

# Development of TIF for transaction cost allocation in deregulated power system

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**Abstract:** In deregulated power system due to the increase of power transactions in transmission open access the transmission cost allocation is one of the major problems. For each transaction the Transaction Impact Factors (TIFs) are developed for the allocation of the transmission transaction costs. The transmission Impact Factor gives the information about the real power flow in the transmission lines with the transacted power. This logical method provides the impact of the line flows without running power flow solutions when the amount of transacted power changes in real time. This proposed method is evaluated by considering bilateral and multilateral transactions. The results coming from the proposed method is compared with Megawatt Modulus (MM) method on sample six bus and IEEE 30 bus system.

**Key words:** Deregulation, Cost allocation, Transmission Impact Factors, Bilateral transaction, Multilateral transaction.

## 1. INTRODUCTION

In integrated system, wheeling transactions have been accounted for a small portion of the overall transmission network capacity usage. However, recent trends towards unbundling of electric services have resulted in renewed interest in pricing of transmission services, particularly to the wheeling transactions. The cost components [1] for providing transmission services are operating cost, opportunity cost, reinforcement cost and existing system cost. Depending upon the type of the transmission transaction one or all the above mentioned cost components are included in the pricing scheme. Transmission pricing is broadly classified [2] as embedded (rolled-in) transmission pricing, marginal transmission pricing and composite transmission pricing. In embedded pricing (Postage Stamp Method, Contract Path Method, MW-Mile Method) the cost for building infrastructure, operating and maintenance costs are included. Marginal cost of a transmission transaction is defined as the cost of accommodating a marginal increase (of say one KW) in the transacted power. Otherwise the marginal transmission pricing is nothing but a cost allocated to the new customer. Composite pricing scheme include the features of above two methods.

All type of usage based transmission cost allocation schemes require accurate knowledge of change in power flow caused by the transaction. The impact of power flow in the line can be calculated by electricity tracing methods [3,4]. A topological approach to find the share of each generator and load in every power flow is provided in [3]. This topological generation and load distribution factors are always positive but it requires inverse of a matrix of the order equal to the network nodes. Contribution of generator and load on the line flow can also be determined by defining set of domains, commons and links [4]. The transmission cost allocation method based on equivalent bilateral exchanges [5] states that each demand is supplied by a fraction of each generator uniformly divided among all generators. But this method uses dc power flow solution. A methodology based on circuit theory [6] uses the contributions of the nodal currents to line power flows to apportion the usage of the lines.

Different cases of-mile method is discussed in [7]. In order to meet the system reliability, stability and security criteria all the market participants have to pay for the actual capacity use and for the additional reserve [8]. Megawatt Modulus (MM) method ensures recovery of all transmission costs by replacing the circuit capacities by the sum of absolute power flows caused by all agents.

Different usage based transmission cost allocation methods are summarized in [9] and concludes that fixed transmission costs determined by different algorithms are quite similar. The choice of algorithms used for the evaluation of transmission usage depends mainly on the requirements and the market structures. The impact of power flow in all the line in a network due to particular transaction is usually determined by power flow solution. In conventional methods, the line flow impacts are calculated by executing repeated power flows by Newton Raphson (NR) method for varying magnitude of power transacted which is a time consuming process. To simplify the evaluation of power flow impact, the line flows are related with the power contract magnitude by the factor called Transaction Impact Factor (TIF). Once the TIF is evaluated, then the power flow impacts can be obtained by multiplying it with the transacted real power between the parties.

