

SERVER AND METHOD FOR FACILITATING RECOMMENDING DECARBONISATION MEASURE FOR INFRASTRUCTURE

TECHNICAL FIELD

[0001] Various embodiments relate to a server and a method for facilitating recommending a decarbonisation measure for an infrastructure.

BACKGROUND

[0002] Decarbonisation and sustainable green buildings may be a common area of interest for infrastructure owners and investors such as financial institutions. To accelerate the decarbonisation through sustainable finance, it may be important for the investors to identify suitable projects/customers to provide the sustainable finance. However, the investors may lack means to access valuable information to find leads for the sustainable finance. For example, the valuable information may include, but is not limited to, lead information (for example, name of the infrastructure owner who needs green loan), existing performance of the infrastructures, and scenario-based potential environmental and financial indicators of the infrastructures. The lead information may include a forecasted green activity (also referred to as a “forecasted environmental activity”), and may further include other information such as green certification information.

[0003] There have been conventional technologies that may recommend a building improvement, calculate a financial impact of the building, and display a combination of recommendations and multiple scenarios. However, the conventional technologies may not calculate a financial indicator and provide the combination of recommendations backward from a sustainability target (also referred to as a “goal”). Therefore, the conventional technologies may not provide the recommendations or financial indicators based on the sustainability target. Hence, the investors may not be able to effectively identify suitable projects which align with the investors’ goals. Moreover, the conventional technologies may only evaluate limited risk types after identifying the combination of recommendations, and may not generate the combination of recommendations backward from a risk requirement.

[0004] Therefore, there is a need to help the investors to identify the suitable projects for an investment while aligning with the investors' goals.

SUMMARY

[0005] According to various embodiments, there is a server for facilitating recommending a decarbonisation measure for an infrastructure, the server comprising: a memory configured to store instructions; and a processor configured to execute the stored instructions, and configured to: receive information about a plurality of decarbonisation measures capable of being applied to the infrastructure, wherein the information about the plurality of decarbonisation measures includes a value of a first indicator and a value of a second indicator for each decarbonisation measure of the plurality of decarbonisation measures; receive at least one target to be achieved for the infrastructure; calculate a total value of the first indicator for the infrastructure to achieve the target; select a set of decarbonisation measures from the plurality of decarbonisation measures, so that a sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator; and calculate a total value of the second indicator for the infrastructure to achieve the target, based on the set of decarbonisation measures and the information about the plurality of decarbonisation measures.

[0006] In some embodiments, the target relates to a sustainable criterion, the first indicator is an environmental indicator, and the second indicator is a financial indicator.

[0007] In some embodiments, the target is at least one of an environmental target indicator and a financial target indicator.

[0008] In some embodiments, if the target is the financial target indicator, the processor is further configured to use the financial target indicator to calculate the total value of the environmental indicator for the infrastructure.

[0009] In some embodiments, if the processor receives a plurality of targets, the processor is further configured to determine whether to merge the plurality of targets, based on a type of each of the plurality of targets.

[0010] In some embodiments, the processor is further configured to: calculate the total value of the first indicator for the infrastructure, based on at least one of a profit from a carbon credit, a profit from energy savings including a carbon tax reduction, and a cost.

[0011] In some embodiments, the processor is further configured to: if the total value of the first indicator exceeds a maximum value of the first indicator of a possible combination of the plurality of decarbonisation measures, return an error.

[0012] In some embodiments, the processor is further configured to: receive one or more constraints; and select the set of decarbonisation measures, so that the sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator and the one or more constraints.

[0013] In some embodiments, the processor is further configured to: calculate a cost benefit of the set of decarbonisation measures based on the sum of values of the first indicator and the total value of the second indicator.

[0014] In some embodiments, the processor is further configured to: display at least one of information about the infrastructure, information about environmental activities, a recommendation of a sustainability criterion target, the set of decarbonisation measures, and the total value of the second indicator.

[0015] According to various embodiments, there is a method for facilitating recommending a decarbonisation measure for an infrastructure, the method comprising: receiving information about a plurality of decarbonisation measures capable of being applied to the infrastructure, wherein the information about the plurality of decarbonisation measures includes a value of a first indicator and a value of a second indicator for each decarbonisation measure of the plurality of decarbonisation measures; receiving at least one target to be achieved for the infrastructure; calculating a total value of the first indicator for the infrastructure to achieve the target; selecting a set of decarbonisation measures from the plurality of decarbonisation measures, so that a sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator; and calculating a total value of the second indicator for the infrastructure to achieve the target, based on the set of decarbonisation measures and the information about the plurality of decarbonisation measures.

[0016] In some embodiments, the target relates to a sustainable criterion, the first indicator is an environmental indicator, and the second indicator is a financial indicator.

[0017] In some embodiments, the target is at least one of an environmental target indicator and a financial target indicator.

[0018] In some embodiments, the method further comprises: if the target is the financial target indicator, using the financial target indicator to calculate the total value of the environmental indicator for the infrastructure.

[0019] In some embodiments, the method further comprises: if a plurality of targets are received, determining whether to merge the plurality of targets, based on a type of each of the plurality of targets..

[0020] In some embodiments, the method further comprises: calculating the total value of the first indicator for the infrastructure, based on at least one of a profit from a carbon credit, a profit from energy savings including a carbon tax reduction, and a cost.

[0021] In some embodiments, the method further comprises: if the total value of the first indicator exceeds a maximum value of the first indicator of a possible combination of the plurality of decarbonisation measures, returning an error.

[0022] In some embodiments, the method further comprises: receiving one or more constraints; and selecting the set of decarbonisation measures, so that the sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator and the one or more constraints.

[0023] In some embodiments, the method further comprises: calculating a cost benefit of the set of decarbonisation measures based on the sum of values of the first indicator and the total value of the second indicator.

[0024] In some embodiments, the method further comprises: displaying at least one of information about the infrastructure, information about environmental activities, a recommendation of a sustainability criterion target, the set of decarbonisation measures, and the total value of the second indicator.

[0025] According to various embodiments, a computer-readable medium having stored thereon the above computer program product is provided.

[0026] According to various embodiments, a data processing apparatus configured to perform the method of any one of the above embodiments is provided.

[0027] According to various embodiments, a computer program element comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of the above embodiments is provided.

[0028] According to various embodiments, a computer-readable medium comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of the above embodiments is provided. The computer-readable medium may include a non-transitory computer-readable medium.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the following description, various embodiments are described with reference to the following drawings, in which:

[0030] FIG. 1 is a block diagram illustrating a server for facilitating recommending a decarbonisation measure for an infrastructure according to various embodiments.

[0031] FIG. 2 is a block diagram illustrating a system architecture of a system for facilitating recommending a decarbonisation measure for an infrastructure according to various embodiments.

[0032] FIG. 3A is a flow diagram illustrating a process of a scenario analysis according to various embodiments.

[0033] FIG. 3B is an exemplary diagram illustrating technology information and infrastructure information according to various embodiments.

[0034] FIG. 4 is a block diagram illustrating a scenario analysis module according to various embodiments.

[0035] FIG. 5 is a flow diagram illustrating a scenario analysis method where a target is an environmental target indicator according to various embodiments.

[0036] FIG. 6 is a flow diagram illustrating a scenario analysis method where a target is a financial target indicator according to various embodiments.

[0037] FIG. 7 is a flow diagram illustrating a process of a scenario analysis for multiple targets according to various embodiments.

[0038] FIG. 8 is a flow diagram illustrating a scenario analysis method where there are multiple targets according to various embodiments.

[0039] FIG. 9 is a flow diagram illustrating an overview of a use process according to various embodiments.

[0040] FIG. 10 is a flow diagram illustrating an overview of a database creation process according to various embodiments.

[0041] FIG. 11 is a flow diagram illustrating a process for generating lead information according to various embodiments.

[0042] FIG. 12 is a block diagram illustrating a lead generation module according to various embodiments.

