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DELAWARE SOLID WASTE AUTHORITY

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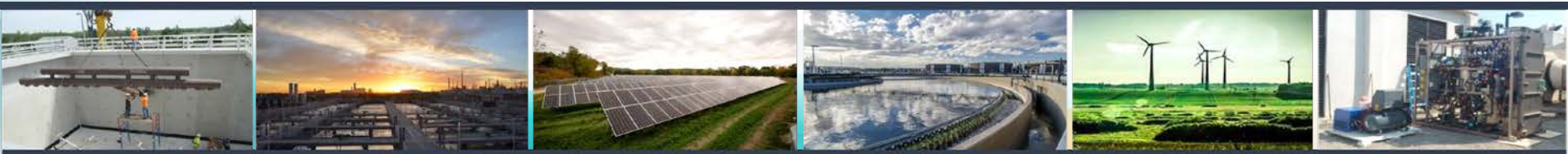
LA DWP Los Angeles Department of Water & Power

We will begin our presentation in a few minutes…



Leadership and Excellence in Environmental Engineering and Science

Webinar Sponsor

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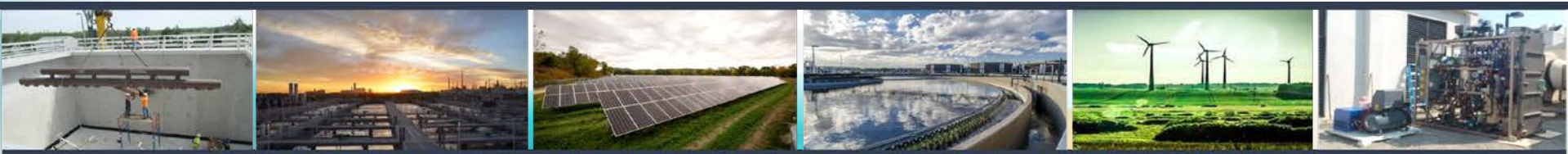
THANK YOU to our valued partner, ABET, for sponsoring this webinar and for their continued support of the Academy.

ABET is a nonprofit organization that accredits college and university programs in applied and natural science, computing, engineering and engineering technology. Our approach, the standards we set and the quality we guarantee, inspires confidence in those who aim to build a better world — one that is safer, more efficient, more comfortable and more sustainable. www.abet.org.

ABET



Leadership and Excellence in Environmental Engineering and Science

Academy, Association, and Society

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American Academy of Environmental Engineers and Scientists (the **Academy**)

- …**provides Board Certification** to those who qualify through experience and testing. The Academy also provides training through workshops and seminars, **participates in accrediting universities**, publishes a periodical and other reference material, interacts with students and young professionals, sponsors a university lecture series, and rewards outstanding achievements through its international awards program. (from: https://www.aaees.org/aboutaaees)

Association of Environmental Engineering and Science Professors (the **Association**)

- …assists its members in **improving education and research programs, encourages graduate education**, and serves the profession by providing information to government agencies and the public, and provides direct benefits to its members. (from: https://aeesp.org/about)

American Society for Engineering Education – Environmental Engineering Division (the **Society**)

- …This division holds as its objective the **advancement of both graduate and undergraduate education** in environmental engineering. The opportunity to participate in sessions at the ASEE Annual Conference, as well as the year-round opportunity to exchange ideas with colleagues, are important facets of this division. (from: https://sites.asee.org/envir/for-members/)

Leadership and Excellence in Environmental Engineering and Science

US Bureau of Labor Statistics

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Standard Occupation Description (SOC) 17-2080 stated that environmental engineers, “research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines,” (BLS, 2018).

The updated description of environmental engineers included in the Occupational Outlook Handbook (OOH) currently states, “Environmental engineers use engineering disciplines in developing solutions to problems of planetary health,” (BLS, 2023).

Environmental Engineering as a leader in Planetary Health

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Environmental engineers use engineering disciplines in developing solutions to problems of planetary health.

Civil engineers plan, design, and supervise the construction and maintenance of building and infrastructure projects.

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment.

Industrial engineers devise efficient systems that integrate workers, machines, materials, information, and energy to make a product or provide a service.

Mechanical engineers design, develop, build, and test mechanical and thermal sensors and devices.

(from: https://www.bls.gov/ooh/architecture-and-engineering/home.htm)

ABET is a nonprofit, ISO 9001 certified quality assurance organization focused on college and university programs in the science, technology, engineering and math (STEM) disciplines.

