

## Engineering Education for Sustainable Development

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### Introduction

The World Federation of Engineering Organization (WFEO) standing committee on education in engineering's fall 2015 congress focused on sustainability (WFEO, 2015). Sustainable Development and sustainability have played an increasingly important role in engineering education over the last 20 years but more needs to be done. The 2015 GSDR specifically noted that: "Many sustainable development research questions also require integrating the humanities and the engineering sciences, with their very different methods and traditions."

The infrastructure – inequality – resilience nexus is in many respects an integration issue. More integrated approaches to infrastructure and resilience that respect social aspects can be accelerated by actively supporting integration of sustainability into tertiary-level education.

### Background

Engineering accreditation plays an important role in assuring the quality of engineering education worldwide. The WFEO and the International Engineering Alliance (IEA) recently signed an MOU and are currently developing a Memorandum of Agreement to work together on engineering accreditation (WFEO, 2014). Specifically what is to be done is to build engineering education capacity - ultimately leading to accreditation - in countries that are not ready for mentoring. Mentoring is the process that IEA uses to prepare accreditation bodies to seek membership in one of the IEA Accords.

Sustainability and sustainable development are prominent in the UNESCO (2010) report on Engineering; see for examples articles by Bugliarello, Ridley, Didier and others. Byrne et al (2010) reviewed sustainability expectations for engineering graduates for most of the Washington Accord signatories. The Washington Accord (WA) is the engineering part of IEA.

In engineering practice, sustainability is explicitly included in the WFEO Model Code of Ethics under Canon 4 protection of the natural and built environment. The WFEO Model Code of Practice for Sustainable Development and Environmental Stewardship provides a comprehensive approach to sustainability in engineering practice (WFEO, 2016).

The IEA Graduate Attributes and Competences are the foundation for accreditation of engineering programs under the Washington Accord. To be recognized under the WA, the accreditation process must provide assurance that the attributes of graduates of a signatory's programs are substantially equivalent to the IEA graduate exemplars. Graduates are expected to be able to demonstrate both knowledge and competencies. For Washington Accord graduates the expected level of knowledge is WK7:

- Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability

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Thus, engineering graduates from all programs accredited under the IEA Washington Accord can be expected to have an understanding of sustainability in the context of engineering practice in their field.

The way that the IEA attributes are implemented varies significantly. For WK7, Engineers Canada expects graduates to have:

- An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interaction

Whereas the South African requirement is for graduates to be able to:

- Demonstrate critical awareness of the sustainability and impact of engineering activity on the social, industrial and physical environment.

Further, graduates are expected to WA7:

- Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (WK7)

Clearly there is a great deal already going on in engineering education around the world, but it would benefit by being more broadly integrated into tertiary-level education. Graduates of non-engineering programs would benefit from an understanding of the role that engineering can and must play in achieving the engineering-centric sustainable development goals. Engineering graduates would benefit by gaining a more holistic understanding of sustainable

development and the role that engineering can play in meeting important social and economic goals.

### **Actions for Consideration**

The High Level Political Forum should explore opportunities to integrate tertiary-level engineering education into strategies for achieving the Sustainable Development Goals especially the engineering-centric goals.

Achieving many of the goals is heavily dependent on engineering science and design and in the long run, the capacity to do this must exist locally and this depends on strong local engineering education. A short term solution is scholarships to send students to developed countries for engineering education, but in the long run building capacity at the country level is necessary for education and research and for continuing professional development for the engineering workforce.

Some specific actions to consider:

- Encourage the WFEO to define needed changes in engineering education for sustainable development;
- Encourage and support the WFEO -IEA initiative to build accreditation capacity - no one left behind;
- Encourage a more rigorous implementation of the IEA attributes; and
- Use existing UN ICT resources to support and encourage sharing of resources on teaching and learning about sustainable development and for faculty development.

## References

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