Claims:

1. A bimodal near-field resonant wireless electrical power transfer system configured for simultaneous capacitive power transfer and inductive power transfer according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at a variable resonant power signal oscillation frequency, the system comprising:

a transmitter subsystem comprising a transmitter antenna subsystem and a power signal tuner module, the power signal tuner module configured to adjust the transfer mode ratio by adjusting a power signal provided by the power signal tuner module to the transmitter antenna subsystem; and

a receiver subsystem comprising a receiver antenna subsystem configured for to receive electrical power from the transmitter antenna at the transfer mode ratio.

2. The system of claim 1, wherein the power signal tuner module is configured to adjust the power signal by adjusting a phase difference between a current and a voltage of the power signal provided to the transmitter antenna subsystem.

3. The system of claim 2, wherein the transmitter subsystem further comprises a controller and at least one sensor, wherein the controller is configured to receive sensor information from the at least one sensor and automatically provide a tuning instruction to the power signal tuner module based on the sensor information, and wherein the tuner module is configured to adjust according to the tuning instruction the phase difference between the current and the voltage of the power signal provided to the transmitter antenna subsystem.

4. The system of claim 3, wherein the at least one sensor is disposed in the transmitter subsystem.

5. The system of claim 3, wherein the at least one sensor is disposed in the receiver subsystem and the controller is configured for wirelessly receiving the sensor information.

6. The system of any one of claims 3-5, wherein the at least one sensor comprises at least one of a power load sensor, a transmission power sensor, a surrounding object detector, and a distance detector for detecting a distance between the transmitter antenna subsystem and the receiver antenna subsystem.

7. The system of any one of claims 1-5, wherein the variable resonant power signal oscillation frequency is free to vary within a predetermined frequency band.

8. The system of claim 7, wherein the predetermined frequency band is between 1MHz and 1GHz.

9. The system of claim 7, wherein the system is detuned to a degree that allows the variable resonant power signal oscillation frequency to vary within opposing limits of the predetermined frequency band.

10. The system of any one of claims 1-9, comprising an electrical load disposed in electrical communication with an electrically conductive mechanical load-bearing structure, wherein the receiver antenna subsystem comprises at least a portion of the electrically conductive mechanical load-bearing structure.

11. A method for bimodally transferring power from a direct current source to a load, the method comprising:

providing in electrical communication with the direct current source a transmitter subsystem comprising a transmitter antenna subsystem, and a power signal tuner module, and a controller;

providing at least one sensor;

providing in electrical communication with the load a receiver subsystem comprising a receiver antenna subsystem;

transferring power by simultaneous capacitive power transfer and inductive power transfer at a variable resonant power signal oscillation frequency from the transmitter antenna subsystem to the receiver antenna subsystem; and

adjusting the power signal module to change a transfer mode ratio of the capacitive power transfer to the inductive power transfer at a variable resonant power signal oscillation frequency.

12. The method of claim 11, wherein adjusting the power signal module comprises adjusting a phase difference between a current and a voltage of a power signal provided from the power signal module to the transmitter antenna subsystem.

13. The method of claim 12, wherein adjusting the phase difference between the current and the voltage of the power signal comprises,

receiving in the controller sensor information from the at least one sensor,

automatically providing a tuning instruction from the controller to the power signal tuner module based on the sensor information, and

adjusting according to the tuning instruction the phase difference between the current and the voltage of the power signal provided to the transmitter antenna subsystem.

14. The method of claim 11, wherein providing the transmitter subsystem comprises providing the at least one sensor disposed in the transmitter subsystem.

15. The method of claim 13, wherein

providing the receiver subsystem comprises providing the at least one sensor disposed in the receiver subsystem; and

the receiving in the controller the sensor information comprises wirelessly receiving the sensor information in the controller.

16. The method of any one of claims 11- 15, wherein providing the at least one sensor comprises at least one of providing a power load sensor, a transmission power sensor, a surrounding object detector, and a distance detector for detecting a distance between the transmitter antenna subsystem and the receiver antenna subsystem.

17. The method according to any one of claims 11-13, wherein the bimodally transferring power comprises allowing the variable resonant power signal oscillation frequency to vary within a predetermined frequency band contained within the range between 1MHz and 1GHz.

18. The method according to claim 17, further allowing the variable resonant power signal oscillation frequency to vary within opposing limits of the predetermined frequency band.

19. A bimodal near-field wireless power transfer system configured for simultaneous capacitive power transfer and inductive power transfer to one or more receiver resonators according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at a variable resonant power signal oscillation frequency, the system comprising:

the one or more receiver resonators;

a transmission subsystem comprising:

transmitter resonators collectively arranged to form a transmission surface; and

corresponding transmitter modules in electrical communication with the transmitter resonators for controlling a power signal output to the transmitter resonators, each transmitter module comprising a transmitter controller and each transmitter module and its corresponding transmitter resonator forming a transmitter pair,

wherein the transmitter pairs are electrically decoupled from one another.

20. The system of claim 19, wherein the transmitter controller of every first one of the transmitter modules is configured for adjusting the phase of the power signal transmitted by the first transmitter module to match a phase of a power signal transmitted by any second one of the transmitter module.

21. The system of claim 20, wherein the transmitter pairs are electrically decoupled from one another by a grounded shield grid.

