



World Federation of Engineering Organizations
Fédération Mondiale des Organisations d'Ingénieurs

From Vision to Actions with Impact:

**Climate Change Education
in Small Island Developing States (SIDS) through
Curriculum Development and Teacher Training in Schools**

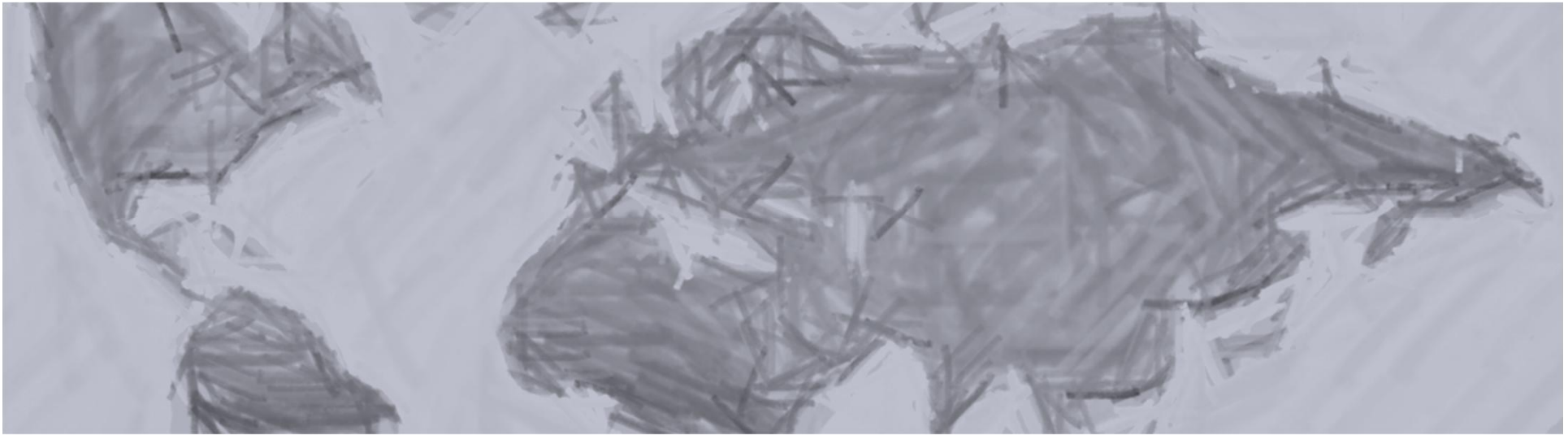
Dr. Marlene Kanga AO FTSE FISC HonFIEAust HonFIChemE

***President, World Federation of Engineering Organisations, 2017-2019
National President, Engineers Australia, 2013***



December 2022





The World Federation of Engineering Organizations (WFEO):

- **The peak international body for professional engineering institutions**
- **Founded in 1968, under the auspices of UNESCO**
- **100+ national professional engineering institutions, 12 international and continental/regional professional engineering institutions, representing 30 million engineers**
- **Co-Chair - Major Science and Technology Group at UN**
- **Representation at major UN Organisations**



Since November 2017, WFEO has a vision and message that every one of the UN Sustainable Development Goals can be advanced through engineering



Engineering for Sustainable Development



WFEO – UNESCO
Declaration, signed on March 7, 2018



WFEO / FMOI

Paris Declaration

**Advancing the United Nations
Sustainable Development Goals
through Engineering**



The World Federation of Engineering Organizations (WFEO) is the main body for engineering globally, representing nearly 100 nations and some 30 million engineers.

The members of WFEO are the national and regional professional engineering institutions of the world. WFEO is a member of the United Nations Scientific and Technological Community (UN STC) Major Group and has an official Associate status with UNESCO.

UNESCO, as the United Nations agency for education, science and culture, supports engineering through its Natural Sciences Sector, and acknowledges engineering as a powerful means to achieve sustainable development, capacity-building in engineering education and gender equality in developing countries, as well as the safeguarding of world heritage.

CELEBRATING 50 YEARS OF INTERNATIONAL ENGINEERING LEADERSHIP

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***Engineering* for Sustainable Development**

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1. **Increase the number and quality of engineering graduates...**

Accordingly, we declare:

1. WFEO, a recognized member of the UN STC Major Group and UNESCO, through its Natural Sciences Sector, will work together and in cooperation with other UN organizations, including UNEP, UNFCCC and UNISDR towards achieving the SDGs through engineering.

