# SUSTAINABLE ENGINEERING

## MCN201

# Module 1

- **Sustainability:**
- Introduction
- Concept - evolution of the concept
- Social, environmental and economic sustainability concepts
- Sustainable development
- Nexus between Technology and Sustainable development
- Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)
- Clean Development Mechanism (CDM)

# Sustainability

- Sustainability can be defined as the practice of reserving resources for future generation without any harm to the nature and other components of it.
- There is an additional focus on the present generations' responsibility to regenerate, maintain and improve planetary resources for use by future generations.
- Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment.

# Evolution of the concept

- The concept of sustainable development emerged out of the environ mental movement of the 1950s and 1960s (*which was concerned that human activity was having severe negative impacts on the planet, and that patterns of growth and development would be unsustainable if they continued as they were*.)

- Key works that highlight this thinking included

  Rachel Carson's **"*Silent Spring*"** (1962), Garret Hardin's **"*Tragedy of the Commons*"** (1968), and the Club of Rome's **"*The Limits to Growth*"** report (1972).

- The sustainability idea, as we know it today, emerged in a series of meetings and reports during the 1970s and 1980s.
- It received its first major international recognition in 1972 at the UN Conference on the Human Environment held in Stockholm.

*(The term was not referred to explicitly, but nevertheless the international community agreed that both development and the environment, until then addressed as separate issues, should be considered together*.)

- The recommendations of this conference led to establishing United Nations Environment Programme (UNEP)

- In 1987, the UN-sponsored Brundtland Commission released "Our Common Future," a report that captured widespread concerns about the environment and poverty in many parts of the world (Brundtland, 1987).
- According to the Brundtland report, economic development is not to stop, but it must change course to fit within the planet's ecological limits.
- It also popularized the term "***sustainable development***," which it defined as "***development that meets the needs of the present without compromising the ability of future generations to meet their own needs.***"

Three concepts are inherent in this definition:

(1) the concept of “need,” and more particularly the basic needs of the most deprived, who should be given the highest priority,

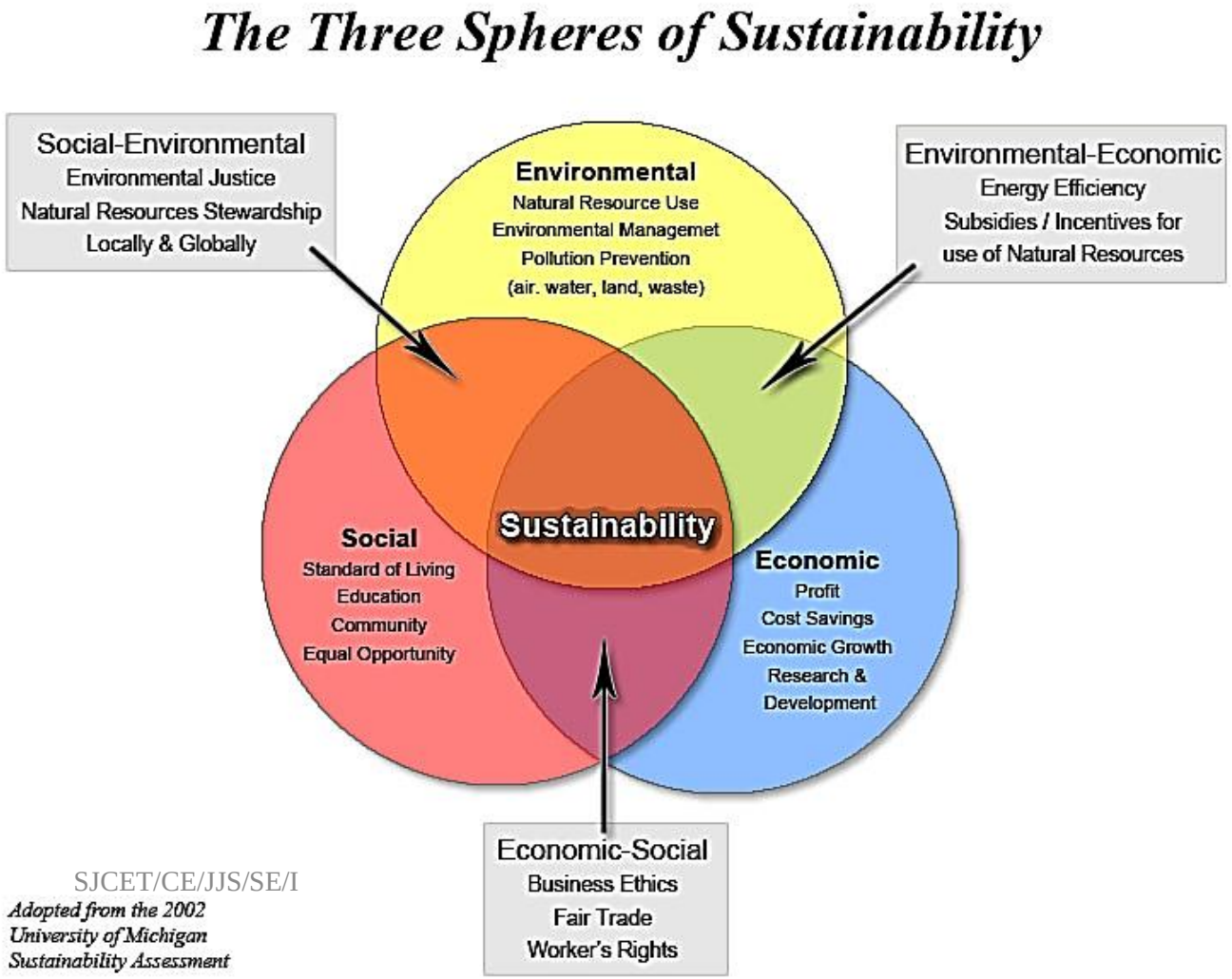
(2) the idea of the limitations that the state of our techniques and our social organization Imposes on the capacity of the environment to meet current and future needs, and

