4.1 Case study:

For the case study IEEE 39 New England test system was used. This system consists of 10 generators units, 39 buses and 46 transmissions line the single line diagram of the system is shown in Figure 4.1 the line and bus data is shown in Appendix A.

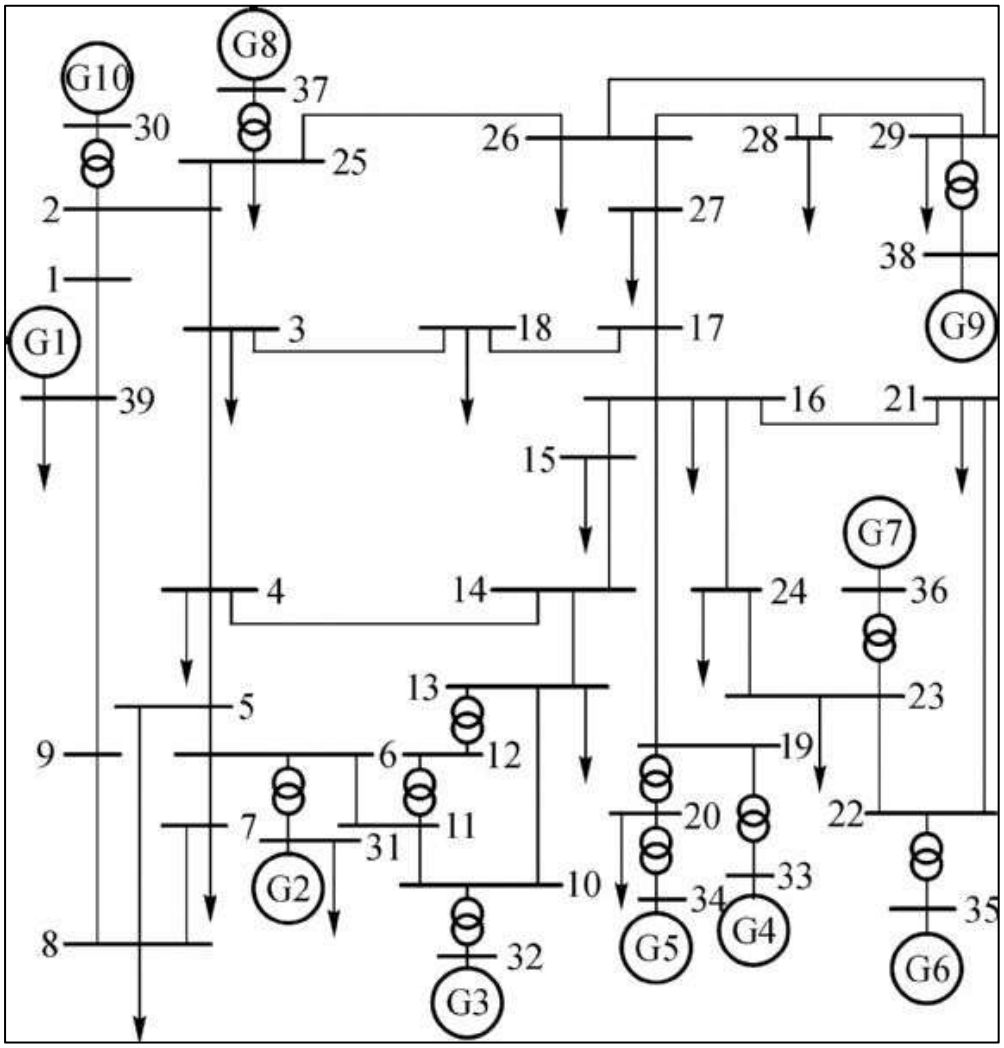

Figure 4.1: Single line diagram of the IEEE 39 New England test system

4.2 Result of the MATLAB Program:

The simulation had been carried out on the case study using NR and PSO methods the analysis had been done to the results.

4.2.1 Result with Newton Raphson Method:

The Newton Raphson method was implemented in MATLAB; the result is shown in Table 4.1.