## II. DERIVATION OF TRANSACTION IMPACT FACTOR

The sensitivity of real power flow in the line  $m-n$  when one megawatt of power is transacted between seller bus  $i$  and buyer bus  $j$  is known as  $TIF_{m-n}^{ij}$ . It means that, if one megawatt of power is injected at bus  $i$  and extracted at bus  $j$  then  $TIF_{m-n}^{ij}$  is the power flow impact of the line  $m-n$  due to this transaction. The change in power flow (MW) in line  $m-n$  can be written as the sum of impact of power flow due to all sellers involved in that transaction as,

$$\Delta P_{m-n} = \sum_{i=1}^{nb} \Delta P_{m-n}^i \quad (1)$$

where,  $\Delta P_{m-n}^i$  is the impact of power flow in line  $m-n$  due to  $i^{th}$  seller and  $ns$  is the number of sellers involved in that transaction. Further the impact of power flow  $\Delta P_{m-n}^i$  can be written as sum of impact due to transaction between seller bus  $i$  and buyer bus  $j$  ( $\Delta P_{m-n}^{ij}$ )

$$\Delta P_{m-n} = \sum_{i=1}^{nb} \Delta P_{m-n}^{ij} \quad (2)$$

Where  $nb$  is the number of buyers, Equation (2) is multiplied and divided by the magnitude of real power transacted ( $P_i^j$ ) between seller bus  $i$  and buyer bus  $j$

$$\Delta P_{m-n}^i = \sum_{i=1}^m \frac{\Delta P_{m-n}^i}{P_i^j} * P_i^j \quad (3)$$

TIF can be defined as the ratio of change in real power flow in the line including the transaction to the magnitude of the corresponding transacted power. It is given as,

$$TIF_{m-n}^{ij} = \frac{\Delta P_{m-n}^{ij}}{P_i^j} \quad (4)$$

Then (3) becomes,

$$\Delta P_{m-n}^i = \sum_{j=1}^{nb} TIF_{m-n}^{ij} * P_i^j \quad (5)$$

The change in real power flow due to multilateral transactions is,

$$\Delta P_{m-n} = \sum_{i=1}^{ns} \sum_{j=1}^{nb} TIF_{m-n}^{ij} * P_i^j = \sum_t TIF_{m-n}^{ij} * P_i^j \quad (6)$$

### III. TRANSACTION COST ALLOCATION

#### A. Wheeling Charges

The suggested method evaluates the change in power flow in all transmission lines when a new transaction is introduced in the system. Wheeling charges to the transaction are then allocated in proportion to the ratio of its absolute value of actual facility usage and the magnitude of total power flows. The proposed allocation rule due to bilateral transaction is given as follows,

$$WC_t = \sum_{All\ lines} C_{m-n} \frac{|TIF_{m-n}^{ij}| * P_i^j}{|P_{m-n}^0| + |TIF_{m-n}^{ij}| * P_i^j} \quad (7)$$

Where  $WC_t$  is wheeling charge (\$/hr) for transaction  $t$ ,  $C_{m-n}$  is charge for transaction facility  $m-n$  and  $P_{m-n}^0$  is base case real power flow. For multilateral transaction, total change in power flow due to all transaction can be obtained by (6).

Wheeling Charge (\$/hr) for multilateral transaction can be written as

$$WC_t = \sum_{All\ lines} C_{m-n} \frac{\sum_t |TIF_{m-n}^{ij}| * P_i^j}{|P_{m-n}^0| + \sum_t |TIF_{m-n}^{ij}| * P_i^j} \quad (8)$$

#### B. Cost allocation to users

In bilateral transaction, the costs have to be allocated to both seller and buyer according to their usage of the network. The proportional sharing of the cost to seller and buyer will differ for different structure. For the case of 50% share to seller and 50% share to buyer, the seller Wheeling Charge and Buyer Wheeling Charge in \$/hr for the transaction  $t$  are given by,

$$SWC_t = \frac{WC_t}{2} \text{ and } BWC_t = \frac{WC_t}{2} \quad (9)$$

Similarly for 30% share to seller and 70% share to buyer the following formulae are used,

$$SWC_t = \frac{3 * WC_t}{2} \text{ and } BWC_t = \frac{7 * WC_t}{2} \quad (10)$$

