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TRABAJO FIN DE MÁSTER

TITULO: ACOPLAMIENTO DE UN SISTEMA DE ALMACENAMIENTO DE ENERGÍA CON UN PARQUE EÓLICO: UN ESTUDIO DE VIABILIDAD

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AUTORIZACIÓN de la TUTORA del TRABAJO FIN DE MÁSTER

Dña. Mª Pilar Lisbona Martín, profesora del departamento de Ingeniería Agrícola y Forestal, como tutora del TFM titulado; ***Acoplamiento de un sistema de almacenamiento de energía con un parque eólico: un estudio de viabilidad (Coupling of an energy storage system with a wind farm: a feasibility study)*** realizado por la estudiante Dña. Paula Peña Carro, da el Vº. Bº. y autoriza la presentación del mismo, considerando que el trabajo realizado alcanza satisfactoriamente los objetivos esperados en un documento de sus características y que la estudiante ha adquirido sobradamente las competencias requeridas para acreditar el nivel académico de máster.

Soria, 18 de Abril de 2018

La tutora del TFM

Fdo.: Mª Pilar Lisbona Martín

DECLARACIÓN DE AUTORÍA Y ORIGINALIDAD

Dña. Paula Peña Carro, estudiante del Máster en Ingeniería de la Bioenergía y Sostenibilidad Energética de la Escuela de Ingeniería de la Industria Forestal, Agronómica y de la Bioenergía de la Universidad de Valladolid, **DECLARO:**

Que el trabajo fin de máster que presento para su exposición y defensa titulado Acoplamiento de un sistema de almacenamiento de energía con un parque eólico: un estudio de viabilidad (Coupling of an energy storage system with a wind farm: a feasibility study).

Es original y que todas las fuentes utilizadas para su realización han sido debidamente citadas en el mismo.

Soria, 18 de Abril de 2018

Fdo.: Paula Peña Carro

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Abstract

This study analyses the coupling between a wind farm and a battery energy storage from an economic point of view. The Electric Energy Storage (ESS) technologies are often seen as those key technologies which will allow the integration of higher shares of renewable energy sources into the traditional electric systems. Despite the deep research interest and the recent development of many EES technologies, the number of current installed facilities is extremely low. In this Master Thesis, the economic viability of one of the most promising EES technology in terms of round-trip efficiency, the lithium-ion battery, is analyzed under two scenarios, Italy and Spain.

The battery is operated to maximize the economic revenue of the wind farm, shifting the changing wind production to the most profitable moments of the day. The costs and the revenues derived from the purchase of the battery and the management of the production are evaluated for several sizes of batteries and power of the wind farm. An algorithm to efficiently manage the charge and discharge of the battery has been formulated and the operation of the plant has been simulated using real wind data and energy price time series.

The study provides the best combination of operating parameters and price criteria to optimize the benefits of the wind power facility.

Resumen

Este estudio analiza desde un punto de vista económico la viabilidad del acoplamiento entre un parque eólico y una batería de almacenamiento de energía. Las tecnologías de almacenamiento de energía eléctrica (ESS) a menudo se consideran como tecnologías clave para permitir la integración de una mayor proporción de fuentes de energía renovables en los sistemas eléctricos tradicionales. A pesar del gran interés en su investigación y el reciente desarrollo de muchas tecnologías EES, el número actual de instalaciones reales es extremadamente bajo. En este Trabajo Fin de Máster, se analiza la viabilidad económica de una de las tecnologías EES más prometedoras en términos de eficiencia de carga y descarga, la batería de iones de litio. Este análisis se reproduce en dos escenarios, Italia y España.

El sistema de baterías se utiliza para maximizar los ingresos económicos del parque eólico, gestionando la producción variable del viento y transportándola a los momentos más rentables del día. Los costes y los ingresos ligados a la compra de la batería y a la gestión de la producción se evalúan para varios tamaños de batería y potencia de parque. Se ha desarrollado un algoritmo para gestionar la carga y descarga de la batería. La operación de la planta ha sido simulada utilizando datos de viento de la vida real y series de tiempo de precios de la energía.

El estudio proporciona la mejor combinación de parámetros operativos y criterios de precio para optimizar los beneficios de la instalación de energía eólica.

1. Introduction

The increasing electricity demand of the consumer sectors and the growing concern for climate change, place renewable energy as a solution with a view to the future. The main objective of a greater penetration of renewable energy sources in the generation technologies of electricity is the reduction of greenhouse gas emissions. Some of the most used technologies are still fueled by fossil fuels creating great dependence on limited resources and an increase in the emission of greenhouse gases that results in a worsening of the environmental situation.

Through the use of renewable energies, cleaner electrical energy can be produced from inexhaustible sources in the long-term, as is the case of the wind energy. One of the main disadvantages associated with electricity generation from natural sources is the dependence of the electricity production of uncontrolled phenomena and, in the case of the wind resource, also chaotic phenomena. On the other hand, the electricity demand is independent of meteorology and follows standard patterns which mainly depend on the socio-economic situation of each zone. Given the characteristics of our current electric market, electricity production introduced into the grid and demanded power must be equal at any time. This Master Thesis is concerned on wind energy utilization and its optimal management in the current electricity market.

Therefore, given the nature of the wind resource, there will be moments in which not all the power produced is necessary because the instantaneous demand is exceeded. In other situations, the opposite can occur when there are peaks of electricity consumption or no wind; that is, a deficit in the electricity market that will have to be alleviated by putting in operation back-up fossil power plants that were stopped until that moment. These back-up power plants can provide to the grid the rest of electricity demanded at that moment by the users. For this reason, the installation of energy storage technologies in wind farms may be interesting. Thus, when wind generates more power than necessary to cover demand, this extra production can be stored. In those cases in which the energy produced in the electrical system is not enough, this deficit can be covered by releasing the energy previously stored.

There are different types of storage technologies suitable for the storage of electrical energy, such as flywheels, lithium-ion batteries, Na-S batteries, vanadium redox flow and supercapacitors. *Table 1* shows the different characteristics of each of the storage technologies mentioned [1].

The feasibility of these technologies has been extensively studied analyzing the pay-back period of the investment. The results pointed out lithium-ion batteries as the most economically viable storage technology [2].

This type of batteries was introduced in the market in 1991, and since then it has continuously evolved, being one of the most popular batteries in the world despite its short history. This is due to its excellent operation, related to its high specific energy, energy density, specific power, high efficiency of 90-95% [3], operation in a wide range of temperatures -20 to 55 °C, low memory effect and long life established around the 10 years [4], being able to be reduced or increased according to the use that is given to them. As a negative aspect, the most important is its high price, although according to different sources it is expected to decrease in a short period of time [2]. They were first used in consumer electronics products such as mobile phones, video cameras, laptops. During the last decade, they have been extensively used in electric vehicles and, currently, in industrial applications such as the studied case in this Thesis for the storage of energy. Therefore, significant growth is expected in the coming years [5].

Table 1- Characteristics of different electrical energy storage technologies

Technology	**Power rating** **Discharge time** **Storage duration** **Efficiency round-trip** **Capital cost** **Stored energy cost**	**Description** **+ Advantages** **- Disadvantages**
Flywheel energy storage	0 - 250 kW ms - 15 min < hour 85 - 95% 250 - 350 $/kW 1000 - 5000 $/kWh	Energy stored in the angular momentum of a spinning mass + Environmentally friendly + High efficiency - Short term storage due to friction - Low scalability
Li-ion battery	0 - 100 kW min - hour hour - days 85 - 90% 1200 - 4000 kW 600 - 2500 $/kWh	Rechargeable batteries based on lithium salt electrolyte + Low self-discharge rate + High energy density - Fragile with temperature - Low scalability due to cost
Na – S battery	0.05 - 8 MW s - hours 6 hours 80-90% 1000 - 3000 $/kW 300 - 500 $/kWh	Rechargeable batteries based on molten sulfur and sodium + Prompt and precise response + High efficiency - High capital cost - Operational hazard
Vanadium redox flow	0.03 - 3 MW s - 10 h months 85 - 90% 600 - 1500 $/kW 150 - 1000 $/kWh	Rechargeable batteries based on vanadium reduction and oxidation + Low maintenance cost + Tolerance to overcharging - Low energy density - High cost
Supercapacitor	0 - 300 kW ms - 1 hour < 1 hour 90 - 95% 100 - 300 $/kW 300 - 2000 $/kWh	High-capacity electrochemical capacitors + High efficiency + Fast discharge times - Limited scale-up - Short-term storage

Currently, the use of batteries in wind farms can be categorized in two purposes both related with the mitigation of the negative impact of wind fluctuations in the wind machines.

(i) The most studied and applied topic deals with the reduction of the tensions that suffers the wind machine by the variability in the speed of the wind.

(ii) The second target is the penalty that the company must face due to the difference between the estimated sales energy and the energy actually sold. The installation of batteries can reduce this cost [6][7][8][9][10].

This Master Thesis is aimed at this second purpose: to achieve an increase of profit through an adequate strategy for the management of the energy produced by the wind turbines. This management will be supported by the installation of batteries which will allow to sale stored energy at the most advantageous moment of the day from an economical point of view.

The main objectives of this Master Thesis can be summarized in the three following points;

(i) to adequately manage the energy produced by the wind turbine of a wind farm with the help of storage of lithium-ion batteries,
(ii) to size these batteries to maximize the increase in the profits from the sale to the grid of produced electricity,
(iii) to study the feasibility of its implementation under two different locations.

Several cases of sizing and different forms of energy management are studied, in order to finally select the best combination (size-energy management) that will allow to increase the benefits. The simulation of the operation of two wind farms is carried out using real wind data and time series of energy prices in two locations. One of these wind farms is located in the South of Italy and the other one in the Northeast of the Spanish peninsula.

It is essential to pay attention to the sizing of storage. The installation of batteries which are smaller than the optimal size may cause limitations in the loading and unloading of electricity and diminishes the opportunity to store the maximum amount of electricity and to maximize benefits. On the contrary, if the batteries are oversized, the investment cost becomes the most influential factor hiding the uselessness of excess store capacity. For this reason, it is a key point to make an estimation of the proper sizing in order to minimize the investment while taking into consideration the maximum electricity that will be stored.

In turn, it is important to establish limits for the factors that affect the useful life conditioning their longevity. The longevity of the battery is determined by a limited number of charge/discharge cycles. Three main factors that influence longevity exist; (i) the operating temperature of the battery, (ii) the depth of discharge level (DOD) and (iii) the magnitudes of the current charge/discharge.

The most influential factors are the limits of charge and discharge. These values will determine the number of cycles; knowing that the battery life is determined by a finite number of cycles. If these limits are too high, it will imply a significant reduction in the useful life. While if they are small, it means a waste of the storage for which it has been invested. Recommended limits of 20 and 80% are found in literature [11][12], as the limit of discharge and charge respectively. These values are used in the calculations developed in this Master Thesis. If the different factors are correctly handled, the longevity of the battery is extended, what means a delay in the replacement cost of the battery.

This type of storage technology needs a control system that manages its operation and takes into account the limitations of use mentioned above, such as the magnitudes related with the charge and discharge levels. An algorithm to handle these aspects has been created with the help of the programming language program for scientific information GNU Octave, in which all these conditions defined in the previous paragraph have been implemented in detail.

The competitiveness of this technology with respect to others previously mentioned could be increased through the feasibility analysis carried out in this Master Thesis. An increase of competitiveness would also boost the batteries and renewable energy sectors, especially wind power sector, encouraging the introduction of lithium-ion batteries in wind farms for management. Despite being a well-known storage technology, a small number of wind farms currently have their installation.

The study carried out is extensively presented throughout this document. It is divided into six sections, which are:

(i) An introduction that describes the data used and their treatment before being used. Annex 1 presents a sample of treated data set.
(ii) The tools and methodology used to model and simulate the different cases to be studied. Annex 2 shows the in-house created algorithms.
(iii) The results obtained from the different partial studies carried out.
(iv) A thorough analysis and discussion of the results.
(v) Conclusions that close to this study and the feasibility study.
(vi) In the last section, different lines of research related to the present study are proposed for further work.

Part of this Master Thesis has been carried out during a three month stay within a research group of the Department of Energy, Systems, Territory and Construction Engineering of the Engineering School, University of Pisa (Italy), led by Professor Umberto Desideri. Two scientific articles entitled "On the suitability of using a battery energy storage in a wind farm" and "Techno-economic sizing of a battery energy storage coupled to a wind farm: an Italian case study" has been derived from the work carried out in this Master Thesis. The first article has been accepted for oral presentation in the 31st International Conference in Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems - ECOS 2018 which will be held in Guimarães (Portugal) between 17th and 21st June, and the second article has been accepted in 73º Congresso Nazionale Associazione Termotecnica Italiana – ATI 2018 which will be celebrated in Pisa (Italy) between 12th and 14th September. Manuscripts are included in Annex 3 and 4.

2. Data sources and treatment

The first step to carry out the proposed study involves a clear description of the data sources and the treatment of the data. Since the study will be performed for an Italian and a Spanish scenario, two groups of data are created, one from Italy and the other one from Spain. In both cases, these data include wind velocity and electricity prices (v_W and p_e) during an annual period. In the following paragraphs, the main characteristics of these data and the operations that have been carried out are presented.

2.1. Data sources

The set of data from Italy (D_I), specifically from the South of Italy, includes the wind velocity [m/s] in a location facility of an electricity generation company that for privacy reasons cannot be revealed. These values were collected at 50 meters height and every ten minutes.

Electricity prices used in the study of the Italian case correspond to those in the South of Italy. This information is highlighted because, in Italy, electricity prices vary depending on the zone of the country. Hourly values of electricity price in the Southern region are taken from Gestore Mercato Elettrico (GME) and expressed in [€/MWh] [13].

Since the acquisition frequency of wind velocity data is ten minutes, electricity prices will be required at the same time discrete points to operate with the pair of values. As already mentioned, electricity prices are gathered each hour, thus these data must be treated to match the time discretization of velocity data. In order to provide the same number of discrete data, and given the fact that electricity prices within the hour are considered constant, six constant values of electricity price are considered every ten minutes in the period of a specific hour.

In the case of Spanish scenario (*D_2*), wind velocities were gathered from the Northeast part of the Iberian Peninsula, specifically from "La Luna" wind farm within the province of Soria. They were obtained in the web page of Photovoltaic Geographical Information System (PVGIS) supported by European Commission [14]. Data were collected every hour at ten meters of altitude during a period of one year.

Electricity prices are obtained from the Operator of the Iberian Energy Market (Operador del Mercado Ibérico de Energía – Polo Portugués, OMIP), which provides electricity price data every hour, expressed in [€/MWh] [15].

Under the Spanish scenario, both data are discretized in the same period of time (1 hour). Therefore, no modification of the data discretization is required before starting to work with them.

2.2. Technical assumptions of the wind turbine

The selected wind machine to perform this study has 2000 kW of nominal power. The device is an ENERCON E82 E2 whose main characteristics are: 2000 kW of nominal power, 98 meters of bushing height and 82 meters of rotor diameter. These technical details of the chosen technology are gathered in *Table 2*.

Table 2- Technical details of ENERCON E-82 E2. [16]

ENERCON E-82 E2 / 2.0 MW. Overview of technical details	
Rated power	2.000 kW
Rotor diameter	82 m
Hub height in meter	78/84/85/98/108/138
Wind zone (DIBt)	WZ III, WZ4 GK I
Wind class (IEC)	IEC/EN IIA
WEC concept	Gearless, variable speed, single blade adjustment

According to the power curve of ENERCON E-82 E2 presented in *Figure 1*, the following relationships (*Equations 1.1 to 1.4*) between velocity of the wind [m/s] and power of the machine [kW] can be extrapolated. Four different parts are identified in the power curve and each of them is expressed through these equations.

(*Equations 1.1 to 1.4*)

$$\begin{cases} \text{if } v_w < 2.5 & p_m = 0 \\ \text{if } 2.5 \leq v_w \leq 12.5 & p_m = -0.2376 \cdot x^4 + 5.2118 \cdot x^3 - 12.901 \cdot x^2 - 6.2001 \cdot x + 24.469 \\ \text{if } 12.5 < v_w < 28 & p_m = 2000 \\ \text{if } v_w \geq 28 & p_m = 0 \end{cases}$$

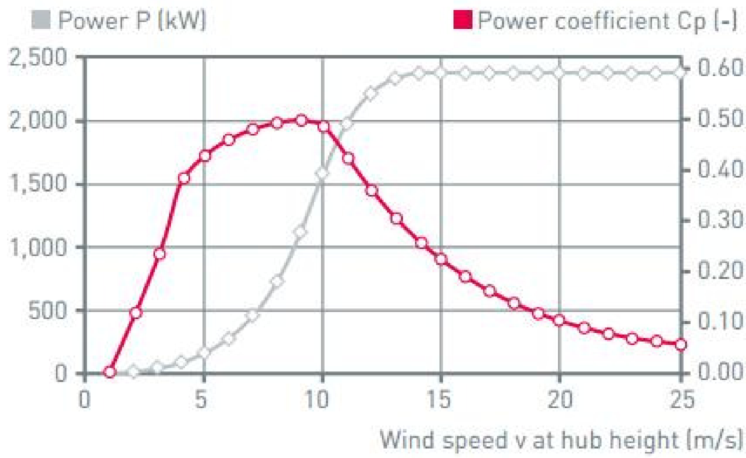

Figure 1- Power curve and power coefficient curve of ENERCON E-82 E2. [16]

Under the second case, when wind velocity ranges between 2.5 and 12.5 m/s, the equation that relates power developed by the machine and wind velocity was calculated by using a series of points provided by the wind turbine company for the different values of power coefficient (C_p). This non-dimensional value indicates the efficiency of the wind turbine to convert the energy from the wind in electricity.

The values taken from *Figure 1* are gathered and shown in *Table 3*. The points are used to plot the power curve and, then, the mathematical function that better adjusts to experimental values is obtained (*Figure 2*). Data can be approximated by different trend lines: linear, logarithmic, different degrees of polynomial lines and mobile media lines with different periods. Among them, the fourth-degree polynomial line provides the best result for the quadratic *R* variable which indicates the best approximation, for this case is 0.9947. The nearest the value of *R* to one, the better fitting between data and mathematical function. This function attends to *Equation 1.2*.

Table 3- Values of wind velocity, power coefficient (C_p) and power of ENERCON E-82 E2 [16]

v_w [m/s]	C_p [-]	p_m [kW]
1	0	0
2	0.12	3
3	0.29	25
4	0.40	82
5	0.43	174
6	0.46	321
7	0.48	532
8	0.49	815
9	0.50	1180
10	0.50	1612
11	0.44	1890
12	0.36	2000
13	0.29	2500

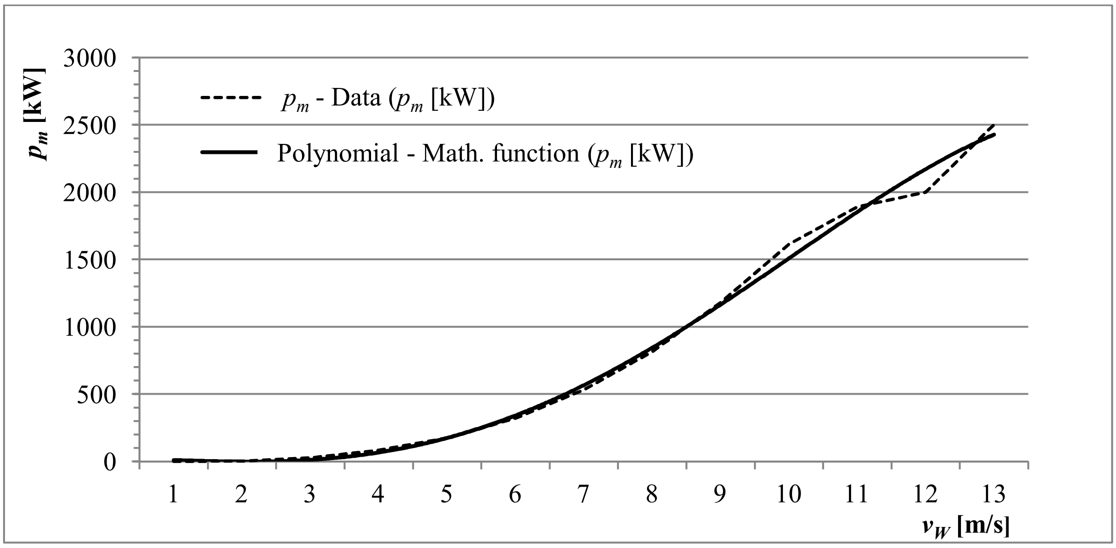

Figure 2- Power curve calculated for different cases (p_m) and the best polynomial approximation

Figure 2 represents the power of the wind turbine (p_m), kW, for different values of the velocity of the wind, m/s, in the range of expected experimental data. The dashed line is the power curve obtained through the representation of the different cases indicated in the table above, *Table 3*. The solid line represents the mathematical function that adjusts the best to the experimental power curve.

2.3. Data extrapolation

Once the type of wind turbine is selected, the value of the wind speed must be extrapolated to the height at which the data has been collected in the selected Italian and Spanish wind farms, at the height of the bushing.

In fluid dynamics, the no-slip condition for viscous fluids assumes that at a solid boundary, the fluid will have zero velocity relative to the boundary. *Figure 3* illustrates this no-slip condition applied to the air and the consequent gradient of velocity from ground level to the height of the wind turbine where the flow is almost completely developed.

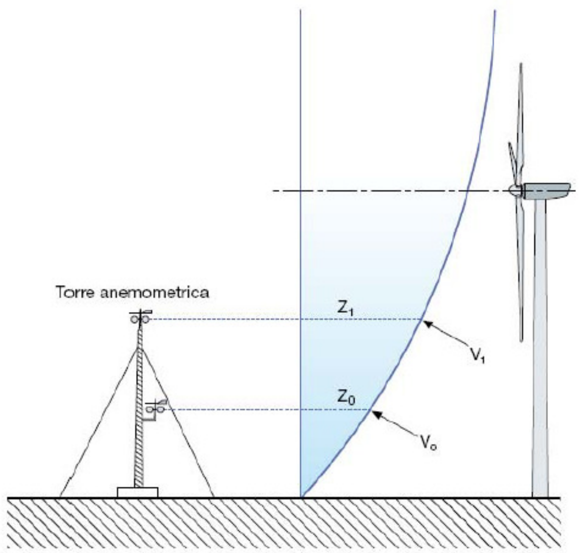

Figure 3- Gradient of wind velocity as a function of height. [17]

Table 4- Typical values of the Wind Shear Exponent *α*. [17]

Terrain	Surface Roughness Length z_0 [m]	Wind Shear Exponent α
Ice	0.00001	0.07
Snow on flat ground	0.0001	0.09
Calm sea	0.0001	0.09
Coast with onshore winds	0.001	0.11
Snow-covered crop stubble	0.002	0.12
Cut grass	0.007	0.14
Short-grass prairie	0.020	0.16
Crops, tall-grass prairie	0.050	0.19
Hedges	0.085	0.21
Scattered trees and hedges	0.150	0.24
Trees, hedges, a few buildings	0.300	0.29
Suburbs	0.400	0.31
Woodlands	1.000	0.43
Note: Relative to a reference height of 10 m (33ft)		

Measured values correspond to z_0 and z_1 but new values can be calculated through an extrapolation in which the height and the wind shear exponent must be accounted. Typical values for the wind shear exponent are collected in *Table 4*.

Wind velocities at different heights are related through the following equation (*Eq. 1.5*) which can be used to extrapolate velocity at the required height [17].

$$v_1 = v_0 \cdot \left(\frac{z_1}{z_0}\right)^{\alpha} \qquad \textit{Equation 1.5}$$

The selected value for the wind shear exponent in this study was 0.19, which corresponds to a terrain of crops or tall-grass prairie at ground. Then, the real wind velocity data must be calculated considering the real density of air at the height of the wind turbine. Therefore the first step will imply the calculation of air density at the bushing height (*Eq. 1.6*). Once this value is obtained, approximate real velocity of the wind may be calculated [18].

$$\rho = \frac{[\,101.29 - (0.011837) \cdot z + (4.793 \cdot 10^{-7}) \cdot\, z^2] \cdot 3.4837}{T} \qquad \textit{Equation 1.6}$$

The air density with which ENERCON obtained the values shown in *Table 3* is 1.225 kg/m^3 [16].

The values of the height and temperature for the Italian and Spanish scenario, as well as the value of the density obtained with the *Equation 1.6*, are included in *Table 5*.

Table 5- Values of height, temperature, and density for Italian and Spanish case

		Italy	Spain
Height	z [m]	235.00	1481.00
Temperature	T [K]	291.05	283.65
Air density	ρ [kg/m^3]	1.179	1.041

The equation that attends the relation between the air density and wind velocity is presented in the following (*Eq. 1.7*).

$$v_{w,real} = v_0 \cdot \left(\frac{\rho_{machine}}{\rho_0}\right)^{1/3} \qquad \textit{Equation 1.7}$$

Once the real wind velocity at the bushing height is calculated, the power of the wind turbine for each value of the wind velocity may be obtained through *Equations 1.1* to *1.4*. Then, the energy supplied in every moment may be calculated for both cases.

In the case of Italy, produced electricity in kJ will be calculated by multiplying power in kW by 600 seconds. This is due to the temporal discretization of D_1 data which are provided every ten minutes (600 seconds).

Lastly, in the case of Spain, produced electricity in kJ will be calculated by multiplying power in kW by 3600 seconds. This is due to the temporal discretization of D_2 data which are provided every hour (3600 seconds).

Finally, the data set available for carrying out this study, presented in Annex I, includes: electricity price, power and energy generated by the wind turbine under the Italian and Spanish scenario.

3. Tools and methodology

In this section, the tools used for the development of this study and the methodology applied are presented. The methodology includes a number steps from the initial data presented in the previous section to the obtained final results. The main codes developed in the framework of this Master Thesis are gathered in Annex II. Results derived from these codes are used to obtain the conclusions that will be presented in section 6.

3.1. Tools

The whole programming work carried out in this Master Thesis has been developed using GNU Octave. GNU Octave is a free-license program that allows the development of in-house codes, designed as a programming language for scientific computing with which the main codes have been created supporting the management of final results. Microsoft Office Excel has been used to manage datasets through the application of its spreadsheets.

3.2. Methodology

This Master Thesis is a non-experimental study, but an analysis of mathematical simulation. Thus, it is not necessary to rely on experimental test. The work carried out implies a mathematical simulation study through the construction of algorithms that make use of existing experimental large amount of data (big data) to build the model and to obtain the final conclusions.

Figure 4 presents the logic diagram which illustrates the methodology followed in the calculations done in the study to arrive to the final results and conclusions. These steps are divided in two sections; (i) data sources and treatment and (ii) methodology.

After the treatment of initial data, the next step was the development of the programming codes which allow for the analysis of existing data for two scenarios, Italy and Spain. During the design of the codes, it has to be accounted that they must be able to manage all the decisions to be considered. Therefore, one of the first steps in the methodology will imply the definition of all possible cases to decide through the definition of decision rules. Once these programs are built, large amounts of results are obtained, treated and analyzed to finally achieve into conclusions.

The first step to start building the main code is to clearly define the final objectives and the different operation and storage characteristics that must be taken into account. The final objectives are: (i) to find out the best operational actuation to manage the energy produced by the wind turbine of a wind farm with the help of storage of Li-ion batteries, and (ii) to size these batteries in order to achieve an increase in the profits obtained from the sale of electricity produced to the market studying the viability in its implementation. With these aims, it is necessary to establish decision rules which will allow to decide at every moment what to do with the energy.

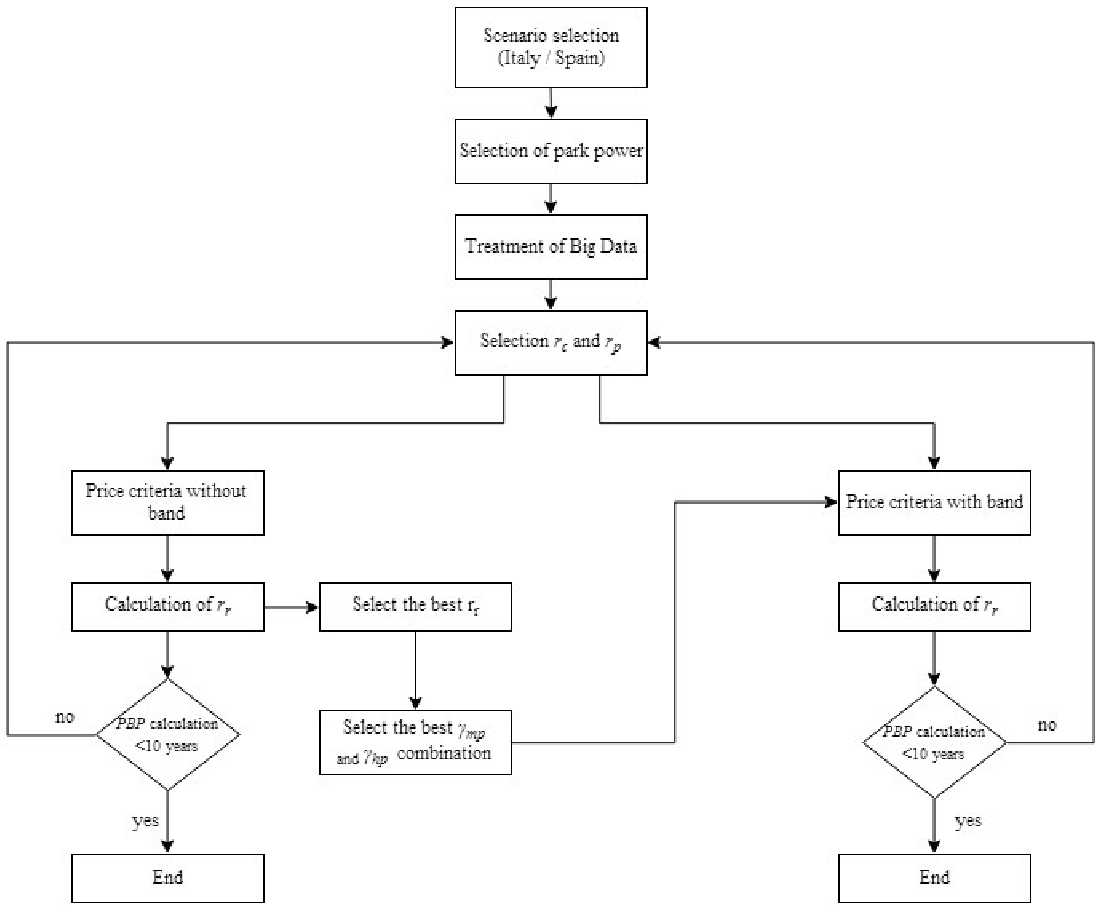

Figure 4- Decision tree of the study carried out

Three situations or possible cases are considered to occur. The first case implies the storage of the instantaneous energy produced in Li-ion batteries, the second one implies the sale to the grid of the instantaneous energy produced and the last one implies the sale to the grid of both the instantaneous energy produced and the stored energy. Decision rules must be defined to operate the system in one or another situation.

Since one of the final objectives is increasing the revenue, the price will be the most relevant variable for taking decisions. To achieve our objective, it will be necessary to release the stored energy to the grid in those moments in which the price of electricity presents the highest value and to store electricity during those moments with low electricity price. This will be called 'Price criteria'.

Two types of Price Criteria are defined; the difference between them relies in the established threshold value to make the decision of storing or selling the accumulated energy in the batteries.

The first criterion used is 'Price criteria without band' in which two fixed values are used as threshold values: the daily average price and the maximum daily price of electricity. The daily average price (*mp*) is establish as a threshold value to decide whether to store the instantaneous produced energy or to directly sale it to the grid, and the maximum daily price (*hp*) as a value used for direct sale of the energy produced to network, or sale of stored energy together with the energy produced at that moment.

The second criterion, called 'Price criteria with band', is similar to the first one; it only varies the threshold values to manage energy in one way or another. In this case, the average daily price is multiplied by a percentage ($\gamma_{mp} \cdot mp$) to set one of the threshold values. Also, a band is created between the value of the maximum daily price multiplied by a percentage (lower limit, $\gamma_{hp} \cdot hp$), and the maximum daily price without modifications (*hp*), the upper limit. This band is defined as [$\gamma_{hp} \cdot hp - hp$]. Both sections criteria are detailed in the following sections.

To understand the influence of the different price criteria and to select the best one in terms of economic profit, two main codes were developed modifying only the applied price criteria. The rest of codes will be derived from these two initial codes. They were applied to the Spanish and Italian scenario - only the dimension of the initial set of data and the timescale are modified between the two scenarios. The original codes can be checked in subsections 1.1 and 1.2 of Annex II.

As said, the threshold values that will be used to determine whether to sale or to store electrical energy will be based in the average daily price (*mp*) and the maximum daily price (*hp*). The first code (Code I) will directly use these values in the decision rules (Price criteria without band), while the second one (Code II) will define two ranges based in percentage modification of these values (Price criteria with band). *Figure 5*, allows us to have a quick overview of the rules considered for energy management under both codes.

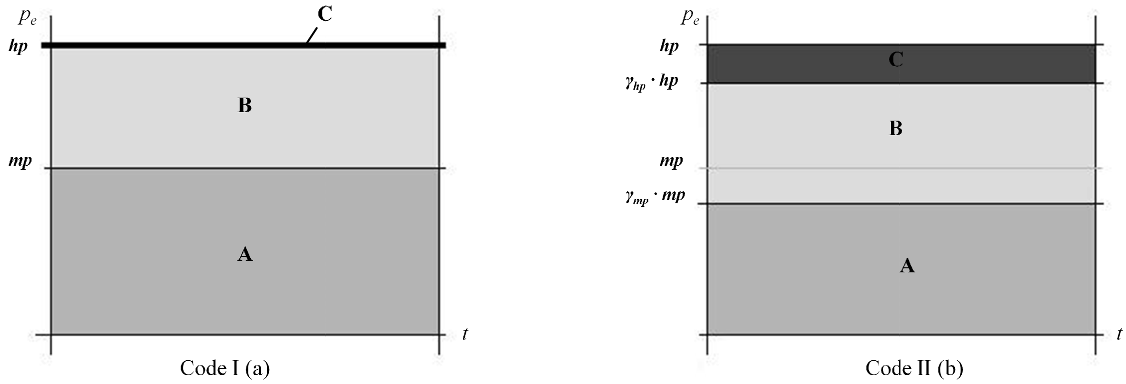

Figure 5- Energy management as a function of electricity price

Code I directly takes into account the values of the average daily price and maximum daily price without applying any modification to them (Price criteria without band). Depending on the price that electricity takes for each time-span, ten minutes for the Italian scenario and every hour for Spanish, the management of the electricity produced will follow a different pattern. As we can see in the first of the illustrations in *Figure 5 (a),* the graph is divided into three sections which limit the actuation depending on the price value.

- **Section A.** $p_e < mp$. The electricity produced will be directed to the storage until our storage capacity is completely full. From this point onwards, when storage capacity has been reached, the rest of the produced electricity will be sold to the grid.
- **Section B.** $mp < p_e < hp$. Only the electricity produced at that specific moment is sold to the grid. The energy that has been previously stored is never discharged under this situation.
- **Section C.** $p_e = hp$. It corresponds to a single line instead of a range of values (see *Fig. 5*). Both, the electricity instantaneously produced and stored electricity will be sold to the grid, taking preference in the sales the energy produced in that specific moment. Our storage capacity is not required to be completely full to start with the discharge.

In section B, the amount of electricity sold at each moment is defined by the power of the wind farm. In sections in which storage equipment participates, the amount of sold electricity is defined by power of the wind farm, capacity of the storage equipment, limit of charge, limit of discharge, charge performance and discharge performance of the storage. In this study, a sensitivity analysis has been performed with power and capacity variables and several cases are presented. The limit of charge of the storage has been set in 80% while the discharge limit is set as 20%. The charge and discharge performances have been set at 90%.

The main difference between Code II and Code I is related to the definition of the limits in the price criteria (Price criteria with band); i.e. the prices which determine whether to store the electricity or sell it to the grid. In this case (Code II), a percentage is applied to the average daily price ($\gamma_{mp} \cdot mp$) reducing the threshold value to stop storing and start selling to the grid. For the daily maximum price, a band is created. Instead of working with a single maximum value, a band is defined between an upper limit which corresponds to the maximum daily price (*hp*) and a lower limit which is established as a percentage of maximum daily price ($\gamma_{hp} \cdot hp$). The percentage was varied and optimized, selecting the final value that will lead to the highest income. The optimization process of the percentage applied will be presented later in the section 4, results.

Regarding *Figure 5 (b),* the decision rules that are applied to manage the produced energy will be as follows;

- **Section A**. $p_e < (\gamma_{mp} \cdot mp)$. The produced electricity in the wind farm will be directed to the battery until our storage capacity is completely full. Once the storage capacity is full, the rest of the produced electricity will be selling to the grid.
- **Section B.** $(\gamma_{mp} \cdot mp) < p_e < (\gamma_{hp} \cdot hp)$. Only the electricity produced at that moment is sold to the grid, not the electricity that has been already stored.
- **Section C.** $p_e > (\gamma_{hp} \cdot hp)$ and $p_e < hp$. The energy instantaneously produced and the stored energy will be sold to the grid, taking preference the energy produced at that specific moment. It is not necessary that our storage capacity is totally full to start with the discharge.

Seven variables can be modified as inputs in these codes: (i) the power of the wind farm, (ii) the storage capacity, (iii) power of the storage, (iv) capacity ratio, (v) power ratio, (vi) percentage applied to average daily price and, (vii) percentage applied to highest daily price of energy. Larger power of the wind farm leads to higher amount of produced electricity. Thus, it will be a dependent variable in the final results. However, the most important information is provided by the results that are only dependent on variables related to storage technologists. For this reason, it has been decided to analyze the system using ratios of variables instead of directly using the variables. These ratios allow to eliminate the dependence of results on the power of the wind farm.

The three defined ratios are: capacity ratio (r_c) which relates the capacity of the battery and the average daily energy produced with a specific power of the wind farm; power ratio (r_p) that relates the power of the battery and the average daily power produced with a specific park power, and revenue ratio (r_r) that relates the total benefit obtained with wind and storage facilities with total benefit obtained with the wind without the storage facility.

To calculate the values of store capacity (c) and power of storage (p) that will be used in the Codes I and II and obtain the different results of revenue ratio (r_r) for the different storage dimensions.

We must first calculate with the help of E*quations 1.8 to 1.11* the values of the average daily energy for an established wind farm power (e_w^*) and the average daily power for an established wind farm power (p_w^*).

$$p_w^* = \beta \cdot p_w \qquad \text{Equation 1.8}$$

$$p_w^{*0} = \beta \cdot p_w^0 \qquad \text{Equation 1.9}$$

$$e_w^* = \alpha^* \cdot p_w \qquad \text{Equation 1.10}$$

$$e_w^{*0} = \alpha^* \cdot p_w^0 \qquad \text{Equation 1.11}$$

Also the values of capacity and power ratios must be defined. Ten values have been established, both for capacity and power ratios, these being; 0.2 to 2.0 with an increase of 0.2.

With this information, storage capacity and power of storage may be calculated by *Equations 1.12 and 1.13*.

$$c = r_c \cdot e_w^* \qquad \textit{Equation 1.12}$$

$$p = r_p \cdot p_w^* \qquad \textit{Equation 1.13}$$

The program code that collects and calculates all these calculations and returns the different values of capacity and power of the battery, for Spanish and Italian scenarios, can be checked in sections 2.1 and 2.2 of Annex II.

As already stated, different values of capacity and power of the storage will allow to calculate the benefits under each case and scenario. These results were analyzed in GNU Octave and Microsoft Excel to finally reach the conclusions.

4. Results

As indicated in the previous section of methodology, one of the first variables to be defined is the power of the wind farm. The calculations have been made for different powers. The results obtained in the evaluation of a 4MW wind farm are shown in the following subsections and can be grouped into four blocks. These four blocks include the following information:

(i) The values of capacity (*c*) and power (*p*) of the storage. These values will be the inputs into the different codes described in the previous section, Tools and Methodology,

(ii) The revenue ratios obtained after the installation of batteries in the wind farm when the price band criteria is not considered in the energy management strategy,

(iii) Optimization of price band and

(iv) The revenue ratios in the wind farm when the price band is accounted in the strategy of energy management.

4.1. Capacity and power values from the ratios used

Once the capacity ratio (r_c) and power ratio (r_p) are established, the values of capacity and power of the storage equipment can be calculated through equations 1.12 and 1.13. A set of values large enough to draw conclusions is reached when ten different values are accounted. The values of capacity and power are derived from ratios from 0.2 to 2.0 with a lineal increment of 0.2 between them.

A data set that allows to observe the influence of the battery dimension in the total revenues is obtained. The size of the battery is varied from small sizes to significant dimensions with respect to the total dimension of wind farm. The largest size of the battery considered in the study is 51.5024 MWh of capacity and 2.1459 MW of power which correspond to the ratios equal to two. Larger battery dimensions are not considered since their relative size in comparison to the wind farm is large enough.

In the tables shown below, *Table 6* for Italian case, and *Table 7* for Spanish case, the different values of capacity and power of the battery obtained for the set of ratios are presented. *Equations 1.8 to 1.13* shown in section 3, Tools and Methodology, are used to obtain the values of capacity and power.

Table 6- Capacity and power values of the battery for different ratios. Italy

r_c	*c* [MWh]
0.2	5.1502
0.4	10.3005
0.6	15.4507
0.8	20.6010
1.0	25.7512
1.2	30.9014
1.4	36.0517
1.6	41.2019
1.8	46.3522
2.0	51.5024

r_p	*p* [MW]
0.2	0.2146
0.4	0.4292
0.6	0.6438
0.8	0.8584
1.0	1.0730
1.2	1.2876
1.4	1.5022
1.6	1.7167
1.8	1.9313
2.0	2.1459

Table 7- Capacity and power values of the battery for different ratios. Spain

r_c	*c* [MWh]
0.2	4.7210
0.4	9.4419
0.6	14.1629
0.8	18.8838
1.0	23.6048
1.2	28.3258
1.4	33.0467
1.6	37.7677
1.8	42.4886
2.0	47.2096

r_p	*p* [MW]
0.2	0.1967
0.4	0.3934
0.6	0.5901
0.8	0.7868
1.0	0.9835
1.2	1.1802
1.4	1.3769
1.6	1.5737
1.8	1.7704
2.0	1.9671

4.2. Revenue ratio without price band

In this section, a representative matrix of the revenue ratio obtained when the decision rules do not take into account a band price is presented. The price criteria without price band uses the average daily price of electricity (*mp*) and the highest daily price (*hp*) of the electricity as reference values in the decision making process. This matrix is built for three values of capacity ratio (0.2, 1.0, 2.0) and power ratio (0.2, 1.0, 2.0), and the different combinations between them for the two scenarios, Italy and Spain.

As presented in *Table 8*, for the Italian case, besides the three ratio values described in the previous paragraph, one more case has been included in the analysis. The motivation to include this extra value is the fact that this ratio provides the best revenue ratio. This optimal value is obtained through the combination of capacity ratio equal to 0.4 and power ratio equal to 2.0. The highest ratio obtained is 1.0260 which corresponds to a capacity of 10.3005 MWh and a power of 2.1459 MW of the battery.

