

Report to IUPAP General Assembly, September 2023

1. Background

Issues around climate change are set to grow in the coming years. These challenges are intimately connected with the need for energy security, food security, water security, and sustainability of the environment, and if not addressed will impact negatively on poverty, inequality, mass migration, and the human condition. These are global problems that require a global effort, including a transdisciplinary endeavour across all sciences, engineering, human and social sciences, law, health sciences, and basic sciences. The 2021 Nobel Prizes emphasised that there are roles for physics.

The proposal to establish a new Working Group on *Physics and the Green Economy* was supported by the General Assembly on 14 July 2022 and approved by the IUPAP Executive Council on 21 September 2022, becoming *Physics for Climate Change Action and Sustainable Development*. The task of the WG is to promote and grow the unique role that physics is and should be playing in the green economy.

2. Members

Capitals indicate family name, underlining preferred first name

Members	country or territory	
Prof. <u>Nithaya</u> CHETTY Chair	South Africa	IUPAP VP Membership U Witwatersrand
Prof. Irvy (<u>Igle</u>) GLEDHILL Secretary	South Africa	Past Chair IUPAP WG5 U Witwatersrand
Dr. <u>Hyunjung</u> LEE	Korea	Korea Institute of Fusion Energy
Prof. <u>Morgan</u> O'NEILL	Canada	Vice Chair APS Topical Group on the Physics of Climate U Toronto
Prof. Dr. <u>Ram</u> Prasad REGMI	Nepal	National Atmospheric Resource and Environmental Research Laboratory Tribhuvan University
Prof. <u>Jon</u> SAMSETH	Norway	Chair SCOPE - Scientific Committee of Problems of the Environment Energy Oslo Metropolitan University
Prof. <u>Jean-Louis</u> SCARTEZZINI	Switzerland	Founder Daylight Academy Former Director EPFL Solar Energy and Building Physics Laboratory
Dr. <u>Tomás</u> M. SINTES	Spain	University of the Balearic Islands
Dr. <u>Gry</u> Merete TVETEN	Norway	Expert Analytics AS, Oslo

During 2024, Prof. Carolina Vera resigned for personal reasons, and appointment of a member from Latin America and the Caribbean region is in progress. Prof Fida Khattak resigned due to work

pressure, and Prof Ram Regmi was appointed. Membership is still to be completed, particularly in terms of island states. Bringing diverse voices to the table is critical.

3. Meetings

The WG meets quarterly and virtually. Most work takes place between meetings, offline. The following meetings were held: 30 October 2023; 28 February 2024; 14 June 2024; 12 September 2024. Terms of Reference have been agreed upon by consensus.

4. Current activities

4.1. Physics research for a sustainable planet: Inter-Commission Symposium, 12-13 October 2024

Prof. Pietro Ubertini, Chair of Commission 19, proposed an Inter-Commission symposium in conjunction with the General Assembly in 2024. WG21 under the chairmanship of Prof. Nithaya Chetty is in partnership with Prof. Ubertini to organise the ICS, together with Prof. Li Lu, Chair of the GA Local Organising Committee, Prof. Xiaoyan Shen, and Prof. Igle Gledhill, WG21 Secretary.

Time has been allocated for discussions. The sessions will be shared with the meeting of the Chinese Physical Society.

The ICS organising committee, with the help of the LOC and Secretariat, has called for speakers from Commissions and Working Groups and invited speakers as follows.

Day 1 12 October 2024	
Welcome address from LOC Chair	Prof. Li Lu, Chair, LOC
Welcome from IUPAP	Prof. Michel Spiro, President, IUPAP
The intention of this Symposium	Prof. Pietro Ubertini, Chair, C19
WG21 and the topics of this Symposium	Prof. Nithaya Chetty, Chair, WG21
Physics for a Sustainable Planet	Prof. Giorgio Parisi NL, Sapienza University of Rome
Climate Change and Geohazards	
Short and long term evolution of the climate	Prof. Ines Camilloni, Vice-Chair, IPCC Working Group I
Energy for the Future	
Chinese magnetic confinement fusion development for a sustainable planet	Prof. Vice President Chinese Physical Society, Chief Scientist EAST, Experimental Advanced Superconducting Tokamak
Solar, Hydrogen and Green Fuels	Prof. Jon Samseth, Chair, SCOPE, Scientific Committee of Problems of the Environment
Artificial Intelligence	
Gen AI? - What is the influence of AI on the young generation of scientists?	Cyrus Walther, Past President, Int. Assoc. of Physics Students
Day 2 12 October 2024	
Opening of Day 2	Prof. Silvina Ponce-Dawson
Nuclear Weapons Production, Control, and Threat	
"Where have all our good minds gone?"	Prof. Ana María Cetto, National Autonomous University of Mexico
Physics for the People: Academia and School, Research and Schooling	
Environmental Injustice and the Need for Physics for and by the People	Prof. Geraldine Cochran, The Ohio State University
Concluding remarks	Prof. Silvina Ponce-Dawson

Speakers have been advised of the intent of the Symposium, which includes the following (courtesy Prof. Ubertini):

Global challenges for humanity include sustainable development and global warming, energy, natural resources, pollution, clean water or the uncontrolled development of artificial intelligence. Solving these problems requires scientific research, politicians and decision makers to talk and listen to scientists and scientists raising public awareness.

