# Wheeling Cost Computation In Deregulated Power System

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**Abstract: In entire power system the transmission network and a fair transmission pricing is a prominent issue. As in the deregulated power system the transmission network is the major structure which supplies to large users. The power tracing helps to figure out fair and tariff. So, through this power tracing method the generators and consumers are charged and adequate payment for transmission line service provider is contributed. This power tracing methodology would make possible to charge customers and the generating firm which will generate power on the basis of transmission capacity which is transmitted through transmission lines of the service provider. This paper spot lights on the power tracing using bialek method algorithm and computes wheeling cost. This gives generators contributions for power flowing and losses in each line. Also the line contributions for each loads at each busses are also predicted and the wheeling cost is determined in this paper for IEEE 30 bus test system.**

**Keywords: Deregulation, Power tracing, Transmission pricing, Wheeling Cost.**

### NOMENCALTURE

TC= total transmission network capacity cost.
t = transaction.
T= set of transactions
k= line
K= set of lines
W= weighing factor=0.25
P=power in line
L=length of line (100 miles)
T$C_t$ = wheeling cost for a transaction t.

## I. INTRODUCTION

Because of continuing trends towards deregulation of power system and unbundling of transmission systems usage allowance has went critical, it is mandatory to denote the generator which supplies a particular load and there is also a need to know the proportion of power in a line contributed to a particular load and the loads which are contributing the losses in the system. Power tracing in electric system gains prominence as the solution will upgrade the clarity in the operation of the transmission system. Important information can be found like the loss contribution by a particular load degrade the power system quality and responsible for transmission losses. This tracing method helps to find the power transfer between individual generators to loads. Tracing method determines the contribution of transmission users to transmission usage. In this view tracing the flow of electricity has gain significance as its solution helps in evaluating fair and transparent tariff. Electricity tracing methods would make it possible to charge the consumers and/or generators on the base of actual transmission capacity used. The power flow tracing algorithm is a mechanism for tracing the contribution of each user on a transmission system to allocate charges for using the transmission line. Its work is based on the concepts of Kirchhoff's current law and proportional sharing principle. It accords with a routine complication of how to administer flows in a meshed network. The proportional sharing principle mostly implement Kirchhoff's current law and assign proportionality principle to treasure the relation between incoming and outgoing power flows. The only assuming is made in this methodology that is considering the given system as a lossless system.

A wheeling charge is a currency per megawatt-hour amount that a transmission owner receives for the use of its system to export energy. The total amount due in transmission access charge associated with wheeling referred as wheeling cost. This is an amount in $/MWh which transmission owner recovers for the use of its system. Wheeling refers to the transfer of electrical power through transmission and distribution lines form one utility service area to another. Wheeling can occur between two adjacent utilities or between utilities in different states. Under existing law, qualifying facilities may only transmit their output to their local utility. Wheeling is important to independent power producers because, independent energy producers do not have the power of eminent domain and generally do not own transmission lines. Therefore, they depend upon the utilities to move their power to market. In the competitive marketplace, where the individual power producers are competing with utilities on their affiliates, access to transmission can be used to limit the participation of independent energy producers. Now the main problematic aspect of wheeling is to determination of the value of transmitted power. In other words, how much should someone charge for allowing electric power to transmit power through its transmission lines? Private utilities also argue that access to too many parties will reduce the reliability of the system. However, utilities have been wheeling for years, the alleged problem with increased access to transmission are attempts by the investor- owned utilities to restrict their competition. Of course, increased access to transmission should be implemented carefully to protect the integrity of the system.

## I. BIALEK'S POWER FLOW TRACING METHOD

As stated above this method determines the contribution of transmission users for the transmission usage with respect to the customers. So there is a principle called proportional sharing principle for determining this contribution of transmission users to the transmission usage. The detailed explanation for the proportional sharing principle is as below

### A. PROPORTIONAL SHARING PRINCIPLE

This method may be used for transmission pricing and recovering fixed transmission costs. In this method, it is assumed that nodal inflows are shared proportionally among nodal outflows. This method uses a topological approach to determine the contribution of individual generators or loads to every line flow based on the calculation of topological distribution factors. This method can deal with both dc-power flow and ac power flows; that is, it can be used to find contributions of both active and reactive power flows. Proportional Sharing Principle method considers as follows

