PJM/MISO Cost Allocation For Economic Upgrades

Stakeholder Meeting
Midwest ISO, Carmel, IN

August 27, 2008

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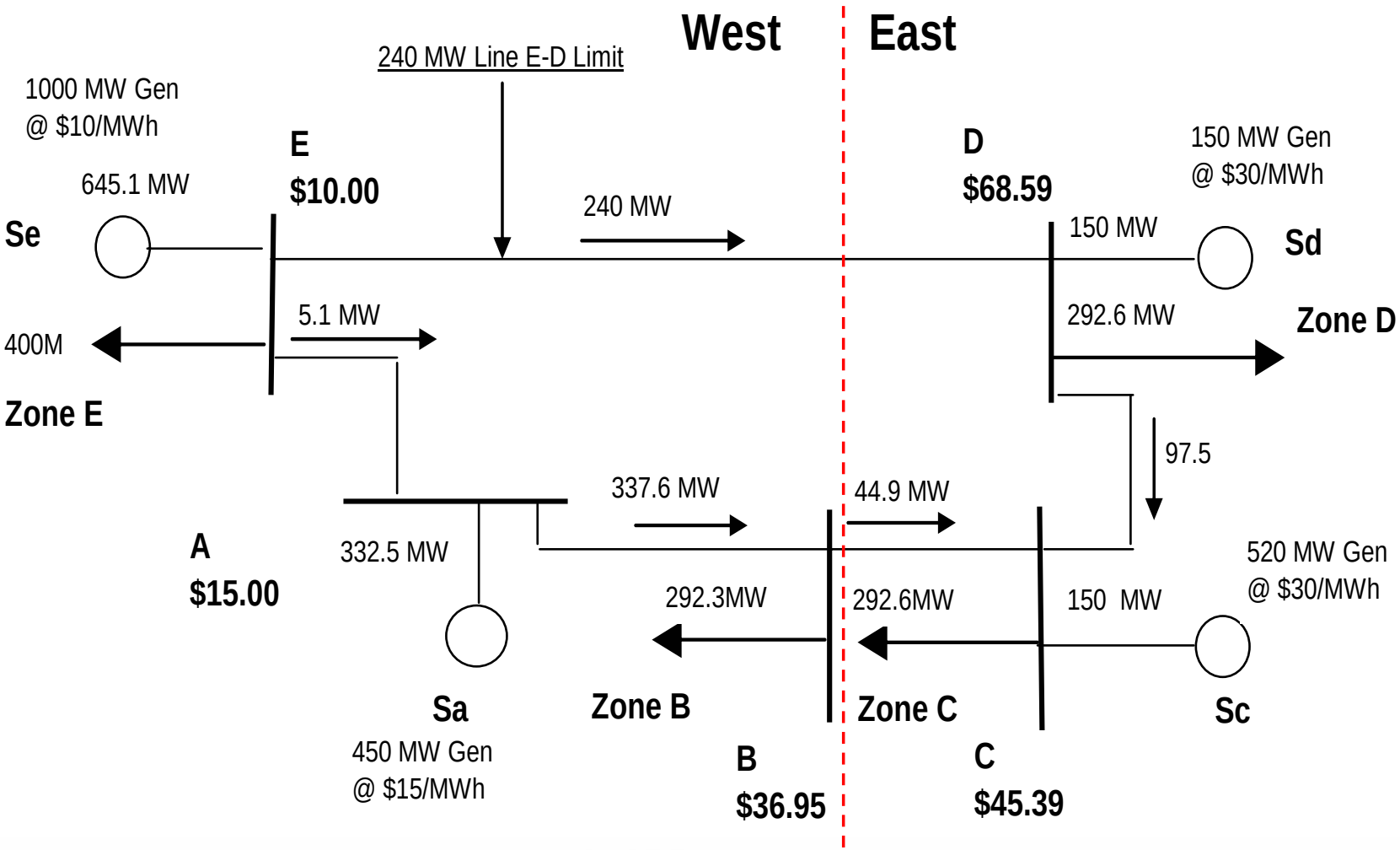
Topics for Discussion

- Revisit 5-Bus Example (RTO Staffs)
- Review Examples (RTO Staffs)
- Cross Border Settlements (PJM) (John Bustard)
- Stakeholder Discussion (All)
- Next Steps (All)

5-Bus Example
Cross-Border Economic Project

5 Bus Example – Before Economic Project
Least Cost-Security Constrained Dispatch



5 Bus Example – Before Economic Project
Gross Load Payment and Gross Generation Revenue

Load Payments

West				East				Total System
Zone	MW	LMP	Gross Load Payment	Zone	MW	LMP	Gross Load Payment	Gross Load Payment
Zone B	292.3	$36.95	$10,800.49	Zone C	292.6	$45.39	$13,281.11	
Zone E	400.0	$10.00	$4,000.00	Zone D	292.6	$68.59	$20,069.43	
Total RTO	692.3	$21.38	$14,800.49	**Total RTO**	585.2	$56.99	$33,350.55	$48,151.03

Generation Revenue

West				East				Total System
Gen	MW	LMP	Gross Gen Revenue	Gen	MW	LMP	Gross Gen Revenue	Gross Gen Revenue
Sa	332.5	$15.00	$4,987.50	Sc	150.0	$45.39	$6,808.50	
Se	645.1	$10.00	$6,451.00	Sd	150.0	$68.59	$10,288.50	
Total RTO	977.6	$11.70	$11,438.50	**Total RTO**	300.0	$56.99	$17,097.00	$28,535.50

