



TO EAT WELL AND FEEL GOOD, WE NEED BETTER FOOD SYSTEMS

May 2023

The team members of Proterra Asia first started investing in the Asian food and agriculture space more than 15 years ago. We have seen the industry mature from focusing on food safety to food sustainability. Given how important food is to us as individuals and to society, we believe that our food systems should reflect our most noble human virtues. Currently, our options to indulge and stay healthy, whilst doing no harm to the earth, are limited. Rather than expecting everyone to try hard to make healthy, ecological choices, we think that we need to invest in systemic change that can make these choices “easy” for the average consumer. In this article, we opine on why our food choices are important, why Asia is a key battleground in tackling climate change, and three areas where we believe we can invest for both profit and impact – namely, Alternative Proteins, Improving Production Efficiencies, and Circular Economies.

THERE IS A LARGE GAP FROM WHERE WE ARE NOW TO WHERE WE WOULD LIKE TO BE

The founding partners of Proterra Asia came from Cargill and started investing in Asia more than 15 years ago. We cut our teeth by building farms to meet the demand for products that met higher food safety standards in the wake of the 2008 “melamine milk scandal”. As our networks deepened and the region developed, we capitalized on a growing middle class through investments in mid-stream processing and consumer food products.

Given our time investing in this field, we think that it warranted to call ourselves food sector specialists. On the other hand, we note that everyone else has also literally been eating since birth! Therefore, at least when it comes to food, we can all be experts.

Drawing on our universal experience, we observe that there are certain similarities in everyone's attitudes toward the food that we eat. To many of us, food is not just something we consume to fill our stomachs, but a passionate, commonly thrice daily choice that can lie very close to our hearts. What, when, and with whom we eat may reflect our culture, our biases, and our values. Food choices, repeated over time, can even become part of our personal identity, from "vegetarian" to "meat-eater", "foodie" to "dieting". In not so many words, we are what we eat.

Shouldn't the saying, "to eat and be satisfied", then, mean that our food choices satisfy not just our basic need for sustenance, but also our most noble thoughts about who we can be? Unfortunately, there seems a stark contrast from what we as individuals and society intends to do, versus what we actually do.

To illustrate, wasting food may be generally frowned upon, yet households are the largest generator of food waste^[1]. The meat industry is perceived as cruel and pollutive by many, yet only an estimated 1 to 2% of the population chooses to be vegan.^[2] Even the packaging that food comes in plays into this conundrum – theoretically, we could agree that recycling is the right thing to do, but in practise, how many of us go through the trouble?

If our food systems truly reflected the universal human virtues of wanting to be able to indulge, to be healthy, and to protect the earth and communities, then we still have a long way to go.

THE STATE OF OUR FOOD SYSTEMS TODAY

Globally, food system emissions account for almost a third of greenhouse gas (GHG) emissions.^{[3][4]} If we do not take counteracting measures, then emissions are projected to increase by up to 60 to 90% as the global population increases and low- and middle-income countries change their diets to consume more animal-source foods.^{[5][6][7][8]} These levels of emissions, both current and projected, will make reaching the Paris Agreement goals highly implausible.^[5]

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If we were to put the GHG emissions from food waste alone in the context of national emissions, it would be the world's third largest emitter, only behind China and the United States^{[9][10]}

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To better illustrate the scale of the problem, let's look at wasted food, which is just one subset of the food supply chain problem. Wasted food represents not just a waste of production resources, but emits greenhouse gases (GHG) when dumped in landfills. If we were to put the GHG emissions from food waste alone in the context of national emissions, it would be the world's third largest emitter, only behind China and the United States^{[9][10]}.

