Sustainable Development Goals (SDG) Affinity Group

UNEVOC
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International Centre for
Technical and Vocational
Education and Training

TVET and climate change action (SDG-13)
An interactive workshop on the En-ROADS climate change simulation tool

Invitation
Join **UNESCO-UNEVOC**, with the co-Leads of the **WFCP SDG Affinity Group** in a 2-hour virtual simulation workshop on **6th April 2022 (Wednesday), 11.00-13.00h** Eastern Time **/ 16.00-18.00h** Central European Time (GMT+1) via Zoom (**registration required**). Annex 1 (attached below) provides some background on the topic addressed by the session.

Workshop facilitators/hosts:
- **Dr. Juliette Rooney-Varga**, Professor & Director, University of Massachusetts Lowell, USA
- **Ms Carolyn McCarthy**, Programme Associate, University of Massachusetts Lowell, USA

Objectives:
Using the En-ROADS simulation tool, the virtual workshop aims
- To establish understanding on the causes and impacts of climate change;
- To identify and demonstrate relevant actions as well as the opportunities and barriers to integrating sustainability into education and training; and
- To explore opportunities to mainstream climate change education in the TVET classroom

Target audience:
- Educators, trainers, training specialists and managers of sustainability/SDGs/climate change education programmes and projects

Additional important information:
- Participants will be requested to respond to a pre-/ and post-simulation survey and briefing statement (to be explained at the session)
- Participants who are able to complete the 2-hour session will be provided with a document stating **record of attendance** (if you attended the entire session, you may send an e-mail requesting for this document after the session to unevoc.greeningtvet@unesco.org)

Technical and other requirements to participate in the simulation and break-out sessions:
- Zoom access via a desktop computer with internet connectivity
- Camera
- Microphone
- Availability for at least 1.5 to 2 hours

To connect, click on the link:
Join Zoom Meeting
https://uml.zoom.us/meeting/register/tJIkcuGvqjktGNQtRVxxCx1eohMgozlRmBQC

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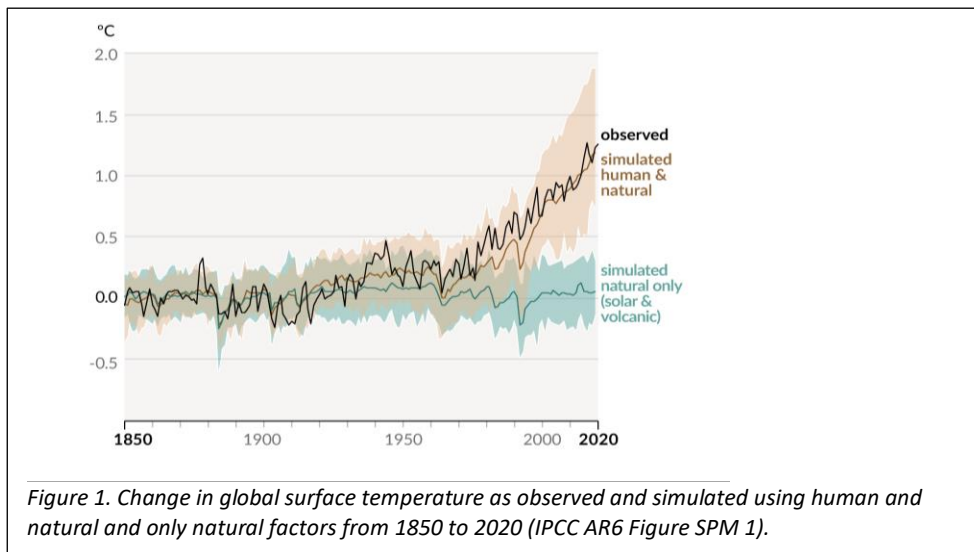   +1 669 900 6833 US (San Jose)
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Annex 1

Background

Most of the world's population has already experienced the impacts of human-caused climate change directly (Callaghan et al., 2021). Heatwaves, droughts, storms, sea level rise, and wildfires are all intensifying as the planet warms. The primary cause of global warming is carbon dioxide, which is emitted when fossil fuels - coal, oil, and natural gas - are burned. Carbon dioxide builds up in the atmosphere where it traps heat, causing our climate to warm. Human activities emit other heat-trapping gases as well, including methane, nitrous oxide, and fluorinated gases. Emissions of all of these gases have risen steadily since the late 1800's, and so has their accumulation in our atmosphere (IPCC, 2021).

