CLAIMS

1. A multifunctional wet waste processing system for generating electricity and clean water generation, comprising:

a sludge dryer assembly having a waste path with a sludge inlet configured to receive wet sludge comprising a mixture of water and solid waste material, the sludge dryer assembly having a drying portion configured to dry the sludge and separate at least some of the water from the solid waste material to provide dried solid fuel, the sludge dryer assembly having a first water outlet, a dry waste outlet, and a condenser portion having a fluid path with a fluid inlet and a first fluid outlet, the fluid path being isolated from the waste path;

a clean water collection system coupled to the first water outlet and configured to collect the separated water from the sludge;

a dry waste combustor assembly coupled to the dry waste outlet of the sludge dryer assembly, the dry waste combustor assembly having a combustion portion that receives the solid fuel from the dry waste outlet and burns the solid fuel and generates heat, and the dry waste combustor assembly having a boiler heated by the heat from the combustion portion burning the solid fuel, the boiler having a first water inlet and a first steam outlet;

a steam-powered generator coupled to the first steam outlet of the boiler and configured to generate electricity, the generator having a second fluid outlet coupled to the fluid inlet of the condenser portion; and

a water pump having a second water inlet coupled to the fluid outlet of the condenser portion, wherein the water pump is coupled to the first water inlet and wherein the boiler is configured to convert a flow of water entering the boiler to a flow of steam to power the steam-powered generator.

2. The system of claim 1 wherein the drying portion of the sludge dryer assembly comprises a steam-heated auger in the waste path and configured to move and heat the sludge during the drying process.

3. The system of claim 1 wherein the waste dryer assembly is a multi-segment dryer having sequential first and second dryer segments each coupled to the condenser portion and each configured to dry the sludge by vaporizing water from the sludge using heat from exhaust steam from the steam-powered generator.

4. The system of claim 3 wherein the first dryer segment generates first dryer water from water separated from the sludge, and the second dryer segment has a first water carrier portion coupled to the first dryer segment and configured to carry the first dryer water adjacent to and isolated from the sludge in the second dryer segment, and the second dryer segment having a second water carrier portion isolated from the first water carrier portion and configured to carry the exhaust steam from the steam-powered generator adjacent to the sludge, wherein heat from the first and second water carrier portions dries the sludge moving therein.

5. The system of claim 1 wherein the waste dryer assembly is configured to receive in the condenser portion exhaust steam from the steam-powered generator, the drying portion having a first segment connected to the sludge inlet and has a first heater portion coupled to the condenser and configured to vaporize a first portion of the water from the sludge with heat from the exhaust steam, and a second dryer segment connected in series to the first dryer segment and configured to vaporize a second portion of the water from thickened sludge received from the first dryer segment with heat from the exhaust steam.

6. A method of processing wet sludge with a multifunctional waste processing system for electricity and clean generation, comprising:

directing a flow of wet organic-based sludge to an inlet of a fuel path of a fuel dryer assembly, wherein the sludge comprises a mixture of water and solid fuel material,

directing the flow of sludge along the fuel path through a heater portion of the fuel dryer assembly and boiling the wet fecal sludge and thermally separating the water from the solid fuel material to provide dried fuel, the fuel dryer having a first steam outlet, a dry fuel outlet;

condensing in a condenser steam liberated from the wet fecal sludge, wherein the condenser has a fresh water condenser assembly coupled to the first steam outlet and configured to condense the steam liberated from the wet fecal sludge for use as potable water;

receiving in a dry fuel combustor assembly dried fuel the dry fuel outlet of the fuel dryer assembly, the dry fuel combustor assembly having a combustor portion and having a boiler configured to receive heat from the combustor portion, the boiler having a water inlet and a second steam outlet;

directing steam from the boiler to a steam inlet of a fluid path of a condenser portion of the fuel dryer assembly, wherein the fluid path through the condenser is isolated from the fuel path and has a fluid outlet;

combusting the dried fuel in the combustor portion to generate heat that boils water in the boiler to generate steam;

generating electricity with a steam powered generator via the steam received from the second steam outlet of the boiler, the steam powered generator having a third steam outlet coupled to the steam inlet of the condenser portion;

directing the condensed steam from the fresh water condenser assembly through a water treatment system that receives the condensed steam in either vapor phase or liquid phase or both, wherein the condensed steam as liquid water is passed through a purifier and filter to provide the potable water; and

pumping with a water pump a flow of water from the fluid outlet of the condenser portion of the fuel dryer; wherein the flow of water is pumped from a water outlet of the water pump to the water inlet of the boiler;

wherein the boiler converts a flow of water entering the boiler to a flow of steam to power the steam-powered generator.

7. The method of claim 6, further comprising moving and heating the sludge in the fuel dryer with a steam heated auger in the fuel carrier during the drying process.

8. The method of claim 6 wherein the fuel dryer is a two-stage dryer having sequential first and second dryer stages each coupled to the condenser portion and the sludge in each of the first and second dryer stages is dried by evaporating water from the fecal sludge using heat from exhaust steam from the steam-powered generator.

9. The method of claim 8, further comprising generating with the first dryer stage sludge steam from the fecal sludge, and using in the second dryer stage the sludge steam from the first dryer stage to dry the sludge.

10. The method of claim 8 wherein the first dryer stage generates first dryer steam from water evaporation from the fecal sludge, and the second dryer stage has a first steam carrier portion coupled to the first dryer stage and the first steam carrier portion carries the first dryer steam adjacent to the fecal sludge, and the second dryer stage has a second steam carrier portion isolated from the first steam carrier portion and the second steam carrier portion carries the exhaust steam from the steam-powered generator adjacent to the fecal sludge, wherein heat from the first and second steam carrier portions dries the fecal sludge moving therein.

11. The method of claim 6, further comprising receiving in the condenser portion of the fuel dryer assembly exhaust steam from the steam-powered generator, and the fuel dryer has a first dryer stage connected to the fuel inlet and has a first heater portion coupled to the condenser and the first heater portion evaporates a first portion of the water from the fecal sludge with heat from the exhaust steam, and a second dryer stage

is connected to the first dryer stage and the second dryer stage evaporates a second portion of the water from thickened fecal sludge received from the first dryer stage with heat from the exhaust steam.

12. The method of claim 6 wherein the condenser of the fuel dryer assembly receives exhaust steam from the steam powered generator through the first steam inlet, and the fuel dryer assembly having a single stage dryer portion connected to the fuel inlet and adjacent to the condenser portion, the single stage dryer portion evaporates water from the fecal sludge using the heat from the exhaust steam in the condenser.

13. The method of claim 6 wherein the combustor portion is a fluidized bed combustor assembly.

14. The method of claim 6 wherein generating electricity includes generating electricity with a single action, liquid cooled steam engine.