BIOENERGY GOVERNANCE IN INDIA: AN ANALYSIS OF POLICIES, LAWS, JUDICIAL DEVELOPMENTS AND GLOBAL COMPARATIVE APPROACHES

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ABSTRACT

The escalating effects of climate change, energy security concerns, and dwindling fossil fuel reserves are driving the global shift to renewable energy, particularly bioenergy, which converts biomass into electricity, heat, and fuels. For India, a rapidly growing economy, bioenergy is crucial for sustainable development and energy security, as well as for achieving net-zero carbon emissions by 2070. To promote bioenergy, the Indian government has launched several initiatives, including the National Policy on Biofuels and the SATAT Scheme. However, the lack of a unified legal framework hampers effective development in this sector. This article analyzes India's bioenergy governance, assessing the effectiveness of the current legal framework in addressing challenges like environmental protection and food security, while identifying issues like fragmented governance and inconsistent policy enforcement. The study compares India's approach to bioenergy governance with that of the European Union, the United States, Brazil, Germany, China, and other regions, noting their successful integration of sustainability standards and regulatory oversight. Despite existing laws like the Electricity Act, 2003, the Energy Conservation Act, 2001, and renewable energy policies, India's regulatory environment remains insufficient to meet emerging challenges. The article advocates for the creation of a dedicated Bioenergy Act to provide legal certainty, promote sustainable practices, and foster innovation. This act should encompass climate goals, rural priorities, and established sustainability standards while ensuring strong monitoring and enforcement.

Ultimately, the article argues for an integrated legal framework, backed by coherent policies and effective institutional coordination, to tap into India's bioenergy potential, contribute to renewable energy goals, enhance energy security, create employment, and promote sustainable economic growth, thereby facilitating a transition to a low-carbon economy.

Keywords: Bioenergy; Renewable Energy; Biofuel Policy; Bioenergy Governance; Legal Framework; Energy Law; Climate Change; Sustainability; Biomass; Comparative Analysis; India; Energy Security.

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1. Introduction

There is a notable global policy and legislative movement that advocates for a transition from fossil fuel-dependent economies to ones that rely on renewable energy information, particularly bioenergy.[2] There are several elements that contribute to the heightened emphasis on bioenergy policy and legislation. The things listed above include the political importance of the long-term effects of climate change right now, as well as how they affect energy use and the economy around the world.[3] Furthermore, the escalating costs of oil and gas, along with the authority ensuring energy sovereignty, have prompted nations to actively explore other sources of energy in lieu of fossil fuels.[4]

One other element that has contributed to the current situation is the crisis in the farm sector, particularly in industrialised nations. This crisis is marked by significant surplus of agricultural products and a decrease in global market prospects. Hence, it is unsurprising that biofuels have been suggested as a potential solution to revive the unsuccessful Doha Round of agricultural trade talks at the World Trade Organisation.[5] Against the backdrop of significant political, economic, and environmental concerns, numerous nations are actively seeking novel mechanisms to regulate and foster the bioenergy industry.

Bioenergy generation is gaining popularity in developing countries due to its potential benefits like increased employment and lower energy costs. However, it also faces environmental and socio-economic consequences like competition with food production, deforestation, and biodiversity depletion. Clear bioenergy regulation is needed for sustainable development.

1.1 Bioenergy definition and its usage as source of Energy

Bioenergy, primarily derived from biomass, is a crucial and widely used source of energy in developing nations. It is a renewable energy resource that can be easily transformed into heat generation, power production, and transportation fuels. Biomass production is an

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[2] Food and Agriculture Organization of the United Nations (FAO), The Energy and Agriculture Nexus (Environment and Natural Resources Working Paper No 4, FAO 2000) vi.

[3] Nicholas Stern, The Economics of Climate Change: The Stern Review (Cambridge University Press 2007).

[4] George W Bush, 'State of the Union Address' (31 January 2006), The White House

[5] T, Biofuels, Agriculture and the Developing World (International Centre for Trade and Sustainable Development (ICTSD), Geneva 2006).See also J Caldwell, Fuelling a New Farm Economy: Creating Incentives for Biofuels in Agriculture and Trade Policy (Center for American Progress 2007).

integral part of the natural ecological cycle, and there is extensive global experience in large-scale biomass production and its use for energy generation.[6]

i. **Agricultural and Silvicultural Law:** Overlapping with food, fodder, and fiber production.

ii. **Environmental and Municipal Law**: Serving as a mechanism for waste mitigation and residue management.

iii. **Development and Equity Law**: Acting as a critical subsistence resource for impoverished populations within developing jurisdictions.

Bioenergy comes from wood energy and agro-energy, which are sources of energy from trees, plant species, and agricultural and animal by-products. Wood energy resources include fuelwood, charcoal, and forestry leftovers, while agro-energy resources include sugar cane, sugar beetroot, maize, palm oil, seed rape, and oilseeds. These resources are commonly known as feedstock and are used in the production of bioenergy[7]. Biofuels, particularly biodiesel and bioethanol have potential as fuel oxygenates in commercial production, but a comprehensive regulatory framework is needed to ensure their safety and sustainability.

As an outcome of society's socioeconomic edifice undergoing swift change, energy demands have increased substantially, and the supply side is experiencing strain. As a result, there is a growing concern regarding the need to optimise the efficiency of the energy sector value chain in order to satisfy the escalating demand. Actual policy-level initiatives and application policies must be formulated and planned in order to address this concern. It is necessary to identify and rectify gaps at the planning level using well-considered execution apparatuses. Given its current development rates, India is projected to rank among the top three global economies, alongside the United States and China, by 2030. And India’s financial liberalisation has made it to grow into a financial powerhouse that is expected to grow by roughly 8% a year over the next ten years.[8]

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[6] L Fagernäs, M Johansson and others, Bioenergy in Europe: Opportunities and Barriers (VTT Research Notes No 2352, VTT Technical Research Centre of Finland 2006) 13.

[7] Food and Agriculture Organization of the United Nations (FAO), The Energy and Agriculture Nexus (Environment and Natural Resources Working Paper No 4, FAO 2000) vi.

[8] IOSR Journal of Business and Management, vol 9, issue 5 (March–April 2013) 11–17 https://www.iosrjournals.org.

India has taken an important step towards achieving net-zero emissions by 2070 and obtaining fifty percent of its electricity requirements from renewable sources by 2030 with its transition to renewable energy.[9] Due to accelerated fossil fuel consumption, the country's rapid economic development, which has included the implementation of 50 million additional electricity connections, has caused a significant increase in CO_2 emissions. Prime Minister Narendra Modi has announced ambitious targets for 2030, including the establishment of 500 gigawatts[10] of renewable energy capacity, the reduction of one billion metric tonnes of CO_2 emissions, and a 45% decrease in the nation's emissions intensity. India has achieved 40% of its electricity capacity from non-fossil fuels nearly nine years earlier than the COP 21 Paris Summit's 40% objective. The integration of solar and wind energy sources into India's energy portfolio has witnessed remarkable expansion, with the addition of two times as much capacity by 2026. India, which has ambitious intentions to integrate modern bioenergy into its entire economy, is also one of the largest producers of this technology.

India, a developing nation with a population exceeding 1.3 billion, possesses ambitions regarding climate adaptation and mitigation that possess worldwide ramifications. Without relying on carbonisation, IEA[11] and NITI Aayog[12] are committed to collaborating to promote India's industrialization, growth, and enhancement of citizen quality of life.[13]

Infrastructure expansion, particularly in the electricity sector, is critical to sustaining India's energy sector is crucial for economic growth and is essential for the country's aspiration of becoming an economic superpower and provide "Electricity for all."[14] The implementation of the Electricity Act of 2003[15] has marked a significant step towards a competitive and streamlined electricity market. The Government of India (GOI) has been implementing innovative measures to foster private sector involvement, resulting in heightened competition and the emergence of authentic market dynamics. Moving towards autonomous market mechanisms is a big part of the ongoing structural reform process. This will lead to better

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9 Press Information Bureau, Government of India, 'India's Panchamrit Action Plan' https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1961797 accessed 18 February 2026.

10 Press Information Bureau, Government of India, 'India's Panchamrit Action Plan' https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1961797 accessed 18 February 2026.

11 https://www.iea.org/search?q=World%20Energy%20Outlook accessed 15April 2026

12 https://www.niti.gov.in/ accessed 15April 2026

13 Birol, F., & Kant, A. (2022, January 10). India's clean energy transition is rapidly underway, benefiting the entire world, International Energy Agency. Retrieved from https://www.iea.org/commentaries/india-s-clean-/energy-transition-is-rapidly-underway-benefiting-the-entire-world. accessed 17/4/2026.

14 SAUBHAGYA- Pradhan Mantri Sahaj Bijli Har Ghar Yojana https://recindia.nic.in/saubhagya. accessed 17April 2026

15 https://powermin.gov.in/en/content/electricity-act-2003 accessed 14April 2026

economic efficiency, level playing fields for everyone, and competition in every part of the industry. Consumers at every stage of the value chain are expected to derive advantages from the implementation of competition and the allocation of options.

To effectively develop India's energy sector, a methodical legislative and institutional approach is required. The energy sector has experienced significant expansion since gaining independence, contributing to the national economy, social welfare, and fundamental energy requirements. The GOI issued its integrated energy policy in 2006[16], addressing conservation, domestic resource reliance, promotion of diverse development patterns, scientific and technological advancements, environmental protection, and enhanced international cooperation for mutual advantage.

