

# Building for a sustainable future

Insights into the critical role  
of infrastructure for the SDGs







**The roads we travel on.  
The roof over our head.  
The streetlights that  
help keep us safe.**

We believe in infrastructure that  
improves life for all people  
– now and in the future.





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Image credit: UNOPS/John Rae

## Foreword



Infrastructure is the foundation for development. From roads and transport infrastructure connecting us to jobs, healthcare, education and food, to water infrastructure allowing us and our crops to live, and housing infrastructure giving us shelter and stability, our lives and livelihoods depend on infrastructure.

Our world has reached a critical point. The global demand for infrastructure is unprecedented: By 2050, the global population is expected to increase by 2 billion people. An estimated \$97 trillion in global infrastructure investments are needed to support sustainable development by 2040.

Importantly, infrastructure is built to last: if we build without considering the needs of users now and in the future, we will perpetuate inequalities. If we build infrastructure not designed to withstand and respond to crises - whether they are due to a changing climate or public health emergencies - we risk wasting valuable resources. We have a moral and financial responsibility to ensure that the huge investment in infrastructure leaves no one behind.

This booklet features essays written by UNOPS infrastructure experts, as well as guest blogs from industry and government specialists, and articles previously published in *The Economist* newspaper. Together they highlight just how fundamental a role infrastructure plays in achieving the Sustainable Development Goals.

From exploring how infrastructure is key to gender equality, to examining how it can mitigate and adapt to a changing climate, and highlighting the much-needed public-private collaborations that are essential to delivering quality infrastructure, this collection presents approaches that ensure our infrastructure benefits the people and the planet. As the UN infrastructure specialists, UNOPS are proud to bring industry best practices to infrastructure projects around the world, always with a focus on how infrastructure serves the 2030 Agenda, to meet the needs of the present generation, and those to come.

I hope that this publication will inspire us all, as we work together towards building a better future for everyone.

*Grete Faremo*  
Under-Secretary-General and  
UNOPS Executive Director



# Making infrastructure work for both women and men

Gaps in access to good infrastructure affect women disproportionately.

CURATED BY



Image credit: UNOPS/John Rae

*Women need to have a voice in setting priorities in the design and the operation of infrastructure if it is to have the desired development impact, argue Anna Wellenstein and Maninder Gill from the World Bank.*

Despite decades of progress, the global infrastructure gap is still significant: around 940m people live without electricity, 2.2bn lack safely managed water, 4.2bn lack safely managed sanitation facilities and 1bn live more than 2 km away from an all-season road.

This gap has a different meaning for women: infrastructure is not gender-neutral. The gaps in access to good infrastructure—and how it is designed, built and run—affects men and women differently. For instance, it is well documented that women are responsible for obtaining water for domestic use in most countries, which has a big impact on how they spend their time. In Niger, the average time women and girls spend fetching water adds up to 13 days a year. Lack of access to electricity results in household drudgery for women, due to lack of lighting, electric water pumps and refrigeration.

Conversely, women benefit tremendously from improved access to electricity, for example through better outdoor lighting around the house and in public spaces. This can improve their personal security and mobility.

Historically, infrastructure design has not properly addressed the different needs of men

and women. Infrastructure planners usually treat the household as homogenous, and primarily from a male perspective. There is evidence that women put higher priority on water quality than men. Lack of proper and safe sanitation facilities in public spaces—especially in the context of refugee or internally displaced people's camps—increases the stigmatisation of menstruation, urinary tract infections and the risk of gender-based violence. Men don't suffer such impacts from a lack of sanitation facilities.

## The gender dimension of urban transport design

Similarly, poor urban transport design has a disproportionately negative effect on women, preventing them from accessing jobs, schools and health centres. Deficient design and operation of urban transport infrastructure, such as commuter buses and trains, exacerbates the risks to women's personal safety and their exposure to gender-based violence. This was articulated by women who participated in a forthcoming World Bank Urban Transport Study (What makes her move? A study of women's agency in mobility in three Latin American cities):

"My husband asked me why I was thinking of working elsewhere. He said: 'working outside means commuting. You will have to take a train and put up with things like men stalking you. You aren't going to like it. It means bosses dishing out orders, whereas here you are working for yourself, at home, with time to use the car and take the kid for a ride.' He was keen to open a snack bar. He sold our car and set me up to work in the snack bar."

Middle-aged woman, low-income neighborhood in Rio de Janeiro, Brazil

A study on the different uses of urban transport for men and women in the city of Buenos Aires, Argentina, shows that women are often limited to jobs closer to home. They take multiple trips on urban transport, combining work and household chores—the lack of integrated, multimodal transport systems makes it too costly in time and money to work far from home. This seriously limits women's earning potential. In parts of the city, men with children effectively have access to over 80% more jobs than their female counterparts.

## Women's voice in design and operation

Women need to have a voice in setting priorities in the design and operation of infrastructure if it is to have the desired development impact. Safety and security concerns need to be paramount if infrastructure is to

be gender-inclusive. In the absence of an assurance of the safety of women, gender norms are likely to prevent them from actively participating in the labour market and community activities. And for such safety to be routinely assured, more work needs to be done on changing behaviour. A Mexico Urban Transport Project worked with bus drivers to identify and implement measures to prevent sexual harassment and gender-based violence in buses, leading to more working women using buses.

Women can also play a critical role in helping close the infrastructure gap. Diversity contributes to innovation. Women's perspectives in the design and management of infrastructure will both enhance service

**“ Women can also play a critical role in helping close the infrastructure gap. Diversity contributes to innovation. Women's perspectives in the design and management of infrastructure will both enhance service delivery today and contribute to innovation in the future. ”**

delivery today and contribute to innovation in the future. We need more women in infrastructure—in design firms, construction companies and utilities. An example of an initiative to enhance women's participation and influence in infrastructure is the Women in Power Sector Network in South Asia. This aims to enable more women to join utilities, so that they can make a stronger contribution to promoting inclusive infrastructure that works for both men and women. ■

## ABOUT THE AUTHORS



Anna Wellenstein is the regional director for Latin America and the Caribbean in the World Bank's Sustainable Development Practice Group. She is responsible for the World Bank's agriculture, climate, disaster risk management, environment, land, social development, urban development and water portfolios in the region.



Maninder Gill is global director for the World Bank's Environmental and Social Framework. Prior to this, he was director for Social Development for the World Bank from 2014 to June 2019, leading a team of around 300 social scientists committed to promoting socially inclusive development in the World Bank's operational and analytical work.



# Rethinking development: Can health centres be power stations?

Renewable energy has long been heralded as the solution for providing hard-to-reach communities with electricity. But how can we ensure that it's sustainable?

WRITTEN BY



Image credit: Olivia Acland

In Sierra Leone, just 13% of the country has access to electricity. In rural areas, that number drops to 1%.

From buying batteries for flashlights to kerosene for lamps to fuel for shared generators, or paying someone else to charge a mobile phone, people in rural areas are already spending up to 9% of their monthly income on power. Village residents are hungry for what limited power exists – and they're prepared to sacrifice a considerable portion of their limited income to get it.

Renewable energy sources like solar energy have long been seen as the best way to address issues surrounding accessing electricity. But Sierra Leone's countryside is littered with examples of solar power installations that are no longer functioning – or never functioned properly in the first place.

Solar power is not the simple and quick solution it is often portrayed to be. Designing the most appropriate solar solution for each local area is incredibly complex. But with the right approach, solar power could be a real game changer in encouraging sustainable development through energy access – driving improvements in health services, education and economic activity.

So how to increase access to electricity for the most underserved areas of the country in a sustainable way?

It may be a context specific question, but in Sierra Leone, with the Government



Image credit: Olivia Acland

and the United Kingdom's Department for International Development, we are building solar-powered mini-grids, centred on community health centres and operated as commercial enterprises, to supply entire villages with electricity.

## Lighting up rural Sierra Leone

In rural areas of the country, health centres and a steady flow of electricity are desperately needed.

Difficulty accessing health services – and the difficulties local health centres face providing round-the-clock care without access to a steady source of electricity – contributes to Sierra Leone being a dangerous place to give birth. Expectant mothers have a 1 in 17 chance of dying in childbirth – one of the highest maternal mortality rates in the world.

In a country where many births occur at night, midwives in many rural communities rely on flashlights or mobile phones to aid deliveries. If something goes wrong, they have little access to the facilities they need to save mothers' lives.

Using renewable solar energy to power the health centres means electricity for the tools needed to perform emergency procedures and full lighting for midwives to work. It means electricity for the refrigerators needed to store blood for transfusions or the vaccines needed to prevent diseases.

## Driving development

However, installing a few solar panels on public buildings, and bringing a few light bulbs, the occasional water pump or solar fridge doesn't ensure long-term sustainability. That requires working with the private sector.

Using the health-centres-as-a-power-station approach, private operators take responsibility for the long-term operations and maintenance of the mini-grid systems. The health centres receive free electricity in

return for the land on which to build the power station for the whole village. And using mini-grid distribution systems to provide power to the whole village will bring down the cost, enabling consumers to save money – or use more power for other activities for the same cost.

Once fully operational, mini-grids in smaller villages provide

immediate income generating opportunities. Private sector operators can go beyond simply providing power. From selling mobile phone top-ups or providing phone banking services, to selling internet access or providing micro-financing for domestic appliances – the possibilities are endless.

And making it attractive for the private sector to operate solar power installations encourages continued investment in the energy sector in rural areas, creating a truly

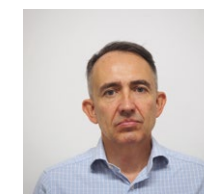
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**From buying batteries for flashlights to kerosene for lamps to fuel for shared generators, or paying someone else to charge a mobile phone, people in rural areas are already spending up to 9% of their monthly income on power.**

sustainable solution.

Although initially aimed at smaller villages, the next phase of this project will encourage private sector operators to co-invest to develop similar mini-grid systems for larger villages. This will eventually create an environment where the private sector is pushing forward the development of mini-grids without the need for donor support.

Sierra Leone will become a model for maximizing sustainable energy access in rural areas – and will show how partnering with the private sector to address development needs can have far-ranging benefits. ■

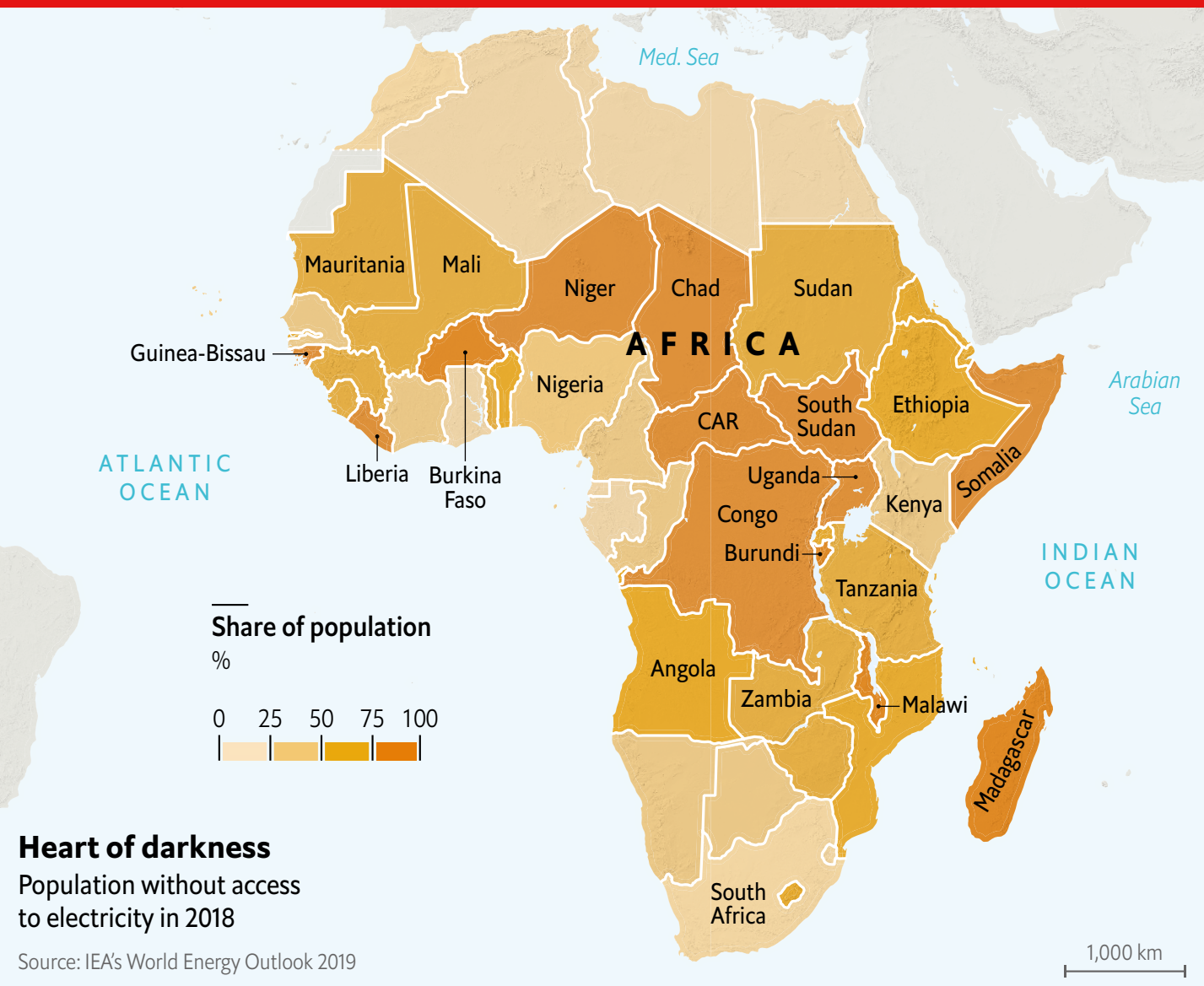
## ABOUT THE AUTHOR



Nick Gardner is UNOPS Sierra Leone Country Manager and Project Manager for the country's Rural Renewable Energy Project. A Chartered Civil Engineer, he joined UNOPS in 2009 after more than 20 years in the private sector. He previously worked for UNOPS in South Sudan, Copenhagen and Jerusalem.