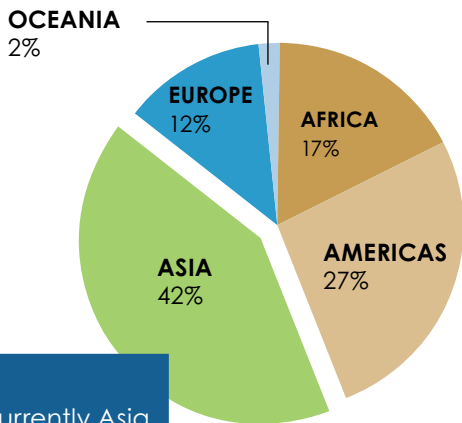


ASIA IS THE KEY BATTLEGROUND, SO WHERE SHOULD WE FOCUS OUR EFFORTS?

Looking at the numbers alone, it is clear that Asia is a key battleground. Already, Asia accounts for over 40% of global GHG, making it the top GHG emitter, by far^{[3][4]}. Going forward, the pollutive contribution by Asia has the potential to get much worse, especially with the rising demand for more animal-based products.^[5]

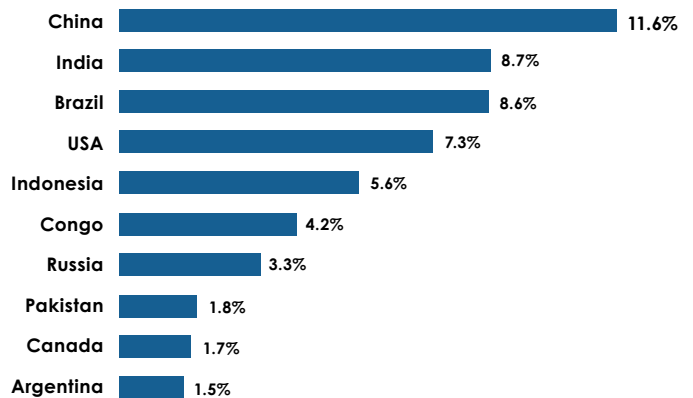
FOOD SYSTEM ACCOUNT FOR APPROXIMATELY A THIRD OF GHG EMISSIONS ASIAN COUNTRIES ARE KEY CONTRIBUTORS

Agri-Related GHG Emissions By Geography^{[3][4]}



Currently Asia is the biggest GHG emitter in the world.

Top 10 Countries By Agriculture Emissions In 2020^{[3][4]}



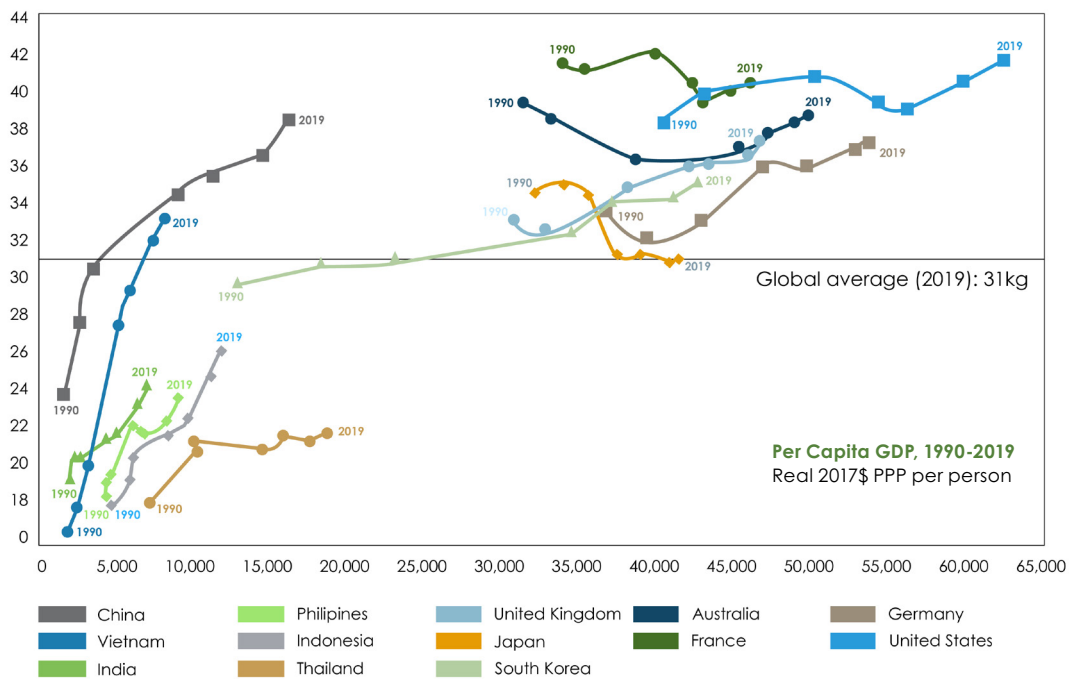
CHINA NOW CONSUMES THE MOST MEAT GLOBALLY, WITH MEAT CONSUMPTION GROWTH IN DEVELOPING ASIA FAR OUTPACING THE DEVELOPED WORLD^[11]

