Environmental System and Modular Power Skid For a Facility

RELATED APPLICATIONS

[001] This application claims the benefit of and priority to U.S. Provisional Patent Application Serial Number 61/641,391, titled "Environmental System and Modular Power Skid For a Facility", filed May 2, 2012, and to U.S. Non-Provisional Patent Application No. 13/875,249, titled "Environmental System and Modular Power Skid For a Facility", filed May 1, 2013, both of which are incorporated herein by reference.

FIELD OF THE INVENTION

[002] Embodiments of the invention generally relate to a pre-wired and pre-engineered integrated platform for power supply and distribution that is pre-assembled, scalable, and modular.

BACKGROUND OF THE INVENTION

[003] Construction projects proceed in stages because certain aspects of the project must be completed prior to the next stage being initiated. However, the traditional stages of constructing a building can be altered with some creative thinking.

SUMMARY OF THE INVENTION

[004] Various methods and apparatuses are described for a power distribution system.

In one aspect, there is provided a power distribution system, comprising: a set of two or more modular-critical-power-distribution skids are arranged in a redundant power center configuration to supply power to electrical loads in a modular data center facility, where a first modular-critical-power-distribution skid is housed in a first hardened building and connects to the electrical loads to supply power as an A-side power for the electrical loads, and where a second modular-critical-power-distribution skid is housed in a second hardened building and connects to the electrical loads to supply power as a B-side power for the electrical loads, where each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system, where each modular-critical-power-distribution skid is pre-wired and pre-engineered for

the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center facility as a monolithic pre-wired preassembled integrated platform, and where the uninterruptable power supply is electrically and mechanically connected into the multiple power distribution cabinets, all of which are mounted onto a steel-framed support structure, which supports a weight of those uninterruptable power supplies and power distribution cabinets, where the modular data center facility contains computing systems that includes servers and storage devices housed in hot and cool zones, routers and switches that transport data traffic between the servers as well as transport the data traffic to a world exterior to the modular data center facility, where the environmental control system controls a cooling system for the set of the two or more modular-critical-power-distribution skids, and electrical power from the A-side power and the B-side power connects in a redundant power configuration to electrical loads in the cooling system, where each power center of the redundant power center configuration contains its own modular-critical-power-distribution skid and is cooled by multiple packaged Heating, Ventilation, and Air Condition (HVAC) Roof-Top Units (RTU) providing at least N+1 system redundancy for the cooling system for each power center, where electrical power for each HVAC roof-top unit that cools the power centers is available from both the A-side power from its own circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and the B-side power from its own circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid, and where each modular-critical-power-distribution skid has a cross tie breaker inside its power distribution cabinets to allow at least the first modular-critical-power-distribution skid to supply both the A-side power and the B-side power in the redundant power configuration when the cross tie breaker is closed and the first modular-critical-power-distribution skid is operational.

In another aspect, there is provided a method of supplying redundant power to electrical loads in a modular data center facility with a set of two or more

modular-critical-power-distribution skids arranged in a redundant power supply configuration, comprising: using a first modular-critical-power-distribution skid housed in a first hardened building to supply power as an A-side power for the electrical loads; using a second modular-critical-power-distribution skid housed in a second hardened building to supply power as a B-side power for the electrical loads, where each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system, where each modular-critical-power-distribution skid is pre-wired and pre-engineered for the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center facility as a monolithic pre-wired preassembled integrated platform, and where the uninterruptable power supply is electrically and mechanically connected into the multiple power distribution cabinets, all of which are mounted onto a steel framed support structure, which supports a weight of those uninterruptable power supplies and power distribution cabinets; and where the environmental control system controls a cooling system for the first and second modular-critical-power-distribution skids, and electrical power from the A-side power and the B-side power connects in a redundant power configuration to electrical loads in the cooling system, where each power center of a number of power centers contains its own modular-critical-power-distribution skid and is cooled by multiple packaged Heating, Ventilation, and Air Condition (HVAC) Roof-Top Units (RTU) providing 2 N system redundancy for the cooling system for each power center where electrical power for each HVAC roof-top unit that cools the power centers is available from both the A-side power from its own circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and the B-side power from its own circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid, and where each modular-critical-power-distribution skid has the cross tie breaker inside its power distribution cabinets to allow at least the first modular-critical-power-distribution skid to supply both the A-side power and the B-side power in the

redundant power configuration when the cross tie breaker is closed and the first modular-critical-power-distribution skid is operational.

