AIRPORT ELECTRIC VEHICLE CHARGING SYSTEM

BACKGROUND

Initiatives underway in various countries are driving electrification of equipment used in airports. Government subsidies, greater awareness about improving air quality, "green" initiative grants, advancements in battery technology, laws in certain jurisdictions requiring reduction or elimination of diesel or gas powered engines, and/or the like support transitioning to use of electric powered equipment (e.g., loaders, baggage tractors, aircraft towers, etc.) in airports.

Although there are clear advantages to converting to electric power from diesel, gas, or similar power sources, the transition is not without difficulty. Among other things, existing electric charging systems may not be directly deployable in airport environments due to power requirements and regulations specific to airports. Installing electric charging systems in airports may involve high construction costs, high installation costs, and/or significant changes may be required to existing infrastructure.

Accordingly, it would be beneficial to have electric charging systems deployable in airports having low installation costs, minimal impact on existing infrastructure, without negative impact to existing systems and requirements, have flexibility to handle a variety of electric powered equipment, and/or the like.

SUMMARY

This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

According to an aspect of the present invention, there is provided an airport electric vehicle charging system configured to be electrically coupled to a power source that is positioned proximate a gate of an airport and that provides alternating current (AC) power, the airport charging system comprising:

an aircraft power branch configured to acquire first AC power and facilitate providing the first AC power to an aircraft proximate the gate;

a ground support equipment (GSE) charging branch configured to acquire second AC power, the GSE charging branch including:

a battery charger including an AC-DC converter configured to convert the second AC power to direct current (DC) power; and

a battery bank comprising one or more batteries electrically coupled to the battery charger, wherein the battery charger is configured to facilitate providing the DC power for charging at least one of (a) the battery bank or (b) one or more electrified GSEs; and

the airport electric vehicle charging system further comprises a controller configured to:

acquire an AC power feedback signal regarding the AC power provided by the power source;

acquire an aircraft power feedback signal regarding power consumption of the aircraft coupled to the aircraft power branch; and

determine a maximum available excess power based on the AC power feedback signal and the aircraft power feedback signal;

wherein the second AC power is less than or equal to the maximum available excess power.

In some embodiments, an airport electric vehicle charging system includes a current transducer electrically coupled with a power source; a solid state converter electrically coupleable with an aircraft at or near an airport gate and configured to provide and maintain power, from the power source, to the aircraft at a power level requested by the aircraft; and

CLAIMS

We claim:

1. An airport electric vehicle charging system configured to be electrically coupled to a power source that is positioned proximate a gate of an airport and that provides alternating current (AC) power, the airport charging system comprising:

an aircraft power branch configured to acquire first AC power and facilitate providing the first AC power to an aircraft proximate the gate;

a ground support equipment (GSE) charging branch configured to acquire second AC power, the GSE charging branch including:

a battery charger including an AC-DC converter configured to convert the second AC power to direct current (DC) power; and

a battery bank comprising one or more batteries electrically coupled to the battery charger, wherein the battery charger is configured to facilitate providing the DC power for charging at least one of (a) the battery bank or (b) one or more electrified GSEs; and

the airport electric vehicle charging system further comprises a controller configured to:

acquire an AC power feedback signal regarding the AC power provided by the power source;

acquire an aircraft power feedback signal regarding power consumption of the aircraft coupled to the aircraft power branch; and

determine a maximum available excess power based on the AC power feedback signal and the aircraft power feedback signal;

wherein the second AC power is less than or equal to the maximum available excess power.

2. The airport electric vehicle charging system of claim 1, further comprising a current transducer configured to be electrically coupled to the power source, the current transducer configured to generate the AC power feedback signal.

3. The airport electric vehicle charging system of claim 1, wherein the GSE charging branch includes a DC-DC charger, wherein the battery bank is positioned between the battery charger and the DC-DC charger, wherein the battery charger is configured to provide the DC power to the battery bank for storage, and wherein the DC-DC charger is

configured to acquire stored DC power from the battery bank and condition the stored DC power before the stored DC power is provided to the one or more electrified GSEs.

4. The airport electric vehicle charging system of claim 1, wherein the battery charger is configured to (a) selectively provide the DC power directly to (i) the battery bank for storage and (ii) the one or more electrified GSEs to charge the one or more electrified GSEs and (b) supplement the DC power provided directly to the one or more electrified GSEs with stored DC power within the battery bank based on a charging demand of the one or more electrified GSEs.

5. The airport electric vehicle charging system of claim 1, wherein the battery bank is configured to facilitate providing stored DC power to the one or more electrified GSEs in excess of the maximum available excess power.

6. The airport electric vehicle charging system of claim 1, wherein the controller is configured to acquire the AC power from the power source, wherein the aircraft power branch is configured to acquire the first AC power from the controller, and wherein the GSE charging branch is configured to acquire the second AC power from the controller.

7. The airport electric vehicle charging system of claim 6, wherein an input of the controller electrically couples with the power source, a first output of the controller electrically couples with the aircraft power branch, and a second output of the controller electrically couples with the battery charger.

8. The airport electric vehicle charging system of claim 1, wherein the aircraft power branch is configured to acquire the first AC power from the power source, and wherein the GSE charging branch is configured to acquire the second AC power from the power source.

9. The airport electric vehicle charging system of claim 8, further comprising a power splitter positioned between (a) the power source and (b) the aircraft power branch and the GSE charging branch.

10. The airport electric vehicle charging system of claim 1, wherein the controller is configured to generate a control signal based on the maximum available excess power, and wherein the battery charger is configured to draw the second AC power based on

the control signal.

11. The airport electric vehicle charging system of claim 10, wherein the battery bank is configured to determine charging requirements of the one or more batteries and generate a third feedback signal indicative of the charging requirements of the one or more batteries.

12. The system of claim 11, wherein the battery charger is configured to receive the control signal and the third feedback signal and draw the second AC power based on the control signal and the third feedback signal.

13. The airport electric vehicle charging system of claim 1, wherein the aircraft power branch includes an AC-AC converter configured to condition the first AC power such that the first AC power is suitable for the aircraft.

14. The airport electric vehicle charging system of claim 13, further comprising a feedback line electrically coupled between the AC-AC converter and the controller, the feedback line configured to provide the aircraft power feedback signal from the AC-AC converter to the controller.

15. The airport electric vehicle charging system of claim 1, further comprising a central monitoring unit in communication with the controller, wherein the central monitoring unit is configured to receive first power consumption data associated with the airport electric vehicle charging system and second power consumption data associated with a second system, different from the airport electric vehicle charging system, located at or near a second gate of the airport.