ATTEST

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WP2

Toolbox specification, support tools and test cases

Market Simulator

D2.6

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Table of Contents

List of Figures

List of Tables

Abbreviations and Acronyms

CSV	Comma-Separated Value
GSK	Generation Shift Key
GLPK	GNU MathProg Modeling Language
LP	Linear Programming
MIC	Minimum Income Condition
PTDF	Power Transfer Distribution Factor
PU	Per Unit
RAM	Remaining Available Margin
SI	International System of Units
TSO	Transmission System Operator

Executive Summary

This report is part of deliverable D2.6 “Market Simulator” of T2.6 of the ATTEST project, which consists of a tool for energy and reserves market clearing. The document describes the models, the data formats, and practical details regarding the implementation. It also includes some practical examples for successfully running the tool.

1. Introduction

The objective of this report is to provide a description of the market simulator tool developed in task 2.6 of ATTEST. This tool encompasses a methodology for clearing energy, secondary and tertiary markets on a day-ahead time-frame. It includes cross-border trading through a flow-based market coupling approach. While it is mainly aimed at day-ahead scheduling, the methodology can be easily extended to real-time stage. The aim of the market simulator is to provide the operation tools to be developed in WP4 with market data and flexibility offers.

This report is structured in three main chapters: methodology, data formats, and a final chapter highlighting the results for a simple test case. The chapter on the methodology contains a brief explanation of the models imbedded, the market clearing mechanisms, and the sequence of operations. The chapter on data formats provides information on the input data required for successfully running the market simulator tool. Finally, the chapter on results gives information on the main outcomes after running the tool.

2. Methodology

The Market Simulator tool is divided into three different optimization modules: energy market, secondary reserve[1] market and tertiary reserve[2] market. All modules are independent of each other requiring the user to select the module to be used upon invoking the tool. This is done by means of a Boolean variable whose state must be set by the user.

The Market Simulator tool was implemented in Python, with open source dependencies on the following packages: NumPy, pandas and PuLP. The role of each package is summarized as follows:

- NumPy is a Python package that supports multidimensional arrays, having a large collection of mathematical functions to work with these structures;
- Pandas is a powerful, flexible and easy to use open source data analysis and manipulation tool;
- PuLP is a Linear Programming (LP) modeling language, which generates a mathematical description of the problem easily interpreted by several open source or commercial solvers (in this case, an open source solver was selected – GLPK [1]).

The software requires relevant network data (transmission line, transformer impedances, generator buses, and load buses) compatible with the DC load flow model. Additionally, each market optimization model requires specific inputs regarding generation and load bids. The outputs of each module are placed in specific folders. The energy market output gives information on the generation and load bids selected while the secondary and tertiary reserve markets provide the generators which will provide the corresponding services to the network operator (single buyer).

2.1. Selection of Market Modules

The tool is initialized through the command line by using the text shown in Figure 2.1. This command must contain the path of the program folder to avoid problems with function pathings. Each of the arguments represent a market clearing option: energy market, secondary reserve market and tertiary reserve market. By setting the argument to "True", the correspoding market will be cleared while if the argument is set to "False", then the respective market will not be cleared.

```
C:\Users\PycharmProjects\test>py main.py True True True
```

FIGURE 2.1: EXAMPLE OF THE COMMAND LINE INPUT FOR INITIALIZING THE MARKET SIMULATOR TOOL.

After invoking the tool through the command line, the arguments' will initiate the selected markets' clearing process (Figure 2.2 and Figure 2.3).

```
# set variables to True to optimize that market, set to False not to optimize


energy = sys.argv[1]
secondary = sys.argv[2]
tertiary = sys.argv[3]

model_selector(energy, secondary, tertiary)
```

FIGURE 2.2: SNAPSHOT OF THE BOOLEAN INPUT, WHICH MUST BE SET BY THE USER TO SELECT THE MARKETS TO BE CLEARED.

[1] Secondary reserve corresponds to the Frequency Restoration Reserve concept (eitheir automatic or manual) in the ENTSO-E Network Code on System Operation.
[2] Tertiary reserve corresponds to the Replacement Reserves conceptin the ENTSO-E Network Code on System Operation.

As seen in Figure 2.3, the Market Simulator tool follows a hierarchical optimization process where, if selected, the energy market is the first one to be cleared, followed by the secondary reserve market, and by the tertiary reserve market. Subections 2.2 and 2.3 detail the mathematical model used for the clearing the energy market (subection 2.2) and the secondary and tertiary reserve markets (subsection 2.3).

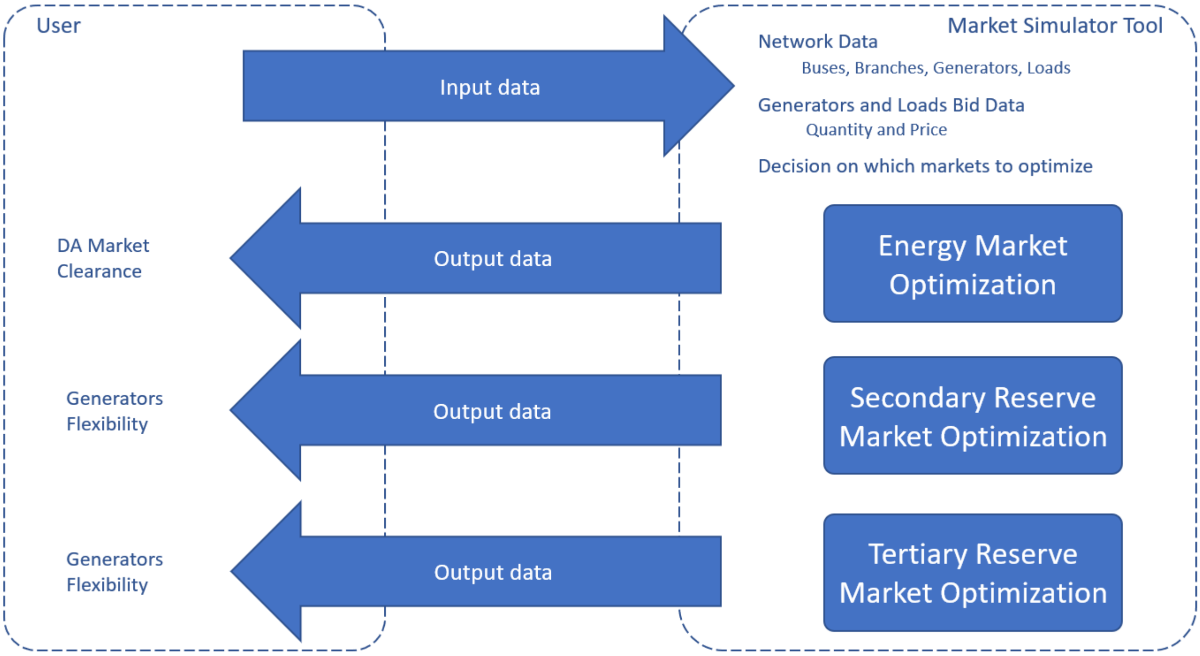

FIGURE 2.3: ARCHITECTURE OF THE MARKET SIMULATOR TOOL.

2.2. Energy Market Optimization

The optimization model for clearing the energy market (see the Python code in Figure 2.4) follows the EUPHEMIA [2], [3] algorithm, which was developed with the aim to unify the different zonal European electricity markets.

The flow-based approach is included in EUPHEMIA and in the Market Simulator tool to consider the energy flows between different bidding areas [4], [5]. This enables a more precise modelling of the physical flows through key elements of the transmission network, leading to a more efficient use of resources. The flow-based approach constraints included in the optimization model are bounded by Remaining Available Margin (RAM), which represent the number of megawatts available in the key elements of the transmission network for active power exchange between zones, and the Power Transfer Distribution Factors (PTDF), which are coefficients relating the change in the active power flow with changes in the active power injected in each zone. These parameters convert the active power flow equations into linear constraints, which are better suited to be used in LP problems.

```python
def market_solver(max_t, generators, loads_info, loads_val, gen_val, Pd, Ps, ram, marg_cost, zones, zones_ptdf):
    n_gen = len(generators.index)
    n_load = len(loads_info.index)
    prob = LpProblem("market_FBMC", LpMaximize)

    Qd = LpVariable.dicts('Qd', range(0, n_load * max_t + 1), lowBound=0, cat='Continuous')
    Qs = LpVariable.dicts('Qs', range(0, n_gen * max_t + 1), lowBound=0, cat='Continuous')

    Qs_max = gen_val
    Qd_max = loads_val

    hour_objective = []

    for t in range(0, max_t):
        generation = pulp.lpSum(- Ps.loc["G" + str(ix), t + 1] * Qs[ix + n_gen * t] for ix in range(0, n_gen))
        load = pulp.lpSum(Pd.loc["L" + str(ix), t + 1] * Qd[ix + n_load * t] for ix in range(0, n_load))
        hour_objective.append(pulp.lpSum(load + generation))

    prob += pulp.lpSum(hour_objective), "obj"

    for t in range(0, max_t):
        for ix in range(0, n_gen):
            prob += Qs[ix + n_gen * t] <= Qs_max.loc["G" + str(ix), t + 1], "max constraint " + str(Qs[ix + n_gen * t])
            prob += Qs[ix + n_gen * t] >= 0, "min constraint " + str(Qs[ix + n_gen * t])

        for ix in range(0, n_load):
            prob += Qd[ix + n_load * t] <= Qd_max.loc["L" + str(ix), t + 1], "max constraint " + str(Qd[ix + n_load * t])
            prob += Qd[ix + n_load * t] >= 0, "min constraint " + str(Qd[ix + n_load * t])
```

FIGURE 2.4: SNAPSHOT OF THE IMPLEMENTATION OF THE ALGORITHM FOR THE ENERGY MARKET CLEARING.

The energy market is cleared using an optimization process with the objective of maximizing the social welfare (1). The decision variables are the quantity of hourly demand bid ***d*** in trading period ***t*** in pu (Q_d^t) and the quantity of hourly supply offer *s* in trading period *t* in pu (Q_s^t).

$$\max \sum_t \left(\sum_d P_d^t \times Q_d^t - \sum_s P_s^t \times Q_s^t \right) \tag{1}$$

Subject to:

$$0 \leq Q_s^t \leq U_s^t \times Q_s^{t\_max} \tag{2}$$

$$0 \leq Q_d^t \leq U_d^t \times Q_d^{t\_max} \tag{3}$$

$$\sum_t Q_d^t = \sum_t Q_s^t \tag{4}$$

$$Q_s^t - Q_s^{t-1} \leq LG_s^{up} \tag{5}$$

$$Q_s^{t-1} - Q_s^t \leq LG_s^{down} \tag{6}$$

in which P_s^t refers to the price of generator s at time t, $Q_s^{t\_max}$ refers to the quantity produced by generator s at time t, P_d^t refers the price of load d at time t, $Q_d^{t\_max}$ refers to the quantity consumed by load d at time t and U_s^t and U_d^t are, respectively, binary variables that determine if the generator s or load d is active at time t

According to EUPHEMIA, Load Gradient conditions define complex orders for the maximum upward and downward variation of the quantity Q_s^t between two consecutive hours . Hence, there is maximum increment / decrement allowed (the same value for all periods) which is modelled by equations (5) and (6), with LG_s^{up} (maximum allowable increase) and LG_s^{down} (maximum allowable decrease).

The Minimum Income Condition (MIC), which intends to guarantee that a bid is only considered submitted if it ensures that the amount of money collected by the order for all periods covers the production costs and, therefore, the minimum income, are represented in (7) and (8).

$$\sum_t Q_s^t \times \lambda_t \geq Rent_{min,s} \tag{7}$$

$$Rent_{min,s} = C\_fix_s + C\_var_s \times \sum_t Q_s^t \quad (8)$$

in which , λ_t is the marginal price for each hour and $Rent_{min,s}$ is given by, C_fix_s represents the fixed cost of generator ***s***, C_var_s refers to the variable costs of generator ***s***. Equation 8 represents the MIC for complex orders. No Merit Orders nor or Block Orders where implemented at this stage, but the model can easily include them by means of manipulating variables U_s^t and U_d^t .

The problem (1) – (8) can be classified as mixed-integer linear programming. In addition, note that MIC orders require the computation of dual variables, namely, the market clearing price for each hour. To speed up the computations using a LP solver, the optimization model is not solved at once, but in an iterative fashion as follows: after solving (1) – (6), the remuneration of MIC orders is computed using (8) to see if the conditions (7) are met; if true, then the market is cleared; otherwise, an iterative process begins, with the generator with the largest violation given by (7) removed from the offers list until there are no violations in (7).

Additionally, the network constraints of the flow-based market coupling approach were considered as

$$-RAM_f \leq A_{f,z} \times q_z \leq RAM_f \quad (9)$$

in which $A_{f,z}$ is the zonal PTDF of the transmission element ***f*** associated with the net export from zone ***z***, and q_z is given by

$$q_z = \sum_{s \in z} Q_s^t - \sum_{d \in z} Q_d^t \quad (10)$$

and the parameter RAM represents the line capacity thatcan be used by the day-ahead market. The value of RAM is determined by the TSO for the critical branches (cross-border line, internal transmission line or transformer), which all those significantly impacted by cross-border trade given an operational situation (normal N-state or contingency cases such as an N-1 state). Accordingly, the value of RAM for each critical branch can be computed as

$$RAM_f = F_f^{max} - F_f^{ref} - FAV_f - FRM_f \quad (11)$$

in which F_f^{max} is the maximum allowable flow of the transmission element ***f***, F_f^{ref} is the reference flow caused by commercial transactions outside the day-ahead energy market (e.g. bilateral trading), FAV_f is a final ajustment value to the marging computed by the TSO based on its experience to model additional capacity decrease due to complex remedial actions, and FRM_f is the flow reliability margin.

