

Impact on Annual Energy Cost due to Air-Conditioner selection for Hotel Business setup in North India

(Right Air- Conditioner Selection for Home or Business)

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Abstract

Energy consumption is a critical factor in determining the overall cost and profitability of a hotel. High energy consumption can significantly increase operating costs, which directly impacts the overall financial performance of a hotel (Filimonau et al., 2011). By reducing energy consumption, hotels can effectively lower their operating costs and increase profitability. This can be achieved through various measures such as implementing energy-efficient lighting systems, optimizing HVAC systems, using smart technologies for better control and monitoring of energy usage, and adopting energy-saving practices in areas such as heating, cooling, and ventilation. Implementing these energy-saving measures can not only reduce the hotel's carbon footprint but also improve its competitiveness in the market (Ćingoski & Petrevska, 2018). Additionally, promoting energy conservation in a hotel can also contribute to enhancing its reputation and attracting environmentally conscious guests (Filimonau et al., 2011). Overall, the impact of energy consumption on the cost and profit of a hotel is significant.

Keywords

Energy consumption, Air-Conditioner Selection, Advance Technologies, Energy Saving, AC Star Rating, Five Star AC, Inverter AC, Split AC, Window AC.

Introduction

Amid the ever-evolving landscape of home climate control solutions, the debate between inverter air conditioners and non-inverter ACs has gained considerable traction among consumers and industry professionals alike. This research paper aims to provide a comprehensive examination of the key distinctions between these two technologies, analyzing their respective performance, energy efficiency, cost implications, and environmental impact to shed light on the most suitable choice for varying household needs and preferences.

One of the primary advantages of inverter ACs lies in their enhanced energy efficiency. Unlike their non-inverter counterparts, which operate at a fixed speed, inverter ACs can dynamically adjust their compressor

speed to match the cooling or heating demand, thereby reducing energy consumption and operating costs. This flexibility allows inverter ACs to maintain the desired temperature with greater precision, leading to significant energy savings over the long term.

The star rating system is a standard for measuring and rating the energy efficiency of electrical appliances. In India, this rating is awarded by the Bureau of Energy Efficiency (BEE). An AC is given a star rating on a scale of 1-star to 5-stars, where the latter means the best and most efficient it can be. When it comes to ACs, it is decided on two factors.

1. The cooling capacity (cooling output)
2. The energy efficiency rating (power input)

Literature Review

Due to the economic crisis, hoteliers are nowadays more environmentally conscious than ever because it can cost far more not only to build a lodging facility but also to operate it if it is not sustainable. The cost of energy has increased so much in recent years that lodging construction now incorporates ways of using natural lighting and constructing energy efficient buildings (Walker, 2010). Hotels use significant amounts of energy for daily operations and recreational activities. In many facilities, energy costs are the second-highest operating costs after payroll. Investments in more efficient energy use and improved housekeeping practices can lead to significant reductions in operating costs and energy bills, with relatively short payback periods (Sweeting and Rosenfeld, Tour Operators Initiative). In simple terms, energy efficiency means using less energy to perform the same tasks and functions. For hotels, this could mean reducing the amount of energy needed for heating by improving insulation of the hotel building, by introducing lighting control or also regulate space heating and cooling. Energy efficiency saves energy, costs and reduces emissions of greenhouse gases like CO₂ (<http://www.mdsideas.com/unwto/>).

Calculations

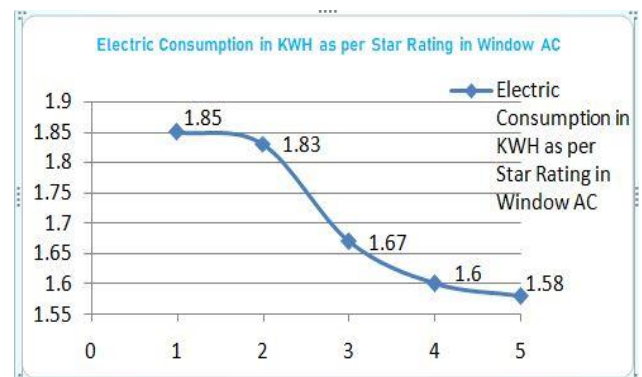
Window Vs Split Air Conditioner

Window AC

Star Rating Window AC	Electric Consumption in KWH	AC Operation per Day in Hrs	AC Operation at Months in a Year	Per Unit Cost for Commercial use (Hotel) in Rs	TOTAL Annual Cost in Rs	TOTAL Annual Cost in Euro
1 *	1.85	8	8	10	35520	395
2 **	1.83	8	8	10	35136	390
3 ***	1.673	8	8	10	32122	357
4 ****	1.6	8	8	10	30720	341
5 *****	1.58	8	8	10	30336	337

Source: (LG Electronics, Inc.)