Table 8- Revenue ratios without band prices. Italy

	r_c				
0.2	**0.4**	**1.0**	**2.0**		
1.0021	1.0017	1.0007	0.9991	**0.2**	
1.0047	1.0044	1.0033	1.0017	**0.4**	
1.0127	1.0125	1.0114	1.0097	**1.0**	r_p
1.0242	**1.0260**	1.0252	1.0233	**2.0**	

Under the Spanish scenario, the best revenue ratio is obtained when capacity ratio (r_c) takes a value of 2.0 and power ratio (r_p) equals 2.0. It corresponds to the highest value with respect to the other combinations as it can be seen in *Table 9*. The highest revenue ratio obtained is 1.0119 which corresponds to a capacity of 47.2096 MWh and a power of 1.9671 MW of the battery.

Table 9- Revenue ratios without band prices. Spain

	r_c			
0.2	**1.0**	**2.0**		
1.0010	0.9998	0.9983	**0.2**	
1.0061	1.0056	1.0040	**1.0**	r_p
1.0095	1.0130	**1.0119**	**2.0**	

4.3. Optimization of the band price

In order to define the most cost-effective energy management strategy, the definition of the optimal band price is crucial. The band price strategy consists in the modification of the value of the average daily price affected by a percentage ($\gamma_{mp} \cdot mp$), and in the creation of a band defined in its lower limit by the multiplication of a percentage of the maximum daily price ($\gamma_{hp} \cdot hp$), and in its upper limit, for the value of the maximum daily price (*hp*).

This sensitivity analysis seeks to obtain the percentage values (γ_{mp}, γ_{hp}) that, multiplied by the average daily price and the highest daily price, maximize the benefits. The study varies these percentages from 70% to 95%, with an increase of 5% for each of the cases (*mp* and *hp*), obtaining 36 values as a result of the combination of all the possibilities. Thirty-six values for each of the scenarios, Italy and Spain.

To start with the analysis, the best case of combined capacity and power ratio among those calculated without band price (see section 4.2) is chosen. The different revenue ratios (r_r) are calculated for different limit values in the decision rules.

For Italian scenario, capacity ratio equal to 0.4 and power ratio equal to 2.0 are chosen since they correspond to the best case obtained for revenue ratio without band price. In *Table 10,* all the revenue ratios for different percentages are shown.

Table 10- Revenue ratios for different percentages. Italy

	0.70·*hp* - *hp*	**0.75·*hp* - *hp***	**0.80·*hp* - *hp***	**0.85·*hp* - *hp***	**0.90·*hp* - *hp***	**0.95·*hp* - *hp***
0.70·*mp*	1.0183	1.0200	1.0219	1.0215	1.0216	1.0210
0.75·*mp*	1.0246	1.0271	1.0291	1.0289	1.0290	1.0279
0.80·*mp*	1.0315	1.0347	1.0368	1.0377	1.0367	1.0346
0.85·*mp*	1.0359	1.0395	1.0420	1.0431	1.0416	1.0386
0.90·*mp*	1.0360	1.0400	1.0435	**1.0452**	1.0438	1.0395
0.95·*mp*	1.0345	1.0379	1.0419	1.0438	1.0421	1.0381

The best revenue ratio, 1.0452, is obtained when the band price thresholds are set in; a 90% of the medium daily price (0.90·*mp*) and an 85% of the highest price day (0.85·*hp*) as the lower limit of the band.

For Spanish scenario, capacity ratio equal to 2.0 and power ratio equal to 2.0 are chosen to correspond with the best case obtained for the study of energy management without the price band criteria. In *Table 11* we can see the all the revenue ratio results obtained for different percentages.

Table 11- Revenue ratios for different percentages. Spain

	0.70·*hp* - *hp*	**0.75·*hp* - *hp***	**0.80·*hp* - *hp***	**0.85·*hp* - *hp***	**0.90·*hp* - *hp***	**0.95·*hp* - *hp***
0.70·*mp*	1.0142	1.0148	1.0157	1.0165	1.0172	1.0182
0.75·*mp*	1.0166	1.0175	1.0188	1.0200	1.0209	1.0214
0.80·*mp*	1.0187	1.0204	1.0221	1.0237	1.0245	1.0246
0.85·*mp*	1.0211	1.0228	1.0249	1.0275	1.0289	1.0270
0.90·*mp*	1.0223	1.0242	1.0269	1.0295	1.0315	1.0300
0.95·*mp*	1.0222	1.0238	1.0271	1.0302	**1.0317**	1.0299

The best revenue ratio, 1.0317, is obtained when the percentages take the following values: 95% · medium daily price (0.95·*mp*), and 90% · highest price day (0.90·*hp*) for the lower limit of the band.

4.4. Revenue ratio with band price

Once the optimal strategy to manage the energy is defined through price band, the revenue ratios with price band can be calculated. In the following, the values obtained for the indicated ratios are presented.

Table 12 shows all the revenue ratios of the different combinations between the capacity and power ratios selected above taking into account the price criteria, which for the Italian case takes these values; (0.90·*mp*) and [0.85·*hp* – *hp*].

Table 12- Revenue ratios with band price. Italy

r_c: 0.2	1.0	2.0	r_p
1.0081	1.0080	1.0080	**0.2**
1.0264	1.0360	1.0364	**1.0**
1.0303	1.0587	**1.0632**	**2.0**

From the results shown, the one that brings the greatest benefit to the wind farm is the combination of capacity ratio equal to 2.0 and power ratio equal to 2.0, leading to a value of revenue ratio of 1.0632. Obtaining thus the dimension of the battery that maximizes the benefit.

In *Table 13*, all the results obtained with the price band for the different values of capacity ratio (r_c) and power ratio (r_p) are shown. The price criteria acquires the following values; ($0.95 \cdot mp$) and [$0.90 \cdot hp - hp$] for the Spanish case.

Table 13- Revenue ratios with band price. Spain

r_c: 0.2	1.0	2.0	r_p
1.0058	1.0073	1.0080	**0.2**
1.0109	1.0202	1.0234	**1.0**
1.0107	1.0248	**1.0317**	**2.0**

The size of the battery that maximizes the benefit to the Spanish wind farm with 1.0317 of revenue ratio, is for a capacity ratio equal to 2.0 and a power ratio equal to 2.0.

5. Analysis of the results

In this section an analysis of the results presented above will be carried out to finally reach the conclusions. Two types of analysis are presented referring to the storage size; (i) one of them focuses on the dimensioning of batteries accounting for the benefits provided to the wind farm, and (ii) the other one, taking into account the Pay-Back Period (PBP) of the batteries to be installed. A summary of the best results obtained is shown in *Table 14* for Italy, and in *Table 15* for Spain.

Table 14- Summary results from Italian case

	r_r	r_c	c [MWh]	r_p	p [MW]
Without band price	1.0260	0.4	10.3005	2.0	2.1459
With band price	1.0632	2.0	51.5024	2.0	2.1459

Band price	$0.90 \cdot mp$	$0.85 \cdot hp - hp$

Table 14 shows the dimensions of the batteries and their corresponding ratios referred to the cases in which a greater benefit is obtained for the two existing price criteria and the percentages used to define the price band that maximizes the benefit of the wind farm.

Table 15- Summary results from Spanish case

	r_r	r_c	c [MWh]	r_p	p [MW]
Without band price	1.0119	2.0	47.2096	2.0	1.9671
With band price	1.0317	2.0	47.2096	2.0	1.9671

Band price	0.95 · *mp*	0.90 · *hp* - *hp*

The dimensions of the batteries and their corresponding ratios referred to cases that maximize the benefits generated by the wind farm are shown in *Table 15*, both for the price criteria. For both scenarios, it may be seen that the revenue ratio is higher when the band price is included in the analysis than when energy is managed without it. The benefit is simply increased by making an optimal management of the energy produced. Therefore, we will focus on this case, since it is the best one among all of them.

Once the sizing of the batteries that maximize the benefit of the wind farm is known, the cost of batteries with those characteristics and their viability for the scenarios, Italian and Spanish, must be considered.

The total cost of Li-ion batteries it is usually divided in two costs; the capacity-related cost ($c_{st,c}$) and the power-related cost ($c_{st,p}$). Capacity-related cost usually accounts for operational and maintenance costs. Since they are related with the amount of final product (electricity kWh). Power-related cost is the so-called investment cost and it is related to the size of the system.

The data used for this study are the average values of [19], taking the following values: capacity-related cost ($c_{st,c}$) equal to 755 €/kWh and power-related cost ($c_{st,p}$) equal to 465 €/kW.

The total cost of the storage ($c_{st,total}$) can be calculated for any combination of capacity (c) and power (p) of the battery *(Eq. 1.14)*:

$$c_{st,total} = c_{st,c} \cdot c + c_{st,p} \cdot p \qquad \text{Equation 1.14}$$

Through of *Eq. 1.14* and selecting the case with the highest benefit, the cost of batteries is calculated. In this way, an approximate cost of 39.9 M€ for the Italian case and 36.6 M€ for the Spanish case are obtained.

Finally, Pay-Back Period (PBP) can be evaluated with *Eq. 1.15.* The lifetime of the battery will be a crucial factor for learning whether this techno-economical solution is viable or not.

$$PBP = \frac{c_{st,total}}{r_{st}} \qquad \text{Equation 1.15}$$

The PBP is calculated without considering the time-value of the money. With this formulation, the PBP always overestimates the investment viability. Hence, in the case of negative response, no further analysis is required. Therefore, this approximation yields a simple and fast criterion to identify the storage sizes that are not profitable or those, on the contrary, that could be feasible.

For the storage life-time, a useful life of a period of 5-15 years is commonly reported in literature [20][4][21][22][23], depending on the strategy of storage management and the number of complete and incomplete charge and discharge cycles of the battery. In this study, 10 years of useful life of the battery is considered since it corresponds to the average value between the maximum and minimum found in literature.

5.1. Optimum size of batteries according to benefit

In this subsection, the feasibility of installing the batteries for the values of capacity (c) and power (p) that make reference to capacity and power ratios equal to 2.0 will be analyzed. This size of the Li-ion batteries has been selected since this factor strongly contributes to increase the benefits of the wind farm, both for the Italian and Spanish cases.

For the Italian case, with the size of battery of 2.1459 MW, the benefits obtained from the sale of stored energy (r_{st}) are 89,116.00 €/year. With this value and the estimated cost of the battery, we calculate in the *Eq. 1.16* the estimated pay-back period.

$$PBP_{IT} = \frac{39{,}882{,}171.00\ €}{89{,}116.00\ €/\text{year}} = 447.53 \text{ years} \sim 448 \text{ years} \qquad \textit{Equation 1.16}$$

As we can see, PBP_{IT} is higher than the storage life-time. Therefore we can conclude that for this battery size, the study in the Italian scenario is not economically viable.

With the size of battery of 1.9671 MW, the benefits obtained from the sale of stored energy (r_{st}) are 76,828.00 €/year for the Spanish case. With this value and the estimated cost of the battery calculated, may be obtained through *Eq. 1.17* the estimated PBP for this storage size.

$$\text{PBP}_{\text{SP}} = \frac{36{,}557{,}949.50\ €}{76{,}828.00\ €/\text{year}} = 475.84 \text{ years} \sim 476 \text{ years} \qquad \textit{Equation 1.17}$$

As in the previous case, the value of the PBP_{SP} is higher than the storage life-time. Thus the study is not viable for this battery size under the Spanish scenario.

5.2. Optimum size of batteries according to their Pay-Back Period

In this section, the possibility of installing batteries according to the PBP of their investment is analysed.

The PBP shows a dependence on the cost of the battery and the generated benefit (*Eq. 1.15*). In turn, the cost is formed by two items, the capacity item and the power item (*Eq. 1.14*). The most important cost is the one related to capacity because the price of MWh is very high. For this reason, a first analysis will be carried out for the lowest of the capacity ratios, having a value of 0.2, since it leads to an important reduction of the cost. And therefore, the storage amortization period will be also reduced. This analysis will consider ten different values of power ratio (r_p) and keeping capacity ratio (r_c) constant. The benefits obtained from the sale of energy produced will be taken for the case in which the energy is managed with price band since, as noted above, it generates a greater benefit for the wind farm.

If the results obtained are positive, the study will be expanded to analyze in which cases it is viable. Otherwise, the study would end at this point because if it is not viable with the lowest possible cost, it will not be for higher costs.

In *Table 16* we can see the different PBP obtained for the Italian case by varying power ratio (r_p) and keeping constant capacity ratio (r_c).

Table 16- PBP when capacity ratio (r_c) is constant and power ratio (r_p) variable. Italy

	***PBP* [years]**									
r_c \ r_p	**0.2**	**0.4**	**0.6**	**0.8**	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**
0.2	312	177	137	121	114	111	110	110	111	112

Analyzing the obtained results, all the values are above the useful life of the battery, established in 10 years. Therefore, we can conclude that the installation of batteries in this wind farm is not feasible according to their useful life.

The results obtained for the Spanish case are shown in *Table 17*, in which capacity ratio (r_c) is constant and varies power ratio (r_p).

Table 17- PBP when capacity ratio (r_c) is constant and power ratio (r_p) variable. Spain

	***PBP* [years]**									
r_c \ r_p	**0.2**	**0.4**	**0.6**	**0.8**	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**
0.2	235	161	140	133	130	131	132	134	136	139

From obtained results in this analysis, the most feasible PBP would be the case when capacity ratio is equal to 0.2 and power ratio equal to 1.0. Although, it acquires a value much higher than the useful life of the batteries, so the non-viability of this study is also assumed.

5.3. Validation of the code

In this section the codes are analyzed with support of two histograms, one for the Spanish case and one for the Italian case. With them, the operation of the batteries can be observed to understand if all the decisions previously defined are properly taken and therefore the problem of the feasibility of this project is the cost of storage and not the criterion of action.

In *Figure 6* and in *Figure 7*, Italy and Spain respectively, it is seen the variation of the battery level in relation to the variation of the energy price in the market.

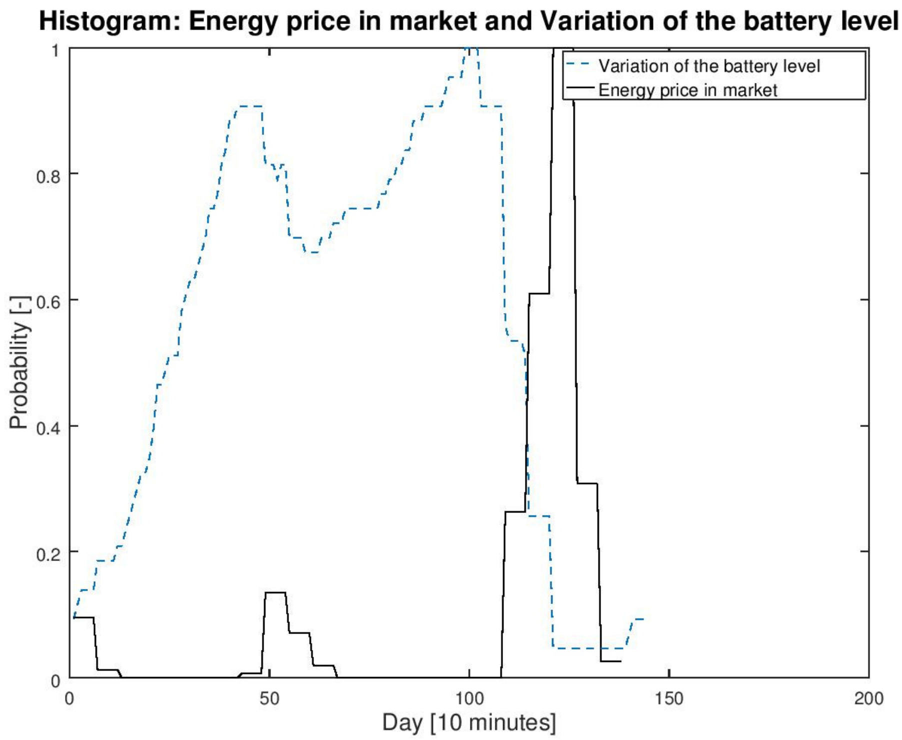

Figure 6- Histogram: Energy price in market and Variation of the battery level. Italy

Figure 6 shows the variation of the battery level (dashed line), in the case in which the ratio size of the battery are 2.0 for capacity and power ratios, together with the variation in the price of energy (solid line), which is only reflected in the graphic when the conditions established for the sale of stored energy with band price are met.

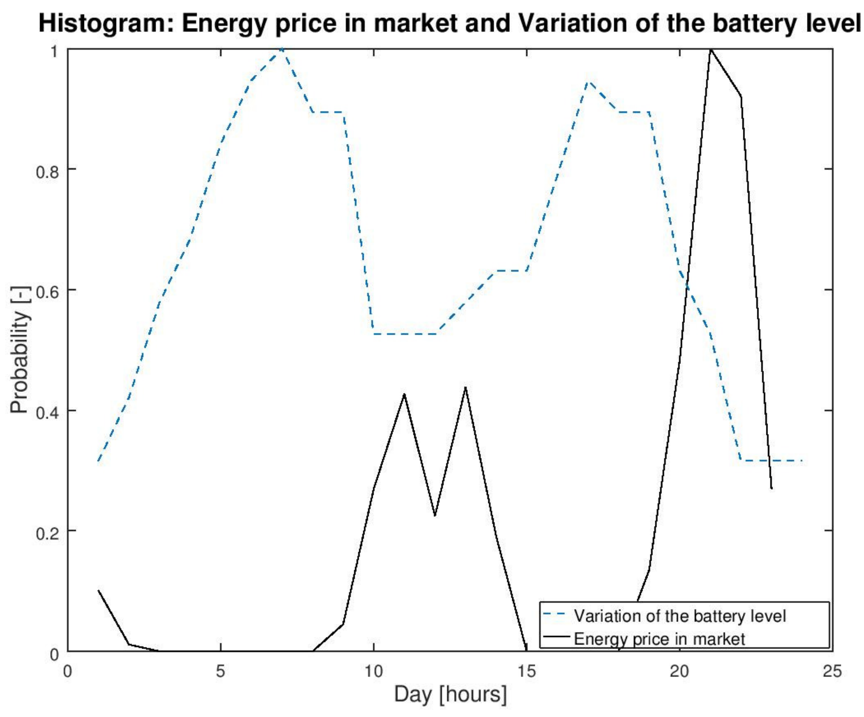

Figure 7- Histogram: Energy price in market and Variation of the battery level. Spain

In the histogram of *Figure 7*, the variation that occurs at the storage level (dashed line) for a ratio equal to 2.0 for capacity and power ratios can be observed. The level of storage decreases when the price of energy (solid line) is high, complying with the criterion of the sale of stored energy for the Spanish case.

The correct response of the code may be observed in both scenarios since when the price of energy reaches values that are within the selection criteria, the sale of the energy stored in the battery decreases its level. Therefore, the problem of the feasibility of this study lies in the price of Li-ion batteries and not in the decision rules that have been defined.

6. Conclusions

Throughout the document, partial results have been presented for the Italian and Spanish scenarios, which have led to a common final conclusion. A brief summary of these partial conclusions that have been acquired is made here.

This Master Thesis had two main objectives; (i) to adequately manage the energy produced by the wind turbine of a wind farm with the help of storage of lithium-ion batteries, and (ii) to size these batteries to achieve an increase in the profits obtained from the sale of electricity produced to the market, by studying the viability in its implementation.

Initially, the optimization of the size of the battery is based in an energy management strategy, called price criteria without band, which makes use of two fixed values per day as a criterion: the average daily price of energy (*mp*) and the highest energy price of the day (*hp*). Electricity sale or storage occurs depending on these static values. For this strategy of energy management, under the Italian scenario, the best result of revenue ratio is 1.0260, which was obtained when capacity ratio is equal to 0.4 and power ratio equal 2.0. Under these ratios, the battery has the following dimensions: 10.3005 MWh of capacity and 2.1459 MW for power. Under the Spanish scenario, the best result of revenue ratio is 1.0119, which was obtained when the dimensions of the battery are 47.2096 MWh of capacity and 1.9671 MW of power, with the corresponding capacity ratio equal to 2.0 and power ratio equal to 2.0.

Then, the consequence of modifying those daily fixed values in the price of energy is studied with a new criterion called, 'Price criteria with band', to detect if the benefit of the sale of energy is modified. The conclusion was positive; when applying a high percentage (90% for the Italian case and 95% for the Spanish) to the average daily price ($\gamma_{mp} \cdot mp$), and creating a band with the highest daily energy price [$\gamma_{hp} \cdot hp$ - hp], being the value of this percentage 85% for the Italian case and 90% for the Spanish, the wind farm acquired the maximum benefit. The dimensions of the battery for the Italian case are 51.5024 MWh of capacity and 2.1459 MW of power, corresponding both capacity and power ratios to 2.0, and obtaining an increase in the revenue ratio of 0.0372 with respect to the energy management without the criterion of price criteria. For Spanish case, the dimension of the storage is 47.2096MWh for capacity and 1.9671 MW for power, corresponding to capacity and power ratio equal to 2.0, and getting an increase of the benefit of 0.0198 points on the value of revenue ratio without price criteria.

In response to this final conclusion related to energy management, the price criteria with band was taken for the following partial studies. The optimal storage size was calculated for two different criteria, one of them taking into account the size of the battery that provides the greatest benefit to the wind farm, and the other, calculating the size of the battery based only on the pay-back period and looking for that combination of values capacity ratio and power ratio that caused its amortization to be below its useful life. The result of both studies points out the non-feasibility of the project because the pay-back period is higher than the useful life of the batteries, 10 years. According to the verification of the code created and its execution, the problem of this study is the cost of batteries being very high, especially the item that refers to capacity. According to the results obtained throughout the project (*Table 12* and *13*), the best results are obtained with high values of capacity and storage power. The important cost of batteries arises when dimensioning capacity. Bearing this in mind and with the objective of reducing investment to maximize economic performance, it is interesting to reduce capacity sizing and maximize power, which will help us to manage energy more quickly, meeting established criteria and increase the total benefit of the wind farm.

7. Future work

Different possible lines of future work have been identified as potential continuity of the present study. Since this Master Thesis is related to the storage of electrical energy produced with renewable energies, future studies will focused on this direction.

The first of these lines would imply the (i) review of this study under a new scenario in which the prices of Li-ion batteries decrease and the assessment of the feasibility of the project under these new conditions.

Another possible field of research in accordance with the developed work would be the (ii) same study developed for companies producing and commercializing electric power, but extrapolated to another type of non-dispatchable renewable energy, such as solar.

The last proposed line for further research would imply the study of (iii) the management of energy produced by renewable sources not according to the maximization of the benefit as in this case, but according to the overproduction. This overproduction of electricity could be motivated either by an excess of "uncontrollable" production for the case of solar, or produced as a consequence of the values of yield for the case of biomass.

Nomenclature

Acronyms

DOD	Depth of discharge level
GME	Gestore Mercati Energetici
OMIP	Operador del Mercado Ibérico de Energía – Polo Portugués
PBP	Payback Period
PBP_{IT}	Payback Period Italian scenario
PBP_{SP}	Payback Period Spanish scenario
PBP	Photovoltaic Geographical Information System

Variables

c	Capacity of the storage [MWh]
C_p	Power coefficient [-]
$c_{st,c}$	Capacity-related cost [€/kWh]
$c_{st,p}$	Power-related cost [€/kW]
$c_{st,total}$	Total purchasing and installation cost of the storage [€]
D_1	Set of data from Italy
D_2	Set of data from Spain
e	Energy produced by the wind turbine [kJ]
e_w^*	Average daily energy for an established wind farm power [MWh]
e_w^{*0}	Average daily energy for a wind farm power of 2 MW [MWh]
hp	Highest energy price of the day [€/MWh]
mp	Average daily price of energy [€/MWh]
p	Power of the storage [MW]
p_m	Power of the wind turbine [kW]
p_e	Electricity prices [€/MWh]
p_w	Power of the wind farm [MW]
p_w^*	Average daily power for an established wind farm power [MW]

p_w^{0}	Power of the wind farm when is equal 2 MW [MW]
p_w^{*0}	Average daily power for a wind farm power of 2 MW [MW]
R	Quadratic variable [-]
r_c	Capacity ratio [-]
r_p	Power ratio [-]
r_r	Revenue ratio [-]
r_{st}	Benefit with the sale of stored energy [-]
T	Absolute temperature at the altitude z [K]
t	Time [hours]
v_W	Wind velocity [m/s]
$v_{W,\ real}$	Estimated real velocity of the wind considering the density of the air [m/s]
v_0	Velocity of the wind at z_0. [m/s]
v_1	Velocity of the wind at z_1. [m/s]
x	Values of v_w for different x points [m/s]
z	Height over sea level to which the calculation is performed [m]
z_0	Height at point zero [m]
z_1	Height at point one [m]

Greek letters

α	Wind shear exponent [-]
α^*	Coefficient [hours]
β	Coefficient [-]
ρ	Air density at altitude z and at temperature T [kg/m^3]
$\rho_{machine}$	Air density to which the experimental data of the wind turbine have been taken [kg/m^3]
ρ_0	Air density of one particular case [kg/m^3]
γ_{hp}	Percentage applied to hp [%]
γ_{mp}	Percentage applied to mp [%]

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ANNEXES

ANNEX I. SET OF AVAILABLE DATA

A small but representative group of the data used in the calculations of the Italian and Spanish cases are presented in Annex I. The methodology used to obtain these values has been described in Section 2 - Data sources and treatment - of the document.

1. Set of Italian data – D_1

The set of data from Italy (D_1), specifically from the south of Italy, includes the wind velocity [m/s] in a location facility of an electricity generation company that for privacy reasons I can't reveal the name. These values were collected at 50 meters height and every ten minutes. Electricity prices used in the study of the Italian case correspond to those in the south of Italy. Hourly values of electricity price in the south region are taken from Gestore Mercato Elettrico (GME) and expressed in €/MWh [13]. Since the acquisition frequency of wind velocity data is ten minutes, electricity prices will be required in the same time discrete points to operate with the pair of values. As already mentioned, electricity prices are gathered each hour, thus these data must be treated to match the time discretization of velocity data. In order to provide the same number of discrete data and given the fact that electricity prices within the hour are considered constant, six equal values of electricity price are considered every ten minutes in the period of a specific hour.

A 5% of the values used for the development of Italian case of this study are presented in the following table, *Table AI.1*, as a sample.

Table AI. 1. Set of Italian data – D_1

Time	v_w [m/s]	v_w at 98m [m/s]	v_w real [m/s]	p_m [kW]	e [kJ]	p_e [h/MWh]
0:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	38.56
0:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	38.56
0:20	6.1	6.9320	7.0202	5.71E+02	3.43E+05	38.56
0:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	38.56
0:40	8.4	9.5457	9.6672	1.39E+03	8.35E+05	38.56
0:50	9.1	10.3412	10.4728	1.67E+03	1.00E+06	38.56
1:00	9.2	10.4548	10.5878	1.71E+03	1.03E+06	32.50
1:10	10	11.3639	11.5085	2.00E+03	1.20E+06	32.50
1:20	9.2	10.4548	10.5878	1.71E+03	1.03E+06	32.50
1:30	8.9	10.1139	10.2426	1.59E+03	9.56E+05	32.50
1:40	8.5	9.6593	9.7822	1.43E+03	8.59E+05	32.50
1:50	7.2	8.1820	8.2861	9.32E+02	5.59E+05	32.50
2:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	31.46
2:10	6.1	6.9320	7.0202	5.71E+02	3.43E+05	31.46
2:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	31.46
2:30	7.2	8.1820	8.2861	9.32E+02	5.59E+05	31.46
2:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	31.46
2:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	31.46
3:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	29.14
3:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	29.14
3:20	6.2	7.0456	7.1353	6.01E+02	3.61E+05	29.14
3:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	29.14
3:40	6.4	7.2729	7.3655	6.62E+02	3.97E+05	29.14

3:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	29.14
4:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	30.55
4:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	30.55
4:20	6.3	7.1593	7.2504	6.31E+02	3.79E+05	30.55
4:30	6.4	7.2729	7.3655	6.62E+02	3.97E+05	30.55
4:40	5.3	6.0229	6.0995	3.61E+02	2.16E+05	30.55
4:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	30.55
5:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	33.33
5:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	33.33
5:20	9.8	11.1367	11.2784	1.95E+03	1.17E+06	33.33
5:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	33.33
5:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	33.33
5:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	33.33
6:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	44.97
6:10	3.3	3.7501	3.7978	5.09E+01	3.05E+04	44.97
6:20	3.7	4.2047	4.2582	8.84E+01	5.31E+04	44.97
6:30	4.3	4.8865	4.9487	1.67E+02	1.00E+05	44.97
6:40	3.9	4.4319	4.4883	1.12E+02	6.69E+04	44.97
6:50	3.8	4.3183	4.3732	9.96E+01	5.98E+04	44.97
7:00	3.7	4.2047	4.2582	8.84E+01	5.31E+04	54.55
7:10	4.7	5.3410	5.4090	2.35E+02	1.41E+05	54.55
7:20	3.9	4.4319	4.4883	1.12E+02	6.69E+04	54.55
7:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	54.55
7:40	3.9	4.4319	4.4883	1.12E+02	6.69E+04	54.55
7:50	2.4	2.7273	2.7620	4.92E+00	2.95E+03	54.55
8:00	2.5	2.8410	2.8771	7.68E+00	4.61E+03	46.00
8:10	3	3.4092	3.4526	3.00E+01	1.80E+04	46.00
8:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	46.00
8:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	46.00
8:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	46.00
8:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	46.00
9:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	40.00
9:10	2.6	2.9546	2.9922	1.10E+01	6.59E+03	40.00
9:20	3.9	4.4319	4.4883	1.12E+02	6.69E+04	40.00
9:30	2.9	3.2955	3.3375	2.43E+01	1.46E+04	40.00
9:40	2.4	2.7273	2.7620	4.92E+00	2.95E+03	40.00
9:50	2.4	2.7273	2.7620	4.92E+00	2.95E+03	40.00
10:00	2.4	2.7273	2.7620	4.92E+00	2.95E+03	37.38
10:10	2.6	2.9546	2.9922	1.10E+01	6.59E+03	37.38
10:20	2	2.2728	2.3017	0.00E+00	0.00E+00	37.38
10:30	2.5	2.8410	2.8771	7.68E+00	4.61E+03	37.38
10:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	37.38
10:50	3.9	4.4319	4.4883	1.12E+02	6.69E+04	37.38
11:00	4.8	5.4547	5.5241	2.54E+02	1.52E+05	32.50
11:10	5.2	5.9092	5.9844	3.38E+02	2.03E+05	32.50

11:20	5.7	6.4774	6.5599	4.60E+02	2.76E+05	32.50
11:30	4.3	4.8865	4.9487	1.67E+02	1.00E+05	32.50
11:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	32.50
11:50	3.6	4.0910	4.1431	7.80E+01	4.68E+04	32.50
12:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	32.50
12:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	32.50
12:20	6	6.8184	6.9051	5.42E+02	3.25E+05	32.50
12:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	32.50
12:40	3.1	3.5228	3.5676	3.63E+01	2.18E+04	32.50
12:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	32.50
13:00	4	4.5456	4.6034	1.24E+02	7.46E+04	32.50
13:10	9	10.2275	10.3577	1.63E+03	9.80E+05	32.50
13:20	8.9	10.1139	10.2426	1.59E+03	9.56E+05	32.50
13:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	32.50
13:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	32.50
13:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	32.50
14:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	33.00
14:10	5.2	5.9092	5.9844	3.38E+02	2.03E+05	33.00
14:20	3.2	3.6365	3.6827	4.33E+01	2.60E+04	33.00
14:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	33.00
14:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	33.00
14:50	4.3	4.8865	4.9487	1.67E+02	1.00E+05	33.00
15:00	4.2	4.7729	4.8336	1.52E+02	9.12E+04	37.00
15:10	3.2	3.6365	3.6827	4.33E+01	2.60E+04	37.00
15:20	2.8	3.1819	3.2224	1.93E+01	1.16E+04	37.00
15:30	4.9	5.5683	5.6392	2.74E+02	1.64E+05	37.00
15:40	2.4	2.7273	2.7620	4.92E+00	2.95E+03	37.00
15:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	37.00
16:00	3.2	3.6365	3.6827	4.33E+01	2.60E+04	40.90
16:10	4.4	5.0001	5.0638	1.83E+02	1.10E+05	40.90
16:20	3.1	3.5228	3.5676	3.63E+01	2.18E+04	40.90
16:30	3.6	4.0910	4.1431	7.80E+01	4.68E+04	40.90
16:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	40.90
16:50	5	5.6820	5.7543	2.94E+02	1.76E+05	40.90
17:00	4	4.5456	4.6034	1.24E+02	7.46E+04	46.67
17:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	46.67
17:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	46.67
17:30	2.7	3.0683	3.1073	1.49E+01	8.91E+03	46.67
17:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	46.67
17:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	46.67
18:00	3.8	4.3183	4.3732	9.96E+01	5.98E+04	48.34
18:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	48.34
18:20	4	4.5456	4.6034	1.24E+02	7.46E+04	48.34
18:30	3.2	3.6365	3.6827	4.33E+01	2.60E+04	48.34
18:40	3.1	3.5228	3.5676	3.63E+01	2.18E+04	48.34

18:50	5.4	6.1365	6.2146	3.84E+02	2.31E+05	48.34
19:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	52.50
19:10	3.9	4.4319	4.4883	1.12E+02	6.69E+04	52.50
19:20	2.6	2.9546	2.9922	1.10E+01	6.59E+03	52.50
19:30	4.5	5.1138	5.1788	1.99E+02	1.20E+05	52.50
19:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	52.50
19:50	2.3	2.6137	2.6470	2.66E+00	1.60E+03	52.50
20:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	50.82
20:10	3.1	3.5228	3.5676	3.63E+01	2.18E+04	50.82
20:20	2	2.2728	2.3017	0.00E+00	0.00E+00	50.82
20:30	2	2.2728	2.3017	0.00E+00	0.00E+00	50.82
20:40	2	2.2728	2.3017	0.00E+00	0.00E+00	50.82
20:50	2.1	2.3864	2.4168	0.00E+00	0.00E+00	50.82
21:00	2.7	3.0683	3.1073	1.49E+01	8.91E+03	48.74
21:10	3.8	4.3183	4.3732	9.96E+01	5.98E+04	48.74
21:20	2.8	3.1819	3.2224	1.93E+01	1.16E+04	48.74
21:30	2	2.2728	2.3017	0.00E+00	0.00E+00	48.74
21:40	2.7	3.0683	3.1073	1.49E+01	8.91E+03	48.74
21:50	3.3	3.7501	3.7978	5.09E+01	3.05E+04	48.74
22:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	44.14
22:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	44.14
22:20	2	2.2728	2.3017	0.00E+00	0.00E+00	44.14
22:30	2.2	2.5001	2.5319	8.96E-01	5.38E+02	44.14
22:40	2.5	2.8410	2.8771	7.68E+00	4.61E+03	44.14
22:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	44.14
23:00	4.3	4.8865	4.9487	1.67E+02	1.00E+05	42.00
23:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	42.00
23:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	42.00
23:30	4.5	5.1138	5.1788	1.99E+02	1.20E+05	42.00
23:40	4.6	5.2274	5.2939	2.17E+02	1.30E+05	42.00
23:50	4.4	5.0001	5.0638	1.83E+02	1.10E+05	42.00
0:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	43.45
0:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	43.45
0:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	43.45
0:30	6	6.8184	6.9051	5.42E+02	3.25E+05	43.45
0:40	6	6.8184	6.9051	5.42E+02	3.25E+05	43.45
0:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	43.45
1:00	6.9	7.8411	7.9409	8.27E+02	4.96E+05	40.51
1:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	40.51
1:20	7.5	8.5229	8.6314	1.04E+03	6.25E+05	40.51
1:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	40.51
1:40	8.2	9.3184	9.4370	1.31E+03	7.88E+05	40.51
1:50	7.8	8.8639	8.9767	1.16E+03	6.94E+05	40.51
2:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	38.27
2:10	7	7.9548	8.0560	8.61E+02	5.17E+05	38.27

2:20	7.6	8.6366	8.7465	1.08E+03	6.48E+05	38.27
2:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	38.27
2:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	38.27
2:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	38.27
3:00	6.9	7.8411	7.9409	8.27E+02	4.96E+05	36.93
3:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	36.93
3:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	36.93
3:30	8.4	9.5457	9.6672	1.39E+03	8.35E+05	36.93
3:40	7.8	8.8639	8.9767	1.16E+03	6.94E+05	36.93
3:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	36.93
4:00	7.8	8.8639	8.9767	1.16E+03	6.94E+05	38.26
4:10	7.5	8.5229	8.6314	1.04E+03	6.25E+05	38.26
4:20	7	7.9548	8.0560	8.61E+02	5.17E+05	38.26
4:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	38.26
4:40	6.3	7.1593	7.2504	6.31E+02	3.79E+05	38.26
4:50	6.3	7.1593	7.2504	6.31E+02	3.79E+05	38.26
5:00	7	7.9548	8.0560	8.61E+02	5.17E+05	42.00
5:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	42.00
5:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	42.00
5:30	6.9	7.8411	7.9409	8.27E+02	4.96E+05	42.00
5:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	42.00
5:50	8.3	9.4321	9.5521	1.35E+03	8.11E+05	42.00
6:00	9.3	10.5685	10.7029	1.75E+03	1.05E+06	50.00
6:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	50.00
6:20	9.8	11.1367	11.2784	1.95E+03	1.17E+06	50.00
6:30	9.5	10.7957	10.9331	1.83E+03	1.10E+06	50.00
6:40	9.4	10.6821	10.8180	1.79E+03	1.08E+06	50.00
6:50	9.5	10.7957	10.9331	1.83E+03	1.10E+06	50.00
7:00	8.6	9.7730	9.8973	1.47E+03	8.83E+05	50.00
7:10	8.9	10.1139	10.2426	1.59E+03	9.56E+05	50.00
7:20	10	11.3639	11.5085	2.00E+03	1.20E+06	50.00
7:30	10.4	11.8185	11.9689	2.00E+03	1.20E+06	50.00
7:40	10.7	12.1594	12.3141	2.00E+03	1.20E+06	50.00
7:50	10	11.3639	11.5085	2.00E+03	1.20E+06	50.00
8:00	9.1	10.3412	10.4728	1.67E+03	1.00E+06	49.10
8:10	9.4	10.6821	10.8180	1.79E+03	1.08E+06	49.10
8:20	9.2	10.4548	10.5878	1.71E+03	1.03E+06	49.10
8:30	9.3	10.5685	10.7029	1.75E+03	1.05E+06	49.10
8:40	9.6	10.9094	11.0482	1.87E+03	1.12E+06	49.10
8:50	9.8	11.1367	11.2784	1.95E+03	1.17E+06	49.10
9:00	9.2	10.4548	10.5878	1.71E+03	1.03E+06	46.00
9:10	9.4	10.6821	10.8180	1.79E+03	1.08E+06	46.00
9:20	9.4	10.6821	10.8180	1.79E+03	1.08E+06	46.00
9:30	9.6	10.9094	11.0482	1.87E+03	1.12E+06	46.00
9:40	9	10.2275	10.3577	1.63E+03	9.80E+05	46.00

9:50	9.7	11.0230	11.1633	1.91E+03	1.14E+06	46.00
10:00	8.8	10.0003	10.1275	1.55E+03	9.32E+05	45.00
10:10	7.5	8.5229	8.6314	1.04E+03	6.25E+05	45.00
10:20	7.6	8.6366	8.7465	1.08E+03	6.48E+05	45.00
10:30	8.1	9.2048	9.3219	1.27E+03	7.64E+05	45.00
10:40	7.5	8.5229	8.6314	1.04E+03	6.25E+05	45.00
10:50	7.8	8.8639	8.9767	1.16E+03	6.94E+05	45.00
11:00	8	9.0911	9.2068	1.23E+03	7.40E+05	44.00
11:10	6.7	7.6138	7.7107	7.59E+02	4.55E+05	44.00
11:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	44.00
11:30	4.1	4.6592	4.7185	1.38E+02	8.26E+04	44.00
11:40	3.3	3.7501	3.7978	5.09E+01	3.05E+04	44.00
11:50	5.4	6.1365	6.2146	3.84E+02	2.31E+05	44.00
12:00	5.4	6.1365	6.2146	3.84E+02	2.31E+05	43.00
12:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	43.00
12:20	5.1	5.7956	5.8693	3.15E+02	1.89E+05	43.00
12:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	43.00
12:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	43.00
12:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	43.00
13:00	3.8	4.3183	4.3732	9.96E+01	5.98E+04	42.16
13:10	4.3	4.8865	4.9487	1.67E+02	1.00E+05	42.16
13:20	5.3	6.0229	6.0995	3.61E+02	2.16E+05	42.16
13:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	42.16
13:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	42.16
13:50	6.1	6.9320	7.0202	5.71E+02	3.43E+05	42.16
14:00	6.6	7.5002	7.5956	7.26E+02	4.36E+05	42.16
14:10	6.1	6.9320	7.0202	5.71E+02	3.43E+05	42.16
14:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	42.16
14:30	6.4	7.2729	7.3655	6.62E+02	3.97E+05	42.16
14:40	5	5.6820	5.7543	2.94E+02	1.76E+05	42.16
14:50	4	4.5456	4.6034	1.24E+02	7.46E+04	42.16
15:00	4.3	4.8865	4.9487	1.67E+02	1.00E+05	42.17
15:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	42.17
15:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	42.17
15:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	42.17
15:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	42.17
15:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	42.17
16:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	45.00
16:10	7.5	8.5229	8.6314	1.04E+03	6.25E+05	45.00
16:20	8.6	9.7730	9.8973	1.47E+03	8.83E+05	45.00
16:30	8.2	9.3184	9.4370	1.31E+03	7.88E+05	45.00
16:40	7.4	8.4093	8.5163	1.01E+03	6.03E+05	45.00
16:50	7.5	8.5229	8.6314	1.04E+03	6.25E+05	45.00
17:00	7.3	8.2957	8.4012	9.69E+02	5.81E+05	52.00
17:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	52.00

