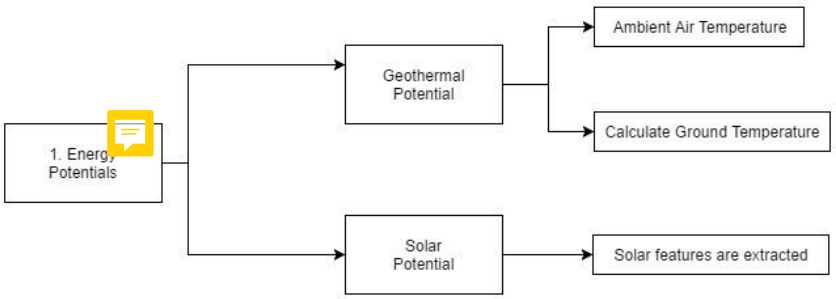
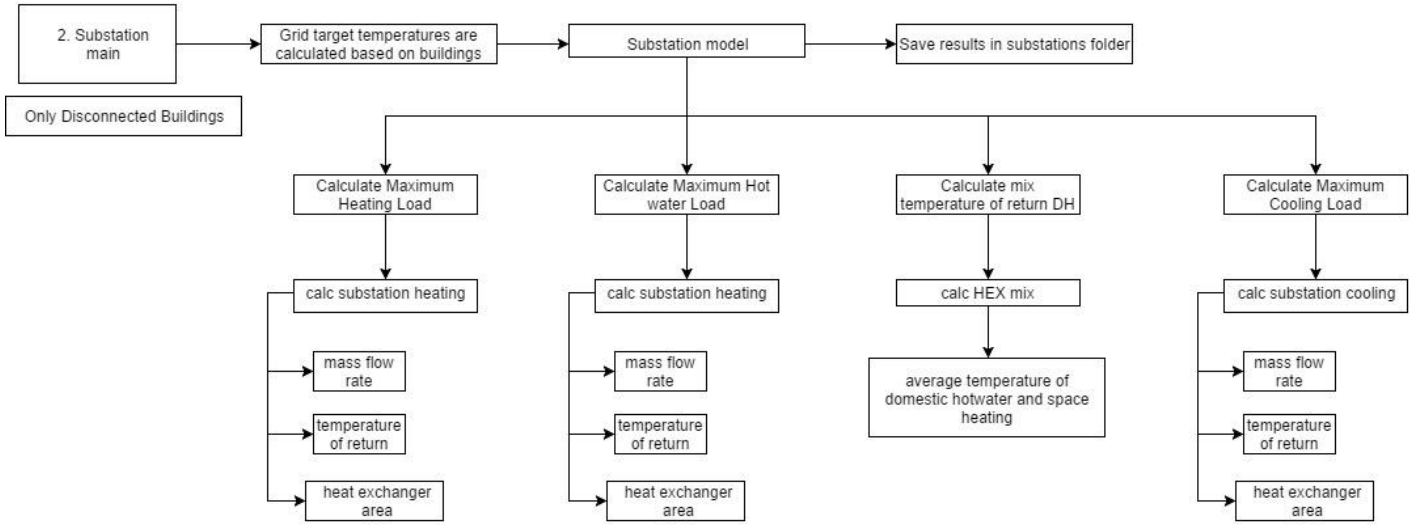
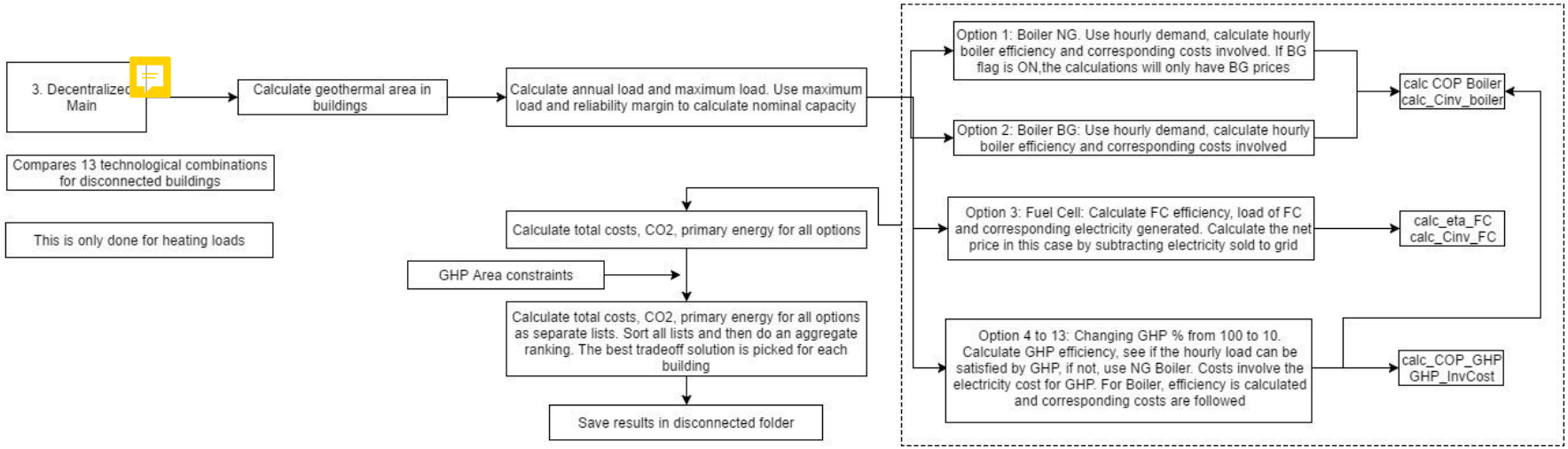
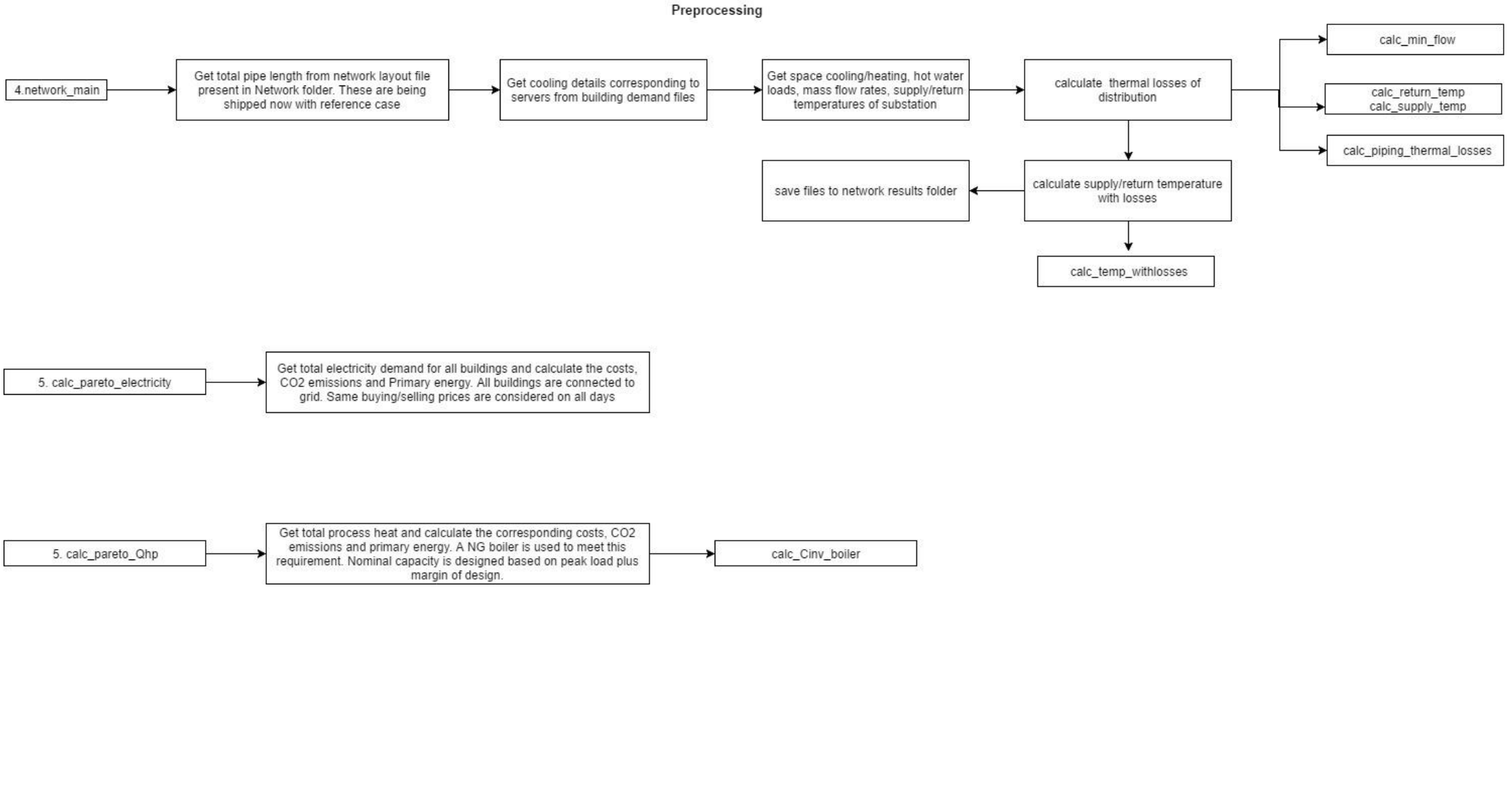
Preprocessing

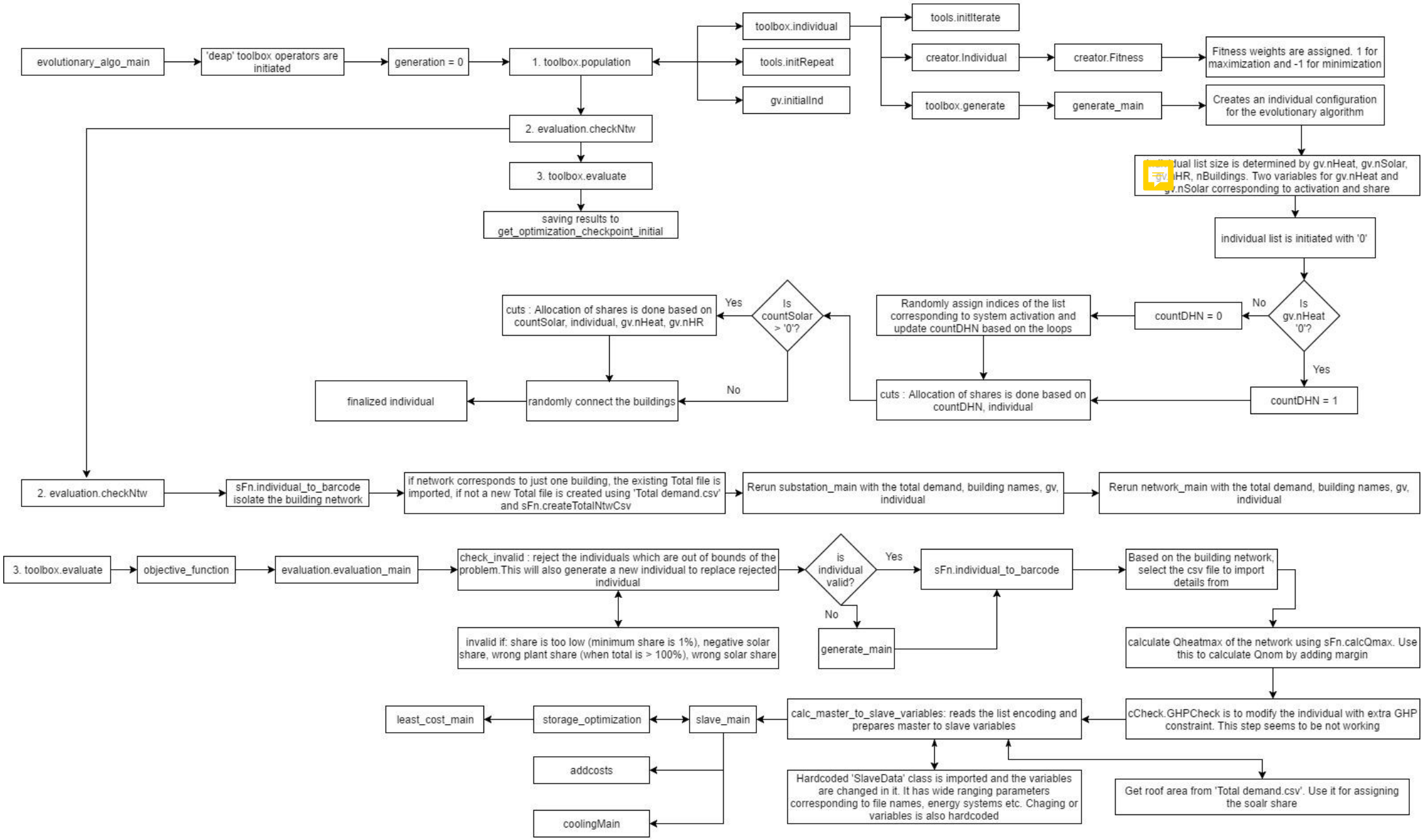




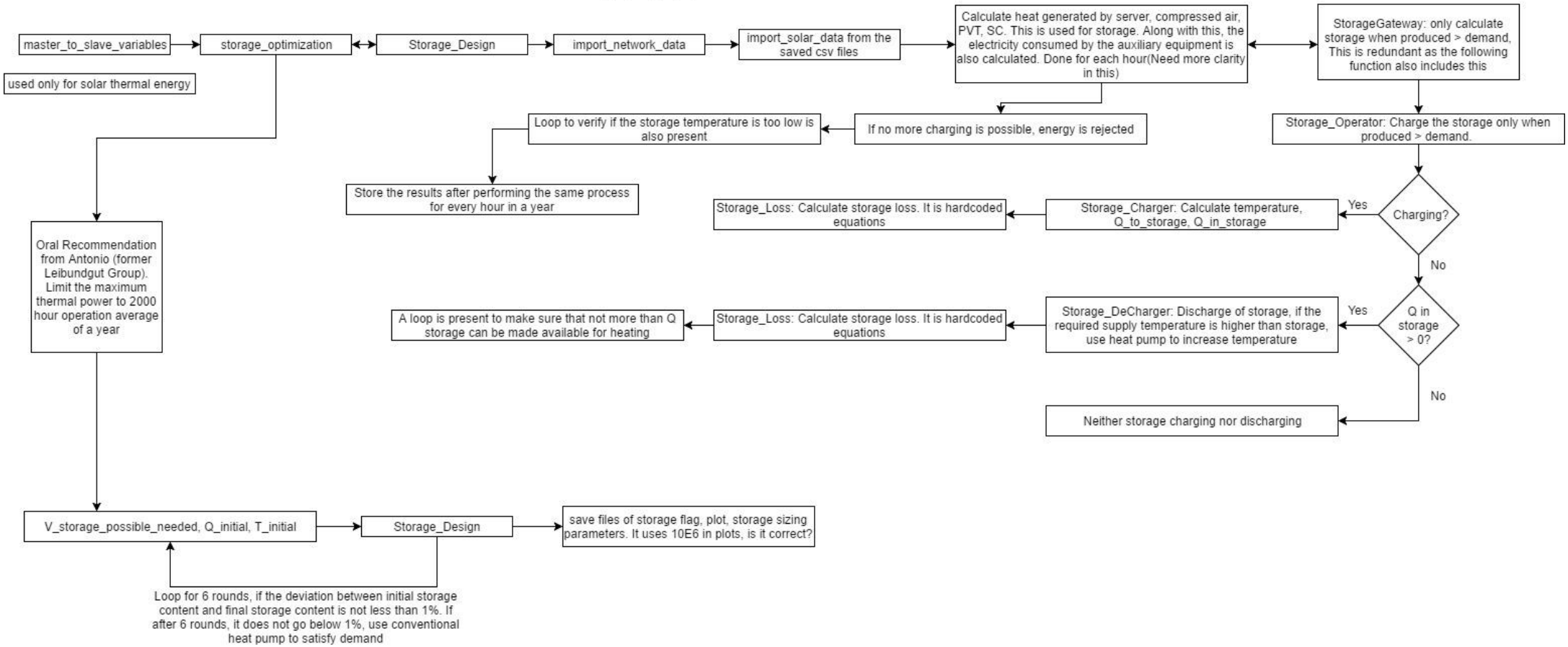


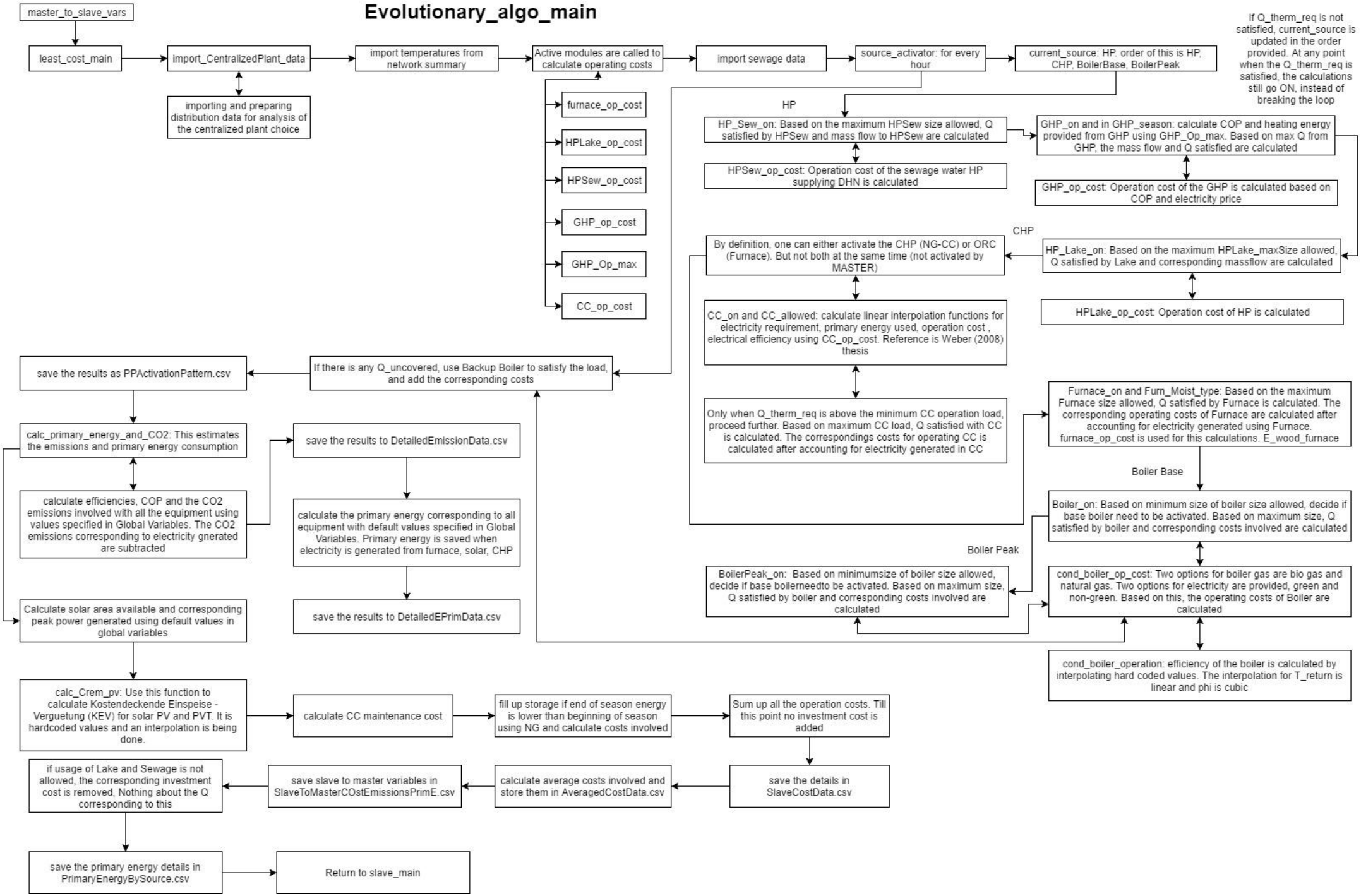

Preprocessing
4.network_main
Get total pipe length from network layout file present in Network folder. These are being shipped now with reference case
Get cooling details corresponding to servers from building demand files
Get space cooling/heating, hot water loads, mass flow rates, supply/return temperatures of substation
calculate thermal losses of distribution
calc_min_flow
calc_return_temp
calc_supply_temp
calc_piping_thermal_losses
