BRIEF SUMMARY

[0007] The present disclosure generally relates to a system and method for managing an industry network. The embodiments disclosed herein describe a system and method for collecting data at different sections of the industry network and analyzing the collected data in order to manage electric vehicle power distribution and charging.

[0008] According to a first aspect, there is provided a method for distributed intelligence of power tracking and power allocation, the method executable by at least one computer including at least one processor and memory, the method may include: receiving data by the at least one computer from a plurality of identified charging stations and vehicles of customers at distributed locations throughout a power grid, wherein the received data ~~comprises~~ includes selections from the customers of scheduling charging times, scheduling charging locations, and scheduling charging durations to charge the electric vehicles; analyzing, with at least one processor of the at least one computer, the data with respect to available power for those locations and customer historical usage and profiles; and sending commands, with the at least one processor, to reallocate power to assets of the power grid to handle fluctuations or forecasted fluctuations in power demand based on the analysis, wherein each asset of the power grid is any one or more of: an electric vehicle; a charging station; a renewable energy source; a substation; and/or a transformer. The analysis may further consider a time of day and/or a day of week. The analysis may further consider customer preferences within the profiles. The analysis may further consider real-time customer inputs regarding planned trips or planned charges.

[0008a] According to a second aspect, there is provided a system for distributed intelligence of power tracking and power allocation ~~comprising~~including: at least one computer including at least one processor and memory, the at least one computer configured to receive data from a plurality of identified charging stations and electric vehicles of customers at distributed locations throughout a power grid, wherein the received data ~~comprises~~ includes selections from the customers of scheduling charging times, scheduling charging locations, and scheduling charging durations to charge the electric vehicles; where the processor is configured to: analyze the data with respect to available power for those locations and customer

historical usage and profiles; and send commands to reallocate power to assets of the power grid to handle fluctuations or forecasted fluctuations, in power demand based on the analysis, wherein each asset of the power grid is one or more of: an electric vehicle; a charging station; a renewable energy source; a substation; and/or a transformer.

[0009] According to a third aspect, there is provided a method for distributed intelligence of power tracking and power allocation, the method executable by at least one computer including at least one processor and memory, the method may include: receiving, by the at least one computer, first parameters related to system and charging infrastructure within power transmission and distribution assets of a power grid; and second parameters associated with a plurality of electric vehicles, wherein the second parameters associated with an electric vehicle (EV) of the plurality of electric vehicles include a scheduled time and a scheduled location for charging the EV, according to a travel plan of the EV, at one or more charging stations of the power grid~~related to electric vehicle (EV) customers and customer preferences~~; analyzing, using the at least one processor, the first parameters to determine available power for charging stations connected to the power grid assets at the scheduled locations; analyzing, using the at least one processor, the first parameters and the second parameters of the electric vehicles to: forecast power demand at the scheduled times and scheduled locations based on an aggregation of the second parameters of the plurality of electric vehicles; determine whether the power demand at the scheduled times and scheduled locations for charging the electric vehicles~~EV charging in relation to the customer preferences~~ can be met by the available power at the charging stations; and in response to determining that the power demand for charging the electric vehicles~~customer preferences~~ cannot be met by the ~~determined~~ available power, the processor executing instructions to: execute a demand response in the power grid to compensate for a lack of available power for ~~EV~~ charging the electric vehicles, wherein the demand response includes allocation and delivery of power at the scheduled locations at the scheduled times; and execute economic rules ~~drawn to EV charging~~ to incentivize charging the electric vehicles in compliance~~the EV customers to comply~~ with the demand response.

[0009a] According to a fourth aspect, there is provided a system for distributed intelligence of power tracking and power allocation, ~~comprising~~the system including: ~~at least one computer including at least one processor and~~

memory, the at least one computera processor configured to receive: first parameters related to system and charging infrastructure within power transmission and distribution assets of a power grid;, and second parameters related to an electric vehicle (EV), the second parameters including a time-interval and a location of a charging station of the power grid to charge the EV based on a travel route of the EVcustomers and customer preferences; where thea processor is configured to: analyze the first parameters to determine available power for at the charging stations connected to the power grid assets at the location during the time-interval; analyze the first and second parameters to: forecast power demand at the charging station at the location during the time-interval; anddetermine whether EV charging in relation to the customer preferences can be met by the available power at the charging stations; compare the forecasted power demand with the available power at the charging station; and in response to the forecasted power demand not beingdetermining that the customer preferences cannot be met by the determined available power: execute a demand response in the power grid to compensate for a lack of available power for EV charging, where the demand response includes allocation and delivery of power to the charging station at the location during the time-interval; and execute economic rules drawn to EV charging to incentivize compliance with the location and time-intervalthe EV customers to comply with the demand response.

