Impact of Technological Progress on Energy Consumption in the Hotel Industry in North-East Europe (Latvia)

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Abstract

The impact of technology on energy consumption in the hotel business is significant (Demir & Bahar, 2021). Technological advancements in the hotel industry have led to the development of energy-efficient systems and devices, such as smart thermostats, LED lighting, and occupancy sensors (Toscano et al., 2019). These technologies allow hotels to better monitor and control their energy usage, leading to reduced energy consumption and lower operational costs. By implementing these energy-efficient technologies, hotels can not only reduce their carbon footprint but also improve their overall sustainability and attract environmentally conscious guests. Additionally, technology has also enabled hotels to collect and analyze data on energy usage, allowing them to identify areas of high consumption and implement targeted strategies for energy optimization. Furthermore, technology has also enhanced guest experiences by allowing guests to have better control over their room's energy usage through features like smart room controls and mobile apps. These technological advancements not only benefit the environment but also contribute to cost savings for hotels. The integration of energy-saving technology in hotels has been proven to be beneficial not only for the environment but also for the financial sustainability of hotel businesses. By implementing energy-efficient technologies, hotels can reduce their operational costs and minimize their environmental impact (Wang, 2016). In conclusion, technology plays a crucial role in reducing energy consumption in the hotel business (Toscano et al., 2019).

Keywords

Energy Consumption, Hotel Business, Hospitality Industry, Gas Energy, Electric Energy, Advanced Technology, Energy Efficient Systems.

Introduction

With the increasing demand for sustainable and energy-efficient practices, it is imperative for North East European hotels to adopt advanced energy techniques to reduce their carbon footprint and lower operating costs. By implementing innovative solutions such as solar panels, energy-efficient lighting systems, smart thermostats, and insulation upgrades, hotels can not only decrease their environmental impact but also attract environmentally conscious travelers who are actively seeking eco-friendly accommodation options. By embracing advanced energy techniques, North East European hotels can also enhance their reputation as industry leaders in sustainability and become pioneers in setting new standards for energy conservation in the hospitality sector. Additionally, by adopting advanced energy techniques, hotels in North East Europe can reduce their reliance on traditional energy sources, which can be expensive and subject to price volatility, and instead transition towards more sustainable and renewable energy sources. This shift can ultimately lead to significant cost savings for hotels, allowing them to allocate resources towards improving guest experiences and expanding their business. Moreover, the adoption of advanced energy techniques can also help North East European hotels mitigate the impact of changing weather patterns and extreme climate events. By implementing energy management systems and utilizing data analytics, hotels can optimize their energy usage, identify opportunities for efficiency improvements, and respond proactively to changing weather conditions. With the unpredictable nature of weather in North East Europe, such as long cold winters and short summers, hotels need to adapt and become more energy-efficient to maintain the comfort and satisfaction of their guests while also ensuring the long-term sustainability of their operations.

Methodology

The methodology used in this study aims to analyze the impact of energy consumption on the hotel business in northeastern and central Europe. It involves collecting data on energy consumption in hotels located in the target regions (Lai, 2016). This data will be obtained through surveys, interviews, and analysis of energy bills. The collected data will include information on electricity consumption, water usage, and the utilization of renewable energy sources in the hotels. Based on the sources provided, the impact of energy consumption on the hotel business in northeastern and central Europe can have various implications. Firstly, energy consumption is a significant operating cost for hotels, often exceeding the cost of personnel.

Reducing energy consumption through efficient use and implementing energy-saving measures can help hotels reduce costs and improve competitiveness. At the same time, implementing energy-saving measures and utilizing renewable energy sources can also enhance the business image of hotels as environmentally conscious and sustainable establishments. This can attract green-minded customers and contribute to the hotel's market share. Furthermore, the study suggests that energy-saving hotels are attractive to global green tourists. This implies that hotels in northeastern and central Europe that prioritize energy-saving practices may have a competitive advantage in attracting environmentally conscious travelers.