1.2 India's Bioenergy Transition: Technological Advancements, Policy Evolution and Institutional Development

In retort to the 1970s oil crisis, India increased its promotion of renewable energy, including bioenergy. In response to this focus, the Fuel Policy Committee[17] and the Working Group on Energy Policy 1979[18] were formed to better understand the energy situation in light of national and international developments. For the next five to fifteen years, the two committees were tasked with developing a solid plan and recommendations for appropriate policy measures for available energy resources and nonconventional energy resources. Despite the two committees' emphasis on the need for a new energy plan, no formal institutional mechanism was established right away. Institutional mechanisms were established for the first time in the early 1980s. In 1981, the Department of Science and Technology established the Commission for Additional Sources of Energy (CASE). [19]

The aforementioned function was formally designated as the Department of Non-conventional Energy Sources (DNES) in 1982.[20] In 1983, the Advisory Board on Energy

[16] https://www.iea.org/policies/1590-integrated-energy-policy accessed 15April 2026
[17] Paritosh Nandi and Sujay Basu, 'A Review of Energy Conservation Initiatives by the Government of India' (2008) 12 *Renewable and Sustainable Energy Reviews* 518.
https://www.sciencedirect.com/science/article/abs/pii/S1364032106001213?via%3Dihub accessed 14 August 2026
[18] Shishir K Mukherjee, 'Energy Policy and Planning in India' (1981) 6 *Energy* 823.
https://www.sciencedirect.com/science/article/abs/pii/0360544281901262 14 August 2026
[19] Ministry of New and Renewable Energy (MNRE), 'What Does the Ministry Do?' (Government of India) https://mnre.gov.in/the-ministry/what-does-the-ministry-do accessed 10 August 2026.
[20] India Science and Technology, 'Ministry of New and Renewable Energy (MNRE) https://www.indiascienceandtechnology.gov.in/organisations/ministry-and-departments/ministry-new-and-

(ABE) was formed. The Nodal Energy Conservation Organisation (NECO), whose findings and recommendations were binding on all Central and State government agencies and the prescribed authorities, was proposed and established by ABE.[21]

In 1989, NECO was quickly replaced by the Energy Management Centre (EMC).[22] Traditional Biomass efficiency enhancement and utilisation (e.g., improved cooking stove programmes) with increased biomass supply (e.g., social forestry, waste land development) and the Improving biomass quality through technological advancements (e.g., biogas, improved cooking stoves). Using biomass-based technology to supply services previously provided by traditional energy sources (for example, wood gasifiers for irrigation and biomass electricity generation).

1.3 Developing institutional support for programme creation and execution of BET's

Insufficient institutional frameworks were present on the installed Bioenergy Technologies (BETs) to facilitate ongoing operation and maintenance, as well as to accelerate replications.[23] The overwhelming majority of financial and economic assistance was supplied in the form of capital subsidies. A considerable proportion of implanted devices did not perform effectively for a variety of reasons, according to several evaluations. Strategies for promoting devices lacked a market-based perspective and were centred around setting targets to state government bodies for programme implementation.

In September 2001, the Indian Parliament passed the Energy Conservation Bill.[24] To enhance the country's energy efficiency push, the Act sets a legal framework, institutional arrangements, and a regulatory mechanism at the federal and state levels. The Bureau of Energy Efficiency (BEE)[25] was formed to carry out the provisions of the Act, which were crucial in laying the framework for future energy policy formulation. The eleventh five-year plan (2007-

renewable-energy-mnre accessed 10 August 2026.

[21]Ministry of New and Renewable Energy, *Bioenergy in India* http://www.indiaenvironmentportal.org.in/files/BioenergyIndia.pdf accessed 10 August 2026.

[22] Energy Conservation Act 2001, s 1(3).

[23] Energy Conservation Act 2001, s 2(l).

[24]Energy Conservation Act 2001 (Act 52 of 2001) https://merc.gov.in/wp-content/uploads/2022/07/Energy-Conservation-Act-2001.pdf.

[25]PlanningCommission2006).page355.https://www.researchgate.net/publication/309172973_Chapter_14_Policy_Reforms_in_Indian_Energy_Sector_to_Achieve_Energy_Security_and_Sustainability. accessed 14 August 2026

2012) highlighted acute energy shortages, coal dominance, and the need to grow resources through exploration, energy efficiency, renewables, and research and development.[26]

Following liberalisation in 1992, certain improvements to bioenergy acceleration tactics were developed in attempt to overcome some of the gaps noted above. To widen the scope of actions to encourage renewable energies in India, the government upgraded Department of Non-Conventional Energy Sources (DNES) 1982 to a full-fledged ministry, namely the Ministry of Non-Conventional Energy Sources (MNES). MNES was renamed the Ministry of New and Renewable Energy in 2006.[27] MNES was thus founded with the mission of promoting and coordinating renewable energy sources, including bioenergy, as well as supporting research and development in 2010.[28] The ministry includes regional offices, three specialised research institutions, and a non-banking financial business, the Indian Renewable Energy Development Agency (IREDA).[29]

1.3 International Targets: The Net-Zero Transition and Sustainable Deployment

On a macroeconomic scale, bioenergy represents approximately 14% of global final energy consumption. This constitutes 6% of the aggregate global energy supply and a commanding 55% share of the renewable energy sector, establishing it as the world's primary renewable energy source.[30] To achieve compliance with international climate accords, specifically the Net Zero Emissions by 2050 Scenario, the substitution of fossil fuels with bioenergy must scale exponentially. While modern bioenergy consumption expanded at an average annual rate of 7% between 2010 and 2021, current treaty benchmarks mandate an acceleration to a 10% annual deployment rate through 2030.[31] Legal and regulatory mechanisms must therefore adapt to fast-track these deployment timelines while simultaneously instituting strict environmental and social safeguards to prevent collateral ecological degradation or human rights impacts during resource extraction.

[26] Planning Commission. 2007. Eleventh Five-Year Plan, 2007-2012. Government of India, New Delhi, https://policy.asiapacificenergy.org/node/2510. accessed 14 August 2026
[27] https://mnre.gov.in/the-ministry/what-does-the-ministry-do. accessed 14 August 2026
[28]https://mnre.gov.in/img/documents/uploads/fafb7d5750d641228c13987ae62d8f3b.pdf.(MNRE2010). accessed 14 August 2026
[29] https://www.ireda.in/home. accessed 14 August 2026
[30] https://www.iea.org/energy-system/renewables/bioenergy accessed 14 August 2026.
[31] International Energy Agency, Net Zero by 2050: A Roadmap for the Global Energy Sector (IEA Report, 2021) https://www.iea.org/reports/net-zero-by-2050 accessed 14 August 2026.

1.4 India's Bioenergy Technologies Policies and Institutional Evolutions

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[33]Shishir K Mukherjee, 'Energy Policy and Planning in India' (1981) 6 *Energy* 823. https://www.sciencedirect.com/science/article/abs/pii/0360544281901262 14 August 2026

[34]Ministry of New and Renewable Energy (MNRE), 'What Does the Ministry Do?' (Government of India) https://mnre.gov.in/the-ministry/what-does-the-ministry-do accessed 10 August 2026.

[35]India Science and Technology, 'Ministry of New and Renewable Energy (MNRE) https://www.indiascienceandtechnology.gov.in/organisations/ministry-and-departments/ministry-new-and-renewable-energy-mnre accessed 10 August 2026.

[36]Ministry of New and Renewable Energy, *Bioenergy in India* http://www.indiaenvironmentportal.org.in/files/BioenergyIndia.pdf accessed 10 August 2026.

[37] Energy Conservation Act 2001, s 1(3).

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1.5 Strengthening Institutional Support for the Development and Implementation of BET Programmes

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[38] Energy Conservation Act 2001, s 2(l).
[39]Energy Conservation Act 2001 (Act 52 of 2001) https://merc.gov.in/wp-content/uploads/2022/07/Energy-Conservation-Act-2001.pdf.
[40](After the Energy Conservation Bill of 2001 was signed into law, the Bureau of Energy Efficiency (BEE) was established. The BEE was created to carry out the Energy Conservation Bill's rules. As a result, it has created the first energy conservation plan for putting energy efficiency standards into action. Planning Commission2006).page355.https://www.researchgate.net/publication/309172973_Chapter_14_Policy_Reforms_in_Indian_Energy_Sector_to_Achieve_Energy_Security_and_Sustainability. Accessed on 10/3/2026
[41] Planning Commission. 2007. Eleventh Five-Year Plan, 2007-2012. Government of India, New Delhi, https://policy.asiapacificenergy.org/node/2510. accessed on 20/3/2026
[42] https://mnre.gov.in/the-ministry/what-does-the-ministry-do. Accessed on 21/3/2023

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1.6 Benefits, Challenges and Emerging Issues under the Energy Conservation (Amendment) Bill, 2022

The Ministry creates its policy and implements programme goals. But after the passing of The Energy Conservation (Amendment) Bill, 2022.[45] There is no consensus on who will oversee the carbon credit market. Trading platforms are typically controlled by sectoral authorities. The Securities and Exchange Board of India (SEBI), for example, regulates share and commodity transactions.[46]

The Central Electricity Regulatory Commission (CERC) governs the electricity trade.[47] The governing entities for trade are mentioned in the relevant Acts. The bill does not specify how or who will control the trading of carbon credit certificates. The argument is whether a regulator should be designated in the Act itself. It is worth noting that the Energy Conservation Act includes provisions for energy savings certificates.[48]The Act makes no mention of who will oversee the trading of these certificates. These certificates are traded on power markets that are governed by CERC.[49]

Key issues and analysation of Energy Conservation Bill 2022 and its Amendment.[50]

i. The goal of Carbon Credit trading (CCT) is to minimise carbon emissions and so address climate change. The concern is whether the Ministry of Power is the proper ministry to oversee this scheme. Another debate is whether the Act should specify the

[43]https://mnre.gov.in/img/documents/uploads/fafb7d5750d641228c13987ae62d8f3b.pdf.(MNRE2010). Accessed on 21/3/2023
[44] https://www.ireda.in/home. Accessed on 20/3/2023
[45] PRS Legislative Research, 'The Energy Conservation Amendment Bill, 2022' https://prsindia.org/billtrack/the-energy-conservation-amendment-bill-2022 accessed 17 March 2026.
[46] Securities and Exchange Board of India Act 1992 https://www.sebi.gov.in/legal/acts/jan-1992/securities-and exchange-board-of-india-act-1992-as-amended-by-the-finance-act-2021-13-of-2021-w-e-f-april-1-2021-_3.html accessed 18 March 2026.
[47] *Electricity Act 2003* s 66 https://www.indiacode.nic.in/bitstream/123456789/2058/1/a2003-36.pdf accessed 14 August 2026.
[48] Energy Conservation Act 2001 s 14A https://www.indiacode.nic.in/bitstream/123456789/2003/1/a2001-52.pdf accessed 14 August 2026.
[49] The CERC (Terms & Conditions for Dealing in Energy Savings Certificates) Regulations, 2016.
[50] https://prsindia.org/billtrack/the-energy-conservation-amendment-bill-2022. accessed 14 May 2026

market regulator for Carbon Credit trading.

ii. The same activity may be qualified for renewable energy certificates, energy savings certificates, and carbon credit certificates. The legislation makes no mention of whether these certifications will be interchangeable.

iii. Certain non-fossil energy use obligations must be met by designated users. Consumers may not have a choice in the energy mix due to the limited competition among discoms in any area.

