July 5, 2011

EIPC HIGH LEVEL TRANSMISSION COST ESTIMATION

TASK #5: DOE PROJECT NO. DE-OE0000343

Background:

To support the SSC in assessing the results of the macroeconomic analysis and reaching consensus on the three (3) future scenarios of interest, the EIPC has developed an approach which employs generic, high-level transmission expansion cost estimates for use in comparisons among the macroeconomic scenarios. Because generic cost estimates are needed to develop and select scenarios of interest prior to specific modeling and detailed power flow analysis to be performed in Phase 2 of the Project, they are intended only for use by the SSC in quantifying levels of transmission impacts among the many uncertain future expansion scenarios being considered relative to each other.

The approach applied in developing the high-level cost estimates is to utilize generic transmission line "building blocks" in a consistent manner by each of the PAs to approximate the SSC requested increases in transfer capability between regions represented in the macroeconomic scenarios. These generic building blocks and cost estimates do not represent likely project solutions and are not intended to reflect specific facility costs. The absolute dollar values of these generic estimates are intended only to assist the SSC in selecting scenarios of interest, and are not applicable for other purposes or in any way indicative of actual transmission expansion costs, which must be developed through detailed local and regional assessments of specific expansion requirements. Examples of costs not considered include substation costs, upgrades to existing transmission systems, financing costs, specific ROW routing requirements, etc.

The EIPC will provide a single cost estimate for each macroeconomic "Future" for which the SSC selects specific increased transfer capabilities. These high-level cost estimates are to provide the SSC with guidance of the relative transmission cost differences between the multiple Futures in order to assist the SSC in the determination of the three (3) future scenarios for which detailed transmission expansion information will be developed in Phase 2 of the Project.

Approach:

1) 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.
2) To represent increases in transmission capacity between NEEM regions, the EIPC will use green field, generic transmission line "building blocks".

3) 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).
4) Planning Authorities should approximate termination points for the transmission line "building blocks" based upon knowledge of their local system(s).
5) No power flow analyses will be performed.
6) Local impacts to the sending and receiving ends of the proposed circuits will not be addressed.
7) The integration of remote resources and large blocks of resource additions will be assessed on a case by case basis.
8) HVDC solutions will not be utilized as part of the high-level analyses and cost estimates; however, Planning Authorities will provide the stakeholders guidance where HVDC could potentially be utilized.
9) Terminal costs will be considered for NEEM regions in the event that the terminal costs are a large component of the cost estimate.

The EIPC has compiled a cost matrix of planning level, "cost per mile" estimates for common HVAC voltage levels among the PAs. The EIPC has determined that the NEEM regions have enough geographic diversity to warrant for differences in regional costs. Therefore, this cost matrix will provide the cost per mile ranges for typical transmission line voltage types by applying a range of regional multipliers to the base cost for each "NEEM Bubble". A simplified example of the cost matrix is shown below:

Table 1: Example of Transmission Line Costs per Mile[1]

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	1.02	0.99
230	1200	$B	0.93	1.02	0.99
345	1200	$C	--	1.04	1.01
345	2400	$D	--	1.04	1.01
500	2600	$E	0.97	1.10	1.03
765	4000	$F	--	1.07	1.04

Step 1: The SSC provides the EIPC with the requested increase in transfer capability for each corresponding "NEEM Pipe".

Step 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.

Step 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.