Additionally, the study also highlights the importance of energy conservation programs within hotels (Toscano et al., 2019). These programs, although they may require a high financial cost, can provide significant energy savings and cost reductions for hotels. Overall, the impact of energy consumption on the hotel business in northeastern and central Europe is substantial. By implementing energy-saving measures and utilizing renewable energy sources, hotels can not only reduce their operating costs but also improve their competitiveness and attract environmentally conscious travelers (Lai, 2016). In conclusion, the impact of energy consumption on the hotel business in northeastern and central Europe is multifaceted.

Mixed methodology is used in research topic.

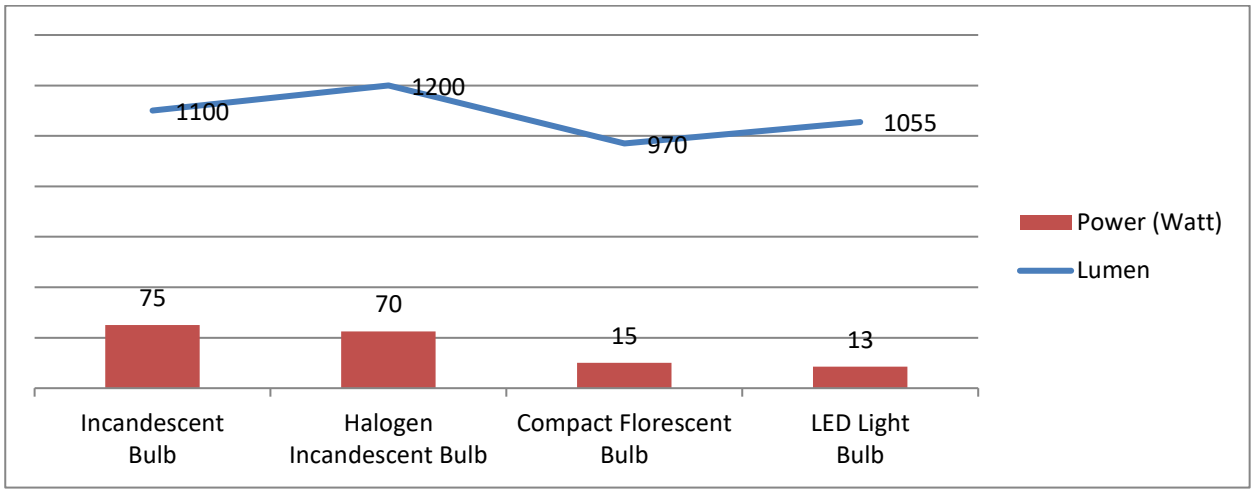
Quantitative and Qualitative, both methods were used.
Questionnaires and surveys were made.
Interviews were conducted.
Observations and calculation were made.
Secondary data analysis.

