

Workshop Report

The Technical and Engineering Challenges of Addressing the United Nations Sustainable Development Goals

Omni William Penn Hotel
Pittsburgh, Pennsylvania, USA
November 1-2, 2018

Steering Committee:

- Heriberto Cabezas, US EPA, AIChE
- Lucy Alexander, AIChE
- Randy Over, AAES
- Bill Kelly, ASCE
- Dele Ogunseitan, UC Irvine, TMS
- Linda Battalora, Colorado School of Mines, SPE
- Dick Wright, ASCE
- Reggie Vachon, ASME

Organizer: American Institute of Chemical Engineers (AIChE)

Sponsor: United Engineering Foundation

Introduction

The goal for this United Engineering Foundation grant was to conduct a workshop to frame the discussions that must occur across the U.S. engineering profession to support achievement of the United Nations Sustainable Development Goals (UN SDGs).

The UN SDGs are broad and interconnected but engineering is important to most if not all of the goals, and it is critical to the achievement of a number including water and sanitation, energy, sustainable production and consumption, and sustainable and resilient infrastructure. Achieving the 17 Goals will require new engineering, re-engineering, and retrofitting across all of the engineering disciplines. It is particularly important to promote the development of practical, actionable, and realistic means of accomplishing as many of these goals as possible. This was the overall theme for the workshop which looked in more detail at three areas: education and training of engineers; sustainable production and consumption, and infrastructure. The program for the workshop is included as Appendix A.

The workshop was organized around a series of plenary presentations intended to provide an overview and panels for each of the focus areas. Workshop participants represented government, industry, and academe. A complete list of participants is included as Appendix B.

Outcomes of Workshop

The SDGs have important social, ethical and moral dimensions that must be considered in finding and advocating for the appropriate engineering approaches to achieving the SDGs. Goal 16 - Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels - has implications for engineering practice that need to be explored and discussed within the profession. The Sustainable Development Goals are for everyone and although they are national level goals, implementation must happen and is happening at the local level; New York City's One NYC is an example but there are others.¹ Engineering approaches need to be transformed, traditional assumptions challenged, and systems thinking needs to become the new norm in all disciplines. For instance, using bridges as wind turbines is just one of the many possibilities that could be explored.²

Harnessing Science Technology and Innovation (STI) is integral to achievement of the SDGs. The STI community needs to engage broadly with decisions makers at all levels to provide advice on the STI opportunities, barriers, and constraints to achieving the SDGs. There are many Goals that are not essentially technical that would also benefit from an input from the STI community; e.g. Goals 5, 20, and 16.

¹ NYC One NYC <https://www1.nyc.gov/site/international/programs/global-vision-urban-action.page>

² Smithsonian Could a Wind Turbine be Coming to a Bridge Near You <https://www.smithsonianmag.com/innovation/could-wind-turbine-be-coming-bridge-near-you-180955854/>

Education and training - The Sustainable Development Goals (SDGs) are broad and interconnected and should be taught both on a broad overview basis - university level , and then in discipline-level courses so that all graduates gain a knowledge sufficient to promote sustainable development generally and in their discipline. Students need to see that the SDGs are good for everyone not just developing countries. The SDGs need to be introduced early in curriculum and introducing concepts like life-cycle analysis can support this; e.g. Goal 12. This is consistent with UN SDG 4 specifically target 4.7 that will be reviewed at the UN in the summer of 2019.³ Synergies may be possible between education for the SDGs and the Grand Challenges Scholars program, and these should be explored.⁴ Also learning opportunities beyond the classroom like Engineers Without Borders and Engineers for a Sustainable World can introduce students to the SDGs and need to be supported and encouraged. There are opportunities for students and young engineers to get directly involved in UN SDG activities through the Children and Youth major group and this information needs to be shared widely.⁵

All engineering graduates need to gain a basic background in sustainability concepts and on the ethical and moral imperative that underlie these concepts, and on how they apply in their discipline (SDG4). The engineering profession needs to work together on this to facilitate sharing what some disciplines are already doing and having success with. Faculty need help with this and teaching modules would be extremely helpful. The engineering professions needs to do much more to improve inclusion and diversity with respect to technical fields, ethnicity, and other groups. This is called for in SD4 and in SDG 5 Gender Equality.⁶

The engineering profession lacks mechanisms to deliver knowledge of the SDGs to all engineering fields. This workshop was a good first step but only reached a relatively small number of already knowledgeable engineers and not all fields of engineering.

