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New sustainable bioenergy value chain using rice straw in India to avoid open burning

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CONTEXT

- An estimated **500 Mt of crop residues** are generated annually across India
- **Residues from many crop are burnt across India.** In the north of India, straw from rice and wheat is a major challenge
- While wheat straw is largely used as animal feed, rice straw is burnt as a way to quickly and cheaply dispose them off (only 20 days between two cropping seasons).
- Around **39 million tonnes of rice straw** is burnt in Haryana, Punjab, Rajasthan and Uttar Pradesh
- In **PUNJAB alone, around 15.4 million tonnes** of rice straw is burnt in the fields

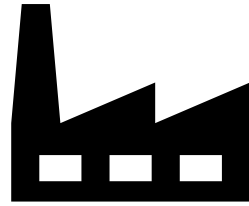
→ damaging soil & increasing pollution



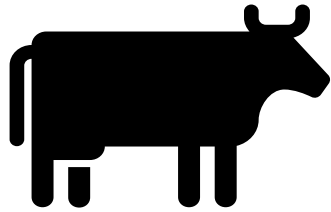


CROP RESIDUES ARE A VALUABLE RESOURCE

Ex-Situ Uses



- Chemicals
- Paper
- Compressed boards
- Charcoal
- Other industrial products



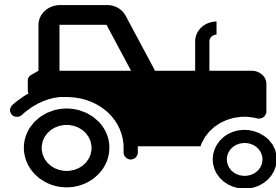
- Feed
- Bedding

In-Situ Uses



- Energy (e.g. thermal power plants, CHP, 2G Ethanol)

- Composting
- Mushroom production
- Other local applications



- Mulch
- Happy seeder



CHALLENGE

1. While the broad policy framework is in place (Happy seeder subsidy ,Electricity, BioCNG, Ethanol, Briquettes etc.), **burning continues.**
2. For ex-situ uses, the challenge is the **short time frame between the 2 cropping seasons** (around 3 weeks) to collect, mobilize and store the residue for industrial uses
→ **Lack of value chain**

