

Comparative Analysis of Alternatives of R-22 Refrigerant in Vapour Compression Refrigeration Cycle for Eco-Friendly environment: A Survey of Recent States of Arts

Rajni Kant Kumar¹ Ashish Verma²

^{1,2}Department of Mechanical Engineering

^{1,2}RITS, Bhopal India

Abstract— Vapour compression refrigeration is employed in nearly 80 take advantages of the refrigeration industries within the world for refrigeration, heating, ventilating and air-con. The finest energy consumption of those devices is extremely high and therefore the operating substance creates environmental issues thanks to environmental unfriendly refrigerants like Chlorofluoro carbons, hydro chlorofluoro carbons and hydro fluoro carbons. Heating, ventilating, air-con and refrigeration industries square measure sorting out ways in which to extend performance, sturdiness of equipment's and energy potency in a very property approach whereas reducing the price of producing. With this refrigerants environmental issues like ozonosphere depletion, heating potential, greenhouse gases and carbon emission square measure increasing day by day. during this paper, the favored refrigerant is completely studied through an experiment and suggestions square measure given for alternatives like dioxide, ammonia and hydrocarbons and new unnaturally created fluid, Hydro- Fluoro-Olefin 1234yf by DuPont and Honeywell that exhibit sensible thermo-physical and environmental properties and can be commercialized within the close to future.

Key words: Alternatives of R-22, GWP, ODP, Ecofriendly with Environment, Carbon Emission

I. INTRODUCTION

The trade that never lags behind in its contribution to the social, economic and environmental pillars of property development is refrigeration. The refrigeration trade is an indicator of the event of the country. On the opposite hand, it's vital to reduce emission of refrigerants to scale back the impact on the surroundings and to scale back energy consumption of refrigerators and air conditioners (Awad et al. [1] and Fernando et al.). The primary generation of refrigerants was introduced within the decennium, with the invention of the vapor-compression machine by Perkins. For nearly a hundred years (1830–1930) no matter worked as a refrigerant [e.g. greenhouse emission (CO₂), ammonia (NH₃), dissolvent (CCl₄), hydro carbons (HCs), water (H₂O), etc.] was used for refrigeration and air-con (Perkins [27]). Most of them were cyanogenic, burnable or each. Some refrigerants, like element (ethyl) ether, ammonia and organic compounds were extremely reactive. Several accidents occurred because the primary goal was solely to supply refrigeration at that point. DuPont's "Freon" merchandise, chlorofluorocarbons, CFC-11, CFC-12, and hydro fluorocarbons, HCFC-22 were in all probability the foremost well-known halocarbon refrigerants for the refrigeration and air-conditioning trade. CFCs were the refrigerants of selection for refrigeration and air-con system from the inventions within the 1930s till their ultimate end within the 1990s in accordance with the city Protocol. For

nearly half a century, fluorocarbons are the dominant selection of refrigerants till they were related to the "ozone hole" story—the initial world environmental drawback known by Molina and Rowland (Philip et al). Since then, a landmark international written agreement, i.e. the city Protocol was created in 1987 to safeguard the ozonosphere. Chlorinated and brominated refrigerants, together with similar solvents, foam processing agents, aerosol propellants, fireplace suppressants and alternative chemicals are scheduled to be phased out. Gas depletion was the sole environmental concern at that point. However because of environmental considerations like gas depleting potential (ODP), increase in heating potential (GWP), greenhouse gases (GHG), carbon emissions, CFCs were prohibited and so additional analysis continued. Heating potential could be a relative live of what quantity heats are often at bay within the atmosphere. It's a relative scale that compares the gas in question to it of an equivalent mass of greenhouse emission whose GWP is by definition one. GWPs are calculated because the magnitude relation of the radiative forcing that will result from the emissions of one kilo of a greenhouse emission to it from emission of one kilo of greenhouse emission over an amount of your time, (UNEP and Daniel et al) (Table 1).

The second generation was distinguished by a shift to fluoro chemicals for safety and sturdiness as HCs had some accidents, thus CFCs like R-11 (CCl₃F), R-12 (CCl₂F₂) and HCFC, R-22 (CHClF₂) were used and serve the refrigeration and air-con trade for an extended time. Third generation was associated with gas depletion protection.

