POWERGEN-PY

by Energy for Development

Documentation Manual

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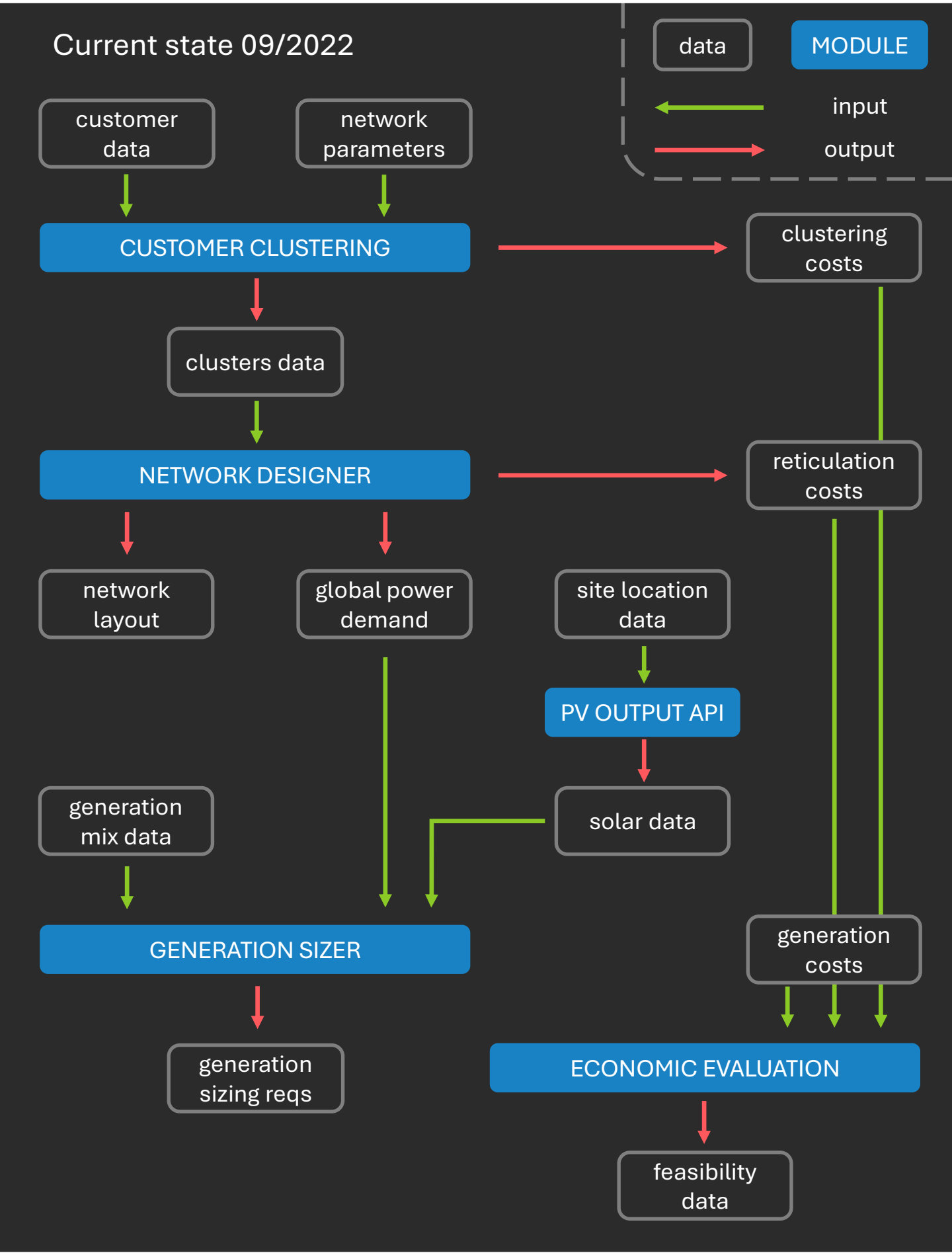
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CustomerClustering class

from customer_clustering.py

class customer_clustering.**CustomerClustering**(*init_cluster, network_voltage, pole_cost, pole_spacing, resistance_per_km, current_rating, cost_per_km, max_voltage_drop=None, max_distance=None*)

Parameters

init_cluster : *InitCluster*
InitCluster object which initially pools all customers together.
max_connections : *int*
Maximum customers allowed per cluster.
network_voltage : *float*
Voltage at which network operates.
pole_cost : *float*
Cost of electrical pole which will be placed at centroid location of cluster and to support line.
pole_spacing : *flaot*
Space between each electrical pole in meters.
resistance_per_km : *float*
Resistance per kilometer of cable used in ohm/km.
current_rating : *float*
Cable's max current rating.
cost_per_km : *float*
Cable's cost per kilometer.
max_voltage_drop : *float, optional*
Maximum voltage drop allowed between pole and customer. If None then maximum voltage drop is dictated by voltage regulation. The default is *None*.
max_distance : *float, optional*
Maximum distance allowed between pole and customer in meters.
The default is *None*.

Attributes

clusters : *list*
List of cluster objects.
total_cable_length : *float*
Total cable length of all clusters combined.
total_cost : *float*
Combined capital cost of cables and poles.

