

MWG Recommendations On Transmission Sensitivities For BAU, and How Sensitivities 1 and 2 Work Together

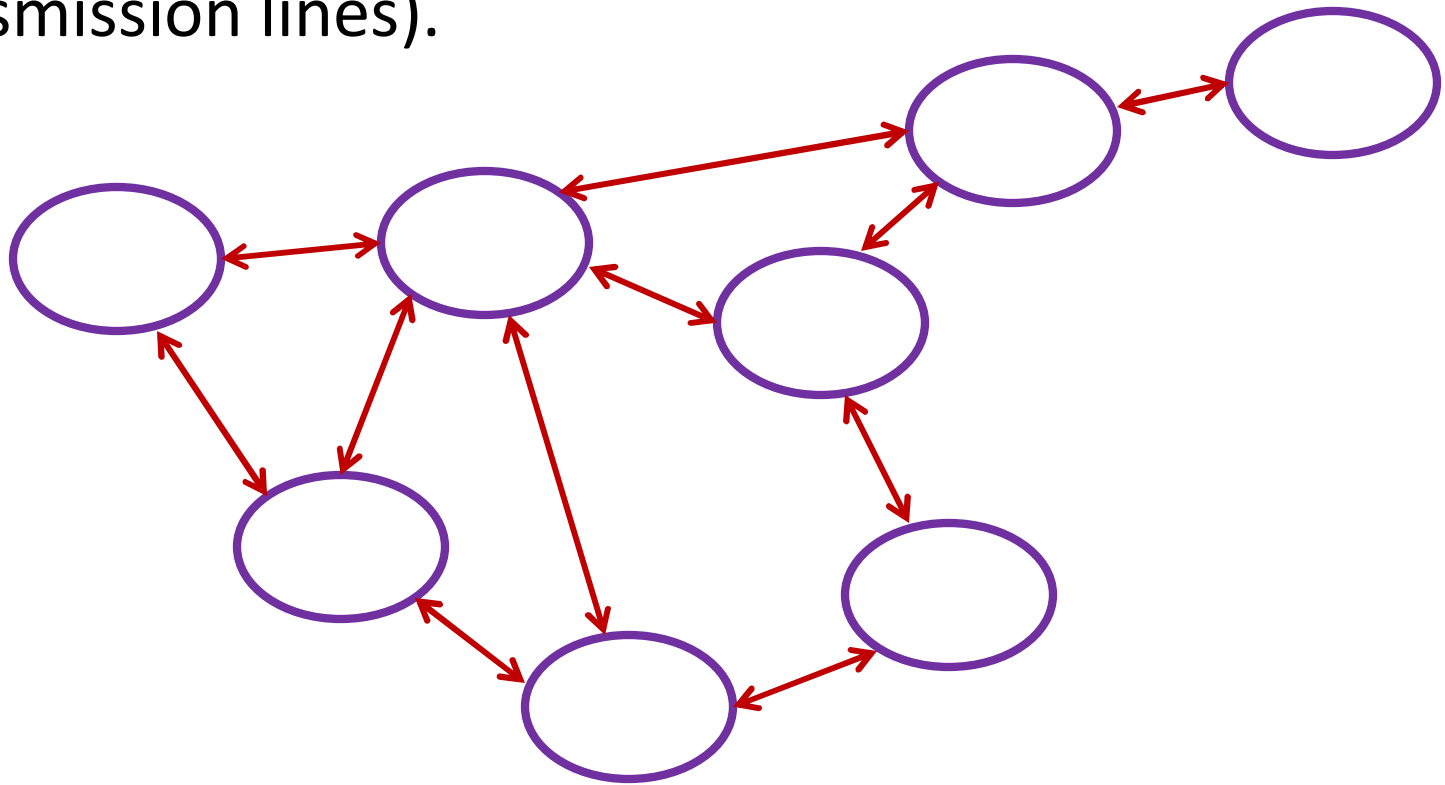
SSC Meeting February 6, 2011

Background

- The NEEM model does not automatically alter transfer capability over the modeling period.
- The transfer capability is usually fixed.
- Transmission limits are a key driver of the NEEM modeling results.