1. Two flows in each line, one entering the line and the other exiting the line.
2. Generation and load at each bus.

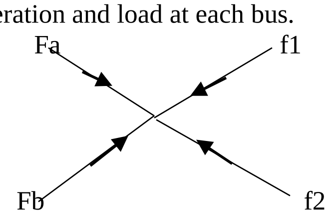


Fig1: illustration of proportional sharing principle

The main principle used to trace the power flow will be that proportional sharing. This principle follows the Kirchhoff current law asshown in figure1.The figure shows four lines connected to a node. The outflows (f1 and f2) can be representedin terms of the inflows (fa and fb); in other words, we candetermine how much of f1 comes from fa and how much of f1 comes from fb ,is given by equationf1, how much of f2 comes from fa and how much of f2 comes from fb, is given by equation f2

$$\mathrm{f1} = \mathrm{f1}\frac{\mathrm{fa}}{\mathrm{fa}+\mathrm{fb}} + \mathrm{f1}\frac{\mathrm{fb}}{\mathrm{fa}+\mathrm{fb}}$$

$$\mathrm{f2} = \mathrm{f2}\frac{\mathrm{fa}}{\mathrm{fa}+\mathrm{fb}} + \mathrm{f2}\frac{\mathrm{fb}}{\mathrm{fa}+\mathrm{fb}}$$

The following figure shown is example for proportional sharing principle. Four lines are connected to bus i, two with inflows and two without flows.

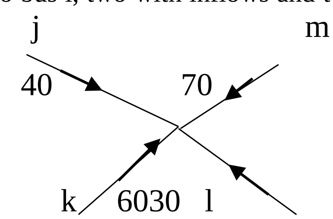


fig: example of proportional sharing principle

The total power flow through node is 40+60=100MW in which 40% is supplied by line j-i and 60% by line k-i. As the electricity is indistinguishable and each of the outflows down the line from node i is dependent only on the voltage gradient and impedance of the line, it can be assumed that each MW leaving the node contains the same proportion of the inflows as the total nodal flow Pi. Hence, the 70 MW out flowing in the line i-m consists of 70*40/100=28 MW supplied by line j-i and 70*60/100=42 MW supplied by line k-i. Similarly, the 30MW out flowing in line i-l consists of 30*40/100=12 MW supplied by line j-i and 30*60/100=18 MW supplied by line k-i.

The magnitude of power flow MW on every line is then multiplied by its length $L_1$ and a predetermined weighting factor reflecting the cost per unit capacity of the line, $W_1$ and summed over all network lines. This leads to equation 1

$$\mathrm{MWMile}_t = \sum\nolimits_l W_l WM_{t,l} L_l (1)$$

This process is repeated for every transaction by considering only the generations and loads associated with each transaction. The share of the total transmission network capacity cost, TC, allocated to transaction t can be calculated according to the following equation 2

$$TC_t = TC * \frac{\sum_{k\in K} W_k MW_k \; KM_{t,k}}{\sum_{t\in T}\sum_{k\in K} W_k MW_k \; KM_{t,k}} (2)$$

Total transmission network capacity cost is calculated as follow equation

$$TC = \sum_l W_l \, P_{max,l} L_l (3)$$

B. UPSTREAM ALGORITHM

The total flow, the inflow to the i[th] bus, is the sum of all the inflows through the lines connected to the bus and the local bus injection is given by below equation.

$$P_i = \sum_{j\in\alpha_i^u} |P_{i-j}| + P_{Gi} \qquad \text{for i=1,2,…..,n}$$

Where $\alpha_i^u$ is the set of nodes directly supplying node i, implying Power flow towards $i_{th}$ node.

If the line losses are neglected, then $|P_{i-j}| = |P_{j-i}|$
The above equation can be further expanded to the following equation

$$P_i = \sum_{j\in\alpha_i^u} \frac{|P_{j-i}|}{P_j} P_j + P_{Gi} (4)$$

Where $C_{ji} = \frac{|P_{j-i}|}{P_j}$ to express relationship between line flow and the nodal flow at the $jth$ node, using proportional sharing principle

$|P_{j-i}| = C_{ji} P_j$.
Substituting this in 4 which gives equation 5

$$P_i = \sum_{j\in\alpha_i^u} C_{ji} P_j + P_{Gi} (5)$$

Which on arrangement becomes
$P_i - \sum_{j\in\alpha_i^u} C_{ji} P_j = P_{Gi}$ or $A_u P = P_G$