About ABET

- Through our work and our partnerships, we help ensure that the next generation of STEM professionals is equipped to help build a world that is safer, more efficient, more inclusive and more sustainable.
- Every year 200,000 problem solvers graduate from ABET 4,674 accredited programs at 920 institutions around the world.
- ABET accreditation is peer reviewed with over 2,300 evaluators worldwide.

About ABET

- ABET accredits programs in Environmental Engineering, Environmental Engineering Technology and Environmental Science in 113 programs globally.
- The Academy's involvement with ABET
  - Criteria
  - Program Evaluators/Volunteers

- Growth in Environmental Science programs
- Promoting sustainability in ALL disciplines

About ABET

- ABET is a member of the UN Global Compact
- Commitment to SDGs

Engineering for One Planet

Helping engineering educators change the course of engineering by infusing sustainability & leadership competencies into engineering curriculum

AAEES Webinar: Nov 15, 2023

Cindy Anderson
EOP Strategy Consultant, The Lemelson Foundation &
Sustainability Consultant, Alula Consulting

Thank you!

- AAEES – Marisa Waterman & Co-host, Dan Oerther
- ABET – Co-host, Stephanie Harrington
- Everyone – for taking time to be here today!

Engineering for One Planet

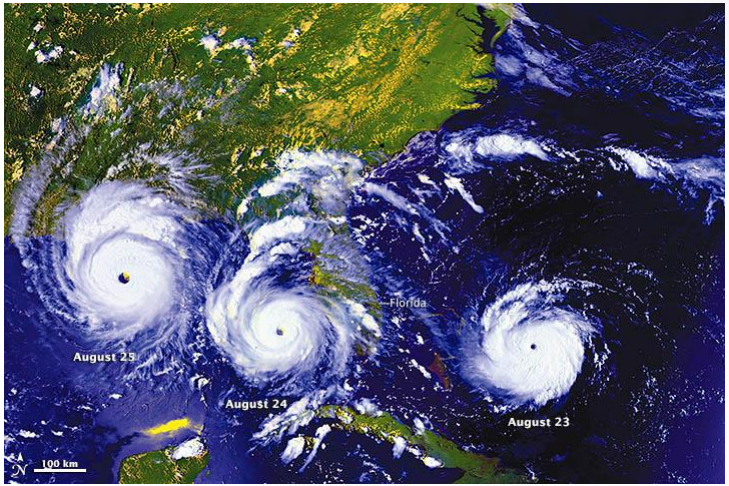
Agenda

- Why sustainability? Why now?
- EOP Initiative Overview
- EOP Resources
- How to get involved
- Conversation // Q&A

Engineering for One Planet

Climate Change → Climate Crisis

- Global temperature is rising - will 2023 be our hottest year? (WEF)
- Oceans are getting warmer
- Ice sheets are shrinking
- Glaciers are retreating
- Snow cover is decreasing
- Sea level is rising
- Arctic sea ice is declining
- Extreme weather events are becoming more frequent
- Ocean acidification is increasing
- Species biodiversity is declining



Engineering for One Planet

https://climate.nasa.gov/evidence/

EOP Initiative:
Who, Why, What, and Ways to Get Involved

Learn more at:

www.EngineeringforOnePlanet.org

Engineering for One Planet

Engineering for One Planet

Vision:

Sustainability becomes a core tenet of the profession.

Goal:

Transform engineering education so all engineers are equipped to design, build, and create in environmentally and socially sustainable ways.

Learn more:

www.EngineeringforOnePlanet.org

EOP video

Engineering for One Planet

Who Catalyzed Engineering for One Planet?

The Lemelson Foundation
improving lives through invention

VENTUREWELL™
idea to impact

EOP Strategic Advisory Group - 2020-2022

Kit Batten
Climate Change & Sustainability Innovator
Kit Batten Consulting

Boma Brown-West
Director, EDF+Business
Environmental Defense Fund

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Executive Director & CEO
American Society of Mechanical Engineering

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Founder & CEO
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Rosalyn W. Berne
The Anne Shirley Carter Olsson Professor of Applied Ethics, Department of Engineering and Society

