

# AT THE FRONTIER

How engineering can  
build a brave new world



UK  
**ENGINEERS**  
WITHOUT BORDERS

Annual Review 2017



From Hollywood disaster movies to doom-laden magazine features, most predictions for the future of humanity can be summed up in one word:

bleak.



**Katie Cresswell-Maynard**  
Chief Executive,  
Engineers Without Borders UK

## At the frontier

For all our mind-spinning advances in science, technology, economic development and human organisation, we seem increasingly anxious about where it's all heading. We feel powerless in the face of a looming set of potential crises: rising global temperatures, mounting pressure on the planet's resources, an inexorable increase in the world's population, dizzying levels of inequality.

The fact we face some daunting challenges is beyond dispute, but we are far from powerless. **More than at any time in human history, the future is ours to shape.** But to build a better world, we have to push beyond our existing frontiers – business as usual is no longer an option. We have some serious choices to make.

As a matter of urgency, we need to find cleaner, more sustainable sources of energy; optimise our use of resources so everyone can enjoy at least the basics without devastating the environment; and revolutionise our cities and towns to promote healthy and inclusive societies.

**Engineering should be at the forefront** of taking on each and every one of these challenges. Engineers can rise to the occasion and take centre stage in building this brave new world.

But to do this we need:

- To transform **how the world sees engineering**, so it is regarded as a force for good with the power to change billions of people's lives.
- A **change of mindset** so that the social and environmental impact that engineering can have is recognised.
- To **re-engineer**, innovating to find responses to the global challenges that threaten our future.

These are the transformations Engineers Without Borders UK aims to bring about.

In the pages that follow you'll see how, in 2017, we worked to change how engineering is perceived, taught and practised, and helped to bring people, ideas and engineering together to respond to the world's most pressing problems. You'll read how we nurtured innovation and helped foster the flow of exciting new ideas. You'll meet some of the people we inspired – talented individuals determined to take engineering in a new direction. You'll discover how you can be part of this transformation as we build a movement for change.

Join the movement and together let's put engineering in its rightful place: at the frontier, **leading the world towards a brighter future.**



We have the power to shape a better world and choose a brighter future.

RUNAWAY CLIMATE CHANGE

# The choice

DEEPENING INEQUALITY

BIODIVERSITY LOSS

SOIL EXHAUSTION

OCEAN FISHERIES COLLAPSE

IF WE CARRY ON WITH BUSINESS AS USUAL...

We're leading a movement to make sure engineers use their skills and talent to create the future we all want.

MORE EQUAL, INCLUSIVE SOCIETIES

# we face

HARMONY WITH NATURE

GREENER URBAN SPACES

RENEWABLES REVOLUTION

IF WE CHOOSE TO CHANGE COURSE...





We're leading a movement to transform how the world sees engineering.

This isn't about superficial window-dressing. If we are to attract a new generation of talented, diverse and globally responsible engineers, we need a profound change of image.

# Changing PERCEPTIONS

For most of the public, engineering is about hard hats, spanners, maths and physics. This image problem has real-world repercussions.

In the UK, we now face a chronic shortage of people wanting to become engineers. We will need an extra 180,000 engineers a year to meet the expected demand by 2022. At the same time, the sector's existing workforce is the least diverse in Europe and lacks a global mindset. Only 6% of engineers in the UK are non-white and only 9% are women.

We really shouldn't be here. A massive 83% of millennials say they want to

work for organisations that have a positive impact on society - that's a vast wellspring of passion, talent and potential we could tap into if we could get them to see engineering differently.

To do so, we may need to change the way we see ourselves. Engineers tend to slip into the role of maintaining the status quo: keeping the country's infrastructure in good order, safeguarding living standards and expanding existing services to meet demand.

These are worthy aims, but they won't inspire a generation of idealistic young

people. They undersell the innovative and creative world-changing force we know engineering can be. In the face of climate change, resource scarcity, overpopulation and rising inequality we need to think much bigger.