NEEM: Pipe and Bubble Example

- Red arrows depict transfer capability (not transmission lines).

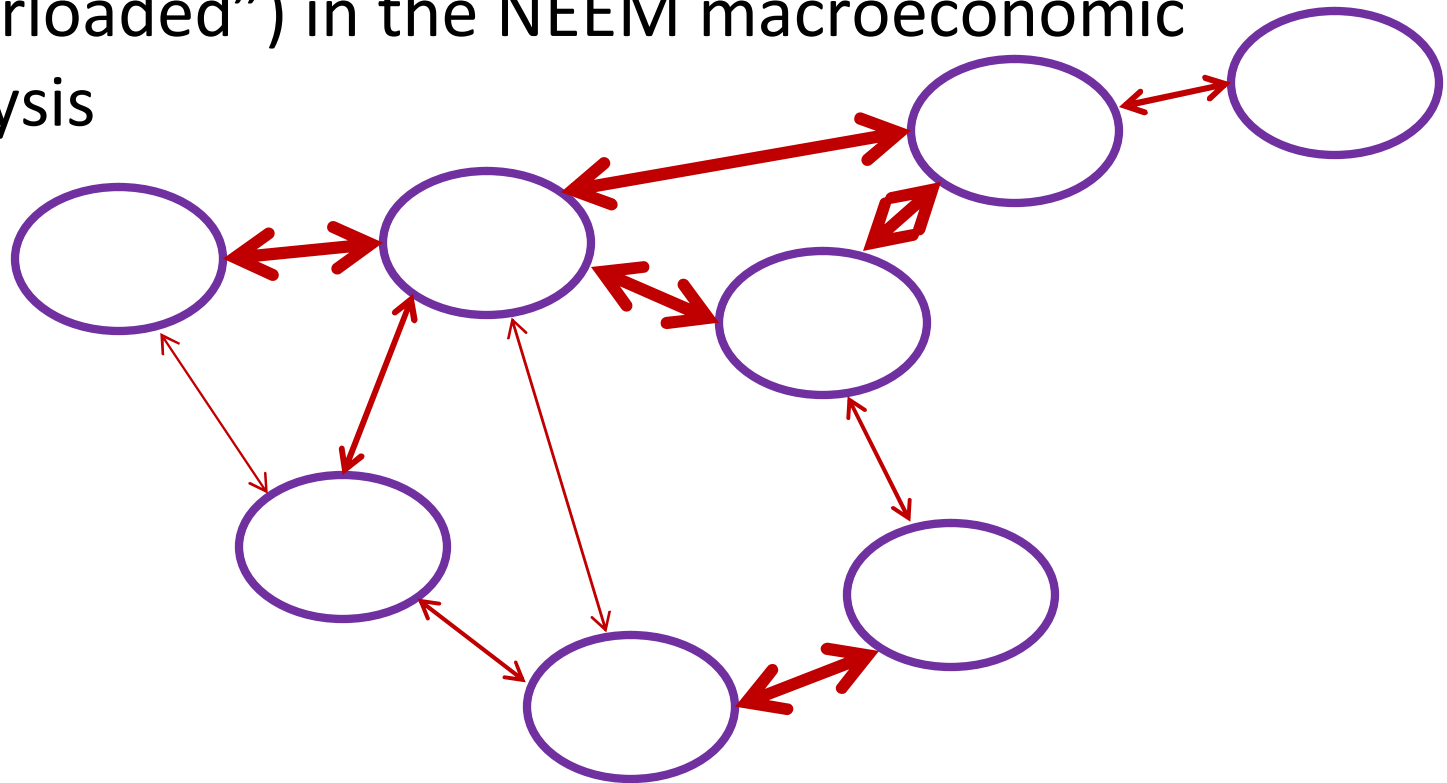


Transmission Sensitivities

- The SSC agreed that 1-2 sensitivities per future should modify the transfer limits.
- One way to do this is to *manually* change the transfer limits between NEEM regions.
- EIPC proposed a “*soft constraint*” instead. (See December 30 Revision of the presentation at Macro Future Workshop November 8-9, 2010).