17:20	6.7	7.6138	7.7107	7.59E+02	4.55E+05	52.00
17:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	52.00
17:40	5.5	6.2502	6.3297	4.09E+02	2.45E+05	52.00
17:50	5.5	6.2502	6.3297	4.09E+02	2.45E+05	52.00
18:00	5.8	6.5911	6.6749	4.87E+02	2.92E+05	53.05
18:10	5.6	6.3638	6.4448	4.34E+02	2.60E+05	53.05
18:20	5.8	6.5911	6.6749	4.87E+02	2.92E+05	53.05
18:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	53.05
18:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	53.05
18:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	53.05
19:00	5.5	6.2502	6.3297	4.09E+02	2.45E+05	53.03
19:10	5.2	5.9092	5.9844	3.38E+02	2.03E+05	53.03
19:20	4.9	5.5683	5.6392	2.74E+02	1.64E+05	53.03
19:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	53.03
19:40	3.5	3.9774	4.0280	6.82E+01	4.09E+04	53.03
19:50	4	4.5456	4.6034	1.24E+02	7.46E+04	53.03
20:00	3	3.4092	3.4526	3.00E+01	1.80E+04	53.03
20:10	2.6	2.9546	2.9922	1.10E+01	6.59E+03	53.03
20:20	3.1	3.5228	3.5676	3.63E+01	2.18E+04	53.03
20:30	3.6	4.0910	4.1431	7.80E+01	4.68E+04	53.03
20:40	3.3	3.7501	3.7978	5.09E+01	3.05E+04	53.03
20:50	3.8	4.3183	4.3732	9.96E+01	5.98E+04	53.03
21:00	3.6	4.0910	4.1431	7.80E+01	4.68E+04	52.49
21:10	3.4	3.8637	3.9129	5.92E+01	3.55E+04	52.49
21:20	2.4	2.7273	2.7620	4.92E+00	2.95E+03	52.49
21:30	3.6	4.0910	4.1431	7.80E+01	4.68E+04	52.49
21:40	4	4.5456	4.6034	1.24E+02	7.46E+04	52.49
21:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	52.49
22:00	3.7	4.2047	4.2582	8.84E+01	5.31E+04	48.77
22:10	3.6	4.0910	4.1431	7.80E+01	4.68E+04	48.77
22:20	2.9	3.2955	3.3375	2.43E+01	1.46E+04	48.77
22:30	2.3	2.6137	2.6470	2.66E+00	1.60E+03	48.77
22:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	48.77
22:50	3.3	3.7501	3.7978	5.09E+01	3.05E+04	48.77
23:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	44.75
23:10	3.1	3.5228	3.5676	3.63E+01	2.18E+04	44.75
23:20	2.2	2.5001	2.5319	8.96E-01	5.38E+02	44.75
23:30	2	2.2728	2.3017	0.00E+00	0.00E+00	44.75
23:40	2.1	2.3864	2.4168	0.00E+00	0.00E+00	44.75
23:50	3.6	4.0910	4.1431	7.80E+01	4.68E+04	44.75
0:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	41.56
0:10	2.7	3.0683	3.1073	1.49E+01	8.91E+03	41.56
0:20	2	2.2728	2.3017	0.00E+00	0.00E+00	41.56
0:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	41.56
0:40	4.4	5.0001	5.0638	1.83E+02	1.10E+05	41.56

0:50	5.4	6.1365	6.2146	3.84E+02	2.31E+05	41.56
1:00	5.3	6.0229	6.0995	3.61E+02	2.16E+05	39.29
1:10	5.3	6.0229	6.0995	3.61E+02	2.16E+05	39.29
1:20	5.4	6.1365	6.2146	3.84E+02	2.31E+05	39.29
1:30	5.3	6.0229	6.0995	3.61E+02	2.16E+05	39.29
1:40	5.3	6.0229	6.0995	3.61E+02	2.16E+05	39.29
1:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	39.29
2:00	5.3	6.0229	6.0995	3.61E+02	2.16E+05	37.76
2:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	37.76
2:20	3	3.4092	3.4526	3.00E+01	1.80E+04	37.76
2:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	37.76
2:40	2.2	2.5001	2.5319	8.96E-01	5.38E+02	37.76
2:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	37.76
3:00	2.1	2.3864	2.4168	0.00E+00	0.00E+00	37.48
3:10	2	2.2728	2.3017	0.00E+00	0.00E+00	37.48
3:20	2.8	3.1819	3.2224	1.93E+01	1.16E+04	37.48
3:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	37.48
3:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	37.48
3:50	3.9	4.4319	4.4883	1.12E+02	6.69E+04	37.48
4:00	3.8	4.3183	4.3732	9.96E+01	5.98E+04	36.61
4:10	3.1	3.5228	3.5676	3.63E+01	2.18E+04	36.61
4:20	2.6	2.9546	2.9922	1.10E+01	6.59E+03	36.61
4:30	3.4	3.8637	3.9129	5.92E+01	3.55E+04	36.61
4:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	36.61
4:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	36.61
5:00	3.2	3.6365	3.6827	4.33E+01	2.60E+04	37.00
5:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	37.00
5:20	4.6	5.2274	5.2939	2.17E+02	1.30E+05	37.00
5:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	37.00
5:40	4.6	5.2274	5.2939	2.17E+02	1.30E+05	37.00
5:50	5.3	6.0229	6.0995	3.61E+02	2.16E+05	37.00
6:00	5.3	6.0229	6.0995	3.61E+02	2.16E+05	41.00
6:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	41.00
6:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	41.00
6:30	5.9	6.7047	6.7900	5.14E+02	3.08E+05	41.00
6:40	5.2	5.9092	5.9844	3.38E+02	2.03E+05	41.00
6:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	41.00
7:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	43.53
7:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	43.53
7:20	5.7	6.4774	6.5599	4.60E+02	2.76E+05	43.53
7:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	43.53
7:40	5.4	6.1365	6.2146	3.84E+02	2.31E+05	43.53
7:50	5.5	6.2502	6.3297	4.09E+02	2.45E+05	43.53
8:00	5.8	6.5911	6.6749	4.87E+02	2.92E+05	48.01
8:10	5.7	6.4774	6.5599	4.60E+02	2.76E+05	48.01

8:20	5.2	5.9092	5.9844	3.38E+02	2.03E+05	48.01
8:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	48.01
8:40	5.4	6.1365	6.2146	3.84E+02	2.31E+05	48.01
8:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	48.01
9:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	47.61
9:10	5	5.6820	5.7543	2.94E+02	1.76E+05	47.61
9:20	5.1	5.7956	5.8693	3.15E+02	1.89E+05	47.61
9:30	4.8	5.4547	5.5241	2.54E+02	1.52E+05	47.61
9:40	5.5	6.2502	6.3297	4.09E+02	2.45E+05	47.61
9:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	47.61
10:00	5.6	6.3638	6.4448	4.34E+02	2.60E+05	44.90
10:10	5.9	6.7047	6.7900	5.14E+02	3.08E+05	44.90
10:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	44.90
10:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	44.90
10:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	44.90
10:50	4.8	5.4547	5.5241	2.54E+02	1.52E+05	44.90
11:00	5.7	6.4774	6.5599	4.60E+02	2.76E+05	41.87
11:10	6	6.8184	6.9051	5.42E+02	3.25E+05	41.87
11:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	41.87
11:30	6.3	7.1593	7.2504	6.31E+02	3.79E+05	41.87
11:40	6.4	7.2729	7.3655	6.62E+02	3.97E+05	41.87
11:50	6.7	7.6138	7.7107	7.59E+02	4.55E+05	41.87
12:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	41.50
12:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	41.50
12:20	5.8	6.5911	6.6749	4.87E+02	2.92E+05	41.50
12:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	41.50
12:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	41.50
12:50	3.7	4.2047	4.2582	8.84E+01	5.31E+04	41.50
13:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	39.89
13:10	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.89
13:20	4.9	5.5683	5.6392	2.74E+02	1.64E+05	39.89
13:30	4.8	5.4547	5.5241	2.54E+02	1.52E+05	39.89
13:40	4	4.5456	4.6034	1.24E+02	7.46E+04	39.89
13:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	39.89
14:00	2.3	2.6137	2.6470	2.66E+00	1.60E+03	38.24
14:10	2.5	2.8410	2.8771	7.68E+00	4.61E+03	38.24
14:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	38.24
14:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	38.24
14:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	38.24
14:50	2.1	2.3864	2.4168	0.00E+00	0.00E+00	38.24
15:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	39.11
15:10	2	2.2728	2.3017	0.00E+00	0.00E+00	39.11
15:20	2.9	3.2955	3.3375	2.43E+01	1.46E+04	39.11
15:30	2.2	2.5001	2.5319	8.96E-01	5.38E+02	39.11
15:40	2.2	2.5001	2.5319	8.96E-01	5.38E+02	39.11

15:50	3.1	3.5228	3.5676	3.63E+01	2.18E+04	39.11
16:00	2.4	2.7273	2.7620	4.92E+00	2.95E+03	40.56
16:10	2.4	2.7273	2.7620	4.92E+00	2.95E+03	40.56
16:20	3.9	4.4319	4.4883	1.12E+02	6.69E+04	40.56
16:30	5.3	6.0229	6.0995	3.61E+02	2.16E+05	40.56
16:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	40.56
16:50	6.3	7.1593	7.2504	6.31E+02	3.79E+05	40.56
17:00	4.8	5.4547	5.5241	2.54E+02	1.52E+05	42.67
17:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	42.67
17:20	6.2	7.0456	7.1353	6.01E+02	3.61E+05	42.67
17:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	42.67
17:40	6.8	7.7275	7.8258	7.93E+02	4.76E+05	42.67
17:50	6.1	6.9320	7.0202	5.71E+02	3.43E+05	42.67
18:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	51.00
18:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	51.00
18:20	5.8	6.5911	6.6749	4.87E+02	2.92E+05	51.00
18:30	5.4	6.1365	6.2146	3.84E+02	2.31E+05	51.00
18:40	5.2	5.9092	5.9844	3.38E+02	2.03E+05	51.00
18:50	5.4	6.1365	6.2146	3.84E+02	2.31E+05	51.00
19:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	63.00
19:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	63.00
19:20	6.5	7.3866	7.4805	6.94E+02	4.16E+05	63.00
19:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	63.00
19:40	6.9	7.8411	7.9409	8.27E+02	4.96E+05	63.00
19:50	6.5	7.3866	7.4805	6.94E+02	4.16E+05	63.00
20:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	51.78
20:10	6.3	7.1593	7.2504	6.31E+02	3.79E+05	51.78
20:20	6.3	7.1593	7.2504	6.31E+02	3.79E+05	51.78
20:30	6.8	7.7275	7.8258	7.93E+02	4.76E+05	51.78
20:40	6.8	7.7275	7.8258	7.93E+02	4.76E+05	51.78
20:50	6.7	7.6138	7.7107	7.59E+02	4.55E+05	51.78
21:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	49.02
21:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	49.02
21:20	6.1	6.9320	7.0202	5.71E+02	3.43E+05	49.02
21:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	49.02
21:40	5.2	5.9092	5.9844	3.38E+02	2.03E+05	49.02
21:50	5.9	6.7047	6.7900	5.14E+02	3.08E+05	49.02
22:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	42.50
22:10	5.9	6.7047	6.7900	5.14E+02	3.08E+05	42.50
22:20	6.2	7.0456	7.1353	6.01E+02	3.61E+05	42.50
22:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	42.50
22:40	4.9	5.5683	5.6392	2.74E+02	1.64E+05	42.50
22:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	42.50
23:00	5.5	6.2502	6.3297	4.09E+02	2.45E+05	41.50
23:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	41.50

23:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	41.50
23:30	3.6	4.0910	4.1431	7.80E+01	4.68E+04	41.50
23:40	4	4.5456	4.6034	1.24E+02	7.46E+04	41.50
23:50	3.1	3.5228	3.5676	3.63E+01	2.18E+04	41.50
0:00	3.9	4.4319	4.4883	1.12E+02	6.69E+04	39.81
0:10	4.8	5.4547	5.5241	2.54E+02	1.52E+05	39.81
0:20	5.3	6.0229	6.0995	3.61E+02	2.16E+05	39.81
0:30	5.6	6.3638	6.4448	4.34E+02	2.60E+05	39.81
0:40	6	6.8184	6.9051	5.42E+02	3.25E+05	39.81
0:50	8.1	9.2048	9.3219	1.27E+03	7.64E+05	39.81
1:00	8.4	9.5457	9.6672	1.39E+03	8.35E+05	39.26
1:10	8.1	9.2048	9.3219	1.27E+03	7.64E+05	39.26
1:20	8.1	9.2048	9.3219	1.27E+03	7.64E+05	39.26
1:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	39.26
1:40	8	9.0911	9.2068	1.23E+03	7.40E+05	39.26
1:50	8.1	9.2048	9.3219	1.27E+03	7.64E+05	39.26
2:00	7.8	8.8639	8.9767	1.16E+03	6.94E+05	35.12
2:10	7.7	8.7502	8.8616	1.12E+03	6.71E+05	35.12
2:20	7.9	8.9775	9.0917	1.20E+03	7.17E+05	35.12
2:30	8.1	9.2048	9.3219	1.27E+03	7.64E+05	35.12
2:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	35.12
2:50	7.5	8.5229	8.6314	1.04E+03	6.25E+05	35.12
3:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	32.92
3:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.92
3:20	7.6	8.6366	8.7465	1.08E+03	6.48E+05	32.92
3:30	7.2	8.1820	8.2861	9.32E+02	5.59E+05	32.92
3:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.92
3:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.92
4:00	7	7.9548	8.0560	8.61E+02	5.17E+05	32.50
4:10	6.7	7.6138	7.7107	7.59E+02	4.55E+05	32.50
4:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	32.50
4:30	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.50
4:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	32.50
4:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	32.50
5:00	7.6	8.6366	8.7465	1.08E+03	6.48E+05	32.50
5:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	32.50
5:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	32.50
5:30	7.3	8.2957	8.4012	9.69E+02	5.81E+05	32.50
5:40	7.3	8.2957	8.4012	9.69E+02	5.81E+05	32.50
5:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.50
6:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	33.00
6:10	7.5	8.5229	8.6314	1.04E+03	6.25E+05	33.00
6:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	33.00
6:30	7	7.9548	8.0560	8.61E+02	5.17E+05	33.00
6:40	6.4	7.2729	7.3655	6.62E+02	3.97E+05	33.00

6:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	33.00
7:00	5.3	6.0229	6.0995	3.61E+02	2.16E+05	34.98
7:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	34.98
7:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	34.98
7:30	4.1	4.6592	4.7185	1.38E+02	8.26E+04	34.98
7:40	3.5	3.9774	4.0280	6.82E+01	4.09E+04	34.98
7:50	3.5	3.9774	4.0280	6.82E+01	4.09E+04	34.98
8:00	4.2	4.7729	4.8336	1.52E+02	9.12E+04	41.61
8:10	4.4	5.0001	5.0638	1.83E+02	1.10E+05	41.61
8:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	41.61
8:30	2.7	3.0683	3.1073	1.49E+01	8.91E+03	41.61
8:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	41.61
8:50	2.1	2.3864	2.4168	0.00E+00	0.00E+00	41.61
9:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	43.44
9:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	43.44
9:20	2.3	2.6137	2.6470	2.66E+00	1.60E+03	43.44
9:30	2.6	2.9546	2.9922	1.10E+01	6.59E+03	43.44
9:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	43.44
9:50	3.1	3.5228	3.5676	3.63E+01	2.18E+04	43.44
10:00	2.3	2.6137	2.6470	2.66E+00	1.60E+03	43.74
10:10	1.6	1.8182	1.8414	0.00E+00	0.00E+00	43.74
10:20	3.3	3.7501	3.7978	5.09E+01	3.05E+04	43.74
10:30	3.5	3.9774	4.0280	6.82E+01	4.09E+04	43.74
10:40	2.2	2.5001	2.5319	8.96E-01	5.38E+02	43.74
10:50	3.6	4.0910	4.1431	7.80E+01	4.68E+04	43.74
11:00	3.9	4.4319	4.4883	1.12E+02	6.69E+04	42.00
11:10	2.5	2.8410	2.8771	7.68E+00	4.61E+03	42.00
11:20	2.9	3.2955	3.3375	2.43E+01	1.46E+04	42.00
11:30	3.2	3.6365	3.6827	4.33E+01	2.60E+04	42.00
11:40	3	3.4092	3.4526	3.00E+01	1.80E+04	42.00
11:50	1.3	1.4773	1.4961	0.00E+00	0.00E+00	42.00
12:00	2.5	2.8410	2.8771	7.68E+00	4.61E+03	39.64
12:10	2.3	2.6137	2.6470	2.66E+00	1.60E+03	39.64
12:20	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.64
12:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.64
12:40	2.9	3.2955	3.3375	2.43E+01	1.46E+04	39.64
12:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	39.64
13:00	3.6	4.0910	4.1431	7.80E+01	4.68E+04	37.26
13:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	37.26
13:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	37.26
13:30	0.6	0.6818	0.6905	0.00E+00	0.00E+00	37.26
13:40	0.8	0.9091	0.9207	0.00E+00	0.00E+00	37.26
13:50	1.2	1.3637	1.3810	0.00E+00	0.00E+00	37.26
14:00	1.3	1.4773	1.4961	0.00E+00	0.00E+00	39.53
14:10	0.8	0.9091	0.9207	0.00E+00	0.00E+00	39.53

14:20	0.5	0.5682	0.5754	0.00E+00	0.00E+00	39.53
14:30	0.5	0.5682	0.5754	0.00E+00	0.00E+00	39.53
14:40	0.5	0.5682	0.5754	0.00E+00	0.00E+00	39.53
14:50	0.6	0.6818	0.6905	0.00E+00	0.00E+00	39.53
15:00	0.5	0.5682	0.5754	0.00E+00	0.00E+00	41.00
15:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	41.00
15:20	3	3.4092	3.4526	3.00E+01	1.80E+04	41.00
15:30	3.7	4.2047	4.2582	8.84E+01	5.31E+04	41.00
15:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	41.00
15:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	41.00
16:00	2.2	2.5001	2.5319	8.96E-01	5.38E+02	44.44
16:10	3.4	3.8637	3.9129	5.92E+01	3.55E+04	44.44
16:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	44.44
16:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	44.44
16:40	4.4	5.0001	5.0638	1.83E+02	1.10E+05	44.44
16:50	4.6	5.2274	5.2939	2.17E+02	1.30E+05	44.44
17:00	4.2	4.7729	4.8336	1.52E+02	9.12E+04	45.75
17:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	45.75
17:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	45.75
17:30	4.5	5.1138	5.1788	1.99E+02	1.20E+05	45.75
17:40	4.6	5.2274	5.2939	2.17E+02	1.30E+05	45.75
17:50	3.8	4.3183	4.3732	9.96E+01	5.98E+04	45.75
18:00	2.7	3.0683	3.1073	1.49E+01	8.91E+03	48.99
18:10	2.4	2.7273	2.7620	4.92E+00	2.95E+03	48.99
18:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	48.99
18:30	4.1	4.6592	4.7185	1.38E+02	8.26E+04	48.99
18:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	48.99
18:50	4.5	5.1138	5.1788	1.99E+02	1.20E+05	48.99
19:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	55.99
19:10	4.5	5.1138	5.1788	1.99E+02	1.20E+05	55.99
19:20	5.8	6.5911	6.6749	4.87E+02	2.92E+05	55.99
19:30	5.6	6.3638	6.4448	4.34E+02	2.60E+05	55.99
19:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	55.99
19:50	5.3	6.0229	6.0995	3.61E+02	2.16E+05	55.99
20:00	5.2	5.9092	5.9844	3.38E+02	2.03E+05	51.17
20:10	5.5	6.2502	6.3297	4.09E+02	2.45E+05	51.17
20:20	4.6	5.2274	5.2939	2.17E+02	1.30E+05	51.17
20:30	3.7	4.2047	4.2582	8.84E+01	5.31E+04	51.17
20:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	51.17
20:50	4.2	4.7729	4.8336	1.52E+02	9.12E+04	51.17
21:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	48.10
21:10	3.7	4.2047	4.2582	8.84E+01	5.31E+04	48.10
21:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	48.10
21:30	3.4	3.8637	3.9129	5.92E+01	3.55E+04	48.10
21:40	2.7	3.0683	3.1073	1.49E+01	8.91E+03	48.10

21:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	48.10
22:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	43.00
22:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	43.00
22:20	1.9	2.1591	2.1866	0.00E+00	0.00E+00	43.00
22:30	2.1	2.3864	2.4168	0.00E+00	0.00E+00	43.00
22:40	2.7	3.0683	3.1073	1.49E+01	8.91E+03	43.00
22:50	3.8	4.3183	4.3732	9.96E+01	5.98E+04	43.00
23:00	3.3	3.7501	3.7978	5.09E+01	3.05E+04	39.29
23:10	2.9	3.2955	3.3375	2.43E+01	1.46E+04	39.29
23:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	39.29
23:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	39.29
23:40	5	5.6820	5.7543	2.94E+02	1.76E+05	39.29
23:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	39.29
0:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	34.77
0:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	34.77
0:20	5.4	6.1365	6.2146	3.84E+02	2.31E+05	34.77
0:30	5.5	6.2502	6.3297	4.09E+02	2.45E+05	34.77
0:40	5.2	5.9092	5.9844	3.38E+02	2.03E+05	34.77
0:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	34.77
1:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	31.19
1:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	31.19
1:20	3.4	3.8637	3.9129	5.92E+01	3.55E+04	31.19
1:30	2.6	2.9546	2.9922	1.10E+01	6.59E+03	31.19
1:40	2.1	2.3864	2.4168	0.00E+00	0.00E+00	31.19
1:50	3.6	4.0910	4.1431	7.80E+01	4.68E+04	31.19
2:00	4.4	5.0001	5.0638	1.83E+02	1.10E+05	29.99
2:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	29.99
2:20	2.5	2.8410	2.8771	7.68E+00	4.61E+03	29.99
2:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	29.99
2:40	1.9	2.1591	2.1866	0.00E+00	0.00E+00	29.99
2:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	29.99
3:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	26.69
3:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	26.69
3:20	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.69
3:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.69
3:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.69
3:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.69
4:00	3.3	3.7501	3.7978	5.09E+01	3.05E+04	26.02
4:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	26.02
4:20	2.8	3.1819	3.2224	1.93E+01	1.16E+04	26.02
4:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.02
4:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.02
4:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	26.02
5:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	29.59
5:10	4.7	5.3410	5.4090	2.35E+02	1.41E+05	29.59

5:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	29.59
5:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	29.59
5:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	29.59
5:50	2	2.2728	2.3017	0.00E+00	0.00E+00	29.59
6:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	42.17
6:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	42.17
6:20	4.5	5.1138	5.1788	1.99E+02	1.20E+05	42.17
6:30	3.6	4.0910	4.1431	7.80E+01	4.68E+04	42.17
6:40	1.7	1.9319	1.9564	0.00E+00	0.00E+00	42.17
6:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	42.17
7:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	51.33
7:10	2.4	2.7273	2.7620	4.92E+00	2.95E+03	51.33
7:20	1.9	2.1591	2.1866	0.00E+00	0.00E+00	51.33
7:30	2.4	2.7273	2.7620	4.92E+00	2.95E+03	51.33
7:40	2	2.2728	2.3017	0.00E+00	0.00E+00	51.33
7:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	51.33
8:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	54.07
8:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	54.07
8:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.07
8:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.07
8:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.07
8:50	1.7	1.9319	1.9564	0.00E+00	0.00E+00	54.07
9:00	1.6	1.8182	1.8414	0.00E+00	0.00E+00	52.25
9:10	1.6	1.8182	1.8414	0.00E+00	0.00E+00	52.25
9:20	2.2	2.5001	2.5319	8.96E-01	5.38E+02	52.25
9:30	3.1	3.5228	3.5676	3.63E+01	2.18E+04	52.25
9:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	52.25
9:50	2.6	2.9546	2.9922	1.10E+01	6.59E+03	52.25
10:00	2.3	2.6137	2.6470	2.66E+00	1.60E+03	47.73
10:10	2.1	2.3864	2.4168	0.00E+00	0.00E+00	47.73
10:20	2	2.2728	2.3017	0.00E+00	0.00E+00	47.73
10:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	47.73
10:40	1.5	1.7046	1.7263	0.00E+00	0.00E+00	47.73
10:50	1.2	1.3637	1.3810	0.00E+00	0.00E+00	47.73
11:00	1.1	1.2500	1.2659	0.00E+00	0.00E+00	47.61
11:10	0.9	1.0228	1.0358	0.00E+00	0.00E+00	47.61
11:20	0.9	1.0228	1.0358	0.00E+00	0.00E+00	47.61
11:30	0.8	0.9091	0.9207	0.00E+00	0.00E+00	47.61
11:40	0.6	0.6818	0.6905	0.00E+00	0.00E+00	47.61
11:50	0.5	0.5682	0.5754	0.00E+00	0.00E+00	47.61
12:00	0.6	0.6818	0.6905	0.00E+00	0.00E+00	44.00
12:10	0.5	0.5682	0.5754	0.00E+00	0.00E+00	44.00
12:20	0.5	0.5682	0.5754	0.00E+00	0.00E+00	44.00
12:30	0.5	0.5682	0.5754	0.00E+00	0.00E+00	44.00
12:40	0.5	0.5682	0.5754	0.00E+00	0.00E+00	44.00

12:50	0.5	0.5682	0.5754	0.00E+00	0.00E+00	44.00
13:00	0.5	0.5682	0.5754	0.00E+00	0.00E+00	42.56
13:10	0.5	0.5682	0.5754	0.00E+00	0.00E+00	42.56
13:20	0.5	0.5682	0.5754	0.00E+00	0.00E+00	42.56
13:30	0.5	0.5682	0.5754	0.00E+00	0.00E+00	42.56
13:40	0.5	0.5682	0.5754	0.00E+00	0.00E+00	42.56
13:50	0.5	0.5682	0.5754	0.00E+00	0.00E+00	42.56
14:00	0.6	0.6818	0.6905	0.00E+00	0.00E+00	44.50
14:10	1.2	1.3637	1.3810	0.00E+00	0.00E+00	44.50
14:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	44.50
14:30	0.6	0.6818	0.6905	0.00E+00	0.00E+00	44.50
14:40	0.5	0.5682	0.5754	0.00E+00	0.00E+00	44.50
14:50	1	1.1364	1.1509	0.00E+00	0.00E+00	44.50
15:00	0.9	1.0228	1.0358	0.00E+00	0.00E+00	46.08
15:10	0.5	0.5682	0.5754	0.00E+00	0.00E+00	46.08
15:20	0.5	0.5682	0.5754	0.00E+00	0.00E+00	46.08
15:30	0.7	0.7955	0.8056	0.00E+00	0.00E+00	46.08
15:40	0.5	0.5682	0.5754	0.00E+00	0.00E+00	46.08
15:50	0.5	0.5682	0.5754	0.00E+00	0.00E+00	46.08
16:00	0.6	0.6818	0.6905	0.00E+00	0.00E+00	53.00
16:10	0.7	0.7955	0.8056	0.00E+00	0.00E+00	53.00
16:20	1.2	1.3637	1.3810	0.00E+00	0.00E+00	53.00
16:30	1.6	1.8182	1.8414	0.00E+00	0.00E+00	53.00
16:40	1.5	1.7046	1.7263	0.00E+00	0.00E+00	53.00
16:50	2.4	2.7273	2.7620	4.92E+00	2.95E+03	53.00
17:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	54.00
17:10	1.5	1.7046	1.7263	0.00E+00	0.00E+00	54.00
17:20	1.6	1.8182	1.8414	0.00E+00	0.00E+00	54.00
17:30	1.6	1.8182	1.8414	0.00E+00	0.00E+00	54.00
17:40	1.6	1.8182	1.8414	0.00E+00	0.00E+00	54.00
17:50	1.6	1.8182	1.8414	0.00E+00	0.00E+00	54.00
18:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	55.99
18:10	2	2.2728	2.3017	0.00E+00	0.00E+00	55.99
18:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	55.99
18:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	55.99
18:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	55.99
18:50	2	2.2728	2.3017	0.00E+00	0.00E+00	55.99
19:00	1.7	1.9319	1.9564	0.00E+00	0.00E+00	67.32
19:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	67.32
19:20	2.3	2.6137	2.6470	2.66E+00	1.60E+03	67.32
19:30	2.3	2.6137	2.6470	2.66E+00	1.60E+03	67.32
19:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	67.32
19:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	67.32
20:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	56.99
20:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	56.99

20:20	2.8	3.1819	3.2224	1.93E+01	1.16E+04	56.99
20:30	2.5	2.8410	2.8771	7.68E+00	4.61E+03	56.99
20:40	1.9	2.1591	2.1866	0.00E+00	0.00E+00	56.99
20:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	56.99
21:00	1.6	1.8182	1.8414	0.00E+00	0.00E+00	55.00
21:10	1.6	1.8182	1.8414	0.00E+00	0.00E+00	55.00
21:20	1.7	1.9319	1.9564	0.00E+00	0.00E+00	55.00
21:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	55.00
21:40	1.9	2.1591	2.1866	0.00E+00	0.00E+00	55.00
21:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	55.00
22:00	1.7	1.9319	1.9564	0.00E+00	0.00E+00	52.24
22:10	1.6	1.8182	1.8414	0.00E+00	0.00E+00	52.24
22:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	52.24
22:30	2.7	3.0683	3.1073	1.49E+01	8.91E+03	52.24
22:40	1.7	1.9319	1.9564	0.00E+00	0.00E+00	52.24
22:50	1.7	1.9319	1.9564	0.00E+00	0.00E+00	52.24
23:00	2.1	2.3864	2.4168	0.00E+00	0.00E+00	43.99
23:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	43.99
23:20	4.6	5.2274	5.2939	2.17E+02	1.30E+05	43.99
23:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	43.99
23:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	43.99
23:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	43.99
0:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.98
0:10	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.98
0:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	39.98
0:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.98
0:40	2.1	2.3864	2.4168	0.00E+00	0.00E+00	39.98
0:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	39.98
1:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.69
1:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	39.69
1:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	39.69
1:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.69
1:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.69
1:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.69
2:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	37.56
2:10	4.7	5.3410	5.4090	2.35E+02	1.41E+05	37.56
2:20	3.4	3.8637	3.9129	5.92E+01	3.55E+04	37.56
2:30	2.1	2.3864	2.4168	0.00E+00	0.00E+00	37.56
2:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	37.56
2:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	37.56
3:00	2.2	2.5001	2.5319	8.96E-01	5.38E+02	36.15
3:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	36.15
3:20	3	3.4092	3.4526	3.00E+01	1.80E+04	36.15
3:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	36.15
3:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	36.15

3:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	36.15
4:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	36.15
4:10	4.7	5.3410	5.4090	2.35E+02	1.41E+05	36.15
4:20	4.7	5.3410	5.4090	2.35E+02	1.41E+05	36.15
4:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	36.15
4:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	36.15
4:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	36.15
5:00	3.7	4.2047	4.2582	8.84E+01	5.31E+04	38.07
5:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	38.07
5:20	1.9	2.1591	2.1866	0.00E+00	0.00E+00	38.07
5:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	38.07
5:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	38.07
5:50	4.2	4.7729	4.8336	1.52E+02	9.12E+04	38.07
6:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	45.11
6:10	2.8	3.1819	3.2224	1.93E+01	1.16E+04	45.11
6:20	3.1	3.5228	3.5676	3.63E+01	2.18E+04	45.11
6:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	45.11
6:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	45.11
6:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	45.11
7:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	51.53
7:10	2.4	2.7273	2.7620	4.92E+00	2.95E+03	51.53
7:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	51.53
7:30	2.3	2.6137	2.6470	2.66E+00	1.60E+03	51.53
7:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	51.53
7:50	4.2	4.7729	4.8336	1.52E+02	9.12E+04	51.53
8:00	3.6	4.0910	4.1431	7.80E+01	4.68E+04	57.47
8:10	3.9	4.4319	4.4883	1.12E+02	6.69E+04	57.47
8:20	2.7	3.0683	3.1073	1.49E+01	8.91E+03	57.47
8:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	57.47
8:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	57.47
8:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	57.47
9:00	2.6	2.9546	2.9922	1.10E+01	6.59E+03	57.72
9:10	2.6	2.9546	2.9922	1.10E+01	6.59E+03	57.72
9:20	3.1	3.5228	3.5676	3.63E+01	2.18E+04	57.72
9:30	2.9	3.2955	3.3375	2.43E+01	1.46E+04	57.72
9:40	2.9	3.2955	3.3375	2.43E+01	1.46E+04	57.72
9:50	3.5	3.9774	4.0280	6.82E+01	4.09E+04	57.72
10:00	2.6	2.9546	2.9922	1.10E+01	6.59E+03	44.18
10:10	2.9	3.2955	3.3375	2.43E+01	1.46E+04	44.18
10:20	3.5	3.9774	4.0280	6.82E+01	4.09E+04	44.18
10:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	44.18
10:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	44.18
10:50	2	2.2728	2.3017	0.00E+00	0.00E+00	44.18
11:00	2.1	2.3864	2.4168	0.00E+00	0.00E+00	39.98
11:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	39.98

11:20	2.4	2.7273	2.7620	4.92E+00	2.95E+03	39.98
11:30	2	2.2728	2.3017	0.00E+00	0.00E+00	39.98
11:40	3.7	4.2047	4.2582	8.84E+01	5.31E+04	39.98
11:50	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.98
12:00	3.4	3.8637	3.9129	5.92E+01	3.55E+04	36.79
12:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	36.79
12:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	36.79
12:30	2.4	2.7273	2.7620	4.92E+00	2.95E+03	36.79
12:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	36.79
12:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	36.79
13:00	3.9	4.4319	4.4883	1.12E+02	6.69E+04	32.50
13:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	32.50
13:20	3	3.4092	3.4526	3.00E+01	1.80E+04	32.50
13:30	2.7	3.0683	3.1073	1.49E+01	8.91E+03	32.50
13:40	2.9	3.2955	3.3375	2.43E+01	1.46E+04	32.50
13:50	3.9	4.4319	4.4883	1.12E+02	6.69E+04	32.50
14:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.34
14:10	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.34
14:20	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.34
14:30	4.4	5.0001	5.0638	1.83E+02	1.10E+05	39.34
14:40	4.4	5.0001	5.0638	1.83E+02	1.10E+05	39.34
14:50	4.3	4.8865	4.9487	1.67E+02	1.00E+05	39.34
15:00	4.2	4.7729	4.8336	1.52E+02	9.12E+04	40.00
15:10	4.3	4.8865	4.9487	1.67E+02	1.00E+05	40.00
15:20	4.3	4.8865	4.9487	1.67E+02	1.00E+05	40.00
15:30	4.3	4.8865	4.9487	1.67E+02	1.00E+05	40.00
15:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	40.00
15:50	4.4	5.0001	5.0638	1.83E+02	1.10E+05	40.00
16:00	2.9	3.2955	3.3375	2.43E+01	1.46E+04	44.64
16:10	1.6	1.8182	1.8414	0.00E+00	0.00E+00	44.64
16:20	1.7	1.9319	1.9564	0.00E+00	0.00E+00	44.64
16:30	1.6	1.8182	1.8414	0.00E+00	0.00E+00	44.64
16:40	1.6	1.8182	1.8414	0.00E+00	0.00E+00	44.64
16:50	2.6	2.9546	2.9922	1.10E+01	6.59E+03	44.64
17:00	2.9	3.2955	3.3375	2.43E+01	1.46E+04	51.71
17:10	1.7	1.9319	1.9564	0.00E+00	0.00E+00	51.71
17:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	51.71
17:30	1.6	1.8182	1.8414	0.00E+00	0.00E+00	51.71
17:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	51.71
17:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	51.71
18:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.00
18:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	54.00
18:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.00
18:30	2	2.2728	2.3017	0.00E+00	0.00E+00	54.00
18:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.00

18:50	1.6	1.8182	1.8414	0.00E+00	0.00E+00	54.00
19:00	1.7	1.9319	1.9564	0.00E+00	0.00E+00	68.00
19:10	3.8	4.3183	4.3732	9.96E+01	5.98E+04	68.00
19:20	4.2	4.7729	4.8336	1.52E+02	9.12E+04	68.00
19:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	68.00
19:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	68.00
19:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	68.00
20:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.01
20:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	54.01
20:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	54.01
20:30	2.4	2.7273	2.7620	4.92E+00	2.95E+03	54.01
20:40	3.1	3.5228	3.5676	3.63E+01	2.18E+04	54.01
20:50	2.5	2.8410	2.8771	7.68E+00	4.61E+03	54.01
21:00	2	2.2728	2.3017	0.00E+00	0.00E+00	47.83
21:10	2.1	2.3864	2.4168	0.00E+00	0.00E+00	47.83
21:20	2.5	2.8410	2.8771	7.68E+00	4.61E+03	47.83
21:30	2.9	3.2955	3.3375	2.43E+01	1.46E+04	47.83
21:40	3	3.4092	3.4526	3.00E+01	1.80E+04	47.83
21:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	47.83
22:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	45.00
22:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	45.00
22:20	2.3	2.6137	2.6470	2.66E+00	1.60E+03	45.00
22:30	3.6	4.0910	4.1431	7.80E+01	4.68E+04	45.00
22:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	45.00
22:50	3.1	3.5228	3.5676	3.63E+01	2.18E+04	45.00
23:00	3.8	4.3183	4.3732	9.96E+01	5.98E+04	41.18
23:10	4.9	5.5683	5.6392	2.74E+02	1.64E+05	41.18
23:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	41.18
23:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	41.18
23:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	41.18
23:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	41.18
0:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	37.00
0:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	37.00
0:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	37.00
0:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	37.00
0:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	37.00
0:50	4.8	5.4547	5.5241	2.54E+02	1.52E+05	37.00
1:00	5	5.6820	5.7543	2.94E+02	1.76E+05	32.50
1:10	5.3	6.0229	6.0995	3.61E+02	2.16E+05	32.50
1:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	32.50
1:30	4.9	5.5683	5.6392	2.74E+02	1.64E+05	32.50
1:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	32.50
1:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	32.50
2:00	5.8	6.5911	6.6749	4.87E+02	2.92E+05	32.00
2:10	5	5.6820	5.7543	2.94E+02	1.76E+05	32.00

2:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	32.00
2:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	32.00
2:40	11.2	12.7276	12.8896	2.00E+03	1.20E+06	32.00
2:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	32.00
3:00	6.6	7.5002	7.5956	7.26E+02	4.36E+05	30.00
3:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	30.00
3:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	30.00
3:30	9.8	11.1367	11.2784	1.95E+03	1.17E+06	30.00
3:40	8.4	9.5457	9.6672	1.39E+03	8.35E+05	30.00
3:50	6.4	7.2729	7.3655	6.62E+02	3.97E+05	30.00
4:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	32.00
4:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	32.00
4:20	9.6	10.9094	11.0482	1.87E+03	1.12E+06	32.00
4:30	8.5	9.6593	9.7822	1.43E+03	8.59E+05	32.00
4:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	32.00
4:50	8.6	9.7730	9.8973	1.47E+03	8.83E+05	32.00
5:00	9.3	10.5685	10.7029	1.75E+03	1.05E+06	34.37
5:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	34.37
5:20	7.8	8.8639	8.9767	1.16E+03	6.94E+05	34.37
5:30	9.3	10.5685	10.7029	1.75E+03	1.05E+06	34.37
5:40	9.5	10.7957	10.9331	1.83E+03	1.10E+06	34.37
5:50	9.3	10.5685	10.7029	1.75E+03	1.05E+06	34.37
6:00	9.8	11.1367	11.2784	1.95E+03	1.17E+06	40.63
6:10	9.9	11.2503	11.3934	1.98E+03	1.19E+06	40.63
6:20	10	11.3639	11.5085	2.00E+03	1.20E+06	40.63
6:30	9.9	11.2503	11.3934	1.98E+03	1.19E+06	40.63
6:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	40.63
6:50	9.4	10.6821	10.8180	1.79E+03	1.08E+06	40.63
7:00	9.7	11.0230	11.1633	1.91E+03	1.14E+06	48.00
7:10	10.6	12.0458	12.1990	2.00E+03	1.20E+06	48.00
7:20	10.4	11.8185	11.9689	2.00E+03	1.20E+06	48.00
7:30	10.3	11.7049	11.8538	2.00E+03	1.20E+06	48.00
7:40	10.3	11.7049	11.8538	2.00E+03	1.20E+06	48.00
7:50	10.7	12.1594	12.3141	2.00E+03	1.20E+06	48.00
8:00	10.7	12.1594	12.3141	2.00E+03	1.20E+06	49.59
8:10	9.9	11.2503	11.3934	1.98E+03	1.19E+06	49.59
8:20	9.6	10.9094	11.0482	1.87E+03	1.12E+06	49.59
8:30	10.1	11.4776	11.6236	2.00E+03	1.20E+06	49.59
8:40	10.4	11.8185	11.9689	2.00E+03	1.20E+06	49.59
8:50	10.4	11.8185	11.9689	2.00E+03	1.20E+06	49.59
9:00	10.6	12.0458	12.1990	2.00E+03	1.20E+06	45.70
9:10	10.2	11.5912	11.7387	2.00E+03	1.20E+06	45.70
9:20	10.3	11.7049	11.8538	2.00E+03	1.20E+06	45.70
9:30	10.1	11.4776	11.6236	2.00E+03	1.20E+06	45.70
9:40	10	11.3639	11.5085	2.00E+03	1.20E+06	45.70

9:50	9.4	10.6821	10.8180	1.79E+03	1.08E+06	45.70
10:00	10	11.3639	11.5085	2.00E+03	1.20E+06	38.48
10:10	9.8	11.1367	11.2784	1.95E+03	1.17E+06	38.48
10:20	10.2	11.5912	11.7387	2.00E+03	1.20E+06	38.48
10:30	11.1	12.6140	12.7745	2.00E+03	1.20E+06	38.48
10:40	9.9	11.2503	11.3934	1.98E+03	1.19E+06	38.48
10:50	11.8	13.4094	13.5801	2.00E+03	1.20E+06	38.48
11:00	11	12.5003	12.6594	2.00E+03	1.20E+06	36.00
11:10	10.3	11.7049	11.8538	2.00E+03	1.20E+06	36.00
11:20	10.5	11.9321	12.0840	2.00E+03	1.20E+06	36.00
11:30	8.1	9.2048	9.3219	1.27E+03	7.64E+05	36.00
11:40	9.4	10.6821	10.8180	1.79E+03	1.08E+06	36.00
11:50	10.6	12.0458	12.1990	2.00E+03	1.20E+06	36.00
12:00	10.8	12.2730	12.4292	2.00E+03	1.20E+06	35.00
12:10	10.4	11.8185	11.9689	2.00E+03	1.20E+06	35.00
12:20	9.1	10.3412	10.4728	1.67E+03	1.00E+06	35.00
12:30	9.6	10.9094	11.0482	1.87E+03	1.12E+06	35.00
12:40	8.5	9.6593	9.7822	1.43E+03	8.59E+05	35.00
12:50	9.1	10.3412	10.4728	1.67E+03	1.00E+06	35.00
13:00	8.7	9.8866	10.0124	1.51E+03	9.08E+05	34.45
13:10	8.6	9.7730	9.8973	1.47E+03	8.83E+05	34.45
13:20	7.3	8.2957	8.4012	9.69E+02	5.81E+05	34.45
13:30	8.9	10.1139	10.2426	1.59E+03	9.56E+05	34.45
13:40	9.7	11.0230	11.1633	1.91E+03	1.14E+06	34.45
13:50	9.1	10.3412	10.4728	1.67E+03	1.00E+06	34.45
14:00	10.4	11.8185	11.9689	2.00E+03	1.20E+06	35.00
14:10	9.3	10.5685	10.7029	1.75E+03	1.05E+06	35.00
14:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	35.00
14:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	35.00
14:40	9.9	11.2503	11.3934	1.98E+03	1.19E+06	35.00
14:50	11.2	12.7276	12.8896	2.00E+03	1.20E+06	35.00
15:00	11.6	13.1822	13.3499	2.00E+03	1.20E+06	40.63
15:10	10.8	12.2730	12.4292	2.00E+03	1.20E+06	40.63
15:20	10.9	12.3867	12.5443	2.00E+03	1.20E+06	40.63
15:30	10.5	11.9321	12.0840	2.00E+03	1.20E+06	40.63
15:40	8.8	10.0003	10.1275	1.55E+03	9.32E+05	40.63
15:50	9.2	10.4548	10.5878	1.71E+03	1.03E+06	40.63
16:00	9.2	10.4548	10.5878	1.71E+03	1.03E+06	46.50
16:10	9.1	10.3412	10.4728	1.67E+03	1.00E+06	46.50
16:20	10.3	11.7049	11.8538	2.00E+03	1.20E+06	46.50
16:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	46.50
16:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	46.50
16:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	46.50
17:00	7.8	8.8639	8.9767	1.16E+03	6.94E+05	53.20
17:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	53.20

17:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	53.20
17:30	6.8	7.7275	7.8258	7.93E+02	4.76E+05	53.20
17:40	6.9	7.8411	7.9409	8.27E+02	4.96E+05	53.20
17:50	7.2	8.1820	8.2861	9.32E+02	5.59E+05	53.20
18:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	54.01
18:10	7.2	8.1820	8.2861	9.32E+02	5.59E+05	54.01
18:20	7.9	8.9775	9.0917	1.20E+03	7.17E+05	54.01
18:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	54.01
18:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	54.01
18:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	54.01
19:00	7.3	8.2957	8.4012	9.69E+02	5.81E+05	67.84
19:10	8.6	9.7730	9.8973	1.47E+03	8.83E+05	67.84
19:20	6.7	7.6138	7.7107	7.59E+02	4.55E+05	67.84
19:30	6.7	7.6138	7.7107	7.59E+02	4.55E+05	67.84
19:40	7.5	8.5229	8.6314	1.04E+03	6.25E+05	67.84
19:50	8.9	10.1139	10.2426	1.59E+03	9.56E+05	67.84
20:00	7.9	8.9775	9.0917	1.20E+03	7.17E+05	63.07
20:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	63.07
20:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	63.07
20:30	7.8	8.8639	8.9767	1.16E+03	6.94E+05	63.07
20:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	63.07
20:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	63.07
21:00	5.5	6.2502	6.3297	4.09E+02	2.45E+05	53.07
21:10	6	6.8184	6.9051	5.42E+02	3.25E+05	53.07
21:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	53.07
21:30	15.4	17.5005	17.7231	2.00E+03	1.20E+06	53.07
21:40	12.9	14.6595	14.8460	2.00E+03	1.20E+06	53.07
21:50	13.1	14.8868	15.0762	2.00E+03	1.20E+06	53.07
22:00	9.3	10.5685	10.7029	1.75E+03	1.05E+06	49.89
22:10	10.9	12.3867	12.5443	2.00E+03	1.20E+06	49.89
22:20	9.1	10.3412	10.4728	1.67E+03	1.00E+06	49.89
22:30	8.3	9.4321	9.5521	1.35E+03	8.11E+05	49.89
22:40	6.6	7.5002	7.5956	7.26E+02	4.36E+05	49.89
22:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	49.89
23:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	43.50
23:10	8.9	10.1139	10.2426	1.59E+03	9.56E+05	43.50
23:20	7.8	8.8639	8.9767	1.16E+03	6.94E+05	43.50
23:30	8	9.0911	9.2068	1.23E+03	7.40E+05	43.50
23:40	9.1	10.3412	10.4728	1.67E+03	1.00E+06	43.50
23:50	9.2	10.4548	10.5878	1.71E+03	1.03E+06	43.50
0:00	8.4	9.5457	9.6672	1.39E+03	8.35E+05	40.61
0:10	9.4	10.6821	10.8180	1.79E+03	1.08E+06	40.61
0:20	8.1	9.2048	9.3219	1.27E+03	7.64E+05	40.61
0:30	8.7	9.8866	10.0124	1.51E+03	9.08E+05	40.61
0:40	6.1	6.9320	7.0202	5.71E+02	3.43E+05	40.61

0:50	6.4	7.2729	7.3655	6.62E+02	3.97E+05	40.61
1:00	4.3	4.8865	4.9487	1.67E+02	1.00E+05	38.61
1:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	38.61
1:20	5.8	6.5911	6.6749	4.87E+02	2.92E+05	38.61
1:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	38.61
1:40	7	7.9548	8.0560	8.61E+02	5.17E+05	38.61
1:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	38.61
2:00	7.8	8.8639	8.9767	1.16E+03	6.94E+05	35.01
2:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	35.01
2:20	7.3	8.2957	8.4012	9.69E+02	5.81E+05	35.01
2:30	7.7	8.7502	8.8616	1.12E+03	6.71E+05	35.01
2:40	5.7	6.4774	6.5599	4.60E+02	2.76E+05	35.01
2:50	5.5	6.2502	6.3297	4.09E+02	2.45E+05	35.01
3:00	5.4	6.1365	6.2146	3.84E+02	2.31E+05	34.15
3:10	3.9	4.4319	4.4883	1.12E+02	6.69E+04	34.15
3:20	3.7	4.2047	4.2582	8.84E+01	5.31E+04	34.15
3:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	34.15
3:40	5.7	6.4774	6.5599	4.60E+02	2.76E+05	34.15
3:50	5.1	5.7956	5.8693	3.15E+02	1.89E+05	34.15
4:00	2.6	2.9546	2.9922	1.10E+01	6.59E+03	35.00
4:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	35.00
4:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	35.00
4:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	35.00
4:40	3.1	3.5228	3.5676	3.63E+01	2.18E+04	35.00
4:50	3.5	3.9774	4.0280	6.82E+01	4.09E+04	35.00
5:00	2.5	2.8410	2.8771	7.68E+00	4.61E+03	38.93
5:10	2.8	3.1819	3.2224	1.93E+01	1.16E+04	38.93
5:20	3	3.4092	3.4526	3.00E+01	1.80E+04	38.93
5:30	3.2	3.6365	3.6827	4.33E+01	2.60E+04	38.93
5:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	38.93
5:50	3.1	3.5228	3.5676	3.63E+01	2.18E+04	38.93
6:00	2.9	3.2955	3.3375	2.43E+01	1.46E+04	46.49
6:10	3.2	3.6365	3.6827	4.33E+01	2.60E+04	46.49
6:20	4.5	5.1138	5.1788	1.99E+02	1.20E+05	46.49
6:30	5.3	6.0229	6.0995	3.61E+02	2.16E+05	46.49
6:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	46.49
6:50	6.5	7.3866	7.4805	6.94E+02	4.16E+05	46.49
7:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	55.70
7:10	4.8	5.4547	5.5241	2.54E+02	1.52E+05	55.70
7:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	55.70
7:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	55.70
7:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	55.70
7:50	7	7.9548	8.0560	8.61E+02	5.17E+05	55.70
8:00	7	7.9548	8.0560	8.61E+02	5.17E+05	59.84
8:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	59.84

8:20	8.5	9.6593	9.7822	1.43E+03	8.59E+05	59.84
8:30	8.6	9.7730	9.8973	1.47E+03	8.83E+05	59.84
8:40	8.6	9.7730	9.8973	1.47E+03	8.83E+05	59.84
8:50	6.4	7.2729	7.3655	6.62E+02	3.97E+05	59.84
9:00	5.6	6.3638	6.4448	4.34E+02	2.60E+05	61.14
9:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	61.14
9:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	61.14
9:30	5.9	6.7047	6.7900	5.14E+02	3.08E+05	61.14
9:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	61.14
9:50	8	9.0911	9.2068	1.23E+03	7.40E+05	61.14
10:00	5.7	6.4774	6.5599	4.60E+02	2.76E+05	49.60
10:10	9.4	10.6821	10.8180	1.79E+03	1.08E+06	49.60
10:20	6.5	7.3866	7.4805	6.94E+02	4.16E+05	49.60
10:30	4.4	5.0001	5.0638	1.83E+02	1.10E+05	49.60
10:40	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.60
10:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	49.60
11:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	45.50
11:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	45.50
11:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	45.50
11:30	8.8	10.0003	10.1275	1.55E+03	9.32E+05	45.50
11:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	45.50
11:50	10.7	12.1594	12.3141	2.00E+03	1.20E+06	45.50
12:00	9.4	10.6821	10.8180	1.79E+03	1.08E+06	43.50
12:10	6.7	7.6138	7.7107	7.59E+02	4.55E+05	43.50
12:20	5.4	6.1365	6.2146	3.84E+02	2.31E+05	43.50
12:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	43.50
12:40	7.5	8.5229	8.6314	1.04E+03	6.25E+05	43.50
12:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	43.50
13:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	42.18
13:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	42.18
13:20	5	5.6820	5.7543	2.94E+02	1.76E+05	42.18
13:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	42.18
13:40	6.4	7.2729	7.3655	6.62E+02	3.97E+05	42.18
13:50	5.8	6.5911	6.6749	4.87E+02	2.92E+05	42.18
14:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	44.00
14:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	44.00
14:20	4.5	5.1138	5.1788	1.99E+02	1.20E+05	44.00
14:30	3.2	3.6365	3.6827	4.33E+01	2.60E+04	44.00
14:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	44.00
14:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	44.00
15:00	3.9	4.4319	4.4883	1.12E+02	6.69E+04	47.58
15:10	4.4	5.0001	5.0638	1.83E+02	1.10E+05	47.58
15:20	3.7	4.2047	4.2582	8.84E+01	5.31E+04	47.58
15:30	3.4	3.8637	3.9129	5.92E+01	3.55E+04	47.58
15:40	3.9	4.4319	4.4883	1.12E+02	6.69E+04	47.58

15:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	47.58
16:00	3.8	4.3183	4.3732	9.96E+01	5.98E+04	50.00
16:10	3.4	3.8637	3.9129	5.92E+01	3.55E+04	50.00
16:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	50.00
16:30	3.7	4.2047	4.2582	8.84E+01	5.31E+04	50.00
16:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	50.00
16:50	3.7	4.2047	4.2582	8.84E+01	5.31E+04	50.00
17:00	4.1	4.6592	4.7185	1.38E+02	8.26E+04	51.69
17:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	51.69
17:20	4.5	5.1138	5.1788	1.99E+02	1.20E+05	51.69
17:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	51.69
17:40	5.2	5.9092	5.9844	3.38E+02	2.03E+05	51.69
17:50	4	4.5456	4.6034	1.24E+02	7.46E+04	51.69
18:00	4.4	5.0001	5.0638	1.83E+02	1.10E+05	55.99
18:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	55.99
18:20	4.2	4.7729	4.8336	1.52E+02	9.12E+04	55.99
18:30	4.4	5.0001	5.0638	1.83E+02	1.10E+05	55.99
18:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	55.99
18:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	55.99
19:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	79.61
19:10	5	5.6820	5.7543	2.94E+02	1.76E+05	79.61
19:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	79.61
19:30	6.8	7.7275	7.8258	7.93E+02	4.76E+05	79.61
19:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	79.61
19:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	79.61
20:00	6.6	7.5002	7.5956	7.26E+02	4.36E+05	67.97
20:10	5.6	6.3638	6.4448	4.34E+02	2.60E+05	67.97
20:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	67.97
20:30	4.1	4.6592	4.7185	1.38E+02	8.26E+04	67.97
20:40	3	3.4092	3.4526	3.00E+01	1.80E+04	67.97
20:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	67.97
21:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	60.42
21:10	4	4.5456	4.6034	1.24E+02	7.46E+04	60.42
21:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	60.42
21:30	3.7	4.2047	4.2582	8.84E+01	5.31E+04	60.42
21:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	60.42
21:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	60.42
22:00	1.7	1.9319	1.9564	0.00E+00	0.00E+00	50.13
22:10	1.7	1.9319	1.9564	0.00E+00	0.00E+00	50.13
22:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	50.13
22:30	2.5	2.8410	2.8771	7.68E+00	4.61E+03	50.13
22:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	50.13
22:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	50.13
23:00	2.2	2.5001	2.5319	8.96E-01	5.38E+02	48.24
23:10	1.9	2.1591	2.1866	0.00E+00	0.00E+00	48.24

23:20	1.7	1.9319	1.9564	0.00E+00	0.00E+00	48.24
23:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	48.24
23:40	2.4	2.7273	2.7620	4.92E+00	2.95E+03	48.24
23:50	3.1	3.5228	3.5676	3.63E+01	2.18E+04	48.24
0:00	4.1	4.6592	4.7185	1.38E+02	8.26E+04	42.00
0:10	3.1	3.5228	3.5676	3.63E+01	2.18E+04	42.00
0:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	42.00
0:30	1.7	1.9319	1.9564	0.00E+00	0.00E+00	42.00
0:40	1.7	1.9319	1.9564	0.00E+00	0.00E+00	42.00
0:50	1.6	1.8182	1.8414	0.00E+00	0.00E+00	42.00
1:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	37.01
1:10	2.1	2.3864	2.4168	0.00E+00	0.00E+00	37.01
1:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	37.01
1:30	2.3	2.6137	2.6470	2.66E+00	1.60E+03	37.01
1:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	37.01
1:50	1.9	2.1591	2.1866	0.00E+00	0.00E+00	37.01
2:00	2.1	2.3864	2.4168	0.00E+00	0.00E+00	35.01
2:10	2.8	3.1819	3.2224	1.93E+01	1.16E+04	35.01
2:20	1.9	2.1591	2.1866	0.00E+00	0.00E+00	35.01
2:30	2.6	2.9546	2.9922	1.10E+01	6.59E+03	35.01
2:40	2.1	2.3864	2.4168	0.00E+00	0.00E+00	35.01
2:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	35.01
3:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	33.99
3:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	33.99
3:20	1.6	1.8182	1.8414	0.00E+00	0.00E+00	33.99
3:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	33.99
3:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	33.99
3:50	1.7	1.9319	1.9564	0.00E+00	0.00E+00	33.99
4:00	2	2.2728	2.3017	0.00E+00	0.00E+00	34.87
4:10	3.2	3.6365	3.6827	4.33E+01	2.60E+04	34.87
4:20	2.2	2.5001	2.5319	8.96E-01	5.38E+02	34.87
4:30	2.3	2.6137	2.6470	2.66E+00	1.60E+03	34.87
4:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	34.87
4:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	34.87
5:00	2.6	2.9546	2.9922	1.10E+01	6.59E+03	39.49
5:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.49
5:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.49
5:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	39.49
5:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.49
5:50	3.3	3.7501	3.7978	5.09E+01	3.05E+04	39.49
6:00	3.6	4.0910	4.1431	7.80E+01	4.68E+04	47.31
6:10	3.1	3.5228	3.5676	3.63E+01	2.18E+04	47.31
6:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	47.31
6:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	47.31
6:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	47.31

6:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	47.31
7:00	3.2	3.6365	3.6827	4.33E+01	2.60E+04	55.48
7:10	3.1	3.5228	3.5676	3.63E+01	2.18E+04	55.48
7:20	2	2.2728	2.3017	0.00E+00	0.00E+00	55.48
7:30	1.7	1.9319	1.9564	0.00E+00	0.00E+00	55.48
7:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	55.48
7:50	3.9	4.4319	4.4883	1.12E+02	6.69E+04	55.48
8:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	61.04
8:10	1.7	1.9319	1.9564	0.00E+00	0.00E+00	61.04
8:20	2	2.2728	2.3017	0.00E+00	0.00E+00	61.04
8:30	2.2	2.5001	2.5319	8.96E-01	5.38E+02	61.04
8:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	61.04
8:50	2.4	2.7273	2.7620	4.92E+00	2.95E+03	61.04
9:00	2.9	3.2955	3.3375	2.43E+01	1.46E+04	61.00
9:10	3.5	3.9774	4.0280	6.82E+01	4.09E+04	61.00
9:20	4	4.5456	4.6034	1.24E+02	7.46E+04	61.00
9:30	4	4.5456	4.6034	1.24E+02	7.46E+04	61.00
9:40	4.5	5.1138	5.1788	1.99E+02	1.20E+05	61.00
9:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	61.00
10:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	50.13
10:10	2.7	3.0683	3.1073	1.49E+01	8.91E+03	50.13
10:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	50.13
10:30	1.9	2.1591	2.1866	0.00E+00	0.00E+00	50.13
10:40	2.3	2.6137	2.6470	2.66E+00	1.60E+03	50.13
10:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	50.13
11:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	47.01
11:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	47.01
11:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	47.01
11:30	6.1	6.9320	7.0202	5.71E+02	3.43E+05	47.01
11:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	47.01
11:50	5.1	5.7956	5.8693	3.15E+02	1.89E+05	47.01
12:00	5.2	5.9092	5.9844	3.38E+02	2.03E+05	44.50
12:10	5.7	6.4774	6.5599	4.60E+02	2.76E+05	44.50
12:20	6.3	7.1593	7.2504	6.31E+02	3.79E+05	44.50
12:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	44.50
12:40	6.6	7.5002	7.5956	7.26E+02	4.36E+05	44.50
12:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	44.50
13:00	6.9	7.8411	7.9409	8.27E+02	4.96E+05	47.01
13:10	7.2	8.1820	8.2861	9.32E+02	5.59E+05	47.01
13:20	7.8	8.8639	8.9767	1.16E+03	6.94E+05	47.01
13:30	7.2	8.1820	8.2861	9.32E+02	5.59E+05	47.01
13:40	6.5	7.3866	7.4805	6.94E+02	4.16E+05	47.01
13:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	47.01
14:00	7.6	8.6366	8.7465	1.08E+03	6.48E+05	46.80
14:10	7.3	8.2957	8.4012	9.69E+02	5.81E+05	46.80

14:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	46.80
14:30	7.8	8.8639	8.9767	1.16E+03	6.94E+05	46.80
14:40	6.6	7.5002	7.5956	7.26E+02	4.36E+05	46.80
14:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	46.80
15:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	49.00
15:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	49.00
15:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	49.00
15:30	8.2	9.3184	9.4370	1.31E+03	7.88E+05	49.00
15:40	9.8	11.1367	11.2784	1.95E+03	1.17E+06	49.00
15:50	12.1	13.7504	13.9253	2.00E+03	1.20E+06	49.00
16:00	12.5	14.2049	14.3857	2.00E+03	1.20E+06	50.00
16:10	10.5	11.9321	12.0840	2.00E+03	1.20E+06	50.00
16:20	8.7	9.8866	10.0124	1.51E+03	9.08E+05	50.00
16:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	50.00
16:40	8.8	10.0003	10.1275	1.55E+03	9.32E+05	50.00
16:50	10.6	12.0458	12.1990	2.00E+03	1.20E+06	50.00
17:00	10.5	11.9321	12.0840	2.00E+03	1.20E+06	51.59
17:10	10.5	11.9321	12.0840	2.00E+03	1.20E+06	51.59
17:20	8.3	9.4321	9.5521	1.35E+03	8.11E+05	51.59
17:30	6.4	7.2729	7.3655	6.62E+02	3.97E+05	51.59
17:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	51.59
17:50	9.2	10.4548	10.5878	1.71E+03	1.03E+06	51.59
18:00	8.1	9.2048	9.3219	1.27E+03	7.64E+05	52.81
18:10	9	10.2275	10.3577	1.63E+03	9.80E+05	52.81
18:20	11.5	13.0685	13.2348	2.00E+03	1.20E+06	52.81
18:30	13.1	14.8868	15.0762	2.00E+03	1.20E+06	52.81
18:40	11.9	13.5231	13.6951	2.00E+03	1.20E+06	52.81
18:50	11.9	13.5231	13.6951	2.00E+03	1.20E+06	52.81
19:00	12.1	13.7504	13.9253	2.00E+03	1.20E+06	60.42
19:10	13.9	15.7959	15.9969	2.00E+03	1.20E+06	60.42
19:20	12.5	14.2049	14.3857	2.00E+03	1.20E+06	60.42
19:30	13.6	15.4549	15.6516	2.00E+03	1.20E+06	60.42
19:40	16.1	18.2959	18.5287	2.00E+03	1.20E+06	60.42
19:50	14.4	16.3641	16.5723	2.00E+03	1.20E+06	60.42
20:00	15.6	17.7277	17.9533	2.00E+03	1.20E+06	52.28
20:10	13.6	15.4549	15.6516	2.00E+03	1.20E+06	52.28
20:20	10.1	11.4776	11.6236	2.00E+03	1.20E+06	52.28
20:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	52.28
20:40	8.5	9.6593	9.7822	1.43E+03	8.59E+05	52.28
20:50	10	11.3639	11.5085	2.00E+03	1.20E+06	52.28
21:00	11.8	13.4094	13.5801	2.00E+03	1.20E+06	47.50
21:10	12.9	14.6595	14.8460	2.00E+03	1.20E+06	47.50
21:20	11.6	13.1822	13.3499	2.00E+03	1.20E+06	47.50
21:30	10.4	11.8185	11.9689	2.00E+03	1.20E+06	47.50
21:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	47.50

21:50	8.2	9.3184	9.4370	1.31E+03	7.88E+05	47.50
22:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	45.00
22:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	45.00
22:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	45.00
22:30	6.5	7.3866	7.4805	6.94E+02	4.16E+05	45.00
22:40	6.1	6.9320	7.0202	5.71E+02	3.43E+05	45.00
22:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	45.00
23:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	42.57
23:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	42.57
23:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	42.57
23:30	6.7	7.6138	7.7107	7.59E+02	4.55E+05	42.57
23:40	6.1	6.9320	7.0202	5.71E+02	3.43E+05	42.57
23:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	42.57
0:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	39.34
0:10	8.2	9.3184	9.4370	1.31E+03	7.88E+05	39.34
0:20	8.6	9.7730	9.8973	1.47E+03	8.83E+05	39.34
0:30	9.4	10.6821	10.8180	1.79E+03	1.08E+06	39.34
0:40	9.2	10.4548	10.5878	1.71E+03	1.03E+06	39.34
0:50	8.6	9.7730	9.8973	1.47E+03	8.83E+05	39.34
1:00	8.3	9.4321	9.5521	1.35E+03	8.11E+05	34.70
1:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	34.70
1:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	34.70
1:30	6.1	6.9320	7.0202	5.71E+02	3.43E+05	34.70
1:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	34.70
1:50	6	6.8184	6.9051	5.42E+02	3.25E+05	34.70
2:00	5.6	6.3638	6.4448	4.34E+02	2.60E+05	32.41
2:10	5.5	6.2502	6.3297	4.09E+02	2.45E+05	32.41
2:20	6.2	7.0456	7.1353	6.01E+02	3.61E+05	32.41
2:30	6.8	7.7275	7.8258	7.93E+02	4.76E+05	32.41
2:40	6.9	7.8411	7.9409	8.27E+02	4.96E+05	32.41
2:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.41
3:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	30.35
3:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	30.35
3:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	30.35
3:30	6	6.8184	6.9051	5.42E+02	3.25E+05	30.35
3:40	7.4	8.4093	8.5163	1.01E+03	6.03E+05	30.35
3:50	8.1	9.2048	9.3219	1.27E+03	7.64E+05	30.35
4:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	29.95
4:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	29.95
4:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	29.95
4:30	5.9	6.7047	6.7900	5.14E+02	3.08E+05	29.95
4:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	29.95
4:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	29.95
5:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	31.01
5:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	31.01

5:20	5.1	5.7956	5.8693	3.15E+02	1.89E+05	31.01
5:30	5.4	6.1365	6.2146	3.84E+02	2.31E+05	31.01
5:40	6.4	7.2729	7.3655	6.62E+02	3.97E+05	31.01
5:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	31.01
6:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	34.71
6:10	6	6.8184	6.9051	5.42E+02	3.25E+05	34.71
6:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	34.71
6:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	34.71
6:40	5.2	5.9092	5.9844	3.38E+02	2.03E+05	34.71
6:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	34.71
7:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	39.73
7:10	6	6.8184	6.9051	5.42E+02	3.25E+05	39.73
7:20	5.2	5.9092	5.9844	3.38E+02	2.03E+05	39.73
7:30	5.3	6.0229	6.0995	3.61E+02	2.16E+05	39.73
7:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	39.73
7:50	7	7.9548	8.0560	8.61E+02	5.17E+05	39.73
8:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	43.30
8:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	43.30
8:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	43.30
8:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	43.30
8:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	43.30
8:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	43.30
9:00	6	6.8184	6.9051	5.42E+02	3.25E+05	47.00
9:10	5.1	5.7956	5.8693	3.15E+02	1.89E+05	47.00
9:20	5.5	6.2502	6.3297	4.09E+02	2.45E+05	47.00
9:30	2.9	3.2955	3.3375	2.43E+01	1.46E+04	47.00
9:40	2.2	2.5001	2.5319	8.96E-01	5.38E+02	47.00
9:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	47.00
10:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	45.00
10:10	4.4	5.0001	5.0638	1.83E+02	1.10E+05	45.00
10:20	5.7	6.4774	6.5599	4.60E+02	2.76E+05	45.00
10:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	45.00
10:40	8.8	10.0003	10.1275	1.55E+03	9.32E+05	45.00
10:50	9.4	10.6821	10.8180	1.79E+03	1.08E+06	45.00
11:00	8.8	10.0003	10.1275	1.55E+03	9.32E+05	41.61
11:10	7.8	8.8639	8.9767	1.16E+03	6.94E+05	41.61
11:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	41.61
11:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	41.61
11:40	4.4	5.0001	5.0638	1.83E+02	1.10E+05	41.61
11:50	6	6.8184	6.9051	5.42E+02	3.25E+05	41.61
12:00	5.4	6.1365	6.2146	3.84E+02	2.31E+05	39.66
12:10	4.3	4.8865	4.9487	1.67E+02	1.00E+05	39.66
12:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	39.66
12:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.66
12:40	4.4	5.0001	5.0638	1.83E+02	1.10E+05	39.66

12:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	39.66
13:00	4.5	5.1138	5.1788	1.99E+02	1.20E+05	36.18
13:10	4.5	5.1138	5.1788	1.99E+02	1.20E+05	36.18
13:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	36.18
13:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	36.18
13:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	36.18
13:50	2.6	2.9546	2.9922	1.10E+01	6.59E+03	36.18
14:00	2.2	2.5001	2.5319	8.96E-01	5.38E+02	33.12
14:10	3.9	4.4319	4.4883	1.12E+02	6.69E+04	33.12
14:20	3.9	4.4319	4.4883	1.12E+02	6.69E+04	33.12
14:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	33.12
14:40	2.9	3.2955	3.3375	2.43E+01	1.46E+04	33.12
14:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	33.12
15:00	3.2	3.6365	3.6827	4.33E+01	2.60E+04	34.00
15:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	34.00
15:20	4.4	5.0001	5.0638	1.83E+02	1.10E+05	34.00
15:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	34.00
15:40	3.3	3.7501	3.7978	5.09E+01	3.05E+04	34.00
15:50	3.7	4.2047	4.2582	8.84E+01	5.31E+04	34.00
16:00	3.1	3.5228	3.5676	3.63E+01	2.18E+04	34.49
16:10	3.4	3.8637	3.9129	5.92E+01	3.55E+04	34.49
16:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	34.49
16:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	34.49
16:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	34.49
16:50	2.9	3.2955	3.3375	2.43E+01	1.46E+04	34.49
17:00	3.7	4.2047	4.2582	8.84E+01	5.31E+04	39.84
17:10	3.8	4.3183	4.3732	9.96E+01	5.98E+04	39.84
17:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	39.84
17:30	4.1	4.6592	4.7185	1.38E+02	8.26E+04	39.84
17:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.84
17:50	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.84
18:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	43.10
18:10	5.3	6.0229	6.0995	3.61E+02	2.16E+05	43.10
18:20	4.9	5.5683	5.6392	2.74E+02	1.64E+05	43.10
18:30	5.5	6.2502	6.3297	4.09E+02	2.45E+05	43.10
18:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	43.10
18:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	43.10
19:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	52.37
19:10	5.6	6.3638	6.4448	4.34E+02	2.60E+05	52.37
19:20	5	5.6820	5.7543	2.94E+02	1.76E+05	52.37
19:30	5.4	6.1365	6.2146	3.84E+02	2.31E+05	52.37
19:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	52.37
19:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	52.37
20:00	4.4	5.0001	5.0638	1.83E+02	1.10E+05	46.94
20:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	46.94

20:20	5.8	6.5911	6.6749	4.87E+02	2.92E+05	46.94
20:30	5.7	6.4774	6.5599	4.60E+02	2.76E+05	46.94
20:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	46.94
20:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	46.94
21:00	6.2	7.0456	7.1353	6.01E+02	3.61E+05	43.00
21:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	43.00
21:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	43.00
21:30	5.6	6.3638	6.4448	4.34E+02	2.60E+05	43.00
21:40	6.3	7.1593	7.2504	6.31E+02	3.79E+05	43.00
21:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	43.00
22:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	40.66
22:10	6.7	7.6138	7.7107	7.59E+02	4.55E+05	40.66
22:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	40.66
22:30	6.5	7.3866	7.4805	6.94E+02	4.16E+05	40.66
22:40	7	7.9548	8.0560	8.61E+02	5.17E+05	40.66
22:50	7.2	8.1820	8.2861	9.32E+02	5.59E+05	40.66
23:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	38.70
23:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	38.70
23:20	7.9	8.9775	9.0917	1.20E+03	7.17E+05	38.70
23:30	7.2	8.1820	8.2861	9.32E+02	5.59E+05	38.70
23:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	38.70
23:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	38.70
0:00	7	7.9548	8.0560	8.61E+02	5.17E+05	38.39
0:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	38.39
0:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	38.39
0:30	7.3	8.2957	8.4012	9.69E+02	5.81E+05	38.39
0:40	8.8	10.0003	10.1275	1.55E+03	9.32E+05	38.39
0:50	8.8	10.0003	10.1275	1.55E+03	9.32E+05	38.39
1:00	8.9	10.1139	10.2426	1.59E+03	9.56E+05	33.63
1:10	9.3	10.5685	10.7029	1.75E+03	1.05E+06	33.63
1:20	9.4	10.6821	10.8180	1.79E+03	1.08E+06	33.63
1:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	33.63
1:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	33.63
1:50	9.1	10.3412	10.4728	1.67E+03	1.00E+06	33.63
2:00	9.8	11.1367	11.2784	1.95E+03	1.17E+06	30.00
2:10	9.3	10.5685	10.7029	1.75E+03	1.05E+06	30.00
2:20	8.6	9.7730	9.8973	1.47E+03	8.83E+05	30.00
2:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	30.00
2:40	7.7	8.7502	8.8616	1.12E+03	6.71E+05	30.00
2:50	8	9.0911	9.2068	1.23E+03	7.40E+05	30.00
3:00	8.5	9.6593	9.7822	1.43E+03	8.59E+05	23.84
3:10	8.9	10.1139	10.2426	1.59E+03	9.56E+05	23.84
3:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	23.84
3:30	8.4	9.5457	9.6672	1.39E+03	8.35E+05	23.84
3:40	8.7	9.8866	10.0124	1.51E+03	9.08E+05	23.84

3:50	9.1	10.3412	10.4728	1.67E+03	1.00E+06	23.84
4:00	8.7	9.8866	10.0124	1.51E+03	9.08E+05	21.30
4:10	8.9	10.1139	10.2426	1.59E+03	9.56E+05	21.30
4:20	9.4	10.6821	10.8180	1.79E+03	1.08E+06	21.30
4:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	21.30
4:40	8.4	9.5457	9.6672	1.39E+03	8.35E+05	21.30
4:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	21.30
5:00	8.8	10.0003	10.1275	1.55E+03	9.32E+05	22.32
5:10	8.6	9.7730	9.8973	1.47E+03	8.83E+05	22.32
5:20	8.9	10.1139	10.2426	1.59E+03	9.56E+05	22.32
5:30	8.9	10.1139	10.2426	1.59E+03	9.56E+05	22.32
5:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	22.32
5:50	8.5	9.6593	9.7822	1.43E+03	8.59E+05	22.32
6:00	7.9	8.9775	9.0917	1.20E+03	7.17E+05	24.85
6:10	8.2	9.3184	9.4370	1.31E+03	7.88E+05	24.85
6:20	7.5	8.5229	8.6314	1.04E+03	6.25E+05	24.85
6:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	24.85
6:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	24.85
6:50	6.4	7.2729	7.3655	6.62E+02	3.97E+05	24.85
7:00	7	7.9548	8.0560	8.61E+02	5.17E+05	29.66
7:10	7.9	8.9775	9.0917	1.20E+03	7.17E+05	29.66
7:20	10.6	12.0458	12.1990	2.00E+03	1.20E+06	29.66
7:30	9.9	11.2503	11.3934	1.98E+03	1.19E+06	29.66
7:40	8.6	9.7730	9.8973	1.47E+03	8.83E+05	29.66
7:50	9.8	11.1367	11.2784	1.95E+03	1.17E+06	29.66
8:00	9.9	11.2503	11.3934	1.98E+03	1.19E+06	37.03
8:10	9.8	11.1367	11.2784	1.95E+03	1.17E+06	37.03
8:20	9.2	10.4548	10.5878	1.71E+03	1.03E+06	37.03
8:30	7.8	8.8639	8.9767	1.16E+03	6.94E+05	37.03
8:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	37.03
8:50	7.5	8.5229	8.6314	1.04E+03	6.25E+05	37.03
9:00	8.9	10.1139	10.2426	1.59E+03	9.56E+05	41.50
9:10	9.9	11.2503	11.3934	1.98E+03	1.19E+06	41.50
9:20	10.2	11.5912	11.7387	2.00E+03	1.20E+06	41.50
9:30	11.7	13.2958	13.4650	2.00E+03	1.20E+06	41.50
9:40	11	12.5003	12.6594	2.00E+03	1.20E+06	41.50
9:50	9.4	10.6821	10.8180	1.79E+03	1.08E+06	41.50
10:00	8.5	9.6593	9.7822	1.43E+03	8.59E+05	41.80
10:10	5.2	5.9092	5.9844	3.38E+02	2.03E+05	41.80
10:20	5.7	6.4774	6.5599	4.60E+02	2.76E+05	41.80
10:30	4.3	4.8865	4.9487	1.67E+02	1.00E+05	41.80
10:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	41.80
10:50	5.3	6.0229	6.0995	3.61E+02	2.16E+05	41.80
11:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	39.66
11:10	6	6.8184	6.9051	5.42E+02	3.25E+05	39.66

11:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	39.66
11:30	7.1	8.0684	8.1711	8.97E+02	5.38E+05	39.66
11:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	39.66
11:50	6.4	7.2729	7.3655	6.62E+02	3.97E+05	39.66
12:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	37.35
12:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	37.35
12:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	37.35
12:30	8.2	9.3184	9.4370	1.31E+03	7.88E+05	37.35
12:40	9.1	10.3412	10.4728	1.67E+03	1.00E+06	37.35
12:50	8.9	10.1139	10.2426	1.59E+03	9.56E+05	37.35
13:00	8.3	9.4321	9.5521	1.35E+03	8.11E+05	33.31
13:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	33.31
13:20	8.7	9.8866	10.0124	1.51E+03	9.08E+05	33.31
13:30	7.2	8.1820	8.2861	9.32E+02	5.59E+05	33.31
13:40	6.6	7.5002	7.5956	7.26E+02	4.36E+05	33.31
13:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	33.31
14:00	7.8	8.8639	8.9767	1.16E+03	6.94E+05	33.50
14:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	33.50
14:20	9.2	10.4548	10.5878	1.71E+03	1.03E+06	33.50
14:30	9.4	10.6821	10.8180	1.79E+03	1.08E+06	33.50
14:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	33.50
14:50	8.3	9.4321	9.5521	1.35E+03	8.11E+05	33.50
15:00	8.2	9.3184	9.4370	1.31E+03	7.88E+05	35.12
15:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	35.12
15:20	4.9	5.5683	5.6392	2.74E+02	1.64E+05	35.12
15:30	3.3	3.7501	3.7978	5.09E+01	3.05E+04	35.12
15:40	3.9	4.4319	4.4883	1.12E+02	6.69E+04	35.12
15:50	5.4	6.1365	6.2146	3.84E+02	2.31E+05	35.12
16:00	4.9	5.5683	5.6392	2.74E+02	1.64E+05	39.66
16:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	39.66
16:20	4.9	5.5683	5.6392	2.74E+02	1.64E+05	39.66
16:30	4.8	5.4547	5.5241	2.54E+02	1.52E+05	39.66
16:40	4.8	5.4547	5.5241	2.54E+02	1.52E+05	39.66
16:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	39.66
17:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	41.01
17:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	41.01
17:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	41.01
17:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	41.01
17:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	41.01
17:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	41.01
18:00	7.6	8.6366	8.7465	1.08E+03	6.48E+05	47.00
18:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	47.00
18:20	7.3	8.2957	8.4012	9.69E+02	5.81E+05	47.00
18:30	8.6	9.7730	9.8973	1.47E+03	8.83E+05	47.00
18:40	8.4	9.5457	9.6672	1.39E+03	8.35E+05	47.00

18:50	8.4	9.5457	9.6672	1.39E+03	8.35E+05	47.00
19:00	7.7	8.7502	8.8616	1.12E+03	6.71E+05	60.14
19:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	60.14
19:20	7.7	8.7502	8.8616	1.12E+03	6.71E+05	60.14
19:30	8.5	9.6593	9.7822	1.43E+03	8.59E+05	60.14
19:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	60.14
19:50	8	9.0911	9.2068	1.23E+03	7.40E+05	60.14
20:00	6.6	7.5002	7.5956	7.26E+02	4.36E+05	56.13
20:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	56.13
20:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	56.13
20:30	6.1	6.9320	7.0202	5.71E+02	3.43E+05	56.13
20:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	56.13
20:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	56.13
21:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	49.88
21:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	49.88
21:20	6.1	6.9320	7.0202	5.71E+02	3.43E+05	49.88
21:30	6.3	7.1593	7.2504	6.31E+02	3.79E+05	49.88
21:40	6	6.8184	6.9051	5.42E+02	3.25E+05	49.88
21:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	49.88
22:00	6.7	7.6138	7.7107	7.59E+02	4.55E+05	44.25
22:10	5.9	6.7047	6.7900	5.14E+02	3.08E+05	44.25
22:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	44.25
22:30	5.4	6.1365	6.2146	3.84E+02	2.31E+05	44.25
22:40	5.3	6.0229	6.0995	3.61E+02	2.16E+05	44.25
22:50	5.1	5.7956	5.8693	3.15E+02	1.89E+05	44.25
23:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	40.95
23:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	40.95
23:20	5.4	6.1365	6.2146	3.84E+02	2.31E+05	40.95
23:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	40.95
23:40	4.8	5.4547	5.5241	2.54E+02	1.52E+05	40.95
23:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	40.95
0:00	5.2	5.9092	5.9844	3.38E+02	2.03E+05	33.72
0:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	33.72
0:20	5.1	5.7956	5.8693	3.15E+02	1.89E+05	33.72
0:30	5.5	6.2502	6.3297	4.09E+02	2.45E+05	33.72
0:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	33.72
0:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	33.72
1:00	3.2	3.6365	3.6827	4.33E+01	2.60E+04	28.09
1:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	28.09
1:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	28.09
1:30	7.1	8.0684	8.1711	8.97E+02	5.38E+05	28.09
1:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	28.09
1:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	28.09
2:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	27.26
2:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	27.26

2:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	27.26
2:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	27.26
2:40	7.4	8.4093	8.5163	1.01E+03	6.03E+05	27.26
2:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	27.26
3:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	23.68
3:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	23.68
3:20	7.3	8.2957	8.4012	9.69E+02	5.81E+05	23.68
3:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	23.68
3:40	7.8	8.8639	8.9767	1.16E+03	6.94E+05	23.68
3:50	7.3	8.2957	8.4012	9.69E+02	5.81E+05	23.68
4:00	6.1	6.9320	7.0202	5.71E+02	3.43E+05	23.91
4:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	23.91
4:20	9.1	10.3412	10.4728	1.67E+03	1.00E+06	23.91
4:30	12.2	13.8640	14.0404	2.00E+03	1.20E+06	23.91
4:40	12.6	14.3186	14.5007	2.00E+03	1.20E+06	23.91
4:50	10.5	11.9321	12.0840	2.00E+03	1.20E+06	23.91
5:00	10.5	11.9321	12.0840	2.00E+03	1.20E+06	30.20
5:10	10.4	11.8185	11.9689	2.00E+03	1.20E+06	30.20
5:20	9.1	10.3412	10.4728	1.67E+03	1.00E+06	30.20
5:30	8.5	9.6593	9.7822	1.43E+03	8.59E+05	30.20
5:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	30.20
5:50	9.1	10.3412	10.4728	1.67E+03	1.00E+06	30.20
6:00	9.9	11.2503	11.3934	1.98E+03	1.19E+06	49.88
6:10	9	10.2275	10.3577	1.63E+03	9.80E+05	49.88
6:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	49.88
6:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	49.88
6:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	49.88
6:50	10.1	11.4776	11.6236	2.00E+03	1.20E+06	49.88
7:00	9.7	11.0230	11.1633	1.91E+03	1.14E+06	58.00
7:10	8.2	9.3184	9.4370	1.31E+03	7.88E+05	58.00
7:20	8.1	9.2048	9.3219	1.27E+03	7.64E+05	58.00
7:30	8.5	9.6593	9.7822	1.43E+03	8.59E+05	58.00
7:40	9.2	10.4548	10.5878	1.71E+03	1.03E+06	58.00
7:50	10.6	12.0458	12.1990	2.00E+03	1.20E+06	58.00
8:00	9.1	10.3412	10.4728	1.67E+03	1.00E+06	60.99
8:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	60.99
8:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	60.99
8:30	5.9	6.7047	6.7900	5.14E+02	3.08E+05	60.99
8:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	60.99
8:50	6.7	7.6138	7.7107	7.59E+02	4.55E+05	60.99
9:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	56.56
9:10	7.1	8.0684	8.1711	8.97E+02	5.38E+05	56.56
9:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	56.56
9:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	56.56
9:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	56.56

9:50	7.8	8.8639	8.9767	1.16E+03	6.94E+05	56.56
10:00	8.2	9.3184	9.4370	1.31E+03	7.88E+05	49.88
10:10	8.5	9.6593	9.7822	1.43E+03	8.59E+05	49.88
10:20	8.7	9.8866	10.0124	1.51E+03	9.08E+05	49.88
10:30	8.7	9.8866	10.0124	1.51E+03	9.08E+05	49.88
10:40	8.2	9.3184	9.4370	1.31E+03	7.88E+05	49.88
10:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	49.88
11:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	44.15
11:10	7.8	8.8639	8.9767	1.16E+03	6.94E+05	44.15
11:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	44.15
11:30	6.4	7.2729	7.3655	6.62E+02	3.97E+05	44.15
11:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	44.15
11:50	9.4	10.6821	10.8180	1.79E+03	1.08E+06	44.15
12:00	10.2	11.5912	11.7387	2.00E+03	1.20E+06	43.00
12:10	10.8	12.2730	12.4292	2.00E+03	1.20E+06	43.00
12:20	10.1	11.4776	11.6236	2.00E+03	1.20E+06	43.00
12:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	43.00
12:40	9.4	10.6821	10.8180	1.79E+03	1.08E+06	43.00
12:50	9.7	11.0230	11.1633	1.91E+03	1.14E+06	43.00
13:00	8.5	9.6593	9.7822	1.43E+03	8.59E+05	42.00
13:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	42.00
13:20	7.3	8.2957	8.4012	9.69E+02	5.81E+05	42.00
13:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	42.00
13:40	5.4	6.1365	6.2146	3.84E+02	2.31E+05	42.00
13:50	5.1	5.7956	5.8693	3.15E+02	1.89E+05	42.00
14:00	5.4	6.1365	6.2146	3.84E+02	2.31E+05	43.00
14:10	6.9	7.8411	7.9409	8.27E+02	4.96E+05	43.00
14:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	43.00
14:30	7.8	8.8639	8.9767	1.16E+03	6.94E+05	43.00
14:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	43.00
14:50	8.5	9.6593	9.7822	1.43E+03	8.59E+05	43.00
15:00	8.3	9.4321	9.5521	1.35E+03	8.11E+05	44.25
15:10	8.5	9.6593	9.7822	1.43E+03	8.59E+05	44.25
15:20	8.1	9.2048	9.3219	1.27E+03	7.64E+05	44.25
15:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	44.25
15:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	44.25
15:50	6.4	7.2729	7.3655	6.62E+02	3.97E+05	44.25
16:00	8.1	9.2048	9.3219	1.27E+03	7.64E+05	50.10
16:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	50.10
16:20	5.2	5.9092	5.9844	3.38E+02	2.03E+05	50.10
16:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	50.10
16:40	5.3	6.0229	6.0995	3.61E+02	2.16E+05	50.10
16:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	50.10
17:00	8.2	9.3184	9.4370	1.31E+03	7.88E+05	51.00
17:10	8.9	10.1139	10.2426	1.59E+03	9.56E+05	51.00

17:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	51.00
17:30	8	9.0911	9.2068	1.23E+03	7.40E+05	51.00
17:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	51.00
17:50	7.2	8.1820	8.2861	9.32E+02	5.59E+05	51.00
18:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	63.43
18:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	63.43
18:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	63.43
18:30	7.1	8.0684	8.1711	8.97E+02	5.38E+05	63.43
18:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	63.43
18:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	63.43
19:00	7.6	8.6366	8.7465	1.08E+03	6.48E+05	85.00
19:10	7.2	8.1820	8.2861	9.32E+02	5.59E+05	85.00
19:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	85.00
19:30	8.1	9.2048	9.3219	1.27E+03	7.64E+05	85.00
19:40	7.7	8.7502	8.8616	1.12E+03	6.71E+05	85.00
19:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	85.00
20:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	89.95
20:10	6.1	6.9320	7.0202	5.71E+02	3.43E+05	89.95
20:20	7.8	8.8639	8.9767	1.16E+03	6.94E+05	89.95
20:30	8.9	10.1139	10.2426	1.59E+03	9.56E+05	89.95
20:40	7.8	8.8639	8.9767	1.16E+03	6.94E+05	89.95
20:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	89.95
21:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	69.26
21:10	7.2	8.1820	8.2861	9.32E+02	5.59E+05	69.26
21:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	69.26
21:30	5.3	6.0229	6.0995	3.61E+02	2.16E+05	69.26
21:40	5.6	6.3638	6.4448	4.34E+02	2.60E+05	69.26
21:50	5.3	6.0229	6.0995	3.61E+02	2.16E+05	69.26
22:00	5.6	6.3638	6.4448	4.34E+02	2.60E+05	50.11
22:10	5.3	6.0229	6.0995	3.61E+02	2.16E+05	50.11
22:20	5.2	5.9092	5.9844	3.38E+02	2.03E+05	50.11
22:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	50.11
22:40	5.3	6.0229	6.0995	3.61E+02	2.16E+05	50.11
22:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	50.11
23:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	46.30
23:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	46.30
23:20	6.1	6.9320	7.0202	5.71E+02	3.43E+05	46.30
23:30	5.6	6.3638	6.4448	4.34E+02	2.60E+05	46.30
23:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	46.30
23:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	46.30
0:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	40.00
0:10	3.9	4.4319	4.4883	1.12E+02	6.69E+04	40.00
0:20	3.4	3.8637	3.9129	5.92E+01	3.55E+04	40.00
0:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	40.00
0:40	4.1	4.6592	4.7185	1.38E+02	8.26E+04	40.00

0:50	4.5	5.1138	5.1788	1.99E+02	1.20E+05	40.00
1:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	37.03
1:10	5.7	6.4774	6.5599	4.60E+02	2.76E+05	37.03
1:20	4.9	5.5683	5.6392	2.74E+02	1.64E+05	37.03
1:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	37.03
1:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	37.03
1:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	37.03
2:00	3.9	4.4319	4.4883	1.12E+02	6.69E+04	32.52
2:10	3.2	3.6365	3.6827	4.33E+01	2.60E+04	32.52
2:20	2.9	3.2955	3.3375	2.43E+01	1.46E+04	32.52
2:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	32.52
2:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	32.52
2:50	5.9	6.7047	6.7900	5.14E+02	3.08E+05	32.52
3:00	4.6	5.2274	5.2939	2.17E+02	1.30E+05	32.01
3:10	4.8	5.4547	5.5241	2.54E+02	1.52E+05	32.01
3:20	4.2	4.7729	4.8336	1.52E+02	9.12E+04	32.01
3:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	32.01
3:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	32.01
3:50	4.6	5.2274	5.2939	2.17E+02	1.30E+05	32.01
4:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	32.01
4:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	32.01
4:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	32.01
4:30	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.01
4:40	4.7	5.3410	5.4090	2.35E+02	1.41E+05	32.01
4:50	5	5.6820	5.7543	2.94E+02	1.76E+05	32.01
5:00	4.3	4.8865	4.9487	1.67E+02	1.00E+05	38.60
5:10	2.8	3.1819	3.2224	1.93E+01	1.16E+04	38.60
5:20	3.6	4.0910	4.1431	7.80E+01	4.68E+04	38.60
5:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	38.60
5:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	38.60
5:50	2.7	3.0683	3.1073	1.49E+01	8.91E+03	38.60
6:00	3.6	4.0910	4.1431	7.80E+01	4.68E+04	49.00
6:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	49.00
6:20	4.6	5.2274	5.2939	2.17E+02	1.30E+05	49.00
6:30	4.9	5.5683	5.6392	2.74E+02	1.64E+05	49.00
6:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	49.00
6:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.00
7:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	54.28
7:10	5.2	5.9092	5.9844	3.38E+02	2.03E+05	54.28
7:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	54.28
7:30	3.5	3.9774	4.0280	6.82E+01	4.09E+04	54.28
7:40	3.1	3.5228	3.5676	3.63E+01	2.18E+04	54.28
7:50	4	4.5456	4.6034	1.24E+02	7.46E+04	54.28
8:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	62.99
8:10	2.6	2.9546	2.9922	1.10E+01	6.59E+03	62.99

8:20	2.1	2.3864	2.4168	0.00E+00	0.00E+00	62.99
8:30	3.4	3.8637	3.9129	5.92E+01	3.55E+04	62.99
8:40	3.6	4.0910	4.1431	7.80E+01	4.68E+04	62.99
8:50	4.1	4.6592	4.7185	1.38E+02	8.26E+04	62.99
9:00	4.5	5.1138	5.1788	1.99E+02	1.20E+05	62.00
9:10	4.2	4.7729	4.8336	1.52E+02	9.12E+04	62.00
9:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	62.00
9:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	62.00
9:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	62.00
9:50	3.4	3.8637	3.9129	5.92E+01	3.55E+04	62.00
10:00	3.6	4.0910	4.1431	7.80E+01	4.68E+04	45.00
10:10	3.3	3.7501	3.7978	5.09E+01	3.05E+04	45.00
10:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	45.00
10:30	2.4	2.7273	2.7620	4.92E+00	2.95E+03	45.00
10:40	2.4	2.7273	2.7620	4.92E+00	2.95E+03	45.00
10:50	2.4	2.7273	2.7620	4.92E+00	2.95E+03	45.00
11:00	2.9	3.2955	3.3375	2.43E+01	1.46E+04	40.78
11:10	3.2	3.6365	3.6827	4.33E+01	2.60E+04	40.78
11:20	3.5	3.9774	4.0280	6.82E+01	4.09E+04	40.78
11:30	3.4	3.8637	3.9129	5.92E+01	3.55E+04	40.78
11:40	2.4	2.7273	2.7620	4.92E+00	2.95E+03	40.78
11:50	3.3	3.7501	3.7978	5.09E+01	3.05E+04	40.78
12:00	2.5	2.8410	2.8771	7.68E+00	4.61E+03	39.00
12:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	39.00
12:20	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.00
12:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.00
12:40	3.8	4.3183	4.3732	9.96E+01	5.98E+04	39.00
12:50	3.5	3.9774	4.0280	6.82E+01	4.09E+04	39.00
13:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.78
13:10	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.78
13:20	4	4.5456	4.6034	1.24E+02	7.46E+04	39.78
13:30	2.9	3.2955	3.3375	2.43E+01	1.46E+04	39.78
13:40	3.5	3.9774	4.0280	6.82E+01	4.09E+04	39.78
13:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	39.78
14:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	39.98
14:10	4.9	5.5683	5.6392	2.74E+02	1.64E+05	39.98
14:20	3.3	3.7501	3.7978	5.09E+01	3.05E+04	39.98
14:30	4.3	4.8865	4.9487	1.67E+02	1.00E+05	39.98
14:40	3.4	3.8637	3.9129	5.92E+01	3.55E+04	39.98
14:50	3.7	4.2047	4.2582	8.84E+01	5.31E+04	39.98
15:00	4.4	5.0001	5.0638	1.83E+02	1.10E+05	40.98
15:10	4.9	5.5683	5.6392	2.74E+02	1.64E+05	40.98
15:20	3.8	4.3183	4.3732	9.96E+01	5.98E+04	40.98
15:30	3.9	4.4319	4.4883	1.12E+02	6.69E+04	40.98
15:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	40.98

15:50	5.3	6.0229	6.0995	3.61E+02	2.16E+05	40.98
16:00	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.00
16:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	49.00
16:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	49.00
16:30	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.00
16:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	49.00
16:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.00
17:00	4.3	4.8865	4.9487	1.67E+02	1.00E+05	52.89
17:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	52.89
17:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	52.89
17:30	8.4	9.5457	9.6672	1.39E+03	8.35E+05	52.89
17:40	7.5	8.5229	8.6314	1.04E+03	6.25E+05	52.89
17:50	7	7.9548	8.0560	8.61E+02	5.17E+05	52.89
18:00	7.6	8.6366	8.7465	1.08E+03	6.48E+05	54.99
18:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	54.99
18:20	6.2	7.0456	7.1353	6.01E+02	3.61E+05	54.99
18:30	5.7	6.4774	6.5599	4.60E+02	2.76E+05	54.99
18:40	5.4	6.1365	6.2146	3.84E+02	2.31E+05	54.99
18:50	8.7	9.8866	10.0124	1.51E+03	9.08E+05	54.99
19:00	9.2	10.4548	10.5878	1.71E+03	1.03E+06	64.99
19:10	10.9	12.3867	12.5443	2.00E+03	1.20E+06	64.99
19:20	11.1	12.6140	12.7745	2.00E+03	1.20E+06	64.99
19:30	8.7	9.8866	10.0124	1.51E+03	9.08E+05	64.99
19:40	10.4	11.8185	11.9689	2.00E+03	1.20E+06	64.99
19:50	8.4	9.5457	9.6672	1.39E+03	8.35E+05	64.99
20:00	8.6	9.7730	9.8973	1.47E+03	8.83E+05	54.39
20:10	8.8	10.0003	10.1275	1.55E+03	9.32E+05	54.39
20:20	9.1	10.3412	10.4728	1.67E+03	1.00E+06	54.39
20:30	9.2	10.4548	10.5878	1.71E+03	1.03E+06	54.39
20:40	9.1	10.3412	10.4728	1.67E+03	1.00E+06	54.39
20:50	8.3	9.4321	9.5521	1.35E+03	8.11E+05	54.39
21:00	9.3	10.5685	10.7029	1.75E+03	1.05E+06	47.77
21:10	11.2	12.7276	12.8896	2.00E+03	1.20E+06	47.77
21:20	12.2	13.8640	14.0404	2.00E+03	1.20E+06	47.77
21:30	14.1	16.0231	16.2270	2.00E+03	1.20E+06	47.77
21:40	13.1	14.8868	15.0762	2.00E+03	1.20E+06	47.77
21:50	12.3	13.9776	14.1555	2.00E+03	1.20E+06	47.77
22:00	11.6	13.1822	13.3499	2.00E+03	1.20E+06	46.68
22:10	13.9	15.7959	15.9969	2.00E+03	1.20E+06	46.68
22:20	13.7	15.5686	15.7667	2.00E+03	1.20E+06	46.68
22:30	13.9	15.7959	15.9969	2.00E+03	1.20E+06	46.68
22:40	11.8	13.4094	13.5801	2.00E+03	1.20E+06	46.68
22:50	11.3	12.8412	13.0046	2.00E+03	1.20E+06	46.68
23:00	12.2	13.8640	14.0404	2.00E+03	1.20E+06	42.22
23:10	12.4	14.0913	14.2706	2.00E+03	1.20E+06	42.22

23:20	13.9	15.7959	15.9969	2.00E+03	1.20E+06	42.22
23:30	12.9	14.6595	14.8460	2.00E+03	1.20E+06	42.22
23:40	12.9	14.6595	14.8460	2.00E+03	1.20E+06	42.22
23:50	11.5	13.0685	13.2348	2.00E+03	1.20E+06	42.22
0:00	12.5	14.2049	14.3857	2.00E+03	1.20E+06	40.20
0:10	10.6	12.0458	12.1990	2.00E+03	1.20E+06	40.20
0:20	11.8	13.4094	13.5801	2.00E+03	1.20E+06	40.20
0:30	11.2	12.7276	12.8896	2.00E+03	1.20E+06	40.20
0:40	11.1	12.6140	12.7745	2.00E+03	1.20E+06	40.20
0:50	10.9	12.3867	12.5443	2.00E+03	1.20E+06	40.20
1:00	10.4	11.8185	11.9689	2.00E+03	1.20E+06	39.25
1:10	10.8	12.2730	12.4292	2.00E+03	1.20E+06	39.25
1:20	10.9	12.3867	12.5443	2.00E+03	1.20E+06	39.25
1:30	12.9	14.6595	14.8460	2.00E+03	1.20E+06	39.25
1:40	13.5	15.3413	15.5365	2.00E+03	1.20E+06	39.25
1:50	13.4	15.2277	15.4214	2.00E+03	1.20E+06	39.25
2:00	14.5	16.4777	16.6874	2.00E+03	1.20E+06	38.35
2:10	14.9	16.9323	17.1477	2.00E+03	1.20E+06	38.35
2:20	12.6	14.3186	14.5007	2.00E+03	1.20E+06	38.35
2:30	15.2	17.2732	17.4930	2.00E+03	1.20E+06	38.35
2:40	14.2	16.1368	16.3421	2.00E+03	1.20E+06	38.35
2:50	14.3	16.2504	16.4572	2.00E+03	1.20E+06	38.35
3:00	14	15.9095	16.1119	2.00E+03	1.20E+06	35.52
3:10	13.1	14.8868	15.0762	2.00E+03	1.20E+06	35.52
3:20	13.7	15.5686	15.7667	2.00E+03	1.20E+06	35.52
3:30	14.1	16.0231	16.2270	2.00E+03	1.20E+06	35.52
3:40	12	13.6367	13.8102	2.00E+03	1.20E+06	35.52
3:50	13.1	14.8868	15.0762	2.00E+03	1.20E+06	35.52
4:00	12.4	14.0913	14.2706	2.00E+03	1.20E+06	33.62
4:10	12.4	14.0913	14.2706	2.00E+03	1.20E+06	33.62
4:20	11.4	12.9549	13.1197	2.00E+03	1.20E+06	33.62
4:30	12.1	13.7504	13.9253	2.00E+03	1.20E+06	33.62
4:40	11.8	13.4094	13.5801	2.00E+03	1.20E+06	33.62
4:50	11.9	13.5231	13.6951	2.00E+03	1.20E+06	33.62
5:00	11.2	12.7276	12.8896	2.00E+03	1.20E+06	38.35
5:10	11.1	12.6140	12.7745	2.00E+03	1.20E+06	38.35
5:20	12.1	13.7504	13.9253	2.00E+03	1.20E+06	38.35
5:30	11.2	12.7276	12.8896	2.00E+03	1.20E+06	38.35
5:40	12.7	14.4322	14.6158	2.00E+03	1.20E+06	38.35
5:50	10.5	11.9321	12.0840	2.00E+03	1.20E+06	38.35
6:00	10	11.3639	11.5085	2.00E+03	1.20E+06	46.83
6:10	10.6	12.0458	12.1990	2.00E+03	1.20E+06	46.83
6:20	10.4	11.8185	11.9689	2.00E+03	1.20E+06	46.83
6:30	11.9	13.5231	13.6951	2.00E+03	1.20E+06	46.83
6:40	10.9	12.3867	12.5443	2.00E+03	1.20E+06	46.83

6:50	13.6	15.4549	15.6516	2.00E+03	1.20E+06	46.83
7:00	12.1	13.7504	13.9253	2.00E+03	1.20E+06	50.42
7:10	12.5	14.2049	14.3857	2.00E+03	1.20E+06	50.42
7:20	13	14.7731	14.9611	2.00E+03	1.20E+06	50.42
7:30	14.6	16.5913	16.8025	2.00E+03	1.20E+06	50.42
7:40	12.1	13.7504	13.9253	2.00E+03	1.20E+06	50.42
7:50	12.2	13.8640	14.0404	2.00E+03	1.20E+06	50.42
8:00	13.7	15.5686	15.7667	2.00E+03	1.20E+06	50.43
8:10	13.9	15.7959	15.9969	2.00E+03	1.20E+06	50.43
8:20	11.4	12.9549	13.1197	2.00E+03	1.20E+06	50.43
8:30	12.3	13.9776	14.1555	2.00E+03	1.20E+06	50.43
8:40	12.2	13.8640	14.0404	2.00E+03	1.20E+06	50.43
8:50	12	13.6367	13.8102	2.00E+03	1.20E+06	50.43
9:00	12.9	14.6595	14.8460	2.00E+03	1.20E+06	49.89
9:10	13.3	15.1140	15.3063	2.00E+03	1.20E+06	49.89
9:20	14.6	16.5913	16.8025	2.00E+03	1.20E+06	49.89
9:30	13.4	15.2277	15.4214	2.00E+03	1.20E+06	49.89
9:40	12.6	14.3186	14.5007	2.00E+03	1.20E+06	49.89
9:50	14.1	16.0231	16.2270	2.00E+03	1.20E+06	49.89
10:00	14.2	16.1368	16.3421	2.00E+03	1.20E+06	44.90
10:10	13.1	14.8868	15.0762	2.00E+03	1.20E+06	44.90
10:20	16.2	18.4096	18.6438	2.00E+03	1.20E+06	44.90
10:30	16.9	19.2050	19.4494	2.00E+03	1.20E+06	44.90
10:40	18.4	20.9096	21.1757	2.00E+03	1.20E+06	44.90
10:50	14.5	16.4777	16.6874	2.00E+03	1.20E+06	44.90
11:00	15.3	17.3868	17.6080	2.00E+03	1.20E+06	41.87
11:10	17.6	20.0005	20.2550	2.00E+03	1.20E+06	41.87
11:20	15.6	17.7277	17.9533	2.00E+03	1.20E+06	41.87
11:30	16.4	18.6368	18.8740	2.00E+03	1.20E+06	41.87
11:40	17.6	20.0005	20.2550	2.00E+03	1.20E+06	41.87
11:50	16.7	18.9778	19.2192	2.00E+03	1.20E+06	41.87
12:00	17.2	19.5460	19.7947	2.00E+03	1.20E+06	39.41
12:10	15.6	17.7277	17.9533	2.00E+03	1.20E+06	39.41
12:20	16.7	18.9778	19.2192	2.00E+03	1.20E+06	39.41
12:30	17.8	20.2278	20.4852	2.00E+03	1.20E+06	39.41
12:40	17.5	19.8869	20.1399	2.00E+03	1.20E+06	39.41
12:50	16.7	18.9778	19.2192	2.00E+03	1.20E+06	39.41
13:00	16.8	19.0914	19.3343	2.00E+03	1.20E+06	38.48
13:10	16.4	18.6368	18.8740	2.00E+03	1.20E+06	38.48
13:20	15.9	18.0687	18.2986	2.00E+03	1.20E+06	38.48
13:30	15.8	17.9550	18.1835	2.00E+03	1.20E+06	38.48
13:40	14.4	16.3641	16.5723	2.00E+03	1.20E+06	38.48
13:50	13.7	15.5686	15.7667	2.00E+03	1.20E+06	38.48
14:00	14.7	16.7050	16.9175	2.00E+03	1.20E+06	39.01
14:10	12.1	13.7504	13.9253	2.00E+03	1.20E+06	39.01

14:20	12.3	13.9776	14.1555	2.00E+03	1.20E+06	39.01
14:30	11.5	13.0685	13.2348	2.00E+03	1.20E+06	39.01
14:40	10.2	11.5912	11.7387	2.00E+03	1.20E+06	39.01
14:50	12.2	13.8640	14.0404	2.00E+03	1.20E+06	39.01
15:00	14.3	16.2504	16.4572	2.00E+03	1.20E+06	40.34
15:10	14.5	16.4777	16.6874	2.00E+03	1.20E+06	40.34
15:20	13.2	15.0004	15.1913	2.00E+03	1.20E+06	40.34
15:30	14.2	16.1368	16.3421	2.00E+03	1.20E+06	40.34
15:40	13.6	15.4549	15.6516	2.00E+03	1.20E+06	40.34
15:50	12.8	14.5458	14.7309	2.00E+03	1.20E+06	40.34
16:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	46.41
16:10	4.4	5.0001	5.0638	1.83E+02	1.10E+05	46.41
16:20	3.1	3.5228	3.5676	3.63E+01	2.18E+04	46.41
16:30	6.1	6.9320	7.0202	5.71E+02	3.43E+05	46.41
16:40	12.6	14.3186	14.5007	2.00E+03	1.20E+06	46.41
16:50	14.1	16.0231	16.2270	2.00E+03	1.20E+06	46.41
17:00	12.6	14.3186	14.5007	2.00E+03	1.20E+06	49.90
17:10	14.2	16.1368	16.3421	2.00E+03	1.20E+06	49.90
17:20	14	15.9095	16.1119	2.00E+03	1.20E+06	49.90
17:30	12.6	14.3186	14.5007	2.00E+03	1.20E+06	49.90
17:40	11.8	13.4094	13.5801	2.00E+03	1.20E+06	49.90
17:50	12.3	13.9776	14.1555	2.00E+03	1.20E+06	49.90
18:00	7.9	8.9775	9.0917	1.20E+03	7.17E+05	56.28
18:10	8.5	9.6593	9.7822	1.43E+03	8.59E+05	56.28
18:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	56.28
18:30	10.3	11.7049	11.8538	2.00E+03	1.20E+06	56.28
18:40	10.2	11.5912	11.7387	2.00E+03	1.20E+06	56.28
18:50	9.3	10.5685	10.7029	1.75E+03	1.05E+06	56.28
19:00	10	11.3639	11.5085	2.00E+03	1.20E+06	68.76
19:10	10.6	12.0458	12.1990	2.00E+03	1.20E+06	68.76
19:20	11.1	12.6140	12.7745	2.00E+03	1.20E+06	68.76
19:30	11.5	13.0685	13.2348	2.00E+03	1.20E+06	68.76
19:40	13.6	15.4549	15.6516	2.00E+03	1.20E+06	68.76
19:50	13.4	15.2277	15.4214	2.00E+03	1.20E+06	68.76
20:00	15.6	17.7277	17.9533	2.00E+03	1.20E+06	57.99
20:10	15.1	17.1595	17.3779	2.00E+03	1.20E+06	57.99
20:20	13.2	15.0004	15.1913	2.00E+03	1.20E+06	57.99
20:30	13.5	15.3413	15.5365	2.00E+03	1.20E+06	57.99
20:40	15	17.0459	17.2628	2.00E+03	1.20E+06	57.99
20:50	16.1	18.2959	18.5287	2.00E+03	1.20E+06	57.99
21:00	17.5	19.8869	20.1399	2.00E+03	1.20E+06	50.52
21:10	18.5	21.0233	21.2908	2.00E+03	1.20E+06	50.52
21:20	15.6	17.7277	17.9533	2.00E+03	1.20E+06	50.52
21:30	13.8	15.6822	15.8818	2.00E+03	1.20E+06	50.52
21:40	13.8	15.6822	15.8818	2.00E+03	1.20E+06	50.52

21:50	17.8	20.2278	20.4852	2.00E+03	1.20E+06	50.52
22:00	15.8	17.9550	18.1835	2.00E+03	1.20E+06	49.88
22:10	15.4	17.5005	17.7231	2.00E+03	1.20E+06	49.88
22:20	10.6	12.0458	12.1990	2.00E+03	1.20E+06	49.88
22:30	15.2	17.2732	17.4930	2.00E+03	1.20E+06	49.88
22:40	12.9	14.6595	14.8460	2.00E+03	1.20E+06	49.88
22:50	11.4	12.9549	13.1197	2.00E+03	1.20E+06	49.88
23:00	12.1	13.7504	13.9253	2.00E+03	1.20E+06	44.25
23:10	9.9	11.2503	11.3934	1.98E+03	1.19E+06	44.25
23:20	10.6	12.0458	12.1990	2.00E+03	1.20E+06	44.25
23:30	11.1	12.6140	12.7745	2.00E+03	1.20E+06	44.25
23:40	12.9	14.6595	14.8460	2.00E+03	1.20E+06	44.25
23:50	12.9	14.6595	14.8460	2.00E+03	1.20E+06	44.25
0:00	11.8	13.4094	13.5801	2.00E+03	1.20E+06	38.20
0:10	12.9	14.6595	14.8460	2.00E+03	1.20E+06	38.20
0:20	13.5	15.3413	15.5365	2.00E+03	1.20E+06	38.20
0:30	11.7	13.2958	13.4650	2.00E+03	1.20E+06	38.20
0:40	11.4	12.9549	13.1197	2.00E+03	1.20E+06	38.20
0:50	11.2	12.7276	12.8896	2.00E+03	1.20E+06	38.20
1:00	11.6	13.1822	13.3499	2.00E+03	1.20E+06	37.11
1:10	11.5	13.0685	13.2348	2.00E+03	1.20E+06	37.11
1:20	12.2	13.8640	14.0404	2.00E+03	1.20E+06	37.11
1:30	10	11.3639	11.5085	2.00E+03	1.20E+06	37.11
1:40	8.4	9.5457	9.6672	1.39E+03	8.35E+05	37.11
1:50	6.7	7.6138	7.7107	7.59E+02	4.55E+05	37.11
2:00	6.2	7.0456	7.1353	6.01E+02	3.61E+05	32.26
2:10	7.2	8.1820	8.2861	9.32E+02	5.59E+05	32.26
2:20	8.5	9.6593	9.7822	1.43E+03	8.59E+05	32.26
2:30	6.8	7.7275	7.8258	7.93E+02	4.76E+05	32.26
2:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	32.26
2:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	32.26
3:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	32.09
3:10	8.1	9.2048	9.3219	1.27E+03	7.64E+05	32.09
3:20	8.4	9.5457	9.6672	1.39E+03	8.35E+05	32.09
3:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	32.09
3:40	8.6	9.7730	9.8973	1.47E+03	8.83E+05	32.09
3:50	8.9	10.1139	10.2426	1.59E+03	9.56E+05	32.09
4:00	10.1	11.4776	11.6236	2.00E+03	1.20E+06	31.06
4:10	8.6	9.7730	9.8973	1.47E+03	8.83E+05	31.06
4:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	31.06
4:30	10.9	12.3867	12.5443	2.00E+03	1.20E+06	31.06
4:40	9.9	11.2503	11.3934	1.98E+03	1.19E+06	31.06
4:50	9.5	10.7957	10.9331	1.83E+03	1.10E+06	31.06
5:00	9.6	10.9094	11.0482	1.87E+03	1.12E+06	35.21
5:10	9.5	10.7957	10.9331	1.83E+03	1.10E+06	35.21

5:20	8.9	10.1139	10.2426	1.59E+03	9.56E+05	35.21
5:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	35.21
5:40	9.1	10.3412	10.4728	1.67E+03	1.00E+06	35.21
5:50	9.6	10.9094	11.0482	1.87E+03	1.12E+06	35.21
6:00	8.6	9.7730	9.8973	1.47E+03	8.83E+05	44.56
6:10	9.3	10.5685	10.7029	1.75E+03	1.05E+06	44.56
6:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	44.56
6:30	9	10.2275	10.3577	1.63E+03	9.80E+05	44.56
6:40	9.1	10.3412	10.4728	1.67E+03	1.00E+06	44.56
6:50	8.4	9.5457	9.6672	1.39E+03	8.35E+05	44.56
7:00	8.8	10.0003	10.1275	1.55E+03	9.32E+05	49.66
7:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	49.66
7:20	8.6	9.7730	9.8973	1.47E+03	8.83E+05	49.66
7:30	9.8	11.1367	11.2784	1.95E+03	1.17E+06	49.66
7:40	10.4	11.8185	11.9689	2.00E+03	1.20E+06	49.66
7:50	9.5	10.7957	10.9331	1.83E+03	1.10E+06	49.66
8:00	9.8	11.1367	11.2784	1.95E+03	1.17E+06	50.70
8:10	8.5	9.6593	9.7822	1.43E+03	8.59E+05	50.70
8:20	8.9	10.1139	10.2426	1.59E+03	9.56E+05	50.70
8:30	9.2	10.4548	10.5878	1.71E+03	1.03E+06	50.70
8:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	50.70
8:50	7.7	8.7502	8.8616	1.12E+03	6.71E+05	50.70
9:00	7.9	8.9775	9.0917	1.20E+03	7.17E+05	46.53
9:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	46.53
9:20	8.9	10.1139	10.2426	1.59E+03	9.56E+05	46.53
9:30	10	11.3639	11.5085	2.00E+03	1.20E+06	46.53
9:40	9.2	10.4548	10.5878	1.71E+03	1.03E+06	46.53
9:50	8.3	9.4321	9.5521	1.35E+03	8.11E+05	46.53
10:00	8.1	9.2048	9.3219	1.27E+03	7.64E+05	46.46
10:10	9.3	10.5685	10.7029	1.75E+03	1.05E+06	46.46
10:20	9.7	11.0230	11.1633	1.91E+03	1.14E+06	46.46
10:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	46.46
10:40	8.2	9.3184	9.4370	1.31E+03	7.88E+05	46.46
10:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	46.46
11:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	44.55
11:10	8.3	9.4321	9.5521	1.35E+03	8.11E+05	44.55
11:20	7.6	8.6366	8.7465	1.08E+03	6.48E+05	44.55
11:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	44.55
11:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	44.55
11:50	8.4	9.5457	9.6672	1.39E+03	8.35E+05	44.55
12:00	7.7	8.7502	8.8616	1.12E+03	6.71E+05	37.56
12:10	7.3	8.2957	8.4012	9.69E+02	5.81E+05	37.56
12:20	8.5	9.6593	9.7822	1.43E+03	8.59E+05	37.56
12:30	9.8	11.1367	11.2784	1.95E+03	1.17E+06	37.56
12:40	10.9	12.3867	12.5443	2.00E+03	1.20E+06	37.56

12:50	10.2	11.5912	11.7387	2.00E+03	1.20E+06	37.56
13:00	9.1	10.3412	10.4728	1.67E+03	1.00E+06	36.58
13:10	10	11.3639	11.5085	2.00E+03	1.20E+06	36.58
13:20	9.2	10.4548	10.5878	1.71E+03	1.03E+06	36.58
13:30	8.5	9.6593	9.7822	1.43E+03	8.59E+05	36.58
13:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	36.58
13:50	11.1	12.6140	12.7745	2.00E+03	1.20E+06	36.58
14:00	10.8	12.2730	12.4292	2.00E+03	1.20E+06	36.58
14:10	8.8	10.0003	10.1275	1.55E+03	9.32E+05	36.58
14:20	10.3	11.7049	11.8538	2.00E+03	1.20E+06	36.58
14:30	10.7	12.1594	12.3141	2.00E+03	1.20E+06	36.58
14:40	9.2	10.4548	10.5878	1.71E+03	1.03E+06	36.58
14:50	10.3	11.7049	11.8538	2.00E+03	1.20E+06	36.58
15:00	9.6	10.9094	11.0482	1.87E+03	1.12E+06	39.66
15:10	10.9	12.3867	12.5443	2.00E+03	1.20E+06	39.66
15:20	10.2	11.5912	11.7387	2.00E+03	1.20E+06	39.66
15:30	9.4	10.6821	10.8180	1.79E+03	1.08E+06	39.66
15:40	9.1	10.3412	10.4728	1.67E+03	1.00E+06	39.66
15:50	8.9	10.1139	10.2426	1.59E+03	9.56E+05	39.66
16:00	11.1	12.6140	12.7745	2.00E+03	1.20E+06	46.60
16:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	46.60
16:20	9.9	11.2503	11.3934	1.98E+03	1.19E+06	46.60
16:30	10.5	11.9321	12.0840	2.00E+03	1.20E+06	46.60
16:40	10.7	12.1594	12.3141	2.00E+03	1.20E+06	46.60
16:50	10	11.3639	11.5085	2.00E+03	1.20E+06	46.60
17:00	10.8	12.2730	12.4292	2.00E+03	1.20E+06	50.70
17:10	11.4	12.9549	13.1197	2.00E+03	1.20E+06	50.70
17:20	10.4	11.8185	11.9689	2.00E+03	1.20E+06	50.70
17:30	9.5	10.7957	10.9331	1.83E+03	1.10E+06	50.70
17:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	50.70
17:50	8.6	9.7730	9.8973	1.47E+03	8.83E+05	50.70
18:00	6.5	7.3866	7.4805	6.94E+02	4.16E+05	57.78
18:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	57.78
18:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	57.78
18:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	57.78
18:40	7.5	8.5229	8.6314	1.04E+03	6.25E+05	57.78
18:50	8.1	9.2048	9.3219	1.27E+03	7.64E+05	57.78
19:00	7.9	8.9775	9.0917	1.20E+03	7.17E+05	70.88
19:10	7.9	8.9775	9.0917	1.20E+03	7.17E+05	70.88
19:20	9	10.2275	10.3577	1.63E+03	9.80E+05	70.88
19:30	8.6	9.7730	9.8973	1.47E+03	8.83E+05	70.88
19:40	8.6	9.7730	9.8973	1.47E+03	8.83E+05	70.88
19:50	7.9	8.9775	9.0917	1.20E+03	7.17E+05	70.88
20:00	6.9	7.8411	7.9409	8.27E+02	4.96E+05	57.41
20:10	7.5	8.5229	8.6314	1.04E+03	6.25E+05	57.41

20:20	8.8	10.0003	10.1275	1.55E+03	9.32E+05	57.41
20:30	9.8	11.1367	11.2784	1.95E+03	1.17E+06	57.41
20:40	10.4	11.8185	11.9689	2.00E+03	1.20E+06	57.41
20:50	11.7	13.2958	13.4650	2.00E+03	1.20E+06	57.41
21:00	10.6	12.0458	12.1990	2.00E+03	1.20E+06	53.01
21:10	9.8	11.1367	11.2784	1.95E+03	1.17E+06	53.01
21:20	10.2	11.5912	11.7387	2.00E+03	1.20E+06	53.01
21:30	8.3	9.4321	9.5521	1.35E+03	8.11E+05	53.01
21:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	53.01
21:50	8.3	9.4321	9.5521	1.35E+03	8.11E+05	53.01
22:00	8	9.0911	9.2068	1.23E+03	7.40E+05	51.16
22:10	8.1	9.2048	9.3219	1.27E+03	7.64E+05	51.16
22:20	7.9	8.9775	9.0917	1.20E+03	7.17E+05	51.16
22:30	8.6	9.7730	9.8973	1.47E+03	8.83E+05	51.16
22:40	8.2	9.3184	9.4370	1.31E+03	7.88E+05	51.16
22:50	6.5	7.3866	7.4805	6.94E+02	4.16E+05	51.16
23:00	6.8	7.7275	7.8258	7.93E+02	4.76E+05	47.54
23:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	47.54
23:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	47.54
23:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	47.54
23:40	7.4	8.4093	8.5163	1.01E+03	6.03E+05	47.54
23:50	7.7	8.7502	8.8616	1.12E+03	6.71E+05	47.54
0:00	6.6	7.5002	7.5956	7.26E+02	4.36E+05	44.01
0:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	44.01
0:20	5.3	6.0229	6.0995	3.61E+02	2.16E+05	44.01
0:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	44.01
0:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	44.01
0:50	7.5	8.5229	8.6314	1.04E+03	6.25E+05	44.01
1:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	42.03
1:10	7.3	8.2957	8.4012	9.69E+02	5.81E+05	42.03
1:20	6.7	7.6138	7.7107	7.59E+02	4.55E+05	42.03
1:30	5.7	6.4774	6.5599	4.60E+02	2.76E+05	42.03
1:40	6.8	7.7275	7.8258	7.93E+02	4.76E+05	42.03
1:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	42.03
2:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	41.88
2:10	7.5	8.5229	8.6314	1.04E+03	6.25E+05	41.88
2:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	41.88
2:30	6.5	7.3866	7.4805	6.94E+02	4.16E+05	41.88
2:40	6.4	7.2729	7.3655	6.62E+02	3.97E+05	41.88
2:50	6.5	7.3866	7.4805	6.94E+02	4.16E+05	41.88
3:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	39.07
3:10	8	9.0911	9.2068	1.23E+03	7.40E+05	39.07
3:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	39.07
3:30	6.9	7.8411	7.9409	8.27E+02	4.96E+05	39.07
3:40	6.8	7.7275	7.8258	7.93E+02	4.76E+05	39.07

3:50	7.1	8.0684	8.1711	8.97E+02	5.38E+05	39.07
4:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	37.73
4:10	5.7	6.4774	6.5599	4.60E+02	2.76E+05	37.73
4:20	5	5.6820	5.7543	2.94E+02	1.76E+05	37.73
4:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	37.73
4:40	4	4.5456	4.6034	1.24E+02	7.46E+04	37.73
4:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	37.73
5:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	42.07
5:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	42.07
5:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	42.07
5:30	7.5	8.5229	8.6314	1.04E+03	6.25E+05	42.07
5:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	42.07
5:50	5.6	6.3638	6.4448	4.34E+02	2.60E+05	42.07
6:00	3.7	4.2047	4.2582	8.84E+01	5.31E+04	51.37
6:10	3.2	3.6365	3.6827	4.33E+01	2.60E+04	51.37
6:20	3	3.4092	3.4526	3.00E+01	1.80E+04	51.37
6:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	51.37
6:40	3	3.4092	3.4526	3.00E+01	1.80E+04	51.37
6:50	2.7	3.0683	3.1073	1.49E+01	8.91E+03	51.37
7:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	68.47
7:10	2.4	2.7273	2.7620	4.92E+00	2.95E+03	68.47
7:20	2.4	2.7273	2.7620	4.92E+00	2.95E+03	68.47
7:30	2.1	2.3864	2.4168	0.00E+00	0.00E+00	68.47
7:40	2.1	2.3864	2.4168	0.00E+00	0.00E+00	68.47
7:50	2.3	2.6137	2.6470	2.66E+00	1.60E+03	68.47
8:00	2.4	2.7273	2.7620	4.92E+00	2.95E+03	74.90
8:10	5.2	5.9092	5.9844	3.38E+02	2.03E+05	74.90
8:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	74.90
8:30	6.3	7.1593	7.2504	6.31E+02	3.79E+05	74.90
8:40	5	5.6820	5.7543	2.94E+02	1.76E+05	74.90
8:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	74.90
9:00	5.3	6.0229	6.0995	3.61E+02	2.16E+05	70.12
9:10	5	5.6820	5.7543	2.94E+02	1.76E+05	70.12
9:20	5.5	6.2502	6.3297	4.09E+02	2.45E+05	70.12
9:30	4.7	5.3410	5.4090	2.35E+02	1.41E+05	70.12
9:40	6.7	7.6138	7.7107	7.59E+02	4.55E+05	70.12
9:50	3.8	4.3183	4.3732	9.96E+01	5.98E+04	70.12
10:00	3.7	4.2047	4.2582	8.84E+01	5.31E+04	66.23
10:10	3.8	4.3183	4.3732	9.96E+01	5.98E+04	66.23
10:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	66.23
10:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	66.23
10:40	3.9	4.4319	4.4883	1.12E+02	6.69E+04	66.23
10:50	2.8	3.1819	3.2224	1.93E+01	1.16E+04	66.23
11:00	4.2	4.7729	4.8336	1.52E+02	9.12E+04	51.19
11:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	51.19

11:20	3.7	4.2047	4.2582	8.84E+01	5.31E+04	51.19
11:30	7.7	8.7502	8.8616	1.12E+03	6.71E+05	51.19
11:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	51.19
11:50	5.9	6.7047	6.7900	5.14E+02	3.08E+05	51.19
12:00	5.1	5.7956	5.8693	3.15E+02	1.89E+05	47.80
12:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	47.80
12:20	5.9	6.7047	6.7900	5.14E+02	3.08E+05	47.80
12:30	5.2	5.9092	5.9844	3.38E+02	2.03E+05	47.80
12:40	5.6	6.3638	6.4448	4.34E+02	2.60E+05	47.80
12:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	47.80
13:00	6.9	7.8411	7.9409	8.27E+02	4.96E+05	47.01
13:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	47.01
13:20	7.8	8.8639	8.9767	1.16E+03	6.94E+05	47.01
13:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	47.01
13:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	47.01
13:50	6.6	7.5002	7.5956	7.26E+02	4.36E+05	47.01
14:00	6.3	7.1593	7.2504	6.31E+02	3.79E+05	47.94
14:10	6.3	7.1593	7.2504	6.31E+02	3.79E+05	47.94
14:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	47.94
14:30	5.9	6.7047	6.7900	5.14E+02	3.08E+05	47.94
14:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	47.94
14:50	6.1	6.9320	7.0202	5.71E+02	3.43E+05	47.94
15:00	6.4	7.2729	7.3655	6.62E+02	3.97E+05	49.08
15:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	49.08
15:20	6.3	7.1593	7.2504	6.31E+02	3.79E+05	49.08
15:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	49.08
15:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	49.08
15:50	5.2	5.9092	5.9844	3.38E+02	2.03E+05	49.08
16:00	6	6.8184	6.9051	5.42E+02	3.25E+05	51.41
16:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	51.41
16:20	5.2	5.9092	5.9844	3.38E+02	2.03E+05	51.41
16:30	4.8	5.4547	5.5241	2.54E+02	1.52E+05	51.41
16:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	51.41
16:50	4.6	5.2274	5.2939	2.17E+02	1.30E+05	51.41
17:00	4.1	4.6592	4.7185	1.38E+02	8.26E+04	55.17
17:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	55.17
17:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	55.17
17:30	5.6	6.3638	6.4448	4.34E+02	2.60E+05	55.17
17:40	5.5	6.2502	6.3297	4.09E+02	2.45E+05	55.17
17:50	5.9	6.7047	6.7900	5.14E+02	3.08E+05	55.17
18:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	59.87
18:10	6.2	7.0456	7.1353	6.01E+02	3.61E+05	59.87
18:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	59.87
18:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	59.87
18:40	5.6	6.3638	6.4448	4.34E+02	2.60E+05	59.87