The zonal PTDFs calculation (12) is a weighted average of the nodal power transfer distribution function, with the weights being the Generation Shift Key (GSK). For the optimization, the GSK was considered as being $^1/_{\#Q_s}$ [6].

$$A_{f,z} \leq \sum_z A_{f,i} \times GSK_{z,i} \leq \overline{RAM_f} \quad (12)$$

in which $A_{f,i}$ represent the nodal PTDF of zone z in node i. The $A_{f,i}$ are the values of the sensitivity matrix. The two modules used for the calculation of the sensitivity matrix and for the zonal PTDFs are presented in Figure 2.5.

```python
def sensitivity_matrix(branches, buses):

    ref = int(buses.loc[buses.slack == 1].index[0])

    # B Matrix
    B = np.zeros((max(buses.index.astype(int)), max(buses.index.astype(int))))
    B[branches.bus0.astype(int) - 1, branches.bus1.astype(int) - 1] = - 1 / branches.x
    B[branches.bus1.astype(int) - 1, branches.bus0.astype(int) - 1] = - 1 / branches.x
    print()
    B[ref, :] = 0
    B[:, ref] = 0

    A = np.zeros((len(branches["bus0"].index), (max(buses.index.astype(int)))))

    for bus in buses.index:
        B[int(bus) - 1, int(bus) - 1] = 1 / (sum(branches[branches.bus0 == bus].x) + sum(branches[branches.bus1 == bus].x))
        A[:, int(bus) - 1] = (B[branches.bus0.astype(int) - 1, int(bus) - 1] - B[branches.bus1.astype(int) - 1, int(bus) - 1]) / branches.x
    A[:, ref] = 0
    PTDF = pd.DataFrame(A, index=branches.index, columns=buses.index.astype(int))

    return PTDF, A


def zonal_ptdf(nodal_ptdf, zones):
    # flat partitioning gsk - doi: 10.1109/EEM.2017.7981901
    #  creating zonal ptdf function
    gsk = []

    # creating zonal ptdf function
    zones_ptdf = pd.DataFrame(columns=["zone " + str((col + 1)) for col in range(len(zones))], index=nodal_ptdf.index)
    for ix, val in enumerate(zones):
        gsk.append(1 / len(zones[val]))
        zones_ptdf.loc[:, val] = nodal_ptdf.loc[:, [i for i in zones[val]]].sum(axis=1) * gsk[ix]
    return zones_ptdf, gsk
```

FIGURE 2.5: SNAPSHOT OF THE SENSITIVITY MATRIX AND THE ZONAL PTDF CALCULATION MODULES.

2.3. Secondary and Tertiary Reserve Markets

The optimization process for clearing the secondary and tertiary reserve markets is done per zone by a merit order approach (see Figure 2.6). This means that the bids with the lowest price are selected first to attend to the market demand. The formulation of the optimization problem is set as:

$$\max \sum_{t} \left(\sum_{s\_z} P_{s\_z}^{t} \times Q_{s\_z}^{t} \right) \tag{13}$$

Subject to:

$$0 \leq Q_{s\_z}^{t} \leq Q_{s\_z}^{t\_max} \tag{14}$$

$$\sum_{s\_z} Q_{s\_z}^{t} \leq Q_{d\_z}^{t} \tag{15}$$

in which $P_{s\_z}^{t}$ refers to the price of generator s of zone z at time t, $Q_{s\_z}^{t}$ is the decision variable of the optimization problem and determines the quantity of energy selected from generator s offer, on zone z at time t,, $Q_{s\_z}^{t\_max}$ refers to the offer placed by generator s of zone z at time t and $Q_{d\_z}^{t}$ refers to the secondary or tertiary reserve needs of zone z at time t.

$Q_{d\_z}^{t}$ is inserted by the user according to the Transmission System Operator (TSO) requirements and will be inserted as inputs in the respective load requirements file.

If paired with secondary and/or tertiary reserve markets optimization, the software will automatically sort the generators according to a pre-determined rule:

1. The generators accepted in the energy market are included in the pool of bids of the secondary reserve market with the same price but with a different quantity according to the margin between $Q_s^{t\_max}$ and Q_d^t;
2. The generators not accepted in the energy market are included in the pool of bids of the tertiary reserve market using the price and the quantity offered to the energy market optimization.

If the user does not want to follow this pre-determined order, then the energy market optimization can be solved separately and afterwards manually introduce the secondary and tertiary reserve offers according to the intended goals and run the Market Optimizator tool for both reserve markets separately.

```
def merit_order(gen, price, load, database):

    gen_list = []
    for v in gen.index.values:
        gen_list.append(int(v.replace("G", "")))

    prob = LpProblem("merit_order", LpMaximize)
    G = LpVariable.dicts('G', gen_list, lowBound=0, cat='Continuous')

    prob += pulp.lpSum(G[gen_list[ix]] * price.iloc[ix] for ix in range(0, len(gen_list))), "obj"
    prob += pulp.lpSum(G[gen_list[ix]] for ix in range(0, len(gen_list))) <= load
    prob.solve()

    for v in prob.variables():
        database.loc[v.name.replace("_", "")] = v.varValue

    return database
```

Figure 2.6: Snapshot of the Merit Order optimization algorithm.

3. Data Inputs and Outputs

To successfully run the Market Simulator tool, it is required that all the input files for the network data and for the markets' bids are in their respective input folder (see subsections 3.1 and 3.2 and 3.3). As input data, the Market Simulator tool requires all files to be in Comma-Separated Value (CSV) format. These files must be included in the respective folder, which represent specific input data requirements: network, energy market, secondary reserve market and tertiary reserve market (Figure 3.1).

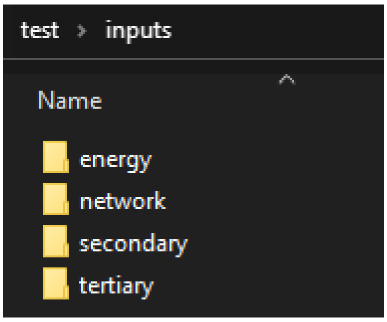

Figure 3.1: Snapshot of the input folders.

3.1. Network

The network input data must be placed in the inputs\network folder and there must be four CSV files: generators.csv, loads_info.csv, branches.csv and buses.csv (see Figure 4.2 and Annex A.1 – A.4).

The file for the bus information has 3 columns: bus, zone and slack. These represent the bus number, the area in which the bus is in and a Boolean number that signals if the bus is (1) the slack bus or not (0) (Annex A.2).

The CSV file with the branches' information has 7 columns: branch, bus0, bus1, r, x, b, s_nom. They represent the branch number, the bus number the branch starts from, the bus number the branch goes to, its resistance, its reactance, its susceptance, and its capacity respectively, with all characteristic parameters in pu (Annex A.1). The conversion from SI to pu must be done prior to the use of the tool. The pu base must be the same for the network data and for the generation and load quantities' bids.

The generator.csv file is comprised of 8 columns values: gen_id, bus, fixed_cost, variable_cost and , r_up, r_down, LGC, MIC, being gen_id, the identification code for the generator (which must be composed of the letter "G" followed by its number, staring from 0 onwards), bus represents the bus number where the generator is connected, and the fields fixed_cost and variable_cost parameters represent the fixed and variable costs value in €/pu the r_up and r_down columns represent the amount of energy that the generator is able to increase/decrease in production between periods, LGC represents a Boolean value to indicate if the energy market optimization considers the generator load gradient curve for complex orders and MIC represents a Boolean values to indicate if the energy market optimization considers the generator minimum income coefficient for the complex order (Annex A.3).

The load_info.csv file (Annex A.4) has 2 columns values: load, bus, which represent the load id and the number of the bus the load is connected to. The load id must be generated as a L followed by a number (e.g. L0) which numbering must start from 0 onwards.

3.2. Energy Market

3.2.1. Inputs

The energy market clearing module requires 4 input files in the inputs\energy folder (Figure 4.2). Two files refer to generation parameters, one for the bid price and the other for the bid quantity: gen_bid_prices.csv, gen_bid_qnt.csv, respectively. The other two refer to the load parameters, one for bid price and the other for the bid quantity: load_bid_prices.csv, load_bid_qnt.csv, respectively. All files follow the same structure, in which each row represents a component, generator or load, and each column a period. The first column must be filled with the parameter id (gen_id or load_id) and the first row with "gen_id" or "load_id", dependent on the file and the rest with integers starting in 1 to 24 (see Annex A.5 – A.8).

3.2.1. Outputs

After the energy market is cleared, two output files are created: results_gen.csv and results_load.csv (Figure 3.2).

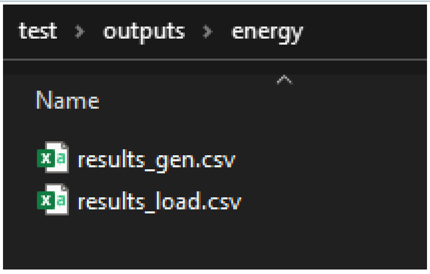

FIGURE 3.2: SNAPSHOT OF THE ENERGY MARKET OUTPUT FOLDER.

These consist on the result of the optimization problem for this market and determine the amount of energy cleared for each generator (results_gen.csv) and load (results_load.csv) for each period. The structure of both files is the same as the one used in the files input files for the energy market: each row represents a component and each column a period (see Annexes A.11 & A.12).

3.3. Secondary and Tertiary Reserve Markets

3.3.1. Inputs

The inputs required for the secondary and tertiary reserve markets depend on whether the energy market will be cleared or not. If true, then only one CSV file must be added. The file must be named "sec_req.csv" for the secondary reserve market or "ter_req.csv" for the tertiary reserve market. It must contain 25 columns. The first column must be called "zone" and the rest named by integers from 1 to 24. The field "zone" will represent the zone number for the TSO requirement of secondary/tertiary reserve and in each of the integers, it represents the amount of reserve required for that hour by the TSO (see Annex A.9 & A.10).

If the energy market is not cleared, then the gen_bid_prices.csv and gen_bid_qnt.csv files must be added following the same structure as the gen_bid_prices.csv and gen_ bids_qnt.csv files used as inputs for the energy market that contain the information on the bids price and quantity, respectively, for the generators available for the secondary and/or tertiary reserve markets (Figure 4.2).

3.3.2. Outputs

Both reserve markets produce an output file that follows the same layout as the output file of the energy market with the quantity cleared for each generator for the secondary and tertiary markets. These files are named "results_secundary.csv" and "results_tertiary.csv" (see Annex A.13 & A.14 and Figure 3.3).

FIGURE 3.3: SNAPSHOT OF THE TERTIARY RESERVE MARKET OUTPUT FOLDER WHEN THE ENERGY MARKET IS NOT CLEARED.

4. Application Examples

This chapter focuses on examples for the utilization of the Market Simulator tool. The tool can be used in different combinations as seen in Table 4.1. In this chapter, four usage examples are presented.

In Example 1, the tool is used to clear all markets in sequence while Example 2 clears the energy market and secondary reserve market for the same dataset. Examples 3 and 4 provide the procedures and outcomes associated with clearing only the secondary reserve market (Example 3) or the tertiary reserve market (Example 4).

TABLE 4.1: DIFFERENT OPTIMIZATION CONFIGURATIONS FOR THE MARKET SIMULATOR TOOL .

USE CASES	1	2	3	4	5	6	7
ENERGY MARKET	X	X			X	X	
SECONDARY RESERVE MARKET	X		X		X		X
TERTIARY RESERVE MARKET	X			X		X	X

Examples of the CSV files required with the input data are displayed in Annex A as well as all the CSV output files. For this example, the IEEE 118 bus test network [7] was used, with 16 generators and 99 loads. It has been divided into three areas to exploit the flow-based coupling model. The branches connecting the three areas are detailed in Table 4.2. Finally, note that all datasets have their units in pu, with base 100 MVA.

TABLE 4.2: BRANCHES DELIMITING THE THREE AREAS IN THE IEEE 118 BUS.

BRANCH	BUS0	BUS1	ZONE 0	ZONE 1
L48	37	40	1	2
L50	39	40	1	2
L55	34	43	1	2
L89	38	65	1	2
L100	24	70	1	2
L102	24	72	1	2
L114	77	80	2	3
L115	77	80	2	3
L116	79	80	2	3
L117	68	81	2	3
L118	77	82	2	3
L167	17	113	1	3
L168	32	113	1	3
L169	32	114	1	3
L170	27	115	1	3
L172	12	117	1	3
L173	75	118	2	3
L174	76	118	2	3
T10	68	116	2	3

4.1. Example 1: Clearing all Markets in Sequence

To run this example, the command line input must be as in Figure 4.1.

```
C:\Users\PycharmProjects\test>py main.py True True True
```

FIGURE 4.1: COMMAND LINE INPUT FOR INITIALIZING THE MARKET SIMULATOR TOOL FOR EXAMPLE 1.