Meat Consumed In Billion Kgs Per Year

Developed Nations	2019	10y growth	Developing Asia	2019	10y growth
US	42.17	15%	Sri Lanka	0.22	72%
Spain	4.99	11%	South Korea	4.11	51%
Canada	3.52	11%	Pakistan	3.54	41%
UK	5.28	6%	Philippines	3.96	29%
France	5.41	(8%)	India	6.76	28%
Germany	6.35	(12%)	Vietnam	5.50	24%
Italy	4.50	(15%)	China	89.63	22%
Netherlands	0.91	(37%)	Indonesia	3.30	20%
			Malaysia	1.74	19%
			Bangladesh	0.69	16%
			Thailand	1.84	3%

CONSUMPTION PER CAPITA STILL LAGS DEVELOPED NATIONS^[12], BUT IS PROJECTED TO INCREASE WITH INCOME GROWTH

Protein Consumption Per Capita (Kg/Capita, Annual)



HOW CAN WE, AS INDIVIDUALS AND AS A SOCIETY, MAKE THINGS RIGHT?

It is too simplistic to say that we should all choose more sustainable food choices, because in practice, not everyone is willing to make the “right” choice if it requires “giving up” something else, be it time, taste, or money.

We believe that the best way to help us make the “right” choices are to make these choices “easy” for everyone. This means investing in realistic, system-level solutions that embed sustainability into the core of their design.

We have seen this being played out in the Auto industry. Instead of banning cars completely, which would be unacceptable to many, Auto makers have started to electrify them, a solution that is gaining mainstream adoption since consumers can support their ecological goals without “giving up” the convenience of driving.



So how can we make healthy, sustainable choices “easy”?

We would like to talk about three areas:

1. Alternative proteins
2. Increased production efficiencies in traditional industries
3. Circular economies



1. Alternative Proteins

ALTERNATIVE PROTEINS ALLOW US TO HAVE OUR STEAK AND EAT IT ALL WITHOUT HARASSING A COW



Alternative Proteins are a food technology innovation that seek to give consumers the sensory experience of consuming meat, eggs or dairy without involving live animals. This is achieved either through plant- or fungi-derived mock meat products, or real animal proteins produced from cell cultures.

Switching over to Alternative Proteins would enable us to reduce our reliance on farming and fishing, and in so doing avoid the milieu of negative outcomes these resource-intensive activities produce, including deforestation, pollution, biodiversity depletion and animal suffering.

The UN Intergovernmental Panel on Climate Change called cultivated meat a “transformative” approach to mitigating emissions, and it has featured prominently in the recent COP27 conference and talks^[16].

Despite last year’s stock price weakness in well-known alternative protein companies Impossible Burger, Beyond Meat and Oatly, these plant-based products have since traversed the niche world of veganism into conventional menus.

In Asia, we have seen Outside, a portfolio company, rapidly expand across coffee chains and other distribution channels as consumers eagerly swap out conventional dairy for what is perceived as a healthy, tasty, dairy-free alternative.