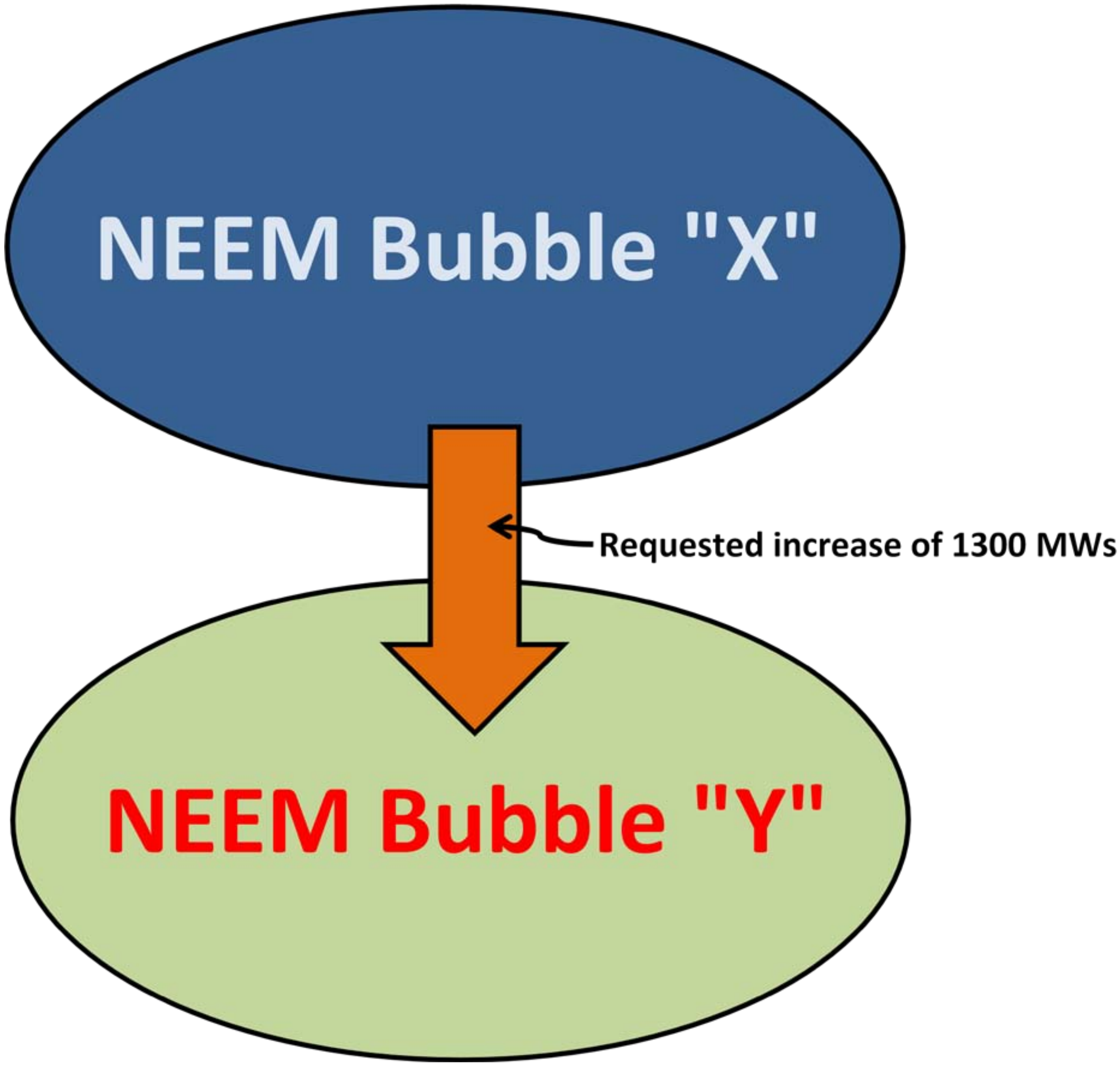
Step 4: Once the new transmission building blocks, as well as, the corresponding mileages of the proposed circuits have been approximated, the PAs shall apply the base costs per mile for the amount of facilities located within each NEEM Bubble and the multipliers applicable to the NEEM Bubbles involved.

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

[1] This table is a simplified example of the developed matrix and does not represent specific cost of any NEEM region.

An Example of the methodology follows:

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.



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 below 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.

