Real time analysis of Air-Conditioners

Harmanjeet Singh Bilkhu : Reversing Global Warming

Problem Statement

Participants are expected to come up with innovative engineering solutions to reduce the deep decarbonisation of our society from all possible pollution sources (cooking, air conditioning, etc.) to reverse the global warming.

Background & Research:

a. Current ways used to counter the problem:

In today's world of rising temperature, finally current generation has realized that 'There is no "Plan B" for action as there is no "Planet B"' i.e. global warming can be harmful to current and future generations. Responding to a question about US president Donald Trump's withdrawal of US from the Paris Accord, Indian Prime Minister Narendra Modi boldly said, "Paris or no Paris, our commitment to preserving the climate is for the sake of future generations". In account to this, various techniques and methods are followed to counter the problem.

The current ways to tackle rising global warming are-

- Expanded use of renewable energy resources like solar energy, wind energy, etc.
- Reduce tropical deforestation by planting more trees around us
- Plastic bans in Mumbai and other cities have been very helpful move by the government for achieving this goal of reduced global warming
- Indian government has also taken efficient steps in order to reduce global warming

b. Pros & Cons of current solution:

Pros of the current ways used to bring down global warming are many. Some of them are –

- Planting more trees is helping reducing temperature and at the same time making environment cleaner, greener and beautiful
- Regarding solar energy, as in India sun is available in almost all the places, solar energy can be widely used as a renewable energy source to generate electricity
- Plastic ban, yes have troubled people a lot because it was a basic need but in the long run we will definitely realize the benefits of this. This

was one of the easiest ways incorporated by Government to tackle global warming.

But as we all know that each coin has two sides, same implies to the above. If there are Pros, but there are some Cons of the cultural ways followed to treat global warming as stated below-

- Statistics from 2011 shows that the literacy rate of India was 75% then, which directly implies that the common man of India is not up to the mark to understand technical terms. Energy efficient devices are available in India but at a very high price
- Common man only understands two things, one is the price and other is the comfort level. Lower price and more comfort level is most of the time satisfied by inefficient products. So it is natural tendency of most of the people to buy those products. People will not be able to understand the efficiency against the high price of the devices
- This ultimately leads to wastage of power, most importantly electricity
- Statistics shown in year 2013 clearly states that of all the energy produced in India, around 71% is generated from thermal power plants (extensively coal) which is one of the extensively used sources of energy. Coal is one of the reliable sources of producing energy in the form of electricity
- The total demand of electricity consumption in India is expected to rise up to 950,000 MW by 2030. This clearly states how extensively coal will be used in future
- Using more and more inefficient products leads to more wastage of electricity which in turn requires more coal and other resources thus leading to increased levels of greenhouse gases which ultimately leads to global warming
- **Electrification is the most direct, effective and efficient way of reaching the decarbonization objectives**

We must try to use electricity everywhere but at the same time **we should not waste it**.

c. Proposed Solution:

One of the ways to educate people about this is giving them accurate and reliable comparison between different products available in markets, be it Air Conditioners (AC) or any other devices. So that they can chose wisely the device which suits best to their pockets, their requirements and most importantly **saving electricity**. This report mainly emphasizes on comparing different types of Air Conditioners (ACs) through interactive GUI based on end user requirements. This information can be best shared to the end users in the form of graphs and numbers which can be easily understood by all. These graphs would include real-time comparison based on various metrics such as BEE ratings, room Dimensions and rated power input.

