

PAPER ID: 20260202024

Impact of GST Practices on Sustainable Growth in India's Bioenergy Sector: A Systematic Literature Review

Priti Gupta¹ and Dr. Geeta Rani²

¹Research Scholar, Department of Management and Commerce, Jagannath University, Delhi NCR, Bahadurgarh

²Associate Professor, Department of Management and Commerce, Jagannath University, Delhi NCR, Bahadurgarh

Abstract: This Goods and Services Tax (GST) was inaugurated in 2017 as one of the biggest indirect tax reforms in India to enhance the tax efficiency, to simplify the tax compliance and to create a single national market. India has been making efforts towards sustainable development by promoting the use of renewable energy sources, including the bioenergy sector, which is crucial for energy security, improving rural development, promoting waste utilization and reducing carbon emissions, while simultaneously doing so. Although the implementation of the GST is gaining much attention both in the context of the reform of the tax system and the transition towards sustainable growth, little scholarly work has been dedicated to understanding the connection between GST practices and sustainable growth in the bioenergy sector. This research work is a structured literature review that investigates the potential impact of GST on sustainable development of the Indian Bioenergy industry. The review brings together existing literature on the issue of implementation of GST, tax and economic growth, sustainable development, renewable energy policy and performance of bioenergy sector. The results show that, since implementation of GST, more greater fiscal transparency, better tax compliance systems and higher fiscal capacity have also been observed. Additionally, transparent tax systems, better tax compliance systems and higher fiscal capacity are noted. The result has been increased efficiency, and better market integration, which has created an enabling environment for the development of the sugar industry. Investment and business-friendly environment. At the same time, the literature highlights the fact that the results are presented in terms of policy support, technical innovations, fiscal support, infrastructure, Rural community? and sustainable development of the rural community as factors that influence the sustainable development of the bioenergy sector. However, there are very few empirical studies that set up a clear link between the two. It is concluded that the introduction of GST and sustainable growth is related to each other in the following way: There are several bioenergy sector options to choose from. The review identifies key research gaps such as the importance of the role of the efficiencies of compliance on bioenergy investments, GST rates and input tax credits, productivity, employment creation and environmental performance. A conceptual framework is proposed based on the integration of existing studies to understand how GST may affect sustainable growth in the bioenergy sector of India. For policy makers, researchers, and industry players interested in tax reform for sustainability, the study offers insight on how to pursue sustainable development by reforming taxes.

Keywords: Goods and Services Tax (GST), Sustainable Growth, Bioenergy Sector, Renewable Energy, Sustainable Development, Tax Policy, Biofuels, Fiscal Reform, India, Green Growth.

1.Introduction

As economies work towards economic success, they are also aiming for sustainable growth and ensuring the proper care and protection of the environment and social welfare. The Brundtland Report was the first to define sustainable development as development that satisfies the needs of the present without endangering the ability of future generations to satisfy their needs (World Commission on Environment and Development [WCED], 1987). Fears of climate change, resource depletion, environmental degradation, and energy security have grown considerably over the past few years and consequently, the need for long-term and inclusive economic growth policies has grown. Taxation is one of the more important policy instruments to shape economic activity, efficiency in the use of resources and sustainable development goals (Ekins, 1999).

Goods and Services Tax (GST) was launched in India on 1st July 2017, which was one of the largest tax reforms in the nation's history. GST eliminated the several indirect taxes imposed by

both the Central and State Governments such as excise duty, service tax, value added tax (VAT) and entry tax and provided a uniform taxation system in the country. The main thrust of GST was to make the tax administration easier, cut down on cascading effect, boost compliance and make the domestic market more efficient. Keen and Lockwood (2010) argue that V.A.T. systems, like the GST, help to achieve economic efficiency by reducing tax distortions and enhancing revenue collection processes. The GST was supposed to help in uplifting the ease of doing business and improve the economic growth by creating a common market and by reducing the transaction costs.

