Southwest Power Pool

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

February 19th, 2014

Web Conference

• SUMMARY OF ACTIONS TAKEN •

1. SPP Staff will provide more details about the methodology to identify local issues caused by new generation.
2. SPP Staff will contact PJM to exchange knowledge about the DFAX methodology
3. Run DFAX not scaling units with generation shift factor greater than 20%.
4. SPP Staff will include positive and negative DFAX in the analysis.
5. ESWG members will provide feedback regarding must-run on February 20th 4 PM.

Southwest Power Pool

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

February 19th, 2014

Web Conference

• MINUTES •

Agenda Item 1 – Administrative Items

Agenda Item 1a - Call to Order, Introductions

Chair Alan Myers (ITC Great Plains, LLC) called the meeting of the Economic Studies Working Group (ESWG) to order at 9:34 a.m., welcomed those in attendance. (Attachment 1 – Attendance List)

There were 33 web conference participants representing 10 of 11 members.

Agenda Item 1b – Receipt of Proxies

Juliano Freitas (SPP staff) requested proxy statements. Two proxies were identified, Greg Sweet (EMDE) proxy to Bary Warren (EMDE) and Kip Fox (AEP-Transource) proxy to Wayman Smith (AEP). (Attachment 2 – Proxies)

Agenda Item 1c – Review of Agenda

Chair Alan Myers (ITC Great Plains, LLC) presented the agenda for review and asked for any additions or corrections. The agenda was approved unanimously. (Attachment 3 – Agenda)

> **A motion to approve the proposed agenda was made by Kurt Stradley (LES) and seconded by Leon Howell (OGE). The motion was approved unanimously.**

Agenda Item 2 – 2015 ITP10 Benchmarking

Juliano Freitas (SPP staff) asked for ESWG members to approve the Benchmarking model and results. SPP Staff posted the Benchmarking model on February 13th for members review. No major issues were found in the model.

> **A motion to approve the proposed agenda was made by Kurt Stradley (LES) and seconded by Leon Howell (OGE). The motion was approved. Bary Warren (EMDE) abstained.**

ACTION ITEM: Post results with latest model assumptions

Agenda Item 3 – 2015 ITP10 Must Run Units

Juliano Freitas (SPP Staff) asked for ESWG members to approve the list of Must-Run units proposed submitted by members during the generation review process. ESWG did not find a consensus regarding the units to be classified as must-run, the group had different points of view. One of the main concerns is about the minimum run time for coal units. Another idea is to let the model dispatch the units according SCUC/SCED, not designating any units as must run. ESWG members asked for more time to evaluate the units used as must-run, the new deadline to provide feedback is February 20th, 4PM.

Agenda Item 4 – Metrics Review

Antoine Lucas (SPP Staff) presented potential allocation methodologies and numerical examples regarding mitigation of transmission outage costs, assumed benefit of mandated reliability projects and public policy benefits. For assumed benefit of mandated reliability projects, Antoine considered two 345 kV reliability projects that were a part of the 2012 ITP10 and RCAR, Summit – Elm Creek 345kV and Elk City – Gracemont 345kV. SPP Staff performed DFAX analysis to obtain TDF by zone and then compared

DFAX reliability benefit to the benefit obtained using the highway/byway cost allocation approach. ESWG members pointed some possible issues involving the DFAX methodology:

- Units close to the transmission line being monitored can impact final results depending on how big is the generation shift factor. The recommendation is not to scale units with generation shift factor greater than 20%.
- Wind units below their maximum capacity were among the generation scaled in the transfers, even though wind cannot simply be dispatched to a higher capacity if desired.
- Negative DFAX can be an issue due to changes in flow direction. PJM checks the 8760 hours, groups the positive and negative DFAX and allocate the benefits separating both flow directions based on percentage of time the flow is positive and percentage of time the flow is negative.

ACTION ITEM: SPP Staff will contact PJM to exchange knowledge about the DFAX methodology.

ACTION ITEM: Run DFAX without scaling units that have generation shift factors greater than 20%.

ACTION ITEM: SPP Staff will include positive and negative DFAX in the analysis.

The second metric discussed was the public policy benefits. The benefits are allocated to zones in proportion to each zone's share of unmet renewable energy goals. SPP Staff used the Gentleman – Cherry – Holt 345 kV line from the 2012 ITP10 to illustrate the difference between the proposed and old methodology. The results showed benefits being allocated only to zones in the state in which the mandate/goal is driving the project; the previous methodology was based on SPP's percentage share of unmet renewable goals.

The last metric discussed was the mitigation of transmission outages; since it is difficult to develop normalized transmission outage data that reliably reflects the outages that could affect each load zone, this benefit is calculated on an SPP-wide basis and allocated to zones based on a load ratio share (Attachment 4 – Metrics Review). SPP Staff proposed two new methods to calculate the benefit:

- Method 1: Multiply each zone's APC benefit % by the Mitigation of Transmission Outage Costs total benefit to determine that zone's allocation of the Total Outage benefit
- Method 2: The number of outages by zone was divided by total outages for the region to obtain allocation factors by zone. Allocation factors were multiplied by total outages benefit.

