Energy Analysis on a Traditional Portuguese *Tasca*

Diogo Cotrim, Gonçalo Guedes, Pedro Preto, Pietro Brussich

Article Info

Abstract

This paper reports a study done in *Cantinho do Aziz* in an energy perspective. The aim of the report is to analyze the results obtained and to discuss the possibility of extrapolation of the results for the whole community. Both an economic and environmental ana--lysis of the results were made. In the end the possibility of the economic impact on the *tasca* and on the tourists will be approached.

1. Introduction

The use of energy goes back to the roots of humanity, however as the years went by, lust began to cause problems in the balance of the environment. In these past few years incentives to rationalize the use of energy were made and also to promote the use of renewable energy sources and energy efficiency. The energy efficiency and rationalization is still neglected in some of the portuguese companies, mainly at the lower level, such as the traditional restaurants.

The traditional restaurants in Portugal (called *tascas*) are most known by the fantastic food but also for the dirty machinery and not so clean methods. The main objective of this project is to fit the trends of the environmental concerns into these restaurants. These would be the last places where people would expect to see this kind of projects and if positive outcomes result the concept is proved and the project is ready for a broader in implementation (in shopping centers, cinemas, museums, etc).

2. Motivation and acknowledgments

Photo 1: The group in "Cantinho do Aziz"

Since most portuguese people really love their *tascas*, it's important that something is done to improve the efficiency of the methods used by their owners and frame these restaurants in the current standard social consciousness. These restaurants could not only improve in economical terms but also in terms of being more environmentally friendly.

Tourism in Lisbon is growing by 8.4% each year in a steady rate[1]. These tourists are mainly from Northern countries, such as Germany or England, which

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have a strong mentality towards environmental-friendly premises. These trend, even though, much more accentuated in these countries is also all around, even in Portugal.

The factors stated above could lead to an increasingly value for the *tascas.* Following sometimes simple instructions which might not be known by the owners (due to the fact that they are usually elderly people) large effects can be achieved (as can be confirmed in sections below).

We would like to thank Mr. Aziz for lending us his restaurant, *Cantinho do Aziz*, and for showing interest on the outcome of the project. Also we should thank Prof. Manuel Heitor, Nate Gilbraith, Guilherme Farinha, Pedro Quental and Diogo Henriques for the guidance along the semester.

3. The Idea

The first goal of the group in this project was always to do something that could at some stage help some people. The second goal was obviously to do something related with energy and energy measurements. With these premises in mind the idea was born.

The idea was to create a route of *environmentally green tascas* route and to promote these restaurants and Mouraria in general through the use of a smart phone app. To achieve this the owners of the *tascas* had to be educated. This was done with a series of measurements followed by proper interpretation of the behavior of the *tasca* and by an adequate counseling fitted to the performance of the restaurant.

One of the aims of the project was to show some value to the owner of the *tasca* as it was continuously being developed. Because of the context of the neighborhood, the instructions should be kept at an easy level of understanding and to a level where the owners wouldn't be bored to repeat them each week or month.

The desired effect was to develop a social and environmental consciousness and to benefit the restaurants in two ways. On one hand they would have an indirect daily benefit due the savings induced by their new behavior and on the other hand they would benefit from the increase of clients due to the free publicity in the app. The increase of tourists would not only benefit the restaurants but also the whole region.

The project involved, then, the elaboration of the software of the app but also the hardware and respective software for the energy meter.

3.1. Initial Feedback

In an early stage of the study, a field trip around Mouraria was conducted to see the reaction to every intervenient of the project. As suspected, tourists (mainly from northern and central European countries) responded well to the idea and said that they would consider going to a restaurant that had environmental responsibilities over one that did not have them. Also the owners of the *tascas* were excited to know that they could save some money and at the same time develop Mouraria and attract a new kind of clients. Ultimately, as said before, *Cantinho do Aziz* was chosen to be our pilot test.

Photo 2: Prototype of the energy measurement system.

3.2. Arduino Energy Meter[2]

In order to measure the energy spent by each device an Arduino Board with a CT sensor, a real-time clock, an SD Card Breakout and LED's were chosen. The first prototype cost around €80. After getting experience with the board and with the hardware, it can be assumed that the system could work automatically through an wireless channel instead of via the SD card used in the prototype and thus changing only slightly the first concept and not changing significantly the final price. The figure on the left shows a photograph of the prototype used to conduct this study.