calculate supply/return temperature with losses
save files to network results folder
calc_temp_withlosses
5. calc_pareto_electricity
Get total electricity demand for all buildings and calculate the costs, CO2 emissions and Primary energy. All buildings are connected to grid. Same buying/selling prices are considered on all days
5. calc_pareto_Qhp
Get total process heat and calculate the corresponding costs, CO2 emissions and primary energy. A NG boiler is used to meet this requirement. Nominal capacity is designed based on peak load plus margin of design.
calc_Cinv_boiler

evolutionary_algo_main

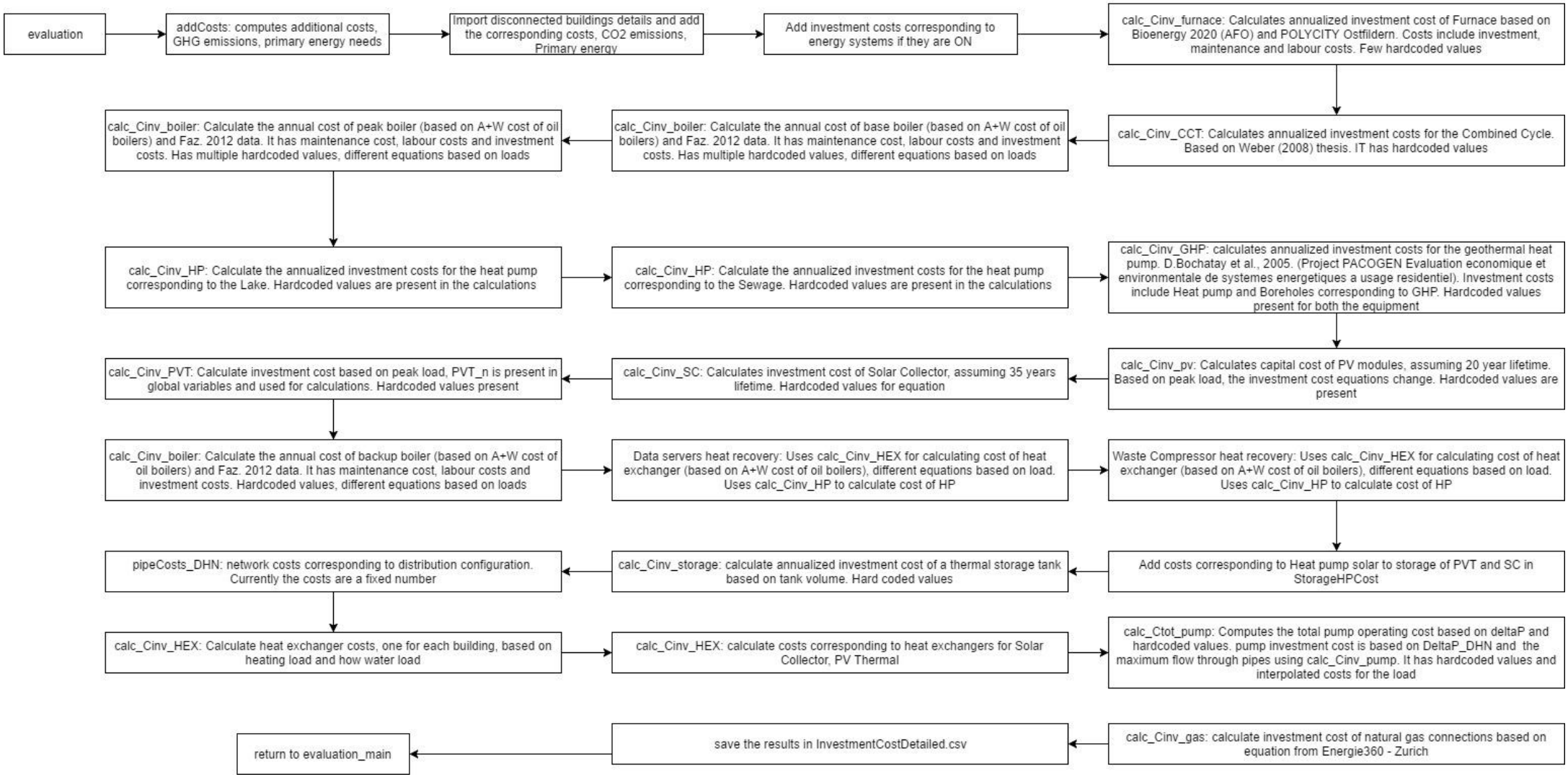


Evolutionary_algo_main

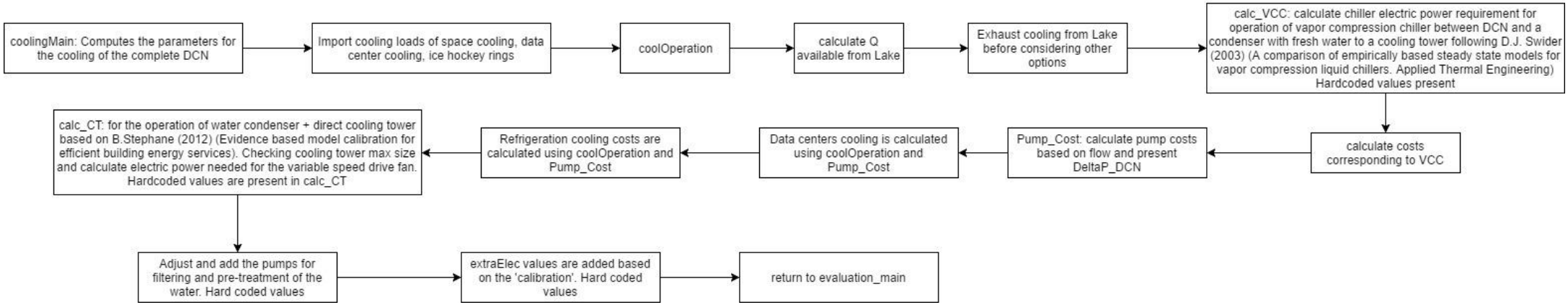



Evolutionary_algo_main
master_to_slave_vars