The halogen atom in CFCs and HCFCs reacts with gas molecules and destroys ozonosphere within the layer, nearly eleven kilometer from the world surface that acts sort of an umbrella for the world by fascinating ultraviolet (UV) rays from the Sun. The Vienna Convention and ensuing city Protocol forced the abandonment of gas depleting substances (ODSs) for developed countries, to end CFC refrigerant use in new instrumentation by 1996 and for developing countries by 2010, requiring end of R-22 by 2010 in new instrumentation then ban all HCFC use in new instrumentation by 2020. Fourth generation is currently associated with heating (Calm et al.) (Figure1). The Kyoto Protocol, consistent to the world organization Framework Convention on global climate change (UNFCCC), sets binding targets for greenhouse emission emissions supported calculated equivalents of greenhouse emission, methane, inhalation anesthetic, HFCs, per fluorocarbons (PFCs) and greenhouse emission. The eu Parliament set the temporal arrangement with a directive that bans fluoro chemical (F-Gas) refrigerants having GWPs Olympian one hundred fifty for a hundred years integration in air

conditioners for brand spanking new model cars effective from 2011 and for all new cars beginning in 2017. The immediate result of those measures is to ban R-134a (C2H2F4) that is most generally employed in the planet as a refrigerant in mobile air conditioners. Because of the potential heating caused by HFC refrigerants, there's an increasing universal interest to analysis environmentally friendly fluids in refrigerants and different approaches to the normal dry enlargement (DX) cooling system (Tony [37]

and Cavallinia et al. [4]). These refrigerants embody ammonia, greenhouse emission, hydrocarbon, R-152a and HFO-1234yf. The key drawbacks of those refrigerants are their potential flammability and alternative safety hazards. A way to beat this issue is to use the new refrigerants in conjunction with a secondary loop cooling system (Kai et al. [18]). Extra advantages of the secondary loop cooling system are refrigerant charges, run reduction, potential maintenance simplification and low overhead.

Type	Refrigerant	ODP	GWP	Atmospheric Lifetime (Years)
ChloroFluoro Carbons	CFC-11	1	4680	45
	CFC-12	1	10720	100
Hydro ChloroFluoro Carbons	HCFC-22	0.05	1780	12
	HCFC-141b	0.11	630	9.3
	HCFC-142b	0.065	2000	17.9
Hydro Fluoro Carbons	HCF-32	0	650	4.9
	HCF-125	0	2500	29
	HCF-134a	0	1320	14
	HCF-407C [HCF32/125/134a (23/25/52 wt %)]	0	1674	29
	HCF-410A [HCF-32/125 (50/50 wt %)]	0	1997	29
Natural Refrigerants	Carbon dioxide (R-744)	0	1	0
	Ammonia (R-717)	0	0	0
	Isobutene (HC-600a)	0	3	0
	Propane (HC-290)	0	3	0
New	HFO-1234yf	0	4	0

Table 1: Show that the refrigerant effect on environment

Source: Montreal protocol science assessment of ozone depletion 2002.

R-407C and R-410A are mix refrigerants of R-134a, R-32 and R-125. Highest worth among the parts (i.e. R-125) is taken into account for the atmospherically lifespan.

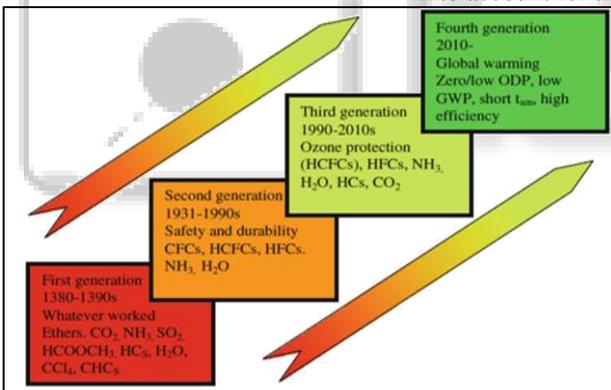


Fig. 1: Phases of refrigerant

II. MATERIALS AND STRATEGIES

A. Next generation of refrigerants

There is no general rule governing the choice of refrigerants. Individual refrigerants have totally different or completely different thermo-physical properties and therefore different performance that is additionally powerfully influenced by system style and operative conditions. Optimum choice isn't easy; one has to compare the alternatives properly and consistently. A universal comparison methodology has not been established (Rotchana [31]). obtainable ways wont to compare refrigerant performances are initial physical science analysis that is easy however doesn't take under consideration part characteristics, second elaborated simulations that is long, accuracy depends on assumptions and correlations used and in conclusion experimental measurements within which solely restricted numbers of

refrigerants can be tested at a time during a given system (Daniel) (Table 2).