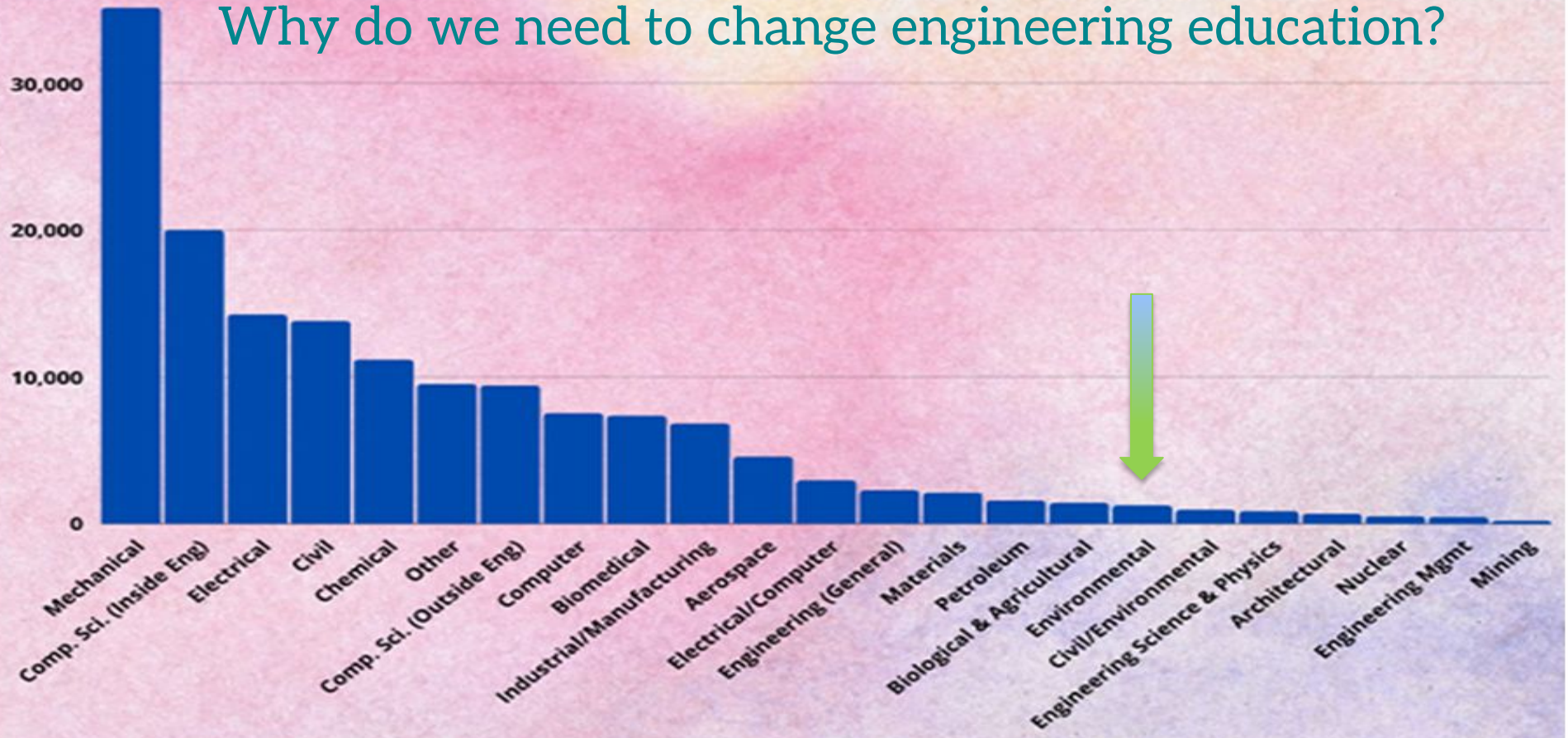
School of Engineering and Applied Sciences, University of Virginia

Don Norman
Director (Emeritus), Design Lab
University of California San Diego

Why do we need to change engineering education?

- We need all engineers to have sustainability skills because all engineering activity impacts our planet. But not all engineers are trained in sustainability.
- Sustainability is an imperative for our youth
- Sustainability is an imperative for industry – there's a looming shortage of people with sustainability skills

Why do we need to change engineering education?