Since its introduction, GST has generated much interest from the research and policy communities. Empirical evidence has also shown that GST has resulted in higher levels of tax compliance, transparency, a wider tax base, and improved revenue collection in India (Narwal & Kumar, 2020; Singhal et al., 2022). Further, with the advent of digitization of tax regime in the era of GST, there has been an improvement in the accountability and

reduction in the tax evasion opportunities. Garg et al. (2023) argue that it has successfully gained the efficiency of revenue, which has given governments a greater fiscal capacity to invest more in infrastructure, public services and development programs. These investments are crucial for sustainable growth and, overall, for the development goals.

Except for the fiscal reforms, India has made considerable progress towards the promotion of renewable energy sector. The demand for energy has grown, dependence on foreign fossil sources has also grown and commitments to climate change mitigation have also been taken up, resulting in the uptake of renewables. Bioenergy has become a key part of India's green energy initiative among the renewable energy sources. Bioenergy is energy obtained from agricultural residues, biomass, organic wastes and biofuels. In contrast to conventional fossil fuels, bioenergy is a renewable and environmentally friendly energy source that can help to lower greenhouse gas emissions and improve energy security (Ravindranath et al., 2005).

The importance of bioenergy goes beyond environmental implications. The sector provides employment, provides extra income to farmers, and helps promote the productive use of agricultural waste, all of which are factors that help in rural development. Bioenergy production also promotes the principles of the circular economy by transforming waste materials into valuable energy resources. Balachandra et al. (2010) state that sustainable bioenergy development can be achieved to support economic growth, environmental sustainability and social inclusion at the same time. The Government of India has realized these advantages and launched a number of policy measures such as the National Policy on Biofuels and ethanol blending programs to push the development of the bioenergy industry (Singh et al., 2020).

Although both the taxation policies and the growing significance of both GST and bioenergy development, little research has analysed the links between taxation policy and sustainable growth in the bioenergy sector. Previous research on GST was mostly conducted on the economic performance, tax administration, compliance, and generation of revenue (Narwal & Kumar, 2020; Singhal et al., 2022). Likewise, the study of bioenergy has been mainly focused on technological innovations, energy security, environmental sustainability and policy

d)

interventions (Sreenivas et al., 2021). As a result, there is a lack of a comprehensive understanding of the influence of GST practices on sustainable growth outcomes in bioenergy.

This linkage between GST and sustainable growth particularly is significant because Tax policies can have the potential of influencing investment decisions, production costs and efficiency. The implementation of Input Tax Credits (ITC) under the GST will help reduce the tax cost to businesses and improve their competitiveness and an unambiguous and predictable tax regime may help to encourage long-term investment in the infrastructure of renewable energy and technological innovation. On the other hand, negative tax policies can raise production expenses and reduce the development of industry. Hence, it is important to understand the effect of GST practices on the bioenergy sector so as to formulate policies which would be supportive of economic development and environmental sustainability.

The analysis of the role of GST in promoting sustainable growth in India has policy relevance given that India has pledged to achieve the United Nations Sustainable Development Goals (SDGs) in the areas of "affordable and clean energy", "climate action" and "sustainable industrialization". In this regard, a structured literature review is conducted to explore the current knowledge regarding GST practices, sustainable growth and development of bioenergy in India. The review aims on the one hand to identify the main themes, to make a synthesis of existing results, to highlight research gaps, and on the other hand to provide a conceptual basis for further empirical research in this emerging field.

Objectives

The current study aims to achieve the following objectives:

- To explore the literature on the current situation of GST practices and influence on economically and sustainably grow.
- To examine the effect of GST practices on the efficiency of businesses, and investment and development in the bioenergy sector in India.
- To investigate the possible link between GST practices and sustainability. impact, such as job creation and generation of renewable energy, and environmental performance.

Author(s) & Year	Focus Area	Key Findings / Contribution
Keen & Lockwood (2010)	VAT systems and economic efficiency	VAT-type systems such as GST reduce tax distortions and improve revenue collection mechanisms.
Narwal & Kumar (2020)	GST and macroeconomic stability	GST improved tax compliance, transparency, and macroeconomic stability in India.