In an embodiment, a set of two or more modular-critical-power-distribution skids are arranged in a redundant power center configuration to supply power to electrical loads in a modular data center facility. A first modular-critical-power-distribution skid is housed in a first hardened building and connects to the electrical loads to supply power as an A-side power for the electrical loads. Likewise, a second modular-critical-power-distribution skid is housed in a second hardened building and connects to the electrical loads to supply power as a B-side power for the electrical loads. Each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system. Each modular-critical-power-distribution skid is pre-wired, pre-engineered, and pre-assembled for the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center

CLAIMS

We claim:

1. A power distribution system, comprising:

a set of two or more modular-critical-power-distribution skids are arranged in a redundant power center configuration to supply power to electrical loads in a modular data center facility,

where a first modular-critical-power-distribution skid is housed in a first hardened building and connects to the electrical loads to supply power as an A-side power for the electrical loads, and

where a second modular-critical-power-distribution skid is housed in a second hardened building and connects to the electrical loads to supply power as a B-side power for the electrical loads,

where each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system,

where each modular-critical-power-distribution skid is pre-wired and pre-engineered for the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center facility as a monolithic pre-wired preassembled integrated platform, and

where the uninterruptable power supply is electrically and mechanically connected into the multiple power distribution cabinets, all of which are mounted onto a steel-framed support structure, which supports a weight of those uninterruptable power supplies and power distribution cabinets,

where the modular data center facility contains computing systems that includes servers and storage devices housed in hot and cool zones, routers and switches that transport data traffic between the servers as well as transport the data traffic to a world exterior to the modular data center facility,

where the environmental control system controls a cooling system for the set of the two or more modular-critical-power-distribution skids, and electrical power from the A-side power and the B-side power connects in a redundant power configuration to electrical loads in the cooling system,

where each power center of the redundant power center configuration contains its own modular-critical-power-distribution skid and is cooled by multiple packaged Heating, Ventilation, and Air Condition (HVAC) Roof-Top Units (RTU) providing at least N+1 system redundancy for the cooling system for each power center,

where electrical power for each HVAC roof-top unit that cools the power centers is available from both the A-side power from its own circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and the B-side power from its own circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid, and

where each modular-critical-power-distribution skid has a cross tie breaker inside its power distribution cabinets to allow at least the first modular-critical-power-distribution skid to supply both the A-side power and the B-side power in the redundant power configuration when the cross tie breaker is closed and the first modular-critical-power-distribution skid is operational.

2. The system of claim 1, where the environmental control system electrically couples to one or more automatic transfer switches for the N+1-redundant cooling system, and in a failure event of a first HVAC RTU that cools the power centers is detected by the environmental control system, then the environmental control system ensures enough HVAC RTUs operate to supply cooling with enough capacity to meet the A-side power and the B-side power electrical loads in accordance with modular data center facility room full-load requirements.

3. The system of claim 2,

where the servers, storage devices, routers, and switches in the modular data center facility are cooled by a second set of two or more packaged HVAC roof top units that cools modular data center facility electrical loads,

where electrical power for the second set of HVAC roof-top units is available from both the A-side power from a first circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and the B-side power from a second circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid via one or more automatic transfer switches, and in a failure event of a first packaged HVAC RTU in the second set of packaged HVAC roof top units that cools the modular data center facility electrical loads is detected by the environmental control system, then the environmental control system ensures another packaged HVAC RTU in the second set of packaged HVAC roof top units operates to supply cooling with enough capacity to meet the A-side power and the B-side power electrical loads in accordance with the modular data center facility full-load requirements.

4. The system of claim 2, where the uninterruptable power supply for each skid incorporates a valve-regulated lead-acid battery backup component configured to supply electrical loads in the modular data center facility for at least several minutes from that uninterruptable

power supply, and each uninterruptable power supply has a dedicated external static bypass switch configured such that 1) when an inverter of the uninterruptable power supply detects failure or 2) the battery backup component of the uninterruptable power supply runs below a minimum threshold voltage, then the static bypass switch ensures an electrical load changes over automatically onto a main AC electrical power input feed.