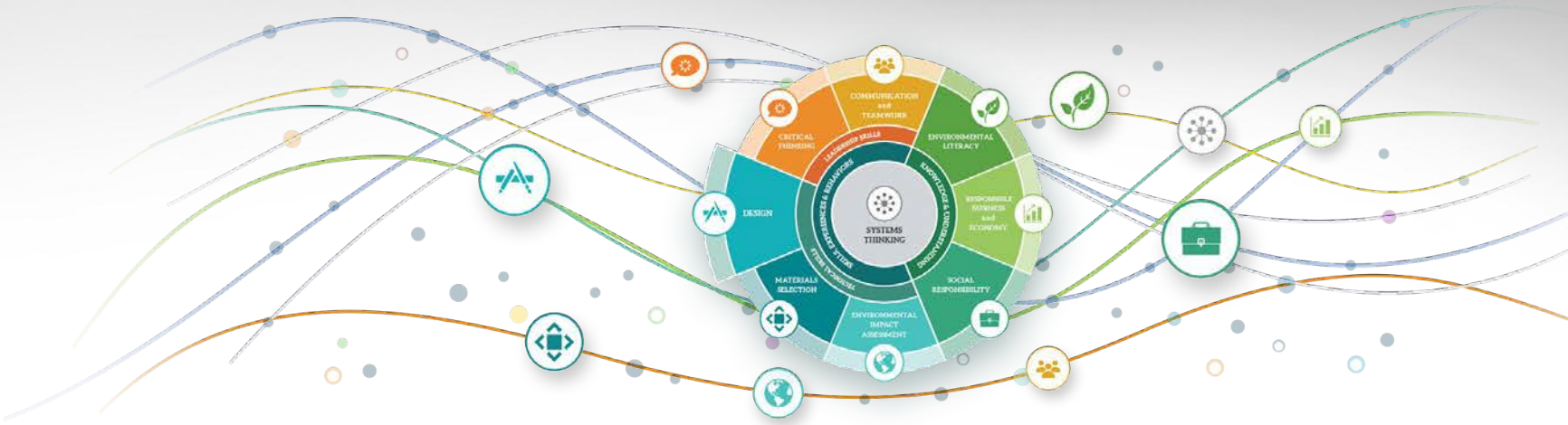


SOURCE: SEE ASEE'S ENGINEERING AND ENGINEERING TECHNOLOGY BY THE NUMBERS TABLE 1, P. 6 FOR FULL NUMERIC BREAKDOWN.
HTTPS://IRA.ASEE.ORG/WP-CONTENT/UPLOADS/2021/02/ENGINEERING-BY-THE-NUMBERS-FINAL-2021.PDF

Why isn't sustainability already integrated? What are possible approaches/barriers for changing engineering ed?

It's important but too hard to transform engineering education because….

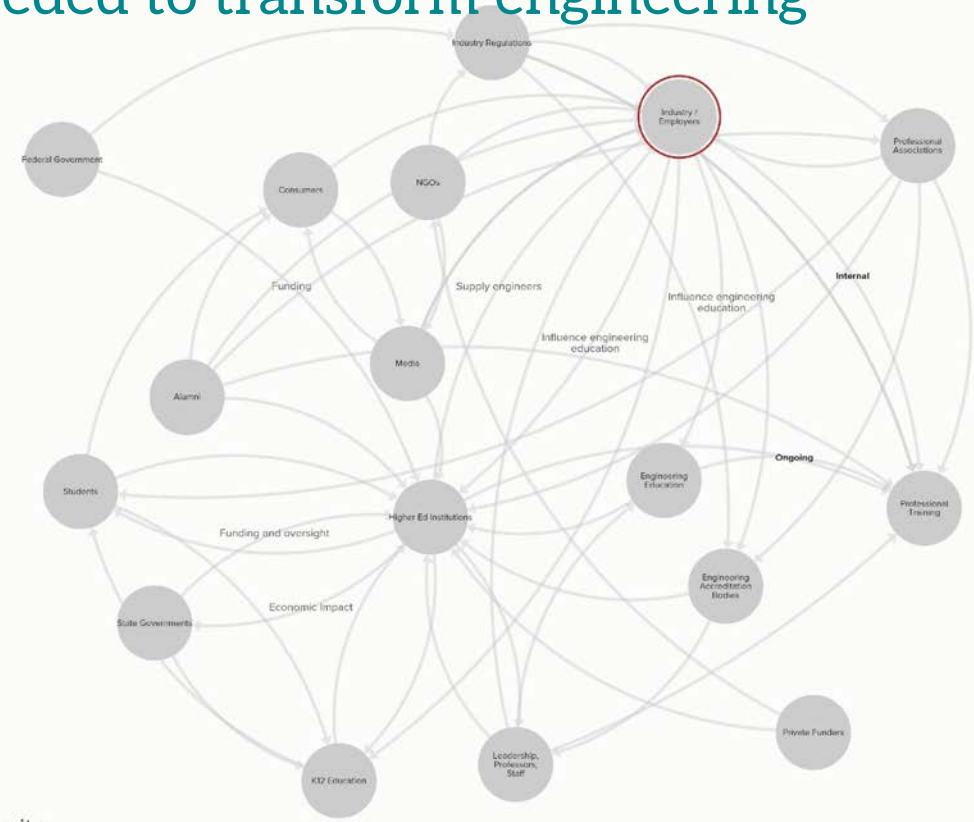
- Inertia – hard to overcome and change status quo
- Too much to teach already
- Faculty don't have the time or resources they need to make changes
- Professional "suicide" – publish or perish paradigm
- Faculty don't know how to teach it
- Not enough support from academic leaders
- Industry is not demanding it – but this is changing!
- Faculty can make changes here and there, but changes fizzle out without broader cultural changes and beliefs about what it means to be an engineer



How might we go from changing engineering courses… to changing the course of engineering?