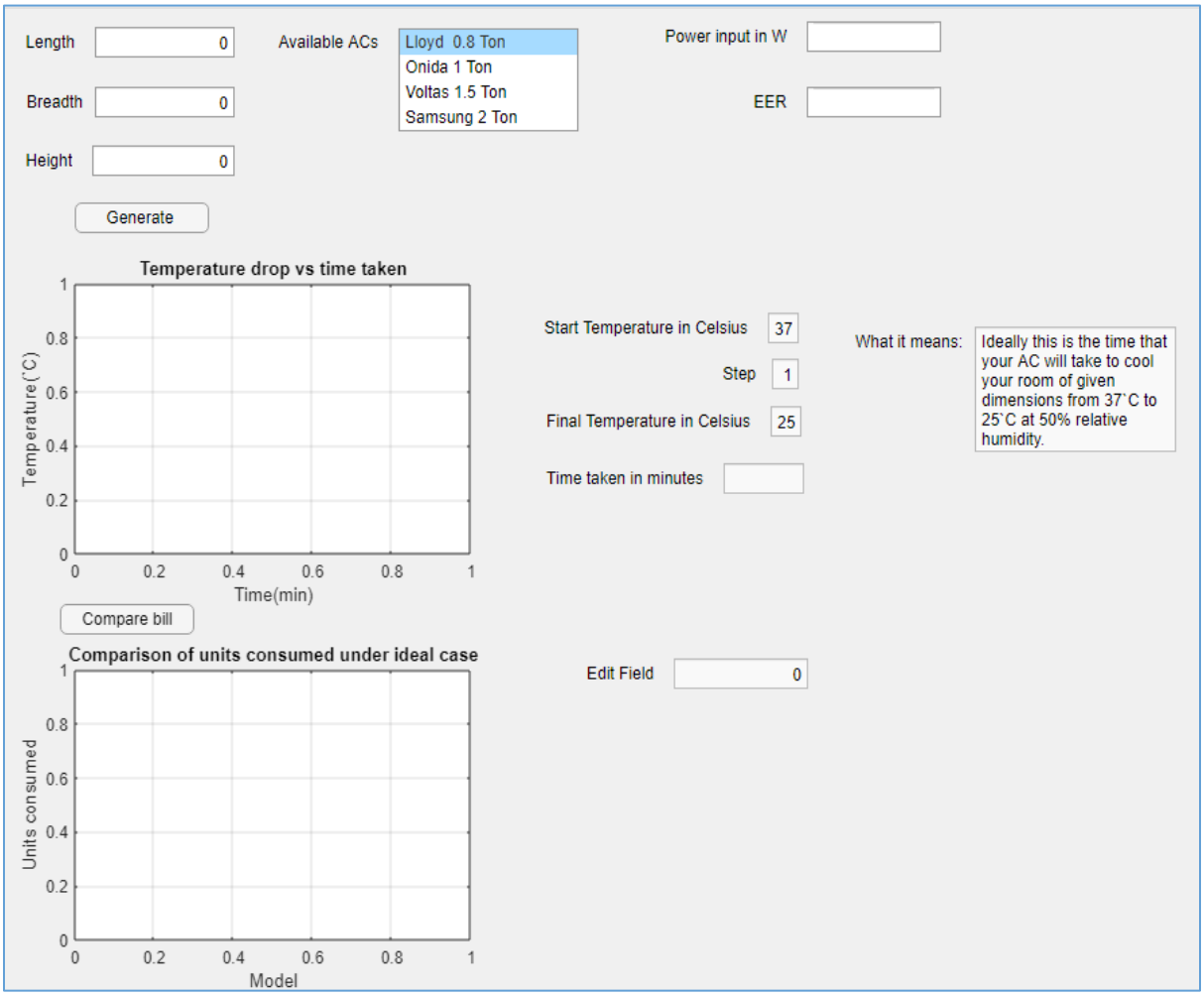


Fig (1): Interactive GUI

d.Originality of your Solution:

There is no existing way which gives the comparison between the usability of different brands of Air Conditioners. The proposed solution is effective way to measure the efficiency of your AC (in ideal conditions) with other brands available in the market, in the form of graphs and other charts which could be easily understood by all, by taking into consideration the room dimensions of the user along with other technical parameters.

Here ideal conditions corresponds to – Outside Temp = 37 °C, Inside Temp = 25°C and 50% relative humidity.

This solution gives the best balanced analysis based on efficiency, comfort level and price of the products.

Technical Report:

The proposed solution for Air Conditioners is basically **interactive GUI** which will take the room dimensions along with the model numbers of different brands of AC's from the user. The database stores the power input and Energy Efficiency Ratio (EER) of all available AC models.

In the beginning, user needs to enter the room dimensions and select the AC models to be compared, which are in his budget and then click on 'Generate' button. Once clicked, the GUI will show the comparison of different models in the form of graphs.

