Transfer Limit Hardening (TLH) Methodology

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Transfer Limit Hardening (TLH) Methodology

- Need to translate the NEEM soft constraint results to fixed transfer limits for futures 2, 3, 5, 6, 7 and 8
- For each future, SSC will have to decide whether to use Baseline Infrastructure transfer limits or transfer limits based on the soft constraint sensitivity results
- If the SSC chooses the latter, the approved transfer limit hardening methodology will be applied to the preferred soft constraint sensitivity flows to develop new fixed transfer limits

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TLH Methodology Notes

- Methodology is not based on reliability
  - PAs will consider reliability implications of increased transfer limits in Phase II
    - Consideration of reliability implications will lead to larger name-plate increases in transmission than are utilized in the model
- Methodology is only about increasing the "pipes" (i.e. transfer limits) not about building specific lines
- Soft constraint sensitivity will not be a true "Base Case"
  - Establishing fixed transfer limits based on soft constraint sensitivity flows will lead to different flows than occurred in the soft constraint sensitivity
- Changes in pipe size will be a vital input to Phase II of the process

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TLH Methodology Options

- Three proposed methodologies
  - NGO Proposal
    - Focused on Flow Duration Curve and fraction of time the pipe is full
  - Ruthven/Hadley/Chattopadhyay (RHC) Proposal
    - Focused on pipe capacity factors and shadow prices
  - Johnson Proposal
    - Focused on total energy flow and base line utilization
- All methodologies based on 2020-35 data
- SSC can change parameters used in proposals

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NGO Proposal

- Set pipe size equal to total flow at designated cutoff point on OL75 or OL25 flow duration curve
  - Flow above the limit is eliminated
  - No transfer limit increase if cutoff point is below baseline limit
  - NGO default value for cutoff is 20% for OL25 and 10% for OL75

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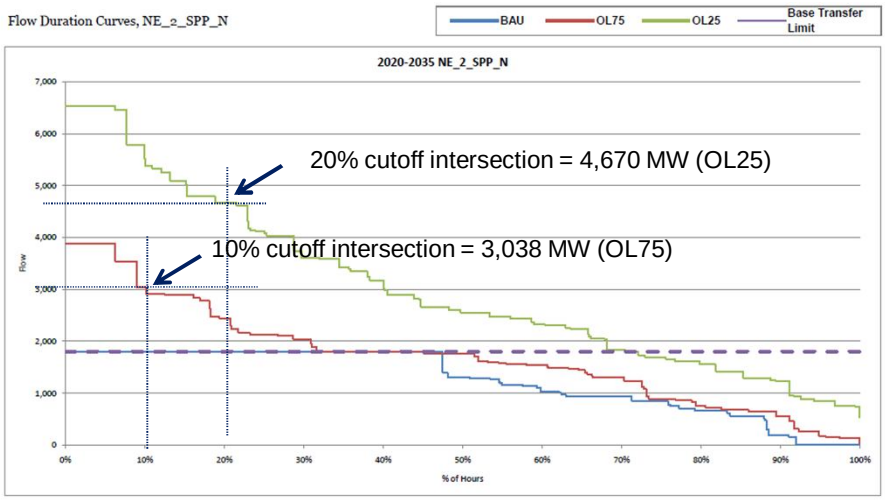
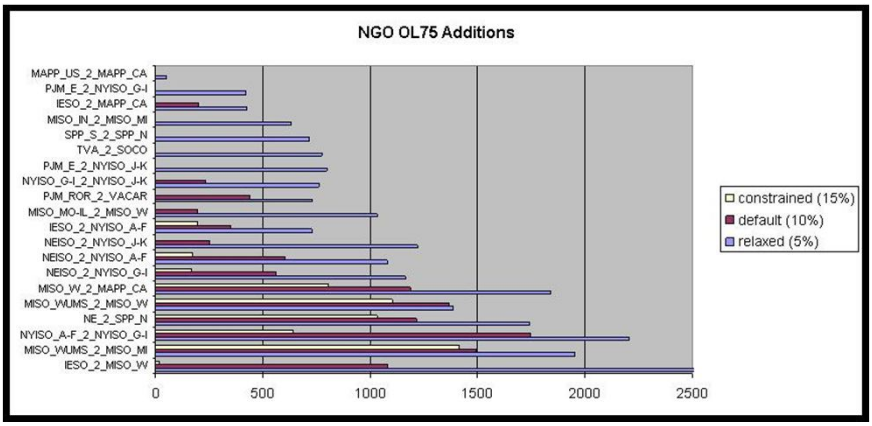
NGO Example