[0043] FIG. 13 is a flow diagram illustrating a process for generating a recommended target according to various embodiments.

[0044] FIG. 14 is a flow diagram illustrating a process for generating performance indicator values for a group simulation according to various embodiments.

[0045] FIG. 15 is a flow diagram illustrating a process for selecting suitable technologies, generating environmental and financial indicators, and risk information according to various embodiments.

[0046] FIG. 16 is a data flow diagram illustrating entity relationships according to various embodiments.

[0047] FIGS. 17A and 17B are exemplary diagrams illustrating a User Interface (UI) according to various embodiments.

[0048] FIG. 18 is a flow diagram illustrating a method for facilitating recommending a decarbonisation measure for an infrastructure according to various embodiments.

DESCRIPTION

[0049] Embodiments described below in context of the method are analogously valid for the server, and vice versa. Furthermore, it will be understood that the embodiments described below may be combined, for example, a part of one embodiment may be combined with a part of another embodiment.

[0050] It will be understood that any property described herein for a specific device may also hold for any device described herein. Furthermore, it will be understood that for any device described herein, not necessarily all the components described must be enclosed in the device, but only some (but not all) components may be enclosed.

[0051] It should be understood that the terms “on”, “over”, “top”, “bottom”, “down”, “side”, “back”, “left”, “right”, “front”, “lateral”, “side”, “up”, “down” etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of any device, structure or any part of any device or structure. In addition, the singular terms “a”, “an”, and “the” include plural references unless context clearly indicates otherwise. Similarly, the word “or” is intended to include “and” unless the context clearly indicates otherwise.

[0052] The term “coupled” (or “connected”) herein may be understood as electrically coupled or as mechanically coupled, for example attached or fixed, or just in contact without any

fixation, and it will be understood that both direct coupling or indirect coupling (in other words: coupling without direct contact) may be provided.

[0053] In order that the invention may be readily understood and put into practical effect, various embodiments will now be described by way of examples and not limitations, and with reference to the figures.

[0054] FIG. 1 is a block diagram illustrating a server 10 for facilitating recommending a decarbonisation measure for an infrastructure according to various embodiments.

[0055] In some embodiments, the server 10, for example, implemented by a server computer, may include a communication interface 11, a processor 12, and a memory 13. In some embodiments, a system 1001 of FIG. 2 may include the server 10.

[0056] In some embodiments, the memory 13 (also referred to as a “database (DB)” or a “storage”) may store input data and/or output data temporarily or permanently. In some embodiments, the memory 13 may store program code which allows the server 10 to perform a method 2000 (as will be described with reference to FIG. 18). In some embodiments, the program code may be embedded in a Software Development Kit (SDK). The memory 13 may include an internal memory of the server 10 and/or an external memory. The external memory may include, but is not limited to, an external storage medium, for example, a memory card, a flash drive, and a web storage.

[0057] In some embodiments, the communication interface 11 may allow one or more external systems to communicate with the processor 12 via a network. In some embodiments, the communication interface 11 may transmit signals to the external systems, and/or receive signals from the external systems via the network.

[0058] In some embodiments, the processor 12 may include, but is not limited to, a microprocessor, an analogue circuit, a digital circuit, a mixed-signal circuit, a logic circuit, an integrated circuit, a Central Processing Unit (CPU), a Graphics Processing Unit (GPU), a Digital Signal Processor (DSP), a Field Programmable Gate Array (FPGA), an Application Specific Integrated Circuit (ASIC), or any combination thereof. Any other kind of implementation of the respective functions, which will be described below in further detail, may also be understood as the processor 12.

[0059] In some embodiments, the processor 12 may be connectable to the communication interface 11. In some embodiments, the processor 12 may be arranged in data or signal communication with the communication interface 11.

[0060] In some embodiments, the communication interface 11 may receive information about a plurality of decarbonisation measures capable of being applied to the infrastructure. In some embodiments, the communication interface 11 may transmit the information about the plurality of decarbonisation measures capable of being applied to the infrastructure to the processor 12, and the processor 12 may receive the information about the plurality of decarbonisation measures capable of being applied to the infrastructure.

[0061] In some embodiments, the infrastructure may refer to a property (also referred to as a “real estate”) that a person or an entity (for example, an owner, a landlord, and/or a tenant) owns, resides and/or manages that is attached to a piece of land. For example, the owner of the infrastructure may need a green loan. In some embodiments, the infrastructure may be used for residential, commercial and/or industrial purposes. For example, the infrastructure may include, but is not limited to, a building, a shop house, a landed house, an apartment, and a land.

[0062] In some embodiments, information about the infrastructure (also referred to as “infrastructure information”) may refer to information about a performance of the infrastructure. For example, the information about the infrastructure may include, but is not limited to, an existing performance of an existing infrastructure, and a predicted performance of a new infrastructure (without the decarbonisation measures). Examples of the information about the infrastructure are shown in FIG. 3B.

[0063] In some embodiments, the plurality of decarbonisation measures (also referred to as “a plurality of technologies”) may be capable of being applied to the infrastructure. In some embodiments, the decarbonisation measure may refer to a technology for the decarbonisation applicable to the infrastructure. In some embodiments, the plurality of decarbonisation measures may refer to a plurality of technologies.

[0064] In some embodiments, the information about the plurality of decarbonisation measures (also referred to as “information about the plurality of technologies”, “decarbonisation measure information” or “technology information”) may include, but is not limited to, a value of a first indicator and a value of a second indicator for each decarbonisation measure of the plurality of decarbonisation measures. In some embodiments, the first indicator may be an environmental indicator (also referred to as a “sustainability indicator”). For example, the environmental indicator may include, but is not limited to, an EUI (Energy Use Intensity) improvement, energy savings, and a carbon emission reduction for the infrastructure. For example, the environmental indicator may be a variable of infrastructure characteristics (for example,

infrastructure type). In some embodiments, the second indicator may be a financial indicator (also referred to as an “other sustainability indicator”). For example, the financial indicator may include, but is not limited to, a cost (for example, an initial cost, an operation cost, an end-of-life cost, and a whole life cycle cost), a payback period, and an ROI (Return on Investment) for the infrastructure. In some embodiments, each decarbonisation measure (for example, each technology) of the plurality of decarbonisation measures may have a corresponding set of the first indicator and the second indicator. Examples of the information about the plurality of decarbonisation measures are shown in FIG. 3B.

[0065] In some embodiments, the communication interface 11 may receive at least one target to be achieved for the infrastructure. In some embodiments, the communication interface 11 may receive the at least one target to be achieved for the infrastructure, and transmit the at least one target to be achieved for the infrastructure to the processor 12, and the processor 12 may receive the at least one target to be achieved for the infrastructure.

[0066] In some embodiments, the target (also referred to as a “target indicator”, a “sustainability target” or a “sustainability criterion target” or a “goal”) may relate to a sustainable criterion. For example, the target may be a measurable sustainability-related target. In some embodiments, the target may be at least one of an environmental target indicator and a financial target indicator. As an example, the target may be one or more environmental target indicators, one or more financial target indicators, or a combination thereof. For example, the target which may be the environmental target indicator may include, but is not limited to, an EUI (Energy Use Intensity), a water usage, and a carbon emission. For example, the target which may be the financial target indicator may include, but is not limited to, a payback period, and an ROI (Return on Investment). In some embodiments, the target may come with different formats. For example, the target may be in the form of a set of a baseline and a percentage improvement over the baseline. As another example, the target may be in the form of an absolute value. As another example, the target may be in the form of a rating according to a green certification criterion, which may be derived into the above-mentioned two formats.

[0067] In some embodiments, if the processor 12 receives a plurality of targets, the processor 12 may determine whether to merge the plurality of targets based on a type of each of the plurality of targets, and merge the plurality of targets where possible. In some embodiments, the processor 12 may check if the plurality of target indicators are of the same type (for example, the financial target indicators), and merge the plurality of target indicators if the plurality of target indicators are of the same type. For example, the processor 12 may select the

highest requirement among the plurality of target indicators of the same type as the merged target indicator.