Agenda Item 5 – Adding vs Combining Multiple Benefits

Mike Proctor brought a new idea to the ESWG members in order to calculate the benefits of reliability, policy and economic projects. The main purpose of his presentation was to discuss the arguments for and against including 100% of multiple benefits for a single project, leading to DECISION 1: Adding Multiple Benefits (100%) vs. Combining Multiple Benefits (less than 100%). Multiple benefits being discussed are: Reliability (reliability mandates are NERC/FERC public policy); Renewable Policy (renewable mandates and goals are state & local public policy); and Economic (economic upgrades that are cost beneficial are FERC public policy and include SO2 and NOX). In addition to the discussion, the formulas (equations) were developed for when inclusion of less than 100% of multiple benefits is chosen, leading to DECISION 2. This decision involves how much to include of each of the multiple benefits resulting in the total benefits to be included. This decision is also necessary because the various types of benefits are allocated to the zones using different allocation factors. (Attachment 5 – Adding vs Combining Multiple Benefits)

Closing Items

Chair Alan Myers (ITC Great Plains, LLC) requested if any other items merited discussion.

The meeting was adjourned at 12:30 a.m.

Respectfully Submitted,

Juliano Freitas,

Secretary

NAME
Alan Myers
Amber Greb
Anita
Barry Huddleston
Bary/Empire
Ben Roubique (PWR Solutions)
Bennie Weeks (SPS)
Bill Leung (NPRB)
Bruce Walkup (AECC)
Caitlin Shank
Dan Jones
Gayle Freier (SPP)
Jason Shook (GDS/ETEC)
Jason Speer
Jeremy Harris (Westar)
Jim Krajecki (Customized Energy Solutions)
Joe Lang
Jon Iverson
Jon Shipman (OPPD)
Kurt Stradley (LES)
Leon Howell
Meena Thomas (PUCT)
Michael Watt - OMPA
Mike Collins
Mike Proctor
Nathan McNeil
Pat McCool
Paul Dietz
Randy Collier (CUS)
Rosemary Mittal
Steve Gaw
Tim Owens (NPPD)
Wayman Smith (AEP)

Kip Fox (AEP-Transource) proxy to Wayman Smith (AEP)

Proxy for 2/19 conf call

Kip M Fox [kmfox@aep.com]

You replied on 2/14/2014 1:50 PM.

Sent: Fri 2/14/2014 11:16 AM

To: Juliano Freitas; Myers, Alan

Cc: Smith, Wayman; Kidd, David

I will not be able to attend the conference call on 2/19. Please allow this email to have Wayman Smith as my proxy for the call. Any questions, please advise.

Thank you, Kip

Kip Fox
Director, Transmission Asset Strategy and Grid Development

kmfox@aep.com
office: 214-777-1063
cell: 972-400-1384

Southwest Power Pool

ECONOMIC STUDIES WORKING GROUP

February 19, 2014

Conference Call

• A G E N D A •

9:00 am – 12:00 pm

1. Administrative items
   a. Call to Order, Introductions.. Alan Myers (5 minutes)
   b. Receipt of Proxies .... Juliano Freitas (1 minute)
   c. Review of Agenda .... Alan Myers (5 minutes)
2. 2015 ITP10 Benchmarking (Approval Item) .... Juliano Freitas (5 minutes)
3. 2015 ITP10 Must Run Units (Approval Item).. Juliano Freitas (5 minutes)
4. Metrics Review .... SPP Staff (2 Hours)
5. Adding vs Combining Multiple Benefits ....Mike Proctor (1 Hour)
6. Closing Items .... All

Relationship-Based • Member-Driven • Independence Through Diversity

Evolutionary vs. Revolutionary • Reliability & Economics Inseparable

Metrics Review

February 19th , 2014

SPP Southwest Power Pool

Helping our members work together to keep the lights on... today and in the future

Overview

- ESWG has been tasked with reviewing the calculation of metrics going forward
  - ITP10
  - RCAR 2
- Today – continue discussion of metrics that have been developed previously
  - Focus will be on the calculation of metrics that have received more attention from stakeholders during ITP and the previous RCAR

Approved Metrics for the RCAR

- Adjusted Production Cost (APC) Savings
- Reduction of Emission Rates and Values
- Savings due to Lower Ancillary Service Needs and Production Costs
- Avoided or Delayed Reliability Projects
- Capacity Cost Savings due to Reduced On-Peak Transmission Losses
- Mitigation of Transmission Outage Costs
- Assumed Benefit of Mandated Reliability Projects
- Public Policy Benefits