Systems level change is needed to transform engineering education.

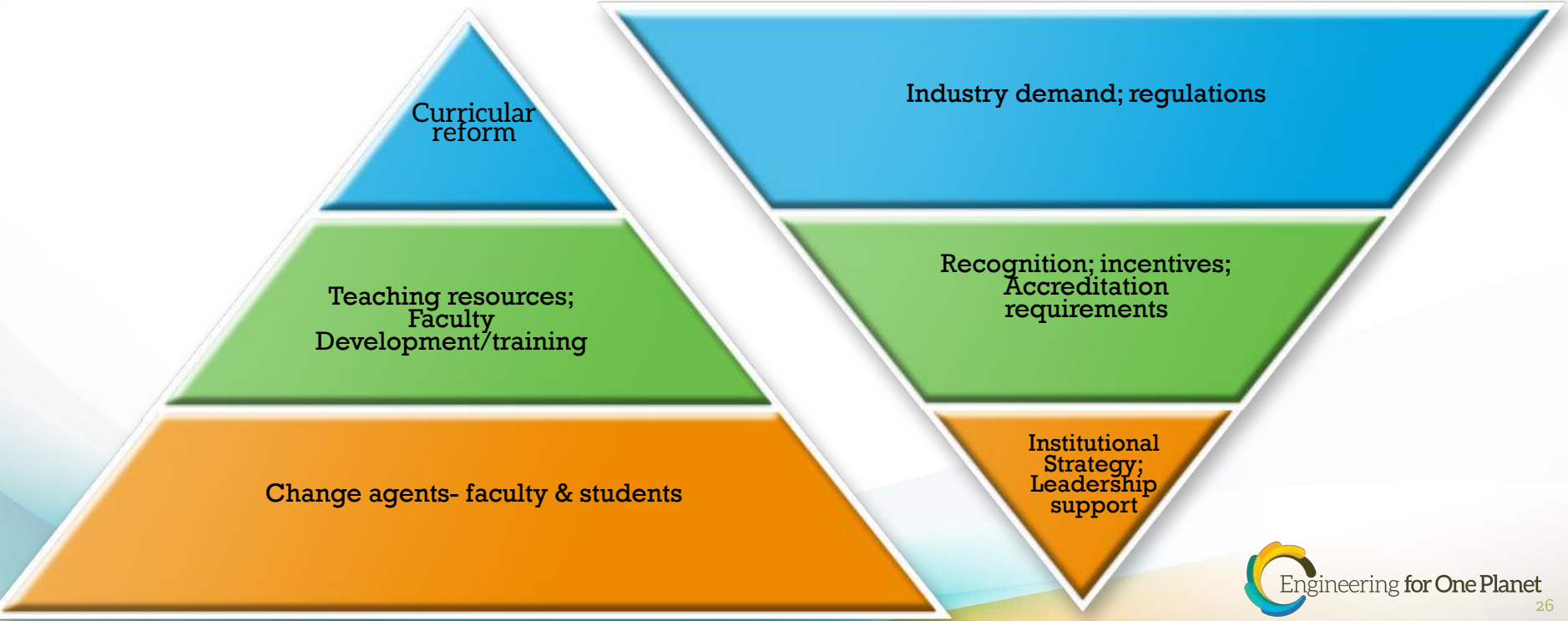
1. Consumers
2. Leadership, Professors, Staff
3. Industry Regulations
4. Higher Ed Institutions
5. State Governments
6. Students
7. Alumni
8. Professional Training
9. Federal Government
10. NGOs
11. Media
12. Professional Associations
13. K12 Education



Engineering Education System (simplified)

What is needed to embed sustainability in all engineering disciplines?

Bottom up and top down approaches



Three Interrelated Approaches to Catalyze Systems Change

1. Developing & sharing resources through community feedback & vetting in diverse courses & programs (EOP Framework of core learning outcomes & companion "how-to" teaching guides)

2. Funding faculty change efforts & support capacity-building efforts (grants, mentorship, communities of practice)

ASU Arizona State University · University of Central Florida · Oregon State University · A. James Clark School of Engineering · Villanova University

ASEE | Engineering for One Planet Mini-Grant Program

3. Activating & supporting collaboration among diverse stakeholders across sectors

Community Co-created Resources

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EOP Framework: Core & Advanced Student LOs

Download for free online

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EOP Framework:

A vetted menu of sustainability-focused learning outcomes across 9 topic areas.

