3. Results and Discussion

IEEE 14bus test system is used to assess the effectiveness of concentrated and distributed loss model developed in this paper. Two cases are considered, concentrated loss model with fixed bids and linear bids and distributed loss model with fixed bids and linear bids. The energy cost for IEEE-14 bus system is calculated from DCOPF.

Table-1 gives the LMP calculation for IEEE 14 bus system for concentrated loss model with fixed bids and linear bids and distributed loss model with fixed bids and linear bids.

Table-1: LMP calculation for IEEE-14 bus system

Bus No.	*Concentrated loss Model*		*Distributed loss Model*	
	Fixed Bids	*Linear Bids*	*Fixed Bids*	*Linear Bids*
1	39.016	38.69	39.016	38.69
2	45.979	45.643	45.969	45.633
3	49.8045	49.4585	49.7845	48.2485
4	53.0518	51.9947	53.0307	52.1837
5	54.5789	53.2459	54.5568	53.0382
6	56.9667	54.6847	56.9554	54.4755
7	57.0468	55.3813	57.0246	55.7705
8	59.1201	58.3829	59.107	58.2737
9	60.3769	60.0353	60.3534	59.6162
10	60.8313	61.2941	60.8196	60.4868
11	63.0962	61.7618	63.0572	62.0416
12	66.8643	64.6295	66.7943	63.4819
13	67.4265	65.0706	67.4125	63.8524
14	78.2173	72.8791	78.1963	71.8581

Table-2 gives the decomposition of LMP for IEEE-14 bus system for concentrated and distributed model for fixed bids. Table-2 gives the decomposition of LMP for IEEE-14 bus system for concentrated and distributed model for linear bids.

Table 2: LMP Decomposition for IEEE 14 bus system for both models-Fixed Bids

Bus No.	*Decomposition of LMP with Concentrated loss Model with Fixed bids*				*Decomposition of LMP with Distributed loss Model with Fixed bids*			
	Energy Price	*Congestion price*	*Loss Price*	*LMP ($/MWh)*	*Energy Price*	*Congestion price*	*Loss Price*	*LMP ($/MWh)*
1	39.016	0	0	39.016	39.016	0	0	39.016
2	39.016	6.843	0.12	45.979	39.016	6.843	0.11	45.969
3	39.016	10.6285	0.16	49.8045	39.016	10.6285	0.14	49.7845
4	39.016	13.8145	0.2213	53.0518	39.016	13.8145	0.2002	53.0307
5	39.016	15.3384	0.2245	54.5789	39.016	15.3384	0.2024	54.5568
6	39.016	17.6746	0.2761	56.9667	39.016	17.6746	0.2648	56.9554
7	39.016	17.7428	0.288	57.0468	39.016	17.7428	0.2658	57.0246
8	39.016	19.8145	0.2896	59.1201	39.016	19.8145	0.2765	59.107
9	39.016	21.0397	0.3212	60.3769	39.016	21.0397	0.2977	60.3534
10	39.016	21.4909	0.3244	60.8313	39.016	21.4909	0.3127	60.8196
11	39.016	23.7428	0.3374	63.0962	39.016	23.7428	0.2984	63.0572
12	39.016	27.4909	0.3574	66.8643	39.016	27.4909	0.2874	66.7943
13	39.016	28.0397	0.3708	67.4265	39.016	28.0397	0.3568	67.4125
14	39.016	38.8145	0.3868	78.2173	39.016	38.8145	0.3658	78.1963

Table-3 : LMP Decomposition for IEEE 14 bus system for both models-Linear Bids

	Decomposition of LMP with Concentrated loss Model with Linear bids				*Decomposition of LMP with Distributed loss Model with Linear bids*			
Bus no.	*Energy Price*	*Congestion Price*	*Loss Price*	*LMP ($/MWh)*	*Energy Price*	*Congestion Price*	*Loss Price*	*LMP ($/MWh)*
1	38.69	0	0	38.69	38.69	0	0	38.69
2	38.69	6.843	0.11	45.643	38.69	6.843	0.1	45.633
3	38.69	10.6285	0.14	49.4585	38.69	9.4285	0.13	48.248
4	38.69	13.1145	0.1902	51.9947	38.69	13.3145	0.1792	52.183
5	38.69	14.3384	0.2175	53.2459	38.69	14.1384	0.2098	53.038
6	38.69	15.7746	0.2201	54.6847	38.69	15.5746	0.2109	54.475
7	38.69	16.4428	0.2485	55.3813	38.69	16.8428	0.2377	55.770
8	38.69	19.4145	0.2784	58.3829	38.69	19.3145	0.2692	58.273
9	38.69	21.0397	0.3056	60.0353	38.69	20.6397	0.2865	59.616
10	38.69	22.2909	0.3132	61.2941	38.69	21.4909	0.3059	60.486
11	38.69	22.7428	0.329	61.7618	38.69	23.0428	0.3088	62.0416
12	38.69	25.5909	0.3486	64.6295	38.69	24.4909	0.301	63.4819
13	38.69	26.0397	0.3409	65.0706	38.69	24.8397	0.3227	63.8524
14	38.69	33.8145	0.3746	72.8791	38.69	32.8145	0.3536	71.8581

Figure.1 gives the comparison of concentrated and distributed model for IEEE-14 bus system for fixed bids. Figure.2 gives the comparison of concentrated and distributed model for IEEE-14 bus system for linear bids.

Figure.3 gives the comparison of concentrated and distributed loss model for both fixed bids and linear bids.

