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Analyzing the Impact of Placement and Sizing of Electric Vehicle Charging Station in a Grid Integrated Microgrid

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INTRODUCTION

- Renewable energy comes from sources or processes that are constantly replenished
- Eco-friendly
- Reliable source of energy
- Less maintenance

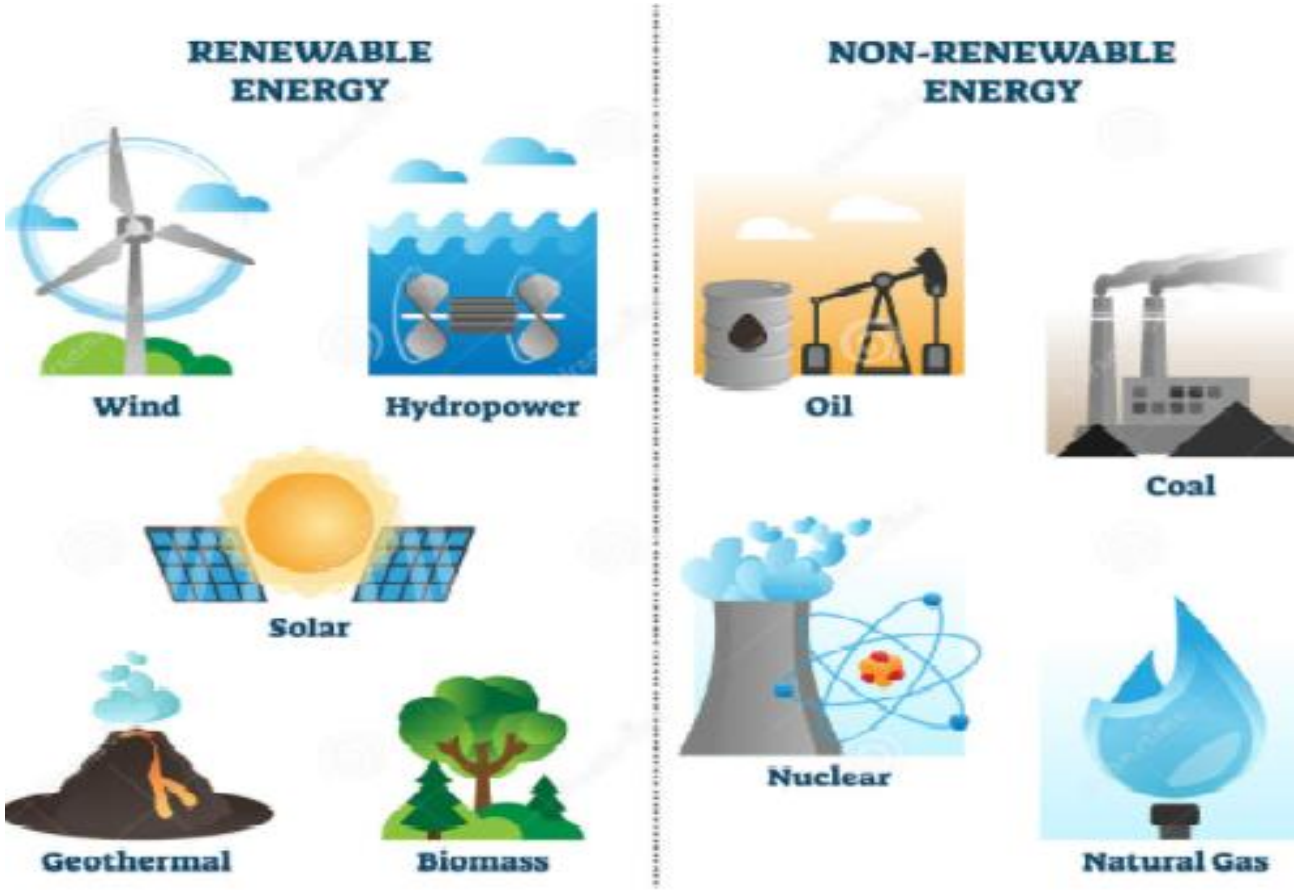

Fig.1. Energy sources.

