

Agricultural Resource Management Through Shared Responsibility:

Combining Technology, Policy, and Community Initiatives to Reduce Transboundary SMOG Across the Indo-Pak Border Region

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INTRODUCTION & AIM

1. Each winter the Indo-Pak border region suffers dense SMOG episodes caused mainly by open-field burning of nearly 50 million tons of rice and wheat residues.
2. These fires release CO₂, CO, PM_{2.5}, PM₁₀ and black carbon, degrading air quality and visibility while causing severe respiratory illnesses across Punjab, Lahore and Delhi.
3. Despite government bans and awareness programs, farmers continue burning because affordable, practical management options remain limited.
4. This study explores shared environmental responsibility by combining technology, policy and community participation for sustainable residue utilization and SMOG reduction.

METHOD

1. Field assessment: measured residue generation and burning trends in major cropping zones.
2. Technology evaluation: tested indigenous biomass briquetting system, bio-composting and community-collection models.
3. Emission testing: analyzed flue gases from briquette combustion using Testo 350 for CO, NO_x, SO₂, CO₂.
4. Policy review: compared Indo-Pak air-quality governance and circular-economy initiatives.

RESULTS & DISCUSSION

1. Residue burning emits ≈ 20 Mt CO₂, 200 kt CO, 10 kt PM each year.
2. Briquetting converts 25–30 % of residues into dense renewable fuel (17–21 MJ kg⁻¹).
3. Bulk density increased > 10× and storage losses fell sharply.
4. Emission cuts: CO ↓ 85 %, NO_x ↓ 65 %, SO₂ minimal vs open burning.
5. Enhances rural income and energy security while cutting pollution.
6. Success depends on policy incentives, farmer–industry links and cross-border cooperation.

Figure 1: Emission Comparison (Open Burning vs Briquettes)

Emission	Open Burning (%)	Briquettes (%)
CO ₂	100	30
CO	100	15
NO _x	100	35
SO ₂	100	5
PM	100	25

CONCLUSION

1. Mitigating transboundary SMOG requires joint technological and policy action rooted in shared responsibility.
2. Turning crop residues into bio-briquettes through local innovation transforms waste into economic value.
3. Coordinated Indo Pak strategies and climate-finance support can create a circular bio-economy, delivering cleaner air and sustainable livelihoods for rural communities.

FUTURE WORK

Future work will include life cycle assessments of briquetting systems, transboundary emission inventory sharing and pilot demonstrations under regional climate cooperation.

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