So far, global average temperature has warmed by about 1.1 ˚C above pre-industrial times *(Figure 1; IPCC, 2021)*. Without strong action, the global temperature is expected to continue to rise to 2.7 to 3.6 ˚C by 2100 {Climate Action Tracker, 2021 #6588} and its impacts would be devastating. To avoid these potentially catastrophic consequences and meet our international goal of limiting warming to 1.5 ˚C to 2 ˚C, global emissions of heat-trapping gases must reach 'net zero' by mid-century. In other words, emissions must be cut to near zero and any remaining emissions must be balanced by equivalent sequestration of carbon dioxide.

Figure 1. Change in global surface temperature as observed and simulated using human and natural and only natural factors from 1850 to 2020 (IPCC AR6 Figure SPM 1).

The good news is that momentum for climate action is building. As of November 2021, 140 countries that together account for ~90% of global emissions pledged to achieve net zero emissions {Climate Action Tracker, 2021 #6588}. It may still be possible to limit warming to 1.5 ˚C if these pledges are fully implemented and expanded to include all nations.

The accumulated economic benefits of meeting the 1.5 ˚C goal are estimated at >$20 trillion USD by 2100, with poorer countries benefiting the most (Burke et al., 2018; IPCC, 2018). As demand for energy efficiency, wind turbines, solar panels, fuel cells and more grows, an annual market

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opportunity of more than $1 trillion USD is projected by 2050, with most of that investment made in emerging markets and developing countries (IEA, 2021).

We now have an opportunity and an urgent need to educate young people and train the technical workforce that can build a climate-resilient green economy for a prosperous, healthy, and secure future. Climate change education is a starting point. Situated at the nexus of natural, social, and economic systems, climate change is a complex global challenge. For this reason, we need climate change education that reflects its complexity and that enables students to learn for themselves about how human systems interact with the climate so that they can develop new solutions to build a better future.

In this session, participants will use a simulation-based tool for engaging, rigorous climate change education that supports and motivates science-based climate action *(Rooney-Varga, 2018; Rooney-Varga, et al., 2021; Rooney-Varga, Hensel, et al., 2021; Rooney-Varga et al., 2020; Rooney-Varga et al., 2018)*.

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This approach to climate change education for action intersects with many of the **United Nations Sustainable Development Goals** (SDGs; United Nations, 2021a). It directly supports
- SDG4 (Quality Education),
- SDG8 (Decent Work and Economic Growth), and
- SDG13 (Climate Action),

while the climate action it fosters also supports
- SDG6 (Clean Water and Sanitation),
- SDG7 (Affordable and Clean Energy,
- SDG9 (Industry, Innovation, and Infrastructure),
- SDG14 (Life Below Water), and
- SDG15 (Life on Land).

A systems thinking approach to climate change education

We define a *system* as a set of elements whose interactions generate behavior and are organized to achieve a goal. A system can be tangible, such as a heating system, or it can be intangible, like a person's belief system. *Systems thinking* is a framework or perspective that examines the whole, including a system's goal, behavior, and interconnections, rather than focusing on elements of a system in isolation.

Considering the complexity of climate change, we need tools to support climate change education that best reflect its interconnected natural and human elements and replicate the dynamic behavior we observe. Simulation-based learning provides this opportunity in an interactive manner that allows learners to discover for themselves how and why a system behaves as it does. Resembling the scientific method, learners can test decisions in a simulated reality, observe their results, and design a combination of actions to achieve their goal.

Enhancing systems thinking using a simulation-based tool

There are available simulation-based tools for engaging, rigorous action learning. One of these tools, the **En-ROADS Climate Change Solutions Simulator**, is a free, easy-to-use computer simulation model that allows learners, or educators or facilitators of learning to design climate action scenarios at a global scale and get immediate feedback about the expected results of decisions that are made over the 21st century.

En-ROADS (Energy Rapid Overview and Decision Support) is grounded in the best available science, tested against other trusted climate and energy models, and is updated regularly.

Watch the following video to learn about the En-ROADS interface and explore eight actions and policies related to energy supply.

En-ROADS Energy Supply
(click link to go to video clip)

Watch the following video to see how the results of any action taken in En-ROADS can be instantly observed across the interface graphs and temperature displays. Continue to learn about the remaining actions and policies in En-ROADS related to transportation, buildings and industry, growth, land and agriculture, and more.

En-ROADS Transport, Buildings, and Land
(click link to go to video clip)

The En-ROADS model has been used around the world by policymakers, business and nonprofit leaders, and educators to design effective climate policies and educate tens of thousands of people. As you learn about the tool, you will see for yourself why this tool has the potential to provide insight and stimulate rich discussion among diverse learners.

(Note: The information contained in this background brief was based on an introductory module developed for UNESCO-UNEVOC by Dr. Rooney-Varga and Ms. McCarthy on the same topic.)

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