Author(s) & Year	Focus Area	Key Findings / Contribution
Singhal et al. (2022)	GST and economic development	Empirical evidence linking GST implementation to broader indicators of economic development.
Garg et al. (2023)	GST and sub-national revenue efficiency	Improvements in revenue efficiency under GST strengthened the fiscal capacity of governments.
Ravindranath et al. (2005)	Sustainable bioenergy potential in India	Bioenergy offers a renewable, environmentally sustainable source of energy with strong emissions-reduction potential.
Balachandra et al. (2010)	Sustainable bioenergy development in India	Bioenergy development can simultaneously advance economic growth, environmental sustainability, and social inclusion.
Singh et al. (2020)	National biofuels policy	Reviews India's National Policy on Biofuels and associated ethanol blending programs.
Sreenivas et al. (2021)	Bioenergy potential, policy and prospects	Synthesizes bioenergy research on technological innovation, energy security, and environmental sustainability.
Johnstone et al. (2010)	Renewable energy policy and innovation	Links renewable energy policy design to technological innovation, measured through patent activity.
Mitchell et al. (2006)	Renewable energy policy effectiveness	Compares the risk-reduction effectiveness of different renewable energy policy instruments.

Table 1. Summary of key studies informing the relationship between GST practices, economic growth, and bioenergy sector development.

2. Theoretical Foundations

The bioenergy sector in India has a strong connection to sustainable growth which needs a multi-disciplinary theoretical framework to understand the linkage between GST practices and the growth of the bioenergy sector in India. Taxation policy affects investment, business efficiency, innovation, and outcome of sustainability. This study is based on Endogenous Growth Theory, Sustainable Development Theory, Institutional Theory and Stakeholder Theory in order to explain these relationships.

2.1 Endogenous Growth Theory

The endogenous Growth Theory of Romer (1986) and Lucas (1988) states that the growth of an economy is determined by endogenous factors like innovation, technological progress, human capital, investment etc. The theory focuses on the role of government policy in increasing productivity and aiding in the process of continued economic growth.

The goal of a simplified and transparent tax system in the context of GST can be to Reduce transaction costs and market distortions to further efficiency in operations of businesses. Adoption of GST in India was an attempt to establish a single national market and more efficient use of resources. In the

bioenergy sector, efficient tax administration and by using input tax credit, you can reduce cost of operations and motivate investments in sustainable. New technologies that enable sustainable growth in energy.

2.2 Sustainable Development Theory

One of the fundamental tenets of Sustainable Development Theory is balancing economic growth and environmental protection and social well being. The Brundtland Commission (1987) describes development as being able to meet the needs of the present whilst not compromising the ability of future generations to meet their own needs. At the expense of the future generations having the same facility.

Bioenergy is connected to sustainable development through the creation of renewable. energy, reducing carbon emissions, improved waste management and rural jobs. It's through this lens that GST should be viewed as more than just a tax; this is a lens in which GST should be viewed as more than a tax; a policy instrument that can enable environment-friendly and socially inclusive economic activities.

2.3 Institutional Theory

The institutional theory helps to understand the reactions of organizations to regulatory structures, frameworks and governance (North, 1990). GST was an important Institutional transformation introducing efficient processes, digital information systems for compliance and transparency.

The governance, compliance and efficiency of good administration of GST can be improved. for bioenergy companies. Also, a consistent and consistent regulatory environment fosters investors' confidence and encourages long-term investment in renewable energy initiatives.

2.4 Stakeholder Theory

Freeman (1984) came up with Stakeholder Theory which states that to develop value for all of their stakeholders, organizations should consider their investors and workers. The customer, government, community and environment.