INTRODUCTION

Microgrid (MG) [1]

- It is a small scale power supply network that is designed to provide power for a small community. It comprises of various generating sources, storage options and energy users.

EV charging station

- It is an infrastructure that supplies electrical energy for recharging of different types of EV's.
- In India government is planning to sell only EV's by 2030, country needs nation wide network of charging stations for EV's.

Different fast charging levels [3]

DC level 1: 36 kW, 200/450 V, 80 A
DC level 2: 90 kW, 200/450 V, 200 A
DC level3: 240 kW, 200/600 V, 400 A

OBJECTIVES

1. To investigate optimal location and sizing of electric vehicle charging and discharging station in a DC microgrid considering uncertainty of renewable energy sources and load, for minimizing loss, cost and energy import from the grid, etc.

2. To investigate and optimize the power quality issues such as voltage profile and voltage unbalance in grid connected EV charging and discharging stations in DC microgrid with the consideration of uncertain nature of renewable energy sources and load.

3. To explore and develop suitable pricing mechanism for EV charging and discharging station in uncertain DC microgrid.

METHODOLOGY

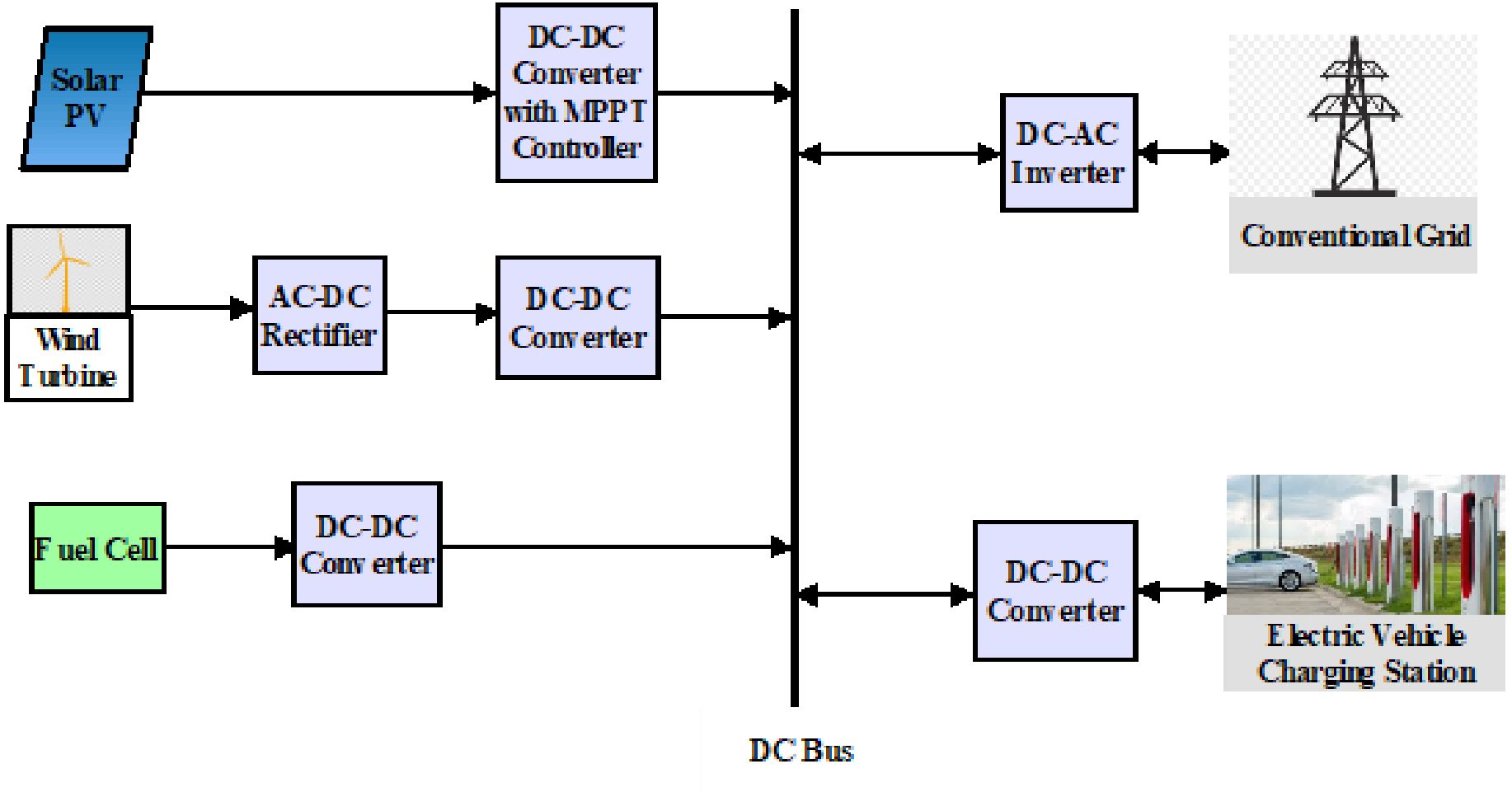

Fig. 2. Block diagram of DC MG integrated with EVCS.

METHODOLOGY

Step 1

- The IEEE 33 bus test system is selected for analysis
- The suitable data are collected for different sources which are used in MG

Step 2

- The different load flow techniques are reviewed and forward-backward sweep load flow technique is adopted for optimal location and sizing of EVCS
- Uncertainty modeling of RESs and EVCS load is performed

Step 3

- Different optimization techniques are reviewed
- TLBO and JAYA algorithm are used for achieving the objectives

Fig. 3. Methodology for achieving the objectives.

