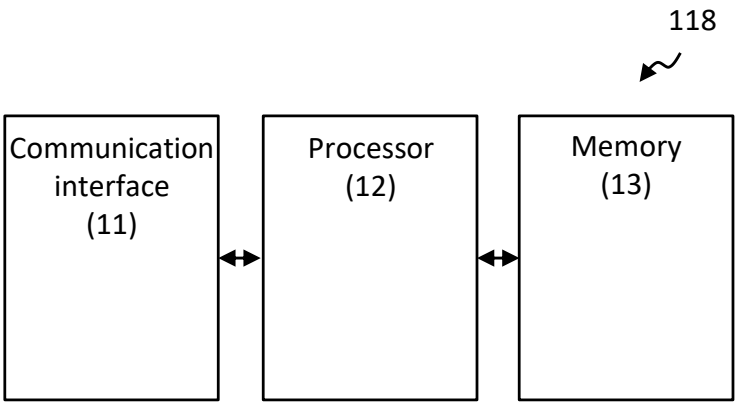


FIG. 1

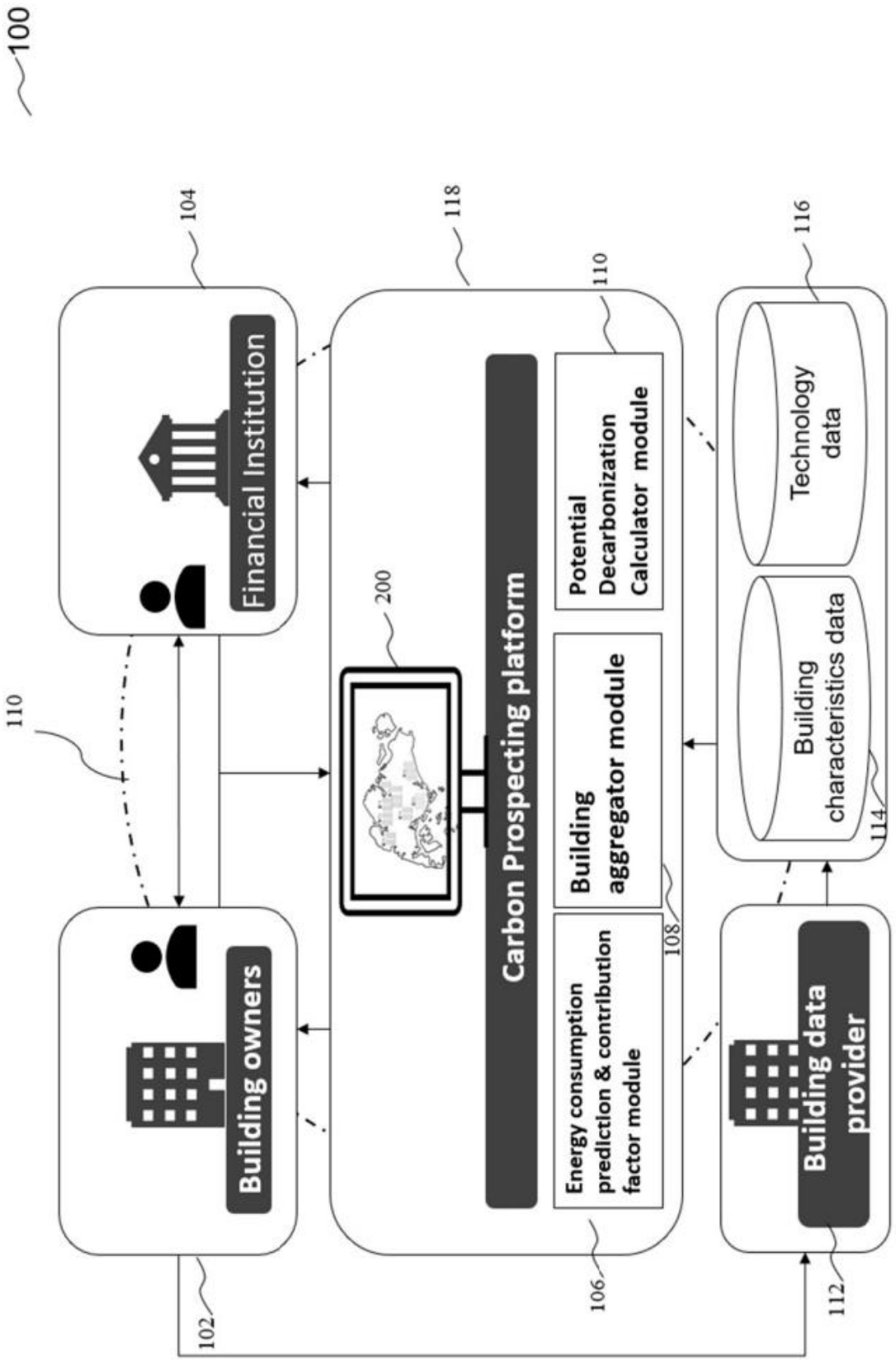

100
104
Financial Institution
118
110
116
Technology data
200
Carbon Prospecting platform
Potential Decarbonization Calculator module
Building aggregator module
Building characteristics data
110
Building owners
Energy consumption prediction & contribution factor module
108
Building data provider
102
106
112
114

