# BIOGRAPHY

- Sarah Nakanyika is a trailblazing  Refrigeration & Air-Conditioning Technician who has broken limitation in a male dominated industry. Dedicated to empowering others, promoting innovation and advancing the industry. As the President of Women in Refrigeration Comparative (WRAAZ) Sarah Champions gender equality and exclusion in the sector.
- With a very strong technical back ground Sarah served as a Technician Representative Ndola branch under the auspices of Engineering Institution of Zambia(EIZ). Her leadership extends to chairing both women's committee and Northern Region under the auspices of Refrigeration and Air-Conditioning Association of Zambia (RAAZ)
- Sarah's influence  reaches beyond Zambian borders. She holds the position of Vice Secretary for women mobilization in Africa and a Female African Trainer in Refrigeration & Air-Conditioning under the auspices of Union of Associations of African Actors in Refrigeration and Air-Conditioning(U-3ARC). Sarah Nakanyika is a Board Member of an International Network of Women in Cooling(INWIC) Representing Africa. INWIC  is a global initiative that brings together women leaders in the cooling sector. As a board member Sarah Joins other Esteemed members from organization like United Nations Environment programmed (UNEP) Ozone Action, United Nations Industrial Development Organization(UNIDO) & other International  Associations.
- Further solidifying her commitment to promoting innovation and advancing the industry. Sarah Nakanyika founded S.G.N Refrigeration & General Dealers, Demonstrating her dedication expertise and business acumen.
- Sarah Nakanyika has proudly represented Zambia on prominent African & global flatforms, including Zimbabwe, Bukina Faso, Egypt and Italy. She is also a strong advocate for the Dr. Charity Babpek African competition, an annal U-3ARC event for all women in RAC sector in Africa to show case their skills and excellence. Additionally Sarah has shared her expertise through webinars and forums at EIZ  and other organization both locally and internationally.

# SKILLS DEVELOPMENT, INNOVATION AND INDUSTRY INTERGRETION

SUBTITLE: REFRIGERATION ENGINEERING FOR  A SUSTANABLE FUTURE

# CONTENT

- Introduction
- Sustainability Challenges in Refrigeration & Mitigation Strategies
- Skills Development
- Innovation in Sustainable Refrigeration
- Industry integration
- Conclusion