5. The system of claim 2, where an initial set of building modules can be built upon a parcel of land to form the modular data center facility, and then as needs of space and additional capacity of the modular data center facility increase, then at a future point in time an additional pre-engineered data hall as well as a power center containing a redundant set of modular-critical-power-distribution skids to supply the A-side power and the B-side power and cooling for electrical loads of the data hall and the power center can be rapidly added to the initial set of building modules to form an integrated modular data center facility; and thus, the integrated data center facility transformation takes a step-by-step approach carried out over time through an addition of more building modules added to the initial set of building modules.

6. The system of claim 1,
where wall sections forming the first hardened building containing the first modular-critical-power-distribution skid and wall sections forming the second hardened building containing the second modular-critical-power-distribution skid have reinforced frameworks to meet Miami-Dade County standards to withstand up to 149 mph winds and a 1.5 seismic importance factor, and
where the wall sections forming the hardened buildings are connected to a foundation.

7. The system of claim 6,
where the cooling system is mechanical and also has a hardened modular container; and
where the first hardened building bridges with a mechanical platform to the second hardened building, and two or more standby critical power generators connect to the first modular-critical-power-distribution skid,
where each standby critical power generator electrically connects to one of the power distribution cabinets on its own corresponding modular-critical-power-distribution skid and then via the cross tie breaker of that skid to supply critical power to both the A-side power and the B-side power, and
where each standby critical power generator is installed outdoors in a weather protective enclosure.

8. The system of claim 1, where each modular-critical-power-distribution skid incorporates a modular fault tolerant control system,
where the uninterruptable power supply of each skid is configured to deliver continuous conditioned power to the electrical loads that are classified as critical in the modular data center facility and each skid has interlocked circuit breakers in the power distribution cabinets to open and isolate the circuit breakers electrically near a detected fault to isolate that fault from affecting a rest of the electrical loads in the modular data center facility,
where in a failure event of the first modular-critical-power-distribution skid is detected by the fault tolerant control system, then the fault tolerant control system ensures the second modular-critical-power-distribution skid operates to supply electrical power with enough capacity to meet the A-side power center and B-side power center electrical loads in accordance with modular data center facility full-load requirements,
where the modular-critical-power-distribution skids in the redundant power center configuration provide for concurrent maintainability for all cooling system electrical loads as well as other electrical loads classified as critical in the modular data center facility.

9. The system of claim 8,
where input power from a Utility Power grid feed to the first modular-critical-power-distribution skid and the second modular-critical-power-distribution skid is delivered from two separate switchboards,
where one switchboard comes from each modular-critical-power-distribution skid, and the first and second modular-critical-power-distribution skids are electrically connected via two cross tie circuit breakers housed in the power distribution cabinets that operate in the normally closed position.

10. The system of claim 1,
where an electrical power output of each uninterruptable power supply is distributed through its own distribution switchboard in the power distribution cabinets,
where each distribution switchboard is equipped with a maintenance bypass breaker with control logic to ensure the uninterruptable power supply has transferred to bypass before the maintenance bypass breaker can be engaged to the electrical power output of the distribution switchboard,
where the control logic ensures that this will always be a closed transition transfer so that electrical power to electrical loads classified as critical will never be lost.

11. The system of claim 1, where each modular-critical-power-distribution skid has a manual or fully automated cross tie breaker inside its power distribution cabinets, where the cross tie

breaker has a control system to cause for full electrical load transfers to be powered from either the first modular-critical-power-distribution skid or the second modular-critical-power-distribution skid while maintaining continuous uninterruptable power to electrical loads classified as critical on both the A-side power and the B-side power in an event when a detector determines that one of the modular-critical-power-distribution skids has failed.

12. The system of claim 1,
where multiple power distribution units per modular-critical-power-distribution skid are electrically connected to the uninterruptable power supply of a skid via one or more circuit breakers in the power distribution cabinets mounted on the steel-framed support structure of the skid,
where the multiple power distribution units are electrically connected in an alternating A-side power/B-side power arrangement in a data hall to provide electrical power to electrical loads classified as critical via 1) an overhead bus way, 2) a Remote Power Panel, or 3) from panels within the multiple power distribution units and
where each power distribution unit has a step down transformer to convert a supplied input Volts AC into an outputted lower Volts AC,
where each individual power distribution unit feeds electrical power to a portion of critical electrical power loads in the modular data center facility, and
where each power distribution unit has a paired circuit breaker and power monitoring meter going to critical power computing equipment loads in a data floor portion of the modular data center facility.