18:50	5.5	6.2502	6.3297	4.09E+02	2.45E+05	59.87
19:00	4.4	5.0001	5.0638	1.83E+02	1.10E+05	78.63
19:10	4	4.5456	4.6034	1.24E+02	7.46E+04	78.63
19:20	4.2	4.7729	4.8336	1.52E+02	9.12E+04	78.63
19:30	4.8	5.4547	5.5241	2.54E+02	1.52E+05	78.63
19:40	5.8	6.5911	6.6749	4.87E+02	2.92E+05	78.63
19:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	78.63
20:00	7	7.9548	8.0560	8.61E+02	5.17E+05	57.50
20:10	6.8	7.7275	7.8258	7.93E+02	4.76E+05	57.50
20:20	6.1	6.9320	7.0202	5.71E+02	3.43E+05	57.50
20:30	5	5.6820	5.7543	2.94E+02	1.76E+05	57.50
20:40	2.6	2.9546	2.9922	1.10E+01	6.59E+03	57.50
20:50	3.2	3.6365	3.6827	4.33E+01	2.60E+04	57.50
21:00	3	3.4092	3.4526	3.00E+01	1.80E+04	51.01
21:10	3.9	4.4319	4.4883	1.12E+02	6.69E+04	51.01
21:20	4.7	5.3410	5.4090	2.35E+02	1.41E+05	51.01
21:30	5.1	5.7956	5.8693	3.15E+02	1.89E+05	51.01
21:40	5.6	6.3638	6.4448	4.34E+02	2.60E+05	51.01
21:50	4.6	5.2274	5.2939	2.17E+02	1.30E+05	51.01
22:00	5.5	6.2502	6.3297	4.09E+02	2.45E+05	51.00
22:10	6.9	7.8411	7.9409	8.27E+02	4.96E+05	51.00
22:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	51.00
22:30	5.3	6.0229	6.0995	3.61E+02	2.16E+05	51.00
22:40	6.1	6.9320	7.0202	5.71E+02	3.43E+05	51.00
22:50	4.3	4.8865	4.9487	1.67E+02	1.00E+05	51.00
23:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	49.90
23:10	2.9	3.2955	3.3375	2.43E+01	1.46E+04	49.90
23:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	49.90
23:30	6.6	7.5002	7.5956	7.26E+02	4.36E+05	49.90
23:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	49.90
23:50	8.4	9.5457	9.6672	1.39E+03	8.35E+05	49.90
0:00	7.7	8.7502	8.8616	1.12E+03	6.71E+05	45.01
0:10	9.2	10.4548	10.5878	1.71E+03	1.03E+06	45.01
0:20	9.9	11.2503	11.3934	1.98E+03	1.19E+06	45.01
0:30	10.2	11.5912	11.7387	2.00E+03	1.20E+06	45.01
0:40	9.3	10.5685	10.7029	1.75E+03	1.05E+06	45.01
0:50	9.6	10.9094	11.0482	1.87E+03	1.12E+06	45.01
1:00	9.5	10.7957	10.9331	1.83E+03	1.10E+06	41.19
1:10	8.8	10.0003	10.1275	1.55E+03	9.32E+05	41.19
1:20	8.4	9.5457	9.6672	1.39E+03	8.35E+05	41.19
1:30	7.8	8.8639	8.9767	1.16E+03	6.94E+05	41.19
1:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	41.19
1:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	41.19
2:00	8.4	9.5457	9.6672	1.39E+03	8.35E+05	41.12
2:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	41.12

2:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	41.12
2:30	6.5	7.3866	7.4805	6.94E+02	4.16E+05	41.12
2:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	41.12
2:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	41.12
3:00	6.9	7.8411	7.9409	8.27E+02	4.96E+05	38.82
3:10	6.1	6.9320	7.0202	5.71E+02	3.43E+05	38.82
3:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	38.82
3:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	38.82
3:40	7.6	8.6366	8.7465	1.08E+03	6.48E+05	38.82
3:50	8.1	9.2048	9.3219	1.27E+03	7.64E+05	38.82
4:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	35.27
4:10	7.9	8.9775	9.0917	1.20E+03	7.17E+05	35.27
4:20	7.4	8.4093	8.5163	1.01E+03	6.03E+05	35.27
4:30	6.1	6.9320	7.0202	5.71E+02	3.43E+05	35.27
4:40	3.9	4.4319	4.4883	1.12E+02	6.69E+04	35.27
4:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	35.27
5:00	6	6.8184	6.9051	5.42E+02	3.25E+05	37.23
5:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	37.23
5:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	37.23
5:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	37.23
5:40	7.4	8.4093	8.5163	1.01E+03	6.03E+05	37.23
5:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	37.23
6:00	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.98
6:10	4.1	4.6592	4.7185	1.38E+02	8.26E+04	39.98
6:20	5.2	5.9092	5.9844	3.38E+02	2.03E+05	39.98
6:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	39.98
6:40	6.5	7.3866	7.4805	6.94E+02	4.16E+05	39.98
6:50	7.2	8.1820	8.2861	9.32E+02	5.59E+05	39.98
7:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	43.08
7:10	7	7.9548	8.0560	8.61E+02	5.17E+05	43.08
7:20	6.6	7.5002	7.5956	7.26E+02	4.36E+05	43.08
7:30	6.2	7.0456	7.1353	6.01E+02	3.61E+05	43.08
7:40	6.2	7.0456	7.1353	6.01E+02	3.61E+05	43.08
7:50	5.4	6.1365	6.2146	3.84E+02	2.31E+05	43.08
8:00	5.2	5.9092	5.9844	3.38E+02	2.03E+05	46.64
8:10	5.4	6.1365	6.2146	3.84E+02	2.31E+05	46.64
8:20	5.1	5.7956	5.8693	3.15E+02	1.89E+05	46.64
8:30	4.2	4.7729	4.8336	1.52E+02	9.12E+04	46.64
8:40	2.8	3.1819	3.2224	1.93E+01	1.16E+04	46.64
8:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	46.64
9:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	44.19
9:10	2.1	2.3864	2.4168	0.00E+00	0.00E+00	44.19
9:20	1.9	2.1591	2.1866	0.00E+00	0.00E+00	44.19
9:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	44.19
9:40	2.1	2.3864	2.4168	0.00E+00	0.00E+00	44.19

9:50	2.1	2.3864	2.4168	0.00E+00	0.00E+00	44.19
10:00	2.3	2.6137	2.6470	2.66E+00	1.60E+03	48.28
10:10	2	2.2728	2.3017	0.00E+00	0.00E+00	48.28
10:20	2.6	2.9546	2.9922	1.10E+01	6.59E+03	48.28
10:30	2.6	2.9546	2.9922	1.10E+01	6.59E+03	48.28
10:40	2.5	2.8410	2.8771	7.68E+00	4.61E+03	48.28
10:50	2.9	3.2955	3.3375	2.43E+01	1.46E+04	48.28
11:00	2.8	3.1819	3.2224	1.93E+01	1.16E+04	46.52
11:10	2.9	3.2955	3.3375	2.43E+01	1.46E+04	46.52
11:20	2.5	2.8410	2.8771	7.68E+00	4.61E+03	46.52
11:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	46.52
11:40	1.8	2.0455	2.0715	0.00E+00	0.00E+00	46.52
11:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	46.52
12:00	1.7	1.9319	1.9564	0.00E+00	0.00E+00	40.79
12:10	2.3	2.6137	2.6470	2.66E+00	1.60E+03	40.79
12:20	2.5	2.8410	2.8771	7.68E+00	4.61E+03	40.79
12:30	2.5	2.8410	2.8771	7.68E+00	4.61E+03	40.79
12:40	2.3	2.6137	2.6470	2.66E+00	1.60E+03	40.79
12:50	2.2	2.5001	2.5319	8.96E-01	5.38E+02	40.79
13:00	2.2	2.5001	2.5319	8.96E-01	5.38E+02	39.54
13:10	2.2	2.5001	2.5319	8.96E-01	5.38E+02	39.54
13:20	2.3	2.6137	2.6470	2.66E+00	1.60E+03	39.54
13:30	2.9	3.2955	3.3375	2.43E+01	1.46E+04	39.54
13:40	2.6	2.9546	2.9922	1.10E+01	6.59E+03	39.54
13:50	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.54
14:00	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.18
14:10	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.18
14:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.18
14:30	1.6	1.8182	1.8414	0.00E+00	0.00E+00	39.18
14:40	1.7	1.9319	1.9564	0.00E+00	0.00E+00	39.18
14:50	2.1	2.3864	2.4168	0.00E+00	0.00E+00	39.18
15:00	1.9	2.1591	2.1866	0.00E+00	0.00E+00	38.48
15:10	2.1	2.3864	2.4168	0.00E+00	0.00E+00	38.48
15:20	1.6	1.8182	1.8414	0.00E+00	0.00E+00	38.48
15:30	1.8	2.0455	2.0715	0.00E+00	0.00E+00	38.48
15:40	2.3	2.6137	2.6470	2.66E+00	1.60E+03	38.48
15:50	2.9	3.2955	3.3375	2.43E+01	1.46E+04	38.48
16:00	3	3.4092	3.4526	3.00E+01	1.80E+04	39.18
16:10	2.9	3.2955	3.3375	2.43E+01	1.46E+04	39.18
16:20	1.8	2.0455	2.0715	0.00E+00	0.00E+00	39.18
16:30	2.8	3.1819	3.2224	1.93E+01	1.16E+04	39.18
16:40	4.2	4.7729	4.8336	1.52E+02	9.12E+04	39.18
16:50	4.7	5.3410	5.4090	2.35E+02	1.41E+05	39.18
17:00	4.8	5.4547	5.5241	2.54E+02	1.52E+05	42.60
17:10	4.6	5.2274	5.2939	2.17E+02	1.30E+05	42.60

17:20	4.8	5.4547	5.5241	2.54E+02	1.52E+05	42.60
17:30	5.1	5.7956	5.8693	3.15E+02	1.89E+05	42.60
17:40	4.9	5.5683	5.6392	2.74E+02	1.64E+05	42.60
17:50	4.9	5.5683	5.6392	2.74E+02	1.64E+05	42.60
18:00	5.4	6.1365	6.2146	3.84E+02	2.31E+05	48.80
18:10	5.9	6.7047	6.7900	5.14E+02	3.08E+05	48.80
18:20	5.5	6.2502	6.3297	4.09E+02	2.45E+05	48.80
18:30	5.4	6.1365	6.2146	3.84E+02	2.31E+05	48.80
18:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	48.80
18:50	4.6	5.2274	5.2939	2.17E+02	1.30E+05	48.80
19:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	60.99
19:10	4.8	5.4547	5.5241	2.54E+02	1.52E+05	60.99
19:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	60.99
19:30	3.8	4.3183	4.3732	9.96E+01	5.98E+04	60.99
19:40	4.4	5.0001	5.0638	1.83E+02	1.10E+05	60.99
19:50	4.6	5.2274	5.2939	2.17E+02	1.30E+05	60.99
20:00	5	5.6820	5.7543	2.94E+02	1.76E+05	55.44
20:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	55.44
20:20	6.4	7.2729	7.3655	6.62E+02	3.97E+05	55.44
20:30	6.1	6.9320	7.0202	5.71E+02	3.43E+05	55.44
20:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	55.44
20:50	5.8	6.5911	6.6749	4.87E+02	2.92E+05	55.44
21:00	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.99
21:10	5.6	6.3638	6.4448	4.34E+02	2.60E+05	49.99
21:20	5.3	6.0229	6.0995	3.61E+02	2.16E+05	49.99
21:30	5.8	6.5911	6.6749	4.87E+02	2.92E+05	49.99
21:40	5.4	6.1365	6.2146	3.84E+02	2.31E+05	49.99
21:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	49.99
22:00	6	6.8184	6.9051	5.42E+02	3.25E+05	46.49
22:10	5.6	6.3638	6.4448	4.34E+02	2.60E+05	46.49
22:20	4.1	4.6592	4.7185	1.38E+02	8.26E+04	46.49
22:30	4.8	5.4547	5.5241	2.54E+02	1.52E+05	46.49
22:40	5.1	5.7956	5.8693	3.15E+02	1.89E+05	46.49
22:50	4.4	5.0001	5.0638	1.83E+02	1.10E+05	46.49
23:00	4.7	5.3410	5.4090	2.35E+02	1.41E+05	43.72
23:10	5.9	6.7047	6.7900	5.14E+02	3.08E+05	43.72
23:20	4.5	5.1138	5.1788	1.99E+02	1.20E+05	43.72
23:30	4.6	5.2274	5.2939	2.17E+02	1.30E+05	43.72
23:40	4.9	5.5683	5.6392	2.74E+02	1.64E+05	43.72
23:50	5.8	6.5911	6.6749	4.87E+02	2.92E+05	43.72
0:00	6.6	7.5002	7.5956	7.26E+02	4.36E+05	41.67
0:10	7.2	8.1820	8.2861	9.32E+02	5.59E+05	41.67
0:20	7.6	8.6366	8.7465	1.08E+03	6.48E+05	41.67
0:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	41.67
0:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	41.67

0:50	8.1	9.2048	9.3219	1.27E+03	7.64E+05	41.67
1:00	8.1	9.2048	9.3219	1.27E+03	7.64E+05	40.96
1:10	8.4	9.5457	9.6672	1.39E+03	8.35E+05	40.96
1:20	8.2	9.3184	9.4370	1.31E+03	7.88E+05	40.96
1:30	8.4	9.5457	9.6672	1.39E+03	8.35E+05	40.96
1:40	7.8	8.8639	8.9767	1.16E+03	6.94E+05	40.96
1:50	8	9.0911	9.2068	1.23E+03	7.40E+05	40.96
2:00	7.5	8.5229	8.6314	1.04E+03	6.25E+05	39.63
2:10	7.9	8.9775	9.0917	1.20E+03	7.17E+05	39.63
2:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	39.63
2:30	7.2	8.1820	8.2861	9.32E+02	5.59E+05	39.63
2:40	7.1	8.0684	8.1711	8.97E+02	5.38E+05	39.63
2:50	7.4	8.4093	8.5163	1.01E+03	6.03E+05	39.63
3:00	7.1	8.0684	8.1711	8.97E+02	5.38E+05	35.62
3:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	35.62
3:20	7.2	8.1820	8.2861	9.32E+02	5.59E+05	35.62
3:30	7.6	8.6366	8.7465	1.08E+03	6.48E+05	35.62
3:40	6.8	7.7275	7.8258	7.93E+02	4.76E+05	35.62
3:50	7.8	8.8639	8.9767	1.16E+03	6.94E+05	35.62
4:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	30.91
4:10	6.6	7.5002	7.5956	7.26E+02	4.36E+05	30.91
4:20	7.6	8.6366	8.7465	1.08E+03	6.48E+05	30.91
4:30	7.9	8.9775	9.0917	1.20E+03	7.17E+05	30.91
4:40	7.9	8.9775	9.0917	1.20E+03	7.17E+05	30.91
4:50	8.3	9.4321	9.5521	1.35E+03	8.11E+05	30.91
5:00	7.9	8.9775	9.0917	1.20E+03	7.17E+05	31.03
5:10	8.2	9.3184	9.4370	1.31E+03	7.88E+05	31.03
5:20	8.6	9.7730	9.8973	1.47E+03	8.83E+05	31.03
5:30	8.3	9.4321	9.5521	1.35E+03	8.11E+05	31.03
5:40	8.5	9.6593	9.7822	1.43E+03	8.59E+05	31.03
5:50	9.7	11.0230	11.1633	1.91E+03	1.14E+06	31.03
6:00	9.5	10.7957	10.9331	1.83E+03	1.10E+06	36.85
6:10	8.1	9.2048	9.3219	1.27E+03	7.64E+05	36.85
6:20	8.4	9.5457	9.6672	1.39E+03	8.35E+05	36.85
6:30	8.8	10.0003	10.1275	1.55E+03	9.32E+05	36.85
6:40	8.9	10.1139	10.2426	1.59E+03	9.56E+05	36.85
6:50	9.3	10.5685	10.7029	1.75E+03	1.05E+06	36.85
7:00	8.9	10.1139	10.2426	1.59E+03	9.56E+05	39.93
7:10	8.2	9.3184	9.4370	1.31E+03	7.88E+05	39.93
7:20	8	9.0911	9.2068	1.23E+03	7.40E+05	39.93
7:30	8.1	9.2048	9.3219	1.27E+03	7.64E+05	39.93
7:40	9	10.2275	10.3577	1.63E+03	9.80E+05	39.93
7:50	8.5	9.6593	9.7822	1.43E+03	8.59E+05	39.93
8:00	9.3	10.5685	10.7029	1.75E+03	1.05E+06	36.80
8:10	9.8	11.1367	11.2784	1.95E+03	1.17E+06	36.80

8:20	10.1	11.4776	11.6236	2.00E+03	1.20E+06	36.80
8:30	9.4	10.6821	10.8180	1.79E+03	1.08E+06	36.80
8:40	8.6	9.7730	9.8973	1.47E+03	8.83E+05	36.80
8:50	8.4	9.5457	9.6672	1.39E+03	8.35E+05	36.80
9:00	9.8	11.1367	11.2784	1.95E+03	1.17E+06	40.63
9:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	40.63
9:20	10.2	11.5912	11.7387	2.00E+03	1.20E+06	40.63
9:30	10.1	11.4776	11.6236	2.00E+03	1.20E+06	40.63
9:40	9.6	10.9094	11.0482	1.87E+03	1.12E+06	40.63
9:50	9.8	11.1367	11.2784	1.95E+03	1.17E+06	40.63
10:00	10.5	11.9321	12.0840	2.00E+03	1.20E+06	42.75
10:10	10.2	11.5912	11.7387	2.00E+03	1.20E+06	42.75
10:20	10.8	12.2730	12.4292	2.00E+03	1.20E+06	42.75
10:30	11.5	13.0685	13.2348	2.00E+03	1.20E+06	42.75
10:40	11.7	13.2958	13.4650	2.00E+03	1.20E+06	42.75
10:50	10.7	12.1594	12.3141	2.00E+03	1.20E+06	42.75
11:00	9.8	11.1367	11.2784	1.95E+03	1.17E+06	39.63
11:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	39.63
11:20	8.4	9.5457	9.6672	1.39E+03	8.35E+05	39.63
11:30	8.7	9.8866	10.0124	1.51E+03	9.08E+05	39.63
11:40	9.2	10.4548	10.5878	1.71E+03	1.03E+06	39.63
11:50	8.7	9.8866	10.0124	1.51E+03	9.08E+05	39.63
12:00	9.5	10.7957	10.9331	1.83E+03	1.10E+06	39.54
12:10	11	12.5003	12.6594	2.00E+03	1.20E+06	39.54
12:20	9.3	10.5685	10.7029	1.75E+03	1.05E+06	39.54
12:30	10.8	12.2730	12.4292	2.00E+03	1.20E+06	39.54
12:40	9.8	11.1367	11.2784	1.95E+03	1.17E+06	39.54
12:50	9	10.2275	10.3577	1.63E+03	9.80E+05	39.54
13:00	8.1	9.2048	9.3219	1.27E+03	7.64E+05	39.54
13:10	8.8	10.0003	10.1275	1.55E+03	9.32E+05	39.54
13:20	8.6	9.7730	9.8973	1.47E+03	8.83E+05	39.54
13:30	8.3	9.4321	9.5521	1.35E+03	8.11E+05	39.54
13:40	8.6	9.7730	9.8973	1.47E+03	8.83E+05	39.54
13:50	8.5	9.6593	9.7822	1.43E+03	8.59E+05	39.54
14:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	36.20
14:10	7.7	8.7502	8.8616	1.12E+03	6.71E+05	36.20
14:20	7.1	8.0684	8.1711	8.97E+02	5.38E+05	36.20
14:30	9.9	11.2503	11.3934	1.98E+03	1.19E+06	36.20
14:40	11.4	12.9549	13.1197	2.00E+03	1.20E+06	36.20
14:50	9.8	11.1367	11.2784	1.95E+03	1.17E+06	36.20
15:00	10	11.3639	11.5085	2.00E+03	1.20E+06	35.00
15:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	35.00
15:20	9.6	10.9094	11.0482	1.87E+03	1.12E+06	35.00
15:30	8.9	10.1139	10.2426	1.59E+03	9.56E+05	35.00
15:40	9.4	10.6821	10.8180	1.79E+03	1.08E+06	35.00

15:50	9.4	10.6821	10.8180	1.79E+03	1.08E+06	35.00
16:00	8.8	10.0003	10.1275	1.55E+03	9.32E+05	36.20
16:10	9.5	10.7957	10.9331	1.83E+03	1.10E+06	36.20
16:20	9.6	10.9094	11.0482	1.87E+03	1.12E+06	36.20
16:30	10.9	12.3867	12.5443	2.00E+03	1.20E+06	36.20
16:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	36.20
16:50	9.9	11.2503	11.3934	1.98E+03	1.19E+06	36.20
17:00	10.1	11.4776	11.6236	2.00E+03	1.20E+06	39.18
17:10	10.9	12.3867	12.5443	2.00E+03	1.20E+06	39.18
17:20	12	13.6367	13.8102	2.00E+03	1.20E+06	39.18
17:30	10.1	11.4776	11.6236	2.00E+03	1.20E+06	39.18
17:40	10.2	11.5912	11.7387	2.00E+03	1.20E+06	39.18
17:50	10.4	11.8185	11.9689	2.00E+03	1.20E+06	39.18
18:00	10.6	12.0458	12.1990	2.00E+03	1.20E+06	47.44
18:10	11.1	12.6140	12.7745	2.00E+03	1.20E+06	47.44
18:20	10.7	12.1594	12.3141	2.00E+03	1.20E+06	47.44
18:30	10	11.3639	11.5085	2.00E+03	1.20E+06	47.44
18:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	47.44
18:50	8.9	10.1139	10.2426	1.59E+03	9.56E+05	47.44
19:00	8.4	9.5457	9.6672	1.39E+03	8.35E+05	60.42
19:10	8.6	9.7730	9.8973	1.47E+03	8.83E+05	60.42
19:20	9.1	10.3412	10.4728	1.67E+03	1.00E+06	60.42
19:30	9.1	10.3412	10.4728	1.67E+03	1.00E+06	60.42
19:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	60.42
19:50	10.2	11.5912	11.7387	2.00E+03	1.20E+06	60.42
20:00	10.1	11.4776	11.6236	2.00E+03	1.20E+06	52.99
20:10	9.6	10.9094	11.0482	1.87E+03	1.12E+06	52.99
20:20	9.7	11.0230	11.1633	1.91E+03	1.14E+06	52.99
20:30	10.8	12.2730	12.4292	2.00E+03	1.20E+06	52.99
20:40	10.1	11.4776	11.6236	2.00E+03	1.20E+06	52.99
20:50	9.9	11.2503	11.3934	1.98E+03	1.19E+06	52.99
21:00	10.8	12.2730	12.4292	2.00E+03	1.20E+06	49.88
21:10	11.6	13.1822	13.3499	2.00E+03	1.20E+06	49.88
21:20	10.3	11.7049	11.8538	2.00E+03	1.20E+06	49.88
21:30	10.1	11.4776	11.6236	2.00E+03	1.20E+06	49.88
21:40	9.4	10.6821	10.8180	1.79E+03	1.08E+06	49.88
21:50	10.4	11.8185	11.9689	2.00E+03	1.20E+06	49.88
22:00	11.8	13.4094	13.5801	2.00E+03	1.20E+06	46.23
22:10	11.2	12.7276	12.8896	2.00E+03	1.20E+06	46.23
22:20	9.9	11.2503	11.3934	1.98E+03	1.19E+06	46.23
22:30	10	11.3639	11.5085	2.00E+03	1.20E+06	46.23
22:40	11.9	13.5231	13.6951	2.00E+03	1.20E+06	46.23
22:50	10.6	12.0458	12.1990	2.00E+03	1.20E+06	46.23
23:00	10.2	11.5912	11.7387	2.00E+03	1.20E+06	42.10
23:10	10.2	11.5912	11.7387	2.00E+03	1.20E+06	42.10

23:20	11.9	13.5231	13.6951	2.00E+03	1.20E+06	42.10
23:30	13.3	15.1140	15.3063	2.00E+03	1.20E+06	42.10
23:40	12.8	14.5458	14.7309	2.00E+03	1.20E+06	42.10
23:50	12	13.6367	13.8102	2.00E+03	1.20E+06	42.10
0:00	8.2	9.3184	9.4370	1.31E+03	7.88E+05	43.18
0:10	7.4	8.4093	8.5163	1.01E+03	6.03E+05	43.18
0:20	7.7	8.7502	8.8616	1.12E+03	6.71E+05	43.18
0:30	7.3	8.2957	8.4012	9.69E+02	5.81E+05	43.18
0:40	7.5	8.5229	8.6314	1.04E+03	6.25E+05	43.18
0:50	6.5	7.3866	7.4805	6.94E+02	4.16E+05	43.18
1:00	5.4	6.1365	6.2146	3.84E+02	2.31E+05	38.77
1:10	6.3	7.1593	7.2504	6.31E+02	3.79E+05	38.77
1:20	6.2	7.0456	7.1353	6.01E+02	3.61E+05	38.77
1:30	5.9	6.7047	6.7900	5.14E+02	3.08E+05	38.77
1:40	6.3	7.1593	7.2504	6.31E+02	3.79E+05	38.77
1:50	6.9	7.8411	7.9409	8.27E+02	4.96E+05	38.77
2:00	5.9	6.7047	6.7900	5.14E+02	3.08E+05	37.18
2:10	6.4	7.2729	7.3655	6.62E+02	3.97E+05	37.18
2:20	6.9	7.8411	7.9409	8.27E+02	4.96E+05	37.18
2:30	8.2	9.3184	9.4370	1.31E+03	7.88E+05	37.18
2:40	8.1	9.2048	9.3219	1.27E+03	7.64E+05	37.18
2:50	7.6	8.6366	8.7465	1.08E+03	6.48E+05	37.18
3:00	7.4	8.4093	8.5163	1.01E+03	6.03E+05	32.59
3:10	7.6	8.6366	8.7465	1.08E+03	6.48E+05	32.59
3:20	6.8	7.7275	7.8258	7.93E+02	4.76E+05	32.59
3:30	7.4	8.4093	8.5163	1.01E+03	6.03E+05	32.59
3:40	7.2	8.1820	8.2861	9.32E+02	5.59E+05	32.59
3:50	6.2	7.0456	7.1353	6.01E+02	3.61E+05	32.59
4:00	5.8	6.5911	6.6749	4.87E+02	2.92E+05	32.34
4:10	5.8	6.5911	6.6749	4.87E+02	2.92E+05	32.34
4:20	5.6	6.3638	6.4448	4.34E+02	2.60E+05	32.34
4:30	5.7	6.4774	6.5599	4.60E+02	2.76E+05	32.34
4:40	5.9	6.7047	6.7900	5.14E+02	3.08E+05	32.34
4:50	6.8	7.7275	7.8258	7.93E+02	4.76E+05	32.34
5:00	6.2	7.0456	7.1353	6.01E+02	3.61E+05	37.52
5:10	5.3	6.0229	6.0995	3.61E+02	2.16E+05	37.52
5:20	5.3	6.0229	6.0995	3.61E+02	2.16E+05	37.52
…	…	…	…	…	…	…
23:40	1.9	2.1591	2.1866	0.00e+00	0.00e+00	44.00
23:50	1.8	2.0455	2.0715	0.00e+00	0.00e+00	44.00

2. Set of Spanish data – D_2

In the case of Spanish scenario (D_2), wind velocities were gathered from the northeast part of the Iberian Peninsula, specifically from “La Luna” wind farm within the province of Soria. They were obtained in the web page of Photovoltaic Geographical Information System (PVGIS) supported by European Commission [14]. Data were collected every hour at ten meters of altitude during a period of one year. Electricity prices are obtained from the information of the Operator of the Iberian Energy Market (Operador del Mercado Ibérico de Energía – Polo Portugués, OMIP) which provides electricity price data every each hour, expressed in €/MWh [15]. Under the Spanish scenario, both data are discretized in the same period of time, every each hour. Therefore, no modification of the data discretization is required before starting to work with them.

A 5% of the values used for the development of Spanish case of this study are presented in the following table, *Table AI.2*, as a sample.

Table AI. 2. Set of Spanish data – D_2

Time	v_w [m/s]	v_w at 98m [m/s]	v_w real [m/s]	p_m [kW]	e [kJ]	p_e [h/MWh]
0:00	3.07	4.7367	4.9997	1.74E+02	6.26E+05	5.00
1:00	3.12	4.8138	5.0812	1.85E+02	6.67E+05	4.00
2:00	3.18	4.9064	5.1789	1.99E+02	7.18E+05	4.00
3:00	3.24	4.9989	5.2766	2.14E+02	7.71E+05	4.00
4:00	3.3	5.0915	5.3743	2.29E+02	8.26E+05	4.00
5:00	3.36	5.1841	5.4720	2.45E+02	8.83E+05	4.00
6:00	3.41	5.2612	5.5535	2.59E+02	9.32E+05	5.00
7:00	3.47	5.3538	5.6512	2.76E+02	9.93E+05	9.20
8:00	3.17	4.8909	5.1626	1.97E+02	7.09E+05	17.20
9:00	3.08	4.7521	5.0160	1.76E+02	6.34E+05	25.10
10:00	2.99	4.6132	4.8695	1.57E+02	5.64E+05	35.62
11:00	2.9	4.4744	4.7229	1.38E+02	4.98E+05	34.30
12:00	3.01	4.6441	4.9020	1.61E+02	5.79E+05	23.23
13:00	3.12	4.8138	5.0812	1.85E+02	6.67E+05	18.20
14:00	3.23	4.9835	5.2603	2.12E+02	7.62E+05	7.50
15:00	2.99	4.6132	4.8695	1.57E+02	5.64E+05	5.00
16:00	2.76	4.2584	4.4949	1.12E+02	4.04E+05	5.00
17:00	2.52	3.8881	4.1040	7.46E+01	2.69E+05	9.00
18:00	2.5	3.8572	4.0714	7.18E+01	2.59E+05	22.33
19:00	2.47	3.8109	4.0226	6.78E+01	2.44E+05	35.62
20:00	2.44	3.7646	3.9737	6.39E+01	2.30E+05	40.40
21:00	2.46	3.7955	4.0063	6.65E+01	2.39E+05	37.54
22:00	2.47	3.8109	4.0226	6.78E+01	2.44E+05	34.60
23:00	2.48	3.8263	4.0389	6.91E+01	2.49E+05	22.43
0:00	2.63	4.0578	4.2832	9.08E+01	3.27E+05	20.00
1:00	2.78	4.2892	4.5274	1.16E+02	4.17E+05	7.88
2:00	2.92	4.5052	4.7555	1.42E+02	5.12E+05	7.04
3:00	2.86	4.4126	4.6577	1.31E+02	4.70E+05	7.04
4:00	2.79	4.3046	4.5437	1.18E+02	4.23E+05	5.00

5:00	2.72	4.1966	4.4297	1.05E+02	3.79E+05	7.04
6:00	2.92	4.5052	4.7555	1.42E+02	5.12E+05	25.00
7:00	3.13	4.8292	5.0975	1.88E+02	6.75E+05	34.31
8:00	3.34	5.1532	5.4395	2.40E+02	8.63E+05	42.59
9:00	3.59	5.5389	5.8466	3.11E+02	1.12E+06	49.02
10:00	3.83	5.9092	6.2375	3.89E+02	1.40E+06	52.01
11:00	4.08	6.2950	6.6446	4.79E+02	1.73E+06	50.01
12:00	4.09	6.3104	6.6609	4.83E+02	1.74E+06	47.45
13:00	4.09	6.3104	6.6609	4.83E+02	1.74E+06	42.59
14:00	4.1	6.3258	6.6772	4.87E+02	1.75E+06	34.48
15:00	4.18	6.4493	6.8075	5.18E+02	1.87E+06	33.80
16:00	4.27	6.5881	6.9540	5.55E+02	2.00E+06	36.00
17:00	4.36	6.7270	7.1006	5.92E+02	2.13E+06	42.00
18:00	4.49	6.9275	7.3123	6.48E+02	2.33E+06	50.00
19:00	4.62	7.1281	7.5240	7.06E+02	2.54E+06	52.01
20:00	4.74	7.3133	7.7195	7.62E+02	2.74E+06	49.00
21:00	4.97	7.6681	8.0940	8.73E+02	3.14E+06	42.94
22:00	5.2	8.0230	8.4686	9.90E+02	3.56E+06	38.40
23:00	5.42	8.3624	8.8269	1.11E+03	3.98E+06	29.93
0:00	5.41	8.3470	8.8106	1.10E+03	3.96E+06	45.28
1:00	5.4	8.3316	8.7943	1.10E+03	3.94E+06	42.67
2:00	5.39	8.3161	8.7780	1.09E+03	3.93E+06	40.09
3:00	5.61	8.6556	9.1363	1.21E+03	4.36E+06	39.10
4:00	5.83	8.9950	9.4946	1.33E+03	4.80E+06	38.40
5:00	6.06	9.3499	9.8692	1.46E+03	5.27E+06	38.50
6:00	6.48	9.9979	10.5532	1.70E+03	6.12E+06	44.52
7:00	6.91	10.6613	11.2535	1.94E+03	6.98E+06	49.69
8:00	7.34	11.3248	11.9538	2.00E+03	7.20E+06	54.55
9:00	7.31	11.2785	11.9049	2.00E+03	7.20E+06	59.82
10:00	7.28	11.2322	11.8561	2.00E+03	7.20E+06	61.44
11:00	7.26	11.2013	11.8235	2.00E+03	7.20E+06	56.01
12:00	7.18	11.0779	11.6932	2.00E+03	7.20E+06	48.77
13:00	7.11	10.9699	11.5792	2.00E+03	7.20E+06	41.45
14:00	7.03	10.8465	11.4489	2.00E+03	7.20E+06	37.63
15:00	5.99	9.2419	9.7552	1.42E+03	5.12E+06	34.52
16:00	4.94	7.6218	8.0452	8.58E+02	3.09E+06	37.40
17:00	3.89	6.0018	6.3352	4.10E+02	1.48E+06	39.10
18:00	3.68	5.6778	5.9932	3.39E+02	1.22E+06	49.19
19:00	3.48	5.3692	5.6675	2.79E+02	1.00E+06	52.00
20:00	3.27	5.0452	5.3255	2.22E+02	7.98E+05	47.87
21:00	3.2	4.9372	5.2115	2.04E+02	7.35E+05	39.90
22:00	3.14	4.8447	5.1137	1.90E+02	6.84E+05	36.07
23:00	3.08	4.7521	5.0160	1.76E+02	6.34E+05	30.52
0:00	2.78	4.2892	4.5274	1.16E+02	4.17E+05	47.10
1:00	2.83	4.3664	4.6089	1.25E+02	4.50E+05	43.76

2:00	2.88	4.4435	4.6903	1.34E+02	4.84E+05	41.36
3:00	2.92	4.5052	4.7555	1.42E+02	5.12E+05	37.50
4:00	2.96	4.5669	4.8206	1.50E+02	5.41E+05	35.13
5:00	2.99	4.6132	4.8695	1.57E+02	5.64E+05	34.75
6:00	3.94	6.0790	6.4166	4.28E+02	1.54E+06	37.32
7:00	4.9	7.5601	7.9800	8.38E+02	3.02E+06	39.99
8:00	5.85	9.0259	9.5272	1.34E+03	4.84E+06	45.09
9:00	6.21	9.5813	10.1135	1.55E+03	5.57E+06	48.10
10:00	6.57	10.1367	10.6998	1.75E+03	6.30E+06	46.14
11:00	6.92	10.6767	11.2698	1.94E+03	7.00E+06	45.10
12:00	6.8	10.4916	11.0743	1.88E+03	6.76E+06	45.10
13:00	6.67	10.2910	10.8626	1.81E+03	6.50E+06	46.00
14:00	6.54	10.0905	10.6509	1.73E+03	6.24E+06	45.09
15:00	5.96	9.1956	9.7063	1.41E+03	5.06E+06	43.40
16:00	5.38	8.3007	8.7618	1.09E+03	3.91E+06	43.00
17:00	4.8	7.4058	7.8172	7.90E+02	2.84E+06	43.08
18:00	4.51	6.9584	7.3449	6.57E+02	2.36E+06	46.10
19:00	4.23	6.5264	6.8889	5.38E+02	1.94E+06	56.40
20:00	3.94	6.0790	6.4166	4.28E+02	1.54E+06	60.75
21:00	4.45	6.8658	7.2472	6.30E+02	2.27E+06	60.00
22:00	4.95	7.6373	8.0615	8.63E+02	3.11E+06	53.38
23:00	5.45	8.4087	8.8758	1.12E+03	4.04E+06	48.10
0:00	5.95	9.1802	9.6900	1.40E+03	5.04E+06	39.00
1:00	6.46	9.9670	10.5206	1.69E+03	6.08E+06	35.03
2:00	6.97	10.7539	11.3512	1.97E+03	7.09E+06	30.00
3:00	6.97	10.7539	11.3512	1.97E+03	7.09E+06	28.25
4:00	6.97	10.7539	11.3512	1.97E+03	7.09E+06	28.24
5:00	6.98	10.7693	11.3675	1.98E+03	7.11E+06	34.75
6:00	7.36	11.3556	11.9863	2.00E+03	7.20E+06	43.40
7:00	7.74	11.9419	12.6052	2.00E+03	7.20E+06	50.48
8:00	8.12	12.5282	13.2241	2.00E+03	7.20E+06	52.95
9:00	8.44	13.0219	13.7452	2.00E+03	7.20E+06	59.01
10:00	8.76	13.5157	14.2664	2.00E+03	7.20E+06	57.00
11:00	9.08	14.0094	14.7875	2.00E+03	7.20E+06	52.97
12:00	9.13	14.0865	14.8689	2.00E+03	7.20E+06	50.48
13:00	9.18	14.1637	14.9504	2.00E+03	7.20E+06	50.48
14:00	9.23	14.2408	15.0318	2.00E+03	7.20E+06	49.33
15:00	8.44	13.0219	13.7452	2.00E+03	7.20E+06	45.40
16:00	7.65	11.8031	12.4586	2.00E+03	7.20E+06	45.10
17:00	6.86	10.5842	11.1721	1.91E+03	6.88E+06	47.01
18:00	6.12	9.4424	9.9669	1.50E+03	5.39E+06	52.69
19:00	5.39	8.3161	8.7780	1.09E+03	3.93E+06	62.00
20:00	4.66	7.1898	7.5892	7.24E+02	2.61E+06	71.00
21:00	4.48	6.9121	7.2960	6.43E+02	2.32E+06	62.00
22:00	4.3	6.6344	7.0029	5.67E+02	2.04E+06	52.69

23:00	4.12	6.3567	6.7097	4.95E+02	1.78E+06	50.48
0:00	4.34	6.6961	7.0680	5.83E+02	2.10E+06	15.99
1:00	4.57	7.0510	7.4426	6.83E+02	2.46E+06	7.88
2:00	4.79	7.3904	7.8009	7.85E+02	2.83E+06	5.13
3:00	4.45	6.8658	7.2472	6.30E+02	2.27E+06	5.00
4:00	4.11	6.3412	6.6935	4.91E+02	1.77E+06	4.13
5:00	3.77	5.8167	6.1397	3.69E+02	1.33E+06	5.00
6:00	4.43	6.8350	7.2146	6.22E+02	2.24E+06	12.22
7:00	5.09	7.8533	8.2895	9.33E+02	3.36E+06	20.00
8:00	5.75	8.8716	9.3643	1.29E+03	4.64E+06	27.57
9:00	5.34	8.2390	8.6966	1.06E+03	3.83E+06	30.00
10:00	4.93	7.6064	8.0289	8.53E+02	3.07E+06	30.68
11:00	4.52	6.9738	7.3612	6.61E+02	2.38E+06	28.70
12:00	4.88	7.5293	7.9475	8.29E+02	2.98E+06	28.76
13:00	5.24	8.0847	8.5338	1.01E+03	3.64E+06	28.85
14:00	5.6	8.6401	9.1200	1.20E+03	4.34E+06	27.56
15:00	5.31	8.1927	8.6478	1.05E+03	3.77E+06	27.95
16:00	5.02	7.7453	8.1755	8.98E+02	3.23E+06	28.45
17:00	4.73	7.2978	7.7032	7.57E+02	2.72E+06	33.00
18:00	4.45	6.8658	7.2472	6.30E+02	2.27E+06	39.59
19:00	4.16	6.4184	6.7749	5.10E+02	1.84E+06	47.29
20:00	3.88	5.9864	6.3189	4.06E+02	1.46E+06	52.10
21:00	4.06	6.2641	6.6120	4.72E+02	1.70E+06	47.09
22:00	4.23	6.5264	6.8889	5.38E+02	1.94E+06	42.59
23:00	4.41	6.8041	7.1820	6.13E+02	2.21E+06	40.40
0:00	4.23	6.5264	6.8889	5.38E+02	1.94E+06	43.99
1:00	4.06	6.2641	6.6120	4.72E+02	1.70E+06	41.00
2:00	3.88	5.9864	6.3189	4.06E+02	1.46E+06	38.15
3:00	3.78	5.8321	6.1560	3.72E+02	1.34E+06	31.95
4:00	3.69	5.6932	6.0095	3.43E+02	1.23E+06	25.00
5:00	3.6	5.5544	5.8629	3.14E+02	1.13E+06	22.12
6:00	4.02	6.2024	6.5469	4.57E+02	1.64E+06	28.83
7:00	4.44	6.8504	7.2309	6.26E+02	2.25E+06	32.95
8:00	4.86	7.4984	7.9149	8.19E+02	2.95E+06	41.00
9:00	5.04	7.7761	8.2080	9.08E+02	3.27E+06	42.10
10:00	5.22	8.0538	8.5012	1.00E+03	3.60E+06	42.00
11:00	5.41	8.3470	8.8106	1.10E+03	3.96E+06	40.00
12:00	5.72	8.8253	9.3155	1.27E+03	4.58E+06	35.50
13:00	6.04	9.3190	9.8366	1.45E+03	5.22E+06	38.40
14:00	6.36	9.8127	10.3578	1.63E+03	5.88E+06	31.45
15:00	5.48	8.4550	8.9246	1.14E+03	4.10E+06	28.48
16:00	4.6	7.0973	7.4915	6.97E+02	2.51E+06	28.41
17:00	3.72	5.7395	6.0583	3.52E+02	1.27E+06	30.00
18:00	3.39	5.2304	5.5209	2.53E+02	9.12E+05	32.45
19:00	3.05	4.7058	4.9672	1.69E+02	6.10E+05	41.60

