

Balancing Sustainability and Cost: Green Electricity Adoption in Chinese Vehicle Manufacturing

Junyi Yang^{1,a,*}

¹*Kelly School of Business, Indiana University, Bloomington, Indiana, 47406, USA*

a. yangjuny@iu.edu

**corresponding author*

Abstract: Against the backdrop of escalating environmental concerns and the worldwide drive towards achieving carbon neutrality, this paper tackles the urgent task of incorporating environmentally-friendly electricity into an industry known for its substantial energy usage. The central research focuses on the justification of investing in green electricity for vehicle manufacturers in China, taking into account the abundance of other carbon reduction choices that may provide more economically efficient solutions. The study utilizes literature analysis and review to examine the economic and environmental consequences of adopting green electricity. It situates the topic within the larger framework of China's goals for sustainable economic growth and carbon neutrality. Its objective is to provide clarity on the compromises between sustainability and affordability, providing valuable perspectives on how automobile manufacturers may effectively negotiate these obstacles while actively supporting the worldwide initiative to combat climate change.

Keywords: Green Electricity, Chinese Vehicle Manufacturing, sustainable economic development

1. Introduction

The appeal of green electricity in the energy market stems from its capacity to substantially mitigate carbon emissions for manufacturing enterprises. Nevertheless, the restricted accessibility and strong demand have led to significantly elevated pricing compared to conventional electricity sources. Industries such as vehicle production have significant challenges due to their high electricity use, resulting in a considerable rise in costs. While green power offers environmental advantages, it is worth considering if it is the most effective investment for automobile manufacturers in China. There are other solutions that may provide better outcomes in terms of reducing carbon emissions. Efforts to safeguard the environment have developed over many years, yet it is still difficult to achieve measurable results in the manufacturing industry [1-2]. The rules on industrial waste have been in place since the 20th century, and due to continued economic expansion, carbon emissions are inevitably increasing. Achieving carbon neutrality and sustainable development is a challenging endeavor. The importance of green power in decreasing carbon footprints, particularly in energy-intensive industries such as car manufacture, is underscored by advancements in green production methods. Nevertheless, the exorbitant cost of environmentally-friendly electricity raises concerns regarding its economic viability for prominent automobile manufacturers in China. This study will analyze and examine literature to investigate the validity of the increased expenses associated with

green electricity. It will specifically focus on the advantages and alternative options of green electricity, taking into account China's aims of achieving carbon neutrality and its strategy for economic development. This paper presents a comprehensive analysis of the scholarly research on sustainable automobile manufacturing. It aims to provide valuable insights and practical recommendations for effectively addressing the persistent issue of excessive carbon emissions in the future.

2. The challenges and costs of green electricity in car manufacturing in China

2.1. Higher costs of green electricity in car manufacturing

The substantial increase in manufacturing costs associated with using green electricity can result in a large decline in the company's revenue, hence further escalating the potential expenses of utilizing green electricity. As per the State-owned Assets Supervision and Administration Commission of the State Council, the cost of renewable electricity in China is around 0.6 percent higher than conventional electricity. Lei Zhang says that "green-e is considered a luxury item" for Chinese customers, particularly in China [3]. Green electricity in China is a scarce resource due to its limited production amount. The adoption of green electricity in China has unquestionably been a substantial measure towards mitigating environmental effect and tackling problems related to climate change. Nevertheless, it is crucial to recognize that this shift has posed significant difficulties, especially for sectors like automobile production. An essential factor that warrants consideration is the influence of environmentally-friendly electricity on the manufacturing expenses of automobile producers in the nation. The time expenditure associated with transitioning to renewable electricity sources must also be taken into consideration. China's transition to renewable energy sources such as wind, solar, and hydroelectric power is causing vehicle manufacturers to incur greater operational expenses. This is mostly due to the significant initial investment needed to adopt these cleaner energy sources and the continuous costs associated with their maintenance. Moreover, the process of shifting to environmentally-friendly power frequently necessitates the enhancement or modification of current industrial facilities to suit these novel energy systems, which can incur significant expenses and consume a considerable amount of time. The combination of these elements leads to a notable rise in production expenses for automobile manufacturers, which can have a big effect on their profitability in the fiercely competitive global automotive industry.