In time, we believe that improved formulations, textures and price points will further make the Alternative Proteins space an “easy” choice for consumers. And, we have put our money where our proverbial mouth is, not just with Outside, but also with NR Food in Thailand, JUST Egg and GOOD MEAT in Singapore, and PFI in China, each of which are pioneers in alternative protein ventures, mung bean-based eggs, cultivated meats, and soy-based meat replacements.

However, despite our optimism, we must balance the industry’s potential against what is realistically achievable today. Currently, plant-based meats have a penetration rate estimated at just 0.4% of an approximately USD1.7 trillion global meat market. In Asia, this penetration rate is almost ten times smaller at just 0.05%^[17]. Given more than 99% of the global meat market is still supplied through traditional meat products^[17], only focusing on nascent technologies is insufficient.

2. Efficiency Gains

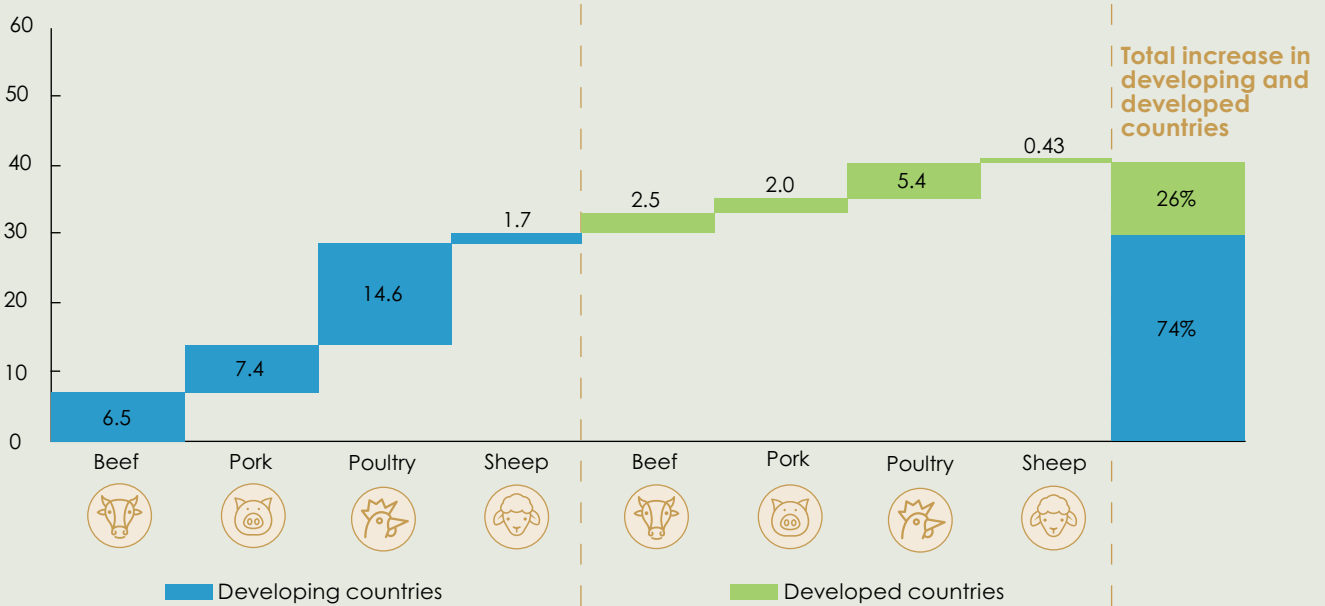
EFFICIENCY GAINS THROUGH UPGRADING TRADITIONAL MEAT AND DAIRY PRODUCTION IS KEY

The largest impacts we can create now – and climate change cannot wait – is by improving production efficiencies in traditional animal protein production, especially in developing markets, where chronic underinvestment has led to low efficiencies of production despite accelerating demand.

