# Everywhere, forever

Robert Templer


ICE AXE

Photo: Brent Lewin

Plastic Soup: An Atlas of Ocean Pollution Michiel Roscam Abbing Island Press: 2019 “Human Consumption of Microplastics” Kieran D. Cox, Garth A. Covernton, Hailey L. Davies et al Environmental Science & Technology 53 (12): 7068–74

G

.I. Joe was an early victim of the Vietnam War. Joe — an action figure and *never* a doll, as boys did not play with dolls — might not have served in-country, but his sales shrank along with support for US involvement. By 1969, he was focussed more on adventuring than on fighting communism. His place of manufacture switched from Japan to Hong Kong, where injection moulding plants were advanced enough to make the complex toy, which had joints that both bent and could hold a pose. In the early 1970s, he evolved into a tree-hugging environmentalist with swivelling eyes, a “realistic” beard and a kung-fu grip. Joe the eco-warrior better suited the times. But by late in the decade, his career was over, doomed not just by declining support for the military but by the rise in oil prices that had made plastics more expensive.

G.I. Joe was made in the factories of the Cheung Kong Group, the first company owned by Li Ka-shing, the Hong Kong property tycoon once popularly known as “Superman”, whose first fortune was built on injection moulded plastic. Joe’s story weaves together the threads of Asian development over the past fifty years: the economic boost from the Vietnam War which shaped the economies of the emerging Asian Tigers; the emergence of a new tycoon class that would dominate business across the region, forming vast conglomerates and making even bigger personal fortunes; and the advent of plastic as a driver of growth. And now there’s another thread: rising disillusionment and anxiety.

Petrochemical polymers built Asia: from Sony, to Formosa Plastics, to the Ambani brothers, to most of the manufacturing base in Hong Kong. In 1955, there was one factory making plastic flowers in Hong Kong. Just seven years later there were 997, employing more than 30,000 people. Artificial blooms had wilted by the late 1960s, but not Cheung Kong. Like many of the plastics companies, it had moved into property, eventually accounting for one in twelve privately built homes in the city, as well as office towers, hotels and ports. Li is the most famous of the billionaires who got their starts in plastic, but across Hong Kong vast amounts of wealth stems from the 1960s boom, when this miracle material, initially shunned for its brittle cheapness but eventually embraced for its practicality and endless potential, became ubiquitous. In 1950,

about 1.5 million metric tons of plastic was made; now, it is around 350 million tons a year and is set to double by 2030.

Since Li began making plastic flowers as a twenty-four-year-old refugee from China, plastic has become the most manufactured material on earth. It was developed as a cheap substitute for much more valuable materials, a way to make billiard balls that looked as though they were ivory, or to mimic tortoiseshell or ebony. The basic building blocks of polymers are produced when oil is refined into petrol and its various by-products. Soon the production of ethylene and other chemicals began to exceed demand, so the oil majors invested billions in finding new ways to use them in plastics. That required new products, preferably adopted in a way that ensured ever-rising demand. The ubiquitous single-use plastic bags that foul our rivers and choke sea life were developed by a Swedish firm in the 1960s. The chemicals division of Mobil Oil began to push them on supermarkets in the early 1970s, but they were initially a failure. Consumers were wary of them: they were weak and spilled groceries in the trunks of cars. Dozens of children had died by suffocating while playing with dry-cleaning bags. Plastic was viewed as more life-threatening than life-enhancing; indeed, it was something of a joke. Audiences chortled in 1967 when Benjamin Braddock, the young protagonist of *The Graduate*, was taken aside at a pool party by a pushy neighbour, who told him: “One word: plastics … There’s

a great future in plastics.”

The future *was* in plastics. Mobil persisted with a huge marketing campaign and lured in supermarkets with the cheapness of their bags. Soon it had 80 per cent of the bag market.

Half the world’s plastics are made in Asia. Half of all the plastic in the world has been made since 2000. In just two decades, we have all consumed half of all the plastic ever made, and about half of that has been used only once. Many great Asian fortunes were founded or sustained by plastics, be it the raw materials produced by Taiwan Plastics, started with a US aid grant in 1954, or the car dashboards made by the Tata Group. The sheer ubiquity of plastics in our lives — think, for a moment, of all the plastic objects you have touched so far today — and the manufacturing power of Asia made it inevitable that the region would be the centre of the industry.