Before initializing the optimization, it is necessary to insert all the inputs for the network and markets. These must be placed in the corresponding folder as mentioned in Chapter 2. Figure 4.2 shows the files must be in the Network, Energy and Secondary/Tertiary folders before running the Market Simulator tool.

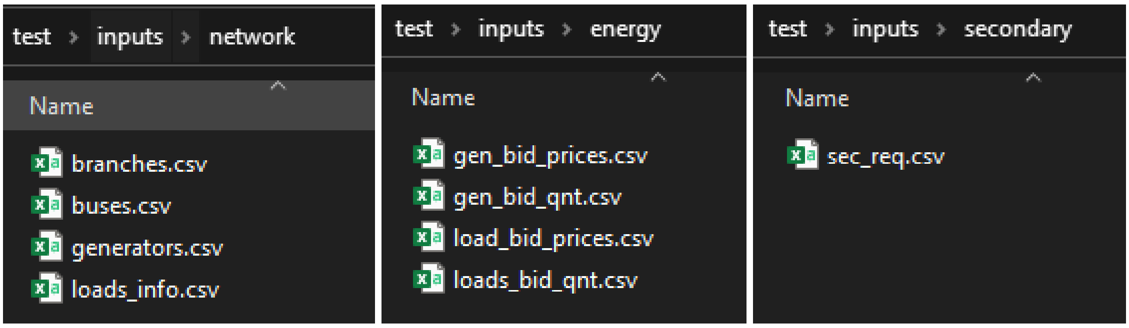

FIGURE 4.2: SNAPSHOT OF THE NETWORK INPUT DATA FOLDER (LEFT), THE ENERGY MARKET INPUT DATA FOLDER (CENTER) AND THE SECONDARY RESERVE MARKETS INPUT DATA FOLDER WHEN THE ENERGY MARKET IS CLEARED (RIGHT).

As mentioned in subsection 2.4, the input files for the generators are not required to be inserted in the secondary and tertiary reserve markets' folders as the information of the bids for the energy market will be automatically adjusted by the tool after the energy market clearing and placed in the corresponding folder. With all the input files in place, the program is initiated, with results provided in subsections 4.1.1, 4.1.2 and 4.1.3.

4.1.1. Energy Market Results

The energy market results consist of generation (Annex A.11) and load (Annex A.12) quantities cleared in each hour of the next day. Figures 4.3 and 4.4 show these two outputs obtained for the test case. The example was set with the load bids having a greater price than the generator bids to force all load bids to be accepted allowing to keep track of the last generation bid accepted. The Market Simulator tool provided a performance as expected with all load bids being accepted. Figure 4.3 shows that the last generation bid accepted varies according to the total demand while respecting the respective bid prices.

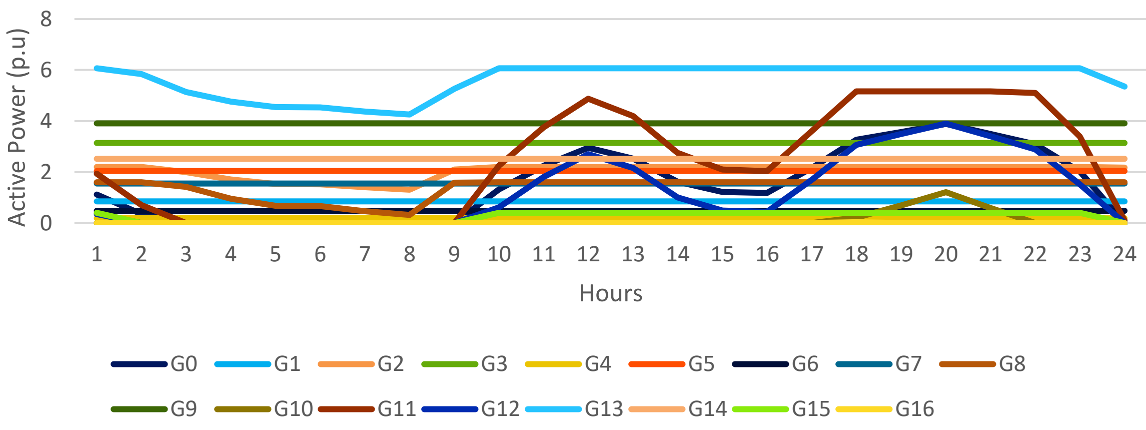

FIGURE 4.3: RESULTS OF THE ENERGY MARKET CLEARING FOR THE GENERATOR BIDS (EXAMPLE 1).

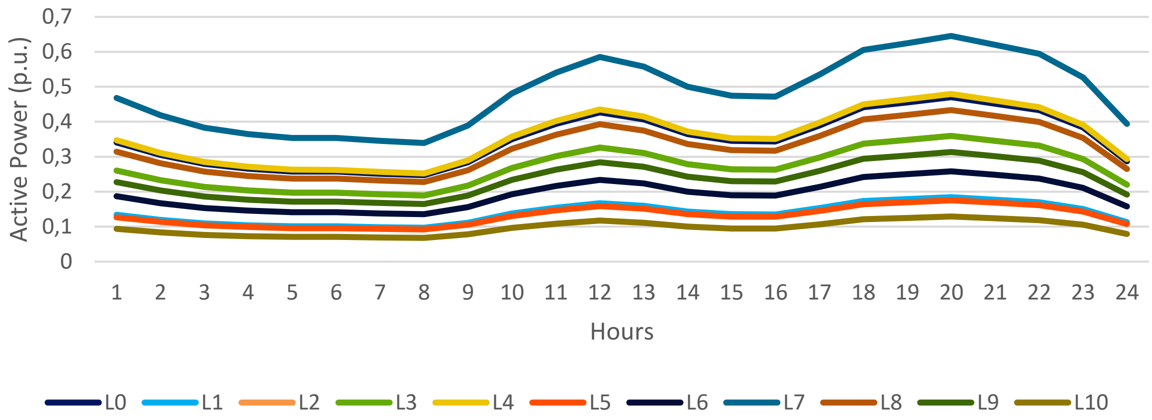

FIGURE 4.4: EXCERPT OF THE ENERGY MARKET CLEARING RESULTS FOR 10 LOADS (EXAMPLE 1).

4.1.2. Secondary Reserve Market Results

The secondary reserve market clearing result consists of the generation offers accepted under the merit order approach to supply the secondary reserve requirements (see Annex A.13). Note that there is a single buyer in this market, which in this case is the TSO. Figure 4.5 shows the market clearing for the secondary reserve market.

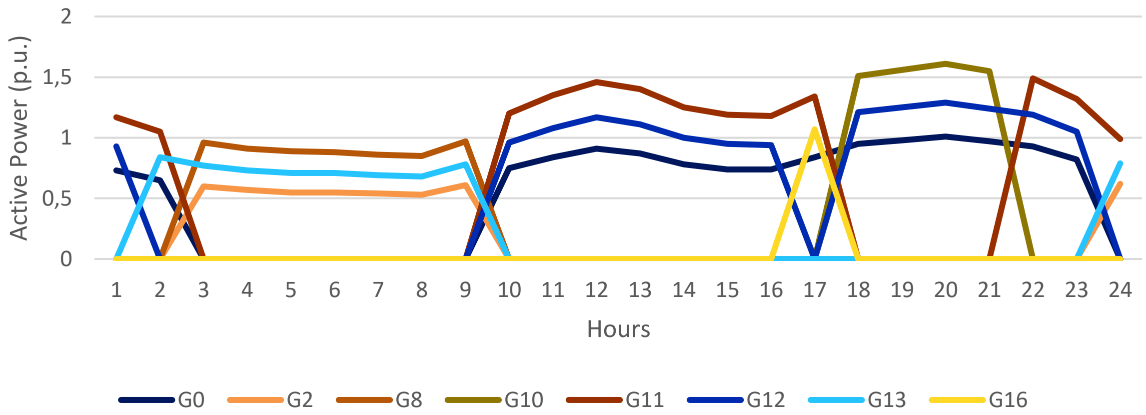

FIGURE 4.5: RESULTS FOR THE SECONDARY RESERVE MARKET CLEARING (EXAMPLE 1).

4.1.3. Tertiary Reserve Market Results

The secondary reserve market clearing result consists of the generation offers accepted under the merit order approach to supply the tertiary reserve requirements (see Annex A.14). Similar to the secondary reserve market, there is only a single buyer, which in this case is the TSO. Finally, the bids accepted are from the generators not cleared in the energy and secondary reserve markets (see Figure 4.6).

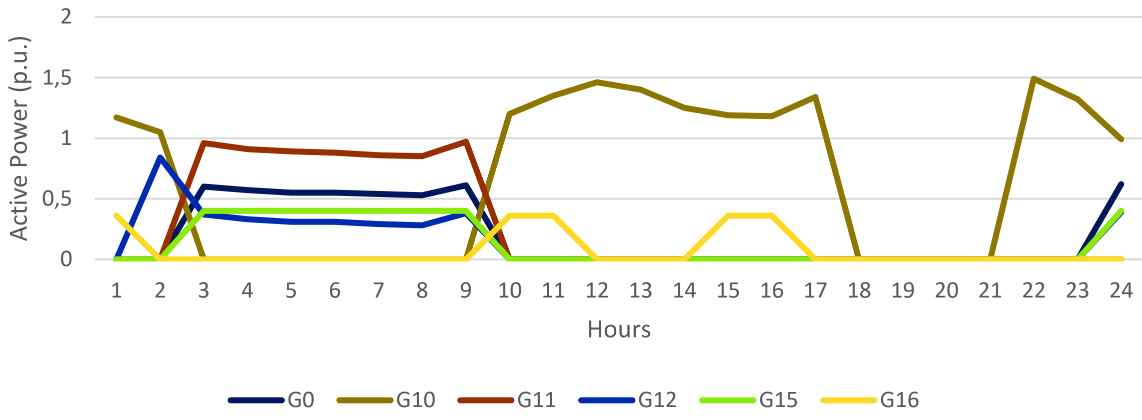

FIGURE 4.6: RESULTS FOR THE TERTIARY RESERVE MARKET CLEARING (EXAMPLE 1).

4.2. Example 2: Energy Market and Tertiary Reserve Market Clearing

Example 2 objective to illustrate the input process for the use of the energy market optimization paired with the tertiary reserve market optimization. For this, the exact same csv files as Example 1 are used in Example 2, however, in this optimization, the secondary reserve market is not selected. To initiate the optimization, the user must run the command line input must be as in Figure 4.7.

```
C:\Users\tiago\PycharmProjects\test>py main.py True False True
```

FIGURE 4.7: COMMAND LINE INPUT FOR INITIALIZING THE MARKET SIMULATOR TOOL FOR EXAMPLE 2.

The input files required must be placed in the Network, Energy and Tertiary folders as in Figure 4.8. The output files results of Example 2 can be seen in Figures 4.3, 4.4 and 4.6.

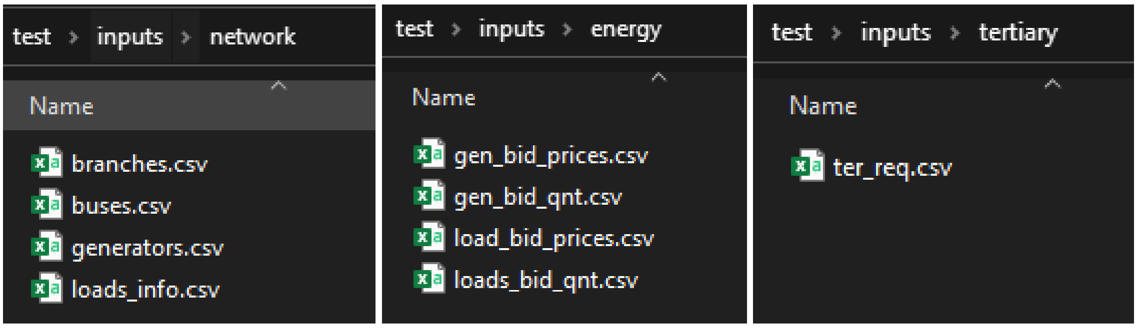

FIGURE 4.8: SNAPSHOT OF THE NETWORK INPUT DATA FOLDER (LEFT), THE ENERGY MARKET INPUT DATA FOLDER (CENTER) AND THE TERTIARY RESERVE MARKETS INPUT DATA FOLDER WHEN THE ENERGY MARKET IS CLEARED (RIGHT).

4.3. Example 3: Secondary Reserve Market Clearing

Example 2 consists of the secondary reserve market clearing without clearing the energy market first. To run only the optimization of the secondary reserve market, the command prompt must be as in Figure 4.7, setting only the second argument as "True".

```
C:\Users\tiago\PycharmProjects\test>py main.py False True False
```

FIGURE 4.9: COMMAND PROMPT FOR THE INDEPENDENT CLEARING OF THE SECONDARY RESERVE MARKET.

For this optimization, the network input folder must contain the same files as in Example 1 and as in the Figure 4.2 left image. The network is not used directly in the optimization. However, they are required as they are used to determine the loads and generators' locations and zones.