Also for multilateral transaction, the cost has to be allocated to individual seller and buyer based on their usage of the transmission facilities. For this, the usage of transmission line by individual seller and buyer has to be separated. The usage of line  $m-n$  by the seller at bus  $i$  due to multilateral transaction  $\Delta P_{m-n}^i$  is calculated by (5). Similarly, the usage of line  $m-n$  by the buyer at bus  $j$  due to multilateral transaction is given by,

$$\Delta P_{m-n}^j = \sum_{i=1}^{ns} TIF_{m-n}^{ij} * P_i^j \quad (11)$$

The wheeling charge for seller  $i$  for using all the lines  $SWC_i$  (\$/hr) and the wheeling charge for buyer  $j$  for using all the lines  $BWC_j$  are given by,

$$SWC_t = \sum_{All\ lines} r_{m-n} * \Delta P_{m-n}^i \quad (12a)$$

$$BWC_t = \sum_{All\ lines} r_{m-n} * \Delta P_{m-n}^j \quad (12b)$$

Where,  $r_{m-n}$  is the charge rate of line  $m-n$  in \$/MWhr which is obtained by dividing the cost for each line by total usage of that line by all the transactions.

$$r_{m-n} = \frac{C_{m-n}}{|P_{m-n}^0| + |TIF_{m-n}^{ij}| * P_i^j} \quad (13)$$

The proportional sharing of the cost to seller and buyer for the case of 50% share to seller and 50% share to buyer the cost is evaluated by following equations,

$$SWC_t = \frac{SWC_t}{2} \text{ and } BWC_t = \frac{BWC_t}{2} \quad (14)$$

Similarly for 30%-70% sharing policy the following formulae are used,

$$SWC_t = \frac{3 * SWC_t}{2} \text{ and } BWC_t = \frac{7 * BWC_t}{2} \quad (15)$$

#### IV. ALGORITHM

- Step1. Read system bus data and line data.
- Step2. Run base case power flow solution.
- Step3. Consider bilateral transaction between seller *i* and buyer *j*, or multilateral transaction between group of sellers and buyers. Calculate TIF values using (4).
- Step4. The change in power flow due to power contract is evaluated by (6). The value of *ns* and *nb* are equal to 1 for bilateral transaction in (6).
- Step5. Cost of transmission transactions for bilateral transaction is calculated by (7).
- Step6. If multilateral transaction is considered then find cost of transmission transaction by (8).
- Step7. The transmission usage cost allocated to seller *SWC<sub>i</sub>* and buyer *BWC<sub>j</sub>* for the use of all lines is calculated by using (9) or (10) for bilateral transaction.
- Step8. If multilateral transaction is considered then the transmission usage cost allocated to seller *SWC<sub>i</sub>* and buyer *BWC<sub>j</sub>* for the use of all lines is evaluated by using (14) or (15).

#### V. RESULTS AND DISCUSSION

In this paper, an analytical method is proposed using TIF for the calculation of transmission transaction cost and the results are compared with conventional Megawatt Modulus (MM) method [8]. The proposed method is tested on sample six bus system and IEEE 30 bus system. The program is developed in MATLAB 7.0 environment.

##### A. Six bus system

The sample six bus system [10] consists of three generators, three loads and eleven transmission lines. The total system demand is 210 MW. The first bus is considered as slack bus. One bilateral transaction T1 and a multilateral transaction T2 with two cases are considered for this system.

(1) *Bilateral transaction (T1) of 20 MW between seller bus 2 and buyer bus 5*

TIF values are obtained for the above transaction by (4). The TIF values for transaction T1 and change in power flow due to this transaction are given in Table I. Once the transaction impact factor for any transaction is known then it is easy to calculate the change in power flow due to that transaction by multiplying TIF with the magnitude of power transacted as given in (6).

The actual power flow after including particular transaction is obtained by adding the change in power flow due to that transaction with the base case power flow.