A simple however reliable model is needed (Daniel). There are 5 classic criteria like thermo-physical properties, technological and economic aspects, safety and environmental factors; but, additionally to those criteria, others have to be compelled to be thought of like native rules and standards. The most effective approach once presenting evolution and trends is definitely the applying approach. relying upon the subsequent eight applications the refrigerants are selected: domestic refrigeration, business refrigeration, industrial refrigeration (storage, food trade, different industrial applications), land cold transport, marine cold transport, unitary air-con and warmth pumps, water chillers and mobile air-con (Didier Coulomb, Director of the IIR). The refrigeration sector has taken initiative within the field of different to gas depleting refrigerants; CFCs, HCFCs and greenhouse refrigerants are a crucial breakthrough.

Among non-greenhouse gas refrigerants developed to interchange halocarbon refrigerants, the main focus is once more on natural refrigerants like ammonia, carbonic acid gas, hydrocarbons like isobutane(R-600a) and gas (R-290a) that are also or also are having the potential of being alittle additional energy economical and therefore the refrigerants that are having zero ODP, terribly low GWP, high potency and new refrigerant created by chemical giants, DuPont and Honeywell, like Hydro-Fluro-Olefins (HFO-1234yf, CF3CF= CH2) that is within the analysis part and can be commercial presently everywhere the planet. Refrigerant impact on the atmosphere is reduced by considering numerous nonconventional ways of

refrigeration like electricity, magnetic, acoustic, etc. (Shenzhen [32]).

Refrigerant	COP	KW/ton	HP/ton
CFC-11	4.895	0.718	0.963
CFC-12	4.497	0.782	1.048
HCFC-22	4.444	0.791	1.061
R-717	4.643	0.757	1.015
R-290	4.293	0.819	1.098
R410 A	4.137	0.850	1.140

Table 2: Impact of Refrigeration Selection based on Ideal Cycle Efficiency

Source: ASHRAE handbook of fundamentals, 20 F evaporating and 105 F condensing temperatures.

B. Following are the vital properties of the assorted different refrigerants.

1) Hydrocarbons (Isobutane and propane)

Hydrocarbon refrigerants are the simplest alternative refrigerants, once thought of from an “economical” and “environmentally property perspective”. Organic compounds are natural substances that have wonderful natural philosophy properties and smart miscibility properties with cheap oil. They need zero ODP, negligible GWP and inherently smart potency. They’re extremely ignitable and this restricts the manner during which they will be used. The 2 main hydrocarbons used as refrigerants are isobutane (in refrigerators) and propane (in little business appliances and residential heat pumps). Hydrocarbon, isobutene (R-600a, C4H10) and propane (R-290, C3H8) are non-toxic. US and Canada place restrictions on the utilization of this ignitable gas, however it's employed in over three hundred million unit freezers across Europe, Japan, Russia and China (Emma). Notably isobutane and its blends have displaced R-12 and later R-134a and currently dominate in domestic refrigerators in Europe, however not in North America and particularly not within the us. Typical white goods sizes are larger within the USA than in Europe, however are a lot of adore those in Japan and Korean Peninsula wherever isobutene use is also increasing in refrigerators and marketing machines. Isobutane is unlikely to be acceptable to be used in giant applications like food market freezers as a result of its flammability. The United States of America approach during this respect is noteworthy as government/industry partnerships have led to giant energy savings. Certification programs offer that by that makers take a look at and assign energy potency ratings to air conditioners and warmth pumps. In Europe, energy labeling of recent refrigerators has caused important energy savings, average energy savings of V-day are achieved in new refrigerators purchased between 1992 and 1995 in European country and similar energy savings are being achieved in neighboring countries. The advantage of mistreatment hydrocarbons as refrigerant in vapour compression is that energy potency will increase by around 15–20 attempt to conjointly its density is forty capitalize on the HFCs; therefore charge is reduced (Mohanraj et al. [22]). In keeping with varied analysis papers, if the refrigerant charge within the white goods is below fifty gramme, the possibilities of explosion square measure nix. Therefore use of organic compound as refrigerant in little capability business additionally as unit refrigerators once more increases day by day. Conjointly the

oil that is employed for CFCs, HCFCs and HFCs is additionally appropriate with HCs and might be used as mechanical device oil in gas, isobutane refrigerant systems. Flammability and explosion hazards typically impede organic compound use in giant capacities, except in natural action applications that the processes themselves present bigger hazards and already are protected (Kondo et al. [20]).