Total System Congestion = Gross Load Payment - Gross Gen Revenue
= $48,151.03 - $28,535.50
= $19,615.53

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- Total system congestion costs comprised of congestion associated with delivering own gen-to-own load plus congestion associated with interchange purchases/sales
- Gen-to-load congestion calculated for each RTO by multiplying difference between RTO load-weighted LMP minus RTO gen-weighted LMP times lower of RTO gen MWs or RTO load MWs
- Interchange related congestion is calculated by multiplying interchange MW times difference between RTO load-weighted LMP (of buying RTO) minus RTO gen-weighted LMP (of selling RTO)

5 Bus Example – Before Economic Project
Breakdown of Congestion Costs

	Congestion Costs	Congestion Cost Calculation
Gen-to-Load Congestion		
West	$6,701.46	= 692.3 MW x ($21.38 - $11.70)
East	$0.00	= 300.0 MW x ($56.99 - $56.99)
Interchange Congestion	$12,916.71	= 285.2 MW x ($56.99 - $11.70)
Total Congestion	**$19,618.17**	

- High interchange congestion to total congestion ratio is exaggerated in 5-bus example due to high level of interchange relative to total system load. In an actual system, Gen-to-load congestion will represent the majority of total congestion cost
- Gen-to-load congestion assigns congestion costs to each RTO and is assumed to be rebated back to RTO load in the form of transmission rights credits

5 Bus Example – Before Economic Project
Net Generation Revenue and Net Load Payment

Net Generation Revenue

West						East					
Gen	MW	LMP	Gross Gen Revenue	Gen Prod Cost	Net Gen Revenue	Gen	MW	LMP	Gross Gen Revenue	Gen Prod Cost	Net Gen Revenue
Sa	332.5	$15.00	$4,987.50	$4,987.50	$0.00	Sc	150.0	$45.39	$6,808.50	$4,500.00	$2,308.50
Se	645.1	$10.00	$6,451.00	$6,451.00	$0.00	Sd	150.0	$68.59	$10,288.50	$4,500.00	$5,788.50
Total RTO	977.6	$11.70	$11,438.50	$11,438.50	$0.00	**Total RTO**	300.0	$56.99	$17,097.00	$9,000.00	$8,097.00

Net Load Payments

West						East					
Zone	MW	LMP	Gross Load Payment	FTR Credits	Net Load Payment	Zone	MW	LMP	Gross Load Payment	FTR Credits	Net Load Payment
Zone B	292.3	$36.95	$10,800.49	--	--	Zone C	292.6	$45.39	$13,281.11	--	--
Zone E	400.0	$10.00	$4,000.00	--	--	Zone D	292.6	$68.59	$20,069.43	--	--
Total RTO	692.3	$21.38	$14,800.49	$6,701.46	$8,099.02	**Total RTO**	585.2	$56.99	$33,350.55	$0.00	$33,350.55

5 Bus Example – Before Economic Project

	West	East	Total System
Generation MW	977.6	300.0	1277.6
Gross Gen Revenue (GGR)	$11,438.50	$17,097.00	$28,535.50
Gen Production Cost	$11,438.50	$9,000.00	$20,438.50
Net Gen Revenue (NGR)	$0.00	$8,097.00	$8,097.00
Load MW	692.3	585.2	1277.5
Gross Load Payment (GLP)	$14,800.49	$33,350.55	$48,151.03
FTR Credits	$6,701.46	$0.00	$6,700.16
Net Load Payment (NLP)	$8,099.02	$33,350.55	$41,450.87
Net Cost (NLP - NGR)	$8,099.02	$25,253.55	$33,352.57

Blended Metrics

Adjusted Production Cost	$8,099.02	$25,253.55	$33,352.57	
70%(Gen Prod Cost) + 30%(NLP)	$10,436.66	$16,305.16	$26,741.82	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	$10,109.46	$27,682.65	$37,792.11	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	$8,099.02	$27,682.65	$35,781.67	MISO Method (w/ NLP)

