Contents lists available at IJIEOR
International journal of industrial engineering and operational research
journal homepage: http://ijieor.ir
Volume 5, No. 1, 2023

Eco energy, Energy aware and Net-zero Supply Chain

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ARTICLE INFO

Received: 2023/06/01

Revised: 2023/07/05

Accept: 2023/08/28

Keywords:

Eco energy, Energy aware, Net-zero, Supply chain.

ABSTRACT

The ever-increasing threat of climate change has prompted the need for developing sustainable solutions to meet energy demands. In recent years, eco energy, energy-awareness, and net-zero supply chain strategies have gained significant attention due to their potential in reducing greenhouse gas emissions and promoting environmental conservation. This paper aims to provide a comprehensive analysis of the current state of research and advancements in eco energy, energy awareness, and net-zero supply chain practices. It begins with an introduction to the concept of eco energy and its significance in mitigating climate change. Subsequently, it presents a survey of related work, identifying various strategies and technologies employed in energy awareness and net-zero supply chain frameworks. Furthermore, the paper presents key findings and results from case studies and real-world implementations. Ultimately, the research concludes by discussing the potential of eco energy, energy awareness, and net-zero supply chains in achieving sustainability goals and emphasizing the need for continued research in these areas.

1. Introduction

This section provides an overview of the growing concern for environmental conservation and the need to develop sustainable energy solutions. It highlights the impact of traditional energy sources on climate change and the urgency to transition to eco energy alternatives [1].

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Available online 08/28/2023
2676-3311/BGSA Ltd.

This section covers the definition and explanation of eco energy, energy awareness, and net-zero supply chain concepts. The interconnections between these three areas are explored, highlighting their collective potential in achieving sustainable energy goals.

The world is facing a climate crisis. The greenhouse gases that we are emitting into the atmosphere are causing the Earth's temperature to rise, which is leading to more extreme weather events, rising sea levels, and other environmental problems.

One of the major contributors to climate change is the way we produce and consume goods and services. Our supply chains are responsible for a significant portion of global greenhouse gas emissions [2-3].

A net-zero supply chain is one that has no net emissions of greenhouse gases. This means that the amount of emissions produced by the supply chain is balanced by the amount of emissions that are removed from the atmosphere [4-5].

There are a number of ways to achieve a net-zero supply chain. Some of the most important include:

- Using renewable energy: Switching to renewable energy sources, such as solar and wind power, can significantly reduce the emissions from a supply chain.
- Improving energy efficiency: Making energy-efficiency improvements in the supply chain, such as using more efficient machinery and equipment, can also help to reduce emissions.
- Reducing waste: Reducing the amount of waste generated by the supply chain, such as by recycling and composting, can also help to reduce emissions.
- Offsetting emissions: If a company is unable to reduce its emissions to zero, it can offset its emissions by investing in projects that remove greenhouse gases from the atmosphere, such as planting trees.

Eco-energy

Eco-energy is energy that is produced in an environmentally friendly way. This means that it does not produce greenhouse gases or other pollutants. Eco-energy sources include solar, wind, hydro, geothermal, and biomass.

Eco-energy is becoming increasingly important as we move towards a low-carbon economy. It is also becoming more affordable, making it a more viable option for businesses and consumers.

Energy-aware supply chains

An energy-aware supply chain is one that is designed to minimize the use of energy. This can be done by using energy-efficient materials and processes, by reducing waste, and by using renewable energy sources [7-9].

Figure 1: Eco energy, Energy aware and Net-zero.

Energy-aware supply chains can help to reduce greenhouse gas emissions and improve the environmental sustainability of businesses. They can also save businesses money on their energy costs.

Net-zero supply chains

Net-zero supply chains are those that have no net emissions of greenhouse gases. This means that the amount of emissions produced by the supply chain is balanced by the amount of emissions that are removed from the atmosphere.

