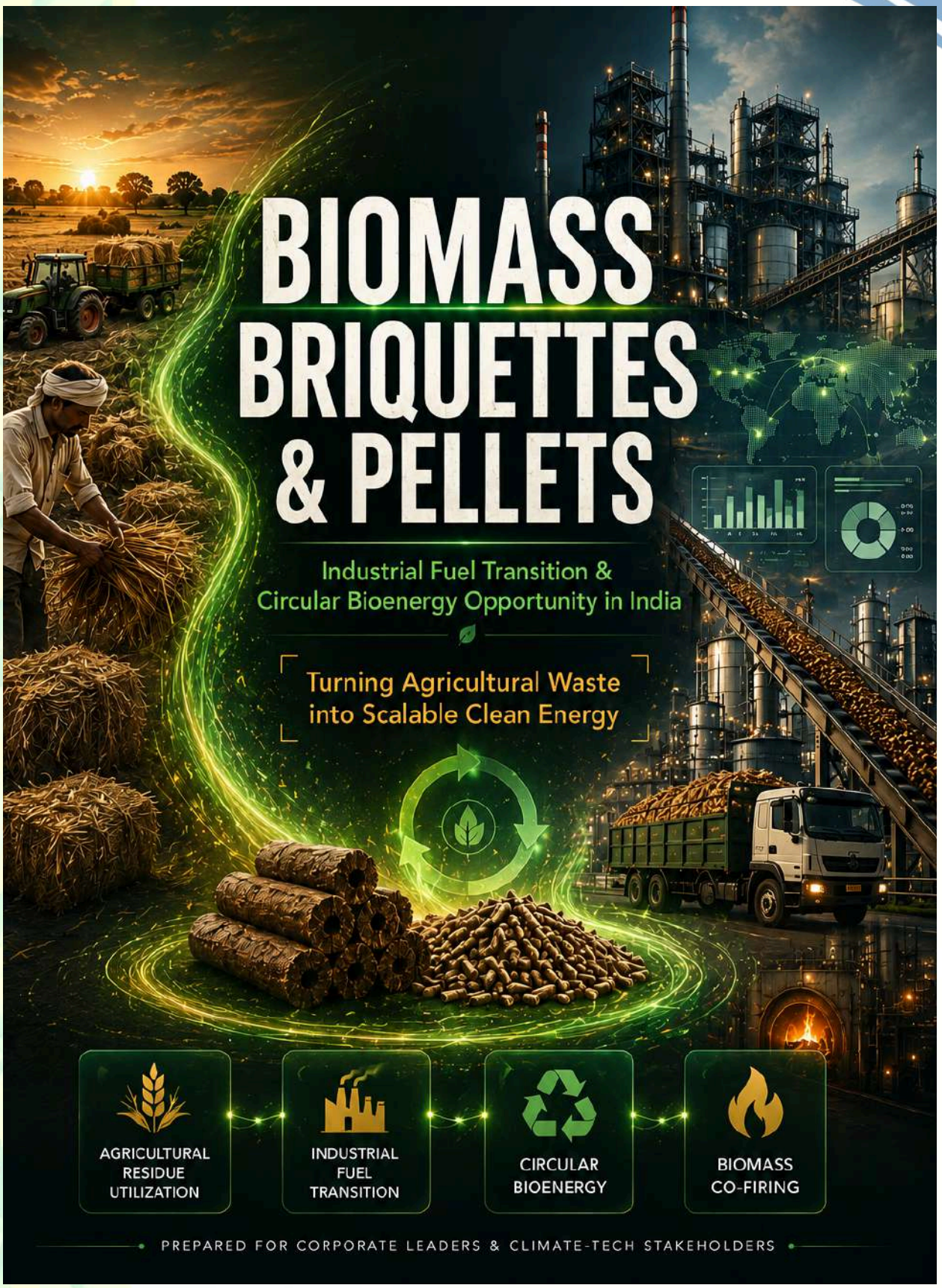
BIOMASS
BRIQUETTES
& PELLETS
Industrial Fuel Transition &
Circular Bioenergy Opportunity in India
Turning Agricultural Waste
into Scalable Clean Energy
AGRICULTURAL RESIDUE UTILIZATION
INDUSTRIAL FUEL TRANSITION
CIRCULAR BIOENERGY
BIOMASS CO-FIRING
PREPARED FOR CORPORATE LEADERS & CLIMATE-TECH STAKEHOLDERS

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Bio Energy

Biomass Briquettes & Pellets

This section provides key inputs on the Indian Biomass Briquettes & Pellets Opportunities for corporate leaders.