P is the vector of gross nodal flows;
$P_G$ is the vector of nodal generations,
while $A_u$ is $(n\times n)$ the Upstream matrix.
The $(i, j)$ element of $A_u$ is given by the following equation 6

$$[A_u]_{ij} = \begin{cases} 1 & \text{for } i = j \\ -C_{ji} & \text{for } j \in \alpha_i^u \\ 0 & \text{otherwise} \end{cases} (6)$$

If $A_u^{-1}$ exists then $P = A_u^{-1} P_G$ and its $i_{th}$ element is given by equation 7

$$P_i = \sum_{k=1}^{n} [A_u^{-1}]_{ik} P_{Gk} \quad \text{for i=1,2,….,n} \qquad (7)$$

This equation shows the contribution of $k_{th}$ system generator to $i_{th}$ nodal power.

A line out flow in line j-i from node i can be therefore calculated using proportional sharing principle, as given by equation 8

$$|P_{j-i}| = \frac{|P_{j-i}|}{P_j} \sum_{k=1}^{n} [A_u^{-1}]_{ik} P_{gk} (8)$$

$$P_{Li} = \frac{P_{Li}}{P_j} \qquad (9)$$

C. DOWNSTREAM ALGOTRITHM

When the distribution of power flow has been assigned, starting from the load node, according to a user's power flow paths and the contribution factor of each node, the relation between load and line flow can be conformed, as well as that between load and generator output. The total flow $P_i$, the outflow to the $i_{th}$ bus, is the sum of all the outflows through the lines connected to the bus and the local bus load is given by equation 10

$$P_i = \sum_{l\in\alpha_i^u} |P_{i-l}| + P_{Li} (10)$$

Where αis the set of nodes directly supplied from node i, implying power flowing from the $i_{th}$ node. If the line losses are neglected, then

$$|P_{i-l}| = |P_{l-i}|$$

Equation can be further expanded to

$$P_i = \sum_{l\in\alpha_i^u} \frac{|P_{l-i}|}{P_l} P_l + P_{Li} (11)$$

Where $C_{li} = \frac{|P_{l-i}|}{P_l}$ to express relationship between line flow and the nodal flow at the $jth$ node, using proportional sharing principle

$|P_{l-i}| = C_{li} P_l$. Substituting this in equation 11 which gives
$$P_i = \sum_{l\in\alpha_i^u} C_{li} P_l + P_{Li} \qquad (12)$$

Which on arrangement becomes
$P_i - \sum_{l\in\alpha_i^u} C_{li} P_l = P_{Li}$ Or $A_d P = P_L$
P is the vector of net nodal powers,
$P_L$ is the vector of nodal load demands,
While $A_d$ is called the downstream matrix.
The $(i, l)$ element of $A_d$ is equal to given by equation

$$[A_d]_{il} = \begin{cases} 1 & \text{for } i = l \\ -C_{li} & \text{for } l \in \alpha_i^d \\ 0 & \text{otherwise} \end{cases} (13)$$

If $A_d^{-1}$ exists, then $P = A_d^{-1} P_L$ and its $i_{th}$ element is given by equation 14

$$P_i = \sum_{k=1}^{n} [A_d^{-1}]_{ik} P_{Lk} \quad \text{for i=1, 2,.,n} \qquad (14)$$

The inflow to node i from line i-l can be calculated using the proportional sharing principle as equation 15

$$|P_{l-i}| = \frac{|P_{l-i}|}{P_l} \sum_{k=1}^{n} [A_d^{-1}]_{ik} P_{Lk} \qquad \text{for } i=1,2,….,n \quad 15$$

The generation at a node is also an inflow and can be calculated using the proportionalsharing principle as given by equation 16

$$P_{Gi} = \frac{P_{Gi}}{P_i}\sum_{k=1}^{n}[A_d^{-1}]_{ik}P_{Lk} (16)$$

$$P_{Gi} = \frac{P_{Gi}}{P_i}$$

PROCEDURE:

After calculating power flows and load flows of IEEE 30 bus system through newton Raphson method, From the upstream algorithm we get all the generator contributions for power flowing in each line and also the loss contributions for each generator in each line from the equations (1) to (8). From the downstream algorithm we can evaluate each line contribution for the loads at each bus in the given bus system from equations (9) to (16). By using those contributions of generator and lines, then compute wheeling cost by using the above stated formulae (1) to (3). The results were shown below for wheeling cost for total network.