History:

- Launched in 2020
- Input with nearly 100 stakeholders through open commenting period
- Resolved over 400 comments
- Tested with 5 pilot schools over 2 years

EOP Framework:
9 Topic Areas

- Systems Thinking
- Environmental Literacy
- Responsible Business and Economy
- Social Responsibility
- Environmental Impact Assessment
- Materials Selection
- Design
- Critical Thinking
- Communication and Teamwork

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EOP Framework:
Collecting feedback to revise the framework

Pilot Feedback

Feedback from Pilot Schools

EOP Pilot Grantees were interviewed for their feedback on the EOP Framework in Jan 2022

Open to Review

Open for public feedback

Framework document was open from January 17, 2022 to June 30, 2022 for **public feedback**

Prework

Workshop Participant Feedback

Greater than 600 comments were collected and incorporated

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EOP Framework:

Priority areas for refinement based on feedback

- ✅ 1 Defining sustainability as social and environmental
- ✅ 2 Clarity on EOP Framework audience
- ✅ 3 Reframing goal to be “net zero” or “restorative”
- ✅ 4 Align ABET & Framework learning outcomes
- ✅ 5 Describe how United Nations Sustainable Development Goals are reflected
- ✅ 6 Revise outcomes to be measurable
- ✅ 7 Explore overlap between EOP learning outcomes based on Bloom’s Taxonomy
- ✅ 8 DEIJ-related revisions

✅ = Reflects revisions that were made to framework based on 2022 feedback

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EOP Framework:
Mapping to ABET & UN SDGs

ABET Engineering Technology Accreditation Commission

SUSTAINABLE DEVELOPMENT GOALS

- Explain interconnectedness (e.g. intersecting, related and/or connected systems; human actions and global environmental and social impacts and consequences; synergies and rebound effects) and how all human-made designs and activities rely upon and are embedded within ecological and social systems ○ (4)
- Identify dynamic impacts between and among different parts of the system (i.e., social, environmental, and economic considerations) ○ (4)
- Apply relevant concepts from required disciplines to the study of real-world problems and their solutions with empathic and ethical consideration for communities/societies, environmental justice, and cultural awareness ○ (2,4,7)
- Create solutions that consider the scale of the activity relative to the planetary system boundaries (i.e., carrying capacities) ○ (2)
- Create designs that include communities/societies, environmental ecosystems, and the life they sustain while keeping systems dynamics concepts in mind (e.g., feedback loops, complex cause-effect chains, cascading effects, inertia, tipping points, legacy, resilience, adaptation, energy systems and flows, etc.) ○ (2,4)

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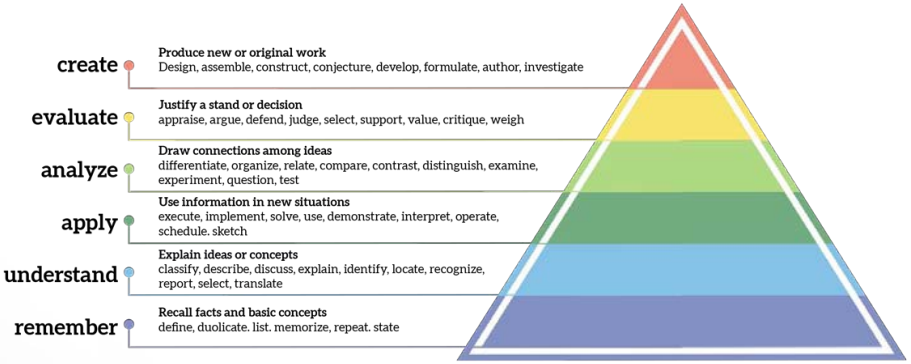
EOP Framework:
Mapping to Bloom's Taxonomy



[High]

- Discuss varying standpoints w
normative thinking) O (3) ∞

[Medium]

- Distinguish the consequences
the precautionary principle) O

[Low]