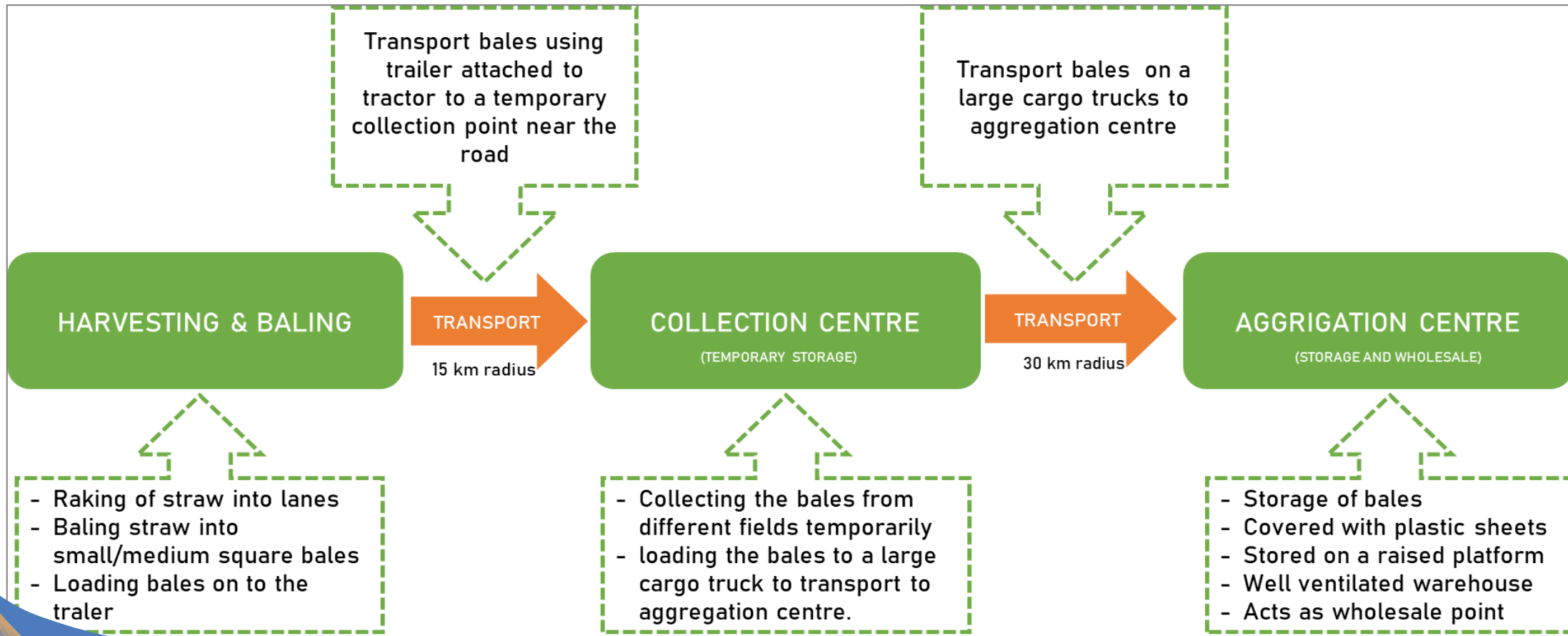
WHAT'S NEEDED TO TAKE OUT THE BEST FROM THIS OPPORTUNITY

1. Provide strong incentives to farmers to stop burning
2. Develop a supply chain for crop residues for ex-situ uses
3. Increase awareness that residue is a resource not a waste



PROPOSED VALUE CHAIN STRUCTURE -

Collecting rice straw with in the 20 days available between rice harvest and wheat sowing



INVESTMENT REQUIRED IN PUNJAB (using 30% available rice straw)

District	Aggregation centres (Crore)	Tractors (Crore)	Balers (Crore)	Rakers (Crore)	Trailers (Crore)	Trucks (Crore)	Total Investment required (Crore)	Total Investment required (Million USD)
Amritsar	₹ 29	₹ 13	₹ 51	₹ 10	₹ 3	₹ 10	₹ 117	\$16
Barnala	₹ 28	₹ 8	₹ 32	₹ 6	₹ 2	₹ 10	₹ 86	\$12
Bathinda	₹ 38	₹ 13	₹ 49	₹ 9	₹ 3	₹ 13	₹ 126	\$18
Faridkot	₹ 22	₹ 8	₹ 32	₹ 6	₹ 2	₹ 8	₹ 79	\$11
Fatehgarh Sahib	₹ 19	₹ 6	₹ 24	₹ 5	₹ 2	₹ 7	₹ 63	\$9
Fazilka	₹ 18	₹ 8	₹ 32	₹ 6	₹ 2	₹ 6	₹ 73	\$10
Firozpur	₹ 38	₹ 14	₹ 52	₹ 10	₹ 3	₹ 13	₹ 131	\$18
Gurdaspur	₹ 32	₹ 13	₹ 48	₹ 9	₹ 3	₹ 11	₹ 116	\$16
Hoshiarpur	₹ 15	₹ 6	₹ 22	₹ 4	₹ 1	₹ 5	₹ 54	\$8
Jalandhar	₹ 37	₹ 13	₹ 49	₹ 9	₹ 3	₹ 13	₹ 124	\$17
