Unit Commitment And Economic Dispatch Of Hybrid Microgrid With Residential Load

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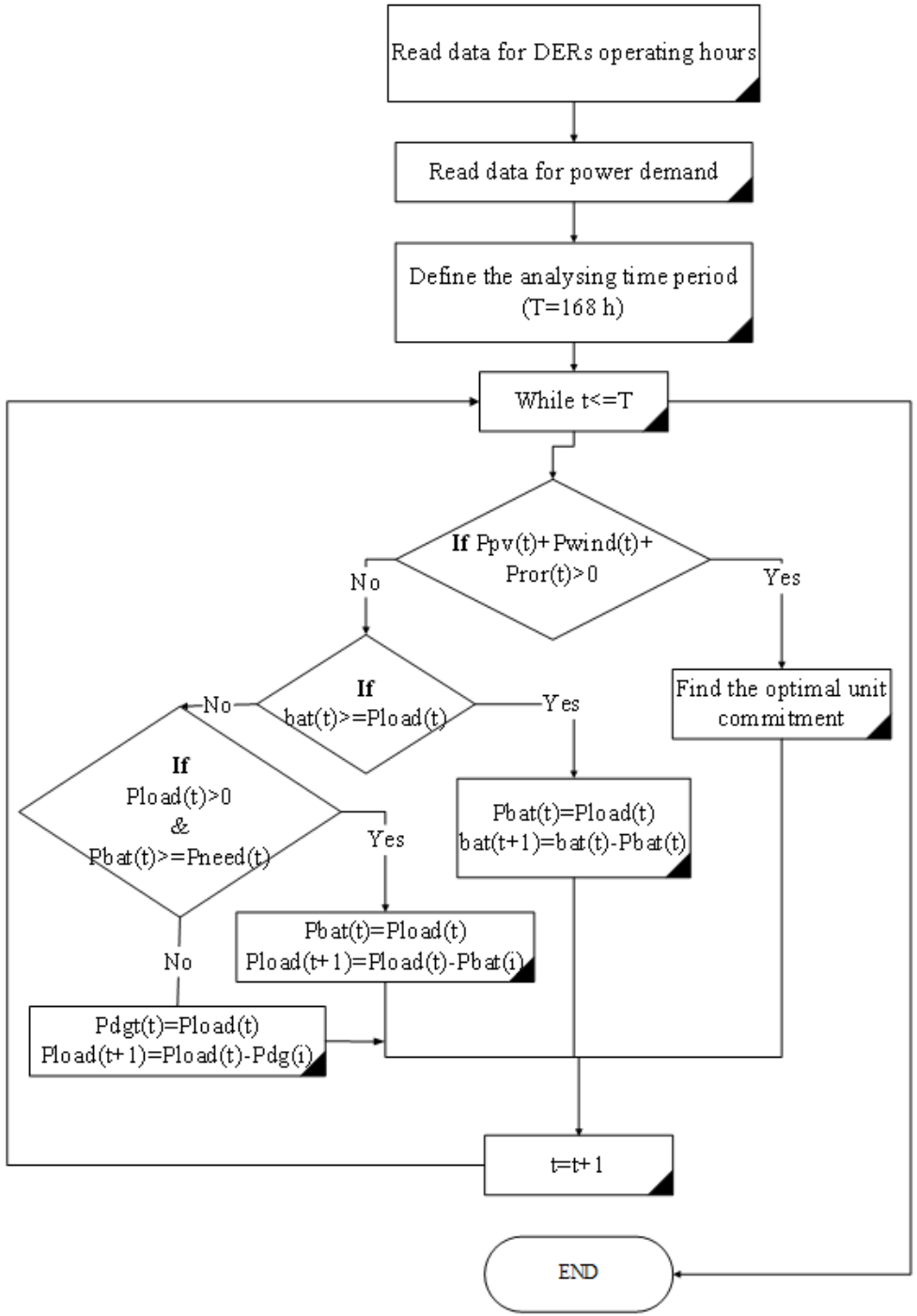
1. Introduction