After applying The MATLAB program the below results was found:

- The total Demand for both cases is 6150.130 MW.
- The generation Error is zero (power generation-load –losses=0).
- The power loss had been calculated and had been found to be equal to 63.11 MW.
- The optimal power generation is calculated by using Newton Raphson Method for the optimal power flow the program as shown in Table 4.1

Table 4.1 Newton Raphson MATLAB Result

Unit No	***Real Power Generation (MW)***	***Generation Cost ($/hr)***
G1	299.00	14,737.58
G2	439.59	22,123.85
G3	497.11	24,960.67
G4	572.51	29,281.60
G5	498.31	25,117.13
G6	673.71	33,648.63
G7	620.00	27,430.78
G8	643.00	25,033.85
G9	920.00	42,286.85
G10	1,050.00	51,140.10
Total	6,213.24	295,761.01
Power Loss (MW)	63.11	

4.2.2 Result with Particle swarm optimization Method:

The Particle swarm optimization method was implemented in the MATLAB program the result is shown in Table 4.2. In the PSO analysis the number of particles was set to 100. Besides, the weight factor was between the ranges of 0.4 to 0.9. When weight factor was set from 0.4 to 0.9, the PSO was able to search for larger space and discover the Gbest using shortest time. The constants and was set to be 2. Then, the number of iteration was set as 100000 iterations to avoid the analysis complete before it was really done the iteration. Error was set as 1e-06, so if the error was less than this value, the iteration process will terminate after 5000 iterations. During the analysis, the B-coefficient was considered to calculate the losses in transmission line for more accurate result. Besides, the generators power limit constraint was also involved in the analysis.

Table 4.2 Particle Swarm Optimization MATLAB Result

Unit No	***Real Power Generation (MW)***	***Generation Cost($/hr)***
G1	353.77	18,845.4996
G2	445.19	22,564.3987
G3	485.24	24,015.3960
G4	540.78	26,717.6073
G5	477.83	23,471.5681
G6	693.75	35,213.1706
G7	620.00	27,430.7719
G8	643.00	25,033.8461
G9	920.00	42,286.8480
G10	1,011.39	48,038.6893
Total	6,190.95	293,617.7956
Power loss (MW)	39.10	

4.3 Discussion:

Comparing results of the two methods, the generation Cost, total Real power Generation and Power loss is less in PSO method than NR method as shown in Table 4.3.

Table 4.3 Comparison between NR & PSO Results

Methods / ***Area Of discussion***	***Newton Raphson Method***	***Particle swarm optimization***	***Difference***
Total Real power Generation (MW)	6,213.24	6,190.95	22.29 (MW)
Total Generation Cost ($/hr)	295,761.01	293,617.7956	2,143.2144($/hr)
Power Losses (MW)	63.11	39.10	24.01(MW)

Table 4.3 shows a comparison between Newton Raphson and Particle Swarm Optimization result in the 10 generators units and 39 bus systems, it was found that Particle Swarm Optimization was able to produce the lower generation cost. Besides, the transmission losses in Particle Swarm Optimization were also lower than Newton Raphson method, dispatches of output power for each generator was different for both methods. However, Newton Raphson method was used less computational time compared to Particle Swarm Optimization. It was faster in the iteration process.

Finally, it can be concluded that Particle Swarm Optimization method was more suitable to be used in solving the economic dispatch problem as it could produce lower generation cost while satisfying the power demand. In the purpose of cost saving and environmental problem, Particle Swarm Optimization had done better contribution. Thus, PSO method was superior compared to Newton Raphson method.

As shown in Figure 4.2 the difference between Real Power Generation for each unit to the two methods.