Note that if the secondary input folder has only the sec_req.csv file as seen in the right image of Figure 4.2, then the tool will not run due to the lack of input files in the secondary input folder. To run properly, the input folder must contain the gen_bid_prices.csv, gen_bid_qnt.csv and sec_req.csv files as in Figure 4.10 with the data filled as previously determined.

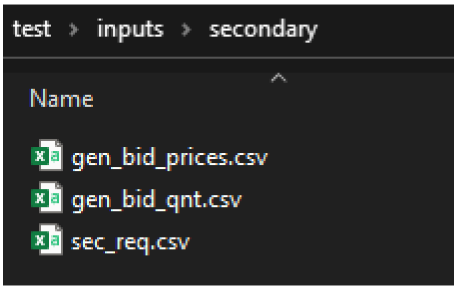

FIGURE 4.10: REQUIRED INPUT FILES FOR THE SECONDARY RESERVE MARKET INDEPENDENT CLEARING.

In this example, the generators available for the secondary reserve market are the same as in Example 1, with the gen_bid_qnt.csv (Annex A.15) and sec_req.csv files being the same as for Example 1. However, the prices inserted in gen_bid_prices.csv file (Annex A.16) were as show in Figure 4.11.

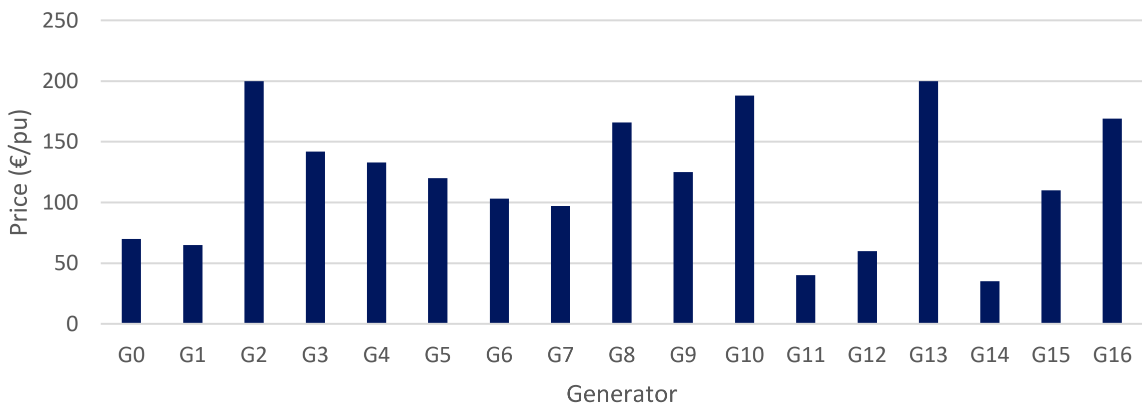

FIGURE 4.11: GENERATORS PRICE BID FOR EXAMPLE 2.

As seen in Figure 4.10, the results of the secondary reserve market optimization of Example 2 differ from Example 1 as expected.

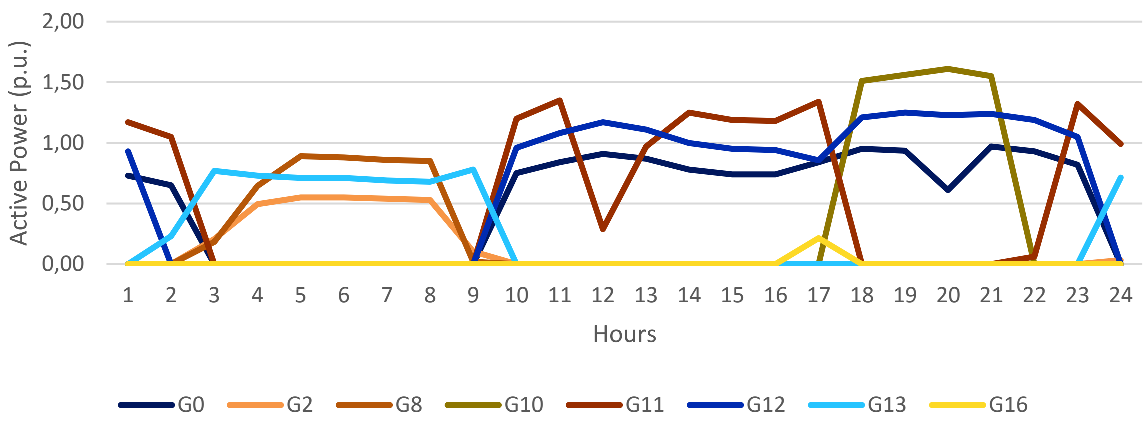

FIGURE 4.12: RESULTS FOR THE SECONDARY RESERVE MARKET CLEARING (EXAMPLE 2).

4.4. Example 4: Tertiary Reserve Market Clearing

Example 4 objective is to determines the process of solely optimizing the tertiary reserve market. The command line input required for this is as in Figure 4.13.

```
C:\Users\tiago\PycharmProjects\test>py main.py False False True
```

FIGURE 4.13: COMMAND PROMPT FOR THE INDEPENDENT CLEARING OF THE TERTIART RESERVE MARKET.

As there is no optimization of the energy market, the tertiary input folder must contain the gen_bid_prices.csv, the gen_bid_qnt.csv (Annex A.18) and the ter_req.csv files or the optimization will fail due to missing inputs (see Figure 4.14). For Example 4, the data files used were the same as in Example 1. So, the network data in the network input folder is the same as in Example 1 and the gen_bid_prices.csv that is in the tertiary input folder is equal to the gen_bid_prices.csv file that is in the energy input folder of Example 1.

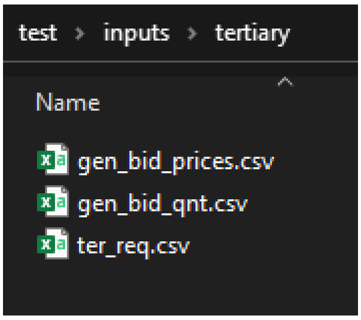

FIGURE 4.14: REQUIRED INPUT FILES FOR THE TERTIARY RESERVE MARKET INDEPENDENT CLEARING.

The final output is the same as in Example 1 and can be seen in Figure 4.6 and Annex A.14.

5. References

[1] GNU Project, "GNU Linear Programming Kit." 2020, [Online]. Available: https://www.gnu.org/software/glpk/.

[2] NEMO, "EUPHEMIA Public Description," 2020. [Online]. Available: http://www.nemo-committee.eu/assets/files/euphemia-public-description.pdf.

[3] C. I. Soares Nunes, "Modeling the Iberian Market Clearing Procedure based on EUPHEMIA," University of Porto, 2018.

[4] B. Matthes, C. Spieker, D. Klein, and C. Rehtanz, "Impact of a Minimum Remaining Available Margin Adjustment in Flow-Based Market Coupling," in *2019 IEEE Milan PowerTech*, Jun. 2019, pp. 1–6, doi: 10.1109/PTC.2019.8810504.

[5] B. Felten, T. Felling, P. Osinski, and C. Weber, "Flow-Based Market Coupling Revised - Part I: Analyses of Small- and Large-Scale Systems," *SSRN Electron. J.*, no. 06, 2019, doi: 10.2139/ssrn.3404044.

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[7] IEEE, "118 Bus Network." [Online]. Available: https://icseg.iti.illinois.edu/ieee-118-bus-system/.

ANNEX A – EXAMPLES' INPUT DATA AND RESULTS

This annex describes the CVS files structure by displaying the input data used to run the examples in Chapter 4.

Network Data

ANNEX A. 1 BRANCHES.CSV

LINE	BUS0	BUS1	R	X	B	S_NOM
L0	1	2	5.770332	19.02496	0.000133	9900
L1	1	3	2.456676	8.074656	5.68E-05	9900
L2	4	5	0.335174	1.519711	1.10E-05	9900
L3	3	5	4.589604	20.56752	0.000149	9900
L4	5	6	2.266236	10.28376	7.49E-05	9900
L5	6	7	0.87412	3.961152	2.89E-05	9900
L6	8	9	2.90421	36.30263	0.000976	9900
L7	9	10	3.070845	38.32605	0.001033	9900
L8	4	11	3.980196	13.10227	9.18E-05	9900
L9	5	11	3.865932	12.98801	9.13E-05	9900
L10	11	12	1.133118	3.732624	2.64E-05	9900
L11	2	12	3.561228	11.7311	8.25E-05	9900
L12	3	12	9.217296	30.4704	0.000213	9900
L13	7	12	1.641593	6.47496	4.59E-05	9900
L14	11	13	4.23729	13.92116	9.85E-05	9900
L15	12	14	4.09446	13.46411	9.54E-05	9900
L16	13	15	14.16874	46.54354	0.000329	9900
L17	14	15	11.33118	37.1358	0.000264	9900
L18	12	16	4.037328	15.8827	0.000112	9900
L19	15	17	2.513808	8.322228	0.000233	9900
L20	16	17	8.645976	34.29824	0.000245	9900
L21	17	18	2.342412	9.61722	6.82E-05	9900
L22	18	19	2.131024	9.388692	6.00E-05	9900
L23	19	20	4.799088	22.28148	0.000156	9900
L24	15	19	2.28528	7.503336	5.30E-05	9900
L25	20	21	3.485052	16.16836	0.000113	9900
L26	21	22	3.980196	18.47268	0.000129	9900
L27	22	23	6.513048	30.27996	0.000212	9900
L28	23	24	2.57094	9.369648	0.000262	9900
L29	23	25	2.970864	15.2352	0.000454	9900
L30	25	27	6.055992	31.04172	0.000926	9900
L31	27	28	3.643117	16.28262	0.000113	9900
L32	28	29	4.513428	17.95849	0.000125	9900
L33	8	30	5.129978	59.9886	0.000432	9900
L34	26	30	9.510098	102.3615	0.000763	9900
L35	17	31	9.026856	29.76577	0.00021	9900
L36	29	31	2.056752	6.303564	4.36E-05	9900
L37	23	32	6.036948	21.95773	0.000616	9900
L38	31	32	5.675112	18.75834	0.000132	9900
L39	27	32	4.361076	14.37822	0.000101	9900
L40	15	33	7.23672	23.69074	0.000168	9900
L41	19	34	14.32109	47.03868	0.000332	9900
L42	35	36	0.426586	1.942488	1.41E-05	9900
L43	35	37	2.09484	9.464868	6.92E-05	9900
L44	33	37	7.90326	27.04248	0.000192	9900
L45	34	36	1.658732	5.103792	2.98E-05	9900
L46	34	37	0.487526	1.790136	5.17E-05	9900
L47	37	39	6.113124	20.18664	0.000142	9900
L48	37	40	11.29309	31.99392	0.000221	9900
L49	30	38	5.52276	64.2735	0.000355	9900
L50	39	40	3.504096	11.52162	8.15E-05	9900
L51	40	41	2.76138	9.274428	6.42E-05	9900
L52	40	42	10.56942	34.85052	0.000245	9900
L53	41	42	7.80804	25.7094	0.000181	9900
L54	43	44	11.57875	46.73398	0.000319	9900
L55	34	43	7.865172	32.01296	0.000222	9900
L56	44	45	4.265856	17.15864	0.000118	9900
L57	45	46	7.6176	25.82366	0.000174	9900
L58	46	47	7.23672	24.18588	0.000166	9900
L59	46	48	11.44544	35.99316	0.000248	9900