[0068] In some embodiments, the processor 12 may calculate a total value of the first indicator for the infrastructure to achieve the target. In some embodiments, the total value of the first indicator (for example, an objective) may refer to a target value that applications of the decarbonisation measures (for example, the technologies) are intended to achieve. For example, the total value of the first indicator may be a total EUI (Energy Use Intensity) improvement value.

[0069] In some embodiments, the processor 12 may calculate the total value of the first indicator for the infrastructure, based on at least one of a profit from a carbon credit, a profit from energy savings including a carbon tax reduction, and a cost (for example, the initial cost, the operation cost, the end-of-life cost, and the whole life cycle cost) for the infrastructure.

[0070] In some embodiments, if the target is the financial target indicator, the processor 12 may use the financial target indicator to calculate the total value of the first indicator (i.e. the environmental indicator) for the infrastructure.

[0071] In some embodiments, the processor 12 may determine if the total value of the first indicator exceeds a maximum value of the first indicator of a possible combination of the plurality of decarbonisation measures. In some embodiments, if the total value of the first indicator exceeds the maximum value of the first indicator of the possible combination of the plurality of decarbonisation measures, the processor 12 may return an error. In some embodiments, the processor 12 may inform a user of the error. In some embodiments, the user may be the investor, such as financial institutions. In some other embodiments, the user may include at least one of sustainability service providers, carbon service providers, technology providers, and capital seekers.

[0072] In some embodiments, the processor 12 may select a set of decarbonisation measures from the plurality of decarbonisation measures, so that a sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator. In some embodiments, the set of decarbonisation measures may include one or more decarbonisation measures selected from the plurality of decarbonisation measures. In some embodiments, the processor 12 may select the set of decarbonisation measures from the plurality of decarbonisation measures, so that the sum of values of the first indicator of the set of decarbonisation measures is equal to or close to (for example, $\pm 5\%$) the total value of the first indicator for the infrastructure.

[0073] In some embodiments, the processor 12 may receive one or more constraints, for example, a risk. In some embodiments, the risk may include, but is not limited to, a schedule risk (for example, failing to complete in an expected timeline), a performance risk (for example, failing to achieve an expected performance), an operational risk (for example, issues that may appear in operations, such as a system failure), and a cost overrun risk (for example, spending more than an expected amount). In some embodiments, the processor 12 may select the set of decarbonisation measures, so that the sum of values of the first indicator of the set of decarbonisation measures meets (for example, is equal to or close to) the total value of the first indicator and the one or more constraints, for example, the risk.

[0074] In some embodiments, the processor 12 may calculate a total value of the second indicator (i.e. the financial indicator) for the infrastructure to achieve the target, based on the set of decarbonisation measures and the information about the plurality of decarbonisation measures.

[0075] In some embodiments, the processor 12 may calculate a cost benefit of the set of decarbonisation measures based on the sum of values of the first indicator and the total value of the second indicator.

[0076] In some embodiments, the processor 12 may output at least one of information about the infrastructure, information about environmental activities, a recommendation of a sustainability criterion target, the set of decarbonisation measures, and the total value of the second indicator. For example, the processor 12 may display the at least one of the information about the infrastructure, the information about the environmental activities, the recommendation of the sustainability criterion target, the set of decarbonisation measures, and the total value of the second indicator on the user's computing device.

[0077] As described above, to accelerate decarbonisation through sustainable finance, it may be important for the investors to identify suitable projects/customers to provide the sustainable finance. According to the various embodiments, a carbon prospecting service, which may provide valuable information to the investors for them to identify the suitable projects/customers, may be provided. By using the service according to the various embodiments, the investors may be able to access lead information (including a forecasted green activity, and other information such as green certification information), an existing performance, and scenario-based potential environmental and financial indicators of the infrastructures, and potential risks. The scenario-based environmental and financial indicators

(including risks), which may be calculated backwards from the target, may help the investors to identify the suitable projects for an investment, while aligning with the investors' goals.

[0078] FIG. 2 is a block diagram illustrating a system architecture of a system 1001 for facilitating recommending a decarbonisation measure for an infrastructure according to various embodiments.

[0079] In some embodiments, the system 1001 may include a user and data interface 1002. In some embodiments, the user and data interface 1002 may facilitate a data interchange between the system 1001 and one or more users 1009, 1010, 1011, and external data sources 1012. In some embodiments, the one or more users 1009, 1010, 1011 may include, but are not limited to, a capital seeker 1009, an investor 1010, and other users 1011 (including, but not limited to, a sustainable service provider, a carbon service provider, and a technology provider).

[0080] In some embodiments, the system 1001 may include a database 1003. In some embodiments, the database 1003 may be included in the memory 13 of FIG. 1. In some embodiments, the database 1003 may store necessary data used by a service provided by the system 1001. For example, the database 1003 may store at least one of infrastructure information, lead information, a recommended target, scenario-based solutions, performance indicator values and risks, technology information, and regulation, standards and criteria information.

[0081] In some embodiments, the system 1001 may include one or more modules 1004, 1005, 1006, 1007, 1008, 1013. In some embodiments, the one or more modules 1004, 1005, 1006, 1007, 1008, 1013 may support functionalities of the system 1001. In some embodiments, the one or more modules 1004, 1005, 1006, 1007, 1008, 1013 may include, but are not limited to, a main controller 1004, a lead generation module 1005, a performance prediction module 1006, a scenario analysis module 1007, a target recommendation module 1008, and a group simulation module 1013.

[0082] FIG. 3A is a flow diagram illustrating a process of a scenario analysis according to various embodiments. FIG. 3B is an exemplary diagram illustrating technology information and infrastructure information according to various embodiments.

[0083] As shown in FIG. 3A, in some embodiments, in a step 101, the system 1001 may receive information about a plurality of decarbonisation measures (also referred to as “information about a plurality of technologies”, “decarbonisation measure information” or “technology information”). In some embodiments, the information about the plurality of decarbonisation measures may include, but is not limited to, technologies suitable for the infrastructure,

environmental and financial indicators of the technologies, and risk information of the technologies. For example, the environmental indicators may include, but are not limited to, an EUI (Energy Use Intensity) improvement, energy savings, a carbon emission reduction. For example, the environmental indicator may be a variable of infrastructure characteristics, for example, an infrastructure type. For example, the financial indicators may include, but are not limited to, a cost (for example, an initial cost, an operation cost, an end-of-life cost, and a whole life cycle cost), a payback period, and an ROI (Return on Investment). In some embodiments, when calculating the cost and the return, factors to consider may include, but are not limited to, an energy cost, a carbon tax, and carbon credits, referring to planned regulations.

[0084] As shown in FIG. 3B, in some embodiments, the information about the plurality of decarbonisation measures may include, but is not limited to, a technology type, a technology name, an EUI (Energy Use Intensity) improvement, an initial cost, an operation cost and a cost overrun risk of the corresponding technology.

[0085] As shown in FIG. 3A, in some embodiments, in a step 102, the system 1001 may receive a target and calculate a total value of a first indicator (i.e. the environmental indicator) to achieve the target. In some embodiments, the target may relate to a sustainable criterion. In some embodiments, in the step 102, the system 1001 may further receive information about the infrastructure. For example, the target may be a measurable sustainability-related target. In some embodiments, the target may be at least one of an environmental target indicator and a financial target indicator. For example, the target which may be the environmental target indicator may include, but is not limited to, an EUI (Energy Use Intensity), a water usage, and a carbon emission for the infrastructure. For example, the target which may be the financial target indicator may include, but is not limited to, a payback period, and an ROI (Return on Investment) for the infrastructure. In some embodiments, the target may come with different formats. For example, the target may be in the form of a set of a baseline and a percentage improvement over the baseline. As another example, the target may be in the form of an absolute value. As another example, the target may be in the form of a rating according to a green certification criterion, which may be derived into the above-mentioned two formats.