1.7 Need of the Present Study

India is committed to transitioning towards a sustainable and low-carbon energy system by promoting renewable energy through initiatives such as the Green Energy Open Access framework and the Renewable Energy Certificate mechanism. In this context, bioenergy assumes particular significance because of its potential to reduce dependence on fossil fuels, utilize agricultural and organic waste, generate renewable energy, support rural livelihoods, and contribute to greenhouse-gas emission reduction. The National Policy on Biofuels, 2018, as amended on 15 June 2022, seeks to enhance the availability and utilization of biofuels by increasing blending targets and encouraging the development of advanced biofuel technologies. These policy initiatives are closely connected with India's long-term climate commitments, including its objective of achieving net-zero carbon emissions by 2070 under the country's international climate commitments. Despite the growing recognition of bioenergy as an important component of India's energy transition, its development continues to face technological, institutional, regulatory, and legal challenges. Existing studies, including *Biomass as Renewable Energy: Worldwide Research Trends* and *Scientometric Review: Biomass Gasification Study from 2006 to 2020*, demonstrate a substantial increase in scientific research relating to biomass, renewable energy, and biomass gasification. The latter study particularly indicates significant international research collaboration, including cooperation between China and the United States. However, these studies predominantly examine technological, scientific, and bibliometric dimensions and provide comparatively limited attention to the legal and regulatory framework governing bioenergy.

The present study is therefore necessary to examine the extent to which the existing legal and policy framework in India is capable of facilitating the sustainable development and effective

utilization of bioenergy. A comprehensive **Scientific Legal Research** approach is required to bridge the gap between scientific and technological advancement in bioenergy and the legal mechanisms necessary for its regulation, promotion, monitoring, and sustainable utilization. Such research can contribute to the formulation of coherent policies, regulatory standards, institutional mechanisms, incentives, and compliance mechanisms for strengthening India's bioenergy sector.

Further, there is a significant need to examine **judicial precedents relating to renewable energy, environmental protection, sustainable development, pollution control, waste management, energy security, and the constitutional right to a clean and healthy environment**. Judicial decisions in these areas can provide important principles for interpreting existing legislation and developing a stronger jurisprudential foundation for bioenergy regulation. The role of the judiciary is particularly relevant where legislative provisions are inadequate, overlapping, or unable to address emerging technological and environmental challenges. Another important need emerging from the present study is the consideration of a **comprehensive Bioenergy Act in India** after amendment of the Energy Conservation Bill 2022. At present, bioenergy-related activities are governed through a combination of energy laws, environmental legislation, waste-management rules, biofuel policies, electricity regulations, and executive schemes. A dedicated Bioenergy Act could provide an integrated statutory framework covering the production, conversion, distribution, transportation, utilization, environmental safeguards, sustainability standards, waste-to-energy systems, biogas, biomethane, biofuels, biomass power, and advanced bioenergy technologies. It could also establish clear institutional responsibilities, financial incentives, sustainability criteria, monitoring mechanisms, research and development support, and enforcement provisions.

Such a legislative framework would help avoid regulatory fragmentation and provide greater certainty to producers, investors, farmers, industries, local authorities, and consumers. It could also ensure that the environmental and social benefits of bioenergy are maximized while preventing adverse consequences such as unsustainable biomass extraction, land-use conflicts, air pollution, inefficient waste utilization, and ecological degradation.

1.8 UNFCCC, COPs and the National Action Plan on Climate Change: Global and Indian Perspectives on Energy Requirements

Climate change is one of the major components of the broader problem of environmental

degradation. International efforts to address climate change developed gradually through conventions, protocols, conferences and national policies. Environmental protection received international recognition with the United Nations Conference on the Human Environment held at Stockholm in June 1972, following which the United Nations Environment Programme (UNEP) was established. The World Commission on Environment and Development, established in 1983, introduced the concept of sustainable development through its 1987 report *Our Common Future*. [51] In 1992, the United Nations Conference on Environment and Development (Earth Summit) was held at Rio de Janeiro, giving further importance to the relationship between environmental protection and development.

International concern specifically relating to climate change increased during the 1980s. On 6thDecember 1988, the United Nations General Assembly adopted Resolution 43/53 concerning the protection of the global climate for present and future generations. It recognised climate change as a "common concern of humanity" and called for appropriate measures within a global framework. In 1990, the General Assembly supported the establishment of an intergovernmental negotiating process for developing a comprehensive convention on climate change. Consequently, the United Nations Framework Convention on Climate Change (UNFCCC) was negotiated and adopted on 9 May 1992. [52]

The UNFCCC[53] is the principal international legal framework for addressing climate change. It establishes the objective of stabilising greenhouse gas concentrations at a level that prevents dangerous human interference with the climate system. The Convention defines climate change as a change in climate attributable directly or indirectly to human activities that alter the composition of the global atmosphere, in addition to natural climate variability. [54] One of its fundamental principles is that parties should protect the climate system for present and future generations on the basis of equity and common but differentiated responsibilities and respective capabilities (CBDR-RC).[55] Developed countries are therefore expected to take a leading role

[51] World Commission on Environment and Development, Bonn, 1987 available at https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf. accessed 14 May 2026

[52] United Nations Framework Convention on Climate Change https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf accessed 14 May 2026

[53] United Nations Framework Convention on Climate Change, 'History of the Convention' https://unfccc.int/process/the-convention/history-of-the-convention#Essential-background accessed 14 May 2026

[54] A Kumar, 'Mitigation of Climatic Change: Exploring Laws and Policies of China and India in Changing Paradigm' in Usha Tandon (ed), *Climate Change Law, Policy and Governance* (Eastern Book Company 2016) 79–81.

[55] https://legal.un.org/avl/pdf/ls/Hey_outline%20EL.pdf accessed 14 August 2026

in combating climate change.

The Convention requires parties to develop and periodically update national inventories of greenhouse-gas emissions and removals, formulate and implement national and regional programmes to mitigate climate change, promote technologies that control greenhouse-gas emissions, facilitate technology transfer and undertake appropriate measures for the protection of vulnerable ecosystems. Although the UNFCCC established important obligations, it did not prescribe specific binding emission-reduction targets or deadlines for all parties. Nevertheless, it created the basic international framework for subsequent climate agreements.

The Kyoto Protocol[56], adopted on 11 December 1997, was developed to strengthen the implementation of the UNFCCC. It introduced legally binding emission-reduction commitments primarily for developed countries and recognised mechanisms such as emissions trading, the Clean Development Mechanism (CDM) [57], and the use of greenhouse-gas sinks. The CDM was intended to assist developing countries in achieving sustainable development while contributing to the overall objective of the Convention.[58] The Protocol therefore represented an important step towards international cooperation for reducing anthropogenic greenhouse-gas emissions.

The Conference of the Parties (COP) has remained the principal forum for negotiating and implementing international climate commitments under the UNFCCC. Several COPs have contributed to the development of the international climate regime. COP 6 at Bonn in 2000[59] contributed to resolving issues relating to the implementation of the Kyoto Protocol, while the Marrakesh Accords[60], adopted at COP 7 in 2001, provided further rules for its implementation. COP 13 at Bali in 2007[61], adopted the Bali Road Map and Action Plan, which advanced

[56] https://unfccc.int/process-and-meetings/the-kyoto-protocol accessed 14 August 2026

[57] United Nations Framework Convention on Climate Change, 'Clean Development Mechanism' https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism accessed 14 May 2026

[58] S Anderson and others, 'Leaders, Pushers, and Laggards in the Working of the Climate Regime' (2002) 12 *Global Environmental Change* 41–51.

[59] United Nations Framework Convention on Climate Change, 'Clean Development Mechanism' https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism accessed 14August 2026.

[60] United Nations Framework Convention on Climate Change, 'COP 7 Documents' https://unfccc.int/process-and-meetings/conferences/past-conferences/marrakech-climate-change-conference-october-2001/cop-7/cop-7-documents accessed 14 August 2026.

[61] United Nations Framework Convention on Climate Change, 'Chair's Slides: Session 1' https://unfccc.int/sites/default/files/chair_slides_session_1.pdf accessed 14 August 2026.

negotiations on long-term climate action[62],The Copenhagen Accord, associated with COP 15 in 2009[63], further advanced international climate negotiations.[11] COP 16 at Cancun in 2010[64] adopted the Cancun Agreements, strengthening the institutional framework for international climate action.[65] COP 17 at Durban in 2011[66] adopted the Durban Platform for Enhanced Action, while COP 18 at Doha in 2012[67] adopted the Doha Climate Gateway and continued negotiations towards a legally binding climate agreement. Subsequently, COP19[68]at Warsaw in 2013 and COP 20[69] at Lima in 2014 contributed to the negotiations that ultimately resulted in the Paris Agreement.[70] The international focus thereafter increasingly shifted towards national climate policies, nationally determined contributions (NDCs), mitigation measures and long-term strategies for achieving climate goals. [71]

India responded to the international climate framework through the National Action Plan on Climate Change (NAPCC), launched in 2008. The NAPCC demonstrates India's commitment to addressing climate change through national programmes and consists of eight National Missions covering solar energy, enhanced energy efficiency, sustainable habitat, water, sustaining the Himalayan ecosystem, a Green India, sustainable agriculture and strategic knowledge for climate change. The National Mission for a Green India aims to increase forest

[62] United Nations Framework Convention on Climate Change, 'Bali Road Map' https://unfccc.int/process/conferences/the-big-picture/milestones/bali-road-map accessed 14 August 2026

[63] United Nations Framework Convention on Climate Change, 'COP 15 Documents' https://unfccc.int/process-and-meetings/conferences/past-conferences/copenhagen-climate-change-conference-december-2009/cop-15/cop-15-documents accessed 14 August 2026

[64] United Nations Framework Convention on Climate Change, 'Durban Climate Change Conference, November 2011' https://unfccc.int/conference/durban-climate-change-conference-november-2011 accessed 14 August 2026

[65] United Nations Framework Convention on Climate Change, 'Cancun Climate Change Conference, November 2010' https://unfccc.int/conference/cancun-climate-change-conference-november-2010 accessed 14 August 2026

[66] United Nations Framework Convention on Climate Change, 'COP 17 Documents' https://unfccc.int/process-and-meetings/conferences/past-conferences/durban-climate-change-conference-november-2011/cop-17/cop-17-documents accessed 14 August 2026

[67] United Nations Framework Convention on Climate Change, 'COP 18 Decisions' https://unfccc.int/process-and-meetings/conferences/past-conferences/doha-climate-change-conference-november-2012/cop-18/cop-18-decisions accessed 14 August 2026

[68] United Nations Framework Convention on Climate Change, 'COP 19 Reports' https://unfccc.int/process-and-meetings/conferences/past-conferences/warsaw-climate-change-conference-november-2013/cop-19/cop-19-reports accessed 14 August 2026

[69] United Nations Framework Convention on Climate Change, 'COP 20 Decisions' https://unfccc.int/process-and-meetings/conferences/past-conferences/lima-climate-change-conference-december-2014/cop-20/cop-20-decisions accessed 14 August 2026.