13. The system of claim 1,
where the first modular-critical-power-distribution skid includes a first electrical connection to a Utility Power-grid step-down voltage transformer that steps down a Utility Power-grid into a standard working voltage that feeds into a main power supply input circuit breaker located in a Main Switchboard on the skid, a second electrical connection to a standby critical power source that feeds into a standby critical power supply circuit breaker also located in the Main Switchboard, a series of circuit breakers in the power distribution cabinets provide fault protection to components in the cooling system and the electrical computing equipment loads;
where the uninterruptable power supply has a static bypass switch and a battery backup power supply,
where each power distribution cabinet electrically connects to a series of power distribution units, and a circuit breaker in the Main Switchboard connects to one or more automatic transfer switches to provide the N+1 System redundancy for the cooling system for the

HVAC RTUs that cool the power centers, and a set of logic for the skid is configured to select either a Utility Power-grid power source or a standby critical power generator to supply electrical power to the uninterruptable power supply.

14. A method of supplying redundant power to electrical loads in a modular data center facility with a set of two or more modular-critical-power-distribution skids arranged in a redundant power supply configuration, comprising:
using a first modular-critical-power-distribution skid housed in a first hardened building to supply power as an A-side power for the electrical loads;
using a second modular-critical-power-distribution skid housed in a second hardened building to supply power as a B-side power for the electrical loads,
where each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system,
where each modular-critical-power-distribution skid is pre-wired and pre-engineered for the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center facility as a monolithic pre-wired preassembled integrated platform, and
where the uninterruptable power supply is electrically and mechanically connected into the multiple power distribution cabinets, all of which are mounted onto a steel framed support structure, which supports a weight of those uninterruptable power supplies and power distribution cabinets; and
where the environmental control system controls a cooling system for the first and second modular-critical-power-distribution skids, and electrical power from the A-side power and the B-side power connects in a redundant power configuration to electrical loads in the cooling system,
where each power center of a number of power centers contains its own modular-critical-power-distribution skid and is cooled by multiple packaged Heating, Ventilation, and Air Condition (HVAC) Roof-Top Units (RTU) providing 2 N system redundancy for the cooling system for each power center,
where electrical power for each HVAC roof-top unit that cools the power centers is available from both the A-side power from its own circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and the B-side power from its own circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid,
and where each modular-critical-power-distribution skid has the cross tie breaker inside its power distribution cabinets to allow at least the first modular-critical-power-distribution skid to supply both the A-side power and the B-side power in the redundant power configuration

when the cross tie breaker is closed and the first modular-critical-power-distribution skid is operational.

15. The method of claim 14,
where in a failure event of a first HVAC RTU that cools the power centers is detected by the environmental control system, the environmental control system ensures enough HVAC RTUs operates to supply cooling with enough capacity to meet the A-side power and B-side power electrical loads in accordance with modular data center facility room full-load requirements.

16. The method of claim 15,
where the servers, storage devices, routers, and switches in the modular data center facility are cooled by a second set of two or more packaged HVAC roof top units that cools modular data center facility electrical loads,
where electrical power for the second set of HVAC roof-top units is available from both the A-side power from a first circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and the B-side power from a second circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid via one or more automatic transfer switches, and in a failure event of a first packaged HVAC RTU in the second set of packaged HVAC roof top units that cools the modular data center facility electrical loads is detected by the environmental control system, then the environmental control system ensures another packaged HVAC RTU in the second set of packaged HVAC roof top units operates to supply cooling with enough capacity to meet the A-side power and the B-side power electrical loads in accordance with the modular data center facility full-load requirements.