METHODOLOGY

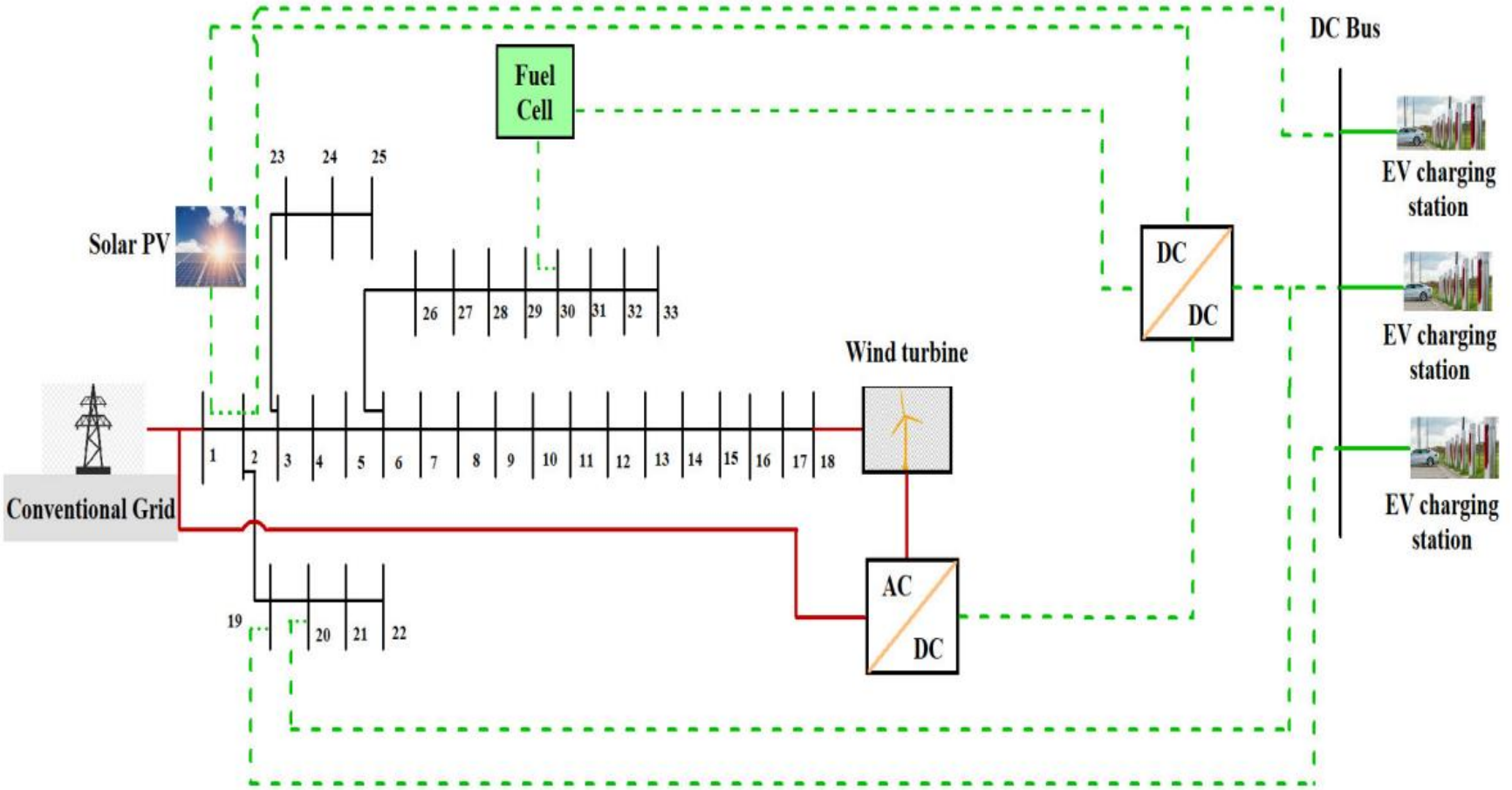

Fig. 4. Framework of modified IEEE 33 bus system.