least_cost_main
import_CentralizedPlant_data
importing and preparing distribution data for analysis of the centralized plant choice
import temperatures from network summary
Active modules are called to calculate operating costs
furnace_op_cost
HPLake_op_cost
HPSew_op_cost
GHP_op_cost
GHP_Op_max
CC_op_cost
import sewage data
source_activator: for every hour
current_source: HP. order of this is HP, CHP, BoilerBase, BoilerPeak
If Q_therm_req is not satisfied, current_source is updated in the order provided. At any point when the Q_therm_req is satisfied, the calculations still go ON, instead of breaking the loop
HP
HP_Sew_on: Based on the maximum HPSew size allowed, Q satisfied by HPSew and mass flow to HPSew are calculated
HPSew_op_cost: Operation cost of the sewage water HP supplying DHN is calculated
GHP_on and in GHP_season: calculate COP and heating energy provided from GHP using GHP_Op_max. Based on max Q from GHP, the mass flow and Q satisfied are calculated
GHP_op_cost: Operation cost of the GHP is calculated based on COP and electricity price
CHP
By definition, one can either activate the CHP (NG-CC) or ORC (Furnace). But not both at the same time (not activated by MASTER)
HP_Lake_on: Based on the maximum HPLake_maxSize allowed, Q satisfied by Lake and corresponding massflow are calculated
HPLake_op_cost: Operation cost of HP is calculated
CC_on and CC_allowed: calculate linear interpolation functions for electricity requirement, primary energy used, operation cost , electrical efficiency using CC_op_cost. Reference is Weber (2008) thesis