2. **Inform global standards for engineering education, support the development of a range of engineering education systems to comply with agreed standards...**

2. WFEO and UNESCO are committed to the following principles for action through engineering to achieve the SDGs:

a. Increase the numbers and quality of engineering graduates that meet the needs of sustainable development with rapidly changing technologies, in collaboration with educators, government and industry;

b. Inform global standards for engineering education, support the development of a range of engineering education systems to comply with agreed standards and facilitate the mobility of engineers;

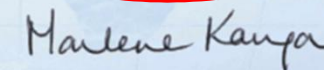
3. **Support Capacity Building through strong institutions for engineering education...**

c. Support capacity-building through strong institutions for engineering education and the development of accreditation bodies for the recognition of professional credentials;

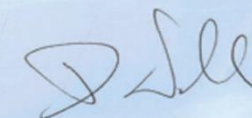
d. Establish policy frameworks and best practices, notably through WFEO Standing Technical Committees, as digital technologies, data sciences and artificial intelligence have ethical and social implications.

stage in bringing together the WFEO members and partners to develop the *WFEO Engineering 2030 Plan*.

Signed in Paris, 7 March 2018



Marlene Kanga
President
World Federation of Engineering Organizations



a.i. Flavia Schlegel
Assistant Director-General for Natural Sciences
UNESCO

Note: "standards" used in 2018, Since 2019, using "benchmarks" to align with IEA definitions



WFEO has an on-going commitment to addressing Climate Change through Education

“WFEO has been continuously advocating in favor of training more engineers, technicians, educators so they can have the right skills to be up to the task of fighting, mitigating and adapting to climate change, especially in countries which face the most consequences of it.

Training the educators, and mentoring the engineering education national system, in order to bring harmonization in standards, are the main pillars of this strategy, and this workshop sets a perfect example of its implementation.”

*Message to Opening of Climate Change
Education Workshop, Mauritius, 22
November 2022*



WFEO President 2021-2023,
Prof. Jose Vieira



Partnerships for Climate Change Education in Primary and Secondary Schools

- UNESCO
- World Federation of Engineering Organisations (WFEO)
- Office of Climate Change Education (OCE)
- National Environment Agency Singapore (NEA)
- Mauritius Ministry of Education, Tertiary Education, Science and Technology
- Mauritius National Commission to UNESCO
- Mauritius Institute of Education (MIE)
- Institution of Engineers Mauritius (WFEO National Member)

Engineering for Sustainable Development



Climate Change Education Project

Objective: Curriculum development and Teacher training for world class climate change education for primary and secondary schools in Mauritius.

Planning: Commenced in September 2019 but in-person delivery was delayed due to COVID:

- first session – virtual - 29-30 June 2021.
- second session – 22-25 November 2022, in person in Mauritius

Funding: Donation of US\$10,000 World Federation of Engineering Organizations Innovation Prize in Nov 2019 from National Environment Agency Singapore

Timing: The project took three years to deliver and remained focused as a result of the passion and dedication of all the representatives of the partners that were involved.



Office of Climate Change Education

A Category II UNESCO Centre

- **The Office for Climate Education (OCE)**, created in 2018 at the initiative of La main à la pâte Foundation and the scientific community, as a response to the global need for climate change education.
- Eric Guilyardi, President of the OCE, is a climatologist and lead author of the IPCC.
- In 2020, the Office for Climate Education became a category 2 center under the auspices of UNESCO.
- OCE aims to promote climate change education at the international level, with a special focus on emerging countries.
- The OCE has a mission to promote climate change education worldwide through:
 - Quality educational resources, based on the IPCC reports (OCE is an official observer) which emphasize interdisciplinarity and active pedagogy;
 - a professional development program to familiarize teachers with climate science, active pedagogy and project design;
 - design and implementation of national - or international- operational projects

