

YUKON TRANSMISSION INTERCONNECTION ALTERNATIVES AND ASSESSMENT

November 27, 2015

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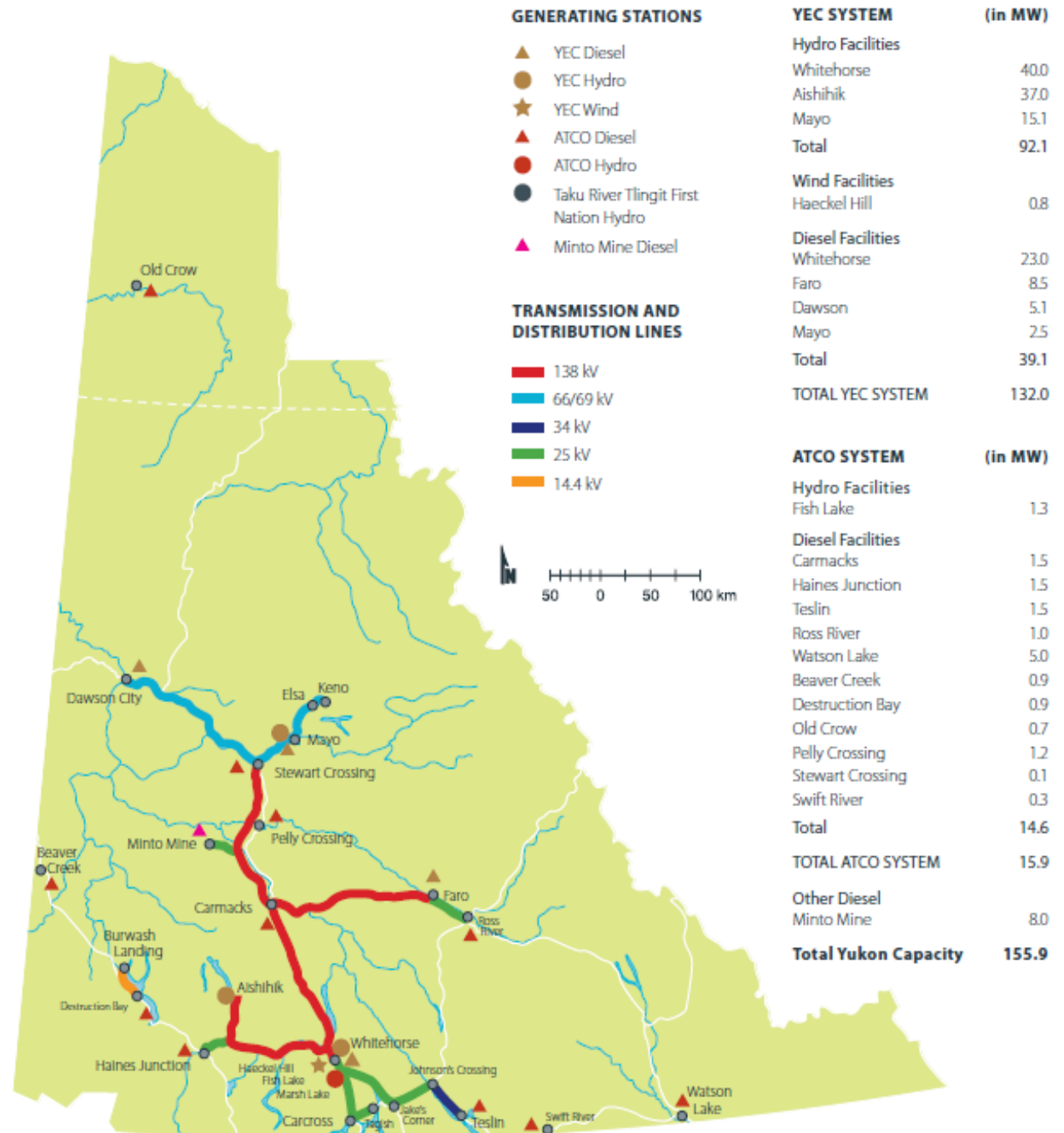
PART 1 – INTRODUCTION