	Base Transfer Limit	BAU	OL75	OL25
5%	1,800	1,800	3,879	6,534
10%	1,800	1,800	3,038	5,515
20%	1,800	1,800	2,442	4,670
30%	1,800	1,800	2,041	3,611

NGO BAU OL75



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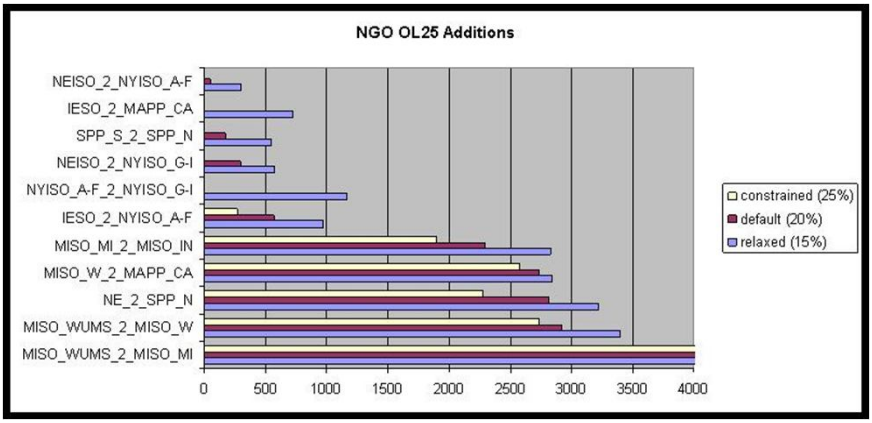
NGO BAU OL25



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NGO Proposal

Pros

- Simple methodology – the lower the cutoff point, the higher the increases in transfer limits
- Implicitly takes into account "value" of path as increased flows of OL75/25 reflect economic response to soft constraint price signals

Cons

- Arbitrary cut-off point
- Doesn't explicitly take into account differential values of expansions
- Method doesn't factor in different shapes of curve to left or right of cut-off point

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RHC Proposal

- Calculate capacity factors for total and overflow pipes from flow duration curves
- Calculate desired capacity factor for pipes
  - Desired capacity factor determined using input parameter and inverse proportion to shadow price
  - For total flows, shadow price over all hours used (parameter 1)
  - For overload flows, shadow price only for congested hours used (parameter 2)
    - Overload flows target CF subject to a Maximum CF (parameter 3)
- Select pipe sizes to achieve desired capacity factor
  - Higher shadow price means lower capacity factor needed so larger pipe selected
- Increased transfer limits developed based on average of total flow (baseline + overload) and overload flow-only calculations

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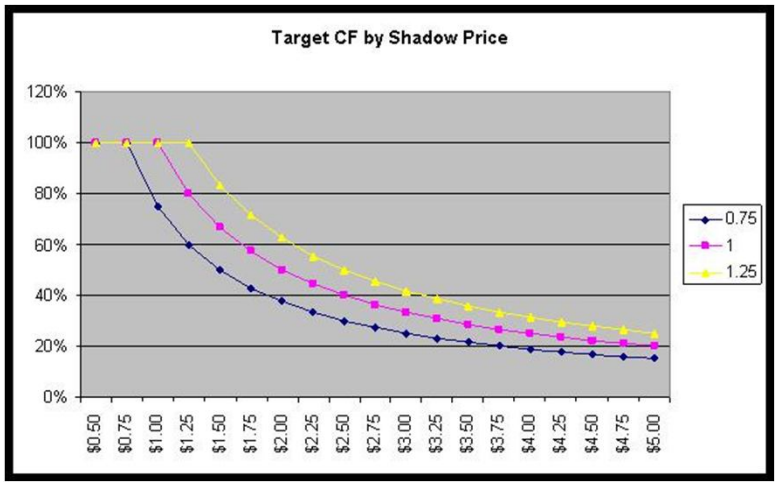
RHC CF-Shadow Price Curve Parameter