RESULTS

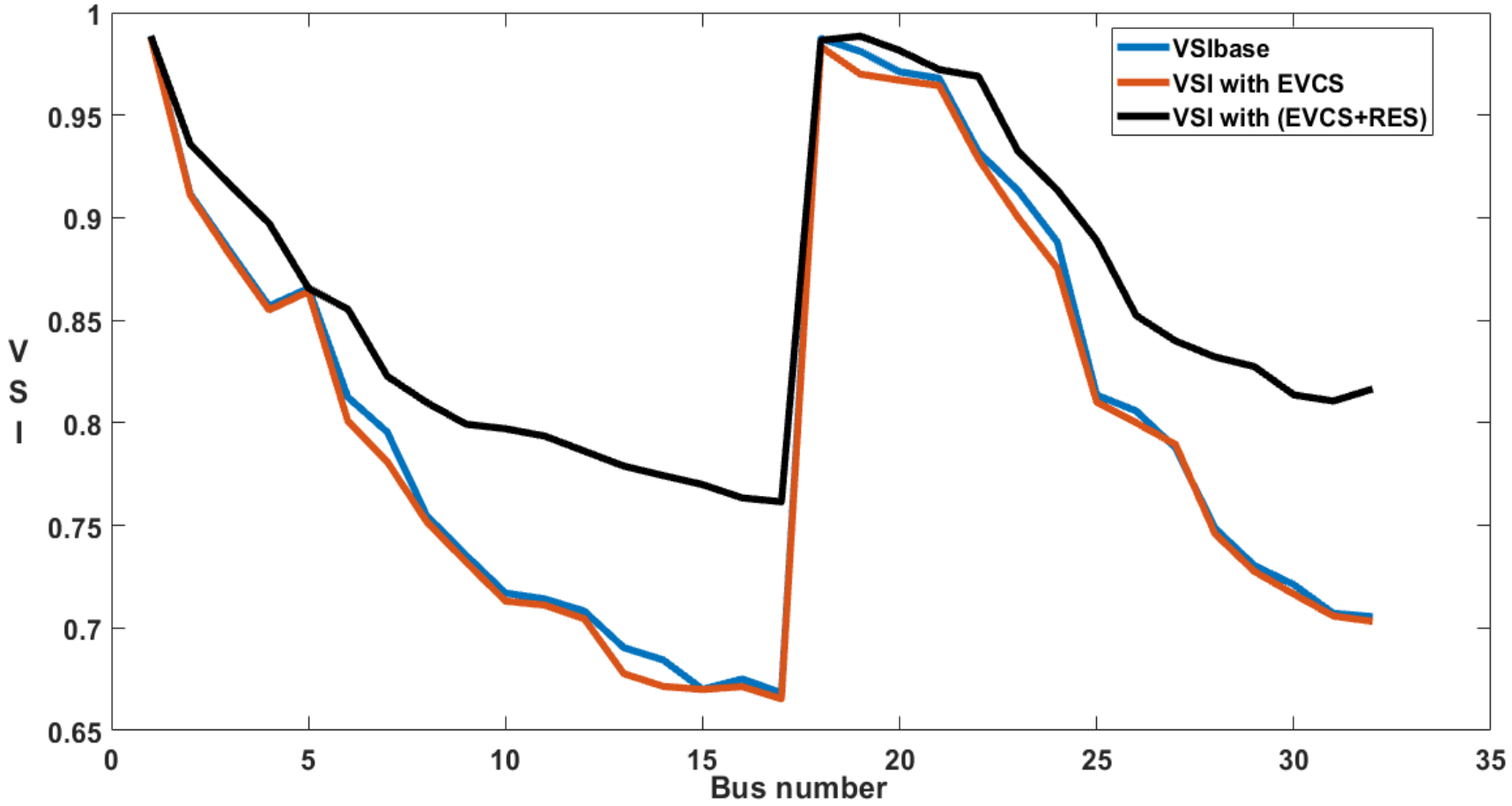

Fig. 5. Voltage stability index of IEEE 33 bus system.

