Business Plan

Problem Summary

1 Background

Hotel companies are promoting actions to make their hotels more sustainable and reduce their impact on the environment. However, they still have limited tools to constrain their structures to respect their sustainability standards.

One idea to reinforce the value of a brand's sustainability policies would be to include sustainability clauses within the operating agreements signed between the brands and their properties, defining which measures can be included (meaning the ones that can be measured and monitored) and how they can be regulated. Energy is one sustainability issue that can be monitored and easily controlled and reduced.

Even if energy costs represent a small percentage of hotel's operating costs, their reduction can provide significant increases in revenue, especially in this economic climate where energy prices are increasing along with consumption.

Indeed, tourism is a key talking point in debates on sustainability. The sector's carbon impact is 2% of the earth's total but will soon increase to 3% due to the fast growing tourist demand (from 25 million travelers in 1950 to 1 billion in 2012, and forecasted to reach 1.8 billion in 2030, according to the United Nations World Tourism Organization, which has urged the tourism industry to take sustainability measures).

2 Energy consumption in hotels

Energy is the second largest spending category for a hotel after employment, representing 3% to 6% of hotel operating costs and accounting for approximately 60% of its CO_2 emissions, according to Energy Solutions.

Energy consumption is influenced by various technical, architectural, local and management factors, as illustrated in the following table. All of these factors can induce significant fluctuations in energy consumption, which makes it difficult to define and estimate energy.

During the past decade, energy consumption in hotels has increased from 25% to 30% due to the growth in occupancy but also because of the new ways of living and consuming. This is most evident in the more demanding standards (more facilities and services), the more intensive usage of electronic equipment (computer, TV, music appliances) and the development of operating equipment (electric cooking, cold rooms, elevators). This exponential curve is expected to continue over the next few years, with a 10% to 25% rise forecasted.

Energy sustainability factor is where most hotels feel they are on firm ground. To be sustainable, a business must be profitable. That said, profit cannot trump the Social and

Environmental factor. In fact, profit at any cost is not at all what the economic factor is about.

It is the inclusion of the economic factor and profit that makes it possible for corporations to come on board with sustainability strategies. The economic factor provides a counterweight to extreme measures that corporations are sometimes pushed to adopt, such as abandoning renewable energy or recycled water sypply instantly rather than phasing in changes.

| Factors influencing energy consumption in hotels	Effects	Impact
Building		
Size	The bigger the building, the more energy needed.	Medium
Shape	A hotel where all is condensed in the same building will be more energy efficient than a disparate property.	Medium
Age	A new building is supposed to be better insulated than an old one.	Medium
Materials	The material used is important in terms of insulation and lighting of the building.	High
Technical equipment	The choice of technical (electronic?) appliances is important, as they are to be energy efficient to reduce energy consumption.	High
Hotel features		
Category	The higher the category, the higher the energy need (from 17.30kwhPAR* for economy to 89.35kwhPAR for luxury).	High
Facilities / Services	A hotel with only a few services and facilities will consume less energy than a hotel with a lot of services and facilities.	High
Location		
Climate	Climate will impact the use of air conditioning and heating, more necessary in hot/cold areas.	High
Local policies	Local energy policies affect the prices and CO_2 emissions, as it will determine the type of energy used: gas, electricity, nuclear, wind, etc.	High
Operations		
Energy management	The hotel's energy management policy is crucial in controlling energy costs, as it will involve all the parties (staff, investors, guests) and will set up targets and best practices.	High
Occupancy	Occupancy will impact the energy consumption, as more people in the building will require more energy. However, there are still spaces where energy will be required independently of the occupancy.	Medium
Operational hours	A hotel runs 24/7. However, operational hours could impact the price of energy in certain areas (cheaper in dedicated hours).	Low

* PAR: Per Available Room

3 How is hotel energy consumption split?

Energy in hotels is mainly consumed by temperature regulation, which represents on average 69% of energy consumption (63% for heating and hot water and 6% for air conditioning. These figures can be even more important in extreme climate conditions, where temperature regulation within properties requires even more energy.