See: <https://www.oce.global/en/about-us>

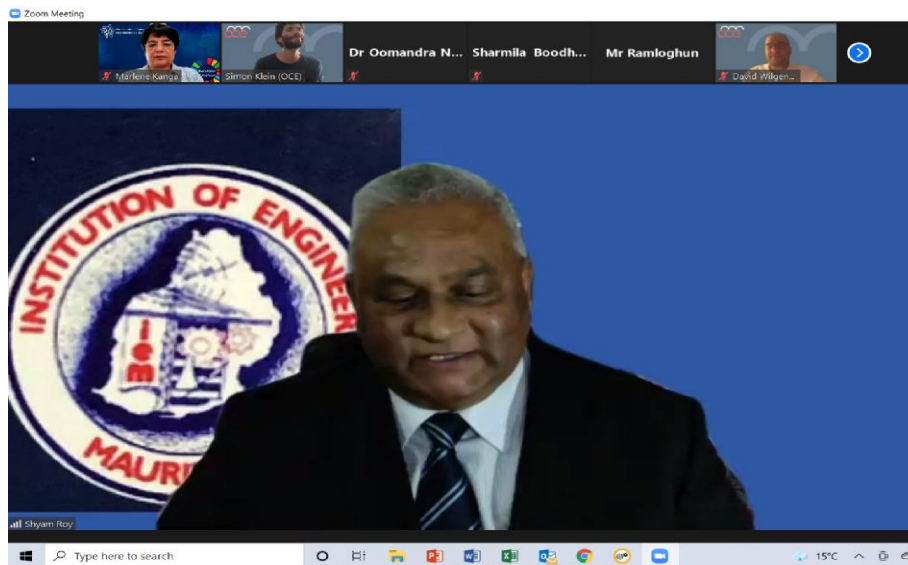


Partners in the Climate Change Education Project

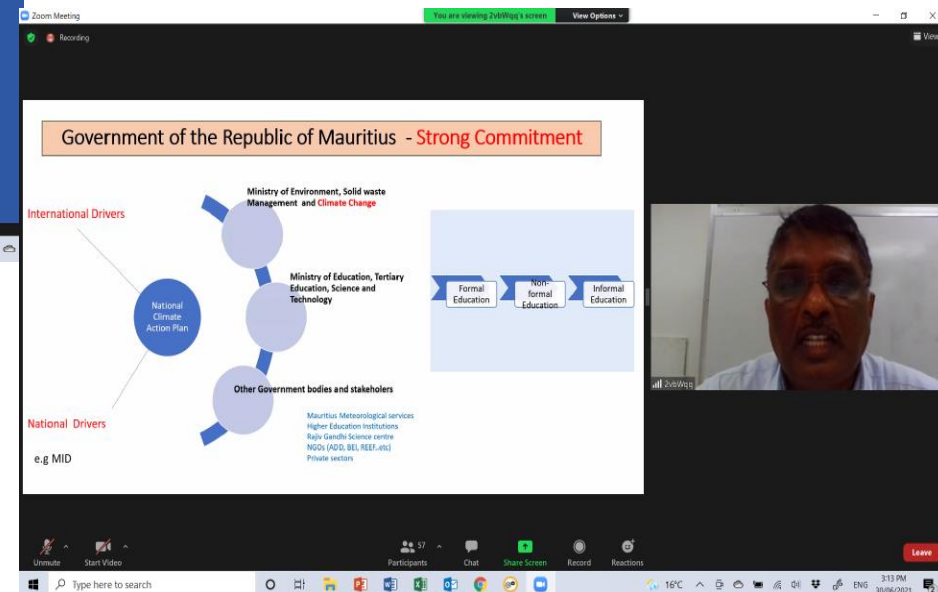
- **The Institution of Engineers Mauritius** is the national professional engineering institution for Mauritius. It is a national member of the World Federation of Engineering Organizations and provides professional development for engineers in Mauritius. See: <https://www.iemauritius.com/>
- **The Mauritius Institute of Education (MIE)** is a degree-awarding teacher education institution of higher learning, with the mandate for Educational Research, Curriculum Development and Teacher Education, responsible for pre-primary, primary, secondary and tertiary Education in the Republic of Mauritius, and operating under the aegis of the Ministry of Education and Human Resources, Tertiary Education and Scientific Research. See: <http://web.mie.ac.mu/about-us-5/>
- **The National Environment Agency (NEA), Singapore**, is the leading public organisation responsible for ensuring a clean and sustainable environment for Singapore. Its key roles are to improve and sustain a clean environment, promote sustainability and resource efficiency, maintain high public health standards, provide timely and reliable meteorological information, and encourage a vibrant hawker culture in Singapore. NEA works closely with its partners and the community to develop and spearhead environmental and public health initiatives and programmes. See: <https://www.nea.gov.sg/>



Climate Change Education Project Part 1 Virtual 29-30 June 2021, Mauritius



Mr Shyam Roy, President of the Institution of Engineers Mauritius, welcomes delegates at the opening of the Climate Change Education Workshop, 29 June 2021



Dr Ravhee Bholah, Associate Professor, Head, School of Science and Mathematics, Education for Sustainable Development Coordinator Mauritius Institute of Education.



