

# Engineering for One Planet

ECL-USA Summit 8  
Houston, Texas  
March 10, 2020

Cindy Cooper, Program Officer  
The Lemelson Foundation



# THE ASPIRATION



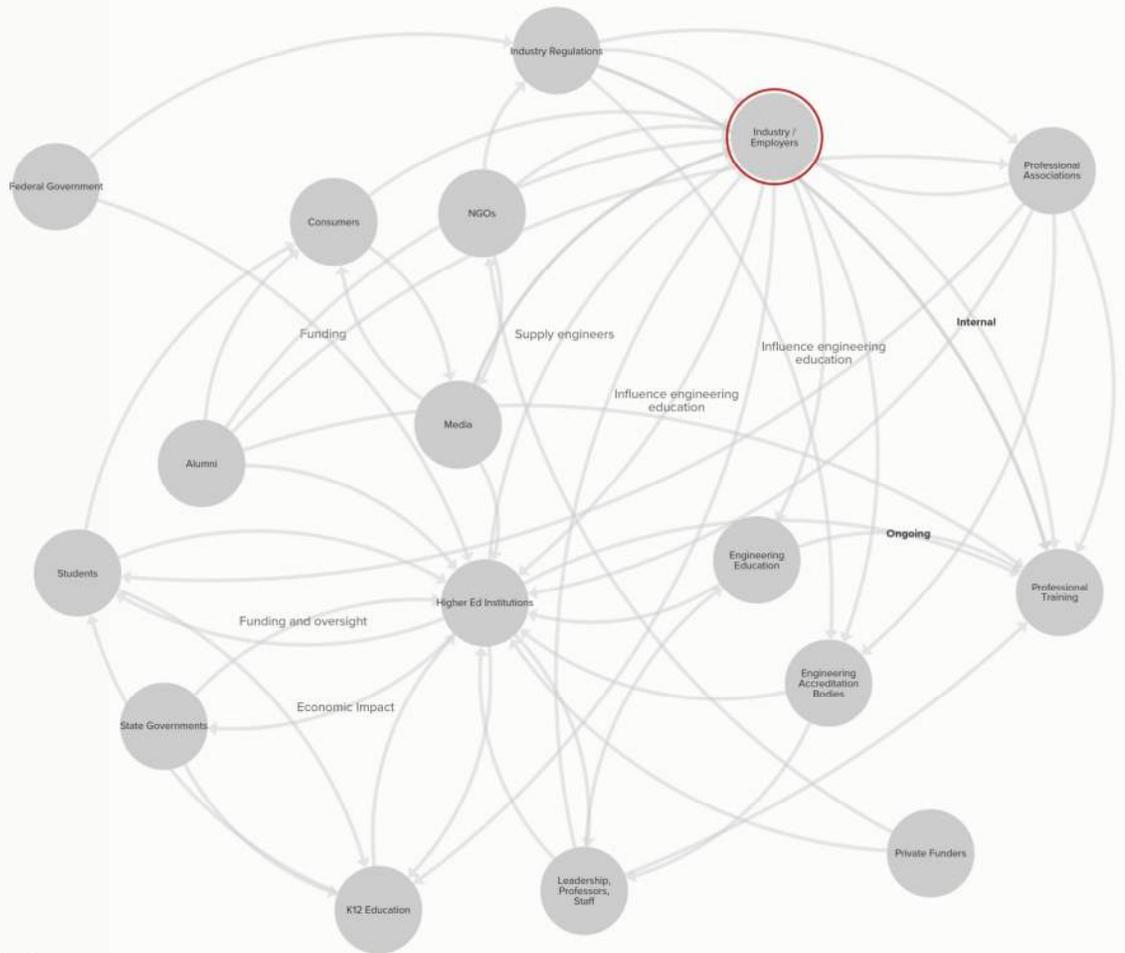
## THE ASPIRATION

- ▶ *Ensure all engineering professionals are equipped with the fundamental competencies and skills in environmentally responsible engineering by transforming 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