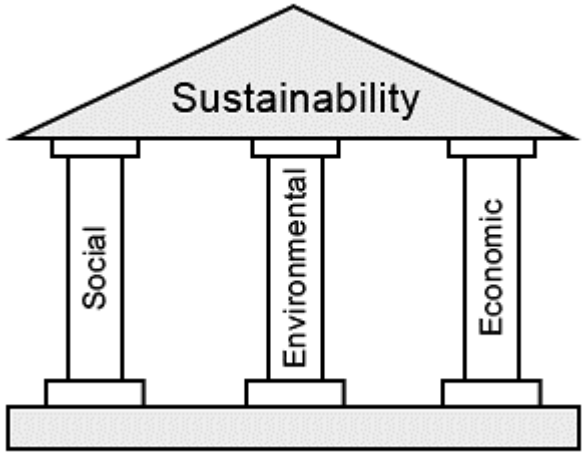
(3) the concept of “intra-generational and intergenerational equity”

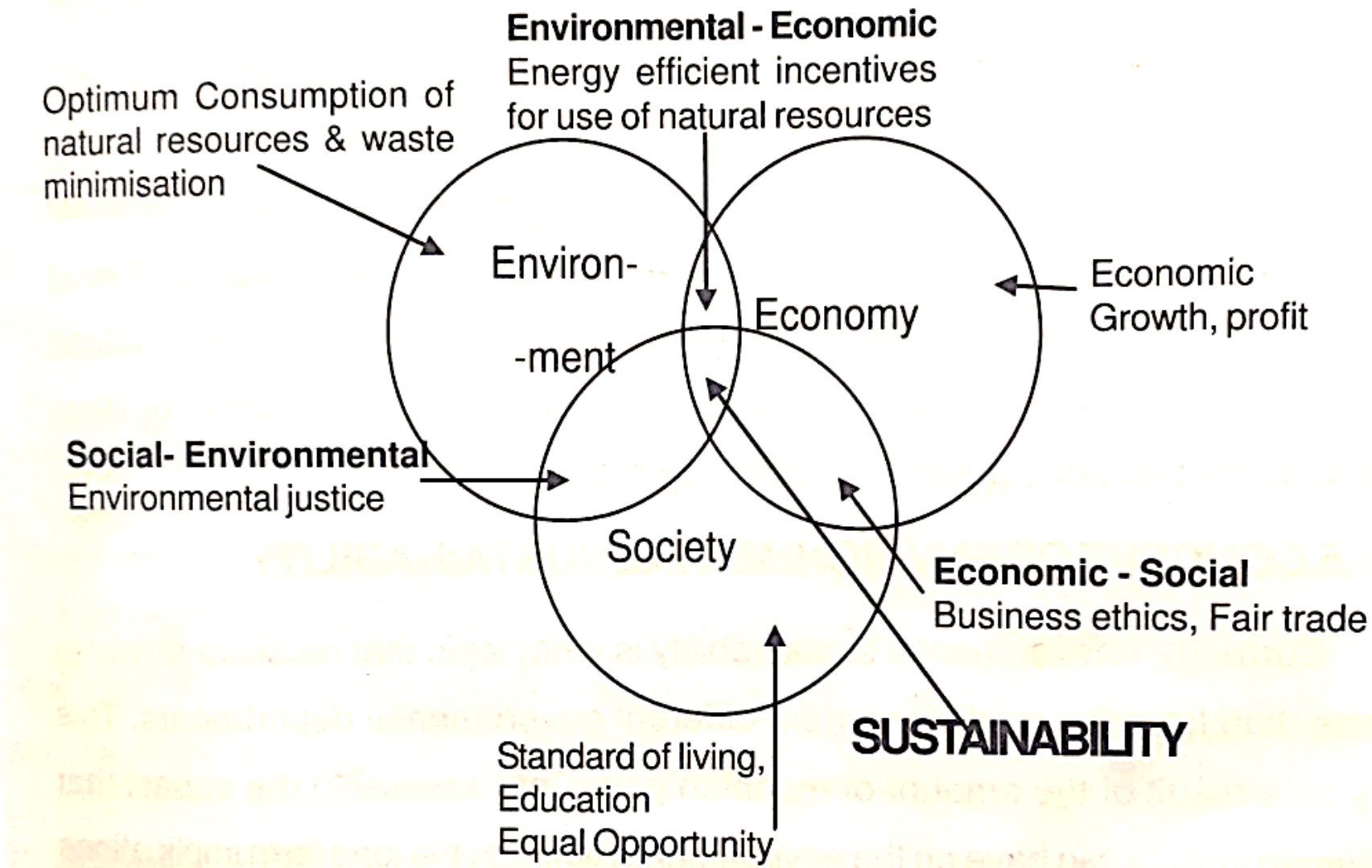
(i.e., the fair distribution of, and access to resources within the same generation, and between succeeding generations).

# The Three Pillars of Sustainability

- The three pillars of sustainability are a powerful tool for defining the complete sustainability problem




Environmental - Economic
Energy efficient incentives for use of natural resources
Optimum Consumption of natural resources & waste minimisation
Environ-
-ment
Economy
Economic
Growth, profit
Social- Environmental
Environmental justice
Society
Economic - Social
Business ethics, Fair trade
SUSTAINABILITY
Standard of living,
Education
Equal Opportunity

# Clean Development Mechanism(CDM)

- The United Nations Conference on Environment and Development (UNCED) held in Rio in June 1992.( or Earth Summit)
- Issues addressed in the conference

✓ climate change

✓ alternate sources to replace fossil fuels

✓ new reliance on public transportation system in order to reduce vehicle emissions and the growing scarcity of water.

- UNFCCC (United Nations Framework Convention on Climate Change) conducts yearly conferences known as Conferences of Parties(COPs).
- They assess progress in dealing with climate change.
- First conference held in Berlin in 1995.

# 1997: Kyoto, Japan

- Established legally binding obligation to developed countries to reduce their Greenhouse Gas(GHG) emission through **Kyoto Protocol.**
- To reduce emission of major GHG namely
  - carbondioxide
  - methane
  - nitrous oxide
  - set of per fluorocarbons
  - hydro fluorocarbons

- The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005.
- Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of *"common but differentiated responsibilities.“*
- Under the Protocol, countries must meet their targets primarily through national measures.
- However, the Protocol also offers them an additional means to meet their targets by way of three *market-based mechanisms*.

