STUDY OBJECTIVES

Updated 4-19-05

The objective of the Canada-NW-California studies is to provide high-level information on the feasibility of potential transmission projects to transfer a variety of new resources out of Canada into the Northwest and California. This study will not investigate the particular interconnection requirements for individual resource projects. The analysis required to fully develop a plan of service for transmission projects of this magnitude would be very complex and could take several years. What is proposed here is to perform a limited analysis that will determine if the types of projects proposed are viable.

The ultimate objective of the study is to provide the total cost of delivered energy of various potential resources for various load centers. To do this, the following information will be provided:

1. Capital cost of the transmission options
2. The additional capacity that transmission options provide
3. Cost of collector system for potential resources
4. Cost of receiver system to distribute energy to loads

This information will be provided phases. The first phase of the study will concentrate on the cost and capacity of the main transfer paths. The cost of the resources will need to include the collector system to get the energy to the main transfer paths. As the receiver systems involves more combinations, only general requirements will be provided in the first phase. Later more detailed information will be provided on the more promising options.

Each project Option is shown extending from Canada to California however this analysis is designed so that projects can be split up. From the full option, one could determine not only what would be required to move energy from Canada into California but also from Canada to the NW or starting from areas within the NW into California. This information is intended to be used as building blocks to provide information on many more options and alternatives than the nine that are actually presented. As these options are cut up, there will be different collector and receiver system requirements.

Different types of analysis are proposed for Phase 1. These are listed below and discussed on the following pages. Not all levels will be done on all options. An interested party must step up to perform the analysis. A minimum level of work (mileage and corridor) is proposed to be done for all options.

- Mileage/Cost/Corridor
- Equal Angle, Voltage Profile studies
- PF studies
- Cost of new resources (generation equipment and transmission interconnection)

The proposed transmission options were developed from analysis of the 15-year Resources for Interregional Trade map. A variety of plausible routes were determined that would accommodate most of the resources shown.

No siting analysis will be done other than to use professional judgment of plausible routes for the new transmission projects. There will undoubtedly be siting issues along each corridor. These routes are perceived as generally doable and should meet N-2 planning standards requirements.

To load up these new line projects for simulation, generation will be selected at the far northern end of the lines and load will be increased in California to absorb that energy. There is no attempt here to make any judgment on the consumer value of the resources actually connected; they are only used to test the ability of the new line projects to move energy to the south.

TYPES OF STUDIES PROPOSED FOR NTAC ANALYSIS

Cost/Mileage/Corridor

This study will designate viable corridors for the new transmission options. These corridors will determine the mileage of the new transmission additions. Logical line termination points will be identified along with expected shunt and series reactive devices. Using generic cost estimates, total project costs will be estimated.

Equal Angle – Voltage Profile Studies

Theory:
The workability of new projects/transfers can be tested quickly by the voltage angle method. If projects are added to the system, transfers will be increased up to the level where the old cutplanes (without the new projects) are returned to their previous limits. At this transfer level, the voltage angles and magnitudes should be similar to the existing system (or the project can then be modified). With similar voltage angles and magnitudes, the new system stress should be similar to the existing system, which has been shown to be able to withstand the reliability criteria outages. Although in-depth system studies will still be needed before any project is designed, this method should provide a screening of rough costs and project capabilities to determine if it is worthwhile to pursue specific options further.

The methodology for this type of study is as follows:

- Start with a powerflow basecase of the existing system that has high transfers in the direction (paths) desired and voltages tuned.
- Add the new project.
- Increase transfers to the desired level.
- Compare voltage angles at representative busses.
- Compare voltage magnitudes at representative busses.
- If voltage angles have increased or voltage magnitudes have decreased, adjust the project components or reduce transfers until similar voltage angles and magnitudes are obtained.

For the DC option studies, initially only the receiving end AC system will be studied.

The basecase is a modified version of the 2007HS2A case. Path target flows are as follows:
COI at COB = 4500 MW
PDCI = 2900 MW
MT to NW = 1143 MW
Alb to BC = 700 MW
BC to NW = 2565 MW

The buses that are to be monitored are included in Attachment A.

Powerflow Studies

After modeling the new transmission, generation and increased path transfers similar to the Equal Angle method described above, powerflow studies of known critical outages will be run to provide an initial determination if the increased transfers are possible. If unacceptable conditions result from these outages, the project will be modified or transfers reduced until acceptable performance is reached.

For initial screening (this is a draft list, want about 10 outages)

- 2PV outage with synchronous condensor at Malin (measure before/after)
- PDCI Bipole (RAS?)
- Keeler-Allston
- Ashe-Slatt/Coyote-Slatt double line loss (RAS?)
- Williston to Kelly Lake 500 kV circuit 1
- Nicola to Ingledow 500 kV line
- Kelly Lake to Clayborn 500 kV line (needed? Where is clayborn?))
- Ingledow to Custer 500 kV circuit 1
- Langdon - Cranbrook 500 kV line.
- Cranbrook - Bell 500 kV line.
- Nicola - Vaseux Lake 500 kV line.
- Vaseux Lake - Coulee 500 kV line.
- Malin-Round Mountain 500 kV double line (RAS?)
- Round Mountain-Table Mountain 500 kV double line (needed?)
- Table Mountain – 500 kV double line (Needed?)
- Captain Jack-Olinda 500 kV double line outage (RAS like M-RM?)

