Transmission Access Charge Options - Benefits Assessment Methods -

Stakeholder Working Group – March 9, 2016

March 9, 2016 working group agenda

Time (PT)	Topic	Presenter
10:00-10:10	Introduction and context	Lorenzo Kristov
10:15-11:00	Survey of other ISO/RTO approaches	Bill Weaver
11:00-12:00	TEAM approach for economic projects	Abhishek Singh
12:00-12:45	Lunch	
12:45-1:45	DFAX approach for reliability projects	Abhishek Singh
1:45-2:00	Stakeholder proposal	
2:00-2:50	Policy projects	Open discussion
2:50-3:00	Next Steps	Lorenzo Kristov

Initiative Schedule

Milestone	Date
Issue Paper posted	October 23, 2015
Stakeholder conference call	October 30, 2015
Stakeholder comments due	November 13, 2015
Workshop #1 on Issue Paper (SLC)	December 15, 2015
Workshop #2 on Issue Paper (Folsom)	January 11, 2016
Straw Proposal & Spreadsheet Tool posted	February 10
Stakeholder meeting	March 1
Working group on benefits methodologies	March 9
Stakeholder comments due	March 23
Post Draft Final Proposal	Mid April
Stakeholder meetings & comments	Dates TBD
Present proposal to ISO Board of Governors	June 28, 2016

Context:
ISO Straw Proposal of Feb. 10, 2016

Only facilities eligible for regional cost allocation will be "new regional facilities."

Three steps necessary to determine regional cost allocation:

1. Facility must be planned and approved through the integrated TPP for the expanded BAA. This makes it a "new" facility, but this is just the first step.
2. Facility must meet at least one of the following to be a "new regional facility":
   a) Voltage rating >300 kV (i.e., 345 kV or 500 kV)
   b) Interconnects or increases interconnection capacity between two sub-regions
   c) Creates, increases, or supports increase of intertie between expanded BAA and a neighbor BAA
3. Sub-region cost shares will align with benefit shares, per benefits assessment methodology

Three methods of benefits assessment are proposed for three major transmission project categories.

- Reliability – DFAX
- Economic – TEAM with allocation of total benefits to sub-regions
  - Energy benefits
  - Local capacity benefits (increased import capability into constrained internal areas)
  - System capacity benefits (increased import capability to the expanded BAA)
- Policy – Basic principle is that all sub-regions may benefit from a policy project that was initially driven by one sub-region's or one state's policy.

These are initial proposals – other suggestions are invited!

