

Report to Science Board and (later) to Council 2025

**Interdivisional Committee on Green Chemistry for Sustainable Development
(ICGCSD)**

January 6, 2025

Chair: Buxing Han

(Secretary: Jane Wissinger)

Part 1. Highlights and/or Executive Summary

The Interdivisional Committee on Green Chemistry for Sustainable Development (ICGCSD) would first like to acknowledge the loss of their long-term leader, Professor Pietro Tundo. Much of what was accomplished in this report is a result of his drive and commitment to enhance green chemistry and sustainable development within IUPAC divisions and committees as well as forging strong relationships between IUPAC and external stakeholders. His leadership will be missed.

The committee has a dedicated leadership team (1 chair, 1 secretary, 3 TM, 3AM), 9 national representatives (NR), and 8 division representatives (DR). We held two all member meetings in 2024 and plan to provide minimally four opportunities for engagement in 2025. A highlight of 2024 was the 10th International Conference on Green Chemistry (ICGC) held in Beijing, China where fifteen of our committee members gathered in-person to learn about and share ideas for the future direction of the ICGCSD.

The ICGCSD maintained a focus on both leading and participating in IUPAC projects that promote green chemistry, sustainable development, and the UN SDGs. Through Project no. 2020-011-2-041, *Assessment of the contribution of IUPAC projects to the achievement of the United Nations Sustainable Development Goals*, IUPAC's cross-disciplinary contributions to The Goals over 20 years was affirmed. Capitalizing on this outcome, a new project (2022-021-041), assisted by Fabienne Meyers and the Project committee, revised the submission form to include consideration of a new project's objectives with addressing the UN SDGS. Active and continual monitoring of division and committee efforts that apply to sustainable development illustrates IUPAC's role as a leader in applying chemistry as a tool for a sustainable society and planet. This strongly aligns with the IUPAC's strategic plan mission to “*foster sustainable development.*”

Additional projects include developing universal guidelines for determining metrics in green chemistry (*“*providing a common language for the [green] chemistry*” community*), publication of a book on Green Chemistry in Sub-Saharan Africa, and committee members contributions to sustainable education projects through systems thinking (*“*free exchange of scientific information*”). The ICGCSD consciously seeks to uphold the mission* of the IUPAC strategic plan's mission.

ICGCSD manages several collaborative awards centered on Green Chemistry. The PhosAgro/UNESCO/IUPAC awards were presented at the ICGC held in Beijing, October 19, 2024. In late 2024, the Secretary, AM, and TM members of the ICGCS, evaluated the applications for the IUPAC-Zhejiang/NHU awards in Green Chemistry and selected the awardees who will be awarded and present their work at the 2025 World Congress.

ICGCSD leaders are planning the 2025 edition of the Green Chemistry Summer school and the 11th ICGC to be held in Lisbon, Portugal in 2026. ICGCSD has established relationships (and in a few cases collaboration) with: UNESCO, OPCW, ACS/GCI, EuCheMS, ISC3, GSSD Foundation and with industry, including PhosAgro and NHU.

Part 2. Plans and priorities for the remainder of 2024-2025 biennium, and beyond

Current Project Priorities and Plans:

- **Metrics for Green Syntheses**- Project No.: 2017-030-2-041), Chair: Fabio Aricò, an interdisciplinary project that finalized a draft in 2024 and plans for completion in 2025.
This project will provide a common language and tools for presenting green metrics analyses in publications under the IUPAC umbrella.
- **Green Chemistry in Sub-Saharan Africa**, Project No.: 2021-005-1-041, Chair: Liliana L. Mammino. Editor Mammino plans for publication by De Gruyter in 2025.
Related to IUPAC mission of fostering sustainable development worldwide.
- **Assessment of the contribution of IUPAC projects to the achievement of the United Nations Sustainable Development Goals**, Project No.: 2020-011-2-041, Chair: Pietro Tundo/Jane Wissinger, completed in December 2024, *Identifies IUPAC as a worldwide leader in sustainable development and the application of the chemical sciences to the betterment of humankind.*
- **Cross-Disciplinary Goals of Green Chemistry and the Basics Sciences for Sustainable Development**, Project No. 2022-021-2-041, Chairs: Jane Wissinger & Mirabbos Hojamberdiev. Achieved revision of the project submission form. Endeavor to characterize IUPACs efforts and collaborations in the basic sciences for sustainable development.
- **Systems thinking in chemistry for sustainability: toward 2030 and beyond (STCS 2030+)**- Project No.: 2020-014-3-050, Chairs: Peter Mahaffy, Stephen Matlin, Marietjie Potgieter, Bipul Behari Saha, Aurelia Visa.
- **Green Chemistry impact toward 2050 Green Deal in Chemistry and Sustainability**, Project No.: 2022-017-3-041, Chair: Fabio Aricò.

