CLAIMS

1. A modular energy system controllable to supply power to a load, comprising:

a plurality of modules connected together to output an AC voltage signal comprising a superposition of first output voltages from each module,

wherein each module comprises:

an energy source;

a first converter connected to the energy source and configured to generate the first output voltage at a first port of the module; and

a second converter connected between a second port of the module and the energy source, wherein the second converter is configured to receive an input signal and convert the input signal into a second output voltage.

2. The system of claim 1, wherein the first converter comprises a plurality of switches.

3. The system of claim 2, wherein the plurality of switches are configured as a full bridge converter.

4. The system of claim 1, wherein the second converter is a DC-DC converter comprising a transformer configured to isolate the energy source and the first converter from the second port.

5. The system of claim 4, wherein the second converter comprises a DC-AC converter connected between the second port and the transformer.

6. The system of claim 5, wherein the second converter comprises a diode rectifier connected between the transformer and the energy source.

7. The system of claim 4, wherein the second converter comprises an AC-DC converter connected between the transformer and the energy source.

8. The system of claim 7, wherein the AC-DC converter is configured as a full bridge converter or a push-pull converter.

9. The system of claim 4, wherein the second converter is a unidirectional converter that conducts electricity from the second port to the energy source.

10. The system of claim 4, wherein the second converter is a bidirectional converter that conducts electricity between the second port and the energy source.

11. The system of claim 1, wherein the plurality of modules are serially connected as an array and are connected to receive a total charge source voltage such that a voltage of the charge signal applied to the second port of each module is divided down from the total charge source voltage.

12. The system of any of claims 1-11, wherein the energy source is a first energy source, and wherein each module comprises a second energy source.

13. The system of claim 12, wherein the second energy source is connected to the first converter by an inductor.

14. The system of claim 12, wherein the first energy source is a lithium ion battery of a first type and the second energy source is a lithium ion battery of a second type, wherein the first and second types are different.

15. The system of claim 12, wherein the first energy source is a battery and the second energy source is a high energy density (HED) capacitor.

16. The system of any of claims 1-11, wherein each module further comprises an energy buffer connected in parallel with the energy source.

17. The system of claim 16, wherein the energy buffer is a capacitor.

18. The system of any of claims 1-17, further comprising a control system configured to control switching of the first and second converters.

19. The system of claim 18, wherein the control system comprises a plurality of local control devices associated with the plurality of modules, and a master control device communicatively coupled with the plurality of local control devices.

20. The system of claim 18, wherein the control system is configured to control switching of the second converter of each module to exchange energy between energy sources of the modules.

21. The system of claim 1, wherein the input signal is a charge signal and the second converter is configured to receive the charge signal at the second port and convert the charge signal into the second output voltage to charge the energy source.

22. The system of claim 1, wherein the input signal is an output voltage of the energy source and the second converter is configured to convert the output voltage of the energy source to a supply voltage for an auxiliary converter.

23. A modular energy system controllable to supply power to a load, comprising:

a first array comprising a first plurality of modules connected together to output a first AC voltage signal comprising a superposition of output voltages from the first plurality of modules; and

a second array comprising a second plurality of modules connected together to output a second AC voltage signal comprising a superposition of output voltages from the second plurality of modules,

wherein each module of the first plurality and second plurality of modules comprises:

an energy source;

a first converter connected to the energy source and configured to generate the output voltage at a first port of the module; and

a second converter connected to a second port of the module and the energy source, wherein the second converter is configured to receive an input signal and convert the input signal into an output signal.

24. The system of claim 23, further comprising a first interconnection module coupled with the first array and a second interconnection module coupled with the second array, wherein the first and second interconnection modules each comprise:

a first port and a second port;

an energy source;

a first converter connected to the energy source and configured to generate an output voltage at the first port; and

a second converter connected to the second port and the energy source, wherein the second converter is configured to receive a charge signal at the second port and convert the charge signal into a charge voltage to charge the energy source.

25. The system of claim 24, wherein the first interconnection module comprises a third port configured to connect the energy source of the first interconnection module to an auxiliary load.

26. The system of claim 24, further comprising a control system configured to control the first converter of each of the first and second interconnection modules to balance energy between the first and second arrays.

27. The system of claim 24, wherein the second converter is a DC-DC converter comprising a transformer configured to isolate the energy source and the first converter from the second port.

28. A modular energy system controllable to supply power to a load, comprising:

a plurality of modules connected together to output an AC voltage signal comprising a superposition of first output voltages from each module, wherein each module comprises an energy source, a first converter connected to the energy source and configured to generate the first output voltage at a first port of the module, and a second converter connected between a second port of the module and the energy source; and

a control system configured to control the first converter and the second converter of each module.

29. The system of claim 28, wherein the control system is configured to control the second converter of each module to charge the energy source of the module and concurrently control the first converter of each module to output the first output voltage.

30. The system of claim 28, further comprising an auxiliary converter coupled to DC lines of the system, the auxiliary converter configured to convert DC power from the DC lines to AC power for an auxiliary load.