L60	47	49	3.637404	11.9025	8.42E-05	9900
L61	42	49	13.61646	61.51212	0.000452	9900
L62	42	49	13.61646	61.51212	0.000452	9900
L63	45	49	13.0261	35.42184	0.000233	9900
L64	48	49	3.408876	9.61722	6.61E-05	9900
L65	49	50	5.084748	14.32109	9.84E-05	9900
L66	49	51	9.255384	26.09028	0.00018	9900
L67	51	52	3.865932	11.19787	7.33E-05	9900
L68	52	53	7.71282	31.13694	0.000213	9900
L69	53	54	5.008572	23.23368	0.000163	9900
L70	49	54	13.90212	55.03716	0.000388	9900
L71	49	54	16.54924	55.41804	0.000383	9900
L72	54	55	3.218436	13.46411	0.000106	9900
L73	54	56	0.52371	1.818702	3.84E-05	9900
L74	55	56	0.929347	2.875644	1.96E-05	9900
L75	56	57	6.532092	18.3965	0.000127	9900
L76	50	57	9.026856	25.51896	0.000174	9900
L77	56	58	6.532092	18.3965	0.000127	9900
L78	51	58	4.85622	13.69264	9.39E-05	9900
L79	54	59	9.579132	43.66789	0.000314	9900
L80	56	59	15.7113	47.80044	0.000299	9900
L81	56	59	15.29233	45.51516	0.000281	9900
L82	55	59	9.024952	41.09695	0.000296	9900
L83	59	60	6.036948	27.6138	0.000197	9900
L84	59	61	6.246432	28.566	0.000204	9900
L85	60	61	0.502762	2.57094	7.65E-05	9900
L86	60	62	2.342412	10.68368	7.71E-05	9900
L87	61	62	1.569226	7.160544	5.15E-05	9900
L88	63	64	2.04723	23.805	0.000181	9900
L89	38	65	10.72415	117.3587	0.000879	9900
L90	64	65	3.201773	35.94555	0.000319	9900
L91	49	66	3.42792	17.50144	0.00013	9900
L92	49	66	3.42792	17.50144	0.00013	9900
L93	62	66	9.179208	41.51592	0.000304	9900
L94	62	67	4.913352	22.28148	0.000163	9900
L95	66	67	4.265856	19.32966	0.000141	9900
L96	65	68	1.642545	19.044	0.000536	9900
L97	47	69	16.07314	52.90423	0.000372	9900
L98	49	69	18.75834	61.70256	0.000435	9900
L99	69	70	5.7132	24.18588	0.000641	9900
L100	24	70	0.420872	78.36606	0.000535	9900
L101	70	71	1.679681	6.76062	4.61E-05	9900
L102	24	72	9.293472	37.32624	0.000256	9900
L103	71	72	8.493624	34.2792	0.000233	9900
L104	71	73	1.64921	8.645976	6.19E-05	9900
L105	70	74	7.636644	25.19521	0.000177	9900
L106	70	75	8.150832	26.85204	0.000189	9900
L107	69	75	7.71282	23.23368	0.000651	9900
L108	74	75	2.342412	7.731864	5.43E-05	9900
L109	76	77	8.455536	28.18512	0.000193	9900
L110	69	77	5.884596	19.23444	0.000545	9900
L111	75	77	11.44544	38.06896	0.000261	9900
L112	77	78	0.716054	2.361456	6.64E-05	9900
L113	78	79	1.039802	4.646736	3.40E-05	9900
L114	77	80	3.23748	9.23634	0.000248	9900
L115	77	80	5.598936	19.9962	0.00012	9900
L116	79	80	2.970864	13.40698	9.82E-05	9900
L117	68	81	2.082938	24.04305	0.000679	9900
L118	77	82	5.675112	16.24453	0.000429	9900
L119	82	83	2.132928	6.979626	0.000199	9900
L120	83	84	11.9025	25.13808	0.000135	9900
L121	83	85	8.18892	28.18512	0.000183	9900
L122	84	85	5.751288	12.2072	6.48E-05	9900
L123	85	86	6.6654	23.42412	0.000145	9900
L124	85	88	3.8088	19.42488	0.000145	9900
L125	85	89	4.551516	32.94612	0.000247	9900
L126	88	89	2.647116	13.55933	0.000102	9900
L127	89	90	9.864792	35.80272	0.000277	9900
L128	89	90	4.532472	18.98687	0.000557	9900
L129	90	91	4.837176	15.92078	0.000112	9900
L130	89	92	1.885356	9.61722	0.000288	9900

L131	89	92	7.484292	30.10856	0.000217	9900
L132	91	92	7.370028	24.22397	0.000172	9900
L133	92	93	4.913352	16.14931	0.000114	9900
L134	92	94	9.160164	30.08952	0.000213	9900
L135	93	94	4.246812	13.94021	9.85E-05	9900
L136	94	95	2.513808	8.265096	5.83E-05	9900
L137	80	96	6.779664	34.66008	0.000259	9900
L138	82	96	3.085128	10.09332	0.000286	9900
L139	94	96	5.122836	16.54924	0.000121	9900
L140	80	97	3.485052	17.7871	0.000133	9900
L141	80	98	4.532472	20.56752	0.00015	9900
L142	80	99	8.645976	39.23064	0.000287	9900
L143	92	100	12.34051	56.1798	0.000248	9900
L144	94	100	3.389832	11.04552	0.000317	9900
L145	95	96	3.256524	10.41707	7.74E-05	9900
L146	96	97	3.294612	16.85394	0.000126	9900
L147	98	100	7.560468	34.08876	0.00025	9900
L148	99	100	3.42792	15.48277	0.000113	9900
L149	100	101	5.275188	24.03353	0.000172	9900
L150	92	102	2.342412	10.6456	7.69E-05	9900
L151	101	102	4.684824	21.32928	0.000154	9900
L152	100	103	3.04704	9.9981	0.000281	9900
L153	100	104	8.588844	38.84976	0.000284	9900
L154	103	104	8.874504	30.1657	0.000214	9900
L155	103	105	10.18854	30.9465	0.000214	9900
L156	100	106	11.52162	43.61076	0.000326	9900
L157	104	105	1.892974	7.198632	5.18E-05	9900
L158	105	106	2.66616	10.41707	7.53E-05	9900
L159	105	107	10.09332	34.85052	0.000248	9900
L160	105	108	4.970484	13.38793	9.68E-05	9900
L161	106	107	10.09332	34.85052	0.000248	9900
L162	108	109	1.99962	5.484672	3.99E-05	9900
L163	103	110	7.438586	34.52677	0.000242	9900
L164	109	110	5.294232	14.51153	0.000106	9900
L165	110	111	4.18968	14.37822	0.000105	9900
L166	110	112	4.703868	12.18816	0.000326	9900
L167	17	113	1.738717	5.732244	4.03E-05	9900
L168	32	113	11.71206	38.65932	0.000272	9900
L169	32	114	2.57094	11.65493	8.55E-05	9900
L170	27	115	3.123216	14.1116	0.000104	9900
L171	114	115	0.438012	1.980576	1.45E-05	9900
L172	12	117	6.265476	26.6616	0.000188	9900
L173	75	118	2.76138	9.160164	6.29E-05	9900
L174	76	118	3.123216	10.35994	7.12E-05	9900
T0	8	5	0	2.6433	0	9900
T1	26	25	0	3.7818	0	9900
T2	30	17	0	3.8412	0	9900
T3	38	37	0	3.7125	0	9900
T4	63	59	0	3.8214	0	9900
T5	64	61	0	2.6532	0	9900
T6	65	66	0	3.663	0	9900
T7	68	69	0	3.663	0	9900
T8	81	80	0	3.663	0	9900
T9	86	87	2.79972	20.5326	0.000449	9900
T10	68	116	0.03366	0.40095	0.001657	9900

ANNEX A. 2 BUSES.CSV

BUS	ZONE	SLACK
1	1	0
2	1	0
3	1	0
4	1	0
5	1	0
6	1	0
7	1	0
8	1	0
9	1	0
10	1	0
11	1	0
12	1	0
13	1	0
14	1	0
15	1	0
16	1	0
17	1	0
18	1	0
19	1	0
20	1	0
21	1	0
22	1	0
23	1	0
24	1	0
25	1	0
26	1	0
27	1	0
28	1	0
29	1	0
30	1	0
31	1	0
32	1	0
33	1	0
34	1	0
35	1	0
36	1	0
37	1	0
38	1	0
39	1	0
40	2	0
41	2	0
42	2	0
43	2	0
44	2	0
45	2	0
46	2	0
47	2	0
48	2	0
49	2	0
50	2	0
51	2	0
52	2	0
53	2	0
54	2	0
55	2	0
56	2	0
57	2	0
58	2	0
59	2	0
60	2	0
61	2	0
62	2	0
63	2	0
64	2	0
65	2	0
66	2	0
67	2	0
68	2	0
69	2	1
70	2	0
71	2	0
72	2	0
73	2	0
74	2	0
75	2	0
76	2	0
77	2	0
78	2	0
79	2	0
80	3	0
81	3	0
82	3	0
83	3	0
84	3	0
85	3	0
86	3	0
87	3	0
88	3	0
89	3	0
90	3	0
91	3	0
92	3	0
93	3	0
94	3	0
95	3	0
96	3	0
97	3	0
98	3	0
99	3	0
100	3	0
101	3	0
102	3	0
103	3	0
104	3	0
105	3	0
106	3	0
107	3	0
108	3	0
109	3	0
110	3	0
111	3	0
112	3	0
113	3	0
114	3	0
115	3	0
116	3	0
117	3	0
118	3	0

ANNEX A. 3 GENERATORS.CSV

GEN_ID	BUS	FIXED_COST	VARIABLE_COST	R_UP	R_DOWN	LGC	MIC
G0	10	507	36	50	50	1	1
G1	12	389	25	50	50	1	1
G2	25	370	34	50	50	1	1
G3	26	481	42	50	50	1	1
G4	46	478	47	50	50	1	1
G5	49	410	29	50	50	1	1
G6	54	329	39	50	50	1	1
G7	59	541	27	50	50	1	1
G8	61	425	67	50	50	1	1
G9	65	599	32	50	50	1	1
G10	66	474	47	50	50	1	1
G11	69	504	67	50	50	1	1
G12	80	358	59	50	50	1	1
G13	89	580	20	50	50	1	1
G14	100	568	34	50	50	1	1
G15	103	462	48	50	50	1	1
G16	111	414	47	50	50	1	1

ANNEX A. 4 LOAD_INFO.CS

LOAD_ID	BUS
L0	1
L1	2
L2	3
L3	4
L4	6
L5	7
L6	8
L7	11
L8	12
L9	13
L10	14
L11	15
L12	16
L13	17
L14	18
L15	19
L16	20
L17	21
L18	22
L19	23
L20	24
L21	27
L22	28
L23	29
L24	31
L25	32
L26	33
L27	34
L28	35
L29	36
L30	39
L31	40
L32	41
L33	42
L34	43
L35	44
L36	45
L37	46
L38	47
L39	48
L40	49
L41	50
L42	51
L43	52
L44	53
L45	54
L46	55
L47	56
L48	57
L49	58
L50	59
L51	60
L52	62
L53	66
L54	67
L55	70
L56	72
L57	73
L58	74
L59	75
L60	76
L61	77
L62	78
L63	79
L64	80
L65	82
L66	83
L67	84
L68	85
L69	86
L70	88
L71	90
L72	91
L73	92
L74	93
L75	94
L76	95
L77	96
L78	97
L79	98
L80	99
L81	100
L82	101
L83	102
L84	103
L85	104
L86	105
L87	106
L88	107
L89	108
L90	109
L91	110
L92	112
L93	113
L94	114
L95	115
L96	116
L97	117
L98	118

Example 1 Market Input Data

Annex A. 5: gen_bid_prices.csv

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
G1	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
G2	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
G3	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
G4	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
G5	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
G6	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103
G7	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
G8	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166
G9	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
G10	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188
G11	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168	168
G12	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127	127
G13	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
G14	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
G15	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
G16	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169

Annex A. 6 gen_bid_qnt.csv

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
G1	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
G2	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
G3	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
G4	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
G5	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04
G6	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
G7	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
G8	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
G9	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91
G10	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
G11	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16
G12	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77
G13	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07
G14	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52
G15	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
G16	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36

ANNEX A. 7 LOAD_BID_PRICES.CSV

LOAD_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L1	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L2	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L3	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L4	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L5	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L6	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L7	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L8	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L9	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L12	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L13	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L14	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L15	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L16	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L17	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L18	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L19	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L20	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L21	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L22	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L23	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L24	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L25	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L26	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L27	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L28	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L29	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L30	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L31	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L32	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L33	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L34	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L35	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L36	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L37	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L38	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L39	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L40	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L41	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L42	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L43	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

L44	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L45	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L46	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L47	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L48	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L49	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L50	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L51	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L52	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L53	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L54	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L55	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L56	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L57	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L58	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L59	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L60	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L61	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L62	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L63	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L64	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L65	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L66	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L67	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L68	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L69	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L70	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L71	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L72	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L73	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L74	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L75	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L76	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L77	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L78	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L79	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L80	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L81	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L82	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L83	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L84	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L85	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L86	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L87	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L88	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L89	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

L90	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L91	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L92	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L93	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L94	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L95	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L96	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L97	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
L98	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ANNEX A. 8 LOAD_BID_QNT.CSV