TABLE I. TIF VALUES AND CHANGE IN POWER FLOW FOR 6 BUS SYSTEM

Line <i>m-n</i>	TIF values	Change in Power flow (MW)
1-2	-0.1430	-2.8601
1-4	-0.0655	-1.3106
1-5	0.1490	2.9796
2-3	0.1663	3.3263
2-4	0.1359	2.7181
2-5	0.2862	5.7239
2-6	0.1884	3.7674
3-5	0.1492	2.9831
3-6	-0.0852	-1.7043
4-5	0.1856	3.7114
5-6	-0.1689	-3.3775

For the transaction T1, the actual power flow in all the lines obtained by proposed method is compared with the Newton Raphson (NR) power flow solution values and they are given in Table II. Power flow in each line obtained by both methods is almost same. In proposed method, no need to run the power flow solution repeatedly. The advantage of the proposed method is best being explained with the help of multilateral transaction in the following sections.

TABLE II. POWER FLOW COMPARISON FOR T1

Line <i>m-n</i>	Power flow (MW)	
	NR method	Proposed method
1-2	26.0624	26.7345
1-4	42.8631	43.3619
1-5	39.8136	39.6541
2-3	6.5720	6.2970
2-4	36.9897	37.3142
2-5	21.5933	21.7363
2-6	30.1586	30.5997
3-5	23.1126	23.1935
3-6	43.3976	43.0723
4-5	7.1846	7.8308
5-6	-1.7576	-1.7137

The total wheeling charges for transaction T1 is obtained by (7). The cost for each line *C<sub>m-n</sub>* is assumed as the value of line reactance for that line multiplied by 1000 in \$/hr. The total wheeling charge for T1 is 731.4 \$/hr. This amount is allocated among the seller and buyer by two cases of cost sharing policy as per Table III based on (9) and (10). Also the results of proposed method are compared with Megawatt Modulus (MM) method [8]. The MM method needs two power flow solutions, one is without transaction and the other is with the transaction to find the change in power flow. Total wheeling charges obtained by both the methods are almost similar.

TABLE III. COST ALLOCATION FOR T1

Sharing policy (%)	Method	Cost for Seller at	Cost for Buyer at	Total cost (\$/hr)
		bus 2 (\$/hr)	bus 5 (\$/hr)	
50-50	Proposed	361.3136	361.3136	722.6273
	MM	366.2	366.2	732.4
30-70	Proposed	216.7882	505.8391	722.627
	MM	219.7	512.7	732.4

(2) Multilateral transaction T2 - case 1

A Multilateral transaction T2 of case 1 is considered for the six bus system as per Table IV. The prefix S refers seller bus and B refers buyer bus. There are two seller buses 1, 2 and two buyer buses 4, 5 involved in this transaction. Buyer at bus 4 is agreed to buy 10 MW from seller 1 and 5 MW from seller 2 to meet its demand of 15MW. Similarly Buyer at bus 5 is agreed to buy 5 MW from seller 1 and 10 MW from seller 2 to meet its demand of 15MW. Total of 30 MW is transacted in this multilateral transaction.

TABLE IV. MULTILATERAL TRANSACTION T2 - CASE 1

	Transaction in MW		Total Generation (MW)
	To B4	To B5	
From S1	10	5	15
From S2	5	10	15
Total Load (MW)	15	15	30

This multilateral transaction includes four transactions. The TIF for all these transactions are calculated and given in Table V. These factors are constant for any possible magnitude power transacted between these sellers and buyers. The TIF values may be positive or negative depending upon the power flow direction. But in calculating Wheeling charges, the magnitude of TIF is considered. For any possible combination of power contracts the line flow impacts can be easily obtained. The change in power flow for this multilateral transaction is given in Table VI. Here there are two *ns* and two *nb*. Actual power flow in each line by proposed method is calculated by summing up this change in power flow with the base case power flow. The total wheeling charge for multilateral transaction evaluated by (8) is 962.8 \$/hr. This cost is allocated among the sellers and buyers based on their usage of the transmission facility to carry out this transaction. The cost for two seller buses and two buyer buses are allocated by (14) and (15) and given in Table VII