A

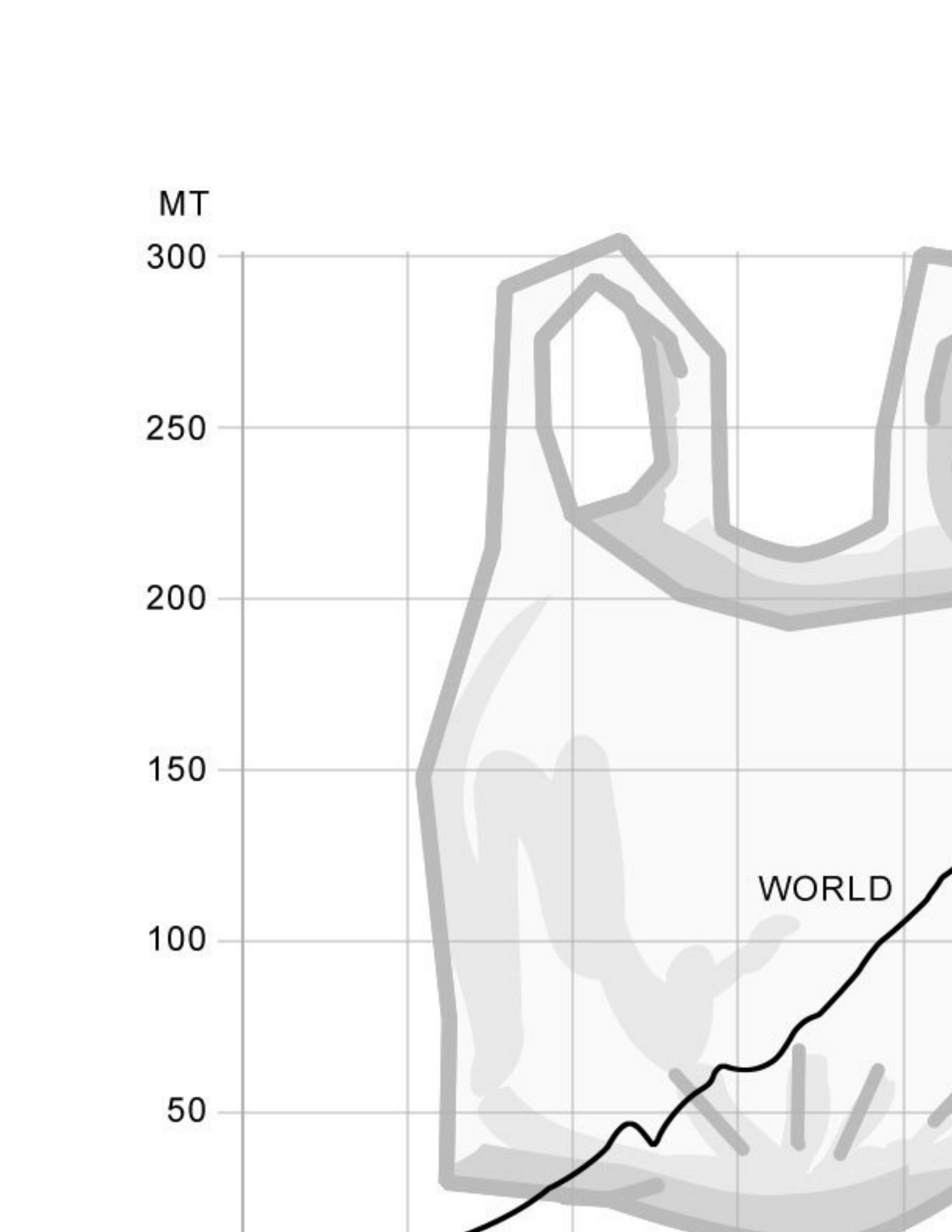
darkness hangs over the Norwegian islands of Svalbard even during the summers, when the sun never sets. Long-abandoned mining equipment, the skeletons of industrial dinosaurs, litters the treeless hills. Signs

warn of polar bears; wandering off the main street in the capital, Longyearbyen, puts you at risk. Just outside town, a narrow prism of concrete juts from a hill. Its forbidding doorway leads hundreds of metres into an old mine that houses the Global Seed Vault. Almost all nations have sent samples of food crop seeds here so they might survive whatever cataclysm befalls the world in the future. This precious DNA is supposed to be frozen deep in the vault, but it is no longer clear that it will stay that way for eternity. The permafrost is melting faster than expected.

High inside the Arctic Circle, Longyearbyen is the northernmost permanently inhabited city in the world, three hours' flying time towards the north pole from Oslo. The nearest city is Murmansk, in northern Russia, a thousand kilometres away. It can snow here at any time of the year and, when it does, each flake brings with it microplastics, invisible fragments of all the G.I. Joes and plastic flowers from decades back that have made their way into the environment and are now everywhere. Some are so tiny they can enter cells, changing the chemistry of life in ways we have not begun to understand. We have now moved beyond microplastics to nanoplastics, which can interact at a molecular level with natural systems.