22. The system of claim 19, wherein the transmission controller of each transmitter module in a transmitter pair comprises

a tuner module for varying a phase of the power signal; and

a load detector configured for measuring an input impedance of the transmitter resonators, and wherein the load detector is configured to detect a change in the input impedance when the one or more receiver resonators are proximate to the transmitter resonators.

23. The system of claim 22, wherein the transmission controller is configured to vary the variable resonant power signal oscillation frequency based on a measured input impedance of the transmitter resonators.

24. The system of claim 22, wherein the load detector of the transmission controller of each transmitter module measures an input impedance of one transmitter resonator.

25. The system of claim 22, wherein the load detector of the transmission controller of each transmitter module measures an input impedance of two or more transmitter resonators.

26. A bimodal near-field resonant wireless system for transferring power from one or more photovoltaic cells to a power load, the system comprising:

one or more transmission modules in electrical communication with the one or more photovoltaic cells, each transmission module configured to convert the power from at least one

of the one or more photovoltaic cells into an oscillating electrical power signal having a variable oscillation frequency;

one or more transmitter resonators in electrical communication with the one or more transmission modules, each transmitter resonator configured to resonate at the variable oscillation frequency;

one or more receiver resonators, each receiver resonator configured to resonate at the variable oscillation frequency and disposed to bimodally receive power from at least one of the one or more transmitter resonators simultaneously via capacitive coupling and magnetic induction according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at the variable oscillation frequency; and

one or more receiver modules in electrical communication with the receiver resonator, each receiver module configured to receive power from at least one of the one or more receiver resonators, render the power received from the one or more receiver resonators into a direct current voltage, and transmit the direct current voltage to the power load.

27. The system according to claim 26, wherein the one or more transmission modules each comprises a power amplifier configured to modulate the power received from the one or more photovoltaic cell at the variable oscillation frequency.

28. The system according to claim 27, wherein the one or more transmission modules each comprises an oscillator configured to provide the variable oscillation frequency to the power amplifier.

29. The system according to any one of claims 26-28, wherein the one or more transmission modules each further comprises a controller and one or more sensors, the controller configured to vary the variable oscillation frequency based on first information from at least one of the one or more sensors.

30. The system according to claim 29, wherein the one or more transmission modules each comprises a transmission tuning network configured to change under control of the controller at least a phase of the power provided by the transmission module to the one or more transmitter resonators based on second information from at least one of the one or more sensors.

31. The system according to any one of claims 26-28, wherein one or more receiver resonator is disposed for receiving power from any proximate transmitter resonator.

32. The system according to any one of claims 26-28, wherein the one or more transmitter resonators are disposed on a surface of at least one of the one or more photovoltaic cells opposing an active solar radiation receiving surface of the at least one of the one or more photovoltaic cells.

33. The system according to any one of claims 26-28, wherein the variable oscillation frequency of the oscillating electrical power signal is free to vary within a predetermined frequency band contained within the range between 1MHz and 1GHz.

34. The system of claim 33, wherein the system is detuned to a degree that allows the variable oscillation frequency of the oscillating electrical power signal to vary within opposing limits of the predetermined frequency band

35. A method method for bimodally transferring power from one or more photovoltaic cells to a power load, the method comprising

providing one or more transmission modules, each transmission module being in electrical communication with a corresponding one of the one or more photovoltaic cells;

providing one or more transmitter resonators configured to resonate at a variable oscillation frequency, each transmitter resonator being in electrical communication with a corresponding one of the one or more transmission modules;

providing one or more receiver resonators configured to resonate at the variable oscillation frequency, each receiver resonator in electrical communication with a corresponding receiver module;

converting in each transmission module power from the corresponding one of the one or more photovoltaic cells into an oscillating electrical power signal having the variable oscillation frequency;

bimodally transferring power from at least one of the one or more transmitter resonators to one or more of the receiver resonators via simultaneously capacitive coupling and magnetic induction according to an adjustable transfer mode ratio of the capacitive power transfer to the inductive power transfer at the variable oscillation frequency;

rendering the power received from the one or more receiver resonators into a direct current voltage; and

supplying the direct current voltage to the power load.

36. The method of claim 35, wherein:

providing the one or more transmission modules comprises providing one or more transmission modules each comprising a power amplifier; and

modulating in at least one power amplifier the power received from the one or more photovoltaic cells at the variable oscillation frequency.

37. The method according to claim 36, wherein:

providing the one or more transmission modules comprises providing one or more transmission modules each comprising an oscillator; and

providing from the oscillator to the power amplifier the variable oscillation frequency.

38. The method according to any one of claims 35-37, wherein providing the one or more transmission modules comprises providing one or more transmission modules each having a controller and one or more sensors, and the method comprises adjusting via the controller the variable oscillation frequency based on first information from at least one of the one or more sensors.

39. The method according to claim 38, wherein providing the one or more transmission modules comprises providing one or more transmission modules each having a transmission tuning network, and the method comprises adjusting via the controller based on second information from at least one of the one or more sensors at least a phase of the power provided by the transmission module to the one or more transmitter resonators.

40. The method of claim 35, wherein providing the one or more receiver resonator comprises providing at least one of the one more receiver resonators disposed proximate to more than one of the transmitter resonators and receiving in the at least one receiver resonator power from one or more receiver resonators proximate the at least one receiver resonator.

41. The method according to any one of claims 26-28, wherein the bimodally transferring power comprises allowing the variable oscillation frequency to vary within a predetermined frequency band contained within the range between 1MHz and 1GHz.