Highlights

- Rapidly growing demand driven by industrial fuel switching from coal/diesel to biomass under ESG pressure and air-quality regulations
- Strong policy tailwinds through mandates on co-firing in thermal plants, pollution control norms, and renewable heat incentives
- Waste-to-value opportunity converting agricultural residues into standardized commercial fuel while addressing stubble burning and rural income gaps
- Scalable distributed manufacturing model allowing cluster-based expansion with relatively low capex compared to large energy infrastructure projects

Key recommendations for corporate leaders include:

- Build reliable feedstock aggregation ecosystems via farmer partnerships and decentralized storage networks
- Standardize product quality and certification to secure industrial buyers and long-term supply contracts
- Target industrial clusters and power co-firing demand at power plants where fuel offtake is significant, concentrated and predictable
- Invest in automation and digital logistics systems to improve yield, consistency, and operating margins

Opportunity Snapshot: Biomass Briquettes & Pellets

Agri residues are converted into solid fuel replacing coal in industrial boilers

Market Signal

- **Strong demand** from cement, steel, brick kilns, and thermal plants (co-firing mandates)
- Government push for **biomass co-firing in coal plants** (5–10%)
- **Annual Market size by 2030:** 15,000 - 20,000 ₹ Cr

What Makes or Breaks It?

- **Secured feedstock supply** (FPOs/aggregators) at stable pricing
- **Proximity to demand centers** (≤100 km to reduce logistics cost)
- **Long-term industrial offtake** (cement, power plants)

Why It Matters NOW?

- Rising coal prices ; need for **cost-competitive fuel alternative**
- Immediate substitution opportunity with **minimal tech change**
- Helps address stubble burning and waste management

Well Aligned Opportunity for

- **Agri supply chain players** (FPOs, aggregators)
- **Industrial fuel suppliers and traders**
- **Local entrepreneurs near biomass clusters**

Key Challenges

- Heavy dependency on **logistics off feed stock**
- **Seasonal availability** of agri residues
- **Price volatility** when compared to coal

Business Model

- Set up plants near high-residue zones (Punjab, Haryana, UP)
- Tie-ups with industries for long-term fuel supply contracts
- Integrate aggregation + processing + distribution

Introduction and Business Case

Biomass briquettes and pellets are densified biofuels made from crop residues, sawdust, husk, shells and other agri-waste. They provide a renewable and standardised substitute for coal, diesel and furnace oil in industrial boilers, cement kilns and power plants, and also to select commercial & institutional segments like community kitchens etc.

For India, which boasts of a large amount of diverse agri residues, and where stubble burning and fossil imports remain major challenges, briquettes and pellets offer a triple win: lower emissions, reliable industrial fuel and new rural incomes.

Further, co-firing mandates in thermal plants and demand from cement and steel industries for a low carbon heating fuel make this a rapidly scalable opportunity.

Market Potential for Biomass Briquettes & Pellets in India

Year	Estimated Market Size	Key Demand Drivers
2025	₹5,000-7,000 Cr	Biomass co-firing mandates, small-scale industrial use
2030	₹15,000-20,000 Cr	Large-scale industrial substitution, carbon credits, rural clean energy
2040	₹40,000-50,000 Cr	Deep decarbonization in steel, power, cement and rural cooking

Market Segments and Applications

Segment	Applications	Business Model	Key Drivers
Utility-Scale Biomass Power	Coal replacement & baseload power	Long-term supply contracts (10–20 yrs)	Coal phase-out, renewable mandates
Coal-to-Biomass Co-firing	Partial decarbonization of coal plants	Fuel supply + performance guarantees	Fuel supply + performance guarantees
CHP & District Heating	Power + heat for cities & industry	Heat + pellet supply contracts	High efficiency, energy security
Industrial Captive Boilers	Process heat & steam	Long-term fuel supply contracts	Scope-1 emission reduction

Residential Heating (Pellets)	Space heating	Branded retail distribution	Clean heating regulations, convenience
Commercial Heating	Hotels, hospitals, campuses	Fuel + boiler O&M contracts	ESG mandates, fuel cost stability
Export-Oriented Industrial Pellets	Overseas biomass power plants	FOB/CIF export contracts	Lack of local biomass, energy security
Integrated Pellet-to-Power	Captive fuel for own plants	Vertical integration	Margin control, supply certainty
Waste & Residue-Based Pellets	Waste-to-energy & circular economy	Tipping fees + pellet sales	Waste disposal pressure
Bioenergy-as-a-Service (BaaS)	Outsourced clean energy	Long-term service contracts	Capex avoidance, ESG reporting