RESULTS

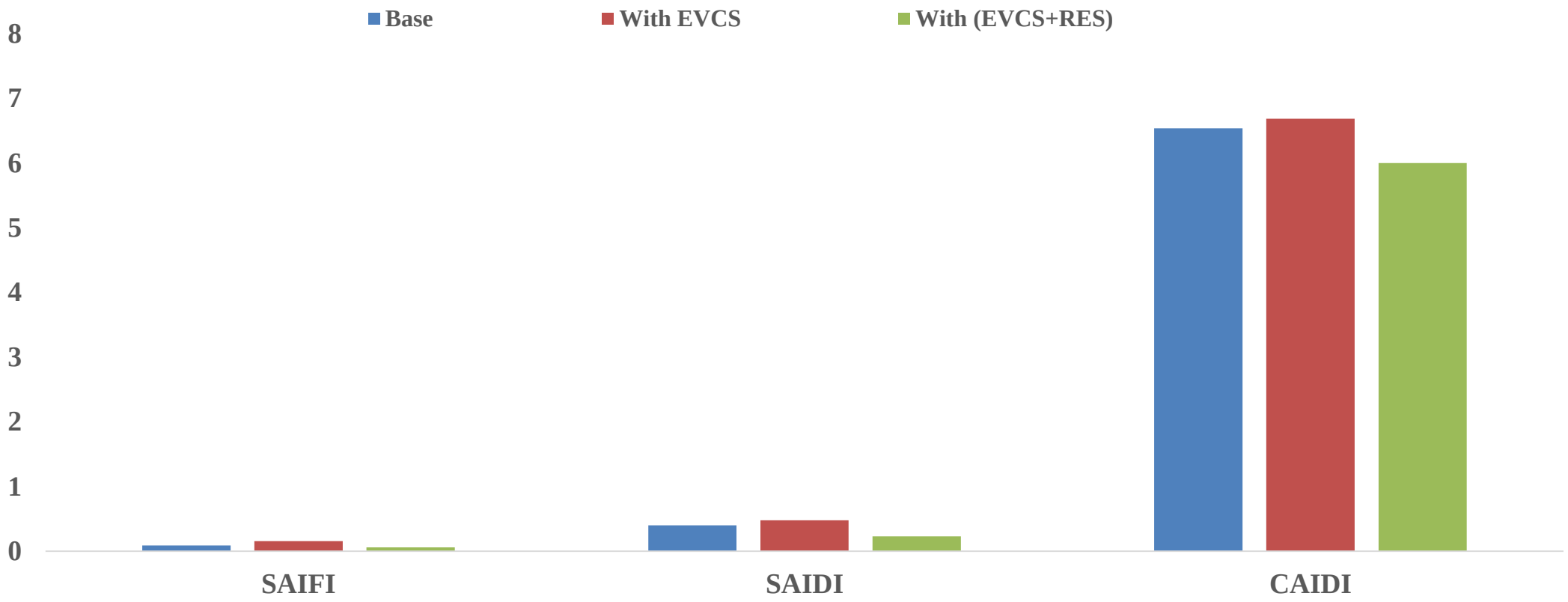

Fig. 6. Reliability of IEEE 33 bus system.