FIG. 2

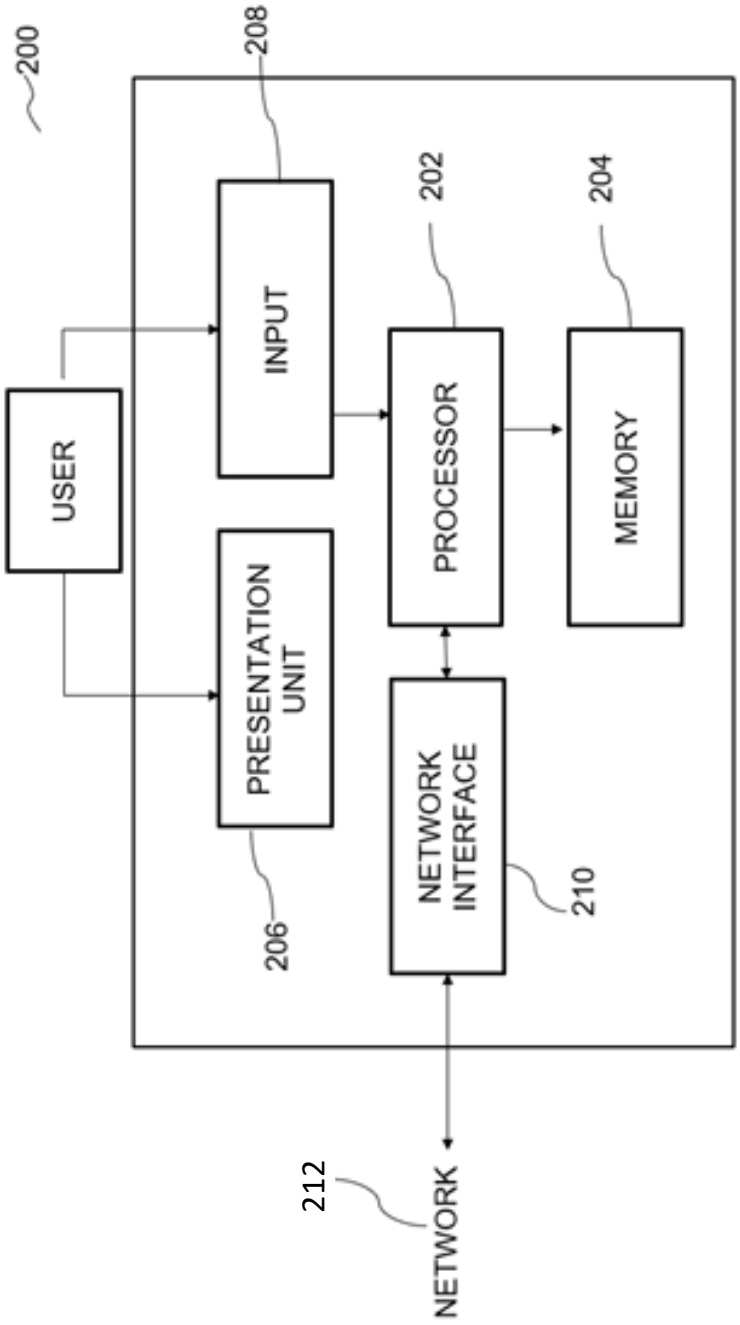

200
208
INPUT
202
PROCESSOR
204
MEMORY
USER
PRESENTATION UNIT
206
NETWORK INTERFACE
210
212
NETWORK

FIG. 3

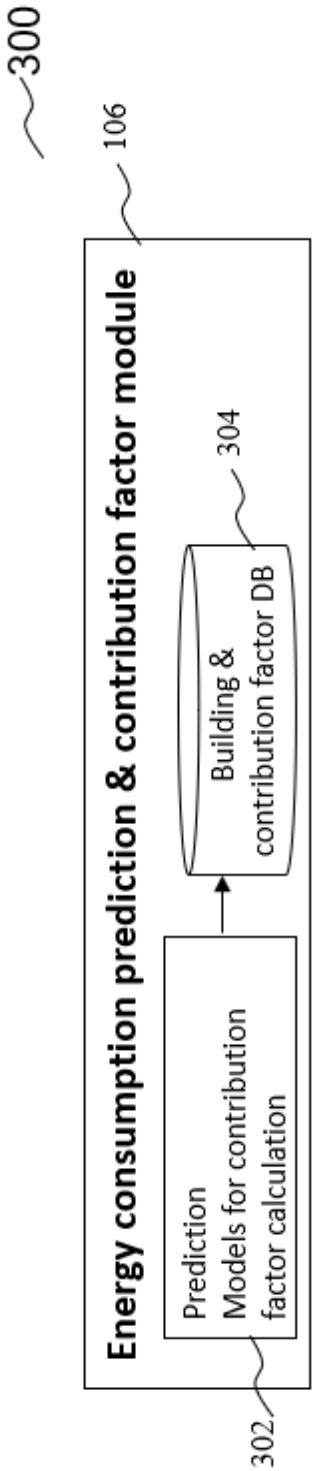

300
106
Energy consumption prediction & contribution factor module
Prediction
Models for contribution
factor calculation
302
Building &
contribution factor DB
304