Results & Discussions

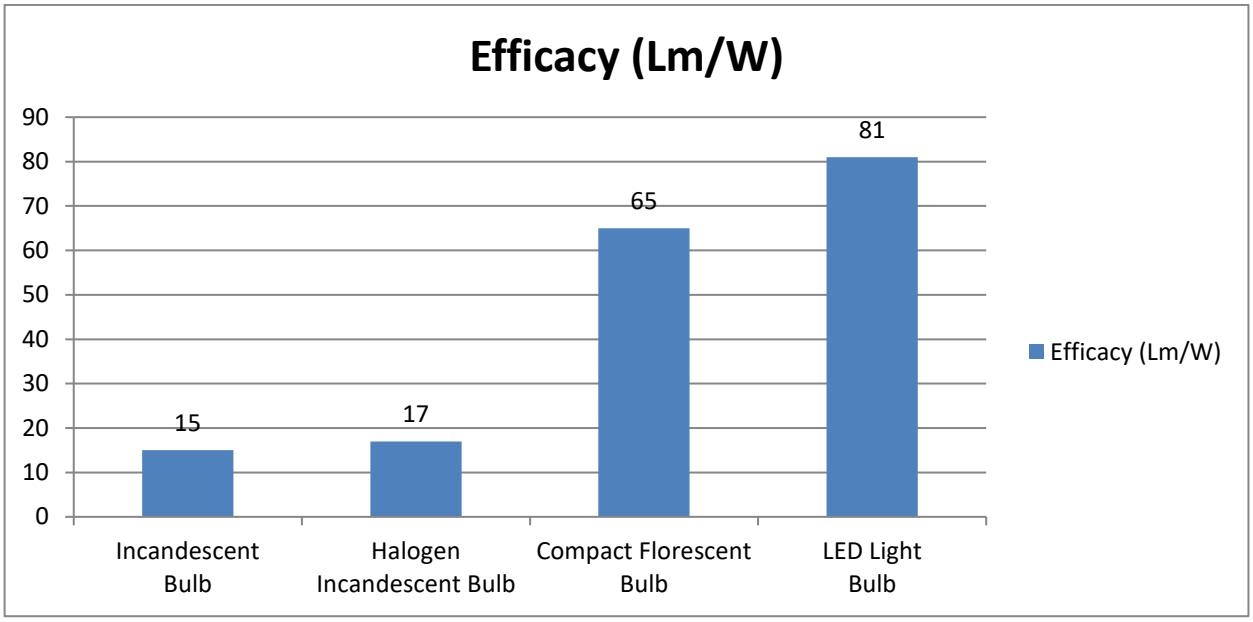
In the world of lighting, there are several types of bulbs to choose from, each with their own unique characteristics and benefits. One of the most traditional and widely used types of bulbs is the incandescent bulb. This type of bulb uses a wire filament that is heated by an electric current, causing it to emit light. However, incandescent bulbs have a relatively short lifespan of around 750 to 2,000 hours and are less energy-efficient compared to other options such as halogen incandescent bulbs, fluorescent bulbs, and LED bulbs. Halogen incandescent bulbs are more energy-efficient than traditional incandescent bulbs, making them a popular choice for many households. Fluorescent bulbs are another energy-efficient option. These bulbs work by passing an electric current through a gas, which creates ultraviolet light. Fluorescent bulbs are known for their long lifespan of approximately 10,000 hours and their ability to produce a significant amount of light while consuming significantly less energy compared to incandescent bulbs. LED bulbs, or light-emitting diode bulbs, are the most advanced and energy-efficient option available. They use semiconductors to convert electricity into light. LED bulbs have the longest lifespan among all the options, typically lasting for tens of thousands of hours. Additionally, LED bulbs are highly energy-efficient, consuming significantly less electricity than incandescent or fluorescent bulbs while still producing high luminous fluxes. In comparison to conventional incandescent, fluorescent, and halogen lamps, LED bulbs are the most energy-efficient option.

Bulb Types →	Incandescent Bulb	Halogen Incandescent Bulb	Compact Florescent Bulb	LED Light Bulb
Bulb Properties ↓				
Lumen	1100	1200	970	1055
Power (Watt)	75	70	15	13
Efficacy (Lm/W)	15	17	65	81
Rated Lifetime (h)	750-2000	2000	10000	15000

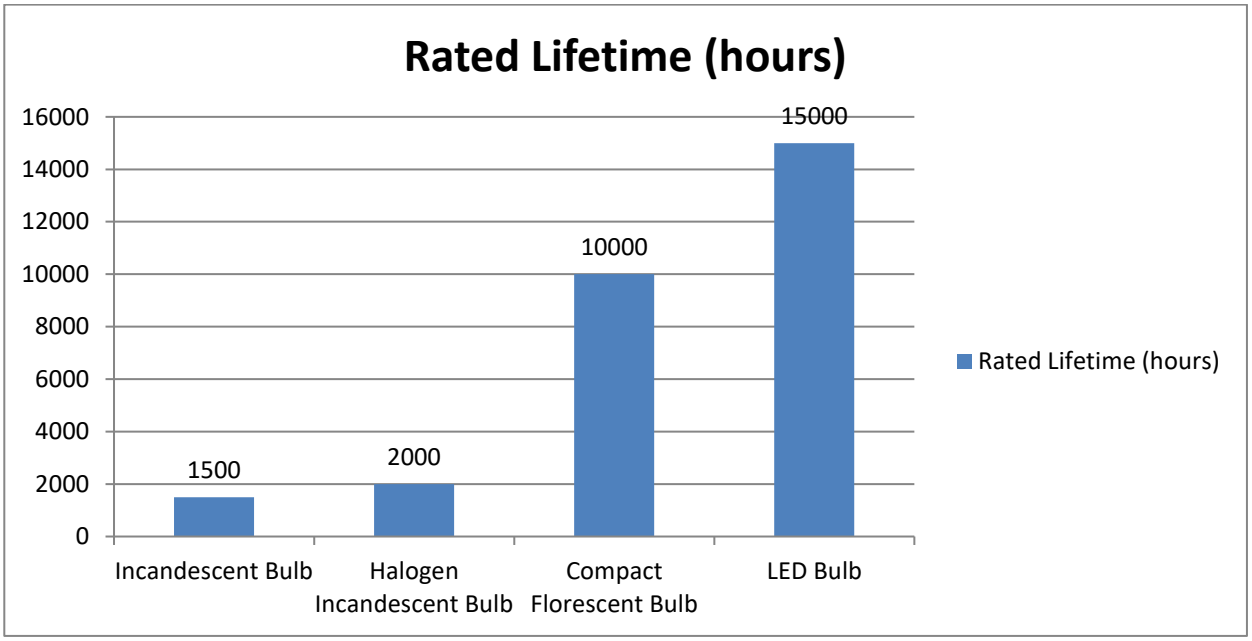
Image: 1
(Type of Electric Bulbs with their Lumen, Power, Efficacy and Rated Life)