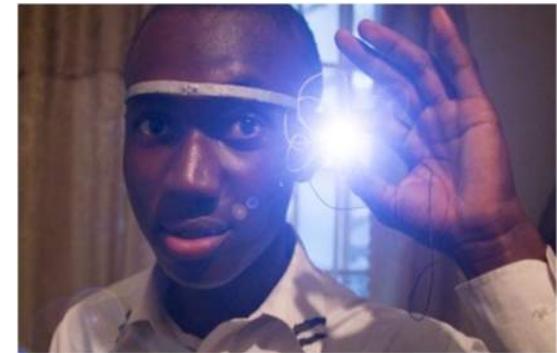
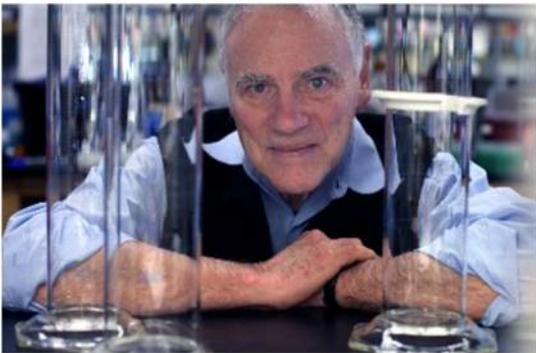
**Legend**  
 ----- Opposite



# THE INSPIRATION

# THE INSPIRATION: Improving lives through invention

- Inventions are essential for: addressing the critical challenges of our time; creating high-growth businesses; strengthening the economy.
- And, we must prepare inventors so that the solutions of today do not become the problems of tomorrow.



Jerry Lemelson  
envisioned a program

that would foster the next  
generation of collegiate inventors

and help them bring  
their ideas to impact



# U.S. Higher Education & Entrepreneurship

- ▶ **\$9+MM** in grants teams of student inventors and entrepreneurs who are driven to solve the world's greatest challenges
  - ▶ **\$600+MM** in follow on funding raised by 230+ alumni ventures
- ▶ **\$12+MM** in grants to faculty for innovation courses and programs
  - ▶ In 2018 alone, **13,000+** students participated in new or improved courses
- ▶ **360+** universities

## THE GAP

**70%**

Personal sustainability of  
“utmost” importance,  
yet...

between  
values,  
skillsets  
and  
mindsets

**60%**

Had not considered  
environmental impacts of  
design at all before the  
using VentureWell’s  
Inventing Green Toolkit

# Inventing Green

- ▶ Setting sustainability goals and constraints during design stage creates the opportunity for maximizing innovation and minimizing negative impacts
- ▶ Systems thinking - broaden the boundary to include impacts on people and planet
- ▶ Measuring environmental impacts from birth to death (or rebirth)
  - ▶ Waste generated throughout lifecycle
  - ▶ Energy / carbon use in manufacturing, storage, transport
  - ▶ Energy / carbon use during useful life
  - ▶ Materials extraction and manufacturing
- ▶ Lightweighting, designing for deconstruction, repair or retrofitting
- ▶ Material selection - toxicity, durability, recyclability, renewability, etc.
- ▶ Business models that align with the sustainable design



# Sustaining Our Planet: A Toolkit for Entrepreneurs

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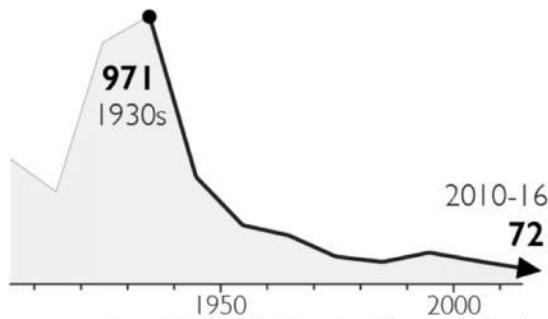
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# THE OPPORTUNITY



### DEATHS FROM DISASTER

1,000 deaths/year (10-year averages)



Source: EM-DAT (The international disasters database)