New Project Proposal:

- **Systems Thinking, Sustainability, and Chemical Industry** – ICGCSD committee members Wissinger (chair), Forman, Allais, Visa (members). Project proposal draft was prepared and will be submitted early spring. Spearheaded by Dr. Stephen Matlin, this project is an extension of the Systems Thinking Project 2020-014-3-050.

Summer School and Conference Plans

- **17th Summer School on Green Chemistry** – Committee members in collaboration with the Green Sciences for Sustainable Development Foundation (GSSD) are planning a revised version of the school.
- **11th IUPAC International Green Chemistry Conference, 2026**
Committee members Christopher Brett and Ana Aguiar-Ricardo will host the ICGC in Lisbon Portugal in the fall of 2026.

Collaborative Efforts:

The ICGCSD communicates with and supports the International Younger Chemists Network in publicizing their events such as the Global Conversations on Sustainability and Science Café. We also prioritize welcoming their diverse, young contingency to our committee.

Part 3. Overall report of activities and achievements of Division/Committee since the last report to Council and organized according to the priorities listed below:

The ICGCSD promoted green and sustainable chemistry through global scientific cooperation and collaborations. It sought to provide high standards for use of the term and definition of green chemistry, sustainable chemistry, and sustainable development. Here are several examples based on current projects:

- 2021-005-1-041 - [Green Chemistry in Sub-Saharan Africa](#)
The book titled, “Green Chemistry in Sub-Saharan Africa” by editor Professor Liliana Mammino is scheduled for publication by De Gruyter in 2025. Three of the chapters have already been published by *Physical Science Reviews* in 2024. Additional reviewers were needed to complete the work. The book will highlight the growing development of green chemistry in this region of the world to build collaborations and networking capacities.
- 2017-030-2-041 - [Metrics for Green Syntheses](#) (target 2025)
Chairmanship was taken over by Fabio Aricò in 2024 and technical report draft was completed. A summary was presented by Giacomo Trapasso at the ICGC. When it's complete that will present a comprehensive list of terminology and tools on green metrics to be used for characterizing the “greenness” of chemical syntheses. This will be an important addition to the scientific community.
- 2022-017-3-041 - [Green Chemistry impact toward 2050 Green Deal in Chemistry and Sustainability](#)
Looking to the future of the 2050 Green New Deal, this project will seek to identify green chemistry technologies essential for a “climate-neutral bloc”. Focus sessions and symposium are planned for the coming year.
- 2022-021-2-041- [Cross-Disciplinary Goals of Green Chemistry and the Basics Sciences for Sustainable Development](#), Chairs: Jane Wissinger & Mirabbos Hojamberdiev. Working with Fabienne Meyers and the Project Committee, the IUPAC project submission form was revised to include proposals contemplating the impact their work will have on achieving one or more UN SDGs. Several versions were reviewed before finalizing the format. The hope is that accumulation of this data will enable concrete presentation of the impact IUPAC has in utilizing chemistry technologies for sustainable development.

The ICGCSD engages with professional societies, academia, and industries in facilitating the sharing of best practices. This includes recognition of outstanding green/sustainable chemistry research achievements with awards and organization of conference and symposia. For example:

- **10th IUPAC International Conference on Green Chemistry, 2024**
The 10th IUPAC International Conference on Green Chemistry was held October 18-22, 2024, in Beijing, China. It was co-chaired by Professor Zhimin Liu and Professor Buxing

Han and was organized by the IUPAC ICGCSD, Chinese Chemical Society, and Institute of Chemistry, Chinese Academy of Sciences. More than 1000 participants from 56 countries attended the conference. The current president and 5 former presidents of IUPAC attended the conference.

ICGCSD has worked with industrial and academic partners to honor researchers advancing the field of green/sustainable chemistry through financial awards. Awards are selected assuring equity, diversity, and inclusion.

- The PhosAgro/UNESCO/IUPAC awards were presented at the ICGC held in Beijing, October 19, 2024.
- The ICGCS leadership team and Zhejiang representative evaluated the applications for the 2024 IUPAC-Zhejiang/NHU awards in Green Chemistry. Three younger chemists and one experienced chemist were selected. The winners will be invited to present their work at the 2025 World Congress.

In the area of Chemical Education, an important partner project of the ICGCSD was leadership provided by Aurelia Visa (co-chair) and Jane Wissinger (member) on the *Systems Thinking in Chemistry for Sustainability: Toward 2030 and Beyond (STCS 2030+)*. This project, led by Peter Mahaffy, completed the majority of its education initiatives through publication of a website (SaSTICE) dedicated to guiding instructors around the world incorporating sustainability and systems thinking into their classrooms. Presentations summarizing the group work were given at the IUPAC International Conference in Chemical Education 2024 (ICCE) and the Biennial Conference on Chemical Education 2024 (BCCE); the latter where Jane Wissinger presented her work on the project.

Jonathan Forman also provided leadership at the ICCE through the abstract selection committee for the chemical safety/security symposium and coordinated a presentation from a Pacific Northwest National Laboratory (PNNL) colleague. This individual is now involved the IUPAC 2025 World Congress.