Kapurthala	₹ 24	₹ 9	₹ 33	₹ 6	₹ 2	₹ 8	₹ 81	\$11
Ludhiana	₹ 59	₹ 19	₹ 72	₹ 14	₹ 5	₹ 20	₹ 188	\$26
Mansa	₹ 27	₹ 9	₹ 34	₹ 6	₹ 2	₹ 9	₹ 87	\$12
Moga	₹ 43	₹ 13	₹ 51	₹ 10	₹ 3	₹ 15	₹ 134	\$19
Mohali	₹ 5	₹ 2	₹ 8	₹ 1	₹ 1	₹ 2	₹ 18	\$3
Muktsar	₹ 38	₹ 13	₹ 51	₹ 10	₹ 3	₹ 13	₹ 128	\$18
Pathankot	₹ 5	₹ 2	₹ 8	₹ 1	₹ 1	₹ 2	₹ 19	\$3
Patiala	₹ 49	₹ 17	₹ 65	₹ 12	₹ 4	₹ 16	₹ 164	\$23
Rupnagar	₹ 7	₹ 3	₹ 11	₹ 2	₹ 1	₹ 3	₹ 27	\$4
Sangrur	₹ 71	₹ 21	₹ 81	₹ 15	₹ 5	₹ 24	₹ 218	\$31
Shahid Bhagat Singh Nagar	₹ 13	₹ 5	₹ 17	₹ 3	₹ 1	₹ 4	₹ 43	\$6
Tarn Taran	₹ 35	₹ 13	₹ 51	₹ 10	₹ 3	₹ 12	₹ 125	\$18
Total							₹ 2,201	\$309

NATIONAL TARGETS

→ RICE STRAW (even just 30% use) CAN CONTRIBUTE TO REACH THESE TARGETS → in PUNJAB

Pellets

- NTPC (National Thermal Power Company) is India's largest coal consumer power producer.
- NTPC aims to use pellets made from biomass to co-fire with coal
- **National Target – 5 million tonnes of pellets** are expected to be used per year

Ethanol

India Ethanol blending program

- Aims to achieve E20 by 2025
- Both 1G and 2G ethanol envisaged
- Multiple feedstock expected to be utilized
- Need to produce around **9 billion litres** to reach the E20 target by 2025.

