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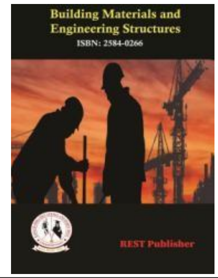

Assessing Sustainable Eco-Friendly Refrigerants: An EDAS Methodology Approach

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Abstract: Environmental concerns have made looking for eco-friendly refrigerants essential in recent years. Natural refrigerants including ammonium (R717), carbon dioxide (R744), & hydrocarbons (R290 and R600a) are some of the most promising alternatives. Compared to synthetic alternatives. Natural refrigerants are the best option for many cooling applications because of their excellent thermodynamic characteristics and energy efficiency. The usage of these environmentally friendly refrigerants will support sustainable refrigeration practises and help to lower greenhouse gas emissions. The search for environmentally friendly refrigerators has drawn a lot of attention recently as environmental concerns have increased. The investigation of alternate alternatives has been motivated by concerns over the negative impact of conventional chemical the refrigerants on the loss of ozone and global warming. Natural refrigerants, which provide a sustainable and environmentally benign alternative to cooling applications, are among the most promising choices. such as ammonia (R717), carbon monoxide (R744), and hydrocarbon (R290 and R600a), have emerged as the best options. for artificial substitutes. This introduction lays the groundwork for further investigation into the characteristics and advantages of these environmentally benign refrigerants. Investigating more suitable eco-friendly refrigerants is crucial for tackling the urgent environmental issues connected to conventional synthetic refrigerants. These refrigerants are problematic in the long run since they contribute to the destruction of the ozone barrier and the acceleration of global warming. Through the identification and promotion of natural refrigerants including ammonia (R717), oxygen (R744), and oils (R290 and R600a), the research seeks to create environmentally friendly alternatives. By using these green refrigerants in cooling systems, greenhouse gas emissions can be significantly reduced, which will help slow the effects of climate change. Additionally, by advancing environmentally conscious and energy-efficient refrigeration technology, our research promotes a more sustainable and greener future. A multi-objective optimisation strategy used to resolve choice issues is called EDAS, which It entails assessing prospective solutions according to how far they are from the Pareto front's average answer, which captures trade-offs between competing goals. By considering both the diversity of the solutions and their proximity to the mean, EDAS seeks to identify the most desirable options. The EDAS methodology assists decision-makers in finding the best solutions that balance various goals by combining these elements. In several disciplines, including engineering, finance, and environmental management, this strategy has been employed with success. Alternative parameters taken as r134a, r152a, r1234yf, r1234ze (E), r1233zd (E), r290, r600a, r744. Evaluation parameters taken as Critical Temperature, Vapor density, Latent heat of vaporization, Critical Pressure, Saturated pressure, Liquid density, Viscosity of liquid. r134a in 6^{th} rank. r152a in 5^{th} rank. r1234yf in 7^{th} rank. r1234ze (E) in 4^{th} rank. r1233zd (E) in 3^{rd} rank. r290 in 2^{nd} rank. r600a in 1^{st} rank. r744 in 8^{th} rank. Best sustainable eco-friendly refrigerants are compared and given rank. According to the characteristics. r134a in 6^{th} rank. r152a in 5^{th} rank. r1234yf in 7^{th} rank. r1234ze (E) in 4^{th} rank. r1233zd (E) in 3^{rd} rank. r290 in 2^{nd} rank. r600a in 1^{st} rank. r744 in 8^{th} rank.