## RESULTS

**Upstream**

I. Shows generator contribution for power in each line

| S.NO | Line | G1 MW | G2 MW | G3 MW | G4 MW | G5 MW | G6 MW |
|---|---|---|---|---|---|---|---|
| 1 | 1-2 | 88.0934 | 0 | 0 | 0 | 0 | 0 |
| 2 | 1-3 | 50.5312 | 0 | 0 | 0 | 0 | 0 |
| 3 | 2-4 | 17.1784 | 11.2243 | 0 | 0 | 0 | 0 |
| 4 | 3-4 | 48.0804 | 0 | 0 | 0 | 0 | 0 |
| 5 | 2-5 | 35.1637 | 22.9759 | 0 | 0 | 0 | 0 |
| 6 | 2-6 | 22.5037 | 14.7039 | 0 | 0 | 0 | 0 |
| 7 | 4-6 | 34.0762 | 5.8610 | 0 | 0 | 0 | 0 |
| 8 | 5-7 | -6.5126 | -3.8297 | -3.5234 | -0.0290 | 0 | 0 |
| 9 | 6-7 | 27.3888 | 9.9549 | 0.5419 | 00 | 0 | 0 |
| 10 | 6-8 | -0.8330 | -0.8330 | -0.0105 | 0 | 0 | 0 |
| 11 | 6-9 | 11.1404 | 4.0491 | 0.2204 | 0 | 0 | 0 |
| 12 | 6-10 | 8.7801 | 3.1913 | 0.1737 | 0 | 0 | 0 |
| 13 | 9-11 | -6.0747 | -2.2080 | 0 | -0.1202 | -9.7770 | 0 |
| 14 | 9-10 | 11.1404 | 4.0491 | 0 | 0.2204 | 17.9300 | 0 |
| 15 | 4-12 | 24.5270 | 4.2186 | 0 | 0 | 0 | 0 |
| 16 | 12-13 | -9.2337 | -1.5882 | 0 | 0 | 0 | -6.3661 |
| 17 | 12-14 | 4.3149 | 0.7421 | 0 | 0 | 0 | 2.9748 |
| 18 | 12-15 | 9.8625 | 1.6963 | 0 | 0 | 0 | 6.7996 |
| 19 | 12-16 | 4.2339 | 0.7282 | 0 | 0 | 0 | 2.9191 |
| 20 | 14-15 | 0.8979 | 0.1544 | 0 | 0 | 0 | 0.6190 |
| 21 | 16-17 | 2.3083 | 0.3970 | 0 | 0 | 0 | 1.5915 |
| 22 | 15-18 | 3.5205 | 0.6055 | 0 | 0 | 0 | 2.4272 |
| 23 | 18-19 | 1.7403 | 0.2993 | 0 | 0 | 0 | 1.1999 |
| 24 | 19-20 | -3.0987 | -0.9026 | 0 | -0.0382 | -1.7375 | -0.8055 |
| 25 | 10-20 | 3.8650 | 1.4048 | 0 | 0.0765 | 3.4788 | 0 |
| 26 | 10-17 | 2.1547 | 0.7831 | 0 | 0.0462 | 1.9394 | 0 |
| 27 | 10-21 | 8.3351 | 3.0295 | 0 | 0.1649 | 7.5022 | 0 |
| 28 | 10-22 | 2.9790 | 1.0828 | 0 | 0.0589 | 2.6813 | 0 |
| 29 | 21-23 | 0.4619 | 0.1679 | 0 | 0.0091 | 0.4157 | 0 |
| 30 | 15-23 | 2.7081 | 0.4658 | 0 | 0 | 0 | 1.8671 |
| 31 | 22-24 | 2.9790 | 1.0828 | 0 | 0.0589 | 2.6813 | 0 |
| 32 | 23-24 | 1.4499 | 0.2898 | 0 | 0.0042 | 0.1901 | 0.8540 |
| 33 | 24-25 | 0.2608 | 0.0808 | 0 | 0.0037 | 0.1691 | 0.0503 |
| 34 | 25-26 | 1.9756 | 0.7041 | 0 | 0.7554 | 0.1691 | 0.0503 |
| 35 | 25-27 | -1.6730 | -0.5963 | 0 | -0.6397 | -0.1432 | -0.0426 |
| 36 | 28-27 | 9.2706 | 3.3696 | 0 | 4.0640 | 0 | 0 |
| 37 | 27-29 | 3.5214 | 1.2799 | 0 | 1.5437 | 0 | 0 |
| 38 | 27-30 | 4.0344 | 1.4664 | 0 | 1.7686 | 0 | 0 |
| 39 | 29-30 | 2.1366 | 0.7766 | 0 | 0.9366 | 0 | 0 |
| 40 | 8-28 | 0 | 0 | 0 | 3.8806 | 0 | 0 |
| 41 | 6-28 | 9.2706 | 3.3696 | 0 | 0.1834 | 0 | 0 |