Graph No: 1
Luminosity of four different bulbs Vs Power (Watts)



Graph No: 2
(Efficacy of four different Bulbs)



Graph No: 3
(Rated life in hours of four different Bulbs)

Image: 2

(Price per KWh in Latvia from three different electricity supplier companies)

1 KWh = 0.158 Euro

Incandescent Bulb	LED Bulb
1 Incandescent Bulb = 75 Watt If Usages per day = 10 hours Total Annual Consumption = 365x10x75 ~ 273,750 Watt hour 1000 Watt hour = 1 KWh 273750 Watt hour = 273.75 KWh Annual Cost = 273.75 x 0.158 = 43.25 Euro **If 50 Incandescent Bulb in Hotel** Total Annual Cost = 50 x 43.25 = **2162.5 Euro**	1 LED Bulb = 13 Watt If Usages per day = 10 hours Total Annual Consumption = 365x10x13 ~ 47,450 Watt hour 1000 Watt hour = 1 KWh 47450 Watt hour = 47.45 KWh Annual Cost = 47.45 x 0.158 = 7.50 Euro **If 50 Incandescent Bulb in Hotel** Total Annual Cost = 50 x 7.50 = **375 Euro**
Annual Cost Saving	**2162.5-375 = 1787.5 Euros**

Table: 1

(Annual cost saving between Incandescent and LED Bulb)

AC Rating Impact on Hotel Business

The star rating of an air conditioner can have a significant impact on the success and profitability of a hotel business. Hotels with higher star-rated energy-saving air conditioners are more likely to attract and satisfy customers who prioritize energy efficiency and sustainability. These customers are often willing to pay higher prices for environmentally friendly accommodations. This ultimately results in increased profits for hotels that invest in high-star appliances. Not only do energy-efficient air conditioners contribute to cost savings for hotels, but they also align with the growing consumer demand for eco-friendly accommodations. Additionally, hotels that achieve higher star ratings for their air conditioning systems are more likely to be recognized for their commitment to environmental sustainability. Furthermore, research has shown that customers are more likely to book rooms and stay at hotels with higher star-rated energy-saving air conditioners. Therefore, it is crucial for hotel owners to recognize the financial and environmental benefits of investing in energy-efficient air conditioning systems and to educate themselves on how these systems can work to their advantage.