The bioenergy sector involves several stakeholder groups, all of which are impacted by GST policies. Tax policies have the potential to boost investment, create employment opportunities, and Design and contribute to environmental objectives. Therefore, tax policies should be carefully formulated to: Designed to fulfill fiscal goals taking into account the broader economic and social and environmental interests.

Theory	Key Proponent(s)	Core Premise	Relevance to This Study
Endogenous Growth Theory	Romer (1986); Lucas (1988)	Long-term growth is driven by internal factors such as innovation, technology, human capital, and investment.	Explains how simplified GST administration and ITC mechanisms can lower costs and spur investment in bioenergy technologies.
Sustainable Development Theory	Brundtland Commission (1987)	Development should meet present needs without compromising future generations' ability to meet their own.	Frames GST as a policy tool that can support environmentally sustainable and socially inclusive economic activity.
Institutional Theory	North (1990)	Organizational behavior is shaped by regulatory frameworks and governance structures.	Positions GST as an institutional reform that strengthens governance and compliance among bioenergy firms.
Stakeholder Theory	Freeman (1984)	Organizations should create value for all stakeholders, not only shareholders.	Highlights how GST policies affect investors, employees, farmers, government, and the environment across the bioenergy value chain.



Figure 1. Theoretical foundations linking GST practices to sustainable growth in India's bioenergy sector.

3. GST and Economic growth

One of the most important fiscal reforms in India is the Goods and Services Tax (GST) which came into the country on 1 July 2017. GST was introduced to streamline tax, increase compliance, cut transaction costs and boost the economy. The reform has affected economic growth in terms of better market integration, better collection of revenue, better business competitiveness, better promotion of investments and better economic formalization.

3.1 GST and Market Integration

GST has achieved one of the biggest success stories in the creation of a unified national market. Prior to the implementation, businesses had to deal with varying tax regimes and other regulatory impediments at the state level which caused higher costs of doing business and limited interstate trade.

Introduced GST concept of indirect tax across States for smooth movement of goods/services. This helped to cut down on logistical problems and boost the efficiency of businesses. Better market integration has boosted productivity, improved value chain and overall competitiveness.

3.2 GST and Revenue Efficiency

GST has simplified the tax administration by providing digital tools for tax compliance such as: Real-time transaction monitoring, e-invoicing and online filing of tax returns. These measures have led to more transparency and fewer opportunities of tax evasion.

Research shows that GST has expanded the tax base and has enhanced revenue collection. Raising revenue helps to build the government's fiscal strength and boosts investment in infrastructure, education, health care, and renewable energy. These investments are for the long-term for economic growth and sustainable development.

3.3 GST and Business Competitiveness

Business competitiveness is an important aspect of the economic development. GST has simplified the tax system and

eliminated the effect of multiple tax systems on businesses. One of the important features of this system is the Input Tax Credit (ITC) which reduces the double taxation effect by enabling the companies to avail tax credit for taxes paid on the input being used in the production process.

The ITC mechanism lowers the manufacturing cost, boosts the profitability of operations and enhances efficiency of operations. This, in turn, helps businesses concentrate on innovation, expansion and increasing productivity more effectively. These advantages of transparency and efficiency have helped to make the business world more competitive, despite the problems small and medium-sized enterprises have been facing when it comes to compliance.

3.4 GST and Investment Promotion

It is crucial to have a clear and predictable tax regime to attract investment. GST has made business transaction easy due to its simplification of the tax regime and of the tax regime for businesses.

When investors' confidence is high, there is an increase in industrial growth, Technological advancement, employment generation and domestic and foreign investments. The advantages are especially applicable to emerging sectors, such as renewable energy and in addition to policy support, bioenergy technologies must be backed by substantial investments and span the entire value-chain, long-term.

3.5 GST and Formalization of the Economy

With the introduction of GST, the economy has come into the formal sector because of, businesses are now encouraged to register, keep the necessary records and adhere to digital tax systems.

It also boosts transparency, improves governance and lowers tax evasion. GST helps in creating a more accountable and organized business environment, which further helps in inclusive and sustainable economic growth.