3.3. Android Application[3]

To capture the attention of the tourists an android application was developed. This platform was chosen because it has more than half of the share of the smartphones market and due to the constraints faced both technological and economical on developing an iOS one. The application should show all the restaurants that subscribed to the idea, providing them with free publicity. To earn this free publicity the only thing asked was for the restaurants to follow the recommendations along the year to reduce their energy consumption.

3.4. MATLAB Program[4]

To make the interpretation of the results easier and since the document retrieved from each device was pre-defined, a program was developed that could read it and with little effort compare it with another and also that could send the information visually throughout a graphic.

3.5. Tests

The first idea was to measure the whole restaurant energy consumption, however it led to some difficulties. Firstly it is difficult to interact with the central power board of the restaurant without shutting it down and some problems could eventually appear regarding EDP. Secondly, the wire's protection needed to be cut down so that the intensity of the current could be measured independently of the interference from the three wires (incoming, outgoing electrons, and earth). Finally it would be of little to no-interest to know the overall consumption of the restaurant because it would not be possible know where a change could be made and which were the critical devices. After taking these factors into consideration only the most energetically demanding devices of the *tasca* were chosen for the measurements in order to understand their performance. With this in mind the fridge, the freezer and microwave were chosen.

Due to the restricted amount of time only 3 devices were considered. Would this be a bigger project or as a follow-up, more devices should be considered such as the heater, the electric oven or some washing machines. On the first week of tests the consumption would be measured and on the third week it would be measured again to check the improvements resulting from the changes. On the second week the changes required to increase savings were discussed with Mr. Aziz.

4. Results

As the study progressed, some technical difficulties were faced. The power drawn by the batteries was higher than initially expected and also the inexperience of the owners of the *tasca* when managing the prototype affected the first set of results.

After the first week of results and after analyzing the data of the *tasca* some practices that could be improved were spotted. First of all it is worth noting that little could be done about the operation of the microwave because they had to use it when they needed it, so instead the focus was on the fridge and on the freezer.

4.1. Recommendations

Regarding the fridge the recommendation made was to clean it more often in order to lower the cooling energy requirements. Also it was recommended to, if possible, load the fridge in the cheapest electricity hours and the response was very positive. As an addition the prototype had also 2 LED's: one red and one green. The red one corresponding to the time of the day where the energy was more expensive to buy and the green one when it was cheaper according to the EDP dual tariff[5]. The LED's would light up green for the owner know when he should turn on the more demanding devices such as the washing machine and others whose operation can be retarded.

Regarding the freezer the advice given were again to clean it and defrost it more often and also to increase its temperature from -8°C to -4°C or adjusted it accordingly to the food stored.

As an overall study of the *tasca* it also conducted some qualitative analysis for the other devices. A replacement of the regular lamps by LED ones was recommended (this would significantly increase thre savings on the electricity bill since there were around 12 lamps inside the *tasca*). A new display of the heating devices was also considered. Originally there were two heating devices located near the exit of the restaurant, the advice given was to put them on the opposite side of the *tasca* so the heat wouldn't escape right away to the outside. By doing so, the heating device would in theory be turned on less time.

4.2. Savings

For a better understanding of the data collected it was decided to plot the power spent for each device in a control day and compare it two weeks afterwards to see the effects of the recommendations made. In all graphs there is some noise which is common to all. Since we are interested in a comparison,