Survey of Cost Allocation Approaches of Other ISOs/RTOs

Terminology

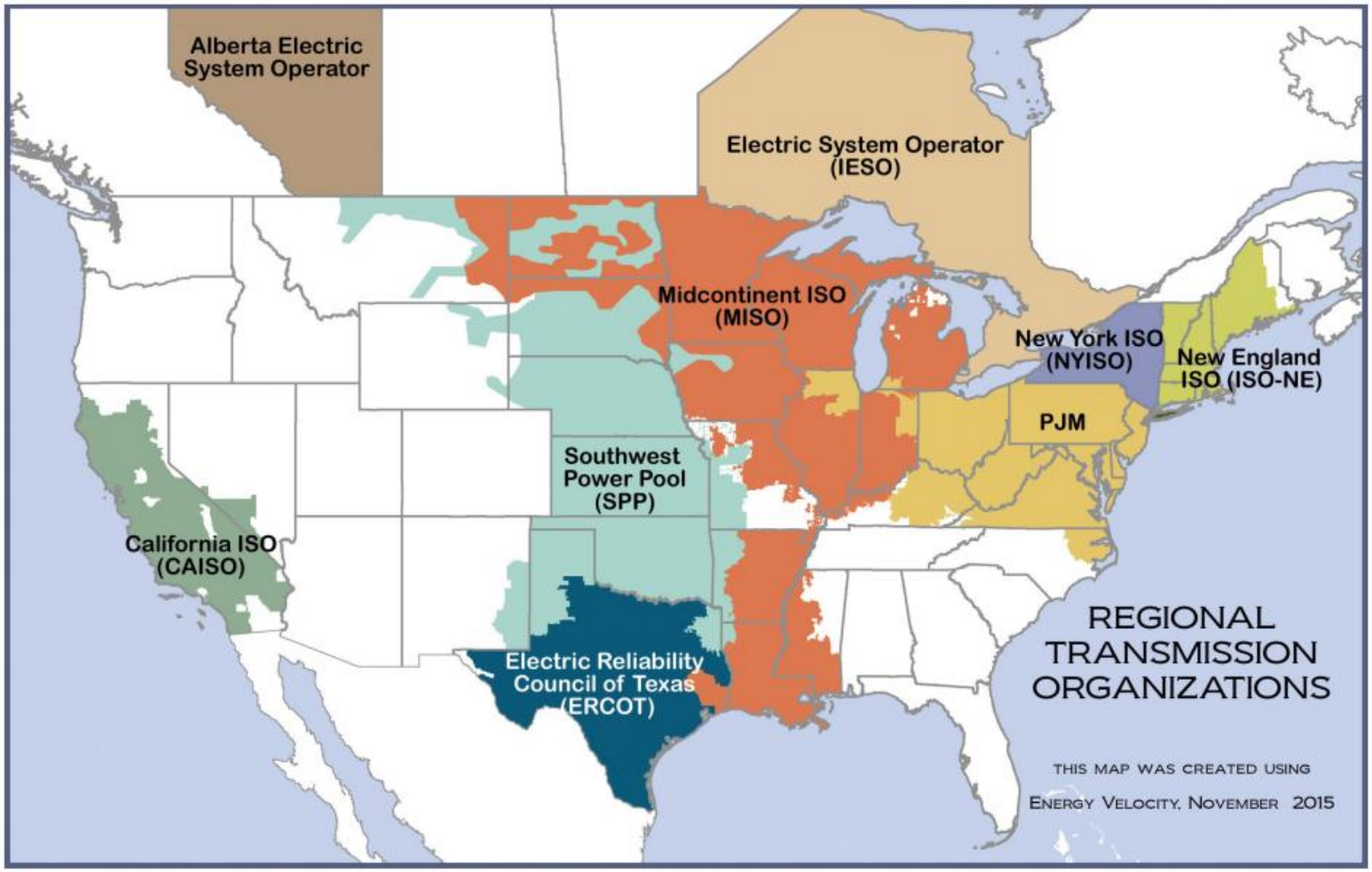
- Postage Stamp:
  - Every transmission customer (load) pays the same rate
  - Also known as a “rolled in” or “peanut butter” rate
  - Generally based on MWh or peak MW usage
  - Currently used to recover CAISO “regional” transmission costs (> 200 kV)
- License Plate:
  - Every transmission customer (load) pays the same rate within its defined sub-region—usually a single TO’s service territory
  - Rates typically differ across sub-regions
  - Generally based on MWh or peak MW usage

Order No. 1000

Established 6 Regional Cost Allocation Principles for New Projects:

1. Costs must be allocated in a way that is roughly commensurate with benefits
2. Costs may not be allocated involuntarily to those who do not benefit
3. A benefit to cost threshold may not exceed 1.25.
4. Costs may not be allocated involuntarily to a region outside of the facility's location
5. The process for determining benefits and beneficiaries must be transparent
6. A planning region may choose to use different allocation methods for different types of projects

ISO/RTOs


Alberta Electric System Operator
Electric System Operator (IESO)
Midcontinent ISO (MISO)
New York ISO (NYISO)
New England ISO (ISO-NE)
PJM
Southwest Power Pool (SPP)
California ISO (CAISO)
Electric Reliability Council of Texas (ERCOT)
REGIONAL TRANSMISSION ORGANIZATIONS
THIS MAP WAS CREATED USING
ENERGY VELOCITY, NOVEMBER 2015

The RTOs

- Order No. 1000 does not mandate specific categories for new projects or specific cost allocation methodologies
- Accordingly, RTOs differ significantly in how they differentiate among project categories (e.g., by voltage, by purpose)
- And RTOs differ in which cost allocation methodologies they use for which project categories

The RTOs (by voltage)

	PJM	MISO	SPP	ISO-NE
High-Voltage	Reliability Projects: 50% allocated on postage-stamp basis to pricing zones based on load ratio share. 50% allocated to identified beneficiaries using DFAX. Economic Projects: 50% allocated on postage-stamp basis to pricing zones based on load ratio share. 50% allocated to identified beneficiaries by analyzing expected decreased LMP payments for LSEs.	Reliability Projects: ◦ Baseline Reliability projects are allocated to the local pricing zones. Economic Projects: ◦ Market Efficiency Project: ≥ 345 kV, cost $5 million or more, and meet certain benefit criteria. ◦ 20% of the costs are allocated on a system-wide basis and 80% of the costs are allocated to one of the 9 “local resource zones,” which generally is the local state. ◦ Market efficiency projects must reduce congestions and the benefits must be 1.25 times greater than the costs. Public Policy Projects ◦ Multi-Value Projects: Regional, high-voltage transmission facilities designed to “address energy policy laws and/or provide widespread benefits across footprint.” Allocated via postage stamp.	"Highway": Facilities ≥ 300 kV are allocated via postage stamp rate. "Byway": Facilities 100 kV to 300 kV: ◦ 1/3 allocated via postage stamp rate. ◦ 2/3 allocated via license plate rate. ◦ Ratios switch when serving designated wind resources across zones.	Reliability Projects Facilities ≥ 115 kV are allocated via postage stamp rate based on monthly zonal coincident peak loads. Economic Projects “Market Efficiency Transmission Upgrades” not needed for reliability but with greater system benefits than costs are allocated the same as reliability upgrades. Also must be ≥ 115 kV. Public Policy Projects 70% allocated via postage stamp. 30% allocated among states driving the public policy need.
Low-Voltage	Neither Regional Facilities nor Necessary Lower Voltage Facilities.[1] Based on identified beneficiaries using DFAX.[2]	Below 345 kV and non-MVP: license plate rate to zone where costs are incurred.	Below 100 kV: zonal/license plate rate to zone where costs are incurred.	Lower voltage and non-METU economic projects: license plate rate to zone where costs are incurred.