Figure 2. Channels through which GST implementation contributes to inclusive and sustainable economic growth.

4. GST and Sustainable Development

Sustainable development is a concern of the world today, as countries strive to build economic growth and meet social needs and environmental protection. The concept, popularized by the Brundtland Report (WCED, 1987), emphasizes meeting present needs without compromising the ability of future generations to meet theirs. The Goods and Services Tax (GST) has been enacted as a tax reform; however, its impact is far-reaching as it has implications for sustainable development.

4.1 GST and Economic Sustainability

Economic sustainability is the capacity to sustain the economy's growth in the long-term in a sustainable and inclusive manner. GST has played a role towards economic sustainability by establishing a transparent tax regime. Cascading taxes have been eliminated and indirect taxes harmonised at the State level, which has helped to lower transaction costs and enhance business efficiency.

Better tax compliance and improved revenue collection has strengthened the government's fiscal capacity. Increased

revenues allow for increased investment in infrastructure, education, healthcare and technological development, critical components for long-term economic growth. Furthermore, GST provided the impetus for businesses to become formal and enabled accessibility to credit and financial services and access to government services. These advances add to a more robust and sustainable economy.

4.2 GST and Social Sustainability

Social sustainability is focused on improving the quality of life, social inclusion and economic opportunities in an equitable manner. GST helps indirectly in achieving these goals by contributing to economic growth and public finances.

With the increase in government revenue, more money can be directed towards social Welfare, health-care, education and even rural development schemes. Further, the GST has brought a better formalisation of businesses. Promote transparency and working conditions through compliance of labour and regulatory aspects. To ensure the growth of businesses, economic efficiency can be improved, too, generate employment opportunities particularly in new sectors such as renewable energy or bioenergy. But it is necessary to continue to support small and medium sized enterprises for inclusive and balanced development.

4.3 GST and Environmental Sustainability

Environmental sustainability means protecting the environment, decreasing pollution, and mitigating climate change. GST is not an environmental tax; however, it may have an indirect impact on environmental outcomes because of its impact on investment and consumption patterns.

The tax treatment of RE equipment, biofuels and clean technologies has an impact on their costs and competitiveness. Reducing tax liabilities has the potential to incentivize investments in “green” technologies and facilitate the shift towards a more environmentally friendly energy system. Further, the revenue of the government can be used for funding renewable energy projects, waste management schemes and other environmental activities, thanks to the increase of revenues from GST.

4.4 GST and the Sustainable Development Goals (SDGs)

GST is linked to a number of United Nations Sustainable Development Goals (SDGs): affordable and clean energy; decent work and economic growth; industry and innovation; responsible consumption; climate action. GST helps to achieve the sustainable development targets by enhancing economic efficiency, good governance and fiscal resources. But its long-term effects would rely on the effectiveness of translating economic gains into social progress and environmental sustainability.

5. Bioenergy Sector and Sustainable Growth in India

The bioenergy industry is now considered as an important part of India's renewable energy strategy and sustainable development policy. With increasing energy demand, environmental concerns and reliance on fossil fuels, there is a growing need for cleaner and more sustainable energy options. Bioenergy, which comes from the agricultural residues, animal wastes, forestry biomass, and organic wastes, is a viable option for economic, environmental, and social development. This has led to its increasing significance in India's efforts to become more sustainable and low-carbon.

5.1 Evolution of the Bioenergy Sector in India

The bioenergy potential in India is high owing to the size of the agriculture base and biomass resources in the country. The use of agricultural residues like rice straw, wheat straw, and sugarcane bagasse is shown to be a good option to use in energy production. The Government of India has identified these opportunities and is implementing several initiatives to encourage the use of bioenergy.