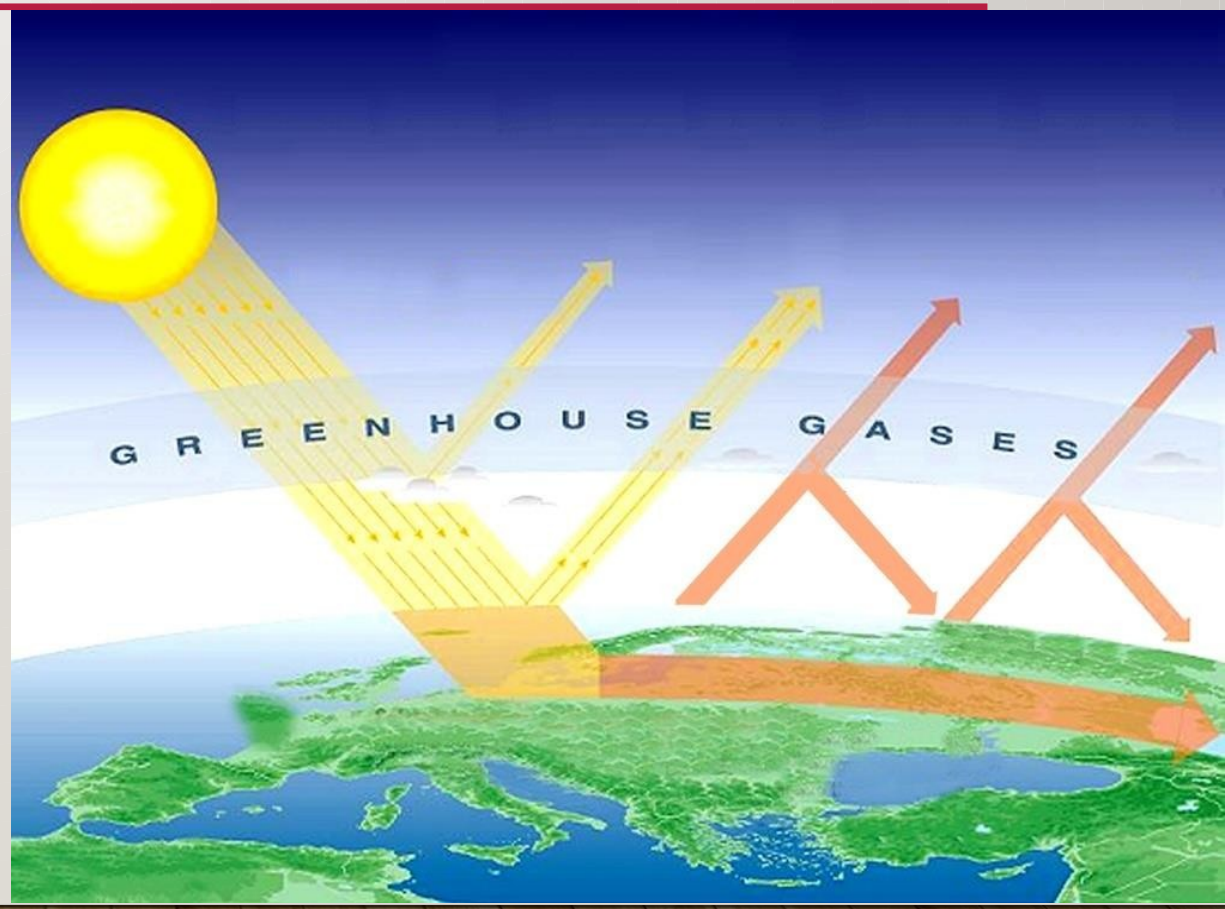
# INTRODUCTION

- Imagine the world without refrigeration.
- Hospitals Medicines
- Cold Chain
- When you are bone, the first things you will be introduced to is refrigeration and it will be the last thing you will be put to when you die.

- Refrigeration engineering plays a vital role in maintaining food safety, reducing food waste and promoting sustainable development. However the refrigeration industry faces significant sustainable development.
- However the refrigeration industry faces significate sustainability challenges, including greenhouse gases emissions and energy consumption.