The ICGCSD has representation and gives strong support to the International Younger Chemists' Network (IYCN). In particular, they have promoted the *Global Conversation on Sustainability* and looked to welcome new members to the ICGCSD community.

Part 4. Tabular material.

This should include a list of publications since 2023. It might also include a list or summary of conferences and symposia organized by the Division or its component bodies. It should include a list of all current Division projects.

Conferences, Symposia, and Workshops

- IUPAC/CHAINS 2023, World Congress, The Hague, The Netherlands, August 20-25, 2023. IUPAC | CHAINS 2023- FOCUS SESSION 40: Development of New Reaction Pathways Towards Green Chemistry held on Tuesday, August 22, 2023.
- **16th IUPAC endorsed Green Chemistry Post Graduate Summer School (2024)**
The 16th Green Chemistry Postgraduate Summer School was held in hybrid mode, both online and in-person in Venice from 30th of June to the 5th of July 2024. [Report and Proceedings](#).
- **10th IUPAC International Conference on Green Chemistry, 2024**
The 10th IUPAC International Conference on Green Chemistry was held October 18-22, 2024, in Beijing, China. There were more than 1000 attendees from 56 countries.
- **11th IUPAC International Conference on Green Chemistry, 2026**
The 11th IUPAC Conference on Green Chemistry will be held in Lisbon, Portugal with preparations underway in 2025.

Projects led by ICGCSD:

- 2024-003-2-041 - [XVI Postgraduate Summer School on Green Chemistry 2024 onsite and online](#). Fabio Aricò submitted the proposal which included a scholarship in honor of Professor Pietro Tundo.
- 2022-017-3-041 - [Green Chemistry impact toward 2050 Green Deal in Chemistry and Sustainability](#). Chair: Fabio Aricò
- 2022-021-2-041 - [Cross-Disciplinary Goals of Green Chemistry and the Basics Sciences for Sustainable Development](#) Co-Chairs: Jane Wissinger and Mirabbos Hojamberdiev
- 2021-034-2-041 - [Global Conversation on Sustainability](#) (IYCN)
- 2021-005-1-041 - [Green Chemistry in Sub-Saharan Africa](#), Chair: Liliana Mammino
- 2020-011-2-041 - [Assessment of the Contribution of IUPAC Projects to the Achievement of the United Nations Sustainable Development Goals](#), Chair: Jane Wissinger
- 2017-030-2-041 - [Metrics for Green Syntheses](#) Chair: Fabio Aricò

Projects led by other Committees/Division involving ICGCSD members:

- 2020-014-3-050 - [Systems Thinking in Chemistry for Sustainability: Toward 2030 and Beyond \(STCS 2030+\)](#).

ICGCSD members Aurelia Visa (co-chair), Jane Wissinger (member) were active participants in this committee. Both contributed to a [poster](#) presented at IUPAC General Assembly in the Hague (Aug. 2023) and in building the “SaSTICE” website (see publications). Wissinger designed a Systems Thinking [teaching module](#) on “The Plastics Problem” and Visa was instrumental in multiple aspects of the project, including “Acknowledging and Overcoming Challenges” in systems thinking.

- 2021-012-2-400 - [Personal Protective Equipment Disposal for the Future](#)
ICGCSD member Jane Wissinger participated on this committee.

Publications:

- **Sustainability and Systems Thinking in Chemistry Education [Website](#)**
ICGCSD members Aurelia Visa (co-chair), Jane Wissinger (member) were actively involved with the *Sustainability and Systems Thinking in Chemistry Education* project led by CCE. One project output was this website as a universal resource for chemistry educators to incorporate systems thinking and sustainability into their curriculum.
- **Proceeding of the 16th IUPAC endorsed Green Chemistry Post Graduate Summer School (2024): [Report and Proceedings](#).**
- **Chapters for IUPAC collaborative book “*Green Chemistry in Sub-Saharan Africa*,” Editor Liliana Mammino**
 - Guyo, Upenyu, Chigondo, Fidelis, Nyoni, Stephen, Muchanyereyi, Netai, Zinyama, Ngceboyakwethu P., Kusena, Winmore and Nyoni, Dubekile. "Green chemistry: current status and challenges in Zimbabwe" *Physical Sciences Reviews*, **2024**. <https://doi.org/10.1515/psr-2022-0202> (AOP 29 Apr 2024)
 - Mohlala, Reagan L. and Coyanis, E. Mabel. "A facile and efficient one-pot 3-component reaction (3-CR) method for the synthesis of thiazine-based heterocyclic compounds using zwitterion adduct intermediates" *Physical Sciences Reviews*, **2024**. <https://doi.org/10.1515/psr-2022-0206> (AOP 16 May 2024)
 - Bradley, John Dolman and Moodie, Peter. "Preparing new secondary science teachers in the context of sustainable development goals: green and sustainable chemistry" *Physical Sciences Reviews*, **2024**. <https://doi.org/10.1515/psr-2022-0198> (AOP 11 June 2024)