[70] https://unfccc.int/process-and-meetings/the-paris-agreement accessed 14 August 2026.

[71] United Nations Framework Convention on Climate Change, 'COP 18 Decisions' https://unfccc.int/process-and-meetings/conferences/past-conferences/doha-climate-change-conference-november-2012/cop-18/cop-18-decisions accessed 14 August 2026on-climate-change/cop-18 accessed 14 August 2026

and tree cover and improve the ecological condition of degraded lands.[72]

Bioenergy is particularly relevant to India's climate and energy policies because biomass is an important renewable and non-conventional energy resource. It contributes significantly to global energy supply, while bagasse-based cogeneration in sugar mills constitutes a substantial component of India's biomass power generation. [73] India has considerable biomass-energy potential, and the Ministry of New and Renewable Energy (MNRE) has implemented biomass power and cogeneration programmes since the 1990s. Several bagasse cogeneration projects have been established, contributing significantly to renewable electricity generation. India has also continued to promote biomass-based power generation and the efficient use of biomass resources as part of its broader renewable-energy and climate-mitigation strategy. [74]

1.9 Progress of India's Global Climate Action COP28

India is actively involved in global initiatives like the Global Biofuel Alliance and International Solar Alliance to combat climate change and promote equity. Successfully implementing the Loss and Damage Fund and the Green Credit Initiative at COP28, India has met its 2030 NDC target by reducing emission intensity by 33% from 2005 to 2019. The Global Biofuel Alliance promotes international cooperation in biofuels, while India awaits the Global Stock-take results to enhance climate action. Highlighting the need for climate funding for developing nations, Modi ji emphasizes the importance of local communities in sustainable development. Union Minister Shri Bhupender Yadav noted India's comprehensive approach to environmental preservation, including land degradation and biodiversity. India's participation in COP-28 reflects its commitment to innovative and localized strategies to address climate change.[75]

1.10 India's National Policy Framework: Strategies and Targets

India, ranking as the third largest energy consumer globally, predominantly depends on

[72] D Ravindranath and SS Nagesha Rao, *Bioenergy in India – Barriers and Policy Options* (United Nations Development Programme 2015) 4.
[73] Atul Sharma and others, *A Comprehensive Overview of Renewable Energy Status in India* (Energy Publication Division, Ministry of Information and Broadcasting, Government of India 2009) 96–97.
[74] World Resources Institute, 'India's Approach Towards the Nationally Determined Contributions (NDC) in the Paris Agreement' https://www.wri.org/insights/5-key-takeaways-indias-new-climate-plan-indc accessed 19 March 2026; Government of India, *India's Intended Nationally Determined Contribution to UNFCCC* 9 https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.
[75] Press Information Bureau, Government of India, 'COP28: Year's Biggest Climate Conference' https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/nov/doc20231130275501.pdf accessed 15 April 2026.

imported fossil fuels to fulfil a substantial portion of its energy demands. It is projected that India's emissions of energy into the world will double by 2050. A high reliance on imports and rising energy demand present significant energy security challenges. It also results in a significant outflow of foreign currency. Moreover, the overconsumption of fossil fuels results in increased carbon emissions, which in turn give rise to health threats.

1.10.1 India's Renewable Energy Strategy

i. Energy provision for various purposes can enhance living standards.

ii. Bioenergy can significantly contribute to this goal.

iii. The government aims to electrify all homes by 2022 and 2030.

iv. The country aims to decrease energy emissions by 33–35% by 2030.

v. Non-fossil fuel-based electricity generation is expected to exceed 40% by the same year.

vi. Biofuels align with government initiatives like Make in India and Swachh Bharat Abhiyan.

vii. They can help double farmers' income, reduce imports, generate employment, convert waste into wealth, and mitigate air pollution.

1.10.2 Approach and Strategy

As part of the national bioenergy promotion strategy, periodic fiscal and financial measures that support the development and promotion of bioenergy applications and their utilisation across sectors are implemented. By means of a variety of policies (current and forthcoming initiatives), the government is implementing a comprehensive strategy to encourage and subsidise the utilisation of bioenergy across an extensive spectrum of applications.

This consists of:

i. Production and utilisation of biofuels derived from agricultural, industrial, and

municipal waste for thermal and propulsion purposes in transportation and industry.

ii. Power generation from municipal and agricultural solid waste (MSW) for grid input and to meet the energy needs of diverse consumers.

iii. Emphasis has been placed on fostering the development of a robust and dynamic bioenergy market that combines technological advancements and decades of experience to promote livelihood and environmental sustainability.

iv. The objective of these strategies has been to implement interventions that target the following:

v. Supply chain management that ensures feedstock is readily available. Assistance for innovative and new applications.

vi. Scalable availability of finance.

vii. Support for innovation, research, and development to maximise use and co-benefits and increase efficiency.

1.11 Biofuels and Global Biofuels Alliance [76]

In light of global efforts to address climate change through the adoption of sustainable energy sources, biofuels have emerged as a viable prospect. The recently concluded G20 conference in New Delhi witnessed the establishment of the Global Biofuels Alliance, a project led by India. The primary objective is to establish a coalition comprising governmental bodies, international organisations, and industrial entities with the purpose of facilitating the widespread acceptance and utilisation of biofuels.[77]

However, biofuels also present land, water, food-security and environmental challenges. Excessive diversion of agricultural land towards biofuel production may create a food-versus-fuel conflict, while cultivation involving deforestation or unsustainable practices can reduce or even eliminate the expected climate benefits. Therefore, biofuels should be

[76] https://www.drishtiias.com/daily-updates/daily-news-editorials/biofuels-and-global-biofuels-alliance. accessed 25 April 2026

[77] 'Are Biofuels a Viable Energy Source?' The Hindu Businessline (29 September 2023) thehindubusinessline.com accessed 14 August 2026

evaluated through a life-cycle sustainability approach. The Global Biofuel Alliance (GBA), launched during India's G20 Presidency, seeks to promote international cooperation in sustainable biofuel development through technology sharing, investment, standards, knowledge exchange and development of global biofuel markets. For India, the GBA is important because it can facilitate technology transfer, climate ,investment, advanced biofuel development and international best practices. It can support ethanol blending, flex-fuel vehicles, reduction of crude-oil imports, employment generation and India's potential growth as a biofuel producer and exporter.

1.11.1 Biofuels are generally classified into four generations:

1. First generation – produced mainly from food crops such as sugar, starch and vegetable oils.

2. Second generation – produced from non-food crops, agricultural residues and lignocellulosic biomass.

3. Third generation – mainly derived from algae and other microorganisms.

4. Fourth generation – uses advanced biotechnology and carbon-capture approaches, with potential for very low or negative carbon emissions.

The biofuels can contribute significantly to India's energy security, rural development and climate-change mitigation, but their expansion must be governed by a strong legal and policy framework based on sustainable development, precaution, intergenerational equity and environmental protection, while safeguarding food security, water resources and biodiversity.

1.11.2 Steps taken Recently Regarding Biofuels

Initiatives in India:

i. **Pradhan Mantri JI-VAN Yojana (2019)[78]:** The initiative's goal is to create an environment that encourages the establishment of commercial firms while also stimulating (R&D) in the 2G ethanol industry.

[78] PM G-One Scheme, https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1945555&reg=48&lang=2 accessed 14 August 2026

ii. **Blending of ethanol and biodiesel:** By 2030, the 2018 Biofuel Policy aims to achieve a 20% ethanol-blending ratio and a 5% biodiesel-blending ratio. In recent times, the Centre has revised its ethanol blending target from 2030 to 2025–26, with the intention of reaching 20% ethanol-containing petrol.

iii. **GOBAR DHAN scheme[79](Galvanising Organic Bio-Agro Resources), 2018**: It concentrates on the management and conversion of farm solid waste and cattle manure into biogas, bio-CNG, and compost, thereby increasing the income of rural households and preserving the cleanliness of rural communities. It was initiated as part of the Gramin Swachh Bharat Mission.

iv. **The initiative known as Repurpose Used Cooking Oil (RUCO)[80]**: It was introduced by the Food Safety and Standards Authority of India (FSSAI) with the objective of establishing an ecosystem that facilitates the gathering and transformation of used cooking oil into biodiesel.

v. **National Policy on Biofuels, 2018:** In order to ease the extension of suitable financial and fiscal incentives under each category, the policy classifies biofuels as "Advanced Biofuels" (second generation (2G) ethanol, municipal solid waste (MSW) to drop-in fuels, third generation (3G) biofuels, bio-CNG, etc.) and "Basic Biofuels" (first generation (1G) bioethanol and biodiesel).

1.11.3 Global Initiatives (GIVs):

a) The RSB: Roundtable on Sustainable Biomaterials

- Scientists, governments, corporations, non-governmental organisations, and producers all participate in this international initiative, which aims to promote the sustainability of biofuel distribution and production.

- The "RSB Certification System[81]," a set of all-encompassing sustainability criteria, was introduced in April 2011. Biofuel producers who satisfy these standards can demonstrate

[79] GOBARdhan: Fuelling Clean Energy and Rural Growth https://www.pib.gov.in/PressNoteDetails.aspx?id=159462&NoteId=159462&ModuleId=3&reg=48&lang=2 accessed 14 August 2026
[80] https://eatrightindia.gov.in/ruco/# accessed 14 August 2026
[81] https://www.lrqa.com/en-in/rsb-certification-services/ accessed 14 August 2026

to purchasers and regulatory bodies that the production process did not compromise human rights or the environment.

b) The Sustainable Biofuels Agreement:

- It is a global endeavour that urges stakeholders, including governments, the private sector, and others, to adopt resolute measures in order to guarantee the environmentally sustainable utilisation, manufacturing, and distribution of biofuels.

- **Bonsucro,**[82] Founded in 2008, it is a global, multi-stakeholder, non-profit organisation with a mission to promote sustainable sugar cane.