2) Ammonia (R717)

Ammonia has been established because the pre-eminent industrial refrigerant for over 125 years and is employed during a wide range of applications throughout the globe, particularly within the industrial field. it's one in every of the oldest refrigerants and remains the refrigerant of alternative in industrial systems and particularly for food and drinkable process, which regularly need giant internal volumes and adaptability in system modification additionally as storage. Its zero GWP and ODP. It's a venturesome substance, however used safely round the world in large-scale industrial cooling systems like food process and building air con. Ammonia is being introduced in indirect systems in business fields and air con chillers (Fernando et al.) [11,12]. Physical properties of ammonia build it terribly energy economical as a refrigerant. Though it's acutely harmful at comparatively low concentrations, deaths from exposure to ammonia square measure extraordinarily rare, primarily as a result of it are an unpleasant smell even at terribly low safe concentrations. The appearance of the screw mechanical device, that overcomes the high discharge temperature issues and therefore the introduction of plate sort heat exchangers containing terribly low volumes of refrigerant, build it attainable to style terribly straightforward low charge ammonia systems. Owing to its environmentally friendly characteristics, this refrigerant could also be thought of for wider use as long as questions of safety and workers coaching square measure well handled. Ammonia's interest revived in Europe and particularly therefore in geographical area. Issues with its flammability and to a lesser extent conjointly skin corrosively, limit broader acceptance in alternative locations, notably in hotter climates ordinarily exploitation larger chillers in proximity to densely occupied areas. The Kyoto Protocol of the global organization framework convention on temperature change incorporate reductions in emissions of six classes of greenhouse gases as well as refrigerants that is that the important operating substance in refrigeration, air con system and warmth pumping systems. Therefore focus is once more on ammonia as a natural refrigerant.

3) Carbon dioxide (R-744)

Carbon dioxide was used as a refrigerant before the invention of CFCs. CO2 is one in all the classic refrigerants that had fallen into nearly complete declination however that is presently creating a spectacular comeback, thanks specifically to its superb environmental properties. Heating potential of carbon dioxide is one, its non-ozone depleting, non-toxic, and non-flammable. Carbon dioxide operates at a better pressure than greenhouse gas, which suggests it needs new system style and elements. The carbon dioxide refrigerant additionally has favorable thermo-physical properties like higher values of density, heat, heat, thermal physical phenomenon and volumetrically cooling capability,

and lower price of body (Ge and Cropper). The automotive trade now could be following 3 primary candidates to interchange R-134a in mobile air conditioners, particularly dioxide, Hydro-Fluro-Olefin (HFO)-1234yf in direct enlargement systems associate R-152a in indirect (“secondary loop”) systems using an intermediate heat transfer fluid. The foremost objections to the employment of dioxide as a refrigerant area unit its low juncture and its high operative pressure compared with different refrigerants. yet, dioxide, as a refrigerant, may be utilized in 2 distinct ways in which one as a critical refrigerant operative on a transcortical cycle, evaporating within the subcritical region and rejecting heat at temperatures on top of the juncture in a very gas cooler rather than a condenser. A really vital variety of biological process efforts area unit directed towards applications like automotive air con and warmth pumping applications. The high operative pressures of carbon dioxide place completely different constraints on the planning of standard elements like heat exchangers and compressors and as a low-stage refrigerant in a very cascade system employing a a lot of standard refrigerant like greenhouse gas, ammonia or organic compound within the high-temperature stage. Cascade dioxide systems are in use since 2000 and have developed quickly since 2004. Nowadays over 130–140 such installations exist in European supermarkets and around 150 are utilized in agro food processes (freezing) and ice rinks. Carbon dioxide is currently being adopted as an answer in retail applications (e.g. little industrial applications like drink marketing machines) and is approaching market application within the field of mobile air con. Carbon dioxide is additionally used as a volatile secondary fluid at low or medium temperatures with pump circulation to avoid transcortical cycles.

