Comments on Incremental Loss Factor Methodology

Attached are revised evaluation tables from the Teshmont Part 1 report. The tables include an evaluation of our analytical interpretation of ATCO's proposed methodology.

The evaluation is based on the twelve 2003 base-case load flows, as used in the original evaluation.

The methodology uses the corrected R-bus for each load flow as a starting point. The loss factor at a generator bus is determined by reducing the output of the generator to zero and redistributing the reduction to all loads in the Alberta system. The loss factor is determined by dividing the change in system losses by the amount of generation reduction. At generator buses where the output is zero, the amount of power reduction is set equal to 0.00001MW (i.e. the marginal loss factor).

Similar to the rest of the analytical methods, an assumption is made that the R-matrix is unchanged as a result of the change in generation and load.

The methodology ranks in the middle (8th to 12th) of all 19 of the alternatives in terms of magnitude of shift factor required, the number of generators that exceed the loss factor limits, the range of the loss factors, and the seasonal volatility in the loss factors, and ranks 10th overall.

The methodology ranks low (6th to 9th) of all 11 of the corrected matrix alternatives in terms of magnitude of shift factor required, the number of generators that exceed the loss factor limits, the range of the loss factors, and the seasonal volatility in the loss factors, and ranks 7th overall.

The conclusions using the full system model are for the most part similar to the conclusions drawn with the 4 bus test system (ATCO's test system). The 4 bus test system however showed a smaller relative shift factor than the full test system. It is believed that with the radial nature of the test circuit, the majority of the losses associated with each branch are relegated to the nearest generator. We ran a small test with an artificial branch between Fort Mac Murray and Rainbow Lake and while the overall losses were reduced, unallocated losses increased by about 20 MW, indicating that meshing of the network will result in over allocation of losses using the incremental loss factor method. In the full system test, the overall loss allocation is close to 50% of the total system losses with the ILF method.

With the relatively large range in loss factors (37%) and the large number of generators exceeding the criteria, (78) the compression algorithm proposed in the Part 3 report would not be satisfactory. The majority of the units would be either at maximum charge or maximum credit and the locational-based incentives required by the Department of Energy would be lost. To achieve a distribution of loss factors closer to the intent of compression, the linear compression algorithm would be required.

Applying linear compression to the loss factors for the 4-bus ATCO test system would result in a reduction in charges and credits at Fort Mac Murray and Rainbow Lake respectively but would result in a loss factor charge of about 3% at the load bus.

The proposed ILF methodology will not provide meaningful results for areas where shutdown of generation will create an unreasonable situation. This is almost the case in the 4-bus test system for shutdown of the Rainbow Lake generator. Loss of that unit in the load flow results in losses in the Rainbow lake circuit equal to the power delivered. If huge voltage support is not provided at Rainbow Lake, the power flow will not solve.

A set of charts plotting the ranking of the average adjusted loss factor by load flow area is also attached. The area with the highest average adjusted loss factor receives the lowest ranking and the area with the lowest average adjusted loss factor receives the highest ranking.

The ILF method does shift some responsibility for losses between areas from the swing bus methodology (similar to the current methodology), but overall still exhibits a similar trend as the other methodologies.

The main weaknesses that we see with the incremental loss factor methodology are:

- Large shift factor required. We have interpreted the Department of Energy's directives that the loss factor methodology should accurately reflect contribution to system losses and a large shift factor represents a reduction in accuracy in assigning losses and hence in a deviation from the Department of Energy's directives.

- Large range in loss factors, and the large number of generators with loss factors outside the range set by the Department of Energy. As noted above, the compression methodology that is proposed based on the 50% area load adjustment method would not give the correct locational signals. Loss factors for the majority of the generators would either be on maximum credit or on maximum charge. Linear compression of the loss factors would result in a more reasonable distribution of loss factors but would be subject to influences of small generators with large loss factors compressing all generator loss factors to the average, again with loss of locational-based signals.

- Large seasonal volatility. One of the objectives of the new loss factor methodology was to introduce some degree of stability in the loss factors applied to each generator. The large seasonal volatility indicates that loss factors calculated using the ILF method are very dependent on system dispatch and as such would change more than other methodologies on an annual basis.