Compressed Biogas

- Sustainable Alternative Towards Affordable Transportation (SATAT) scheme aims to increase production of compressed biogas in the country as transport fuel
- Planned to roll out **5 000 CBG plants** by 2024
- The target is set to produce **15 million tonnes of CBG per year**



PELLETS in Punjab - technical potential

Biomass

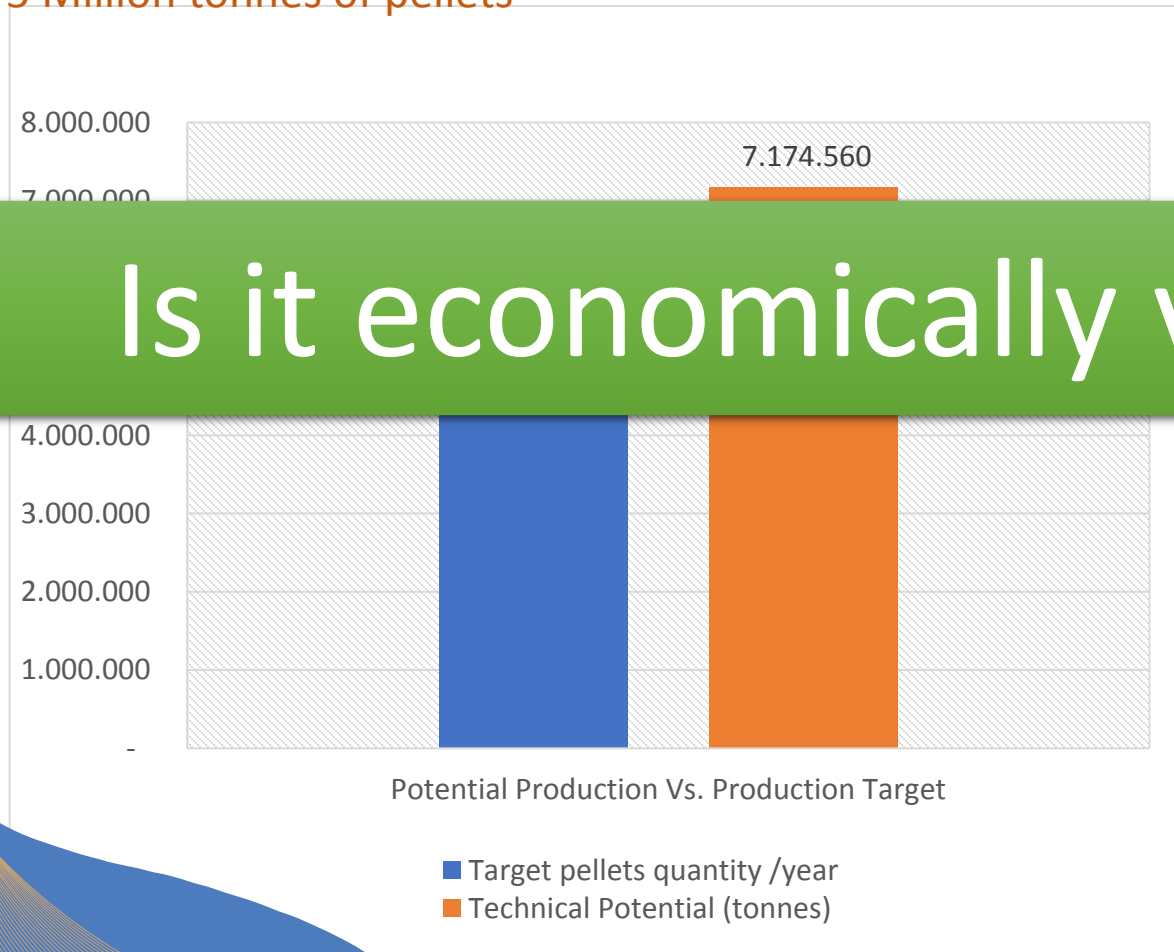
Pre-treatment

Pelletizing

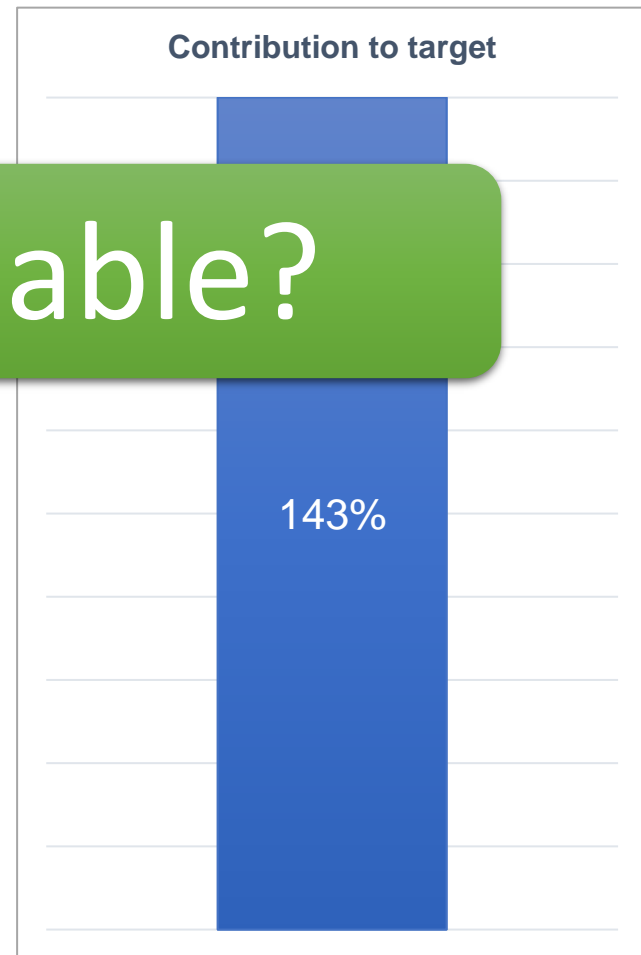
Packaging

Final use

Target - 5 Million tonnes of pellets



Is it economically viable?