II generator contribution for losses in each line

| S.NO | Line | G1 MW | G2 MW | G3 MW | G4 MW | G5 MW | G6 MW |
|---|---|---|---|---|---|---|---|
| 1 | 1-2 | 1.3538 | 00 | 0 | 0 | 0 | 0 |
| 2 | 1-3 | 1.0483 | 0 | 0 | 0 | 0 | 0 |
| 3 | 2-4 | 0.2601 | 0.1699 | 0 | 0 | 0 | 0 |

| S.NO | Line | G1 MW | G2 MW | G3 MW | G4 MW | G5 MW | G6 MW |
|---|---|---|---|---|---|---|---|
| 4 | 3-4 | 0.2826 | 0 | 0 | 0 | 0 | 0 |
| 5 | 2-5 | 0.8993 | 0.5876 | 0 | 0 | 0 | 0 |
| 6 | 2-6 | 0.4626 | 0.3023 | 0 | 0 | 0 | 0 |
| 7 | 4-6 | 0.1725 | 0.0297 | 0 | 0 | 0 | 0 |
| 8 | 5-7 | 0.0417 | 0.0245 | 0.0225 | 0.0002 | 0 | 0 |
| 9 | 6-7 | 0.2671 | 0.0971 | 0 | 0.0053 | 0 | 0 |
| 10 | 6-8 | 0.0010 | 0.0004 | 0 | 0 | 0 | 0 |
| 11 | 6-9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 6-10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 9-11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 9-10 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 4-12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 12-13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 12-14 | 0.0398 | 0.0068 | 0 | 0 | 0 | 0.0274 |
| 18 | 12-15 | 0.1170 | 0.0201 | 0 | 0 | 0 | 0.0806 |
| 19 | 12-16 | 0.0317 | 0.0055 | 0 | 0 | 0 | 0.0219 |
| 20 | 14-15 | 0.0033 | 0.0006 | 0 | 0 | 0 | 0.0023 |
| 21 | 16-17 | 0.0078 | 0.0013 | 0 | 0 | 0 | 0.0054 |
| 22 | 15-18 | 0.0232 | 0.0040 | 0 | 0 | 0 | 0.0160 |
| 23 | 18-19 | 0.0034 | 0.0006 | 0 | 0 | 0 | 0.0023 |
| 24 | 19-20 | 0.0023 | 0.0021 | 0 | 0.0001 | 0.0041 | 0.0019 |
| 25 | 10-20 | 0.0327 | 0.0119 | 0 | 0.0006 | 0.0294 | 0 |
| 26 | 10-17 | 0.0056 | 0.0020 | 0 | 0.0001 | 0.0050 | 0 |
| 27 | 10-21 | 0.0724 | 0.0263 | 0 | 0.0014 | 0.0651 | 0 |
| 28 | 10-22 | 0.0196 | 0.0071 | 0 | 0.0004 | 0.0177 | 0 |
| 29 | 21-23 | 0.0002 | 0.0001 | 0 | 0 | 0.0002 | 0 |
| 30 | 15-23 | 0.0160 | 0.0028 | 0 | 0 | 0 | 0.0111 |
| 31 | 22-24 | 0.0313 | 0.441 | 0 | 0.0006 | 0.0281 | 0 |
| 32 | 23-24 | 0.0101 | 0.0020 | 0 | 0 | 0.0013 | 0.0060 |
| 33 | 24-25 | 0.0008 | 0.0002 | 0 | 0 | 0.0005 | 0.0001 |
| 34 | 25-26 | 0.0243 | 0.0086 | 0 | 0.0093 | 0.0021 | 0.0006 |
| 35 | 25-27 | 0.0066 | 0.0024 | 0 | 0.0025 | 0.0006 | 0.0002 |
| 36 | 28-27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37 | 27-29 | 0.478 | 0.174 | 0 | 0.0210 | 0 | 0 |
| 38 | 27-30 | 0.0899 | 0.0327 | 0 | 0.0394 | 0 | 0 |
| 39 | 29-30 | 0.0188 | 0.0068 | 0 | 0.0083 | 0 | 0 |
| 40 | 8-28 | 0 | 0 | 0 | 0.0102 | 0 | 0 |
| 41 | 6-28 | 0.0189 | 0.0069 | 0 | 0.0004 | 0 | 0 |