20:00	2.72	4.1966	4.4297	1.05E+02	3.79E+05	44.69
21:00	3.02	4.6595	4.9183	1.63E+02	5.87E+05	41.52
22:00	3.32	5.1224	5.4069	2.35E+02	8.44E+05	34.67
23:00	3.63	5.6007	5.9117	3.24E+02	1.16E+06	27.55
0:00	4.12	6.3567	6.7097	4.95E+02	1.78E+06	53.10
1:00	4.62	7.1281	7.5240	7.06E+02	2.54E+06	49.34
2:00	5.12	7.8996	8.3383	9.49E+02	3.42E+06	46.16
3:00	5.27	8.1310	8.5826	1.03E+03	3.70E+06	44.40
4:00	5.43	8.3779	8.8432	1.11E+03	4.00E+06	41.96
5:00	5.59	8.6247	9.1038	1.20E+03	4.32E+06	45.53
6:00	5.85	9.0259	9.5272	1.34E+03	4.84E+06	51.10
7:00	6.11	9.4270	9.9506	1.49E+03	5.37E+06	55.49
8:00	6.37	9.8282	10.3740	1.64E+03	5.90E+06	60.19
9:00	6.27	9.6739	10.2112	1.58E+03	5.69E+06	63.50
10:00	6.16	9.5042	10.0320	1.52E+03	5.47E+06	61.69
11:00	6.06	9.3499	9.8692	1.46E+03	5.27E+06	58.69
12:00	6.1	9.4116	9.9343	1.49E+03	5.35E+06	57.19
13:00	6.14	9.4733	9.9995	1.51E+03	5.43E+06	57.69
14:00	6.18	9.5350	10.0646	1.53E+03	5.51E+06	53.69
15:00	4.99	7.6990	8.1266	8.83E+02	3.18E+06	51.80
16:00	3.8	5.8630	6.1886	3.79E+02	1.36E+06	51.10
17:00	2.61	4.0269	4.2506	8.77E+01	3.16E+05	52.52
18:00	2.64	4.0732	4.2994	9.24E+01	3.32E+05	55.49
19:00	2.67	4.1195	4.3483	9.71E+01	3.50E+05	67.32
20:00	2.7	4.1658	4.3972	1.02E+02	3.67E+05	69.69
21:00	2.86	4.4126	4.6577	1.31E+02	4.70E+05	60.53
22:00	3.01	4.6441	4.9020	1.61E+02	5.79E+05	53.15
23:00	3.16	4.8755	5.1463	1.95E+02	7.00E+05	48.97
0:00	3.09	4.7675	5.0323	1.78E+02	6.42E+05	20.17
1:00	3.03	4.6749	4.9346	1.65E+02	5.94E+05	15.10
2:00	2.97	4.5824	4.8369	1.52E+02	5.49E+05	13.55
3:00	3.14	4.8447	5.1137	1.90E+02	6.84E+05	13.00
4:00	3.31	5.1069	5.3906	2.32E+02	8.35E+05	12.00
5:00	3.48	5.3692	5.6675	2.79E+02	1.00E+06	18.10
6:00	2.95	4.5515	4.8043	1.48E+02	5.34E+05	30.23
7:00	2.43	3.7492	3.9574	6.26E+01	2.25E+05	43.52
8:00	1.9	2.9315	3.0943	1.44E+01	5.18E+04	47.05
9:00	1.84	2.8389	2.9966	1.11E+01	4.01E+04	50.00
10:00	1.78	2.7463	2.8989	8.27E+00	2.98E+04	50.48
11:00	1.72	2.6538	2.8012	5.80E+00	2.09E+04	49.38
12:00	1.82	2.8080	2.9640	1.01E+01	3.65E+04	49.12
13:00	1.92	2.9623	3.1269	1.56E+01	5.60E+04	49.05
14:00	2.01	3.1012	3.2734	2.15E+01	7.73E+04	47.47
15:00	1.86	2.8698	3.0292	1.22E+01	4.38E+04	45.94
16:00	1.71	2.6383	2.7849	5.42E+00	1.95E+04	45.94

17:00	1.56	2.4069	2.5406	1.01E+00	3.65E+03	46.26
18:00	2.12	3.2709	3.4526	3.00E+01	1.08E+05	50.48
19:00	2.68	4.1349	4.3646	9.88E+01	3.56E+05	70.16
20:00	3.24	4.9989	5.2766	2.14E+02	7.71E+05	77.15
21:00	3.31	5.1069	5.3906	2.32E+02	8.35E+05	75.60
22:00	3.37	5.1995	5.4883	2.48E+02	8.92E+05	54.92
23:00	3.43	5.2921	5.5860	2.64E+02	9.52E+05	50.94
0:00	3.24	4.9989	5.2766	2.14E+02	7.71E+05	35.62
1:00	3.04	4.6904	4.9509	1.67E+02	6.02E+05	27.10
2:00	2.84	4.3818	4.6252	1.27E+02	4.56E+05	25.00
3:00	2.81	4.3355	4.5763	1.21E+02	4.36E+05	20.01
4:00	2.78	4.2892	4.5274	1.16E+02	4.17E+05	17.10
5:00	2.74	4.2275	4.4623	1.09E+02	3.92E+05	17.22
6:00	2.95	4.5515	4.8043	1.48E+02	5.34E+05	20.14
7:00	3.15	4.8601	5.1300	1.92E+02	6.92E+05	19.87
8:00	3.35	5.1687	5.4557	2.42E+02	8.73E+05	20.22
9:00	3.47	5.3538	5.6512	2.76E+02	9.93E+05	25.22
10:00	3.59	5.5389	5.8466	3.11E+02	1.12E+06	25.13
11:00	3.71	5.7241	6.0420	3.49E+02	1.26E+06	27.10
12:00	3.93	6.0635	6.4003	4.24E+02	1.53E+06	28.71
13:00	4.15	6.4030	6.7586	5.07E+02	1.82E+06	25.00
14:00	4.37	6.7424	7.1169	5.96E+02	2.15E+06	23.68
15:00	3.66	5.6470	5.9606	3.33E+02	1.20E+06	14.87
16:00	2.05	3.1629	3.3386	2.44E+01	8.78E+04	11.70
17:00	2.35	3.6258	3.8272	5.30E+01	1.91E+05	19.52
18:00	2.65	4.0886	4.3157	9.39E+01	3.38E+05	25.13
19:00	2.95	4.5515	4.8043	1.48E+02	5.34E+05	39.71
20:00	3.25	5.0144	5.2929	2.17E+02	7.80E+05	44.00
21:00	3.55	5.4772	5.7815	2.99E+02	1.08E+06	41.21
22:00	3.85	5.9401	6.2700	3.96E+02	1.43E+06	35.69
23:00	4.15	6.4030	6.7586	5.07E+02	1.82E+06	30.23
0:00	4.45	6.8658	7.2472	6.30E+02	2.27E+06	57.88
1:00	4.75	7.3287	7.7357	7.66E+02	2.76E+06	57.58
2:00	5.05	7.7916	8.2243	9.13E+02	3.29E+06	55.10
3:00	5.35	8.2544	8.7129	1.07E+03	3.85E+06	55.10
4:00	5.65	8.7173	9.2015	1.23E+03	4.44E+06	53.52
5:00	5.95	9.1802	9.6900	1.40E+03	5.04E+06	54.00
6:00	6.25	9.6430	10.1786	1.57E+03	5.65E+06	57.60
7:00	6.55	10.1059	10.6672	1.74E+03	6.26E+06	59.85
8:00	8.46	13.0528	13.7778	2.00E+03	7.20E+06	59.97
9:00	8.61	13.2842	14.0221	2.00E+03	7.20E+06	59.99
10:00	8.76	13.5157	14.2664	2.00E+03	7.20E+06	58.55
11:00	8.91	13.7471	14.5106	2.00E+03	7.20E+06	55.35
12:00	9.09	14.0248	14.8038	2.00E+03	7.20E+06	55.85
13:00	9.28	14.3180	15.1132	2.00E+03	7.20E+06	54.52

14:00	9.46	14.5957	15.4064	2.00E+03	7.20E+06	49.71
15:00	8.55	13.1916	13.9243	2.00E+03	7.20E+06	45.45
16:00	7.64	11.7876	12.4423	2.00E+03	7.20E+06	45.25
17:00	6.73	10.3836	10.9603	1.84E+03	6.62E+06	45.35
18:00	6.23	9.6122	10.1460	1.56E+03	5.61E+06	45.35
19:00	5.73	8.8407	9.3318	1.28E+03	4.60E+06	49.10
20:00	5.23	8.0693	8.5175	1.01E+03	3.62E+06	55.10
21:00	5.26	8.1156	8.5663	1.02E+03	3.68E+06	59.85
22:00	5.3	8.1773	8.6315	1.04E+03	3.75E+06	54.57
23:00	5.34	8.2390	8.6966	1.06E+03	3.83E+06	45.80
0:00	5.49	8.4704	8.9409	1.14E+03	4.12E+06	60.01
1:00	5.64	8.7019	9.1852	1.23E+03	4.42E+06	58.10
2:00	5.79	8.9333	9.4295	1.31E+03	4.72E+06	56.02
3:00	5.8	8.9487	9.4458	1.32E+03	4.74E+06	54.70
4:00	5.81	8.9641	9.4620	1.32E+03	4.76E+06	53.02
5:00	5.82	8.9796	9.4783	1.33E+03	4.78E+06	55.10
6:00	6.81	10.5070	11.0906	1.88E+03	6.78E+06	58.42
7:00	7.8	12.0345	12.7029	2.00E+03	7.20E+06	60.95
8:00	8.79	13.5619	14.3152	2.00E+03	7.20E+06	62.60
9:00	8.82	13.6082	14.3641	2.00E+03	7.20E+06	65.10
10:00	8.86	13.6699	14.4292	2.00E+03	7.20E+06	62.85
11:00	8.9	13.7317	14.4944	2.00E+03	7.20E+06	62.03
12:00	8.84	13.6391	14.3966	2.00E+03	7.20E+06	60.95
13:00	8.79	13.5619	14.3152	2.00E+03	7.20E+06	60.60
14:00	8.73	13.4694	14.2175	2.00E+03	7.20E+06	57.99
15:00	8.03	12.3893	13.0775	2.00E+03	7.20E+06	57.48
16:00	7.32	11.2939	11.9212	2.00E+03	7.20E+06	55.62
17:00	6.62	10.2139	10.7812	1.78E+03	6.40E+06	57.48
18:00	6.09	9.3962	9.9180	1.48E+03	5.33E+06	56.30
19:00	5.55	8.5630	9.0386	1.18E+03	4.24E+06	57.60
20:00	5.02	7.7453	8.1755	8.98E+02	3.23E+06	60.95
21:00	4.65	7.1744	7.5729	7.20E+02	2.59E+06	66.20
22:00	4.29	6.6190	6.9866	5.63E+02	2.03E+06	62.42
23:00	3.92	6.0481	6.3840	4.20E+02	1.51E+06	60.10
0:00	3.68	5.6778	5.9932	3.39E+02	1.22E+06	51.88
1:00	3.45	5.3229	5.6186	2.70E+02	9.72E+05	41.38
2:00	3.21	4.9527	5.2277	2.07E+02	7.44E+05	39.86
3:00	3.13	4.8292	5.0975	1.88E+02	6.75E+05	38.40
4:00	3.04	4.6904	4.9509	1.67E+02	6.02E+05	38.40
5:00	2.95	4.5515	4.8043	1.48E+02	5.34E+05	39.86
6:00	3.17	4.8909	5.1626	1.97E+02	7.09E+05	51.82
7:00	3.38	5.2149	5.5046	2.51E+02	9.02E+05	57.20
8:00	3.6	5.5544	5.8629	3.14E+02	1.13E+06	59.23
9:00	3.28	5.0607	5.3417	2.24E+02	8.07E+05	60.95
10:00	2.97	4.5824	4.8369	1.52E+02	5.49E+05	60.49

11:00	2.65	4.0886	4.3157	9.39E+01	3.38E+05	60.35
12:00	2.88	4.4435	4.6903	1.34E+02	4.84E+05	60.95
13:00	3.11	4.7984	5.0649	1.83E+02	6.59E+05	60.99
14:00	3.34	5.1532	5.4395	2.40E+02	8.63E+05	60.35
15:00	3.24	4.9989	5.2766	2.14E+02	7.71E+05	60.10
16:00	3.14	4.8447	5.1137	1.90E+02	6.84E+05	60.12
17:00	3.03	4.6749	4.9346	1.65E+02	5.94E+05	60.60
18:00	2.88	4.4435	4.6903	1.34E+02	4.84E+05	60.23
19:00	2.72	4.1966	4.4297	1.05E+02	3.79E+05	59.69
20:00	2.57	3.9652	4.1854	8.17E+01	2.94E+05	60.99
21:00	2.51	3.8726	4.0877	7.32E+01	2.64E+05	67.10
22:00	2.46	3.7955	4.0063	6.65E+01	2.39E+05	61.42
23:00	2.41	3.7183	3.9249	6.01E+01	2.16E+05	60.01
0:00	2.47	3.8109	4.0226	6.78E+01	2.44E+05	37.52
1:00	2.53	3.9035	4.1203	7.60E+01	2.74E+05	31.51
2:00	2.59	3.9961	4.2180	8.47E+01	3.05E+05	27.10
3:00	2.54	3.9189	4.1366	7.74E+01	2.79E+05	27.10
4:00	2.48	3.8263	4.0389	6.91E+01	2.49E+05	27.10
5:00	2.43	3.7492	3.9574	6.26E+01	2.25E+05	29.20
6:00	2.51	3.8726	4.0877	7.32E+01	2.64E+05	38.00
7:00	2.59	3.9961	4.2180	8.47E+01	3.05E+05	43.94
8:00	2.68	4.1349	4.3646	9.88E+01	3.56E+05	48.57
9:00	2.65	4.0886	4.3157	9.39E+01	3.38E+05	48.43
10:00	2.63	4.0578	4.2832	9.08E+01	3.27E+05	48.28
11:00	2.61	4.0269	4.2506	8.77E+01	3.16E+05	48.43
12:00	3.32	5.1224	5.4069	2.35E+02	8.44E+05	50.35
13:00	4.03	6.2178	6.5632	4.61E+02	1.66E+06	50.10
14:00	4.74	7.3133	7.7195	7.62E+02	2.74E+06	45.90
15:00	4.3	6.6344	7.0029	5.67E+02	2.04E+06	41.49
16:00	3.85	5.9401	6.2700	3.96E+02	1.43E+06	40.41
17:00	3.41	5.2612	5.5535	2.59E+02	9.32E+05	43.18
18:00	3.11	4.7984	5.0649	1.83E+02	6.59E+05	44.97
19:00	2.81	4.3355	4.5763	1.21E+02	4.36E+05	46.88
20:00	2.51	3.8726	4.0877	7.32E+01	2.64E+05	50.01
21:00	2.4	3.7029	3.9086	5.89E+01	2.12E+05	58.10
22:00	2.3	3.5486	3.7457	4.74E+01	1.71E+05	54.85
23:00	2.19	3.3789	3.5666	3.63E+01	1.31E+05	51.15
0:00	2.1	3.2401	3.4200	2.83E+01	1.02E+05	37.52
1:00	2	3.0858	3.2572	2.08E+01	7.47E+04	26.86
2:00	1.9	2.9315	3.0943	1.44E+01	5.18E+04	21.59
3:00	1.83	2.8235	2.9803	1.06E+01	3.82E+04	25.00
4:00	1.75	2.7000	2.8500	6.98E+00	2.51E+04	21.59
5:00	1.67	2.5766	2.7197	4.03E+00	1.45E+04	21.49
6:00	1.83	2.8235	2.9803	1.06E+01	3.82E+04	25.00
7:00	1.98	3.0549	3.2246	1.94E+01	6.98E+04	21.69

8:00	2.14	3.3018	3.4852	3.17E+01	1.14E+05	25.00
9:00	2.07	3.1938	3.3712	2.59E+01	9.34E+04	28.56
10:00	2	3.0858	3.2572	2.08E+01	7.47E+04	37.52
11:00	1.93	2.9778	3.1432	1.62E+01	5.82E+04	37.52
12:00	2.35	3.6258	3.8272	5.30E+01	1.91E+05	40.95
13:00	2.77	4.2738	4.5112	1.14E+02	4.10E+05	46.00
14:00	3.19	4.9218	5.1952	2.02E+02	7.26E+05	37.52
15:00	2.73	4.2121	4.4460	1.07E+02	3.86E+05	26.03
16:00	2.28	3.5178	3.7132	4.52E+01	1.63E+05	19.95
17:00	1.82	2.8080	2.9640	1.01E+01	3.65E+04	21.57
18:00	2.01	3.1012	3.2734	2.15E+01	7.73E+04	23.35
19:00	2.2	3.3943	3.5829	3.72E+01	1.34E+05	27.84
20:00	2.39	3.6875	3.8923	5.77E+01	2.08E+05	35.10
21:00	2.25	3.4715	3.6643	4.21E+01	1.52E+05	56.60
22:00	2.12	3.2709	3.4526	3.00E+01	1.08E+05	54.10
23:00	1.99	3.0703	3.2409	2.01E+01	7.22E+04	40.00
0:00	1.73	2.6692	2.8174	6.18E+00	2.23E+04	56.00
1:00	1.47	2.2680	2.3940	0.00E+00	0.00E+00	44.69
2:00	1.21	1.8669	1.9706	0.00E+00	0.00E+00	37.52
3:00	0.87	1.3423	1.4169	0.00E+00	0.00E+00	37.52
4:00	0.52	0.8023	0.8469	0.00E+00	0.00E+00	33.10
5:00	0.18	0.2777	0.2931	0.00E+00	0.00E+00	33.01
6:00	0.23	0.3549	0.3746	0.00E+00	0.00E+00	37.52
7:00	0.28	0.4320	0.4560	0.00E+00	0.00E+00	37.52
8:00	0.33	0.5092	0.5374	0.00E+00	0.00E+00	40.00
9:00	0.82	1.2652	1.3354	0.00E+00	0.00E+00	47.28
10:00	1.31	2.0212	2.1334	0.00E+00	0.00E+00	48.96
11:00	1.81	2.7926	2.9477	9.65E+00	3.47E+04	49.80
12:00	2.07	3.1938	3.3712	2.59E+01	9.34E+04	48.10
13:00	2.33	3.5949	3.7946	5.07E+01	1.82E+05	48.96
14:00	2.59	3.9961	4.2180	8.47E+01	3.05E+05	47.10
15:00	2.39	3.6875	3.8923	5.77E+01	2.08E+05	39.83
16:00	2.19	3.3789	3.5666	3.63E+01	1.31E+05	36.94
17:00	1.99	3.0703	3.2409	2.01E+01	7.22E+04	37.52
18:00	2.34	3.6103	3.8109	5.18E+01	1.87E+05	38.99
19:00	2.69	4.1504	4.3809	1.00E+02	3.61E+05	43.99
20:00	3.03	4.6749	4.9346	1.65E+02	5.94E+05	52.10
21:00	2.59	3.9961	4.2180	8.47E+01	3.05E+05	60.01
22:00	2.14	3.3018	3.4852	3.17E+01	1.14E+05	56.10
23:00	1.7	2.6229	2.7686	5.06E+00	1.82E+04	49.80
0:00	1.92	2.9623	3.1269	1.56E+01	5.60E+04	58.75
1:00	2.15	3.3172	3.5014	3.26E+01	1.17E+05	57.10
2:00	2.37	3.6566	3.8597	5.53E+01	1.99E+05	54.61
3:00	2.61	4.0269	4.2506	8.77E+01	3.16E+05	54.50
4:00	2.84	4.3818	4.6252	1.27E+02	4.56E+05	52.20

5:00	3.08	4.7521	5.0160	1.76E+02	6.34E+05	54.02
6:00	3.09	4.7675	5.0323	1.78E+02	6.42E+05	57.40
7:00	3.09	4.7675	5.0323	1.78E+02	6.42E+05	59.96
8:00	3.1	4.7829	5.0486	1.81E+02	6.50E+05	60.95
9:00	4.06	6.2641	6.6120	4.72E+02	1.70E+06	61.46
10:00	5.03	7.7607	8.1918	9.03E+02	3.25E+06	63.10
11:00	5.99	9.2419	9.7552	1.42E+03	5.12E+06	61.42
12:00	6.13	9.4579	9.9832	1.50E+03	5.41E+06	60.99
13:00	6.27	9.6739	10.2112	1.58E+03	5.69E+06	59.23
14:00	6.41	9.8899	10.4392	1.66E+03	5.98E+06	56.77
15:00	5.21	8.0384	8.4849	9.95E+02	3.58E+06	53.28
16:00	4	6.1715	6.5143	4.49E+02	1.62E+06	51.72
17:00	2.8	4.3201	4.5600	1.19E+02	4.30E+05	52.40
18:00	2.82	4.3509	4.5926	1.23E+02	4.43E+05	50.98
19:00	2.84	4.3818	4.6252	1.27E+02	4.56E+05	50.76
20:00	2.86	4.4126	4.6577	1.31E+02	4.70E+05	54.01
21:00	2.74	4.2275	4.4623	1.09E+02	3.92E+05	60.10
22:00	2.62	4.0424	4.2669	8.93E+01	3.21E+05	54.50
23:00	2.5	3.8572	4.0714	7.18E+01	2.59E+05	49.08
0:00	2.05	3.1629	3.3386	2.44E+01	8.78E+04	59.85
1:00	1.6	2.4686	2.6057	1.97E+00	7.10E+03	57.10
2:00	1.16	1.7897	1.8892	0.00E+00	0.00E+00	52.25
3:00	1.37	2.1137	2.2312	0.00E+00	0.00E+00	55.03
4:00	1.58	2.4378	2.5732	1.47E+00	5.31E+03	55.00
5:00	1.79	2.7618	2.9152	8.72E+00	3.14E+04	55.00
6:00	2.29	3.5332	3.7294	4.63E+01	1.67E+05	59.50
7:00	2.8	4.3201	4.5600	1.19E+02	4.30E+05	63.10
8:00	3.3	5.0915	5.3743	2.29E+02	8.26E+05	65.10
9:00	4.62	7.1281	7.5240	7.06E+02	2.54E+06	66.69
10:00	5.94	9.1647	9.6738	1.39E+03	5.02E+06	66.89
11:00	7.26	11.2013	11.8235	2.00E+03	7.20E+06	65.69
12:00	7.47	11.5253	12.1655	2.00E+03	7.20E+06	65.20
13:00	7.68	11.8493	12.5075	2.00E+03	7.20E+06	64.19
14:00	7.89	12.1733	12.8495	2.00E+03	7.20E+06	62.69
15:00	7.55	11.6488	12.2958	2.00E+03	7.20E+06	60.00
16:00	7.22	11.1396	11.7583	2.00E+03	7.20E+06	60.00
17:00	6.88	10.6150	11.2046	1.92E+03	6.92E+06	60.01
18:00	7.26	11.2013	11.8235	2.00E+03	7.20E+06	60.95
19:00	7.63	11.7722	12.4261	2.00E+03	7.20E+06	63.65
20:00	8	12.3431	13.0286	2.00E+03	7.20E+06	65.10
…	…	...	…	…	…	…
16:00	2.6	4.0115	4.2343	8.62E+01	3.10E+05	62.53
17:00	2.66	4.1041	4.3320	9.55E+01	3.44E+05	63.01

18:00	2.72	4.1966	4.4297	1.05E+02	3.79E+05	62.29
19:00	2.77	4.2738	4.5112	1.14E+02	4.10E+05	61.51
20:00	2.83	4.3664	4.6089	1.25E+02	4.50E+05	65.50
21:00	2.89	4.4589	4.7066	1.36E+02	4.91E+05	67.67
22:00	2.95	4.5515	4.8043	1.48E+02	5.34E+05	61.51
23:00	3.01	4.6441	4.9020	1.61E+02	5.79E+05	54.90

ANNEX II. MATHEMATICAL CODES

In this annex, the different codes used for the management of the initial data and the obtention of the results are gathered. In Section 3 - Tools and methodology - of the document, the operation of these codes and the motivation for using ratios are explained. The generated codes are divided in two blocks (i) main code and (ii) ratios calculation.

1. Main Code

The main code is divided into two sections. In the first part, which is the part that I need to separate depending if it's the Italian or Spanish case, I defining the variables that I will use after, calculate the energy and price matrix, medium daily price, and the lowest and highest price of the day. In the second part, I calculate the energy that I sell to the network, the energy that I send to the storage, the level of the battery, and the money that I win with the energy that I sell. In this last part, it is where I will implant the condition of charge o not the storage and sale of the energy taking into account or not the price band.

The main code that is shared in both scenarios without taking into account the price band is presented in the first place. Then, the main code module that allows for setting a price band is presented. Finally, the code modules that varies depending on whether the case of Italy or Spain is studied are shown.

List of programs:

- MAIN CODE - Without price band
- MAIN CODE* - With price band
- CODE MODULE "Italian scenario"
- CODE MODULE "Spanish scenario"

1.1 MAIN CODE - Without price band

```
%%%Main code

%

for i=1:N_i

  for j=1:N_j

    if (i==1 && j==1)

          if prices_mat(i,j)<=medio_price_day(i)

                if       0.2*e_st_max+min([energy_mat(i,j),p_st_max*t])*rend_c        >=
e_st_max*lim_c

                   e_st(i,j)=e_st_max*lim_c;

                   stored(i,j)=e_st(i,j)-0.2*e_st_max;

                   sell(i,j)=energy_mat(i,j)-stored(i,j)/rend_c;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=0.2*e_st_max+min([energy_mat(i,j),p_st_max*t])*rend_c;

                   stored(i,j)=e_st(i,j)-0.2*e_st_max;

                   sell(i,j)=energy_mat(i,j)-(stored(i,j)/rend_c);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                end

          else

                if prices_mat(i,j) == highest_price_day(i)

                   sell(i,j)=min([energy_mat(i,j),   (energy_mat(i,j)+p_st_max*t*rend_d),
pot_machine*t]);

                   sell_st(i,j)=sell(i,j)-energy_mat(i,j);

                   e_st(i,j)=0.2*e_st_max-sell_st(i,j)/rend_d;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=0.2*e_st_max+0;

                   stored(i,j)=e_st(i,j)-0.2*e_st_max;

                   sell(i,j)=energy_mat(i,j)-stored(i,j);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);
```

```
                end

          end

    elseif (j==1)

          if prices_mat(i,j)<=medio_price_day(i)

                if        e_st(i-1,end)+min([energy_mat(i,j),p_st_max*t])*rend_c        >=
e_st_max*lim_c

                   e_st(i,j)=e_st_max*lim_c;

                   stored(i,j)=e_st(i,j)-e_st(i-1,end);

                   sell(i,j)=energy_mat(i,j)-stored(i,j)/rend_c;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=e_st(i-1,end)+min([energy_mat(i,j),p_st_max*t])*rend_c;

                   stored(i,j)=e_st(i,j)-e_st(i-1,end);

                   sell(i,j)=energy_mat(i,j)-(stored(i,j)/rend_c);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                end

           else

                if prices_mat(i,j) == highest_price_day(i)

                   sell(i,j)=min([energy_mat(i,j)+(e_st(i-1,end)-0.2*e_st_max)*rend_d,
(energy_mat(i,j)+p_st_max*t*rend_d), pot_machine*t]);

                   sell_st(i,j)=sell(i,j)-energy_mat(i,j);

                   e_st(i,j)=e_st(i-1,end)-sell_st(i,j)/rend_d;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=e_st(i-1,end)+0;

                   stored(i,j)=e_st(i,j)-e_st(i-1,end);

                   sell(i,j)=energy_mat(i,j)-stored(i,j);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                end

           end

      else

         if prices_mat(i,j)<=medio_price_day(i)
```

```
                if        e_st(i,j-1)+min([energy_mat(i,j),p_st_max*t])*rend_c        >=
e_st_max*lim_c

                   e_st(i,j)=e_st_max*lim_c;

                   stored(i,j)=e_st(i,j)-e_st(i,j-1);

                   sell(i,j)=energy_mat(i,j)-stored(i,j)/rend_c;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=e_st(i,j-1)+min([energy_mat(i,j),p_st_max*t])*rend_c;

                   stored(i,j)=e_st(i,j)-e_st(i,j-1);

                   sell(i,j)=energy_mat(i,j)-(stored(i,j)/rend_c);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                end

           else

                if prices_mat(i,j) == highest_price_day(i)

                   sell(i,j)=min([energy_mat(i,j)+(e_st(i,j-1)-0.2*e_st_max)*rend_d,
(energy_mat(i,j)+p_st_max*t*rend_d), pot_machine*t]);

                   sell_st(i,j)=sell(i,j)-energy_mat(i,j);

                   e_st(i,j)=e_st(i,j-1)-sell_st(i,j)/rend_d;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=e_st(i,j-1)+0;

                   stored(i,j)=e_st(i,j)-e_st(i,j-1);

                   sell(i,j)=energy_mat(i,j)-stored(i,j);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                end

           end

      end

    end

  end
```

1.2 MAIN CODE* - With price band

```
%%%Variation of the percentage of medio_price_day and highest_price_day

x=[ --- ]; %Medium daily price

xx=length(x);

y=[ --- ]; %Highest daily price

yy=length(y);

%%

for q=1:xx

  m_variation=x(q);

 for w=1:yy

  h_variation=y(w);

  for i=1:N_i

    for j=1:N_j

      if (i==1 && j==1)

          if (prices_mat(i,j) <= medio_price_day(i)*m_variation)

                if        0.2*e_st_max+min([energy_mat(i,j),p_st_max*t])*rend_c        >=
e_st_max*lim_c

                   e_st(i,j)=e_st_max*lim_c;

                   stored(i,j)=e_st(i,j)-0.2*e_st_max;

                   sell(i,j)=energy_mat(i,j)-stored(i,j)/rend_c;

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                else

                   e_st(i,j)=0.2*e_st_max+min([energy_mat(i,j),p_st_max*t])*rend_c;

                   stored(i,j)=e_st(i,j)-0.2*e_st_max;

                   sell(i,j)=energy_mat(i,j)-(stored(i,j)/rend_c);

                   money_win(i,j)=sell(i,j)*prices_mat(i,j);

                   lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

                end

          else

                if     (prices_mat(i,j)     >=     highest_price_day(i)*h_variation     &&
prices_mat(i,j) <= highest_price_day(i))

                   sell(i,j)=min([energy_mat(i,j),     energy_mat(i,j)+p_st_max*t*rend_d,
pot_machine*t]);

                   sell_st(i,j)=sell(i,j)-energy_mat(i,j);
```

```
            e_st(i,j)=0.2*e_st_max-sell_st(i,j)/rend_d;

            money_win(i,j)=sell(i,j)*prices_mat(i,j);

         else

            e_st(i,j)=0.2*e_st_max+0;

            stored(i,j)=e_st(i,j)-0.2*e_st_max;

            sell(i,j)=energy_mat(i,j)-stored(i,j);

            money_win(i,j)=sell(i,j)*prices_mat(i,j);

            lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

         end

      end

   elseif (j==1)

      if (prices_mat(i,j) <= medio_price_day(i)*m_variation)

         if       e_st(i-1,end)+min([energy_mat(i,j),p_st_max*t])*rend_c       >=
e_st_max*lim_c

            e_st(i,j)=e_st_max*lim_c;

            stored(i,j)=e_st(i,j)-e_st(i-1,end);

            sell(i,j)=energy_mat(i,j)-stored(i,j)/rend_c;

            money_win(i,j)=sell(i,j)*prices_mat(i,j);

            lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

         else

            e_st(i,j)=e_st(i-1,end)+min([energy_mat(i,j),p_st_max*t])*rend_c;

            stored(i,j)=e_st(i,j)-e_st(i-1,end);

            sell(i,j)=energy_mat(i,j)-(stored(i,j)/rend_c);

            money_win(i,j)=sell(i,j)*prices_mat(i,j);

            lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

         end

       else

         if     (prices_mat(i,j)     >=     highest_price_day(i)*h_variation     &&
prices_mat(i,j) <= highest_price_day(i))

            sell(i,j)=min([energy_mat(i,j)+(e_st(i-1,end)-0.2*e_st_max)*rend_d,
energy_mat(i,j)+p_st_max*t*rend_d, pot_machine*t]);

            sell_st(i,j)=sell(i,j)-energy_mat(i,j);

            e_st(i,j)=e_st(i-1,end)-sell_st(i,j)/rend_d;

            money_win(i,j)=sell(i,j)*prices_mat(i,j);

         else

            e_st(i,j)=e_st(i-1,end)+0;
```

```
                stored(i,j)=e_st(i,j)-e_st(i-1,end);

                sell(i,j)=energy_mat(i,j)-stored(i,j);

                money_win(i,j)=sell(i,j)*prices_mat(i,j);

                lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

             end

        end

    else

       if (prices_mat(i,j) <= medio_price_day(i)*m_variation)

             if        e_st(i,j-1)+min([energy_mat(i,j),p_st_max*t])*rend_c        >=
e_st_max*lim_c

                e_st(i,j)=e_st_max*lim_c;

                stored(i,j)=e_st(i,j)-e_st(i,j-1);

                sell(i,j)=energy_mat(i,j)-stored(i,j)/rend_c;

                money_win(i,j)=sell(i,j)*prices_mat(i,j);

                lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

             else

                e_st(i,j)=e_st(i,j-1)+min([energy_mat(i,j),p_st_max*t])*rend_c;

                stored(i,j)=e_st(i,j)-e_st(i,j-1);

                sell(i,j)=energy_mat(i,j)-(stored(i,j)/rend_c);

                money_win(i,j)=sell(i,j)*prices_mat(i,j);

                lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);

             end

        else

             if    (prices_mat(i,j)    >=    highest_price_day(i)*h_variation    &&
prices_mat(i,j) <= highest_price_day(i))

                sell(i,j)=min([energy_mat(i,j)+(e_st(i,j-1)-0.2*e_st_max)*rend_d,
energy_mat(i,j)+p_st_max*t*rend_d, pot_machine*t]);

                sell_st(i,j)=sell(i,j)-energy_mat(i,j);

                e_st(i,j)=e_st(i,j-1)-sell_st(i,j)/rend_d;

                money_win(i,j)=sell(i,j)*prices_mat(i,j);

             else

                e_st(i,j)=e_st(i,j-1)+0;

                stored(i,j)=e_st(i,j)-e_st(i,j-1);

                sell(i,j)=energy_mat(i,j)-stored(i,j);

                money_win(i,j)=sell(i,j)*prices_mat(i,j);

                lost_m_st(i,j)=stored(i,j)*prices_mat(i,j);
```

```
                end
           end
        end
      end
     end
    money_storage_total(q,w)=sum(sum(sell_st.*prices_mat));
    money_win_total(q,w)=sum(sum(money_win));
  end
end
```

1.3 CODE MODULE "Italian scenario"

```
%%Numbers of machine
machine= --- ;
%
%%Capacity of the storage
c= --- ; %MWh
%%Power of the storage
p= --- ; %MW
%
%%Characteristics of the battery
%
e_st_max=c*(3.6*10^6); %MWh to kJ
p_st_max=p*1000; %MW to kW
pot_machine=machine*2*1000; %MW to kW
rend_c=0.9; %Charge performance 90%
rend_d=0.9; %Discharge performance 90%
t=10*60; %seconds
lim_c=0.8; %Max. charge capacity 80%
lim_d=0.2; %Max. discharge capacity 20%
%
%%Variation of basic data power [machine/2]
power=pot_machine/2000*power;
%
%%Energy matrix 365x144
energy=power*600; %Conversion factor from power [kW] to energy [kJ]
energy_mat=reshape(energy, 144, 365);
energy_mat=energy_mat';
%
%%Price matrix 365x144
prices_mat=reshape(prices10, 144, 365);
prices_mat=prices_mat'*(3.6*10^6)^-1; %Conversion factor from [€/MWh] to [€/kJ]
[N_i,N_j]=size(prices_mat);
%
%%Medium daily price
```

```
medio_price_day=mean(prices_mat,2);

%

%%%Minimum and Maximum daily price%%%

%

for i=1:N_i

    for j=1:N_j

      if prices_mat(i,j)<=medio_price_day(i)

        low_prices_day(i,j)=prices_mat(i,j);

        else

        high_prices_day(i,j)=prices_mat(i,j);

      end

    end

end

%

highest_price_day=max(high_prices_day');

highest_price_day=highest_price_day';

lowest_price_day=max(low_prices_day');

lowest_price_day=lowest_price_day';

%
```

1.4 CODE MODULE "Spanish scenario"

```
%%Numbers of machine

machine= --- ;

%

%%Capacity of the storage

c= --- ; %MWh

%%Power of the storage

p= --- ; %MW

%

%%Characteristics of the battery

%

e_st_max=c*(3.6*10^6); %MWh to kJ

p_st_max=p*1000; %MW to kW

pot_machine=machine*2*1000; %MW to kW

rend_c=0.9; %Charge performance 90%

rend_d=0.9; %Discharge performance 90%

t=3600; %seconds

lim_c=0.8; %Max. capacity charge 80%

lim_d=0.2; %Max. capacity discharge 20%

%

%%Variation of basic data power [machine/2]

power=pot_machine/2000*power;

%

%%Energy matrix 365x24

energy=power*3600; %Conversion factor from power [kW] to energy [kJ]

energy_mat=reshape(energy, 24, 365);

energy_mat=energy_mat';

%

%%Price matrix 365x24

prices_mat=prices*(3.6*10^6)^-1; %Conversion factor from [€/MWh] to [€/kJ]

[N_i,N_j]=size(prices_mat);

%

%%Medium daily price

medio_price_day=mean(prices_mat,2);
```

```
%
%%%Minimum and Maximum daily price%%%
%
for i=1:N_i
    for j=1:N_j
      if prices_mat(i,j)<=medio_price_day(i)
        low_prices_day(i,j)=prices_mat(i,j);
        else
        high_prices_day(i,j)=prices_mat(i,j);
      end
    end
end
%
highest_price_day=max(high_prices_day');
highest_price_day=highest_price_day';
lowest_price_day=max(low_prices_day');
lowest_price_day=lowest_price_day';
%
```

2. Ratios calculation

To calculate the different values of *c* and *p* from the different values of the ratios, it is necessary to differentiate between the Italian case and the Spanish case because each one has different dimension data and different results of power and energy of the basic case, 2 MW of power of the wind farm.

List of programs:

- CODE MODULE “Ratios for Italian scenario”
- CODE MODULE “Ratios for Spanish scenario”

2.1 CODE MODULE “Ratios for Italian scenario”

```
%%Numbers of machine
machine= --- ;
pot_machine=machine*2*1000;
%
%%Variation of basic data power [kW]
powerr=pot_machine/2000*power; %52560x1
power_mat=reshape(powerr,144,365); %144x365
%
pow=mean(mean(power_mat)); %1x365
p=pow/1000; %kW to MW
%
%%Energy matrix 365x144
energy=powerr*600; %Conversion factor from power [kW] to energy [kJ]
energy_mat=reshape(energy, 144, 365);
%
ee=sum(energy_mat); %1x365
e=mean(ee); %1x1
e=e*(2.778*10^-7); %kJ to MWh
%
park= --- ; %Power Park [MW]
x=6.4378; %alfa [hours]
e=x*park; %MWh
p=e/24; %MW
%
ratio=[ --- ];
%
for q=1:length(ratio)
  capacity(q)=ratio(q)*e;
 end
%
for q=1:length(ratio)
  power(q)=ratio(q)*p;
 end
```

2.2 CODE MODULE "Ratios for Spanish scenario"

```
%%Numbers of machine
machine= --- ;
pot_machine=machine*2*1000;
%
%%Variation of basic data power [kW]
powerr=pot_machine/2000*power; %8760x1
power_mat=reshape(powerr,24,365); %24x365
%
pow=mean(mean(power_mat)); %1x365
p=pow/1000; %kW to MW
%
%%Energy matrix 365x24
energy=powerr*3600; %Conversion factor from power [kW] to energy [kJ]
energy_mat=reshape(energy, 24, 365);
%
ee=sum(energy_mat); %1x365
e=mean(ee); %1x1
e=e*(2.778*10^-7); %kJ to MWh
%
park= --- ; %Power park [MW]
x=5.9012; %alfa [hours]
e=x*park; %MWh
p=e/24; %MW
%
ratio=[ --- ];
%
for q=1:length(ratio)
  capacity(q)=ratio(q)*e;
 end
%
for q=1:length(ratio)
  power(q)=ratio(q)*p;
 end
```

ANNEX III. MANUSCRIPT ACCEPTED TO THE 31ST INTERNATIONAL CONFERENCE ON EFFICENCY, COST, OPTIMIZATION, SIMULATION AND ENVIRONMENTAL IMPACT OF ENERGY SYSTEMS

This annex 3 shows the paper that has been developed together with a research group of the Department of Energy, Systems, Territory and Construction Engineering of the Engineering School, University of Pisa (Italy), led by Professor Umberto Desideri.

The article has been accepted for oral presentation in the 31st International Conference in Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems - ECOS 2018 which will be held in Guimarães (Portugal) between 17th and 21st June.

On the suitability of a battery energy storage use in a wind farm

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Abstract:

This study analyses the coupling between a wind farm and a Battery Energy Storage (BES) from an economic point of view. The focus is set on the use of the storage to mitigate the so-called “merit order effect”, which essentially is the lowering of the energy market clearing price due to the substantial share of Renewable Energy Sources (RES) dispatched on it. The lowering of the prices translates in a lowering of the profits, such that a further RES development becomes un-economical. The Electric Energy Storage (EES) technologies are seen as a key factor to allow the RES integration into the electric systems, since they are suitable to solve the many technical issues which this process arose. Therefore, it is interesting to investigate if the EES could fulfil the same role for the economic issues posed by the RES development. As a matter of fact, the EES can be used to maximise the economic profit of a RES plant shifting its production towards more profitable moments. In this paper, the economic viability of such practice is analysed, referring to the case of three Italian wind farms. The storage operation is simulated and two different BES technology (NaS and Li-ion) are compared. Both technologies show a good profit increment potential. Despite this, the actual economic benefits brought by the storage are lower than those needed to repay the battery itself. This means that this application cannot be used to counterbalance the profit loss dictated by “merit order effect” in the Italian scenario. Therefore, the study highlights the necessity to resort to alternative solutions to make a further RES development possible also from the economic point of view

Keywords:

Energy storage, Renewable energy sources, Economic viability, Production shifting, Merit order effect.

1. Introduction

The European countries have faced in the last decade deep change in the energy production mix, mostly due to the great rise of non-programmable Renewable Energy Sources (RESs) introduced in the European energy systems. This revolution has been dictated by the increasing concern for the environmental impact of human activities and ambitious goals were set for near future [1,2]. The integration of such share of intermittent non-programmable plants in the electric systems pose several technical problems which could be addressed resorting to Electric Energy Storage (EES) technologies [3,4] and promoting the integration of different energy sectors (electrical, thermal and mobility) [5]. Apart from the technical issues, a large share of RESs has a non-negligible impact also on the energy markets. As a matter of fact, a substantial lowering of the prices is induced by the low selling price with which the non-programmable RESs offer on the market. This is known as “merit order effect”, and has been studied both theoretically and experimentally for many European countries [6–8]. Paradoxically, the market price fall did not translate in an energy price lowering for the final consumer, which, conversely, is increased [9,10]. This is mostly due to the additional economic resources employed for the management of the system under these new complex operating conditions, plus the overheads generated by the large amount of subsidies that fuelled the RESs development [11]. Therefore, the question is: in a scenario in which the support schemes for the RESs are absent or strongly reduced (as it is happening in many European countries), is further deployment of RESs possible? In other words, since the RESs negative feedback on the energy price lowers the profitability of the RES plants itself, discouraging further developments, there is a necessity for alternative solutions to solve this problem.