Lack of awareness and motivation on the part of faculty members to include sustainability concepts in courses is a significant barrier, but the new ABET Criteria to be implemented in the 2019-2020 cycle provide new opportunities and incentives to include sustainability in all engineering curricula.⁷

We need to find ways to do more like activities this workshop did with crossover communication between the different engineering disciplines and disciplines outside engineering. On campus workshops for faculty and students need to be encouraged; webinars can also be useful. A coherent

³ UN SDG 4 Education <https://sustainabledevelopment.un.org/sdg4>

⁴ NAE Grand Challenges Scholars Program
<http://www.engineeringchallenges.org/GrandChallengeScholarsProgram.aspx>

⁵ UN Major Group for Children and Youth <https://www.unmgcy.org/>

⁶ UN SDG 5 Gender Equality <https://sustainabledevelopment.un.org/sdg5>

⁷ ABET Engineering Criteria Proposed changes to certain sections of the Criteria for Accrediting Engineering Programs **have been approved** by the ABET Engineering Area Delegation as of October 20, 2017, for implementation in the 2019–20 accreditation review cycle.

<https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2018-2019/#4>

case needs to be made for why faculty should care about the SDGs and the supporting educational resources shared. Having one engineering voice and collaborating with non-engineering disciplines should be encouraged and would help improve awareness and focus resources.

Workshop participants should act together to take a significant and impactful lead as soon as possible. This should start with a strategy and a campaign to achieve stakeholder buy in. There is no need to wait. An effort should begin to seek industry and foundation support and collaboration in keeping with SDG 17 Partnerships for the Goals.

Production and Consumption - SDG 12 Ensuring sustainable consumption and production patterns "doing more with less" poses challenges and opportunities for all engineering fields.⁸ All aspects of natural resource use and impact must be addressed. For example, the mining industry has taken the lead in defining how the industry can address the SDGs; see e.g. International Council on Mining & Metals (ICMM 10) Principles.⁹ Change and disruption are inevitable in the fossil fuel-based industries and transitioning to a zero carbon footprint in part of their reengineering.

Infrastructure - the engineering profession needs to find ways to promote the understanding that the UN SDGs are all related, across all engineering disciplines and the public. This might be accomplished by creating or by encouraging the formation of multi-disciplinary teams/groups/associations that could develop outreach programs for technical and engineering professions and educators as well as prepare public through service announcements/commercials/news briefs/editorials.

The UN SDGs need to be presented with examples, in a way that shows engineers and the public that even what are perceived to be the most unrelated issues are indeed related to sustainable infrastructure (such as examples given in workshop: water-energy-food, transportation-gender equality nexuses). Infrastructure should be presented in a broad sense as the critical link between the environment and human well-being.¹⁰

The engineering and technical disciplines have been "siloes" for too long. One possibility would be to emulate the medical profession where there are just as many specific technical areas, but they are working toward "treating the whole person" rather than just the specific diseases or medical issues. Human well-being is a common cause that binds people together. Could we (all engineering, technical, science disciplines) find a way to express that common cause, state it boldly, and encourage the formation or strengthen of the existing organizations that can provide interdisciplinary interactions.

⁸ UN SDG 12 Ensure sustainable consumption and production patterns

<https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

⁹ ICMM 10 Principles <https://www.icmm.com/en-gb/about-us/member-commitments/icmm-10-principles>

¹⁰ Waage et al (2015) Governing the UN Sustainable Development Goals: Interactions, Infrastructures, and Institutions [https://www.thelancet.com/journals/langlo/article/PIIS2214-109X\(15\)70112-9/fulltext](https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(15)70112-9/fulltext)

This is consistent with what the UN tries to do with its engagement and involvement of the major groups and other stakeholders.¹¹

Workshop Recommendations

This workshop was organized under the leadership of the Engineers Forum for Sustainability with support from United Engineering Foundation. A steering committee supported by staff from the AIChE planned and organized the workshop. The workshop successfully framed the discussion but much more needs to be done, and there needs to be continuing support - financial and organizational - to do this.

As a starting point, forward this report to the engineering society members of ABET and the National Academy of Engineering with a covering letter requesting their consideration and comments on the report and interest in supporting and collaborating on continuing action. This is critical because a broadly-based and sustained effort will be necessary for the urgently needed changes in education and engineering practice to take firm hold.

The Engineers Forum on Sustainability should reach out broadly to the professional societies with a known or potential interest in the UN SDGs in the Washington DC area and convene forums to share information on ongoing activities on the SDGs and promote collaboration. Volunteers should be recruited to lead and organize this effort until the support issue can be addressed.