1.11.4 Global Biofuel Alliance to promote environmental sustainability

While biofuels have the potential to be a substantial energy source in the fight against climate change, their feasibility remains a cause for worry. The Global Biofuel Alliance has significant potential to advance environmental sustainability, while the actual execution of its goals remains unknown. While the absence of excess agricultural production in nations such as India may impede the feasibility of biofuels as a main energy source, they can nevertheless play a role in advancing environmental sustainability by encouraging the adoption of sustainable production and consumption methods.

1.11.5 Promotional Policies for Bioenergy in India

It is stated in India's Second National Communication to the UNFCCC[83] that India accounts for approximately 20% of anthropogenic methane emissions, with initiatives aimed at reducing greenhouse gas emissions through increased bioenergy production.
The bioenergy strategy includes policy initiatives, capacity development, and public-private partnerships, aimed at sustainable development and renewable energy enhancement.
• **Electricity Act of 2003**[84]: Supports cogeneration and electricity generation from non-conventional sources, emphasizing bioenergy through provisions like Renewable Purchase

[82] https://bonsucro.com/ accessed 14 August 2026
[83]https://unfccc.int/process-and-meetings/what-is-the-united-nations-framework-convention-on-climate-change accessed 28 April 2026
[84] https://www.indiacode.nic.in/bitstream/123456789/2058/1/a200336.pdf accessed 13 August 2026

Obligation (RPO)[85], and preferential tariffs.

a. **National Tariff Policy (2016)** [86]: Mandates state distribution licensees to purchase all power generated from waste-to-energy plants at rates set by the Appropriate Commission.

b. **Biomass Utilization Policy (2017)[87]:** Allows biomass co-firing with coal in electricity generation, followed by technical guidelines for biomass pellets in 2018.

c. **Renewable Energy Qualification (2019):** Power from biomass co-firing is classified as renewable and counts towards non-solar RPOs.

d. **Open Access Policy (2021):** Investigates waivers for charges on interstate sales of power from municipal solid waste plants and comparable DSM[88] regulations as for solar and wind.

e. **Biogas Usage (2015):** Amendments allow the use of bio-CNG[89] in waste-powered vehicles under the Central Motor Vehicles Rules.[90]

1.11.6 National Policy on Biofuels, 2018: Amendments and Developments

The National Policy on Biofuels, 2018, announced by the Government of India, aims to enhance the biofuels sector by promoting renewable energy from organic materials. This Policy replaces the 2009 initiative by the Ministry of New and Renewable Energy and emphasizes ethanol blending with petrol, targeting 20% ethanol blending (E20) by 2025-26. Implementation began on April 1, 2023, alongside measures to develop second-generation biorefineries. It also allows surplus food grains for ethanol production and categorizes biofuels

[85]Ministry of Power, Government of India, 'Renewable Purchase Obligation (RPO) and Energy Storage Obligation (ESO) Trajectory till 2029–30' https://powermin.gov.in/sites/default/files/Renewable_Purchase_Obligation_and_Energy_Storage_Obligation_Trajectory_till_2029_30.pdf accessed 25 February 2026.
[86]West Bengal Electricity Regulatory Commission, 'Tariff Policy, 2016' https://www.wberc.gov.in/sites/default/files/tariff-policy-28.01.2016.pdf accessed 25 February 2026.
[87] https://samarth.powermin.gov.in/home/regulatory_policies accessed 14 August 2026.
[88]Bureau of Energy Efficiency, 'Demand Side Management – Action Plan for DISCOMs' https://beeindia.gov.in/en/programmesdemand-side-managementdiscom/dsm-action-plan accessed 28 May 2026.
[89] NuGreen Energy, 'Bio-CNG' https://nugreenenergy.in/bio-cng.php accessed 28 May 2026.
[90] Ministry of Road Transport and Highways, Government of India, 'Central Motor Vehicles Rules, 1989' https://morth.nic.in/central-motor-vehicles-rules-1989-1 accessed 28 May 2026.

into basic and advanced types. Financial support of about ₹5,000 crore is proposed for second-generation biorefineries, along with tax incentives for first-generation biofuels, thus facilitating energy security and sustainable development in India.

The recent amendments to the National Biofuel Policy introduce significant changes aimed at enhancing biofuel production and utilization in India. Key highlights include the approval for additional feedstocks, a new ethanol blending target of 20% by 2025–26, and the authorization of new members to the National Biofuel Coordination Committee (NBCC) under the Ministry of Petroleum and Natural Gas (MoP&NG). The amendments support the Atmanirbhar Bharat Initiative, aiming for energy independence by 2047, and are expected to bolster the Make in India initiative by fostering domestic biofuel production and reducing petroleum imports.

The policy framework includes financial support for commercial ventures and research in the second-generation (2G) ethanol industry, advancing from food to non-food crops and waste materials. This approach aims to lower greenhouse gas emissions and enhance employment opportunities within the biofuel sector. The Ethanol Blended Petrol (EBP) initiative, operational since 2003, currently mandates a 10% ethanol blend in petrol across 21 states and 4 Union Territories, although the national blending rate remains low at 4.22%.

1.12 Bioenergy in India: Legal Framework, Biomass, Biodiesel, Biogas, Biofuel and Judicial Perspectives

The legal framework regarding bioenergy in India encompasses various biomass sources, including biodiesel, biofuel, and biogas, which collectively generate bioenergy. This bioenergy can power biopower-operated networks to produce electricity and reduce dependence on imported petroleum, serving as a transportation fuel. Solid biomass can also be utilized to mitigate coal demand by combusting it alongside coal. Advances in biogas production have facilitated the creation of bio manure, beneficial to agriculture, and the integration of compressed natural gas (Bio-CNG) enhances biogas's efficiency as a transport fuel and electricity source through biogas generators. India has significant forest residue and agricultural refuse that can be harnessed with proper regulatory frameworks.

1.12.1. Biomass Energy: Key Judicial Decisions and Legal Developments

a) M/s Orient Green Power Company Ltd v Central Electricity Regulatory

Commission (17 September 2012)[91]

The petitioner sought revision of the CERC Renewable Energy Tariff Regulations, 2009 concerning **biomass fuel prices and tariffs** for biomass-based power projects. It requested consideration of the actual biomass price, Gross Calorific Value (GCV), and Station Heat Rate (SHR) for determining appropriate tariffs. The petitioner relied on **Section 61 of the Electricity Act, 2003**, which requires promotion of cogeneration and generation of electricity from renewable sources.

Decision: The Commission held that renewable-energy regulations must be formulated through a **consultative and transparent process**. Stakeholders must provide relevant information during the regulatory process. The concerns raised were considered while framing the CERC Regulations, 2012.[92]

b) CCE, Delhi-IV v M/s Dee Development Engineers (P) Ltd (1 April 2015) [93]

The case concerned the **excise-duty exemption applicable to equipment used in non-energy systems**, including biomass energy-generating systems. The dispute arose regarding whether certain components supplied for biomass energy equipment qualified for the exemption under Notification No 6/2002-CE.

Decision: Relying on the principles laid down in *Binny Ltd* and *Maharashtra Safety Glass Works Ltd v CCE, Pune*, the Tribunal held that the claimed exemption could not be granted and restored the order of the Joint Commissioner.

c) Sampelly Satyanarayana Rao v M/s Indian Renewable Energy Development Agency Ltd (8 May 2014) [94]

The case concerned a loan advanced by **IREDA** and post-dated cheques issued by the borrower as security. The petitioner sought to quash proceedings under **Section 138 of the**

[91] M/s Orient Green Power Company Ltd v Central Electricity Regulatory Commission, MANU/ET/0018/2017 (CERC).
[92] Central Electricity Regulatory Commission, 'Current Regulations' https://cercind.gov.in/Current_reg.html accessed on 06 August 2026
[93] CCE, Delhi-IV v M/s Dee Development Engineers (P) Ltd [2015] SCC OnLine CESTAT 497.
[94] Sampelly Satyanarayana Rao v M/s Indian Renewable Energy Development Agency Ltd, MANU/DE/1136/2014

Negotiable Instruments Act, contending that there was no existing liability when the cheques were issued.

Decision: The Court held that the loan had already been sanctioned and there was an admitted financial liability. Since the existence of the liability required examination at trial, the proceedings could not be quashed under Article 226 read with Section 482 CrPC. The petition was therefore dismissed.

d) M/s Kamarhatty Power Ltd v State of West Bengal & Ors (11 September 2014)[95]

The case involved a **biomass-based power plant** established with the permission of the West Bengal Renewable Energy Development Agency. The dispute concerned the tariff payable for electricity supplied under the Power Purchase Agreement (PPA).

Decision: The Court held that the parties could enter into appropriate agreements for finalising the tariff. It recognised the applicable tariff of **Rs 4 per unit for 2008–09 and 2009–10 and Rs 4.14 per unit for 2010–11**, subject to the terms of the agreement.

e) Suo Motu Petition No 12/SM/2019 – Methodology for Estimation of Electricity Generated from Biomass in Biomass Co-fired Thermal Power Plants (18 February 2020) [96]

The CERC considered the methodology for determining electricity generated from **biomass co-firing with coal** in thermal power plants. The methodology was based on actual biomass and coal consumption and their respective GCV.

Decision: The generating company was required to maintain **separate fuel accounts for coal and biomass**, regularly inform beneficiaries about biomass co-firing, and disclose the quantity of biomass used and the electricity generated from biomass.

f) Ptacek, Milan – Appellant (Boards of Appeal of the European Patent Office, 1 March 2018) [97]

The case concerned a **technical process for generating thermal energy from biomass**

[95] M/s Kamarhatty Power Ltd v State of West Bengal, MAT No 321 of 2013, MANU/SCOR/10566/2015.
[96] MANU/CR/0296/2019.
[97] 2018 SCC Online BAEPO 154, In the Boards of Appeal of the European Patent Office.

by using biomass containing low-melting-temperature ash and other materials. The issue was whether the claimed process involved an inventive step.

Decision: The Board found that the prior-art documents did not adequately disclose the required combination and mixing ratios for achieving the claimed technical result. The appeal decision was therefore reversed.

g) Rithwik Energy Systems Ltd v Transmission Corporation of Andhra Pradesh (28 September 2006) [98]

The case concerned a **biomass-based power plant and Power Purchase Agreement** with APTRANSCO. The dispute related to the calculation of the amount of electricity that could be purchased when generation exceeded the prescribed Plant Load Factor (PLF).

Decision: The Court directed that the **monthly PLF should be calculated after deducting auxiliary and captive consumption** to determine the permissible purchasable energy.

h) South India Sugar Mills Association v Karnataka Power Transmission Corporation Ltd (5 April 2011) [99]

The case concerned **biomass-based cogeneration**, particularly specific fuel consumption and tariff-related technical parameters. The appellant argued that the standards applicable to biomass power plants should also be considered for cogeneration plants.