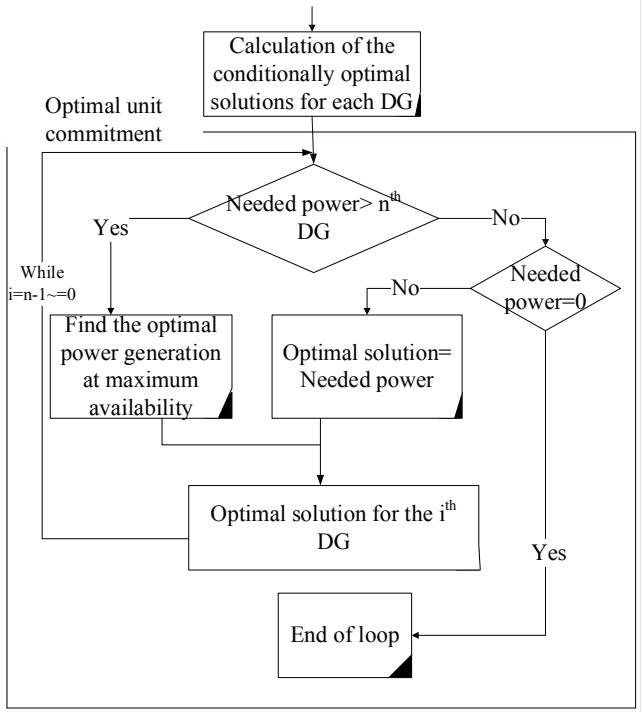
- Microgrids are the future of power systems, providing easy, environmental friendly, and safe electric power to the communities that cannot rely on the continuous power supply from the utility grid.
- In this paper, the optimal unit commitment of a hybrid distribution microgrid, with stochastic load is analysed
- The proposed algorithm analyses the weather condition data, which gives the information for the probability of generation of the installed power capacity of the DER. Based on that data, the optimal unit commitment for one week is forecasted.

2. Problem definition

- The problem analysed in this paper addresses the satisfaction of a residential load in a microgrid that operates in an islanded mode.
- In this paper, the costs and power losses are not considered as constraints. However, since it is a small-scale microgrid, keeping the voltage stability and power balance is very important for proper operation.
- The constraints, which are the input data to the algorithm, refer to the technical limitations of the installed equipment:
  - The probability for favourable weather conditions for each DER,
  - Installed power capacity for each DER,
  - Installed power capacity of the battery,
  - Installed power capacity of the backup generator,
  - Hourly power demand

