Harvesting Value from Agricultural Waste

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Problem & Opportunity:
More than US $120 billion/year of crop & forest residues is burned in the open worldwide

Between October 20 and November 14 this year, Delhi’s Air Quality Index (AQI) had been in the severe zone (401-500) on seven days. On each of these days, the contribution of farm fires to Delhi’s PM 2.5 contribution was between 26%-48%. (TOI, 2021)
Our Solution

Low-cost, small-scale, portable systems to “upgrade” crop residues at source

- Latched onto tractors, trailers, or shipping containers
- Requires no external heat/fuel (auto-thermal)
- 3 pending patents, published in leading journals
- Using the process of torrefaction

Loose, bulky and wet crop residues:

Upgraded, dense, carbon rich feedstock

Enabling new markets and lowering logistics & processing costs by up to 75%
Can be powered by batteries/solar panels
Pollution control

Our technology reduces particulate matter, volatile matter and CO emissions by >95% (Kung, 2017) as compared to open burning of crop residues.
Our design simplifies the reactor and makes it flexible

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Status Quo</th>
<th>Takachar system</th>
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</thead>
<tbody>
<tr>
<td>Gas reactant</td>
<td>Heated special gases</td>
<td>Room temperature air</td>
</tr>
<tr>
<td>Gas handling</td>
<td>Scrubbing, drying</td>
<td>None</td>
</tr>
<tr>
<td>Minimum feasible scale</td>
<td>100+ tons/day</td>
<td>5 tons/day</td>
</tr>
<tr>
<td>Minimum viable cost</td>
<td>US $ 500,000+</td>
<td>US $ 10,000</td>
</tr>
<tr>
<td>Biomass input flexibility</td>
<td>Specific</td>
<td>All kinds of crop residues</td>
</tr>
<tr>
<td>Output characteristics</td>
<td>Specific</td>
<td>Process-controlled as per end use application</td>
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</tbody>
</table>
The biomass agenda

Biomass and its uses are diverse. Takachar’s technology provides bio-based raw materials for a wide variety of industries.

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Takachar connects farmer groups to carbon markets worldwide

Customer segment: Farmer group/agri-processing unit

Farmers

50 tons @ $20
10 tons @ $180
3 tons @ $120
90 tons @ $60

Off-take carbon markets

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Fertilizer opportunity: The Problem

Farmers in Africa/Asia pay 2-3 times the price of world fertilizers, due to logistics cost of importation or the local governments have to heavily subsidize fertilizers.
Fertilizer production today is incompatible with rural farming.

Fertilizer production
- Large-scale
- Centralized
- Logistically complex
- One-size-fits-all

Rural challenges
- Expensive
- Uncustomisable
- Soil degradation
- Food insecurity
We use technology to decentralize and downsize the fertilizer production process, making it feasible to implement localized fertilizer production in rural villages.
Conversion Process

Overall process: 2 hours

1. Collect
   - 2 kg of crop residues (rice husks, bagasse, coconut shells, etc.)

2. Torrefy
   - 250-400°C, 5-30 minutes, oxygen-lean conditions

3. Collect
   - 1-2 mm particle size

4. Mix
   - Nutrient recipes
   - Around 0.1-0.2 kg of nutrient additive (compost, urea, etc.)

5. Package
   - 1 kg of final product; retailed at around $220/ton

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Miniplant Model

Smallholder farmer

Proprietary nutrient recipe blend

Profit margin: ~40%

Distributors/“agrovets”

Improved yield & soil health, 50-100% reduction in chemical fertilizer usage

Voluntary carbon market

370 kg/acre/season CO₂-e removed

730 kg/acre/season CO₂-e avoided

MiniPlant operation

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• Solving for logistics of residue management is key
Integrating with existing farming practices
Integrating with existing farming practices
Value Proposition

At the same price that farmers pay for their fertilizer inputs per season per hectare:

- We increase their yields on average by 27%
- We increase their net income by up to 50%
Carbon removal and climate justice

By sequestering carbon-rich fertilizer blend into the soil, we have potential to remove ~2.4 GT/year CO$_2$e. By reducing open-air biomass burning and chemical manufacturing/transportation, we avoid ~5.6 GT/year CO$_2$e. Furthermore, our real-time control system uniquely advances climate justice by enabling rural, underserved communities verify and earn carbon credits for the first time.
Pilot’s Actual Impact to Date

- 10,000 farmers
- US $ 800,000 added rural livelihood
- 9,000 tonnes waste recycled
- 11,000 tonnes CO₂-e removed
We serve biomass generators and consumers worldwide

Forestry residues

Mitigation of 1 billion tons of CO₂ equivalent and 75,000 tons of particulate matter per year

$3 billion/year (U.S.)

Biofuels

$168 billion/year, 5% growth

Agricultural residues

$2 trillion/year, 2% growth

Biomass based solid fuel

Fertilizer

Biofuels

Other chemicals

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