LOAD_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L0	0.34	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.28	0.35	0.39	0.43	0.41	0.36	0.35	0.34	0.39	0.44	0.46	0.47	0.45	0.43	0.38	0.29
L1	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L2	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L3	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L4	0.35	0.31	0.28	0.27	0.26	0.26	0.26	0.25	0.29	0.36	0.40	0.43	0.41	0.37	0.35	0.35	0.40	0.45	0.46	0.48	0.46	0.44	0.39	0.29
L5	0.13	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.11	0.13	0.15	0.16	0.15	0.14	0.13	0.13	0.15	0.16	0.17	0.18	0.17	0.16	0.14	0.11
L6	0.19	0.17	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.19	0.22	0.23	0.22	0.20	0.19	0.19	0.21	0.24	0.25	0.26	0.25	0.24	0.21	0.16
L7	0.47	0.42	0.38	0.36	0.35	0.35	0.35	0.34	0.39	0.48	0.54	0.59	0.56	0.50	0.47	0.47	0.53	0.61	0.62	0.65	0.62	0.59	0.53	0.39
L8	0.31	0.28	0.26	0.25	0.24	0.24	0.23	0.23	0.26	0.32	0.36	0.39	0.37	0.34	0.32	0.32	0.36	0.41	0.42	0.43	0.42	0.40	0.35	0.26
L9	0.23	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.19	0.23	0.26	0.28	0.27	0.24	0.23	0.23	0.26	0.29	0.30	0.31	0.30	0.29	0.26	0.19
L10	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.10	0.11	0.12	0.11	0.10	0.09	0.09	0.11	0.12	0.13	0.13	0.12	0.12	0.11	0.08
L11	0.60	0.54	0.49	0.47	0.45	0.45	0.44	0.44	0.50	0.62	0.70	0.75	0.72	0.64	0.61	0.61	0.69	0.78	0.80	0.83	0.80	0.76	0.68	0.51
L12	0.17	0.15	0.14	0.13	0.13	0.13	0.12	0.12	0.14	0.17	0.19	0.21	0.20	0.18	0.17	0.17	0.19	0.22	0.22	0.23	0.22	0.21	0.19	0.14
L13	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.06	0.08	0.09	0.09	0.09	0.08	0.07	0.07	0.08	0.10	0.10	0.10	0.10	0.09	0.08	0.06
L14	0.40	0.36	0.33	0.31	0.30	0.30	0.30	0.29	0.33	0.41	0.46	0.50	0.48	0.43	0.41	0.40	0.46	0.52	0.54	0.55	0.53	0.51	0.45	0.34
L15	0.30	0.27	0.25	0.23	0.23	0.23	0.22	0.22	0.25	0.31	0.35	0.38	0.36	0.32	0.31	0.30	0.34	0.39	0.40	0.41	0.40	0.38	0.34	0.25
L16	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.14	0.15	0.14	0.13	0.12	0.12	0.14	0.16	0.16	0.17	0.16	0.15	0.14	0.10
L17	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.10	0.11	0.12	0.11	0.10	0.09	0.09	0.11	0.12	0.13	0.13	0.12	0.12	0.11	0.08
L18	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.06
L19	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.04
L20	0.09	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.09	0.10	0.11	0.10	0.09	0.09	0.09	0.10	0.11	0.12	0.12	0.12	0.11	0.10	0.07
L21	0.47	0.42	0.39	0.37	0.36	0.36	0.35	0.34	0.40	0.49	0.55	0.59	0.57	0.51	0.48	0.48	0.54	0.61	0.63	0.65	0.63	0.60	0.53	0.40
L22	0.11	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.13	0.15	0.15	0.16	0.15	0.14	0.13	0.10
L23	0.16	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.16	0.19	0.20	0.19	0.17	0.16	0.16	0.18	0.21	0.21	0.22	0.21	0.20	0.18	0.14
L24	0.29	0.26	0.24	0.22	0.22	0.22	0.21	0.21	0.24	0.30	0.33	0.36	0.34	0.31	0.29	0.29	0.33	0.37	0.38	0.40	0.38	0.37	0.32	0.24
L25	0.39	0.35	0.32	0.31	0.30	0.30	0.29	0.29	0.33	0.41	0.46	0.49	0.47	0.42	0.40	0.40	0.45	0.51	0.53	0.54	0.52	0.50	0.44	0.33
L26	0.15	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.13	0.16	0.18	0.19	0.18	0.16	0.16	0.16	0.18	0.20	0.21	0.21	0.20	0.20	0.17	0.13
L27	0.39	0.35	0.32	0.31	0.30	0.30	0.29	0.29	0.33	0.41	0.46	0.49	0.47	0.42	0.40	0.40	0.45	0.51	0.53	0.54	0.52	0.50	0.44	0.33
L28	0.22	0.20	0.18	0.17	0.17	0.17	0.16	0.16	0.18	0.23	0.26	0.28	0.26	0.24	0.22	0.22	0.25	0.29	0.29	0.30	0.29	0.28	0.25	0.19
L29	0.21	0.19	0.17	0.16	0.16	0.16	0.15	0.15	0.17	0.21	0.24	0.26	0.25	0.22	0.21	0.21	0.24	0.27	0.28	0.29	0.27	0.26	0.23	0.17
L30	0.18	0.16	0.15	0.14	0.14	0.14	0.13	0.13	0.15	0.19	0.21	0.23	0.22	0.19	0.18	0.18	0.21	0.23	0.24	0.25	0.24	0.23	0.20	0.15

L31	0.44	0.39	0.36	0.34	0.33	0.33	0.33	0.32	0.37	0.45	0.51	0.55	0.53	0.47	0.45	0.44	0.50	0.57	0.59	0.61	0.59	0.56	0.50	0.37
L32	0.25	0.22	0.20	0.19	0.19	0.19	0.18	0.18	0.21	0.25	0.29	0.31	0.30	0.26	0.25	0.25	0.28	0.32	0.33	0.34	0.33	0.31	0.28	0.21
L33	0.64	0.57	0.53	0.50	0.49	0.48	0.47	0.47	0.53	0.66	0.74	0.80	0.77	0.69	0.65	0.65	0.73	0.83	0.86	0.89	0.85	0.82	0.72	0.54
L34	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.14	0.15	0.14	0.13	0.12	0.12	0.14	0.16	0.16	0.17	0.16	0.15	0.14	0.10
L35	0.11	0.10	0.09	0.08	0.08	0.08	0.08	0.08	0.09	0.11	0.12	0.13	0.13	0.11	0.11	0.11	0.12	0.14	0.14	0.15	0.14	0.14	0.12	0.09
L36	0.35	0.32	0.29	0.28	0.27	0.27	0.26	0.26	0.30	0.36	0.41	0.44	0.42	0.38	0.36	0.36	0.40	0.46	0.47	0.49	0.47	0.45	0.40	0.30
L37	0.19	0.17	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.19	0.22	0.23	0.22	0.20	0.19	0.19	0.21	0.24	0.25	0.26	0.25	0.24	0.21	0.16
L38	0.23	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.19	0.23	0.26	0.28	0.27	0.24	0.23	0.23	0.26	0.29	0.30	0.31	0.30	0.29	0.26	0.19
L39	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L40	0.58	0.52	0.48	0.45	0.44	0.44	0.43	0.42	0.48	0.60	0.67	0.73	0.69	0.62	0.59	0.59	0.66	0.75	0.78	0.80	0.77	0.74	0.65	0.49
L41	0.11	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.13	0.15	0.15	0.16	0.15	0.14	0.13	0.10
L42	0.11	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.13	0.15	0.15	0.16	0.15	0.14	0.13	0.10
L43	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.14	0.15	0.14	0.13	0.12	0.12	0.14	0.16	0.16	0.17	0.16	0.15	0.14	0.10
L44	0.15	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.13	0.16	0.18	0.19	0.18	0.16	0.16	0.16	0.18	0.20	0.21	0.21	0.20	0.20	0.17	0.13
L45	0.76	0.68	0.62	0.59	0.57	0.57	0.56	0.55	0.63	0.78	0.87	0.95	0.90	0.81	0.77	0.76	0.86	0.98	1.01	1.04	1.00	0.96	0.85	0.64
L46	0.42	0.38	0.34	0.33	0.32	0.32	0.31	0.31	0.35	0.43	0.49	0.53	0.50	0.45	0.43	0.42	0.48	0.55	0.56	0.58	0.56	0.54	0.47	0.36
L47	0.56	0.50	0.46	0.44	0.42	0.42	0.41	0.41	0.47	0.58	0.65	0.70	0.67	0.60	0.57	0.57	0.64	0.73	0.75	0.77	0.74	0.71	0.63	0.47
L48	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L49	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L50	1.85	1.66	1.52	1.44	1.40	1.40	1.37	1.34	1.54	1.90	2.14	2.32	2.21	1.98	1.88	1.87	2.12	2.40	2.47	2.55	2.46	2.35	2.08	1.56
L51	0.52	0.47	0.43	0.41	0.39	0.39	0.38	0.38	0.43	0.54	0.60	0.65	0.62	0.56	0.53	0.53	0.60	0.67	0.70	0.72	0.69	0.66	0.59	0.44
L52	0.51	0.46	0.42	0.40	0.39	0.39	0.38	0.37	0.43	0.53	0.59	0.64	0.61	0.55	0.52	0.52	0.59	0.67	0.69	0.71	0.68	0.65	0.58	0.43
L53	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L54	0.19	0.17	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.19	0.22	0.23	0.22	0.20	0.19	0.19	0.21	0.24	0.25	0.26	0.25	0.24	0.21	0.16
L55	0.44	0.39	0.36	0.34	0.33	0.33	0.33	0.32	0.37	0.45	0.51	0.55	0.53	0.47	0.45	0.44	0.50	0.57	0.59	0.61	0.59	0.56	0.50	0.37
L56	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L57	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.03
L58	0.45	0.41	0.37	0.35	0.34	0.34	0.34	0.33	0.38	0.47	0.53	0.57	0.54	0.49	0.46	0.46	0.52	0.59	0.61	0.63	0.60	0.58	0.51	0.38
L59	0.31	0.28	0.26	0.25	0.24	0.24	0.23	0.23	0.26	0.32	0.36	0.39	0.37	0.34	0.32	0.32	0.36	0.41	0.42	0.43	0.42	0.40	0.35	0.26
L60	0.45	0.41	0.37	0.35	0.34	0.34	0.34	0.33	0.38	0.47	0.53	0.57	0.54	0.49	0.46	0.46	0.52	0.59	0.61	0.63	0.60	0.58	0.51	0.38
L61	0.41	0.36	0.33	0.32	0.31	0.31	0.30	0.30	0.34	0.42	0.47	0.51	0.49	0.44	0.41	0.41	0.47	0.53	0.54	0.56	0.54	0.52	0.46	0.34
L62	0.47	0.42	0.39	0.37	0.36	0.36	0.35	0.34	0.40	0.49	0.55	0.59	0.57	0.51	0.48	0.48	0.54	0.61	0.63	0.65	0.63	0.60	0.53	0.40
L63	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L64	0.87	0.78	0.71	0.68	0.66	0.66	0.64	0.63	0.72	0.89	1.00	1.09	1.04	0.93	0.88	0.88	0.99	1.12	1.16	1.20	1.15	1.10	0.98	0.73
L65	0.36	0.32	0.30	0.28	0.27	0.27	0.27	0.26	0.30	0.37	0.42	0.45	0.43	0.39	0.37	0.36	0.41	0.47	0.48	0.50	0.48	0.46	0.41	0.30
L66	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L67	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.06	0.08	0.09	0.09	0.09	0.08	0.07	0.07	0.08	0.10	0.10	0.10	0.10	0.09	0.08	0.06
L68	0.16	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.16	0.19	0.20	0.19	0.17	0.16	0.16	0.18	0.21	0.21	0.22	0.21	0.20	0.18	0.14
L69	0.14	0.13	0.12	0.11	0.11	0.11	0.10	0.10	0.12	0.14	0.16	0.18	0.17	0.15	0.14	0.14	0.16	0.18	0.19	0.19	0.19	0.18	0.16	0.12
L70	0.32	0.29	0.26	0.25	0.24	0.24	0.24	0.23	0.27	0.33	0.37	0.40	0.38	0.34	0.33	0.32	0.37	0.42	0.43	0.44	0.43	0.41	0.36	0.27
L71	1.09	0.97	0.89	0.85	0.82	0.82	0.80	0.79	0.91	1.12	1.26	1.36	1.30	1.17	1.10	1.10	1.25	1.41	1.45	1.50	1.44	1.38	1.23	0.92
L72	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.06
L73	0.43	0.39	0.36	0.34	0.33	0.33	0.32	0.32	0.36	0.45	0.50	0.54	0.52	0.46	0.44	0.44	0.50	0.56	0.58	0.60	0.58	0.55	0.49	0.37
L74	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L75	0.20	0.18	0.16	0.16	0.15	0.15	0.15	0.15	0.17	0.21	0.23	0.25	0.24	0.21	0.20	0.20	0.23	0.26	0.27	0.28	0.27	0.25	0.23	0.17
L76	0.28	0.25	0.23	0.22	0.21	0.21	0.21	0.20	0.23	0.29	0.32	0.35	0.33	0.30	0.28	0.28	0.32	0.36	0.37	0.39	0.37	0.36	0.32	0.24

