

1. **Title of grant:** Combined Heat and Power Stage 1 Development Plan OPP1139950
2. **Subtitle (more descriptive title):** To support the development of an off-grid resource recovery technology solution and institutional framework to refine septage and fecal sludge from non-sewered toilets for pathogen free treatment and reuse.
3. **Name of lead organization:** Biomass Controls, LLC
4. **Primary contact at lead organization:** Jeffrey Hallowell, Founder & CEO, jeff@biomasscontrols.com
5. **Grantee location:** Putnam, Connecticut, United States of America
6. **Developing country where the research is being or will be tested:** India (India initially, with various Africa countries later)
7. **Start and end date:** 12 November 2015 – 31 March 2016
8. **Grant type:** Reinvent the Toilet Challenge
9. **Grant size:** USD 150,000.00

<https://www.gatesfoundation.org/How-We-Work/Quick-Links/GrantsDatabase/Grants/2015/11/OPP1139950>

10. **Short description of the project:** Under this proposal, Biomass Controls, LLC (Biomass Controls) of Putnam, CT would explore and develop micro-combined heat and power (mCHP) technology for off-grid resource recovery of human feces and/or other biogenic materials. This work shall be, initially, in conjunction with the Biomass Controls Biogenic Refinery being presently operated in India and the United States. Biomass Controls shall investigate available thermal power generator technologies, develop metrics for determining compatibility to the energy balance, and finally work to integrate selected technologies into the Biogenic Refinery. Being a condition of the sustainable sanitation solution that it operates off-grid, Biomass Controls has already explored several options for power generation with biogenic fuels.

In 2013, under the Bill and Melinda Gate's Foundation Re-Invent the Toilet Challenge a transportable system for the drying and refining of human solid feces to thermal energy and granulated carbon (biochar) was developed using control technology from Biomass Control's and components from AgFuel Energy Systems. This first prototype did not include a self-sustaining power solution that will be required for installation in locations such as Africa. The Biogenic Refinery project would be more widely adaptable if it contained a power solution to operate in rural areas where energy from fossil fuels is not financially feasible.

Goal(s): Identify technologies that can use thermal energy from fecal sludge to generate electrical power under 1 MW.

11. Objectives:

To develop a system that can power an appliance for sanitation in areas where electricity is not available or economically feasible, such as Africa or India, thus enabling self-sustaining technologies for use by the poor in the developing world. The

power system will be fed either directly from fecal waste or the product of a fecal waste processing system.

- 12. Research or implementation partners:** Tide Technocrats, Bengaluru, India
- 13. Links, further readings – results to date:** <https://www.biomasscontrols.com/projects>
- 14. Current state of affairs:** Demonstrations are underway, with further iterative development ongoing. Framework for management of faecal sludges is in development with several partners in different areas of the sanitation service delivery chain.
- 15. Biggest successes so far:** Successful demonstration of the Biogenic Refineries has met all KPIs, and the demonstration has been expanded to three more provinces in India.
- 16. Main challenges / frustration:** Development of standards which will govern the compliance of FSPs.