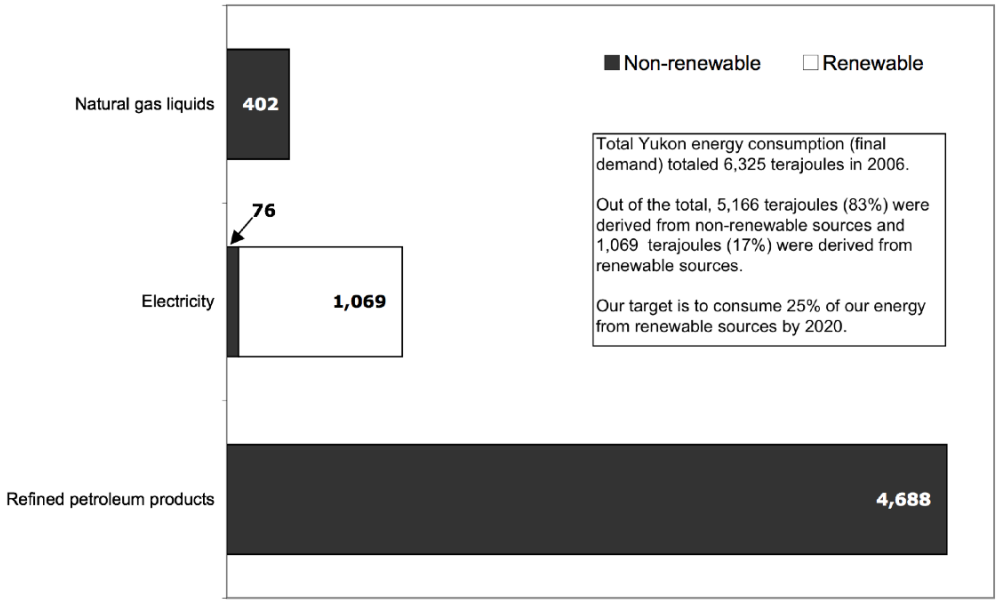
4. Possible Yukon renewable energy targets

Four possible renewable energy targets were identified and are described below:

Target 1: Change the Yukon's *energy mix* to move away from non-renewable sources towards renewable sources.

> Example: by 2020, one quarter of the energy needs of Yukoners will be met from a variety of renewable energy sources.

Yukon Final Demand for Energy by Energy Type - 2006
(terajoules)



Source: Statistics Canada, *Report on Energy Supply-Demand in Canada*, Cat. No. 27-003, 2008.

The table on the following page presents a different conceptual approach to the Yukon's energy mix. As noted above, data currently available for the Yukon does not allow for a quantitative illustration of the Yukon's current energy mix. The grey shading in the table indicates the existence of an undefined amount of consumption. If data were available, the basic idea would be to show shifts in non-renewable energy consumption towards renewable energy consumption for targeted uses such as space heating and cooling by commercial and institutional users (shown by red arrow).

[2] Barbara Campbell and Andrew Pape, (1999), *Economic Development from Renewable Energy: Yukon Opportunities,* Pembina Institute for Appropriate Development, page 5.

Yukon's Energy Mix				
	Non-renewable		Renewable	
Energy Use	**Electricity** (refined petroleum)	**Non-electricity** (refined petroleum and propane)	**Electricity** (hydro, wind, solar, geothermal)	**Non-electricity,** (wood, solar, geothermal)
Residential				
Space heating and cooling				
Water heating				
Appliances				
Lighting				
Commercial/Institutional				
Space heating and cooling				
Water heating				
Auxiliary equipment and motors				
Lighting				
Street lighting				
Industrial/Agriculture				
Mining				
Manufacturing				
Forestry				
Construction				
Agriculture				
Passenger transportation				
Cars, light trucks, motorcycles, buses, air, rail				
Freight transportation				
Light trucks, medium trucks, heavy trucks, air, rail, marine				

Target 2: Increase the absolute level of energy consumed that derives from renewable sources.

> Example: by 2020, more than 1,500 terajoules of energy consumed by Yukoners will be from renewable energy sources.