¹¹ UN About Major Groups and Other Stakeholders
<https://sustainabledevelopment.un.org/majorgroups/about>

Appendix A: Workshop Program

Thursday, November 1, 2018	
9:00 AM - 9:30 AM	Opening Remarks and Workshop Agenda - Organizers
9:30 AM - 10:15 AM	Keynote Speaker: Szabolcs Szuromi, Pázmány Péter Catholic University, Hungary
10:15 AM - 11:00 AM	Keynote Speaker: Cristina Contreras Casado, Harvard University
11:00 AM - 11:30 AM	Break
11:30 AM - 12:30 PM	Panel 1: Education and Professional Training of Engineers
	Moderator: Barbara Arnold, SME
	Patricia Brackin, ABET
	Liv Haselbach, Lamar University
	Yvette E. Pearson, Rice University
	Facilitated discussion/ Q&A
12:30 PM -1:30 PM	Lunch
1:30 PM - 2:15 PM	Keynote Speaker: William Colglazier, AAAS
2:15 PM - 3:00 PM	Keynote Speaker: Joe Lima, Schlumberger
3:00 PM - 3:30 PM	Break
3:30 PM -4:30 PM	Panel 2: Production Systems for Goods and Energy
	Moderator: Heriberto Cabezas, U.S. EPA
	Martin Green, NIST
	John Craynon, Export-Import Bank of the United States
	Dale Keairns, Deloitte Consulting LLP.
	Facilitated discussion/ Q&A
4:30 PM - 5:00 PM	Summary Session
5:00 PM -6:00 PM	Networking Reception
Friday, November 2, 2018	
9:00 AM - 9:30 AM	Recap from Previous Day and Agenda
9:30 AM - 10:15 AM	Keynote Speaker: Bill Kelly, ASCE
10:15 AM - 10:30 AM	Break
10:30 AM - 11:30 AM	Panel 3: Infrastructure
	Moderator: Bill Kelly, ASCE
	Melissa Bilec, University of Pittsburgh
	Denise Nelson, The Berkley Group
	Theresa Harrison, Public Works - City of South Bend, IN
	Facilitated discussion/ Q&A
11:30 PM - 12:00 PM	Recap and End of General Workshop
12:00 PM - 1:00 PM	Organizing Committee only: Working Lunch: Next Steps and Action Items

Appendix B: Participants List

Name	Last Name	Affiliation
Zach	Agioutantis	University of Kentucky
Lucy	Alexander	AICHE
Carl	Anderson	National Academy of Engineering
Iana	Aranda	Engineering For Change
Barbara	Arnold	Preptech, Inc.
Nick	AuYeung	Oregon State University
William	Barrett	US Environmental Protection Agency
Linda	Battalora	Colorado School of Mines
Melissa	Bilec	University of Pittsburgh
Patricia	Brackin	Rose-Hulman Institute of Technology
Michelle	Bryner	AICHE
Heriberto	Cabezas	US EPA, Office of Research and Development
E William	Colglazier	AAAS
Cristina	Contreras Casado	Harvard University
John	Craynon	Export-Import Bank of the United States
Sebnem	Duzgun	Colorado School of Mines
Robert	Giraud	Chemours
Michael	Gonzalez	US EPA
Alyssa	Graham	Rice University
Jeffrey	Greenfield	Broward County Water/Wastewater Services
Philip	Grossweiler	M&H Energy Services
James	Haggerty	Stony Brook University
Theresa	Harrison	City of South Bend, IN, Dept. of Public Works / ASCE
Liv	Haselbach	Lamar University
Yinlun	Huang	Wayne State University
Ashley	Huderson	ASME
Sunwoo	Joo	Louisiana State University
Chandni	Joshi	University of Kentucky
Dale	Keairns	Deloitte Consulting LLP.
William	Kelly	Retired
Rodney	Kidd	NA
Ilia	Killeen	AICHE
Cliff	Kowall	Lubrizol
Elizabeth	Kupp	Penn State Univ. and Materials Res. Soc.
Gabriel	Levesque-Tremblay	AICHE
Fernando	Lima	West Virginia University

Joe	Lima	Schlumberger
Eric	Lundborg	Engineers Without Borders
Mark	Minster	Rose-Hulman Institute of Technology
Hailey	Murphy	AIChE
Denise	Nelson	Berkley Group
Oladele	Ogunseitan	University of California, Irvine
Benson	Pair	KBR/AAEES
Ignasi	Palou Rivera	RAPID/AIChE
Yvette	Pearson	Rice University
Fahima	Rafiqi	Manhattan College
Jessica	Rannow	Society of Women Engineers
Shaibal	Roy	Chemours
Gerardo	Ruiz-Mercado	US EPA
Jeffrey	Seay	University of Kentucky
Raymond	Smith	US Environmental Protection Agency
Szabolcs	Szuromi	Pázmány Péter Catholic University
Elisabeth	Van Roijen	Stony Brook University
Drue	Whittecar	SABIC
XiaoYu	Wu	MIT
Vera	Yangildina	NA
Kirti	Yenkie	Rowan University
De-Wei	Yin	The Dow Chemical Company AIChE Societal Impact Operating Council