Infrastructure plays a central role in achieving all 17 of the Sustainable Development Goals (SDGs). In fact, networked infrastructure such as water, waste and transport, influences 72% of SDG targets, while non-networked infrastructure such as buildings, influences 81%. Read more in the report [Infrastructure: Underpinning Sustainable Development](#), produced by the University of Oxford and UNOPS





**Heart of darkness**  
Population without access to electricity in 2018

Source: IEA's World Energy Outlook 2019

Daily chart

## More than half of sub-Saharan Africans lack access to electricity

NOV 13TH 2019  
*Africa will require an unprecedented effort to meet the UN's target of electricity for all by 2030*

In most parts of the world energy demand is growing too quickly to keep greenhouse-gas emissions within international targets, according to a report released by the International Energy Agency (IEA), a think-tank. Many in Africa, however, worry about the opposite problem: the acute shortage of electricity. The continent is home to almost a fifth of the world's population, but accounts for less than 4% of global electricity use.

North Africa enjoys near-universal access to electricity, yet more than half of the sub-Saharan population—600m people—live in the dark (see map). This can hinder the provision of basic services. Half of secondary schools in sub-Saharan Africa do not have power; many clinics and hospitals in the region also lack access to reliable electricity. Poverty is part of the problem. More than 40% of sub-Saharan Africans live on

less than \$2 a day. The IEA report notes that paying for the electricity needed to power a few basic appliances would eat up a tenth of earnings for poorer households. Rural areas are hit particularly hard. Whereas nearly three-quarters of households in cities have access to electricity, in rural places the figure is closer to one-quarter. Progress has been painfully slow. Since 2013 the number of Africans

without electricity has fallen from 610m to 595m. Kenya, Rwanda and Ethiopia have performed particularly well. In 2013 roughly a quarter of Kenyans had access to electricity; today three-quarters do. But development is still too slow, if the continent is to reach the UN's sustainable-development goal of access to "affordable, reliable, sustainable and modern energy for all" by 2030. On current plans, the IEA reckons, 530m Africans will still lack access to electricity in 2030. To achieve the target, Africa will have to expand the provision of electricity faster than China and India did (see chart below).

The IEA says African countries should focus on two groups. One is people who live "under the grid"—in informal urban settlements near a supply of electricity—but face cost or other barriers to using it. Offering poor residents reduced connection fees and instalment-based payment plans can help bring them onto the grid. The second group comprises people who live far from existing transmission and distribution systems. Here, the IEA points to the use

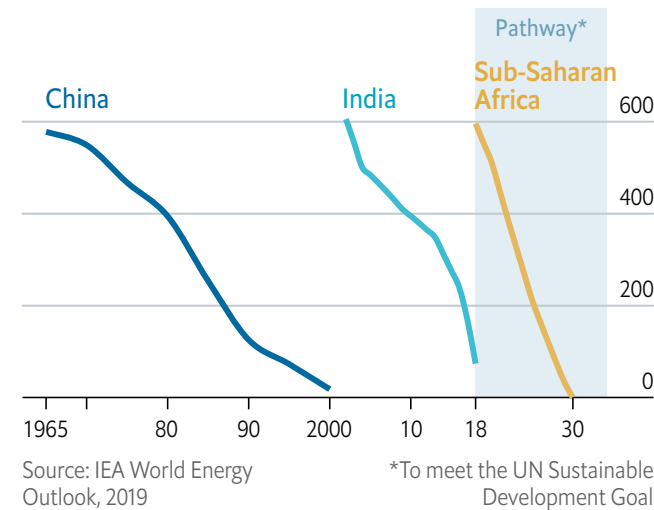
of decentralised methods, such as home solar-panel systems, as an efficient and cost-effective way to provide energy to rural areas which would otherwise rely on polluting and inefficient sources of energy (such as wood for cooking). "Africa has a unique opportunity to pursue a much less carbon-intensive



development path than many other parts of the world," says Dr Fatih Birol, the IEA's executive director. For instance, he notes, Africa has "the richest solar resources on the planet", yet has installed just 1% of the world's solar electricity-generation capacity. As with much else, Africa has a long way to go to reach its potential. ■

## Lighting up

Population without access to electricity, m





# How to build sustainable energy infrastructure in Europe

The EU must ensure that its energy infrastructure is sustainable, goal-oriented, operational and comprehensive, argues Miguel Arias Cañete, former European Commissioner for Climate Action and Energy.

The EU's vision to create an Energy Union and put Europe at the forefront of clean and renewable energy production in the context of climate change is now becoming a reality. Our policies are accelerating public and private investment in innovation and modernisation, creating jobs, and enabling citizens to benefit from the transition to a modern and clean economy.

We have shown that the world can count on Europe for climate leadership. In 2018 the EU has anchored in legislation its pledges under the Paris Agreement, the only large economy in the world to do so. We have set higher renewable-energy and energy-efficiency targets, enabling us to go further than our emission-reduction commitments. We have also put in place a robust governance system based on national energy and climate plans that will be monitored by the European Commission.

And as a crucial element of our overall energy and climate strategy, we need to ensure that our energy infrastructure is sustainable, goal-oriented, operational and comprehensive. This is a must for our Energy Union, and we therefore need to foster cheap and easy access to financing, and encourage innovative approaches and the use of cutting-edge technology.

## Projects of Common Interest

As a consequence, EU public support needs



Image credit: Getty Images/Adam Smigielski

to be targeted towards the right projects. In order to do so, we have recently adopted a list of key infrastructure and network projects, the so-called Projects of Common Interest (PCIs), which include 173 projects throughout Europe, 110 of which cover electricity and smart grids and 53 cover gas. For the first time we have four carbon-dioxide transportation projects.

PCIs can automatically benefit from several advantages, including accelerated permit granting and improved regulatory treatment. Likewise, PCI status is a precondition for receiving grants under our Connecting Europe Facility budgetary line, although it does not guarantee the award of such a grant. These projects will help deliver the goals of the Energy Union to ensure affordable, secure and sustainable energy in Europe. The current list showcases our stronger shift towards electricity and integrating renewables into the grid, and underlines the strategic role of our trans-European networks policy when supporting the energy transition with the necessary infrastructure.

## Green infrastructure investment

The EU has also championed green infrastructure projects. The restructuring of the wastewater system of the Emscher River in Germany integrates environmental concerns in the development of infrastructure, created 1,400 jobs and improved quality of life for local citizens. By supporting economic, social and environmental links, projects like these support progress towards Sustainable Development Goal (SDG) 11, which aims to make cities and human settlements inclusive, safe, resilient and sustainable. Indeed, the local

dimension is extremely important for us. This is why we launched the Covenant of Mayors, the world's largest movement for local climate and energy actions.

We are already investing in the infrastructure technology of the future. Our biggest research and innovation programme to date, Horizon 2020, with a budget of nearly €80bn (US\$92bn) over seven years, contributes at least 60% of its budget to sustainable development. Another €20bn is invested through the Strategic Energy Technology Plan with the aim to accelerate the deployment of the

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**In 2018 the EU has anchored in legislation its pledges under the Paris Agreement, the only large economy in the world to do so.**

technologies that will support the EU's energy transition.

Finally, we have pointed the way towards our long-term future: in November 2018 we presented the EU's strategy to become the world's first major economy to achieve net-zero emissions by 2050. With these efforts, we will move towards a more sustainable energy sector as part of our overall commitment to meeting the SDGs. ■

## ABOUT THE AUTHOR



Miguel Arias Cañete was the European Commissioner for Climate Action and Energy, serving in the role from 2014 to November 30th 2019. Born in Madrid, Mr Arias Cañete graduated in law in 1974. Before being selected to head his party list in the 2014 European Parliamentary elections, he had dedicated much of his career to the environment. From 1986 to 1999 he served as a Member of the European Parliament, chairing the Committees on Agriculture and Regional Development. He served as minister of agriculture and fisheries of Spain from 2000 until 2004 and as minister for agriculture, food and environment in the Spanish government from 2011 until 2014.





Image credit: UNOPS/Elise Laker

# Quality infrastructure should be inclusive

Infrastructure development should demonstrate social outcomes, argues Marie Lam-Frendo, CEO of the Global Infrastructure Hub.

Economic growth is tightly linked to increased infrastructure investments. Over the past two decades, and particularly during economic downturns such as the global financial crisis, redoubling investments in infrastructure has for many countries been a strategy to achieve growth. China was the first. In 1998 its former minister of the State Development Planning Commission, Zeng Peiyan, stated that the country’s targeted economic growth rate of 8% could only be achieved if infrastructure investment grew by 15-18% per year.

In 2019, more than 20 years later, the same thought is shared by the US government: “Stronger GDP growth from increased infrastructure investment would help boost the American economy, raise wages for American workers, and improve the standard of living in American communities.”

### The need for social and inclusive development

The economic importance of infrastructure is widely understood. Now it’s time to recognise infrastructure’s vital significance to improving social and inclusive development.

Simply put, there is no inclusive development without infrastructure. Water and sanitation projects define basic health. Power projects provide electricity to improve extreme poverty. Information and communications technology projects catalyse drivers for productivity, innovation and business.

Transport projects expand productivity and economic opportunities.

For the past decade China and the US have been the top spenders in infrastructure, yet their investment strategies in infrastructure have not yielded the expected and needed results for socioeconomic welfare. Both countries accumulated economic growth through building new infrastructure, but they have not been effective at addressing the unequal distribution of its economic and social outcomes. So, what is the situation for other countries, especially emerging markets?

The amount spent on infrastructure investment and GDP per head are poor indicators of development and prosperity. In its Inclusive Development Index (IDI) the World Economic Forum (WEF) concludes that IDI indicators declined in 27% of the 103

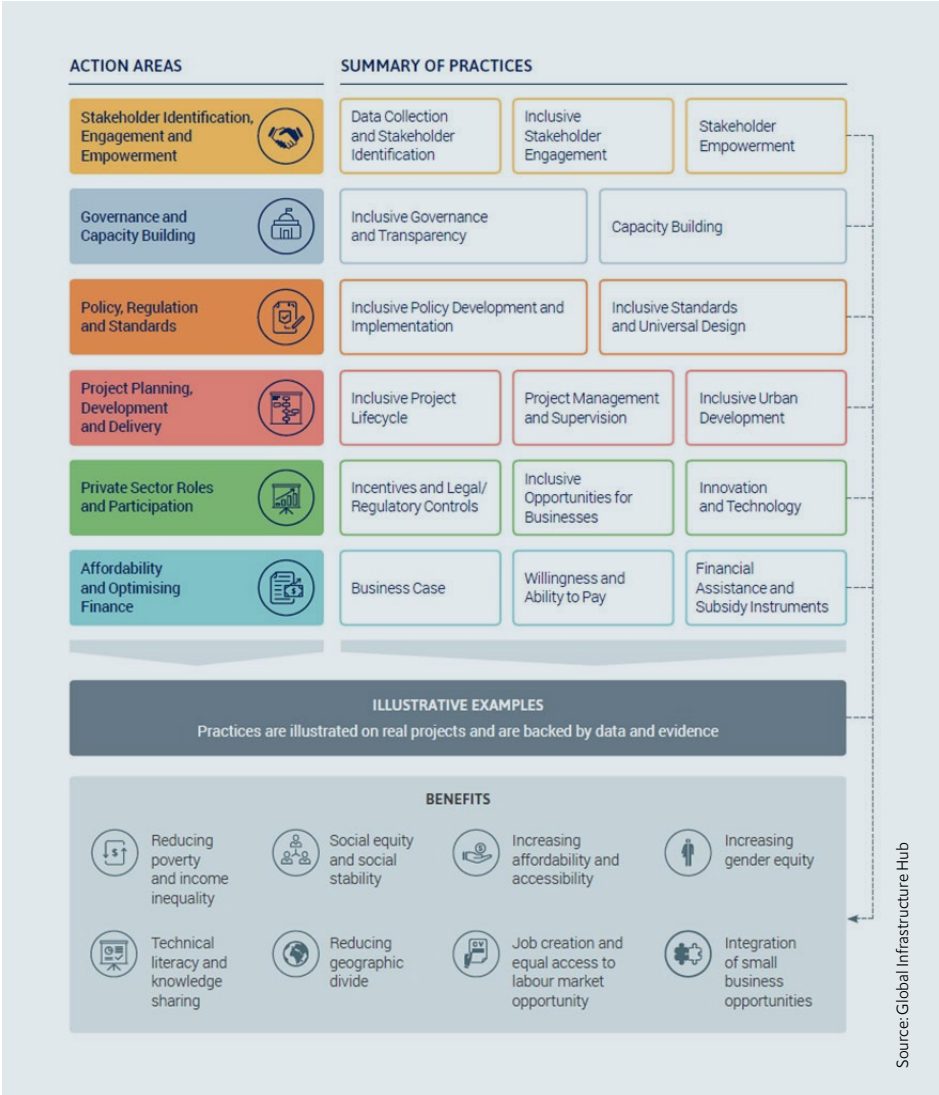
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Quality infrastructure should be inclusive, enabling the economic participation and social inclusion of all. Particular consideration should be given to how infrastructure facilitates the economic empowerment of women.”

economies assessed over the past five years, even as their GDP per head increased. The trickled-down benefits of their infrastructure investment have clearly not been reaching

### ABOUT THE AUTHOR



Marie Lam-Frendo has been the CEO of the Global Infrastructure Hub since January 2019. She has 18 years of experience in developing, financing and managing large infrastructure programmes and initiatives, with a particular focus on emerging markets. Previously she was the head of APAC for Atkins Acuity and headed the Infrastructure Initiatives department of the WEF. She holds Master’s degree in civil engineering from EPF School of Engineering, in marketing and strategy from ESCP-EAP (Paris) and in management and leadership from the WEF (in partnership with LBS and INSEAD). She is also a Global Leadership Fellow of the WEF.





society as a whole. So how can infrastructure foster more inclusive benefits?