MISO

- Reliability Projects
  - Allocated to the PTO where it's located (local pricing zone).
    - Formerly: At/Above 345 kV: 20% allocated system-wide and 80% allocated to affected pricing zones based on Line Outage Distribution Factors

MISO

- Economic Projects
  - Market Efficiency Project (formerly Regionally Beneficial Project): 345 kV, cost $5 million or more, and where benefits are 1.25 times the costs.
  - 20% of the costs are allocated on a postage stamp basis and 80% of the costs are allocated to one or more of the 9 “local resource zones,” which generally are the states
  - 80% is allocated among zones based on relative benefits to each zone

MISO

- Public Policy Projects
  - MISO selected its “Multi Value Projects” or “MVPs” through a 2011 stakeholder initiative
  - The MVP Portfolio consisted of sixteen 345 kV transmission lines and one 765kV transmission line designed to reach remote wind areas
  - ➢ MVP costs are allocated via postage stamp rate based on MWh

MISO MVPs

Must meet 3 public policy criteria:

1. Must support public policy requirements that govern the minimum or maximum amount of energy to be generated
2. Must provide multiple types of economic value across multiple pricing zones, with benefits exceeding costs
3. With quantifiable benefits, must address at least: one potential NERC reliability violation; *and* one economic-based transmission issue

Must satisfy 6 conditions:

1. Associated facilities cannot be approved or in-service before 2010 (or when new TO joins)
2. Relevant TO must approve before construction
3. May not contain certain pre-selected facilities
4. Cost must exceed $20mm
5. Must be above 100kV
6. Cannot be driven solely by an interconnection request

PJM

- Regional Facilities:
  - All facilities above 500kV, and double-circuit facilities above 345 kV
- Necessary Lower Voltage Facilities:
  - Below the voltage limits for Regional Facilities, but must be constructed to support new Regional Facilities

PJM

- Regional Facilities and Necessary Lower Voltage Facilities:
  - 50% of costs allocated on postage-stamp basis to pricing zones based on load ratio share (MWh)
  - Reliability Projects:
    - Other 50% is allocated to identified beneficiaries using solution-based distribution factor (DFAX)
  - Economic Projects:
    - Other 50% is allocated to identified beneficiaries by analyzing expected decreased LMP payments for LSEs
    - ARRs and FTRs excluded from analysis

PJM

- Lower Voltage Facilities:
  - Neither Regional Facilities nor Necessary Lower Voltage Facilities
  - PJM applies the same cost allocation methodologies to reliability and economic projects, but removes the 50% postage stamp component
    - Reliability projects allocated 100% via DFAX
    - Economic projects allocated 100% via LMP analysis

SPP

- SPP uses its “Highway/Byway System”
- Highway: Facilities at or above 300kV
  - Costs allocated via postage stamp rate
- Byway: Facilities between 100 kV and 300 kV
  - 1/3 of costs are allocated via postage stamp rate
  - 2/3 of costs are allocated via zonal/license plate rate (TO service territory)
  - But ratios switch where an SPP wind plant is the source and the transmission facility crosses multiple TO zones
  - The costs of facilities below 100 kV are allocated 100% via zonal/license plate rate

ISO-NE

- Reliability Projects:
  - Facilities needed for reliability reasons ≥ 115 kV
- "Market Efficiency Transmission Upgrades"
  - Not needed for reliability but have greater system benefits than costs. Also ≥ 115 kV
- Reliability and METUs are allocated via postage stamp rate based on monthly zonal coincident peak loads
- Lower voltage facilities are allocated via license plate rate to local TO service territory

ISO-NE

- Public Policy Projects
- NESCOE (Board appointed by each of the 6 NE governors) identifies public policy requirements driving transmission needs for ISO-NE's Regional System Plan
  - Stakeholders may submit any other public policy requirements for consideration by ISO-NE
- Potential project sponsors then submit proposed solutions (first conceptually, then concretely)