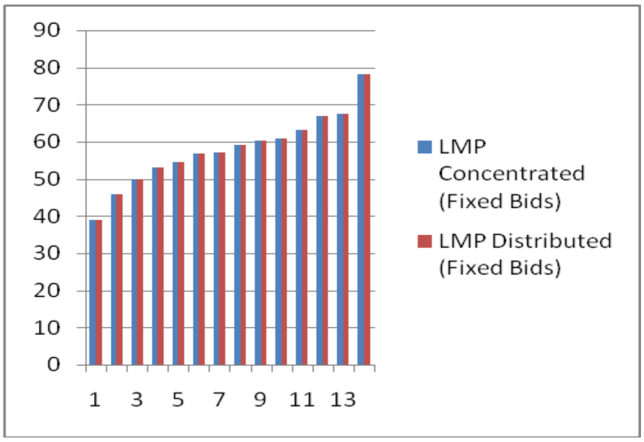

Figure 1: LMP for IEEE-14 bus system for concentrated and distributed model-Fixed Bids

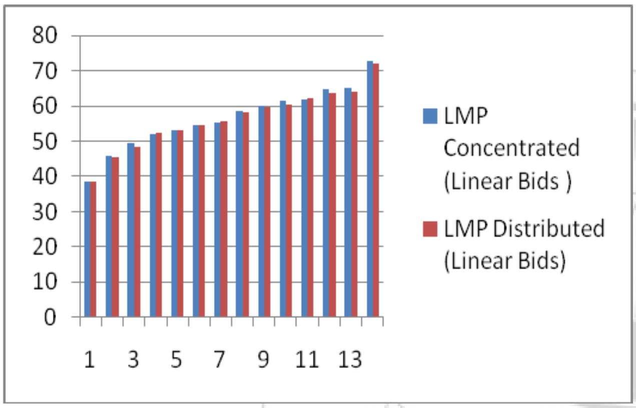

Figure 2: LMP for IEEE-14 bus system for concentrated and distributed model-Linear Bids

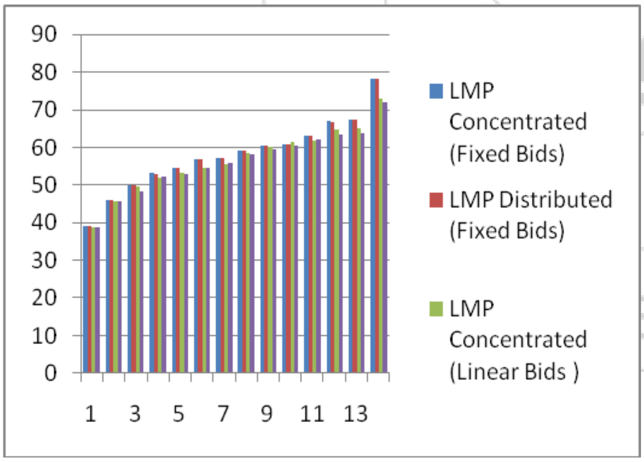

Figure 3: Comparison of LMP for IEEE-14 bus system for concentrated and distributed model for Fixed bids and Linear bids

4. Conclusion

This paper work presented Concentrated Loss Model and Distributed loss Model for LMP calculation, considering transmission constraints. Fuel cost minimization is taken as the objective function for this work. This is attempted with two types of bids i.e., fixed bids and linear bids for the generators. The proposed models are calculated based on dcopf and the distributed loss approach is compared with the concentrated loss approach for IEEE 14 bus system. LMP Decomposition ie., Energy price , Congestion price and Loss price are calculated. Comparison is made between Concentrated loss model and distributed loss model for both fixed bids and linear bids. It is observed that considerable savings in total fuel cost of generators can be achieved with distributed loss approach with linear bids.

References

[1] U.S. Federal Energy Regulatory Commission, Notice of White Paper, April 28, 2003.
[2] H.Singh, S.Hao, A.Papalexopoulos, "Transmission congestion management in competitive electricity markets", IEEE Trans. Power Syst., vol. 13, pp. 672-680, May 1998.
[3] F. C. Schweppe, M. C. Caramanis, and R. D. Tabors and R.E.Bohn, Spot Pricing of Electricity. Boston, MA: Kluwer, 1988.
[4] Murali Matcha, Sailaja Kumari Matam, SyduluMaheswarapu," LMP Calculation with Distributed Loss using GA based DCOPF", J. Electrical Systems 8-3 (2012): 292-303.
[5] Yong Fu, Zuyi Li, "Different models and properties on LMP calculations", IEEE Power engineering society general meeting, 2006.
[6] Thomas J. Overbye, Xu Cheng, Yan Sun, "A comparison of the AC and DC power flow models for LMP calculations", IEEE Proceedings of the 37th Hawaii International conference on System Sciences-2004.
[7] E. Litvinov, T. Zheng, G. Rosenwald, and P. Shamsollahi, "Marginal loss modeling in LMP calculation," IEEE Trans. Power Syst., vol. 19, no. 2, pp. 880–888, May 2004.
[8] S.M.H.Nabav, Shahram Jadid, M.A.S.Masoum, A.Kazemi, "Congestion Management in Nodal pricing with Genetic Algorithm" International conference on Power Electronics, Drives and Energy Systems, PEDES,2006.

Author Profile

Jenita Shanthini.D Received B-tech in Electrical and Electronics Engineering from Karunya University, Coimbatore in 2013, currently pursuing M-tech with specialization in Power System Engineering in SRM University, Kattankulathur campus, Chennai (2013-2015).