RESULTS

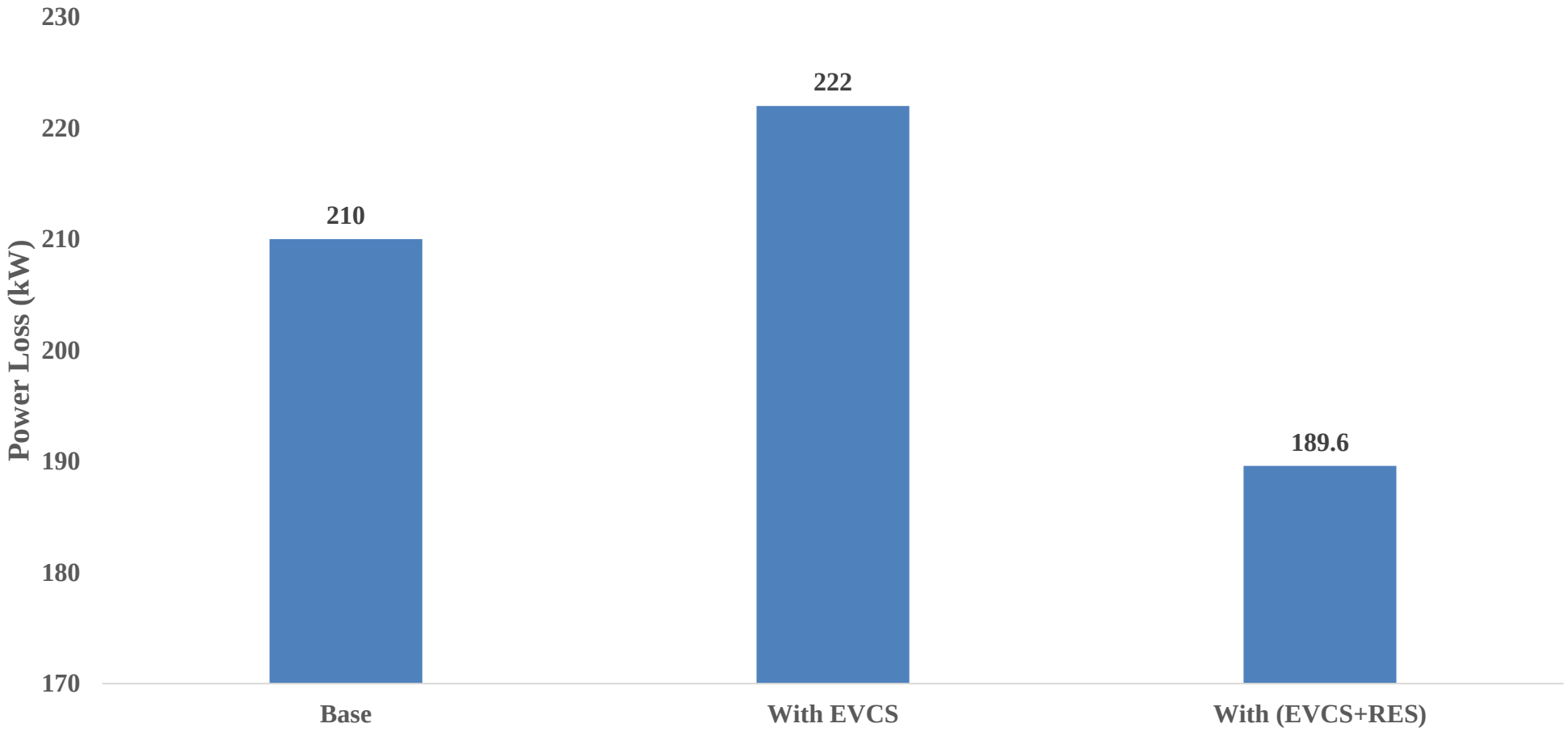

Fig. 7. Power loss of the IEEE 33 bus system.