- Evaluate possible, probable, a
create their own visions for th

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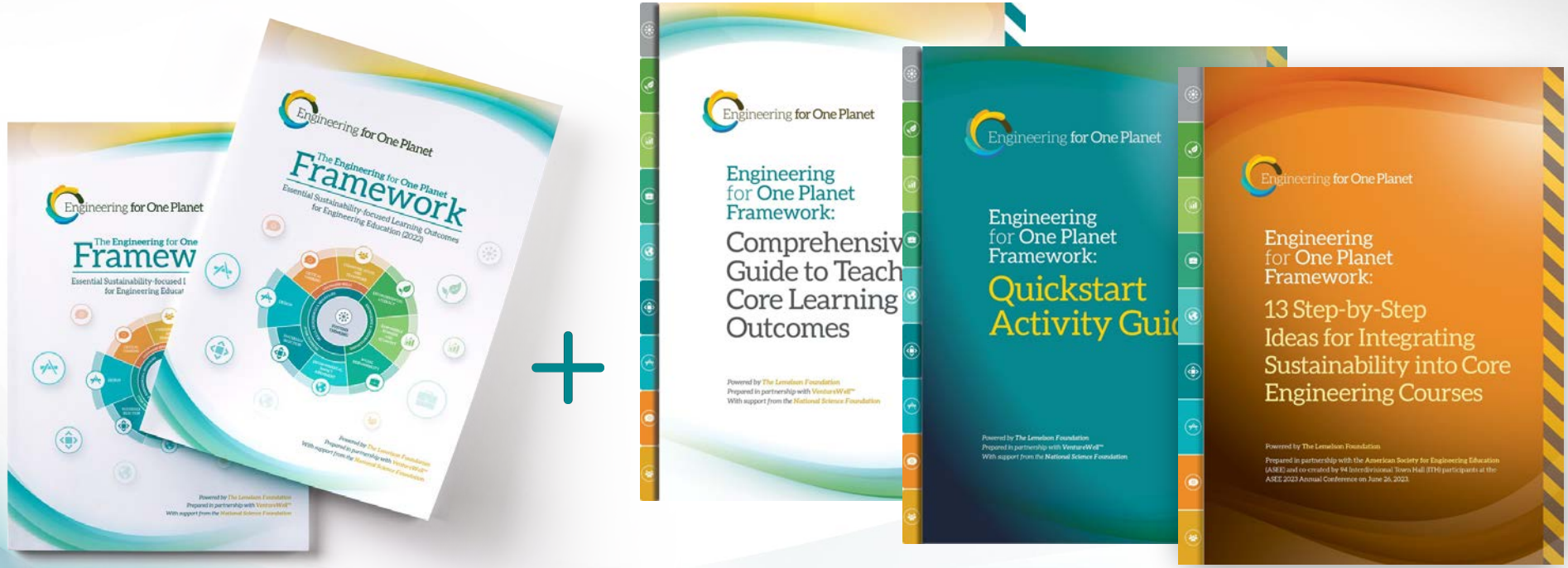
EOP Framework and Companion Teaching Guides

Goal: Make EOP Framework implementation easier



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EOP Framework

Comprehensive Guide to Teaching Core Learning Outcomes

Goal: Create implementation resources & activities guides

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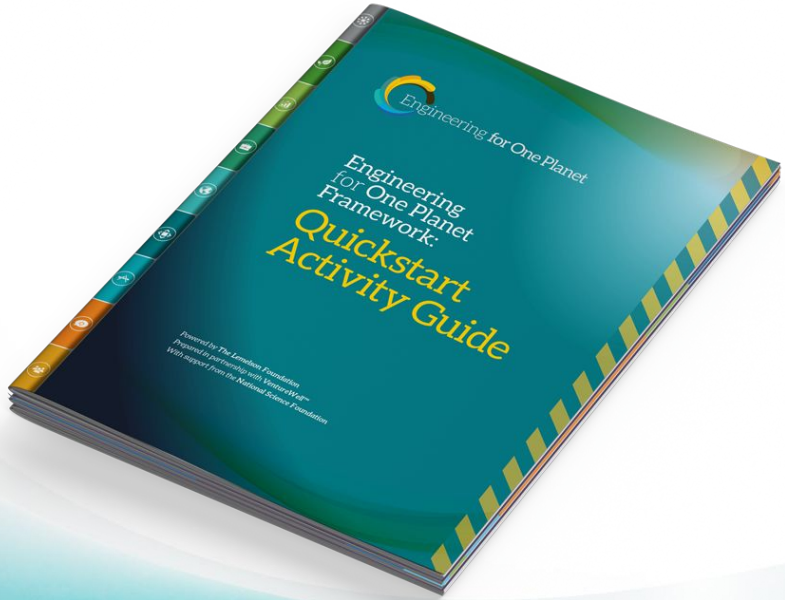
EOP Framework

Quickstart Activity Guide

Goal: create implementation resources & activities guides



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EOP Framework

13 Step-by-Step Ideas for Integrating Sustainability into Core Engineering Courses.

Goal: create implementation resources & activities guides

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ASEE | Engineering for One Planet
Mini-Grant Program