Only when Q_therm_req is above the minimum CC operation load, proceed further. Based on maximum CC load, Q satisfied with CC is calculated. The correspondings costs for operating CC is calculated after accounting for electricity generated in CC
Furnace_on and Furn_Moist_type: Based on the maximum Furnace size allowed, Q satisfied by Furnace is calculated. The corresponding operating costs of Furnace are calculated after accounting for electricity generated using Furnace. furnace_op_cost is used for this calculations. E_wood_furnace
Boiler Base
Boiler_on: Based on minimum size of boiler size allowed, decide if base boiler need to be activated. Based on maximum size, Q satisfied by boiler and corresponding costs involved are calculated
Boiler Peak
BoilerPeak_on: Based on minimumsize of boiler size allowed, decide if base boilerneedto be activated. Based on maximum size, Q satisfied by boiler and corresponding costs involved are calculated
cond_boiler_op_cost: Two options for boiler gas are bio gas and natural gas. Two options for electricity are provided, green and non-green. Based on this, the operating costs of Boiler are calculated
cond_boiler_operation: efficiency of the boiler is calculated by interpolating hard coded values. The interpolation for T_return is linear and phi is cubic
If there is any Q_uncovered, use Backup Boiler to satisfy the load, and add the corresponding costs
save the results as PPActivationPattern.csv