ASSUMED BENEFIT OF MANDATED RELIABILITY PROJECTS

Potential Alternative for allocation – DFAX

- DFAX analysis could be used for the purposes of assignment of cost responsibility for Reliability Projects
- Distribution factors (DFAX) used to calculate the portion of a transfer of energy from a defined source to a defined sink that will flow across a specific transmission facility or group of transmission facilities
  - Expressed as decimal values or percentages
  - Represent a measure of the use by the load of each transmission zone of the required Reliability Project as determined by power flow analysis

DFAX Calculation

- *DFAX = (Post-shift power flow – Pre-shift power flow) / Total amount of power shifted*
- *Total Amount of Power Shifted = Modeled incremental MW transfer to a given transmission zone*
- *Pre-shift Power Flow = MW flow over specified transmission enhancement before the incremental MW transfer*
- *Post-shift Power Flow = MW flow over specified transmission enhancement after the incremental MW transfer*
- When calculating DFAX:
  - All DFAX are calculated with respect to the specified transmission enhancement(s) that are subject to cost allocation
  - Use of a specified transmission enhancement is based on the DFAX to the aggregate load within a transmission zone
  - The calculation of DFAX shall be determined using linear matrix algebra, such that DFAX represent the ratio of (i) a change in MW flow on specified transmission enhancement to (ii) a change in MW transferred to aggregate load within a transmission zone
  - SPP shall calculate a DFAX for each transmission zone by modeling a transfer from all generation in the SPP region individually to the loads in each transmission zone

DFAX Example

- Considered two 345 kV reliability projects that were a part of the 2012 ITP10 and RCAR
  - Summit – Elm Creek 345
  - Elk City – Gracemont 345
- Performed DFAX analysis to obtain TDF by zone
  - Normalized TDF’s to obtain a benefit allocation % by zone
  - Multiplied this allocation % by the total benefit of the project
- Compared DFAX reliability benefit to the benefit obtained using the old approach (LRS)

Elk City – Gracemont 345 kV

	Pre-Shift	Post-Shift	TDF		Allocation %	Reliability Benefit - RCAR	Reliability Benefit - DFAX	DFAX Increase in Benefit
SUNC Import	-155.3	-149.2	0.0061	0.0061	1.58%	$1,893,089	$2,760,792	$867,703
SWPS Import	-155.3	-193.4	-0.0381	0.0381	9.85%	$22,725,093	$17,243,638	($5,481,456)
WEFA Import	-155.3	-141.3	0.014	0.014	3.62%	$5,723,806	$6,336,245	$612,439
OKGE Import	-155.3	-119.8	0.0355	0.0355	9.18%	$25,325,133	$16,066,906	($9,258,227)
GRDA Import	-155.3	-123.2	0.0321	0.0321	8.30%	$3,523,360	$14,528,104	$11,004,744
AEPW Import	-155.3	-125.2	0.0301	0.0301	7.78%	$39,292,246	$13,622,926	($25,669,320)
WRI Import	-155.3	-131.7	0.0236	0.0236	6.10%	$20,100,127	$10,681,098	($9,419,029)
EDE Import	-155.3	-125.1	0.0302	0.0302	7.81%	$4,430,995	$13,668,185	$9,237,190
CUS Import	-155.3	-125.5	0.0298	0.0298	7.70%	$2,782,656	$13,487,150	$10,704,493
MIDW Import	-155.3	-140	0.0153	0.0153	3.96%	$1,485,501	$6,924,610	$5,439,109
KCPL Import	-155.3	-130.1	0.0252	0.0252	6.51%	$13,761,449	$11,405,241	($2,356,208)
GMO Import	-155.3	-129.9	0.0254	0.0254	6.57%	$7,318,366	$11,495,758	$4,177,392
OPPD Import	-155.3	-131.4	0.0239	0.0239	6.18%	$8,953,392	$10,816,875	$1,863,483
NPPD Import	-155.3	-134	0.0213	0.0213	5.51%	$11,706,991	$9,640,144	($2,066,847)
LES Import	-155.3	-132.1	0.0232	0.0232	6.00%	$3,555,862	$10,500,063	$6,944,201
MKEC Import	-155.3	-142.3	0.013	0.013	3.36%	$2,483,325	$5,883,656	$3,400,331
Total				0.3868		$175,061,392	$175,061,392	$0