Quality infrastructure could really deliver the expected socioeconomic outcomes, as it is directly correlated to the IDI. Accessibility, availability, affordability and acceptability of infrastructure are all basic benefits of inclusive infrastructure, especially if they are targeting vulnerable groups.

This has been an important discussion point at the recent G20 meeting of finance ministers and central bank governors held in Fukuoka, where the Principles for Quality Infrastructure Investment were endorsed. These principles encourage countries to implement infrastructure projects that comply with quality infrastructure principles, such as raising economic efficiency across the project life cycle; integrating environmental and social considerations; building resilience against natural disasters; and strengthening institutional and project governance.

#### Facilitating the economic empowerment of women

When inequalities within the household—knowledge gaps, lack of education and cultural restrictions—are addressed, higher gender parity in earnings can be achieved and

a significant increase in human capital wealth can be generated.

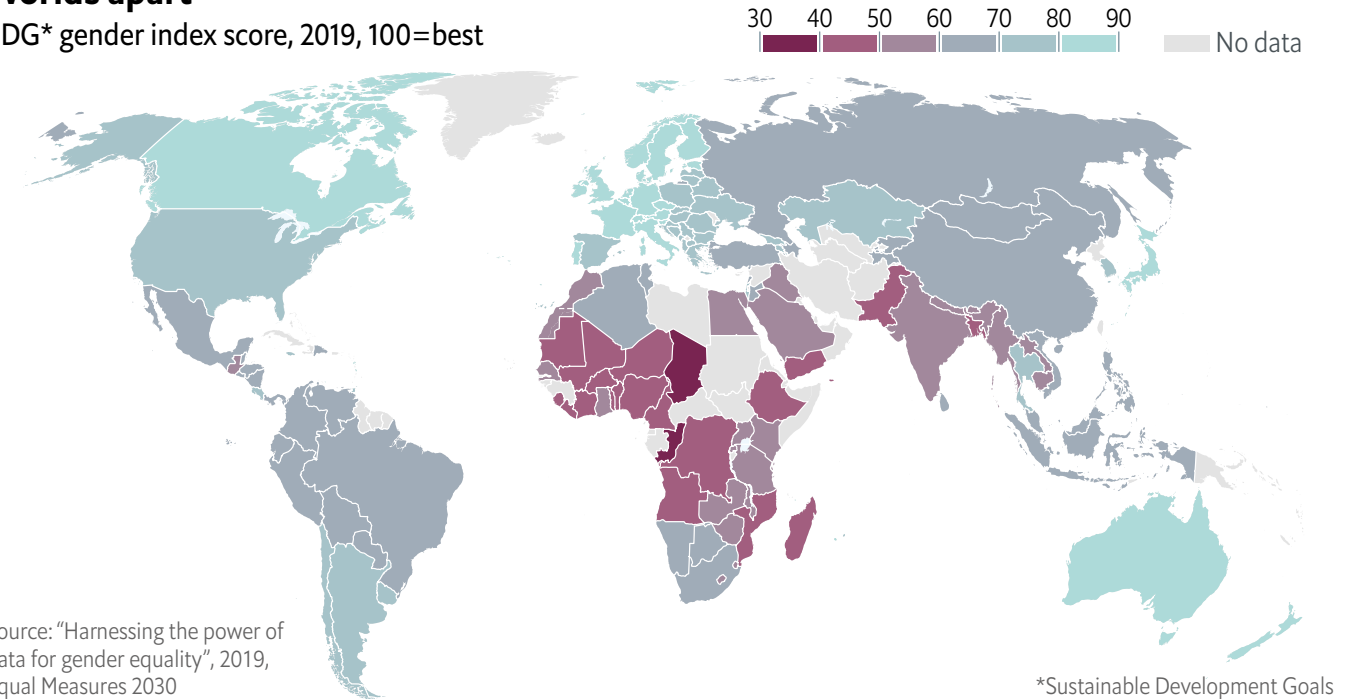
To ensure inclusive infrastructure is streamlined throughout the entire project life cycle, the Global Infrastructure Hub will soon release a Reference Tool for Inclusive Infrastructure for decision-makers and stakeholders. The tool defines six action areas for decision-makers to plan and execute large infrastructure projects looking at multiple social dimensions (see Figure 1)

The action areas contain practices and guidelines at every phase of the project life cycle. The tool uses eight case studies of infrastructure projects to illustrate different success factors for inclusive infrastructure development.

Infrastructure development should demonstrate social outcomes, which will help create more inclusive growth. This is no longer an aspiration. It is the bottom-line result societies across the world are seeking, regardless of income levels. Developed and developing economies have the same urgency to implement structural reforms to transform aspirations into action with a new global growth agenda that places people and living standards at the centre of national economic policies. ■

## Worlds apart

SDG\* gender index score, 2019, 100=best



### Daily chart

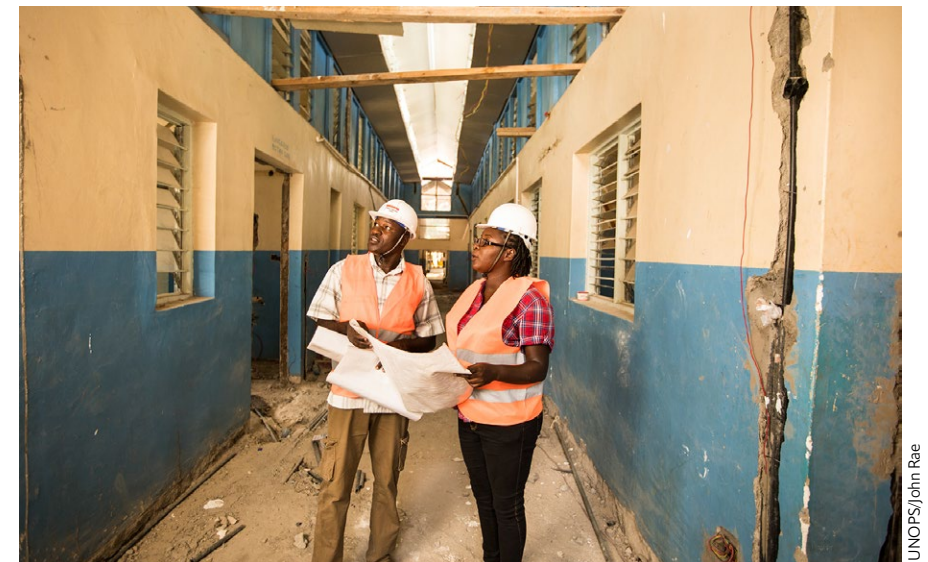
## The world is a long way from meeting its gender-equality target

JUN 5TH 2019

**Wealthier countries do better at ending discrimination against women and girls**

"This is a man's world," sang James Brown in the spring of 1966. The adage still holds true today. In 2015 the United Nations General Assembly approved the Sustainable Development Goals (SDGs), a collection of targets for social progress to be achieved by 2030. The goals closest to being met are those for hunger and nutrition, water and sanitation, and health and education. In contrast, one of the objectives that the world is farthest from meeting concerns gender equality.

A recent report from Equal Measures 2030, an initiative co-sponsored by the Gates Foundation, ranks 129 countries on a scale from zero to 100 on 15 of the 17 SDGs, taking measures on 51 issues including health, gender-based violence and climate change. Data are drawn from UN agencies, the World Bank, NGOs, think-tanks and Gallup, a polling firm.





On gender equality, the index shows that no country exceeds the 90-point threshold to be considered “excellent”, though Denmark, the top performer, comes close with a score of 89.3. It is closely followed by nearby Finland, Sweden, Norway and the Netherlands. Unsurprisingly, fragile and conflict-ridden states, such as Niger, Yemen and the Republic of Congo lag far behind. Chad, the lowest-ranked country on the list, scores just 33.4 points. The global average score of 65.7 is “poor”, according to the index’s scoring

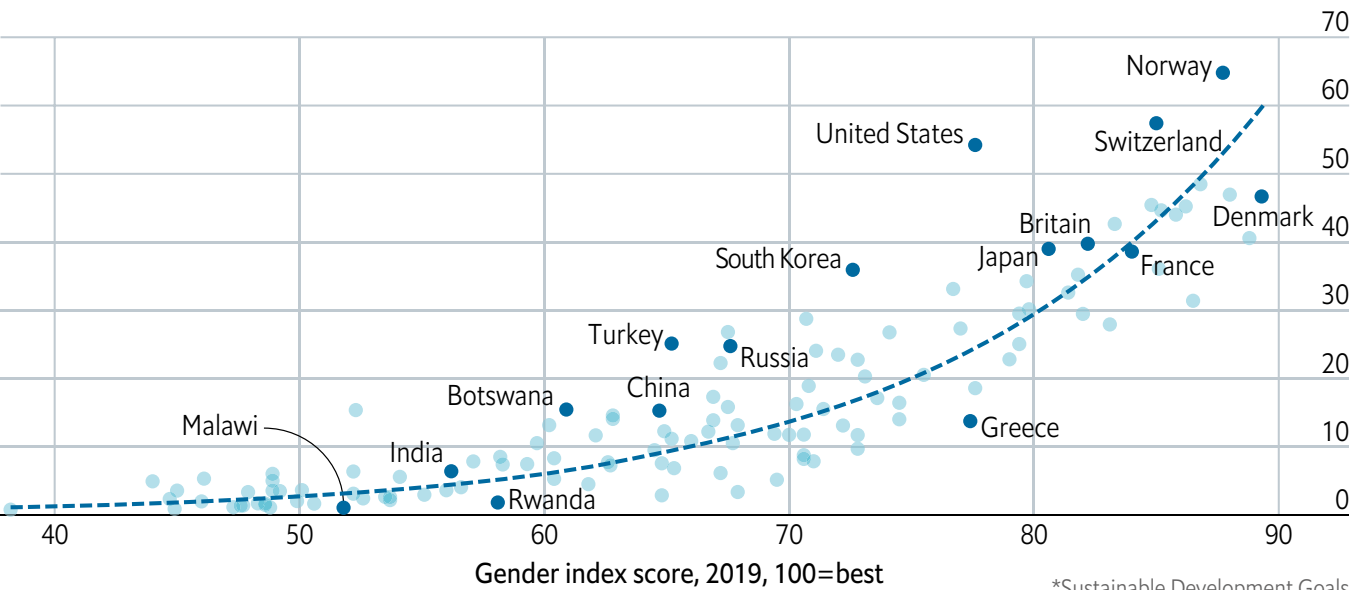
system. Just 8% of the world’s population of girls and women live in countries that received a “good” rating of 80-89 points. Overall, countries’ scores on the index seem to track national income levels. Notable exceptions are South Korea, Switzerland and the United States, which all have lower gender-equality scores than might be expected considering their wealth. In the United States, for example, this is caused by poor performance on indicators related to poverty and women’s participation in the economy. At the other

end of the scale is Rwanda, which does better than its national income level might suggest. One of the reasons for this is the high proportion of female members of parliament. Women make up 61% of its lower house, the highest percentage in the world. But this also demonstrates the limits of statistical targets: even though a far higher share of the legislature is female in Rwanda than in Denmark (where the proportion is just 37%), its parliament is little more than a rubber-stamp. ■

On track?

SDG\* gender index score and GDP per person

GDP per person at PPP†, 2016, \$'000 (constant 2011 dollars)



Source: “Harnessing the power of data for gender equality”, 2019, Equal Measures 2030

\*Sustainable Development Goals  
†Purchasing-power parity



Image credit: Getty Images/Images By Tang Ming Tung

Infrastructure that works for women in Asia-Pacific

Smarter infrastructure will narrow gender gaps and accelerate the advancement of women and girls, argues Takehiko Nakao, president of the Asian Development Bank.

As the G20 gathers in Osaka, Japan, for a major summit, infrastructure is high on the international agenda. If women are given a say in infrastructure design and investment, projects can become more effective enablers of their growth.

In Peshawar, Pakistan, 90% of women surveyed in 2016 on the use of public transport said that their fear of harassment prevented them from using the available services. Only 15% of women in Peshawar use public transport, limiting their access to basic services and economic opportunities.

To address this problem, the ADB and partners are helping the Khyber Pakhtunkhwa Urban Mobility Authority to improve bus services. Improvements will include securing women’s safety and mobility through separate entrances and sections for women and men, well-lit bus stations, security cameras, well-trained station staff, and help-desks and helplines to report harassment.

This type of well designed, built and managed infrastructure and services can greatly contribute to narrowing gender gaps and empowering women and girls. The positive correlations between quality infrastructure and women’s empowerment are recognised across the Sustainable Development Goals. The need for infrastructure that better reflects the requirements of women and girls has recently been agreed during the UN’s 63rd Commission on the Status of Women.

CURATED BY



Quality infrastructure

The G20 principles for quality infrastructure investments, adopted by finance ministers and central bank governors in Fukuoka in June 2019, emphasise the importance of “integrating social considerations in infrastructure investments” (Principle 5). Mainstreaming inclusiveness and gender equality should be one of the core elements.

Since the adoption of its Policy on Gender and Development in 1998, ADB has pioneered efforts to maximise the positive impacts of infrastructure on women and girls in Asia and the Pacific, via projects to empower women through education, health and jobs. In 2016-18 ADB invested US\$12bn annually in both public- and private-sector infrastructure. Two-thirds of these projects included components designed to enhance gender equality. Our aim is that by 2030 75% of all ADB investments will include interventions to promote gender equality.

