CLAIMS

What is claimed is:

1. A method of managing a photovoltaic device, comprising:

applying a first component of a voltage signal to the photovoltaic device, the first component representing an on state for generating an external electric field across the photovoltaic device; and

applying a second component of the voltage signal to the photovoltaic device, the second component representing an off cycle.

2. The method of claim 1, wherein said applying the first component comprises applying a high voltage of a time-varying voltage pulse from a voltage pulser circuit, and wherein said applying the second component comprises shutting off the voltage pulser circuit.

3. The method of claim 1 or claim 2, wherein said applying the first component comprises connecting a voltage source and the photovoltaic device in a first position of a switch disposed between the voltage source and the photovoltaic device, and wherein said applying the second component comprises disconnecting the voltage source and the photovoltaic device in a second position of the switch to optionally provide electrical isolation between the voltage source and a load driven by the photovoltaic device when the switch is in the second position.

4. The method of claim 2 or claim 3, wherein said applying the first component comprises impressing an output of a high voltage source of the voltage pulser circuit onto the photovoltaic device when a switching transistor of the voltage pulser circuit is in an on position for generating the first component, and optionally continuing said impressing the output of the high voltage source until a pulse generator of the voltage pulser circuit turns the switching transistor to an off position for generating the second component.

5. The method of any one of the above claims, wherein said applying the first component comprises generating the external electric field with a first direction or a second direction, the first direction and a polarity of internal electrodes of the photovoltaic device being in a same direction for increasing a power output of the photovoltaic device, and the second direction being in an opposite direction of the polarity of the internal electrodes for decreasing the power output.

6. The method of any one of the above claims, further comprising monitoring an output voltage of the photovoltaic device, wherein said monitoring the output voltage optionally is performed via a voltage probe coupled across the photovoltaic device, or monitoring an output current of the photovoltaic device, wherein said monitoring the output current optionally is performed via a current sensor coupled in series between the photovoltaic device and a load driven by the photovoltaic device.

7. The method of claim 6, further comprising adjusting, wherein said adjusting optionally is performed via a control circuit coupled to the voltage source, at least one of a magnitude, a duration, and a frequency of the first component to maximize a power output of the photovoltaic device based on said monitoring.

8. The method of any one of the above claims, wherein said applying the first component comprises generating the external electric field across at least one of a solar cell, an array of solar cells, a solar panel, and an array of solar panels.

9. A method of managing a photovoltaic device, comprising:

enabling a voltage pulser to be coupled to the photovoltaic device; and

applying a voltage signal generated by the voltage pulser to the photovoltaic device, the voltage signal having a first state for generating an external electric field across the photovoltaic device and a second state representing an off cycle.

10. The method of claim 9, wherein said applying the voltage signal comprises applying an adjustable voltage to the photovoltaic device, and

optionally impressing an output of a high voltage source of the voltage pulser onto the photovoltaic device when a switching transistor of the voltage pulser is in an on position for generating the first state, and optionally continuing said impressing the output of the high voltage source until a pulse generator of the voltage pulser turns the switching transistor to an off position for generating the second state.

11. The method of claim 9 or claim 10, further comprising enabling one or more series inductors to be coupled between the voltage pulser and a load of the photovoltaic device for blocking frequencies of the voltage signal to the load that are greater than a predetermined frequency.

12. The method of any one of claims 9-11, further comprising controlling at least one of a frequency and a duration of the first state and the second state via a control circuit coupled to the voltage pulser.

13. A system for managing a photovoltaic device, comprising:

a voltage application means being adapted to apply a first component of a voltage signal to a plurality of photovoltaic devices, the first component comprising series of voltage pulses with a positive magnitude, each of the voltage pulses comprising an on state for generating an external electric field across the photovoltaic devices; and

said voltage application means being further adapted to apply a second component of the voltage signal to the photovoltaic devices, the second component comprising an off cycle between adjacent voltage pulses.

14. The system of claim 13, wherein the voltage application means comprises a voltage pulser circuit, wherein application of the first component comprises applying a high voltage of a time-varying voltage pulse from the voltage pulser circuit, and wherein application of the second component comprises shutting off the voltage pulser circuit.

15. The system of claim 13 or claim 14, wherein the voltage application means comprises a switch disposed between a voltage source and the photovoltaic devices, wherein application of the first component comprises connecting the voltage source and the photovoltaic devices in a first position of the switch and wherein application of the second component comprises disconnecting the voltage source and the photovoltaic devices in a second position of the switch.

16. The system of claim 14 or claim 15, wherein the voltage pulser circuit comprises a switching transistor and a pulse generator, and wherein application of the first component comprises impressing an output of a high voltage source of the voltage pulser circuit onto the photovoltaic devices when the switching transistor of the voltage pulser circuit is in an on position for generating the first state, and optionally continuing the impressing of the output of the high voltage source until the pulse generator of the voltage pulser circuit turns the switching transistor to an off position for generating the second state.

17. The system of any one of claims 13-16, wherein application of the first component comprises generating the external electric field with a first direction or a second direction, the first direction and a polarity of internal electrodes of the photovoltaic devices being in a same direction for increasing a power output of the photovoltaic devices, and the second direction being in an opposite direction of the polarity of the internal electrodes for decreasing the power output.

18. The system of any one of claims 15-17, further comprising a monitoring means adapted for monitoring an output voltage of the photovoltaic devices or for monitoring an output current of the photovoltaic devices.