ISO-NE

- Public Policy Projects
- Cost Allocation
  - 70% of costs are allocated region-wide via postage stamp rate
  - 30% of costs are allocated among states with a public policy the project addresses based on each state's share of the planning need, as determined by NESCOE
    - Generally each state's load ratio share

TEAM Approach for Assessing Benefits of Economic Projects

Economic Projects – Overview of TEAM methodology and ISO's current practice

- Transmission Economic Assessment Methodology (TEAM) provides principles for economic planning assessment
  - Framework to quantify economic benefits of a proposed transmission project
    - Energy benefits
    - Capacity benefits
    - Other benefits if applicable
  - Normally for rate-based economic driven projects
- ISO implemented TEAM in the TPP economic planning studies
  - All benefits are assessed from ISO ratepayers' perspective

Economic Projects – Benefits evaluated

- Energy Benefits from production simulation
  - Difference of net load payment between pre and post project cases
  - Generally,

    Net load payment = Gross load payment – Generator profit – Transmission revenue

    Gross load payment = sum (Load * LMP)

    Generator profit = Gen. revenue – Gen. cost

    Transmission revenue = shadow price * trans. limit
  - Only generators owned by the utilities serving ISO load are considered
  - Only PTO transmission is considered

Economic Projects – Benefits evaluated (cont.)

- Capacity Benefits
  - Local area capacity benefits
    - Conceptually an upgrade reduces the local capacity requirement
  - System capacity benefits
    - Potential increase in import capability from adjacent BAAs
      - Normally assessed through power flow and stability studies
    - Difference of marginal capacity costs between regions
  - Framework for expanded BAA still under development

Economic Projects – Assumptions for benefit assessment

- TEPPC Common Case for production cost simulation as the starting point
- Update load, natural gas and GHG prices based on the latest CEC forecasts
- Renewable portfolio from CPUC – currently assumes 33% RPS portfolio
- Generation retirement consistent with TPP reliability assumption
- All approved transmission projects
- Transmission constraints based on reliability, policy, and LCR study results
- Other updates reflecting market and grid operations

Economic Project Example – Energy Benefits

- Currently the benefits are reported for the ISO footprint.
- For the expanded BAA the economic benefits can be allocated across multiple sub-regions.
- The cost allocation would be based on the benefits shares observed for each of the sub-regions.

BAA Sub Region	Economic benefit calculated by production simulation	Load benefit	Generation benefit	Transmission benefit
Sub region 1	$25.6M	$30.3M	($4.1M)	($0.7M)
Sub region 2	$17.0M	$21.7M	($3.4M)	($1.3M)
Sub region 3	$15.0M	$21.7M	($4.4M)	($2.3M)

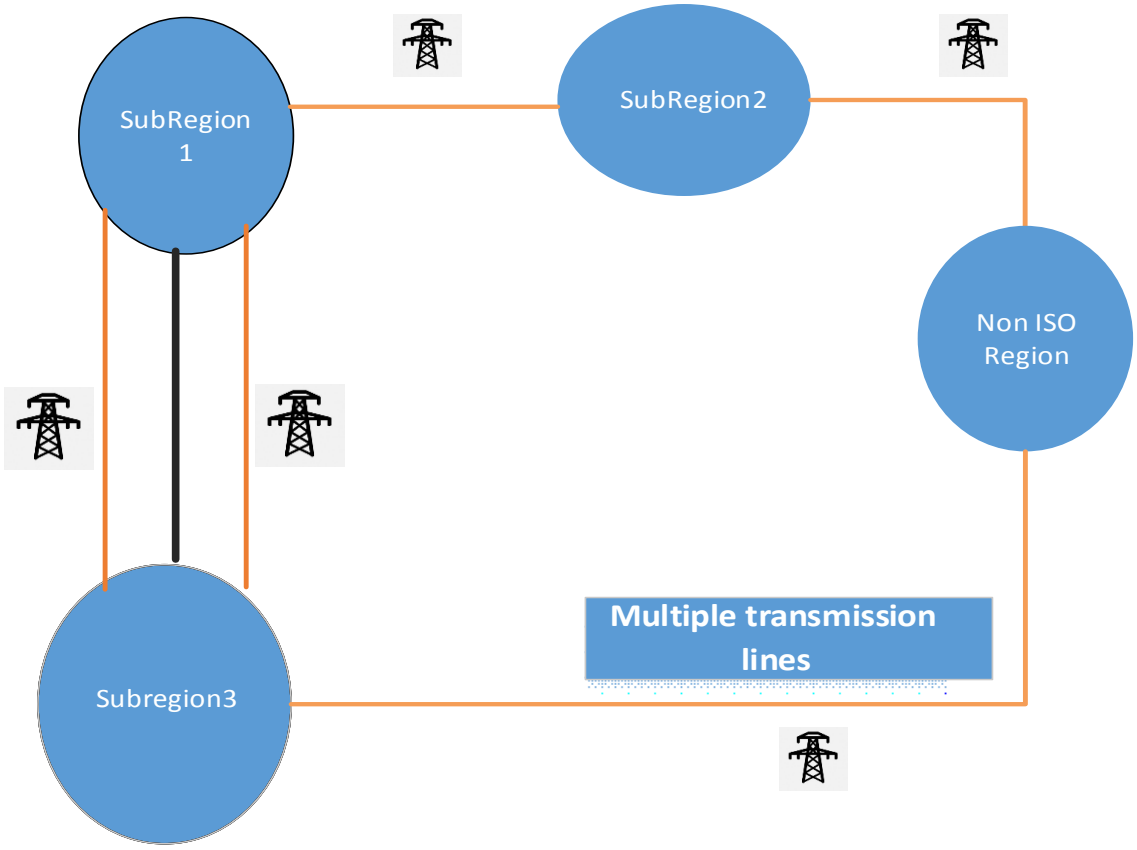
DFAX Approach for Assessing Benefits of Reliability Projects

