

WHAT IS CLAIMED IS:

1. A fuel production system comprising:
a first modular unit comprising:
a first housing;
a process vessel;
an agitator rotor assembly passing through the process vessel;
a first drivetrain coupled to the agitator rotor assembly and configured to rotate the agitator rotor assembly;
an extrusion screw passing through the process vessel;
a second drivetrain coupled to the extrusion screw and configured to rotate the extrusion screw;
a first separation vessel in fluid communication with the process vessel; and
a product shaping system,
wherein at least a portion of each of the process vessel, the agitator rotor assembly, the first drivetrain, the extrusion screw, the second drivetrain, the first separation vessel, and the product shaping system are contained in the first housing;
and
a second modular unit configured to be coupled to the first modular unit, the second modular unit comprising:
a second housing;
a thermal fluid heater system configured to be in fluid communication with the process vessel;
a condenser configured to be in fluid communication with the first separation vessel;
a second separation vessel in fluid communication with the condenser; and
a vacuum pump in fluid communication with the second separation vessel,
wherein at least a portion of each of the thermal fluid heater system, the condenser, the second separation vessel, and the vacuum pump are contained in the second housing.
2. The system of claim 1, wherein the thermal fluid heater system comprises an expansion tank, a heater, a deaerator, and a conduit system.
3. The system of claim 2, wherein the expansion tank is configured to contain a gas and a

thermal fluid.

4. The system of claim 1, wherein the vacuum pump is configured to move fluid from the process vessel to the first separation vessel, move fluid from the first separation vessel to the condenser, move fluid from the condenser to the second separation vessel, or any combination thereof.
5. The system of claim 1, wherein the system weighs about 80,000 lbs or less.
6. The system of claim 1, further comprising a skid, wherein the process vessel, the product shaping system, and the thermal fluid heater system are coupled to the skid.
7. The system of claim 1, wherein the system is configured to be transported from a first location to a second location.
8. The system of claim 1, wherein the system is configured to operate while the first modular unit is contained within the first housing and the second modular unit is contained within the second housing.
9. The system of claim 1, wherein each modular unit has dimensions of approximately 20' x 8' x 8'.
10. The system of claim 1, wherein the product shaping system comprises:
 - an extrusion barrel coupled to the process vessel, the extrusion barrel defining a plurality of annular spaces configured to allow a solid fuel composition to pass through the extrusion barrel;
 - a reducer coupled to the extrusion barrel, the reducer comprising a thermal fluid piping configured to flow a thermal fluid, thereby providing heat to the solid fuel composition; and
 - a die coupled to the reducer, the die defining a plurality of openings configured to shape the solid fuel composition as the solid fuel composition is extruded through the die.
11. A modular fuel production system comprising:
 - modules, each module comprising the fuel production system of claim 1, and wherein each module is configured to be removably coupled to one or more other modules.

12. A method comprising:
- coupling a first modular unit to a second modular unit, wherein:
 - the first modular unit comprises:
 - a process vessel;
 - an agitator rotor assembly passing through the process vessel;
 - a first drivetrain coupled to the agitator rotor assembly;
 - an extrusion screw passing through the process vessel;
 - a second drivetrain coupled to the extrusion screw;
 - a first separation vessel in fluid communication with the process vessel;
 - and
 - a product shaping system;
 - the second modular unit comprises:
 - a thermal fluid heater system;
 - a condenser;
 - a second separation vessel in fluid communication with the condenser;
 - and
 - a vacuum pump in fluid communication with the second separation vessel;
- wherein coupling the first modular unit to the second modular unit comprises:
- fluidly coupling the thermal fluid heater system of the second modular unit to one or both of the process vessel and the agitator rotor assembly of the first modular unit; and
 - fluidly coupling the first separation vessel of the first modular unit to the condenser of the second modular unit.
13. The method of claim 12, further comprising:
- providing a solid waste mixture to the process vessel;
 - producing a solid fuel composition from the solid waste mixture, wherein producing the solid fuel composition comprises:
 - rotating the agitator rotor assembly using the first drivetrain, thereby agitating the solid waste mixture within the process vessel; and
 - providing heat to the solid waste mixture within the process vessel; and
 - extruding the solid fuel composition from the process vessel, wherein extruding the

solid fuel composition comprises:

- rotating the extrusion screw using the second drivetrain; and
- shaping the solid fuel composition using the product shaping system.