19. The system of claim 18, wherein the monitoring means comprises a voltage probe coupled across the photovoltaic devices or a current sensor coupled in series between the photovoltaic devices and a load driven by the photovoltaic devices.

20. The system of claim 18 or 19, further comprising a control circuit coupled to the voltage source, wherein the control circuit is adapted for adjusting the output voltage, wherein said adjusting includes adjusting at least one of a magnitude, a duration, and a frequency of the first component to maximize a power output of the photovoltaic devices based on a monitored an output voltage or current of the photovoltaic devices.

21. The system of any one of claims 13-20, wherein application of the first component comprises generating the external electric field across at least one of a solar cell, an array of solar cells, a solar panel, and an array of solar panels.

22. A system for managing a photovoltaic device, comprising:

a voltage pulser coupled to a plurality of photovoltaic devices; and

a voltage application means for applying a voltage signal generated by the voltage pulser to each of the photovoltaic devices, the voltage signal having a first state for generating an external electric field across the photovoltaic devices, the first state comprising a series of voltage pulses with a positive magnitude and a second state comprising an off cycle between adjacent voltage pulses.

23. The system of claim 22, wherein the voltage pulser comprises a switching transistor and a pulse generator, wherein application of the voltage signal comprises applying an adjustable voltage to the photovoltaic devices, and wherein a high voltage source of the voltage pulser is optionally impressed onto the photovoltaic devices when the switching transistor is in an on position for generating the first state, and wherein the pulse generator turns the switching transistor to an off position for generating the second state.

24. The system of claim 22 or claim 23, further comprising one or more series inductors coupled between the voltage pulser and a load of the photovoltaic devices for blocking frequencies of the voltage signal to the load that are greater than a predetermined frequency.

25. The system of any one of claims 22-24, further comprising a control circuit coupled to the voltage pulser for controlling at least one of a frequency and a duration of the first state and the second state.

26. The method of any one of claims 1-8, wherein application of the external electric field to across the photovoltaic device increases an output power and/or an output current of the photovoltaic device.

27. The method of claim 26, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by up to fifty percent under low light conditions.

28. The method of claim 26, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by more than fifty percent under low light conditions.

29. The method of any one of claims 26-28, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by up to twenty percent under high intensity light conditions.

30. The method of any one of claims 26-29, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device between twenty percent and fifty percent.

31. The method of any one of claims 26-29, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by more than fifty percent.

32. The method of any one of claims 26-31, wherein the increase in the output power and/or an output current is based upon an intensity of light incident on the photovoltaic device, the voltage signal applied to the photovoltaic device, a thickness of the photovoltaic device, a pulse width of the voltage pulses, and/or a frequency of the voltage pulses.

33. The method of any one of claims 9-12, wherein application of the external electric field to across the photovoltaic device increases an output power and/or an output current of the photovoltaic device.

34. The method of claim 33, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by up to fifty percent under low light conditions.

35. The method of claim 33, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by more than fifty percent under low light conditions.

36. The method of any one of claims 33-35, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by up to twenty percent under high intensity light conditions.

37. The method of any one of claims 33-36, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device between twenty percent and fifty percent.

38. The method of any one of claims 33-36, wherein the application of the external electric field to across the photovoltaic device increases the output power and/or the output current of the photovoltaic device by more than fifty percent.

39. The method of any one of claims 33-38, wherein the increase in the output power and/or an output current is based upon an intensity of light incident on the photovoltaic device, the voltage signal applied to the photovoltaic device, a thickness of the photovoltaic device, a pulse width of the voltage pulses, and/or a frequency of the voltage pulses.

40. The system of any one of claims 13-21, wherein, for a selected photovoltaic device of the plurality of photovoltaic devices, application of the external electric field to across the selected photovoltaic device increases an output power and/or an output current of the selected photovoltaic device.

41. The system of claim 40, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by up to fifty percent under low light conditions.

42. The system of claim 40, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by more than fifty percent under low light conditions.

43. The system of any one of claims 40-42, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by up to twenty percent under high intensity light conditions.

44. The system of any one of claims 40-43, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device between twenty percent and fifty percent.

45. The system of any one of claims 40-43, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by more than fifty percent.

46. The system of any one of claims 40-45, wherein the increase in the output power and/or an output current is based upon an intensity of light incident on the selected photovoltaic device, the voltage signal applied to the selected photovoltaic device, a thickness of the selected photovoltaic device, a pulse width of the voltage pulses, and/or a frequency of the voltage pulses.

47. The system of any one of claims 22-25, wherein, for a selected photovoltaic device of the plurality of photovoltaic devices, application of the external electric field to across the selected photovoltaic device increases an output power and/or an output current of the selected photovoltaic device.

48. The system of claim 47, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by up to fifty percent under low light conditions.

49. The system of claim 47, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by more than fifty percent under low light conditions.

50. The system of any one of claims 47-49, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by up to twenty percent under high intensity light conditions.

51. The system of any one of claims 47-50, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device between twenty percent and fifty percent.

52. The system of any one of claims 47-50, wherein the application of the external electric field to across the selected photovoltaic device increases the output power and/or the output current of the selected photovoltaic device by more than fifty percent.

53. The system of any one of claims 47-52, wherein the increase in the output power and/or an output current is based upon an intensity of light incident on the selected photovoltaic device, the voltage signal applied to the selected photovoltaic device, a thickness of the selected photovoltaic device, a pulse width of the voltage pulses, and/or a frequency of the voltage pulses.

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