CLAIMS

What is claimed is:

1. A method of collecting a fluid species present in a gas stream, comprising:

establishing a plurality of charged fluid species in the gas stream using a first electrode, electrically biased against a second electrode, the second electrode comprising a collector;

urging the plurality of charged fluid species towards the second electrode, wherein at least a portion of the plurality of charged fluid species passes through a front surface and a back surface of the collector;

urging at least the portion of the plurality of charged fluid species towards the back surface of the collector after at least the portion of the plurality of charged fluid species passes through the front surface and the back surface of the collector; and

collecting the charged fluid species at the collector to form a collected fluid species at a collection efficiency of greater than or equal to 10%.

2. A method of collecting a fluid species present in a gas stream, comprising:

arranging at least a first and second electrode comprising a collector so as to apply an electric field to at least a portion of the gas stream thereby urging the fluid species toward a front surface and a back surface of the collector and isolating at least a portion of the fluid species from the gas stream,

wherein a minimum distance between the first electrode and the second electrode is between 2 cm and 50 cm.

3. A method of collecting a fluid species present in a gas stream, comprising:

arranging, within the gas stream, a first electrode and a second electrode comprising a collector proximate the first electrode;

applying a potential to the first electrode such that at least a portion of the fluid species present in the gas stream deposits on a front surface and a back surface of the collector; and

collecting the fluid species on a collector, and

directing the fluid species from a portion of the collector at which it is collected to a different portion of the collector,

wherein a minimum distance between the first electrode and the second electrode is between 2 cm and 50 cm.

4. A method of collecting a fluid species present in a gas stream, comprising:

arranging, within the gas stream, a first electrode and a second electrode comprising a collector proximate the first electrode;

applying a potential to the first electrode such that at least a portion of the fluid species present in the gas stream deposits on a front surface and a back surface of the collector; and

collecting the fluid species to form a collected fluid species at an energy efficiency of greater than or equal to 1 liter per kWh of energy applied in applying the potential.

5. A fluid collection system for collecting a fluid system, comprising:

a first electrode;

a collector comprising a mesh with a front surface and a back surface;

a second electrode comprising at least a portion of the collector configured to be positioned proximate the first electrode; and

a power source in electrical communication with at least the first electrode,

wherein the collection system is configured to collect the fluid species present within a gas stream on the front surface and the back surface of the mesh with an energy efficiency of greater than or equal to 1 liter per kWh of energy applied in creating a field with the second electrode.

6. The method or fluid collection system of any preceding claim, wherein the fluid species comprises water.

7. The method or fluid collection system of any preceding claim, wherein the second electrode comprises a mesh.

8. The method or fluid collection system of any preceding claim, wherein the second electrode comprises parallel wires.

9. The method or fluid collection system of any preceding claim, wherein the first electrode comprises needles.

10. The method or fluid collection system of any preceding claim, wherein the average radius of curvature of the needles is greater than or equal to 10 microns.

11. The method or fluid collection system of any preceding claim, wherein the second electrode is positioned downstream of the first electrode.

12. The method or fluid collection system of any preceding claim, wherein the second electrode is positioned upstream of the first electrode.

13. The method or fluid collection system of any preceding claim, wherein the first electrode is held at a negative potential.

14.The method or fluid collection system of any preceding claim, wherein the first electrode is held at a positive potential.

15. The method or fluid collection system of any preceding claim, wherein the second electrode is grounded.

16. The method or fluid collection system of any preceding claim, wherein the second electrode is held at a negative potential.

17. The method or fluid collection system of any preceding claim, wherein the second electrode is held at a positive potential.

18. The method or fluid collection system of any preceding claim, wherein water is collected on a surface of the second electrode facing the first electrode.

19. The method or fluid collection system of any preceding claim, wherein water is collected on a surface of the second electrode not facing the first electrode.

20. The method or fluid collection system of any preceding claim, wherein a difference in potential between the first electrode and the second electrode is greater than or equal to 2 kV and less than or equal to 100 kV.

21. The method or fluid collection system of any preceding claim, wherein applying the potential to the first electrode comprises ionizing at least a portion of the air stream.

22. The method as in any one of claims 1 to 4, 6 to 21, comprising exposing the air stream to ozone.

23. The method as in any one of claims 1 to 4, 6 to 22, comprising applying the potential to the first electrode such that ozone is generated.

24. The method as in any one of claims 1 to 4, 6 to 23, wherein a corona discharge is generated by the first electrode.

25. The method as in any one of claims 1 to 4, 6 to 24, wherein the corona discharge purifies at least a portion of the fluid collected.

26. The method or fluid collection system as in any preceding claim, further comprising a third electrode.

27. The method or fluid collection system of claim 26, wherein the third electrode is positioned downstream of the second electrode.

28. The method or fluid collection system of any one of claims 26-27, wherein the third electrode is capable of charging the fluid species.

29. The method or fluid collection system of any preceding claim, wherein the electrode or component used to charge fluid species does not contribute to the electric field used to collect the fluid species.

30. The method or fluid collection system of any one of claims 1-28, wherein the electrode or component used to charge fluid species does contribute to the electric field used to collect the fluid species.

31. The method or fluid collection system of any preceding claim, wherein the combination of a perforated plate and a grounded electrode is used to charge the fluid species.

32. The method or fluid collection system of any preceding claim, wherein a Taylor cone of an ionic liquid is used to generate space charge.

33. The method or fluid collection system of any preceding claim, wherein electrospraying a volatile liquid is used to generate space charge.

34. The method of claim 1, wherein establishing the plurality of charged fluid species in the gas stream comprises providing corona discharge using a first electrode.

35. The method of claims 1 or 34, wherein the collector is positioned downstream the first electrode, and wherein the collector comprises a front surface and back surface.

36. The method of claims 1 or 34-35, wherein the collecting step comprises a deposition efficiency of greater than or equal to 100%.

37. The method of claims 2-3, wherein the second electrode comprises a mesh with a front surface and back surface.

38. The method of claims 2-3 or 37, wherein at least a portion of the fluid species present in the gas stream deposits on the front surface and the back surface of the mesh.

39. The method of any one of claims 1-4, wherein the method comprises directing the collected fluid species from a portion of the collector at which it is collected to a gutter.

40. The method of any one of claims 1-4, wherein the method comprises shedding the collected fluid species by gravity.

41. The method of any one of claims 1-4, wherein the method comprises coalescing the collected fluid species in larger droplets.

42. The collection system of claim 5, further comprising a gutter, wherein the collection system is configured to direct collected fluid species to the gutter.

43. The collection system of claim 5, wherein the collection system is configured to shed collected fluid species by gravity.

44. The method of claim 3, wherein the fluid species deposits with a deposition efficiency of greater than or equal to 100%.

45. The method of claims 2-3, wherein the fluid species comprises a droplet.

46. The method of claim 45, wherein the droplet comprises water.