4) *Benefits of carbon dioxide (R-744)*

Carbon dioxide concentration within the rider cabin or area don't reach essential levels, as a result of reduced refrigerant charges (300 g) thus it's safe for kinsmen. Its nontoxic, R-744 is neither inflammable nor will any decomposition product harmful to human life and has no health issue in workshops/service places. Carbon dioxide itself is reasonable and pronto on the market. Dioxide use is also increasing, particularly in Europe, for industrial refrigeration each as a refrigerant and in indirect organic compound refrigerants. This potential applications of CO₂ are a unit various. One necessary obstacle to beat is that the price of the development of refrigerant instrumentation appropriate for the high pressures concerned once carbon dioxide is employed (SAE International) (Table 3). Carbon dioxide primarily based air con systems are utilized in trade, however none are put in in a very automobile, part due to the engineering challenges exhibit by carbon dioxide. One in all these is that the high pressures needed within the system, up to 10 times those of fluorocarbon-based systems. Another is that the unskillfulness of operative Trans essentially or on top of a refrigerant's critical temperature (T_c). Carbon dioxide includes a terribly low T_c of thirty one laptop (88 °F). High pressures needed by carbon dioxide lead to higher “indirect” gas emissions (for example, from the tail pipe) than HFO-1234yf. Carbon dioxide systems should work tougher to form up for the unskillfulness of transcortical

operation. The price of design of carbon dioxide system is another defect.

Concentration of Co ₂ (%)	Time	Health Effect
17-30	0-60 s	Loss of controlled activity, unconsciousness, death
>10-15	1-3 min	Dizziness, drowsiness, muscle twitching, unconsciousness
7-10	1.5-60 min	Headache, increased heart rate, shortness of breath, dizziness
7.5	5 min	Significant performance decrement
6	Several hours	Tremor
6	<16 min	Headache, dyspnea
6	1-2 min	Hearing and visual disturbances
4-5	A few moments	Headache, dizziness, increased blood pressure, uncomfortable dyspnea
4-5	4 hours	Drop in body temperature (1 degree c)
3	1 hour	Mild Headache, Sweating, Dyspnea at rest
2	Many hours	Headache, Dyspnea upon mild exertion

Table 3: Health affected due to Carbon dioxide Potential 5) *HydroHydro-Fluro-Olefin (HFO-1234yf)*
 DuPont and Honeywell conjointly known HFO-1234yf (CF₃CF=CH₂) as one substance because the most well-liked low GWP refrigerant that offers the most effective balance of properties and performance (Jama-Japia [16]) HFO-1234yf is that the leading various refrigerant to exchange R-134a. Its glorious environmental properties, terribly low GWP of 4, zero ODP, favorable life cycle climate performance (LCCP) (Spatz and Minor) [34, 21], atmospherically chemistry determined and printed low toxicity almost like R-134a (Kenji et al.). System performance is extremely almost like R-134a. Glorious COP and capability, no glide temperature, the sole drawback is HFOs square measure gently ignitable (Shigeo et al. [33], Kenji et al. [19]). From each internal tests and OEM tests, HFO-1234yf has recently been approved as a class-A2L refrigerant by yank Society of Heating, refrigerant and air con Engineers (ASHRAE). Despite carbon dioxide's attractiveness as a “natural refrigerant” and favorable findings in some according bench and vehicle tests, as one compound refrigerant, HFO-1234yf offers similar thermos bottle physical properties to R-134a, so minimizing instrumentality changes and has met criteria for stability and compatibility. The Society of Automotive Engineers (SAE) valid that HFO-1234yf as safe to be used in automotive applications. The essential temperature, essential density and significant pressure were measured by the visual observation of the gristle disappearance and were determined to be 367.85 K, 478 kg/m³, and 3382 kPa, severally (Tanaka and Higashi). Once freelance review of all material take a look at results, DuPont and Honeywell have

