CHAPTER II

CLIMATE ENGINEERING AND TRANSPORT ENGINEERING هندسة المناخ وهندسة النقل

Climate engineering

Definition:

- The Climate Engineering is all the techniques of heating, ventilation and air conditioning, combining thermal comfort and energy performance.

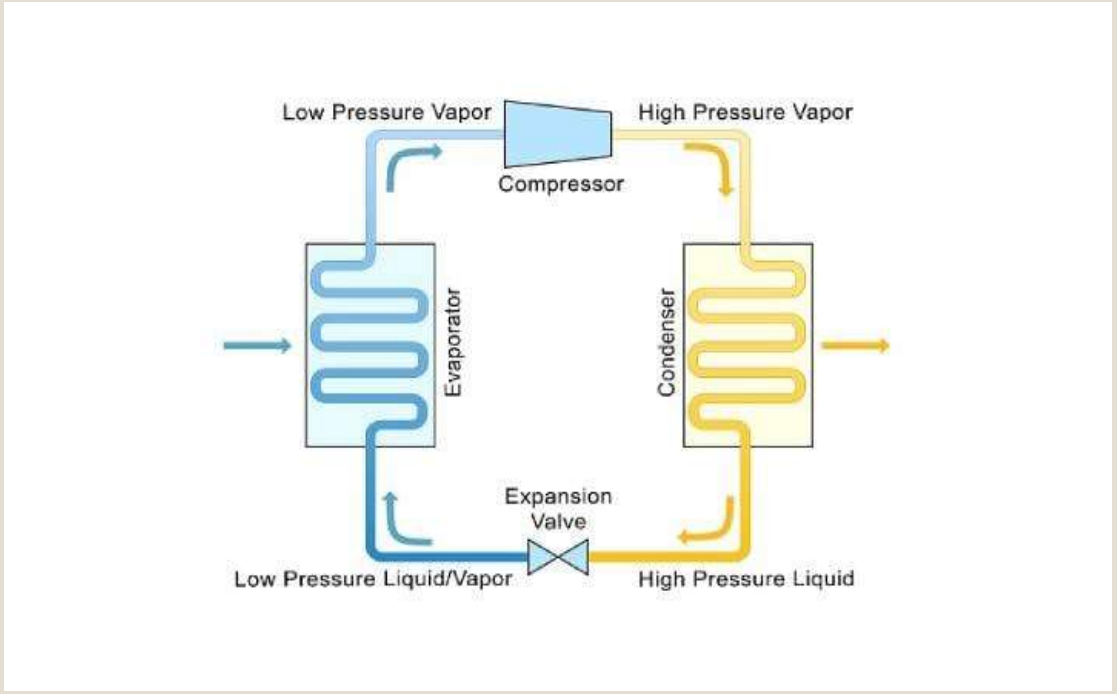
- It seems there might be some confusion here. Climate engineering, also known as geoengineering, refers to deliberate and large-scale interventions in the Earth's climate system to counteract or mitigate climate change. These interventions involve methods such as solar radiation management (SRM) and carbon dioxide removal (CDR) to manipulate factors like solar radiation, greenhouse gas concentrations, or oceanic processes.

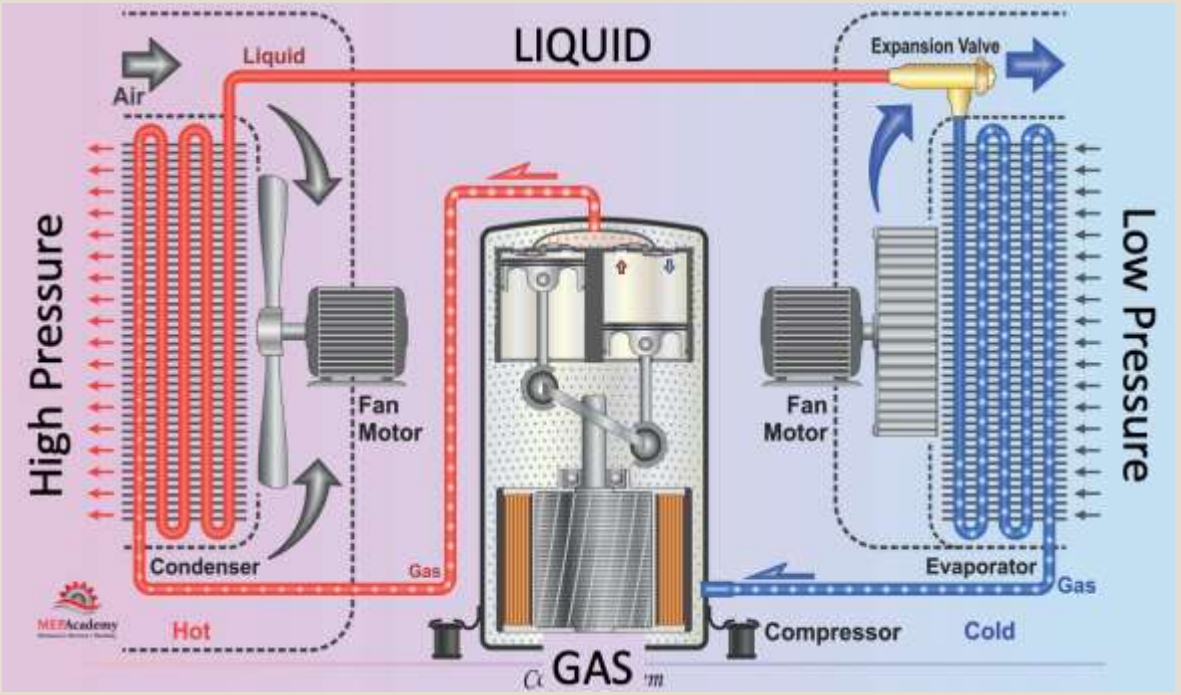
- On the other hand, heating, ventilation, and air conditioning (HVAC) techniques are focused on regulating indoor environments within buildings or vehicles to ensure thermal comfort, indoor air quality, and energy efficiency. HVAC systems include equipment such as air conditioners, heaters, ventilation systems, and air purifiers to control temperature, humidity, air circulation, and filtration within confined spaces.