Climate Change Education Project – Part 1 Virtual

The screenshot shows a Zoom meeting window. The main content is a presentation slide from the Office of Climate Change Education (OCC). The slide is divided into two main sections: 'OUR RESOURCES – SUMMARY FOR TEACHERS' and 'CLASS ACTIVITY # ACTIVITY'. The left section includes a diagram of the greenhouse effect and a line graph showing 'Global mean surface air temperature' from 1880 to 2100. The graph compares historical data (red line) with two projections: RCP2.6 (blue line) and RCP4.5 (orange line). The right section contains text about understanding ocean acidification and a 'TO DO' list for a class activity. A video of Simon Klein is visible in the bottom right corner of the presentation area.

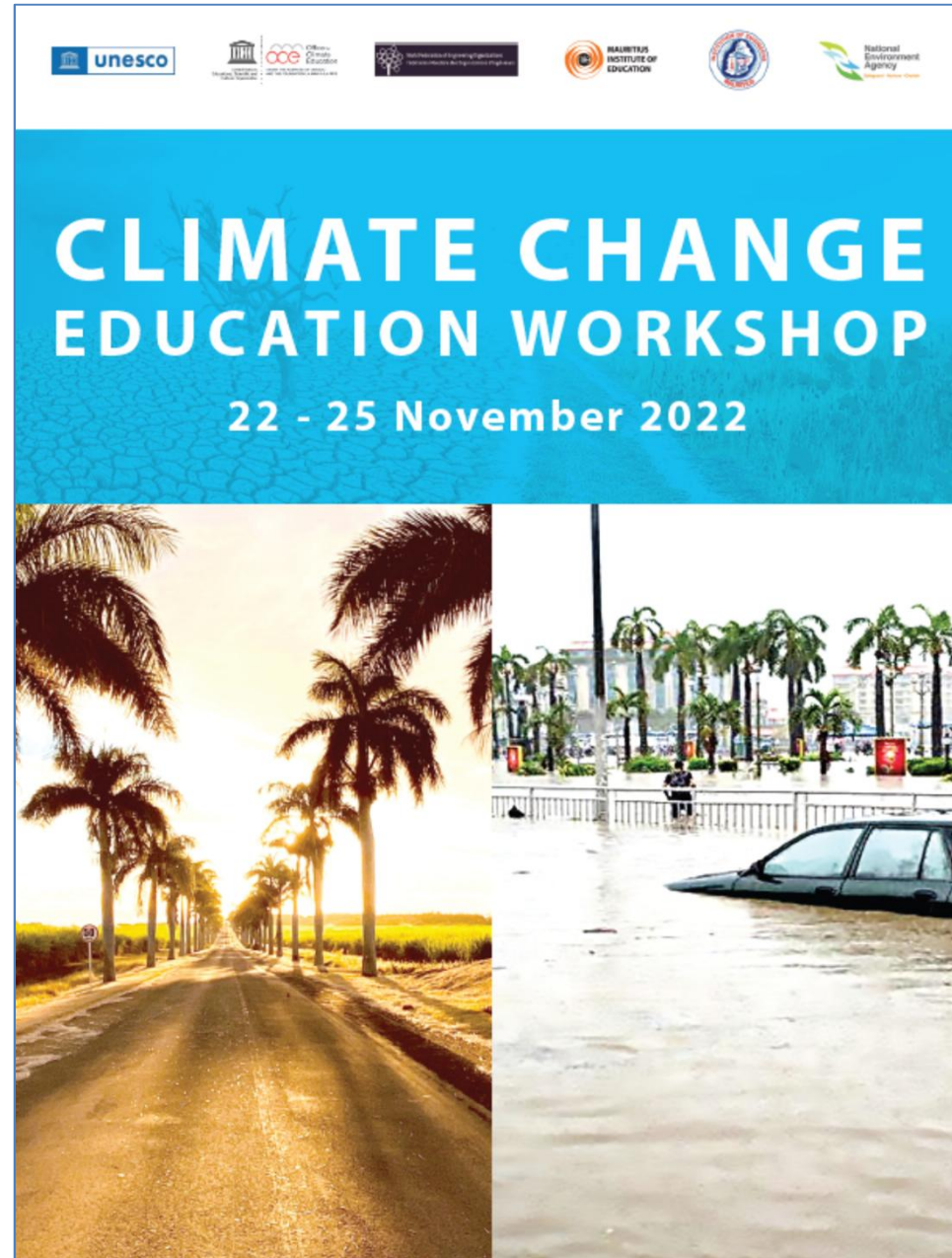
Dr Simon Klein presents information from the Office of Climate Change Education, UNESCO Category II Centre