- Inability to handle TMR situations. Under 'transmission must run' load flow conditions, shut down of a TMR generator (or reduction of power to zero) could result in load flow convergence failure. Although the analytical implementation of the ILF methodology is not

subject to convergence issues, the assumptions made would deviate significantly from the practical situation and a significant reduction in accuracy would result.

Based on the above factors, inclusion of the incremental loss factor methodology in our methodology evaluation will not alter our original recommendation.

Table 1 Load Flow Shift Factors Required For Each Methodology (Part "a")

		Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix
Loading Condition	Average Loss Factor	Swing Bus Methodology	Swing Bus Methodology	Area Load Methodology	Area Load Methodology	50% Area Load Methodology	50% Area Load Methodology	Direct Methodology	Direct Methodology	Gradient Methodology	Gradient Methodology
WnPk	4.77%	2.07%	1.43%	-4.79%	-4.57%	-0.01%	0.10%	2.07%	7.87%	-2.84%	-0.70%
WnMd	5.16%	3.75%	2.88%	-5.25%	-4.99%	-0.04%	0.09%	1.73%	7.47%	-3.62%	-1.84%
WnLw	6.42%	4.19%	3.99%	-7.82%	-6.37%	-0.70%	0.02%	0.86%	6.58%	-6.77%	-5.72%
SpPk	5.01%	2.06%	1.48%	-4.93%	-4.84%	0.04%	0.09%	1.91%	7.87%	-3.19%	-1.67%
SpMd	5.05%	3.30%	2.43%	-5.09%	-4.90%	-0.02%	0.07%	1.63%	8.21%	-3.66%	-2.16%
SpLw	6.41%	3.38%	3.37%	-7.66%	-6.47%	-0.62%	-0.03%	0.93%	6.85%	-6.87%	-7.16%
SmPk	4.32%	1.69%	1.20%	-4.80%	-4.15%	-0.24%	0.08%	1.79%	6.67%	-2.95%	-0.43%
SmMd	4.55%	3.44%	2.67%	-5.12%	-4.42%	-0.29%	0.06%	1.34%	6.43%	-3.66%	-1.85%
SmLw	6.03%	3.04%	3.43%	-8.02%	-6.05%	-0.99%	-0.01%	0.57%	5.93%	-7.14%	-6.41%
FlPk	4.22%	1.03%	0.58%	-4.50%	-4.06%	-0.14%	0.08%	0.57%	6.26%	-2.61%	-0.51%
FlMd	4.65%	3.70%	2.93%	-5.36%	-4.53%	-0.35%	0.06%	1.30%	5.64%	-3.81%	-2.09%
FlLw	5.86%	3.24%	3.42%	-7.70%	-5.86%	-0.92%	0.00%	0.74%	5.55%	-6.77%	-5.73%
Winter Average		3.34%	2.77%	-5.95%	-5.31%	-0.25%	0.07%	1.55%	7.31%	-4.41%	-2.75%
Spring Average		2.91%	2.43%	-5.90%	-5.40%	-0.20%	0.04%	1.49%	7.64%	-4.57%	-3.66%
Summer Average		2.72%	2.43%	-5.98%	-4.88%	-0.51%	0.04%	1.23%	6.34%	-4.58%	-2.90%
Fall Average		2.66%	2.31%	-5.85%	-4.82%	-0.47%	0.05%	0.87%	5.82%	-4.40%	-2.78%
Annual Average		2.91%	2.48%	-5.92%	-5.10%	-0.36%	0.05%	1.29%	6.78%	-4.49%	-3.02%