Keywords: *r134a, r152a, r1234yf, r1234ze (E), Critical Temperature*

1. INTRODUCTION

A fantastic way to combat the issue of global warming is to utilise eco-friendly freezers. When choosing new refrigerants, nevertheless, a thorough analysis is required. All products should be assessed for their total environmental impact, energy efficiency, cost-effectiveness, and safety. This work examines the theoretical and practical research on eco-friendly refrigerants, including hydrocarbons, hydrofluorocarbons, carbon dioxide, R744, hydrofluoroolefin, and nano-refrigerants. The paper's major goals are to assess the potential of every refrigerant used in the air conditioning and refrigeration sectors and to outline the key uses of nano- and environmentally friendly refrigerants. But with the Kigali Accord in 2016, debate concerning the high warming potential (GWP) of HFCs arose. The degradation of ozone potential (ODP) and global warming potential (GWP) can be decreased by using eco-friendly refrigerants like hydrocarbon (HCs), hydrofluoric polyolefin (HFO), R744 (carbon dioxide), and environmentally friendly nano-refrigerants [1]. Solar cells, solar power, and electronic gadgets that utilise renewable energy are cooled using both inorganic and organic refrigerants. The relevance of green power in the neighbourhood has accelerated growth within this area during the previous few years. In the HVAC sector and in supermarkets around the world for both preservation and frozen food refrigeration, R134a, R404, and R717 are now the most frequently utilised refrigerants. Due to its significant potential for global warming (GWP) and subpar energy use in many uses, R134a and R404A, also have three important disadvantages. Therefore, using the HVAC Division and Supermarkets (MCDN) tools, optimisation experiments were conducted to choose refrigerants with poor global efficiency in place of R134a and R404A [2]. This study was motivated by the major warming potential (GWP) and ozone-depleting potential (ODP) of refrigerants, as well as by its adverse effect on the climate and the near environment. The favoured alternative refrigerants now are natural ones, & substance make up one of those having 0% ODP and very low GWP. To enhance and enhance the reliability of the system, the performance elements of the cooling system were experimentally assessed using the ecologically benign condensation HC600a is a comparable to HFC134a. To contrast the materials, 46 g weight offers of an amalgam (70 grammes) of conventional refrigerant (HFC134a) and HC600a were utilised. Thermodynamic parameter study was performed on the imposed masses costs, battery consumption, COP, cooling load, and draw time (PDT). The thermodynamic characteristics of a vapour compression system (VCS) were recorded using REFPROP software [3]. The study discusses the secondary evaporator circuit, overall compressor heat transfer coefficient, and performance parameters of vapour compression refrigeration systems without secondary fluid input levels, eco-friendly refrigerants, and nanomaterials. principal circuit, compressor power usage, and overall energy efficiency of the system. This comparison of the thermal properties of nanofluid based on various nanoparticles (i.e., Al2O3, TiO2) as auxiliary fluid in a vapour compression refrigeration system is made possible with the use of the Mechanical Problem-Solving Software (EES) tool. Elsevier Ltd. reserves all rights for 2020. [4]. Insist on using cutlery, glass, and reusable plastics. Install dispensers with refills and remove little disposable bottles from the garbage in the guest bathrooms. 5 5 Demand that products come in the fewest possible quantities packaged and give the purchasing staff instructions to buy items in bulk. Use fewer chemicals. Make a list of the detergents and cleansers that are currently in use and check to see which ones are harmful. A fast-expanding trend is the switch from harmful cleaning solutions to non-toxic ones [5]. Regulations mandate that working fluids in household refrigeration systems have low warming potentials (GWPs) of 150 or less. The performance of a total of five new refrigerant mixes (R440A, R441A, R444A, R445A, and R451A) with ODP and GWP < 150 was therefore theoretically studied in this work. The findings demonstrated that all the refrigerants under study had extremely low stress ratios. R451A and R440A had average discharge temperatures that were 8 and 7% lower than R134a, respectively. R451A and R440A can be used as R134a substitutes since they share the same vapor-specific volume & pressure-temperature properties as R134a. In comparison to R134a, R440A and R451A have higher COPs & volumetric cooling capacities (VCC). Their respective average COPs were 14 or 5% higher than R134a. R441A and R445A have average electricity consumptions (SPCs) that are 56 and 44% higher, respectively, than R134a, whereas R440A and R451A have average SPCs that are 8 and 4% lower, etc. R440A and R451A regularly outperformed R134a in every way, according to all performance metrics considered, but R441A and R445A generally performed badly [6]. For fishery products after harvest, cooling technology is crucial. Additionally, Indonesian is a tropical country with high temperatures. Fish can have their shelf life extended by lowering temperatures. Fish that has been frozen can be kept for a long time. Fish must be frozen before being placed in low-temperature cold storage. The operating substance utilised in freezing facilities to chill low-temperature spaces and disperse heat in high-temperature surroundings is known as refrigerant. R-22, which contains HCFCs, is the most widely used coolant in cold storage. A gas called soli has a the ODP (ozone depletion potential), whereas a gas called wheat has a GWP (global heating potential). Implementation of the government's phase-out management strategy for hydro fluorocarbon started in 2015 [7]. It compares R12 to the compressor performance of five environmentally friendly refrigerants. The efficiency of the system using refrigerants was assessed using a test rig for a full cooling system that included a reciprocating compressor. According to the data, R134a and R152a, which have efficiency ratings of R12 with reductions of 6.6% and 3.1%, respectively [8]. In order to replace R-134a refrigerants, a recently developed vapour compression cooling system (VCRS) using environmentally friendly R1234ze or R1234fyare has been evaluated under varied operating conditions. Efficiency and labour are analysed. Additionally, a thorough investigation is made to determine the impact of subcooling temperatures on the functionality and radical decomposition of all VCRS components. To achieve the operating efficiency, it was calculated that the mechanical devices would need to be extensively destroyed. The thermal refrigerant characteristics were obtained using the Engineering The formula Solver (EES) software programme for simulation and analysis of the VCRS, which was developed to find the best replacement for the VCRS that operates with greater environmental friendliness, power, and energy efficiency. R134a replacement refrigerant [9]. We investigated how Heating efficiency was higher by 13.8% and 17.53% and lower by 45.8%