Interactive session with teachers from Mauritius, Ms Rauma Imrit asks a question, 29 June 2021

This screenshot shows a Zoom meeting interface. At the top, there is a grid of participant thumbnails. From left to right, the participants are Rauma Imrit, Marlene Kanga, David Wigen, Simon Klein, and Mathilde Fricate. The name 'Shakeel Mauritius' is also visible on the right side of the grid. Below the grid, a large video window shows Ms Rauma Imrit. The Zoom meeting controls are visible at the bottom of the window, including a search bar, system tray, and a 'Recording' indicator.



Climate Change Education Project Part 2 - Mauritius



Climate Change Education Project – Part 2 - Mauritius

Hands-On Learning with UNESCO SANDWATCH

UNESCO Teaching Tool in Small Island Developing States



Sandwatch is a volunteer network of children, youth and adults working together to enhance their beach environment and build resilience to climate change. Supported by a well-illustrated manual, in various languages, Sandwatch groups can select to investigate different aspects of the beach such as: *beach erosion and accretion, sediment composition, impact of human activities on the beach, beach debris, pollution, water quality, waves, currents, plants and animals.*

See: <https://en.unesco.org/sids/sandwatch>; <https://www.sandwatchfoundation.org/>



Office of Climate Change Education (OCE) Training Materials for Teachers from World Class Experts



WORKSHOP
Ocean and climate change

This resource is a guide for a professional development workshop for teachers, about the relationship between the ocean and the climate, and specifically about the consequences of climate change for the oceans. Teachers carry out experiments to investigate glacier and sea ice melting, sea level rise, ocean acidification, and its consequences for biodiversity.

OVERVIEW
Participants wonder about the consequences of climate change for the oceans. They realize, using simple experiments, that the melting of continental ice and the thermal expansion of water lead to a rise in sea level, but not the melting of sea ice. On the other hand, they discover that the melting of sea ice is responsible for an amplification and acceleration of global warming, due to the albedo of ice, which is very different from the ocean's.

Participants also highlight, with experiments, the dissolution of CO₂ in water, and its consequences in terms of ocean acidification. They understand the consequences of this acidification for biodiversity, particularly for corals and phytoplankton.

Two extensions are suggested, one on the thermal inertia of the oceans, the other on marine currents, and their possible disruption due to global warming.

These different simulations also provide a good introduction to science teaching using an inquiry-based approach.

Summary

- 3 Overview and required material
- 4 Initial representations
- 5 Sea level rise : ice melting
- 8 Sea level rise : thermal expansion
- 10 Sea ice melting and albedo
- 12 Ocean acidification
- 14 Consequences of ocean acidification on marine biodiversity
- 17 Follow-up workshops
- 17 Attached documents

Resource
1st through 10th grades teachers
Duration: 3h - 5h (optional)

Subjects
Natural sciences
Geography

Pedagogical approach
Experimentation
Inquiry-based learning




WORKSHOP
Developing a sequence of lessons from a conceptual framework

The goal of this professional development activity is to learn how to design an educational project that uses inquiry-based learning.

This activity is aimed primarily at professional development providers, education advisors, curriculum managers, inspectors, etc. However, it can be attended by experienced teachers.

OVERVIEW
The participants, divided into groups, identify topics they would like to explore in the classroom.

Each group works on a topic, for a specific level (age group). The groups start by developing a conceptual framework: this means formulating their theme's fundamental concepts, using simple and clear sentences ("student formulation"), organized spatially and linked together by logical links.

After presenting their conceptual frameworks to the other groups, and discussing possible improvements, they complete them and then use them to produce a "turnkey" sequence of lessons.