Soft Constraint Proposal

- Specific transfer limits can be expanded (or “overloaded”) in the NEEM macroeconomic analysis



Soft Constraint Proposal

1. CRA performs the initial run for each future.
2. Results provided to SSC before any sensitivities are run:
 - Shadow prices for binding constraints (pipes)
 - Energy and capacity prices within regions
 - Number of binding hours on transfers between regions (pipes)
 - Average flow between regions (through pipes)
 - Future generation additions and retirements by region

Soft Constraint Proposal (con't)

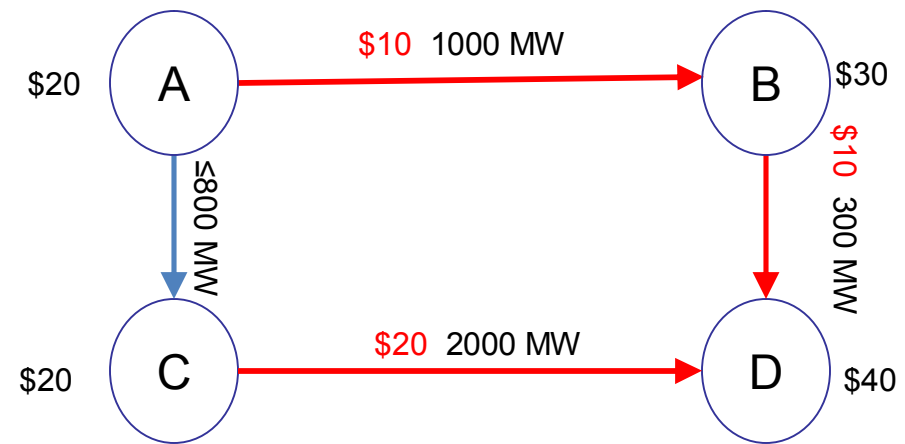
3. CRA runs Sensitivity #1 in which transfer limits are treated as “soft constraints” - flows are allowed to exceed transfer limits at an “overload charge”.
 - The magnitude and duration of the overloads are identified. CRA provides results to SSC.

How the Soft Constraint Approach Works

Constrained Case Run Results

Zone energy prices are shown next to bubbles.
 Constrained pipes are shown in red, along with transfer limits and shadow prices.
 Unconstrained pipes are shown in blue.

The picture corresponds to a single snapshot in time. In NEEM there are 20 snapshots (time blocks) per year resulting in 20 picture like that for each year-run.



Soft Constrained Case Set-up

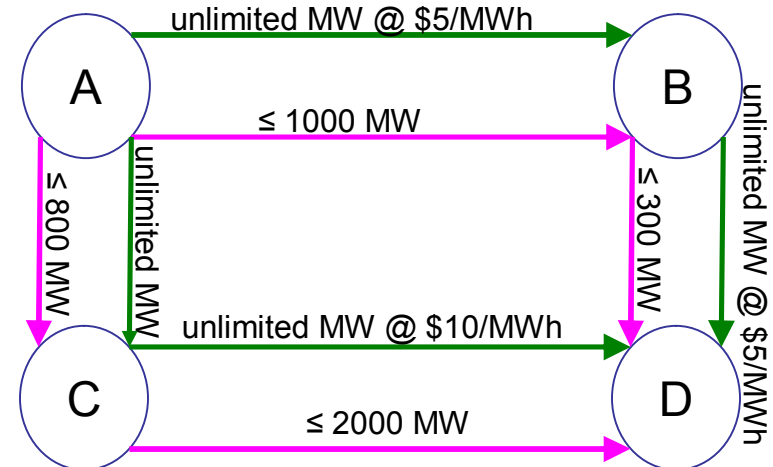
All pipes are split into two:

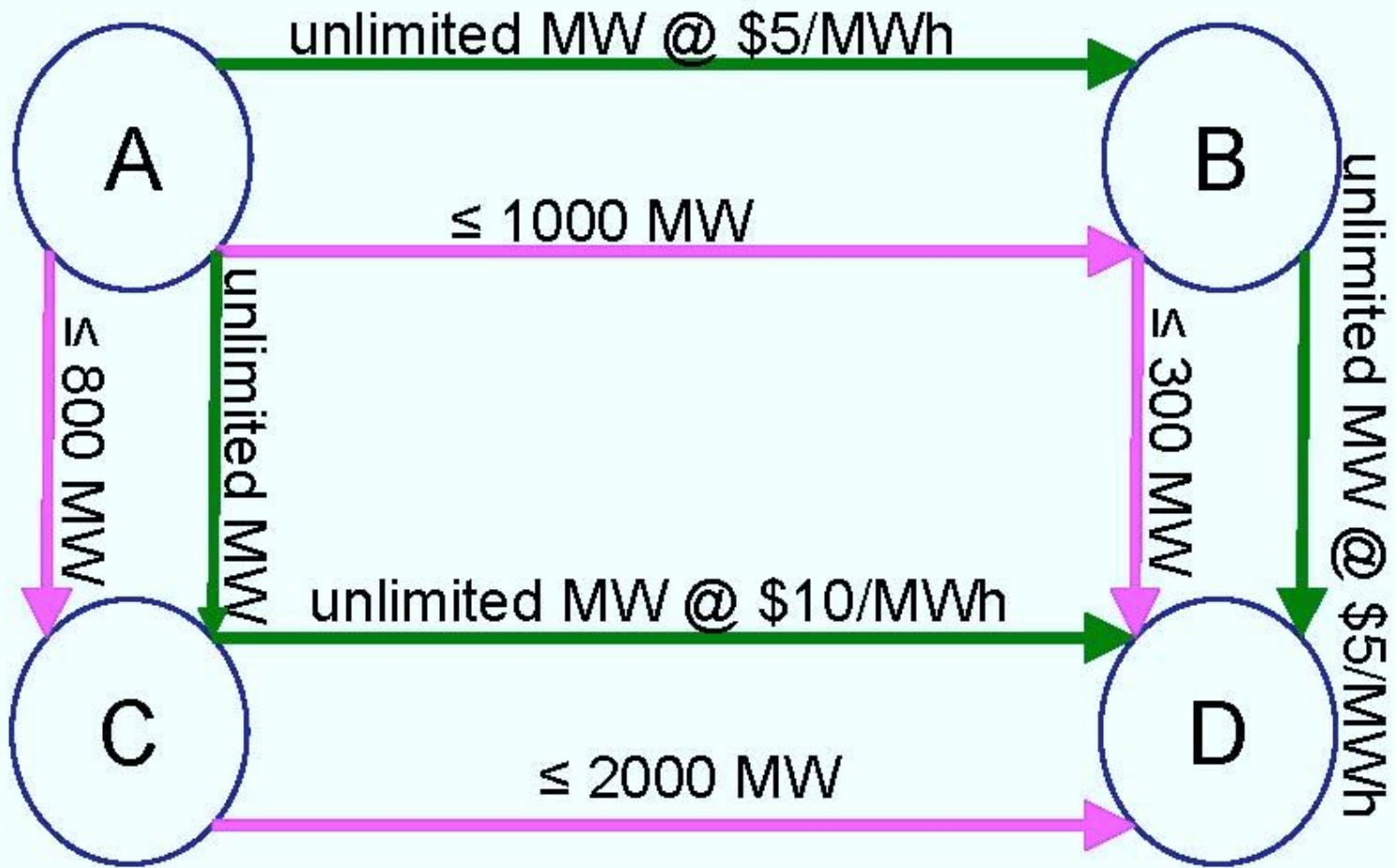
- a limited in flow (pink) pipe as in the Constrained Run; and
- an unlimited (green) pipe.

When a red pipe is split, the flow over a green pipe is subject to the overload charge set below the shadow price determined in the Constrained Run. (In this example charges are set at 50% of shadow prices)

When a blue pipe is split, no overload charge is assessed on the green pipe flow (shadow price for an unconstrained flow is zero)

A green pipe is a proxy used to track the overload flows which are indicative of the need for transmission expansion





Setting Overload Charges

- *For the BAU*, EIPC recommended one standard deviation below the average shadow price difference, with a \$2 floor (minimum) for lines that showed congestion.
- The EIPC indicated that Sensitivity 1 for *other futures* might be different - perhaps using two standard deviations.