FIG. 4

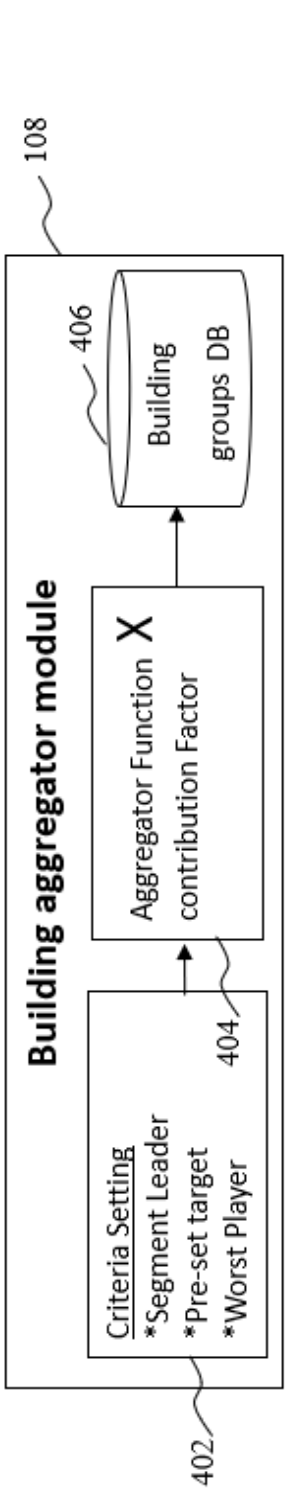

400
108
Building aggregator module
406
Building groups DB
Aggregator Function X contribution Factor
404
Criteria Setting
*Segment Leader
*Pre-set target
*Worst Player
402

FIG. 5

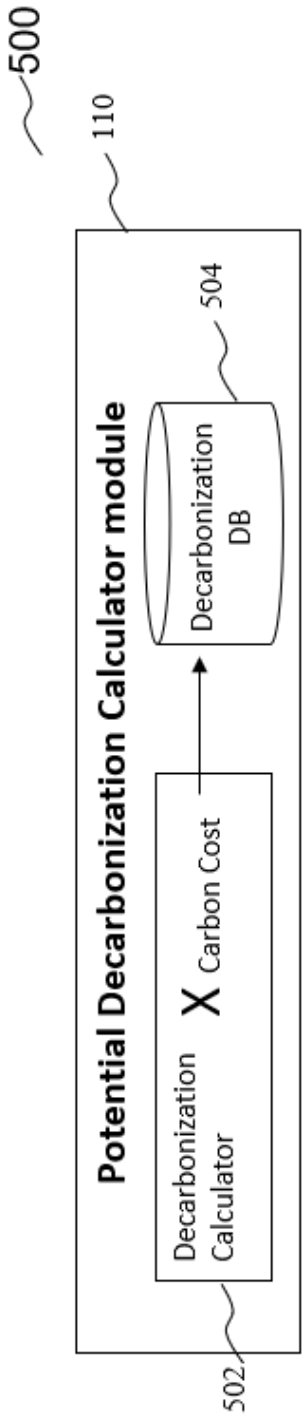

500
110
Potential Decarbonization Calculator module
Decarbonization Calculator
X Carbon Cost
Decarbonization DB
502
504