17. The method of claim 14,
where the cooling system is mechanical and also has a hardened modular container;
where wall sections forming the first hardened building containing the first modular-critical-power-distribution skid and wall sections forming the second hardened building containing the second modular-critical-power-distribution skid have reinforced frameworks to meet Miami-Dade County standards to withstand up to 149 mph winds and a 1.5 seismic importance factor,
where the wall sections forming the hardened buildings are connected to a foundation, and where the first hardened building bridges with a mechanical platform to the second hardened building; and

where two or more standby critical power generators connect to the first modular-critical-power-distribution skid,
where each standby critical power generator electrically connects to one of the power distribution cabinets on its own corresponding modular-critical-power-distribution skid and then via the cross tie breaker of that skid supplies critical power to both the A-side power and the B-side power, and
where each standby critical power generator is installed outdoors in a weather protective enclosure.

18. The method of claim 14,
where the uninterruptable power supply in each skid incorporates a valve-regulated lead-acid battery backup component configured to supply electrical loads in the modular data center facility for at least several minutes from that uninterruptable power supply, and each uninterruptable power supply has a dedicated external static bypass switch configured such that 1) when an inverter of the uninterruptable power supply detects failure or 2) the battery backup component of the uninterruptable power supply runs below a minimum threshold voltage, then the static bypass switch ensures an electrical load changes over automatically onto a main AC electrical power input feed.

19. The method of claim 14,
where each modular-critical-power-distribution skid incorporates a modular fault tolerant control system,
where the uninterruptable power supply of each skid is configured to deliver continuous conditioned power to the electrical loads that are classified as critical in the modular data center facility and each skid has interlocked circuit breakers in the power distribution cabinets to open and isolate the circuit breakers electrically near a detected fault to isolate that fault from affecting the rest of the modular data center loads,
where in a failure event of the first modular-critical-power-distribution skid is detected by the fault tolerant control system, then the fault tolerant control system ensures the second modular-critical-power-distribution skid operates to supply electrical power with enough capacity to meet A-side power center and B-side power center electrical loads in accordance with modular data center facility full-load requirements,
where the modular-critical-power-distribution skids in the redundant power configuration provide for concurrent maintainability for all the cooling system electrical loads as well as electrical loads classified as critical in the modular data center facility,

where input power from a Utility Power grid feed to the first modular-critical-power-distribution skid and the second modular-critical-power-distribution skid is delivered from two separate switchboards,
where one switchboard comes from each modular-critical-power-distribution skid, and the first and second modular-critical-power-distribution skids are electrically connected via two cross tie circuit breakers housed in the power distribution cabinets that operate in the normally closed position.

20. The method of claim 14,
where the first modular-critical-power-distribution skid has the cross tie breaker inside its power distribution cabinets,
where the cross tie breaker has a control system to cause for full electrical load transfers to be powered from either the first modular-critical-power-distribution skid or the second modular-critical-power-distribution skid while maintaining continuous uninterruptable power to electrical loads classified as critical on both the A-side power and the B-side power in an event when a detector determines that one of the modular-critical-power-distribution skids has failed.

CLAIMS

We claim:

1. A power distribution system, comprising:

a set of two or more modular-critical-power-distribution skids are arranged in a redundant power center configuration to supply power to electrical loads in a modular data center facility, where a first modular-critical-power-distribution skid is housed in a first hardened building and connects to the electrical loads to supply power as an A-side power for the electrical loads, and where a second modular-critical-power-distribution skid is housed in a second hardened building and connects to the electrical loads to supply power as a B-side power for the electrical loads, where each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system, where each modular-critical-power-distribution skid is pre-wired and pre-engineered for the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center facility as a monolithic pre-wired preassembled integrated platform, and where the uninterruptable power supply is electrically and mechanically connected into the multiple power distribution cabinets, all of which are mounted onto a steel framed support structure, which supports a weight of those uninterruptable power supplies and power distribution cabinets, where the modular data center facility contains computing systems that includes servers and storage devices housed in hot and cool zones, routers and switches that transport data traffic between the servers as well as transport traffic to a world exterior to the modular data center facility, where the environmental control system controls a cooling system for the modular-critical-power-distribution skids, and electrical power from the A-side and B-side connects in a redundant power configuration to electrical loads in the cooling system, where each power center contains its own modular-critical-power-distribution skid and is cooled by multiple packaged Heating, Ventilation,

and Air Condition (HVAC) Roof-Top Units (RTU) providing at least N+1 system redundancy for the cooling system for each power center, where the electrical power for each HVAC roof-top unit that cools the power centers is available from both the A-side power from its own circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and B-side power from its own circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid, and where each modular-critical-power-distribution skid has a cross tie breaker inside its power distribution cabinets to allow at least the first modular-critical-power-distribution skid to supply both A-side and B-side redundant power when the cross tie breaker is closed and the first modular-critical-power-distribution skid is operational.