Improving gender equality and women’s economic potential

Infrastructure improves lives, livelihoods and economies, and can directly improve gender equality in multiple ways. First, women’s “time poverty”—the large amount of time spent on unpaid care and domestic work that is disproportionately done by women and girls—can be alleviated by direct access by individuals and households to basic infrastructure, such as clean and affordable water and sanitation, electricity and transport. In Asia-Pacific countries, women spend much more time on these kinds of tasks, ranging from 1.7 to 11 times that of men. Quality infrastructure is key to reducing the overall time spent on household work and gives women more choice over how to use their time.

Second, infrastructure can help realise women’s economic potential. Digital technology and telecommunication infrastructure are already helping women entrepreneurs through e-commerce, online banking and fintech solutions. Women farmers are benefiting from better access to vital information and networking for production and sales. Rural electrification projects across South Asia have enabled many poor women to become “microentrepreneurs”, using newfound access to electricity to make products like pottery and jewellery and to run small enterprises in services, such as tailoring.

A regional corridor project at the Uzbekistan-Tajikistan border offers a snapshot of these new opportunities. An improved border crossing point now has separate sanitation facilities, safe body-check procedures and breastfeeding rooms. This has facilitated the growth of small trade activities by women from

the border communities who were previously unable to capture new economic opportunities.

Infrastructure projects are offering direct employment for women across the region, whether as road construction or maintenance laborers or as maintenance technicians for solar panels or transmission lines. It is important that such job creation for women supports the acquisition of skills. In Laos, engineering scholarships and leadership training for women employees in a water utility project are easing their entry into good jobs and nurturing more women leaders in a traditionally male-dominated sector.

Participation in decision-making processes

A third way that infrastructure can improve women’s lives is through user and citizens’ inputs and feedback during the planning, construction and operation phases. Greater participation in these decision-making processes can empower women to voice their needs and become active change agents.

In Bangladesh, women account for more than a third of local governance committee members on urban infrastructure and governance projects, and regular open meetings are held with local women’s groups. This has

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Well designed, built and managed infrastructure and services can greatly contribute to narrowing gender gaps and empowering women and girls.

boosted the capacity of women leaders to manage local budgets and ensure women have a say in how infrastructure is designed. As a result, women have influenced the design of community-based disaster early warning systems and been able to secure women’s private spaces in flood refuges.

Infrastructure has a critical role in narrowing gender gaps and accelerating the advancement of women and girls. If women are given a say in infrastructure design and investment, projects can become more effective enablers of their growth. ■

ABOUT THE AUTHOR



Takehiko Nakao is the president of the ADB and chairperson of the ADB’s Board of Directors. He was elected president by ADB’s Board of Governors and assumed office in April 2013. Before joining ADB, Mr Nakao was the vice-minister of finance for international affairs at the Ministry of Finance of Japan.



Image credit: Getty Images/kiankhoon

# Quality infrastructure needs social considerations

Putting the G20 principles into practice will be key to achieving sustainable development, argues Tarō Kōno, Japan’s former minister for foreign affairs.

*As Japan hosted the G20 Osaka summit in late June 2019, global leaders turned their attention to the design, delivery and management of quality infrastructure and endorsed the G20 Osaka Principles for Quality Infrastructure Investment. It includes the integration of social considerations, such as promoting women’s empowerment, in all aspects of infrastructure.*

From roads and bridges to ports and underwater cables, quality infrastructure underpins our economic prosperity. The demand for infrastructure development is growing exponentially, especially in developing countries. The world faces a US\$15trn investment gap to 2040.

This is not to say that all infrastructure projects are equally beneficial. We have seen how substandard projects can do more harm than good, damaging the environment, overburdening communities with unsustainable debt and even costing lives.

Quality as a priority

Fortunately, the international community has largely converged around the consensus that when it comes to infrastructure, quality must be a prerequisite. Japan, in particular, has spearheaded efforts to promote the concept of quality infrastructure as an international standard. For example, the G7 Ise-Shima Principles for Promoting Quality Infrastructure

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Investment were adopted under Japan's G7 presidency in 2016.

This year, under Japan's G20 presidency, a high priority was placed on the issue of quality infrastructure, leading to the endorsement of the G20 Osaka Principles for Quality Infrastructure Investment at the summit at the end of June.

The newly endorsed principles address a variety of issues of growing concern, such as transparency, open access, economic efficiency and debt sustainability. It was a momentous achievement that G20 participants, including major purveyors as well as recipients of infrastructure investments, agreed for the first time on a common set of principles to guide the implementation of infrastructure projects.

#### Integrating social considerations

One of the principal pillars of the G20 principles is the integration of social considerations. Infrastructure projects can have a positive impact on local communities. This is why the G20 principles clearly state that infrastructure should be inclusive and enable the economic participation and social inclusion of all. The principles also stress that "particular consideration should be given to how infrastructure facilitates women's economic empowerment through equal access to jobs".

Japan is putting these words into action. Through our Expanded Partnership for Quality Infrastructure we are making investments in quality infrastructure projects that have a positive social impact.

One such example is the Delhi Metro Project, which was carried out by the Japan International Cooperation Agency (JICA). The 317-km subway system provides a safe and reliable commute for female workers in the metropolis of India's capital, New Delhi. The introduction of female-exclusive cars and CCTV security cameras provides added security and convenience to female passengers. The fact that 31% of Delhi Metro passengers are female and that 82% of these travel alone bears testament to the positive social impact that quality infrastructure projects bring.

Women are not only benefitting from our quality infrastructure projects, but they are also playing an active role in leading them. For example, Japanese civil engineer Abe Reiko served as the quality control expert for the Delhi Metro Project, managing more than 40,000 workers. She oversaw the engineering aspects of the project and fostered a work culture that respected the health and safety of workers, and thanks in large part to her leadership, the construction was completed

in a much shorter period than originally estimated.

Elsewhere, JICA is also supporting the Light Rail Transit (LRT) Project in Colombo, the very first modern transit system in the Sri Lankan capital. This LRT system will be installed with priority seats for passengers who need support, including pregnant women, as well as female-exclusive cars and surveillance cameras so that female passengers can travel in safety and comfort.

#### Promoting quality infrastructure investment

These are some good practices in our long-lasting efforts to provide quality infrastructure that fosters economic participation and social inclusion. This is what we are pursuing within Japanese society as well, with an eye on the success of the Tokyo 2020 Olympic and Paralympic Games. Through our experience, Japan will continue to foster quality infrastructure investment for inclusive and sustainable growth across the world, in accordance with the newly endorsed G20 Principles.

We will spare no effort in promoting the implementation of these principles, especially

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**Infrastructure projects can have a positive impact on local communities. This is why the G20 principles clearly state that infrastructure should be inclusive and enable the economic participation and social inclusion of all.**

in developing countries and among emerging donors, so that all citizens may reap the benefits of quality infrastructure. ■

#### ABOUT THE AUTHOR



Tarō Kōno served as Japan's minister for foreign affairs from August 2017 to September 2019. In October 2017 he was re-elected to the House of Representatives in the 15th electoral district of Kanagawa Prefecture for his eighth term. After graduating in 1985 from Georgetown University in Washington, DC, he worked in the private sector before entering parliament for the first time in October 1996.



UNOPS/John Rae

#### “Build, Build, Build”

## The Philippines, a country with dreadful traffic, may start to unclog

JAN 25TH 2020

**President Rodrigo Duterte is investing massively in roads, ports and airports**

Should you get up at 4am to get to work on time, or risk waiting until five? That is the question confronting many commuters in Manila, the capital of the Philippines, which has some of the world's worst traffic jams. Geography is one reason: the 2m people trying to get in and out of the metropolis each day must squeeze into a narrow strip between the sea on one side and a lake and hills on the other. But poor urban planning and a dearth of infrastructure investment in recent decades have compounded the problem. Filipinos spend 16 days a year stuck in jams, according to the Boston Consulting Group. The World Economic Forum ranks the Philippines 96th of 141 countries for the quality of its infrastructure. Nearby Indonesia, another nation of thousands of islands, is 72nd.

On January 17th the public-works minister announced that by the time President

Rodrigo Duterte leaves office in 2022, he wants to have cut the number of cars that pass along the city's main artery each day by a third. Such bold declarations have been characteristic of Mr Duterte's approach to infrastructure. When he became president in 2016 he considered demanding emergency powers from Congress to help him deal with the traffic. In the end, he settled instead on a long-term scheme to spend 9trn pesos (\$177bn) on new infrastructure called “Build, Build, Build”. The focus on construction represents a “very bold shift in government priority”, believes Vince Dizon, a presidential adviser.

As the jams in Manila suggest, not much has shifted yet. But change is coming. “Build, Build, Build” involves 100 big projects. Construction is under way on almost half of them. In 2018 the government introduced a law to cut red tape in permit-

ting, partly to speed up infrastructure investments. Some planning committees are meeting three times as often as they used to. Twenty projects were approved in the final three months of last year, says Mr Dizon. Impractical schemes promoted by the president, such as a plan to link all the main islands of the Philippines by bridge, have been quietly set aside.

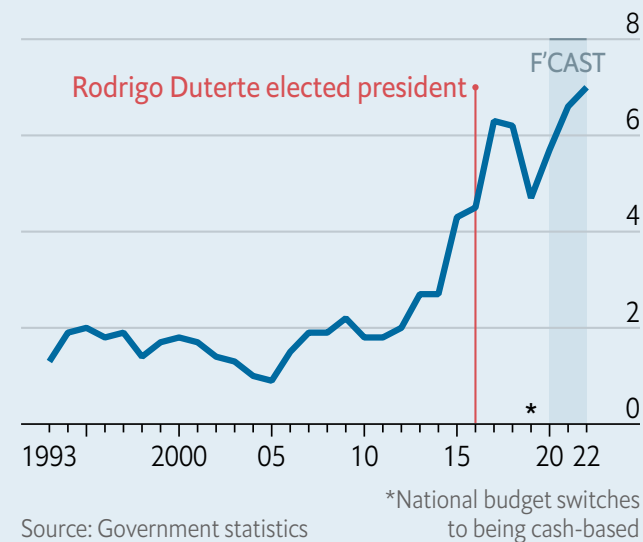
One of the biggest projects still in the works is New Clark City, which is eventually supposed to house 1.2m people and lots of government offices, in an effort to ease traffic in nearby Manila. The city was planned under Mr Duterte's predecessor, but embraced by him in an unusual display of political continuity. The first phase was completed in November. Mr Duterte has also presided over the opening of a new airport in the province of Bohol, and of the Philippines' largest





## Spend, spend, spend

Philippines, infrastructure outlays, % of GDP



series of sensible tax reforms, which are expected to help boost government revenue, and diversified the Philippines' sources of funding. Japan has provided some \$12bn in recent years. The Asian Development Bank (ADB) is so enthusiastic about Mr Duterte's infrastructure plans that last year it lent the Philippines more than any other country bar India. China has also promised \$9bn for infrastructure, although it has signed formal agreements to provide only \$900m.

Public-private partnerships are also being used. More than a quarter of big projects under "Build, Build, Build" will involve private investors. Ensuring that the terms of concessionary agreements are fair, however, has been an obsession of Mr Duterte's administration. The president's ongoing spat with two water companies

in Manila over their contractual rights is a case in point. Shares in one of the firms, Manila Water, dropped to a 14-year low at the height of the furore last month. That may worry companies that are thinking about joining the infrastructure push.

The government says that by the middle of 2022 roughly half of the 100 "Build, Build, Build" projects should have been completed. Kelly Bird of the ADB says even finishing 30 would make the programme "hugely successful". Filipinos are well aware of Mr Duterte's efforts. A survey by Pulse Asia, a pollster, in December found that 69% of respondents thought his government was doing a "better" job of developing infrastructure than its predecessor.

Obstacles will mount as Mr Duterte nears the end of his time in office, however, and his political power begins to ebb. And once he steps down there is no certainty that his successor will complete his plans. New presidents in the Philippines often kill projects initiated by their predecessors. In 2011 Benigno Aquino, the president of the day, cancelled 66 of 72 car-ferry ports planned by the previous president, Gloria Arroyo, alleging corruption. With luck, though, Mr Duterte's successor will see the benefit in inheriting dozens of partially constructed projects and a host of shovel-ready ones. A bulging pipeline of sensible projects could prove as important a legacy as the infrastructure Mr Duterte actually manages to build. ■

passenger-ferry terminal on his home island of Mindanao.

Spending on infrastructure has roughly doubled since the president took office. The plan is for it to reach 7% of GDP by 2022, up from 2.6% in 2015 (see chart). The austere policies of past presidents have left Mr Duterte scope to borrow. Public debt is around 41% of GDP. He has introduced a



Image credit: UNOPS/John Rae

# How to build a global infrastructure architecture for the SDGs

A novel Public-Private Collaboration Framework is needed to provide the necessary solutions for resilient and sustainable infrastructure.

*Systemic leaders in infrastructure should build strategic alliances and coalitions that reinforce institutions and push for a necessary reform agenda, argue Michael Max Buehler, head of Infrastructure and development at the World Economic Forum (WEF) and Vangelis Papa-konstantinou, project lead for Infrastructure Initiatives at the WEF.*

### The most pressing issues at hand

As the WEF's Global Risks Report 2019 shows only too clearly, environmental crises—notably a failure to tackle climate change—are among the likeliest and highest-impact risks that the world faces over the next decade.

Moreover, a recent report on the progress on the implementation of the Sustainable Development Goals (SDGs) concludes that 2.3bn people still lack even a basic level of sanitation service. This is just one, albeit critical, example that the world urgently needs to close its annual infrastructure investment gap of around US\$1trn. Investing in sustainable infrastructure can help us fight climate change.

Unfortunately, short-term thinking still governs today's world, inhibiting faster implementation of the SDGs. More urgently than ever, the world needs to design long-term investment frameworks to create a sustainable future.