FIG. 6

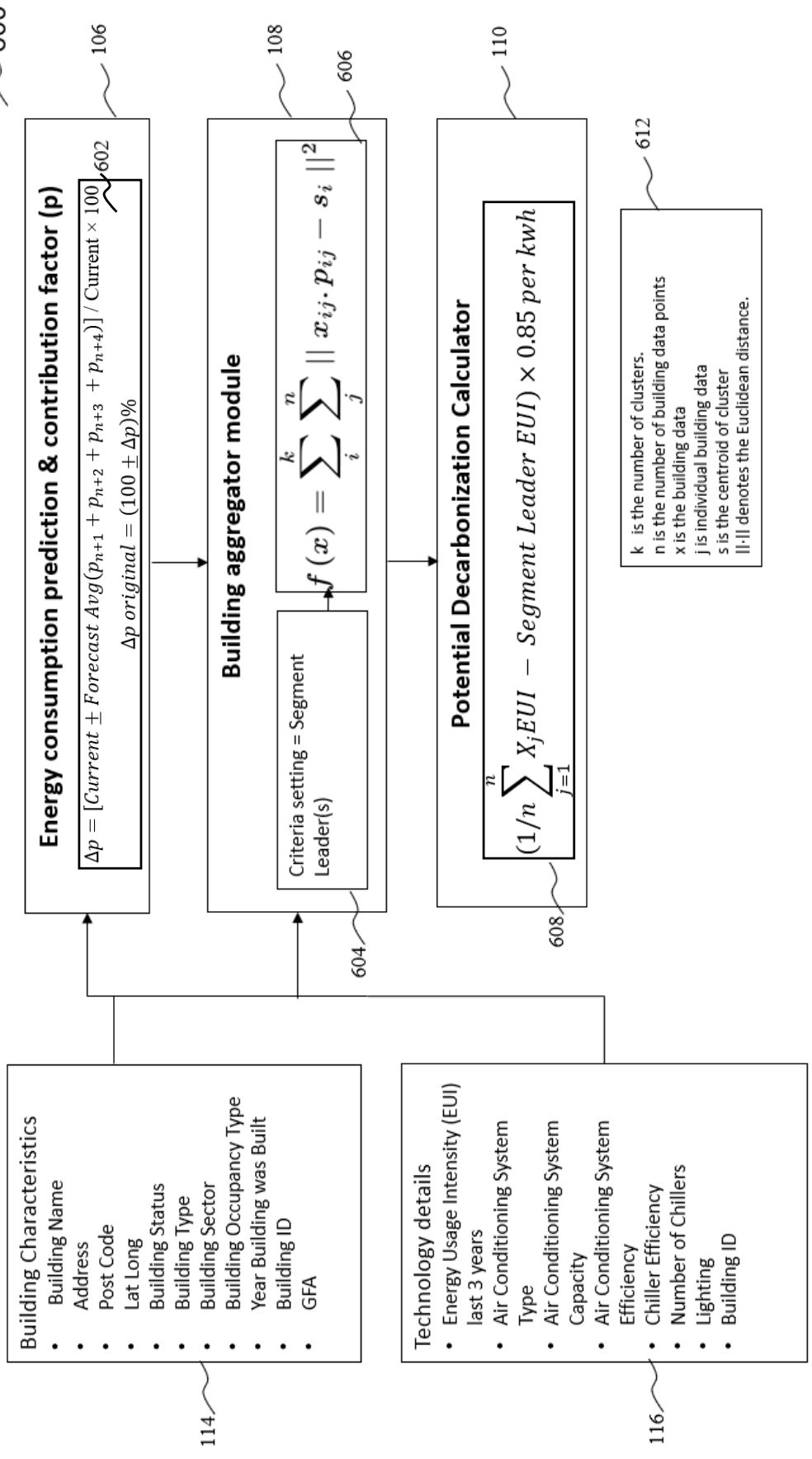

600
Energy consumption prediction & contribution factor (p)
106
$\Delta p = [Current \pm Forecast\ Avg(p_{n+1} + p_{n+2} + p_{n+3} + p_{n+4})] / \text{Current} \times 100$
602
$\Delta p\ original = (100 \pm \Delta p)\%$
Building aggregator module
108
Criteria setting = Segment Leader(s)
$f(x) = \sum_{i}^{k} \sum_{j}^{n} || x_{ij} \cdot p_{ij} - s_i ||^2$
606
604
Potential Decarbonization Calculator
110
$(1/n \sum_{j=1}^{n} X_j EUI - Segment\ Leader\ EUI) \times 0.85\ per\ kwh$
608
612
k is the number of clusters.
n is the number of building data points
x is the building data
j is individual building data
s is the centroid of cluster
||·|| denotes the Euclidean distance.
Building Characteristics
Building Name
Address
Post Code
Lat Long
Building Status
Building Type
Building Sector
Building Occupancy Type
Year Building was Built
Building ID
GFA
114
Technology details
Energy Usage Intensity (EUI) last 3 years
Air Conditioning System Type
Air Conditioning System Capacity
Air Conditioning System Efficiency
Chiller Efficiency
Number of Chillers
Lighting
Building ID
116