Reliability Projects Cost allocation – DFAX method overview

- Use DFAX methodology similar to one used in PJM
  - Solution Based Directional DFAX
- DFAX methodology has 2 components :
  - Production Cost
  - Power Flow
- 8760 Production Cost determines hours of flow in each direction
- Power Flow component is based on a linearized (DC) power transfer on the transmission upgrade where
  - Source is the entire generation fleet (CAISO + new sub-region)
  - Sink is the individual sub-regional load
- Power Flow component provides the usage of transmission upgrade under peak conditions

Reliability Projects Cost allocation – DFAX method

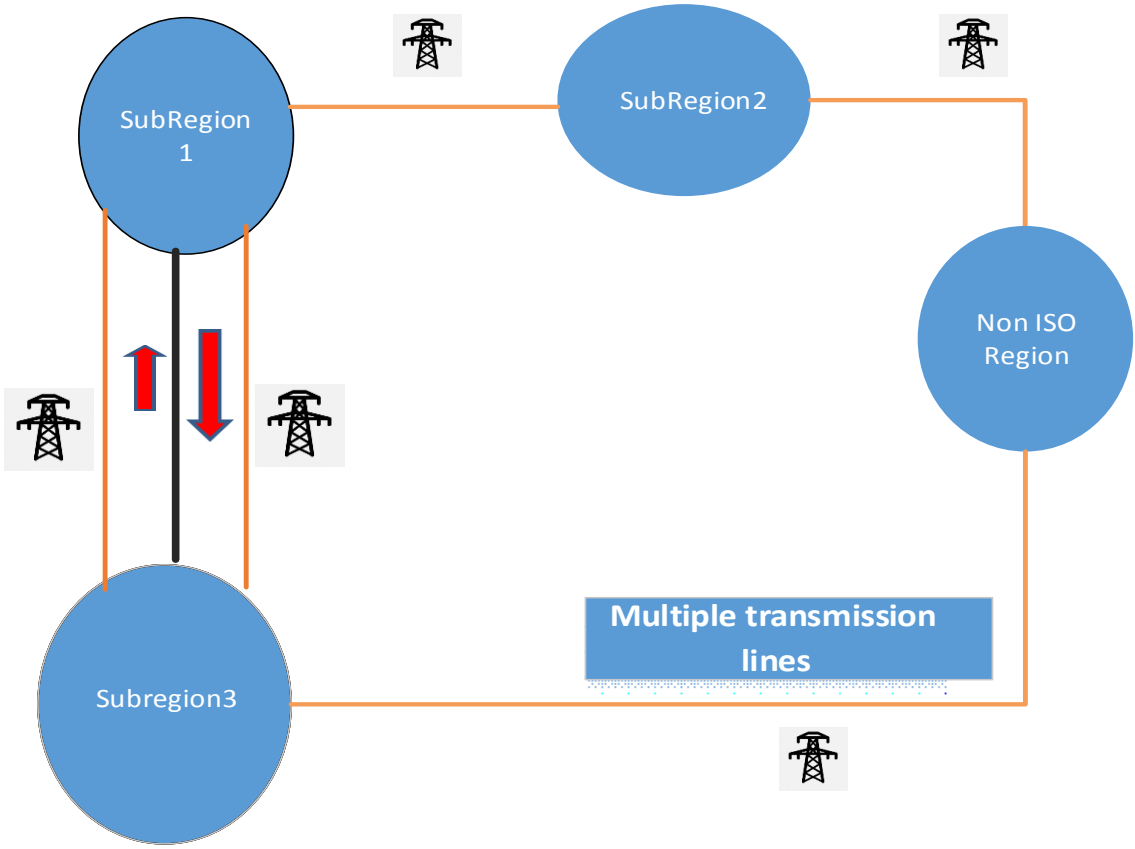
- 3 sub-regions and one non-ISO region connected by transmission lines
- The black line between sub-region 1 & 3 is the proposed new 500 kV upgrade in this hypothetical scenario.



