

Engineering for Global Development Research Forum

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Development Engineering: Actionable Research and Global Impact

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Development Engineering

A new interdisciplinary **research** field that integrates:

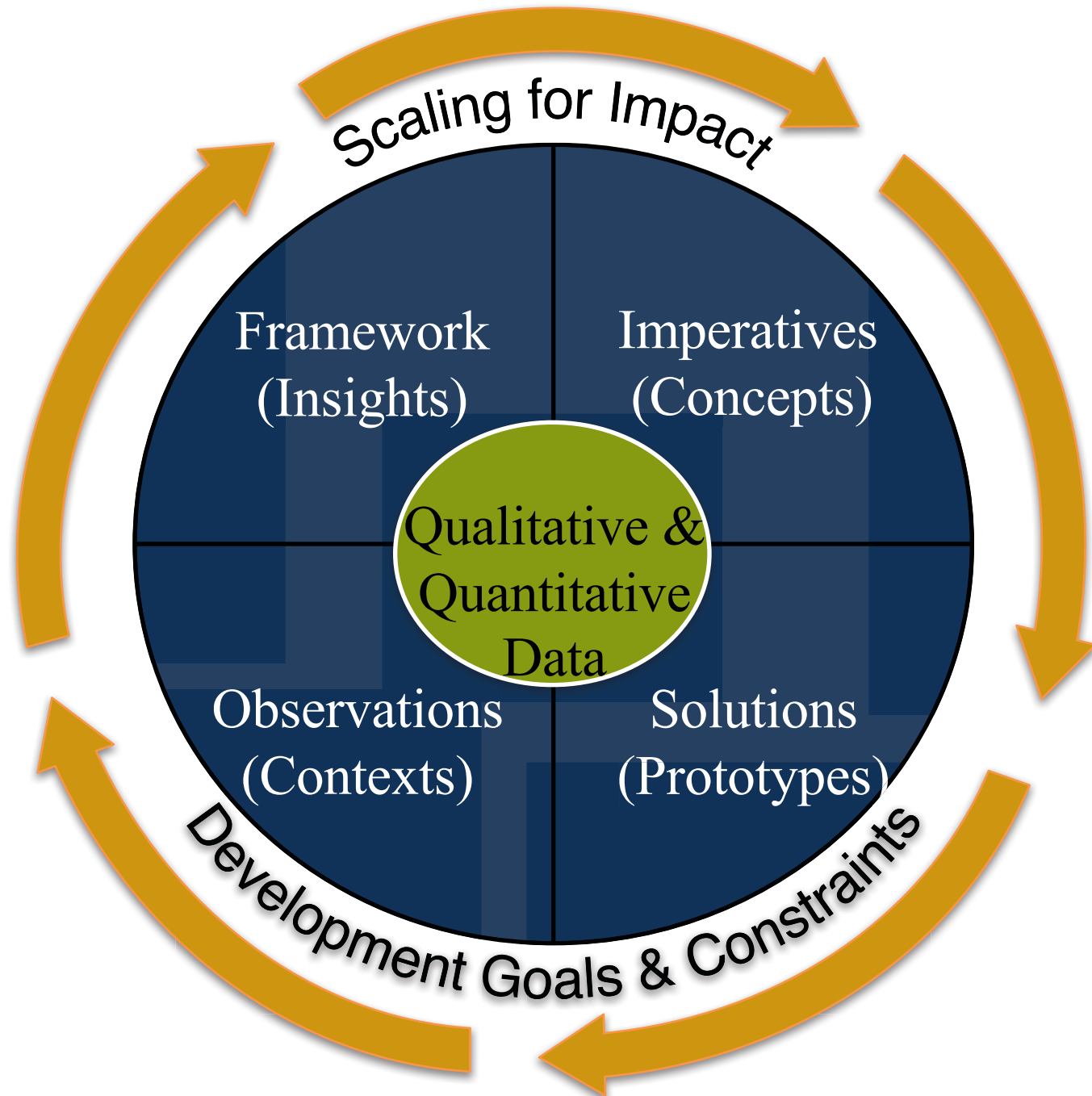
- Engineering, physical sciences, energy & resource development
- Economics, business & social sciences

to develop, implement, evaluate & scale technologies to benefit people living in poverty in developing regions and low-income areas of the U.S.