For this, we need to close the infrastructure financing shortfall and help investors to adopt a longer-term outlook. That is why

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we see the need for a public-private collaboration framework in line with the G20's Roadmap to Infrastructure as an Asset Class and Principles for the Infrastructure Project Preparation Phase. We have to convene the relevant systemic actors that can build and agree on an "architecture" for more efficient delivery of infrastructure at scale.

#### Towards a Public-Private Collaboration Framework

The theme of this year's Annual Meeting of the World Economic Forum will be Globalisation 4.0: Shaping a Global Architecture in the Age of the Fourth Industrial Revolution. We need to foster collaboration and design policy frameworks with the private sector in mind to ensure that the successes of the multilateral institutional architecture are renewed and upgraded. We need to identify the most impactful areas for collaboration, focusing on the next generation of infrastructure. It will no longer be possible to rely solely on efficiency and cost-cutting for project success; innovation, flexibility, adaptation to change and inclusiveness of sustainability criteria are becoming the key ingredients.

We jointly have to build a global architecture for public-private collaboration by first identifying the key systemic issues and challenges that hinder the delivery of vital infrastructure globally. Then, we need to call on key actors that can help design effective solutions. And finally, we need to promote and foster coalitions and strategic alliances that can spark multi-stakeholder collaboration initiatives to accelerate the achievement of the SDGs.

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**The future demands collective leadership that is visionary, innovative, agile and adaptable.**

To be most effective, we need to move from a competitive play towards more collaboration on SDG 9, which aims to build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation. Current working methods are not yet designed to incentivise collaboration.

#### A systemic leadership response to drive change

Unprecedented collaboration among the different stakeholders at organisational, sectorial, municipal, national and international levels will be required to find smart and sustainable answers. The future demands collective leadership that is visionary, innovative, agile and adaptable. The profound changes needed to accelerate progress on society's most pressing problems require distinctive leaders: systemic leaders, able to lead organisations, systems, industries, communities and even nations through transformative change. Therefore, we need to design our framework in a way that enables the conditions for global leaders to drive systemic change. Potential collaborations will need a shared vision for infrastructure and urban development that provides the compass for the global infrastructure system. ■

#### ABOUT THE AUTHORS

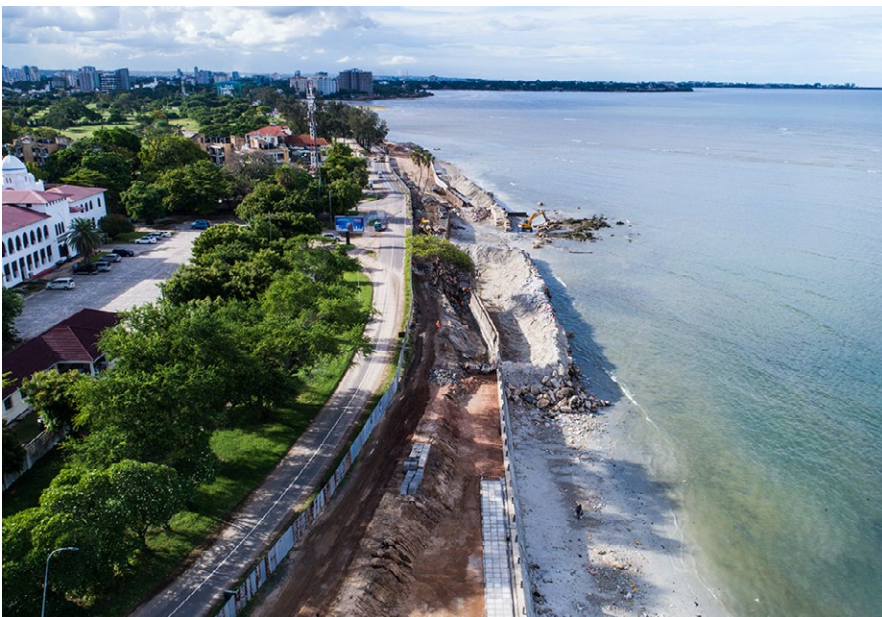


Michael Max Buehler is the head of infrastructure and urban development at the WEF, where he drives the industry agenda in the engineering, construction, real estate and urban services sectors by combining research, platform curation and community engagement. He is responsible for managing strategic relationships with approximately 50 global CEOs. Prior to joining the WEF, he worked with Deloitte's Infrastructure and Capital Projects Advisory practices in Vancouver, British Columbia, and has 18 years of international, academic and professional experience in the construction, mining and real-estate industries. He has a PhD in civil engineering and an MBA with finance and accounting specialisation.



Vangelis Papakonstantinou leads strategic infrastructure initiatives at the WEF, with the aim to bring more long-term investment into public infrastructure. Additionally, he is working on global capability building projects that aim to close the knowledge and skills gaps in infrastructure. A World Economic Forum Global Leadership Fellow, he has led infrastructure public-private partnership transactions worth more than €8bn in transport, environment and energy with EY's Project Finance and the Public Private Partnerships Secretariat in Greece. He studied economics and public policy at Warwick University, the London School of Economics and Political Science, and the Athens University of Economics and Business.

Image credit: UNOPS/John Rae



UN Photo/OCHA/Mark Garten

Nothing so concentrates the world's mind

## Island states have had an outsized influence on climate policy

SEP 19TH 2019

**Climate issue: Small islands are on the front line of climate change. Yet many still face extinction**

When Hurricane Dorian rolled across the Abaco islands on September 1st, packing winds of 300kph (185mph) and bringing sea surges of nearly eight metres (26 feet), it was as powerful as any Atlantic storm ever to have hit land. The destruction it wrought was devastating, the death toll said to be "staggering". Dorian's ravages have drawn attention to the vulnerability of small islands. It is, laments James Cameron, head of the ODI, a development think-tank, "a vision of the future".

The fear is that climbing global temperatures will bring more extreme storms and rising sea levels which threaten the very existence of small island states and low-lying coastal regions. They are vulnerable not only to violent weather but also to loss of livelihoods as farmers and fishermen feel the effects of warming. Eventually whole islands may be submerged. More than half of the territory of the Maldives is less than a metre above sea level. "We are

most impacted and we are continuously leading the way by example, advocating and persuading others to increase ambition on addressing climate change," says Thilmeeza Hussain, the Maldives' ambassador to the UN.

Small island developing states (SIDS) account for less than 1% of the world's GDP, territory, population and greenhouse-gas emissions. On most issues their voice barely registers on the world stage. Yet on climate matters they have, over three decades, become an effective lobby.

Mr Cameron was one of a small group of young British lawyers who helped them come together. In 1988 he wrote a legal opinion for Greenpeace on whether the United States could be taken to the International Court of Justice for its failure to act on climate change. He concluded that such a case would be hard to bring as America would refuse jurisdiction for it, but that the arguments for state respon-

sibility based on the evidence could and should be made in an international treaty. Along with the most affected states, he and others pushed for one. This led to the formation in 1990 of the Alliance of Small Island States (AOSIS).

By the Earth Summit in Rio de Janeiro in 1992 Mr Cameron had his treaty—the UN Framework Convention on Climate Change. AOSIS had grown to more than three dozen members and gained recognition as representing a distinct set of interests. Today, its 39 full members and five observers are spread across three regions (the Caribbean, the Pacific and a group straddling the African, Indian and South China seas) and include some low-lying coastal countries, such as Belize and Guyana. Individually, they have limited means: when Fiji presided over the annual global climate gathering in 2017 it had to be held in Bonn. But their collective influence has been big.





“AOSIS put the climate crisis on the map, way before anyone else was taking it seriously,” says Mark Lynas, a writer and adviser to the Maldives’ government. Island states were the first to feel the impact of rising sea levels. They risked being drowned by richer nations’ carbon emissions—and they told those countries so. “They’ve been incredibly successful in changing the tone and influencing policy,” says Mr Lynas.

They have managed to get wording included in climate accords that addresses their specific concerns—on losses and damages from climate change, for example, or on their need for financial support to adapt to it. In the Paris agreement of 2015 the inclusion of an aspiration to restrain global warming to 1.5°C above pre-industrial levels (going beyond the target of 2°C) was “almost entirely down to SIDS and other developing states”, according to Mr Lynas. More generally, the island states have offered an example of getting organised and pushing for international collaboration, in an area where joint action is the only way to make a difference.

On September 27th a whole day is to be devoted to the SIDS towards the end of the UN General Assembly in New York. Leaders will review progress of the SAMOA Pathway (short for SIDS Accelerated Modalities of Action Pathway), a blueprint for sustainable development which happened to emerge from a summit in Samoa in 2014.

Why the outsized impact? The SIDS have three things going for them. One is focus: survival concentrates the mind. Ms Hus-

sain, of the Maldives, estimates she spends 70-80% of her time on climate-change and sustainable-development issues.

Second, their moral argument packs a punch. The islanders have been skilled at pointing to the peril they face, with catchphrases such as “Save Tuvalu, save the world” and “1.5 to stay alive”. Shortly before the Copenhagen climate summit in 2009, the Maldives’ government held a cabinet meeting under water.

Island leaders do not mince their words. Take the recent summit of the Pacific Islands Forum in Tuvalu. Australia, one of the group’s 18 members, insisted on removing references to coal in the final declaration and on softening the language. Tuvalu’s prime minister, Enele Sopoaga, chided his Australian counterpart, Scott Morrison: “You are concerned about saving your economy in Australia...I am concerned about saving my people in Tuvalu.” Mr Sopoaga reported that during the meeting Tonga’s prime minister, Akilisi Pohiva (who died this month), “actually cried”.

Third, crucially, the SIDS have strength in numbers. Together, they are about a third of all developing countries and a fifth of UN members. That gives them ample speaking time and voting power in the UN.

Kevin Conrad, who became an activist after seeing beaches disappearing at home in Papua New Guinea and now heads the Coalition for Rainforest Nations, recalls the drama of the Montreal climate summit in 2005. More than 20 countries spoke in support of greater efforts to reduce greenhouse-

gas emissions that America was resisting. The momentum worked: “Building broad coalitions is what wins,” he says.

Mr Conrad was involved in more drama two years later, at the UN climate conference in Bali. Once again, America was holding out against the consensus, this time for a plan for a new climate treaty. Speaking as Papua New Guinea’s representative, Mr Conrad addressed the United States: “We seek your leadership, but if for some reason you’re not willing to lead, leave it to the rest of us; please, get out of the way.” He was cheered. In a moment that has gone down in climate-diplomacy lore, America soon announced it would join the consensus.

There is no chance of a similar moment at the UN secretary-general’s Climate Action Summit in New York on September 23rd (2019). President Donald Trump is not about to reverse his decision to take America out of the Paris agreement. But the island states are still hoped to make a splash in New York [at the Climate Action Summit in 2019], and put together a “SIDS package” to be presented there.

For a start, they want to highlight the need to heed the warnings from the Intergovernmental Panel on Climate Change (IPCC) on what is required to limit global warming to 1.5°C. In a report published last October (2018) the IPCC stressed the difference in terms of impact between capping warming at 1.5°C and letting it rise to 2°C; drastic action would be needed over the next decade to have any hope of achieving this. The islanders are calling for scaled-up ambi-

tion. They hope to see the bigger carbon-emitters publicly accepting the IPCC’s report.

They also want to show how bold action can be taken. “SIDS have absolutely nothing to do with this mess that we’re in with climate change, we have contributed the least, and yet we want to proceed by example,” says Lois Young, the UN ambassador of Belize, which this year took over from the Maldives as chair of AOSIS. They aspire to shift to 100% renewable energy and map a path to carbon neutrality. The Marshall Islands have led the way in submitting a plan to become carbon-neutral by 2050.

**No island is an island**

Such plans are costly, as is investment needed in things like reinforced harbours and desalination plants to adapt to the climate changes the island states are already seeing. So mobilising finance is another priority. The SIDS complain that the money pledged to date is inadequate and often tied up in red tape. In New York, they want chunky commitments from big countries. Impressive as their diplomatic efforts

have been, however, the island states face further struggles. Keeping the world’s attention is not easy. Belize has been scrambling to persuade world leaders to attend the SIDS day on September 27th (2019). Climate outrage has spread, and other groups of countries have piled in. For the island states the broadening of climate concern is welcome but means their own leaders are less often the go-to spokesperson.

AOSIS remains largely united in its message and strategy. But its members are affected by climate change in different ways so divisions can arise. Advisers who push for climate radicalism and those who give priority to getting things done for development do not always see eye to eye.

Nor is it clear that the island states are winning the diplomatic fight. Apparent victories in public forums can get beaten back in subsequent bureaucratic battles. As the spat with Australia in Tuvalu shows, and as arguments ahead of next week’s review of the SAMOA Pathway also suggest, the island states still find themselves having to argue over language that reflects the

scale of action needed.

Above all, the threat has not gone away. In the long term, extinction still beckons since the world has done far too little to curb greenhouse-gas emissions. “Adaptation can only go so far when your nation is going under water,” says Mr Lynas of the atoll countries. If the moral case does not work, some say, it is time for a new strategy, for example embracing radical technologies such as climate engineering.

Failing that, for some small island states the future may involve negotiating with countries that can offer higher land to move their people to, or trying to defend rights over territorial waters whose boundaries were drawn based on land that has become submerged. AOSIS could find itself back where it began—with lawyers.