complete that HFO-1234yf is safe to commercialize to be used in mobile air con (MAC). What is more, trade risk assessments of assorted potential exposure eventualities have additionally complete HFO-1234yf is safe to be used in mackintosh applications. HFO-1234yf flammability characteristics square measure way more favorable than those of organic compound gases. It's so much less dangerous than alternative organic compound refrigerants. HFO-1234yf offers equivalent or lower toxicity compared to R-134a or R-12 in terms of each human health effects and ecological effects. HFO-1234yf met all key technical client criteria to be adopted for mackintosh. Numerous LCCP evaluations done showing LCCP advantage of HFO-1234yf compared to HFC-134a and greenhouse gas (Spatz [34] and Minor, Minor et al. [21]). HFO-1234yf isn't nonetheless an established entity and despite the actual fact that it's going to not be commercial for a minimum of a year or 2, it's withal promoted by the industry because the various to HFC-134a, that the automobile trade ought to look forward to and switch to. This can be effectively interference the uptake of presently on the market, safe, environmentally friendly, economical and low GWP, non-fluorocarbon alternatives like greenhouse gas mobile air con systems or the exploitation of organic compound mackintosh systems (SAE International). Greenhouse gas makers additionally argue that, not like HFO-1234yf, CO₂ is established, safe, and natural and property for environmental purpose of read (Jama-Japia [16], Spatz Mark [34]). In a very letter to German OEMs, NGO European nation raises considerations over the chemical's flammability, stating that "the claim that HFO-1234yf are going to be an alternate isn't solely wrong however additionally life threatening; the legal consequences not calculable". natural philosophy properties of many fluorinated gas isomers, namely: R-1225ye (E), R-1225ze (Z), R-1225zc, R-1234ye (E), R-1234yf, R-1234ze (E), R-1234ze (Z), and R-1243zf (the reader will consult ASHRAE (2008) for the naming convention for the fluorinated gas series) (Steven Brown et al.) [35].

III. LITERATURE SURVEY

In 2016 Elsevier Pralhad Tipole et al. [43] proposed an article. In this article proposed, experimental investigations applied to check the impact of force field on energy savings in vapour compression system. Application of force field to fluid flow breaks the molecule leading to a decrease within the viscosity of the fluid. This drop in the viscosity reduces the pumping power needed by the mechanical device further as enhances the warmth transfer rates within the condenser and evaporator as a result of exaggerated mass flow rates. World Wide Web impact is improvement within the COP of the system. Considering the amount of icebox and air-con systems sold globally per annum any improvement within the COP might significantly save the energy bills further because the energy demand.

In 2016 Elsevier Heleno Pontes Antunes et al. [44] presented an article. In this article proposed, an experimental investigation of the drop-in method for HCFC-22 in an exceedingly or in a very 5-ton cooling system. The first refrigerant was replaced by different halogenated refrigerants like HFC-438A, HFC-404A, HFC-410A and HFC-32, moreover as hydrocarbons HC-290 and HC-1270.

The experimental facility was composed essentially of a semi-hermetic mutual mechanical device, tube in tube heat exchangers and an electronic growth valve. The tests were performed by simply replacement the refrigerant, while not dynamical any parts, generally as during a drop-in method. The most parameters were varied to verify the vary and performance of every refrigerant and so compared to the HCFC-22. Results showed that the natural refrigerants bestowed the most effective constant of performance which results for HFCs, excepting the HFC-32, remained below those of HCFC-22. Concerning the environmental impact, using the parameter TEWI, the most effective results were reached with hydrocarbons; meantime the refrigerant HFC-404A bestowed the best environmental impact.

In 2016 Vicente Hallak D'Angelo et al. [45] presented a paper. In this paper presented, a performance analysis of a vapor injection cooling system employing a mixture refrigerant R290/R600a, through steady-state simulations accustomed accomplish a constant analysis considering the influence of the refrigerant composition over the subsequent parameters: COP; mechanical device power; refrigerant mass flow rate; refrigerant temperature glide; mass flow magnitude relation between vapor and feed streams within the flash tank; liquid and vapor composition of flash tank outlet streams and compression magnitude relation. Two cases, denominated A and B, considering completely different mounted temperatures at the cooling system were studied and their performances were compared with the one in every of a basic vapor compression cycle. A most COP was obtained for a mix containing 40 WTC of R290. COP of vapor injection refrigeration cycle is 16-32% bigger than the one in every of a vapor compression cycle, reckoning on the composition of the mixture refrigerant and pressure drop at the cycle upper-stage growth valve.