On the deck of a boat floating next to the Esmarkbreen glacier, a scientist held up a vial of seawater and told the crowd of visitors that it contained thousands of

microplastics, including many fibres, particularly from polar fleeces. Almost everyone on board was wearing fleece — Svalbard is cold even in June — and other plastic-based materials, some of them worthily recycled from other plastics. With each wash of a polar fleece, each shake, each abrasion against a rough surface, it sheds thousands more fibres into the plastic soup.


MT
300
250
200
150
100
50
WORLD

Source: Wikipedia

If there are historians in the future, what will they write about our age, the start of the Anthropocene, in which humans began to change the climate and environment to an almost unfathomable extent? A layer of plastics will define our time in the future geological record, from the snows compacted in glaciers in Svalbard to the coral sands of Indian Ocean islands. Living standards have risen rapidly in the past fifty years, and some of that is due to plastics: they preserve food, improve medical care and even increase energy efficiency. Moving milk around in plastic bottles rather than those of glass reduces the carbon footprint, even though the plastics come from oil. Plastic bags use less energy than paper bags; if climate change is your main concern then plastic is the way forward.

But plastic lasts forever. About 10 per cent has been incinerated, releasing dioxins, furans and heavy metals into the atmosphere and food chain, where those chemicals persist for decades or longer. By 2015, we had created 6.3 billion tons of plastic waste — equivalent to the weight of 46 million empty 787 jets or 17,000 Empire State Buildings. Or nearly a ton for every person on earth. About 5.6 billion tons have been

either recycled (which moves it from one use to another) or sent to landfill. A large amount never reaches the waste system; it becomes part of the soil and the sea, the rain and the snow, part of your food and now part of your body.

Plastics break down in sunlight. Ultraviolet radiation severs the long bonds that hold G.I. Joe together. First an action figure fades and then it falls apart. As those pieces get washed into streams and rivers, they finally end up in the sea, where the action of waves reduce them to ever smaller pieces. Synthetic fabrics break down into microfibres; with every batch of laundry, millions of invisible filaments are swept into the oceans. Every tyre, made from a mix of rubber and plastic, sheds dust as it rolls; every plastic bag takes about a year to turn into microplastic, but unlike wood or cotton, it does not break down into chemical components that become part of a productive food chain. Most of the plastic that enters the ocean sinks to the seabed.

In the sea, tiny fragments of plastic become home to microbes and algae. Indeed, microplastics might be raising oxygen levels in the sea, but alas insufficiently to counter other trends. The harm massively outweighs the benefits. Microorganisms are now migrating on their tiny plastic rafts to places where they have not been before, disrupting ecosystems. All forms of marine life end up consuming the particles. Albatrosses and

whales have been found with stomachs full of plastic waste. It not only shreds their intestines but may also disrupt their feeding, making them feel full as they waste away. Ropes and fishing nets, once made from biodegradable materials but now all nylon, kill turtles and large marine mammals. Microplastics stunt shellfish and interrupt the digestion of krill and other essential life forms. Plastic never goes away; it just gets smaller.

Eventually it becomes nanoplastic — tiny pieces from one to 1,000 nanometres in diameter (a human hair is about 100,000 nanometres thick). These invisible fragments remain suspended in fluids rather than sinking. Scientists know they are there, but the study of them is in its infancy. Nobody yet knows how they interact with other chemicals, whether they attract heavy metals and other toxins, or if they can get into cells and what effects they might have there.

This is the most shocking element of *Plastic Soup*, an illustrated book by the Dutch political scientist Michiel Roscam Abbing. While the focus has been on the rafts of plastic that swirl in the centre of our oceans, the more troubling aspect is the persistence and ubiquity of plastic in the sea and on land. In a stark manner, *Plastic Soup* lays out the enormity of a problem that has attracted little study up to now.

Five countries account for nearly two-thirds of the plastic waste that ends up in oceans. China, Indonesia, the Philippines, Vietnam and Thailand all have populations that live close to the coast, but more importantly, not one of them has managed to establish an effective waste-disposal regimen. It is far from inevitable that plastic bags wash into the sea, but they do if not collected and disposed of safely. That requires laws, systems, governance, enforcement and limits on corruption. All these nations have large fishing fleets, which are responsible for much of the waste that ends up swirling in vast gyres far from land.

All five nations have at various times imported plastic waste from the West, as richer nations palm off their pollution on poorer countries in what has become the defining act of environmental injustice of our time. Now they are all starting to push back, but their own domestic consumption, particularly of single use objects, is soaring.

Asia represents the major share of global gross domestic product growth over the past quarter century. Our consumption of plastic, and our heedless disregard for where it ends up, shows the flaws in our thinking

about economics and what we regard as important. We are unable collectively to consider all the costs involved in our actions. Plastics are cheap (if you don't count the environmental costs). Plastics are handy (if you don't think about disposal). Plastics are cost effective (as long as manufacturers and consumers don't have to think about the carbon impact of their Fiji Water and the bottle it came in). Plastics help in the fight against disease (if you ignore the endocrine impacts of some additives).