Operators can reduce energy consumption by first defining average temperature levels inside properties to avoid extreme temperatures (e.g. too hot, too cold) and find a balance between acceptable temperatures for guests and appropriate energy spending. An acceptable average is 19°C (66°F), according to various worldwide health authorities.

To a lesser extent, other important energy end-users are kitchens and "other unidentified" sources (11% each). Surprisingly, lighting/TV/radio ranks fifth in this classification (4%), followed by laundry (4%).

The following graph shows the repartition of hotels' energy end-users.
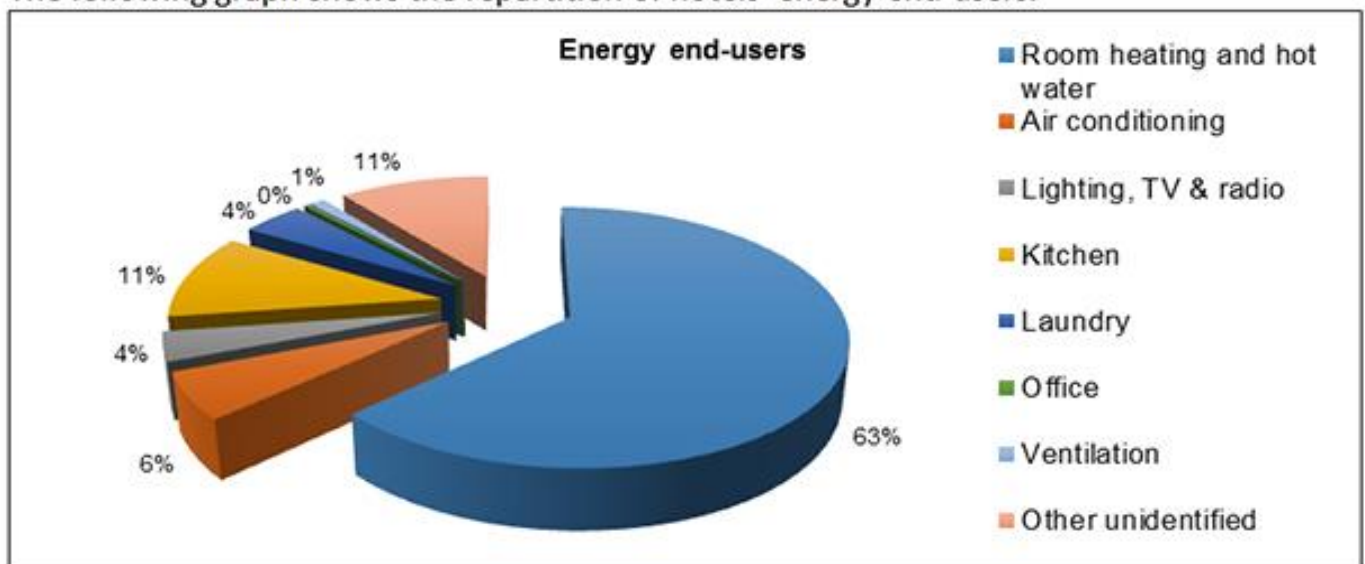
4 How to reduce energy consumption in hotels

In order to reduce energy consumption, hoteliers have at their disposal a range of tools and practices that can be easily implemented, depending on the state of the hotel. Hotel owners are frequently reluctant to install sustainability measures in general, especially in the more economic segments that are more cost-sensitive and perceive eco-friendly measures as expensive.

However, even if the cost of the following actions might vary, the impacts on the environment and the cost reduction will be significant, justifying the investments needed. Moreover, some of the suggested actions listed in the table below have no financial costs; they only need human investment and care.

It is important to point out that the difficulty in implementation and costs mentioned are informative and based on an industry average. They might vary depending if the hotel is already opened or planned, and if the building is existing or not. Indeed, it is easier to include environment friendly technical requirements when planning a new-build rather than modifying the technical characteristics (shape, insulation, specific construction materials, equipment) of an already constructed building.

