**Artificial Intelligence for enhancing the Renewable Energy sector**

**Introduction:**

Artificial Intelligence is the new buzz word in the tech sector these days. From healthcare using it to develop AI-powered systems to detect and diagnose diabetic retinopathy and breast cancer, to self-driving cars and AI-powered traffic management in transportation sector, to business using it for AI-powered systems to help with customer service, automate repetitive tasks, and provide more accurate data analysis and predictions, every sector is incorporating AI into its workflow. Then why would renewable energy stay behind and not quickly adopt AI as other sectors?

**Gap**

One of the greatest reasons is the high cost of implementing AI in renewable energy systems, particularly for smaller companies or projects. A lot of the work done to advocate clean energy is by non-profits, thereby making it difficult to justify the cost of implementing AI technology to donors.

While cost is a big barrier, the expertise isn’t abundant too. When looking for the literature on this topic, most of it was machine learning models built to predict renewable energy availability thereby reducing uncertainty in planning, organization and decision making. There was also some implementation of ML visualization/classification models to judge the effectiveness of a material as a renewable energy source.

What was missing was different ways in which AI could be incorporated to double enhance the renewable energy sector. For example, there isn't much on application of artificial intelligence to the power grid. More specifically I was looking for an answer to the question: How can we use the newly emerging power of Artificial Intelligence and Machine Learning to enhance the renewable energy sector ?

Another possible challenge could be the whole essence of AI: Data quality: AI relies on high-quality data to make accurate predictions and optimize renewable energy systems. However, data collection and management can be challenging in the renewable energy sector, particularly in remote locations or in areas with limited access to technology and infrastructure.

**Proposed Methods:**

There are so many ways to solve this. Starting with congregating good information. The second step could be to actually built some of these models on a simpler level just to see if it actually works.

Where ICONS comes in is the multidisciplinary specialty. A group of students could work on creating enriching datasets, or could explore business solutions to make intensify intersection of technology and renewable energy. As I see it, you move with the world or get left behind. AI/Technology is a very powerful resource that if incorporated properly in the renewable energy sector can increase their efficiency and speed of growth fourfold.

Here’s some different areas that could possibly benefit from the implementation of Artificial Intelligence:

1. Identification AI systems for monitoring and repairs: Renewable energy systems, such as wind turbines and solar panels, are complex and require continuous monitoring and maintenance. AI can help optimize the performance of these systems, improve their efficiency, and reduce downtime.
2. Predicting Failure: Renewable energy systems are often located in remote areas and can be difficult to access for maintenance. AI can help predict equipment failure and maintenance needs, ensuring that renewable energy systems are reliable and available when needed. One of the companies in the manufacturing sector already implemented this for big clients like Walmart warehouses.
3. Smart Grid Technology: AI can help balance energy supply and demand by predicting energy consumption patterns and adjusting the output of renewable energy systems accordingly. This can help maximize the use of renewable energy and reduce the reliance on fossil fuels.
4. Optimization: As the world's population grows, there is a growing demand for energy. Renewable energy sources are becoming increasingly important in meeting this demand. AI can help ensure that renewable energy systems are operating at maximum capacity. There isn’t much work on how this can be done but it surely is a possible area of exploration.

**Broader Impact:**

History has shown that industries that do not advance with changing times, eventually fade away and disappear from the world. Just like any other power holders, leaders in the renewable energy sector want to adopt to the new technology because of fear of being left behind. But to bring any change, the whole world relies on scientific community to publish papers and offer pathways. A classic example is the Internet. Built in the 1980s, wasn’t implemented in schools until 3 decades later. Then the scientific community came up with ideas of simulation based education, Zoom meetings, personalized Kindle readers, etc. Just like that to bring about any change, people need start talking and publishing work on how Artificial Intelligence can enhance renewable energy. Only if a decade later if there is enough scholarly debates and papers, would people and companies start to actually implement these systems. Hence the importance of this IRR.

**References**

Wang, H., Lei, Z., Zhang, X., Zhou, B., & Peng, J. (2019). A review of deep learning for renewable energy forecasting. *Energy Conversion and Management*, *198*, 111799. https://doi.org/10.1016/j.enconman.2019.111799

Lai, J., Chang, Y. K., Chen, C., & Pai, P. C. (2020). A Survey of Machine Learning Models in Renewable Energy Predictions. *Applied Sciences*, *10*(17), 5975. https://doi.org/10.3390/app10175975

Yao, Z., Lum, Y., Johnston, A., Mejia-Mendoza, L. M., Zhou, X., Wen, Y., Aspuru-Guzik, A., Sargent, E. H., & Seh, Z. W. (2022). Machine learning for a sustainable energy future. *Nature Reviews Materials*. https://doi.org/10.1038/s41578-022-00490-5