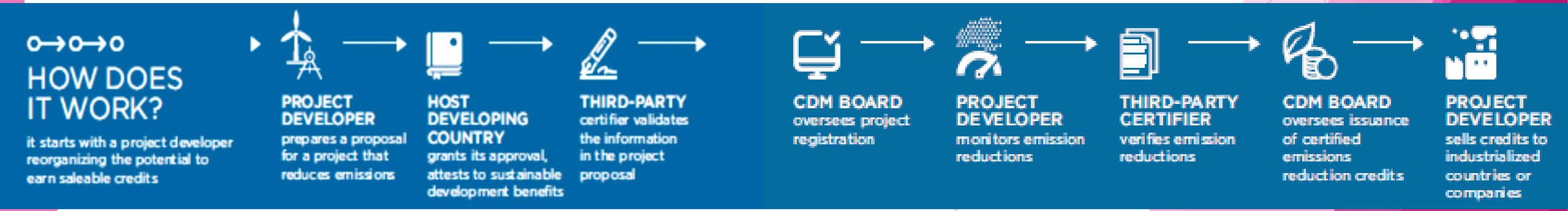
# The Kyoto mechanisms

- **International Emissions Trading**
- **Clean Development Mechanism (CDM)**
- **Joint implementation (JI)**

# Clean Development Mechanism(CDM)

- UFCCC follows principle of *common but differentiated responsibilities,* which recognizes that burden of responsibility should fall heaviest on countries which has historically emitted the greatest quantity of GHGs.
- The Protocol legally requires highly industrialized countries(known as **Annex 1 parties**) to achieve quantified reductions in manmade GHGS.
- The less developed countries have(**non-Annex1** parties) have no binding target reduction.

- CDM is a market based mechanism.
- It entices private companies to fund GHG reducing projects in developing countries by awarding these projects **Certified Emission Reductions(CER)** also called OFFSET CREDITS that bring huge profits in carbon trading markets.
- Annex 1 countries buy these CERs to offset their own emissions with reductions made in non-Annex 1 countries.