[0086] As shown in FIG. 3B, in some embodiments, the information about the infrastructure may include, but is not limited to, an existing EUI (Energy Use Intensity) of the corresponding infrastructure.

[0087] As shown in FIG. 3A, in some embodiments, the total value of the first indicator (for example, an objective) may refer to a target value that applications of the decarbonisation

measures (for example, the technologies) are intended to achieve. For example, the total value of the first indicator may be a total EUI (Energy Use Intensity) improvement value.

[0088] In some embodiments, when the target is the financial target indicator (for example, the payback period, and the ROI (Return on Investment)), the financial target indicator may be used to calculate the total value of the environmental indicator (as the first indicator) to achieve the financial target indicator.

[0089] In some embodiments, the target, the sustainability indicator, the decarbonisation measure information, and the infrastructure information of FIG. 3A may refer to the following:

a) Target

- Energy Use Intensity (EUI)
- Water Usage
- Carbon Emission (for example, operational, embodied, and whole life carbon.)
- Baseline and percentage of savings over baseline → a baseline may be defined by standards or derived based on the standards
- Scores of green certification
- Carbon credits and baseline
- Renewable Energy Generation
- Renewable Energy Certificates
- Cost (for example, initial, operation, end-of-life, and life cycle cost)
- ROI
- Payback Period
- Green Certification Rating
- Metrics of specifications of sub-systems (for example, air-conditioning system efficiency, and percentage of LED usage)

b) Sustainability indicator

- EUI Improvement
- Water Reduction
- Carbon Emission Reduction
- Scores of green certification
- Renewable Energy Generation
- Renewable Energy Certificates
- Cost

- ROI
- Payback Period
- Metrics of specifications of sub-systems
- c) Decarbonisation measure information (Technology information)
 - Technology suitable for the infrastructure
 - Sustainability indicators of the technologies
- d) Infrastructure information
 - Existing performance of existing infrastructure
 - Predicted performance of new infrastructure without decarbonisation measures

[0090] In some embodiments, among the above values, the baseline and percentage of savings over baseline (as the target), the EUI improvement (as the sustainability indicator), the technology suitable for the infrastructure and the sustainability indicators of the technologies (as the decarbonisation measure information), and the existing performance of existing infrastructure and the predicted performance of new infrastructure without decarbonisation measures (as the infrastructure information) may be the minimum values for the implementation of the system 1001. In some embodiments, one or more values of the other values may be additionally included to increase a coverage for an enhancement of the system 1001.

[0091] In some embodiments, in a step 103, the system 1001 may select a set of decarbonisation measures from the received decarbonisation measures (i.e. the plurality of decarbonisation measures), so that a sum of values of the first indicator of the set of decarbonisation measures meets (for example, is equal to or close to) the total value of the first indicator and satisfy other constraints, for example, a risk. In some embodiments, the risk may include, but is not limited to, a schedule risk (for example, failing to complete in an expected timeline), a performance risk (for example, failing to achieve an expected performance), an operational risk (for example, issues that may appear in operations, such as a system failure), and a cost overrun risk (for example, spending more than an expected amount).

[0092] In some embodiments, an expression of the risk may include, but is not limited to: a qualitative expression, indicating if a certain risk is present for a technology; and a quantitative expression such as a probability of occurrence, an impact (for example, a total loss associated with the risk), and a categorisation/rating (for example, low, medium, or high).

[0093] In some embodiments, the risk of the set of decarbonisation measures may be determined based on a risk of each decarbonisation measure (generated from a step 1503 of

FIG. 15) in the set of decarbonisation measures based on a pre-defined aggregation methods as follows:

- a) Logical OR Method: The overall project has a risk when at least one decarbonisation measure has such risk.
- b) Union of Independent Events: Calculate the combined probability of at least one risk occurring
- c) Summation of Risk Impact
- d) Variance-Covariance Method: It considers correlations between the risks of different decarbonisation measures. It is suitable when the risks are interdependent.

[0094] In some embodiments, in a step 104, the system 1001 may calculate the total value of the second indicator of the infrastructure based on the set of decarbonisation measures and the information of the plurality of decarbonisation measures.

[0095] In some embodiments, as shown in FIG. 3A, the information about the plurality of decarbonisation measures may be saved in the database 1003 of the system 1001 and pulled from the database 1003 in the steps 101 and 104. In some embodiments, the target and the constraint, which may be used in the steps 102 and 103 respectively, may be pre-defined in the system 1001. In some embodiments, the information about the infrastructure may be saved in the database 1003 of the system 1001 and pulled from the database 1003 in the step 102.

[0096] FIG. 4 is a block diagram illustrating a scenario analysis module 1007 according to various embodiments.

[0097] FIG. 4 shows a system for steps 101 to 104 (as shown in FIG. 3A). The system shown in FIG. 4 may be included in the scenario analysis module 1007 of FIG. 2.

[0098] As shown in FIG. 4, the scenario analysis module 1007 may include an objective generation model 201, an objective validation model 202, a set generation model 203, and an indicator generation model 204. In some embodiments, a target may be input to the objective generation model 201. The objective generation model 201 may generate an objective (for example, the first indicator), and send the generated objective (for example, the first indicator) to the objective validation model 202. The objective validation model 202 may validate the objective (for example, the first indicator), and send the validated objective (for example, the first indicator) to the set generation model 203. The set generation model 203 may obtain a set of decarbonisation measures that meet the total indicator value, and send the set of decarbonisation measures to the indicator generation model 204. The indicator generation model 204 may output financial indicators and environmental indicators.

[0099] FIG. 5 is a flow diagram illustrating a scenario analysis method where a target is an environmental target indicator according to various embodiments.

[00100] FIG. 5 shows an example the scenario analysis method implementation for steps 101 to 104 (as shown in FIG. 3A), when the target is the environmental target indicator.

[00101] In some embodiments, steps 301 and 302 may be conducted by an objective generation model 201. In some embodiments, in the step 301, a baseline (E_b) and a target percentage of improvement over the baseline for each scenario (p) may be received. In some embodiments, in the step 301, a target performance of each scenario (E_i) may be obtained by " $E_b \times (1-p\%)$ ". In some embodiments, in the step 302, the obtained target performance of each scenario (E_i) and an existing performance (E_0) may be received. In some embodiments, in the step 302, a target improvement of each scenario (R_i) may be obtained by " $E_0 - E_i$ ". In some embodiments, the target performance may be directly received, instead of deriving it from the baseline (E_b) and the target percentage of improvement over the baseline for each scenario (p).

[00102] In some embodiments, the baseline may be a value as defined by at least one of a regulation, a standard, and a criterion. For example, the baseline may include, but is not limited to, the existing performance of the infrastructure, and a benchmark value based on a peer performance. In some embodiments, the target percentage of improvement may be a value as defined by at least one of a regulation, a standard, and a criterion, with reference to the baseline. For example, the target percentage of improvement may be 50% over the baseline in order to achieve a certain rating of a green certification scheme.

[00103] In some embodiments, steps 303 and 304 may be conducted by an objective validation model 202. In some embodiments, in the step 303, the target improvement of each scenario (R_i) may be received. In some embodiments, in the step 303, the target improvement of each scenario (R_i) may be validated. In the step 304, it may be determined whether the target improvement of each scenario (R_i) is valid. If the target improvement of each scenario (R_i) exceeds 0 and the target improvement of each scenario (R_i) is less than a maximum possible improvement, the target improvement of each scenario (R_i) may be determined to be valid in the step 304. Otherwise, the target improvement of each scenario (R_i) may be determined to be invalid in the step 304. If the target improvement of each scenario (R_i) may be determined to be valid in the step 304, the desired improvement may be the target improvement of each scenario (R_i). If the target improvement of each scenario (R_i) may be determined to be invalid in the step 304, the output (O_i) may be NA (Not Available).