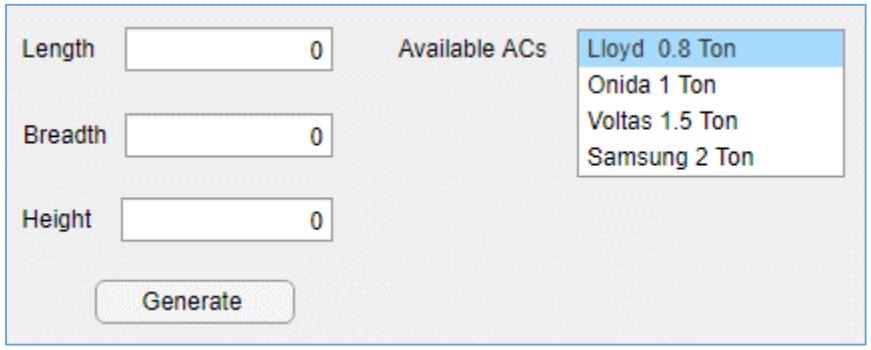


Fig (2): Input Parameters

As shown in Fig (2), the user needs to input the room dimensions in terms of Length, Breadth and Height. Apart from this he needs to select the AC's which the user wants to compare, and click on Generate button.

The results will be shown to the user and they are as follows:

(All results are shown under ideal conditions which is to cool room from 37°C to 25°C)

Considering user enters Length = 12ft, Breadth = 9ft, Height = 10ft and selects all four AC's shown in Fig (2)

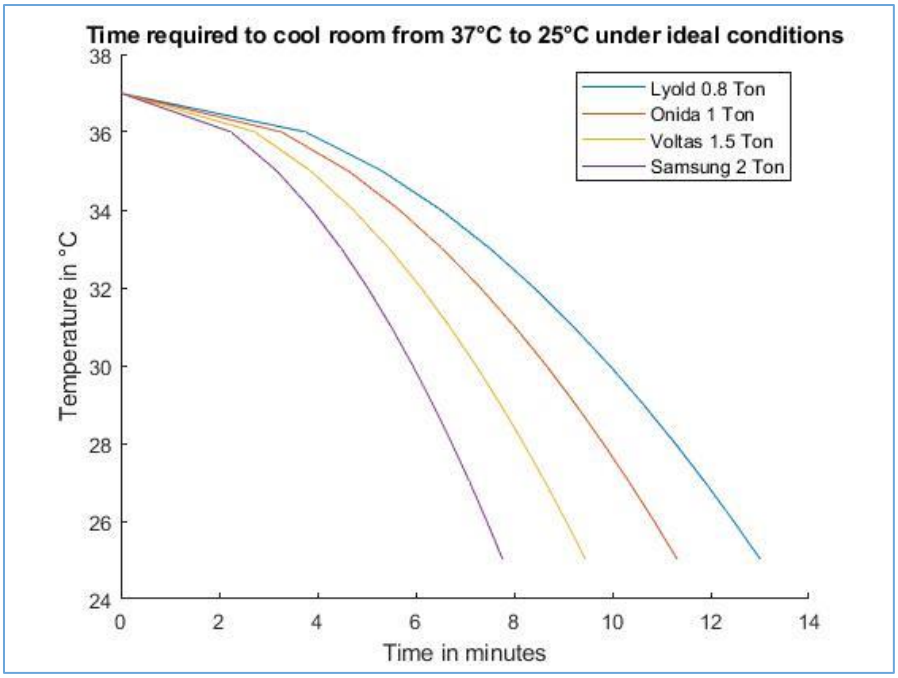

Time required to cool room from 37°C to 25°C under ideal conditions
Lyold 0.8 Ton
Onida 1 Ton
Voltas 1.5 Ton
Samsung 2 Ton
Temperature in °C
Time in minutes
38
36
34
32
30
28
26
24
0
2
4
6
8
10
12
14

Fig (3)