14. The method of claim 13, wherein providing heat to the solid waste mixture comprises flowing a thermal fluid from the thermal fluid heater system to one or both of the process vessel and the agitator rotor assembly.

15. The method of claim 14, further comprising flowing the thermal fluid from one or both of the process vessel and the agitator rotor assembly to the thermal fluid heater system.

16. The method of claim 14, further comprising:
flowing a fluid stream from the process vessel to the first separation vessel;
separating phases of matter of the fluid stream using the first separation vessel;
flowing the fluid stream from the first separation vessel to the condenser;
cooling the fluid stream using the condenser;
flowing the fluid stream from the condenser to the second separation vessel; and
separating phases of matter of the fluid stream using the second separation vessel,
wherein the vacuum pump facilitates each of:

- flowing the fluid stream from the process vessel to the first separation vessel,
- flowing the fluid stream from the first separation vessel to the condenser, and
- flowing the fluid stream from the condenser to the second separation vessel.

17. The method of claim 14, wherein:
the product shaping system comprises:
an extrusion barrel coupled to the process vessel, the extrusion barrel defining a plurality of annular spaces configured to allow the solid fuel composition to pass through the extrusion barrel;
a reducer coupled to the extrusion barrel; and
a die coupled to the reducer, the die defining a plurality of openings; and
shaping the solid fuel composition comprises passing the solid fuel composition through the plurality of annular spaces of the extrusion barrel, the reducer, and the die, thereby shaping the solid fuel composition by the plurality of openings defined by the die.

18. The method of claim 17, wherein the reducer comprises a thermal fluid piping, and shaping the solid fuel composition comprises flowing the thermal fluid through the thermal fluid piping, thereby heating the solid fuel composition as the solid fuel composition passes through the reducer.

19. A fuel production system comprising:
- a first modular unit comprising:
 - a first housing:
 - a process vessel configured to receive a solid mixture;
 - an agitator rotor assembly passing through the process vessel, the agitator rotor assembly configured to agitate the solid mixture within the process vessel in response to being rotated, the agitator rotor assembly defining an inner bore configured to receive a thermal fluid and flow the thermal fluid through at least a portion of the agitator rotor assembly;
 - a first drivetrain coupled to the agitator rotor assembly and configured to rotate the agitator rotor assembly;
 - an extrusion screw passing through the process vessel, the extrusion screw configured to extrude a solid fuel composition from the process vessel in response to being rotated, the solid fuel composition formed from the solid mixture;
 - a second drivetrain coupled to the extrusion screw and configured to rotate the extrusion screw;
 - a first separation vessel in fluid communication with the process vessel; and
 - a product shaping system comprising:
 - an extrusion barrel coupled to the process vessel, the extrusion barrel defining a plurality of annular spaces configured to allow the solid fuel composition to pass through the extrusion barrel;
 - a reducer coupled to the extrusion barrel, the reducer comprising a thermal fluid piping configured to flow the thermal fluid, thereby providing heat to the solid fuel composition; and
 - a die coupled to the reducer, the die defining a plurality of openings configured to shape the solid fuel composition as the solid fuel composition is extruded through the die,
 - wherein at least a portion of each of the process vessel, the agitator rotor assembly, the first drivetrain, the extrusion screw, the second drivetrain, the first

separation vessel, and the product shaping system are contained in the first housing.

20. The fuel production system of claim 19, further comprising a second modular unit configured to be coupled to the first modular unit, the second modular unit comprising:

- a second housing;

- a thermal fluid heater system configured to be in fluid communication with the process vessel;

- a condenser configured to be in fluid communication with the first separation vessel;

- a second separation vessel in fluid communication with the condenser; and

- a vacuum pump in fluid communication with the second separation vessel,

wherein at least a portion of each of the thermal fluid heater system, the condenser, the second separation vessel, and the vacuum pump are contained in the second housing.