1.5 Ton Split AC Star Ratings							
Star Rating	EER	Cooling Capacity (Watts)	Input Power (Watts)	KWh Consumption / Day	Per KWh Charge	Cost/ Year	Cost Saving/ Year w.r.t Base Star
				KWh	Euro	Euro	Euro
Base Star	2.5	5200	2080	17	0.158	327	0
1	2.7	5200	1926	15	0.158	289	38
2	2.9	5200	1793	14	0.158	270	57
3	3.1	5200	1677	13	0.158	250	77
4	3.3	5200	1576	13	0.158	250	77
5	3.9	5200	1486	12	0.158	231	96
Note: Assuming 8 hours operation per day for 4 months							

Table: 2
(1.5 Ton Split AC star ratings with its specifics)

Advantages of Advanced Radiators in Hotel Business

Advanced radiators offer numerous benefits over old radiators in the hotel business, making them a valuable investment for improving guest comfort and operational efficiency. Some potential advantages include:

1. Improved energy efficiency and cost savings: Advanced radiators are designed with energy-saving features such as programmable timers, thermostatic controls, and smart heating technology. These features allow hoteliers to optimize heating schedules, regulate temperature levels, and reduce energy consumption, resulting in lower utility bills and higher cost savings.

2. Enhanced guest comfort: Advanced radiators provide more precise and controllable heating, allowing guests to adjust the temperature according to their preference. This ensures a comfortable and personalized experience for each guest, increasing overall satisfaction and potentially leading to repeat business.

3. Improved heating performance: Advanced radiators utilize innovative heating technologies such as enhanced heat distribution, faster warm-up times, and efficient heat retention. This translates to quicker and more effective heating throughout the hotel rooms, resulting in cozy and warm environments for guests, even during colder seasons.

4. Simplified maintenance and management: Advanced radiators often come with remote control or centralized management systems, allowing hotel staff to easily monitor and adjust heating settings for multiple rooms or areas. This simplifies maintenance and management tasks, reducing the time and effort required to ensure optimal heating conditions throughout the hotel.

Image: 3
(Old Style Cast Iron Radiator)

Image: 4
(Old Style Cast Iron Radiator without Regulator)

Image: 5
(Stainless Steel Radiator)

Image: 6
(Aluminium Radiator)

Image: 7
(Aluminium Radiator with controlling Regulator)

	Aluminum	Steel	Cast Iron
Delta 40 Watts	1064	1030	1009
Mass (KG)	22.7	45.2	118
Water Content (L)	3.5	28.4	34
Material Specific Heat Capacity (KJ)	1	0.5	0.5
Water Specific Heat Capacity	4.18	4.18	4.18
Energy Required to Raise water Temp. for Initial Heating	3.5 * 4.18 = 14.63 KJ 14.63 x 60°C = 877.8 KJ	28.4 * 4.18 = 118.7 KJ 118.7 * 60°C = 7122 KJ	34 * 4.18 = 142 KJ 142 * 60°C = 8520 KJ
Energy Required to Raise Material Mass for Initial Heating	22.7 * 1 = 22.7 KJ 22.7 * 60°C = 1362 KJ	45.2 * 0.5 = 22.6 KJ 22.6 * 60°C = 1356 KJ	118 * 0.5 = 59 KJ 59 * 60°C = 3540 KJ
Total Energy for Water & Material Mass	2239.3 KJ	8478 KJ	12060 KJ

Table: 3
(Cast Iron, Steel and Aluminium Radiator and their specifics)

As a summary, we consider Aluminium to be overall best for most categories with Steel being a close second. Cast Iron for numerous reasons, water content, mass, lack of design choice, high prices compared to heat output, space occupied in the room compared to heat output.

Solar Energy Benefits in Northeast Europe Hotel Industry

Solar energy offers numerous advantages for the hotel business in Northeast Europe. Firstly, solar energy is a clean and renewable source of power, making it an environmentally friendly choice for hotels. By installing solar panels on the hotel's rooftop or surrounding areas, hotels can reduce their carbon emissions

and contribute to a more sustainable future. Additionally, solar energy can help hotels save on their energy costs. By harnessing the power of the sun, hotels can generate electricity to meet their energy needs, reducing their dependence on traditional forms of energy and saving money in the long run. Moreover, solar energy is a reliable source of power in Northeast Europe. With abundant daylight hours in the summer and advancements in solar technology, hotels can rely on consistent energy production, even during the region's colder and darker winter months. Furthermore, by adopting solar energy, hotels can enhance their brand image and attract eco-conscious guests. These guests are increasingly seeking accommodations that prioritize sustainability and renewable energy sources. By embracing solar energy, hotels can position themselves as leaders in the industry and appeal to a growing market segment.