Mandate

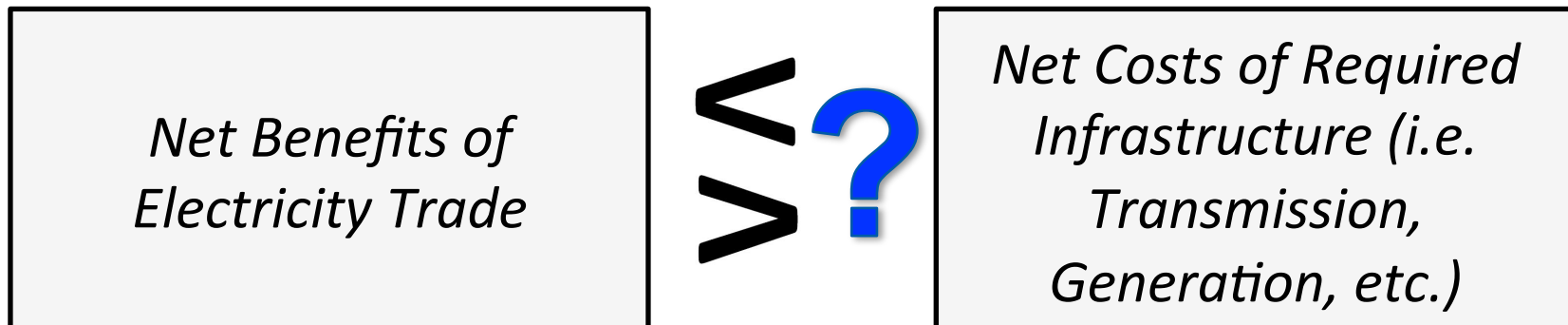


The Yukon Development Corporation (YDC) commissioned Midgard Consulting Incorporated (Midgard) and its team of sub-consultants to complete the Yukon Next Generation Hydro and Transmission Viability Study.

The following relates to transmission.



1. Determined feasible transmission interconnections
2. Estimated cost to construct (and operate) transmission interconnections
3. Estimated net benefits of electricity trade
4. Compared costs to benefits



The Yukon power system is isolated from all of its neighbouring jurisdictions, and is therefore considered to be an electrical “island”.

This means:

1. Self-sufficient
2. Instantaneously match electricity demand and generation
3. Self-restore following generation or transmission outages

Transmission interconnection would be a bridge from the island!



PART 2 – TRANSMISSION ALTERNATIVES AND COSTS

Interconnection Option	Start	End	Distance
YK – BC Option 1	Whitehorse	Iskut	763 km
YK – BC Option 1A	Whitehorse	Iskut	763 km
YK – AK Option 2	Aishihik	Fairbanks	660 km

Only two options with interconnection path lengths shorter than 1000 km were chosen for further consideration:

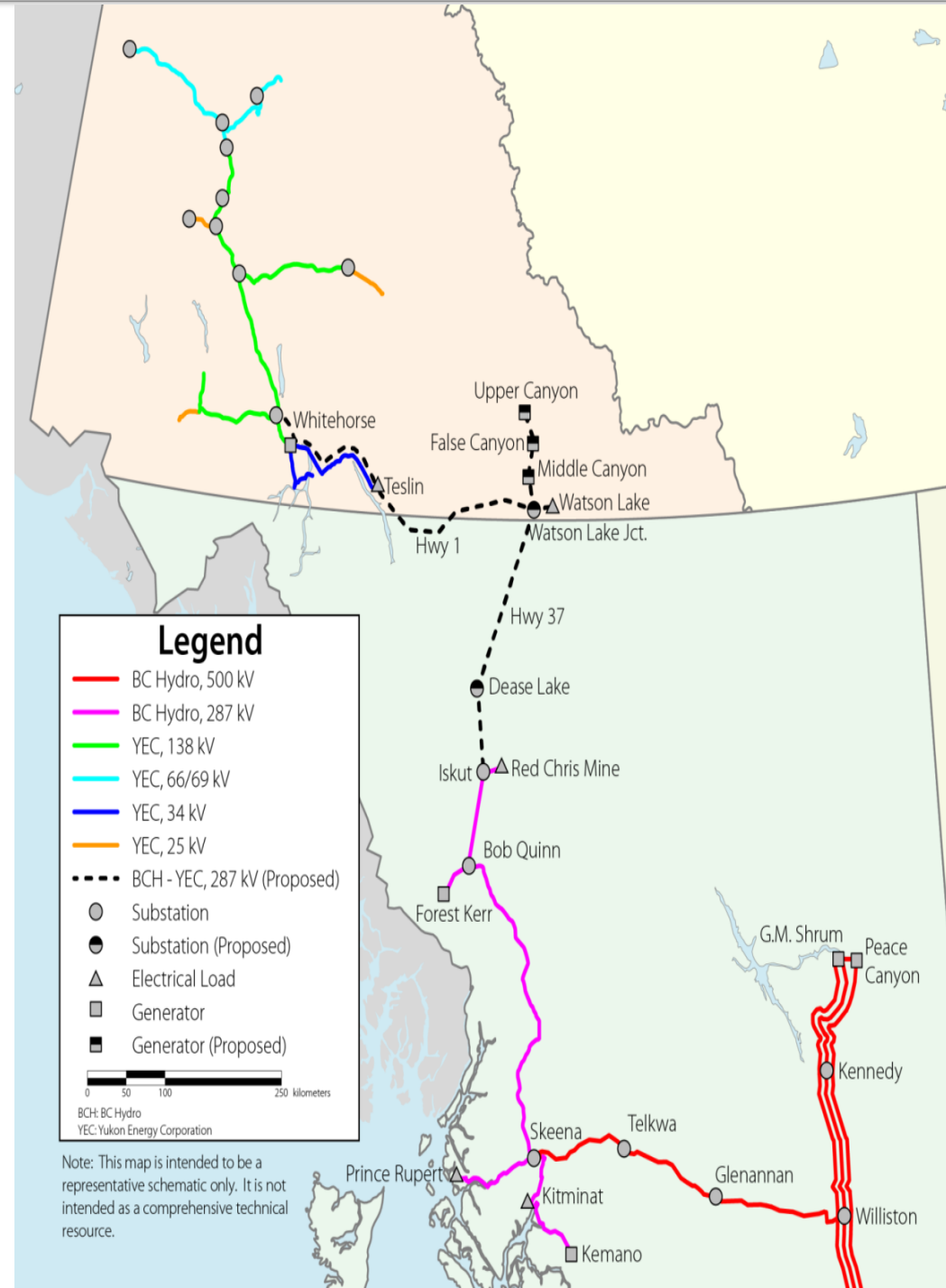
1. Option 1: Whitehorse to Iskut, British Columbia – 763 km
 - a) Option 1A: Includes the addition of a connection to Upper Canyon, False Canyon and/or Middle Canyon
2. Option 2: Aishihik to Fairbanks via Delta Junction, Alaska – 660 km