Table No. 1

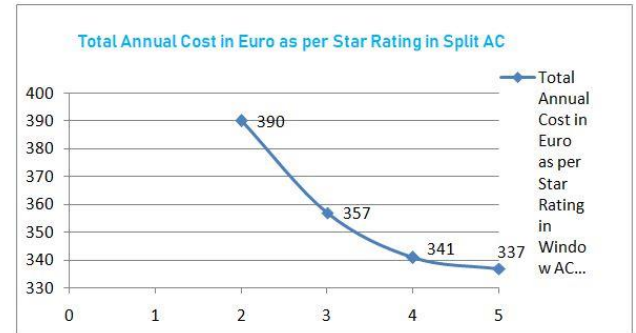


Source: (LG Electronics, Inc.)

Graph No.1



Source: (LG Electronics, Inc.)
Graph No.2



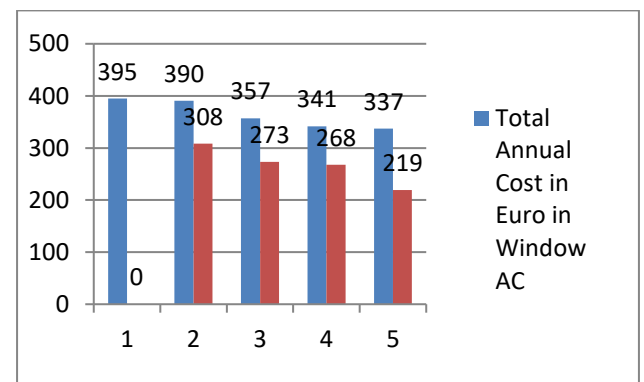
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Split AC

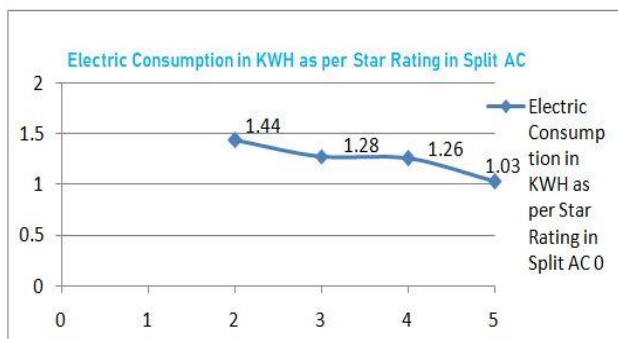
Star Rating Split AC	Electric Consumption in KWH as per Star Rating	AC Operation per Day in Hrs	AC Operational Months in a Year	Per Unit Cost for Commercial use (Hotel) in Rs	TOTAL Annual Cost in Rs	TOTAL Annual Cost in Euro
x	x	x	x	x	x	x
2	1.44	8	8	10	27725	308
3	1.28	8	8	10	24557	273
4	1.26	8	8	10	24154	268
5	1.03	8	8	10	19738	219

Source: (LG Electronics, Inc.)
Table No. 2

Annual Cost Window Vs Split AC

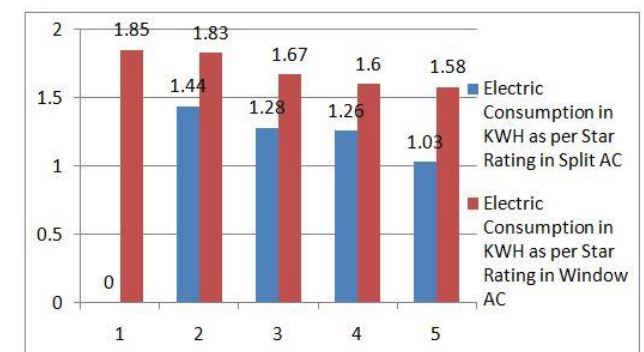


Source: (LG Electronics, Inc.)
Graph No.5



Source: (LG Electronics, Inc.)
Graph No.3

Energy Consumption Split Vs Window AC



Source: (LG Electronics, Inc.)
Graph No.6

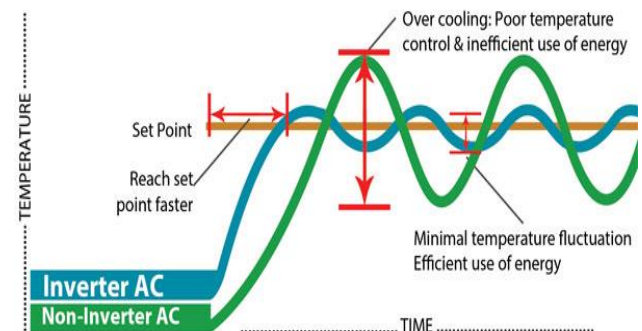
Inverter Air Conditioner Benefits Over Non-Inverter Air Conditioners