		Uncorrected R-matrix	Corrected R-matrix	Kron Matrix	Kron Matrix	Kron Matrix	Corrected R-matrix	Branch Loss Matrix
Loading Condition	Average Loss Factor	Gradient/2 Methodology	Gradient/2 Methodology	Direct Methodology	Swing Bus Methodology	Gradient/2 Methodology	ILF Methodology	Flow Tracking
WnPk	4.77%	0.96%	2.03%	1.19%	-11.95%	0.65%	-2.50%	0.51%
WnMd	5.16%	0.77%	1.66%	1.28%	-7.63%	0.68%	-2.89%	0.50%
WnLw	6.42%	-0.18%	0.35%	1.82%	2.50%	0.40%	-3.68%	0.55%
SpPk	5.01%	0.91%	1.67%	1.26%	-9.02%	0.70%	-2.68%	0.56%
SpMd	5.05%	0.69%	1.45%	1.27%	-5.68%	0.75%	-2.83%	0.50%
SpLw	6.41%	-0.23%	-0.37%	1.98%	9.49%	0.38%	-3.57%	0.54%
SmPk	4.32%	0.68%	1.94%	0.91%	-11.19%	0.49%	-2.13%	0.20%
SmMd	4.55%	0.44%	1.35%	0.90%	-5.28%	0.47%	-2.45%	0.18%
SmLw	6.03%	-0.55%	-0.19%	1.72%	5.81%	0.06%	-3.08%	0.19%
FlPk	4.22%	0.81%	1.86%	0.86%	-12.00%	0.46%	-1.93%	0.20%
FlMd	4.65%	0.42%	1.28%	0.89%	-5.52%	0.39%	-2.51%	0.17%
FlLw	5.86%	-0.45%	0.07%	1.47%	3.33%	0.11%	-3.18%	0.18%
Winter Average		0.52%	1.35%	1.43%	-5.69%	0.58%	-3.02%	0.52%
Spring Average		0.46%	0.92%	1.50%	-1.74%	0.61%	-3.03%	0.53%
Summer Average		0.19%	1.03%	1.18%	-3.55%	0.34%	-2.55%	0.19%
Fall Average		0.26%	1.07%	1.07%	-4.73%	0.32%	-2.54%	0.18%
Annual Average		0.36%	1.09%	1.29%	-3.93%	0.46%	-2.79%	0.36%

Legend
Largest Shift Factor per Methodology
Smallest Shift Factor per Methodology

Table 2 Load Flow Shift Factors Required For Each Methodology (Part "b")

		Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix
Loading Condition	Average Loss Factor	Swing Bus Methodology	Swing Bus Methodology	Area Load Methodology	Area Load Methodology	50% Area Load Methodology	50% Area Load Methodology	Direct Methodology	Direct Methodology	Gradient Methodology	Gradient Methodology
WnPk	4.77%	2.07%	1.43%	-4.79%	-4.57%	-0.01%	0.10%	2.07%	7.87%	-2.84%	-0.70%
WnMd	5.16%	3.75%	2.88%	-5.25%	-4.99%	-0.04%	0.09%	1.73%	7.47%	-3.62%	-1.84%
WnLw	6.42%	4.19%	3.99%	-7.82%	-6.37%	-0.70%	0.02%	0.86%	6.58%	-6.77%	-5.72%
SpPk	5.01%	2.06%	1.48%	-4.93%	-4.84%	0.04%	0.09%	1.91%	7.87%	-3.19%	-1.67%
SpMd	5.05%	3.30%	2.43%	-5.09%	-4.90%	-0.02%	0.07%	1.63%	8.21%	-3.66%	-2.16%
SpLw	6.41%	3.38%	3.37%	-7.66%	-6.47%	-0.62%	-0.03%	0.93%	6.85%	-6.87%	-7.16%
SmPk	4.32%	1.69%	1.20%	-4.80%	-4.15%	-0.24%	0.08%	1.79%	6.67%	-2.95%	-0.43%
SmMd	4.55%	3.44%	2.67%	-5.12%	-4.42%	-0.29%	0.06%	1.34%	6.43%	-3.66%	-1.85%
SmLw	6.03%	3.04%	3.43%	-8.02%	-6.05%	-0.99%	-0.01%	0.57%	5.93%	-7.14%	-6.41%
FlPk	4.22%	1.03%	0.58%	-4.50%	-4.06%	-0.14%	0.08%	0.57%	6.26%	-2.61%	-0.51%
FlMd	4.65%	3.70%	2.93%	-5.36%	-4.53%	-0.35%	0.06%	1.30%	5.64%	-3.81%	-2.09%
FlLw	5.86%	3.24%	3.42%	-7.70%	-5.86%	-0.92%	0.00%	0.74%	5.55%	-6.77%	-5.73%
Winter Average		3.34%	2.77%	-5.95%	-5.31%	-0.25%	0.07%	1.55%	7.31%	-4.41%	-2.75%
Spring Average		2.91%	2.43%	-5.90%	-5.40%	-0.20%	0.04%	1.49%	7.64%	-4.57%	-3.66%
Summer Average		2.72%	2.43%	-5.98%	-4.88%	-0.51%	0.04%	1.23%	6.34%	-4.58%	-2.90%
Fall Average		2.66%	2.31%	-5.85%	-4.82%	-0.47%	0.05%	0.87%	5.82%	-4.40%	-2.78%
Annual Average		2.91%	2.48%	-5.92%	-5.10%	-0.36%	0.05%	1.29%	6.78%	-4.49%	-3.02%