The significant policy initiatives are: National Policy on Biofuels, Ethanol Blended Petrol (EBP) Programme, Sustainable Alternative Towards Affordable Transportation (SATAT) scheme. These schemes focus on enhancing the biofuel production volumes, on the use of compressed biogas and on decreasing the reliance on imported fossil fuel. The Ministry of New and Renewable Energy (MNRE) has also been pushing the development of biomass power, biogas and waste-to-energy projects with financial assistance and technical support at a faster pace nationwide

Policy / Scheme	Implementing Body	Primary Objective
National Policy on Biofuels	Ministry of Petroleum & Natural Gas	Promote biofuel production and reduce dependence on imported fossil fuels.
Ethanol Blended Petrol (EBP) Programme	Government of India / Oil Marketing Companies	Increase ethanol blending in petrol to reduce crude oil imports and emissions.

Policy / Scheme	Implementing Body	Primary Objective
Sustainable Alternative Towards Affordable Transportation (SATAT)	Ministry of Petroleum & Natural Gas	Promote compressed biogas (CBG) production from waste and biomass sources.
Financial & Technical Support Schemes	Ministry of New and Renewable Energy (MNRE)	Accelerate growth of biomass power, biogas, and waste-to-energy projects.

Table 3. Key government policy initiatives supporting bioenergy development in India.

5.2 Bioenergy and economic sustainability

Bioenergy plays an important role in promoting investment, industrial development and energy security, which leads to economic sustainability. The sector provides jobs in the agriculture, manufacturing, transportation and energy sectors. The investments in biofuel plants and biomass based power supply projects encourage technological innovations and economic activities.

Furthermore, bioenergy helps to lessen dependence on imported fossil fuels, promoting national energy security. The added income opportunities for farmers are also derived from the sale of agricultural residues and biomass feedstocks which help to boost rural livelihoods and inclusive economic growth.

5.3 Bioenergy and Social Sustainability

The bioenergy industry is a key contributor to rural development and job creation. Direct and indirect jobs are created through activities like biomass collection, transport, processing and plant management. Most of the bioenergy projects are installed in the rural regions, which helps in the economic development and infrastructure improvement of the region.

Additionally, decentralized bioenergy systems, especially biogas plants, can ensure access to decent energy for remote rural communities. Access to energy is linked to education, healthcare, communication and small enterprises, therefore, it has an impact on the overall quality of life and social inclusion.

5.4 Bioenergy and Environmental Sustainability

The sustainability of the environment is among the best of the bioenergy. Bioenergy has lower GHG emissions than the traditional fossil fuels and can help mitigate against climate change. It is also an effective way of handling organic and agricultural waste products.

Utilization of crops residues and wastes as energy helps to minimize open field burning, landfills and pollution. Besides, waste-to-energy technologies are conducive to the concept of circular economy, which encourages resource recovery and optimizes waste utilization. These contributions will assist India in achieving its climate targets and lead to a cleaner and greener energy future.

6. GST and the Bioenergy Sector

Goods and Service Tax (GST) is a really huge step in the indirect tax regime. The Indian context, in general, and its nature of revenue and tax, in particular, have far reaching implications. administration. There are number of impacts on

Production cost, Investment as a result of the GST. decision, operation efficiency and competitiveness of Bioenergy. Bioenergy is a It is an important part of India's journey towards sustainable development and plays an essential role. understand how the GST can play a role in development of a sector.

An efficient tax system can provide investment, innovation and business expansion. The sustainable economic, social and environmental opportunities are beneficial and can be achieved through this. development.

6.1 GST Structure and the Bioenergy Sector

Bioenergy production encompasses a variety of goods and services such as energy production. Machinery, transportation services, processing equipment and biomass feedstocks. The Input Tax Credit (ITC) is the most important feature of GST which allows. The tax credit would be available to businesses to claim the taxes they already paid on the production inputs. This minimizes the "cascade effect" of taxing and it helps spending to be kept at a minimum through the minimum taxing. the system.

The ITC mechanism can be advantageous for bioenergy business, in which the supply chain long ranging from collection of the feedstock, transportation, processing, etc. resulting in More cost effectiveness and profitability. But the effectiveness of GST will rely on the rate of Taxation of bioenergy products and equipment. Low rates will encourage investment, High rates will increase the cost and decrease the competitiveness of sectors, which will affect their development.