[00104] In some embodiments, a step 305 may be conducted by a set generation model 203. In some embodiments, in the step 305, the desired improvement which may be the target improvement of each scenario (R_i) may be provided to a genetic algorithm 305. In some embodiments, candidate technologies (also referred to as “information about a plurality of decarbonisation measures” or “candidate decarbonisation measures”) and a constraint may be provided to the genetic algorithm 305. In some embodiments, the genetic algorithm 305 may select a set of decarbonisation measures (also referred to as a “combination of technologies” or a “combination of decarbonisation measures”) for each scenario (C_i). In some embodiments, a method used for the selection of the set of decarbonisation measures may be using the genetic algorithm. Alternatively, other optimisation algorithms such as a random search or a grid search may be used. In these optimisation algorithms, an example of the objective is to find the set of decarbonisation measures which has a minimum cost while satisfying the total indicator value, for example, a total EUI (Energy Use Intensity) improvement and other constraints (for example, risks). In this case, the risks may be the constraints. Alternatively, the risks may be set as an objective of the optimisation, for example, minimising the risks while satisfying the total indicator value, for example, the total EUI improvement. In this case, the risks may be the objective. Alternatively, both risks and costs may be set as objectives using a multi-objective optimisation. In this case, the risks may be one of the objectives.

[00105] In some embodiments, a step 306 may be conducted by an indicator generation model 204 to calculate different types of environmental and financial indicators for the selected set of decarbonisation measures. Thereafter, the environmental and financial indicators for the selected set of decarbonisation measures may be output.

[00106] FIG. 6 is a flow diagram illustrating a scenario analysis method where a target is a financial target indicator according to various embodiments.

[00107] FIG. 6 shows an example of the scenario analysis method implementation for steps 101 to 104 (as shown in FIG. 3A), when the target is the financial target indicator.

[00108] In some embodiments, a step 1401 may be conducted by an objective generation model 201. In some embodiments, in the step 1401, a baseline (E_b), a target ROI (Return on Investment) (for example, in the form of an amount of money) for each scenario (r), and an existing performance (E_0) may be received. In some embodiments, in the step 1401, the target ROI (Return on Investment) may be converted to a target improvement over the existing performance. In this manner, a target improvement of each scenario (R_i) may be obtained.

[00109] In some embodiments, the baseline may be a value as defined by a carbon credit scheme. For example, the baseline may include, but is not limited to, the existing performance of the infrastructure, and a benchmark value based on peer performance. In some embodiments, the target ROI (Return on Investment) may be equal to a profit from a carbon credit plus a profit from an energy reduction (also referred to as “energy savings”) minus a cost. In some embodiments, the profit from the carbon credit may be calculated by multiplying a carbon emission reduction over the baseline and a carbon credit price. In some embodiments, the profit from the energy reduction may be calculated by multiplying the energy improvement over the existing performance and an energy cost. In some embodiments, the energy cost may include, but is not limited to, an energy cost itself and a carbon tax.

[00110] In some embodiments, steps 1402 and 1403 may be conducted by an objective validation model 202. In some embodiments, in the step 1402, the target improvement of each scenario (R_i) may be received. In some embodiments, in the step 1402, the target improvement of each scenario (R_i) may be validated. In the step 1403, it may be determined whether the target improvement of each scenario (R_i) is valid. If the target improvement of each scenario (R_i) exceeds 0 and the target improvement of each scenario (R_i) is less than a maximum possible improvement, the target improvement of each scenario (R_i) may be determined to be valid in the step 1403. Otherwise, the target improvement of each scenario (R_i) may be determined to be invalid in the step 1403. If the target improvement of each scenario (R_i) may be determined to be valid in the step 1403, the desired improvement may be the target improvement of each scenario (R_i). If the target improvement of each scenario (R_i) may be determined to be invalid in the step 1403, the output (O_i) may be NA (Not Available).

[00111] In some embodiments, a step 1404 may be conducted by a set generation model 203. In some embodiments, in the step 1404, the desired improvement which may be the target improvement of each scenario (R_i) may be provided to a genetic algorithm 1404. In some embodiments, candidate technologies (also referred to as “information about a plurality of decarbonisation measures” or “candidate decarbonisation measures”) may be provided to the genetic algorithm 1404. In some embodiments, the genetic algorithm 1404 may select a set of decarbonisation measures (also referred to as a “combination of technologies” or a “combination of decarbonisation measures”) for each scenario (C_i). In some embodiments, a method used for the selection of the set of decarbonisation measures may be using the genetic algorithm. Alternatively, other optimisation algorithms such as a random search or a grid search may be used. In these optimisation algorithms, an example of the objective is to find the set of

decarbonisation measures which has a minimum cost while satisfying the total indicator value, for example, a total EUI (Energy Use Intensity) improvement.

[00112] In some embodiments, a step 1405 may be conducted by an indicator generation model 204 to calculate different types of environmental and financial indicators for the selected set of decarbonisation measures. Thereafter, the environmental and financial indicators for the selected set of decarbonisation measures may be output.

[00113] FIG. 7 is a flow diagram illustrating a process of a scenario analysis for multiple targets according to various embodiments.

[00114] In some embodiments, in a step 101, the system 1001 may receive information about a plurality of decarbonisation measures (also referred to as “information about a plurality of technologies”, “decarbonisation measure information” or “technology information”).

[00115] In some embodiments, in a step 102a, the system 1001 may receive a plurality of targets and calculate a total value of a first indicator (i.e. an environmental indicator (also referred to as a “sustainability indicator”)) to achieve each of the plurality of targets.

[00116] In some embodiments, in a step 105 (in a step 307 of FIG. 8), the system 1001 may merge the received environmental target indicators (also referred to as “sustainability target indicators”) where possible. Merging the plurality of target indicators may be possible when the plurality of target indicators are of the same type. In this case, the highest requirement among the plurality of target indicators of the same type may be selected as the merged target indicator. For example, indicator A from target A is an EUI (Energy Use Intensity) improvement of 50 kWh/m²/year, while indicator B from target B is an EUI improvement of 70 kWh/m²/year. Therefore, a merged target indicator of EUI improvement of 70 kWh/m²/year may be output as the merged target indicator and used for the following steps.

[00117] In some embodiments, after merging the target indicators, if only one target indicator is left, the process may go to step 103 (as shown in FIG. 3A). Otherwise, the process goes to a step 103a, in which a set of decarbonisation measures may be selected from the plurality of decarbonisation measures, to satisfy the multiple target indicators along with other constraints.

[00118] In some embodiments, in a step 104, the system 1001 may calculate the total value of a second indicator (i.e. a financial indicator (also referred to as an “other sustainability indicator”)) of the infrastructure based on the set of decarbonisation measures and the information of the plurality of decarbonisation measures.

[00119] FIG. 8 is a flow diagram illustrating a scenario analysis method where there are multiple targets according to various embodiments.

[00120] FIG. 8 is an example of the scenario analysis method implementation (multiple targets) for the steps shown in FIG. 7. In FIG. 8, “T1” refers to a first target, and “T2” refers to a second target.

[00121] In some embodiments, steps 301 and 302 may be conducted by an objective generation model 201. In some embodiments, in the step 301, a baseline (E_b) and a target percentage of improvement over the baseline for each scenario (p) as the first target may be received. In some embodiments, in the step 301, a target performance of each scenario (E_i) may be obtained by “ $E_b \times (1-p\%)$ ”. In some embodiments, in the step 302, the obtained target performance of each scenario (E_i) and an existing performance (E_0) may be received. In some embodiments, in the step 302, a target improvement of each scenario (R_i) may be obtained by “ $E_0 - E_i$ ”.