and 64.7% compared to R134a. In comparison to R13, the energy loss in the evaporator compressor, condenser, and capillary tube were, respectively, 38.27% and 35.5% lower, 49.19% & 55.56%, 29.7% & 33.7%, 39.1%, and 73.8% lower. By drastically reducing the exigic loss within the compressor, refrigerants with nano-lubricant mixtures generally outperformed pure refrigerants in terms of performance. LPG + TiO2 (0. 15wt%) also performed better in terms of energy efficiency and refrigeration system. Analysis of fitness [10].

2. METHODOLOGY

EDAS method: The EDAS approach evaluates alternatives using an average solution. The positive distance from the mean & Nda represent the two measures that are taken into consideration for evaluation in this method, which was created in (2015). In situations where there are some competing criteria, this strategy is most useful. Measuring the distance from both the negative and positive optimal solutions yield the best alternative in compromise MCDM approaches like VIKOR and TOPSIS. The best MCDM approach has the greatest distance from the ideal solution that is negative (NIS) and the least distance from the ideal solution that is positive (PIS) among these methods [11]. proposed multi-objective optimisation based on ratio estimation (MULTIMOORA) in conjunction with the EDAS method of evaluation. The six categories with the highest rankings were political and regulatory barriers, and the sub-barriers with the highest rankings were corruption and nepotism. The results point to the necessity for defined criteria for renewable energy, grid connection allocations, and streamlining of certification processes. For inclusivity and sustainability, a top-down approach to green energy policy is preferred. Additionally, a system has been created to evaluate the degree to which each obstacle impedes the development of renewable energy [12]. Decision-makers typically want more adaptable methods for effective analysis in the final assessment of options because stochastic MCDM problems have unclear data. Although there are various ways to approach stochastic MCDM issues, the majority of them do not combine the fundamental characteristics of statistical distributions with MCDM techniques. As a result, current techniques frequently necessitate intricate computations and offer rigid solutions to decision-makers. This work intends to provide a solution based on the features of the normal distribution and the EDAS approach in response to this issue. The suggested method can offer both positive and negative outcomes, giving decision-makers flexibility in their assessment. The key benefit of the suggested strategy is this feature. We presume that the MCDM problem's performance values reflect a normal distribution. The normal distribution, which is beneficial in many situations and areas of science and engineering, is the most significant and often used distributed in statistics [13]. First, the MACBETH method is used to calculate the weights for the evaluation criterion. The EDAS approach is then used to rank the different steam boiler options. The best boiler for steam substitute is ultimately chosen. For challenges with firm selection, several multiple-criteria decision-making (MCTM) techniques have been suggested. Additionally, MCDM techniques, MACBETH and EDAS have been used in a variety of literature applications. This paper's integration of the MACBETH and EDAS methodologies is a unique aspect. This study is the first in the literature to combine both MACBETH and EDAS methodologies. Due to the MACBETH method's recent development and usage of the Analytical Hierarchical Process (AHP) to establish the weight of the criterion, these two techniques were selected [14]. based on the HF-EDAS proposal. This study demonstrates how the distance between the average 187 answer (EDAS) technique and the cautious fuzzy sets of 188 (HFSs) approach may be used to assess the quality of service of hospitals' 186 stories. There are two private hospitals in competition—189 and 190—and you must choose one based on a few contradictory factors. 192 Health care providers have largely ignored the evaluation of service quality, despite it being crucial to human life. The service quality metrics intersect with 194 in the goal 193 of this study in the context of the 4 SERVQUAL (Service dimensions, and their significant levels are determined using the HF-196 EDAS method. Three 197 decision-makers 198 were rated on three different aspects of service quality, such as responsiveness, dependability, 199 empathies, and aggressiveness [15]. To integrate the benefits of these sets, including the independence of neural set subsets and relativity and reflection of expert completeness, the EDAS technique was first extended to neuromorphic sets. Professionals have more freedom when assigning value to subgroups thanks to this freedom. All the benefits for neuromorphic sets above other set types are included in the neurotropic EDAS approach that is being presented. Since they began to appear in the literature, kind-2 fuzzy sets have caught the interest of numerous scholars. They are commonly employed in information granularity, probabilistic clustering, fuzzy control applications, and image processing [16]. The achievement of construction projects depends on selecting the best subcontractors for outsourcing. This will raise the general quality of undertakings and enhance the skill and standing of important contractors. In accordance with certain criteria, experts or decision-makers may evaluate subcontractors. A fluid multi-criterion collective decision-making (MCGDM) dilemma is how it is described. In this article, we offer a novel fuzzy dynamic MCGDM strategy for subcontractor assessment based on the EDAS, which (estimation dependent on distance to average solution) method. The list of possibilities, the selection process, and the decision-makers can all be altered over the course of the proposed approach's implementation. Additionally, in order to incorporate the general outcome of the alternatives, the proposed approach assigns higher weight to the new judgement information [17]. Our covering-based varied precision fuzzy roughness set (CVPFRS) model, which addresses the issue of misclassifications or perturbations in decision problems, is created using such an operator. We offer a new way for resolving multi-attribute making choices (MADM) problems by fusing the CVPFRS framework with two conventional decision-making techniques (also known as the PROMETHE technique and the DEAS method). The usefulness of the suggested approach is illustrated with an exemplary example. By contrasting the new method with existing ones, its effectiveness is confirmed. We offer an experimental investigation to demonstrate the validity and reliability of the suggested strategy through the cross-validation and hypothesis verification [18]. Next, we suggest an extended EDAS based on EDAS. Language Neural Numbers (LNNs) are used to present the evaluation data, and predicted functions are considered. A key phase in the MCGDM dispute resolution procedure is obtaining criterion weights. The criterion values are fully known in the best instances. However, due to the limitations of a DM's expertise and the intricate nature of the environment, it is frequently challenging to establish precise values of criterion weights. As a result, weight information is frequently only partially or never known. Therefore, it is crucial that scale weights are derived correctly. In order to collect objective weight information, we develop a single-objective programme model based on language neural positive best solution in this study [19]. We use multi-attribute groups selection (MAGDM) with PLTS to the distance-based estimate from average answer (EDAS) technique. First, a brief introduction to the PLTS idea, the comparison formula, and distances. Then, in order to address the MAGDM issues in PLTSs, an expanded EDAS approach is applied. The usefulness of the expanded method is also confirmed using a computer example involving sustainable supplier ordering. As an outcome, the example demonstrates how simple it is to comprehend and use this strategy. [20] Other selection issues can also be solved by employing this strategy to choose the best option.