FIG. 7

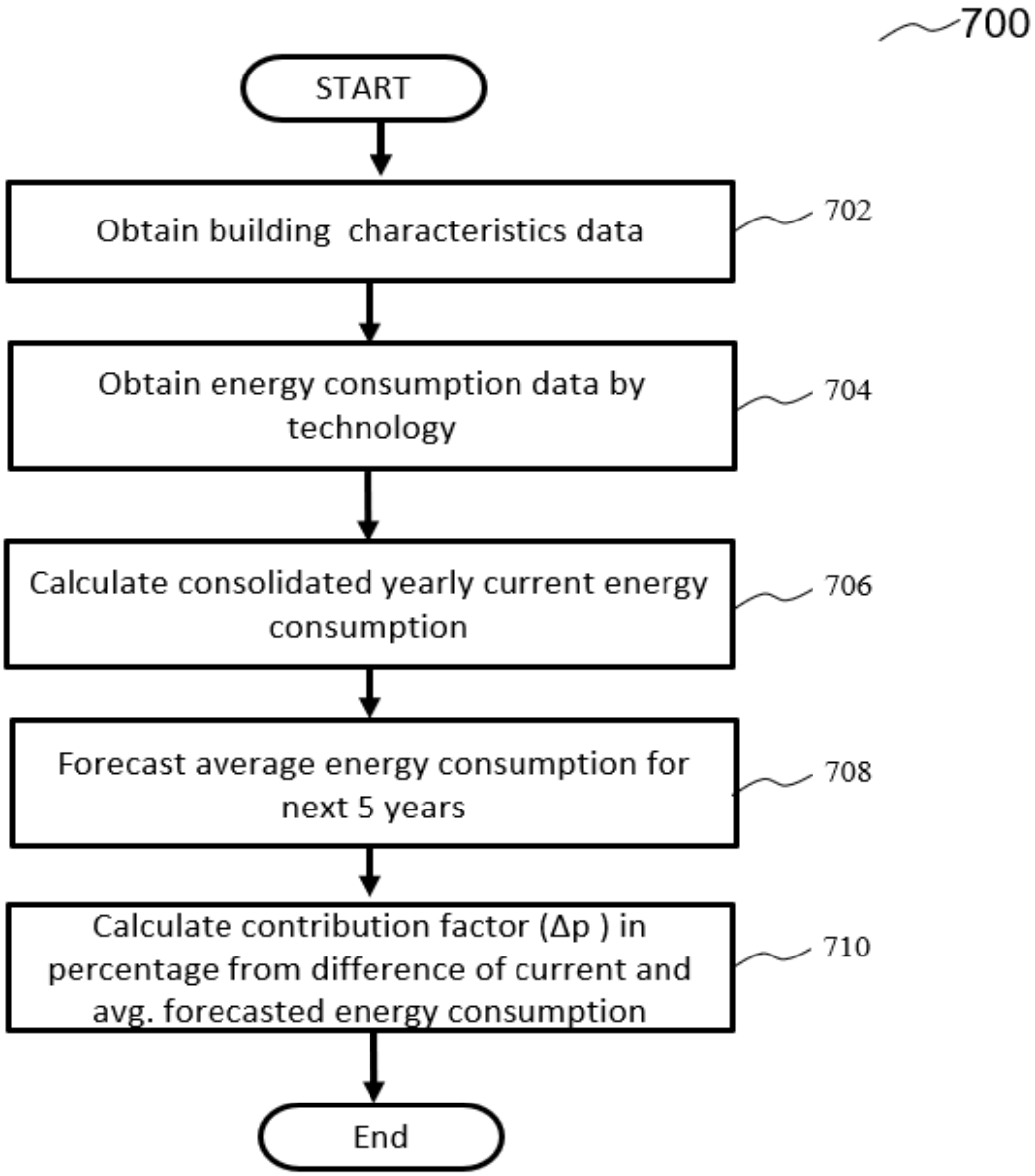

700
START
Obtain building characteristics data
702
Obtain energy consumption data by technology
704
Calculate consolidated yearly current energy consumption
706
Forecast average energy consumption for next 5 years
708
Calculate contribution factor (Δp) in percentage from difference of current and avg. forecasted energy consumption
710
End