Total System Congestion $19,615.53

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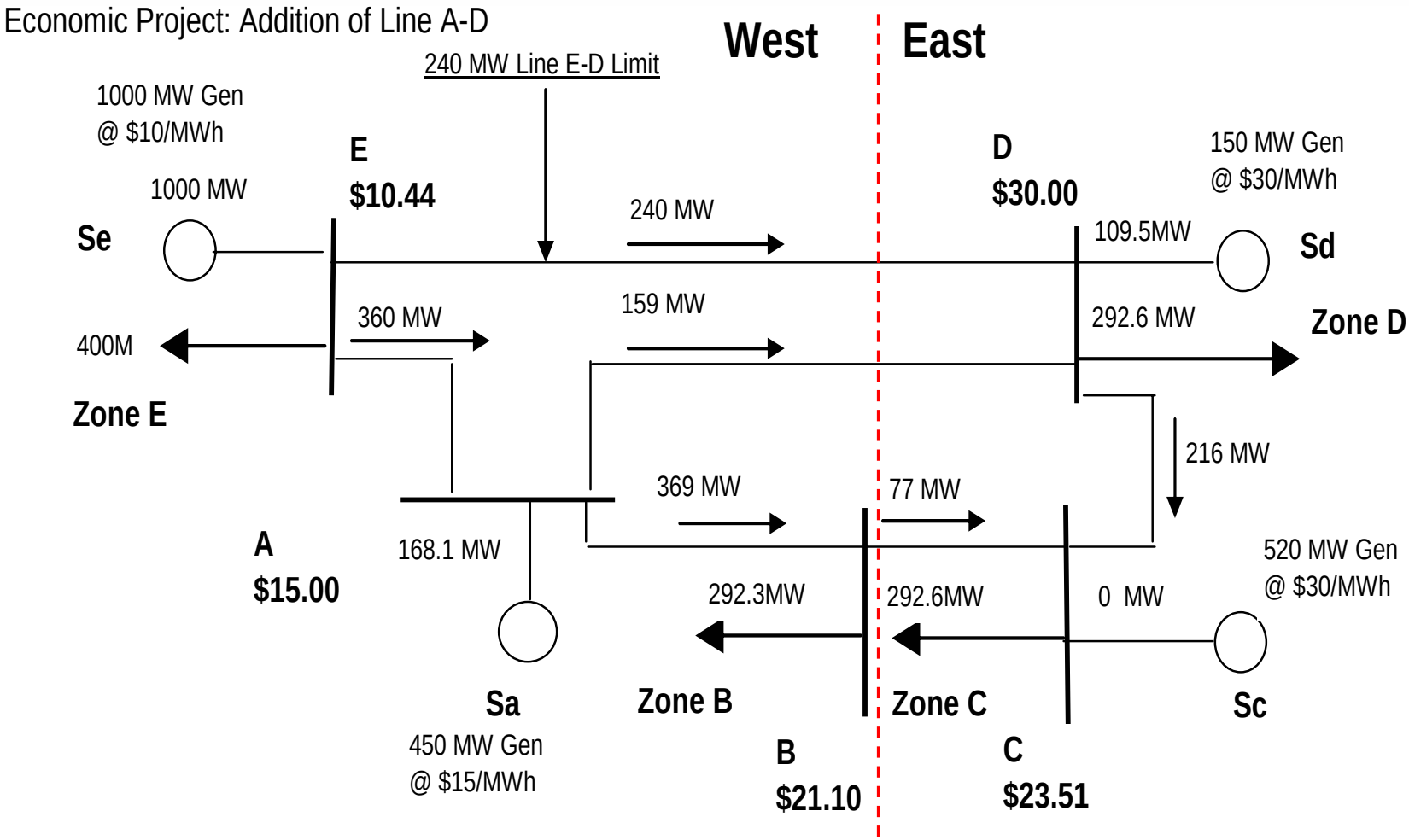
5 Bus Example – After Economic Project
Least Cost-Security Constrained Dispatch



5 Bus Example – After Economic Project
Gross Load Payment and Gross Generation Revenue

Load Payments

West				East				Total System
Zone	MW	LMP	Gross Load Payment	Zone	MW	LMP	Gross Load Payment	Gross Load Payment
Zone B	292.3	$21.10	$6,167.53	Zone C	292.6	$23.51	$6,879.03	
Zone E	400.0	$10.44	$4,176.00	Zone D	292.6	$30.00	$8,778.00	
Total RTO	692.3	$14.94	$10,343.53	**Total RTO**	585.2	$26.76	$15,657.03	$26,000.56

Generation Revenue

West				East				Total System
Gen	MW	LMP	Gross Gen Revenue	Gen	MW	LMP	Gross Gen Revenue	Gross Gen Revenue
Sa	168.1	$15.00	$2,521.50	Sc	0.0	$23.51	$0.00	
Se	1000.0	$10.44	$10,440.00	Sd	109.5	$30.00	$3,285.00	
Total RTO	1168.1	$11.10	$12,961.50	**Total RTO**	109.5	$30.00	$3,285.00	$16,246.50

Total System Congestion = Gross Load Payment - Gross Gen Revenue
= $26,000.56 - $16,246.50
= $9,754.06

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5 Bus Example – After Economic Project
Breakdown of Congestion Costs

	Congestion Costs	Congestion Cost Calculation
Gen-to-Load Congestion		
West	$2,658.43	= 692.3 MW x ($14.94 - $11.10)
East	-$354.78	= 109.5 MW x ($26.76 - $30.00)
Interchange Congestion	$7,451.03	= 475.8 MW x ($26.76 - $11.10)
Total Congestion	**$9,754.68**	

5 Bus Example – After Economic Project
Net Generation Revenue and Net Load Payment

Net Generation Revenue

West						East					
Gen	MW	LMP	Gross Gen Revenue	Gen Prod Cost	Net Gen Revenue	Gen	MW	LMP	Gross Gen Revenue	Gen Prod Cost	Net Gen Revenue
Sa	168.1	$15.00	$2,521.50	$2,521.50	$0.00	Sc	0.0	$23.51	$0.00	$0.00	$0.00
Se	1000.0	$10.44	$10,440.00	$10,000.00	$440.00	Sd	109.5	$30.00	$3,285.00	$3,285.00	$0.00
Total RTO	1168.1	$11.10	$12,961.50	$12,521.50	$440.00	**Total RTO**	109.5	$30.00	$3,285.00	$3,285.00	$0.00

Net Load Payments

West						East					
Zone	MW	LMP	Gross Load Payment	FTR Credits	Net Load Payment	Zone	MW	LMP	Gross Load Payment	FTR Credits	Net Load Payment
Zone B	292.3	$21.10	$6,167.53	--	--	Zone C	292.6	$23.51	$6,879.03	--	--
Zone E	400.0	$10.44	$4,176.00	--	--	Zone D	292.6	$30.00	$8,778.00	--	--
Total RTO	692.3	$14.94	$10,343.53	$2,658.43	$7,685.10	**Total RTO**	585.2	$26.76	$15,657.03	-$354.78	$16,011.81