Alternative parameters

R134a: R134a is a widely used hydrofluorocarbon (HFC) coolant that is non-flammable and toxic-free. It is frequently utilised in automobile air conditioning systems despite having a high warming potential (GWP).

R152a: Another HFC refrigerant with a lower GWP than R134a is R152a. Small refrigerated and cooling applications employ R152a.

R1234yf: Known for being a hydro fluoroo lefin (HFO) the refrigerant R1234yf is regarded as an environmentally beneficial and much lower GWP alternative. It is primarily utilised in air conditioning systems for automobiles.

R1234ze(E): R1234ze (E): A low GWP HFO refrigerant, R1234ze (E) is used in chillers and heat pumps, among other industrial and industrial refrigeration systems.

R1233zd(E): An HFO refrigerant that balances effectiveness and environmental impact is R1233zd (E), which has a very low GWP. Large-scale cooling systems, like centrifugal chillers, frequently use it.

R290: R290 is a hydrocarbons refrigerant having a low GWP that is also referred to as propane. It is perfect for residential refrigerators, freezers, and small air conditioners thanks to its outstanding thermodynamic qualities.

R600a: R600a is an isobutane hydrocarbon refrigerant that is frequently used in commercial refrigeration applications as well as home refrigerators and freezers because of its low GWP.

R744: It Commonly called the gas carbon dioxide (CO2), which R744 acts as a natural coolant that has become more well-liked because of how little of an influence it has on the environment. Commercial refrigeration, heat pumps, and auto air conditioning systems all use it.

Evaluation parameters

Critical Temperature: The maximum temperature at which a substance can exist in equilibrium as both a gaseous state and a gas is known as the critical temperature. No pressure can cause the material to liquefy above this temperature. It is a crucial factor in comprehending how a material behaves and what its limitations are in a variety of processes, including industrial and refrigeration ones.