That's why, in 2017, we were part of national campaigns to promote this positive image of engineering - including Tomorrow's Engineers Week and the Institution of Engineering and Technology's Open House Day. It's why we launched our new membership scheme and began building a movement dedicated to taking engineering in an exciting new direction.



"We need to think much bigger. We need to promote the innovative and world-changing force we know engineering can be."

TRADITIONAL PERCEPTIONS OF ENGINEERING



# Change of MINDSET

**The next generation of engineers need to understand what engineering is actually for, if they are to shape the future of the planet.**

The UK has some of the best universities in the world, capable of training outstanding engineers. But our educational institutions aren't doing enough to help students move beyond theory to solve real-world problems and appreciate the social impact of engineering.<sup>1</sup>

We need to inspire engineering students to think of themselves as creators and innovators, solving the most urgent problems people are really facing.

That is exactly what our award-winning inter-university competition, the Engineering for People Design Challenge, aims to do. It is now an integral part of the undergraduate engineering curriculum at 27 universities around the UK and Ireland, and has already benefited more than 23,000 students – 4,600 in 2017 alone.

Once new graduates leave university, there's nothing like first-hand experience to learn what it takes to be a globally responsible engineer. We give students and recent graduates the opportunity to work with our engineers on real-world projects to find out what it's like to make a tangible difference to people's lives.



**These experiences have had a career-changing impact on hundreds of fledgling engineers. Here's what a few of them said about their experiences in 2017:**

*"The most important thing for me was discovering the human element of engineering. Because we were given a real-world problem to solve, I was made aware of how engineers interact and engage with people. It really made me consider our responsibility to them, something I now bring to my team at Arup."*

Tsanko



## Inspiring the next generation

The UK's schools are full of children who want to do something meaningful with their lives, but haven't decided what that is yet. That's why we have hundreds of Ambassadors who visit classrooms across the UK and speak to thousands of pupils. We give them a simple message: **if you want to change the world, there's no better way to do it than through engineering.**

It's a message that resonates – as one

of our Ambassadors, Adedamola, explains.

"It was amazing to witness the moment the students realised how much engineering had shaped things around them – they all began to understand how important engineers are to our world. But what makes this role so enjoyable is what happens after that – seeing them link everyday uses and go beyond, working together to solve problems and challenges faced by others. It's in those moments where we see engineers created."

*"This was one of the most valuable parts of my personal development. It has reaffirmed my belief that all engineering should be done with a long term and sustainable approach as the priority."*

Audrey

*"My experience made me aware of how engineering interacts with other disciplines to provide much more suitable and efficient solutions."*

Juliet

2017: EDUCATION  
WORK IN NUMBERS

# 4,600

undergraduates took the Engineering for People Design Challenge

# +90%

said experiences boosted their creativity, communication, teamwork and design skills

# 400+

Engineers Without Borders Ambassadors

# RE-ENGINEER

**Ideas and expertise are of no value if they are confined to the classroom or the boardroom.**

**In 2017 we made sure they permeated out across the world in a process of collaboration with small but innovative organisations that work in some of the toughest places on the planet - places where engineering is critically under-resourced. Ideas came back in the opposite direction too - enriching the way we in industrialised societies see engineering, often giving us a more human perspective on the work we do. Because this isn't about charity, it's about collaboration, shared development and social justice.**

We worked in partnership with 14 local organisations across Africa, Asia and Latin America in 2017. We sent 22 of our trained engineers to provide these organisations with a total of 20,800 hours of pro bono expertise for innovative development projects.

We worked with them on everything from research and development, to their commercial practices, to product design, to health and safety, to training their staff - supporting them on their journey to fully realise their organisational potential. This knowledge and expertise will become permanently embedded within these organisations and their wider communities. It will reduce their need for outside support and allow them to drive real, permanent change for millions of people at the frontline of poverty, climate change and resource scarcity.