TABLE V. TIF VALUES FOR T2 - SAMPLE 6 BUS SYSTEM

Line <i>m-n</i>	Seller at bus 1		Seller at bus 2	
	Buyer at bus 4	Buyer at bus 5	Buyer at bus 4	Buyer at bus 5
1-2	0.3039	0.2371	-0.2376	-0.1672
1-4	0.4222	0.1212	-0.0092	-0.1127
1-5	0.1283	0.2458	-0.1968	0.1098
2-3	-0.0239	0.1224	0.0351	0.1881
2-4	0.2761	-0.4264	0.4385	0.0475
2-5	-0.0887	0.0968	-0.0317	0.2526
2-6	-0.0733	0.0388	-0.0589	0.1574
3-5	-0.1349	-0.0746	-0.1827	0.1077
3-6	-0.1049	-0.2350	-0.2141	-0.1359
4-5	-0.1277	0.1798	-0.1384	0.1744
5-6	0.0187	-0.1118	-0.0455	-0.1668

TABLE VI. CHANGE IN POWER FLOW FOR T2-CASE1

Line <i>m-n</i>	Seller at bus 1		Seller at bus 2	
	Buyer at bus 4	Buyer at bus 5	Buyer at bus 4	Buyer at bus 5
1-2	3.0393	1.1857	-1.1881	-1.6725
1-4	4.2217	0.6062	-0.0459	-1.1266
1-5	1.2828	1.2288	-0.9841	1.0981
2-3	-0.2388	0.6122	0.1755	1.8814
2-4	2.7608	-2.1320	2.1927	0.4749
2-5	-0.8875	0.4839	-0.1587	0.5260
2-6	-0.7327	0.1942	-0.2945	1.5736
3-5	-1.3486	-0.3728	-0.9133	1.0774
3-6	-1.0494	-1.1750	-1.0707	-1.3586
4-5	-1.2771	0.8988	-0.6919	1.7444
5-6	0.1874	-0.5588	-0.2274	-1.6682

The cost for S2 and B5 are high because the usage of the transmission network by these parties are more by providing more impact in line flows. The same pattern of results is obtained in MM method also. But the MM method needs five power flow solutions to evaluate the change in power flow for this multilateral transaction. One for base case and four for transaction cases with specified magnitude. If any one of the transaction magnitude changes then power flow solution has to be done again.

TABLE VII. COST ALLOCATION FOR T2 - CASE 1 – 6 BUS SYSTEM

	50 % - 50 % share				30 % - 70 % share			
	Proposed		mm		Proposed		Mm	
	SWC(\$/hr)	BWC(\$/hr)	SWC(\$/hr)	BWC(\$/hr)	SWC(\$/hr)	BWC(\$/hr)	SWC(\$/hr)	BWC(\$/hr)
S1	196.1	--	198.5	--	117.6	--	119.1	--
S2	280.6	--	283.3	--	168.3	--	170.0	--
B4	--	148.4	--	150.3	--	207.8	--	210.5
B5	--	33.6	--	331.5	--	467.0	--	464.0
Total Wheeling charge (\$/hr)	476.7	482.0	481.8	481.8	286.0	674.8	289.1	674.5
	958.88		963.6		960.9		963.6	

(3) Multilateral transaction T2 - case 2

To explain the advantage of proposed method one more transaction case is considered for the same multilateral transaction between seller buses 1, 2 and buyer buses 4, 5 with different power level as per Table VIII. Here total of 40 MW is transacted between the parties. Buyer at bus 4 is agreed to buy 10 MW from seller 1 and 10 MW from seller 2 to meet its demand of 20MW. Similarly Buyer at bus 5 is agreed to buy 15 MW from seller 1 and 5 MW from seller 2 to meet its demand of 20 MW