that is not a determinant factor. The graphs below illustrate the data for the fridge and freezer for the two periods of time:
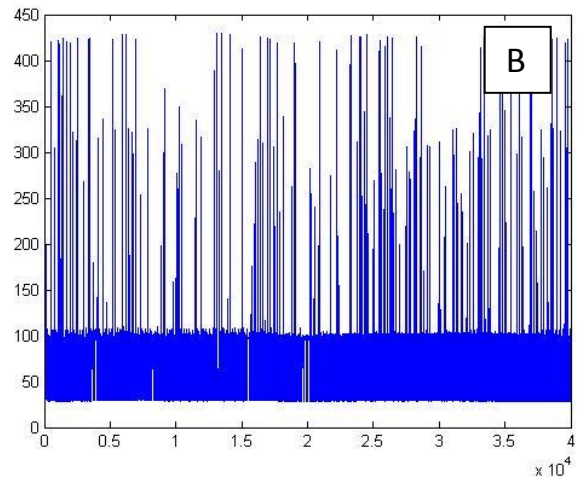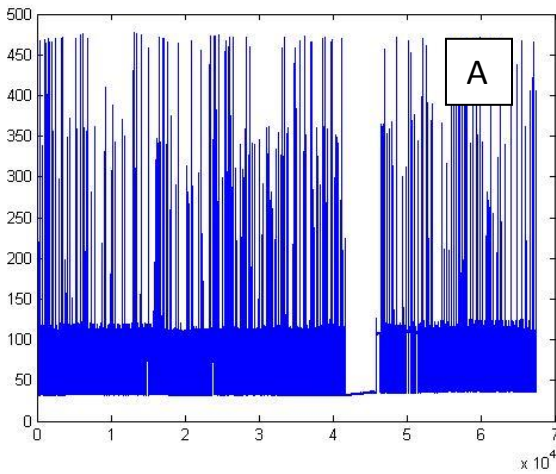
Graphic 1: Freezer power output (in W) for each second of operation in two control days. (A and B)
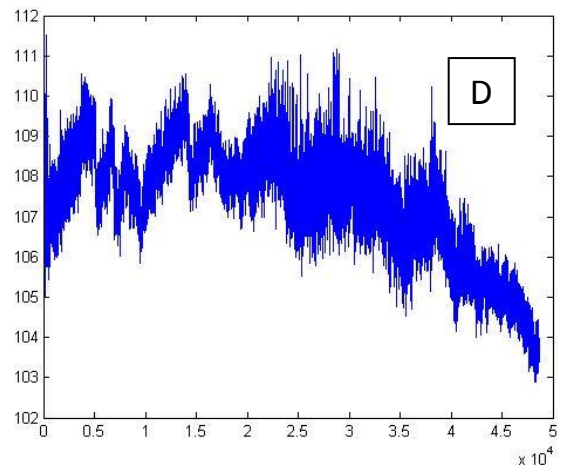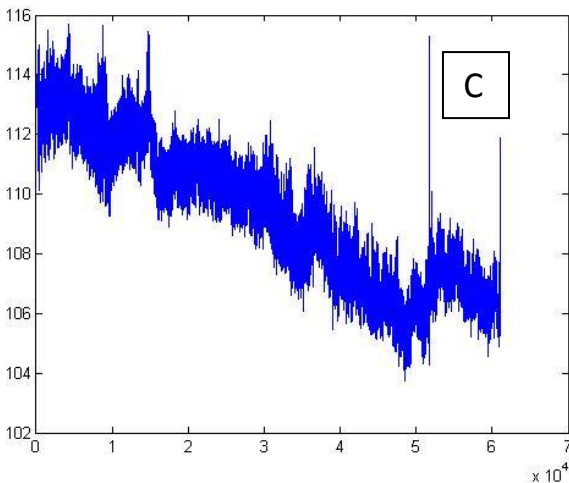
Graphic 2: Fridge power output (in W) for each second of operation in two control days. (C and D)

4.2.1. Freezer

The data from the first measurement (graph A) was taken on the 20th of November and the second (graph B) on the 2nd of December. Firstly it can be seen that there was a power shortage or a bug of the program for about 1h on the first measurement. Secondly on the second measurement, the time covered is shorter due to a scarce of power supply by the batteries. However since the power is paid by kWh, the data for a typical day could be extrapolated. Knowing that Mr. Aziz is on a dual tariff[6] the calculations to compute how much was spent on a each day (before and after the applying the changes) can be made. The savings follow directly from this calculation.

With the current behavior the restaurant was spending around 0.627€ per day only for the freezer which accounts approximately for 228.96€ a year. After increasing the temperature and defrosting the

freezer the registered cost measured was 0.565€ per day, which accounts for a reduction of around 9.88% on the electricity bill and energy spent. Mr. Aziz would then pay around 206.35€ per year and save up to 22.61€ per year.

4.2.2. Fridge

The first set of data from the graphic 2 was collected on the 18th of November (graph C) and the second data feed on the 1st of December (graph D). In the second data feed the data was retrieved earlier than usual because of a schedule restrictions.

From graph D it can be seen that since the data began to be collected at the middle of the afternoon Mr. Aziz loaded the fridge at the cheapest electricity hours corresponding to (around) midnight (corresponding to D in the graph), following the recommendations. The fridge was also defrosted what explains the slightly lower average energy consumption.