For the well-known supply and demand law, the most direct way to increase the prices on the market is to increase the demand. In this case, this can be done essentially in the same two ways proposed for the RESs technical integration: using EES technologies [12], or merging (electrifying) the energy sectors. Both solutions are theoretically viable, but the second implies an overhaul of the energy system which is greater than the former. Such process could translate in costs difficult to address for the private investors which operates in the energy systems. Therefore, the electrification of thermal and mobility sector could require government support, which is not a negative thing per se, but makes other options more attractive, at least in the first phase of this process.

For what concerns the storage, it could help the further RES deployment realizing the arbitrage on the energy market, thus shifting the RESs energy production in more profitable moments [13,14]. From this point of view the storage solution could be weaker, at least for no other reason that also the storage has a negative feedback on the energy prices. As a matter of fact, a massive storage presence modifies the demand and supply curve, affecting the prices in such way that the differences tend to be flattened. In other words, the more storage is deployed, the less profitable it becomes. Despite this, the storage could help the further RESs development in an initial phase, bridging the energy systems towards other more effective and stable solutions. To verify this, the economic revenue improvement due to the storage application to three Italian wind farms (WFs) has been investigated. The storage operation has been simulated with a simplified control logic, based on the real Italian hourly energy prices and wind data. The performances of two different EES technologies has been investigated and compared, considering the different characteristic efficiency, life time and the capacity and power specific capital cost.

2. RES effect on energy prices

2.1. Case study description

To characterize the economic performances of coupled WF-BES systems, the hourly wind and energy prices data are needed. For what concerns the energy prices, the analysis considers only the day-ahead market, in which, however, the vast majority of the energy is sold and purchased. From the electric energy market point of view the Italian territory is divided into 21 interconnected market zones. There are six geographical zones (North, Central-North, Central-South, South, Sardinia and Sicily); five virtual non-foreign zones, which are essentially five major power plants, or power plant aggregations, and ten virtual foreign zones, which represent the foreign market zones with which the Italian market exchanges energy [8]. Each zone is connected to the neighbouring ones by one or more power transmission lines with limited transmission capacity, which cannot be exceeded for security reasons. All the producers and the consumers submit their offers and bids to the market which determines the clearing price at the intersection of the supply and demand curves. If during this process one or more transmission limits are exceeded, the market is divided across the congested lines and the market procedures is iterate until a physically feasible dispatchment is found. Since market segmentation can arise, different zones can have different final clearing price.

Since in Italy the vast majority of RES power plants has been installed into the zones South, Sicily and Sardinia, their hourly price data were selected for the analysis. In the paper the three zones are referred to as Zone 1 (South), Zone 2 (Sicily) and Zone 3 (Sardinia). The energy price data for these three market zones are reported in Fig. 1. The wind data selected for the analysis are assumed to be representative of the investigated market zones, since several WFs has been installed there in the last years. The selected wind data time-series come from three geographical zones characterized by a high-specific production, to guarantee the use of high quality wind resource [15,16]. The Weibull histograms of the selected wind data are reported in Fig. 2. Each wind farm is assumed to be made up of WT with nominal power of 2 MW. The cut-in velocity of such turbine is equal to 2 *m/s* while the cut-off velocity is 25 *m/s* [17]. The non-dimensional power production $f(v_{w,ij})$ is defined as the *kW* of power produced for each *kW* installed in the WF. Without considering the mutual aerodynamic interference phenomena between the WT of the farm, $P_{w,ij}$ is a function only of the wind speed $v_{w,ij}$ in *m/s* and of the turbine model, size and number, which influence also the WF nominal power P_{farm}.

Finally, the hourly average power produced by the WF can be expressed as in (1) where the $f(v_{w,ij})$ functional form (Table 1) is influenced essentially by the turbine model.

$$P_{w,ij} = P_{farm} \cdot f(v_{w,ij}) \qquad (1)$$

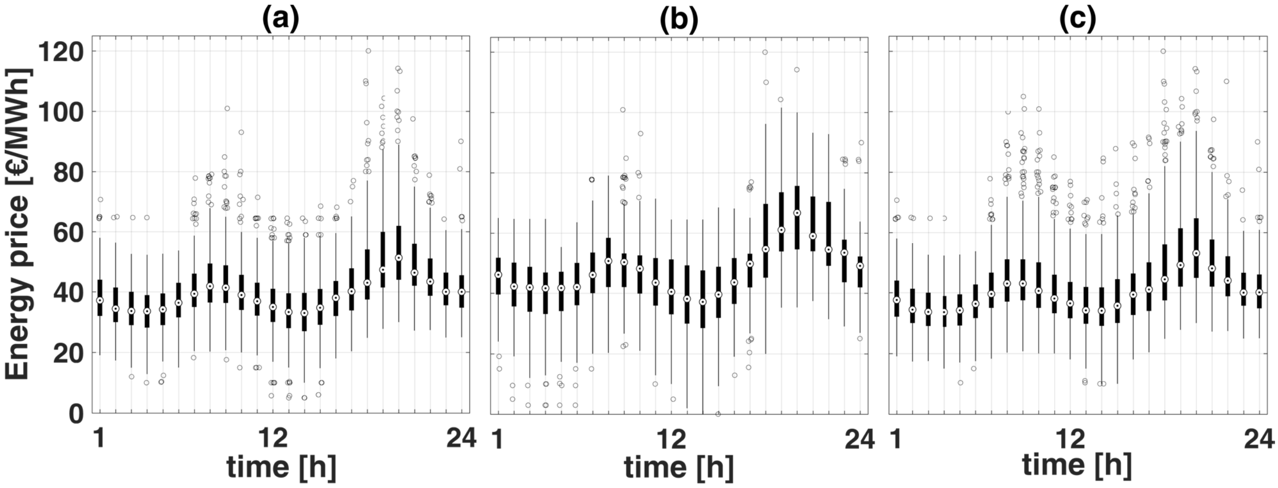

Fig. 1. Annual distribution of 2016 energy price of Zone 1 a), 2 b) and 3 c). The white circle inside the box is the median; the box contains the 50% of the data; the upper and the lower value of the whiskers contains the 74.65% of the data; the black circles are the outliers.

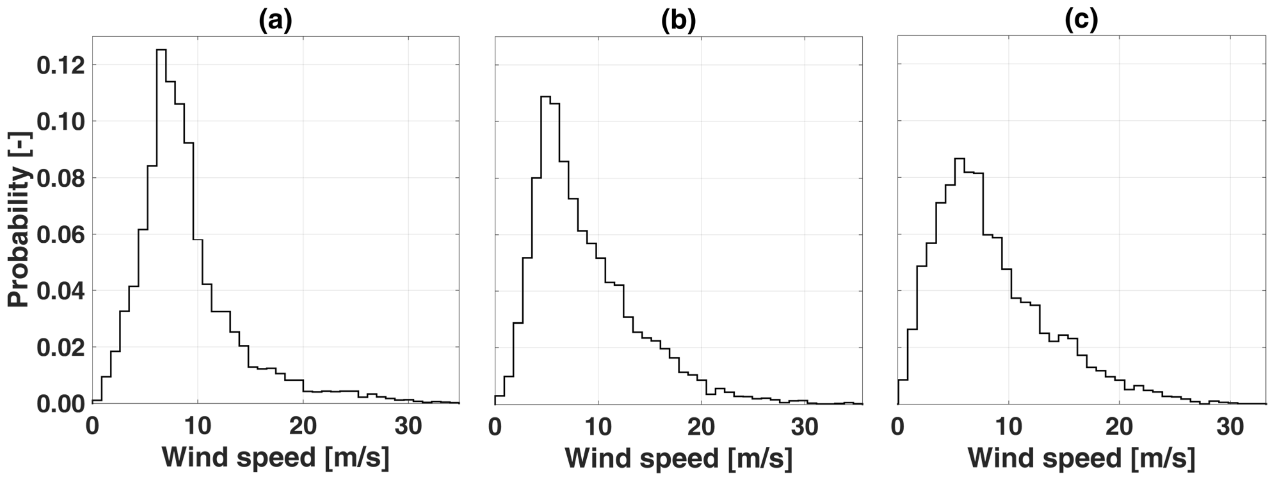

Fig. 2. Histograms of wind data series for the Zone 1 a), 2 b) and 3 c).

Table 1. Non-dimensional power characteristic curve $f(v_{w,ij})$ of the WT [17].

Wind speed range	*Non-dimensional power output [kW/kW]*
$v_w < 2$ m/s	0
2 m/s $\leq v_w \leq$ 12 m/s	$10^{-3} \cdot [-0.119 (v_w)^4 + 2.607 (v_w)^3 - 6.451 (v_w)^2 - 3.100 v_w + 12.235]$
12 m/s $\leq v_w \leq$ 25 m/s	1
$v_w > 25$ m/s	0

Once the relationship between $P_{w,ij}$ and $v_{w,ij}$ has been defined, the daily average wind energy production $En_{w,mean}$ can be calculated as follows in (2):

$$En_{w,mean} = \sum_{j=1}^{365}\sum_{i=1}^{24} P_{w,ij} \cdot \tau / 365 = P_{farm} \cdot \sum_{j=1}^{365}\sum_{i=1}^{24} f\left(v_{w,ij}\right) \cdot \tau / 365 = P_{farm} \cdot K_{farm} \qquad (2)$$

Where K_{farm} can be interpreted as the average daily amount of equivalent operating hours. The resulting K_{farm} values, 11.502, 10.997 and 10.659, for Zone 1, 2 and 3, respectively, are high because they are calculated from the WF gross production.

2.2. Profit reduction along the years

The main idea is that there is a critical quantity of non-programmable RESs that can be installed, and thus dispatched on the energy market, such that the energy price fall under a value low enough to make further RESs deployment uneconomical. Assess this quantity can be very challenging, since the energy price is affected not only by the energy production mix, but also by many other factors, like fossil fuel price and geo-political and economic situations, which are very difficult to forecast and model. Despite this, the trend followed by the Italian energy prices during the years 2008 – 2016 is sharply descending, as reported in Fig. 3 a) for three zones. The analysed time span is characterized by a massive RESs deployment, as the installed gross capacity of photovoltaic plants and WT increased of about seven times between 2008 and 2015 [8,18], going from 4 GW to slightly over 28 GW. The data reported in Fig. 3 a) show that the diurnal prices experienced the strongest reduction, due to the high quota of solar PV among the introduced RESs. Therefore, not only the average energy price dropped sharply between the 2008 and 2016, but also the relative difference between the minimum and maximum daily price experienced a strong reduction. The fall of the average energy price has directly affected the power plants revenue, as reported in Fig.3 b), which reports the ratio between the gross revenue achievable by a WF in the years between 2008 and 2016 and that of 2008 (without support schemes). As it can be noted, the revenues show a similar descending trend for all the three investigated market zones and the reduction can be up to the 60% compared to the 2008 values, with an average reduction between the 6% and 7 % per year.

The gross revenue G_w does not consider the efficiency loss due to the inverter and the production reduction due to the maintenance and network unavailability. G_w is calculated as in (3) where $P_{w,ij}$ is the average power in *MW* supplied by the wind farm in the *i*-th hour of the *j*-th day, for the time interval τ (one hour) and $c_{en,ij}$ is the related energy price in *€/MWh*.

$$G_w = \sum_{j=1}^{365} \sum_{i=1}^{24} P_{w,ij} \cdot \tau \cdot c_{en,ij} \qquad (3)$$

It is worth noting that, while a detailed economic feasibility analysis requires the calculation of the net revenue, the aim of the paper is to give some figures to assess the effect of the RESs integration into the energy market and the potentiality of the storage to mitigate the resulting loss of profitability. Therefore, an approximate evaluation of the WF and the storage economic performance is enough to highlight potential issues of this solution.

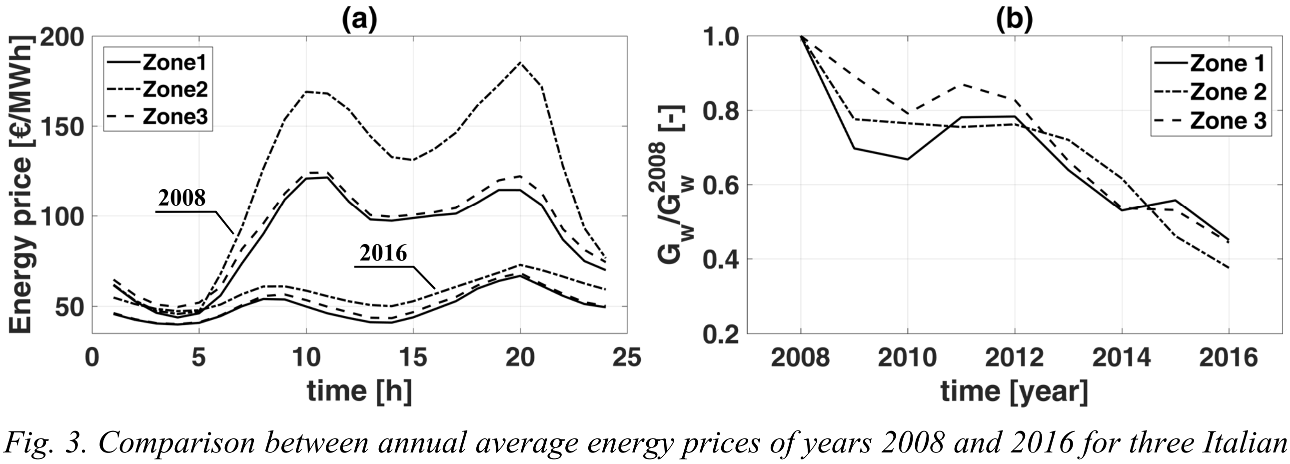

Fig. 3. Comparison between annual average energy prices of years 2008 and 2016 for three Italian market zones a). Ratio between the annual gross revenue of a WF in the years 2008 - 2016 and that of 2008 b).

3. Methods

3.1. Storage management logic

There are essentially two opposite approaches to model the behaviour of storage used to make arbitrage on the energy market. On one hand, there is the optimization approach in which, given a forecasted price and wind data series, the optimal dispatch strategy is calculated solving an optimization problem. On the other hand, there is the price-threshold approach, in which the control logic is simplified fixing a minimum energy price under which the energy is stored and a maximum energy price over which the energy is sold [13,19]. The optimization approach can be further divided into two categories: non-linear optimization, when the size of the storage is optimised together with the control strategy [20], and linear optimization, when the storage sizing is a separate process and only the control strategy is optimized [14,21,22]. While the optimization is a more rigorous approach and it guarantees higher revenue, the price-threshold approach is simpler and more adapt for the actual implementation in real-life installation. Furthermore, the relative revenue difference between the threshold price logic and the optimized logic is reported to be around 10% or 20 %[19], hence the results achieved by this simplified approach are valid for the revenue estimation purpose.

The technique adopted in the paper is somewhat hybrid between the two introduced. As a matter of fact, the price-threshold is applied but the actual threshold values are optimized on the yearly basis with a simple direct search algorithm (Nelder-Mead algorithm). Such algorithm is provided with MATLAB (ver. 2018a) in the formulation developed by [23].

The storage selling and storing prices are calculated for the j-th day as the maximum and medium energy price, $c_{en,max,j}$ and $c_{en,mean,j}$, which are multiplied for two factors, δ_{mean} and δ_{max}, respectively. These parameters are chosen to maximise the ratio between the economic WF revenue with and without the storage and are assumed to be constant during the whole year. δ_{mean} and δ_{max} are comprised between 1 and 0.6, ensuring that the price at which the storage starts to discharge is always higher than that at which starts to charge.

The storage management algorithm checks the price of each i-th hour of the j-th day of the year to decide if it is the moment to charge, discharge or do nothing. While the price sets the storage mode of operation, the limitation about the available energy, the storage SoC, the storage power and the WF maximum power decide how much energy can be charged/discharged.

The main steps of the algorithm are here detailed:

I. If: $c_{en,ij} \geq \delta_{max} \cdot c_{en,max,j}$, The energy supplied to the grid by the WF plus the storage $En_{grid,ij}$ can be calculated with (4):

$$En_{grid,ij} = MIN\left\{P_{w,ij} \cdot \tau + \left(SoC_{i-1,j} - SoC_{\min}\right) \cdot C_{st}\eta_d ; \left(P_{st} + P_{w,ij}\right) \cdot \tau ; P_{farm} \cdot \tau\right\} \quad (4)$$

Where C_{st} is the storage capacity in MWh, η_d is the discharge efficiency and $P_{st,max}$ is the storage maximum power in MW. Given this, the energy supplied by the storage alone $En_{d,ij}$ is defined as in (5):

$$En_{d,ij} = En_{grid,ij} - P_{w,ij} \cdot \tau \quad (5)$$

The storage SoC can be finally updated with (6):

$$SoC_{ij} = SoC_{i-1,j} - \frac{En_{d,ij}}{C_{st} \cdot \eta_d} \quad (6)$$

II. If: $\delta_{mean} \cdot c_{en,mean,j} \geq c_{en,ij} \geq \delta_{max} \cdot c_{en,max,j}$, then the storage does nothing and thus the SoC_{ij} is equal to $SoC_{i-1,j}$;

III. If: $c_{en,ij} \leq \delta_{mean} \cdot c_{en,mean,j}$, then the energy charged by the storage $En_{c,ij}$ is equal to (7):

$$En_{c,ij} = MIN\left\{\left(SoC_{\max} - SoC_{i-1,j}\right) \cdot C_{st} / \eta_c ; P_{w,ij} \cdot \tau ; P_{st} \cdot \tau\right\} \quad (7)$$

Where η_c is the charge efficiency. With this, the storage SoC be finally updated (8):

$$SoC_{ij} = SoC_{i-1,j} + \frac{En_{c,ij}}{C_{st}} \cdot \eta_c \quad (8)$$

The minimum and maximum allowable SoC are assumed to be 0.2 and 0.95, respectively. These values are required to maintain an adequate life cycle duration of batteries, whose performances tend to deteriorate quickly for higher depths of discharge.

As stated in (4), during the discharge phase the WF production have always the priority. Therefore, the power that the storage can discharge is always lower than the difference between the WF nominal power and the wind production. Hence, the power supplied by the WF plus the storage is always lower than the nominal power of the WF. This choice has been dictated by the additional costs which could be required to change this value, which is generally subject to a contract between the plant owner and the grid TSO. These costs are different in each country and depend on the regulatory framework in which the WF operates. Relaxing this constraint could bring additional economic benefits, but the investigation of this effect is out of the scope of the present work.

During the charge phase, defined in (7), the charged energy is limited by the *SoC* and by the energy produced by the WF. In other words, the storage does not buy energy from the grid, but only shifts the wind production in other more profitable moments. From this perspective, the storage carries out the arbitrage only with the local energy production. This limitation is dictated by the fact that in some a regulatory framework to change the nature of the plant-grid connection from a pure feed-in point, to a mixed feed-in/absorption point could entail some additional costs.

Once that the storage *SoC* is known, the energy fluxes through the battery can be calculated considering that a positive variation of the *SoC* means that the battery is charging, while a negative variation means that it is discharging. Knowing this, the energy that is sold to the grid by the WF plus the storage can be calculated from (9):

$$En_{sold,ij} = P_{w,ij} \cdot \tau - C_{st} \cdot \left(SoC_{ij} - SoC_{i-i,j} \right) \qquad (9)$$

Therefore, the annual gross economic revenue of the system G_{w+st} can be written as in (10):

$$G_{w+st} = \sum_{j=i}^{365} \sum_{i=1}^{24} c_{en,ij} \cdot En_{sold,ij} = \sum_{j=i}^{365} \sum_{i=1}^{24} c_{en,ij} \cdot \left[P_{w,ij} \cdot \tau - C_{st} \cdot \left(SoC_{ij} - SoC_{i-i,j} \right) \right] \qquad (10)$$

Finally, the gross revenue percentage increment due to the storage introduction (Δg) can be evaluated through the (11):

$$\Delta g = \frac{G_{w+st} - G_w}{G_w} \cdot 100 \qquad (11)$$

3.2. Storage techno-economic characteristics

For the sake of simplicity, two EES technologies that need only electric energy inputs were investigated. Furthermore, since the WFs are often located in places difficult to reach, the use of only electric energy for storage and arbitrage purpose does not require the building of additional energy distribution network branches, like would be required, for example, for a compressed air energy storage plant. The technologies considered in this paper are: Li-ion Batteries (LiB) and NaS Batteries (NaSB). These are both suitable for the production shifting in terms of power and capacity, as reported by [24], but have different round trip efficiency and different specific costs.

In the analysis, the charge and discharge efficiency are assumed to be equal to the square root of the storage round-trip efficiency η_{rt} (12):

$$\eta_c = \eta_d = \sqrt{\eta_{rt}} \qquad (12)$$

For what concerns the storage capital cost, it is usually divided into capacity-related cost $c_{st,kWh}$, in *€/kWh*, and power-related costs $c_{st,kW}$, in *€/kW*. From the specific costs, the total purchasing and installation cost of the storage $c_{st,tot}$ can be calculated for any combination of C_{st} and P_{st}, as in (13):

$$c_{st,tot} = c_{st,kWh} \cdot C_{st} + c_{st,kW} \cdot P_{st} \qquad (13)$$

Finally, also the storage life-time in *years* must be considered in the analysis. The data for the efficiency and the life-time are taken from [4,24], while the average cost data are provided by [25]. The data assumed for the analysis are summarized in Table 2.

The actual life-time value depends on the management of the storage and on the number of complete and incomplete cycles that the battery does. In the analysis the average value between the reported maximum and minimum is assumed to be achieved, reflecting the different life expectancy that the two technologies commonly have. Since the WT life-time (20-25 years) is longer than the storage one, the time horizon to repay the storage purchasing is set by the latter.

Even though the NaSB could require some additional energy to reach the right operating temperature during the starting phase of the system after a period of stop, since only periodic operation is considered in the paper, this effect is assumed to be negligible.

Several combinations of storage capacity and charge/discharge power are investigated. The values assumed by C_{st} and P_{st} are adapted to the plant size (P_{farm}), thus the results are conveniently reported for the non-dimensional storage power and capacity, π_{st} and γ_{st}, respectively. The non-dimensional power π_{st} can be calculated directly as the ratio between the storage charge/discharge power and the farm nominal power, as in (14):

$$\pi_{st} = P_{st} / P_{farm} \qquad (14)$$

The non-dimensional capacity, on the other hand, is related to the daily average WF energy production $En_{w,mean}$, as defined in (15):

$$\gamma_{st} = C_{st} / En_{w,mean} \qquad (15)$$

It is worth noting that from (15), combined with (11), (1) and (2), Δg does not depend on the WF nominal power P_{farm}. Taking advantage of (14), (15) and (3), (13) can be re-write as (16):

$$c_{st,tot} = P_{farm} \left(c_{st,kWh} \cdot K_{farm} \cdot \gamma_{st} + c_{st,kW} \cdot \pi_{st} \right) \qquad (16)$$

From the storage cost and the profit increment Δg (11), the storage simple Pay-Back Period (PBP) can be evaluated as (17):

$$PBP = \frac{c_{st,tot}}{G_{w+st} - G_w} = \frac{c_{st,tot}}{\Delta g \cdot G_w} \qquad (17)$$

It is worth noting that both denominator and numerator are linearly related to P_{farm}, hence the PBP results do not depend on the WF size. The PBP is calculated with the gross revenue, hence the resulting values are lower than those achievable in practice by the system. Furthermore, this figure is calculated without considering the time-value of the money. In this formulation the PBP always overestimates the investment viability, hence in the case of negative response no further analysis are required. Therefore, this approximation yields a simple and fast criterium to identify the storage sizes which are not profitable and which one, on the contrary, could prove feasible and worthwhile of further investigation.

Table 2. Techno-economic parameters of EES technologies suitable for arbitrage purposes.

Technology	$c_{st,kWh}$ [€/kWh]	$c_{st,kW}$ [€/kW]	*Life-time [years]*	η_{rt} [-]
Li-ion (LiB)	755	465	5-15 (10)	0.90
NaS (NaSB)	300	365	10-15 (12.5)	0.80

4. Results and discussion

Since the storage round-trip efficiency affects the economic revenue of the hybrid WF-storage system, for each market zone the gross economic revenue must be calculated two times: one using the characteristic efficiency of the LiB, and the second using that of the NaSB. Each run of the storage management algorithm yields a Δg value for each combination of C_{st} and P_{st}. The results for the LiB (η_{rt} = 0.9) are reported in Figure 4, and since they do not depend on the WF size, as already stated in Section 3, they are reported for the non-dimensional storage capacity γ_{st} and power π_{st}.

As can be noted, the wind speed and price data influence the results such that the same relative storage size yields quite different revenue increment in different market zones. Zone 2 results to be the most profitable to operate the WF production shifting as one it might have expected from Fig. 2 b) which shows how the average maximum price of this zone is slightly higher than that of the other two. This difference reflects in a relative revenue increment which are between the 30% and 40% higher in zone 2 than in zone 1 and 3. Even considering that the simplified management could decrease the effective storage profit of about a 20%, compared to an optimized control logic, Δg higher than 10% for zones 1 and 3 and higher than 15% for zone 2 could hardly be achievable.

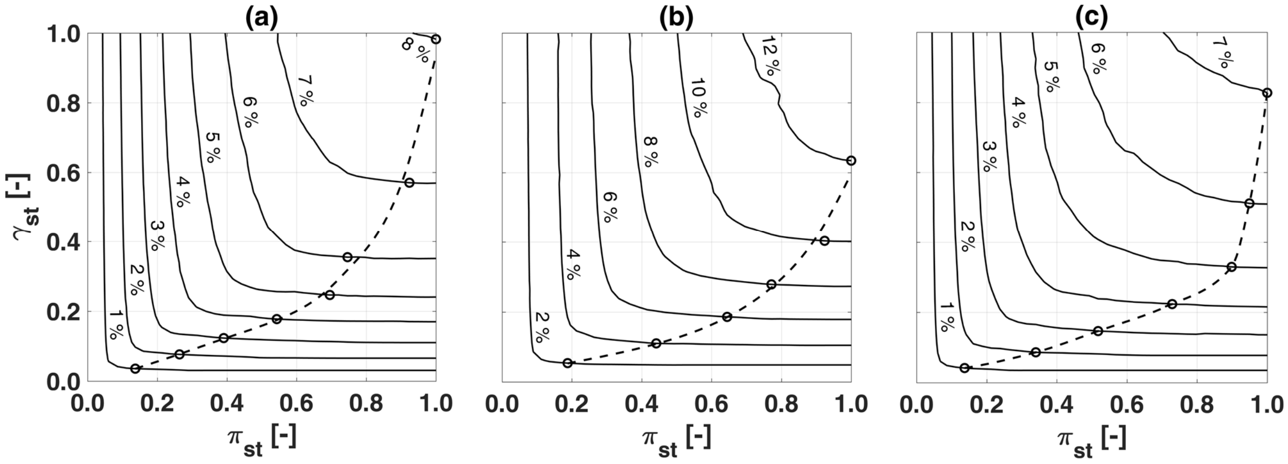

Fig. 4. Percentage revenue increment Δg due to storage introduction for Zone 1 a), 2 b) and 3 c) as a function of γ_{st} and π_{st} and for storage η_{rt} equal to 0.9. The dashed line connects the cost-optimal combinations of γ_{st} and π_{st} which guarantee the Δg value specified on the level lines.

The shape of the iso–Δg lines in figure 4 provides valuable information about the optimal storage sizing. As a matter of fact, apart from a limited zone across the bisector of the plane, the contour lines resulted to be practically parallel to the axis. This means that for every value of γ_{st} there is a value of π_{st} over which adding more storage power brings no more economic benefits, and vice versa. This effect can be explained both intuitively and with a more rigorous mathematical approach. Intuitively, for any given storage capacity, once the power exceeds the value which guarantees to discharge all the stored energy in one hour for the vast majority of the year, additional discharge power yields no more economic value. From a mathematical point of view, it must be considered that for a 2-D contour plot the gradient is always perpendicular to the contour lines. Therefore, when a contour line is parallel to an axis, the gradient vector is perpendicular in respect of it. This is the same to say that its component which is parallel to the axis is equal to zero. Since the components of the gradient vector are the partial derivates, the previous considerations imply the nullity of the one along the direction of the above-mentioned axis. Which is to say that a change of the variable under consideration has no effect over the quantity plotted as a contour map.

While the obvious result is that the bigger the battery is, the more additional revenue it can bring, it is interesting to observe that almost all the revenue increase can be achieved with a battery which is substantially smaller than the maximum investigated size. As a matter of fact, for all the zones, nearly the 90% of the relative income increment can be realised with a battery that has a capacity as low as the 60% of the WF daily average production $En_{w,mean}$ ($\gamma_{st} \approx 0.6$), but at the cost of having nearly the highest possible power ($\pi_{st} \approx 1$). The same consideration can be drawn for the storage power, which could be low ($\pi_{st} \approx 0.6$) without significantly affecting the revenue increment but at the cost of having the highest possible storage capacity ($\gamma_{st} \approx 1$). The same holds for any given value of Δg, which can be achieved with several different combinations of γ_{st} and π_{st}.

To select the less costly combinations of storage capacity and power that guarantee a particular value of Δg, (16) can be used. Such combinations are reported in Fig. 4 for each Δg contour level as a dashed line. As can be observed, the cost-optimal solutions are those which minimize the capacity in favour of the charge/discharge power. This is due to term K_{farm} in (16), which makes the capacity-related cost term more influential than the power-related one. This effect is exacerbated in the case of LiB by the fact that the storage kWh-specific cost is much higher than its kW-specific counterpart. All the considerations that have been drawn for the LiB, apply to the case of NaSB, whose results are reported in Figure 5.

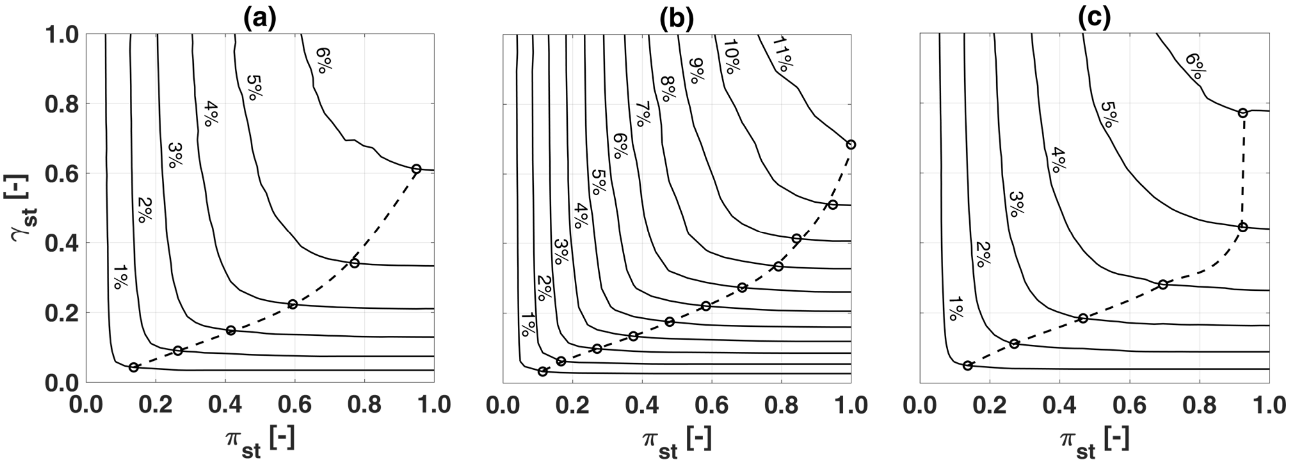

Fig. 5 Percentage revenue increment Δg due to storage introduction for Zone 1 a), 2 b) and 3 c) as a function of γ_{st} and π_{st} and for storage η_{rt} equal to 0.8. The dashed line connects the cost-optimal combinations of γ_{st} and π_{st} which guarantee the Δg value specified on the level lines.

Obviously, the lower round-trip efficiency influences negatively the revenue increment, which can be up to a percentage point lower for high values of γ_{st} and π_{st}, compared to the LiB case. Even for the NaSB, around the 90% of revenue increment can be achieved with a battery which has $\gamma_{st} \approx 0.6$ and $\pi_{st} \approx 1$ or, alternatively, which has the "symmetric" combination $\gamma_{st} \approx 1$ and $\pi_{st} \approx 0.6$. With the same procedure followed for the LiB, the cost-optimal combination of γ_{st} and π_{st} for each value of Δg can be found. Such values are reported in Fig. 5 for each percentage revenue increment value as a dashed line. Even tough for the NaSB $c_{st,kWh}$ is lower than $c_{st,kW}$, the difference of this two parameters is not enough to counterbalance the effect of the term K_{farm}, such that the cost-optimal combinations of γ_{st} and π_{st} are, once again, those which minimize the storage capacity. This effect can be interpreted in the sense that, compared to the size of the farm (in terms of power and produced energy), a storage for the production shifting requires relatively much more capacity than power. In other words, the ability to quickly charge and discharge (i.e. the power) is surely beneficial, but to achieve significant revenue improvement, the ability to treat a large amount of energy (i.e. the capacity) is more important. Therefore, the amount of kWh required to realize an effective energy shifting is much higher than the related amount of kW. Thus, even if the capacity-specific storage cost is lower than its power-specific counterpart, the cost-optimal storage sizing is the one which favours the power over the capacity.

Often the storage size is expressed in *hours*. Such figure can be calculated simply dividing C_{st} by P_{st}. In the cases under consideration, since the high-power combinations are those economically preferable and combinations like $\gamma_{st} \approx 0.6$ / $\pi_{st} \approx 1$ and $\gamma_{st} \approx 0.4$ / $\pi_{st} \approx 1$ yield the 90% and 80% of the maximum revenue increment, respectively, the batteries suitable for the production shifting are those which have size from 4 *h* to 6 *h.*

To finally evaluate if the storage introduction actually brings economic benefits, the revenue increment must be compared with the related storage purchasing and installation cost $c_{st,tot}$. This comparison is done through the PBP. An investment should at least have a PBP lower than its own life-time, even if in the industrial world much more severe limitations are usually encountered (i.e. PBP < 2 - 4 *years*). Given this, the cost-optimal combinations which show a PBP higher than 10 years (for the LiB) and higher than 12.5 years (for NaSB) should be discarded. In the investigated cases, all the solutions, even the cost-optimal ones, show a PBP which is much higher than the defined threshold. This is due both to the high price of batteries and the low difference of energy prices during the day (Fig. 3). Given this, the ratio between the actual battery cost and the cost that it should have to guarantee a desired PBP has been estimated (Fig. 6). For a fair comparison, for each *Δg* only the cost-optimal solution (dashed lines in Fig 4 and 5) are selected.

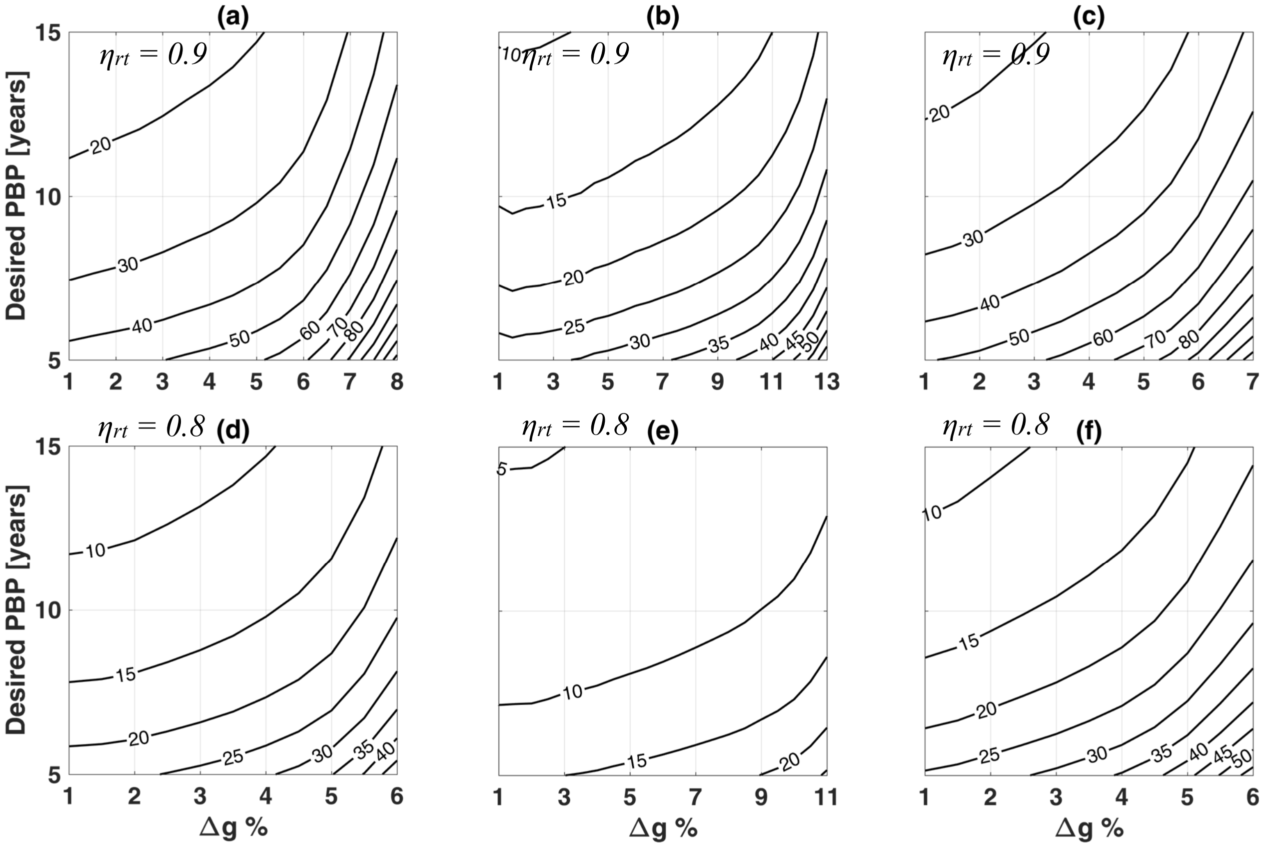

Fig. 6 Ratio between the actual cost of the cost-optimal battery for each Δg and the cost which would guarantee the desired PBP. Zone 1 a) and d); Zone 2 b) and e); Zone 3 c) and f). η_{rt} = 0.9 for a), b) and c); η_{rt} = 0.8 for d), e) and f).

Even though the NaSB lower efficiency penalises the revenue increment, the lower capital costs make them more accessible in case of a price reduction. In the investigated scenario, a LiB should cost between 20 and 50 times less to be potentially viable. For the NaSB the trends are very similar, while the numerical values are essentially halved, so a cost reduction between 10 and 25 times is required to achieve a fair PBP. This could change considering the time-value of money, which penalise the revenue stream, while keeping the initial expenditure unchanged. By returning to the initial issue, are such relative revenue increments enough to revert the trends reported in Figure 1 b)? The answer is simply no. As a matter of fact, even without considering the capital costs, the storage introduction in some cases cannot even compensate for single year of price reduction, which is, as stated previously, around the 6% or 7%. In addition to this, the production shifting is not economically viable. Even in the best-case scenario, the battery should cost around 20 times less to achieve satisfactory PBP. Therefore, the storage cannot solve the “merit order effect” and cannot help in pushing further the RESs development. As a matter of fact, even if the energy price fall could stop at the current values, the revenue loss suffered by a RES plant is the 50% and 60% in respect of the 2008 situation, and it could be already enough to impair a RESs further introduction. The implications of such result are that a solution for the “merit order effect” should not be searched in the storage economic applications but, at least for Italian situation, must be searched into the energy sectors merging or resorting to a new phase of national support schemes.

5. Conclusion

A substantial share of RESs dispatched on the energy market causes a not negligible lowering of the market clearing price. This is known in literature as the “merit order effect”. Since the clearing price is directly related to the power plants revenue, this effect strongly reduces the plants profits, making further RESs deployment un-economical. A possible solution to this problem could be shifting the non-programmable RESs production towards more profitable moments of the day using an EES, trying to increase, in this way, the plant revenue.

The effective additional profits that a storage can bring to three Italian WFs has been evaluated, simulating the storage operation. The storage control logic has been based on a price threshold algorithm which manages the daily charging and discharging phases along the whole year. Two different battery storage technologies have been compared. The cost-optimal size of the battery has been evaluated for several revenue increment values. Unfortunately, none of them resulted to be profitable compared to their high capital costs. For Li-ion batteries a capital cost reduction of about 20 times is required to achieve affordable PBP, while for NaS ones the required reduction is halved due to lower initial costs. This leads to conclude that the storage may help a further RESs development, but only by solving the related technical issues, since it cannot do anything against the economic issues arose by additional RESs deployment. From this perspective, to push further the RES integration, alternative solutions like the electrification of the other energy sectors or the financing of another phase of national support schemes could be needed.

Nomenclature

Acronyms	
LiB	lithium-ion battery
NaSB	sodium sulphur battery
PBP	pay-back period, years
Symbols	
c	price, *€/[-]* (specified by the subscript)
C	capacity, *kWh*
En	energy, *kWh*
f	specific power production, *kW/kW*
G	gross revenue, *€*
Δg	percentage revenue increment, *€/€*
K	WF equivalent operating hours, *h*
P	average power, *kWh/h*
SoC	battery state of charge, *kWh/kWh*
Greek symbols	
γ	non-dimensional storage capacity
η	efficiency
δ	energy price multiplication factor
π	non-dimensional storage power
Subscripts and superscripts	
c	charge
d	discharge
en	energy
farm	wind farm
i	*i*-th hours of the day (i = 1…24)
j	*j*-th day of the year (j = 1…365)
max	maximum
mean	average
rt	round-trip
st	storage
tot	total
w	wind

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ANNEX IV. MANUSCRIPT ACCEPTED TO THE 73º CONGRESSO NAZIONALE ASSOCIAZIONE TERMOTECNICA ITALIANA

This annex 4 shows the article that has been carried out together with a research group of the Department of Energy, Systems, Territory and Construction Engineering of the Engineering School, University of Pisa (Italy), led by Professor Umberto Desideri.

The paper has been accepted in 73º Congresso Nazionale Associazione Termotecnica Italiana – ATI 2018 which will be celebrated in Pisa (Italy) between 12^{th} and 14^{th} September.

Techno-economic sizing of a battery energy storage coupled to a wind farm: an Italian case study

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Abstract

The study focuses on the technical and economic issues which arise when a Battery Energy Storage (BES) is coupled to a Wind Farm (WF) to improve its profitability. The Electric Energy Storage (ESS) technologies may fulfil the dual role of promoting the Renewable Energy Sources (RES) development, while also allowing an economic optimization of the energy output. In this study, the optimal economic and technical sizing of a lithium-ion battery, is analysed focusing on the day-ahead market profit maximization. This is done shifting the aleatory wind production to the most profitable moments of the day using a common LP optimization algorithm. The daily utilization profile and depth of discharge are analysed to verify if the optimization algorithms lead to charging and discharging phases which may endanger the storage itself. Furthermore, the role of some reasonable practical limitations, like the maximum farm output power, is discussed and its influence on the profit is assessed. Finally, the battery cost is compared to the additional revenues to assess the profitability of the application in the Italian energy price context for several sizes of the battery. The analysis is based on real-life wind data and energy price time series.