TABLE VIII. MULTILATERAL TRANSACTION T2 - CASE 2

	Transaction in MW		Total Generation (MW)
	To B4	To B5	
From S1	10	15	25
From S2	10	5	15
Total Load (MW)	20	20	40

For transaction case 2 of T2, since the parties involved in the transaction remains same, the TIF factors are also same as in Table V. The change in power is obtained by (6) is given in Table IX. But in MM method, the power flow solution should be repeated for every change in power transacted. The actual power flow obtained in this case is also similar to that of NR method. The total cost allocated for multilateral transaction of 40 MW is about 1156.6 \$/hr. The transmission usage charges for different percentage of sharing in transmission cost for seller and buyer is evaluated and given in Table X. In case of 50%-50% share to seller and buyer, the buyer will get benefited and whereas in the case of 30% -70% share, the consumer pays maximum share, so the seller will get benefited.

TABLE IX. CHANGE IN POWER FLOW FOR T2- CASE 2

Line m-n	Seller at bus 1		Seller at bus 2	
	Buyer at bus 4	Buyer at bus 5	Buyer at bus 4	Buyer at bus 5
1-2	3.0393	4.9679	-1.6974	-1.1765
1-4	4.2217	3.8355	0.9085	-1.0606
1-5	1.2828	5.5699	-1.0320	0.0777
2-3	-0.2388	1.9235	0.3817	0.9215
2-4	2.7608	-3.3236	5.9440	-0.5332
2-5	-0.8875	2.4642	0.1770	1.0136
2-6	-0.7327	1.6442	-0.0705	0.5241
3-5	-1.3486	1.2059	-0.6789	-0.0393
3-6	-1.0494	-1.4451	-1.0991	-1.1998
4-5	-1.2771	2.7635	-1.3595	0.8572
5-6	0.1874	-1.5930	-0.4110	-0.8564

TABLE X. COST ALLOCATION FOR T2 CASE 2 – 6 BUS SYSTEM

	50 % - 50 % share				30 % -70 % share			
	Proposed		mm		Proposed		Mm	
	SWC (\$/hr)	BWC (\$/hr)	SWC (\$/hr)	BWC (\$/hr)	SWC (\$/hr)	BWC (\$/hr)	SWC (\$/hr)	BWC (\$/hr)
S1	377.3	--	373.3	--	226.3	--	223.9	--
S2	206.3	--	205.6	--	123.8	--	123.4	--
B4	--	193.3	--	189.9	--	207.8	--	265.9
B5	--	395.5	--	389.0	--	553.8	--	544.6
Total Wheeling charge (\$/hr)	583.6	588.9	578.9	578.9	350.1	824.5	347.3	810.5
	1172.6		1157.8		1174.7		1157.8	

B. IEEE 30 bus system

The numerical data for IEEE 30 bus system is taken from [11]. In this system there are 6 generators, 24 loads and 41 transmission lines with the total demand of 283.4 MW. Generator connected at bus 1 is considered as slack. A multilateral transaction with two cases is considered for this system.

(1) Multilateral transaction - case 1

Multilateral transaction involving three seller buses 2,5,8 and three buyer buses 12,16,29 is considered as given in Table XI. Total of 50 MW is transacted in this multilateral transaction. S8 has highest generation and B12 has highest load in the transaction considered. The TIF for all the nine transactions is calculated as explained earlier.

TABLE XI. MULTILATERAL TRANSACTION CASE 1 FOR IEEE30 BUS SYSTEM

	Transaction in MW			Total Generation (MW)
	To B12	To B16	To B29	
From S2	5	2	5	12
From S5	5	8	2	15
From S8	10	3	10	23
Total Load (MW)	20	13	17	50

The actual line flows in all the lines due to contract case 1, by proposed method and NR method are compared and multilateral transaction is within the line capacity. The above considered multilateral transactions provide highest impact on flow in first line 1-2 (72.13 MW) because generation at bus 1 including base case is the maximum of all. The line number 9, 30 and 37 has least impact of power flow because these lines are relatively away from the buses that involved in the considered transaction.