CustomerClustering class

from customer_clustering.py

class customer_clustering.**CustomerClustering**(*init_cluster, network_voltage, pole_cost, pole_spacing, resistance_per_km, current_rating, cost_per_km, max_voltage_drop=None, max_distance=None*)

Methods

import_from_csv(*filename, network_voltage, pole_cost, pole_spacing, resistance_per_km, current_rating, cost_per_km, scale_factor=1, max_voltage_drop=None, max_distance=None*)

Description	Imports customer data from CSV file (must use specific template, see template generator)
Parameters	**filename** : *str* CSV file location. [Remaining are same as initialisation parameters. See Page 2]
Returns	**self** : *object* Returns CustomerClustering object with specified parameters.

cluster(*max_customers=6*)

Description	Compute customer clustering using k-means clustering. Calculates total cost as sum of pole cost and cable cost.
Parameters	**max_customers** : *int* Maximum number of customers per cluster.
Returns	**self** : *object* Returns CustomerClustering object with clustered customers.

InitCluster & Customer classes

from customer_clustering.py

class customer_cluster.**InitCluster**(*customers)*

Description	Special cluster object used for first cluster created. Centroid is automatically calculated at creation.
Parameters	**customers** : *array-like* 1D array of Customer objects.
Attributes	**customers** : *list* 1D array of Customer objects. **position** : *tuple* X and Y coordinates of Cluster. **distance** : *ndarray of shape (customers,)* 1D array containing distance between customers and centroid.

class customer_cluster.**Customer**(*customer_id,position,power_demand)*

Description	Customer object for clustering algorithm.
Parameters	**customer_id** : *str* Customer Identifier. **position** : *array-like of shape (1,2)* X and Y coordinates of customer. **power-demand** : *array-like of shape (1,)* 1D array of customer's hourly power demand.

NetworkDesigner class

from network_designer.py

class network_designer.**NetworkDesigner**(*self, source_location, nodes_locations, nodes_power_dem, network_voltage, pole_cost, pole_spacing, res_per_km, max_current, cost_per_km, scl=1, max_V_drop=None, node_ids=None, V_reg=6*)

Parameters

source_location : *array-like*
1x2 array containing X and Y coordinates of source.

nodes_locations : *array-like*
Array of 1x2 arrays containing X and Y coordinates of nodes.

nodes_power_dem : *array-like*
Array of arrays containing power demands (W) of each node in network.

network_voltage : *float*
Operating voltage of network.

pole_cost : *float*
Cost of single electrical pole.

pole_spacing : *float*
Spacing between poles in meters.

res_per_km : *float*
Cable's resistance per kilometer (ohm/km).

max_current : *float*
Cable's maximum current rating (A).

cost_per_km : *float*
Cable's cost per km.

scl : *float, optional*
Scales coordinates of source and nodes by chosen amount. The default is *1*.

max_V_drop : *flaot, optional*
Maximum voltage drop. If not specified value dictated by voltage regulation. The default is *None*.

node_ids : *array-like, optional*
Array containing node identifiers. The default is None.

V_reg : *float, optional*
Maximum voltage drop as percentage of network voltage. The default is *6*.

NetworkDesigner class

from network_designer.py

class network_designer.**NetworkDesigner**(*self, source_location, nodes_locations, nodes_power_dem, network_voltage, pole_cost, pole_spacing, res_per_km, max_current, cost_per_km, scl=1, max_V_drop=None, node_ids=None, V_reg=6*)

Attributes

nodes : *list*
List of nodes in network.
total_length : *float*
Total length of cables connecting nodes.
line_cost : *float*
Cables total cost.
num_poles : *float*
Number of required electrical poles.
poles_cost : *float*
Poles total cost.
total_cost : *float*
Total network cost (poles and cables).
total_Pdem : *ndarray of shape (1,)*
Network's total hourly power demand.
distances : *ndarray of size (nodes,nodes)*
Distances matrix. Distances between each node
connections : *ndarray of size (nodes,nodes)*
Connection matrix. Populated with distances between nodes where connection made.
Vdrop_max : *float*
Maximum voltage drop allowed in network.
max_V_drop : *flaot, optional*
Maximum voltage drop. If not specified value dictated by voltage regulation. The default is *None*.
node_ids : *array-like, optional*
Array containing node identifiers. The default is None.
V_reg : *float, optional*
Maximum voltage drop as percentage of network voltage. The default is *6*.

NetworkDesigner class

from network_designer.py

class network_designer.**NetworkDesigner**(*self, source_location, nodes_locations, nodes_power_dem, network_voltage, pole_cost, pole_spacing, res_per_km, max_current, cost_per_km, scl=1, max_V_drop=None, node_ids=None, V_reg=6*)

Methods

import_from_csv(*filename, network_voltage, pole_cost, pole_spacing, res_per_km, max_current, cost_per_km, scl=1, max_V_drop=None, V_reg=6***)**

Description	Imports source location and nodes locations and power demands from specified CSV file.
Parameters	**filename** : *str* CSV file location. [Remaining are same as initialisation parameters. See Page 5]
Returns	**self** : *object* Returns NetworkDesigner object with specified parameters and data extracted from CSV file.

build_network()

Description	Build network based on parameters assigned when initialised.
Returns	**self** : *object* Returns NetworkDesigner with completed connections.

draw_graph(*save=False*)

Description	Imports source location and nodes locations and power demands from specified CSV file.
Parameters	**save** : *bool* If true saves graph image. The default is False.
Returns	**self** : *object* Returns NetworkDesigner object with specified parameters and data extracted from CSV file.

pv_output function

from pvoutput.py

function pvoutput.**pv_output**(*lati, long, capacity, year=2019, auto_dataset=True, dataset="merra2", system_loss=0, auto_tilt=True, tilt=40, azim=180*)

Description	Retrieves PV panel output in Watts from renewables.ninja API.