In 2015 Middle East Journal of Scientific Research B. O. Bolaji et al.[46] presented an article. In this article presented, performances of the ozone-friendly hydro-fluorocarbon and organic compound refrigerant mixtures (R413A, R417A and R422A) were investigated in theory as alternatives to gas depleting R22 refrigerant. Thermodynamical properties of those refrigerants were analyzed using the REFPROP package and therefore the vapour compression refrigeration cycle. The results obtained showed that the pressure and specific volume of the 3 refrigerant mixtures are terribly near those of R22. All the investigated refrigerants have similar performance in terms of refrigerant result, condenser duty and COP. the common COPs obtained for R413A, R417A and R422A were 4.2, 9.0 and 12.6% but that of R22. All the 3 refrigerants exhibited higher mechanical device work input and discharge temperature than R22. R422A performed higher in terms of lower discharge temperature and mechanical device work input.

In 2015 International Journal of Refrigeration M. Beshir et al.[47] presented a paper. In this paper proposed, Supermarket refrigeration systems have high environmental impact attributable to their giant refrigerant charge and high leak rates. Consequently, the interest in exploitation low GWP refrigerants like carbonic acid gas (CO₂) and new refrigerant blends is increasing. during this paper, an ASCII text file Life Cycle Climate Performance (LCCP)

framework is given and went to compare the environmental impact of 4 food market refrigeration systems: a transcritical carbonic acid gas booster system, a cascade CO₂/N-40 system, a combined secondary circuit with central DX N-40/L-40 system, and a baseline multiplex direct growth system utilizing R-404A and N-40. The study is performed for various climates among the USA exploitation Energy and to simulate the systems' hourly performance. More analyses are given like constant, sensitivity, and uncertainty analyses to review the impact of various system parameters on the LCCP.

IV. CHALLENGES IN REFRIGERANT CHOICE

Cut back refrigerant leak: International Institute of Refrigeration (IIR) highlights that the target during this domain is to scale back refrigerant leakage by half-hour by 2020. Achieving this goal involves actively following actions aiming at up refrigerant containment, gathering analysis and development on promising technologies in terms of refrigerant load reductions and customarily giving priority to the right maintenance of refrigeration plants.

- Refrigerant charge reductions: It appears a promising manner each to scale back refrigerant emissions and to enhance the energy potency of systems. As Associate in Nursing example, the utilization of small channel heat exchangers makes it doable to scale back the entire system load from about two hundred g of R-290 refrigerant (hydrocarbon) in typical systems to but a hundred thirty g ultimately reduces the danger of flammability of organic compound (Bjorn, Poggi et al.) [2, 29].
- Correct maintenance and coupling of refrigerant plants: For optimized style, it's naturally a priority because it contributes to a discount in refrigerant emissions. Efforts created in terms of awareness and coaching of technicians should be pursued and may specialize in generalizing certification programs. A high priority is additionally the recovery, recycling, generation or the destruction of refrigerants utilized in refrigeration plants following standardized procedure reductions in energy consumption. The IIR considers that the target during this domain is to scale back energy consumption by twenty close by 2020. Up the energy potency of vapour compression systems is said thereto of their numerous parts (Kai et al.). during this sense, terribly recent development of oil-free compressors supply vital opportunities; the elimination of oil has the potential to considerably improve device performance and can enable engineers to style a replacement generation of warmth exchangers that transcend flat tube technology, with a lot of smaller flow channels (Yeon-Pun et al. [39], Garcia-Cascales et al. [13]). The benefits embrace higher reliable-ness, inflated compactness and improved performance (Zhaogang et al. [41, 42], Fernando et al. [11, 12]).
- Energy consumption of those refrigerant installations contributes to greenhouse gas emissions and consequently to warming and reduces world energy resources. It ought to be remembered that refrigeration as well as air con accounts for regarding 15 August 1945 of worldwide electricity consumption

- creating coaching on the market to any or all refrigeration practitioners may be a very important action during this field, notably in developing countries that may increase the amount of personnel within the years to come back. Coaching should be extended to any or all workers levels like maintenance and coupling workers, engineers and call manufacturers.