Decision: The Court decided in favour of the appellant and directed a **re-hearing to consider the relevant technical materials** concerning fuel consumption and biomass calorific value.

1.12.2 Biodiesel: Key Judicial Decisions and Legal Developments

a) Ajay Dhiraj Lal Parmar v State of Gujarat (4 February 2021)[100]

The petition concerned an FIR alleging offences under **Sections 3 and 7 of the Essential Commodities Act, 1955** and Section 285 of the Indian Penal Code in

[98] MANU/ET/0112/2006.
[99] MANU/ET/0067/2011,
[100] Ajay Dhiraj Lal Parmar v State of Gujarat, R/CR.MA/1595/2021 (Gujarat High Court, 4 February 2021)

connection with the production and sale of biodiesel. The applicants were involved in biodiesel production and had sold 21,365 litres of biodiesel.

Decision: The Court directed that no coercive action be taken against the applicants during the pendency of the proceedings.

b) The State of Maharashtra and Five Others v All India Biodiesel Association (1 February 2022) [101]

The petition sought directions concerning the constitution of the State Bio-Diesel Board, implementation of the Central Government's biodiesel policy, and exclusion of the Petroleum and Explosives Safety Organisation from biodiesel matters.

Decision: The Court held that these matters primarily involved **government policy** and that no enforceable fundamental or legal right of the petitioners had been established. Therefore, a writ of mandamus could not be issued and the petition was dismissed without costs.

c) M/S Jai Shree Om Bana Rudra Kash Bio Fuels v State of Rajasthan (20 April 2022)[102]

The petitioner, a licensed biodiesel retailer, challenged an FIR registered under the **Essential Commodities Act, 1955**, contending that the sale and storage of biodiesel were lawful under the applicable State permissions.

Decision: The Court accepted that the petitioner held a valid licence for biodiesel retailing and observed that biodiesel was not treated as a petroleum product. The petition was accordingly allowed, as the proceedings against the petitioner were found unsustainable on the facts presented.

e) Mr Monish Gulati v HPCL Mumbai (20 September 2012)[103]

The case concerned an **RTI application** seeking information from Hindustan

(Indian Kanoon, accessed 06 August 2026).

[101] All India Biodiesel Association v State of Maharashtra and Others, Writ Petition (L) No 1706 of 2022 (Bombay High Court, 1 February 2022) http://indiankanoon.org/doc/144347340/ accessed 06 August 2026.

[102] M/S Jai Shree Om Bana Rudra Kash Bio Fuels v State of Rajasthan, MANU/SCOR/30127/2023

[103] Mr Monish Gulati v HPCL Mumbai, File No CIC/LS/A/2012/001312 (Central Information Commission, 20 September 2012) http://indiankanoon.org/doc/70991884/ accessed 06 August 2026.

Petroleum Corporation Limited regarding the retail sale of biodiesel blends, biodiesel supplied to the Indian Railways, and proposed experimental marketing of ethanol- or biodiesel-blended fuels.

Decision: The Court directed the Central Public Information Officer to provide appropriate responses to the disputed queries within four weeks and allowed the petition.

d) Palak Biodiesel and Chemicals through its Manager v The LD Collector and Ors (6 October 2021)[104]

The dispute concerned whether the petitioner was dealing in **lubricant or biodiesel**. A State Government Resolution dated 11 May 2021 provided a statutory mechanism for seeking redress.

Decision: The Court dismissed the petition and permitted the petitioner to pursue the remedy available under Clause 14 of the Government Resolution. The competent authority was directed to consider the matter in accordance with the prescribed procedure.

e) Pankaj Diwaniya v State of Rajasthan & Anr (16 November 2017)[105]

The petitioner sought quashing of an FIR registered under **Sections 420 and 406 of the Indian Penal Code** in connection with a biodiesel business. It was argued that biodiesel was not a petroleum product and that the Central Government had subsequently permitted its direct sale to consumers for blending with high-speed diesel.

Decision: The Court declined to quash the proceedings and directed the petitioner to submit the relevant documents and cooperate with the investigation. If arrest became necessary, the investigating authority was directed to provide prior notice in accordance with the order.

[104] Palak Biodiesel and Chemical through its Manager v The Ld Collector and Others,WP/10742/2021 (Bombay High Court, 6 October 2021) http://indiankanoon.org/doc/187533814/ accessed 06 August 2026.
[105] Pankaj Diwaniya v State of Rajasthan and Another, S.B. Criminal Miscellaneous Petition No 4011/2017 (Rajasthan High Court, 16 November 2017) http://indiankanoon.org/doc/115089794/ accessed 30 June 2026.

f) Suraj Singh Rawat S/O Ganpat Singh v State of Rajasthan (20 April 2022)[106]

The petitioner, engaged in the manufacture and trade of biodiesel, challenged an FIR and relied upon State directions concerning the storage and retail sale of biodiesel.

Decision: The Court found that the documents relied upon by the petitioner did not establish a valid licence specifically authorising the retail sale of biodiesel. The police proceedings were therefore held to be lawful, and the petition was dismissed.

g) Index one Infracon and Logistics Pvt Ltd v Union of India (18 July 2018)[107]

The case concerned the **import of a consignment declared as biodiesel**. The Customs authorities questioned whether the imported product was actually biodiesel or high-speed diesel and also disputed the applicable IGST rate.

Decision: The Court ordered **provisional release of the goods**, subject to appropriate safeguards and a bond covering the difference in IGST. The authorities were permitted to continue investigation and determine whether the goods were biodiesel or HSD and the correct duty applicable.

1.12.3 Bio Gas: Key Judicial Decisions and Legal Developments

a) Deputy Commissioner of Income Tax v Saraya Industries Ltd (8 August 2006)[108]

The case concerned the assessee's claim for **100 per cent depreciation on a biogas plant**. The Assessing Officer rejected the claim on the ground that biogas production had commenced only in the subsequent financial year. The assessee contended that the plant was already operational because effluent had begun accumulating in the reactor tank.

Decision: The Court held that the plant could be regarded as operational when the

[106] Suraj Singh Rawat S/O Ganpat Singh v State of Rajasthan, S.B. Criminal Miscellaneous Petition No 2647/2022 (Rajasthan High Court, 20 April 2022) https://indiankanoon.org/doc/32724397/ accessed 30 June 2026.

[107] Index one Infracon and Logistics Pvt Ltd v Union of India, Civil Application No 10696 of 2018 (Gujarat High Court, 18 July 2018), MANU/GJ/1502/2018.

[108] ACIT, Central Circle-19 and Ors v Saraya Industries Ltd and Ors, ITA Nos 1310, 1311, 1312, 1537, 1538, 1539, 1563, 1564, 4561 and 4692/Del/2012 (ITAT Delhi, 6 December 2013) MANU/ID/0648/2013.

effluent started accumulating in the tank. Since the depreciation claim was subsequently accepted when biogas production commenced, the imposition of penalty under **section 271(1)(c) of the Income Tax Act** was not justified. The Revenue's appeal was dismissed.

b) Ever Shine Biogas v Director of Panchayat (6 February 2019)[109]

The petitioner sought a writ of mandamus directing the respondents to release **Rs 10,74,000** towards the installation of household pipe-compost units and to make the balance payment with interest.

Decision: The Court found no prima facie case warranting the relief sought and dismissed the petition.

c) National Energy and Waste Management Multipurpose Co-operative Society (Kerala) Ltd v State of Kerala & Ors (14 June 2022)[110]

The petitioner, an approved waste-management service provider, supplied **biogas plants** under a government programme but claimed that payment for the supplied and installed units had not been made.

Decision: The Court held that the petitioner was entitled to payment for the biogas plants supplied and directed the concerned authority to pay the applicable cost and installation charges.

d) Sheo Shankar Shaw v State of Bihar & Ors (19 December 2016)[111]

The case concerned the appointment of **biogas technicians** to sanctioned posts under the Bihar Renewable Energy Development Agency. The petitioners, who had undergone biogas technician training, sought appointment to vacant sanctioned posts.

[109] Ever Shine Biogas v Director of Panchayat, WP(C) No 4572 of 2017 (Kerala High Court, 6 February 2019) http://indiankanoon.org/doc/96634061/ accessed 30 June 2026.
[110] National Energy and Waste Management Multipurpose Co-operative Society (Kerala) Ltd v State of Kerala and Others, WP(C) No 4517 of 2021 (Kerala High Court, 14 June 2022) http://indiankanoon.org/doc/185273558/ accessed 30 June 2026.
[111] Sheo Shankar Shaw v State of Bihar and Others (Patna High Court, 19 December 2016) 1999 (106) TTR 536. http://indiankanoon.org/doc/16814498/ accessed 30 June 2026.

Decision: The Court held that the decision whether to fill vacant sanctioned posts and whether to issue a fresh advertisement was within the employer's authority. The writ petition was consequently dismissed.

e) John Paul v Vengola Grama Panchayat (11 January 2022)[112]

The petitioner had established a **biogas plant** with financial assistance from ANERT. A neighbouring resident alleged that leakage from the plant and slurry tank had contaminated her well water. The Pollution Control Board's inspection report, however, did not establish that the biogas plant was the source of the contamination.

Decision: The Court held that the direction of the State Human Rights Commission requiring relocation of the biogas plant was not legally sustainable. The direction was therefore set aside and the writ petition was allowed.

1.12.4 Biofuels: Key Judicial Decisions and Legal Developments

a) Neeraj Kumar Dubey v Union of India (Delhi High Court, 2023)[113]

The petition challenged the **National Policy on Biofuels 2018 and its 2022 amendments**, particularly the use of food grains such as broken rice and wheat for ethanol production. It was argued that diversion of food grains for biofuel production could adversely affect food security.

Decision: Decision: The Delhi High Court upheld the National Policy on Biofuels, 2018, asserting that it includes mechanisms to ensure a balance between energy and food security. The Court deemed the issue a matter of government policy, finding no grounds for judicial interference. It ruled that judicial review of complex techno-economic policies, such as the use of damaged food grains for bioethanol, is not warranted, deferring to expert bodies on these matters.