[00122] In some embodiments, the baseline may be a value as defined by at least one of a regulation, a standard, and a criterion. For example, the baseline may include, but is not limited to, the existing performance of the infrastructure, and a benchmark value based on a peer performance. In some embodiments, the target percentage of improvement may be a value as defined by at least one of a regulation, a standard, and a criterion, with reference to the baseline. For example, the target percentage of improvement may be 50% over the baseline in order to achieve a certain rating of a green certification scheme.

[00123] In some embodiments, a step 307 (the step 105 of FIG. 7) may be conducted by an objective generation model 201. In some embodiments, in the step 307, a percentage of onsite renewable energy usage (P_i) as the second target may be received. In some embodiments, in the step 307, the system 1001 may evaluate the possibility of merging two received target indicators (i.e. the target improvement of each scenario (R_i) and the percentage of onsite renewable energy usage (P_i)), and determine whether the two received target indicators (R_i and P_i) can be merged. In some embodiments, if the two received target indicators are of the same type, it may be determined that the two received target indicators can be merged. if the two received target indicators are of the different type, it may be determined that the two received target indicators cannot be merged. If it is determined that the two received target indicators (R_i and P_i) can be merged, the two received target indicators (R_i and P_i) may be merged. In some embodiments, in a step 308, it is determined whether there are more than one target indicator. If the two received target indicators (R_i and P_i) are merged and thus there is one target indicator, the process may go to step 303 (as shown in FIG. 5). If the two received target

indicators (R_i and P_i) are not merged and thus there are more than one (for example, two) target indicators, a step 303a may be performed.

[00124] In some embodiments, in the step 303a, the both target indicators (R_i and P_i) may be validated. In the step 304a, it may be determined whether the both target indicators (R_i and P_i) are valid. If the target improvement of each scenario (R_i) exceeds 0, the target improvement of each scenario (R_i) is less than a maximum possible improvement, and the percentage of onsite renewable energy usage (P_i) is less than a maximum possible value, the both target indicators (R_i and P_i) may be determined to be valid in the step 304a. Otherwise, the both target indicators (R_i and P_i) may be determined to be invalid in the step 304a. If the both target indicators (R_i and P_i) may be determined to be valid in the step 304a, the desired improvement may be the target improvement of each scenario (R_i), and the desired renewable percentage may be the percentage of onsite renewable energy usage (P_i). If the both target indicators (R_i and P_i) may be determined to be invalid in the step 304a, the output (O_i) may be NA (Not Available).

[00125] In some embodiments, a step 305 may be conducted by a set generation model 203. In some embodiments, in the step 305, the desired improvement which may be the target improvement of each scenario (R_i) and the desired renewable percentage which may be the percentage of onsite renewable energy usage (P_i) may be provided to a genetic algorithm 305. In some embodiments, candidate technologies (also referred to as “information about a plurality of decarbonisation measures” or “candidate decarbonisation measures”) and a constraint may be provided to the genetic algorithm 305. In some embodiments, the genetic algorithm 305 may select a set of decarbonisation measures (also referred to as a “combination of technologies” or a “combination of decarbonisation measures”) for each scenario (C_i) to satisfy the both target indicators (R_i and P_i). In some embodiments, a method used for the selection of the set of decarbonisation measures may be using the genetic algorithm. Alternatively, other optimisation algorithms such as a random search or a grid search may be used. In these optimisation algorithms, an example of the objective is to find the set of decarbonisation measures which has a minimum cost while satisfying the total indicator value, for example, a total EUI (Energy Use Intensity) improvement.

[00126] In some embodiments, in this case, when multiple target indicators are given, the optimisation algorithm may aim to find the set of decarbonisation measures which has the minimum cost (objective) while satisfying all indicator values, for example, both the total EUI improvement and the percentage of renewable energy usage in this case, along with other constraints (for example, risks).

[00127] In some embodiments, a step 306 may be conducted by an indicator generation model 204 to calculate different types of environmental and financial indicators for the selected set of decarbonisation measures. Thereafter, the environmental and financial indicators for the selected set of decarbonisation measures may be output.

[00128] FIG. 9 is a flow diagram illustrating an overview of a use process according to various embodiments.

[00129] FIG. 9 shows how a user interacts with a system 1001 of FIG. 2.

[00130] In some embodiments, in a step 401, a default view of infrastructure list, and search, filter and sort functions may be displayed on the user's computing device. In some embodiments, the default view may include a default view, for example, a map view, a list view, and a grid view, showing all infrastructures in a location of the user's interest.

[00131] In some embodiments, in a step 402, the user's request, relating to, for example, the search, the filter and the sort, may be received through a user interface (as shown in FIGS. 17A and 17B). In the step 402, the infrastructure list may be updated based on the user's request. In some embodiments, the user's request may include, but is not limited to, the following:

- a) Search by name, postal code, address, and company name
- b) Filter by infrastructure information (including infrastructure characteristics, stakeholder information, and green certification information)
- c) Lead information (including green certification information, and renewable energy potential), a recommended target, predicted environmental and financial performances, and recommendations to the infrastructure
- d) Sort by the infrastructure information, and the predicted environmental and financial performances in ascending or descending order

[00132] In some embodiments, in a step 403, the user's request of viewing detailed information may be received. In the step 403, the infrastructure information, the lead information, the recommended target, a set of decarbonisation measures, and performance indicator values which may be generated based on data using pre-defined methods may be displayed. In some embodiments, the set of decarbonisation measures may refer to one or a combination of decarbonisation measures (i.e. technologies), such as installation of LED lights, and installation of new chillers.

[00133] In some embodiments, in a step 404, the user's request of a customised performance simulation, and the user's input of customised infrastructure information and project assumptions may be received. In the step 404, the set of decarbonisation measures and the

performance indicator values which may be generated based on the user's input data using the pre-defined method may be displayed.

[00134] In some embodiments, in a step 405, the user's selected infrastructures, the user's request of a group simulation, and the user's input project assumption may be received. In the step 405, performance indicator values of the group simulation which may be generated using the pre-defined method may be displayed.

[00135] It may be appreciated that the steps of FIG. 9 may be triggered by respective user requests, and may be performed in different sequences.

[00136] FIG. 10 is a flow diagram illustrating an overview of a database creation process according to various embodiments.

[00137] In some embodiments, the database may support the overall system 1001 of FIG. 2.

[00138] In some embodiments, in a step 501, infrastructure information may be generated and stored using pre-determined methods. In some embodiments, the step 501 may include the following process:

- a) Obtaining data from an external data source via API, web crawling, etc.
- b) Obtaining data from users, such as technology providers, and building owners.
- c) Processing the obtained data to derive new data such as greenwashing information derived from ESG (Environmental, Social, and Governance) data.

[00139] In some embodiments, in a step 502, lead information may be generated and stored, for example, in the database 1003 of the system 1001, using the pre-determined method. In some embodiments, the step 502 may be conducted by a lead generation module 1005 (as shown in FIG. 2).

[00140] In some embodiments, in a step 503, scenario-based sets of decarbonisation measures and performance indicator values may be generated and stored using the pre-determined method. In some embodiments, the step 503 may be conducted by a scenario analysis module 1007 (as shown in FIG. 2).

[00141] In some embodiments, in a step 504, a recommended target may be generated and stored using the pre-determined method. In some embodiments, the step 504 may be conducted by a target recommendation module 1008 (as shown in FIG. 2).

[00142] FIG. 11 is a flow diagram illustrating a process for generating lead information according to various embodiments.

[00143] In some embodiments, the process for generating the lead information (for example, including a green certificate) may be performed by a lead generation module 1005 of FIG. 2.

[00144] In some embodiments, in a step 601, infrastructure information may be used. In the step 601, a probability of green activities (P1) may be generated using a pre-built AI model.

[00145] In some embodiments, in a step 602, the infrastructure information may be used. In the step 602, a probability of green activities (P2) may be generated using a pre-built rule-based model.

[00146] In some embodiments, in a step 603, the probability of green activities (P1) and the probability of green activities (P2) may be received. In the step 603, a final probability of green activities based on the probability of green activities (P1) and (P2) may be generated using a pre-built aggregation model.