2. The system of claim 1, where the environmental control system electrically couples to one or more automatic transfer switches for a N+1 cooling system, and in a failure event of a first HVAC RTU unit that cools the power centers is detected by the environmental control system, then the environmental control system ensures enough HVAC RTUs operate to supply cooling with enough capacity to meet the A-side power center and B-side power center electrical room full load requirements.

3. The system of claim 2, where the servers, storage devices, routers, and switches in the modular data center are cooled by a second set of two or more packaged HVAC roof top units that cools these modular data center electrical loads, where electrical power for the second set of HVAC roof-top units is available from both the A-side power from a first circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and B-side power from a second circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid via one or more automatic transfer switches, and in a failure event of a first packaged HVAC RTU unit in the

second set that cools these modular data center electrical loads is detected by the environmental control system, then the environmental control system ensures another packaged HVAC RTU unit in the second set operates to supply cooling with enough capacity to meet the A-side power and B-side power electrical loads in the modular data center full load requirements.

4. The system of claim 1, where each wall section forming the first hardened building containing the first modular-critical-power-distribution skid and each wall section forming the second hardened building containing the second modular-critical-power-distribution skid has reinforced framework to meet Miami-Dade County standards to withstand up to 149 mph winds and a 1.5 seismic importance factor, where the wall sections forming the hardened buildings are connected to a foundation.

5. The system of claim 4, where the mechanical cooling system also has a hardened modular container; and

where the first hardened building bridges with a mechanical platform to the second hardened building, and

two or more standby critical power generators connect to the first modular-critical-power-distribution skid, where each standby critical power generator electrically connects to one of the power distribution cabinets on its own corresponding modular-critical-power-distribution skid and then via a cross tie breaker of that skid to supply critical power to both the A-side and B-side, and where each standby critical power generator is installed outdoors in a weather protective enclosure.

6. The system of claim 2, where the uninterruptable power supply for each skid incorporates a valve-regulated lead-acid battery backup component configured to supply electrical loads in the modular data center for at least several minutes

from that uninterruptable power supply, and each uninterruptable power supply has a dedicated external static bypass switch configured such that 1) when an inverter of the uninterruptable power supply failure is detected or 2) the battery of the uninterruptable power supply runs below a minimum threshold voltage, then the static bypass switch ensures the electrical load changes over automatically onto a mains AC electrical power input feed.

7. The system of claim 1, where each modular-critical-power-distribution skid incorporates a modular fault tolerant control system, where the uninterruptable power supply of each skid is configured to deliver continuous conditioned power to the electrical loads that are classified as critical in the modular data center and each skid has interlocked circuit breakers in the power distribution cabinets to open and isolate circuit breakers electrically near a detected fault to isolate that fault from affecting a rest of the electrical loads in the modular data center facility, where in a failure event of the first modular-critical-power-distribution skid is detected by the fault tolerant control system, then the fault tolerant control system ensures the second modular-critical-power-distribution skid operates to supply electrical power with enough capacity to meet the A-side power center and B-side power center electrical loads in the modular data center full load requirements, where redundant modular-critical-power-distribution skids provide for concurrent maintainability for all cooling system electrical loads as well as those other electrical loads classified as critical in the modular data center facility.

8. The system of claim 7, where input power from a Utility Power grid feed to the first modular-critical-power-distribution skid and the second modular-critical-power-distribution skid is delivered from two separate switchboards, where one switchboard comes from each modular-critical-power-distribution skid, and the two modular-critical-power-distribution skids are electrically connected via a use

of two cross tie circuit breakers housed in the power distribution cabinets that operate in the normally closed position.

9. The system of claim 1, where an electrical power output of each uninterruptable power supply is distributed through its own distribution switchboard in the power distribution cabinets, where that distribution switchboard is equipped with a maintenance bypass breaker with control logic to ensure the uninterruptable power supply has transferred to bypass before the maintenance bypass breaker can be engaged to an output of the distribution switchboard, where the control logic ensures that this will always be a closed transition transfer so that electrical power to the electrical loads classified as critical will never be lost.