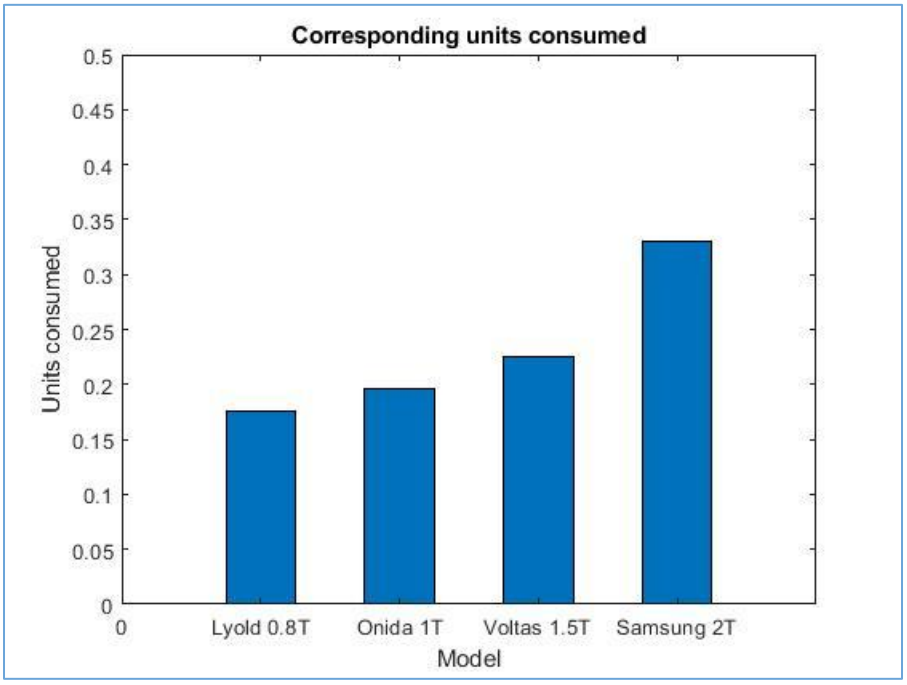

Corresponding units consumed
Units consumed
Model
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
Lyold 0.8T
Onida 1T
Voltas 1.5T
Samsung 2T

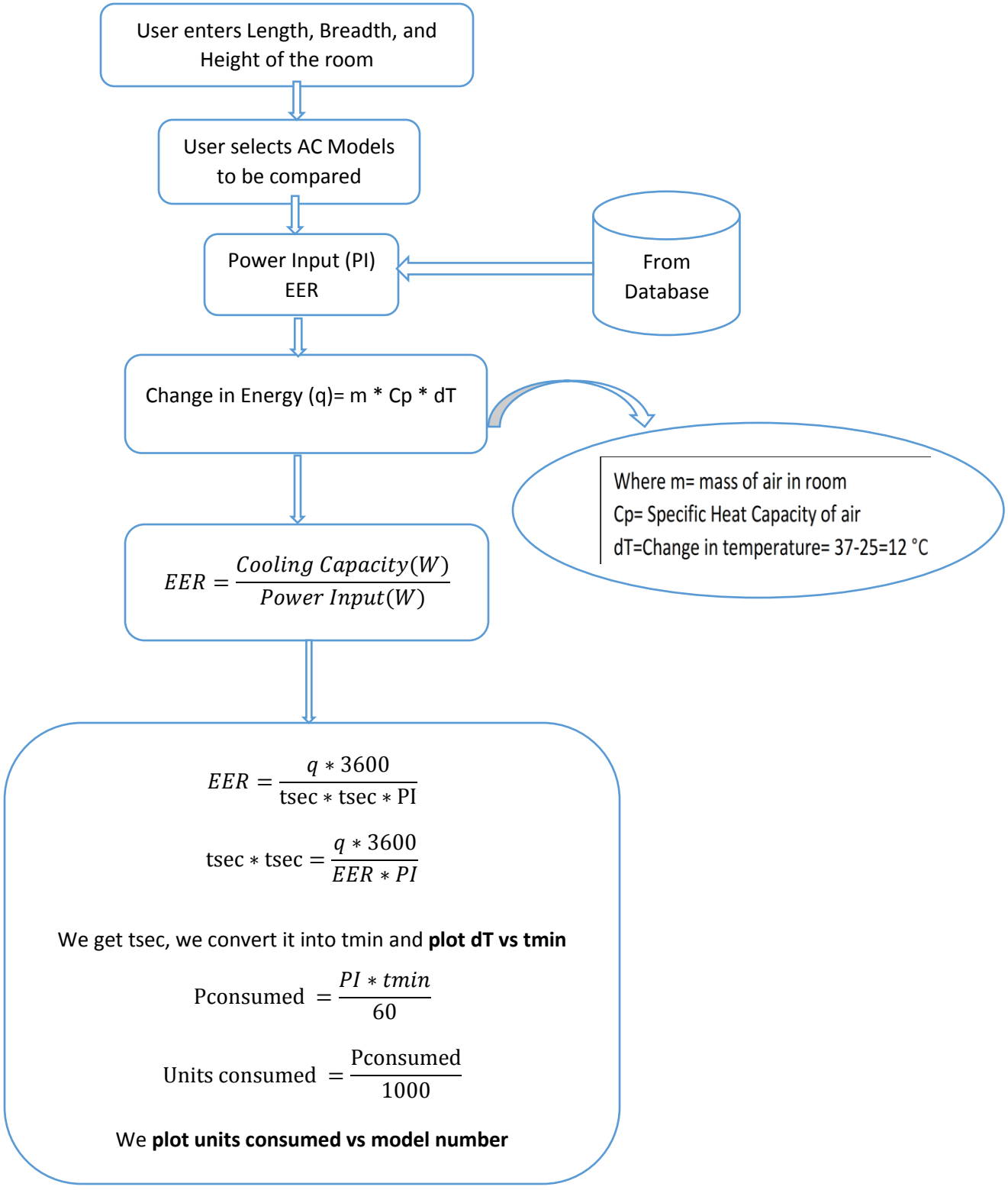
Fig (4)