It also requires scientists to learn how to clearly explain their science in a way that can be understood by non-experts. IUPAP has an enormous potential to play a leading role in such an enterprise. Its diversity from biophysics to nuclear and astrophysics covers all major branches of physics. Run by the physics community itself, it is independent and free. Each community might not have much impact. But if all branches get together and speak with one voice, it could make a major difference.

5. Tasks of WG21

A number of tasks arise from the Resolution forming the Working Group as follows.

1. Identify, promote, engage and discuss the unique role that physics is and should be playing in this area.

At each meeting, one or two members provide a 10-minute talk on their area of speciality. Prof. Carolina Vera has outlined opportunities for physics and physicists in climate science with absolute clarity. The emerging roles are diverse and inspiring.

2. Entrench an evidence-based approach to responses to climate change studies and the energy transition process in close collaboration with experts from other disciplines.

An evidence-based approach to addressing the topics is essential for creating effective policies and actions that can mitigate and adapt to the changing climate. It involves a comprehensive understanding of the science, continuous monitoring, and proactive policy measures. Dr. Hyunjung Lee has provided a preliminary outline, which has been incorporated into a draft position paper for tasks 2 and 3, since the evidence-based approach should be taken into account in every communication, and communication is the channel for entrenching an evidence-based approach.

3. Establish a strong bridge with the broad international public on these topics.

A position paper for tasks 2 and 3 has been drafted in which it is suggested that

- Key stakeholders with whom to communicate are physicists, scientists in general, decision makers, and the general public
- Communication with start with physicists, and extend to sectors of the general public, using lessons learnt
- Specific goals have been set
- Communication with university students (task 4) addresses communication and entrenching an evidence-based approach in their own work

WG21 is developing a system of “Climate contacts” across the world, requesting nominations from member liaisons, but very few have been received.

4. Suggest and encourage ways of incorporating green economy and sustainability thinking in university curricula and research training.

A preliminary draft on elements of a curriculum for physics students in climate and sustainability science is being drawn up. It is essential to establish liaison with C14, Physics Education, but a liaison will be nominated in October 2024.

5. Advise Executive Council on actions to be taken, work to be done, statements to be issued.

Discussion with the EC on the Inter-Commission Symposium, IYBSSD and the Earth-Humanity Coalition has taken place.

6. Organize at least one major conference over the next three years.

A call has been drawn up and sent out for bids to host a major conference in the scope of WG21, in 2027. The members of WG21 will form the International Organising Committee.

1. The aim of the conference is to Provide a forum for the global physics community to engage with climate change action and sustainable development.
2. This conference will be open to registration from any participant, and will be hybrid. Satellite conferences will be encouraged.
3. Principles adopted include
 - a. minimising carbon footprint
 - b. encourage the formation of partnerships and collaborations
 - c. encourage inclusivity; enhance the participation of developing countries, island states, and the global South.
4. Nominations for Plenary speakers are welcome.
5. Sponsorship is needed to allow delegates from developing countries and island states to be present in person or virtually, as well as to allow the production of proceedings.

7. Engage with the activities that are expected to take place in connection with the IDSSD

The declaration of the IDSSD by the United Nations and the formation of the Earth-Humanity Coalition can provide a considerable impetus to WG21 and enhance interaction. Informal contact with ISC has been initiated. In view of the success of IYBSSD, IUPAP members are encouraged to join the Earth-Humanity Coalition.

8. Liaise with Regional, national Physics Societies, with other Unions in other fields in the spirit of IYBSSD.

WG21 is developing a system of “Climate contacts” across the world, requesting nominations from member liaisons, but very few have been received. Part of their function is specifically to be the main contact in an IUPAP member territory, or a country, for the 2027 conference.

Informal contact with the ISC Science Director has been established. Formal contacts are scheduled for 2025.

6. IUPAP Internal liaison

Commissions, Working Groups and Affiliated Commissions have been invited to identify liaisons. The liaisons so far are below.

group	liaison
C3	Prof. Chao Tang
C4	Prof. Takaaki Kajita
C13	Dr. Renee Horton
C20	Prof. Mei-Yin Chou
WG5	Prof. Farida Fassi
WG16	Cyrus Walther
AC5	President (Cyrus Walter to 2024)

7. Focus areas 2025

Two major areas of focus going forward are the 2027 conference and the IDSSD.