Refrigeration Cycle

The refrigeration cycle is a thermodynamic cycle

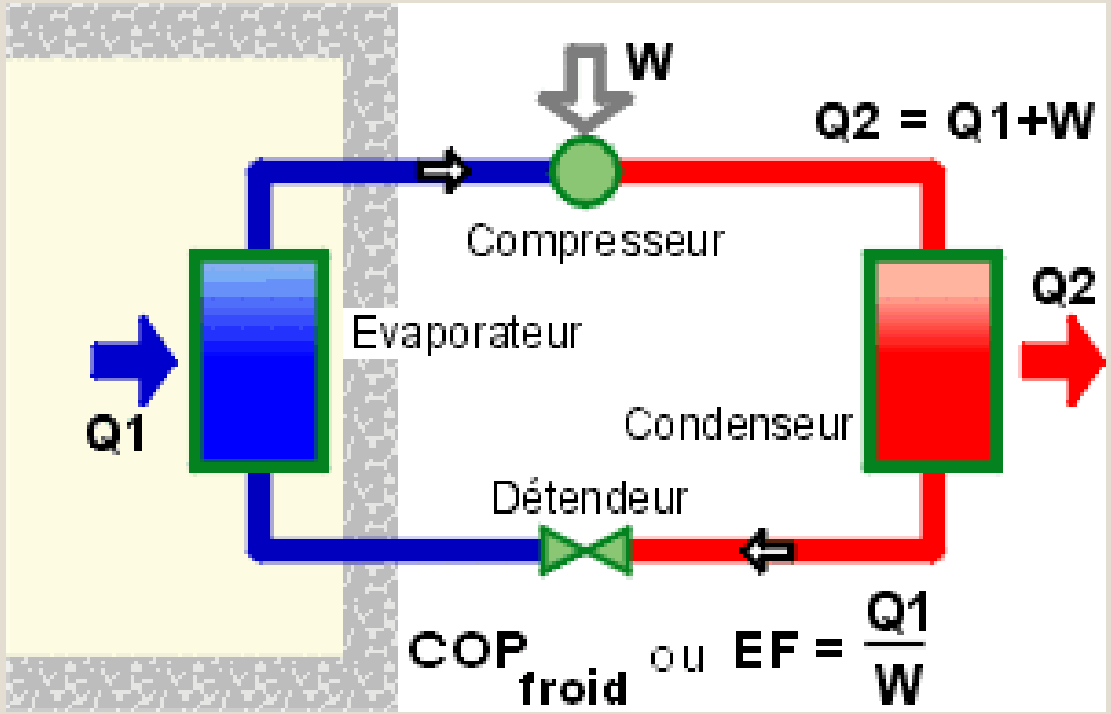
Compressor installation:





Efficiency of refrigerated production

Energy efficiency: This is the ratio between the amount of heat absorbed by the evaporator and the amount of total electrical energy absorbed by the installation, mainly the compressor but also the ancillary equipment (fans, water circulation pumps, etc.)



fields of application of HVAC engineering

HVAC (Heating, Ventilation, and Air Conditioning) engineering finds applications in various fields, encompassing both residential and commercial sectors. Here are some of the primary fields of application for HVAC engineering:

1. **Residential buildings:**

- Design and installation of heating, ventilation, and air conditioning systems for individual houses, apartments, and residential buildings.
- Integration of energy-efficient technologies such as heat pumps, heat recovery systems, and solar thermal systems to reduce energy consumption and greenhouse gas emissions.

2. **Commercial and institutional buildings:**

- Design and management of HVAC-R systems for offices, schools, hospitals, shopping centers, hotels, and other commercial and institutional buildings.
- Optimization of systems to meet the specific needs of occupants while minimizing energy consumption and operating costs.

3. Industry:

- Design and implementation of heating, ventilation, and air conditioning systems for industrial facilities such as factories, warehouses, and production centers.
- Management of temperature and humidity to ensure optimal conditions for manufacturing, storage, and comfort for personnel.