10. The system of claim 1, where each modular-critical-power-distribution skid has a manual or fully automated cross tie breaker inside its power distribution cabinets, where the cross tie breaker has a control system to cause for full electrical load transfers to be powered from either the first modular-critical-power-distribution skid or the second modular-critical-power-distribution skid while maintaining continuous uninterruptable power to the electrical loads classified as critical on both the A-side and the B-side in an event when a detector determines that one of the modular-critical-power-distribution skids has failed.

11. The system of claim 1, where multiple power distribution units per modular power skid are electrically connected to the uninterruptable power supply of that skid via one or more circuit breakers in the power distribution cabinets mounted on the framed support structure of the skid, where the multiple power distribution units are electrically connected in an alternating A-side power/B-side power arrangement in a data hall to provide electrical power to the electrical loads classified as critical via either an 1) overhead bus way, a 2) Remote Power

Panel, or 3) from panels within the power distribution unit and where each power distribution unit has a step down transformer to convert a supplied input Volts AC into an outputted lower Volts AC, where each individual power distribution unit feeds electrical power to a portion of the critical electrical power loads in the modular data center, and where each power distribution units has a paired circuit breaker and power monitoring meter going to the critical power computing equipment loads in a data floor portion of the modular data center facility.

12. The system of claim 1, where the first modular-critical-power-distribution skid includes a first electrical connection to a Utility Power grid voltage step down voltage transformer that steps down the Utility Power grid voltage into a standard working voltage that feeds into a main power supply input circuit breaker located in a Main Switchboard on the skid, a second electrical connection to a standby critical power source into a standby critical power supply circuit breaker also located in the Main Switchboard, a series of circuit breakers in the power distribution cabinets provide fault protection to components in the cooling system and the electrical computing equipment loads; where the universal power supply has a static bypass switch and a battery backup power supply, where the power distribution cabinet electrically connects to a series of power distribution units, and a circuit breaker in the Main Switchboard connects to one or more automatic transfer switches to provide the N+1 System cooling for the HVAC RTUs that cools the power centers, and a set of logic for the skid is configured to select either the Utility Power grid voltage power source or the standby critical power generator to supply electrical power to the uninterruptable power supply.

13. The system of claim 2, where an initial set of building modules can be built upon a parcel of land to form a modular data center facility, and then as needs of space and additional capacity of the modular datacenter facility increase, then at a future point in time an additional pre-engineered data hall as well as power

center containing its redundant set of modular-critical-power-distribution skids to supply A-side and B-side power and cooling for the electrical loads of the data hall and power center can be rapidly added to the initial set of building modules to form an integrated modular data center facility; and thus, the integrated data center facility transformation takes a step-by-step approach carried out over time through an addition of more building modules added to existing building modules.

14. A method of supplying redundant power to electrical loads in a modular data center facility with a set of two or more modular-critical-power-distribution skids arranged in a redundant power supply configuration, comprising:

using a first modular-critical-power-distribution skid housed in a first hardened building to supply power as an A-side power for the electrical loads;

using a second modular-critical-power-distribution skid housed in a second hardened building to supply power as a B-side power for the electrical loads, where each modular-critical-power-distribution skid is assembled with an uninterruptable power supply, multiple power distribution cabinets, and an environmental control system, where each modular-critical-power-distribution skid is pre-wired and pre-engineered for the uninterruptable power supply, the multiple power distribution cabinets, and the environmental control system in an off-site facility prior to being installed in the modular data center facility as a monolithic pre-wired preassembled integrated platform, and where the uninterruptable power supply is electrically and mechanically connected into the multiple power distribution cabinets, all of which are mounted onto a steel framed support structure, which supports a weight of those uninterruptable power supplies and power distribution cabinets; and

where the environmental control system controls a cooling system for both of the modular power skids, and electrical power from the A-side and B-side connects in a redundant power configuration to electrical loads in the cooling system, where each power center contains its own modular-critical-power-

distribution skid and is cooled by multiple packaged Heating, Ventilation, and Air Condition (HVAC) Roof-Top Units (RTU) providing 2 N system redundancy for the cooling system for each power center, where the electrical power for each HVAC roof-top unit that cools the power centers is available from both the A-side power from its own circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and B-side power from its own circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid, and where each modular-critical-power-distribution skid has a cross tie breaker inside its power distribution cabinets to allow at least the first modular-critical-power-distribution skid to supply both A-side and B-side redundant power when the cross tie breaker is closed and the first modular-critical-power-distribution skid is operational.