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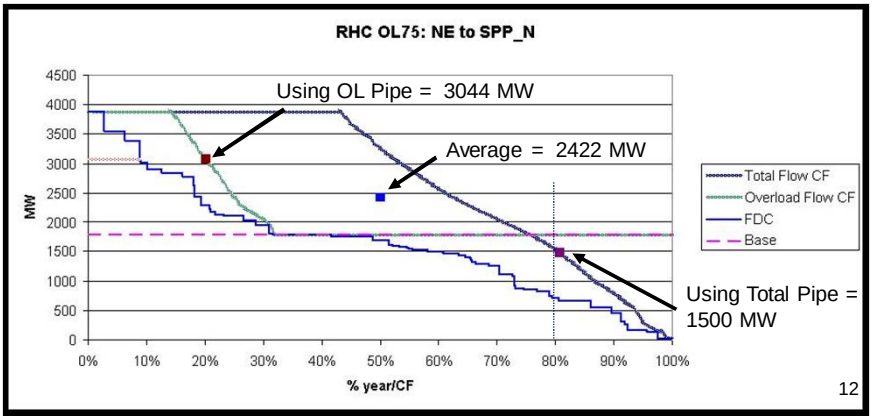
RHC Method Example

- Capacity factor is ratio of energy actually transferred to total possible at given capacity
- Shadow prices set target capacity factor
  - 20% for Overload pipe, 81% for Total pipe



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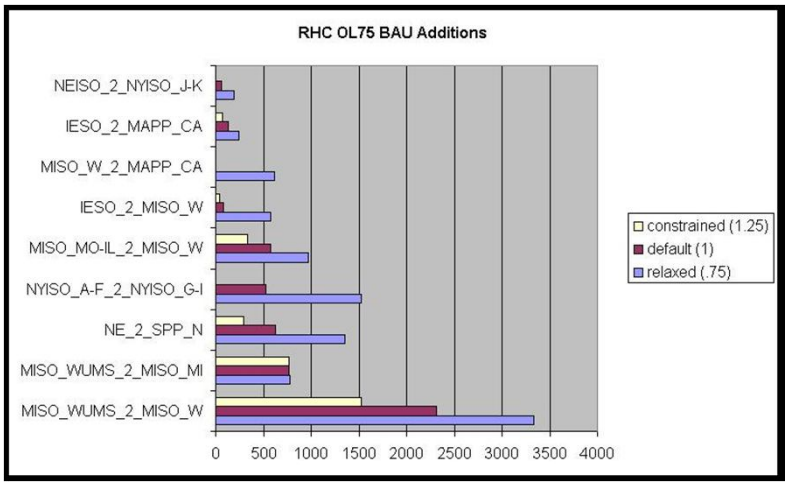
RHC BAU OL75



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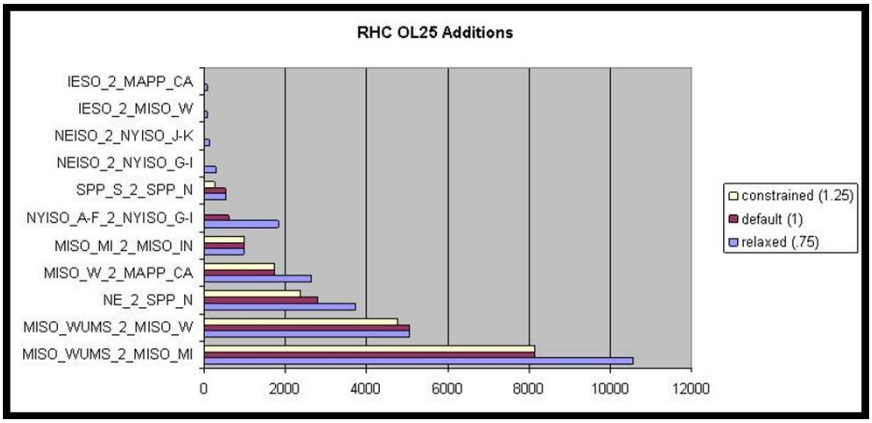
RHC BAU OL25