5 Bus Example – After Economic Project

	West	East	Total System
Generation MW	1168.1	109.5	1277.6
Gross Gen Revenue (GGR)	$12,961.50	$3,285.00	$16,246.50
Gen Production Cost	$12,521.50	$3,285.00	$15,806.50
Net Gen Revenue (NGR)	$440.00	$0.00	$440.00
Load MW	692.3	585.2	1277.5
Gross Load Payment (GLP)	$10,343.53	$15,657.03	$26,000.56
FTR Credits	$2,661.61	-$355.33	$2,306.29
Net Load Payment (NLP)	$7,681.92	$16,012.35	$23,694.27
Net Cost (NLP - NGR)	$7,241.92	$16,012.35	$23,254.27

Blended Metrics

Adjusted Production Cost	$7,241.92	$16,012.35	$23,254.27	
70%(Gen Prod Cost) + 30%(NLP)	$11,069.62	$7,103.21	$18,172.83	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	$8,172.40	$15,905.76	$24,078.16	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	$7,373.92	$16,012.35	$23,386.27	MISO Method (w/ NLP)

Total System Congestion $9,754.06

Impact of Economic Upgrade
Delta due to Upgrades

Delta due to Upgrade	West	East	Total System
Generation MW	190.5	-190.5	0.0
Gross Gen Revenue (GGR)	$1,523.00	-$13,812.00	-$12,289.00
Gen Production Cost	$1,083.00	-$5,715.00	-$4,632.00
Net Gen Revenue (NGR)	$440.00	-$8,097.00	-$7,657.00
Load MW	0.0	0.0	0.0
Gross Load Payment (GLP)	-$4,456.96	-$17,693.52	-$22,150.48
FTR Credits	-$4,039.85	-$355.33	-$4,393.88
Net Load Payment (NLP)	-$417.10	-$17,338.19	-$17,756.60
Net Cost (NLP - NGR)	-$857.10	-$9,241.19	-$10,098.30

Blended Metrics

Adjusted Production Cost	-$857.10	-$9,241.19	-$10,098.30	
70%(Gen Prod Cost) + 30%(NLP)	$632.97	-$9,201.96	-$8,568.99	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	-$1,937.06	-$11,776.89	-$13,713.95	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	-$725.10	-$11,670.29	-$12,395.40	MISO Method (w/ NLP)

Change in Total System Congestion -$9,861.48

MISO/PJM Economic Upgrade Examples

Economic Upgrade Examples

- Examples illustrate the economic impact on MISO, PJM and total system of relieving an economic constraint
- Several constraints selected from a MISO/PJM annual PROMOD base case simulation
- Each constraint was relieved one at a time and results compared back to base case simulation
- Constraint relieved by increasing the facility rating to 9999 simulating an upgrade designed to eliminate constraint
- Purpose of examples is to use actual system simulations to assist group in development of:
  - Cross-border economic constraint threshold/indicator
  - Cross-border economic benefit metric
  - Cross-border economic upgrade cost allocation method

Evaluated Constraints

Monitor Facility	Contingency Facility	Base Case Hours Binding	Estimated Congestion ($Millions)
Black Oak - Bedington 500 kV	Pruntytown - Mt. Storm 500 kV	1842	440
Palisades - Roosevelt 345 kV	No Outage	1038	16
Saukville - Pleasant Valley 138 kV	Saukville - Barton 138 kV	1377	52
Bedford - Seymour 138 kV	Bedford - Columbus 345 kV	221	58

Evaluated Constraints

	MISO	PJM	Total System
Generation MW	157,728	-157,737	-9
Gross Generation Revenue (GGR)	$40,312,798	-$62,651,051	-$22,338,253
Gen Production Cost	$10,060,070	-$25,088,910	-$15,028,840
Net Gen Revenue (NGR)	$30,252,728	-$37,562,141	-$7,309,413
Load MW	0	0	0
Gross Load Payment (GLP)	$35,682,057	-$147,555,128	-$111,873,070
FTR Credits	$3,038,997	-$94,989,142	-$91,950,145
Net Load Payment (NLP)	$32,643,061	-$52,565,986	-$19,922,925
Net Cost (NLP - NGR)	$2,390,333	-$15,003,845	-$12,613,512

Blended Metrics

Adjusted Production Cost	$2,390,333	-$15,003,845	-$12,613,512	
70%(Gen Prod Cost) + 30%(NLP)	$16,834,967	-$33,332,033	**-$16,497,065**	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	**$12,377,850**	**-$54,769,230**	**-$42,391,379**	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	$11,466,152	-$26,272,487	-$14,806,336	MISO Method (w/ NLP)