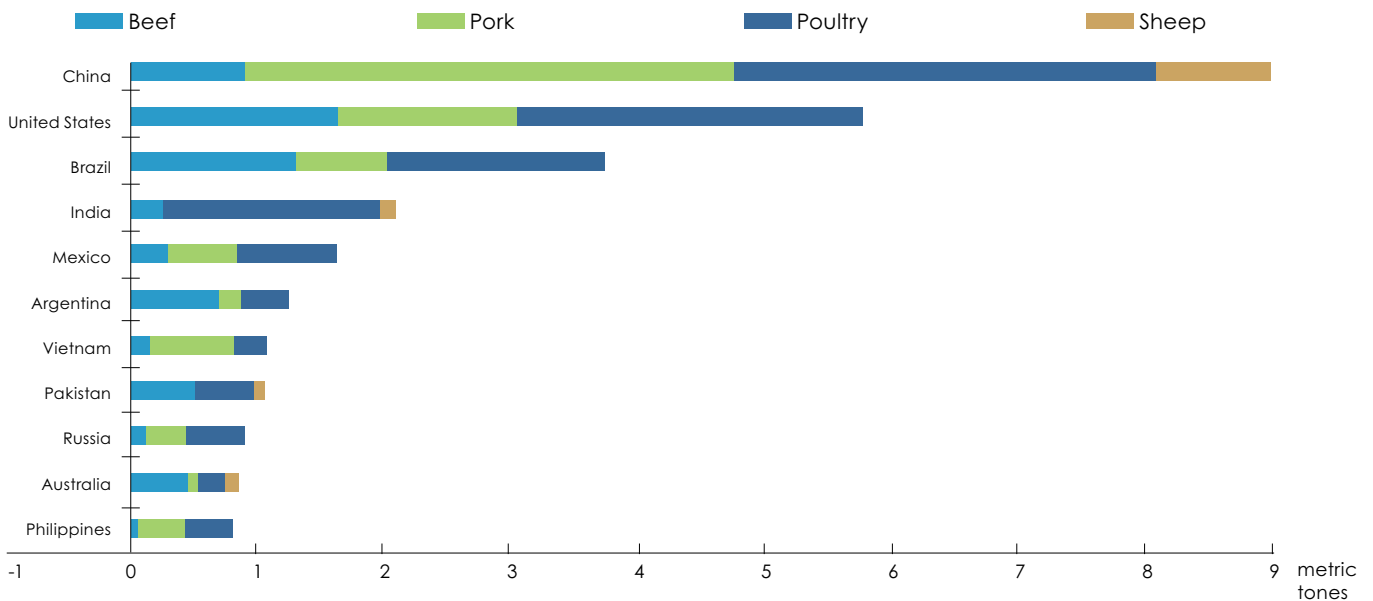
By 2028, the bulk of additional meat production is projected to come from developing economies. In the least developed countries, heavy reliance on small-holder farming structures and underinvestment in the livestock sector continue to weigh on technological improvements and commercialisation, affecting productivity gains.^[18]