Vapor density: Vapour density is the ratio of the weight of a vapour compared with the mass of empty air at the identical pressure and temperature at a given volume. It sheds light on the vapor's molecular composition and density. In safety assessments and ventilation design, vapour density is a crucial factor in figuring out how vapours behave and are distributed in the atmosphere.

Latent heat of vaporization: The quantity of heat energy needed to transform an item from its state of liquid to its vapour state, at the same pressure and temperature, is known as the latent heat of vaporisation. It is an indicator of the amount of energy needed to bring about a phase change. Since it controls the flow of energy during phase transitions, the latent heat of vaporisation is an important characteristic in numerous applications, notably heating and cooling systems. Critical

Pressure: The pressure needed to cause a substance to liquefy at its ideal temperature is known as the crucial pressure of that substance. It stands for the highest possible pressure for a vapour phase. When constructing and running high-pressure systems, such economic processes and compression systems, it is essential to comprehend critical stress.

Saturated pressure: Saturated Pressure: At a specific temperature, a substance's liquid and vapour phases are in equilibrium at the saturation pressure. It is a key characteristic that is used to gauge the melting and boiling temperatures of various substances. For several applications, such as freezing, filtration, and process control, understanding saturation pressure is crucial.

Liquid density: The weight of a fluid per unit volume is referred to as liquid density. It gives details on how dense or compressible a liquid substance is. As it impacts buoyancy, flow behaviour, and separation processes, fluid density is a crucial parameter in several fields, include chemical engineering, materials research, and environmental studies.

Viscosity of liquid: Viscosity is a metric for a fluid's flow resistance. It evaluates a fluid's capacity to deform in response to a given amount of shear stress by measuring the internal friction inside the fluid. Fluid dynamics considers viscosity as a key characteristic, and it is crucial to many industrial operations like lubrication, mixing, and pumping.

3. RESULT AND DISCUSSION

TABLE 1. Best suitable eco-friendly refrigerants

Refrigerants	E1	E2	E3	E4	E5	E6	E7
R134a	102	17.1	194.7	41	3.49	1278.1	250
R152a	113.4	9.89	301.9	45.1	3.14	947.7	206
R1234yf	95	20.7	160.02	34	3.73	1160.4	196
R1234ze (E)	109.4	40.6	154.8	36.3	2.59	1111.5	269
R1233zd (E)	166.6	35.6	188.52	36.2	0.59	1319.8	470
R290	96.74	11.9	367.73	42.5	5.51	521.75	119
R600a	134.6	5.01	349.56	36.3	1.87	574.8	187
R744	30.98	114	214.98	73.8	39.7	896.03	90.8
avj	106.09	31.85	241.5263	43.15	7.5775	976.26	223.475

Table 1. shows the Best suitable eco-friendly refrigerants. Alternative parameters are r134a, r152a, r1234yf, r1234ze (E), r1233zd (E), r290, r600a, r744. Evaluation parameters are Critical Temperature (E1), Vapor density(E2), Latent heat of vaporization(E3), Critical Pressure(E4), Saturated pressure(E5), Liquid density(E6), Viscosity of liquid(E7).