Development Engineering: Designing products and services that improve poor people's lives at scale



Development Engineering Research Model



PhD Minor at UC Berkeley

- Fall Semester: Dev Eng 200 (MBA 290T, ME 200):
Design, Evaluate & Scale Development Technologies

Midwife Education



Black Carbon Meters



- Spring Dev Eng 210: **Theory & Practice Seminar**
- Choice of 3 elective courses, only one of which can be from the student's home department.

Demographics

- 22 affiliated faculty from 13 departments.
- 10 PhD students (50% female, 20% URM, engineering, public health, sociology, energy resources, college of natural resources).
- 100 students have taken or are taking the required courses.

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Research & Teaching Example: cooking over biomass fires kills 4 million people per year



(Lim, 2014) <http://blogs.civicus.org/worldassembly/2012/07/14/wood-fuel-destroying-the-environment-and-harming-the-african-woman/>.

Example: Development issues & stoves

	Needs assess	Creativity	Improvement
Social goals to improve people's lives at scale	Who breathes the most smoke?	How can we reduce smoke exposure?	Are we reducing smoke exposure?
Barriers to design from geographic and cultural distance	How can we learn when far?		How to learn problems with out solutions?
Constraints of poverty, remoteness, liquidity constraints, gender roles,...	How to sell when liquidity constraints?	Find 20 solutions to liquidity constraints	Test our solutions
Opportunities of donors, mobile phones, microfinance,...	What role for mobile phones?	How to use mobile banking?	How collect data via phone?
Tools like impact evaluations	What impacts do donors care about?	How to roll out our product to build in learning?	Low-cost RCT (randomized controlled trials)



Cook Stove Workshop

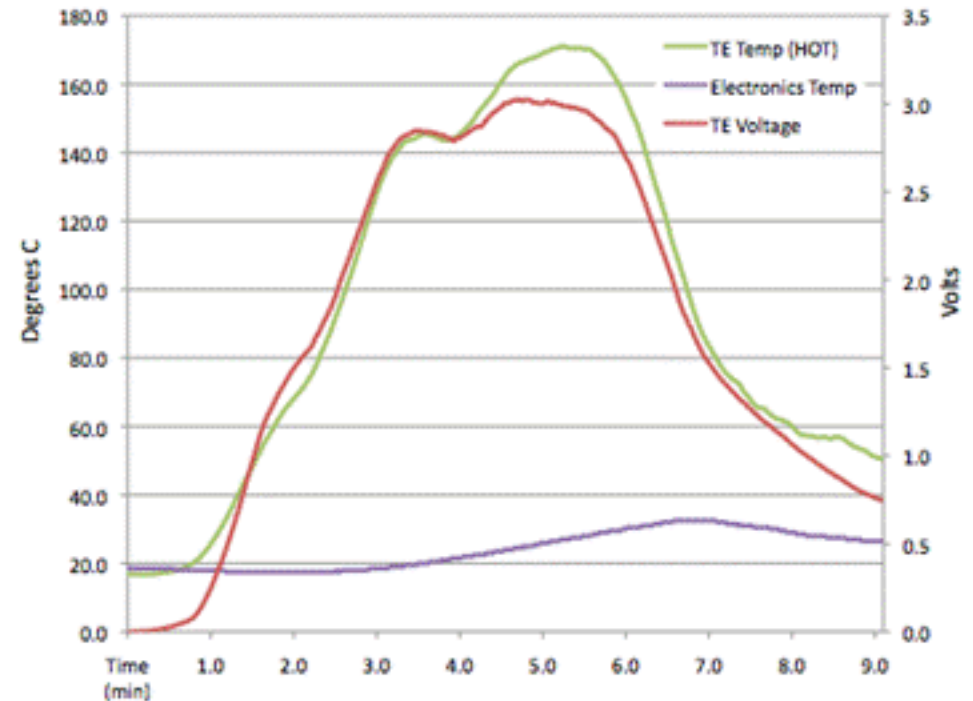
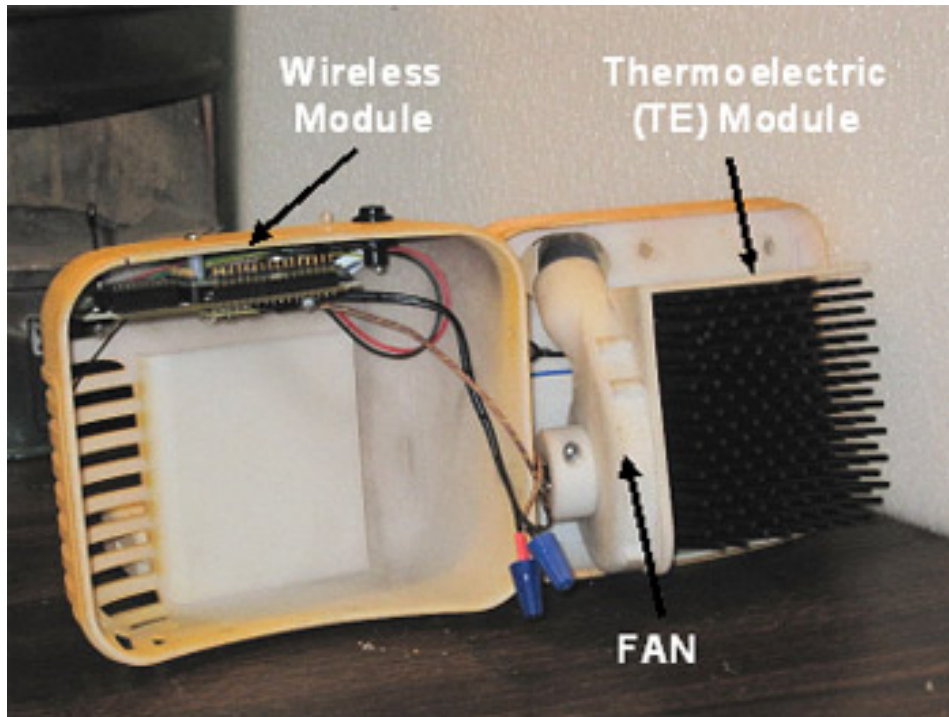
<http://bit.ly/deveng-cookstove>