Headways in discuss conditioning innovation have driven to the advancement of inverter discuss conditioners, which offer critical benefits over their non-inverter partners. Inverter discuss conditioners utilize a special plan that permits for more proficient vitality utilize, coming about in taken a toll reserve funds and natural advantages. One of the essential benefits of inverter discuss conditioners is their capacity to alter the compressor speed based on the cooling request. Not at all like conventional discuss conditioners, which work at a settled speed, inverter models can persistently shift the compressor speed to coordinate the craved temperature, driving to noteworthy vitality reserve funds. This variable speed operation not as it were diminishes power utilization but moreover makes a difference keep up a more steady indoor temperature, driving to improved consolation and decreased strain on the system. Another key advantage of inverter discuss conditioners is their decreased add up to consonant twisting (THD). Inverter models utilize progressed control calculations, such as space vector pulse-width balance (SVPWM), which result in cleaner control yield and moved forward control quality. This lessening in add up to consonant twisting not as it were upgrades the productivity of the framework but moreover contributes to the generally life expectancy and unwavering quality of the discuss conditioner.

Additionally, inverter discuss conditioners offer made strides part-load productivity, permitting them to work more proficiently at lower cooling loads. This is especially useful in scenarios where the cooling request changes, as the inverter can alter its yield to coordinate the changing needs, driving to assist vitality investment funds. Finally, inverter discuss conditioners are frequently calmer in operation compared to their non-inverter partners. This is due to the variable-speed compressor, which can work at lower speeds, lessening

the by and large clamor level and making a more comfortable indoor environment.

In conclusion, the benefits of inverter discuss conditioners, counting their vitality productivity, progressed control quality, part-load proficiency, and diminished clamor levels, make them a prevalent choice over conventional non-inverter models. These preferences contribute to both taken a toll investment funds and a more maintainable, environmentally-friendly cooling arrangement (Rathikrindi et al., 2018) (Thamarai&Kashwan, 2015) (Saeedian et al., 2019) (Leelakulthanit, 2017).



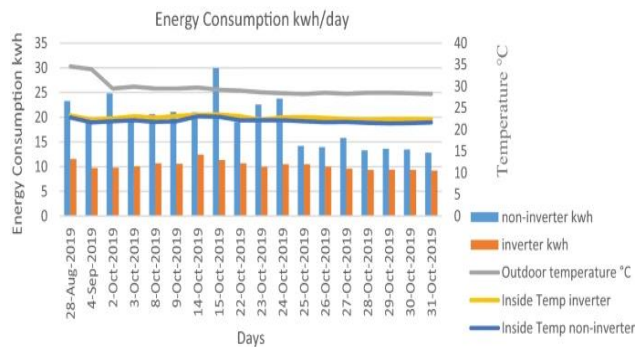
Source: (Vincular Testing Labs India Pvt Ltd)

Image No.1

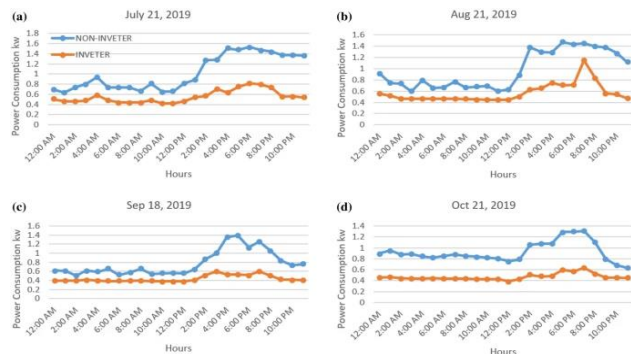
Energy Consumption: Inverter AC vs. Non-Inverter AC