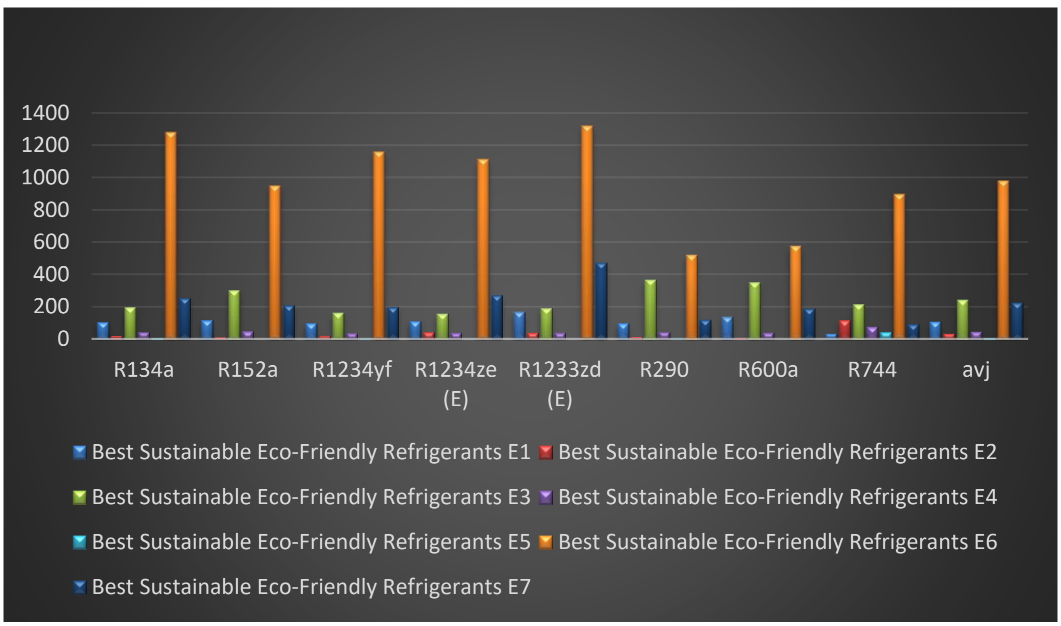

FIGURE 1. Best suitable eco-friendly refrigerants

Figure 1 illustrates the Best suitable eco-friendly refrigerants. Alternative parameters are r134a, r152a, r1234yf, r1234ze (E), r1233zd (E), r290, r600a, r744. Evaluation parameters are Critical Temperature (E1), Vapor density(E2), Latent heat of vaporization(E3), Critical Pressure(E4), Saturated pressure(E5), Liquid density(E6), Viscosity of liquid(E7).

Table 2. Positive Distance from Average (PDA)

E1	E2	E3	E4	E5	E6	E7
0	0	0	0.049826	0.539426	0	0
0.068904	0	0.249968	0	0.585615	0.029255	0.078197
0	0	0	0.212051	0.507753	0	0.122944
0.0312	0.274725	0	0.158749	0.658199	0	0
0.570365	0.117739	0	0.161066	0.922138	0	0
0	0	0.522526	0.015064	0.272847	0.465562	0.467502
0.268734	0	0.447296	0.158749	0.753217	0.411222	0.163217
0	2.579278	0	0	0	0.082181	0.593691

Table 3 shows the positive distance from average. It is obtained by comparing value to the 0 and divide those value by average.

$$PDA_{ij} = \begin{cases} \dfrac{\max(0, (x_{ij} - AV_{ij})}{AV_{ij}} & \mid j \in B \\ \dfrac{\max(0, (AV_{ij} - x_{ij})}{AV_{ij}} & \mid j \in C \end{cases}$$

Table 3. Negative Distance from Average (NDA)

E1	E2	E3	E4	E5	E6	E7
0.038552	0.463108	0.193876	0	0	0.30918	0.118693
0	0.689482	0	0.045191	0	-0.02925	0
0.104534	0.350078	0.337463	0	0	0.188618	0
0	0	0.359076	0	0	0.138529	0.203714
0	0	0.219464	0	0	0.351894	1.103144
0.088133	0.626374	0	0	0	-0.46556	0
0	0.8427	0	0	0	-0.41122	0
0.707984	0	0.10991	0.710313	4.239195	-0.08218	0

Table 4. shows the negative distance from the average. it is obtained as same as PDA but in vice versa concept.

$$NDA_{ij} = \begin{cases} \dfrac{\max(0, (AV_{ij} - x_{ij})}{AV_{ij}} & \mid j \in B \\ \dfrac{\max(0, (x_{ij} - AV_{ij})}{AV_{ij}} & \mid j \in C \end{cases}$$

TABLE 4. Weight

E1	E2	E3	E4	E5	E6	E7
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857
0.142857	0.142857	0.142857	0.142857	0.142857	0.142857	0.142857

Table 4 is the weighted matrix. The value for weight is obtained by 1 divided by the now of columns.

Table 5. Weighted PDA

E1	E2	E3	E4	E5	E6	E7	SPi
0	0	0	0.007118	0.077061	0	0	0.084179
0.009843	0	0.03571	0	0.083659	0.004179	0.011171	0.144563
0	0	0	0.030293	0.072536	0	0.017563	0.120393
0.004457	0.039246	0	0.022678	0.094028	0	0	0.16041
0.081481	0.01682	0	0.023009	0.131734	0	0	0.253044
0	0	0.074647	0.002152	0.038978	0.066509	0.066786	0.249072
0.038391	0	0.063899	0.022678	0.107602	0.058746	0.023317	0.314634
0	0.368468	0	0	0	0.01174	0.084813	0.465021

Table 6 shows the weighted PDA and SPI. these values are calculated by multiplying the weight into PDA.

