Eastern Interconnection Planning Collaborative

High Level Transmission Analysis & Cost Estimation Task 5

Stakeholder Steering Committee Meeting

May 18-19, 2011

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Purpose

- Provide approach for EIPC to perform high level transmission analysis & cost estimates for selected futures in Task 5.

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Outline

- Overview of Task 5 from Statement of Project Objectives (SOPO)
- Application of Analysis
- Approach
- Example
- Questions

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High Level Transmission Analysis described in Task 5 of SOPO

- Provide high-level transmission analysis for the sensitivities of interest indicated by the SSC.
- Analysis will not be detailed power flow analysis, but rather conceptual assessments made by the Planning Authority engineers of potential interregional transmission expansion to support the magnitude of interregional energy exchanges identified in the Macroeconomic Analysis sensitivities.

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Application of Analysis

- Provides relative comparisons between Futures
- Not necessarily representative of what would/could actually be built
- No power-flow analyses will be performed at this stage
- Provides high-level cost estimates for generic transmission line "building blocks" to be used for inter-regional enhancements utilized to transfer large blocks of energy from region to region
  - Ignores any impacts to underlying system at both the "sending" and "receiving" ends of the building blocks
  - Does NOT address internal improvements required for flow through
- Integration of remote resources will be handled on a case-by-case basis

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Key Assumptions

- Existing system capacity between NEEM regions is fully utilized and cannot be relied upon; and therefore, only new transmission enhancements will be utilized to obtain the requested increase in transfer capability.
- To represent contingency capability, include redundant circuits (e.g. for a 1000 MW increase, two 1000 MW circuits are needed; the second circuit to account for reinforcements to support the contingency loss of the first).
- PA's have developed a matrix of green field, generic transmission line "building blocks" with a range of costs representing typical construction cost differences within their respective regions.

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Approach

1. The SSC provides the EIPC with the increase in transfer capability corresponding to each selected "NEEM Pipe". A single set of capability increases will be provided for each selected future.

2. The Planning Authorities ("PA") that were responsible for developing the initial transfer limits for the corresponding NEEM Pipe are to approximate the combination of building blocks using the above matrix that will achieve the requested increase in transfer capability. In general, the PAs should utilize existing voltage types found within the specific NEEM Bubble as part of the solution.

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Approach

3. The PAs should use the knowledge of their local system(s) to approximate the termination points and mileages of the transmission building blocks that could potentially accommodate the increase in transfer capability.

4. Once the new transmission building blocks, as well as, the corresponding mileages of the proposed circuits have been approximated, the PAs shall apply the base costs per mile for the amount of facilities located within each NEEM Bubble and the multipliers applicable to the NEEM Bubbles involved.

5. If applicable, the PAs will provide the SSC with guidance on the potential utilization of HVDC.

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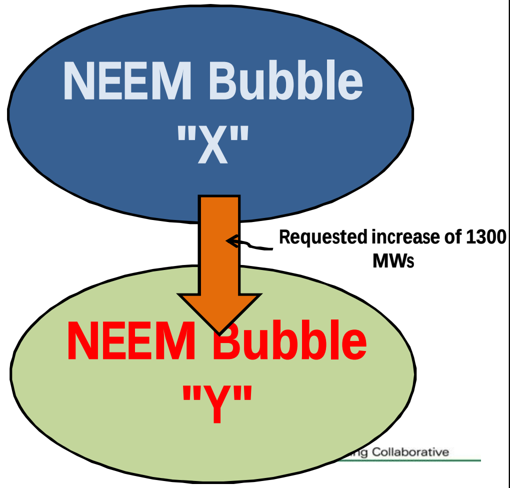
Example – Step 1

The SSC requested the EIPC to develop high level cost estimates for increasing the NEEM Pipe from NEEM Region "X" to NEEM Region "Y" by 1300 MWs.



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Example – Step 2

The Planning Authorities ("PA") that were responsible for developing the initial transfer limits from NEEM Bubble "X" to NEEM Bubble "Y" are to approximate the combination of building blocks using the developed high level cost matrix that will achieve the minimum combination of building blocks to achieve the requested 1300 MWs increase in transfer capability. In general, the PAs should utilize existing voltage types found within the specific NEEM Bubble as part of the solution.

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Example – Step 2 (cont.)

