REDUCTION IN CO₂ EMISSION FROM THERMAL POWER PLANT BY USING LOAD DISPATCH SCHEDULE

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ABSTRACT

Reduction in the emission of the CO₂ gases from the thermal power system operation is the very huge task for the pollution control department of power plant. There are so many methods are used for the reduction of the CO₂ emission from the power plant. All the methods require so many equipment and additional arrangement for the reduction in CO₂ emission from the power plant. On the other hand if we reduce the emission with arraigning load in proper schedule than there are no additional arrangement and equipment require. In this method we can use the optimum output in terms of emission from the different power plant. Overall emissions reduce for the given output of power with same equipment by load dispatch scheduling.

Key Word: Load dispatch, Emission, Scheduling.

INTRODUCTION

Power generation system is the mirror for any developing country. Any development in country is directly related with the development in the power system generation and increase in the power plant. There are different types of power plants are used for the electrical power generation. In India major part of total electrical power generation is form the thermal power plant. Now with the development number of power plant must be increased to fulfill the requirement of load. But due to this increase so many problems arise. Major problem is the pollution from the power plant. In thermal power plant there are so many factors related with the pollution. Green house gases emission from the thermal power plants take main part in air pollution. CO₂ gas creates major effect on the environment among the all flue gases generated from the thermal power plant. So reduction in the amount of CO₂ emission from the thermal power plant is the major task for the pollution control board and authority with the same electrical power generation. Now there are many filter and
accessories are used from the reduction in the CO$_2$ emission from the thermal power plant. All these arrangements require additional equipment so overall cost is also increased with this additional modification. Now in advance management system emission can be reduce by the proper load arrangement among the all power thermal power plant units which are connected in the same grid. In this paper this load dispatch used for the reduction of CO$_2$ gas emission from the thermal power plant.

**Problem Formulation**

A three-generator system has been considered for the load dispatch for the reduction in CO$_2$ emission. General equation for the emission calculation for the individual power plant unit is as per given below.

$$F_1 = \sum_{i=1}^{NG} \left( a_i P_{g_i}^2 + b_i P_{g_i} + c_i \right) \text{ kg/h}$$

Where $a_i$, $b_i$ and $c_i$ are CO$_2$ coefficients and $NG$ is the number of generators and $F_1$ is total CO$_2$ emission from the each thermal power unit.

Our requirement is to minimize the value for the $F_1$ for the each plant at given. At different value of load generating output of plant may be differing but the overall value for the $F_1$ must be minimal. So our problem is to minimize the value of $F_1$ with load. For the above there are so many methods has been used. Some of them used here for the optimization and then compare for the selection of best method.

**METHODOLOGY**

Different methods for the minimization of emission is as per given below. Classical Method, Weight Method, Genetic Algorithms, Evolutionary Method. Computerized program developed for the above methods with Matlab language. Data for the generator is as per the given below. Here we consider three units for the calculation and their maximum and minimum capacity is as per table.

<table>
<thead>
<tr>
<th>No. of Generator</th>
<th>Generator rating in Mw.</th>
<th>Maximum Value in Mw.</th>
<th>Minimum Value in Mw.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>210</td>
<td>240</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>210</td>
<td>238</td>
<td>85</td>
</tr>
<tr>
<td>3</td>
<td>120</td>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

CO$_2$ emission coefficient for the each three plants are as per given in table 2.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>ai</th>
<th>bi</th>
<th>ci</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.265110</td>
<td>-61.01945</td>
<td>5080.148</td>
</tr>
<tr>
<td>2</td>
<td>0.140053</td>
<td>-29.95221</td>
<td>3824.770</td>
</tr>
<tr>
<td>3</td>
<td>0.105929</td>
<td>-9.552794</td>
<td>1342.851</td>
</tr>
</tbody>
</table>
Table: 3
Loss coefficient for the given plant

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>di</th>
<th>fi</th>
<th>gi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.000134</td>
<td>0.0000176</td>
<td>0.000183</td>
</tr>
<tr>
<td>2</td>
<td>0.0000176</td>
<td>0.000153</td>
<td>0.000282</td>
</tr>
<tr>
<td>3</td>
<td>0.000183</td>
<td>0.000282</td>
<td>0.00162</td>
</tr>
</tbody>
</table>

RESULT

Comparison of result for above methods are given below

<table>
<thead>
<tr>
<th>Method</th>
<th>CO₂ Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionary</td>
<td>8426</td>
</tr>
<tr>
<td>Genetic</td>
<td>9391</td>
</tr>
<tr>
<td>Weightage</td>
<td>9168</td>
</tr>
<tr>
<td>Classical</td>
<td>8925</td>
</tr>
</tbody>
</table>

CONCLUSION

Result shows that Emission is low with the help of Evolutionary technique. In all methods total output is never change but the emission of CO₂ gas is reduced with the proper selection of their generating station. Best result shows the lesser emission of CO₂ gas form the generating unit at same load. This will reduce the overall generation of CO₂ gas for the Power system.
REFERENCES