calc_primary_energy_and_CO2: This estimates the emissions and primary energy consumption
calculate efficiencies, COP and the CO2 emissions involved with all the equipment using values specified in Global Variables. The CO2 emissions corresponding to electricity gnerated are subtracted
save the results to DetailedEmissionData.csv
calculate the primary energy corresponding to all equipment with default values specified in Global Variables. Primary energy is saved when electricity is generated from furnace, solar, CHP
save the results to DetailedEPrimData.csv
Calculate solar area available and corresponding peak power generated using default values in global variables
calc_Crem_pv: Use this function to calculate Kostendeckende Einspeise - Verguetung (KEV) for solar PV and PVT. It is hardcoded values and an interpolation is being done.
calculate CC maintenance cost
fill up storage if end of season energy is lower than beginning of season using NG and calculate costs involved
Sum up all the operation costs. Till this point no investment cost is added
save the details in SlaveCostData.csv
calculate average costs involved and store them in AveragedCostData.csv
save slave to master variables in SlaveToMasterCOstEmissionsPrimE.csv
if usage of Lake and Sewage is not allowed, the corresponding investment cost is removed, Nothing about the Q corresponding to this
save the primary energy details in PrimaryEnergyBySource.csv
Return to slave_main

Evolutionary algo main



Evolutionary algo main



Evolutionary algo main