Typical Project Capacities & Investments Required in India

Project *Scale Categories*

Scale	Capacity	Target Market
Micro/Small	1-5 TPD	Local industry, rural stoves
Medium	10-30 TPD	MSMEs, small-scale power/brick kilns
Large	50-100+ TPD	Utility-scale biomass co-firing, exports

Capital Investment Estimates

Capacity	Briquette Plant	Pellet Plant
5 TPD	₹20-30 lakhs	₹40-50 lakhs
10-15 TPD	₹50-75 lakhs	₹80 lakhs - ₹1.2 Cr
30 TPD	₹1.5-2 Cr	₹2.5-3 Cr
100 TPD	₹4-6 Cr	₹7-10 Cr

Underlying Technologies & Processes

Pre-processing (Common to Briquettes & Pellets)

Step	Description
Raw Material Collection	Paddy straw, sawdust, bagasse, groundnut shells, cotton stalks, etc.
Chipping/Crushing	Reduces size of biomass to 5-10 mm using chippers or hammer mills
Drying	Moisture content is reduced to <12% using rotary or flash dryers
Sieving/Screening	Removes stones, metal pieces and oversized particles

Briquetting Technology

Mechanical Piston Press (Most Common in India), Screw Press & Hydraulic Press (Less Common)

Pelleting Technology

Flat Die Pellet Mill, Ring Die Pellet Mill

Key Challenges

Challenge Area	Key Issues	Business Impact	India Specific	Strategic Implications
Feedstock Supply Chain & Price Volatility	Seasonal agri-residue availability, competing uses (fodder, ethanol, biomass power), logistics costs	Raw material price fluctuations reduce margins; inconsistent supply affects production	Fragmented agriculture system; dependence on crop cycles (rice straw, mustard husk, etc.)	Develop localized sourcing networks, farmer partnerships, and long-term supply contracts
Demand Stability & Offtaker Dependence	Limited long-term contracts; demand linked to industrial fuel switching and coal co-firing policies	Revenue unpredictability impacts financing and scaling	Strong demand potential from thermal power plants (biomass co-firing), brick kilns, SMEs	Secure PPAs or fuel supply agreements with utilities and industrial users

Pricing Competition with Coal & Fossil Fuels	Biomass pellets must compete with subsidized or cheaper coal	Profitability sensitive to fuel price fluctuations	Government mandates for biomass co-firing help but enforcement varies	Position as ESG-driven solution; leverage carbon credits and policy incentives
Operational & Quality Challenges	Moisture content variation, equipment wear, inconsistent pellet/briquette quality	Increased maintenance costs; customer rejection risks	Lack of standardized quality control among smaller producers	Invest in preprocessing, drying systems, and quality certification
Logistics, Regional & Infrastructure Constraints	High transportation costs due to low energy density; limited storage infrastructure	Reduced profitability especially for long-distance transport	Biomass concentrated in certain regions (Punjab, Haryana, UP, Maharashtra)	Site plants close to feedstock sources and major industrial clusters

Prominent Players in the Indian Market

Company / Entity	Project Details
PRESPL (Punjab Renewable Energy Systems Pvt. Ltd.)	India's leading biomass supply chain company; aggregation, baling and supply of briquettes/pellets to NTPC, state GENCOs and industries.
Ecostan Biofuel	Manufactures biomass briquettes, pellets and the machinery required to produce those
NTPC Ltd.	Large-scale procurement of biomass pellets for co-firing; floated tenders for millions of tonnes annually.
Sanron Fuel	Biomass briquette & pellet manufacturer

Innovation Perspectives

Innovation	Business Opportunity	For Senior Management
Coal-to-Biomass Conversion Fuel Platforms	Long-term fuel partnerships with utilities	Coal plants need fast decarbonization
Integrated Pellet-to-Power / Fuel-to-User Models	Margin capture + fuel security	Fuel volatility is top risk