*Calculations included in background materials

Summit – Elm Creek 345 kV

	Pre-Shift	Post-Shift	TDF		Allocation %	Reliability Benefit - RCAR	Reliability Benefit - DFAX	DFAX Increase in Benefit
SUNC Import	-21.6	-33.9	-0.0123	0.0123	4.41%	$1,222,496	$4,983,882	$3,761,386
SWPS Import	-21.6	-45.4	-0.0238	0.0238	8.53%	$14,675,137	$9,643,610	($5,031,527)
WEFA Import	-21.6	-44.6	-0.023	0.023	8.24%	$3,696,250	$9,319,455	$5,623,204
OKGE Import	-21.6	-44	-0.0224	0.0224	8.03%	$16,354,160	$9,076,339	($7,277,821)
GRDA Import	-21.6	-42.2	-0.0206	0.0206	7.38%	$2,275,273	$8,346,990	$6,071,717
AEPW Import	-21.6	-41.2	-0.0196	0.0196	7.03%	$25,373,674	$7,941,796	($17,431,877)
WRI Import	-21.6	-39.6	-0.018	0.018	6.45%	$12,980,018	$7,293,486	($5,686,532)
EDE Import	-21.6	-39.4	-0.0178	0.0178	6.38%	$2,861,394	$7,212,448	$4,351,053
CUS Import	-21.6	-38.1	-0.0165	0.0165	5.91%	$1,796,950	$6,685,696	$4,888,746
MIDW Import	-21.6	-33.3	-0.0117	0.0117	4.19%	$959,289	$4,740,766	$3,781,477
KCPL Import	-21.6	-30.2	-0.0086	0.0086	3.08%	$8,886,703	$3,484,666	($5,402,037)
GMO Import	-21.6	-30	-0.0084	0.0084	3.01%	$4,725,966	$3,403,627	($1,322,339)
OPPD Import	-21.6	-24.3	-0.0027	0.0027	0.97%	$5,781,814	$1,094,023	($4,687,791)
NPPD Import	-21.6	-24.1	-0.0025	0.0025	0.90%	$7,560,000	$1,012,984	($6,547,015)
LES Import	-21.6	-22.1	-0.0005	0.0005	0.18%	$2,296,261	$202,597	($2,093,665)
MKEC Import	-21.6	49	0.0706	0.0706	25.30%	$1,603,652	$28,606,674	$27,003,022
Total				0.279		$113,049,038	$113,049,038	$0

*Calculations included in background materials

DFAX Details to Sort Through

- Should all generators scale up? Should wind be excluded?
  - Only units with Pgen < Pmax were scaled up
  - Otherwise, all other generators were scaled
- How should negative distribution factors be handled?
  - Took absolute values in example – no negative DFAX
  - Considered the change in flow on the upgrade, regardless of whether flow increases or decreases
- Should there be a minimum distribution factor cutoff?
  - None utilized in example

LODF Approach to Reliability Benefit Allocation

- Staff is currently working with LES on the details of this approach
- An example will be presented at a later date

PUBLIC POLICY BENEFITS

Public Policy Benefits – Previous Approach

- Benefits allocated to zones in proportion to each zone's share of unmet renewable energy goals.
  - Public Policy Benefit per zone = (% share of unmet goals) x (cost of upgrade)
  - If a zone has no public policy mandate or goal, or already meets their mandate or goal, their public policy benefit is zero
- Production cost savings due to policy upgrades are additional to this benefit

Potential Alternative for Benefit Allocation

- Public Policy Benefit is allocated only to zones in the state in which the mandate/goal is driving the project
- New Gentleman – Cherry – Holt 345 kV line
  - Driven by Nebraska goal
  - Benefits allocated to Nebraska entities
  - Total 40-Year Cost = Public Policy Benefit = $296.4 M

	Unmet Renewable Goal* (MWh)	% Share of Unmet Renewable Goal	Public Policy Benefit (millions $)
NPPD	1,374,534	48%	$143
OPPD	1,470,070	52%	$153
LES	0	0%	$0
Total	**2,844,604**	**100%**	**$296**

*These numbers represent unmet goals from the RCAR; these are not up-to-date with ITP10 data

State Policy Benefit Allocation – Example

	Unmet Renewable Goal (MWh)	% Share of **SPP** Unmet Renewable Goal	Public Policy Benefit - RCAR ($M)	% Share of **Nebraska** Unmet Renewable Goal	Public Policy Benefit - State Policy Allocation ($M)
AEPW	1,787,126	10.1%	$30	0.0%	$0
CUS	0	0.0%	$0	0.0%	$0
EDE	887,873	5.0%	$15	0.0%	$0
GMO	1,737,706	9.8%	$29	0.0%	$0
GRDA	0	0.0%	$0	0.0%	$0
KCPL	2,906,537	16.4%	$49	0.0%	$0
LES	0	0.0%	$0	0.0%	$0
MIDW	0	0.0%	$0	0.0%	$0
MKEC	228,122	1.3%	$4	0.0%	$0
NPPD	1,374,534	7.8%	$23	48.3%	$143
OKGE	3,485,957	19.7%	$58	0.0%	$0
OPPD	1,470,070	8.3%	$25	51.7%	$153
SUNC	126,037	0.7%	$2	0.0%	$0
SWPS	0	0.0%	$0	0.0%	$0
WEFA	804,394	4.6%	$13	0.0%	$0
WRI	2,868,358	16.2%	$48	0.0%	$0
Total	17,676,714	100.0%	$296	100.0%	$296

*If a policy project enables members in multiple states to meet their mandates/goals, the benefit would be applied to all impacted members

MITIGATION OF TRANSMISSION OUTAGES

Mitigation of Outage Costs – Previous

- Add set of historical transmission outages to production cost simulations
- Benefit = APC Benefit$_{\text{With Outages}}$ – APC Benefit$_{\text{Without Outages}}$
  - This metric is an adder to traditional APC Benefit
- Since it is difficult to develop normalized transmission outage data that reliably reflects the outages that could affect each load zone, this benefit is calculated on an SPP-wide basis and allocated to zones based on a load ratio share.