Image: 8
(Solar Panels on roof of Villa Ohaijo, Riga, Latvia, from Google map)

Summary

System price:	Annual savings 1st year:	Overall savings over 25 years:	Payback period:
€14,585.34	€2,197.66	€38,009.60	7 Years

Price per W: €1.05

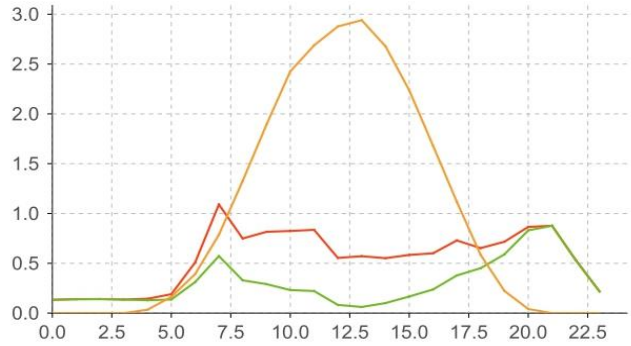
Total system size: 11.480 kW

Total system price: €12,054.00 + Tax: 21.00 (€2,531.34) = €14,585.34

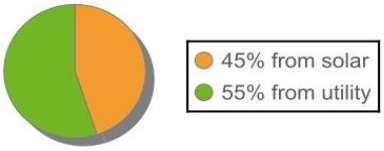
Energy Production

Annual energy production: 8,790.642 kWh

Energy offset



Energy consumption from utility vs solar



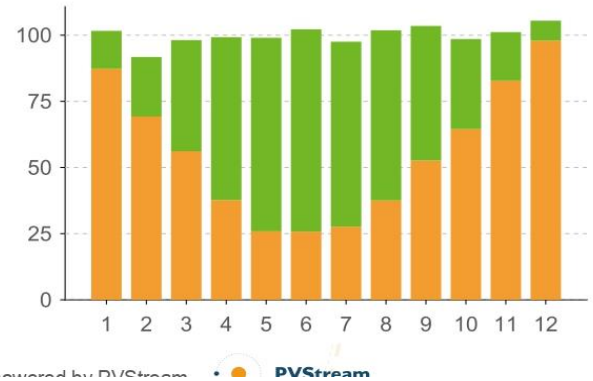
Average monthly energy consumption from utility before solar:
400.00 kWh

Average monthly energy consumption from utility after solar:
221.72 kWh

Average monthly feed-in energy sold back to the grid:
554.27 kWh

Post-Solar energy bill

Monthly energy bill before and after solar



Average monthly bill before solar:
€100.00

Average monthly bill after solar:
€55.43

Average monthly bill savings:
€44.57 (45 %)

Feed-in tariff:
0.25 EUR/kWh

Average monthly feed-in earning:
€138.57

Image: 9
(Post- Solar Energy Bills and Energy Production by Solar by Villa Ohaijo, Riga, Latvia)