Sensor Data



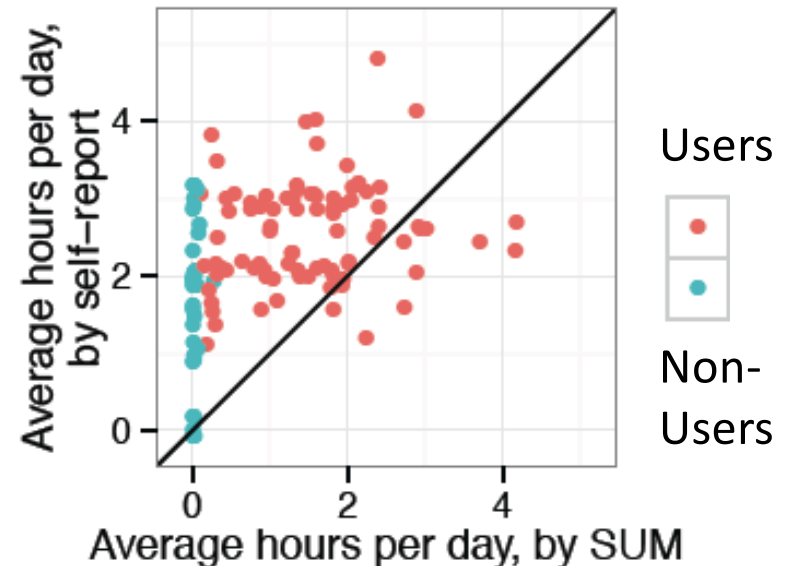
UCB-SUMS Stove Use Monitoring System



Maxim iButton: <http://www.hedon.info/BP55:Low-costTemperatureLoggersAsStoveUseMonitors>

Research: What is Said – What is Done

- Comparison between ODK survey data and sensor data
- 85% over-estimated cooking hours & events
 - Users over-reported time spent cooking by 1.2 hours (almost double)
 - Non-Users over-reported by 1.7 hours.