4. Transport:

- Design and maintenance of air conditioning systems for land, maritime, and aerial vehicles, including cars, trucks, ships, and airplanes.
- Development of efficient air conditioning technologies to reduce fuel consumption and vehicle emissions.

5. Agriculture and Agri-food:

- Design of environmental control systems for greenhouses, refrigerated warehouses, and food processing facilities.
- Use of cooling technologies for food preservation, crop protection, and extending the shelf life of food products.

6. Energy and Environment:

- Development of renewable energy production systems such as wind turbines, solar panels, and bioenergy systems.
- Integration of energy storage solutions and demand management to optimize the use of energy resources and reduce greenhouse gas emissions.

Transport engineering

Traffic management and road, air, naval transport, …)

Traffic management encompasses a wide range of strategies and technologies aimed at optimizing the movement of goods and people across various modes of transportation, including road, air, naval, and rail transport. Here are some key aspects of traffic management in each of these domains:

1. **Road Transport**:

- Traffic Signal Control: Optimizing the timing of traffic signals at intersections to minimize congestion and improve traffic flow.
- Intelligent Transportation Systems (ITS): Implementing technologies such as traffic cameras, sensors, and dynamic message signs to monitor traffic conditions, provide real-time information to drivers, and manage traffic incidents.
- Traffic Flow Optimization: Using data analytics and modeling techniques to predict traffic patterns and optimize roadway design, lane configurations, and speed limits.
- Congestion Pricing: Implementing tolls or fees to manage demand and reduce traffic congestion during peak hours.
- Roadway Infrastructure Maintenance: Regular maintenance and repair of roads, bridges, and tunnels to ensure safety and efficiency.

2.Air Transport:

- Air Traffic Control (ATC): Managing the movement of aircraft within airspace to ensure safe and efficient operations.
- Airport Operations Management: Optimizing runway usage, gate assignments, and ground handling procedures to minimize delays and maximize capacity.
- Air Traffic Flow Management (ATFM): Coordinating the flow of air traffic across regions to balance demand with available capacity and reduce delays.
- Airspace Design and Optimization: Designing airspace routes and procedures to optimize efficiency, minimize fuel consumption, and reduce environmental impacts.

3. Naval Transport:

- Port Operations Management: Efficiently managing the movement of ships within ports, including docking, loading/unloading, and cargo handling.
- Vessel Traffic Management: Monitoring and regulating vessel traffic in waterways to prevent collisions, ensure navigational safety, and minimize environmental risks.
- Maritime Traffic Flow Optimization: Using predictive analytics and route optimization techniques to optimize ship schedules, reduce waiting times, and improve overall efficiency.
- Port Infrastructure Development: Investing in port infrastructure upgrades and expansions to accommodate larger vessels and increase capacity.

4.Rail Transport:

- Train Traffic Management: Optimizing train schedules, routes, and speed profiles to maximize throughput and minimize congestion on rail networks.
- Signaling and Control Systems: Implementing signaling systems such as Positive Train Control (PTC) to ensure safe and efficient operation of trains.
- Freight Yard Operations: Managing the movement of freight trains within rail yards to facilitate sorting, classification, and distribution of cargo.
- High-Speed Rail Planning and Development: Planning and implementing high-speed rail systems to provide fast, reliable, and sustainable transportation options for passengers and freight.

Safety and Security in transport

- They determine the reliability and efficiency of the transport of people, and goods.
- Safety (damage caused intentionally)
- Security (damage that does not result from a malicious act) in different modes of transport.
- Specificity of hazardous materials (Flammable products; nuclear and other radioactive materials)
- Management tools
    - methods and means of risk assessment.
    - preventive measures (to avoid the realization of the risk)
    - protective measures (to limit the consequences).
    - crisis management methods to rescue, backup and restore.
    - Compliance with current standards

Role of the specialist in air conditioning & transport

The air conditioning engineer and the transportation engineer have the following main roles in their respective fields:

- The design of products, systems, machines, and technical installations
- The manufacturing of prototypes and the development of new processes and products and their penetration into the market
- The management and supervision of production
- The maintenance of installations and machines
- Advising the company and customers.

Personal work of the student for this module

Working in groups/pairs: Reading articles on sustainable development and/or reports on successful and sustainable companies and drawing up summaries of the main actions undertaken in the field of SD.

Examples of documents for reading and synthesis:

- Case of ONA and ENIEM: Kadri, Mouloud, 2009, Sustainable development, enterprise and ISO 14001 certification, Market and organizations vol. 1 (No. 8), p. 201-215 (free online access:http://www.cairn.info/revue-marche-et-organisations-2009-1-page-201.htm)
- Mireille Chiroleu-Assouline. Sustainable development strategies for companies. Ideas, The Journal of Economic and Social Sciences, CNDP, 2006, p 32-39 (free online access:http://halshs.archives-ouvertes.fr/hal-00306217/document)
- TOTAL Environmental and Societal Commitments webpage:https://www.total.com/fr/engagement
- PSA Group sustainable mobility innovations: http://www.annualreport.groupe-psa.com/report-2015/commitments/innovative-solutions-for-transport- sustainable/