## Case Study

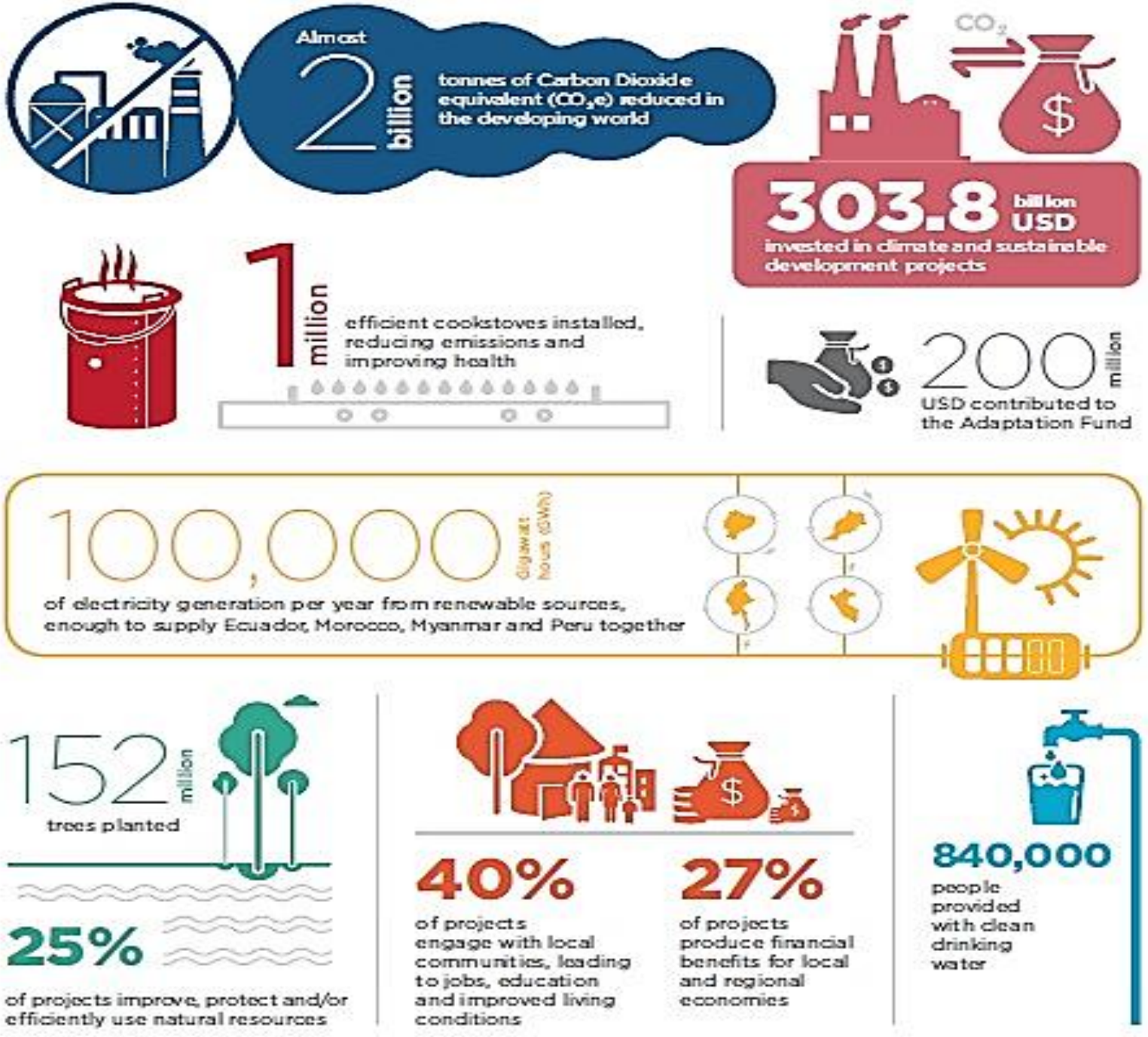

In the late 1990s, Bogotá's public transport system was unreliable, noisy, dirty and struggling to cope with its growing population.

**Opened in 2000,"Transmilenio is a massive transportation system that brings exclusive bus lanes, operating different routes through the city,"**

Transmilenio, registered with the CDM in 2006, has used money from the sale of CERs to fund improvements to the network and its infrastructure. The network now has 12 lines covering about 114 kilometres throughout the city, with around 2,000 buses in operation. It carries over 2 million people each day.

As an estimated 9 per cent of Transmilenio passengers used to commute by car. This means that tens of thousands of private vehicles are off the road, which leads to a major reduction in emissions. Transmilenio users save an average of 223 hours annually compared to the old system, about a one-third reduction in travel time.


111 Non-Annex 1 countries with registered CDM activities
172 CDM Designated National Authorities
7,803
Registered Projects
140 Total countries
involved, including 36 of the world's 48 least developed countries
5
Regional Collaboration Centres across the Caribbean and Asia
216
baseline and monitoring methodologies and 39 standardized baselines in 15 sectoral scopes
700+
CDM consulting firms and countless CDM experts (consultants, project developers, carbon traders, etc.) worldwide
313
Registered Programmes of Activities, with 2,156 component activities
30
Accredited Independent Designated Operational Entities validate projects and verify emission reductions


Almost
2 billion
tonnes of Carbon Dioxide equivalent ($CO_2e$) reduced in the developing world
303.8 billion USD
invested in climate and sustainable development projects
1 million
efficient cookstoves installed, reducing emissions and improving health
200 million
USD contributed to the Adaptation Fund
100,000 gigawatt hours (GWh)
of electricity generation per year from renewable sources, enough to supply Ecuador, Morocco, Myanmar and Peru together
152 million
trees planted
25%
of projects improve, protect and/or efficiently use natural resources
40%
of projects engage with local communities, leading to jobs, education and improved living conditions
27%
of projects produce financial benefits for local and regional economies
840,000
people provided with clean drinking water

# Millennium Development Goals (MDGs)

- ✓ The *Millennium Development Goals (MDGs)* were eight international development goals for the year 2015 that had been established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration.

- ✓ The Sustainable Development Goals (SDGs) succeeded the MDGs in 2016.