Potential Alternative for Benefit Allocation

- Look into TADS outage data, or historical outage data
  - Develop expected outage rates by area
  - Normalize these outage rates to develop allocation factors by area

Not Posted – Outages Benefit Method 1

- For APC Savings with no outages, calculate each zone's benefit as a percentage of the total SPP benefit
- Multiply each zone's APC benefit % by the Mitigation of Transmission Outage Costs total benefit to determine that zone's allocation of the Total Outage benefit

Not Posted – Outages Benefit Method 1

	Mitigation of Transmission Outages Benefit - RCAR, based on LRS ($M)	APC Savings - 40-year NPV benefit* ($M)	Percent of Total APC Savings	Mitigation of Transmission Outages Benefit - allocated by APC Savings % ($M)
AEPW	$76	$240	7.9%	$27
CUS	$5	$7	0.2%	$1
EDE	$9	$7	0.2%	$1
GMO	$14	$23	0.8%	$3
GRDA	$7	$10	0.3%	$1
KCPL	$27	$24	0.8%	$3
LES	$7	$5	0.2%	$1
MIDW	$3	$60	2.0%	$7
MKEC	$5	$42	1.4%	$5
NPPD	$23	$226	7.5%	$25
OKGE	$49	$175	5.8%	$20
OPPD	$17	$34	1.1%	$4
SUNC	$4	-$10	-0.3%	-$1
SWPS	$44	$1,939	64.2%	$218
WEFA	$11	$24	0.8%	$3
WRI	$39	$215	7.1%	$24
Total	$340	$3,021	100.0%	$340

Not Posted – Outages Benefit Method 2

- Obtained operational data for outages from Sept 2011 to present
  - Number of outages by zone
- Some tie lines are being double counted (~5% of outages)
- Number of outages by zone was divided by total outages for region to obtain allocation factor by zone
- Allocation factor multiplied by total outages benefit

Not Posted – Outages Benefit Method 2

Zone	# of outages	Allocation %	Benefit based on outage data ($M)	Benefit based on LRS, from RCAR ($M)	Increase in Benefit with new methodology ($M)
AEP	3,044	21.64%	$74	$76	($2)
EDE	545	3.88%	$13	$9	$4
GRDA	273	1.94%	$7	$7	($0)
KCPL	431	3.06%	$10	$27	($17)
LES	212	1.51%	$5	$7	($2)
MIDW	123	0.87%	$3	$3	($0)
GMO	393	2.79%	$10	$14	($4)
NPPD	1,492	10.61%	$36	$23	$13
OKGE	2,326	16.54%	$56	$49	$7
OPPD	434	3.09%	$10	$17	($7)
SUNC/MKEC	602	4.28%	$15	$9	$6
CUS	218	1.55%	$5	$5	$0
SPS	2,238	15.91%	$54	$44	$10
WFEC	399	2.84%	$10	$11	($1)
WR	1,334	9.49%	$32	$39	($7)
Total	14,064	100.00%	$340	$340	$0

ADDING VS COMBINING MULTIPLE BENEFIT

ESWG Meeting; Feb 13, 2014; Mike Proctor

Purpose of Presentation

- Disclaimer:
  - This presentation has not been endorsed by CAWG or RSC and, therefore, does not represent the views of CAWG or RSC. Because this is a very important topic, I have the RSC's permission to make this presentation.
- This presentation discusses the arguments for and against including 100% of multiple benefits for a single project, leading to DECISION 1: Adding Multiple Benefits (100%) vs. Combining Multiple Benefits (less than 100%).
  - Multiple benefits being discussed are:
    - Reliability (reliability mandates are NERC/FERC public policy);
    - Renewable Policy (renewable mandates and goals are state & local public policy);
    - Economic (economic upgrades that are cost beneficial are FERC public policy and include SO2 and NOX).
- In addition, the formulas (equations) are developed for when inclusion of less than 100% of multiple benefits is chosen, leading to DECISION 2.
  - This decision involves how much to include of each of the multiple benefits resulting in the total benefits to be included.
  - This decision is also necessary because the various types of benefits are allocated to the zones using different allocation factors.