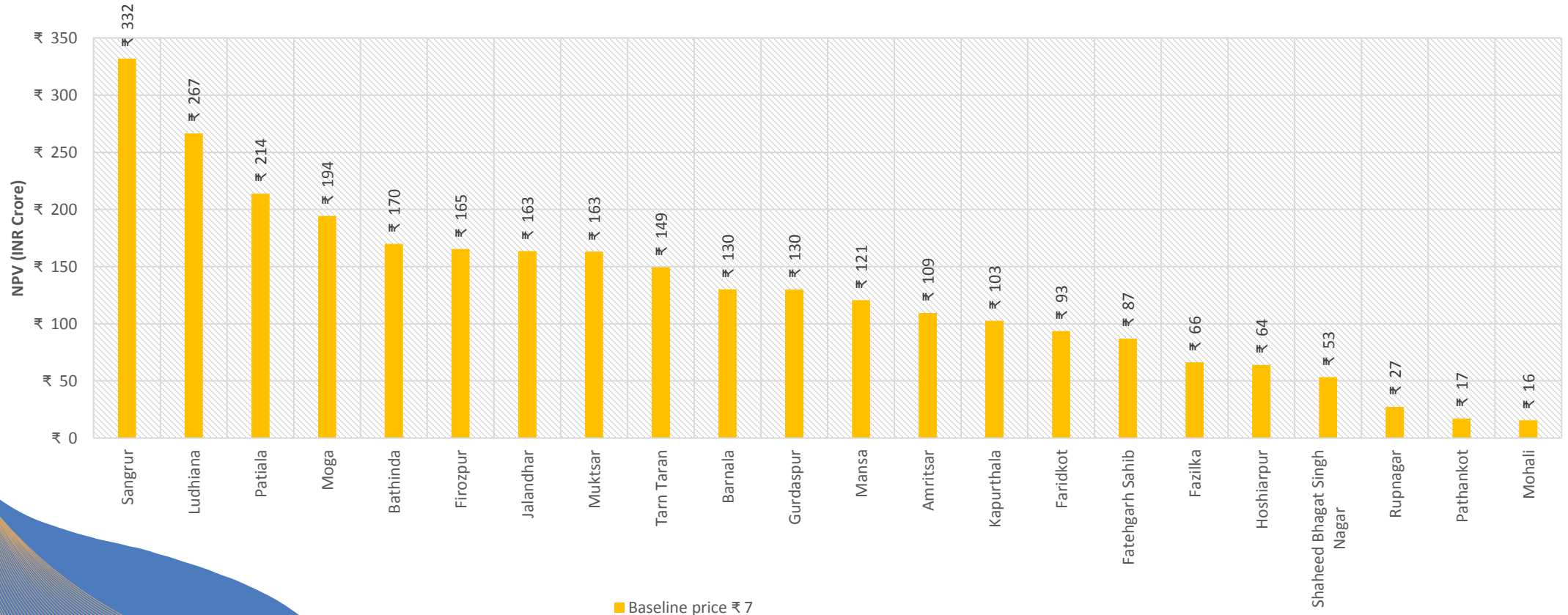
→ Using just 30% rice straw available



PELLETS in Punjab - economic viability

→ At current level pellets production is **profitable** in all districts of Punjab (production costs vs average market/selling price).

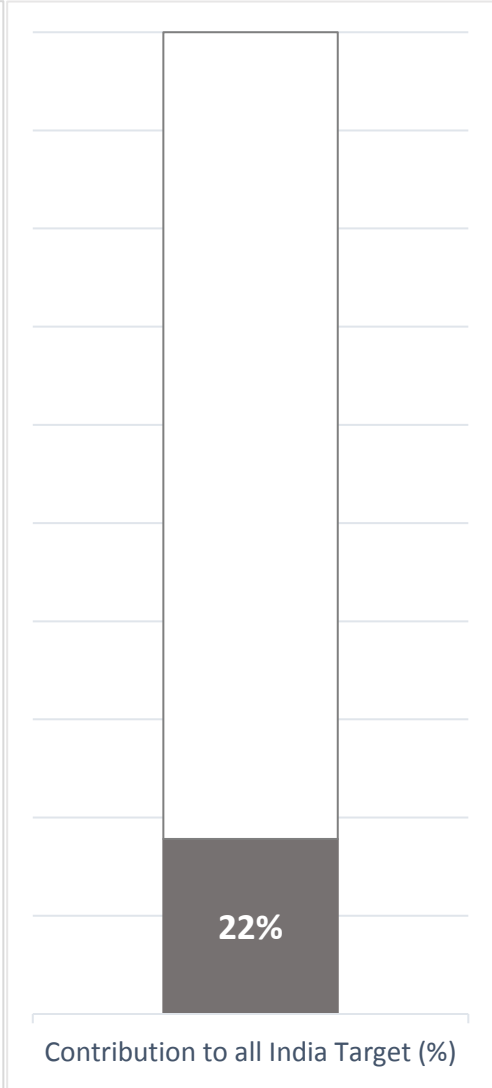
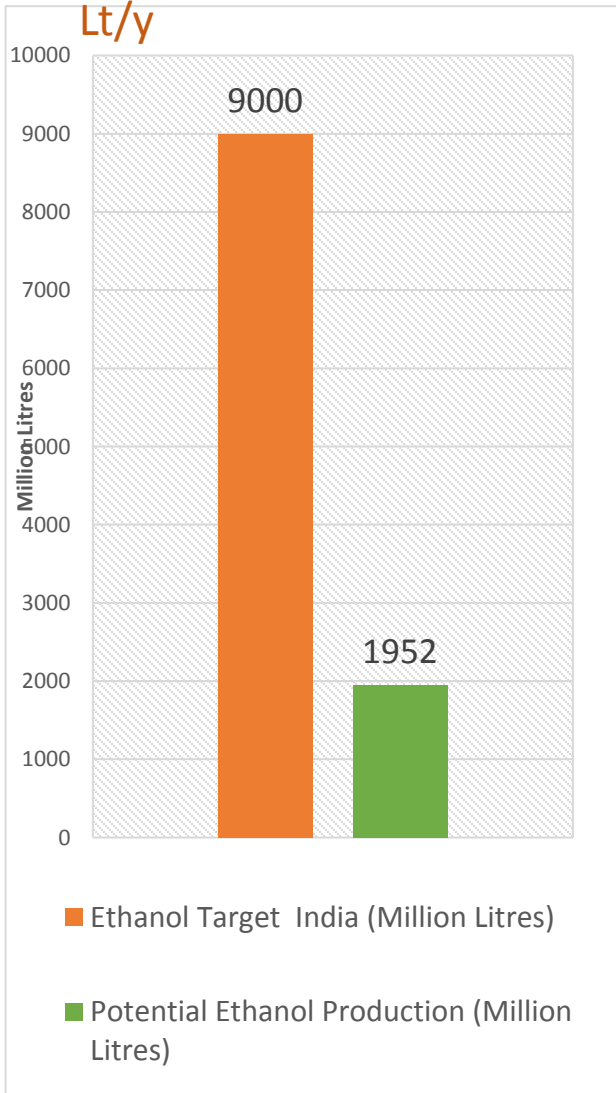
Profitability connected to rice straw availability.