Actions toward energy consumption reduction	Implementation difficulty	Cost
Room heating and hot water		
Efficient building shape	Medium	Medium
Efficient isolation	Medium	Medium
In-room thermostat	High	High
Lower heating temperature	Low	Low
Air conditioning		
Lower cooling temperature	Low	Low
Better isolation	Medium	Medium
In-room thermostat	High	High
Lower cooling when no guests	Low	Low
Lighting, TV & Radio		
Windows allowing natural light to stream in	High	High
Motion sensors	High	High
Low-consumption light bulbs	Medium	Medium
Energy savings mini bar, TV	High	High
Kitchen		
Conversion of kitchen grease into bio-dynamic fuel	Low	Medium
Energy efficient appliances	High	High
Laundry		
Towel reuse	Low	Low
Linen reuse	Low	Low
Energy efficient laundry equipment	High	High
Office		
Motion sensors	High	High
Switch off computers	Low	Low
Limited usage of electronic appliances	Low	Low
Ventilation		
Energy saving ventilation system	High	High
Use natural ventilation	Low	Low
Other		
Staff consciousness	Low	Low
Guests consciousness	Low	Low
Energy monitoring	Low	Low
Solar panels installation	Medium	High
Use of renewable energies (wind, biofuel)	Medium	High

Solution Summary

An energy monitoring system (EMS) is a system that monitor power consumption to provide the energy use within the hotel room managed by the system. Building energy management systems are used to improve energy efficiency by monitoring the power intake for the room.

The EMS will monitor these intake within the room:

1. Air conditioning and ventilation
2. Appliances (TV, Chargers, …..)
3. Lighting

These device's are installed in a hotel room units that consumes energy whatever was it consumption ,to determine the energy consumption by each guest accurately, and this information will be presented to the gust using a small Screen intstlled in the room .

This device will incress awareness by calculating the proportion of energy consumption or the percentage of depletion of the planet and this also creates a competition between hotels. Each hotel has to calculate the operating cost of each room. This cost is calculated as an

estimated cost of the expected energy consumption per guest. With such a device, it can be calculated as the ratio of the operating cost per room .

A 1:12 scale prototype was build as a model of a large hotel room including a bathroom, bedroom, furniture and simulated electrical devices. The devices will be controlled by an Arduino and their usage will be monitored by a Raspberry Pi with a Wifi interface to a dashboard that will be viewed on a computer using the the matiral below:

1. Foam Board – 12 sq feet. (1.3m2)
2. Scrap paper that can used as Wall paper.
3. 1:12 scale dolls house bathroom furniture
4. 1:12 scale dolls house bedroom furniture.
5. 10W computer fan (used to simulate A/C unit.
6. 7 LEDs to simulate lights
7. LCD/LED/Cell phone screen to simulate TV
8. Arduino is micro-processor that the controls the simulated devices & exports usage to Strawberry pi
9. Raspberry Pi – data acquisition & communication to Cloud
10. Eight single pole switches to turn off devices.
11. Multi-switch holder. Either purchased or home-made.
12. Power Supply. i.e. 12V power adaptor or a battery.
13. A 12V to 5V adaptor maybe required. E.g. transformer or DC-DC converter
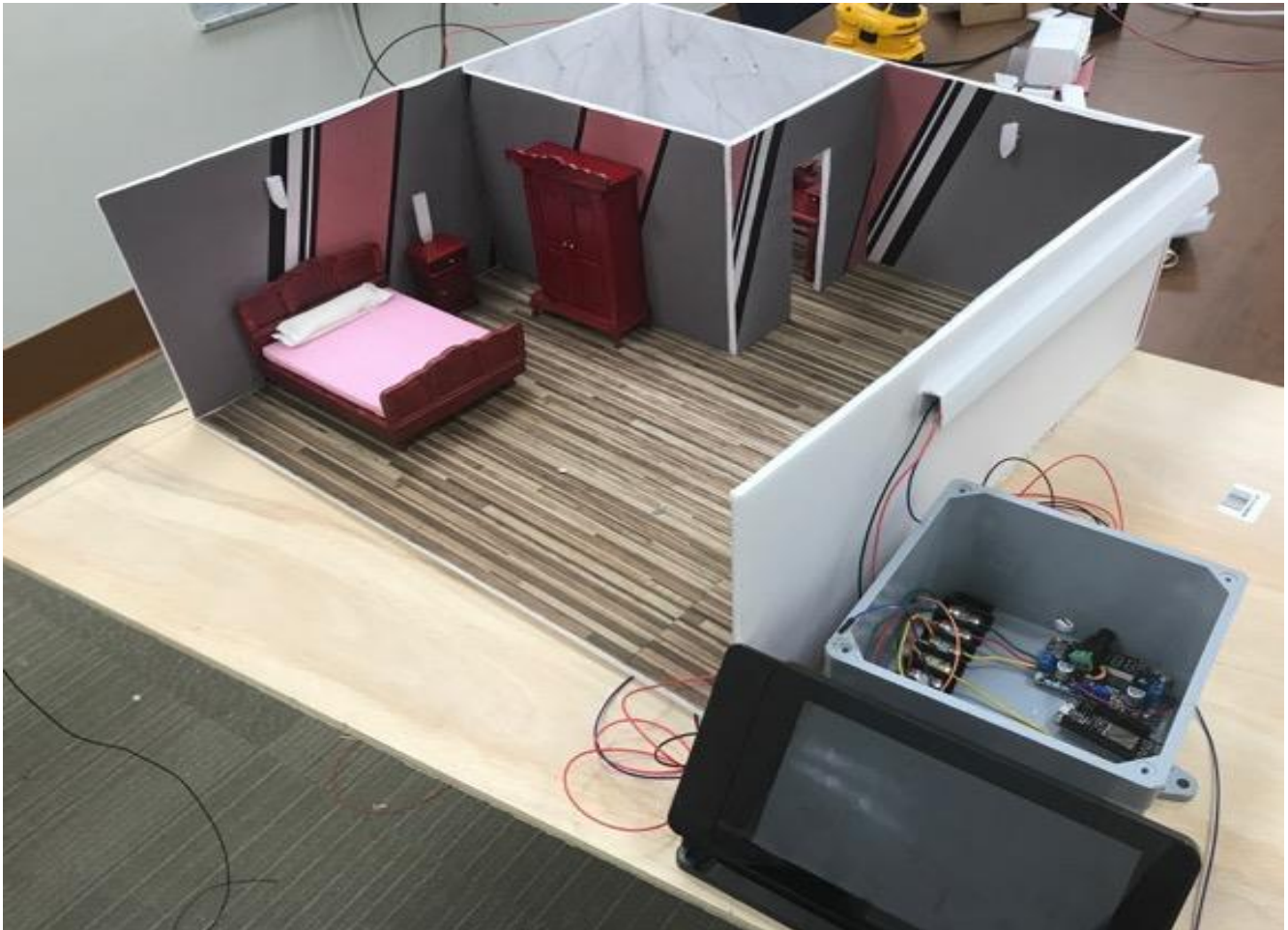
14. Assorted wiring. 22 or 24 gauge.

This device sends readings of the electricity consumption to a system, which through a special mechanism and software calculate the rate of consumption of the room and compares with the predefined threshold limit for each room. If consumption within acceptable limits sends a signal to the device in the room,) Indicates that the consumption is acceptable, and if the consumption increases the color of another indicator (red, for example), and the technician who installs this device in the room to be easy to see and in a place that meets public safety standards

