Objective: Commercialize the process of silica sand (bio-silica) extraction from rice husk food waste. 50 GWh/year of energy will be recovered from this process via its gasifier hot flue gas and used to achieve plant self-sufficiency.

**Plant Capacity:** 15,460 tonnes/yr of Silica

**Novelty**

1. Fluidized bed Gasifier Reactor: Large throughput compared to industry average
2. Silica Extraction process: Developed from a lab-scale paper
3. Multi-Effect Evaporator: Used for intermediate product recovery and re-use

**Social Need**

- Respond to Silica Sand deposit shortage, and slow the global rise in Illegal Sand Mining.
- Re-purpose Agricultural Biowaste in high rice-producing countries.
- Uses in Agrochemical, Food and Rubber Industries due to high chemical stability, absorption capacity, and anti-caking properties.

**Environmental Assessment**

- Solid
  - 2500 kg/hr of soda ash solution at pH 11
  - Reduce to pH 6 - pH 9 according to global IFC standard
  - Recover soda ash and reuse wash water

- Liquid
  - 1 tonne/day of tar extracted from the gasifier
  - Sell as water-repellent coating for boats, ships, and roofs
  - 2,000 tonnes/yr of CO2 release.

**Economics**

- **$750/tonne Silica**
  - **Silica** $11.5M
  - **Electricity** $3M+
  - **REVENUE** $14.5M

- **Profit**: $6M/year
- **IRR**: 16.9%
- **NPV**: $47M
- **PAYBACK**: 5 years

**Plant Layout**

- Plant Size: 100m x 166m

- **Legend**
  - Office
  - Warehouse
  - Energy Generation
  - Gas Cleaning
  - Silica Extraction
  - Rice Farm
  - BioSilica Storage
  - QA/QC
  - Fire Station
  - Control Room
  - Master Point

**Introduction**

- **Process**
  - Rice Husk
  - Gasification
  - Gas Cleaning
  - Silica Extraction
  - Silica Purification
  - Energy Generation
  - Electricity

**Bio-Silica Production and Energy Recovery from Rice Husk Waste**

- **Group P2 - Aidan Kiel, Adib Zakwan Zakaria, Bashirah Salami, Clive Indrawan, Fortune Komolafe, Joya Yamagishi, Sam Oladoyinbo**
- **Department of Chemical & Biological Engineering**

- **Bio-Silica Uses in Agrochemical, Food and Rubber Industries**
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