What will it cost?

- Overload charges do not reflect the cost of increasing the transfer limit.
- The PAs will do one high level transmission expansion cost estimate per future.
- If we have two sensitivities in a given future that may expand transmission, we will have to choose one of them for the cost estimate - or try and get two estimates from the PAs.

Interaction Between BAU Sensitivities 1 and 2

- The SSC asked the MWG and SWG to consider how Sensitivity #2 may interact with Sensitivity #1, considering hurdle rates, transmission service charges, and other charges.
- BAU Sensitivity 1 – “Revised transfer capability”.
- BAU Sensitivity 2 – “Interregional fee/dispatch barriers reduced”.

Interaction Between BAU Sensitivities 1 and 2

- Sensitivity 1 will have three charges associated with transmission transfers: (1) the new “overload charge” (soft constraint); (2) wheeling charges; and (3) hurdle charges.
- If all three charges are reduced to zero in Sensitivity 2, there will be no transfer limits in the model (copper sheet).
- The MWG does not recommend that Sensitivity 2 eliminate all three charges.

Interaction Between BAU Sensitivities 1 and 2

- The SSC will need to decide where to start for Sensitivity 2, and the other sensitivities:
 - using the *hard transfer limits* from the initial *BAU* modeling run;
 - using the *soft constraint* from Sensitivity 1; or
 - taking the results from Sensitivity 1 and turning them into hard transfer limits.
- See further discussion under Decision Points 2 and 3 below.

BAU Transmission Decision Points

1. EIPC/CRA Soft Constraint Approach for BAU Sensitivity 1.
 2. BAU Sensitivity 2 Approach.
 3. Determination of Fixed Transfer Limits.
- Note: BAU Sensitivity 2 will be run approximately *one week* after Sensitivity 1.

Decision 1. Soft Constraint Approach

- MWG Recommends the use of the EIPC/CRA Soft Constraint Approach for Sensitivity 1 of the BAU
 - MWG Recommends that the Overload Charge be set to one standard deviation below shadow prices with a floor set at \$2/MWh as recommended.

Why the Soft Constraint Approach?

- It is unclear what methodology would be used to manually readjust the pipe sizes, and whether it would simply move the congestion to another pipe.
- It is an attempt to reflect some of the actual transmission constraints between NEEM regions - but also allow the model to overload constraints and explore the resource potential beyond existing transmission limitations.
- Given the NEEM model limitations, no one was able to suggest a better methodology for transmission Sensitivity 1.

Decision 2. BAU Sensitivity 2

MWG has developed 3 options for SSC to consider for Sensitivity 2:

- Option A – Hard Constraints, Hurdle Rates/Wheeling Charges removed.
- Option B – Hard Constraints, Hurdle Rates/Wheeling Charges reduced by 50%.
- Option C – Soft Constraints, Hurdle Rates/Wheeling Charges reduced or removed.
 - Option C will result in a different set of transfer limits than Sensitivity 1, but not a “copper sheet”.
- Note: If the Results of Sensitivity 1 produce extremely unusual results, the SSC can decide on an Option D for Sensitivity 2. However, the final decision on Sensitivity 2 is apparently needed one week after Sensitivity 1 is run.

Decision 2. BAU Sensitivity 2.