L77	0.25	0.23	0.21	0.20	0.19	0.19	0.19	0.18	0.21	0.26	0.29	0.32	0.30	0.27	0.26	0.26	0.29	0.33	0.34	0.35	0.34	0.32	0.29	0.21
L78	0.10	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.10	0.12	0.13	0.12	0.11	0.10	0.10	0.11	0.13	0.13	0.14	0.13	0.13	0.11	0.08
L79	0.23	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.19	0.23	0.26	0.28	0.27	0.24	0.23	0.23	0.26	0.29	0.30	0.31	0.30	0.29	0.26	0.19
L80	0.28	0.25	0.23	0.22	0.21	0.21	0.21	0.20	0.23	0.29	0.32	0.35	0.33	0.30	0.28	0.28	0.32	0.36	0.37	0.39	0.37	0.36	0.32	0.24
L81	0.25	0.22	0.20	0.19	0.19	0.19	0.18	0.18	0.21	0.25	0.29	0.31	0.30	0.26	0.25	0.25	0.28	0.32	0.33	0.34	0.33	0.31	0.28	0.21
L82	0.15	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.12	0.15	0.17	0.18	0.18	0.16	0.15	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.17	0.12
L83	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.03
L84	0.15	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.13	0.16	0.18	0.19	0.18	0.16	0.16	0.16	0.18	0.20	0.21	0.21	0.20	0.20	0.17	0.13
L85	0.25	0.23	0.21	0.20	0.19	0.19	0.19	0.18	0.21	0.26	0.29	0.32	0.30	0.27	0.26	0.26	0.29	0.33	0.34	0.35	0.34	0.32	0.29	0.21
L86	0.21	0.19	0.17	0.16	0.16	0.16	0.15	0.15	0.17	0.21	0.24	0.26	0.25	0.22	0.21	0.21	0.24	0.27	0.28	0.29	0.27	0.26	0.23	0.17
L87	0.29	0.26	0.24	0.22	0.22	0.22	0.21	0.21	0.24	0.30	0.33	0.36	0.34	0.31	0.29	0.29	0.33	0.37	0.38	0.40	0.38	0.37	0.32	0.24
L88	0.33	0.30	0.27	0.26	0.25	0.25	0.25	0.24	0.28	0.34	0.39	0.42	0.40	0.36	0.34	0.34	0.38	0.43	0.45	0.46	0.44	0.42	0.38	0.28
L89	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
L90	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.06	0.06	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.05
L91	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L92	0.45	0.41	0.37	0.35	0.34	0.34	0.34	0.33	0.38	0.47	0.53	0.57	0.54	0.49	0.46	0.46	0.52	0.59	0.61	0.63	0.60	0.58	0.51	0.38
L93	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.03
L94	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.06	0.06	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.05
L95	0.15	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.12	0.15	0.17	0.18	0.18	0.16	0.15	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.17	0.12
L96	1.23	1.10	1.01	0.96	0.93	0.93	0.91	0.89	1.02	1.26	1.42	1.54	1.47	1.32	1.25	1.24	1.41	1.59	1.64	1.70	1.63	1.56	1.38	1.04
L97	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L98	0.22	0.20	0.18	0.17	0.17	0.17	0.16	0.16	0.18	0.23	0.26	0.28	0.26	0.24	0.22	0.22	0.25	0.29	0.29	0.30	0.29	0.28	0.25	0.19

ANNEX A. 9 SEC_REC.CSV

ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0.73	0.65	0.60	0.57	0.55	0.55	0.54	0.53	0.61	0.75	0.84	0.91	0.87	0.78	0.74	0.74	0.84	0.95	0.98	1.01	0.97	0.93	0.82	0.62
2	1.17	1.05	0.96	0.91	0.89	0.88	0.86	0.85	0.97	1.20	1.35	1.46	1.40	1.25	1.19	1.18	1.34	1.51	1.56	1.61	1.55	1.49	1.32	0.99
3	0.93	0.84	0.77	0.73	0.71	0.71	0.69	0.68	0.78	0.96	1.08	1.17	1.11	1.00	0.95	0.94	1.07	1.21	1.25	1.29	1.24	1.19	1.05	0.79

ANNEX A. 10 TER_REC.CSV

ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0.73	0.65	0.60	0.57	0.55	0.55	0.54	0.53	0.61	0.75	0.84	0.91	0.87	0.78	0.74	0.74	0.84	0.95	0.98	1.01	0.97	0.93	0.82	0.62
2	1.17	1.05	0.96	0.91	0.89	0.88	0.86	0.85	0.97	1.20	1.35	1.46	1.40	1.25	1.19	1.18	1.34	1.51	1.56	1.61	1.55	1.49	1.32	0.99
3	0.93	0.84	0.77	0.73	0.71	0.71	0.69	0.68	0.78	0.96	1.08	1.17	1.11	1.00	0.95	0.94	1.07	1.21	1.25	1.29	1.24	1.19	1.05	0.79

Example 1 Results

ANNEX A. 11 ENERGY MARKET OUTPUT - GEN_RESULTS.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	1.12	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32	2.25	2.95	2.53	1.63	1.22	1.18	2.16	3.27	3.57	3.89	3.50	3.09	2.03	0.00
G1	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
G2	2.20	2.20	1.99	1.71	1.53	1.53	1.40	1.31	2.10	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.17
G3	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
G4	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
G5	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04
G6	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
G7	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
G8	1.60	1.60	1.42	0.96	0.68	0.67	0.47	0.32	1.58	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
G9	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91
G10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.70	1.21	0.59	0.00	0.00	0.00
G11	1.93	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	3.76	4.88	4.19	2.75	2.10	2.03	3.61	5.16	5.16	5.16	5.16	5.10	3.39	0.10
G12	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	1.81	2.70	2.16	1.01	0.49	0.43	1.69	3.07	3.49	3.90	3.40	2.88	1.52	0.00
G13	6.07	5.84	5.13	4.77	4.55	4.54	4.38	4.26	5.26	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	5.36
G14	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52	2.52
G15	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.00
G16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00

ANNEX A. 12 ENERGY MARKET OUTPUT - LOAD_RESULTS.CSV

LOAD_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
L0	0.34	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.28	0.35	0.39	0.43	0.41	0.36	0.35	0.34	0.39	0.44	0.46	0.47	0.45	0.43	0.38	0.29
L1	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L2	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L3	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L4	0.35	0.31	0.28	0.27	0.26	0.26	0.26	0.25	0.29	0.36	0.40	0.43	0.41	0.37	0.35	0.35	0.40	0.45	0.46	0.48	0.46	0.44	0.39	0.29
L5	0.13	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.11	0.13	0.15	0.16	0.15	0.14	0.13	0.13	0.15	0.16	0.17	0.18	0.17	0.16	0.14	0.11
L6	0.19	0.17	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.19	0.22	0.23	0.22	0.20	0.19	0.19	0.21	0.24	0.25	0.26	0.25	0.24	0.21	0.16
L7	0.47	0.42	0.38	0.36	0.35	0.35	0.35	0.34	0.39	0.48	0.54	0.59	0.56	0.50	0.47	0.47	0.53	0.61	0.62	0.65	0.62	0.59	0.53	0.39
L8	0.31	0.28	0.26	0.25	0.24	0.24	0.23	0.23	0.26	0.32	0.36	0.39	0.37	0.34	0.32	0.32	0.36	0.41	0.42	0.43	0.42	0.40	0.35	0.26
L9	0.23	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.19	0.23	0.26	0.28	0.27	0.24	0.23	0.23	0.26	0.29	0.30	0.31	0.30	0.29	0.26	0.19
L10	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.10	0.11	0.12	0.11	0.10	0.09	0.09	0.11	0.12	0.13	0.13	0.12	0.12	0.11	0.08
L11	0.60	0.54	0.49	0.47	0.45	0.45	0.44	0.44	0.50	0.62	0.70	0.75	0.72	0.64	0.61	0.61	0.69	0.78	0.80	0.83	0.80	0.76	0.68	0.51
L12	0.17	0.15	0.14	0.13	0.13	0.13	0.12	0.12	0.14	0.17	0.19	0.21	0.20	0.18	0.17	0.17	0.19	0.22	0.22	0.23	0.22	0.21	0.19	0.14
L13	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.06	0.08	0.09	0.09	0.09	0.08	0.07	0.07	0.08	0.10	0.10	0.10	0.10	0.09	0.08	0.06
L14	0.40	0.36	0.33	0.31	0.30	0.30	0.30	0.29	0.33	0.41	0.46	0.50	0.48	0.43	0.41	0.40	0.46	0.52	0.54	0.55	0.53	0.51	0.45	0.34
L15	0.30	0.27	0.25	0.23	0.23	0.23	0.22	0.22	0.25	0.31	0.35	0.38	0.36	0.32	0.31	0.30	0.34	0.39	0.40	0.41	0.40	0.38	0.34	0.25
L16	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.14	0.15	0.14	0.13	0.12	0.12	0.14	0.16	0.16	0.17	0.16	0.15	0.14	0.10
L17	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.10	0.11	0.12	0.11	0.10	0.09	0.09	0.11	0.12	0.13	0.13	0.12	0.12	0.11	0.08
L18	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.06
L19	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.04
L20	0.09	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.09	0.10	0.11	0.10	0.09	0.09	0.09	0.10	0.11	0.12	0.12	0.12	0.11	0.10	0.07
L21	0.47	0.42	0.39	0.37	0.36	0.36	0.35	0.34	0.40	0.49	0.55	0.59	0.57	0.51	0.48	0.48	0.54	0.61	0.63	0.65	0.63	0.60	0.53	0.40
L22	0.11	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.13	0.15	0.15	0.16	0.15	0.14	0.13	0.10
L23	0.16	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.16	0.19	0.20	0.19	0.17	0.16	0.16	0.18	0.21	0.21	0.22	0.21	0.20	0.18	0.14
L24	0.29	0.26	0.24	0.22	0.22	0.22	0.21	0.21	0.24	0.30	0.33	0.36	0.34	0.31	0.29	0.29	0.33	0.37	0.38	0.40	0.38	0.37	0.32	0.24
L25	0.39	0.35	0.32	0.31	0.30	0.30	0.29	0.29	0.33	0.41	0.46	0.49	0.47	0.42	0.40	0.40	0.45	0.51	0.53	0.54	0.52	0.50	0.44	0.33
L26	0.15	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.13	0.16	0.18	0.19	0.18	0.16	0.16	0.16	0.18	0.20	0.21	0.21	0.20	0.20	0.17	0.13
L27	0.39	0.35	0.32	0.31	0.30	0.30	0.29	0.29	0.33	0.41	0.46	0.49	0.47	0.42	0.40	0.40	0.45	0.51	0.53	0.54	0.52	0.50	0.44	0.33
L28	0.22	0.20	0.18	0.17	0.17	0.17	0.16	0.16	0.18	0.23	0.26	0.28	0.26	0.24	0.22	0.22	0.25	0.29	0.29	0.30	0.29	0.28	0.25	0.19
L29	0.21	0.19	0.17	0.16	0.16	0.16	0.15	0.15	0.17	0.21	0.24	0.26	0.25	0.22	0.21	0.21	0.24	0.27	0.28	0.29	0.27	0.26	0.23	0.17
L30	0.18	0.16	0.15	0.14	0.14	0.14	0.13	0.13	0.15	0.19	0.21	0.23	0.22	0.19	0.18	0.18	0.21	0.23	0.24	0.25	0.24	0.23	0.20	0.15
L31	0.44	0.39	0.36	0.34	0.33	0.33	0.33	0.32	0.37	0.45	0.51	0.55	0.53	0.47	0.45	0.44	0.50	0.57	0.59	0.61	0.59	0.56	0.50	0.37
L32	0.25	0.22	0.20	0.19	0.19	0.19	0.18	0.18	0.21	0.25	0.29	0.31	0.30	0.26	0.25	0.25	0.28	0.32	0.33	0.34	0.33	0.31	0.28	0.21
L33	0.64	0.57	0.53	0.50	0.49	0.48	0.47	0.47	0.53	0.66	0.74	0.80	0.77	0.69	0.65	0.65	0.73	0.83	0.86	0.89	0.85	0.82	0.72	0.54
L34	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.14	0.15	0.14	0.13	0.12	0.12	0.14	0.16	0.16	0.17	0.16	0.15	0.14	0.10
L35	0.11	0.10	0.09	0.08	0.08	0.08	0.08	0.08	0.09	0.11	0.12	0.13	0.13	0.11	0.11	0.11	0.12	0.14	0.14	0.15	0.14	0.14	0.12	0.09
L36	0.35	0.32	0.29	0.28	0.27	0.27	0.26	0.26	0.30	0.36	0.41	0.44	0.42	0.38	0.36	0.36	0.40	0.46	0.47	0.49	0.47	0.45	0.40	0.30
L37	0.19	0.17	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.19	0.22	0.23	0.22	0.20	0.19	0.19	0.21	0.24	0.25	0.26	0.25	0.24	0.21	0.16
L38	0.23	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.19	0.23	0.26	0.28	0.27	0.24	0.23	0.23	0.26	0.29	0.30	0.31	0.30	0.29	0.26	0.19
L39	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L40	0.58	0.52	0.48	0.45	0.44	0.44	0.43	0.42	0.48	0.60	0.67	0.73	0.69	0.62	0.59	0.59	0.66	0.75	0.78	0.80	0.77	0.74	0.65	0.49
L41	0.11	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.13	0.15	0.15	0.16	0.15	0.14	0.13	0.10
L42	0.11	0.10	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.13	0.15	0.15	0.16	0.15	0.14	0.13	0.10
L43	0.12	0.11	0.10	0.09	0.09	0.09	0.09	0.09	0.10	0.12	0.14	0.15	0.14	0.13	0.12	0.12	0.14	0.16	0.16	0.17	0.16	0.15	0.14	0.10