But first, a few guiding principles:

3

Principles for Multiple Benefits

Multiple Benefits Occur

- Principle: **All transmission projects can provide multiple benefits.** For example:
  - A project put in for reliability relieves congestion, will impact Adjusted Production Costs (APC), and could reduce the number of hours of curtailment on a wind farm, thereby providing both economic and public policy benefits.
  - A project put in for economics relieves congestion and could displace or defer a reliability project or a renewable policy project.
  - A project put in for renewable policy (mandates and goals) relieves congestion and could displace or defer a reliability project, and will impact APC.

Multiple Benefits Should be Included

- Principle: **A project may have a primary benefit driver, but that does not mean that this is the only benefits provided by that project.** For example:
  - A project may primarily be driven by reliability needs, and overall produces APC savings that are positive, but less than the cost of the project.
    - These economic benefits are real and should be counted as benefits for the reliability project. – This does not answer the question of how much of each type of benefit should be included.
    - In addition, it is very possible that the APC for some zones increases (e.g., sales from a higher cost resource downstream from the congestion decrease and profits fall).
      - These negative benefits should be reflected in the zonal benefits for RCAR. – This does not answer the question of how much of each benefit should be counted.

Double Counting

- Principle: **Double counting occurs when the same benefit is counted twice.**
  - If the benefits being counted are **mutually exclusive**, then double counting **<u>does not</u>** occur.
  - In some instances, when only default benefits are considered (e.g., the transmission project cost), it is difficult to determine whether or not the benefits being counted are mutually exclusive or have some overlap.
    - This is why It is important to **focus on direct benefits** rather than default benefit metrics when considering double counting.

Primary, Direct Benefits by Category

- Reliability: **Value of Lost Load (VOLL)**
  - The direct measure of reliability benefits is the reduction in the expected Value of Lost Load (VOLL, i.e., the expected cost to end-users from an increased probability of lost load).
  - The default measure of reliability benefits is the cost-effective costs of a reliability project; i.e., the least-cost project required to fix the reliability issue.
- Renewable Policy: **Reduction in Detrimental Environmental Impacts**
  - Policy maker's precise calculus (if any) for setting renewable mandates and goals is not known, and can be quite different from one policy maker to another. However, it has been clear that the purpose for renewable implementation has been the environment.
  - The default measure for renewable policy benefits is the cost-effective costs of the renewable policy project; i.e., the least-cost project required to get renewable energy to 97% of capability.
- Economic – **Adjusted Production Costs (APC)**

Are Primary Benefits Mutually Exclusive?

- **Reliability & Economic (YES):** NERC reliability criteria are strictly based on power flows for given hours that are focused on keeping the lights on, and therefore do not take into account APC savings which are calculated over 8,760 hours.
- **Reliability & Renewable Policy (YES):** There is clearly some overlap between reliability and deliverability, but there is no overlap in benefits as NERC standards are based on "keeping the lights on" and are not based on reductions in environmental impacts.
- **Economic & Renewable Policy (YES):** While APC includes SO2 and NOx, the costs of these pollutants are already taken into account through federal EPA mandates. Mandates and goals for renewable resources are meant to pick up other types of environmental impacts not already covered by direct EPA mandates.
- <u>Conclusion:</u> **If double counting is the only reason for excluding additive benefits, then total (100%) benefits from all that apply should be included.**

9

Combining vs. Adding Multiple Benefits

Specifying Benefits

- The following symbols will be used to specify the dollar amounts for the three primary benefits
  - **Reliability: $X** = default @ cost-effective transmission upgrade costs.
  - **Public Policy: $Y** = default @ cost-effective transmission upgrade costs.
  - **Economic: $Z** = APC savings (reductions)

Reliability + Economic Benefits?

1. Reliability and Economic Benefits jointly occur when

1.A Reliability upgrades change APC – which always occurs		1.B Economic upgrades resolve reliability issues – which occurs frequently	
This occurs because reliability upgrades relieve congestion, which in turn impacts APC. For specific zones APC can either increase or decrease, but the overall expectation is that APC will decrease resulting in positive economic benefits.		It is not unusual for an economic project with a B/C > 1 to result in replacing reliability project i.e., $X is replaced by $\$X^r < \$X$, where $\$X^r$ could equal $0. The **cost savings** of the displaced or deferred project (**$\$X - \$X^r$**) is then counted as a benefit for the economic project. The project costing $\$X^r$ is treated as a separate reliability project.	
If the APC savings exceed the cost of the project, the SPP then reclassifies the project from reliability to economic → case 1.B. Thus, for case 1.A, $X ≥ $Z.		An incremental cost/benefit decision is made on replacing a reliability upgrade ($X replaced by $\$X^r$) due to an economic upgrade based on whether or not the added APC Savings of the economic upgrade ($Z – APC savings from $X upgrade) are larger than the added costs (Economic Upgrade Cost + $\$X^r - \$X$).	
Adding Total Benefits	Combining Multiple Benefits	Adding Total Benefits	Combining Multiple Benefits
There is no double counting between reduction of VOLL and reduction of APC.	Adding $Z to $X ⇒ free ride for Economic Benefits	There is no double counting between reduction of VOLL and reduction of APC.	Adding ($\$X-\$X^r$) to $Z ⇒ free ride for Reliability Benefits.
Reliability = $X	Reliability = $X-$Z	Economic = $Z	Economic = $\$Z-(\$X - \$X^r)$
Economic = $Z	Economic = $Z	Reliability = $\$X - \$X^r$	Reliability = $\$X - \$X^r$
Total Benefits = $X + $Z	Total Benefits = $X	Total Benefits = $\$Z+(\$X - \$X^r)$	Total Benefits = $Z
It should be clear that reliability and economic benefits are mutually exclusive and there is no double-counting.		The fact that only the added APC Savings are compared to added costs for replacing a cost-effective reliability upgrade with a lower cost upgrade and a more costly economic upgrade is based on the assumption that the APC Savings of the reliability upgrade are directly attributable to and associated with that reliability upgrade.	

