From Stubble to Power

Mains: *GSIII –Energy Security*

Why in News?

The Union Government mandated thermal power plants to co-fire coal with biomass pellets and torrefied charcoal derived from municipal solid waste. The initiative aims to reduce stubble burning, air pollution and dependence on fossil fuels.

What is the Biomass Potential in India?

- **Surplus biomass** – India generates around 228.5 million tonnes of surplus biomass residue annually, according to the National Biomass Atlas of India.
- **Power potential** – Estimated electricity-generation capacity of 28.45 GW, nearly one-tenth of India's record peak power demand of 270.8 GW (May 2026).
- **Biomass Supply Chain**
  - **Farmers** – Supply agricultural residues after harvesting.
  - **Aggregators** – Collect and store crop residues.
  - Processors – Convert loose biomass into pellets and briquettes through densification.
  - **Transporters** – Move processed biomass to thermal power plants.
  - **Power plants** – Co-fire biomass with coal to generate electricity.

What are the Benefits of Biomass Co-firing?

- **Environmental Benefits** – Reduces open-field stubble burning, a seasonal contributor to air pollution, particularly in Delhi-NCR.
  - Reduces greenhouse gas emissions and promotes productive utilisation of agricultural waste.
  - Supports cleaner energy production through partial substitution of coal.
- **Economic Benefits** – Provides additional income opportunities for farmers through the sale of agricultural residues.
  - Reduces expenditure on field preparation and crop-residue management.
  - Promotes domestic manufacturing of biomass-processing machinery and strengthens local supply chains.
- **Employment Generation** – Creates seasonal employment for aggregators, transporters and agricultural labourers.
  - Processing plants generate skilled, semi-skilled and unskilled employment in rural areas.
- **Energy Security** – Utilises an indigenous energy resource and supports energy self-

reliance under Atmanirbhar Bharat.
    - Reduces dependence on imported fossil fuels and complements India's renewable energy transition.

What are the Challenges in Biomass Supply Chain?

- **Inadequate infrastructure** – Limited storage facilities and high moisture content affect biomass quality and processing.
- **Seasonal disruptions** – Monsoon conditions and irregular feedstock availability disrupt procurement and processing operations.
- **Last-mile connectivity** – Limited availability of local aggregators forces farmers to bear residue-management costs.
- **Financial constraints** – Low procurement prices and delayed payments discourage farmers and supply-chain participants.
- **High transportation costs** – Rising fuel costs increase the expense of transporting bulky agricultural residues.
- **Underutilised processing capacity** – Irregular supplies and uncertain market conditions prevent processing plants from operating at full capacity.
- **Gender inequality** – Women remain under-represented and are largely concentrated in administrative roles.

What is the Way Forward?

- **Long-term procurement contracts** – Establish assured supply agreements between biomass suppliers and thermal power plants to reduce market uncertainty.
- **Minimum Support Price** – Introduce remunerative prices for agricultural residues to encourage farmer participation.
- **Strengthen aggregation networks** – Ensure timely availability of local aggregators through cooperative and community-based models.
- **Improve storage infrastructure** – Develop decentralised storage facilities to maintain feedstock quality and overcome seasonal disruptions.
- **Financial support** – Ensure timely payments and provide targeted assistance to biomass-processing units.
- **Skill development** – Introduce training programmes and promote women-led enterprises across the biomass value chain.
- **Carbon credit incentives** – Integrate biomass co-firing into India's Carbon Credit Trading Scheme, subject to reliable measurement and verification of emission reductions.

What lies ahead?

- Biomass co-firing offers a convergence of energy security, environmental protection and rural economic development.
- Strengthening supply chains, ensuring remunerative prices and developing storage infrastructure can transform agricultural waste into a sustainable source of energy and livelihood.

Reference

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