Reliability Projects Cost allocation – DFAX method

Production Cost Component

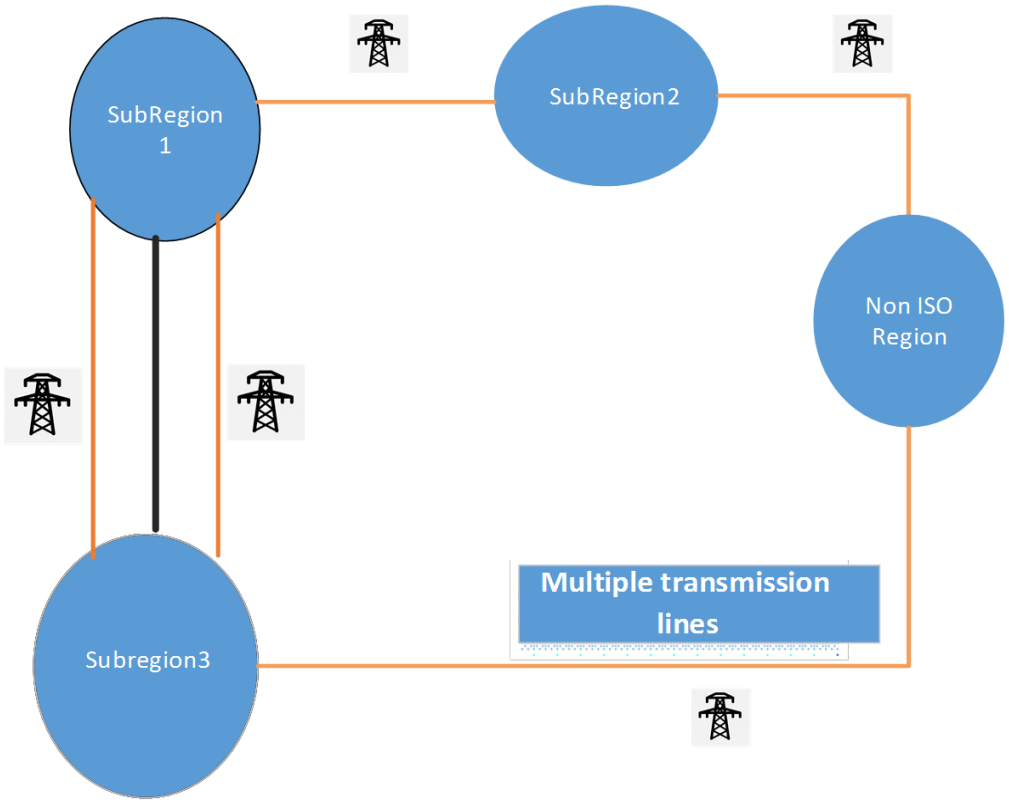
- 8760 hours of simulation
- Simulation determines
  - Number of hours flow in N-S Direction
  - Number of hours flow in S-N Direction
- Calculate the directional % usage of the upgrade by subregions
  - 70% in N-S direction
  - 30% in S-N direction



