Power Plant Energy Predictions.

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**Author’s Note**

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Abstract.

Since the Twentieth Century, Electric Power has been the source of advancement of Human Technology. It has been a basic need for the past 100 years. The Power Plants of today are significantly more efficient than ever, like the Combined Cycle Power Plants which take advantage of the heat exhaust generated by their predecessor designs and reuse it to generate even more electricity. The level of efficiency is so high that we can now measure the effects of the environment on the productivity of the plant. Measuring the variance in the output of an electric plant is essential not only for the workers of the facility, but to the investors, the end users, and to the Economy. This paper explores how linear regression, and other models can be used to predict the output of a power plant based off ambient temperature, atmospheric pressure, and other environment variables automatically.

*Keywords*:Artificial Intelligence, electric power, linear regression, profitability

**Introduction.**

In the Era of Information is quite hard to imagine our lives without computer, without 24/7 access to the Internet, without a fridge and a microwave in our kitchens, or even without LED light bulbs that remove darkness from our nights. None of the prior modern necessities can be resolved without a key element: electric power. Without it, there’s no modern technology, no research, no economy. Electric Power is critical on our daily lives. Just like Hollywood visual FX, when electricity works fine is almost invisible and easy to forget it’s there, but the moment there’s a power outage we surely notice. Predicting its output could be beneficial for multiple purposes; think of Energy Demand Forecasting, Financial Planning, Carbon Emission Management, Energy Trading, Integration with Renewable Energy, and many more that exceed our imagination. This paper is about how a predictive model can work to accurately predict the output of a Combined Cycle Power Plant based off ambient temperature, atmospheric pressure, and other environmental variables that directly affect the productivity of a CCPP.

## Definition of a Combined Cycle Power Plant (CCPP).

Our work is based on the data and research performed by Tüfecki (2014).

# Data Cleaning/Preparation.

## Company X.

Let's define our case study: Company X. This company offers specialized services by generating insights for clients through data analytics, proprietary software, and a unique methodology developed over decades of research. Company X has not only survived economic crises but has also thrived in difficult economic times, as their clients increasingly rely on its insights during those critical decision-making times. The driving force behind these insights? Company X's employees—whom we'll call Human Consultants—who use their expertise, problem-solving skills, and soft skills to understand client needs, build strong relationships, and identify hidden problems.

Now, suppose Company X invests in an AI department to create an AI model, the "AI Consultant," capable of learning the proprietary methodology, accessing data, and generating insights comparable to those produced by Human Consultants. Initially, the AI Consultant requires major adjustments to meet expectations, so there’s little immediate concern. However, once it can produce insights with the same accuracy as Human Consultants, but in a significant fraction of the time—potentially for all U.S. markets and clients simultaneously—delivered to the clients automatically or on-demand, and for only a tiny fraction of the cost, wouldn’t Company X ask itself the question: will all Human Consultants still be necessary?

# Exploratory Data Analysis.

At this stage, Human Consultants might seem obsolete, unable to compete with their virtual counterpart. However, there's a crucial factor to consider from the client's perspective: trust. While AI may be reliable, timely, and efficient, it lacks the ability to build trusting relationships. As Ryan (2020) notes, "Trusting relationships are those between trusted parties, whereas AI is a systematic group of techniques that enable machines to fulfill particular computing tasks." The AI Consultant can provide insights but cannot establish the relationships necessary to build client trust.

# Model Selection.

Client perception may favor human interaction over relying solely on an AI Consultant. For example, customers often prefer human customer service over AI bots when they perceive the task or question to be too complex for the bot (Xu et al., 2020). While AI can generate insights, maintaining relationships and trust still requires a human touch, especially when clients are looking for critical insights. So, if human interaction is still needed, why would companies spend resources in the AI Consultant in the first place? Is it worth it?

# Model Analysis.

Let’s put things in perspective. The AI Consultant excels in handling complex and tedious tasks, but Human Consultants have the upper hand in building trust and long-lasting client relationships. Now, consider this: if Human Consultants no longer needed to perform analyses, how could they use that extra time? Their strength lies in cultivating trust, so wouldn't it make sense to focus on expanding the company's client base? When it’s time to deliver analysis to these new clients, the AI Consultant could handle the technical work. The AI Consultant doesn’t need breaks, overtime, or rest—it can work through the night, allowing Human Consultants to maintain work-life balance while still meeting every client deadline, old and new clients alike.

# Conclusion and Recommendations.

Company X stands to benefit from both AI and Human Consultants. The AI Consultant can handle the technical work, enabling Human Consultants to focus on building strong client relationships and presenting insights. This approach would allow Company X to expand its client base, retain its workforce, and boost profitability simultaneously.

**References.**

Tüfekci, P. (2014). Prediction of full load electrical power output of a base load operated combined cycle power plant using machine learning methods. *International Journal of Electrical Power & Energy Systems*, *60*, 126–140. https://doi.org/10.1016/J.IJEPES.2014.02.027