Target 3: Maintain the same non-renewable/renewable energy mix (83% non-renewable, 17% renewable) and reduce reliance on imported refined petroleum products (and transportation costs associated with petroleum product imports).

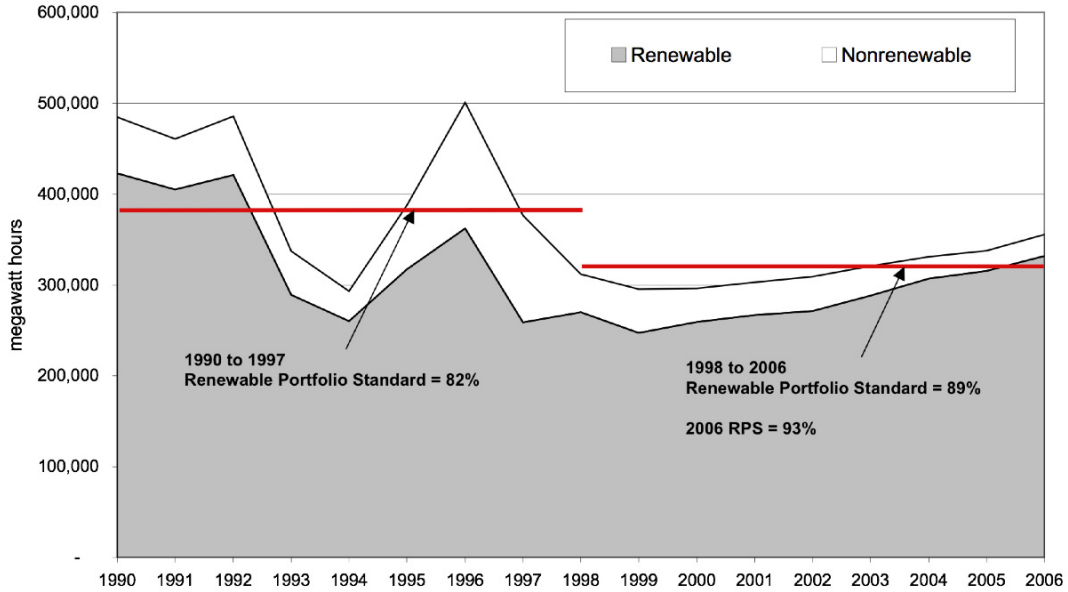
> Example: by 2020, more than 10% of the petroleum products consumed in the Yukon will be made in the Yukon.

Target 4: Set a Renewable Portfolio Standard (RPS) for the Yukon.

A Renewable Portfolio Standard is the percentage of energy generated in a jurisdiction that is derived from renewable sources. In the context of electrical energy, the RPS represents the percentage of electricity generated from renewable sources. For example, in the Yukon in 2006 (the most recent year for which data is available) 332.0 gigawatt hours of electricity were generated from renewable hydro and wind sources (with wind accounting for only 605 megawatts). Production from non-renewable sources (i.e., diesel generated electricity) totaled 23.5 gigawatt hours. With total electrical generation of 355.5 gigawatt hours in 2006, the corresponding electricity RPS for the Yukon in 2006 was 93% (332.0 GW.h divided by 355.5 GW.h times 100).

> Example: maintain a Yukon renewable portfolio standard (RPS) for electrical energy of 80% or better between now and 2020.

Yukon Electricity Production 1990 to 2006
Total Generation from Renewable and Nonrenewable Sources



Source: Yukon Bureau of Statistics, *Yukon Energy Facts 2007*.
Note: Chart does not reflect effects of Minto Mine which commenced production in October 2007.

As noted above, the potential for large swings in resource extraction activity is great in the Yukon. Since new resource extraction activity will potentially involve diesel-generated electricity, achievement of the electricity RPS is tied to upswings in resource sector activity. The potential effects of mine scenarios for two mines, developed with benefit of calculations prepared by Yukon Energy, are illustrated in the table below for the 2010 and 2015 time periods.

For example, commencement of production at the Carmacks Copper mine (with completion of Phase Two of the Carmacks to Stewart Transmission Project) would create a new diesel load of 32,000 megawatts per year and result in a reduction in Yukon's renewable portfolio standard from 93% to 86% in 2010.