Transmission Alternative: Link to BC



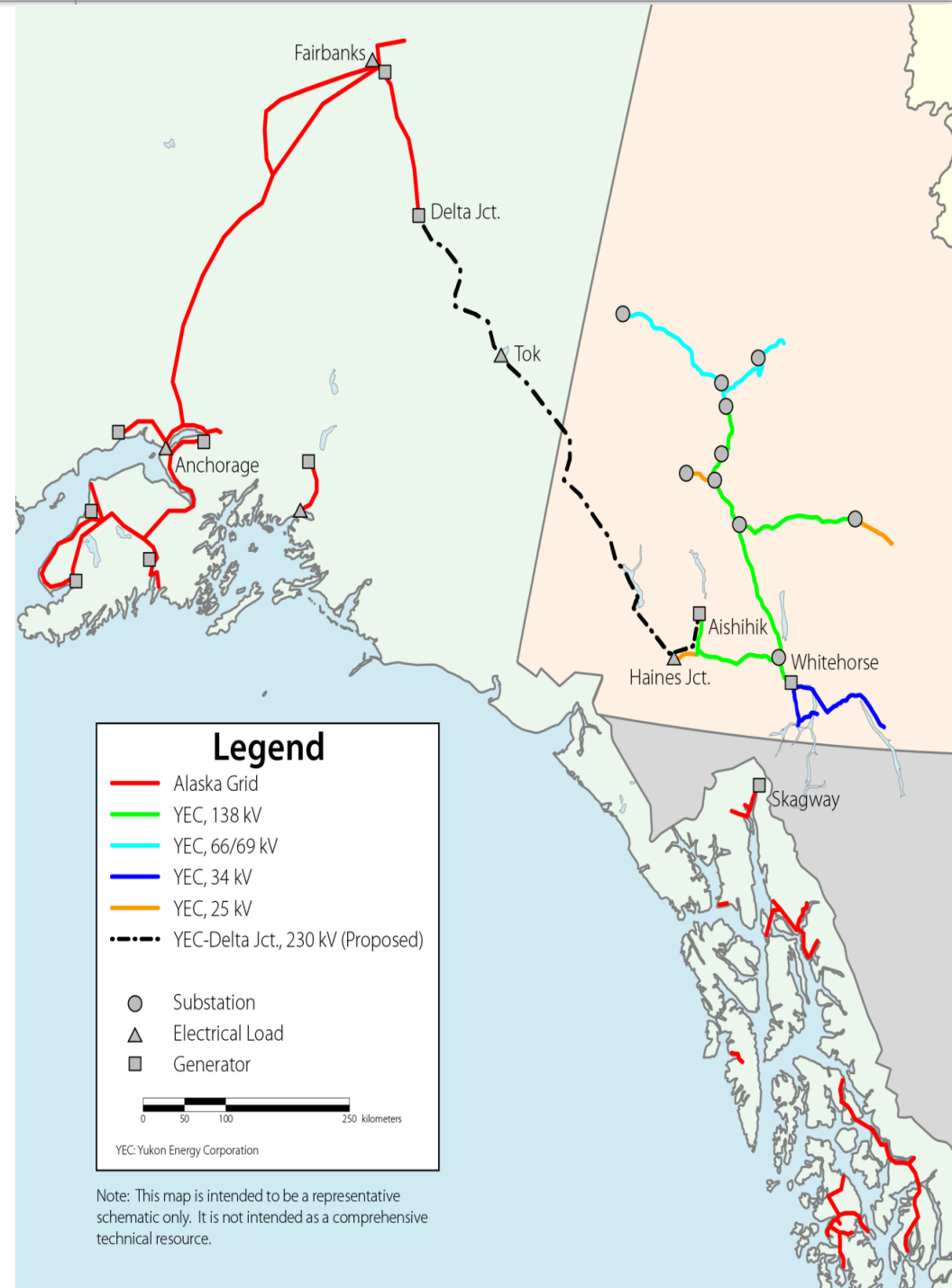
Key Features of BC Interconnection (Whitehorse to Iskut)