Industrial Heat-as-a-Service (HaaS)	Selling heat, not fuel	Industries avoiding capex
Residue Aggregation & Preprocessing Platforms	Multi-customer biomass supply hubs	Feedstock fragmentation
Export-Grade Pellets for Asia	Entry into high-credit Asian markets	Asia lacks domestic biomass
Waste + Biomass Hybrid Pelletization	Tipping fees + pellet sales	Waste disposal pressure
Premium Low-Ash / Low-Carbon Pellets	ESG-premium fuel segment	Carbon disclosure tightening
Decentralized Modular Pellet Plants	Rapid replication near residue hubs	Logistics is cost driver
Digital Feedstock & Quality Optimization	Predictive modeling and production optimization	Higher yield, lower rejection
Pellets as a Bio-Platform Feedstock	Entry into advanced bioeconomy	High energy density and lower carbon footprint.

Concentric & Satellite Opportunities

- Residue aggregation & preprocessing networks: FPO- and startup-led collection, drying and shredding hubs near paddy, sugarcane and sawmill belts.
- Pellet & briquette machinery manufacturing: Localised production of compact presses, grinders and dryers adapted for Indian feedstocks and moisture levels.
- Industrial fuel supply contracts: Long-term PPA-style models supplying briquettes/pellets to cement, textile and food-processing industries.
- Quality testing & certification services: Labs verifying calorific value, ash content and emissions compliance to standardise the market.
- Co-firing infrastructure at TPPs: Retrofitting and logistics services enabling 5-10% biomass co-firing in coal plants under mandated targets.
- Rural entrepreneurship clusters: Decentralised briquetting units offering local employment and income diversification for farmers.
- Innovative biomass consumer products: Satellite spin-offs using densified biomass for clean cooking stoves, BBQ fuels and heating pellets for domestic markets.

Key Takeaway for Senior Management

Takeaway	Details
Feedstock control is the primary strategic moat	• Briquette/pellet businesses are fundamentally logistics platforms, not simple manufacturing plants • Profitability depends on aggregation reliability, along with and price and quality control • ***Examples**:* baling hubs, decentralized farmer contracts, pellet storage silos, moisture-controlled warehouses • **Innovation focus:** AI-driven feedstock mapping, smart aggregation routing, quality sensors • **Competitive advantage:** proprietary biomass sourcing & logistical ecosystems create defensible supply chains competitors cannot easily copy
Quality standardization determines long-term buyer lock-in	• Industrial users demand consistent calorific value, ash content, and combustion performance • ***Sub-components**:* pellet density control, binder optimization, emissions compliance, certification frameworks • **Innovation focus:** automated quality monitoring and batch traceability • **Competitive advantage:** premium-quality suppliers secure long-term industrial contracts over price-driven competitors
Cluster-based platforms outperform isolated plants	• Economics improve when production is located near both feedstock sources and industrial demand centers • ***Examples**:* agro-industrial corridors, thermal plant co-firing zones, manufacturing clusters • **Innovation focus:** shared logistics infrastructure and regional aggregation networks • **Competitive advantage:** reduced logistics cost per ton and scalable platform deployment
Digital logistics and automation unlock hidden margins	• Transportation, drying efficiency, and inventory management materially affect IRR • ***Examples**:* automated pellet lines, IoT moisture sensors, predictive maintenance • **Innovation focus:** digital supply-chain orchestration and plant analytics • **Competitive advantage:** lower O&M cost and higher throughput than manual competitors
Industrial fuel transition is creating a structural demand shift	• ESG mandates, pollution control norms, and coal substitution policies are pushing industries toward biomass fuels • ***Examples**:* thermal co-firing mandates, industrial boiler

	conversions, green procurement standards. • **Innovation focus:** hybrid fuel systems and combustion optimization • **Competitive advantage:** early positioning as a preferred industrial fuel partner

Next Steps for Corporate Leaders

Biomass briquettes and pellets are seeing accelerated adoption as industries seek lower-carbon heat substitutes for coal, FO, HSD, and other fossil fuels without major boiler or burner modifications. Demand is being driven by industrial decarbonization commitments, co-firing policies in thermal power plants, and increasing carbon cost visibility. Supply chains continue to formalize through aggregation platforms, densification plants, and quality standardization — though seasonal agri-residue availability and logistics remain key determinants of delivered cost and reliability.

This could be an attractive climate tech opportunity for industries and firms in specific sectors and industries keen on catering to this fast growing market.

Connect with Team EAI to know more about this opportunity and take your corporate's initial steps. Send a note to consult@eai.in or talk to Muthukrishnan - 9952910083