[00147] FIG. 12 is a block diagram illustrating a lead generation module 1005 according to various embodiments.

[00148] In some embodiments, an AI model 701 may receive infrastructure information. The AI model 701 may output a probability of green activity (P1). In some embodiments, a rule-based model 702 may receive the infrastructure information and at least one of a regulation, standards and criteria. The rule-based model 702 may output a probability of green activity (P2). In some embodiments, an aggregation model 703 may receive the probability of green activities (P1) and (P2), and output a probability of green activity (P_{final}) based on the probability of green activities (P1) and (P2).

[00149] FIG. 13 is a flow diagram illustrating a process for generating a recommended target according to various embodiments.

[00150] In some embodiments, the process for generating the recommended target may be performed by a target recommendation module 1008 of FIG. 2.

[00151] In some embodiments, in a step 801, a total value of the environmental indicator of a set of decarbonisation measures may be used. In the step 801, a target may be generated based on the total value of the environmental indicator of the set of decarbonisation measures using a pre-defined method.

[00152] FIG. 14 is a flow diagram illustrating a process for generating performance indicator values for a group simulation according to various embodiments.

[00153] In some embodiments, the process for generating the performance indicator values may be performed by a group simulation module 1013 of FIG. 2.

[00154] In some embodiments, in a step 1101, a user's request of a group simulation and the user's selected infrastructures may be used. In the step 1101, input fields for project assumptions may be displayed.

[00155] In some embodiments, in a step 1102, the user's input project assumptions and technology information may be used. In the step 1102, performance indicator values may be generated based on a pre-defined method.

[00156] In some embodiments, in a step 1103, the performance indicator values may be received. In the step 1103, the performance indicator values may be displayed.

[00157] FIG. 15 is a flow diagram illustrating a process for selecting suitable technologies, generating environmental and financial indicators, and risk information according to various embodiments.

[00158] FIG. 15 shows the process to select the suitable technologies and generate technology's environmental and financial indicators, and risk information before a step 101 of FIG. 3A.

[00159] In some embodiments, in a step 1501, infrastructure information, technology information, and a constraint may be used. In the step 1501, suitable technologies may be identified.

[00160] In some embodiments, in a step 1502, the infrastructure information and the technology information may be used. In the step 1502, the suitable technologies may be received. In the step 1502, the technologies' environmental and financial indicators may be generated using a performance prediction module 1006.

[00161] In some embodiments, in a step 1503, the infrastructure information and the technology information may be used. In the step 1503, the technologies' risk information may be generated.

[00162] In some embodiments, the constraint may include, but is not limited to, requirements such as available time and space for a technology installation. In some embodiments, the environmental indicators may include, but are not limited to, an EUI (Energy Use Intensity) improvement, energy savings, and carbon emission reduction. In some embodiments, the financial indicators may include, but are not limited to, a cost (for example, an initial cost, an operation cost, an end-of-life cost, and a whole life cycle cost), a payback period, and an ROI (return on investment).

[00163] In some embodiments, a performance prediction model (included in the performance prediction module 1006) may predict the environmental and financial indicators of the decarbonisation measures (i.e. the technologies). The performance prediction models may be created using AI techniques (for example, machine learning), system modelling, and/or an integration of the AI techniques and system modelling. In some embodiments, the performance

prediction module may also include a function to select suitable technologies based on the infrastructure information and the technology information.

[00164] In some embodiments, the technologies' risk information may include, but is not limited to, a schedule risk (for example, failing to complete in the expected timeline), a performance risk (for example, failing to achieve the expected performance), an operational risk (for example, issues that may appear in operations, such as a system failure), and a cost overrun risk (for example, spending more than expected amount). In some embodiments, the technologies' risk information may be collected from a technology provider, an existing user of the technology, an existing infrastructure using the technology, public information (for example, news). In some embodiments, the technologies' risk information may also be generated from a pre-defined model. For example, the pre-defined model may be created using an AI (Machine Learning, Natural Language Processing) based on the existing data mentioned above.

[00165] In some embodiments, an expression of the risk may include, but is not limited to the following:

- a) Qualitative Expression indicating that a certain risk is present for a technology
- b) Quantitative Expression such as probability of occurrence, an impact assessment (for example, a total loss associated with the risk), and a categorisation (for example, low, medium, or high)

[00166] FIG. 16 is a data flow diagram illustrating entity relationships according to various embodiments.

[00167] FIG. 16 shows information exchanges between a system 1001 of FIG. 2 and a plurality of stakeholders.

[00168] In some embodiments, capital seekers may include, but are not limited to, a project owner and an infrastructure owner. In some embodiments, investors may include, but are not limited to, financial institutions and individual investors. In some embodiments, sustainable service providers may include, but are not limited to, consultants, contractors, ESCO (Energy Services Company), an EaaS (Energy as a Service) company, and solar leasing company. In some embodiments, carbon credit service providers may include, but are not limited to, a carbon project developer, a CMEs (Coordinating and Managing Entity), and VVBs (Validation and Verification Body). In some embodiments, technology providers may refer to technology and product providers.

[00169] In some embodiments, an external data source may send infrastructure information regulation, standards and/or criteria to a carbon prospecting platform 001 operated by the system 1001. In some embodiments, the carbon prospecting platform 001 may include the database 1003 (as shown in FIG. 2).

[00170] In some embodiments, the capital seekers may send infrastructure information and request to the carbon prospecting platform 001. The carbon prospecting platform 001 may send the infrastructure information, a recommended target, scenario-based solutions, and performance indicator values and risks to the capital seekers.

[00171] In some embodiments, the investors may send requests to the carbon prospecting platform 001. The carbon prospecting platform 001 may send the infrastructure information, lead information, the recommended target, the scenario-based solutions, and the performance indicator values and risks to the investors.

[00172] In some embodiments, the sustainable service providers may send requests to the carbon prospecting platform 001. The carbon prospecting platform 001 may send the infrastructure information, the lead information, the recommended target, the scenario-based solutions, and the performance indicator values and risks to the sustainable service providers.

[00173] In some embodiments, the carbon credit service providers may send requests to the carbon prospecting platform 001. The carbon prospecting platform 001 may send the infrastructure information, the lead information, the recommended target, the scenario-based solutions, and the performance indicator values and risks to the carbon credit service providers.

[00174] In some embodiments, the technology providers may send technology information to the carbon prospecting platform 001. The carbon prospecting platform 001 may send the infrastructure information, the lead information, the recommended target, the scenario-based solutions, and the performance indicator values and risks to the technology providers.

[00175] FIGS. 17A and 17B are exemplary diagrams illustrating a User Interface (UI) according to various embodiments.

[00176] FIGS. 17A and 17B show a sample UI displaying a function and data provided by a carbon prospecting service.

[00177] As shown in FIG. 17A, the UI may display a search function 1201 to search a list of infrastructures, and a sort function 1201 to sort the list of infrastructures by infrastructure information, and a filter function 1203 to filter the list of infrastructures by the infrastructure information (See the steps 401 and 402 of FIG. 9).

[00178] As shown in FIG. 17B, the UI may display infrastructure characteristics and green certification information 1301 for the infrastructure. The UI may display stakeholder information 1302 for the infrastructure. The UI may display benchmarking and technology data 1303 for the infrastructure. The UI may display forecasted green activities 1304 for the infrastructure. The UI may display recommended sustainability performance targets 1305 for the infrastructure. The UI may display predicted environmental and financial indicators and risks 1306 for the infrastructure. The UI may display a button to link to performance simulator 1307 for the infrastructure. The UI may display a recommended decarbonisation measure (technology) 1308 for the infrastructure. The UI may display scenarios 1309 for the infrastructure.

[00179] In some embodiments, the predicted environmental and financial indicators and risks 1306 for the infrastructure may also show a difference between a performance of a set of the decarbonisation measures and the target, for example, how much more EUI reduction beyond the target. In some embodiments, the recommended decarbonisation measure 1308 for the infrastructure may also show a recommendation on an installation sequence of the technologies for a resource optimisation.

