

CLAIMS

1. A system for processing biogas, the system comprising:
 - a container,
 - a pressure swing adsorption (PSA) unit housed in the container, the PSA unit having:
 - 5 a plurality of beds containing adsorbent material, the adsorbent material configured to selectively adsorb gas species from the biogas to process the biogas,
 - a rotary valve module for distributing flow of the biogas within the PSA unit,
 - an inlet for supplying the biogas to the plurality of beds from outside of the
 - 10 container, and
 - an outlet for transporting the processed biogas away from the PSA unit.
2. The system of claim 1, wherein the pressure swing adsorption unit is a single stage PSA unit.
3. The system of claim 1 or claim 2, wherein the rotary valve module is selectively fluidly
- 15 connectable to each one of the plurality of beds, or can selectively fluidly connect the beds together in use.
4. The system of any of claims 1-3, wherein the rotary valve module is arranged to selectively permit gas flow to, from and/or between the plurality of beds in use.
5. The system of any of claims 1-4, wherein the PSA unit comprises (i) nine beds of
- 20 adsorbent material and the rotary valve module is a nine bed rotary valve, or (ii) twelve beds of adsorbent material and the rotary valve module is a twelve bed rotary valve.
6. The system of any of claims 1-5, wherein the PSA unit comprises a first PSA unit, and the system comprises a second PSA unit, the second PSA unit having a plurality of beds
- 25 containing adsorbent material and a rotary valve module for distributing flow of the biogas within the second PSA unit, an inlet for supplying biogas to the plurality of beds, and an outlet for transporting the processed biogas away from the second PSA unit.
7. The system of claim 6, wherein the first PSA unit and the second PSA unit are arranged in parallel.

8. The system of any of claims 1-5, wherein the system is modular and comprises a PSA unit module removably houseable within the container, the PSA unit module comprising the PSA unit housed in a PSA unit housing.
9. The system of claim 8, wherein the PSA unit module further houses one or both of a vacuum pump and a compressor.
10. The system of claim 8 or claim 9, wherein the PSA unit module is a first PSA unit module housing a first PSA unit and a first rotary valve module, and further comprising a second PSA unit module housing a second PSA unit and a second rotary valve module.
11. The system of claim 10, wherein the first PSA unit and the second PSA unit are configured to operate in parallel.
12. The system of claim 10 or claim 11, wherein the container is sized and shaped to house the first PSA unit module and the second PSA module in a side-by-side configuration.
13. The system of any of claims 10-12, wherein the container comprises at least two compartments, one of the at least two compartments being configured to house the first PSA unit module and the second PSA unit module, and one or both of a vacuum pump and a compressor.
14. The system of claim 13, wherein another one of the at least two compartments is fluidly sealable from the compartment configured to house the first PSA unit module and the second PSA unit module.
15. The system of any of claims 1-14, further comprising one or both of (i) a pre-treatment assembly for pre-treating the biogas before supplying the biogas to the PSA unit, and a (ii) post-treatment assembly for treating a product gas from the PSA unit, the pre-treatment assembly and/or the post-treatment assembly arranged to remove one or more of: hydrogen sulfide, volatile organic compounds, siloxanes and water.
16. The system of claim 15, wherein at least some of the components of the pre-treatment assembly and/or the post-treatment assembly are arranged to be positioned outside of the container and fluidly connected to the PSA unit through the container.

17. The system of any of claims 1-16, further comprising a gas compression unit to compress the processed biogas.

18. The system of any of claims 1-17, further comprising a gas analyzer for detecting a predetermined parameter of the processed biogas or an exhaust gas from the PSA unit.

5 19. The system of any of claims 1-18, further comprising a controller, operatively communicable with the PSA unit for controlling a rotation of the rotary valve module.

20. The system of claim 19 when dependent on claim 18, wherein the controller is operably communicable with the gas analyzer and configured to control the rotation of the rotary valve module responsive to the detected predetermined parameter of the processed biogas or the
10 exhaust gas from the PSA unit.