*Official logos for each of the Millennium Development Goals*

All 191 United Nations member states, and at least 22 international organizations, committed to help achieve the following Millennium Development Goals by 2015:

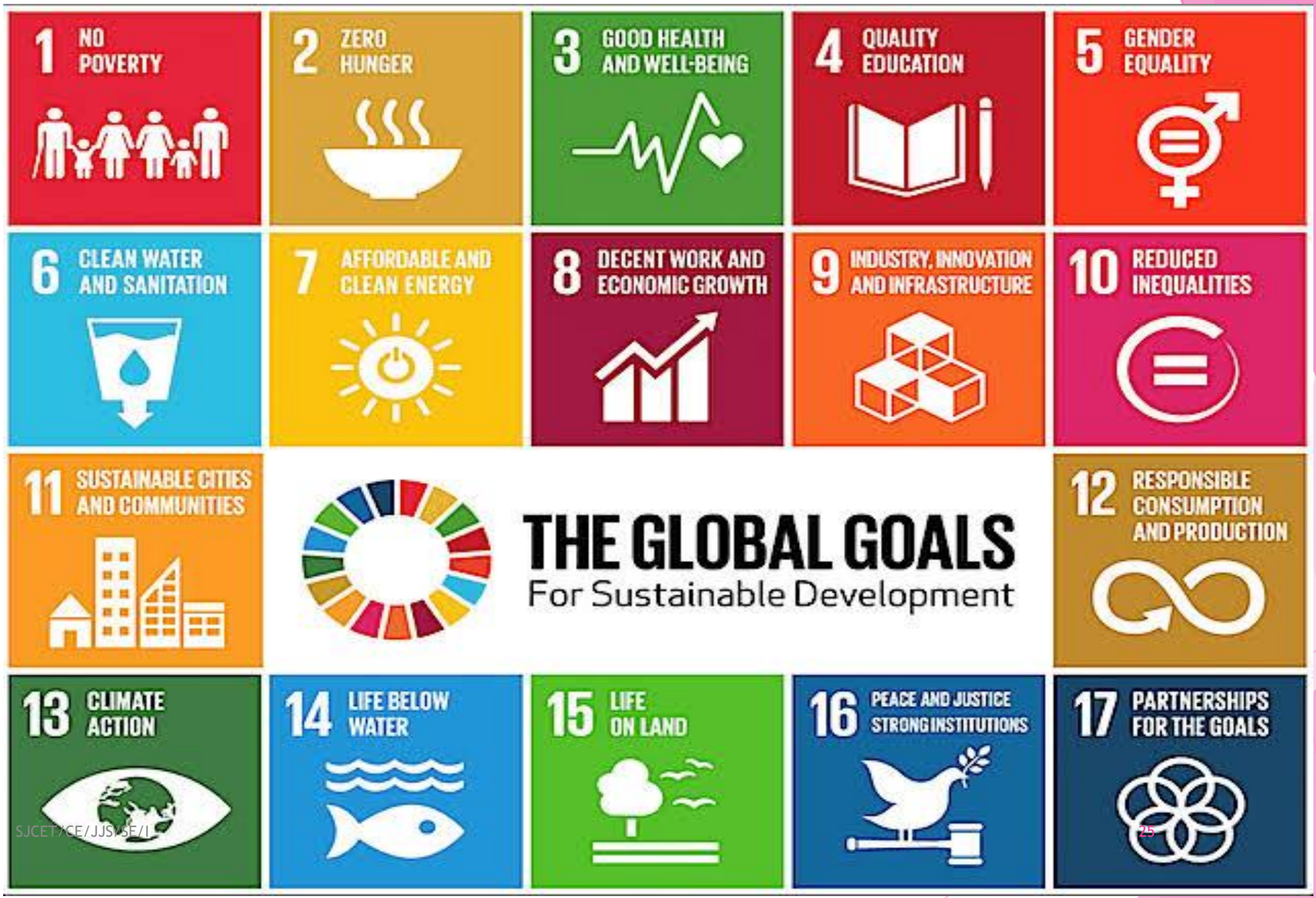
1. To eradicate extreme poverty and hunger
2. To achieve universal primary education
3. To promote gender equality and empower women
4. To reduce child mortality
5. To improve maternal health
6. To combat HIV/AIDS, malaria, and other diseases
7. To ensure environmental sustainability
8. To develop a global partnership for development

| Goal | | Target |
|---|---|---|
| 1. | Eradicate extreme hunger poverty and hunger | Halve, between 1990 and 2015, the proportion of people whose income is less than US$1 a day.<br>Halve, between 1990 and 2015, the proportion of people who suffer from hunger. |
| 2. | Achieve universal primary education | Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling. |
| 3. | Promote gender equality and empower women | Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015. |
| 4. | Reduce child mortality | Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate. |
| 5. | Improve maternal health | Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio. |