$$NSP_i = \frac{SP_i}{max_i(SP_i)}$$

TABLE 6. Weighted NDA

E1	E2	E3	E4	E5	E6	E7	SNi
0.005507	0.066158	0.027697	0	0	0.044169	0.016956	0.160487
0	0.098497	0	0.006456	0	-0.00418	0	0.100774
0.014933	0.050011	0.048209	0	0	0.026945	0	0.140099
0	0	0.051297	0	0	0.01979	0.029102	0.100188
0	0	0.031352	0	0	0.050271	0.157592	0.239214
0.01259	0.089482	0	0	0	-0.06651	0	0.035563
0	0.120386	0	0	0	-0.05875	0	0.06164
0.101141	0	0.015701	0.101473	0.605599	-0.01174	0	0.812174

Table 6 shows the weighted NDA and SNI. these values are calculated by multiplying the weight into NDA.

$$NSN_i = 1 - \left(\frac{SN_i}{max_i(SN_i)}\right)$$

TABLE 7. NSPI, ASI, RANK

	NSPi	NSPi	ASi	Rank
R134a	0.181022	1	0.590511	6
R152a	0.310873	0.875921	0.593397	5
R1234yf	0.258897	0.827501	0.543199	7
R1234ze (E)	0.344953	0.876642	0.610797	4
R1233zd (E)	0.544156	0.705464	0.62481	3
R290	0.535613	0.956212	0.745913	2
R600a	0.6766	0.924105	0.800353	1
R744	1	0	0.5	8

The above table shows the NSPI, ASI, RANK. r134a in 6th rank. r152a in 5th rank. r1234yf in 7th rank. r1234ze (E) in 4th rank. r1233zd (E) in 3rd rank. r290 in 2nd rank. r600a in 1st rank. r744 in 8th rank.

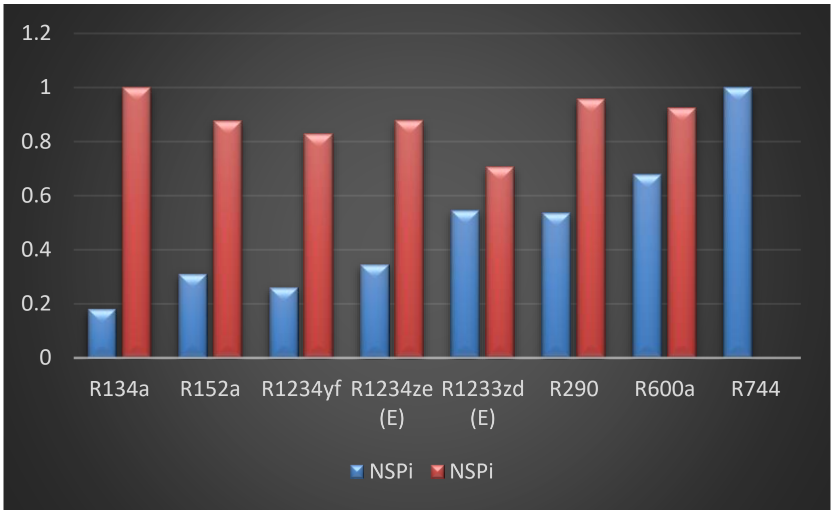

FIGURE 2. NSPI

This graph shows the values of NSPI, NSNI.

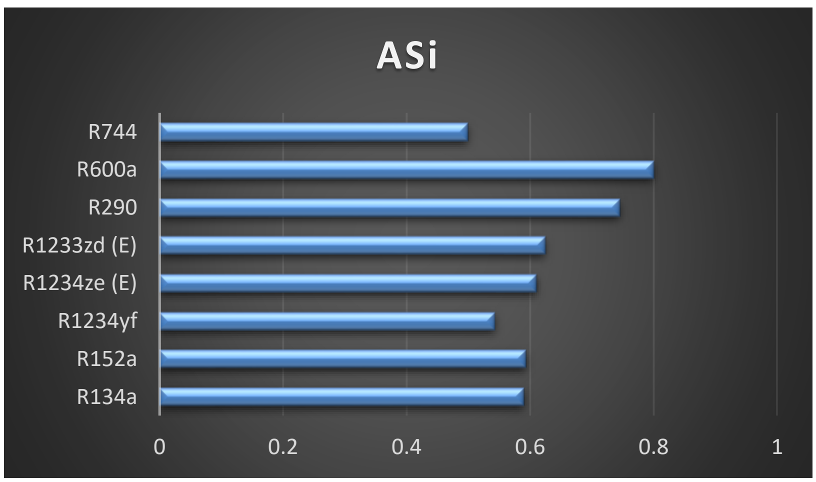

FIGURE 3. ASI

This graph shows the ASI of the data set. It is found by averaging the NSPI columns.