[112] John Paul v Vengola Grama Panchayat, (Kerala High Court, 11 January 2022) http://indiankanoon.org/doc/16814498/ accessed 30 June 2026.
[113]Neeraj Kumar Dubey v Union of India (Delhi High Court, 2023) https://www.scconline.com/blog/post/2023/10/30/delhi-high-court-change-policy-contrary-group-interests-unconstitutional-legal-news/ accessed 14 August 2026.

b) Biodiesel Association of India v Union of India (Supreme Court, 2025–2026)[114]

The Biodiesel Association of India approached the Supreme Court concerning government notifications relating to **excise-duty exemptions for unblended high-speed diesel** and the difficulties faced by independent biodiesel producers in supplying biodiesel to Oil Marketing Companies (OMCs).

Significance: The proceedings concern the **market access of independent biodiesel producers,** OMC procurement practices and the regulatory framework governing biodiesel distribution.

c) *M/S Royal Energy Ltd v M/S Indian Oil Corporation Ltd* (2012)[115]

The case concerned alleged market-entry barriers and restrictions affecting independent biodiesel producers, particularly in relation to petroleum distribution controls and the position of Oil Marketing Companies.

Decision: The court addressed the violations of the Competition Act by the Ministry of P&NG and OMCs, a cease-and-desist order is necessary. The Ministry must immediately withdraw its directive to State Governments to halt biodiesel sales and marketing. Price fixing and competition elimination should be avoided, and the Central Government should not promote monopoly by restricting PSU OMCs to only marketing, storage, and distribution roles.

d) *M/S Arss Biofuel Pvt Ltd v State of Maharashtra* (Bombay High Court, 2017)[116]

Decision: The case concerned State regulation of **denatured and rectified spirits** used for industrial and biofuel purposes. The dispute involved the extent of State regulatory authority and measures intended to prevent diversion of industrial alcohol for unauthorised or potable use. The Court clarified that the State Government's power regarding rectified spirit for industrial use is limited to preventing its diversion for

[114] Biodiesel Association of India v Union of India (Supreme Court, 2025–2026) https://www.livelaw.in/top-stories/bio-diesel-makers-approach-supreme-court-to-direct-oil-marketing-companies-to-accept-their-supplies-304373 accessed 14 August 2026.
[115] M/S Royal Energy Ltd v M/S Indian Oil Corporation Ltd (2012) https://indiankanoon.org/doc/148871783/ accessed 14 August 2026.
[116] M/S Arss Biofuel Pvt Ltd v State of Maharashtra (Bombay High Court, 2017) https://indiankanoon.org/doc/79424299/ accessed14 August 2026.

potable purposes. The State can impose regulations requiring industries to submit periodic statements of raw materials and finished rectified spirits, and it is entitled to verify their accuracy.

e) Modi Biotech Private Limited v. VINP Sugars and Distilleries Private Limited (2026)[117]

Decision: The apex court issued an interim order permitting state-owned OMCs to proceed with procurement contracts for an additional 1.49 billion liters of ethanol under Quarter IV of the Ethanol Supply Year (ESY) 2025–26, staying a conflicting Karnataka High Court directive that had mandated reopening/readjusting allocations for individual long-term offtake agreement holders.

f) Narender Kumar Goswami v. Union of India & Ors. (2026)[118]

Decision: A petition in the Supreme Court by advocate Narendra Kumar Goswami alleges "silent compulsion" in the E20 petrol rollout. It demands full disclosure on the chemical composition and safeguards for legacy vehicles. The petition invokes Article 300A (right to property), the Consumer Protection Act of 2019, and fundamental freedoms, arguing that the public has a constitutional right to know the composition, quality, and compatibility of products in a compulsory market set by the state.

g) All India Bio-diesel Association v. State of Maharashtra (2022)[119]

Decision The High Court refused interim relief to biodiesel associations challenging state-level frameworks that restrict direct open-market retail sales of unblended biodiesel to private vehicle fuel tanks, upholding regulatory compliance and state registration mandates for safety.

h) M/S Shri Bhuriya Baba Fuels v. Union of India (2025)[120]

[117]https://www.business-standard.com/industry/news/supreme-court-allows-omcs-additional-ethanol-procurement-esy-2025-26-126080500241_1.html accessed 14August 2026
[118]https://www.thehindu.com/news/national/litigant-in-supreme-court-claims-silent-compulsion-in-e20-petrol-roll-out/article71194096.ece accessed 14August 2026
[119] https://www.thehindu.com/news/national/other-states/bombay-hc-refuses-relief-to-all-india-bio-diesel-association/article38418710.ece accessed 14August 2026
[120] https://www.thehindu.com/news/national/ethanol-allocation-blending-in-petrol-experiment-supreme-court-case-june-30-2026/article71166111.ece accessed 14August 2026

Decision: Affirmed that state authorities possess valid jurisdiction under the **Essential Commodities Act, 1955** to seize and inspect alternative drop-in fuels or biodiesel blends if they fail to meet statutory quality control standards or are suspected of unauthorized commercial distribution.

1.13 The Significance of International Regulatory Issues

The 1981 UN Conference on New and Renewable Sources of Energy in Nairobi[121] officially initiated the prioritisation of renewable energy by international development organizations, emphasizing proactive research, strategic planning, financial investment, and technology diffusion. Over the past two decades, two inventiveness have been applied to encourage private investment in renewable energy: legal or regulatory advancements and financial support from national, bilateral, or multilateral sources. International concerns have also influenced the global perception of bioenergy, focusing on sustainable development, climate change mitigation, and international trade. Significant legal changes have been implemented in these areas.

1.13.1 The Interplay between Sustainable Development and the Environment

Bioenergy is gaining importance in sustainable development, addressing environmental, social, and economic issues. International conferences have advanced bioenergy regulation, promoting renewable energy use for rural development and poverty alleviation. Three significant international conferences have significantly advanced the field of bioenergy regulation.

i. The United Nations Conference on Environment and Development (UNCED)[122] took place in Rio de Janeiro in 1992.

ii. The World Summit on Sustainable Development (WSSD)[123] was held in Johannesburg in 2002.

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[121] United Nations General Assembly, *United Nations Conference on New and Renewable Sources of Energy*, UNGA Res 36/193 (1981) https://digitallibrary.un.org/record/25034 accessed 29 April 2026.

[122] United Nations, *United Nations Conference on Environment and Development (Rio de Janeiro, 1992)* https://www.un.org/en/conferences/environment/rio1992 accessed 28 April 2026.

[123] United Nations, *World Summit on Sustainable Development (Johannesburg, 2002)* https://www.un.org/en/conferences/environment/johannesburg2002 accessed 28 April 2026.

iii. The International Conference for Renewable Energies was conducted in Bonn in 2004.[124]

These Conferences have fostered global agreement on bioenergy's potential to contribute to Sustainable Development Goals, advocating for principles, legal measures, and enforcing international agreements.

1.13.2 Principles and Soft Law Instruments

The 1992 World Summit on Sustainable Development (UNCED)[125]emphasised the status of bioenergy in preserving the atmosphere, mitigating deforestation, and promoting sustainable farming and bucolic growth after ratifying Agenda 21[126]. The Rio Declaration[127] and non-binding forest principles provide guidance for managing natural resources and promoting sustainable development. The MDGs[128] were officially embraced at the World Summit, focusing on eradicating extreme poverty and ensuring environmental sustainability. The Johannesburg Declaration, issued during the 2002 World Summit, emphasises energy as a fundamental necessity for human well-being. The Johannesburg Plan of Implementation aims to enhance the availability of reliable, cost-effective, financially sustainable, socially acceptable, and ecologically responsible energy services, emphasising the benefits of energy services on poverty alleviation and living conditions.[129] The 2004 International Conference for Renewable Energies[130] identified bioenergy as a promising energy source for the future, and the Commission on Sustainable Development (CSD)[131]has endorsed a political declaration and an international action programme to promote the use and generation of renewable energy, particularly bioenergy.

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[124] REN21, *Renewables 2004: International Conference for Renewable Energies* https://www.ren21.net/renewables-2004/ accessed 28 April 2026.

[125] United Nations, 'United Nations Conference on Environment and Development (UNCED)' https://sustainabledevelopment.un.org/milestones/unced accessed 28 April 2026.

[126] United Nations, *Agenda 21* https://sustainabledevelopment.un.org/outcomedocuments/agenda21/ accessed 28 April 2026.

[127] United Nations, *Rio Declaration on Environment and Development* (1992) https://cil.nus.edu.sg/wp-content/uploads/2019/02/1992-Rio-Declaration-on-Environment-and-Development.pdf accessed 28 April 2026.

[128] World Health Organization, 'Millennium Development Goals (MDGs)' https://www.who.int/news-room/fact-sheets/detail/millennium-development-goals-(mdgs) accessed 28 April 2026.

[129] United Nations Development Programme, *A Review of Energy in National Energy Reports* (UNDP 2007).

[130] International Institute for Sustainable Development, 'International Conference for Renewable Energies (Renewables 2004): Summary Report' https://enb.iisd.org/events/international-conference-renewable-energies-renewables-2004/summary-report-1-4-june-2004 accessed 28 April 2026.

[131] United Nations, 'Commission on Sustainable Development' https://sustainabledevelopment.un.org/csd.html accessed 28 April 2026.

1.13.3 Enforceable Contracts

The United Nations Conference on Environment and Development (UNCED) established the Convention on Biological Diversity[132], a crucial international agreement addressing global environmental issues related to bioenergy feedstocks. The Convention focuses on the relationship between agriculture and forestry, addressing biodiversity and habitat for terrestrial species. It requires participating entities to preserve biodiversity, use its elements responsibly, and distribute genetic resource advantages fairly. The United Nations Convention to Combat Desertification[133] mandates national plans to address land degradation and desertification, focusing on agriculture and forestry. Article5 encourages indigenous communities' engagement in affected areas. The Ramsar Convention[134] on Wetlands mandates sustainable governance of wetlands, while the World Heritage Convention safeguards cultural and natural heritage in regions with exceptional value. These treaties aim to mitigate drought and desertification in the bioenergy sector. Other international treaties include the CITES[135], the Convention on Access to Information, and the International Plant Protection Convention (IPPC).[136]

1.13.4 Case Studies of the Biofuel legislation and policies in the South American, African and Asian Countries.[137]

This Article provides a summary of current legislation and policies concerning biofuels in Latin America, Africa, and Asia. Most countries have enacted legislation specifically for first-generation biofuels, which are currently used in commercial applications. The level of development in bioenergy sectors varies across countries and areas. Brazil's history in ethanol production has influenced Latin American nations, while Southeast Asian nations are promoting ethanol and biodiesel production. However, Asia has limited regulatory frameworks, and Africa has limited expertise in bioenergy regulation and policies. The study

[132] Convention on Biological Diversity, 'Convention on Biological Diversity' https://www.cbd.int/ accessed 29 April 2026.
[133] United Nations Convention to Combat Desertification, 'United Nations Convention to Combat Desertification' https://www.unccd.int/ accessed 28 April 2026.
[134] Ramsar Convention on Wetlands, 'Convention on Wetlands' https://www.ramsar.org/ accessed 28 April 2026.
[135] Convention on International Trade in Endangered Species of Wild Fauna and Flora, 'Convention Text' https://cites.org/eng/disc/text.php accessed 28 April 2026.
[136] International Plant Protection Convention, 'International Plant Protection Convention' https://www.ippc.int/en/ accessed 28 April 2026.
[137] Charlotta Jull, Patricia Carmona Redondo, Victor Mosoti and Jessica Vapnek, *The Legal Framework for Bioenergy: March 26 Draft for Comment* (Food and Agriculture Organization of the United Nations 2007) 30–49.

categorizes legislation and policies into legally binding instruments and non-binding promises or goals. Some countries lack clear distinctions between policies and legislation, making the analysis of these areas limited**.**

1.13.5 Implementation of Legislation at the International Level

Argentina: Argentina adopted the National Programme on Biofuels and Law No 26,093 of 2006 to promote sustainable biofuel production and use. The law introduced a minimum 5% blending requirement for ethanol and biodiesel, encouraged investment, and provided support for farmers, small enterprises and regional economies. Decree No 109/2007 established producer registration, reference pricing and market assessment mechanisms.