This process is already well underway. You'll read in the pages that follow how the organisations we support are delivering vital ethical and sustainable projects, providing communities with clean water and sanitation, affordable, renewable energy and safe public buildings and spaces.

We are working as part of the broad movement of organisations to achieve the UN's Sustainable Development Goals, advocating the critical role of engineering in the implementation and achievement of all 17 goals.



## 2017: OUR GLOBAL REACH

 **14**  
partners developed

 **12**  
countries worked in

**73**  
technicians and engineers trained

**20,800**  
pro bono hours worked

## CATALYSTS FOR CHANGE

HOW OUR PRO-BONO ENGINEERS TRANSFORM WHOLE COMMUNITIES



ENGINEERS



BUILD CAPACITY OF LOCAL ORGANISATIONS



CREATE SELF-SUSTAINING COMMUNITIES







India

# POLLUTION REVOLUTION

**Every day 3 billion people cook over open fires or inefficient stoves. Breathing in the air they produce is equivalent to smoking two packets of cigarettes a day. The result: 4.3 million premature deaths a year, more than from HIV and malaria combined.**

Now, a social enterprise in India called Prakti has come up with a revolutionary solution: clean, efficient cookstoves.

Prakti's cookstoves are good for people's health, for their finances and for the environment. They need half the

biomass fuel of open-fires, slashing the cost for families. They mean people, predominantly women, spend less time gathering firewood and more time earning money. They reduce deforestation and the amount of black carbon smoke in the atmosphere.

Over the past four years, we have helped improve the design and streamline the production of these cookstoves, culminating in the release of Prakti's cheapest and most efficient stove yet: the 'Ray Stove'.

*"Engineers Without Borders' engineers are skilled with solid industrial experience. This allows them to add value to our work in a minimum amount of time. They have the right mindset to adapt to working in an environment that has limited tools or financial means."*

Moushine Serrar, CEO Prakti

**OUR AIM**  
To change  
**500,000**  
people's lives with this  
technology in the next five years



# URBAN SPACES



**Imagine 250,000 people living in an area not that much bigger than Regent's Park in London.**

Any open spaces have become vast rubbish tips or are used for open defecation. There is one toilet for every 250 people. When the rains come, there are no flood defences - homes are swept away and raw sewage spreads. But this is also a place where communities come together to face their challenges. It is a vibrant, creative place. This is Nairobi's Kibera slum - the largest in Africa.

Engineers Without Borders UK has been working with the Kounkuey Design Initiative (KDI) since 2012 to transform these polluted wastegrounds.

We've cleared rubbish dumps, and designed and built sanitation blocks, toilets and flood defences.

**OUR AIM**  
To train KDI engineers so they can continue turning Kibera into somewhere with pleasant open spaces, where people can come together, meet and do business. A place where disease is less able to spread and water is safe to drink





# CLEAN WATER

The groundwater supply of Mexico's Guanajuato region is contaminated, exposing 200,000 people to life-threatening pathogens like Ecoli and toxic amounts of fluoride and arsenic. People take their chances with the poisoned water supply or pay US\$2 a day for environmentally damaging bottled water.

Since 2013, Engineers Without Borders UK has been working with local partners CATIS and Caminos de Agua to develop innovative, high-quality bone-char filters. These filters - which we're constantly refining to make them more efficient and

cheaper to produce - clean out all the harmful impurities as the water passes through them under the force of gravity.

- The people of Guanajuato can now drink clean groundwater, save money on bottled water and reduce plastic waste.
- There are now fewer cases of skeletal fluorosis and developmental difficulties in children.
- Local businesses are also benefiting as they produce, maintain and distribute filters, and make bricks for the kilns.