### CHILDREN DYING

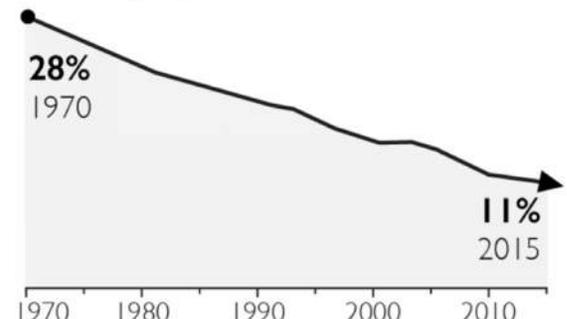
Percent dying before their fifth birthday



Source: Gapminder[6] based on UN-IGME & HMD

### HUNGER

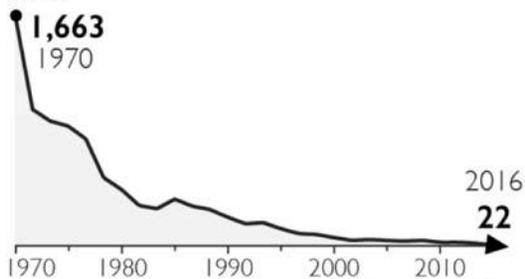
Share of people undernourished



Source: Gapminder[18] based on FAO[1,3]

### OZONE DEPLETION

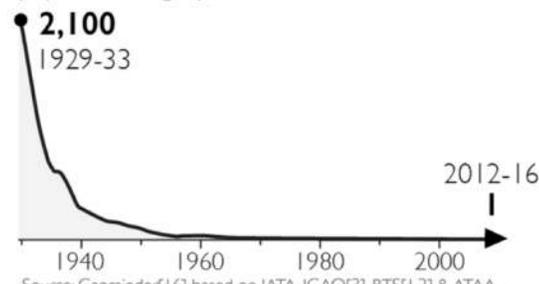
1,000 tons ozone-depleting substances used



Source: UNEP[4]

### PLANE CRASH DEATHS

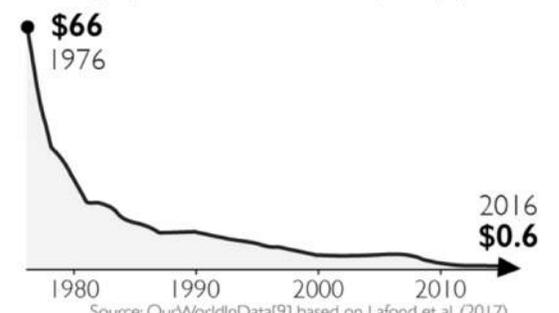
Deaths per 10 billion passenger miles (5-year averages)



Source: Gapminder[16] based on IATA, ICAO[3], BTS[1,2] & ATAA

### EXPENSIVE SOLAR PANELS

Average price of PV modules (\$/Wp)



Source: OurWorldInData[9] based on Lafond et al. (2017)