Reliability + Renewable Benefits?

2. Reliability and Renewable Policy Benefits jointly occur when

<table>
<tr><th colspan="2">2.A Reliability upgrades decrease wind curtailments
- which occurs frequently</th><th colspan="2">2.B Renewable Policy upgrades resolve reliability issues
- which occurs frequently</th></tr>
<tr><td colspan="2">This occurs because reliability upgrades relieve congestion, and if this congestion is resulting from wind power injections into the grid, wind curtailments will be reduced, but not necessarily eliminated. If wind curtailments are not eliminated, an additional renewable policy upgrade is needed and is counted as a separate upgrade.</td><td colspan="2">This occurs when a renewable policy upgrades relieve congestion on wind deliverability to the SPP market, and if this congestion was causing a reliability issue, the associated reliability upgrade will be displaced; i.e., $X is replaced by $\$X^{r} < \$X$, with cost savings of the displaced or deferred project ($\$X - \$X^{r}$) then counted as a benefit for the renewable policy project.</td></tr>
<tr><td colspan="2">The percent reduction in wind curtailments is designated by λ, and is measured as percent of curtailment reduction from before the upgrade compared to after the upgrade.
For example: before 57% of potential wind; after 77% of potential wind, target of 97% of potential wind: λ = (77% - 57%)/ (97% - 57%) = ½ or 0.5. The multiple benefits question is whether or not the reliability project should receive both reliability and renewable policy benefits and how much of each.</td><td colspan="2">Because the renewable policy upgrade is required, there is no incremental cost/benefit decision to make. In essence, the renewable policy upgrade has reduced the cost of the reliability upgrade from $X to $\$X^{r}$.</td></tr>
<tr><td>Adding Total Benefits</td><td>Combining Multiple Benefits</td><td>Adding Total Benefits</td><td>Combining Multiple Benefits</td></tr>
<tr><td>There is no double counting issue regarding reduced VOLL and reduced environmental impacts.</td><td>Some are bothered by the use of project cost for both benefits – i.e., <u>the benefits seem to be double counted when costs are included twice.</u></td><td>There is no double counting issue regarding reduced VOLL and reduced environmental impacts.</td><td>Some are bothered by the use of project cost for both benefits – i.e., <u>the benefits seem to be double counted when costs are included twice.</u></td></tr>
<tr><td>Reliability = $X</td><td>Reliability =$(1- \lambda)\$X$</td><td>Renewable Policy = $Y</td><td>Renew Policy = $\$Y-(\$X - \$X^{r})$</td></tr>
<tr><td>Renewable Policy = $\lambda\$X$</td><td>Renewable Policy = $\lambda\$X$</td><td>Reliability = $(\$X - \$X^{r})$</td><td>Reliability = $\$X - \$X^{r}$</td></tr>
<tr><td>Total Benefits = $\$X + \lambda\$X$</td><td>Total Benefits = $X</td><td>Total Benefits = $\$Y+(\$X - \$X^{r})$</td><td>Total Benefits = $Y</td></tr>
<tr><td colspan="2">It should be clear that reliability and renewable policy benefits are mutually exclusive and there is no double-counting.</td><td colspan="2">It is difficult to resolve not treating displacement of reliability upgrades by renewable policy upgrades in the same way as displacement of reliability by economic upgrades are treated.</td></tr>
</table>

Renewable Policy + Economic Benefits?