Most Meat Production Growth Will Come From Developing Countries

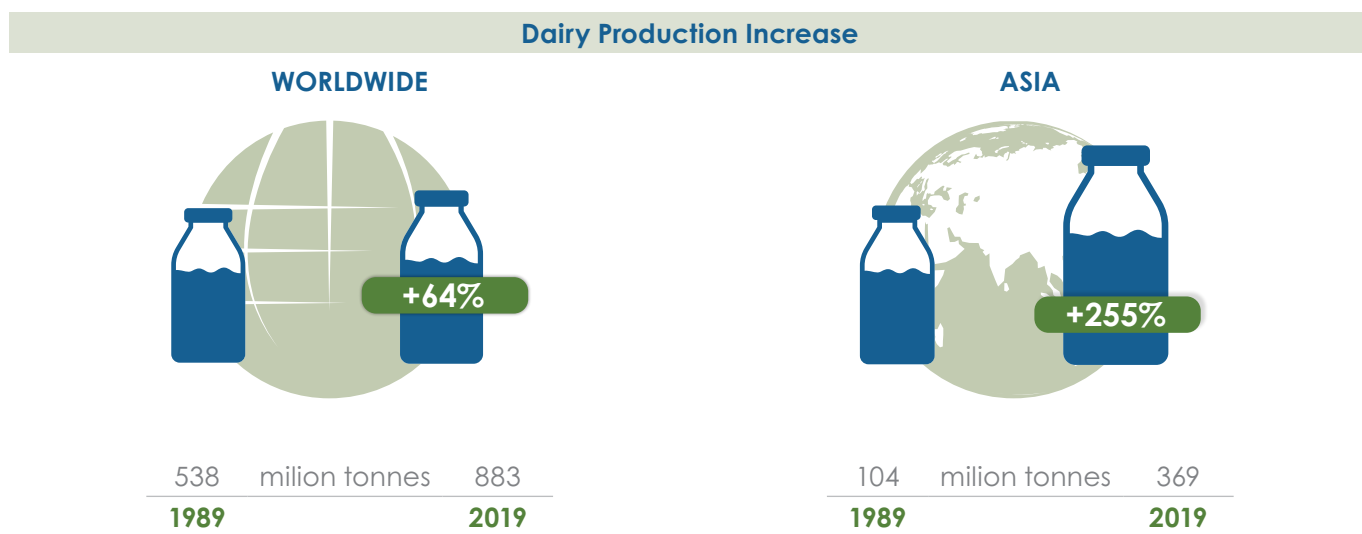
74% of Additional Meat Production from 2016/2018 to 2028 is Projected to Come from Developing countries^[18] versus 24% from developed countries.



Top Producers Will Include Asian Countries Such As China, India, Vietnam And Pakistan^[18]

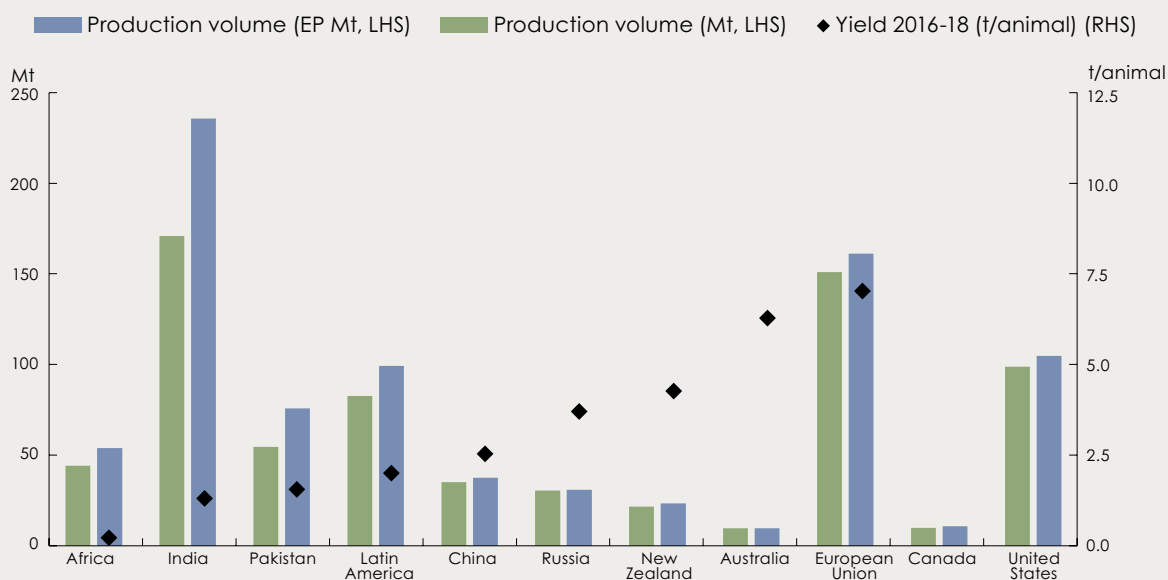


Looking at the example of dairy, milk production in Asia over the past 3 decades has increased by a whopping 255%, far outpacing the rest of the world's 64% growth. Unfortunately, the growth in milk production is mostly a result of increases in numbers of producing animals, rather than by a rise in productivity per head.^[19]



Developing Countries Tend To Have Lower Production Yields.