6.2 GST, Investment, and Operational Efficiency

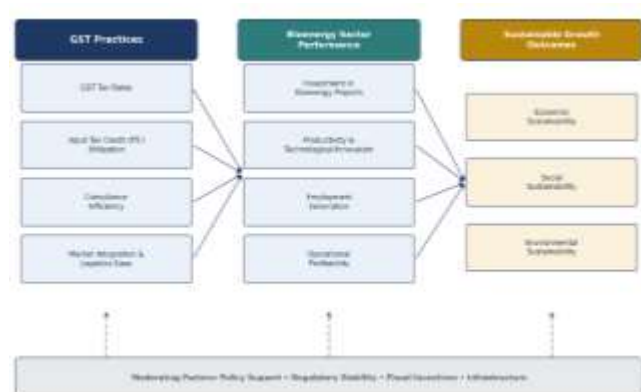
One of the key factors that have been instrumental in the growth of the bioenergy sector is investment. A significant investment in infrastructure, technology and production facilities is needed for bioenergy projects. GST provides a level playing field and clarity for taxation, boosting investor confidence and facilitating business.

GST has also made things easier for compliance and lesser the administration complexities. Dismantling of interstate tax barriers has led to a greater efficiency in logistics and supply-chain operations and eased the flow of biomass resources between regions. The improvements lower the operating costs, increase productivity, and help to build the sustainability of bioenergy businesses. This letter calls on the government of Bangladesh to adopt.

6.3 GST and Sustainable Growth Outcomes.

GST has several modes of contribution to sustainable growth. It helps to eliminate tax-related inefficiencies, which helps to create jobs and encourage business growth and investment. Socially, bioenergy development opens up opportunities for farmers and rural communities in biomass supply chains as a way of generating income. A higher tax revenue can also provide funding for public capital expenditures on education, health care, and rural infrastructure.

GST can indirectly support the uptake of renewable energy through its ability to make bioenergy products more competitive. Increased investments in bioenergy promote waste utilization, fossil fuel reduction and promote GHG emission reduction. Such benefits are in line with the sustainability and climate agenda of India.



7. Conclusion

The Goods and Services Tax (GST) is one of the most important fiscal changes to be implemented in India, with the goal of increasing tax efficiency, transparency, compliance and market integration. The bioenergy industry, meanwhile, has become an important player in sustainable development, providing renewable energy production, rural development, job creation and environmental sustainability.

This literature review explored the possible correlation between GST practices and sustainable development in the bioenergy sector in India. The result is satisfactory: the transparency of taxes, efficiency in tax compliance, revenue generation and businesses competitiveness and hence conducive investment and industry conditions. growth environment. The review also highlights the important role of bioenergy in promoting energy security, waste management, providing rural livelihood and minimizing waste. Green House Gases emission. Studies focusing on GST, however, have been done mostly focused on that. and bioenergy alone and only a limited number of studies have been conducted on the interplay between both. between these two. The review suggests that indirect impacts of GST towards Impacts on investment, productivity, innovation may be related to sustainable growth. The adoption of such conditions as tax rates and ITC use at different stages will affect the profit potential and viability of the bioenergy business. rate, efficiency of GST compliance. If the policy is well designed and it is well implemented the implementation of GST can help in achieving the agenda of sustainable development.

Research Gap	Suggested Future Research Direction
Limited empirical evidence directly linking GST to bioenergy sector outcomes.	Conduct empirical and quantitative studies measuring GST's direct effect on bioenergy investment and output.
Insufficient understanding of how GST rates affect bioenergy equipment affordability.	Examine the impact of specific GST rate slabs on bioenergy technology adoption and pricing.
Unclear role of Input Tax Credit (ITC) efficiency on bioenergy firm profitability.	Analyze how ITC processing delays or efficiency affect bioenergy enterprise cash flow and investment decisions.
Lack of sector-specific compliance cost studies.	Assess compliance costs for bioenergy firms under GST relative to other renewable energy sectors.
Limited analysis of GST's environmental performance linkages.	Develop indicators linking GST-driven cost changes to emissions reduction and waste utilization outcomes.