		Uncorrected R-matrix	Corrected R-matrix	Kron Matrix	Kron Matrix	Kron Matrix	Corrected R-matrix	Branch Loss Matrix
Loading Condition	Average Loss Factor	Gradient/2 Methodology	Gradient/2 Methodology	Direct Methodology	Swing Bus Methodology	Gradient/2 Methodology	ILF Methodology	Flow Tracking
WnPk	4.77%	0.96%	2.03%	1.19%	-11.95%	0.65%	-2.50%	0.51%
WnMd	5.16%	0.77%	1.66%	1.28%	-7.63%	0.68%	-2.89%	0.50%
WnLw	6.42%	-0.18%	0.35%	1.82%	2.50%	0.40%	-3.68%	0.55%
SpPk	5.01%	0.91%	1.67%	1.26%	-9.02%	0.70%	-2.68%	0.56%
SpMd	5.05%	0.69%	1.45%	1.27%	-5.68%	0.75%	-2.83%	0.50%
SpLw	6.41%	-0.23%	-0.37%	1.98%	9.49%	0.38%	-3.57%	0.54%
SmPk	4.32%	0.68%	1.94%	0.91%	-11.19%	0.49%	-2.13%	0.20%
SmMd	4.55%	0.44%	1.35%	0.90%	-5.28%	0.47%	-2.45%	0.18%
SmLw	6.03%	-0.55%	-0.19%	1.72%	5.81%	0.06%	-3.08%	0.19%
FlPk	4.22%	0.81%	1.86%	0.86%	-12.00%	0.46%	-1.93%	0.20%
FlMd	4.65%	0.42%	1.28%	0.89%	-5.52%	0.39%	-2.51%	0.17%
FlLw	5.86%	-0.45%	0.07%	1.47%	3.33%	0.11%	-3.18%	0.18%
Winter Average		0.52%	1.35%	1.43%	-5.69%	0.58%	-3.02%	0.52%
Spring Average		0.46%	0.92%	1.50%	-1.74%	0.61%	-3.03%	0.53%
Summer Average		0.19%	1.03%	1.18%	-3.55%	0.34%	-2.55%	0.19%
Fall Average		0.26%	1.07%	1.07%	-4.73%	0.32%	-2.54%	0.18%
Annual Average		0.36%	1.09%	1.29%	-3.93%	0.46%	-2.79%	0.36%

Legend
Largest Shift Factor Per Load Flow or Season
Smallest Shift Factor Per Load Flow or Season

Table 3 Range of Loss Factors per Methodology

	Uncorrected R-matrix Swing Bus Methodology	Corrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Corrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Corrected R-matrix 50% Area Load Methodology
Maximum Loss Factor	28.72%	18.88%	26.57%	17.82%	15.89%	11.51%
Minimum Loss Factor	-33.14%	-21.29%	-29.76%	-19.21%	-12.28%	-7.00%
Range of Loss Factors	61.86%	40.17%	56.33%	37.03%	28.17%	18.52%
No. Greater Than Maximum Permitted	20	20	20	20	19	3
No. Less Than Minimum Permitted	66	60	63	58	38	9
No of Generators Exceeding Criteria	86	80	83	78	57	12
Seasonal Volatility	11.45%	11.37%	10.22%	10.31%	4.87%	4.92%