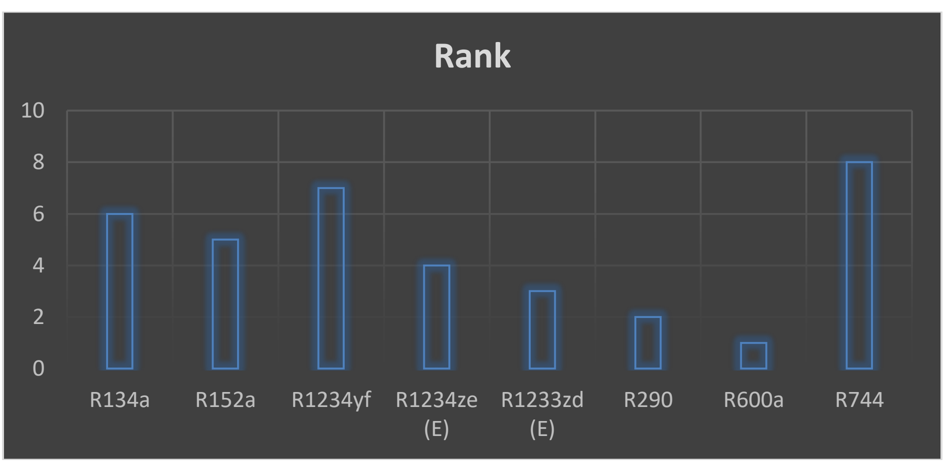

FIGURE 4. RANK

This graph shows the rank of the different materials. According to the characteristics comparison of the materials. r134a in 6th rank. r152a in 5th rank. r1234yf in 7th rank. r1234ze (E) in 4th rank. r1233zd (E) in 3rd rank. r290 in 2nd rank. r600a in 1st rank. r744 in 8th rank.

4. CONCLUSION

In conclusion, selecting the finest environmentally friendly and sustainable refrigerants is essential to halting global warming and minimising the adverse effects of refrigeration systems on the environment. Over time, numerous environmentally acceptable substitutes for conventional refrigerants like hydrofluorocarbons, or HFCs, have been available. The low warming prospective (GWP) and ozone-depleting prospective (ODP) of natural refrigerants such hydrocarbons (HCs), greenhouse gases (CO2), and ammonia (NH3), among others, have made them popular alternatives. Due to their low ecological impact, HCs like gas (R-290) and a mixture of is (R-600a) are frequently utilised in residential refrigerators and freezers. Another common refrigerant ideal for industrial and commercial applications, notably trans critical systems, is CO2, commonly referred to as R-744. Due to its widespread use in industrial applications and large-scale refrigeration, NH3, or R-717 good thermodynamics and no global warming potential. It is crucial to keep in mind every cooler have its own benefits and drawbacks, and the optimal cooler to choose will depend on the system needs, safety concerns, and local laws. In addition, continuous development and research in the coolant sector examines new possibilities that are more efficient and sustainable. Policymakers, business, and consumers must prioritise the use of green refrigerants while minimising the usage of high greenhouse gas emissions refrigerants in order to create a sustainable future. These include making investments in effective refrigeration technologies, encouraging safe handling and disposal procedures, and increasing knowledge of the effects of refrigerants on the environment. We can drastically cut emissions of carbon dioxide and preserve a healthy, sustainable Earth for future generations by making wise decisions and embrace sustainable options. The EDAS technique includes the distance-to-average-solution idea, which aids decision-makers in balancing trade-offs between several criteria and locating the best alternative. The method offers a quantitative assessment of the relative effectiveness of alternatives across several criteria by computing the Euclidean distance that lies among each option and the average solution. The EDAS system's simplicity and transparency, which make it usable by a variety of decision-makers, are among its strengths. By openly stating their picks and values for each criterion, decision-makers can make sure that subjective considerations are taken under account. The EDAS approach has some drawbacks. It makes the supposition that each criterion is distinct and equally significant, which could not always correctly reflect actual situations. Additionally, because the technique is sensitive to alterations in the weights given to criterion, decision-makers should thoroughly analyse and support their choices. In general, the EDAS methodology is a useful tool of multi-criteria decision since it offers an organised framework for assessing options and encourages educated decision-making. When applied properly, it can aid decision-makers in navigating complex problem-solving scenarios and pinpointing the best options in light of their unique preferences and standards.

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