When the customer wants to leave the hotel, a preprogrammed mechanism is used to calculate the amount of consumption and integrate it with the hotel's internal systems so that
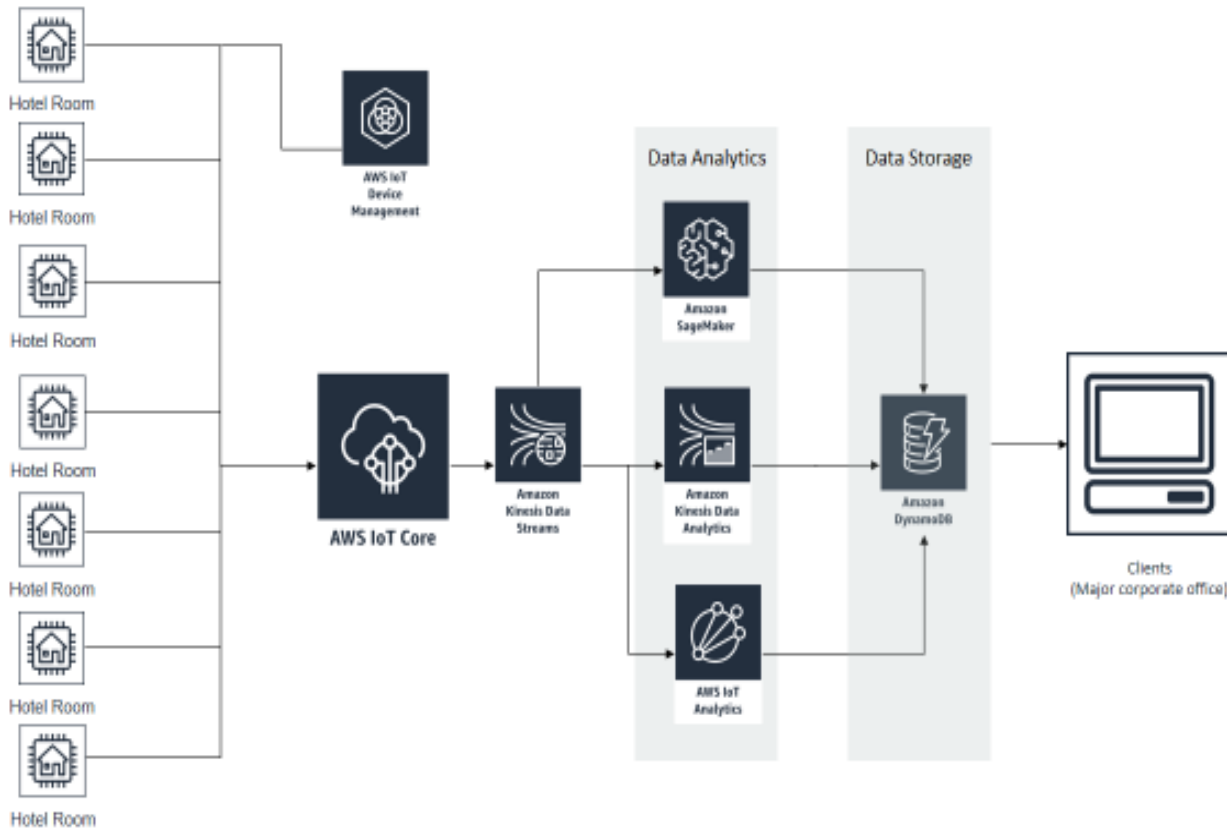
the customer is given a promotional discount on his / her gifts. This increases the degree of customer satisfaction, motivates them to change their behavioral attitudes towards energy and the environment and achieves the credibility and reliability of the hotel.

Forecast

When we talk about how to save energy we surely need the sustainability and the provided ways for that, as we mentioned before, our idea based on energy consumption rationalization, and that's count as primary factor to achieve the sustainability in this field. So to achieve the sustainability, simply in this field we need to save firstly in use of less cost, away from currently provided ideas which counted as a high cost. We had mentioned before the target category and the size of it ,where the size of this category is popular all over the

word .our marketing section has started in Jordan as a starting point to this project then lunch it globally to cover our aim . Until 2019 our expectations for our project that our partner will reached to 15 hotel in Jordan and it can be increased.