Colombia: Colombia has developed a legal framework promoting bioethanol and biodiesel through tax incentives, blending regulations and technical standards. Decree No 3862 of 2005 exempted petrol–ethanol blending from industrial taxation, while Law No 939 of 2004 provided incentives for biofuel production and cultivation.

Costa Rica: Costa Rica established the National Commission on Biofuels under Decree No 33357 of 2006. The Commission coordinates governmental and stakeholder efforts, develops biofuel action plans, monitors implementation and recommends legislative reforms to strengthen the biofuel sector.

Ecuador: Ecuador established the Advisory Council on Biofuels through Decree No 2332 of 2004 to formulate policies and implement pilot projects. Its National Programme on Biofuels promoted staged adoption of ethanol and biodiesel, including pilot blending projects, while seeking to maintain competitive fuel prices.

Guatemala: Guatemala's Decree No 17-85 established a domestic ethanol market and regulated its production and pricing. It also provided tax incentives for ethanol-production equipment. Subsequently, Guatemala participated in the Central American Action Plan for Ethanol to promote sustainable regional ethanol development.

Honduras: Honduras introduced legislation to promote biofuels, energy security, employment and pollution reduction. It established a Technical Unit of Biofuels to determine blending requirements and provided tax incentives, while requiring producers receiving benefits to source a significant proportion of feedstock from local farmers.

Indonesia: Indonesia promoted biodiesel through Presidential Regulations Nos 1/2006 and 5/2006 and related measures. The government established technical standards for biodiesel and regulated the blending of fatty acid methyl ester (FAME) with diesel, while encouraging domestic production and reducing dependence on imported petroleum.

Mexico: Mexico's 2006 Law on the Promotion and Development of Bioenergy promoted biofuel production and energy independence, including a proposed minimum 10% ethanol blending requirement in petrol in urban areas. The framework also encouraged renewable-energy investment and supported projects contributing to sustainable rural development.

Nicaragua: Decree No 42-2006 promoted biofuel production to reduce petroleum imports, improve environmental conditions and strengthen rural economies. It encouraged feedstock cultivation, investment partnerships and the development of a national legal and institutional framework for renewable energy and biofuels.

Paraguay: Paraguay enacted Law No 2748 of 2005 to promote industrial biofuel production as a matter of national interest. The law encouraged local agricultural feedstock, required fuel stations to market biofuels and provided for technical standards, penalties and environmental impact assessment. Decree No 7412 of 2006 designated the Ministry of Industry and Commerce as the implementing authority.

Peru: Peru promoted biofuel development through Law No 28054 and Regulation No 013-2005-EM. The framework sought to expand the biofuel market, improve technological and human-resource capacity and encourage investment through institutions such as DEVIDA and PROBIOCOM, with emphasis on economic, social and environmental benefits.

Philippines: The Biofuels Act of 2006 established a comprehensive framework for alternative transport fuels. It mandated biofuel blending, created the National Biofuel Board and provided tax and VAT incentives. The Department of Energy was entrusted with implementing a national biofuels programme covering investment, supply infrastructure and alternative-fuel technologies.

Uruguay: Uruguay developed biofuel measures aimed at promoting alternative transport fuels, reducing dependence on imported petroleum and improving energy security. Its legislative approach emphasized biofuel production, blending and the integration of renewable fuels into

the national energy system.

Chile: Chile developed a National Policy for the Promotion of Biofuels as part of its National Energy Security Policy in 2006. The framework sought to reduce oil dependence, support agriculture and encourage biofuel blending. An expert committee was also established to develop quality standards for ethanol and biodiesel.

El Salvador: El Salvador promoted renewable energy and alternative fuels through policies aimed at reducing petroleum consumption in the transport sector. The government focused on developing a legal framework, conducting research and implementing pilot projects, particularly for domestic biodiesel production.

Panama: Panama proposed legislation to promote biofuel production and utilisation for environmental protection, energy independence and employment generation. The proposal assigned institutional responsibilities for biofuel development, encouraged agricultural feedstock cultivation and introduced related tax provisions.

Thailand: Thailand promoted ethanol and biodiesel to reduce petroleum imports and meet growing energy demand. The National Biofuels Committee coordinated government initiatives, while the Programme on Petrol sought to expand the use of ethanol-blended gasoline and encouraged investment in projects eligible under the Clean Development Mechanism.

Namibia: Namibia adopted the National Bio-Oil Energy Roadmap in 2006 to promote Jatropha cultivation and biodiesel production, particularly in the Kavango region. The initiative aimed to support local communities, develop commercial biodiesel, explore export opportunities and access carbon-credit mechanisms under the Kyoto Protocol. The National Bio-Oil Energy Committee supervised implementation.

South Africa: South Africa's White Paper on Renewable Energy, 2003, established a national framework for renewable-energy development, including biofuels. The government sought to increase renewable-energy use through financial and legal instruments, technological development and public awareness, with dedicated institutional mechanisms for biodiesel and ethanol initiatives.

1.14 Overview of Selected Countries' Legislative Initiatives

Developing countries have increasingly adopted legislative and policy measures to promote bioenergy, drawing upon international models developed in the United States, European Union and Brazil. Countries such as Argentina, Colombia and the Philippines have established comprehensive frameworks covering blending mandates, fiscal incentives, institutional mechanisms, technical standards and environmental safeguards. These experiences demonstrate that an effective bioenergy framework requires coordinated regulation of production, technology, investment, environmental protection and rural development. India's fragmented legal framework therefore highlights the need for a coherent and integrated legislative approach addressing the technical, operational, economic and environmental dimensions of bioenergy to support sustainable development and climate-change mitigation.

1.15 Conclusion

The foregoing analysis demonstrates that bioenergy has emerged as an important component of India's transition towards a sustainable, secure, and low-carbon energy system. Its capacity to convert agricultural residues, forest resources, organic waste and other biomass into electricity, heat, biogas, biomethane and biofuels provides significant opportunities for reducing fossil-fuel dependence, managing waste, supporting rural livelihoods and mitigating greenhouse-gas emissions. International developments, including the principles of sustainable development, environmental protection and renewable-energy promotion emerging from the Rio, Johannesburg and Bonn processes, together with international environmental agreements, have progressively strengthened the legal and policy foundations for sustainable bioenergy development.

The comparative examination of South American, African and Asian jurisdictions demonstrates that effective bioenergy governance requires more than isolated policy measures. Countries such as Argentina, Brazil, Colombia, the Philippines, Thailand and South Africa have adopted different combinations of blending mandates, fiscal incentives, institutional mechanisms, technical standards, sustainability requirements and environmental safeguards. These experiences indicate that clear legislative mandates, coordinated institutions, economic incentives and effective monitoring are essential for developing a stable and sustainable bioenergy sector. They also demonstrate the importance of balancing energy security and economic development with food security, biodiversity conservation, land protection and

environmental sustainability.

In India, although the National Policy on Biofuels, renewable-energy programmes, the National Mission on Bioenergy, the Green Energy Open Access framework and the Renewable Energy Certificate mechanism have contributed significantly to the development of the sector, the existing regulatory structure remains fragmented. Bioenergy is presently governed through several energy, environmental, electricity, waste-management and policy instruments administered by different authorities. Such fragmentation may result in overlapping institutional responsibilities, inconsistent implementation, regulatory uncertainty and inadequate sustainability standards. The existing framework therefore requires greater integration to address the technological, environmental, economic and social dimensions of bioenergy comprehensively.

The study further establishes the need for a stronger scientific and legal approach to bioenergy governance. Scientific and technological developments in biomass conversion, gasification, biogas, biomethane, biofuels and waste-to-energy systems must be supported by appropriate legal standards governing feedstock sustainability, land use, pollution control, waste utilisation, resource conservation and environmental compliance. Judicial decisions concerning sustainable development, environmental protection, renewable energy, pollution control and energy policy can also contribute to the development of a coherent jurisprudence for bioenergy regulation, particularly where existing legislation is inadequate or fragmented.

Accordingly, the article advocates the consideration of a **comprehensive Bioenergy Act in India** to provide an integrated statutory framework for the production, processing, conversion, transportation, distribution and utilisation of bioenergy. Such legislation should establish clear institutional responsibilities, sustainability criteria, environmental safeguards, technological and safety standards, financial incentives, research and development mechanisms, monitoring and enforcement procedures, and appropriate safeguards for food security, biodiversity and rural communities. It should also incorporate India's climate commitments and internationally recognised principles of sustainable development and circular economy.

A dedicated legal framework would provide greater certainty to farmers, producers, industries, investors, local authorities and consumers while encouraging responsible investment and technological innovation. It would also facilitate the productive utilisation of agricultural and organic waste, promote rural employment and income generation, reduce dependence on

imported fossil fuels, and strengthen India's energy security. Ultimately, the sustainable development of bioenergy requires the integration of **law, science, technology, environmental protection and socio-economic development**. A coherent and comprehensive legal framework, supported by effective institutions and judicial oversight, can enable India to realise the maximum environmental, economic, social and energy-security benefits of its substantial bioenergy potential and contribute meaningfully to its long-term objective of achieving a resilient, low-carbon and sustainable economy.

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