FIG. 8

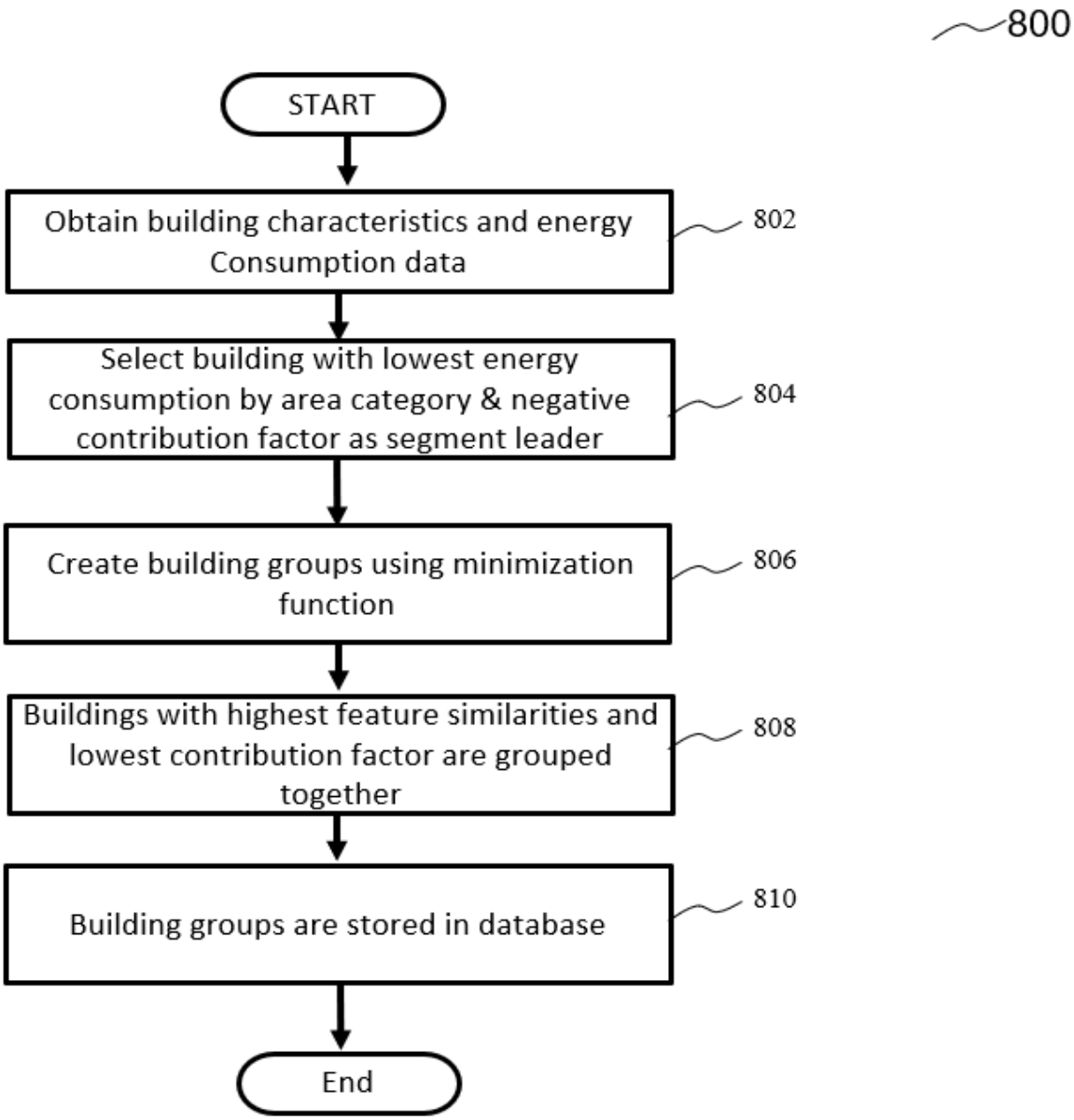

800
START
Obtain building characteristics and energy Consumption data
802
Select building with lowest energy consumption by area category & negative contribution factor as segment leader
804
Create building groups using minimization function
806
Buildings with highest feature similarities and lowest contribution factor are grouped together
808
Building groups are stored in database
810
End