The project and it software is flexible for development with the technological progress we see, whether it was in software or in pieces, and that's including the development and keeping with the coming days for this device and the software use.

The benefits that we will get after the application of the device and its operation are:

1- Saving money

2- Saving the amount of electricity consumption

3- Reducing the percentage of carbon dioxide emissions resulting from power generation

4- Creating awareness of the damage of the process of generating energy and depleted from enable natural sources.

In fact, the American team during this competition has a great impact on the completion of this project after the brainstorming we reached this idea and was approved by both sides the US team built the device and software after many experiments and the actual application of the software and the device together until we reached the final product ready to run

The project achieves the main objectives we have tried to reach

-Achieving financial returns through the sale of this device

-When talking about the provision of electricity, we also do not forget that the percentage of carbon dioxide emissions generated by the power generation process will be reduced

-We achieved our social goals through the necessary awareness to the guests in hotels

-Saving costs on hotels leading to the creation of ideas aimed at developing and improving services

-The sustainability of crescent energy saving, resulting in reduced production quantities

Market Analysis

Our target group includes hotels and resorts of all kinds and their classifications in particular. When talking about the reason for owning a product, the answer is "saving" because our product is an important factor for saving the electricity consumed, there are many benefits and the most important :

• Create a new intellectual trends about sustainability in the Customer.

• Build a relationship of correlation between the guest and the hotel.

- Contribute in saving the energy consumption cost in the hotels.
- Encouraging the guests to adopt the idea by promoting the project and its benefits.

The target segment is reached by communicating with them in meeting and presenting the project to discuss the benefit, the mechanism of work, the main idea, and the cost of the project.
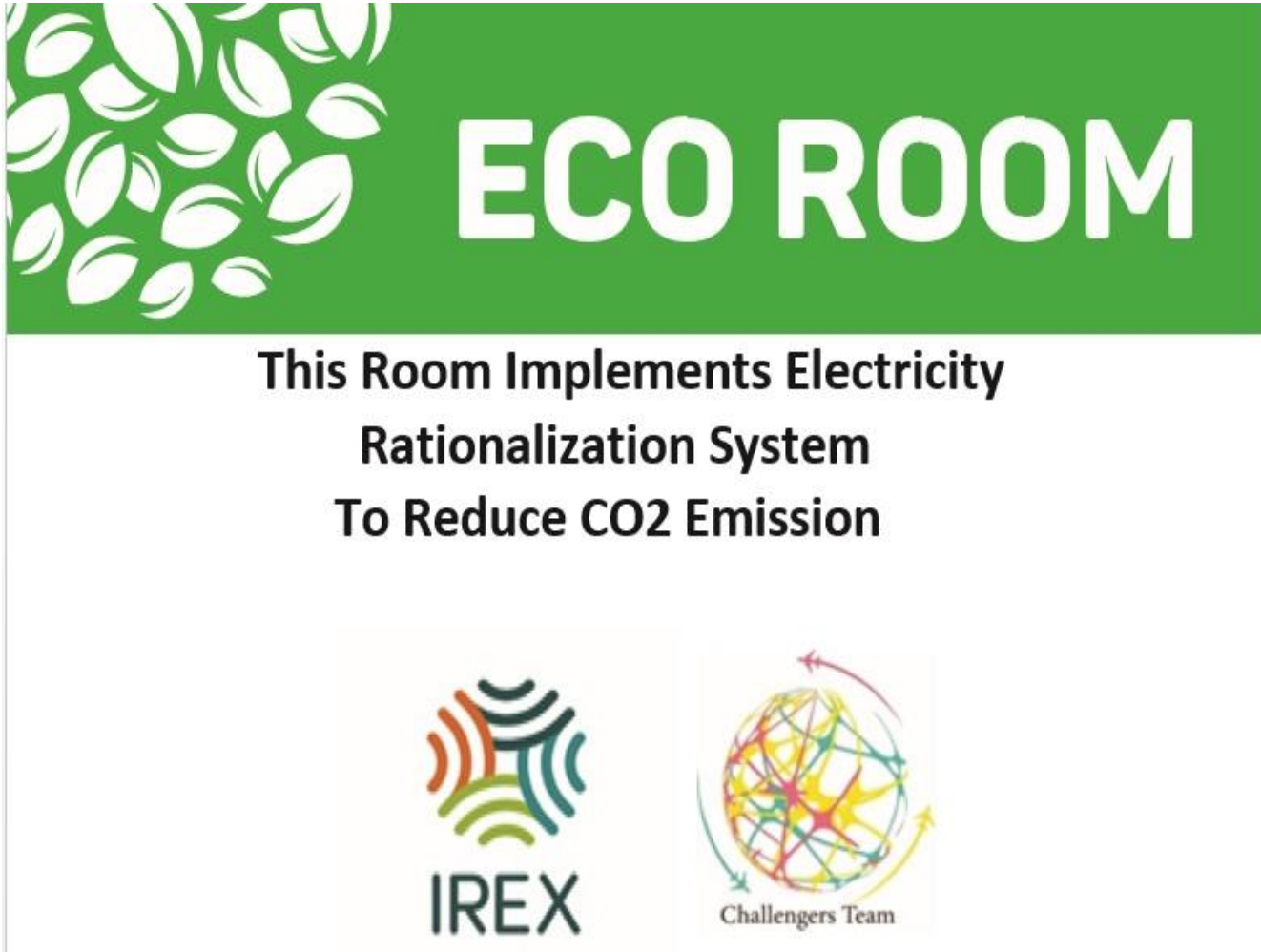
Our partners in this project are hotels and resorts, and the suppliers are us. Where they supplied with the device, software, and permanent support.