2.2. Chinese consumer's price-sensitive attitudes toward the cost

It is important to take into account the Chinese customers' perspectives on the increased expenses associated with green electricity before implementing it and raising the prices of cars. One major obstacle to the adoption of green electricity in China's automotive industry is the Chinese consumers' unwillingness to bear the extra expenses linked to ecologically sustainable power sources. Although green electricity is crucial for achieving a sustainable future, its incorporation into industries such as automobile manufacturing frequently results in elevated production expenses, which subsequently result in higher pricing for green vehicles. Chinese consumers, similar to consumers elsewhere, are cost-conscious and may not be inclined to pay extra for electric cars fueled by environmentally friendly energy when they may choose to buy conventional vehicles that are less expensive. According to Boqiang Lin's heterogeneity analysis, Chinese families show a strong preference for green power [3]. However, in order to encourage residents to consume green electricity, it is crucial to focus on the high-income group. The inclination of consumers towards economical choices can result in a scenario where, despite the endeavors of automobile makers to create eco-friendly automobiles, a substantial segment of the market may select for cars constructed using conventional electricity sources. The economic-driven choice may impede the extensive implementation of green

electricity in China's automotive sector and maybe decelerate the country's advancement towards its sustainability objectives.

2.3. Unsignifican reduction effect of the current production phase

Furthermore, the utilization of green electricity does not alter the company's production phase, hence resulting in no reduction in emissions during the car manufacturing process. Additional methods and alternatives are available to enhance the environmental sustainability of car production in China. According to A. Giampieri, in order to accomplish low-carbon manufacturing and produce automobiles with low or zero emissions, improvements to production processes and plants are necessary [2]. Although the adoption of green power in industries such as vehicle manufacture is commonly linked to beneficial environmental effects, it is important to note that its influence on the production of cars may not necessarily result in a substantial decrease in energy usage. According to Wei Zhang, the carbon trade in China hinders the progress of green technology innovation and also impedes the advancement of environmentally friendly technologies in the country [4]. Green electricity largely impacts the energy source utilized for production by transitioning it to renewable and more environmentally friendly sources. Nonetheless, the energy efficiency and total energy usage during car production are influenced by other factors that extend beyond the electrical supply. The process of car production is intricate and requires a significant amount of energy. It encompasses various steps, including material extraction, processing, assembly, and transportation. The energy efficiency of machinery, industrial procedures, and supply chain logistics are important factors in determining the total energy usage. Utilizing renewable energy sources, such as green electricity, can help lower the environmental impact of power generation. However, it is important to note that this does not necessarily result in a corresponding reduction in energy usage during the manufacturing of cars [5]. Hence, it is imperative to acknowledge that including renewable electricity in the production of cars is merely a single component in attaining a more environmentally friendly and energy-efficient sector. Efforts should prioritize enhancing the energy efficiency of manufacturing processes, optimizing supply networks, and minimizing waste to significantly reduce energy consumption in car manufacture.

3. Countermeasures

There are more efficient and cost-effective methods to reduce carbon emissions in car production in China, which may be utilized to benefit the environment, the firm, and the consumers. When aiming to save energy and reduce carbon emissions in automobile manufacturing in China, it is crucial to recognize that there are other, easier to obtain, and more economical methods that can result in substantial advantages. An effective strategy involves the use of energy-efficient industrial techniques and technology. Automobile manufacturers have the option to spend in enhancing their production lines, implementing sophisticated automation systems, and redesigning procedures in order to reduce energy usage. These enhancements have the potential to result in significant energy conservation without the need for a full shift to renewable electricity.