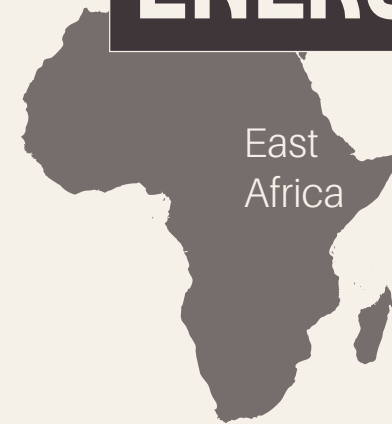
"Every time we get an Engineers Without Borders' engineer, it greatly expands our engineering capability."

Aaron Krupp, Caminos de Agua

**OUR AIM**  
To provide  
**72,000**  
people with clean water access  
over the next five years



# GREEN ENERGY



Worldwide, 1.3 billion people lack access to electricity - 84% of them in rural areas.

In East Africa, this gap is being filled by small off-grid renewable-energy businesses who are providing 60% of new power to rural communities.

These hard-working green-energy enterprises are the future - so we've joined forces with Energy 4 Impact to help them grow and reach more people. Together we've helped train their engineers, increase their commercial skills, improve their products and expand into new markets.

As rural communities get greater access to reliable, renewable energy, the knock-on benefits are immense:

- Healthcare, education, commerce and agriculture can all function more efficiently.
- The harmful use of indoor

cooking fires, diesel generators and other fossil fuels has begun to fall.

Street lighting increases people's safety and electric lighting lets children continue studying after dark - giving them more chance to become the engineers of the future!

**OUR AIM**  
To improve the  
energy access of  
**830,000**  
people over the  
next five years





Rwanda

# DISASTER-RESISTANT BUILDING

**Rwanda sits precariously along a fault line. It suffers frequent, sometimes deadly, earthquakes.**

The country's buildings are not made to withstand these shocks and Rwandan universities do not yet teach engineering students seismic architecture.

For the past three years, Engineers Without Borders UK and local partner MASS Design have worked together to provide on-the-job training and mentoring to local construction

workers, technicians and engineers in modern earthquake-resistant building techniques.

Together, we're applying these techniques to the construction of homes, schools, hospitals and other public buildings across Rwanda. As we train more of the country's engineers, its vital infrastructure will become increasingly able to withstand future quakes - saving lives and cutting the cost of post-disaster rebuilding.

**OUR AIM**  
 To increase the resilience of buildings used by  
**217,000**  
 people over the next five years

# JOIN US

**If you want to make a difference, we believe the smartest investment you can make is with Engineers Without Borders UK.**

You'll be building a new generation of creative, innovative and socially responsible engineers who will spread their expertise across the globe and find solutions to the biggest challenges of our time. What better investment could there be than that?

By helping to inspire young minds, by fostering a culture that prioritises

changing people's lives, by sharing knowledge and skills with communities on the frontline of the world's most pressing problems, your investment will go so much further than the work it funds.

You'll be investing in a small, agile, cost-effective organisation. We have a web of connections across the globe and an ethos of collaboration. We know how to use the power of partnership to catalyse big change.

**We'll make sure every penny you spend goes as far as it can.**

**We're building a movement for change** - and we want you to be part of it. In 2017, for the first time, we invited people to become members of Engineers Without Borders UK.

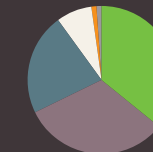
We welcome everyone with a passion to change the world through engineering to sign up and join us. You'll be part of a like-minded community, get the chance to attend special events or work with our international partners on groundbreaking projects, and even have the opportunity to become a Trustee or join the Board of Directors. Find out more at [ewb-uk.org/becomeamember](http://ewb-uk.org/becomeamember)



**Together we can revolutionise the engineering sector and put it centre stage in the fight to build a brighter future for us all.**

It took £734,509 to deliver our work in 2016-17

FOR EVERY £1 WE SPEND



**36p**

goes towards helping skilled engineers provide pro-bono technical expertise to some of the world's poorest communities

**32p**

funds our programme to change how universities teach engineering students - the Engineering for People Design Challenge

**22p**

goes towards supporting our movement to embed global responsibility into the heart of engineering

**8p**

funds our work to inspire a new generation of engineers at schools across the UK

**1p**

goes on raising the next £1 for our cause

**1p**

makes sure we work efficiently, effectively and accountably as an organisation



**Our work wouldn't be possible without the magnificent support of our donors.**

We would like to extend our sincere thanks to the following corporations, organisations, trusts and foundations who so generously supported our work in 2017.