Milk Production and Yield in Selected Countries and Regions^[18]



Most farming in Asia is still done through smallholder farmers. We consistently observe a lack of investment, scale and technology all contribute to sub-optimal operations which reduce resource efficiency and constrain economic growth and community advancement opportunities for farm workers.

When we built AustAsia in Shandong back in 2010, we took particular care to introduce better animal genetics, feed quality, veterinary care and biosecurity measures. These efforts have borne fruit, with Frost and Sullivan ranking AustAsia top in China for 6 years running (2015 to 2021) based on average milk yield, far

exceeding the industry average even when compared on a global scale.^[15] High profit growth, in turn, has allowed AustAsia to improve the lives and livelihoods of the communities that it operates in. Based on internal management data, AustAsia currently provides employment to approximately 2,500 employees, almost 80% of whom are farmers, and many of whom have received upskilling opportunities.

In terms of climate impact, higher milk yields per cow means better resource utilization. This translates to less land, fewer animals, and ultimately reduced carbon emissions per volume of milk produced.^[21]



3. Circular Economies:

REUSE, REDUCE, RECYCLE

Finally, improving sustainability also means reducing waste. Our current linear consumption models continuously extract new resources which end up as waste products.

A circular economy describes markets that give incentives to reusing products.^[22] One way we can turn the food system circular is by collecting food waste and converting it into more useful products, a process known as “upcycling”.

Last year, we invested in Apeiron, a biodiesel company which upcycles food waste and used cooking oil into feedstock to be converted into biodiesel.

The Benefits Of This Are Three-Fold:

First, used cooking oil, which would otherwise fill up landfills or clog pipes, is being made into something useful. Second, the end-product, biodiesel, can be used to substitute for traditional fossil fuels, which would otherwise emit additional carbon and pollutive elements into the atmosphere. Third, using waste products instead of crops such as corn for biofuels is more ecological, because crops could be used for human consumption instead.

Other ways of re-cycling food waste is to use them as feed for farming. An exciting area here is with respect to insect protein. Companies are aiming to use insects such as black soldier fly larvae, which thrive on household food waste, as a source of protein in animal feed. We see potential applications of this feed for use in pet foods or aquaculture.

Finally, reducing waste can also pertain to packaging materials. Many drink products, for example, are packaged in glass bottles which are used just once before being disposed of in landfills. Not every consumer will go to the trouble of recycling the bottle, and even if everyone did, melting down a bottle and reforming it is also carbon intensive. This year, Proterra invested in ecoSPIRITS, a company which seeks to

reduce single-use glass bottles in the spirits and wines industry. ecoSPIRITS has designed an innovative distribution system which transports liquid products in reusable, bulk format carriers to outlets which dispense the product to consumers. These carriers are then returned to be washed and refilled for the next distribution cycle.

We believe that integrating systems such as these, which have sustainability at the core of their design, are key to making sustainable choices “easy” for everyone.

Change Takes Time

Currently, our food systems are unsustainable in terms of how production impacts the environment, even though individuals and society have been calling for change. It is easy to get discouraged when looking at where we are today versus where we would like to be. However, just because change is happening slowly, does not mean that it is not happening steadily.

We see investors increasingly seek not just financial return, but ethical and ecological targets in line with their moral ideals. Companies have started to report on sustainability goals to support society’s climate change targets.

Consumers have also become more amenable to changing age-old, culturally ingrained habits, be it paying for plastic bags at supermarkets, switching to plant-based meats and milks, or abstaining from shark’s fin soup.

We are heartened to see the very many people with good intentions toward making the world a cleaner, healthier place. And we are excited at the widespread changes that can be made once we have the systems in place that can make sustainable options accessible to everyone.

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