Base Cost for Different Types			Regional Multipliers		
Voltage (kV)	Capacity (MW)	$M/mile	NEEM Region X	NEEM Region Y	NEEM Region Z
230	600	$A	0.93 – 1.05	1.02 – 1.09	0.99 – 1.03
230	1200	$B	0.93 – 1.05	1.02 – 1.09	0.99 – 1.04
345	1200	$C	--	1.04 – 1.21	1.01 – 1.11
345	2400	$D	--	1.04 – 1.21	1.01 – 1.11
500	2600	$E	0.97 – 1.12	1.10 – 1.17	1.03 – 1.15
765	4000	$F	--	1.07 – 1.13	1.04 – 1.13

- **Total Increase in Capacity Requested:** 1300 MWs
- **Solution mix:** 2 – 1200 MW, double circuit 230 kV transmission lines and 1 – 600 MW, single circuit 230 kV transmission line

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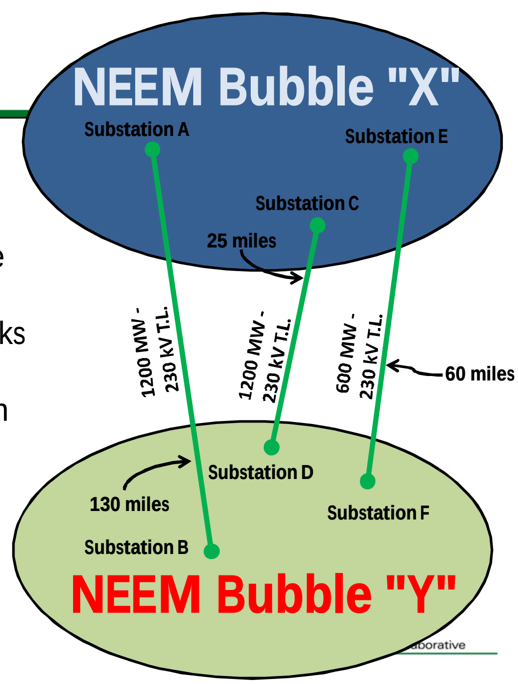
Example – Step 3

The PAs shall use the knowledge of their local system(s) to approximate the termination points and mileages of the building blocks that could potentially accommodate the increase in transfer capability.



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Example – Step 3 (cont.)

The PAs approximated:

- The new 1200 MW, double circuit 230 kV transmission line between Substation A and Substation B to be approximately 130 miles, of which 80 miles are within NEEM Bubble X while the remaining 50 miles are within NEEM Bubble Y.
- The new 1200 MW, double circuit 230 kV transmission line between Substation C and Substation D to be approximately 25 miles, of which 20 miles were within NEEM Bubble X and the remaining 5 miles within NEEM Bubble Y.
- The new 600 MW, single circuit 230 kV transmission line between Substation E and Substation F to be approximately 60 miles, of which 20 miles are within NEEM Bubble X and the remaining 40 miles are within NEEM Bubble Y.

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Example – Step 4

Once the type and quantity of new transmission building blocks , as well as, the corresponding mileages of the proposed circuits have been approximated , the PAs shall apply the base costs per mile for the amount of facilities located within each NEEM Bubble and the multipliers applicable to the NEEM Bubbles involved.

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Example – Step 4 (cont.)

(1) The new 1200 MW, double circuit 230 kV transmission line between Substation A and Substation B to be approximately 130 miles, of which 80 miles are within NEEM Bubble X while the remaining 50 miles are within NEEM Bubble Y.

(Mileage within NEEM Bubble X) * (Base Cost for Type) * (NEEM Bubble Range) +
(Mileage within NEEM Bubble Y) * (Base Cost for Type) * (NEEM Bubble Range) =

[(80 miles) * ($B / mile) * (0.93 to 1.05)] +
[(50 miles) * ($B / mile) * (1.02 to 1.09)] = Cost Range (A-B)

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Example – Step 4 (cont.)

(2) The second new 1200 MW, double circuit 230 kV transmission line between Substation C and Substation D to be approximately 25 miles, of which 20 miles are within NEEM Bubble X while the remaining 5 miles are within NEEM Bubble Y.

(Mileage within NEEM Bubble X) * (Base Cost for Type) * (NEEM Bubble Range) +
(Mileage within NEEM Bubble Y) * (Base Cost for Type) * (NEEM Bubble Range) =

[(20 miles) * ($B / mile) * (0.93 to 1.05)] +
[(5 miles) * ($B / mile) * (1.02 to 1.09)] = Cost Range (C-D)

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Example – Step 4 (cont.)

(3) The new 600 MW, single circuit 230 kV transmission line between Substation E and Substation F to be approximately 60 miles, of which 20 miles are within NEEM Bubble X and the remaining 40 miles are within NEEM Bubble Y.

(Mileage within NEEM Bubble X) * (Base Cost for Type) * (NEEM Bubble Range) +
(Mileage within NEEM Bubble Y) * (Base Cost for Type) * (NEEM Bubble Range) =

[(20 miles) * ($A / mile) * (0.93 to 1.05)] +
[(40 miles) * ($A / mile) * (1.02 to 1.09)] = Cost Range (E-F)

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Example – Step 4 (Cont'd)

- (4) The range of total costs for the requested 1300MW increase in capability between bubbles X and Y is:

  Cost Range (X-Y) = Cost Range (A-B) +
  Cost Range (C-D) +
  Cost Range (E-F)

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Example – Step 5

Given the relative short distances of the proposed circuits, the use of HVDC does not appear to be practical.

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Questions

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