	Uncorrected R-matrix Direct Methodology	Corrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Corrected R-matrix Gradient Methodology	Uncorrected R-matrix Gradient/2 Methodology	Corrected R-matrix Gradient/2 Methodology
Maximum Loss Factor	16.15%	7.95%	26.91%	18.12%	16.06%	11.66%
Minimum Loss Factor	-18.13%	-24.16%	-30.34%	-19.77%	-12.57%	-7.28%
Range of Loss Factors	34.28%	32.12%	57.25%	37.89%	28.62%	18.95%
No. Greater Than Maximum Permitted	17	0	20	20	20	3
No. Less Than Minimum Permitted	41	19	64	60	40	9
No of Generators Exceeding Criteria	58	19	84	80	60	12
Seasonal Volatility	8.07%	6.78%	10.43%	10.69%	4.98%	5.10%

	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
Maximum Loss Factor	10.33%	17.29%	11.23%	16.36%	31.93%
Minimum Loss Factor	-5.30%	-18.06%	-6.35%	-20.74%	0.36%
Range of Loss Factors	15.62%	35.35%	17.57%	37.11%	31.57%
No. Greater Than Maximum Permitted	0	20	3	20	4
No. Less Than Minimum Permitted	1	57	2	58	0
No of Generators Exceeding Criteria	1	77	5	78	4
Seasonal Volatility	4.01%	9.02%	4.46%	7.28%	78.73%

Legend: Largest Magnitude per Methodology; Smallest Magnitude per Methodology

Table 4 Ranking of Methodologies Based on Magnitude of Shift Factor

		Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix	Uncorrected R-matrix	Corrected R-matrix
Loading Condition	Average Loss Factor	Swing Bus Methodology	Swing Bus Methodology	Area Load Methodology	Area Load Methodology	50% Area Load Methodology	50% Area Load Methodology	Direct Methodology	Direct Methodology	Gradient Methodology	Gradient Methodology
WnPk	4.77%	11	8	15	14	1	2	10	16	13	5
WnMd	5.16%	13	10	15	14	1	2	8	16	12	9
WnLw	6.42%	12	11	17	14	6	1	7	15	16	13
SpPk	5.01%	11	7	15	14	1	2	10	16	13	8
SpMd	5.05%	12	10	15	14	1	2	8	17	13	9
SpLw	6.41%	10	9	16	12	6	1	7	13	14	15
SmPk	4.32%	9	8	15	14	3	1	10	16	13	4
SmMd	4.55%	12	11	15	14	3	1	7	17	13	9
SmLw	6.03%	9	11	17	14	7	1	6	13	16	15
FlPk	4.22%	10	7	15	14	2	1	6	16	13	5
FlMd	4.65%	12	11	15	14	3	1	8	17	13	9
FlLw	5.86%	10	12	17	15	7	1	6	13	16	14
Winter Average		12	10	16	14	2	1	8	17	13	9
Spring Average		11	10	16	15	2	1	7	17	14	13
Summer Average		11	9	16	15	5	1	8	17	14	12
Fall Average		11	9	17	15	5	1	6	16	13	12
Annual Average		11	9	16	15	4	1	7	17	14	12
Weighted Average		11.06	9.36	15.94	14.56	3.64	1.11	7.33	16.39	13.75	11.03
Overall Ranking		12	9	16	15	4	1	7	17	14	11

		Uncorrected R-matrix	Corrected R-matrix	Kron Matrix	Kron Matrix	Kron Matrix	Corrected R-matrix	Branch Loss Matrix
Loading Condition	Average Loss Factor	Gradient/2 Methodology	Gradient/2 Methodology	Direct Methodology	Swing Bus Methodology	Gradient/2 Methodology	ILF Methodology	Flow Tracking
WnPk	4.77%	6	9	7	17	4	12	3
WnMd	5.16%	5	7	6	17	4	11	3
WnLw	6.42%	2	3	8	9	4	10	5
SpPk	5.01%	5	9	6	17	4	12	3
SpMd	5.05%	4	7	6	16	5	11	3
SpLw	6.41%	2	3	8	17	4	11	5
SmPk	4.32%	6	11	7	17	5	12	2
SmMd	4.55%	4	8	6	16	5	10	2
SmLw	6.03%	5	4	8	12	2	10	3
FlPk	4.22%	8	11	9	17	4	12	3
FlMd	4.65%	5	7	6	16	4	10	2
FlLw	5.86%	5	2	8	11	3	9	4
Winter Average		3	6	7	15	5	11	4
Spring Average		3	6	8	9	5	12	4
Summer Average		3	6	7	13	4	10	2
Fall Average		3	7	8	14	4	10	2
Annual Average		2	6	8	13	5	10	3
Weighted Average		3.25	6.33	7.53	13.64	4.50	10.53	3.06
Overall Ranking		3	6	8	13	5	10	1