Hence the urgency in the run-up to the sessions in New York [in September 2019]. At stake is the islands’ future—and much more. According to Janine Felson, Ms Young’s deputy and Belize’s technical lead for AOSIS, “we have a very small window of opportunity to make a very big shift.” ■

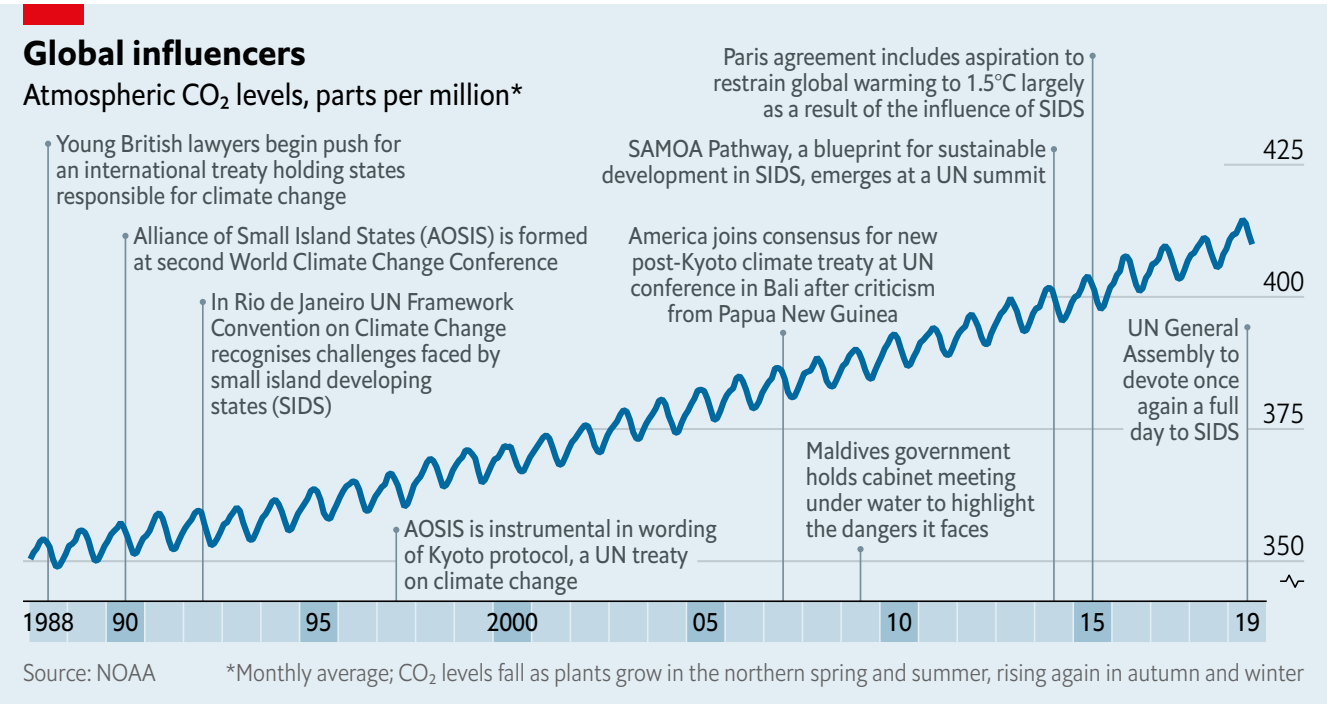






Image credit: Rasmus Hjortshøj

# ‘Hedonistic Sustainability’ delivers infrastructure that protects the planet and improves lives

Andreas Klock Pedersen, of Bjarke Ingels Group (BIG) London speaks to The Economist Intelligence Unit about why it is essential to design sustainable infrastructure that also expands people’s opportunities and quality of life.

## The Economist Intelligence Unit (EIU): How do you define sustainable infrastructure?

Andreas Klok Pedersen (AKP): There are two ways of seeing sustainable infrastructure. On the one hand, you can talk about resilience and infrastructure that makes it easier for cities to deal with the climate change we’re now seeing and the new weather we have to face. The other way to talk about it is in terms of energy and how we create and use resources. Sustainable energy creation is all about mitigating the climate change we’re already seeing and making sure we don’t worsen the situation.

## EIU: How can infrastructure help to combat climate change?

AKP: You can plan less demand for infrastructure by giving cities more mixed functions and shorter distances that are more walkable. That’s the first step in designing for a lower carbon footprint. Then you have to look at the kinds of infrastructure that serve the city, and even more importantly, energy production, water needs, how to deal with wastewater and how these things work on a larger scale. The moment you create it in a sustainable way, energy use can be seen as a good thing. Because we have the technology to harness sun and wind efficiently, we’re entering a time when it will be possible to create cities with

pollution-free infrastructure, freshwater, green environments and extensive recycling by harnessing nothing but sunshine.

## EIU: What is “hedonistic sustainability” when it comes to infrastructure?

AKP: There’s been an idea that sustainability is about limiting what you can do in life and accepting sacrifices. We believe sustainable design should be about creating a more enjoyable world and expanding possibilities. If you do that, you increase the probability of creating a sustainable world—because it’s more attractive. For example, in Copenhagen we won a competition to design a waste-to-energy power plant that would be the city’s tallest building. We proposed a 500-metre artificial ski slope on its rooftop and a 90-metre climbing wall on the side—the tallest in the world. So creating carbon-neutral energy can also be about opening up new possibilities for a better life. Copenhill is a very symbolic project and a good example of hedonistic sustainability.

## EIU: Could you explain how plans for the Dryline—the barrier designed to protect New York City from coastal flooding—follow this approach?

AKP: The Dryline in New York is a massive investment in infrastructure to protect the city from rising water levels. Traditionally, resiliency projects tend to leave large unattractive barriers in the landscape. Our view is that, when making an investment on this scale, you might as well turn it into something that will improve the quality of the public realm. So we propose designing the protection in a way that enables it to become an enjoyable public space, with attractive topography, community amenities and new green spaces for the city. While the now famous High Line transformed a piece of infrastructure—a former industrial railway—into a public park,

the Dryline could be an example of such an infrastructure, but designed as a great public, and resilient, space from the beginning.

## EIU: What is the approach taken at BIG towards sustainable infrastructure?

AKP: As a firm, every project we take on has a strong potential for performing better in terms of energy and other sustainability goals, and in terms of creating good public spaces around that. Also, we see an unfulfilled potential for a modern vernacular. In the years when the world was modernising, the same technologies were replicated in every country and climate—the same glass towers, the same parking garages. But we see potential to invent architecture that’s adapted to the local climate. It performs

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We believe sustainable design should be about creating a more enjoyable world and expanding possibilities.”

## ABOUT THE AUTHOR



Andreas Klok Pedersen is a partner and design director for BIG London. He is partner-in-charge of many competitions, master plans and large-scale projects across Europe and Asia. Among other projects, he led the prize-winning competitions for the 186-metre-high Omniturm Tower in Frankfurt, which is currently in construction, as well as the competition for Battersea Power Station Malaysia Square in London, MECA culture House in Bordeaux completing mid-2019, and the PARC research centre in Paris. He also led the recently completed Transilager mixed-use warehouse project in Basel, as well as the Shenzhen Energy Headquarters in China. He lectures internationally on BIG’s most recent projects and ideas.

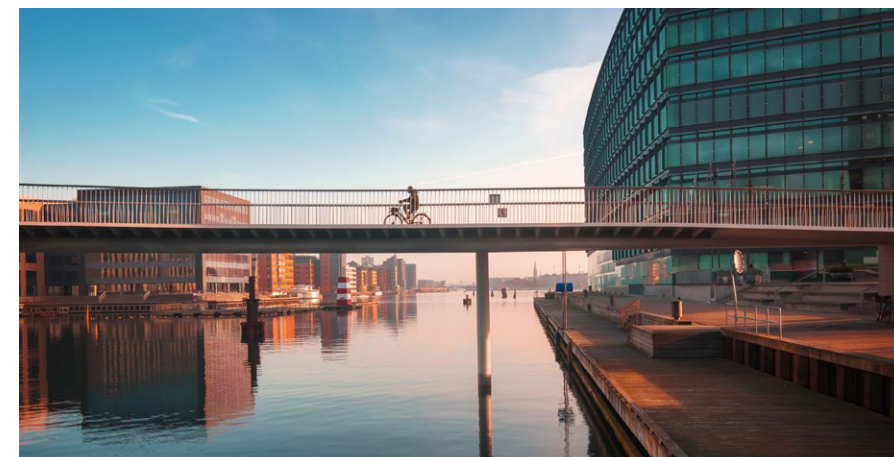


Image credit: Getty Images/shishic

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UN Photo/Eskinder Debebe

## Higher tide

# Climate change is a remorseless threat to the world's coasts

AUG 17TH 2019

*The world is not ready for the sea levels it will face.*

Imagine a huge horizontal a-frame: a recumbent, two-dimensional Eiffel Tower. Pin a pivot through its tip, so it can swivel around 90 degrees. Then add to its splayed feet something like the rocker of a rocking chair, but 210 metres long, 22 metres high and 15 metres wide. Now double it: picture, across a 360-metre-wide canal, its mirror image. Paint all their 13,500 tonnes of steel glistening white.

What you have imagined, the Dutch have built. When the Maeslant barrier (pictured) is open, it allows ships as large as any ever built to pass along the canal to Rotterdam, Europe's biggest port. When closed, it protects that city—80% of which sits below sea level—from the worst storm surges the North Sea can throw at it.

In 1953 such a surge, driven by hurricane-force winds and coinciding with a spring high tide, broke through the

dykes that protect much of the Netherlands from the sea in dozens of places, killing almost 2,000 people and inundating 9% of its farmland. Over the following 50 years the Dutch modernised their sea defences in one of the most ambitious infrastructure projects ever undertaken; the Maeslant barrier, inaugurated in 1997, was its crowning glory. It is to be swung shut whenever the sea surges above three metres (the 1953 surge was 4.5 metres). So far it has yet to be used in an emergency. But with the motor of a regional economy of €150bn (\$167bn) at stake, better to be safe than sorry. In January the city's mayor, Ahmed Aboutaleb, told The Economist he now expects the barrier to have to close more frequently than the once-a-decade its makers planned for. It had come within 20cm just the day before.

As Mr Aboutaleb makes clear, the rising threat is a result of climate change.

Few places are as vulnerable as the Netherlands, 27% of which is below sea level. But many other places also face substantial risk, and almost all of them are far less able to waterproof themselves than the Dutch. It is not just a matter of being able to afford the hardware (the Netherlands has 40,000km of dykes, levees and seawalls, plus innumerable sluices and barriers less mighty than the Maeslant). It is also a matter of social software: a culture of water governance developed over centuries of defending against the waves. The rest of the world cannot afford the centuries it took the Dutch to build that up.

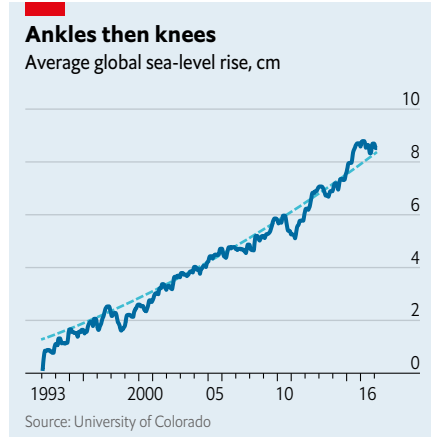
There are some 1.6m kilometres of coastline shared between the 140 countries that face the sea. Along this they have strung two-thirds of the world's large cities. A billion people now live no more than ten metres above sea level. And it

is coming to get them. Global mean sea level (GMSL) ticked up by between 2.7mm and 3.5mm a year between 1993, when reliable satellite measurements began, and 2017 (see chart). That may not sound like much; but to raise GMSL a centimetre means melting over 3trn tonnes of ice. And though forecasts of sea-level rise are vexed with uncertainties and divergences, there is a strong consensus that the rate is accelerating as the world

warms up. The Intergovernmental Panel on Climate Change (IPCC), which assesses climate change for the UN, says sea level rose by around 19cm in the 20th century. It expects it to rise by at least twice that much this century, and probably a good bit more. It is worth noting that last year the authors of a study looking at 40 years of sea-level-rise forecasts concluded that the IPCC's experts consistently "err on the side of least drama".



Getty Images/Frans Lemmens



Sea-level rises on the order of one metre—a bit above the IPCC range for 2100—will cost the world a lot. Leaving aside fatalities owing to storms and storm surges, whose effects are worse in higher seas, one estimate made in 2014 found that by 2100 the value of property at risk from marine flooding would be worth between \$20trn and \$200trn. The Union of Concerned Scientists, an American NGO, estimates that by that time 2.5m existing coastal properties in America, today worth \$1.1trn, could be at risk of flooding every two weeks.

A massive problem for some; an existential risk for others. Atoll nations like Kiribati—average elevation less than two metres—risk losing almost all their territory to floods like that pictured on the previous page. In 2015 the president of Micronesia, another Pacific island state, described the fate of such nations in the global greenhouse as "potential genocide". This, one hopes, goes too far; refugees could surely be resettled. Still, the extirpation of entire territorial states would be without any modern precedent.

## We need to talk about calving

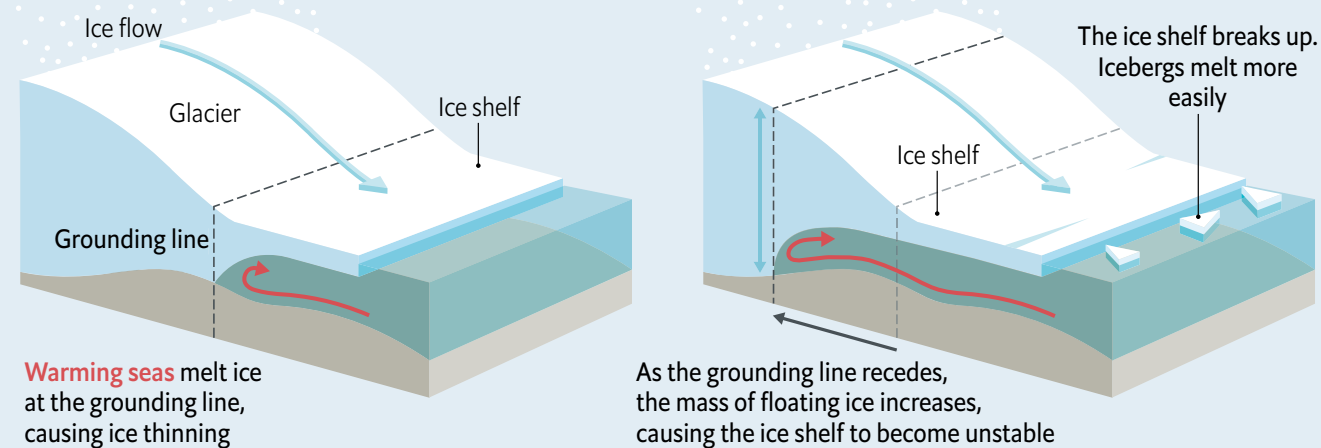
Some of this is unavoidable. About two-fifths of the increase so far comes not from water being added to the oceans, but from the water already in the oceans warming up and thus expanding. Scientists estimate the sea-level rise for a one-degree warming—which is what the world is currently experiencing, measured against the pre-industrial climate—at between 20cm and 60cm. They also note that, because it takes time for the oceans to warm up, that increase takes its time. This means the seas would continue rising for some time even if warming stopped tomorrow.