Delivered Cost of Energy

This type of study will use the cost of the new transmission and typical costs of new resources to determine the cost of deliver energy at the load end. Will we price all generation that line can accomodate?
NEEDS WORK – Bill H to provide.

Production Cost Studies

These types of studies will not determine the technical viability of project (as the above three methods provide in varying degrees), but it will quantify the economic benefits. Given the Transmission Option and the corresponding new generation, detailed mathematical models will be used to simulate the hourly operation of the Western Interconnection over a year's time. The output of these models will estimate the economic savings to both producers and consumers achievable by reducing or eliminating the congestion between this new generation and the loads. If sufficient congestion remains with the new project, the project might be modified to enable increased economic savings. A comparison of these savings to the cost of transmission additions will facilitate decisions of whether or not to pursue detailed studies/construction of transmission project(s).

Bus Records

Number	Name	Area Name	Nom kV	PU Volt	Volt (kV)	Angle (Deg)
59639	DOVII5	ALBERTA	500	1.04205	521.024	175.28
50558	GMS500	B.C.HYDR	500	1.05	525	134.5
50561	WSN500	B.C.HYDR	500	1.05074	525.37	125.16
50704	KLY500	B.C.HYDR	500	1.04804	524.02	116.57
50703	NIC500	B.C.HYDR	500	1.03943	519.713	120
50194	ING500	B.C.HYDR	500	1.03225	516.123	102.57
40323	CUSTER W	NORTHWES	500	1.03219	516.095	99.25
40749	MONROE	NORTHWES	500	1.06659	533.295	88.69
40869	RAVER	NORTHWES	500	1.07526	537.632	82.01
40821	PAUL	NORTHWES	500	1.08	540	72.88
40045	ALLSTON	NORTHWES	500	1.06071	530.354	66.99
40601	KEELER	NORTHWES	500	1.06566	532.828	57.55
40827	PEARL	NORTHWES	500	1.06189	530.944	54.52
40699	MARION	NORTHWES	500	1.06347	531.736	50.22
40051	ALVEY	NORTHWES	500	1.05904	529.522	44.02
45095	DIXONVLE	NORTHWES	500	1.04606	523.03	40.15
45197	MERIDINP	NORTHWES	500	1.03277	516.385	35.46
45035	CAPTJACK	NORTHWES	500	0.99717	498.586	29.56
40687	MALIN	NORTHWES	500	0.99538	497.688	29.22
30005	ROUND MT	PG AND E	500	0.99363	496.814	18.18
30020	OLINDA	PG AND E	500	0.99562	497.811	12.61
30015	TABLE MT	PG AND E	500	0.9876	493.801	10.69
30030	VACA-DIX	PG AND E	500	0.99986	499.932	0.97
30035	TRACY	PG AND E	500	1.01055	505.274	-2.15
30040	TESLA	PG AND E	500	1.00507	502.535	-2.46
50703	NIC500	B.C.HYDR	500	1.03943	519.713	120
51134	VAS500	B.C.HYDR	500	1.05116	525.579	128.02
40287	COULEE	NORTHWES	500	1.08	540	93.32
40499	HANFORD	NORTHWES	500	1.07641	538.205	77.34
40585	JOHN DAY	NORTHWES	500	1.08	540	58.59
40489	GRIZZLY	NORTHWES	500	1.03123	515.617	38.22
41043	SUMMER L	NORTHWES	500	1.01035	505.175	37.48
40687	MALIN	NORTHWES	500	0.99538	497.688	29.22
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30020	OLINDA	PG AND E	500	0.99562	497.811	12.61
30015	TABLE MT	PG AND E	500	0.9876	493.801	10.69
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59639	DOVII5	ALBERTA	500	1.04205	521.024	175.28
54610	KEEPHIL2	ALBERTA	500	1.05334	526.668	177.93
54158	LANGDON2	ALBERTA	500	1.06467	532.334	158.52
50791	CBK500	B.C.HYDR	500	1.0435	521.75	145.64
40091	BELL BPA	NORTHWES	500	1.08281	541.404	93.7
40061	ASHE	NORTHWES	500	1.07169	535.846	75.27
40585	JOHN DAY	NORTHWES	500	1.08	540	58.59
40489	GRIZZLY	NORTHWES	500	1.03123	515.617	38.22
41043	SUMMER L	NORTHWES	500	1.01035	505.175	37.48
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54158	LANGDON2	ALBERTA	500	1.06467	532.334	158.52
40459	GARRISON	NORTHWES	500	1.07543	537.717	97.48
60060	BORAH	IDAHO	345	0.99605	343.638	36.59
66340	SIGURD	PACE	345	1.01257	349.338	28.97
65995	MONA	PACE	345	1.02383	353.222	28.64
65135	BENLOMND	PACE	345	1.01981	351.835	23.8
14003	NAVAJO	ARIZONA	500	1.08608	543.038	-10.21
15021	PALOVRDE	ARIZONA	500	1.06	530	-11.06