Table 4. Key research gaps identified by the review and corresponding directions for future research.

The findings have some implications for the policy-makers and renewable energy and they must de-risk bioenergy equipment industry. GST policies need to be relevant to the objectives of and inputs. Timely processing of the ITC and making the process

easy can enhance business efficiency and investment. The sector can be stimulated to grow and innovate through financial and technological support and stable tax policies. Furthermore, the use of biomass can also bring in money for farmers, and help develop the rural areas. There is a need for better coordination among tax, energy and environmental policies to ensure that tax policy changes are effective in achieving sustainable development goals.

References

- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.
- Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002–1037. <https://doi.org/10.1086/261420>
- World Commission on Environment and Development. (1987). *Our common future*. Oxford University Press.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.
- Ekins, P. (1999). European environmental taxes and charges: Recent experience, issues and trends. *Ecological Economics*, 31(1), 39–62. [https://doi.org/10.1016/S0921-8009\(99\)00051-8](https://doi.org/10.1016/S0921-8009(99)00051-8)
- Ravindranath, N. H., Somashekhar, B. S., Nagaraja, M. S., Sudha, P., Sangeetha, G., Bhattacharya, S. C., & Abdul Salam, P. (2005). Assessment of sustainable bioenergy potential in India. *Biomass and Bioenergy*, 29(3), 178–190. <https://doi.org/10.1016/j.biombioe.2005.03.005>
- Mitchell, C., Bauknecht, D., & Connor, P. M. (2006). Effectiveness through risk reduction: A comparison of renewable energy policies. *Energy Policy*, 34(3), 297–305. <https://doi.org/10.1016/j.enpol.2004.08.046>
- Balachandra, P., Ravindranath, D., Joshi, N. V., & Ravindranath, N. H. (2010). Sustainable bioenergy development in India. *Energy Policy*, 38(5), 2564–2574. <https://doi.org/10.1016/j.enpol.2010.01.020>
- Johnstone, N., Haščič, I., & Popp, D. (2010). Renewable energy policies and technological innovation: Evidence based on patent counts. *Environmental and Resource Economics*, 45(1), 133–155. <https://doi.org/10.1007/s10640-009-9309-1>
- Keen, M., & Lockwood, B. (2010). The value added tax: Its causes and consequences. *Journal of Development Economics*, 92(2), 138–151. <https://doi.org/10.1016/j.jdevco.2009.01.012>
- Narwal, K. P., & Kumar, P. (2020). GST and macroeconomic stability in India. *Journal of Asian Finance, Economics and Business*, 7(8), 569–577. <https://doi.org/10.13106/JAFEB.2020.VOL7.NO8.569>
- Singh, D., Sharma, D., Soni, S. L., Sharma, S., Sharma, P. K., & Jhalani, A. (2020). The national policy of biofuels of India: A perspective. *Energy Policy*, 143, Article 111595. <https://doi.org/10.1016/j.enpol.2020.111595>
- Sreenivas, A., Khan, A. A., & Shukla, P. R. (2021). Bioenergy for sustainable development in India: Potential, policy and prospects. *Renewable and Sustainable Energy Reviews*, 148, Article 111279. <https://doi.org/10.1016/j.rser.2021.111279>
- Singhal, N., Sharma, R., & Gupta, S. (2022). Do goods and services tax influence economic development? An empirical analysis for India. *Vision: The Journal of Business Perspective*, 26(4), 456–470.
- Garg, S., Narwal, K. P., & Kumar, P. (2023). Goods and service tax and its implications on revenue efficiency of sub-national governments in India: An empirical analysis. *Asian Journal of Business and Accounting*, 16(2), 1–29.