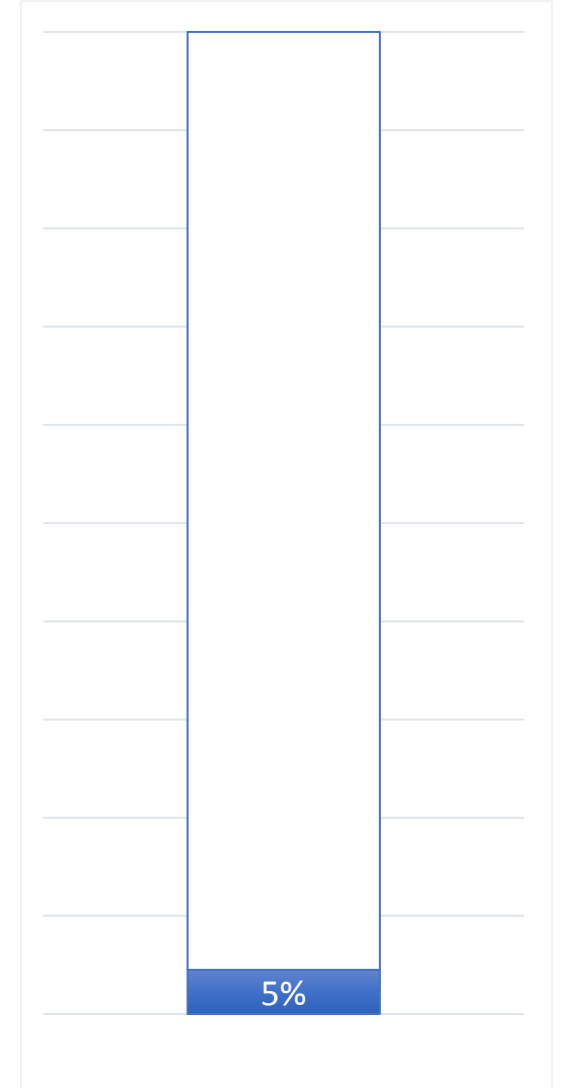
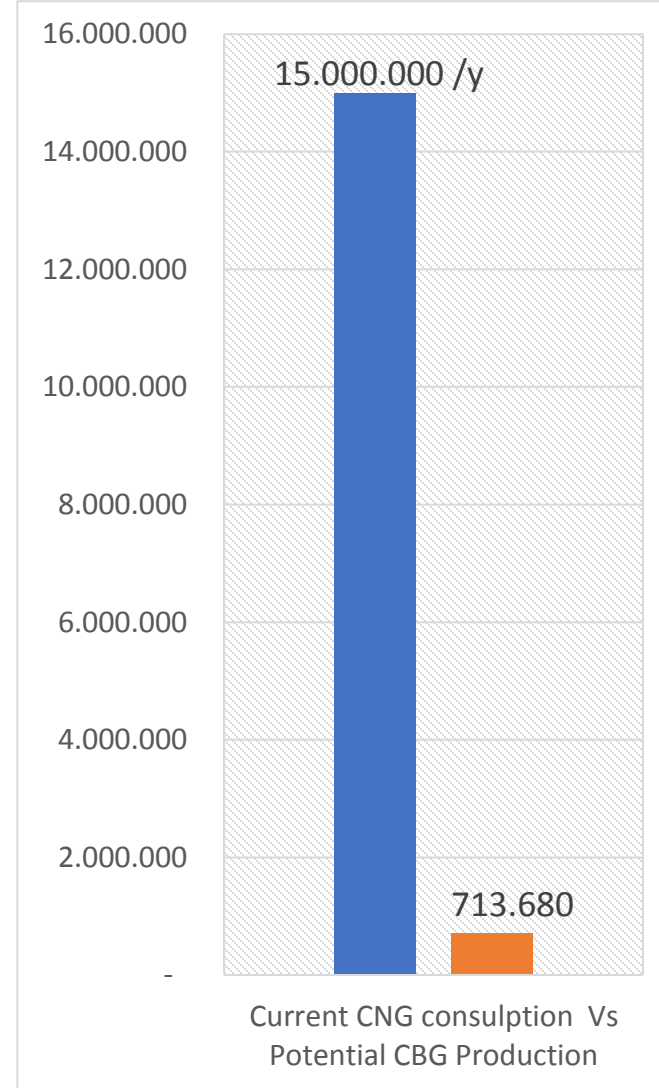


