The Need for Artificial Intelligence for Energy-Efficiency Management: A Review

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INTRODUCTION

- Sustainable energy is one of the biggest challenges we have globally. In Sub-Saharan Africa, It is estimated that 590 Million people live without electricity, three million is in South Africa.
- Most of South Africa's electrical energy is generated through coal.
- The South African government provides subsidies to communities who cannot afford electricity. Often due to overloading, the country experiences outages called load shedding.
- It is estimated that by the year 2075, the country's population will be 80 Million, electricity demand is expected to increase as well.

QUESTIONS ADDRESSED

1) South Africa as a country experiencing energy challenges, can AI be used to address these issues?

2) As compared to conventional methods, which areas does AI offer improvements? and how can AI methods be applied to improve energy efficiency.

MAIN RESULTS FROM THE STUDY

Over three million households in South Africa does not have electricity. Moreover, with an aging infrastructure, the grid is overloaded most of the time. The energy sources are illustrated in figure 1 .
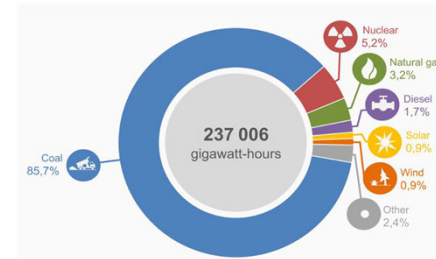

Fig. 1. The energy sources in South Africa

In South Africa, of the total 237 006 Gigawatt-hours of power generated, almost 86% is generated from coal, 5,2% from Nuclear, 3,2% from natural gas, 1,7% from Diesel and solar and wind contributing 0,9% each.

APPLICATIONS OF AI DISCUSSED

Different AI concepts such as ANN (Artificial Neural Networks) are discussed and the real-life applications explored for industries in Air-conditioning, smart lighting systems, building energy management systems and smart grids. Moreover, the potential of AI based forecasting models is explored.

CONCLUSIONS

- Energy subsidies allow for access to electricity however the solution is only temporary.
- Conventional forecasting models are less accurate when modelling non-linear variables such as solar etc.
- The availability of data mining sensors (IoT) allows for AI-based models to be trained easily.
- As compared to conventional methods, AI is more suitable in energy efficiency management.
- Different regions of South Africa have different weather patterns and other variables, it is necessary for a study to be done as per region.

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