**THANK YOU**

**GROUND BREAKERS  
(£100,000+)**

Anglo American Group Foundation

**CHANGE MAKERS  
(£50,000-£99,000)**

Bechtel Group Foundation

**MOVERS  
(£20,000-£49,000)**

Arconic Foundation

Black & Veatch

Department for International Development

Garfield Weston Foundation

Ove Arup and Partners Ltd

**SHAKERS  
(£5,000-£19,999)**

Big Lottery Fund

Chartered Association of Building Engineers

CIHT Foundation

EuropeAid

Happold Foundation

Institution of Engineering and Technology

Institute of Highway Engineers

Institution of Mechanical Engineers

John Laing Charitable Trust

Peter Jost Charitable Foundation

The MacRobert Trust

The Worshipful Company of Information Technologists

**FRIENDS  
(£365-£4,999)**

Accenture

Cloudera UK Ltd

Deutsche Bank

ERA Foundation

Rolls Royce Plc

Society of Public Health Engineers

Souter Charitable Trust

The Madeline Mabey Trust

The Rotary Club of Warwick

**IN-KIND SUPPORT**

Birmingham City University

Google

Jenner & Block London LLP

Latham & Watkins LLP

Newton Europe

Ove Arup and Partners Ltd

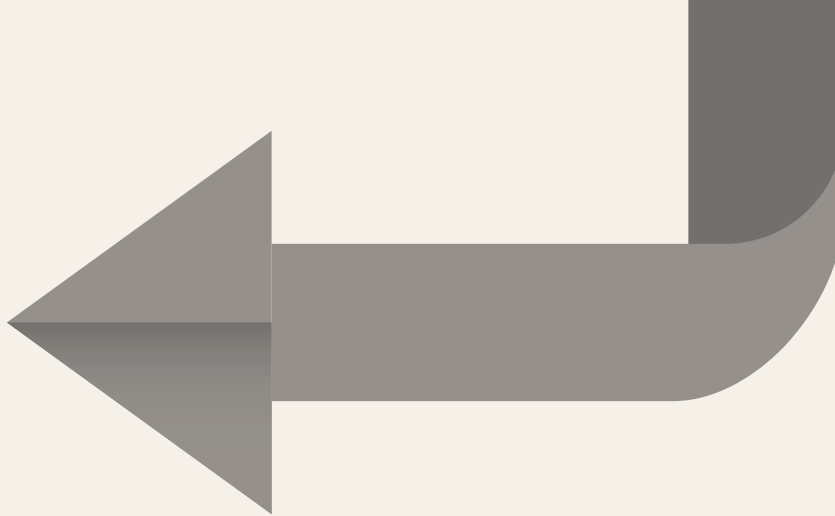
Salesforce Foundation

Simmons & Simmons

WS Atkins Plc

**We are also very grateful to all of the individuals who make regular donations to support our work**





Which future will  
you choose?



JOIN THE MOVEMENT

The Foundry, 17 Oval Way  
London SE11 5RR  
+44 (0)203 752 5820  
[www.ewb-uk.org](http://www.ewb-uk.org)

Engineers Without Borders UK is a registered charity in England & Wales (No. 1101849) and Scotland (No. SC043537) and is a company limited by guarantee (No. 04856607).



UK  
**ENGINEERS**  
WITHOUT BORDERS