21. The system of claim 20, wherein the predetermined parameter of the processed biogas is a biomethane content of the exhaust gas.

22. A method of processing a biogas, the method comprising:

providing, through an inlet, biogas to a pressure swing adsorption (PSA) unit housed
15 in a container, the PSA unit having a plurality of beds containing adsorbent material, the adsorbent material configured to change the composition of the biogas when the biogas contacts the adsorbent material, and a rotary valve module for distributing flow of the biogas within the PSA unit;

operating the rotary valve module to selectively permit biogas to contact the plurality
20 of beds to process the biogas; and

permitting the processed biogas to flow, through an outlet, from the PSA unit.

23. The method of claim 22, wherein the operating the rotary valve module comprises controlling a rotation of the rotary valve module.

25 24. The method of claim 22 or claim 23, further comprising modulating a pressure within the PSA unit.

25. The method of any of claims 22-45, wherein the PSA unit comprises a first PSA unit and a second PSA unit, the method comprising providing biogas to the first PSA unit and the second PSA unit in parallel.
26. The system of any of claims 22-25, further comprising one or both of (i) pre-treating the biogas before supplying the biogas to the PSA unit, and (ii) treating the biogas after it is processed by the PSA unit, the pre-treating and/or the post-treating arranged to remove one or more of: hydrogen sulfide, volatile organic compounds, siloxanes and water.
27. The method of any of claims 22-26, further comprising, before providing the biogas to the PSA unit, cooling the biogas under low pressure followed by a deep-cooling at high pressure.
28. The method of any of claims 22-27, further comprising modulating the operation of the rotary valve module responsive to a detected predetermined parameter of the processed biogas or an exhaust gas from the PSA unit.
29. A system for processing biogas, the system being modular and comprising:
- a container comprising a first compartment and a second compartment fluidly sealable from one another;
 - one or more pressure swing adsorption (PSA) unit modules removably housable in the first compartment of the container, each PSA unit module comprising a PSA unit within a PSA unit housing, each PSA unit comprising a plurality of beds containing adsorbent material, the adsorbent material configured to selectively adsorb gas species from the biogas to process the biogas; and
 - at least one flow path for the biogas from an inlet to the one or more PSA unit modules and to an outlet.
30. The system of claim 29, wherein the first compartment further houses one or both of a vacuum pump and a compressor.
31. The system of claim 29 or claim 30, wherein the PSA unit module is a first PSA unit module housing a first PSA unit, and further comprising a second PSA unit module housing a second PSA unit.

32. The system of claim 31, wherein the first PSA unit and the second PSA unit are configured to operate in parallel.
33. The system of claim 31 or claim 32, wherein the container is sized and shaped to house the first PSA unit module and the second PSA module in a side-by-side configuration.
- 5 34. The system of any of claims 29-33, further comprising one or both of (i) a pre-treatment assembly for pre-treating the biogas before supplying the biogas to the PSA unit, and a (ii) post-treatment assembly for treating a product gas from the PSA unit, the pre-treatment assembly and/or the post-treatment assembly arranged to remove one or more of: hydrogen sulfide, volatile organic compounds, siloxanes and water.
- 10 35. The system of claim 34, wherein at least some of the components of the pre-treatment assembly and/or the post-treatment assembly are arranged to be positioned outside of the container and fluidly connected to the PSA unit through the container.
36. The system of any of claims 29-35, further comprising a gas analyzer for detecting a predetermined parameter of the processed biogas or an exhaust gas from the PSA unit.
- 15 37. The system of claim 36, further comprising a controller, operatively communicable with the PSA unit, for modulating an operation of the PSA unit based on the detected predetermined parameter.
38. The system of claim 37, wherein the predetermined parameter of the processed biogas is a biomethane content of the exhaust gas.
- 20 39. The system of any of claims 29-38, wherein the PSA unit includes a rotary valve module for selectively supplying the biogas to the plurality of beds.