Legend

Largest Ranking Per Load Flow or Season

Smallest Ranking Per Load Flow or Season

Table 5 Overall Ranking Of Methodologies

Criteria	Weighting	Uncorrected R-matrix Swing Bus Methodology	Corrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Corrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Corrected R-matrix 50% Area Load Methodology
Shift Factor	1	12	9	16	15	4	1
Number of Generators That Exceed the Limits	1	17	13	15	11	7	4
Range of Loss Factors	1	17	14	15	11	5	3
Seasonal Volatility	1	16	15	11	12	3	4
Swing Independent	1	15	15	1	1	1	1
Weighted Sum		15.40	13.20	11.60	10.00	4.00	2.60
Final Ranking		17	16	13	11	2	1

Criteria	Weighting	Uncorrected R-matrix Direct Methodology	Corrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Corrected R-matrix Gradient Methodology	Uncorrected R-matrix Gradient/2 Methodology	Corrected R-matrix Gradient/2 Methodology
Shift Factor	1	7	17	14	11	3	6
Number of Generators That Exceed the Limits	1	8	6	16	13	9	4
Range of Loss Factors	1	9	8	16	13	6	4
Seasonal Volatility	1	9	7	13	14	5	6
Swing Independent	1	1	1	1	1	1	1
Weighted Sum		6.80	7.80	12.00	10.40	4.80	4.20
Final Ranking		8	9	15	12	4	3

Criteria	Weighting	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
Shift Factor	1	8	13	5	10	1
Number of Generators That Exceed the Limits	1	1	10	3	11	2
Range of Loss Factors	1	1	10	2	12	7
Seasonal Volatility	1	1	10	2	8	17
Swing Independent	1	15	15	15	1	1
Weighted Sum		5.20	11.60	5.40	8.40	5.60
Final Ranking		5	13	6	10	7

Legend		
	1	Ranking =1
	2	Ranking = 2 or 3
	15	Ranking >= 4

Table 6 Overall Ranking Of Corrected Matrix Methodologies

Criteria	Weighting	Corrected R-matrix Swing Bus Methodology	Corrected R-matrix Area Load Methodology	Corrected R-matrix 50% Area Load Methodology	Corrected R-matrix Direct Methodology	Corrected R-matrix Gradient Methodology	Corrected R-matrix Gradient/2 Methodology
Shift Factor	1	6	10	1	11	8	4
Number of Generators That Exceed the Limits	1	10	8	4	6	10	4
Range of Loss Factors	1	11	8	3	6	10	4
Seasonal Volatility	1	10	8	3	5	9	4
Swing Independent	1	9	1	1	1	1	1
Weighted Sum		9.20	7.00	2.40	5.80	7.60	3.40
Final Ranking		11	8	1	6	9	2

Criteria	Weighting	Kron Matrix Direct Methodology	Kron Matrix Swing Bus Methodology	Kron Matrix Gradient/2 Methodology	Corrected R-matrix ILF Methodology	Branch Loss Matrix Flow Tracking
Shift Factor	1	5	9	3	7	1
Number of Generators That Exceed the Limits	1	1	7	3	8	2
Range of Loss Factors	1	1	7	2	9	5
Seasonal Volatility	1	1	7	2	6	11
Swing Independent	1	9	9	9	1	1
Weighted Sum		3.40	7.80	3.80	6.20	4.00
Final Ranking		2	10	4	7	5