Effect of mine scenarios on the Yukon 2006 Renewable Portfolio Standard

	Potential new **diesel** load (MWhr/yr)	Effect on 2006 RPS (reduction from 93% to…)
2010 (either mine on its own)		
Carmacks Copper, CSTP II not in service	45,000	83%
Carmacks Copper, CSTP II in service	32,000	86%
Alexco, CSTP II not in service	20,000	88%
Alexco, CSTP II in service	12,000	90%
2015 (either mine on its own)		
Carmacks Copper, CSTP II not in service	70,000	78%
Carmacks Copper, CSTP II in service	60,000	80%
Alexco, CSTP II not in service	23,000	88%
Alexco, CSTP II in service	39,000	84%
2010 (both mines and CSTP II in service)		
Carmacks Copper & Alexco (UKHM)	66,000	84%
2015 (both mines and CSTP II in service)		
Carmacks Copper & Alexco (UKHM)	93,000	74%

Source: Potential new diesel loads were calculated by Yukon Energy (May 2008) and take into consideration line losses and projected firm load growth as well as various other factors.
Notes: The Yukon Energy calculations take into account current hydro generation surplus, thus diesel load figures above represent generation requirements that cannot be avoided with existing hydro generation capacity.
RPS = Renewable Portfolio Standard.
CSTP II = Carmacks to Stewart Crossing Transmission Project Phase Two.
The Alexco mine is the former UKHM operation in Elsa.

5. Option evaluation

The table below presents a brief rationale for why each of the targets was selected as well as a high-level identification of possible economic, environmental and social implications of the targets identified.

		Target 1: Change the Yukon's *energy mix* to move away from non-renewable sources towards renewable sources.	**Target 2:** Increase the absolute level of energy consumed that derives from renewable sources.	**Target 3:** Maintain the same non-renewable/ renewable energy mix and reduce reliance on imported petroleum products.	**Target 4:** Set an electricity Renewable Portfolio Standard (RPS) for the Yukon.
EXAMPLE		By 2020, one quarter of the energy needs of Yukoners will be met from a variety of renewable energy sources.	By 2020, more than 1,500 terajoules of energy consumed by Yukoners will be from renewable energy sources.	By 2020, more than 10% of the petroleum products consumed in the Yukon will be made in the Yukon.	Maintain a Yukon renewable portfolio standard (RPS) for electrical energy of 80% or better between now and 2020.
RATIONALE FOR TARGT SELECTION		simple, clear target which imposes some stringency on the relative shares of renewable/non-renewable energy production	simple, clear target which imposes no stringency on the relative shares of renewable/non-renewable energy production	maintains renewable/non-renewable *status quo*, reduces Yukon dependency on imported petroleum products	provides a clear guideline for future electricity generation development which capitalizes on Yukon's hydro wealth
POSSIBLE IMPLICATIONS	ECONOMIC	provides scope for a variety of renewable energy measures, some potential for associated local economic benefits through displacement of refined petroleum product consumption	provides scope for a variety of renewable energy measures, no potential for associated local economic benefits through displacement of refined petroleum product consumption	economic development opportunities associated with local supply of petroleum products	economic capture from hydro development projects greater than for diesel-generated electricity projects, a 'made in Yukon' solution
	ENVIRON-MENTAL	direct link to GHG emissions, potential for reduced air quality (biomass)	no direct link to GHG emission reductions, potential for reduced air quality (biomass)	reduced GHG emissions associated with transportation of petroleum products into Yukon, potential toxic waste buildup	speaks directly to managing GHG emissions from new resource development activity
	SOCIAL	allows for high degree of public participation in changing Yukon's carbon footprint, difficult to demonstrate progress given current data situation	difficult to demonstrate progress given current data situation, does not explicitly require increased use of renewable energy sources other than hydro-electricity	improved energy security, little differentiation from Yukon's *status quo* carbon footprint	new hydro development inclusive of First Nation interests, impressive target vis à vis other Canadian jurisdictions
Notes: GHG = greenhouse gas					