[00180] FIG. 18 is a flow diagram illustrating a method 2000 for facilitating recommending a decarbonisation measure for an infrastructure according to various embodiments.

[00181] In some embodiments, the method 2000 may include a step 2001 of receiving information about a plurality of decarbonisation measures capable of being applied to the infrastructure. The information about the plurality of decarbonisation measures includes a value of a first indicator and a value of a second indicator for each decarbonisation measure of the plurality of decarbonisation measures.

[00182] In some embodiments, the method 2000 may include a step 2002 of receiving at least one target to be achieved for the infrastructure.

[00183] In some embodiments, the method 2000 may include a step 2003 of calculating a total value of the first indicator for the infrastructure to achieve the target.

[00184] In some embodiments, the method 2000 may include a step 2004 of selecting a set of decarbonisation measures from the plurality of decarbonisation measures, so that a sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator.

[00185] In some embodiments, the method 2000 may include a step 2005 of calculating a total value of the second indicator for the infrastructure to achieve the target, based on the set of decarbonisation measures and the information about the plurality of decarbonisation measures.

[00186] As described above, the system 1001 according to various embodiments may be used to identify suitable projects for sustainable finance. For example, a main target user type may include investors, such as financial institutions. For example, the system 1001 may also be used by at least one of sustainability service providers, carbon service providers, technology providers and capital seekers. In some embodiments, when the system 1001 is used by the investors, the system 1001 may help the investors identify the suitable projects to the sustainable finance. In some embodiments, when the system 1001 is used by the sustainability service providers, the carbon service providers and/or the technology providers, the system 1001 may help the sustainability service providers, the carbon service providers and/or the technology providers identify the suitable projects to provide service and/or products. In some embodiments, when the system 1001 is used by the capital seekers, the system 1001 may allow the capital seekers to provide infrastructure information and help the capital seekers understand a potential performance of their infrastructure.

[00187] While embodiments of the invention have been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced. It will be appreciated that common numerals, used in the relevant drawings, refer to components that serve a similar or the same purpose. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. Unless specifically stated otherwise, the term “some” refers to one or more. Combinations such as “at least one of A, B, or C,” “one or more of A, B, or C,” “at least one of A, B, and C,” “one or more of A, B, and C,” and “A, B, C, or any combination thereof” include any combination of A, B, and/or C, and may include multiples of A, multiples of B, or multiples of C. Specifically, combinations

such as “at least one of A, B, or C,” “one or more of A, B, or C,” “at least one of A, B, and C,” “one or more of A, B, and C,” and “A, B, C, or any combination thereof” may be A only, B only, C only, A and B, A and C, B and C, or A and B and C, where any such combinations may contain one or more member or members of A, B, or C. All structural and functional equivalents to the elements of the various aspects described throughout this disclosure that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the claims. Moreover, nothing disclosed herein is intended to be dedicated to the public regardless of whether such disclosure is explicitly recited in the claims. The words “module,” “mechanism,” “element,” “device,” and the like may not be a substitute for the word “means.” As such, no claim element is to be construed as a means plus function unless the element is expressly recited using the phrase “means for.”

CLAIMS

1. A server for facilitating recommending a decarbonisation measure for an infrastructure, the server comprising:
 - a memory configured to store instructions; and
 - a processor configured to execute the stored instructions, and configured to:
 - receive information about a plurality of decarbonisation measures capable of being applied to the infrastructure, wherein the information about the plurality of decarbonisation measures includes a value of a first indicator and a value of a second indicator for each decarbonisation measure of the plurality of decarbonisation measures;
 - receive at least one target to be achieved for the infrastructure;
 - calculate a total value of the first indicator for the infrastructure to achieve the target;
 - select a set of decarbonisation measures from the plurality of decarbonisation measures, so that a sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator; and
 - calculate a total value of the second indicator for the infrastructure to achieve the target, based on the set of decarbonisation measures and the information about the plurality of decarbonisation measures.
2. The server according to claim 1, wherein the target relates to a sustainable criterion, the first indicator is an environmental indicator, and the second indicator is a financial indicator.
3. The server according to claim 2, wherein the target is at least one of an environmental target indicator and a financial target indicator.
4. The server according to claim 3, wherein if the target is the financial target indicator, the processor is further configured to use the financial target indicator to calculate the total value of the environmental indicator for the infrastructure.
5. The server according to any one of claims 1 to 4, wherein if the processor receives a plurality of targets, the processor is further configured to determine whether to merge the plurality of targets, based on a type of each of the plurality of targets.

6. The server according to any one of claims 1 to 5, wherein the processor is further configured to: calculate the total value of the first indicator for the infrastructure, based on at least one of a profit from a carbon credit, a profit from energy savings including a carbon tax reduction, and a cost.

7. The server according to any one of claims 1 to 6, wherein the processor is further configured to: if the total value of the first indicator exceeds a maximum value of the first indicator of a possible combination of the plurality of decarbonisation measures, return an error.

8. The server according to any one of claims 1 to 7, wherein the processor is further configured to:

receive one or more constraints; and

select the set of decarbonisation measures, so that the sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator and the one or more constraints.

9. The server according to any one of claims 1 to 8, wherein the processor is further configured to: calculate a cost benefit of the set of decarbonisation measures based on the sum of values of the first indicator and the total value of the second indicator.

10. The server according to any one of claims 1 to 9, wherein the processor is further configured to: display at least one of information about the infrastructure, information about environmental activities, a recommendation of a sustainability criterion target, the set of decarbonisation measures, and the total value of the second indicator.

11. A method for facilitating recommending a decarbonisation measure for an infrastructure, the method comprising:

receiving information about a plurality of decarbonisation measures capable of being applied to the infrastructure, wherein the information about the plurality of decarbonisation measures includes a value of a first indicator and a value of a second indicator for each decarbonisation measure of the plurality of decarbonisation measures;

receiving at least one target to be achieved for the infrastructure;

calculating a total value of the first indicator for the infrastructure to achieve the target;

selecting a set of decarbonisation measures from the plurality of decarbonisation measures, so that a sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator; and

calculating a total value of the second indicator for the infrastructure to achieve the target, based on the set of decarbonisation measures and the information about the plurality of decarbonisation measures.

12. The method according to claim 11, wherein the target relates to a sustainable criterion, the first indicator is an environmental indicator, and the second indicator is a financial indicator.

13. The method according to claim 12, wherein the target is at least one of an environmental target indicator and a financial target indicator.

14. The method according to claim 13, further comprising: if the target is the financial target indicator, using the financial target indicator to calculate the total value of the environmental indicator for the infrastructure.

15. The method according to any one of claims 11 to 14, further comprising: if a plurality of targets are received, determining whether to merge the plurality of targets, based on a type of each of the plurality of targets..

16. The method according to any one of claims 11 to 15, further comprising: calculating the total value of the first indicator for the infrastructure, based on at least one of a profit from a carbon credit, a profit from energy savings including a carbon tax reduction, and a cost.

17. The method according to any one of claims 11 to 16, further comprising: if the total value of the first indicator exceeds a maximum value of the first indicator of a possible combination of the plurality of decarbonisation measures, returning an error.

18. The method according to any one of claims 11 to 17, further comprising:
receiving one or more constraints; and

selecting the set of decarbonisation measures, so that the sum of values of the first indicator of the set of decarbonisation measures meets the total value of the first indicator and the one or more constraints.

19. The method according to any one of claims 11 to 18, further comprising: calculating a cost benefit of the set of decarbonisation measures based on the sum of values of the first indicator and the total value of the second indicator.

20. The method according to any one of claims 11 to 19, further comprising: displaying at least one of information about the infrastructure, information about environmental activities, a recommendation of a sustainability criterion target, the set of decarbonisation measures, and the total value of the second indicator.