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RHC Proposal

Pros

- Using both total flows and overload flows provides information on most congested interfaces and on areas most economic for generation expansion
- Relating desired pipe capacity factors to shadow prices leads to more "valuable" interfaces being increased more

Cons

- Complex
- Arbitrary target capacity factor-shadow price curve
- Some stakeholders believe shadow prices hide important information and should not be relied upon
  - Shadow prices contain only information on marginal benefits expanding the pipes by 1 MW but do not contain information on full range of capacity expansion value or capital costs

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Johnson Proposal

- Total flows from the OL75 and OL25 sensitivities is used to derive increased transfer limits
- Minimum baseline capacity utilization factor threshold
  - Default value of 90% (parameter 1)
- Increases transfer limits based on average MW flow (derived from total flows) to a desired capacity factor
  - Default value of 75% (parameter 2)
- Simple method that relies on using "energy" transfer in the OL25 or OL75 sensitivities between NEEM regions as a proxy indicator for increasing transfer limits

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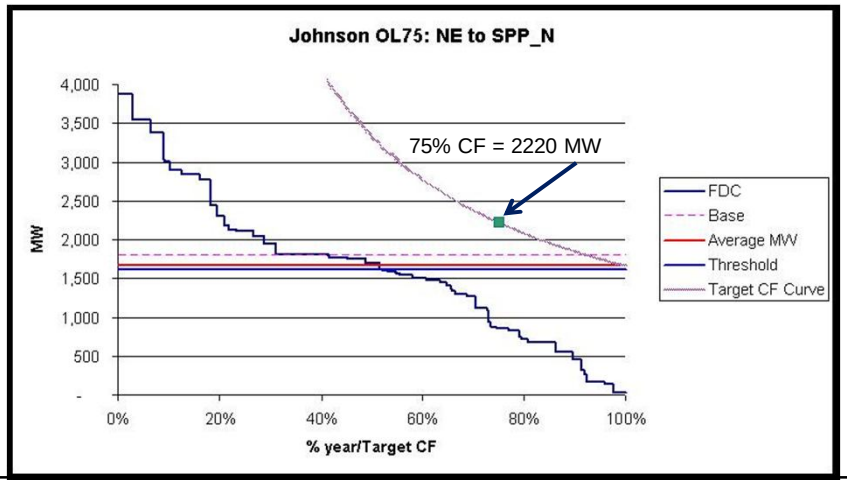
Johnson Method Example

- Utilization Threshold = 1,665/1,800 = 92% > 90% so expand
- Final amount converts energy to pipe with 75% capacity factor



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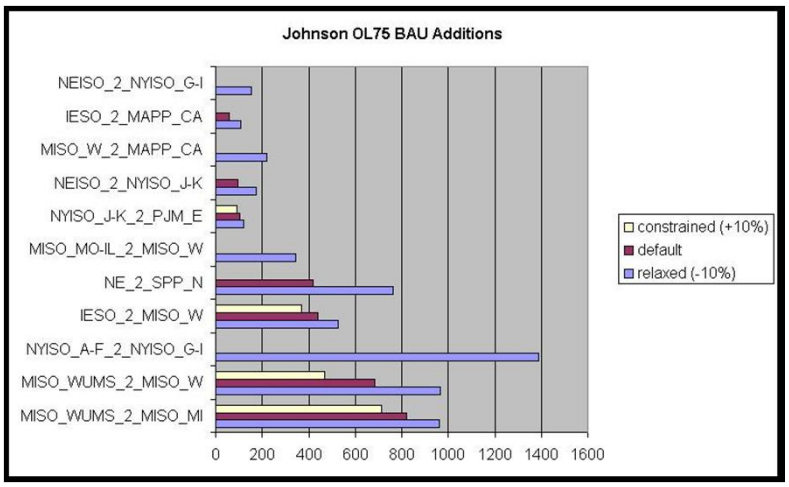
Johnson BAU OL75