Delta Total System Congestion -89,534,817

Black Oak-Bedington Example
Generation Shift due to Constraint Relief

Top 15 Units by Increased Gen MWh

Unit Name	Unit ID	Zone	RTO	delta Gen (MWH)	delta Prod Cost ($)	Unit Name	Unit ID	Zone	RTO	delta Gen (MWH)	delta Prod Cost ($)
FRMNTNRG	1	FE	MISO	14,348		HTFLDSFR	1	PJMW	PJM	98,891	
SAMMIS	4	FE	MISO	13,276		ASWRRRRN	1	PJMW	PJM	70,699	
PRTWSHNG	12	WEP	MISO	10,885		GERMAN	1	PJMW	PJM	42,009	
COVERT	4	CEC	MISO	10,758		SPRNGDLE	1	PJMW	PJM	35,102	
SAMMIS	2	FE	MISO	9,263		ALBRIGHT	3	PJMW	PJM	29,304	
SAMMIS	6	FE	MISO	8,665		FRTMRTNM	2	PJMW	PJM	24,352	
ZLANDMIR	21	CEC	MISO	7,563		HTFLDSFR	3	PJMW	PJM	21,380	
COVERT	3	CEC	MISO	6,432		ALBRIGHT	2	PJMW	PJM	17,327	
COVERT	5	CEC	MISO	5,847		HNTRSTWN	21	PJMW	PJM	17,214	
NEWTON	2	CIPS	MISO	5,527		BTHLHMCV	22	PJME	PJM	15,912	
MDLNDCGN	1	CEC	MISO	4,878		LMPRJECT	1	AEP	PJM	15,881	
SGRCREEK	11	PSI	MISO	4,861		LWRMNTBT	1	PJMW	PJM	15,792	
JACKSON	1	CEC	MISO	4,810		LNGVWPWR	1	PJMW	PJM	15,069	
SAMMIS	3	FE	MISO	4,730		WTRFR2PS	1	AEP	PJM	14,306	
JACKSON	2	CEC	MISO	4,583		WSHNG3NN	1	AEP	PJM	13,753	
			Top 15	116,423	6,418,463				Top 15	446,987	19,986,414
			Total MISO	**287,607**	**15,114,096**				**Total PJM**	**692,518**	**34,926,237**

Top 15 Units by Decreased Gen

STUART	23	CGE	MISO	-8,378		CATOCTIN	1	PJMW	PJM	-106,802	
PRTWSHNG	11	WEP	MISO	-5,191		PSSMPINT	21	VP	PJM	-54,489	
MRONSIPC	4	SIPC	MISO	-4,648		CPVWRREN	1	PJMW	PJM	-43,996	
HAVANA	6	ILPC	MISO	-3,891		DSWLLCMB	1	VP	PJM	-40,274	
BECKJORD	5	CGE	MISO	-2,923		DSWLLCMB	2	VP	PJM	-37,146	
MERAMEC	4	AUEP	MISO	-2,718		ASRNWDPR	1	PJMW	PJM	-31,178	
NEWTON	1	CIPS	MISO	-2,516		FLVNNCNT	1	VP	PJM	-25,054	
BLACKDOG	4	NSP	MISO	-2,515		PNDBRNDY	1	PJMS	PJM	-15,806	
HGHBRDGE	1	NSP	MISO	-2,484		WLMNGTON	21	PJME	PJM	-15,187	
GIBSON	3	PSI	MISO	-2,473		CHSTRFLD	12	VP	PJM	-14,869	
EDGWTRWP	42	WPS	MISO	-2,416		BLLMEADE	1	VP	PJM	-14,295	
EDGWTRWP	41	WPL	MISO	-2,264		WLLWSLND	2	PJMW	PJM	-12,889	
HOOTLAKE	3	OTP	MISO	-2,118		HARRI1ON	1	PJMW	PJM	-11,772	
GIBSON	5	PSI	MISO	-2,044		FLLSTWNS	1	PJME	PJM	-11,124	
DALLMAN	2	SPRIL	MISO	-2,032		HARRI1ON	2	PJMW	PJM	-10,816	
			Top 15	-48,611	-1,640,096				Top 15	-445,698	-31,083,078
			Total MISO	**-130,968**	**-5,054,026**				**Total PJM**	**-849,079**	**-60,015,147**

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	MISO	PJM	Total System
Generation MW	-148,232	148,282	49
Gross Generation Revenue (GGR)	-$6,797,368	$19,452,856	$12,655,488
Gen Production Cost	-$5,904,435	$3,669,824	-$2,234,610
Net Gen Revenue (NGR)	-$892,933	$15,783,032	$14,890,098
Load MW	0	0	0
Gross Load Payment (GLP)	-$8,928,930	$17,192,600	$8,263,670
FTR Credits	-$4,853,541	$2,631,945	-$2,221,596
Net Load Payment (NLP)	-$4,075,389	$14,560,655	$10,485,266
Net Cost (NLP - NGR)	-$3,182,455	-$1,222,377	-$4,404,832

Blended Metrics

Adjusted Production Cost	-$3,182,455	-$1,222,377	-$4,404,832	
70%(Gen Prod Cost) + 30%(NLP)	-$5,355,721	$6,937,074	**$1,581,353**	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	**-$4,906,398**	**$4,302,116**	**-$604,281**	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	-$3,450,335	$3,512,533	$62,197	MISO Method (w/ NLP)