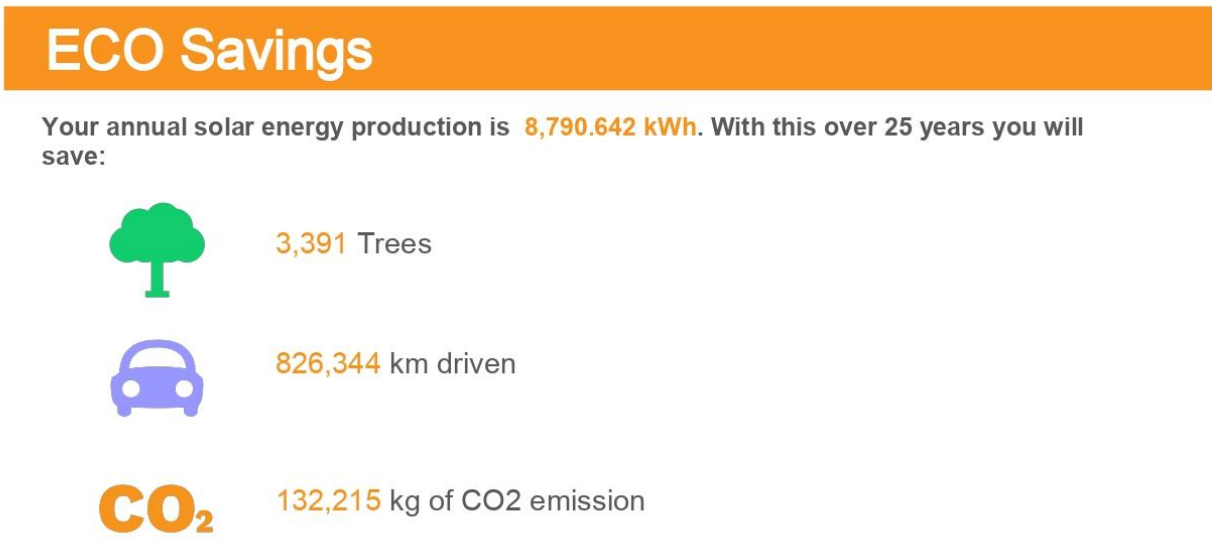
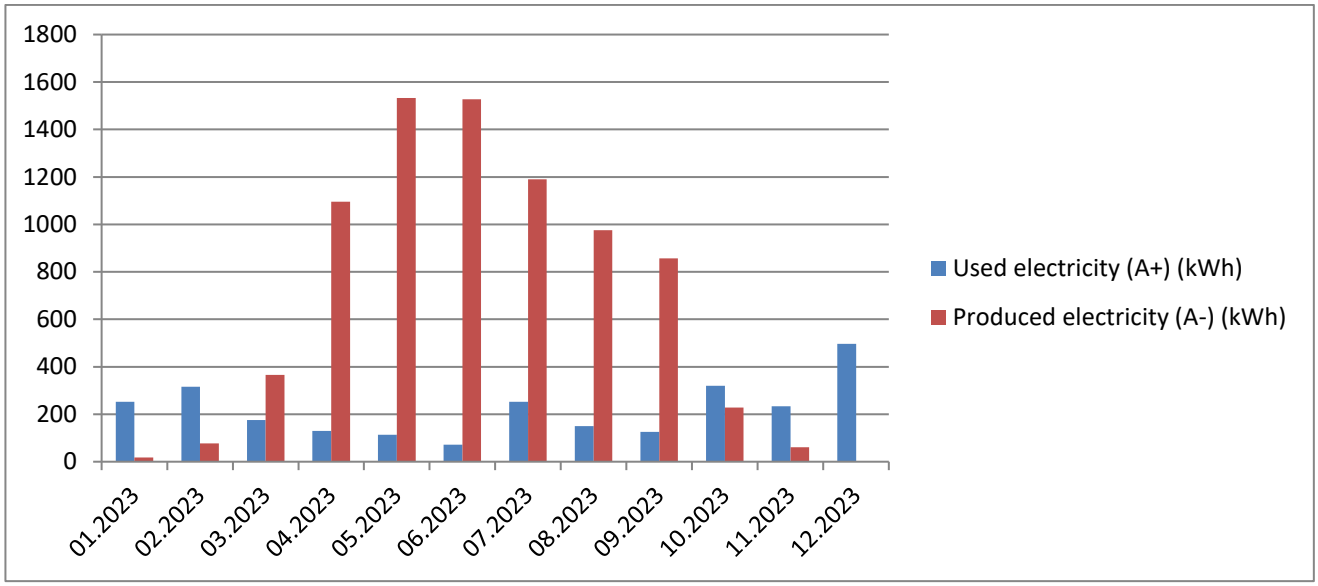
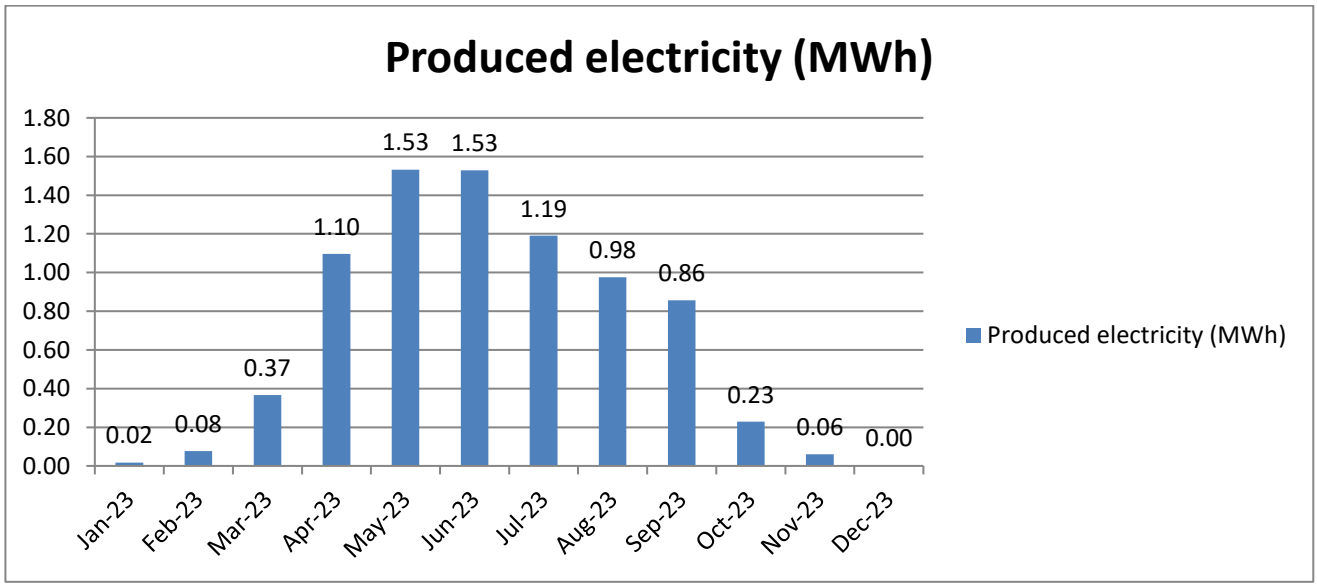