15. The method of claim 14, where in a failure event of a first HVAC RTU unit that cools the power centers is detected by the environmental control system, the environmental control system ensures enough HVAC RTUs operates to supply cooling with enough capacity to meet the A-side power center and B-side power center electrical room full load requirements.

16. The method of claim 15, where the servers, storage devices, routers, and switches in the modular data center are cooled by a second set of two or more packaged HVAC roof top units that cools these modular data center electrical loads, where electrical power for the second set of HVAC roof-top units is available from both the A-side power from a first circuit breaker in the power distribution cabinets in the first modular-critical-power-distribution skid and B-side power from a second circuit breaker in the power distribution cabinets in the second modular-critical-power-distribution skid via one or more automatic transfer switches, and in a failure event of a first packaged HVAC RTU unit in the second set that cools these modular data center electrical loads is detected by

the environmental control system, then the environmental control system ensures another packaged HVAC RTU unit in the second set operates to supply cooling with enough capacity to meet the A-side power and B-side power electrical loads in the modular data center full load requirements.

17. The method of claim 14, where the mechanical cooling system also has a hardened modular container;

where each wall section forming the first hardened building containing the first modular-critical-power-distribution skid and each wall section forming the second hardened building containing the second modular-critical-power-distribution skid has reinforced framework to meet Miami-Dade County standards to withstand up to 149 mph winds and a 1.5 seismic importance factor, where the wall sections forming the hardened buildings are connected to a foundation, and where the first hardened building bridges with a mechanical platform to the second hardened building; and

where two or more standby critical power generators connect to the first modular-critical-power-distribution skid, where each standby critical power generator electrically connects to one of the power distribution cabinets on its own corresponding modular-critical-power-distribution skid and then via the cross tie breaker of that skid supplies critical power to both the A-side and B-side, and where each standby critical power generator is installed outdoors in a weather protective enclosure.

18. The method of claim 14, where the uninterruptable power supply in each skid incorporates a valve-regulated lead-acid battery backup component configured to supply electrical loads in the modular data center for at least several minutes from that uninterruptable power supply, and each uninterruptable power supply has a dedicated external static bypass switch configured such that 1) when an inverter of the uninterruptable power supply failure is detected or 2)

the battery of the uninterruptable power supply runs below a minimum threshold voltage, then the static bypass switch ensures the electrical load changes over automatically onto a mains AC electrical power input feed.

19. The method of claim 14, where each modular-critical-power-distribution skid incorporates a modular fault tolerant control system, where the uninterruptable power supply of each skid is configured to deliver continuous conditioned power to the electrical loads that are classified as critical in the modular data center and each skid has interlocked circuit breakers in the power distribution cabinets to open and isolate circuit breakers electrically near a detected fault to isolate that fault from affecting the rest of the modular data center loads, where in a failure event of the first modular-critical-power-distribution skid is detected by the fault tolerant control system, then the fault tolerant control system ensures the second modular-critical-power-distribution skid operates to supply electrical power with enough capacity to meet the A-side power center and B-side power center electrical loads in the modular data center full load requirements, where the redundant modular-critical-power-distribution skids provide for concurrent maintainability for all cooling system electrical loads as well as those other electrical loads classified as critical in the modular data center facility, where input power from a Utility Power grid feed to the first modular-critical-power-distribution skid and the second modular-critical-power-distribution skid is delivered from two separate switchboards, where one switchboard comes from each modular-critical-power-distribution skid, and the two modular-critical-power-distribution skids are electrically connected via a use of two cross tie circuit breakers housed in the power distribution cabinets that operate in the normally closed position.

20. The method of claim 14, where the first modular-critical-power-distribution skid has the cross tie breaker inside its power distribution cabinets, where the

cross tie breaker has a control system to cause for full electrical load transfers to be powered from either the first modular-critical-power-distribution skid or the second modular-critical-power-distribution skid while maintaining continuous uninterruptable power to the electrical loads classified as critical on both the A-side and the B-side in an event when a detector determines that one of the modular-critical-power-distribution skids has failed.