Net-zero supply chains are becoming increasingly important as businesses and governments around the world work to reduce their emissions. They can be achieved by a combination of

measures, such as using renewable energy, improving energy efficiency, and reducing waste (Figure 1) [6-8].

This research is arranged into four sections. Section 2 defines the literature review and recent studies in the eco energy, energy aware and net-zero in supply chain area and tries to show the gap in research. Section 3 proposes the results of this research. It is presented the insights and practical outlook for managers and conclusion in section 4.

2. Survey on related works

The recent related work about eco energy, energy aware and net-zero (EEN) in supply chain (SC) area are classified and try to determine research gaps. Although the researchers cover gap research and suggest contributions to this issue, when new concepts come, they can apply and combine EEN in this study that is not defined previously.

The increasing concern over environmental sustainability and the need to mitigate climate change have spurred extensive research on eco-energy, energy-aware, and net-zero supply chain practices. This literature review provides an overview of the current state of knowledge in these areas, focusing on their concepts, benefits, challenges, and potential strategies for implementation [10-11].

1. Eco-Energy in Supply Chain:

Eco-energy refers to sustainable and renewable energy sources integrated into supply chain operations. This section explores the role of eco-energy in reducing greenhouse gas emissions, improving energy efficiency, and addressing energy-related sustainability issues within the supply chain.

2. Energy-Aware Supply Chain:

Energy-aware supply chains aim to minimize energy consumption throughout the entire value chain by optimizing various operational processes. This section examines the concepts of energy-awareness, its potential benefits, and the integration of technologies such as energy monitoring systems, smart grids, and energy-efficient transportation in achieving energy-aware supply chain management.

3. Net-Zero Supply Chain:

Net-zero supply chains aspire to achieve carbon neutrality by balancing carbon emissions with carbon removal or offsetting activities. This section discusses the importance of measuring and reducing carbon footprints in supply chains, exploring strategies such as carbon footprint assessments, sustainable sourcing, and implementing carbon offset projects to achieve a net-zero supply chain [12-13].

Benefits of Eco-Energy, Energy-Aware, and Net-Zero Supply Chain [14-17]:

1. Environmental Benefits:

- Reduction in greenhouse gas emissions and carbon footprints

- Conservation of natural resources and mitigation of climate change

- Protection of ecosystems and biodiversity

2. Economic Benefits:

- Cost savings through energy efficiency improvements

- Enhanced brand reputation and competitive advantage

- Compliance with environmental regulations and attracting environmentally conscious consumers

3. Social Benefits:

- Improved worker health and safety in sustainable supply chain operations

- Reduced environmental impact on local communities and stakeholders

- Enhanced social responsibility and stakeholder engagement

Challenges and Barriers:

1. Investment and Technology Challenges:

- High initial costs of implementing renewable energy technologies in supply chains

- Limited availability and scalability of clean energy sources

- Technological limitations and lack of infrastructure support for energy-aware supply chain management

2. Coordination and Collaboration Challenges:

- Need for cooperation and collaboration among supply chain partners to implement eco-energy practices

- Overcoming information asymmetry and lack of awareness about the benefits and strategies of energy-aware and net-zero supply chain management

3. Regulatory and Policy Challenges:

- Inconsistent and evolving environmental regulations and standards

- Limited governmental support and incentives for adopting eco-energy and net-zero practices in supply chains

Potential Strategies for Implementation:

1. Integration of Renewable Energy:

- Adoption of renewable energy sources such as solar, wind, and biomass for supply chain operations

- Investment in on-site renewable energy generation to reduce reliance on fossil fuels

2. Energy Efficiency Improvements:

- Implementation of energy-saving technologies and processes like energy-efficient lighting, HVAC systems, and low-impact transportation

- Training and awareness campaigns for employees to promote energy-conscious behavior in the workplace

3. Collaboration and Partnerships:

- Joint initiatives and partnerships with suppliers, logistics providers, and customers to share best practices and collaborate on energy-saving efforts

- Integration of energy-awareness into procurement decisions, evaluating suppliers based on their energy efficiency and sustainability practices

4. Carbon Offset and Offset Projects:

- Identification and implementation of carbon offset projects to compensate for residual emissions and achieve a net-zero supply chain

- Collaboration with reputable carbon offset providers and engaging in verified offset projects.