Image: 10
(Long Term savings and ECO saving by Solar Energy by Villa Ohaijo, Riga, Latvia)



Graph: 4
(Electricity produced by solar and used in 2023 by Villa Ohaijo, Riga, Latvia)



Graph: 5
(Monthly Electricity produced by solar in 2023 by Villa Ohaijo, Riga, Latvia)

Solar Panel Selection for Hotel Industry in north east Europe: Polycrystalline, Monocrystalline or Thin Film.

Image: 9
(Types of Solar Panels)

The use of solar panels in the hotel industry in northeast Europe has become increasingly popular due to the need for sustainable and renewable energy sources. When it comes to selecting the best solar panels for this region, both polycrystalline and monocrystalline panels are viable options. Polycrystalline panels are known for their affordability and high efficiency in moderate temperatures, making them suitable for a region with varying weather conditions. On the other hand, monocrystalline panels are known for their superior performance in colder climates and lower light conditions, making them a suitable choice for the hotel industry in northeast Europe. Additionally, the choice between polycrystalline and monocrystalline panels may also depend on factors such as available space, budget constraints, and specific energy requirements of the hotel. Thin-film solar panels, while offering flexibility in installation options, may not be the most suitable choice for the hotel industry in northeast Europe due to their lower efficiency and performance in colder climates. Therefore, when considering solar panels for the hotel industry in northeast Europe, both polycrystalline and monocrystalline panels should be considered, but monocrystalline panels may be more suitable for colder climates and lower light conditions. They offer superior performance and efficiency, making them a reliable choice for hotels in northeast Europe.

Conclusion

The implementation of energy efficiency measures in hotels can lead to significant cost savings and increased profitability. These measures not only contribute to environmental sustainability but also serve as a marketing strategy, attracting environmentally conscious guests. Furthermore, financial support and incentives are crucial for promoting and facilitating the adoption of energy efficiency measures in hotels. By lowering energy consumption in the hotel business, hotels can not only reduce their negative impact on the environment but also benefit economically. By implementing energy reduction measures in the hotel business, such as LED lighting, heat pumps, and insulation, use of high star rating air conditioners, advanced gas heating radiators in hotels can achieve significant cost savings and increase their competitive edge in the market. In conclusion, reducing energy consumption in the hotel business has a positive impact on both the environment and the economy.

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