Delta Total System Congestion -4,391,818

Palisades-Roosevelt Example
Generation Shift due to Constraint Relief

	UNIT NAME	UNIT ID	COMPANY	RTO	delta Gen (MWH)	delta Prod Cost ($)	UNIT NAME	UNIT ID	COMPANY	RTO	delta Gen (MWH)	delta Prod Cost ($)
Top 15 Units by Increased Gen MWh	GIBSON	3	PSI	MISO	11,811		AMOS	1	AEP	PJM	8,887	
	ELMROAD	1	WEP	MISO	10,561		AMOS	3	AEP	PJM	8,239	
	NEWTON	2	CIPS	MISO	9,191		MNTINEER	1	AEP	PJM	6,309	
	GIBSON	1	PSI	MISO	8,259		BGSND1KP	2	AEP	PJM	5,813	
	EASTBEND	21	CGE	MISO	8,104		ASREDOAK	1	PJME	PJM	5,520	
	NEWTON	1	CIPS	MISO	8,057		KINCAID	1	COED	PJM	5,402	
	GIBSON	2	PSI	MISO	7,532		BRGNPSGF	6	PJME	PJM	5,258	
	PRRSTTNR	1	ILPC	MISO	6,492		ELWOODEC	1	COED	PJM	5,195	
	CAYUGA	1	PSI	MISO	6,034		KINCAID	2	COED	PJM	4,882	
	GIBSON	4	PSI	MISO	5,576		STUART	31	DP&L	PJM	4,849	
	CAYUGA	2	PSI	MISO	5,539		LNGVWPWR	1	PJMW	PJM	4,330	
	EDWARDS	3	CIL	MISO	5,271		FLLSTWNS	2	PJME	PJM	4,259	
	GIBSON	5	PSI	MISO	5,106		FIVEFORK	1	VP	PJM	4,202	
	MEROM	2	HEC	MISO	4,867		HTFLDSFR	1	PJMW	PJM	3,840	
	SCHAHFER	15	NIPS	MISO	4,774		CLOVER	2	VP	PJM	3,836	
				Top 15	107,173	2,447,093				Top 15	80,820	2,648,924
				Total MISO	**263,905**	**7,462,492**				**Total PJM**	**223,541**	**8,422,585**
Top 15 Units by Decreased Gen	CMPBL1CC	3	CEC	MISO	-51,867		PSSMPINT	21	VP	PJM	-7,117	
	CMPBL1CC	2	CEC	MISO	-42,452		INDNRVRN	4	PJME	PJM	-3,623	
	LAKEMICH	1	CEC	MISO	-25,602		BRGNPSGF	2	PJME	PJM	-3,161	
	KARN	2	CEC	MISO	-20,457		YORKTOWN	1	VP	PJM	-3,078	
	ZLANDMIR	21	CEC	MISO	-20,293		FLLSTWNS	1	PJME	PJM	-2,943	
	MNRDETED	4	DETED	MISO	-20,290		BTHLHMCV	22	PJME	PJM	-2,768	
	CMPBL1CC	1	CEC	MISO	-18,211		KNDLLCNT	1	COED	PJM	-2,613	
	COBB	5	CEC	MISO	-16,948		PORTLAND	2	PJMW	PJM	-2,487	
	COBB	4	CEC	MISO	-14,509		LWRNCBRG	2	AEP	PJM	-1,922	
	MNRDETED	2	DETED	MISO	-10,473		CRNYSPNT	1	PJME	PJM	-1,894	
	KARN	1	CEC	MISO	-9,562		GRNENRGY	1	PJMW	PJM	-1,828	
	TRNTNCHN	9	DETED	MISO	-9,238		BLLMEADE	1	VP	PJM	-1,812	
	WEADOCK	8	CEC	MISO	-8,309		HNGNGRCK	2	AEP	PJM	-1,760	
	MNRDETED	3	DETED	MISO	-7,540		SWRDRLNT	11	PJMW	PJM	-1,735	
	MNRDETED	1	DETED	MISO	-6,966		MRTNSCRK	3	PJMW	PJM	-1,716	
				Top 15	-282,716	-8,214,552				Top 15	-40,457	-2,647,432
				Total MISO	**-411,619**	**-13,366,927**				**Total PJM**	**-75,332**	**-4,752,760**

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	MISO	PJM	Total System
Generation MW	23,449	-23,207	243
Gross Generation Revenue (GGR)	$13,286,628	$20,811,440	$34,098,068
Gen Production Cost	-$10,774,509	-$1,050,821	-$11,825,330
Net Gen Revenue (NGR)	$24,061,137	$21,862,261	$45,923,398
Load MW	0	0	0
Gross Load Payment (GLP)	-$22,460,643	$26,525,040	$4,064,397
FTR Credits	-$34,695,255	$5,863,599	-$28,831,656
Net Load Payment (NLP)	$12,234,612	$20,661,441	$32,896,053
Net Cost (NLP - NGR)	-$11,826,525	-$1,200,819	-$13,027,344

Blended Metrics

Adjusted Production Cost	-$11,826,525	-$1,200,819	-$13,027,344	
70%(Gen Prod Cost) + 30%(NLP)	-$3,871,773	$5,462,858	**$1,591,085**	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	**-$15,016,760**	**$7,116,939**	**-$7,899,822**	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	-$4,608,184	$5,357,859	$749,675	MISO Method (w/ NLP)