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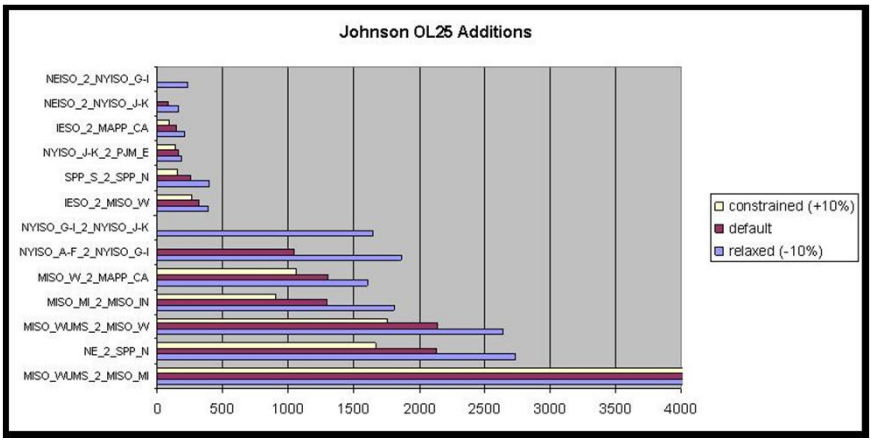
Johnson BAU OL25



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Johnson Combined Proposal

- Proposal also has an “option” to combine the OL75 and OL25 results
  - Designed for facilitating compromise if consensus cannot be achieved of using the OL75 or OL25 results
- Uses logic on OL25/OL75 ratios to combine results from OL75 and OL25 to create one set of results for each future
- Desired capacity factor based on OL25/OL75 ratio range look up table

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Johnson Proposal

Pros

- Simpler methodology based on target capacity factors
- Flows contain implicit information on economics
- Combine method reflects a possible compromise if decisions on OL75 vs OL25 prove difficult

Cons

- Arbitrary thresholds and capacity factors that only indirectly take into account the economics of expansion
- Combine method has arbitrary relationship between OL25 and OL75 flows

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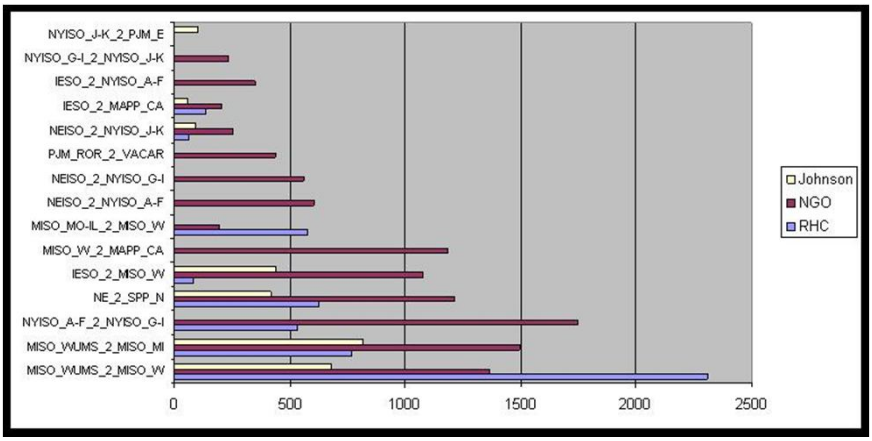
OL75 Methodology Comparison