3. Renewable Policy and Economic Benefits jointly occur when

<table>
<tr><th colspan="2">3.A Renewable Policy upgrades change APC
- which always occurs</th><th colspan="2">3.B Economic upgrades decrease wind curtailments
- which occurs frequently</th></tr>
<tr><td colspan="2">This occurs because renewable policy upgrades relieve congestion, which in turn impacts APC. For specific zones APC can either increase or decrease, but the overall expectation is that APC will decrease resulting in positive economic benefits. More specifically, it is expected that LMPs will fall in the zones where the renewable resources are located. A fall in LMPs can result in APC decreases for those purchasing from the market and APC increases for those selling into the market.</td><td colspan="2">Economic projects reduce congestion and if this congestion is caused by injections of wind power into the grid, the reduced congestion will result in a decrease in wind curtailments. It is not unusual for an economic project with a B/C > 1 to result in replacing renewable policy project i.e., $\$Y$ is replaced by $\$Y^r < \$Y$, where $\$Y^r$ could equal could equal $0. The cost savings of the displaced or deferred project is then counted as a benefit for the economic project; - the cost savings is $\$Y - \$Y^r$. The project costing $\$Y^r$ is treated as an added renewable policy project.</td></tr>
<tr><td colspan="2">If the APC savings exceed the cost of the project, the SPP then reclassifies the project from renewable policy to economic → case 1.B. Thus, for case 1.A, $\$Y \geq \$Z$.</td><td colspan="2">The percent reduction in wind curtailments from the economic upgrade is designated by λ, and is measured as percent of curtailment reduction from before the economic upgrade compared to after the upgrade.</td></tr>
<tr><th>Adding Total Benefits</th><th>Combining Multiple Benefits</th><th>Adding Total Benefits</th><th>Combining Multiple Benefits</th></tr>
<tr><td>There is no double counting issue regarding reduced educed environmental impacts and reduced APC.</td><td>It could be argued that policy makers have taken APC savings into account when setting renewable mandates or goals, but we do not know this for sure.</td><td>There is no double counting issue regarding reduced educed environmental impacts and reduced APC.</td><td>It could be argued that policy makers have taken APC savings into account when setting renewable mandates or goals, but we do not know this for sure.</td></tr>
<tr><td>Renewable Policy = $\$Y$</td><td>Renewable Policy = $\$Y-\$Z$</td><td>Economic = $\$Z$</td><td>Economic = $\$Z-\lambda*(\$Y-\$Y^r)$</td></tr>
<tr><td>Economic = $\$Z$</td><td>Economic = $\$Z$</td><td>Renewable Policy = $\lambda(\$Y-\$Y^r)$</td><td>Renewable Policy = $\lambda(\$Y-\$Y^r)$</td></tr>
<tr><td>Total Benefits = $\$Y + \$Z$</td><td>Total Benefits = $\$Y$</td><td>Total Benefits = $\$Z+\lambda(\$Y-\$Y^r)$</td><td>Total Benefits = $\$Z$</td></tr>
<tr><td colspan="2">What we do know is that the decrease in environmental impacts has been the primary driver for renewable policy and is not included in APC.</td><td colspan="2"></td></tr>
</table>

Reliability + Renewable Policy + Economic?

- When all three benefits jointly occur, it means that a project is meeting some portion of reliability mandates and renewable policy mandates + goals, and also has an impact on APC.
  - Every upgrade has an impact on APC. Just need to take cases 2.A and 2.B that determine the weights given reliability and renewable policy, and factor in the weight given to APC.

Decisions to Make: Decision 1

- Overall Recommendation:
  - Adding Multiple Benefits

    vs.

  - Combining Multiple Benefits

- Special Cases:
  - Are there special cases where deviating from the overall recommendation is justified?

Decisions to Make: Decision 2

- Equations Used to either Add or Combine Multiple Benefits

Adding Total Benefits	Combining Multiple Benefits	Adding Total Benefits	Combining Multiple Benefits
Reliability = $\$X$	Reliability = $\$X-\$Z$	Economic = $\$Z$	Economic = $\$Z-(\$X - \$X^{r})$
Economic = $\$Z$	Economic = $\$Z$	Reliability = $\$X - \$X^{r}$	Reliability = $\$X - \$X^{r}$
Total Benefits = $\$X + \$Z$	Total Benefits = $\$X$	Total Benefits = $\$Z+(\$X - \$X^{r})$	Total Benefits = $\$Z$
Reliability = $\$X$	Reliability $=(1-\lambda)\$X$	Renewable Policy = $\$Y$	Renew Policy = $\$Y-(\$X - \$X^{r})$
Renewable Policy = $\lambda\$X$	Renewable Policy = $\lambda\$X$	Reliability = $(\$X - \$X^{r})$	Reliability = $\$X - \$X^{r}$
Total Benefits = $\$X + \lambda\$X$	Total Benefits = $\$X$	Total Benefits = $\$Y+(\$X - \$X^{r})$	Total Benefits = $\$Y$
Renewable Policy = $\$Y$	Renewable Policy = $\$Y-\$Z$	Economic = $\$Z$	Economic = $\$Z-\lambda*(\$Y-\$Y^{r})$
Economic = $\$Z$	Economic = $\$Z$	Renewable Policy = $\lambda(\$Y-\$Y^{r})$	Renewable Policy = $\lambda(\$Y-\$Y^{r})$
Total Benefits = $\$Y + \$Z$	Total Benefits = $\$Y$	Total Benefits = $\$Z+\lambda(\$Y-\$Y^{r})$	Total Benefits = $\$Z$