**Imperfect Market Equilibrium**



**DAs Results in MPEC vs Optimal**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DA** | **MPEC Profit**  **(Sell – Buy)\*price** | **MPEC Social Welfare** | **Optimal Profit**  **(Sell – Buy)\*price** | **Optimal Social Welfare** |
| **1** | -7117.499356 | -102.630568 | 751.584933 | -20713 |
| **2** | -9620.759900 | -1.573718 | 901.584933 |
| **3** | -9181.249319 | -132.174822 | 751.584933 |
| **4** | -1718.455981 | -293.614721 | 301.584933 |
| **5** | -9124.109317 | -421.874580 | 901.584933 |
| **6** | -4093.673307 | -442.596462 | 751.584933 |
| **7** | 718.208215 | -498.984685 | 451.584933 |
| **8** | -1930.153749 | -639.210378 | 451.584933 |
| **9** | -9446.546394 | -485.113727 | 1051.584933 |
| **SUM** | -51514.2 | -3017.77 | 6314.264 | -20713 |

Icon

Description automatically generated

As shown in the bar plot, DA7 has achieved highest profit among all the Strategic DAs in the MPEC. Interestingly its value is even higher than the Optimal profit for this particular DA. The DAs in optimal profit have profits much closer to each other comparing the DAs profit in the MPEC.

Chart, line chart

Description automatically generatedBus 3 Price (LMPs) for DA1 sitting at that node:

|  |  |  |
| --- | --- | --- |
| **Time** | **Bus 3 - DA1 MPEC** | **Bus 3 – Optimal** |
| 1 | 15 | 150 |
| 2 | 15 | 150 |
| 3 | 15 | 90 |
| 4 | 30 | 60 |
| 5 | 63.98778534 | 44.38544 |
| 6 | 30 | 35.45058 |
| 7 | 60 | 30 |
| 8 | 30 | 30 |
| 9 | 53.8317768 | 28.30219 |
| 10 | 30 | 26.81809 |
| 11 | 30 | 25.19692 |
| 12 | 30 | 23.81077 |
| 13 | 50.79273229 | 24.45108 |
| 14 | 66.63382554 | 30 |
| 15 | 68.81510443 | 60 |
| 16 | 30 | 90 |
| 17 | 15 | 150 |
| 18 | 15 | 150 |
| 19 | 15 | 150 |
| 20 | 14 | 150 |
| 21 | 12 | 150 |
| 22 | 12 | 150 |
| 23 | 15 | 150 |
| 24 | 12 | 150 |

Chart, line chart

Description automatically generatedBus 5 Price (LMPs) for DA7 sitting at that node:

|  |  |  |
| --- | --- | --- |
| **Time** | **Bus 5 – DA7 MPEC** | **Bus 5 – Optimal** |
| 1 | 15 | 150 |
| 2 | 15 | 150 |
| 3 | 30 | 90 |
| 4 | 30 | 60 |
| 5 | 74 | 44.38544 |
| 6 | 60 | 35.45058 |
| 7 | 60 | 30 |
| 8 | 60 | 30 |
| 9 | 63.62066 | 28.30219 |
| 10 | 30 | 26.81809 |
| 11 | 30 | 25.19692 |
| 12 | 60 | 23.81077 |
| 13 | 86.89262 | 24.45108 |
| 14 | 85 | 30 |
| 15 | 92.39485 | 60 |
| 16 | 30 | 90 |
| 17 | 15 | 150 |
| 18 | 15 | 150 |
| 19 | 15 | 150 |
| 20 | 12 | 150 |
| 21 | 12 | 150 |
| 22 | 12 | 150 |
| 23 | 15 | 150 |
| 24 | 12 | 150 |

**DAs Results in EPEC vs Optimal**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DA** | **EPEC Profit**  **(Sell – Buy)\*price** | **EPEC Social Welfare** | **Optimal Profit**  **(Sell – Buy)\*price** | **Optimal Social Welfare** |
| **1** | 29289.049193 | -976.301639470214 | 751.584933 | -20713 |
| **2** | 19968.733300 | -689.2396846259442 | 901.584933 |
| **3** | 21265.890354 | -770.4196477342487 | 751.584933 |
| **4** | 29674.545255 | -917.2555750849252 | 301.584933 |
| **5** | 35921.403161 | -1094.640688782206 | 901.584933 |
| **6** | 37077.299533 | -1126.2077519827928 | 751.584933 |
| **7** | 43937.244704 | -1453.2200180567725 | 451.584933 |
| **8** | 47252.504371 | -1542.98343519458 | 451.584933 |
| **9** | 37150.503193 | -1184.0061853033917 | 1051.584933 |
| **SUM** | 301537.2 | -9754.27 | 6314.264 | -20713 |

Chart, bar chart

Description automatically generated

After running diagonalization algorithm for N=25 iterations, we can see that all the DAs achieved more profit than the optimal model. Sum of all DAs profit increased from (-51514.2) to (301537.2) and their social welfare from (-3017.77) decreased to (-9754.27).