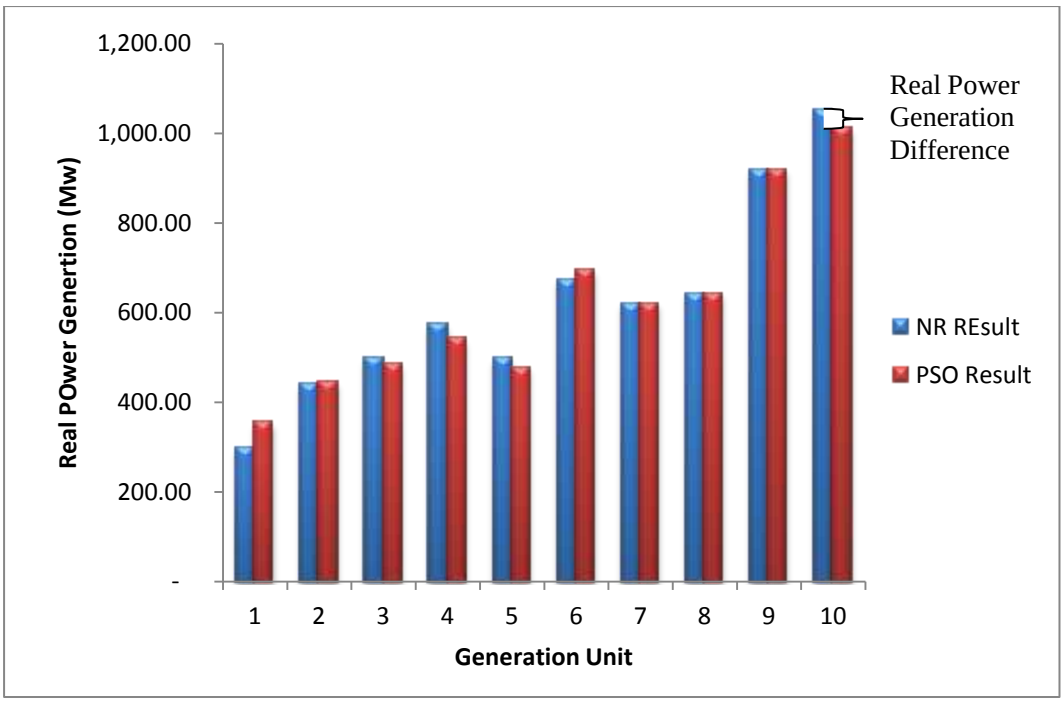

Figure 4.2 Differences between Real Power Generations (Mw)

The difference between the Generation Cost ($/hr) for NR and PSO Methods is shown in Figure 4.3.

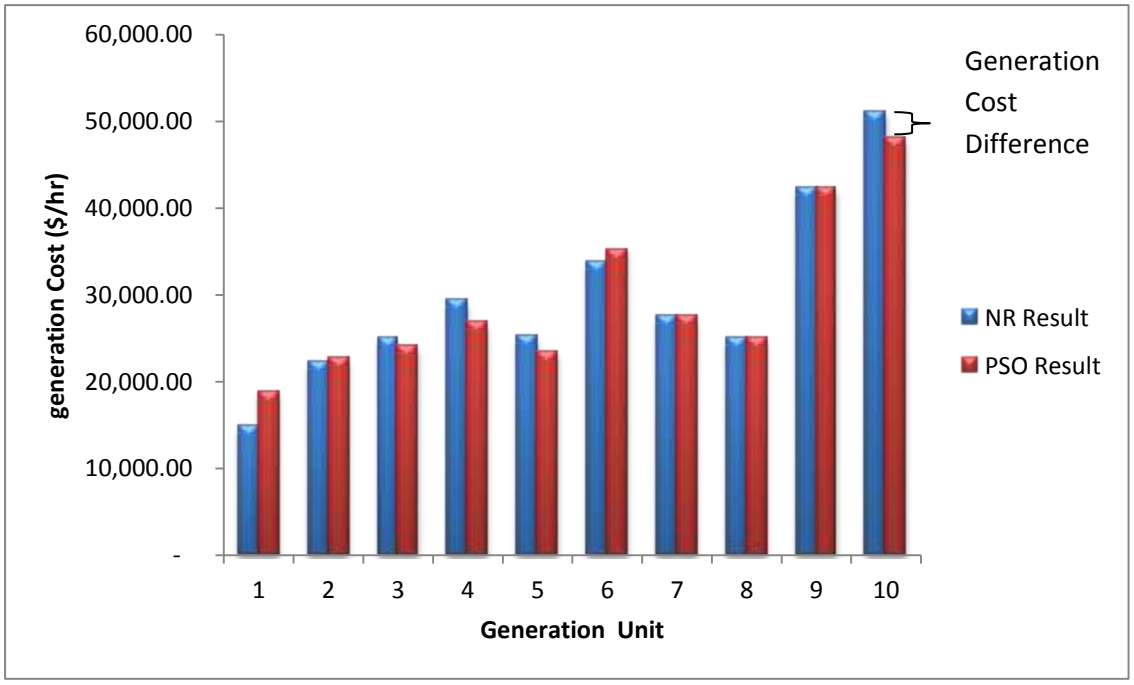

Figure 4.3 Differences Between Generation Cost ($/hr)