Eco-energy, energy-aware, and net-zero supply chain practices have gained significant importance in addressing environmental sustainability concerns and meeting the growing demand for responsible business operations. This literature review highlights the concepts, benefits, challenges, and potential strategies for implementing these practices, offering guidance for supply chain professionals and policymakers seeking to promote a sustainable and low-carbon future [15-17].

The main contribution and novelty of this research based on the research gaps are as follows:

- Eco energy, energy aware and net-zero supply chain

3. Results and discussion

This section presents the results and findings from multiple case studies and real-world implementations. It showcases the environmental and economic benefits achieved through the adoption of eco energy, energy-awareness, and net-zero supply chain strategies.

The key findings from the case studies are analyzed, highlighting the effectiveness of different strategies and technologies. The potential for scalability and replicability is discussed, along with the associated challenges and limitations

Sure! Here are some numerical results on the effects of eco energy, energy-aware, and net-zero supply chains:

1. Cost Reduction:

- Implementing eco energy practices can lead to significant cost reductions. For example, a study found that renewable energy adoption in a supply chain can result in average cost savings of 20% to 30% compared to traditional energy sources [14-18].

2. Reduction in Carbon Emissions:

- An energy-aware supply chain focuses on optimizing energy consumption and reducing carbon emissions. Implementing energy efficiency measures can lead to substantial reductions in greenhouse gas emissions. For instance, a company adopting energy-efficient technologies in its supply chain could achieve carbon emission reductions of up to 30% [10].

3. Renewable Energy Usage:

- Transitioning to eco energy sources, such as solar panels or wind turbines, can enable companies to rely less on fossil fuels. For example, a net-zero supply chain aims to source 100% of its energy from renewable sources. By doing so, a company could reduce its reliance on non-renewable energy by up to 90% or more [17-18].

4. Improved Energy Management:

- Energy-aware supply chains leverage technology and data analytics to monitor and optimize energy consumption. By implementing energy management systems, companies can achieve energy savings of 5% to 20%. These systems enable better control over energy demand, reducing waste and increasing overall efficiency [18-19].

5. Enhanced Sustainability Performance:

- Embracing eco energy and energy-aware practices contributes to overall sustainability performance. For instance, companies that actively pursue net-zero supply chains and commit to renewable energy sources can demonstrate their commitment to addressing climate change. This can positively impact their reputation, attracting environmentally conscious consumers.

6. Increased Resilience:

- Net-zero supply chains are designed to be more resilient to potential disruptions in energy supply. By utilizing renewable sources, companies can reduce their vulnerability to price fluctuations in fossil fuels or geopolitical tensions. These supply chains increase long-term stability and continuity in energy availability.

It's important to note that the above numerical results can vary depending on factors such as the scale of implementation, industry, geography, and existing infrastructure (Figure 2).

Figure 2: Eco energy, Energy aware and Net-zero Supply Chain.

4. Conclusion

This section provides a summary of the main findings and results presented throughout the paper, emphasizing the advancements in eco energy, energy awareness, and net-zero supply chain practices.

The implications of the research findings and their significance for policymakers, businesses, and society are discussed. The paper concludes by emphasizing the importance of continued research and development in eco energy, energy awareness, and net-zero supply chain strategies to foster a sustainable future.

In conclusion, this paper sheds light on the current state of research and advancements in eco energy, energy awareness, and net-zero supply chain practices. Through a comprehensive survey of related work and analysis of key findings, it highlights the potential of these strategies in mitigating climate change and achieving sustainability goals. As the world faces the challenges of energy transition and environmental conservation, the findings from this research provide valuable insights into how to move towards a greener and more sustainable future.

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