Reliability Projects Cost allocation – DFAX method

Power Flow Component

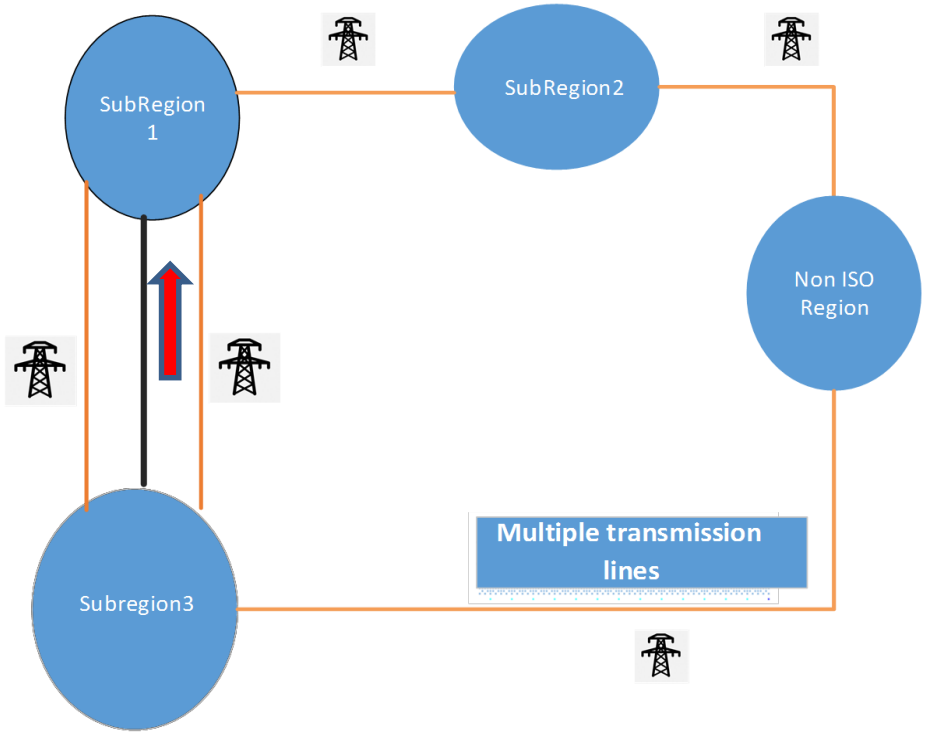
- Assumptions for the example
  - Sub-region 1 & Sub-region 2 peak at the same time (let's assume Winter)
  - Sub-region 3 peaks in Summer
  - We will need two different power flow cases with different generation dispatch assumptions.



Reliability Projects Cost allocation – DFAX method

- Sub region 1 & 2 peak power flow case
  - Sub-region 1 & sub-region 2 peak at the same time (Let's assume Winter)
  - Line Flow in South to North direction on the upgrade
  - If an additional MW is sent from Source to Sub-region 1 in this case what amount will flow on proposed upgrade?

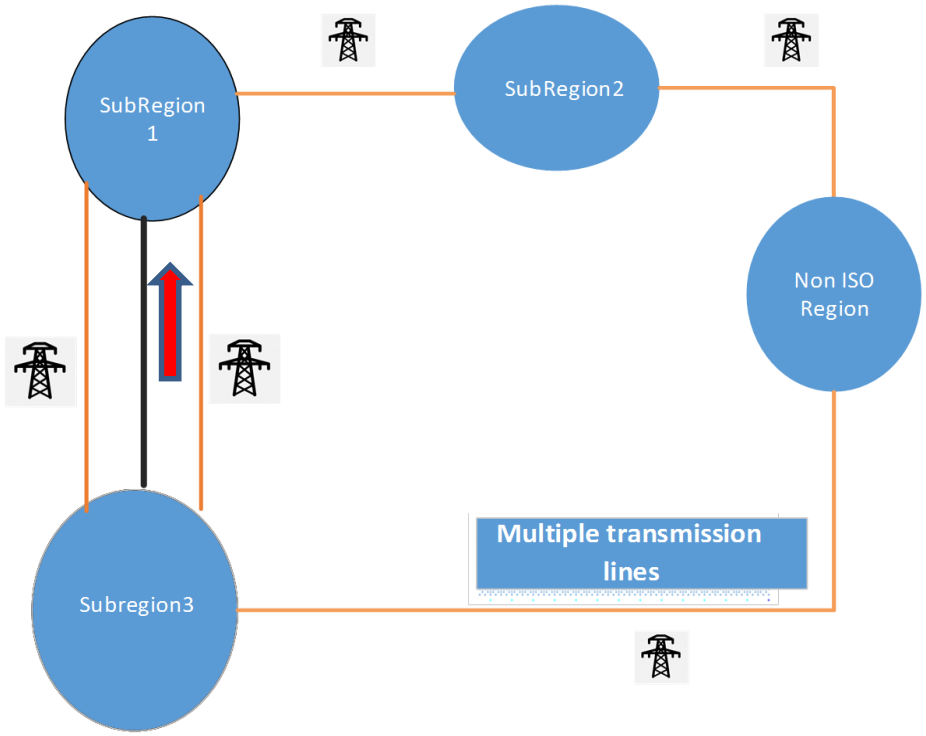
=> DFAX-Sub-region 1



Reliability Projects Cost allocation – DFAX method

- Sub region 1 & 2 peak power flow case
  - Sub-region 1 & Sub-region 2 peak at the same time (Let's assume Winter)
  - Line Flow in South to North direction on the upgrade
  - If an additional MW is sent from Source to Sub-region 2 in this case what amount will flow on proposed upgrade?