III. Shows the total transmission network capacity cost

| S.No | Line | Power in line (MW) | TC= $\sum_l W_l\, P_{max,l} L_l$ crores |
|---|---|---|---|
| 1 | 1-2 | 88.257 | 2206.425 |
| 2 | 1-3 | 50.508 | 1262.7 |
| 3 | 2-4 | 28.268 | 706.7 |
| 4 | 3-4 | 47.055 | 1176.375 |
| 5 | 2-5 | 57.760 | 1444 |
| 6 | 2-6 | 36.731 | 918.275 |
| 7 | 4-6 | 37.668 | 941.7 |
| 8 | 5-7 | -13.361 | 334.025 |
| 9 | 6-7 | 36.607 | 915.175 |
| 10 | 6-8 | -0.945 | 23.625 |
| 11 | 6-9 | 13.680 | 342 |
| 12 | 6-10 | 11.342 | 283.55 |
| 13 | 9-11 | -17.930 | 4448.25 |
| 14 | 9-10 | 31.610 | 790.25 |
| 15 | 4-12 | 29.350 | 733.75 |
| 16 | 12-13 | -16.910 | 422.75 |
| 17 | 12-14 | 8.259 | 206.475 |
| 18 | 12-15 | 18.668 | 466.7 |
| 19 | 12-16 | 8.134 | 203.35 |
| 20 | 14-15 | 1.972 | 49.3 |
| 21 | 16-17 | 4.539 | 113.475 |
| 22 | 15-18 | 6.672 | 166.8 |
| 23 | 18-19 | 3.416 | 85.4 |
| 24 | 19-20 | -6.095 | 152.375 |
| 25 | 10-20 | 8.372 | 209.3 |
| 26 | 10-17 | 4.501 | 112.525 |
| 27 | 10-21 | 18.000 | 450 |
| 28 | 10-22 | 6.279 | 156.975 |
| 29 | 21-23 | 0.366 | 9.15 |
| 30 | 15-23 | 5.478 | 136.95 |
| 31 | 22-24 | 6.244 | 156.1 |
| 32 | 23-24 | 2.578 | 64.45 |
| 33 | 24-25 | 0.050 | 1.25 |
| 34 | 25-26 | 3.545 | 88.625 |
| 35 | 25-27 | -3.497 | 87.425 |
| 36 | 28-27 | 16.802 | 420.05 |
| 37 | 27-29 | 6.190 | 154.75 |
| 38 | 27-30 | 7.092 | 177.3 |
| 39 | 29-30 | 3.704 | 92.6 |
| 40 | 8-28 | 4.044 | 101.1 |
| 41 | 6-28 | 12.797 | 319.925 |
| TOTAL | | | 17004.9 |

IV.shows the transaction wise wheeling cost

| S.No | PV bus number | $TC_t = TC * \frac{\sum_{k\in K} W_k MW_k \text{ KM}_{t,k}}{\sum_{t\in T}\sum_{k\in K} W_k MW_k \text{ KM}_{t,k}}$ Crores |
|---|---|---|
| 1 | 1 | 11897.92999 |
| 2 | 2 | 2808.712695 |
| 3 | 5 | 86.62918352 |
| 4 | 8 | 294.8068006 |
| 5 | 11 | 1197.293799 |
| 6 | 13 | 719.5275353 |
| TOTAL | | 17004.89991 |

## DISCUSSION ON RESULTS

It is observed that the total transmission network capacity cost and the sum of all the wheeling charges of all transactions is equal. It is not crucial, that all the generators should contribute power for a particular line in the network.

## CONCLUSIONS

In a deregulated power system generation, transmission and distributing companies belongs to different individual ownership. In this case unbundling of transmission services has been taking place. This needs power tracing as a solution, i.e. it's been more prominent to find the generator contributions for power and as well as losses in each line in the network. In this paper Bialek's method id used which is based on the proportional sharing principle. By upstream we trace the generator contributions for power in each line and as well as loss contribution of each generator in each line. By downstream we trace each line contribution to loads at each bus and those were sown in results of upstream. As downstream results cannot be used for wheeling cost calculation they are not displayed in this paper.

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