Delta Total System Congestion -30,033,671

Saukville-Pleasant Valley Example
Generation Shift due to Constraint Relief

Top 15 Units by Increased Gen MWh

UNIT NAME	UNIT ID	COMPANY	RTO	delta Gen (MWH)	delta Prod Cost ($)	UNIT NAME	UNIT ID	COMPANY	RTO	delta Gen (MWH)	delta Prod Cost ($)
PRTWSHNG	12	WEP	MISO	232,206		ASREDOAK	1	PJME	PJM	8,766	
PRTWSHNG	11	WEP	MISO	200,628		LWRNCCNT	1	AEP	PJM	6,600	
MDLNDCGN	1	CEC	MISO	5,555		LNDNPSGF	22	PJME	PJM	5,806	
SHEBOYGN	1	WPL	MISO	5,398		CPVWRREN	1	PJMW	PJM	4,710	
NEWTON	2	CIPS	MISO	5,177		ONTLNNRG	1	PJMW	PJM	4,660	
SHEBOYGN	2	WPL	MISO	4,684		BRGNPSGF	6	PJME	PJM	4,021	
SHRBURNE	31	NSP	MISO	4,467		LWRMNTBT	1	PJMW	PJM	3,990	
VLLEYWEP	2	WEP	MISO	4,302		HPWLLCGN	1	VP	PJM	3,876	
VLLEYWEP	1	WEP	MISO	3,271		AEP IGCC	1	AEP	PJM	3,600	
NEENAH	2	WEP	MISO	2,678		DRESDECT	1	AEP	PJM	2,704	
GENOA	32	GRE	MISO	2,227		ZNNRGYCN	2	COED	PJM	2,597	
WSTMR1TT	34	MGE	MISO	1,927		WAGNER	4	PJMS	PJM	2,458	
GRMNTOWN	5	WEP	MISO	1,874		SWRDRLNT	11	PJMW	PJM	2,247	
PARISWEP	4	WEP	MISO	1,701		WKGNMDGN	8	COED	PJM	2,131	
EASTBEND	21	CGE	MISO	1,659		BLLMEADE	1	VP	PJM	1,920	
			Top 15	477,755	31,302,636				Top 15	60,085	4,087,615
			Total MISO	**539,181**	**35,883,794**				**Total PJM**	**158,649**	**12,259,407**

Top 15 Units by Decreased Gen

RVRSD1RG	1	WPL	MISO	-61,398		FLVNNCNT	1	VP	PJM	-9,267	
CONCORD	1	WEP	MISO	-56,660		WSHNG3NN	1	AEP	PJM	-8,573	
CONCORD	4	WEP	MISO	-36,983		ELWOODEC	1	COED	PJM	-8,355	
CONCORD	3	WEP	MISO	-31,614		LNDNPSGF	21	PJME	PJM	-6,978	
CONCORD	2	WEP	MISO	-23,677		PSSMPINT	21	VP	PJM	-6,670	
WESTCMPS	1	MGE	MISO	-18,889		YORKTOWN	3	VP	PJM	-5,486	
FOXEGCTR	1	WPS	MISO	-15,223		FLLSTWNS	2	PJME	PJM	-5,466	
MNKTENRG	1	NSP	MISO	-12,503		RCKFR3II	2	COED	PJM	-4,577	
RCKGNNRG	3	WPL	MISO	-12,257		ELWOODEC	2	COED	PJM	-4,552	
HLLNDNRG	1	CIPS	MISO	-11,995		KNDLLCNT	3	COED	PJM	-4,452	
RCKGNNRG	2	WPL	MISO	-10,145		LWRNCBRG	2	AEP	PJM	-4,390	
WHTWTRCG	1	WEP	MISO	-9,962		JOLIE1 9	6	COED	PJM	-4,342	
PWRIOWA1	1	ALWST	MISO	-9,554		FLLSTWNS	1	PJME	PJM	-4,274	
RCKGNNRG	1	WPL	MISO	-9,156		LBRTYLCT	1	PJME	PJM	-4,169	
SHRBURNE	32	SMMP	MISO	-8,626		LMPRJECT	1	AEP	PJM	-3,946	
			Top 15	-328,643	-33,466,769				Top 15	-85,497	-5,876,872
			Total MISO	**-519,464**	**-46,658,303**				**Total PJM**	**-180,765**	**-13,310,229**

pjm

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	MISO	PJM	Total System
Generation MW	51,512	-51,368	144
Gross Generation Revenue (GGR)	$21,604,348	-$40,634,342	-$19,029,994
Gen Production Cost	$3,548,581	-$5,359,645	-$1,811,064
Net Gen Revenue (NGR)	$18,055,767	-$35,274,696	-$17,218,930
Load MW	0	0	0
Gross Load Payment (GLP)	-$20,538,262	-$34,254,748	-$54,793,010
FTR Credits	-$36,627,216	-$340,542	-$36,967,758
Net Load Payment (NLP)	$16,088,954	-$33,914,205	-$17,825,251
Net Cost (NLP - NGR)	-$1,966,813	$1,360,491	-$606,322

Blended Metrics

Adjusted Production Cost	-$1,966,813	$1,360,491	-$606,322	
70%(Gen Prod Cost) + 30%(NLP)	$7,310,693	-$13,926,013	**-$6,615,320**	PJM Method
70%(Adjusted Prod Cost) + 30%(GLP)	**-$7,538,247**	**-$9,324,081**	**-$16,862,328**	MISO Method
70%(Adjusted Prod Cost) + 30%(NLP)	$3,449,917	-$9,221,918	-$5,772,001	MISO Method (w/ NLP)