- a) Line Length: 763 km following Yukon Highway 1 (AK Highway) and BC Highway 37
- b) Voltage: 287 kV nominal voltage
- c) Sub-options: Includes Yukon generation at Middle, False and/or Upper Canyons
- d) Interconnection Terminus: Substantial load and generation centers near Skeena substation
- e) Terminus Grid Size: Creates an interconnection with the 150,000 MW WECC system



Key Features of AK Interconnection (Aishihik to Fairbanks)

- a) Line Length: New 660 km from Aishihik to Delta Junction, existing 120 km from Delta Junction to Fairbanks
- b) Voltage: New 230 kV from Aishihik to Delta Junction, existing 138 kV transmission line from Delta Junction to Fairbanks
- c) Terminus Grid Characteristics:
230 MW Fairbanks regional load,
280 MW generation (largely coal and diesel) and existing 75 MW transfer capacity from Fairbanks to the Anchorage area



Transmission Alternatives: Summary



Interconnection Option	Description	Distance (km)	Capital Cost (\$M)	Potential Net Yukon Export Capacity (MW)
YK – BC Option 1	287 kV from Whitehorse to Iskut	763	\$1,710	64 - 127
YK – BC Option 1A	Option 1 + NGH sites developed near Watson Lake	763	\$1,710	94 - 139
YK – AK Option 2	230 kV from Aishihik to Delta Junction	662	\$1,325	70 - 80



PART 3 – COSTS AND BENEFITS

Costs and Benefits



Interconnection Option	Start/End	Distance	Construction Cost	Line Losses
YK – BC Option 1	Whitehorse/Iskut	763 km	\$1.710B	5.7%
YK – BC Option 1A	Whitehorse/Iskut	763 km	\$1.710B	5.2%
YK – AK Option 2	Aishihik/Fairbanks	662 km	\$1.325B	6.6%

Electricity Trade Benefits:

Volume x Price = \$\$\$

Transmission Costs and Benefits



Benefits:

Volume X Price = \$\$\$

Costs:

1. Transmission Infrastructure Costs
2. “Overbuild” Generation Costs

	Benefits	Costs	Costs	Benefits minus Costs
Interconnection Option	Export Revenue (Net of Import Costs) (\$M)	New Transmission Costs (\$M)	New Generation Costs (\$M)	Net Benefits (\$M)
YK-BC	214	-1310	-379	-1470
YK-Fairbanks	202	-1015	-379	-1190

NOTE: Cost-Benefits Allowance takes account of the time value of money (i.e. discounting or Net Present Value)



PART 5 - CONCLUSION

1. Transmission line alone will cost well over \$1B to construct
2. Selling power to Alaska or BC would yield \$200M (over 30 year period) if Alaska or BC are keen buyers of power
3. Transmission line project does not yield positive benefits to Yukon

	Benefits minus Costs
Interconnection Option	Net Benefits (\$M)
YK-BC	-1470
YK-Fairbanks	-1190

If the net cost or price of the Yukon transmission-generation assumptions change materially, the above conclusion may change

Thank you & Questions...



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