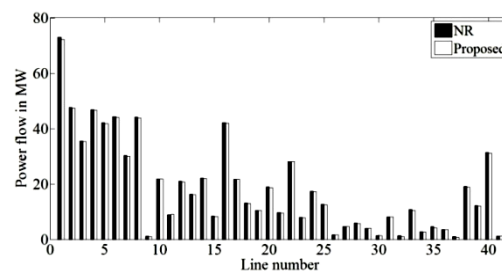


Fig. 1. Power flow by proposed method for transaction case 1 - IEEE 30 bus system.



shown in Fig.1. For all the lines the flow due to this  
(2) *Multilateral transaction - case 2*

In the multilateral transaction case, eight transactions are considered as given in Table XII. Total generation in 8<sup>th</sup> bus is the highest of 30 MW, but in case 1 its value is 23 MW.

TABLE XII. MULTILATERAL TRANSACTION CASE 2 FOR IEEE30 BUS SYSTEM

	Transaction in MW			Total Generation (MW)
	To B12	To B16	To B29	
From S2	10	5	--	15
From S5	5	10	5	20
From S8	10	5	15	30
Total Load (MW)	25	20	20	65

The actual line flows in all the lines due to above contract case, by proposed method and NR method are compared in Fig.2. These transactions provide highest impact on flow in line number 1 connected between buses 1 and 2 (72.015 MW). The line number 30 between buses 18 and 19 has least impact (0.682 MW) because the buses 18 and 19 are not involved in the transaction case considered.

The cost allocated in 50-50 sharing policy and 30-70 sharing policy for both the contract cases are compared in Fig.3. In both cases of cost sharing, the total cost recovered for the use of transmission network for transaction case-1 is 4076.6 \$/hr. Similarly for transaction case-2, the total cost recovered for the use of transmission network is 4642.2 \$/hr. The total wheeling charges in case 2 increases because of the increase in total MW transacted in this case. The cost obtained by proposed method for these two transaction cases are almost similar to the cost calculated by MM method.

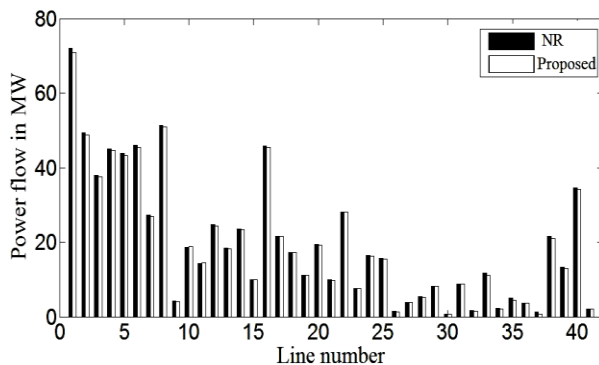


Fig. 2. Power flow by proposed method for transaction case 2 - IEEE 30 bus system

## VI. CONCLUSION

The developed Transaction impact factors relate the line flows with the magnitude of power transacted between the selling and buying entities. The MM method to evaluate the transaction-related flows on all network lines, needs the repeated power flow solution considering the nodal power injections only involved in that transaction. In the proposed method, once the TIFs are obtained for a given transaction, it does not require one to perform the power flow solution to evaluate the transaction related power flows whenever any given different possible combinations of transactions are exercised. Therefore, the proposed method is well suited for real time application. The main advantage of the developed method lies in its capability to consider multilateral transaction simultaneously. The cost allocated to individual seller and buyer and the various schemes of cost sharing principle between seller and buyer are also provided. This helps in taking correct economic decision.

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