RESULTS

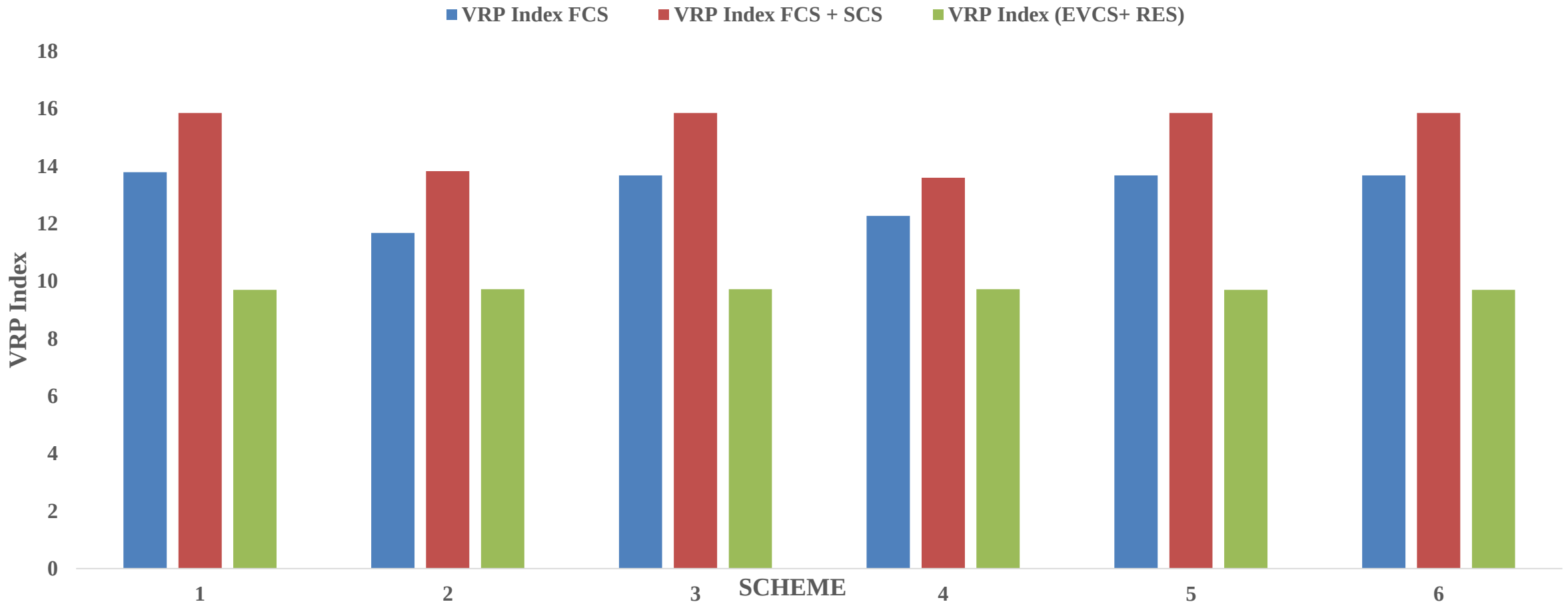

Fig. 8. VRP Index of the IEEE 33 bus system.

CONCLUSION

- The construction of a DC MG system based on RESs is important for the nation's upcoming energy security.
- Techno-economic analysis is performed in a multi-objective context.
- The performance of the proposed strategy is examined using the MATLAB platform.
- CSs and RESs are optimally placed and sized on a medium scale IEEE test network using modified TLBO and JAYA algorithm.
- The statistical results are compared with the existing literature and found better the performance of the proposed technique and operation strategy.

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Thank You