| | | |
|---|---|---|
| 6. | Combat HIV/Aids, malaria, and other diseases | Have halted by 2015 and begun to reverse the spread of HIV/ Aids.<br>Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases. |
| 7. | Ensure environmental sustainability | Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.<br>Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.<br>Have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers. |
| 8. | Develop a global partnership for development | Develop further an open, rule-based, predictable, nondiscriminatory trading and financial systems.<br>Address the special need of Least Developed Countries (LDCs).<br>Address the special needs of landlocked developing countries and small island developing states.<br>Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term. Note some of the indicators are monitored separately for LDCs, Africa, landlocked developing countries, and small island developing states.<br>In cooperation with developing countries, develop and implement strategies for decent and productive work for youth.<br>In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.<br>In cooperation with the private sector, make available the benefits of new technologies especially information and communication technologies (ICT). |

# Sustainable Development Goals (SDGs)

- The SDGs, set in 2015 by the United Nations General Assembly and intended to be achieved by the year 2030, are part of a UN Resolution called "The 2030 Agenda".
- The targets and indicators for the SDGs are included in the UN Resolution adopted by the General Assembly two years later on 6 July 2017


1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
THE GLOBAL GOALS
For Sustainable Development
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

## The Sustainable Development Goals are:

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation, and Infrastructure
10. Reducing Inequality
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life On Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

- SDG's are build on the comprehensive principles of inclusiveness, equity and sustainability, have the potential to fundamentally change human outcomes across the planet.
- By ratifying the declaration, the global community has agreed to take action, collectively and individually, to achieve economic, social and environmental goals in an integrated manner, reflected in the credo of ***'People, Planet, Prosperity, Peace and Partnership'*.**
- SDG goals are crafted, ensuring that the objective of '***leaving no one behind***' is fully met.

# Nexus between Technology and Sustainable Development

- Science and Technology are considered amongst the most effective means to enhance growth and socio-economic development of nations.
- Technology is a offspring of science.
- Technology starts when commercial possibilities of use  of scientific discoveries are recognized.

- Conserving natural resources is the fundamental concept of sustainable development.
- Technology can support sustainability:
  - Reducing waste
  - Raising efficiency standards
  - Finding substitutes.

- Sustainability objectives are realized through technology.
- Modes

(i) Sharing of Information

(ii) Education

(iii) Communication and Information Technologies.

## Agricultural Technologies

Research and Technology should contribute to

- Improving productivity
- Soil and water conservation
- improving human nutrition
- Food quality and safety which contribute to economy as a whole.

- (ii) Energy Technologies

Low technical efficiency with which energy is produced, converted and used in developing countries could be improved through adoption of proven technologies.

Eg: more efficient biomass stoves to reduce fuel use and reduce smoke emission

Simple  motor driven systems for pumping water or grinding grain

Mechanical traction to improve agricultural productivity.

(iii) Environmental Technologies

Environmental awareness and transfer of environmental technologies can reduce day to day operating.

Inefficiencies, emission of environmental contaminants, worker exposed to hazardous material and risk of technological disasters.

## (iv)Disease related bio-medical technologies.

Research institutions in developing countries should serve as training facilities and should help developing countries .

# Challenges for Sustainable Development

(i) Misconception about Sustainable Development:
The popular perception that undertaking sustainable development Path hinders developmental activities

(ii) Population Explosion in Developing Countries

(iii) Absence of adequate political and industrial will for moving towards a sustainable future

(iv) Over exploitation of natural resources in developed countries

(v) Corruption and misuse of sustainable development assistance fund

(vi) Poor Solid waste Management

(vii) High cost of technology to tap renewable energy resources

(viii) Lack of co-ordination between the three pillars of sustainable development

(ix) Fresh water scarcity

(x) Loss of Biodiversity

(xi) Over dependence of fossil fuels leading to global warming and climate change

(xii) Absence of strict environmental laws to curb the menace of pollution.

(xiii) Lack of broad based public awareness towards sustainable development

# References


- http://unfccc.int/bodies/body/6383.php