Delta Total System Congestion -35,763,016

Bedford-Seymour Example
Generation Shift due to Constraint Relief

Top 15 Units by Increased Gen MWh

UNIT NAME	UNIT ID	COMPANY	RTO	delta Gen (MWH)	delta Prod Cost ($)	UNIT NAME	UNIT ID	COMPANY	RTO	delta Gen (MWH)	delta Prod Cost ($)
SGRCREEK	11	PSI	MISO	9,963		BRGNPSGF	6	PJME	PJM	3,119	
PETE1IPL	22	IP&L	MISO	9,936		HNTRSTWN	21	PJMW	PJM	2,110	
HLLNDNRG	1	CIPS	MISO	9,420		DSWLLCMB	2	VP	PJM	1,802	
EDWRDSPR	8	PSI	MISO	8,618		ASREDOAK	1	PJME	PJM	1,665	
WBSHRVER	7	PSI	MISO	7,231		LMPRJECT	1	AEP	PJM	1,492	
PETE1IPL	21	IP&L	MISO	3,853		MNTINEER	1	AEP	PJM	1,308	
PETE1IPL	4	IP&L	MISO	3,769		KNDLLCNT	1	COED	PJM	1,278	
WRTHNGTN	2	HEC	MISO	3,483		HNGNGRCK	2	AEP	PJM	1,122	
WRTHNGTN	4	HEC	MISO	3,452		RLNTNRGY	4	COED	PJM	1,093	
EDWRDSPR	7	PSI	MISO	3,357		BLLMEADE	1	VP	PJM	1,072	
WRTHNGTN	3	HEC	MISO	2,412		GILBERT	21	PJME	PJM	1,053	
WRTHNGTN	1	HEC	MISO	2,218		WLMNGTON	21	PJME	PJM	1,046	
EASTBEND	21	CGE	MISO	2,178		ONTLNNRG	1	PJMW	PJM	1,017	
GENOA	32	GRE	MISO	2,073		ELWOODEC	2	COED	PJM	1,015	
GIBSON	11	AUEP	MISO	1,718		STUART	22	AEP	PJM	937	
			Top 15	73,680	5,122,447				Top 15	21,127	1,427,456
			Total MISO	**139,507**	**10,409,512**				**Total PJM**	**64,033**	**5,021,430**

Top 15 Units by Decreased Gen

NBLSVLLE	3	PSI	MISO	-4,534		LWRNCBRG	1	AEP	PJM	-5,115	
COVERT	5	CEC	MISO	-3,340		FLVNNCNT	1	VP	PJM	-3,840	
SHRBURNE	1	NSP	MISO	-3,299		CSHCTNIG	1	AEP	PJM	-3,800	
FRMNTNRG	1	FE	MISO	-3,255		LWRNCBRG	2	AEP	PJM	-3,234	
SHRBURNE	32	SMMP	MISO	-2,201		ASRNWDPR	1	PJMW	PJM	-3,110	
CTE1	1	FE	MISO	-1,779		LNDNPSGF	21	PJME	PJM	-2,907	
HGHBRDGE	1	NSP	MISO	-1,694		WTRFR2PS	1	AEP	PJM	-2,866	
STUART	13	CGE	MISO	-1,674		YORKTOWN	3	VP	PJM	-2,639	
HRDNGSTR	17	IP&L	MISO	-1,239		GERMAN	1	PJMW	PJM	-2,559	
RNSSNCPW	2	CEC	MISO	-1,214		LWRMNTBT	1	PJMW	PJM	-2,114	
MRONSIPC	4	SIPC	MISO	-1,107		BRNTSLND	10	DQE	PJM	-2,062	
FOXEGCTR	1	WPS	MISO	-1,069		BRGNPSGF	2	PJME	PJM	-2,014	
PRTWSHNG	12	WEP	MISO	-1,041		LBRTYLCT	1	PJME	PJM	-1,931	
HRDNGSTR	15	IP&L	MISO	-1,002		RLLNGHLL	2	AEP	PJM	-1,880	
ZLANDMIR	21	CEC	MISO	-1,000		BTHLHMCV	21	PJME	PJM	-1,877	
			Top 15	-29,448	-1,958,714				Top 15	-41,946	-3,233,923
			Total MISO	**-87,511**	**-6,860,930**				**Total PJM**	**-116,470**	**-10,381,076**

pjm

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DFAX as A Screen?

- Considered Cross Border Reliability DFAX method as a possible screen for performing cross-border economic calcs
- E.g., if the DFAX doesn't show a 5% or greater contribution to flow on constraint (worst) that a potential Economic Upgrade fixes, then not "Cross Border"
- Compared DFAX results with Economic analysis for prior examples
- Some Correlation – more work to be done to understand links

DFAX as A Screen – Comparison (Preliminary)

Flowgate				All Gen to All Load (by Load) Source: All gen in each RTO participate in proportion to Pgen Sink: All load in each RTO participate in proportion to Pload MW Impact: (DF) x (All load for each RTO) Counterflows: Included						
				PJM		MISO				
OASIS Path Code	Flowgate Name	Control Area	FG Flow (MW)	MW	%	MW	%	DFAX "Cause"	Econ Alloc by APC	Econ Alloc by 70 APC+30 NLP
BLOBEDPRNMTS	Black Oak-Bedington 500 (flo) Pruntytown-Mt. Storm 500	PJM	2746	2394	100%	-144	0%	PJM	100% PJM	100% PJM
SAUPSYSAUBTN	Saukville - Pleasant Valley 138 (flo) Saukville - Barton 138	WE	170	0	0%	222	100%	MISO	91% MISO	100% MISO
BDFSEYBDFCLM	Bedford-Seymour 138kV (flo) Bedford-Columbus 345kV	DEM	215	13	5%	220	95%	MOSTLY MISO	100% MISO	100% PJM
PALISAROOST	Palisades to Roosevelt 345 kV	METC	342	65	91%	6	9%	MOSTLY PJM	73% MISO	100% MISO

Review of Concepts Considered to Date

1. Each RTO uses own internal metrics to determine benefit, and max acceptable cost – then calculate share of project cost based on ratio of max acceptable cost (project cost ≤ sum of max costs)
2. Each RTO calculate own benefit – then if both sides benefit, postage stamp (AEP)
3. Variations on existing internal metrics
   - System Benefit = 70% PC + 30% NLP, Allocate on GLP, pass each internal B/C
   - System Benefit = Allocation: APC
   - System Benefit = Allocation: 70% APC + 30% NLP

Stakeholder Discussion / Next Steps

- Stakeholder Discussion
- Next Steps / Additional Material Needed
- Schedule Next Meeting