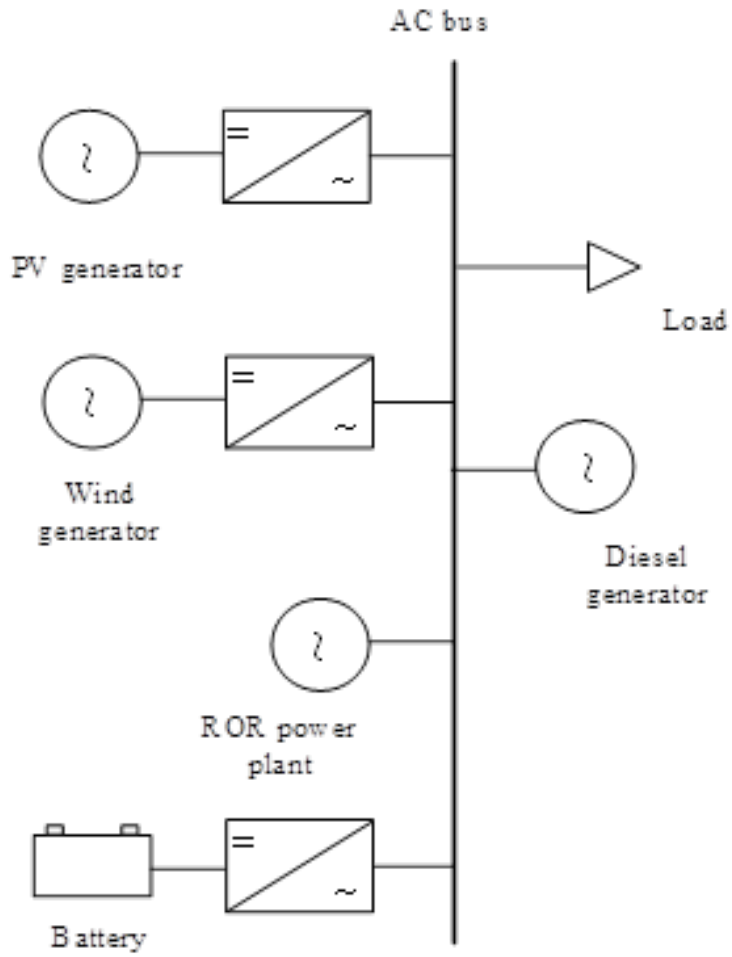
3. Proposed algorithm



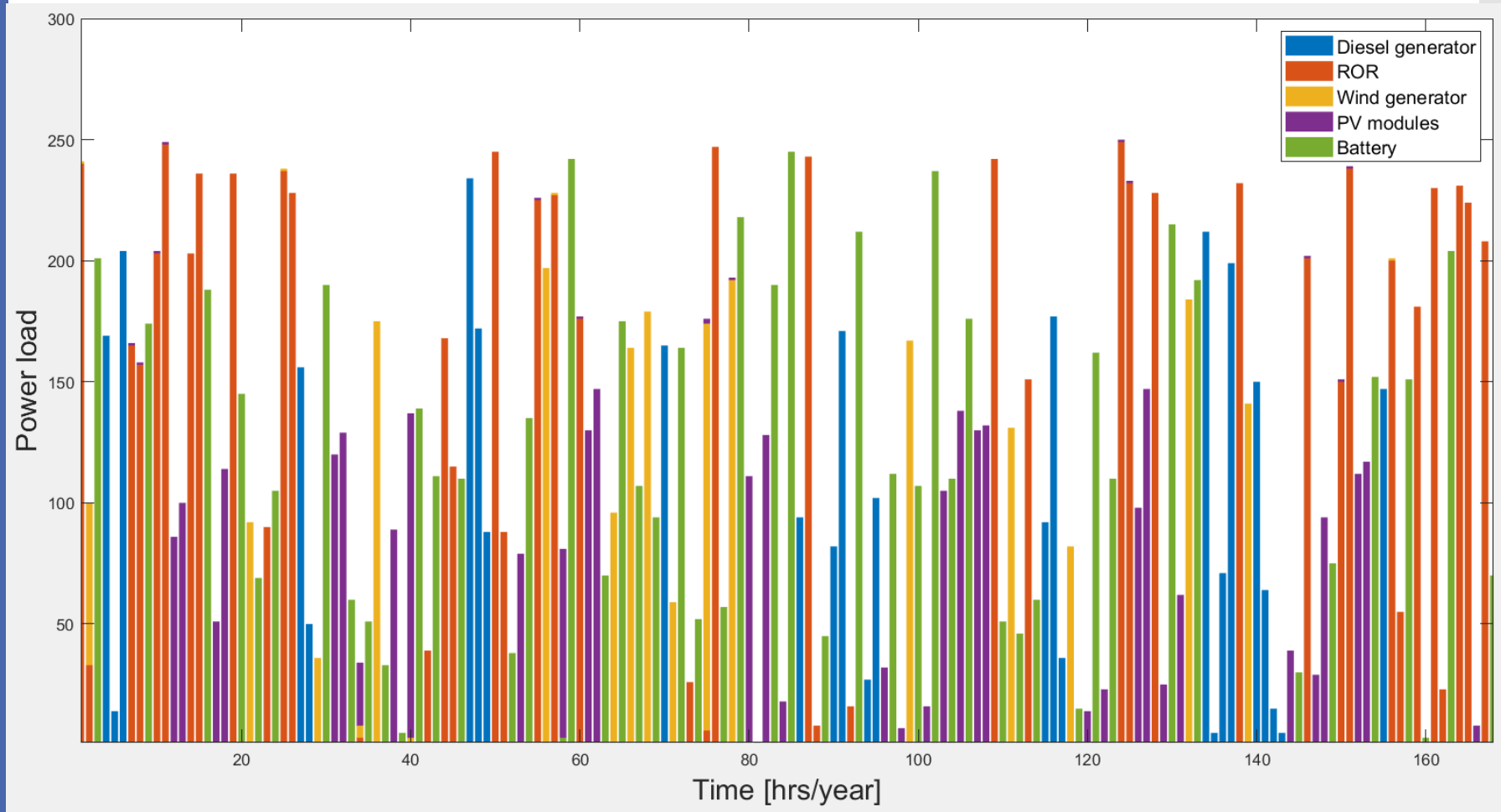


4. Test example

- The test example consists of three DERs: a ROR power plant, PV modules and wind turbines.
- The analysis is made per one week (168 hours) which is the optimal weather forecast period.
- The optimisation is between the distributed generators, following the constraints regarding their maximum power capacity at each hour.
- The output is a vector containing the optimal arrangement of each of the generators.
- The excess power is used for battery charging.



5. Results


Diesel generator
ROR
Wind generator
PV modules
Battery
Power load
300
250
200
150
100
50
20
40
60
80
100
120
140
160
Time [hrs/year]

6. Conclusion

- The proposed algorithm in this paper offers a solution to the unit commitment problem for islanded operation mode, which is very important for obtaining stable network frequency and voltage levels.
- The results show that the proposed algorithm is applicable for this type of problem, providing real and expected results. The proposed algorithm can be easily upgraded and implemented to another network configuration.