The wrangle about encompassing the vitality effectiveness of inverter discuss conditioners (AC) versus non-inverter AC units has been a point of impressive intrigued in the domain of vitality preservation and natural maintainability. Inverter innovation, which permits for variable-speed compressor control, has been touted as a more energy-efficient arrangement compared to conventional non-inverter systems. Recent considers have dove into the

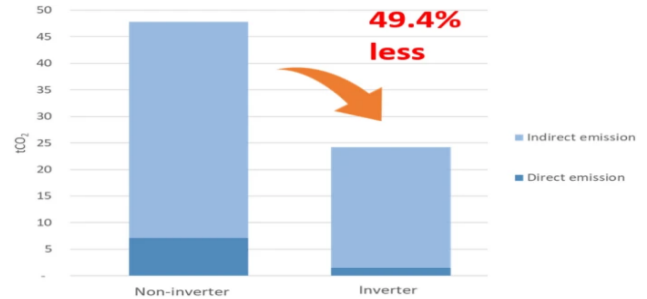
subtleties of this comparison, shedding light on the vitality utilization designs and potential reserve funds related with these two sorts of discuss conditioning frameworks. One key calculate that has developed is the noteworthy energy-saving potential of variable-frequency drives (VFDs) utilized in inverter ACs, which can extend from 20% to 65% depending on the application and working conditions (Rathikrindi et al., 2018). This is due to the reality that electric engines, which drive the compressors, fans, and other components in discuss conditioning frameworks, account for a considerable parcel (45%) of worldwide power consumption(Rathikrindi et al., 2018).



Source: (<https://doi.org/10.1007/s41825-020-00033-y>)
Graph No.7



Source: (<https://doi.org/10.1007/s41825-020-00033-y>)
Image No.2



Source: (<https://doi.org/10.1007/s41825-020-00033-y>)
Image No.3

AR Hotel Pvt. Ltd. , Faridabad, Haryana, India

Sr. No.	Type of AC	No's of AC	Annual Power Consumption	Total Cost in Rs	Total Cost in Euros
1	3 Star Window AC Non-Inverter	4	1.67 X 8 X 4 X 30 X 10 X 4	64128	713
2	3 Star Non-Inverter Split AC	3	1.47 X 8 X 4 X 30 X 10 X 3	42336	470
3	3 Star Inverter Split AC	5	1.28 X 8 X 4 X 30 X 10 X 5	62440	694
4	5 Star Non-Inverter Split AC	2	1.19 X 8 X 4 X 30 X 10 X 2	22848	254
5	5 Star Inverter Split AC	3	1.03 X 8 X 4 X 30 X 10 X 3	29664	330
6	Total	17	22142 KWh	221416	2460

Source: (Physical Data Collection from AR Hotel Pvt. Ltd. , Faridabad, Haryana, India)

Table No. 3

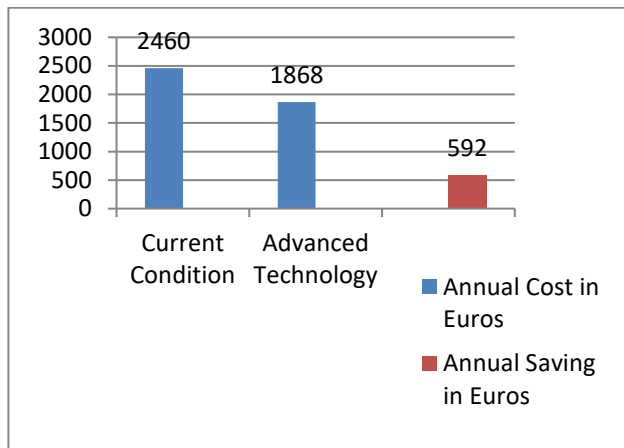
In the case all AC replaced to 5 Star Inverter Split AC by AR Hotel Pvt. Ltd., Faridabad, Haryana, India

Sr. No.	Type of AC	No's of AC	Annual Power Consumption	Total Cost in Rs	Total Cost in Euros
1	5 Star Inverter Split AC	17	1.03 X 8 X 4 X 30 X 10 X 17	168096	1868

Source: (Hypothetical condition for AR Hotel Pvt. Ltd. , Faridabad, Haryana, India)

Table No. 4

Results/Conclusion



Source: (Physical Data Collection Vs Hypothetical condition in AR Hotel Pvt. Ltd., Faridabad, Haryana, India)

Graph No. 8

Five star Split Inverter AC is the best variant for most effective use energy which create lowest cost for use of electric energy used for cooling to rooms of Hotels or apartments in year 2024.

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