Student Profiles: Julia Kramer

- PhD 2019, Mechanical Engineering
- 1st place 2014 Big Ideas winner, global health (“Visualize an end to Cervical Cancer”)
- Research on cervical cancer detection & training in Ghana & world-wide.
- Collaboration with Kathleen Sienko Univ of Michigan.



275,000 women die each year from cervical cancer with 80% of these in the developing world.

Student Profiles: Will Tarpeh

- PhD 2017, Environmental Engineering
- 1st place 2014 Big Ideas winner, poverty alleviation (“ElectroSan”)
- Research on electrochemical cells to recover nitrogen from human urine and to disinfect feces, bringing affordable sanitation to poverty-stricken communities in Kenya.



Student Profiles: Katya Cherukumilli

- PhD 2017, Environmental Engineering
- 2015 Big Ideas 2nd place winner
- DOW Sustainability Innovation Student Challenge Award winner in 2015
- Research on using low-cost bauxite ore to eliminate flouride poisoning from drinking water in India, and globally.



Food, Energy, Water Systems (FEWS)

Grand Challenges & Interconnections

STRESSORS

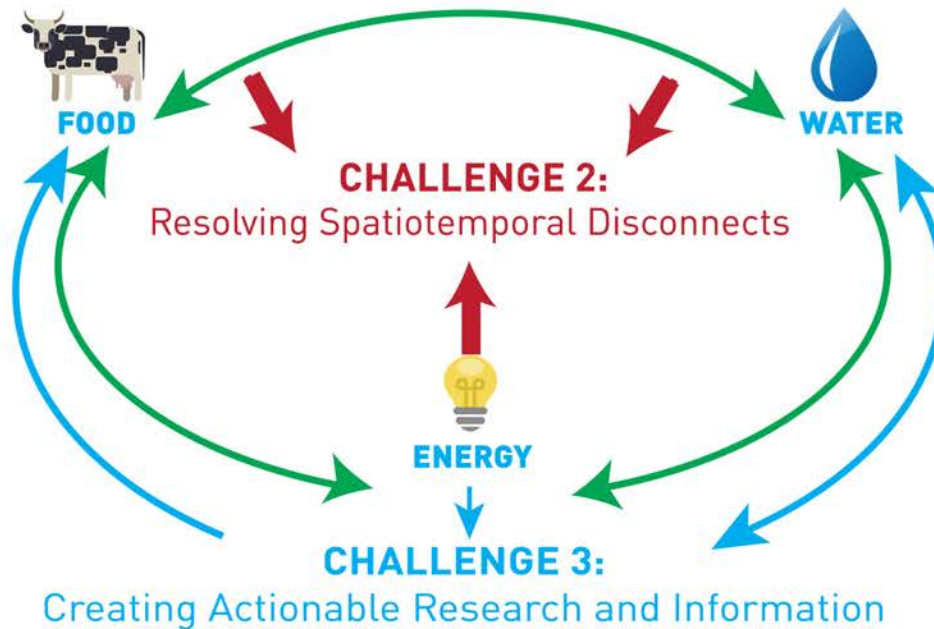
climate variability

shifting demographics

persistent waste and pollution

CHALLENGE 1:

Closing and Optimizing the FEWS Loop



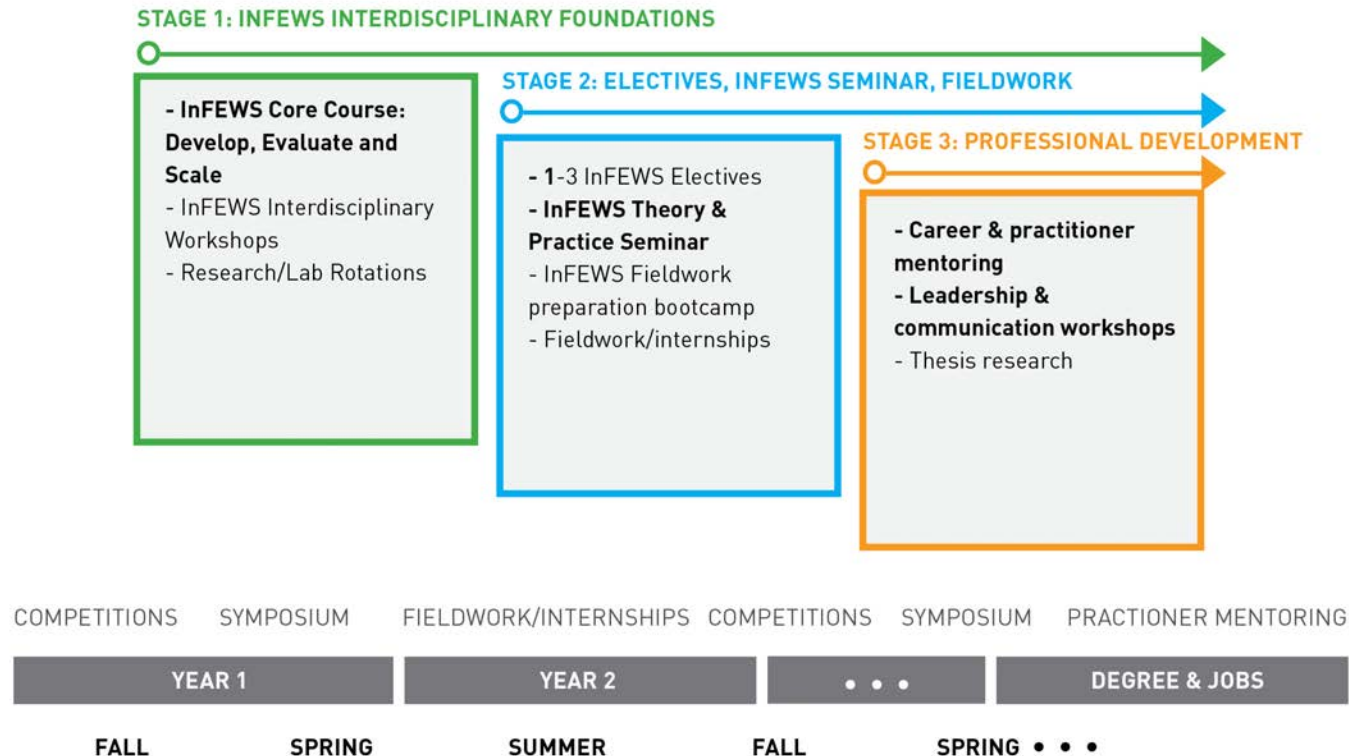
SOLUTION MECHANISMS

information and data

incentives for behavior change

contextualized technology

Program Timeline for FEWS Research Trainees



Bold designates required elements for both the FEWS MS certificate program and the PhD minor. 20 trainees per year over four years. Over 100 additional STEM students (non-trainees) per year will participate in one or more training elements.

Development Engineering Journal



ELSEVIER

Now ACCEPTING SUBMISSIONS

DEVELOPMENT ENGINEERING

THE JOURNAL OF ENGINEERING IN ECONOMIC DEVELOPMENT

AIMS & SCOPE

Development Engineering (Dev Eng) is an open access, interdisciplinary journal applying engineering and economic research to the problems of poverty.

Published studies must present novel research motivated by a specific global development problem. The journal serves as a bridge between engineers, economists, and other scientists involved in research on human, social, and economic development.

SPECIFIC TOPICS INCLUDE:

- Engineering research in response to unique constraints imposed by poverty.
- Assessment of pro-poor technology solutions, including field performance, consumer adoption, and end-user impacts.
- Novel technologies or tools for measuring behavioral, economic, and social outcomes in low-resource settings.
- Lessons from the field, especially null results from field trials and technical failure analyses.
- Rigorous analysis of existing development "solutions" through an engineering or economic lens.

EDITORS IN CHIEF:

Ashok Gadgil Civil and Environmental Engineering, Lawrence Berkeley National Laboratory, Berkeley, California, USA	Paul Gertler Economics University of California, Haas School of Business, Berkeley, California, USA
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- Engineering research in response to unique constraints imposed by poverty.
- Novel technologies or tools for measuring behavioral, economic and social outcomes in low-resource settings.
- Technology markets and the role of innovation in economic development.
- Assessment of technology solutions, including field performance, consumer adoption and end-user impacts.