[0010] Other systems, methods, and features will be, or will become, apparent to one with skill in the art upon examination of the following figures and detailed

Claims

1. A method for distributed intelligence of power tracking and power allocation, the method executable by at least one computer including at least one processor and memory, the method ~~comprising~~including:

receiving data, by the at least one computer, from a plurality of identified charging stations and electric vehicles of customers at distributed locations throughout a power grid, wherein the received data ~~comprises~~ includes selections from the customers of scheduling charging times, scheduling charging locations, and scheduling charging durations to charge the electric vehicles;

analyzing, with the at least one processor, the data with respect to available power for those locations and customer historical usage and profiles; and

sending commands, with the at least one processor, to reallocate power to assets of the power grid to handle fluctuations or forecasted fluctuations in power demand based on the analysis, wherein each asset of the power grid is any one or more of:

an electric vehicle;

a charging station;

a renewable energy source;

a substation; and/or

a transformer.

2. ~~The~~ A method ~~of~~ according to claim 1, where ~~the~~ analyzing also considers one or a combination of a time of day and a day of week.

3. ~~The~~ A method ~~of~~ according to either claim 1 or claim 2, where the analyzing also considers customer preferences that are included in the customer profiles.

4. ~~The~~ A method ~~of claim 1~~ according to any one of the preceding claims, where the analyzing also considers real-time customer inputs regarding planned trips or planned charges.

5. ~~The~~ A method according to any one of the preceding claims~~of claim 1~~, further ~~comprising~~including:

receiving a plurality of system and charging infrastructure parameters from the power grid assets;

where analyzing further ~~comprises~~ includes determining, from the parameters, whether there is sufficient power availability within the power grid to support charging the electric vehicles at locations of the charging stations within the power grid.

6. A system for distributed intelligence of power tracking and power allocation ~~comprising~~including:

at least one computer including at least one processor and memory, the at least one computer configured to receive data from a plurality of identified charging stations and electric vehicles of customers at distributed locations throughout a power grid, wherein the received data ~~comprises~~ includes selections from the customers of scheduling charging times, scheduling charging locations, and scheduling charging durations to charge the electric vehicles;

where the processor is configured to:

analyze the data with respect to available power for those locations and customer historical usage and profiles; and

send commands to reallocate power to assets of the power grid to handle fluctuations or forecasted fluctuations, in power demand based on the analysis, wherein each asset of the power grid is one or more of:

an electric vehicle;

a charging station;

a renewable energy source;

a substation; and/or

a transformer.

7. ~~The~~ A system ~~of~~ according to claim 6, where the at least one processor is further configured to analyze one or a combination of a time of day and a day of week.

8. ~~The~~ A system ~~of~~ according to either claim 6 or claim 7, where the at least one processor is further configured to analyze preferences that are included in the customer profiles.

9. ~~The~~ A system ~~of~~ according to any one of claims 6 to 8~~claim 6~~, where the at least one processor is further configured to analyze real-time customer inputs regarding planned trips or planned charges.

10. ~~The~~ A system ~~of claim 6~~according to any one of claims 6 to 9, where the assets include transmission, distribution and feeder assets of the power grid, and

where the processor is further configured to:

receive parameters related to transmission and distribution availability within the power grid for performing the charging at the charging stations, and related to a level of feeder utilization of a power feeder that feeds the charging stations; and

analyze the parameters to determine whether there is sufficient power availability to support charging the electric vehicles through the power feeders.

11. A method for distributed intelligence of power tracking and power allocation, the method executable by at least one computer including at least one processor and memory, the method ~~comprising~~including:

receiving, by the at least one computer, first parameters related to system and charging infrastructure within power transmission and distribution assets of a power grid; and second parameters associated with a plurality of electric vehicles, wherein the second parameters associated with an electric vehicle (EV) of the plurality of electric vehicles include a scheduled time and a scheduled location for charging the EV, according to a travel plan of the EV, at one or more charging stations of the power grid~~related to electric vehicle (EV) customers and customer preferences~~;

analyzing, using the at least one processor, the first parameters to determine available power for charging stations connected to the power grid assets at the scheduled locations;

analyzing, using the at least one processor, the first parameters and the second parameters of the electric vehicles to:

forecast power demand at the scheduled times and scheduled locations based on an aggregation of the second parameters of the plurality of electric vehicles;

determine whether the power demand at the scheduled times and scheduled locations for charging the electric vehicles~~EV charging in relation to the customer preferences~~ can be met by the available power at the charging stations; and

in response to determining that the power demand for charging the electric vehicles~~customer preferences~~ cannot be met by the ~~determined~~ available power, the processor executing instructions to:

execute a demand response in the power grid to compensate for a lack of available power for ~~EV~~ charging the electric vehicles, wherein the demand response includes allocation and delivery of power at the scheduled locations at the scheduled times; and

execute economic rules ~~drawn to EV charging~~ to incentivize charging the electric vehicles in compliance~~the EV customers to comply~~ with the demand response.