Support for Faculty Change Efforts

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EOP Pilot Grant Program

BACKGROUND

- Launched in 2020
- 2 years, up to $40,000/each
- 5 diverse schools; all R1, 1 MSI
  - diversity of region, size, disciplines
  - diversity of strategy

IMPACT

- 61 courses modified or created
- 5908 students reached
- 80 faculty used EOP Framework in course modifications
- Pilot Program Synopsis available on EOP website

ASEE Mini Grant Program Cohort 1 Totals

ASEE Engineering for One Planet
Mini-Grant Program

BACKGROUND

- 7 months, up to $8000/each
- 13 schools; 5 MSIs
- Final poster presentations during Online Symposium in 1/23
- Visit ASEE MGP website to review video & posters

IMPACT

- 34 courses modified or created
- 1615 students reached
- 48 faculty used EOP Framework in course modifications

ASEE Mini Grant Program Cohort II

- 7 months, up to $8000/each
- 14 schools; 6 MSIs
- Public online symposium in January 2024
- Video & posters will be available in spring 2024

ASEE Mini Grant Program Cohort III

- 7 months, up to $8000/each
- Mentorship & 3 CoP meetings
- Up to 14 schools
- Application period OPEN
- Deadline to apply: Jan 10

EOP Institutionalization Grants

- Up to 3 years
- Up to $200,000/institution
- Piloting program with 10 schools that have gone through MGP
- ⅓ R1s; 4 MSIs
- Unique strategies to expand EOP throughout organization
- Unique foci of proposals
  - Assessment
  - Online, national faculty training

What we have learned so far…best practices

- No one way to do it
  - pilot & MGP schools have diversity of strategies
- Integrate into existing courses, rather than stand alone
- Focus on core/required courses for stability & reach
- Scaffold learning
  - all stages of degree, not just in 1st year or capstone
- Share ideas & learn with peers
- Utilize free online resources
  - Don't need to reinvent the wheel!
- Sustainability skills AND professional/leadership skills
- Faculty mentorship &/or community of practice ideal
- Capture of KPIs critical to measure impact

Activating & Supporting Collaboration

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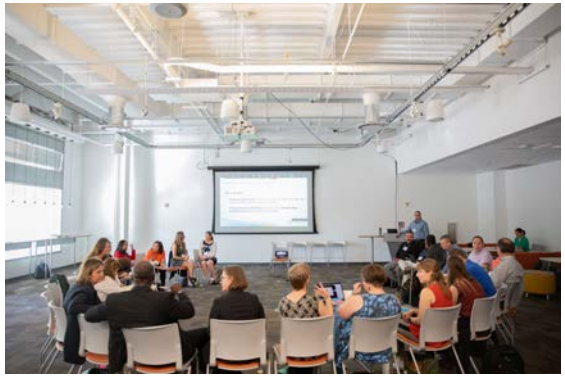
The EOP Network



- Because no single organization or intervention can transform engineering education alone!
- Launched in summer 2021
- Volunteer action network (project-based actions)
- >70 participants currently
- Cross-sectors, regions, backgrounds, lived experiences
- Just had 5th convening (2nd in-person)

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Other Current Collaboration Efforts

- **ABET & Lemelson EOP Innovation in Sustainability Award**
  - Cash prize (amount TBA)
  - STEM & ABET-accredited programs
  - Individual or organization
  - Open for application soon — stay tuned to ABET!
- **NSF & Lemelson partnership on Engineering Edu Sustainability Research**
  - Stay tuned for more info!
- **Extensive collaborations with professional engineering societies**
  - ABET, ASEE, ASME, IEEE, ASCE

Other Current Collaboration Efforts

- **Sustainability Toolkit**
  - In collaboration with UK's Engineering Professors Council with support from Siemens
  - Mapping EOP Framework to UK's AHEP standards
  - To be launched in March 2024
- **ASCE's Shaping the Future of Engineering Education Project**
  - Support from United Engineering Foundation (UEF)
  - Report due December 2023
- **Spanish translation of EOP Framework**
  - Working with Villanova
  - Available in 2024

Your voice & your actions make a difference.
You are not alone.
Join us!

Engineering for One Planet

5 ways you can take immediate action!

Engineering for One Planet

Download, use & share free online teaching resources

- EOP Framework
- 3 "how to" teaching guides
- Tell your peers!
- We'd love to hear your feedback too!

ASEE EOP MGP

- Apply by Jan 10!
- https://eop-mgp.asee.org/apply/

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Sign up for EOP Newsletter (quarterly)

Become an EOP Signatory →

Thank you!

Connect with me on Linkedin:
https://www.linkedin.com/in/cindyandersonalula/

Contact EOP:
info@engineeringforoneplanet.org

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Questions?

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