Summary

- 3 Overview and required material
- 4 Introduction
- 7 Identifying global topics
- 9 Building the conceptual framework
- 11 Developing a sequence of lessons
- 12 Presentations of the educational projects and conclusion
- 12 Attached documents



Resource
100 providers
Duration: 6 to 8 hours (optional)

Subjects
All subjects

Pedagogical approach
Group management
Brainstorming




WORKSHOP
Understanding the greenhouse effect

This resource is a guide for a professional development workshop for teachers, about the greenhouse effect. Teachers carry out different experiments in order to understand the greenhouse effect and the role of infrared radiation.

OVERVIEW
After expressing their conceptions of the greenhouse effect mechanisms, the participants look for a way to demonstrate it through a simple experiment.

They then realize that there is no experiment feasible in the primary or middle school classroom capable of demonstrating it, and that the phenomenon can be studied in several ways: by means of an analogy, by means of a document review, or by means of an experiment highlighting the role of certain materials that are transparent for visible light and opaque for infrared light.

They discuss the benefits and limitations of each approach and develop a better understanding of the greenhouse effect.

This simulation also provides a good introduction to science teaching using an inquiry-based approach.

Summary

- 3 Overview and required material
- 4 Initial representations of the greenhouse effect
- 5 Experimental highlighting of the greenhouse effect
- 8 Preparing an experiment highlighting infrared radiation
- 14 Conclusion: what is the greenhouse effect?
- 15 From the greenhouse effect to climate change
- 16 To learn more
- 17 Follow-up workshops
- 17 Attached documents



Resource
1st through 10th grades teachers
Duration: 3h - 4h (optional)

Subjects
Natural sciences
History

Pedagogical approach
Experimentation
Inquiry-based learning



See: <https://www.oce.global/en/ressources>



Climate Change Education Project – Workshop



Climate Change Education Project – Workshop

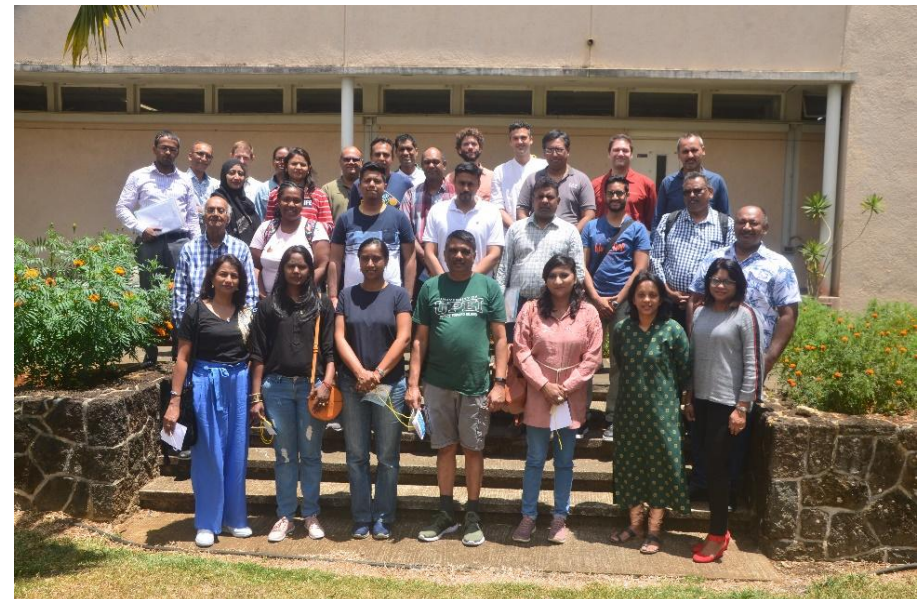


Engineering for Sustainable Development

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Climate Change Education Project – Workshop



Climate Change Education Project – Workshop



Climate Change Education Project – Mauritius - Outcomes

- Training for primary and secondary school teachers, from Mauritius and Rodrigues
- Training for Teacher Trainers
- Curriculum development for ongoing teaching of climate change – causes and effects
- Demonstration of the use of UNESCO SANDWATCH and OCE teaching resources
- Ongoing long term benefits for the people of Mauritius



Teachers, teacher trainers and trainers/speakers from OCE, Mauritius Institution of Education and Institution of Engineers Mauritius at closing session of teacher training workshop, Mauritius, 25 November 2022





***Engineering* for Sustainable Development**

- **Participation**
- **Influence**
- **Representation**



**The world's engineers
united in rising to
the world's challenges.
For a better, sustainable
world.**



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The World Federation of Engineering Organizations
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