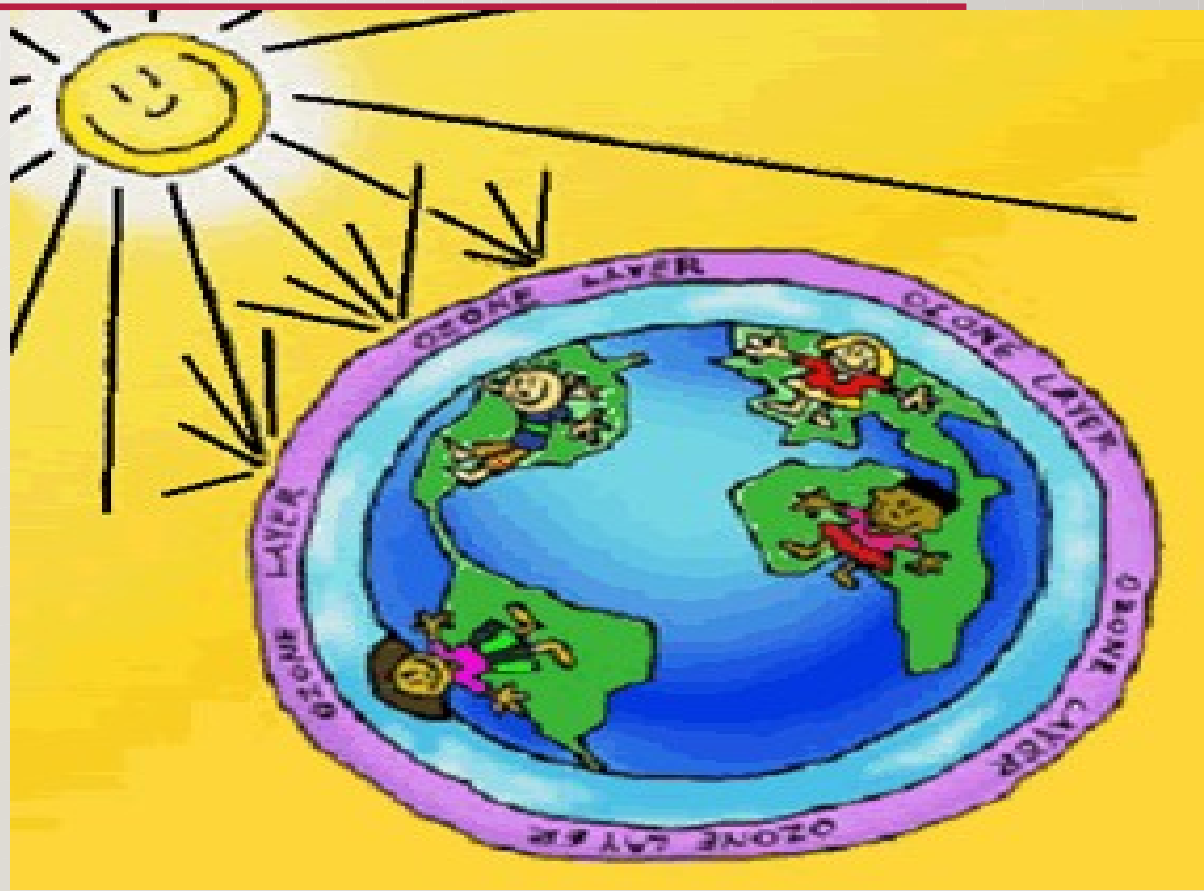
# THE SUSTAINABILITY CHALLENGES IN REFRIGERATION

- CFCs,HCFCs & HFCs these are gases used as refrigerants. These substances have high global warming potential(GWP) and contribute significantly to climate change.
- CFCs – R11(Trichlorofluoromethane), R12(Dichlorodifluoromethane)
- HCFCs – R22(Chlorodifluoromethane)
- HCFCs – R134a(tetrafluoromethane), R410(difluoromethane)



# OZONE DEPLETION

- Ozone Layer Depletion substances CFCs & HCFCs widely used has refrigerants have been phased out & Zambia will completing phase them out by 2023
- CFCs – R11, R12 -  (Phased out completely)
- HCFCs – R22,(Chlorodifluoromethane) - ( Phasing out completely by 2030)
- HCFCs – R134a,(tetrafluoromethane) - (completely by 2030)
- R410(difluoromethane) - (Phasing them down)
- **Reaction of depleting of ozone layer**
- Increased chances of skin cancer
- Increase chances cataracts
- Decreases the photosynthesis of plants species



# REFRIGERANTS & THE ENVIRONMENT

| Refrigerant | ODP | GWP | Flammable | Toxic | Compatible with system materials | Other issues |
|---|---|---|---|---|---|---|
| CFCs<br>R11, R12 | High | High | No | No | Good | Phased out |
| HCFCs<br>R22; R123 | Low | High | No | No | Good | Will be phased out |
| HFCs<br>R134a<br>R410<br>R407 | Zero | High | No | No | Need different oil and filter, some seal problems | Moisture and contamination serious |
| Hydrocarbons R600a; R290 | Zero | Very low (3) | Yes | No | Good | Flammable Explosive |
| Ammonia R717 | Zero | zero | Yes | Yes | No copper components | Toxicity, restricted use |

# MITIGATIONS

- Transitioning to low-global warming potential Refrigerants: Adopting refrigerants with lower GWP such as(HFOs)& (HCs)can significantly reduce GHG emission.
- Energy Efficiency: Improving energy efficiency of refrigeration Systems through advanced technologies such as Inverter  driven compressors & smart controls will reduce energy consumption and associated to GHG emissions.
- Leakage Reduction & Recovery: Implementing best practices for refrigerant handling, Leak detection and recovery will minimize emission from leakage & Venting.

# SKIIS DEVELOPMENT

- Skills development is essential for professional in the refrigeration and air conditioning industry to stay up to date, efficient and effective. By acquiring new skills, knowledge and competencies technicians, engineers and professionals will enhance job prospects, increase efficiency and provide better services in the country.

# INNOVATION IN SUSTAINABLE REFRIGERATION

- The refrigeration industry is undergoing a significant transformation driven by the need of sustainable and environmentally friendly solutions. Emerging technologies, such as inverter technologies and soler powered refrigeration unites.
- **Inverter Technologies**: Inverter technologies are revolutionizing the refrigeration industry by providing more efficient and flexible cooling solutions.
- These technologies uses advanced electronics to regulates compressor speed, reducing energy consumption and improving cooling performance

- **Soler powered refrigeration** is a sustainable and innovative solution for cooling applications, offering numerous benefits, including renewable energy and energy efficiency.
- Solar Panels: photovoltaic (PV) soler panels convert sunlight into electrical energy
- Battery Bank: the electrical energy is stored in a battery bank for letter use
- Refrigeration Unit: The stored energy powers a refrigeration unit, which can be a vapor compression or absorption system
- Cooling: The refrigeration unit provides cooling for various applications, such as food storage, air conditionings or medical storage.

# INDUSTRY INTEGRATION

- Industry collaboration and coordination between different industrial companies or organization achieves common goals, improve efficiency and drive innovation.

# CONCLUSION

- The future of sustainable refrigeration depends on the adoption of emerging technologies and industry integration. By working together we will create more sustainable and environmentally friendly refrigeration industry.