~~12. The method of claim 11, where executing the demand response comprises reallocating power to and from a plurality of assets of the power grid to handle fluctuations or forecasted~~

~~fluctuations in power demand based on the customer preferences that affect demand of power at the charging stations.~~

~~13~~12. ~~The~~ A method ~~of~~ according to claim 11, where the parameters related to the system and charging infrastructure include availability of~~whether~~ on-site power storage at a scheduled location~~exits~~ and level of charge of the on-site power storage ~~is sufficient~~ to support EV charging.

~~14~~13. ~~The~~ A method ~~of claim 11~~according to either claim 11 or claim 12, further ~~comprising~~ including executing business rules ~~in addition to the economic rules, where parameters related to the business rules include whether an~~based on the electric vehicle ~~is~~ being a new or an existing customer~~;~~, and ~~how will~~a payment ~~be made by~~mechanism being used to charge the ~~customer~~electric vehicle.

~~15~~14. ~~The~~ A method ~~of claim 11~~according to any one of claims 11 to 13, where parameters related to the economic rules include~~:~~ a rate in effect at time of charging at a charging station~~;~~, demand response rates in effect at a peak pricing~~;~~, and localized rates.

~~16~~15. ~~The~~ A method ~~of claim 11~~according to any one of claims 11 to 14, where parameters related to the economic rules include penalties for opting out of a scheduled time or a scheduled location~~demand response event that would decrease or stop power available~~ for charging, ~~at a desired time;~~ and applicable rates or tariffs for a transaction during the demand response.

~~17~~16. A system for distributed intelligence of power tracking and power allocation, ~~comprising~~the system including:

~~at least one computer including at least one processor and memory, the at least one computer~~a processor configured to receive:

first parameters related to ~~system and charging infrastructure within~~ power transmission and distribution assets of a power grid~~;~~, and second parameters related to an electric vehicle (EV) , the second parameters including a time-interval and a location of a charging station of the power grid to charge the EV based on a travel route of the EV~~customers and customer preferences~~;

~~where the~~a processor ~~is~~ configured to:

analyze the first parameters to determine available power ~~for~~ at the charging station~~s~~ connected to the power grid assets at the location during the time-interval;

analyze the first and second parameters to:

forecast power demand at the charging station at the location during the time-interval; and ~~determine whether EV charging in relation to the customer preferences can be met by the available power at the charging stations~~

compare the forecasted power demand with the available power at the charging station; and

in response to the forecasted power demand not being~~determining that the customer preferences cannot be~~ met by the determined available power:

execute a demand response in the power grid to compensate for a lack of available power for EV charging, where the demand response includes allocation

and delivery of power to the charging station at the location during the time-interval; and

execute economic rules ~~drawn to EV charging~~ to incentivize compliance with the location and time-interval~~the EV customers to comply with the demand response~~.

~~18~~17. ~~The~~ A system ~~of claim 17~~according to claim 16, where ~~to execute the demand response,~~ the processor is further configured to reallocate power to and from a plurality of assets of the power grid to handle fluctuations, or forecasted fluctuations, in power demand based on receipt of charges in the second parameters~~the customer preferences~~ that affect ~~demand of~~the power demand at the charging station~~s~~.

~~19~~18. ~~The~~ A system ~~of claim 17~~according to either claim 16 or claim 17, where the parameters related to the system and charging infrastructure ~~are selected from the group consisting of: whether~~include an operational restriction ~~exists with reference to~~of a charging station~~;~~, ~~whether~~ a reservation of a charging station ~~is reserved~~ by a customer~~;~~, ~~the~~ a presence of an abnormal event~~;~~, and a level of infrastructure capability as related to a charging station.

~~20~~19. ~~The~~ A system ~~of claim 17~~according to any one of claims 16 to 18, where the processor is further configured to execute business rules ~~in addition to the economic rules~~, where parameters related to the business rules include ~~whether an electric vehicle is~~ the EV being a new or an existing customer~~;~~, and ~~how will~~a payment mechanism associated with the electric vehicle~~be made by the customer~~.

~~21~~20. ~~The~~ A system ~~of claim 17~~according to any one of claims 16 to 19, where the first parameters related to the system and charging infrastructure include availability of~~whether~~ on-site power generation ~~is available that contributes to~~for the EV charging.

~~22~~21. ~~The~~ A system ~~of claim 17~~according to any one of claims 16 to 20, where the parameters related to the economic rules include~~:~~ a rate in effect at time of charging at ~~a~~ the charging station~~s~~;~~,~~ demand response rates in effect at a peak pricing~~;~~, and localized rates.

~~23~~22. ~~The~~ A system ~~of claim 17~~according to any one of claims 16 to 21, where parameters related to the economic rules include penalties for opting out of a demand response event that would decrease or stop power available for charging at the location during the time-interval,~~a desired time;~~ and applicable rates or tariffs for a transaction at the location during ~~demand response~~the time-interval.