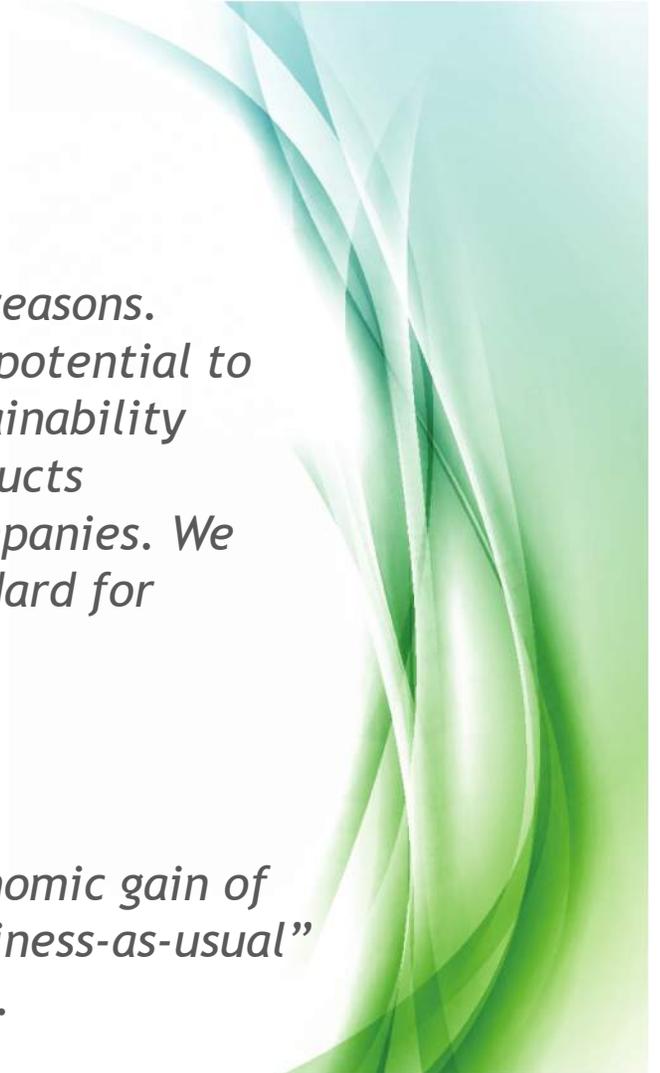
Source: <https://www.gapminder.org/factfulness-book/32-improvements/>



Image by: Surian Soosay, Creative Commons; Source: <https://www.psychologytoday.com/us/blog/talking-about-trauma/201612/trauma-documented-three-decades-after-chernobyl-disaster>

# Demand

- ▶ **Black Rock** goes pro-sustainability for **FINANCIAL** reasons.  
*“Because sustainable investment options have the potential to offer clients better outcomes, we are making sustainability integral to the way BlackRock manages risk, constructs portfolios, designs products, and engages with companies. We believe that sustainability should be our new standard for investing.”*
  - ▶ Bill McKibben, [www.350.org](http://www.350.org), calls it “Seismic”
- ▶ **“Bold action** [on climate] could yield a direct economic gain of **US\$26 trillion** through to 2030 compared with business-as-usual” according to a report by The New Climate Economy.



# Demand

- ▶ *Giants like **Starbucks and Microsoft** say they are all-in to become resource positive - removing more carbon than they emit*
- ▶ ***U.S. Department of Defense** stated in a 2015 report to Congress “Climate change is an urgent and growing threat to our national security, contributing to increased natural disasters, refugee flows, and conflicts over basic resources”*

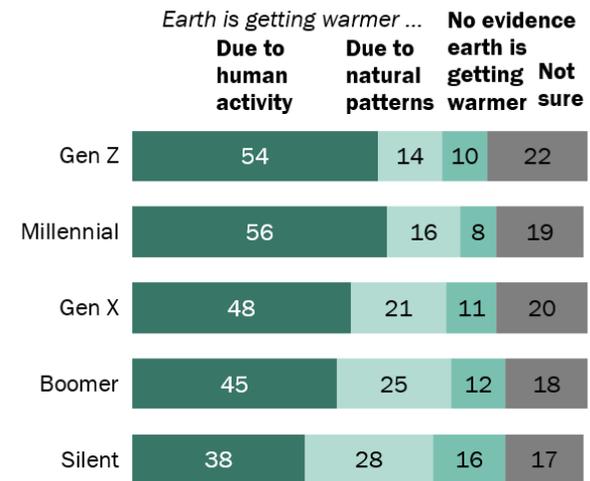


# Supply

- ▶ **Next Generation of Leaders** - 1.8bn millennials will soon be in charge
- ▶ **Digital Natives aka Climate Crisis Natives** - Generation Z - 2.6bn globally

## Gen Z, Millennials most likely to see link between human activity, climate change

% saying ...



Note: Share of respondents who didn't offer an answer not shown.  
Source: Surveys of U.S. adults ages 18 and older conducted Sept. 24-Oct. 7, 2018, and U.S. teens ages 13 to 17 conducted Sept. 17-Nov. 25, 2018.