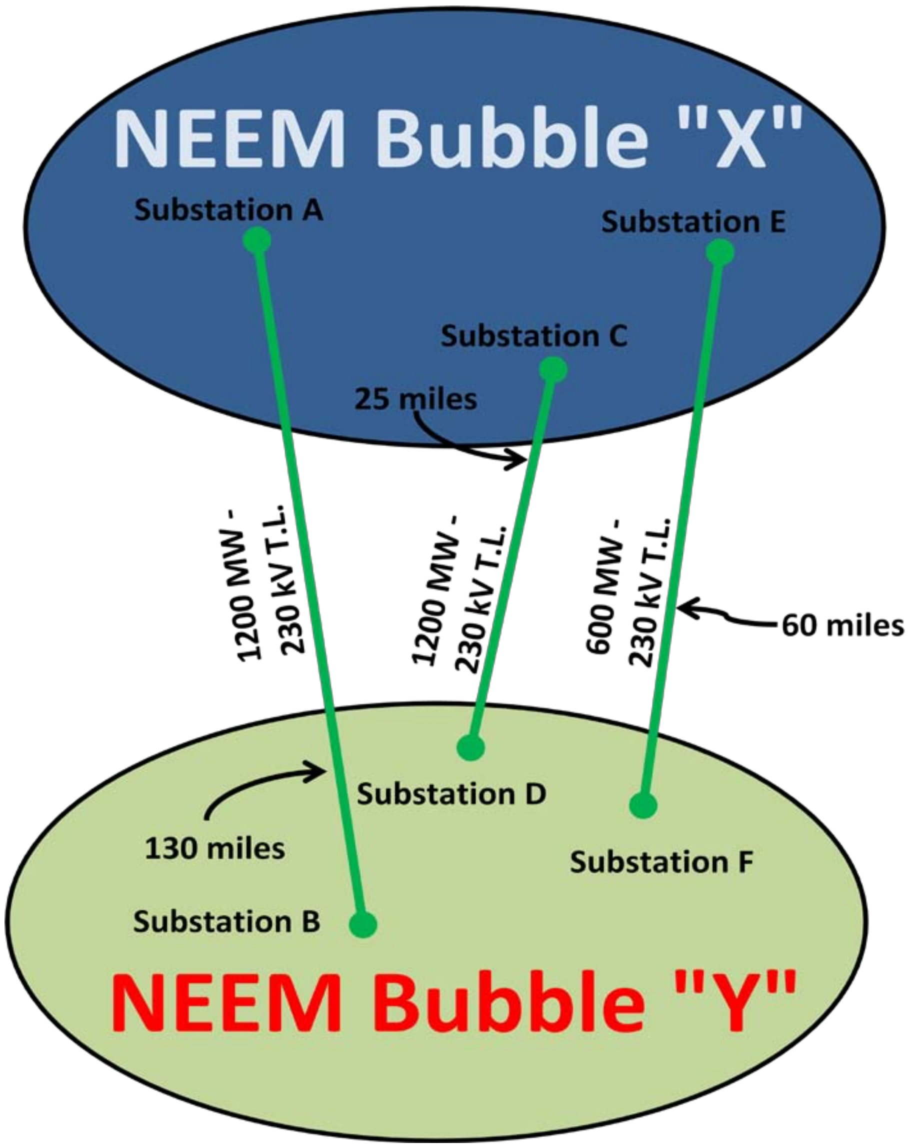
Base Cost for Different Types			Regional Multipliers		
Voltage (kV)	**Capacity (MW)**	**$M/mile**	**NEEM Region X**	**NEEM Region Y**	**NEEM Region Z**
230	600	$A	0.93	1.02	0.99
230	1200	$B	0.93	1.02	0.99
345	1200	$C	--	1.04	1.01
345	2400	$D	--	1.04	1.01
500	2600	$E	0.97	1.10	1.03
765	4000	$F	--	1.07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

Given that Region X does not currently have any 345 kV or 765 kV facilities, the solution should be comprised of a combination of 230 kV and/or 500 kV.

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

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.



The PAs approximated:

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.
2) 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.
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.

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.

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	1.02	0.99
230	1200	$B	0.93	1.02	0.99
345	1200	$C	--	1.04	1.01
345	2400	$D	--	1.04	1.01
500	2600	$E	0.97	1.10	1.03
765	4000	$F	--	1.07	1.04

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

   [(80 miles) * ($B / mile) * (0.93)] + [(50 miles) * ($B / mile) * (1.02)] = Costs

2) 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.

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

   [(20 miles) * ($B / mile) * (0.93)] + [(5 miles) * ($B / mile) * (1.02)] = Costs

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

   [(20 miles) * ($A / mile) * (0.93)] + [(40 miles) * ($A / mile) * (1.02)] = Costs

Step 5: Given the relative short distances of the proposed circuits, the use of HVDC does not appear to be practical.