In energy field and the ways of rationalization and to save money in this field are many, but the idea of the project we are offering is the first of its kind and best in the provision of energy. With an expected saving rate 30% of actual consumption.

The idea is to create a typical hotel room that can monitor the energy of the guest through a sensors located in all the electrical in the room.

The idea of creating awareness will be by showing the quantities of electricity consumption through the smart counter that measures the consumption of electricity consumption of electricity with a frequency of time (every hour or every half hour) for each room. And the counter keeps these measurements on the built – in memory with the meter and then sends them of the central device located in the hotel.

Therefore this device helps to know whether consumes as energy in wasted way or in effective manner and also monitors the pattern of consumption.

After the test the power saving capacity was 18.268 MW of the guest room.

Increasing the energy lifespan won't solve the problem completely but surely leads to reduce the energy shortage qualities, and reduce the expenditure and limit the carbon dioxide emissions nearly about 9.134 ton , that was resulted from combustion process, which causes global warming phenomena.

The electricity rationalization process about 10% and will save about 529.767 JD per month, which mean 6357.204 JD yearly.

https://www.surveymonkey.com/r/VR9GVR9

https://www.surveymonkey.com/r/VSGZ7XV

Costs

This device has many needed pieces for installation, also a software that will be added after installation and the device.

Pieces:

1. RASPBERRY PI3 MODEL B-PLUS (B+)x1
2. KINGSTONE SD CARD 16GB CLASS 10 X1
3. WIRE FEMALE\JUMPER JUMPER X5
4. 5V 3A POWER SUPPLY MICRO USB AC ADAPTER CHARGER FOR RASPBERRY PI 3 X1
5. ACS712 20A CURRENT SENSOR MODULE X2
6. RASPBERRY PI 3.5 INCH TOUCH SCREEN X1

The price of the pieces required 30 dinars per device and if it will be sold, the price of it will be about 100 dinars depending on the sold devices and installation costs in addition to maintenance agreed on maintenance in a binding annual contract for the parties.

Final Report: Previously explained the idea and its benefits and ways of saving possible when using the device that we have built, imagine that you provide electricity by up to 30% of the value of consumption and the lowest costs necessary to achieve it