"Generation Z Looks a Lot Like Millennials on Key Social and Political Issues"

PEW RESEARCH CENTER

Source: <https://www.pewsocialtrends.org/2019/01/17/generation-z-looks-a-lot-like-millennials-on-key-social-and-political-issues/>

*If you want different results,  
do not do the same things.*

- Albert Einstein



# THE ROADMAP



## THE ROADMAP

- ▶ Define fundamental **competencies and skills of environmentally responsible engineering**
- ▶ Support **change** in engineering curriculum
- ▶ Rally and bring together **actors** - from academia, businesses, NGOs, government - to foster changes in the system that advance their goals



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New HECT meeting x Talking Points for M-... M-INC(T)\_Sp19 5D Fi x VentureWell - Calend x Launch Meeting - Zo... For Note Taking 11/12 x ERE Definition and Fr... Copy of ERE Definitio...

docs.google.com/document/d/14HzRFKeKnOfp42zqPO5DY3juhstGwHdVp3brPh1d9Pa/edit

### ERE Definition and Framework: Collaborative Editing Space

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100% Normal text Montserrat 11 B I U A

- Ability to develop creative trans-disciplinary ideas and solutions in engineering contexts along with social and cultural values (e.g. habitat, construction and health)
- Ability to seek, evaluate, adapt and give credit back to local craft traditions, indigenous knowledge systems and vernacular practices and innovate inclusive and regenerative solutions

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- Embrace a design ethos of responsibility to society and culture/wisdom.

#### LEADERSHIP SKILLS

- Critical thinking**
  - Ability to interpret and incorporate qualitative and quantitative research
  - Ability to innovate (radical innovation vs. incremental innovation)
  - Ability to consider, understand, and experience different perspectives, opinions, views, etc., and to articulate varying standpoints (normative thinking)
  - Ability to assess and determine the right/worthy problems to solve
- Communication**
  - Ability to communicate through audience-specific written, graphic/visual, oral, interpersonal communication skills, in order to:
    - sell, pitch and explain ideas and advance learning
    - advocate for underrepresented groups
    - drive organizational change
    - maximize team effectiveness
    - work well with others and across disciplines
  - Ability to prioritize and manage schedules, time and people
  - Ability to design visual information communication systems for monitoring and performance evaluation
  - Ability to cultivate and grow a community of practice

MikeM

Editing

Cindy Gilbert 3:12 PM Nov 1  
Very interesting idea. Thanks for sharing. I will add to the next online conversation.

Bernie Beagle 2:38 PM Nov 4 Resolve  
Ability to understand and articulate relative impact reduction and absolute reduction.

Bernie Beagle 2:40 PM Nov 4 Resolve  
This seems a tall ask to blend two technical fields into one super designer.

Bernie Beagle 2:41 PM Nov 4 Resolve  
Ability to comprehend and articulate the implications of the scale of impacts of material consumption.  
Show more

Daniel Riffell 8:24 AM Oct 18 Resolve  
This is a pretty broad statement. What is "right" and from what perspective?

Cindy Gilbert 8:30 AM Oct 25  
This is a great point, Daniel. Laden with judgment Daniel's comment is a...  
students to be able to discern "worthy challenges?"

00:40:45 / 00:49:53 Speed

**Environmentally Responsible Engineering: Core Student Learning Outcomes**  
 Cross-referenced with Engineering Accreditation Requirements and United Nations Sustainable Development Goals



YOU



You are engineering for one planet by...

- ▶ What you say, what you do
- ▶ Hiring
- ▶ Supporting / catalyzing change in education



*A cooling system, burns out in the Ukraine.  
Trees and umbrellas,  
Protect us from the new rain.  
Armies of engineers  
to analyze the soil.  
The food we contemplate  
The water that we boil.*

*I can't run, but I can walk much faster  
than this.*

*- Paul Simon*



TALK THE  
TALK AND

WALK THE  
WALK  
(faster)



Source: <https://tenor.com/search/speed-walking-gifs>

Join us in  
Engineering  
for One Planet

*[cindyc@lemelson.org](mailto:cindyc@lemelson.org)*