	Transfer Limits	Hurdle/Wheeling	Overload Charge
Sensitivity 1	Soft Constraint (“overload charge”)	Same as BAU	One Standard Deviation below shadow price difference, \$2/MWh floor for congested lines
Sensitivity 2 Option A	Hard Constraint (transfer limits based on SSC choice of Sensitivity 1 <u>or</u> Baseline Infrastructure transfer limits)	Eliminated	NA (no soft constraints)
Sensitivity 2 Option B	Hard Constraint (same as Option A)	50% of BAU values	NA (no soft constraints)
Sensitivity 2 Option C	Soft Constraint (“overload charge”)	Reduced or Removed (TBD)	Same as Sensitivity 1

Hard Constraints vs. Soft Constraints in BAU Sensitivity 2

- Options A and B - *Hard Constraints* (fixed transfer limits that cannot be exceeded):
 - Results in increased use of the transmission system because wheeling and hurdle rates are cut in half or eliminated.
 - Does not allow flow on any pipe to exceed the maximum level identified in Sensitivity 1 for that pipe.
 - CRA is not sure whether Option A or B results would differ much from Sensitivity 1 because the pipe sizes are the same.

Hard Constraints vs. Soft Constraints in BAU Sensitivity 2

- Option C - *Soft Constraints* (overload charge) in conjunction with the reduction or elimination of wheeling and hurdle rates:
 - Allows a different transmission build-out than Sensitivity 1 because you are not fixing the pipe sizes.
 - If wheeling/hurdle rates are reduced instead of eliminated, the SSC needs to decide by how much.
- Summary: Options A&B show a different use of the same-sized pipes; Option C shows a different result based on likely different pipe sizes. What is the SSC trying to model in BAU Sensitivity 2?

3. Determination of Fixed Transfer Limits – BAU

- No matter which option is chosen for BAU Sensitivity 2, the MWG recommends changing the soft constraint to a hard transfer limit for other sensitivities for that future.
- Thus, if Options A or B are chosen, for BAU Sensitivities 2 and above the MWG recommends using Hard Constraints based on either the Baseline Infrastructure or Sensitivity 1 Transfer Limits.

3. Determination of Fixed Transfer Limits – BAU

- If Option C is chosen, for BAU Sensitivities 3 and above the MWG recommends using Hard Constraints based on either the Baseline Infrastructure Transfer Limits or Sensitivity 1 or 2 Transfer Limits.
- If the SSC decides to run BAU Sensitivities with hard transfer limits from either Sensitivity 1 or 2, the SSC needs to determine how those transfer limits will be set.

3. Determination of Fixed Transfer Limits – BAU

MWG has prepared 2 options

- Option 1: Transfer limits set at maximum value of the flows over each pipe from the relevant sensitivity.
- Option 2: Transfer limits would be set to a level of usage over each pipe in the relevant sensitivity based on a specific methodology to be determined.
 - Option 2 will result in a different set of transfer limits than Sensitivity 1.

3. Discussion of the 2 options to determine Fixed Transfer Limits – BAU

- Why set the transfer limits at maximum value of flows from the relevant sensitivity (Option 1):
 - the transmission build-out cost estimate would be consistent with more of the sensitivities that are run (because you would be using the same increased transfer levels as Sensitivity 1);
 - you are already applying a discount to the shadow price before you start Sensitivity 1 (one standard deviation for the BAU);
 - with only 20 load blocks per 5 year period, it is unknown if we will have enough granularity to make an informed decision on what reductions to the transfer limits we would make;
 - no one has proposed a specific alternative method; and
 - it avoids another decision point and judgment call in the process.

3. Discussion of the 2 options to determine Fixed Transfer Limits – BAU

- Why set the transfer limits at a level of average usage over each pipe in the relevant sensitivity, based on a specific methodology to be determined (Option 2):
 - it doesn't make sense to size an upgrade at the maximum flow value—which may only occur for a few hours of the year.
 - CRA has stated that they can provide “flow duration” data for the soft constraint cases on which to base a more reasonable level of the upgrade for each pipe—e.g. – mean, median, one std deviation up or down, etc.

Transmission Decision Points - BAU

1. EIPC/CRA Soft Constraint Approach for BAU Sensitivity 1?
2. BAU Sensitivity 2 Approach – Options A, B or C? If Option C, how much will the charges be reduced, or will they be eliminated?
3. Determination of Fixed Transfer Limits – based on pipe usage (using an agreed-upon methodology) or maximum flow?
4. *Future decision* by the SSC after CRA runs Sensitivities 1 and/or 2 (due within one week)– which transfer limits to use for the other BAU sensitivities.

Questions and Discussion