In some cases, the advantages outweigh the costs: for example, advances in the treatment of premature babies has been vastly helped by the plastic tubes and other equipment used to support their lives. Those babies may suffer from some effects of chemical additives in the plastics threaded into their veins, but the lives saved outweigh any harm. That may no longer be the case for humanity as a whole. Plastics are not inert, mostly because of the additives that make them flexible, strong, solid, silky, coloured or transparent.

These additives leach out into the environment, and some seem to have disturbing effects on people. Since the sixteenth century we have thought about poisons as being a matter of dosage — everything is toxic if you consume too much of it. But the human body is complex and filled with feedback loops driven by hormones. These regulate many of our bodily functions and operate in a way that can make a tiny dose of some

chemical highly disruptive. When it comes to the endocrine system, a small dose can turn something on or off and a high dose will do the opposite. Toxicity is no longer seen as a matter of consuming too much of a chemical.

We do not know enough about where plastic goes and what it does. Is the growing layer on the bottom of the ocean leaching into our food? Do nanoplastics represent an existential threat to life? How can we organise our businesses and societies to ensure more recycling and less waste? Until recently it has been extremely difficult to trace microplastics and nanoplastics: being carbon-based they are difficult to distinguish from biological chemicals and are almost impossible to count. Recent advances have enabled better identification.

Each of us consumes about 74,000 pieces of microplastic a year, according to a recent study based on an American diet and published in *Environmental Science & Technology*. If you drink only bottled water, you probably consume an additional 90,000 pieces, compared with 4,000 if you drink from the tap. But most intake of microplastics comes not from diet but

from breathing, as they now make up a share of all dust. The authors of this study, whose work was supported by the American Chemical Society, a scientific body based in Washington, DC, believe they have underestimated human consumption.

There is little science on what that consumption means. We do know that many additives in plastics are harmful in a range of ways — as cancer-causing agents and as endocrine disruptors. But we have no idea what impact microplastics may be having. Nanoplastics may represent an even greater threat, given their ability to enter cells and to cross the blood–brain barrier.

In Bandung, Indonesia, rivers are sometimes so clogged with plastic waste that the local authorities call in the army to deal with it. What they mostly do is use mechanical diggers to push it downstream, where it clogs again but becomes someone else's problem. That has been the global response to plastics for decades. The problem can be pushed into the future, to a distant time when all plastics are biodegradable. The problem is that we have already crossed the point at which plastics have spread globally, and we have no real idea if claims of biodegradability are real or if some plastics simply become nanoplastics faster than others.

There have been many Davos-style initiatives out there: all aboard the New Plastics Economy, cheered Unilever, which sells millions of plastic sachets of shampoo each

year, almost none of which are recycled. The heads of some of the worst offenders when it comes to plastic packaging, including the food companies Danone and Coca-Cola, have signed up.

But the cyclical economy of plastic barely exists: less than 10 per cent of plastic is recycled, and many products are designed in such a way as to make reuse almost impossible. Shelf-stable cartons, pioneered by the Swedish company Tetra Pak, are rarely recycled, as their layers of plastic, paper and aluminium are too difficult to disentangle. The plastic in bottle caps is different from that in bottles and black plastics — the sort that makes up your phone and many other consumer products often sneaks through the detectors in recycling plants and ends up in landfill. The problems are endless and apparently as durable as plastic.

We could sort all this out, but the oil and gas industry — pampered by governments and subsidised to the tune of US$500 billion a year — needs the plastic sector. Feedstocks are a by-product, albeit a highly profitable one. As cars shift to electricity or reduce their fuel consumption, demand for petrochemicals is increasingly being driven by plastics. It is already more lucrative for countries such as Kuwait or Saudi Arabia to use their oil to make plastic rather than gasoline. By 2050, petrochemicals — mostly plastic feedstocks — will account for half of all oil and gas demand.

Recycling won't make much of a difference, according to the International Energy Agency. Recycled plastic will meet just 5 per cent of demand by the middle of the century.

The oil industry created our demand for plastic, and its heedless promotion of disposability and waste has spread it throughout the world. Recycling will never reach the necessary capacity for a truly circular economy; what is needed is a substantial reduction in single-use plastics. Now is the time for the moonshot; indeed, our crop of barely taxed utopian-minded billionaires such as Amazon's Jeff Bezos would do more for humanity if they developed better packaging rather than firing rockets into the yonder. Li Ka-shing and the Ambani brothers could do their part, too; just a small amount of Li's US$35 billion fortune could go towards finding out what happened to all those plastic flowers and G.I. Joes and what effect they are having on us all.

**Robert Templer** is the managing editor of *Mekong Review*.