Not that it will. Today's mitigation measures are not enough to keep warming "well below" 2°C, the target enshrined in



## Ice, ice, bathing

### Marine ice sheet instability



the Paris agreement of 2015; in the absence of more radical action, 3°C looks more likely. That would suggest a sea-level rise of between 60cm and 180cm from thermal expansion alone.

Though thermal expansion has dominated the rise to date, as things get hotter the melting of ice on land will matter much more. The shrinking of mountain glaciers, the water from which all eventually runs to the sea, is thought to have contributed a bit more than a third of the human-induced GMSL rise to date. The great ice sheets of Greenland and Antarctica have not yet done as much. But their time seems nigh.

In bathtub water-level terms, the melting of continental ice sheets is to thermal expansion as a rubber duck is to a person. When the most recent ice age ended, the melting of the ice sheets sitting atop western Eurasia and much of North America increased GMSL by around 120 metres.

Today's residual ice sheets are smaller—the equivalent of less than 70 metres of sea-level rise. And most of that is in the East Antarctic ice sheet, widely seen as very stable. The Greenland ice sheet, the second largest, is shrinking both because its glaciers are flowing more quickly to the sea and because the surface is melting at an unprecedented rate, but its loss of mass is not yet huge. It is the West Antarctic ice sheet which scares scientists most. Many think it will become unstable in a warmer world—or that it may already be unstable in this one.

The West Antarctic ice sheet looks, in profile, like a flying saucer that has landed on the sea-floor. A thin rim—an ice shelf—floats on the sea. A thicker main body sits on solid rock well below sea level. As

long as the saucer is heavy enough, this arrangement is stable. If the ice thins, though—either through surface melting or through a faster flow of glaciers—buoyancy will cause the now-less-burdened saucer to start lifting itself off the rock. The boundary between the grounded ice sheet and its protruding ice shelf will retreat.

As this grounding line recedes, bits of the ice shelf break off. The presence of an ice shelf normally checks the tendency of ice at the top of the ice sheet's saucer to flow down glaciers into the sea. As the shelf fragments, those glaciers speed up. At the same time the receding grounding line allows water to undermine the ice sheet proper, turning more of the sheet into shelf and accelerating its demise (see diagram).

First suggested in the 1970s, marine-ice-sheet instability of this sort was long considered largely theoretical. In 1995, though, the Larsen A ice shelf on the Antarctic Peninsula, which is adjacent to the West Antarctic ice sheet, collapsed. Its cousin, Larsen B, suffered a similar fate in 2002. By 2017 there was a 160km crack in Larsen C. The glaciers on the peninsula are accelerating; so is the rate at which the sheet itself is melting. Marine-ice-sheet instability feels much more than theoretical. And though the West Antarctic ice sheet is a tiddler compared with its eastern neighbour, its collapse would mean a GMSL rise of about 3.5 metres. Even spread out over a few centuries, that is a lot.

Some fear that collapse could be quicker. In 2016 Robert DeConto, from the University of Massachusetts, and David Pollard, of Pennsylvania State University, noted that the ice cliffs found at the edge

of ice sheets are never more than 100 metres tall. They concluded that ice cliffs taller than that topple over under their own weight. If bigger ice shelves breaking away from ice sheets—a process called calving—leave behind cliffs higher than 100 metres, those cliffs will collapse, exposing cliffs higher still that will collapse in their turn, all speeding the rate at which ice flows to the sea. The rapid retreat of the Jakobshavn glacier in Greenland offers some evidence to back this up.

Such cascades, the researchers calculated, could speed up the collapse in West Antarctica and bring one on in Greenland. That would not be unprecedented. For some of a 15,000-year lull between ice ages that began 130,000 years ago, GMSL was perhaps nine metres higher than it is today, suggesting that large parts of both the West Antarctic and Greenland ice sheets collapsed. Mr DeConto and Mr Pollard point to ice-cliff instability as the reason why. When the process was included in models of today, they found that if greenhouse-gas levels continued to rise at today's reckless rates, Antarctica alone could add a metre to GMSL by 2100 and three metres by 2200.

This conclusion is not unassailable. In February Tamsin Edwards, of King's College, London, and colleagues published more sophisticated computer simulations that replicate the ancient sea levels without large-scale ice-cliff collapse, and thus suggest a slower rate of GMSL rise. Where the earlier work found a one-metre rise due to Antarctic ice this century, they found 22cm. The total rise, though, was still a disturbing 1.5 metres. And the possibility that, over further centuries, levels will rise many metres more remains real. ➤

## A lot less flat than a millpond

Efforts to pin down the extent and speed of ice-sheet collapse are themselves accelerating. When Anders Levermann co-led the sea-level work for the IPCC's most recent climate assessment, published in 2014, marine-ice-sheet instability was just a footnote. There were four computer models of the process back then, Mr Levermann says; today he can count 16. In January a team of British and American scientists embarked on a five-year, \$25m field mission to study the Thwaites glacier in West Antarctica and its ice sheet from above and, using undersea drones, below, thus adding new data to proceedings.

However great the rise in GMSL ends up, not all seas will rise to the same extent. Peculiarly, sea levels near Antarctica and Greenland are expected to drop. At present, the mass of their ice sheets draws the seas to them in the same way the Moon's mass draws tides. As they lose weight, that attraction will wane. Other regional variations are caused by currents—which are expected to shift in response to climate change. A weakening Gulf Stream, widely expected in a warmer world, would cause sea level to rise on America's eastern seaboard even if GMSL did not change at all.

Then there is the rising and falling of terra not-quite firma. Some of this is natural; many northern land masses, long pressed down by the mass of ice-age ice sheets, have been rising up since their unburdening some 15,000 years ago. Some of it is human, and tends to be more local but also much more dramatic.

If you remove enough stuff from the sediments below you, the surface on which you stand will settle. In the first half of the 20th century Tokyo sank by four metres as Tokyoites not yet hooked up to mains water drained aquifers. Parts of Jakarta are now sinking by 25cm a year, as residents and authorities of Indonesia's capital repeat Japan's mistakes. Last year a study of the San Francisco Bay area found that maps of 100-year-flood risk—the risk posed by the worst flood expected over 100 years—based on sea-level rise alone underestimate the area under threat by as much as 90% compared with maps that accounted for land that was getting lower because of subsidence.

As land sinks, the sea erodes it away. Komla Sarkar, who lives in the village of Chandpur in Bangladesh's flood-prone south, recalls childhood days when her parents grew crops and kept goats and chickens between their hut and the water. "When we leave our houses in the morning," she now says, "we don't feel confident they will still be there when we return."

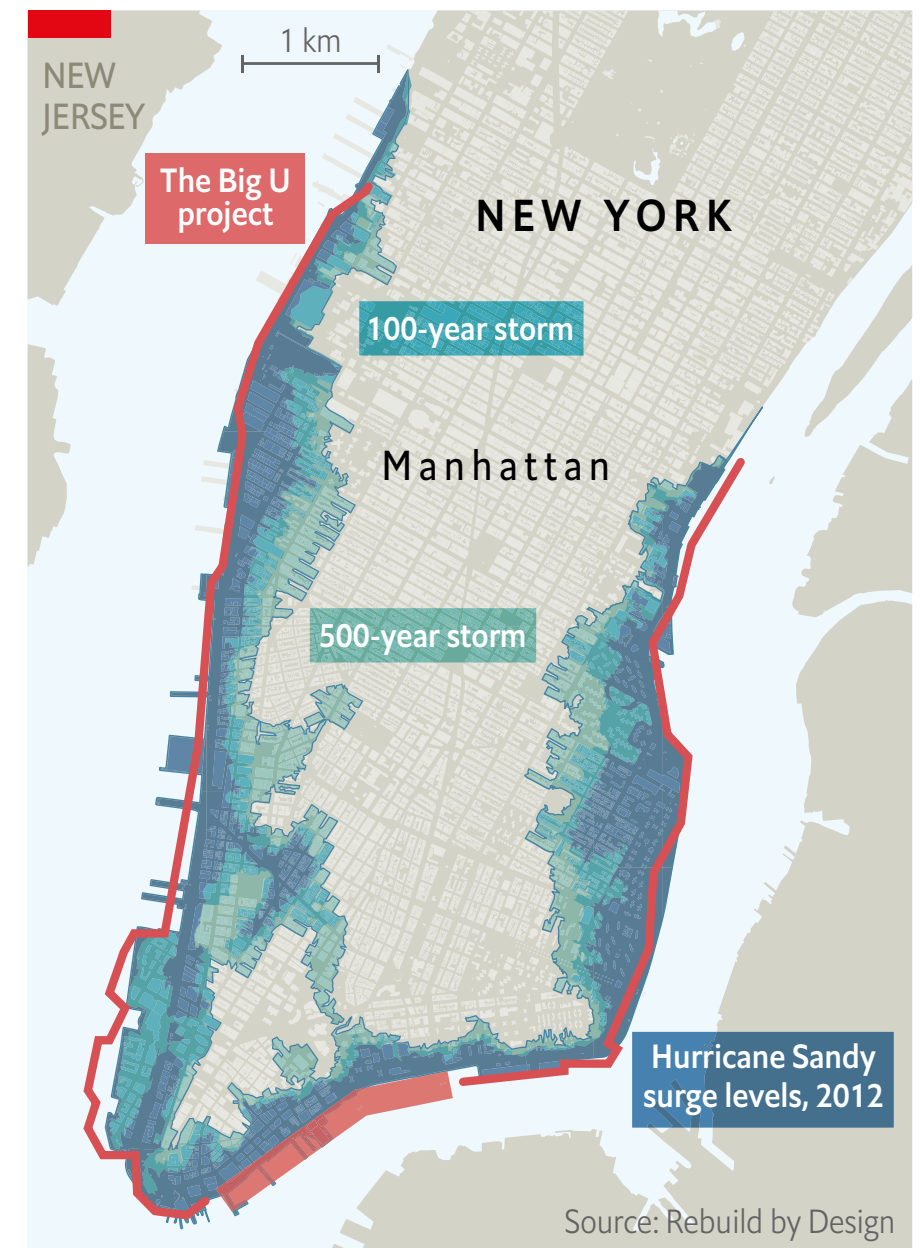
People often worsen erosion. Satellite

images show that stretches of Mumbai's coast have eroded by as much as 18 metres since 2000, in part because developers and slum-dwellers have paved over protective mangroves. Other aspects of climate change will have effects, too. Heavier bursts of rainfall upstream will mean that some low-lying coastlines will see the risks posed by the sea compounded by those from rivers. In 2012 a team of Japanese researchers predicted that by 2200 the Bay of Bengal would experience 31% fewer cyclones than today, but that 46% more will roil the Arabian Sea on the other side of the subcontinent.

The biggest extra effect of human activity, though, may well be putting more

property at risk as a more populous and richer world concentrates itself in cities by the sea. In the rich world, and increasingly in emerging economies too, the closer to the beach you can erect a condo or office block, the better. In New York alone 72,000 buildings sit in flood zones. Their combined worth is \$129bn.

In October 2012 Hurricane Sandy jolted the city into a new awareness of the threats it faces, given that geology, gravity and the Gulf Stream are conspiring to raise the seas lapping at its shores by half as much again as the global average. Other cities are worrying, too. Rotterdam now welcomes 70 delegations a year from fact-finders seeking to apply Dutch know- ➤





how to New Jersey, Jakarta and points in between.

Barrier methods

A lot of effort is devoted to engineering a way out of the problem. New York is paying almost \$800m for the Big U, a necklace of parks, walls and elevated roads to shield lower Manhattan from another Sandy. Mumbai wants to build four huge and costly seawalls. Bangladesh, a delta country ten times more populous and one-thirtieth as rich as the Netherlands, is doubling its coastal embankment system and repairing existing infrastructure. Indonesia intends a \$40bn wall in the shape of a giant mythical bird to seal Jakarta off from the seas.

Such schemes take decades to plan and execute, which means the conditions they end up facing are not necessarily those they were conceived for. When the Big U was first proposed, a year after Sandy, the worst-case scenario for sea-level rise on America’s east coast was one metre. When its environmental assessment report was eventually published this April, that looked closer to the best case.

London’s Thames Barrier—conceived, like the Dutch delta defences, after the floods of 1953—closed just eight times

between its inauguration in 1982 and 1990. Since 2000 it has shut 144 times. In Venice MOSE, a system of flood barriers which cost a staggering €5.5bn, will be needed every day if the seas rise by 50cm. Such near-permanence will render moot the huge effort and expense that went into keeping it unobtrusively submerged when not in use. At one metre of sea-level rise it would be basically pointless. Even the resourceful Dutch only designed Maeslant with one metre of sea-level rise in mind.

Kate Orff, a landscape architect, dismisses walls as one-dimensional attempts to solve multidimensional problems. Her project, a string of offshore breakwaters on the western tip of Staten Island to prevent coastal erosion while preserving sea life, is one of various “softer infrastructure” projects to have been funded by Rebuild by Design, a \$1bn post-Sandy programme. Arunabha Ghosh of the Council on Energy, Environment and Water, an Indian think-tank, favours approaches which can be scaled up over time as the threat increases. These include anything from restoring man-groves, patch by patch, to barriers built out of interlocking blocks that can be added to as needed. “Modularity lets you shorten the time horizon,” Mr Ghosh says.