From the first data feed it can be seen that Mr. Aziz spent around 0.896€ per day for the fridge and on the second measurement he was spending around 0.88€ per day. This represents a 1.79% reduction in price, accounting up to 5.84€ annually (from 327.04€ to 321.20€).

4.2.3. Microwave

As stated before the analysis of the microwave was not covered on this study.

4.2.4. Other devices

As stated in section 4.1. it was also recommended to relocate the heating devices what was also followed. The electricity saved by this change is not covered in this paper but it was verified that the onset time was significantly lower than the previous situation resulting on both thermal and economic savings.

Mr. Aziz has had already done the change from regular lamps to LED in the restaurant. However this will be one of the main recommendations when expanding the system to other restaurants. It is estimated that this is the measure with the highest saving potential. Assuming a change from Halogen light to LED's a *tasca* with approximately the same size as 'Cantinho do Aziz' will save up to €15 per year per bulb[7]. In a *tasca* with around 20 bulbs this will lead to around €300 saved annually. Considering an initial investment of around €6-15 per bulb or €120-300 for all the bulbs the investment would pay off in one year in the worst-case scenario.

5. Business plan

By following the recommendations in both devices the total price saving was around 28.45€ per year. In a rough and pessimistic estimation, let's say that the two devices represent 60% of the total energy consumed in the *tasca*. Extrapolating the results up to 35.56€ could be saved annually. Also as the time passes and as the owner learns more and more the value saved could raise dramatically.

Also the owner of the *tasca* will have an additional return in publicity since more tourists will become clients because of the app. Since tourism is in expansion and after some marketing of the idea and

of the app, and moreover if it is assumed that one couple of tourists enters the restaurant every 2 weeks and spends €15 on average this induces an additional income increase of 360€ per year.

With everything in mind the owner can register savings of 395.56€ per year, 9% from actions that will benefit the environment and the rational use of energy.

For the *tascas* to maintain the environmentally friendly status and the publicity that comes with it, continuously following the recommendations is required. Driven both by a feeling of environmental responsibility and by an economical feedback it is believed that the owner of the *tasca* will not forfeit on the project.

It should be taken into consideration that a larger time sample of the results may be required since there can be other factors that could lead to the decrease of energy consumption by those devices.

6. Final considerations and conclusions

In a final note, to keep the owner of the *tasca* engaged a card with the main recommendations was made and delivered to Mr. Aziz for him to remember what needs to be done in a weekly or monthly basis.

There were, also, some difficulties raised by area chosen to implement the project. Mouraria is a multi-cultural neighborhood in the middle of Lisbon: a world in Lisbon. Its ethnics go from Chinese to African, Pakistanis, among others. Because of the multi-cultural tendency of Mouraria it was not so easy to speak with everyone. Also since most of the inhabitants are from poor countries they did not have the knowledge to sometimes understand the goal of the project or what was being done. This would be one of the main struggles of the project, however with experience and persistance this obstacles could be overcome.

It was chosen not to deliver the results to the owner as a number or a graph in the effort to simplify the implementation of the measures. Instead the results and changes proposed were discussed openly with Mr. Aziz, what allowed both for a better understanding of the procedures to be implemented and also comprehension of the main concerns that the owners of the *tascas* would have.

In the end we should we should aim for a "Rota das Tascas Verdes".

On a more personal note,

We were very pleased to take this project to a real-world environment and understand that sometimes it is needed more than theory and also face some of the struggles that only appear in actual practical projects. The prototype, while working on a concept level, may need some tweaks or repairs in the end-user space. The location proposed by the professor offered us an extra challenge, but one that we would gladly take again because we learned so much more. Opportunity usually follows struggle.

In the beginning other devices were considered to measure the energy such as the GALP kit which revealed to be inadequate for the studied environment (lack of internet connection, lack of access to the system, among others).

It is our belief that if well implemented and analyzed this project could be successful and could be a big help for the environment, for the *tascas*, and for Mouraria.

7. References

[1] http://www.travelweekly.com/Europe-Travel/Insights/Portugal-makes-a-tourism-comeback/

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[3] http://appinventor.mit.edu/

[4] http://www.mathworks.com/products/matlab/

[5] http://www.edpsu.pt/pt/particulares/tarifasehorarios/BTN/Pages/HorariosBTN.aspx

[6] http://www.edpsu.pt/pt/particulares/tarifasehorarios/BTN/Pages/TarifasBTNate20.7kVA.aspx

[7] http://www.jk-forum.com/articles/lighting-tech-led-vs-halogen/#b