Fig (3) shows time required by the selected AC's to cool room temperature from 37`C to 25`C. Fig (4) shows the corresponding units consumed by the AC's.

Conclusion:

- Samsung 2 Ton AC: It takes least time but consumes most units
- Lloyd 0.8 Ton AC: It takes maximum time but consumes least units
- Voltas 1.5 Ton & Onida 1 Ton ACs: Both take moderate time to cool the room and both consume moderate units.

At this point the data shows that Voltas and Onida AC's are highly efficient. Both these AC's prove to be profitable on the basis of operating cost and providing comfort levels to the user. Now it depends on user, which one to buy depending on the buying cost. Irrespective of the user choice both will consume less electricity as compared to others, in turn will **save excess coal to be burned, hence reducing greenhouse gases emission.**



Fig(5): Working

Performance:

a. Feasibility & Adaptability of the solution:

This solution can be proactively converted into an interactive app which can be installed on the mobile devices of all the users. And they can easily compare the AC models they want to buy.

Results from this app are easy to understand. A common man with no prior knowledge to the terms like EER, can be easily able to understand the end results and make out an effective conclusion from this.

Results:

a. Accuracy of the solution:

The results shown are based on the ideal conditions. The real time conditions would not be exactly same, but will be close to these conditions. The actual results also depends on the factors like number of people in the room, other electrical devices which emit heat, etc. These will definitely affect the end results and hence to the AC performance.

As this GUI will be mostly used by household families, these extra factors would be moderate and the results will stand out in these conditions.

b. Pros & Cons of the solution:

The proposed solution can become one of the effective ways to reduce electricity consumption in turn reducing greenhouse gases emission. Since there is no pre-requisite for the user to have technical knowledge about the terms used in this GUI, this app proves to be one of the efficient solutions. With this app, even when AC is bought by the user, they can keep on monitoring the performance of the AC.

These all factors will lead to reduction of greenhouse gases emissions thus resulting in decarbonization of the environment. **Thus helping India to achieve the objectives mentioned in the Paris agreement.**

There are few Cons in the proposed solution:

This GUI measures the units consumed by the AC only when compressor is ON. In today's market, invertor AC's are also available in which the compressor keeps on running at slower speed instead of shutting down even after reaching at the desired temperature. It also doesn't include comparison when there are multiple AC's present in the room. Presence of more number of people, electrical appliances which emit heat, etc. will surely reduce the performance and affect the AC efficiency.

Future Scope:

- This GUI can be made to connect to the AC in some or the other ways through which the AC will send different variables like changing temperature, power consumption, compressor on/off time etc. on daily basis. From this data, co-efficient of performance would be calculated daily by the GUI and the user can compare the COPs periodically. If the user finds cumulative decrease in COP then he can take suitable action to know why AC is performing in such way.
- We can include the units consumed by the AC when the compressor is off or running slowly to calculate the total units consumed in real time.
- We can include calculations based on the left out factors like number of people, machines present in the room, multiple AC's etc.
- These all things can be parsed into Android or iOS application which can then be used by everyone.