As welcome as these ideas are, they

remain niche. Rebuild by Design’s \$1bn is a drop in the bucket compared with the \$60bn which Congress earmarked for post-Sandy recovery efforts. Some of that money was spent sensibly, for example on hardening power stations and hospitals. A lot was used to replace storm-lost buildings with new ones built in the same way and much the same place.

If this were paid for by the owners, or their insurers, it might be unobjectionable. But insurers and banks are only slowly beginning to capture sea-level rise in policies and mortgages. In a world awash with capital eager to build, buy or develop, prices seldom reflect the long-term threat. Some price signals are emerging where the problems are most egregious. Controlling for views and other amenities that they offer, prices of Floridan properties at risk of flooding have underperformed unexposed ones by 10-15% over the past few years, says Christopher Mayer of Columbia Business School. But they have not exactly tanked.

Instead of rebuilding as is, better to put in place appropriate defences, soft as well as hard, and rebuild in styles better suited to the conditions. Alternatively, in some cases, encourage, help or even require people to walk away. In the rich world such “managed retreat” is anathema. People see the government’s job



as protecting them, not moving them. Relocating a neighbourhood in New York requires the consent of the residents; holdouts can block decisions for years. “Across the country, there is no appetite for eminent domain,” admits Dan Zarrilli, in charge of climate policy at New York’s city hall.

In Bangladesh, though, the Ashrayan project, run directly by the prime minister’s office, has relocated 160,000 families affected by cyclones, flooding and river erosion to higher ground at a total cost of \$570m. Each family is housed in an army-built barracks and receives a loan of \$360, plus 30kg of rice, to restart its life. It is expected to be extended for another three years, and cover another 90,000 households. Fiji has resettled a number of communities from low-lying islands, with dozens more earmarked for relocation. Meanwhile Kiribati, 2,000km away, has gained title to 20 square kilometres of Fiji as a bolthole against the day when its 117,000 citizens have to quit their homes.

Such schemes may require few civil engineers but they need plenty of social engineering. Bangladeshi officials familiar with the Ashrayan scheme have found converting fishermen into farmers far from straightforward. High ground wanted by some may also be coveted by others.

When a Kiribati government delegation visited its plot in Fiji recently, it found some non-Kiribatis making themselves at home.

Permanent resettlement is not the only form of people moving that needs considering. In places where communications are good and storms frequent evacuation can be an effective life-saver. But what of places where the big storms are very rare? Drills to make people familiar with plans they have never yet had to enact are possible—but they are also massively inconvenient, and maybe worse. A few years ago Mr Aboutaleb cancelled a test evacuation of 12,000 Rotterdammers after computer models suggested a handful of elderly or infirm evacuees might die in the process.

Even if people move, they cannot take with them everything that they value. This is not just a matter of private property. Last October Lena Reimann of Kiel University published a warning that 37 of the 49 UNESCO world-heritage sites located on the Mediterranean’s coasts can now expect to flood at least once a century. All but seven risk being damaged by erosion in the coming decades. Sites do not need world-heritage status to matter. The headman of the first flood-prone Fijian community resettled by the

government bemoans the burial grounds abandoned to the sea.

No we Canute

The inertia in the climate system means that not even the most radical cuts in emissions—nor, indeed, a dimming of sunlight brought about by means of solar geoengineering—will stop sea levels dead in their tracks. Adaptation will be necessary. But there is little appetite to pay for it. A rise that seems precipitous to Earth scientists remains well beyond the planning horizons of most businesses: even utilities rarely take a century-long perspective. Governments can always find more pressing concerns, both at home and when helping others abroad. Less than one-tenth of \$70bn in annual global climate aid goes to helping poor places cope with all effects of climate change, not just sea-level rise.

The lack of action reflects a lack of drama—for almost everyone, the worst floods of the year or decade happen somewhere else. The oceans will not suddenly crush all the world’s coasts like some biblical retribution or Hollywood tsunami. It will rise slowly, like a tide, its encroachment as imperceptible from moment to moment as it is inexorable. But unlike a tide, it will not turn. Once the oceans rise, they will not fall back. ■



Brent Penman





Image credit: UNOPS/John Rae

# Building a world that leaves no one behind

**Inclusive infrastructure is vital for sustainable development. Here's why.**

Around the world, people depend on infrastructure. Transport infrastructure helps us access food, jobs, healthcare and other services. Water infrastructure helps us access safe drinking water and provides nourishment for crops. Housing infrastructure provides protection, shelter and a stable place to call home.

Infrastructure is the foundation for development – it's key to providing human dignity and improving well-being.

But what happens when infrastructure doesn't take the needs of everyone into account? What happens when the infrastructure that is vital for daily life is accessible and affordable for some but not others?

People can be restricted from infrastructure intended to make their lives easier.

About \$97 trillion in global infrastructure investment is required by 2040 to support sustainable development. Two-thirds of this will need to be in developing countries. If we're not careful, not everyone will share equally in this investment – and unequal development trends will be locked in for generations to come.

Infrastructure must be inclusive – when we plan it, when we design it, when we deliver it and when we manage the services that it provides. We must ensure that infrastructure is responsive to users' needs.

If we fail to do so, the services infrastructure provides become inaccessible to marginalized and vulnerable groups – includ-



Image credit: Getty Images/PongMojj

ing women, the elderly, the physically disabled and the economically disadvantaged, to name a few – causing them to miss out on developmental opportunities.

Take transportation infrastructure.

Roads in many urban areas are mainly designed to reduce traffic congestion and geared towards the needs of car users (who often have higher incomes). In many cities, people who can't afford cars choose to walk or cycle, but often there are non-existent or inadequate sidewalks or cycle lanes. Roads designed with these needs in mind would help them safely access jobs, schools and health services.

Public metro transportation systems are mainly designed to provide a lower cost means of getting around. But access to these services for the elderly or those with physical disabilities may be limited if metro stations have no elevators for people in wheelchairs or people with other mobility issues. Public transportation infrastructure that takes that need into account would enable the elderly to access critical health services more easily and ensure people with physical disabilities are able to access education and economic opportunities.

Gender-blind public transportation can hamper the safety and security of women, exposing them to sexual, verbal or physical harassment. For example, if bus, train and metro stations are not well lit or do not provide adequate safety and security measures, they can leave women vulnerable to attackers while waiting for their ride. Women who try to avoid this harassment may stop using the very infrastructure meant to give them access to education and job opportunities, potentially limiting their economic growth.

The above examples could just as easily apply to other types of infrastructure, including water infrastructure and sanitation

facilities, schools and hospitals, just to name a few.

Practical actions must be embedded into the planning, delivery, and operation and maintenance of infrastructure projects so that they are inclusive and address the needs of all users.

Simply engaging with a wide and representative group of stakeholders at each phase of an infrastructure project is one of the most fundamental actions we can take. This engagement provides information to interested actors, helps us understand their expectations from the project, involves

them in the decision-making processes, and enables us to receive feedback on the results of a project.

Carrying out a needs assessment at the beginning of a project provides a deeper understanding of the people who will be using the infrastructure, including the specific requirements and needs of identified vulnerable groups. This can help inform the design of infrastructure so that it caters to diverse needs.

Once a needs assessment is completed it should be followed by the creation and implementation of an action plan that tackles the identified constraints and opportunities.

Taking steps such as these help address the needs of the most vulnerable to unlock opportunities for marginalized and excluded populations. This inclusive infrastructure acts as a catalyst to alleviate poverty, reduce inequality and grow economies – helping everyone benefit equally from investments in infrastructure. ■

## ABOUT THE AUTHORS



Apoorva Bajpai is an Infrastructure Sustainability and Resilience Analyst at UNOPS, with a background in urbanization and international development, urban planning and architecture. She has experience working on urban infrastructure development projects in South Asia, with a focus on social and environmental sustainability.



Geoffrey Morgan is an Infrastructure Sustainability and Resilience Specialist at UNOPS, where he helps governments improve the way basic services are provided to ensure accessibility to the most vulnerable. He has a background in engineering and social sciences, with experience working on projects in Africa, Asia, the Middle East and Latin America.

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***What is inclusive infrastructure?***  
Inclusive infrastructure is infrastructure that takes into account the needs of everyone, including marginalized and vulnerable groups.

WRITTEN BY





Image credit: Foster + Partners

# Sustainable infrastructure: Remoulding the urban glue

Our experience of the world is shaped by the infrastructure—plazas and streets, parks and gardens, air, rail, and other transport networks—that surrounds us. Together, they form the “urban glue” that binds our cities together, argues Norman Foster, founder and executive chairman of Foster + Partners, a London-based architectural design and engineering firm.

I believe that the future of the city is the future of our society. By 2050 it is predicted that around 70% of the world’s population will be living in urban environments, many of them in megacities of over 10m people. In some countries, the pace of change is extraordinary. What took Europe 200 years is now taking place in China and India in a fraction of that time.

Through careful design of ‘urban glue’, we can enable communities to adapt to an unknown future in a sustainable way that helps the environment, the economy and wider society.

## Sustainable urbanisation

This raises the fundamental question of sustainability: how do we ensure that the nature of urbanisation is sustainable and future-proofed? I believe the design of infrastructure must take into consideration its proficiency, resilience and the wider impact on the environment and humankind.

How do you define sustainable infrastructure? The meaning has surely changed as the challenges we face in an increasingly global society become more shared and mutual. Infrastructure that is sustainable in an environmental, economic and social sense now must go beyond just addressing local challenges: what happens on one side of the globe affects people on the other side as well.

As climate-change science continues to outline, in a stark fashion, the rate at which we

need to decarbonise our economies, the role of infrastructure comes into sharper focus. Highlighting just one part of the puzzle, the International Energy Agency has warned that the existing energy infrastructure has enough potentially “locked in” emissions to take us to the Paris Agreement’s 2°C global warming limit. So, we need to think about our infrastructure systems in a manner that enables us to reach our—increasingly global—sustainability aspirations.

Creating future-proofed and resilient cities requires a holistic approach to environmental, economic and social sustainability (also known as the three pillars of sustainability), benefiting not just the planet but also its people.

Over the past 50 years, Foster + Partners has developed a bespoke framework that helps evaluate projects—from urban masterplans to private homes—in a holistic manner. Based on ten sustainability-related themes, the framework goes beyond the environmental focus of commonly used sustainability assessment methods, such as Leadership in Energy and Environmental Design, Building Research Establishment Environmental Assessment Method and Estidama, by also including ideas of social justice and equity. These ten themes are: wellbeing, community impact, energy and carbon, mobility and connectivity, resources, water, land and ecology, social equity, planning for change, and feedback. The framework therefore views environmental, social and economic sustainability as complementary ideas that must be analysed together.

## Case study: Amaravati, the People’s Capital

We recently had the opportunity to apply our holistic sustainability thinking on the central governmental complex at Amaravati, the “People’s Capital” of Andhra Pradesh, India, to be situated on the banks of the River Krishna. We are designing a masterplan for the city’s government complex at the very heart of the 217 sq km city, within which our current thinking on interlinked sustainability objectives and new urban infrastructure has come together.

The central government quarter, a 5.5-km-long green rectangular grid with meandering and intersecting waterways, brings residents back to nature with 60% of its land made up of green or blue space. There is no central gas network—buildings are powered by renewable energy via rooftop solar photovoltaic panels, combined with battery storage to enable solar power to be utilised throughout the day and night. A supplementary off-site solar array means the complex will operate on 100% renewable power. Rainwater harvest-

ing, stormwater management and reuse of recycled water will halve the development’s freshwater demand.

The masterplan area is designed to be fully walkable, with bicycle and pedestrian routes accompanying electric-vehicle lanes and an unmanned electric-bus route that runs through the complex’s central spine. The masterplan is also wired towards the economy of the future and makes use of smart digital infrastructure that provides resilience while optimising resource use.

Finally, the design instils civic pride and celebrates the heritage of Andhra Pradesh with each of the state’s 13 districts represented by urban squares that integrate local arts, crafts and culture for residents and visitors. Local materials and expertise are being utilised in the complex’s construction, while passive design to maximise cooling breezes, alongside strategic use of shading, allow comfortable enjoyment of the inclusive green squares and public areas. The whole design’s ethos takes its inspiration from India’s traditional sustainable settlements.

Our designs for Amaravati demonstrate a confluence of different strands of our thinking to provide integrated and sustainable infra-

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Through careful design of ‘urban glue’, we can enable communities to adapt to an unknown future in a sustainable way that helps the environment, the economy and wider society.

structure for the cities of today. They provide a model, or benchmark, for the cities of the future, which will continue to evolve. For instance, with the advent of new technologies, such as passenger and cargo drones, fully powered by renewable electricity, we may not need to provide as much space for roads, which could save time, energy and emissions.

The global challenges facing us mean that in the future the infrastructure that binds our cities will continue to change. Through careful design of “urban glue”, we can enable communities to adapt to an unknown future in a sustainable way that helps the environment, the economy and wider society. ■

## ABOUT THE AUTHOR



Frederic Aranda

Norman Foster is the founder and executive chairman of Foster + Partners, a global studio for architecture, urbanism and design, rooted in sustainability. Over the past five decades the practice has pioneered a sustainable approach to architecture and urbanism through a wide range of work, from masterplans to offices, cultural buildings, airports and industrial design. Lord Foster has been awarded architecture’s highest accolades, including the Pritzker Architecture Prize, the Praemium Imperiale Award for Architecture in Japan, the RIBA Royal Gold medal and the AIA Gold medal. He is president of the Norman Foster Foundation, based in Madrid. In 1999 he was honoured with a life peerage, becoming Lord Foster of Thames Bank.

CURATED BY





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