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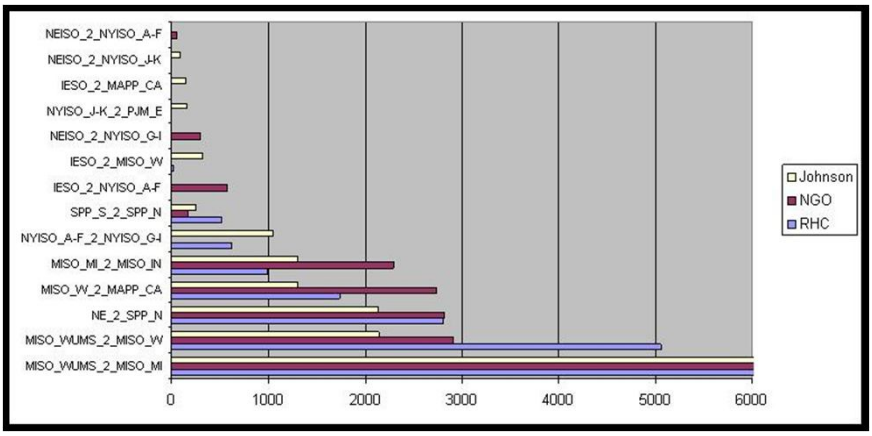
OL25 Methodology Comparison



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SSC Decision Point

- Option A: SSC Chooses a preferred methodology now and agrees upon methodology parameters
- Option B: SSC approves TLH process but defers specific methodology decision

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Option A

- SSC must agree to:
  - A preferred methodology
    - One of the three or a combination
  - Specific parameters to be used in the methodology (i.e. capacity factor-shadow price curve, capacity utilization threshold, flow duration threshold, etc.)

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Option A

- SSC approves a preferred methodology and parameters while allowing NEEM-TX subteam flexibility to analyze Future 2 and Future 3 results using alternative methodologies and/or parameters when results are released
  - Subteam will meet immediately after results are released to make any recommendations (if necessary) on how methodology should be altered given new information
  - If necessary, SSC approves any modifications to the preferred methodology
  - If subteam does not have consensus on any possible alterations then SSC decision is necessary

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Option A

Pro

- Process will be (mostly) finished
- Methodology will be uniformly applied to all futures

Con

- Subteam reluctance to approve any methodology in advance of getting more data
- Decision has large implications for EIPC process therefore as much time as possible should be used

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Option B

- SSC discusses and approves 3 methodologies under discussion be used to evaluate Future 2 and Future 3 data
- After Future 2 and Future 3 soft constraint data are released, NEEM-TX subteam immediately:
  - Processes data using approved methodologies
  - Meets to make a recommendation on a set of fixed transfer limit numbers and a methodology
- SSC approves NEEM-TX recommendation
  - If NEEM-TX subteam does not reach consensus, SSC will have to resolve a decision point

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Option B

- After Future 3, subteam will attempt to make definitive recommendation on a TLH methodology to be applied uniformly to remaining futures
- Certain stakeholders believe it might be reasonable to support separate methodologies for the national and the regional futures, others prefer a uniform methodology for all futures

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Option B Timeline

- Day 0: CRA delivers F2 base case and soft constraint sensitivity results
- Day 0-1: NEEM-TX Subteam processes results using established methodologies and disseminates information to stakeholders
- Day 1 (and 2 if necessary): NEEM-TX subteam meets to discuss results and any alterations necessary to reach a consensus recommendation on one set of numbers and a methodology to be used. Recommendation or decision item sent to EIPC end of day 2
- Day 3-4: EISPC discusses issue
- Day 5: SSC conference call to approve NEEM-TX subteam recommendation or resolve decision item
  - At same call, SSC decides whether to use baseline or soft constraint transmission for remaining F2 sensitivities

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Option B

Pro

- Allows for consideration of a much larger data set
  - Given importance of the EIPC decision on values for interface limits, receiving data from Futures 2 and 3 is anticipated to help solidify a preferred methodology

Con

- Puts off decision until a later date creating possible timing issues
  - Decisions must be completed to match schedules of SSC, EISPC, EIPC and CRA within 1 week
- Creates possible comparability/subjectivity issues if a uniform methodology is not agreed to and utilized for all futures

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