L44	0.15	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.13	0.16	0.18	0.19	0.18	0.16	0.16	0.16	0.18	0.20	0.21	0.21	0.20	0.20	0.17	0.13
L45	0.76	0.68	0.62	0.59	0.57	0.57	0.56	0.55	0.63	0.78	0.87	0.95	0.90	0.81	0.77	0.76	0.86	0.98	1.01	1.04	1.00	0.96	0.85	0.64
L46	0.42	0.38	0.34	0.33	0.32	0.32	0.31	0.31	0.35	0.43	0.49	0.53	0.50	0.45	0.43	0.42	0.48	0.55	0.56	0.58	0.56	0.54	0.47	0.36
L47	0.56	0.50	0.46	0.44	0.42	0.42	0.41	0.41	0.47	0.58	0.65	0.70	0.67	0.60	0.57	0.57	0.64	0.73	0.75	0.77	0.74	0.71	0.63	0.47
L48	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L49	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L50	1.85	1.66	1.52	1.44	1.40	1.40	1.37	1.34	1.54	1.90	2.14	2.32	2.21	1.98	1.88	1.87	2.12	2.40	2.47	2.55	2.46	2.35	2.08	1.56
L51	0.52	0.47	0.43	0.41	0.39	0.39	0.38	0.38	0.43	0.54	0.60	0.65	0.62	0.56	0.53	0.53	0.60	0.67	0.70	0.72	0.69	0.66	0.59	0.44
L52	0.51	0.46	0.42	0.40	0.39	0.39	0.38	0.37	0.43	0.53	0.59	0.64	0.61	0.55	0.52	0.52	0.59	0.67	0.69	0.71	0.68	0.65	0.58	0.43
L53	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L54	0.19	0.17	0.15	0.15	0.14	0.14	0.14	0.14	0.16	0.19	0.22	0.23	0.22	0.20	0.19	0.19	0.21	0.24	0.25	0.26	0.25	0.24	0.21	0.16
L55	0.44	0.39	0.36	0.34	0.33	0.33	0.33	0.32	0.37	0.45	0.51	0.55	0.53	0.47	0.45	0.44	0.50	0.57	0.59	0.61	0.59	0.56	0.50	0.37
L56	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L57	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.03
L58	0.45	0.41	0.37	0.35	0.34	0.34	0.34	0.33	0.38	0.47	0.53	0.57	0.54	0.49	0.46	0.46	0.52	0.59	0.61	0.63	0.60	0.58	0.51	0.38
L59	0.31	0.28	0.26	0.25	0.24	0.24	0.23	0.23	0.26	0.32	0.36	0.39	0.37	0.34	0.32	0.32	0.36	0.41	0.42	0.43	0.42	0.40	0.35	0.26
L60	0.45	0.41	0.37	0.35	0.34	0.34	0.34	0.33	0.38	0.47	0.53	0.57	0.54	0.49	0.46	0.46	0.52	0.59	0.61	0.63	0.60	0.58	0.51	0.38
L61	0.41	0.36	0.33	0.32	0.31	0.31	0.30	0.30	0.34	0.42	0.47	0.51	0.49	0.44	0.41	0.41	0.47	0.53	0.54	0.56	0.54	0.52	0.46	0.34
L62	0.47	0.42	0.39	0.37	0.36	0.36	0.35	0.34	0.40	0.49	0.55	0.59	0.57	0.51	0.48	0.48	0.54	0.61	0.63	0.65	0.63	0.60	0.53	0.40
L63	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L64	0.87	0.78	0.71	0.68	0.66	0.66	0.64	0.63	0.72	0.89	1.00	1.09	1.04	0.93	0.88	0.88	0.99	1.12	1.16	1.20	1.15	1.10	0.98	0.73
L65	0.36	0.32	0.30	0.28	0.27	0.27	0.27	0.26	0.30	0.37	0.42	0.45	0.43	0.39	0.37	0.36	0.41	0.47	0.48	0.50	0.48	0.46	0.41	0.30
L66	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L67	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.06	0.08	0.09	0.09	0.09	0.08	0.07	0.07	0.08	0.10	0.10	0.10	0.10	0.09	0.08	0.06
L68	0.16	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.16	0.19	0.20	0.19	0.17	0.16	0.16	0.18	0.21	0.21	0.22	0.21	0.20	0.18	0.14
L69	0.14	0.13	0.12	0.11	0.11	0.11	0.10	0.10	0.12	0.14	0.16	0.18	0.17	0.15	0.14	0.14	0.16	0.18	0.19	0.19	0.19	0.18	0.16	0.12
L70	0.32	0.29	0.26	0.25	0.24	0.24	0.24	0.23	0.27	0.33	0.37	0.40	0.38	0.34	0.33	0.32	0.37	0.42	0.43	0.44	0.43	0.41	0.36	0.27
L71	1.09	0.97	0.89	0.85	0.82	0.82	0.80	0.79	0.91	1.12	1.26	1.36	1.30	1.17	1.10	1.10	1.25	1.41	1.45	1.50	1.44	1.38	1.23	0.92
L72	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.08	0.06
L73	0.43	0.39	0.36	0.34	0.33	0.33	0.32	0.32	0.36	0.45	0.50	0.54	0.52	0.46	0.44	0.44	0.50	0.56	0.58	0.60	0.58	0.55	0.49	0.37
L74	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.10	0.09	0.08	0.08	0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.07
L75	0.20	0.18	0.16	0.16	0.15	0.15	0.15	0.15	0.17	0.21	0.23	0.25	0.24	0.21	0.20	0.20	0.23	0.26	0.27	0.28	0.27	0.25	0.23	0.17
L76	0.28	0.25	0.23	0.22	0.21	0.21	0.21	0.20	0.23	0.29	0.32	0.35	0.33	0.30	0.28	0.28	0.32	0.36	0.37	0.39	0.37	0.36	0.32	0.24
L77	0.25	0.23	0.21	0.20	0.19	0.19	0.19	0.18	0.21	0.26	0.29	0.32	0.30	0.27	0.26	0.26	0.29	0.33	0.34	0.35	0.34	0.32	0.29	0.21
L78	0.10	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.10	0.12	0.13	0.12	0.11	0.10	0.10	0.11	0.13	0.13	0.14	0.13	0.13	0.11	0.08
L79	0.23	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.19	0.23	0.26	0.28	0.27	0.24	0.23	0.23	0.26	0.29	0.30	0.31	0.30	0.29	0.26	0.19
L80	0.28	0.25	0.23	0.22	0.21	0.21	0.21	0.20	0.23	0.29	0.32	0.35	0.33	0.30	0.28	0.28	0.32	0.36	0.37	0.39	0.37	0.36	0.32	0.24
L81	0.25	0.22	0.20	0.19	0.19	0.19	0.18	0.18	0.21	0.25	0.29	0.31	0.30	0.26	0.25	0.25	0.28	0.32	0.33	0.34	0.33	0.31	0.28	0.21
L82	0.15	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.12	0.15	0.17	0.18	0.18	0.16	0.15	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.17	0.12
L83	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.03
L84	0.15	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.13	0.16	0.18	0.19	0.18	0.16	0.16	0.16	0.18	0.20	0.21	0.21	0.20	0.20	0.17	0.13
L85	0.25	0.23	0.21	0.20	0.19	0.19	0.19	0.18	0.21	0.26	0.29	0.32	0.30	0.27	0.26	0.26	0.29	0.33	0.34	0.35	0.34	0.32	0.29	0.21
L86	0.21	0.19	0.17	0.16	0.16	0.16	0.15	0.15	0.17	0.21	0.24	0.26	0.25	0.22	0.21	0.21	0.24	0.27	0.28	0.29	0.27	0.26	0.23	0.17
L87	0.29	0.26	0.24	0.22	0.22	0.22	0.21	0.21	0.24	0.30	0.33	0.36	0.34	0.31	0.29	0.29	0.33	0.37	0.38	0.40	0.38	0.37	0.32	0.24
L88	0.33	0.30	0.27	0.26	0.25	0.25	0.25	0.24	0.28	0.34	0.39	0.42	0.40	0.36	0.34	0.34	0.38	0.43	0.45	0.46	0.44	0.42	0.38	0.28
L89	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01

L90	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.06	0.06	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.05
L91	0.26	0.23	0.21	0.20	0.20	0.20	0.19	0.19	0.22	0.27	0.30	0.33	0.31	0.28	0.26	0.26	0.30	0.34	0.35	0.36	0.35	0.33	0.29	0.22
L92	0.45	0.41	0.37	0.35	0.34	0.34	0.34	0.33	0.38	0.47	0.53	0.57	0.54	0.49	0.46	0.46	0.52	0.59	0.61	0.63	0.60	0.58	0.51	0.38
L93	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.03
L94	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.06	0.06	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.06	0.05
L95	0.15	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.12	0.15	0.17	0.18	0.18	0.16	0.15	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.17	0.12
L96	1.23	1.10	1.01	0.96	0.93	0.93	0.91	0.89	1.02	1.26	1.42	1.54	1.47	1.32	1.25	1.24	1.41	1.59	1.64	1.70	1.63	1.56	1.38	1.04
L97	0.13	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.14	0.15	0.17	0.16	0.14	0.14	0.13	0.15	0.17	0.18	0.18	0.18	0.17	0.15	0.11
L98	0.22	0.20	0.18	0.17	0.17	0.17	0.16	0.16	0.18	0.23	0.26	0.28	0.26	0.24	0.22	0.22	0.25	0.29	0.29	0.30	0.29	0.28	0.25	0.19

ANNEX A. 13 SECONDARY RESERVE MARKET OUTPUT – RESULTS_SECONDARY.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	0.73	0.65	0	0	0	0	0	0	0	0.75	0.84	0.91	0.87	0.78	0.74	0.74	0.84	0.95	0.98	1.01	0.97	0.93	0.82	0
G1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G2	0	0	0.6	0.57	0.55	0.55	0.54	0.53	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62
G3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G8	0	0	0.96	0.91	0.89	0.88	0.86	0.85	0.97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.51	1.56	1.61	1.55	0	0	0
G11	1.17	1.05	0	0	0	0	0	0	0	1.2	1.35	1.46	1.4	1.25	1.19	1.18	1.34	0	0	0	0	1.49	1.32	0.99
G12	0.93	0	0	0	0	0	0	0	0	0.96	1.08	1.17	1.11	1	0.95	0.94	0	1.21	1.25	1.29	1.24	1.19	1.05	0
G13	0	0.84	0.77	0.73	0.71	0.71	0.69	0.68	0.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.79
G14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.07	0	0	0	0	0	0	0

ANNEX A. 14 TERTIARY RESERVE MARKET OUTPUT – RESULTS_ TERTIARY.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	0	0	0.6	0.57	0.55	0.55	0.54	0.53	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62
G1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

G10	1.17	1.05	0	0	0	0	0	0	0	1.2	1.35	1.46	1.4	1.25	1.19	1.18	1.34	0	0	0	0	1.49	1.32	0.99
G11	0	0	0.96	0.91	0.89	0.88	0.86	0.85	0.97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G12	0	0.84	0.37	0.33	0.31	0.31	0.29	0.28	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.39
G13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G15	0	0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4
G16	0.36	0	0	0	0	0	0	0	0	0.36	0.36	0	0	0	0.36	0.36	0	0	0	0	0	0	0	0

Example 2 Extra Data Files

ANNEX A. 15 EXAMPLE 3 SECONDARY RESERVE MARKET INPUT– GEN_BID_QNT.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	3.38	4.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.18	2.25	1.55	1.97	2.87	3.28	3.32	2.34	1.23	0.93	0.61	1.00	1.41	2.47	0.00
G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G2	0.00	0.00	0.21	0.49	0.67	0.67	0.80	0.89	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
G3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G8	0.00	0.00	0.18	0.64	0.92	0.93	1.13	1.28	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.56	3.22	2.71	3.33	0.00	0.00	0.00
G11	3.23	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.91	1.41	0.29	0.97	2.41	3.06	3.13	1.56	1.15	0.00	0.00	0.00	0.06	1.77	5.07
G12	4.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.16	2.96	2.43	2.97	4.12	4.28	4.34	3.23	2.03	1.64	1.23	1.73	2.25	3.61	0.00
G13	0.00	0.23	0.94	1.30	1.52	1.53	1.69	1.81	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
G14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ANNEX A. 16 EXAMPLE 3 SECONDARY RESERVE MARKET INPUT– GEN_BID_PRICES.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
G1	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
G2	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
G3	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142
G4	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133
G5	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
G6	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103
G7	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
G8	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166
G9	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
G10	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188

G11	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
G12	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
G13	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
G14	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
G15	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
G16	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169	169

ANNEX A. 17 EXAMPLE 3 SECONDARY RESERVE MARKET OUTPUT– RESULTS_SECONDARY.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	0.73	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.84	0.91	0.87	0.78	0.74	0.74	0.84	0.95	0.93	0.61	0.97	0.93	0.82	0.00
G1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G2	0.00	0.00	0.21	0.49	0.55	0.55	0.54	0.53	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
G3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G8	0.00	0.00	0.18	0.64	0.89	0.88	0.86	0.85	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.51	1.56	1.61	1.55	0.00	0.00	0.00
G11	1.17	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.35	0.29	0.97	1.25	1.19	1.18	1.34	0.00	0.00	0.00	0.00	0.06	1.32	0.99
G12	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	1.08	1.17	1.11	1.00	0.95	0.94	0.86	1.21	1.25	1.23	1.24	1.19	1.05	0.00
G13	0.00	0.23	0.77	0.73	0.71	0.71	0.69	0.68	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
G14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ANNEX A. 18 EXAMPLE 3 TTERTIARY RESERVE MARKET INPUT– GEN_BID_QNT.CSV

GEN_ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
G0	0	0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5
G1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G10	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	0	0	0	0	3.92	3.92	3.92
G11	0	0	5.164	5.164	5.164	5.164	5.164	5.164	5.164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G12	0	4.77	4.77	4.77	4.77	4.77	4.77	4.77	4.77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.77
G13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

G14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G15	0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4
G16	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0	0	0	0.36	0.36	0	0	0	0	0	0	0	0.36