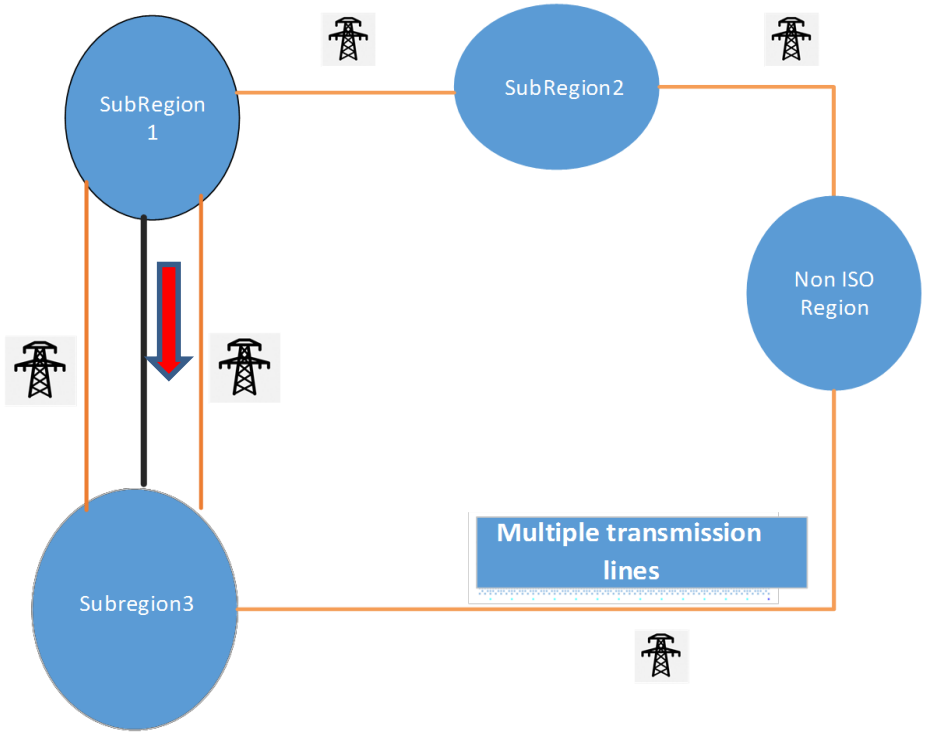
=> DFAX-Subregion 2



Reliability Projects Cost allocation – DFAX method

- Sub region 3 peak power flow case
  - Sub-region 3 peaks in Summer
  - The signs have reversed in this scenario
  - If an additional MW is sent from Source to Sub-region 1 in this case what amount will flow on proposed upgrade?

  => DFAX-Subregion 3



Reliability Projects Cost allocation – DFAX method

- Step 1 values can be derived from the load forecasts for the sub-region (non-coincident peaks)
- Step 2 values were obtained as explained in previous slides.
- Step 3 would be the sub-regional use for a particular load forecast and the static DFAX.

Step	Methodology	Reference	Subregion 1	Subregion 2	Subregion 3	Totals
1	**Peak Load**	**Load Forecast**	**2000**	**1000**	**4000**	**NA**
2	**DFAX**	**Power flow case**	**-0.5**	**-0.2**	**0.6**	**NA**
3	**Sub regional Use**	**step 2*step 1**	**-1000**	**-200**	**2400**	**NA**

Reliability Projects Cost allocation – DFAX method

- For Step 4 & 5 we assign (+ & -) direction based signs. In our case + is N-S flow on the upgrade.
- Step 4 & 5 values are equal to step 3 values
- Step 6 & 7 values calculate the % usage of the upgrade by sub-regions on a directional basis.

Step	Methodology	Reference	Subregion 1	Subregion 2	Subregion 3	Totals
4	**Zonal use (+) direction**	**From Step 3**			**2400**	**2400**
5	**Zonal use (-) direction**	**From Step 3**	**-1000**	**-200**	**0**	**-1200**
6	**% use (+) direction**				**100%**	**100%**
7	**% use (-) direction**		**83%**	**17%**		**100%**

Reliability Projects Cost allocation – DFAX method

- For Step 8 & 9 are the % values obtained from production cost slide
- Step 10 is the final cost allocation

Step	Methodology	Reference	Subregion 1	Subregion 2	Subregion 3	Totals
8	**Weighting Factor (+) direction**	**Production Cost**			**70%**	**NA**
9	**Weighting Factor (-) direction**	**Production Cost**	**30%**	**30%**		**NA**
10	**Cost allocation percentage**		**25.0%**	**5.0%**	**70.0%**	**100%**

DFAX methodology – Extension to non-flow reliability issues.

Reliability issues

- Overloaded lines
- Voltage/Stability issues
- Short circuit issues ?

How do we address Voltage/ Stability issues based on a flow based methodology ?

How do we handle short circuit issues ?

Stakeholder Presentation

Assessing Benefits of Public Policy Projects

Next steps …

- Please submit written comments by March 23
- ISO will post comments template
- ISO will announce dates of subsequent activities by market notice