FIG. 9

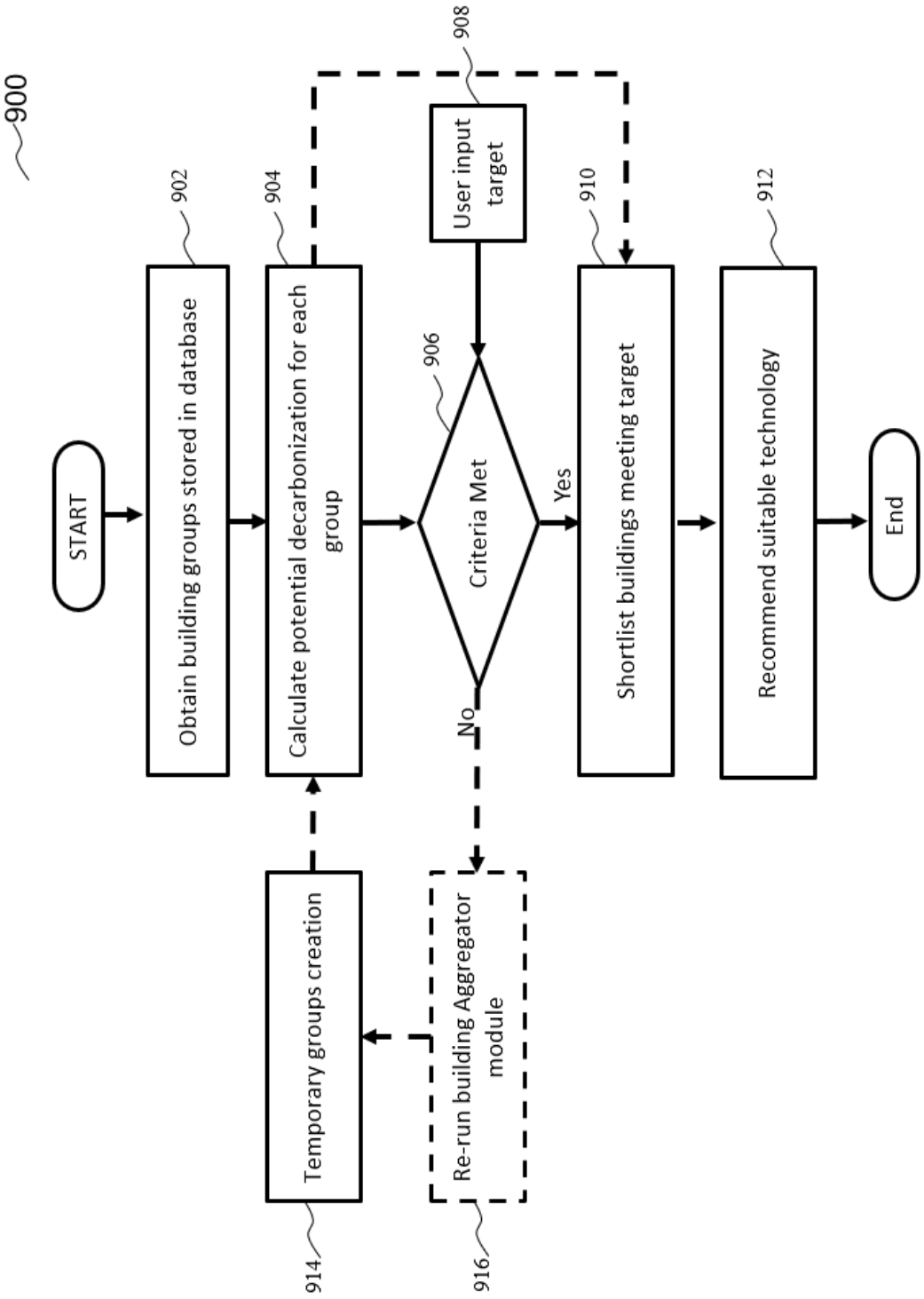
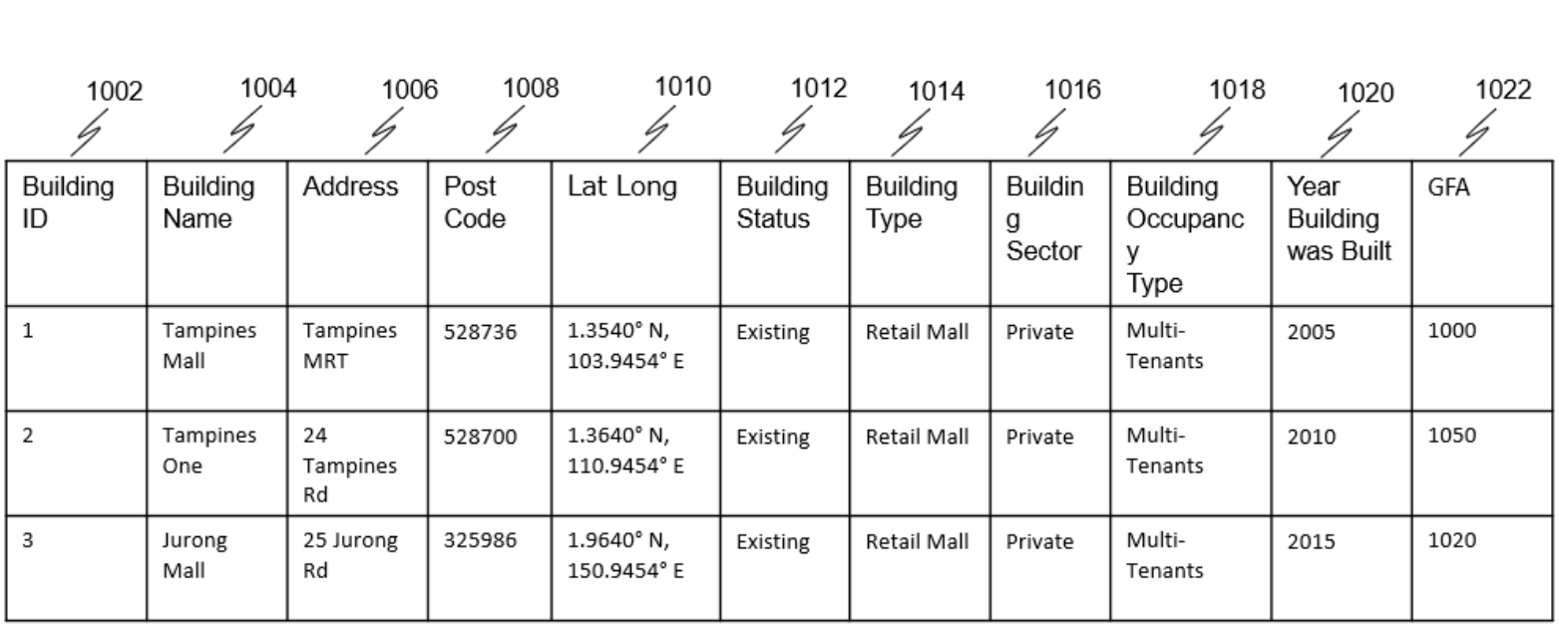

900
START
Obtain building groups stored in database
902
Calculate potential decarbonization for each group
904
Criteria Met
906
User input target
908
Yes
No
Shortlist buildings meeting target
910
Recommend suitable technology
912
End
Temporary groups creation
914
Re-run building Aggregator module
916