2G ETHANOL and CBG in Punjab - Technical potential

2G Ethanol – E20 Blending target by 2025 – 9 bl



CBG target production (SATAT) 15 ml tonnes/y

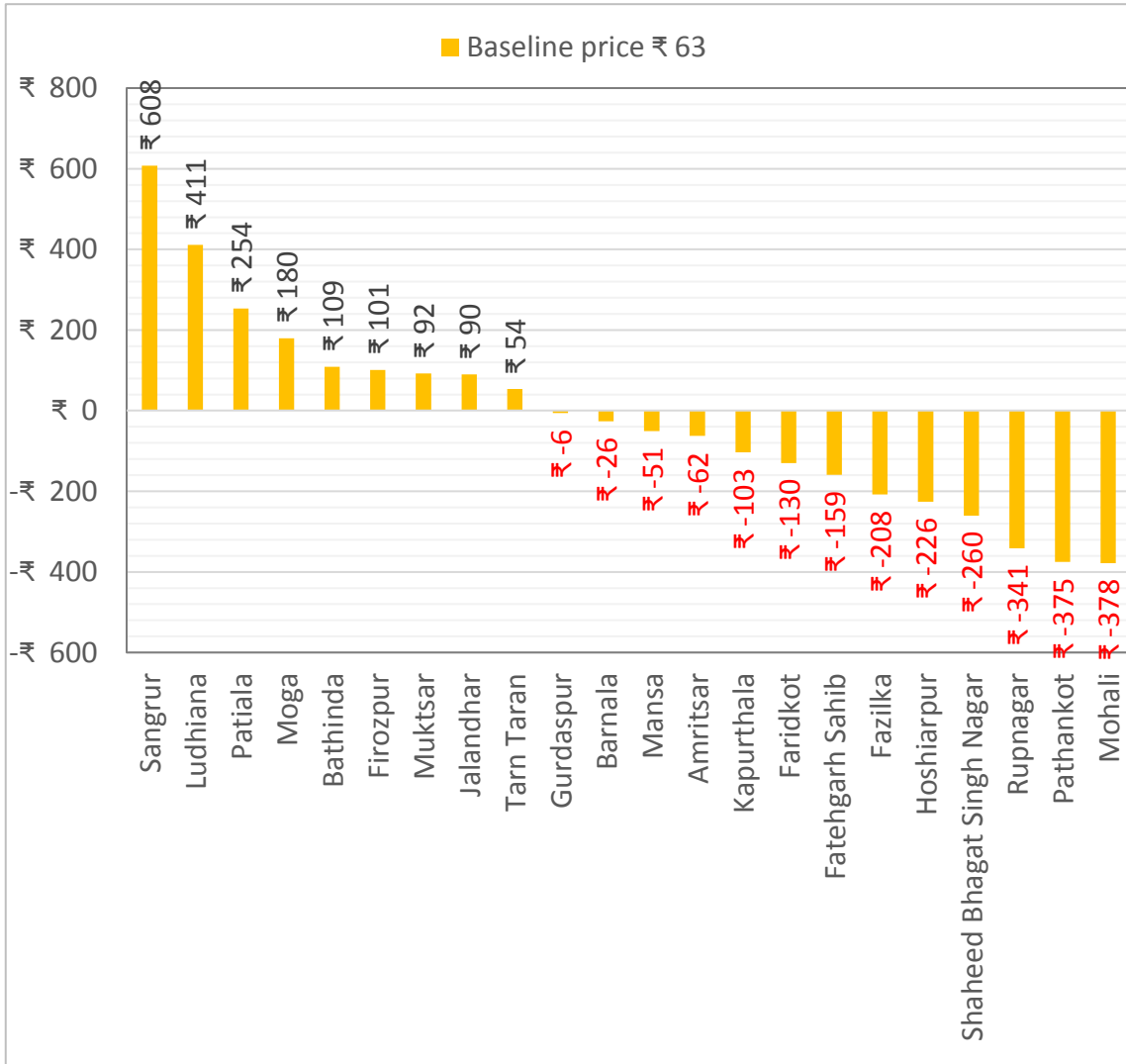


→ Using just 30% rice straw available

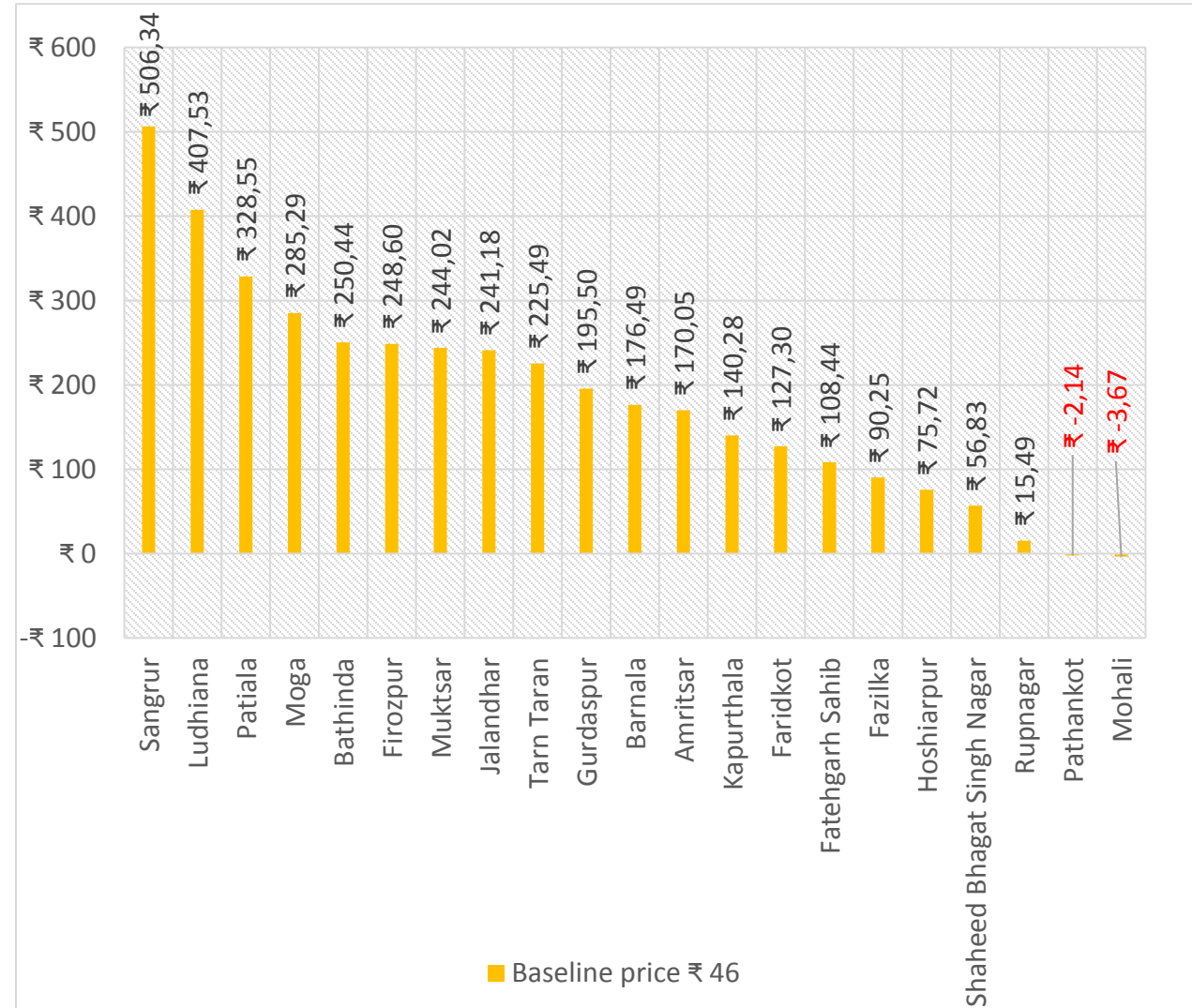


2G ETHANOL and CBG in Punjab - Economic viability

At current level – 2G ethanol is only profitable in a few districts.



At current level – CBG is profitable in most districts.





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OUR WORK IN INDIA IN A VIDEO





CONCLUSIONS

- Specific energy technologies that can use crop residues seem viable.
- There is a need to develop infrastructure to collect and store crop residues → need to develop value chain
- Need to raise awareness of farmers - rice straw is not a waste but a resource and opportunity to diversify farmer incomes
 - Developing related value chains is the key



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Thank you



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PRODUCTION**



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NUTRITION**



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