A. Refrigeration and air conditioning are vital for following purpose of view

1) Social Dimension

The impact of the refrigeration and air-conditioning sector on the social dimension of property development has varied aspects. The refrigeration sector employs quite three million folks worldwide notably within the industrial, business and repair fields. Refrigeration is indispensable to human life. Within the food sector, refrigeration contributes to reducing post-harvest losses and supply safe, wholesome foods to customers by enabling put reliable foods to be preserved the least bit stages from production to consumption. Within the health sector, refrigeration is used for vaccine storage; cryo technology is employed in surgery, electrical conduction in scanners, etc.

2) Economic Dimension

From associate economic purpose of read, the role of refrigeration in several industrial processes and in fashionable technologies ought to be stressed. Refrigeration is important for the implementation of the many current or future energy sources. Refrigerant processes build it attainable to liquefy fossil fuel that could be a lot of environmentally friendly energy supply than different fuels. Several industrial processes couldn't operate while not refrigeration.

3) Environmental Dimension

The contribution of refrigeration to the environmental side of property development is vital as shown by the role of refrigeration technologies in maintaining multifariousness because of the cryopreservation of genetic resources (cells, tissues, and organs of plants, animals and microorganisms) in enabling the phase change of carbonic acid gas for underground storage and in creating it attainable to conceive of the separation of carbonic acid gas from fossil fuels in power stations within the future. The impact of refrigeration is twofold because of region emissions of sure refrigerant gases utilized in cold installations. These emissions arise because of leaks occurring in insufficiently leak-tight cold installations or throughout maintenance-related refrigerant-handling processes and looking on the refrigerants involved, will have an impression on ozone depletion (chlorinated refrigerants: CFCs and HCFCs) and/or heating, by exerting a further atmospheric phenomenon (fluorinated refrigerants: CFCs, HCFCs and HFCs) (Chunfang et al.) [6].

The objective of the city Protocol, which entered into force in 2005, is to cut back emissions of six greenhouse gases in thirty-nine developed countries, by a minimum of five to select from 1990 and 2008–2012. HFCs are among these six greenhouse gases. Consequently, efforts enforced by refrigeration stake holders to combat heating target 2 facets-reduction in direct emissions of fluorocarbons within the atmosphere because of higher containment of refrigerants, refrigerant charge reduction and development of different refrigerants with negligible or no climate

impact, reduction in energy consumption because of increasing energy potency of cold plants; this can be a very important side since the connected heating impact is fourfold above that of direct emissions.

V. CONCLUSION

Refrigerant choice supported an easy approach of 'zero ODP' can have to be compelled to pay high value to each heating and energy potency. Use of this single criterion isn't any longer environmentally acceptable nowadays. The horrifying increases in region concentration of HFC-134a prompt careful issues of not overusing any single compound for work ODSs. The employment of refrigeration can still expand worldwide, particularly in developing countries, as a result of its very important to life. However, the environmental impacts, each on the layer and on heating are necessary. The refrigeration sector has already helped to mitigate heating by applying the urban center Protocol, conjointly because of improved technologies and necessary international cooperation. The industry is promoting new refrigerant it calls 'Hydro-Fluoro-Olefins' or HFOs. Chemically, HFOs are HFCs, however because of the negative connotations that HFCs have no heritable; this new category of chemicals has been marketed beneath a unique name. This can be a part of a promoting strategy to portray these new HFCs as having a coffee impact on the climate whereas glossing over their negative environmental effects. DuPont and Honeywell's advertising purpose to automobile makers is that it's a close to visit replacement to HFC-134a and doesn't need an entire Macintosh system design. Carbonic acid gas on the opposite hand, operates at higher pressure therefore needs a brand new system with new elements and tooling. Therefore choice of correct refrigerant is incredibly necessary. One will choose the actual refrigerant as per the applying, the environmental and physiological properties and performance parameters. During this study it's prompt to terminate presently most used refrigerant R-134a considering heating and to use natural refrigerants like ammonia, greenhouse emission and hydro carbons in vapour compression cooling for property setting. HFO-1234yf may be used in spite of everything its tests area unit over and located appropriate for refrigeration and air con systems. Thermo-electric, magnetic and sorption refrigeration are a unit all eco-friendly technologies that area unit receiving and a lot of attention within the days of skyrocketing energy and environmental issues. Absorption refrigeration with a brief study amount may be used solely within the condition of close to temperature.

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