Legend		
	1	Ranking =1
	2	Ranking = 2 or 3
	15	Ranking >= 4

Table 7 Overall Ranking Of Uncorrected Matrix Methodologies

Criteria	Weighting	Uncorrected R-matrix Swing Bus Methodology	Uncorrected R-matrix Area Load Methodology	Uncorrected R-matrix 50% Area Load Methodology	Uncorrected R-matrix Direct Methodology	Uncorrected R-matrix Gradient Methodology	Uncorrected R-matrix Gradient/2 Methodology
Shift Factor	1	4	6	2	3	5	1
Number of Generators That Exceed the Limits	1	6	4	1	2	5	3
Range of Loss Factors	1	6	4	1	3	5	2
Seasonal Volatility	1	6	4	1	3	5	2
Swing Independent	1	6	1	1	1	1	1
Weighted Sum		5.60	3.80	1.20	2.40	4.20	1.80
Final Ranking		6	4	1	3	5	2

Legend		
	1	Ranking =1
	2	Ranking = 2 or 3
	15	Ranking >= 4

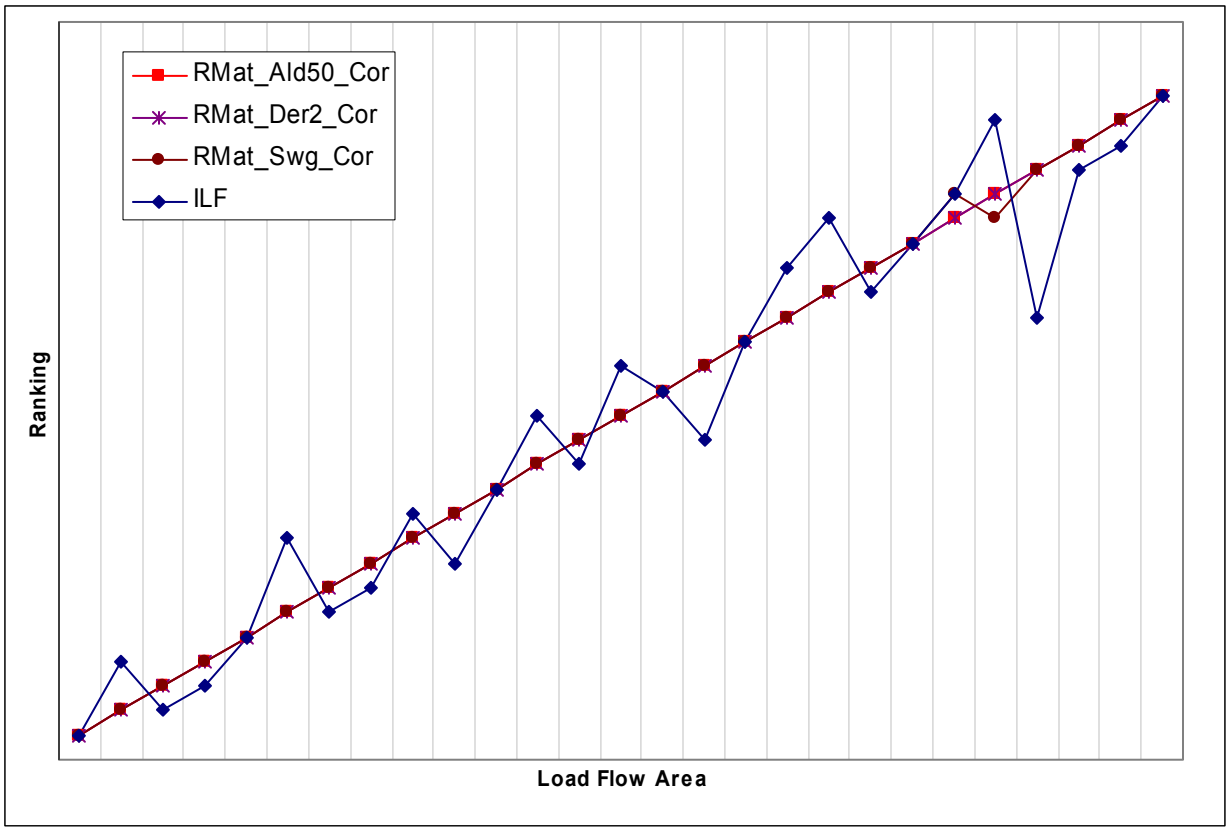

Figure 1 Variation of Ranking of Loss Factors by Methodology and Load Flow Area