FIG. 10



Building ID	Building Name	Address	Post Code	Lat Long	Building Status	Building Type	Building Sector	Building Occupancy Type	Year Building was Built	GFA
1	Tampines Mall	Tampines MRT	528736	1.3540° N, 103.9454° E	Existing	Retail Mall	Private	Multi-Tenants	2005	1000
2	Tampines One	24 Tampines Rd	528700	1.3640° N, 110.9454° E	Existing	Retail Mall	Private	Multi-Tenants	2010	1050
3	Jurong Mall	25 Jurong Rd	325986	1.9640° N, 150.9454° E	Existing	Retail Mall	Private	Multi-Tenants	2015	1020

FIG. 11

1100

1002 Building ID	1104 Energy Usage Intensity (EUI) 2023	1106 Energy Usage Intensity (EUI) 2022	1108 Energy Usage Intensity (EUI) 2021	1112 Air Conditioning System Type	1114 Air Conditioning System Capacity	1118 Air Conditioning System Efficiency	1120 Number of Chillers	1122 Lighting
1	310	330	340	Water-Cooled Chiller	1800	0.6	4	Non-Led
2	290	300	320	Water-Cooled Chiller	1500	0.7	4	Non-Led
3	150	160	165	Water-Cooled Chiller	1900	0.9	4	Led

FIG. 12

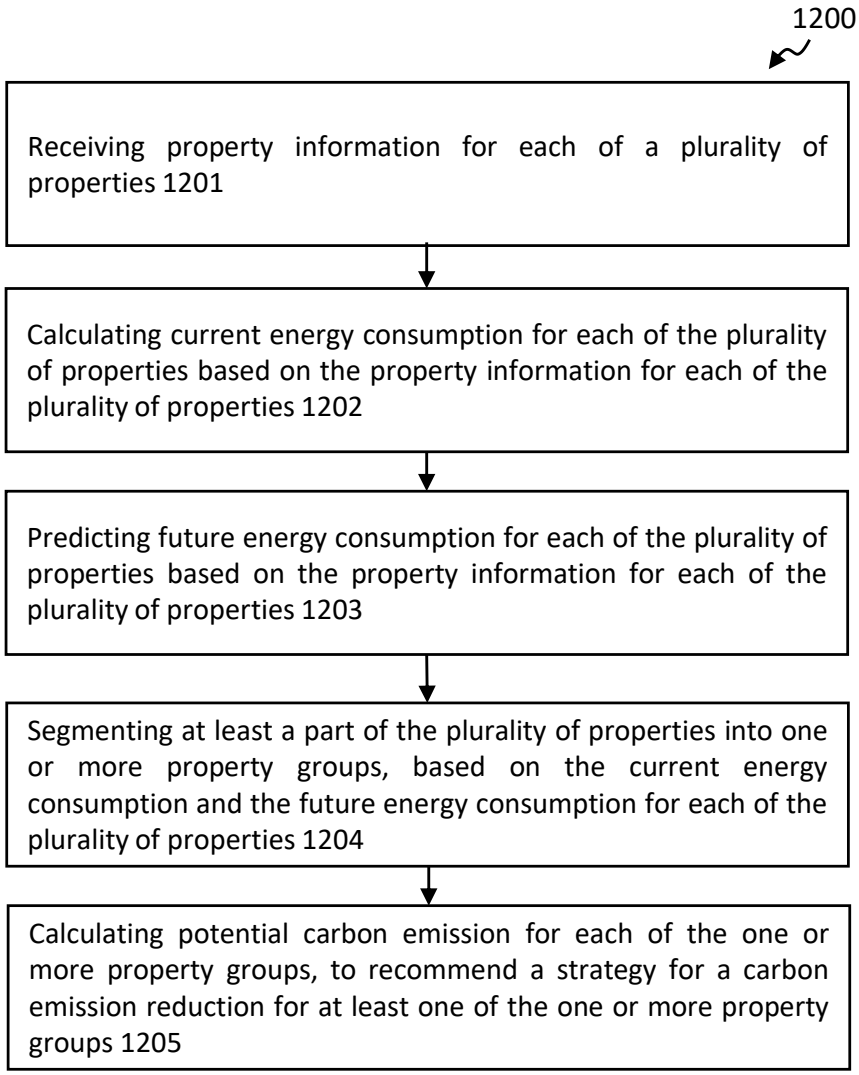

1200
Receiving property information for each of a plurality of properties 1201
Calculating current energy consumption for each of the plurality of properties based on the property information for each of the plurality of properties 1202
Predicting future energy consumption for each of the plurality of properties based on the property information for each of the plurality of properties 1203
Segmenting at least a part of the plurality of properties into one or more property groups, based on the current energy consumption and the future energy consumption for each of the plurality of properties 1204
Calculating potential carbon emission for each of the one or more property groups, to recommend a strategy for a carbon emission reduction for at least one of the one or more property groups 1205

FIG. 13