Additionally, the streamlining of supply chains and the sourcing of materials in a sustainable manner can have a crucial impact on decreasing the carbon emissions associated with the manufacturing of cars. Manufacturers can reduce energy consumption related to transportation and logistics, which often accounts for a substantial part of a car's carbon footprint during production, by obtaining supplies from nearby sources and employing effective logistical tactics. Efforts to decrease carbon emissions in the automotive manufacturing industry in China should prioritize the significance of making gradual advancements in energy efficiency and optimizing processes. These methods offer instant advantages without the financial and logistical challenges linked to a comprehensive revamp

of the energy supply. One example is the installation of energy-saving devices and regular maintenance on existing equipment, which can help avoid wasting energy [6].

Moreover, implementing lean manufacturing concepts helps optimize operations, minimize inefficiencies, and decrease energy use. In addition, the practice of recycling and reusing materials in the production process can result in significant energy conservation and a decrease in carbon emissions. The integration of recycled materials in automotive manufacturing helps to preserve resources and diminishes the energy needed for extracting and processing materials. Ultimately, although the adoption of green electricity is a commendable move towards sustainability, there are alternative and more readily available methods for vehicle makers in China to conserve energy during production and reduce carbon emissions. By prioritizing energy-efficient manufacturing, optimizing the supply chain, and procuring sustainable materials, the sector may achieve its environmental goals in a cost-effective manner. Car manufacturers have the option to enhance their production processes by implementing rigorous energy management systems, such as the ISO 50001 standard [7]. This standard offers a comprehensive framework for effectively managing energy. This involves doing energy audits, tracking energy consumption, and pinpointing opportunities for energy conservation. The knowledge acquired from these audits can subsequently guide focused investments in energy-efficient technologies. Incorporating renewable energy sources into the current power combination is another feasible approach. While achieving a full shift to green electricity may present difficulties, a step-by-step approach, such as the implementation of solar panels on factory roofs, might progressively diminish reliance on fossil fuels. Although this step is modest in size, it still helps reduce carbon emissions and can be expanded gradually. Providing training and empowering staff to embrace energy-saving methods can have a substantial effect. Providing workers with knowledge about the environmental consequences of their actions increases the likelihood that they will conserve energy and help the company achieve its sustainability objectives. Engagement initiatives and incentives have the potential to cultivate a culture of environmental accountability among employees. Investing in research and development (R&D) of innovative industrial methods that require less energy is essential. Research and development (R&D) efforts have the potential to result in substantial advancements that effectively decrease both the energy consumption and carbon footprint associated with the manufacturing of cars. The government plays a crucial role in offering subsidies and incentives for research and development in this field, which can greatly expedite the implementation of cutting-edge technologies. Through the integration of these methods, Chinese automobile manufacturers have the ability to substantially diminish carbon emissions, showcasing a wide range of solutions that vary in complexity, all of which contribute to the overarching objective of environmental sustainability.

4. Conclusion

This paper examines the difficulties and expenses involved in implementing environmentally friendly power in the production of cars in China. It emphasizes that although this approach has positive environmental effects, there might be alternative methods that are more economically efficient. Conversely, the paper promotes a holistic strategy towards sustainability, emphasizing energy-efficient production methods, optimization of the supply chain, sustainable procurement of materials, and recycling techniques. These solutions have the potential to achieve substantial energy efficiency and carbon emission reductions without being solely dependent on renewable electricity. In light of mounting pressure on the automobile sector to minimize its carbon emissions, it is imperative to adopt a well-rounded and practical strategy that takes into account both environmental objectives and cost-effectiveness in order to ensure long-term viability. This paper examines a limited number of potential strategies for achieving sustainable car production. However, further research and practical implementation of these methods in real-world settings are necessary. This topic requires further

research to identify a cost-effective and manageable approach to implementing green manufacturing in industries, with the ultimate objective of achieving carbon neutrality.

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