



Imagine 2050

The future of water, waste and energy

Global trends that Ireland will need to consider
when adapting for tomorrow

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Veolia sits at the heart of a changing world, where water, waste and energy will shape the businesses of tomorrow.

In this report, we bring together thinking around global trends that will impact our industry and society.

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“In a complex and interconnected world, changes in the future can occur faster than ever before, threatening both our existence and way of life. Meeting humanity’s rapidly growing consumption needs, with finite resources on a planet that is already under stress, requires more than greater resource efficiency. With three billion new middle-class consumers anticipated by 2030, new business models must be explored if we are to continue to thrive.”

Dr Nick Voulvoulis
Reader in Environmental Technology, Imperial College London

Contributors

Professor Tony Conway
University of Sheffield
Water Centre

Chris Deakin
Director
Chris Deakin Associates

Steve Evans
Director of Research
University of Cambridge

Dr Morgaine Gaye
Food Futurologist
Bellwether Food Trends

Dr Linda Hilton
Innovation Process and
Business Consultant

Ian Pearson
Futurologist
Futurizon

Dr Nick Voulvoulis
Reader in Environmental
Technology
Imperial College London

Richard Worzel
Senior Futurist
Futuresearch

Veolia customers

Virginie Helias
VP Global Sustainability
P&G

Brian Quin
COO of Labs
Intel

When industry makes key strategic decisions it must look further than the next five years. I don't have a magic crystal ball to tell the future, so when I look ahead I want solutions that make good business sense for us and our customers.



“One of the biggest challenges industry will face is ensuring a secure supply chain, as a result of scarcity of resources caused by a rapidly rising global population. If manufacturers want to continue to meet their production schedules in 2050, we believe they must change their mindsets to think circular rather than linear.

At Veolia, finding innovative solutions to resourcing issues is in our DNA. Our role is to anticipate the forces of change, and we selected three key customer industries: manufacturing; the pharmaceutical and chemical sectors; and the food and beverage industry, as this is where we believe a technology-driven closed-loop approach will have the biggest impact.

We have envisioned a future where industry has been re-engineered and redesigned so products and manufacturing processes can be completed without waste; where our energy needs to power facilities are met onsite from renewable sources, not taken from the national grid; and where we stop seeing waste as a cheap commodity and start managing it as the life source it is.

By bringing these three elements together in a network of water, energy and materials, we can save resources and create industries that will be fit for 2050. Come and join us on this journey and see how we can ensure we are manufacturing the future.”

Estelle Brachlianoff
Senior Executive Vice-President
Veolia UK and Ireland



From climate change to autonomous vehicles, the challenges we'll face in the next 35 years will stem from two key megatrends: population growth and advancing technology. Together, these will mean more people connecting in new ways, leading to an acceleration of ideas and innovation.

The global megatrends

66%

of the world's population will be living in urban areas by 2050

United Nations

55%

increase in global water demand expected by 2050

OECD (Organisation for Economic Co-operation and Development)

"By 2040, there will be roughly **an extra one million people**

living in our country. This population growth will require hundreds of thousands of new jobs and new homes."

National Planning Framework Ireland (2018)

Can a growing population with declining resources improve efficiency?

Trend #1

Population growth

Continuing population growth will lead to environmental degradation and changes to how we manage and consume energy, water and food. It is estimated we will double our resource and energy consumption by 2050, if businesses don't change. The question remains: can a growing population with declining resources improve efficiency?

34%

of the European population are estimated to be aged 60 years or over in 2050

United Nations



Legislating to regulate

By 2050, advances in big data could lead to companies and governments having a firmer grasp on factors influencing CO₂, which will make them better at reporting and managing emissions. Before that, we are likely to see changes in legislation that will enable this achievement, but perhaps not quickly enough.

Strategic development of a clear, long-term policy framework is essential for enabling businesses to progressively invest in low carbon technologies and to help them focus on emission reducing activities that will bring longer-term gains.

More people means more food

Food consumption will rise faster than population as the global middle class expands, leading to increased supply pressure and higher prices. We'll need to establish more dynamic, efficient and agile supply chains.

The pressure of requiring more food will lead to a more joined-up approach to managing water and energy use, creating a food, water and energy network.

"Advancements in innovative technologies, our society's need for constant connectivity, as well as our recent exposure to unprepared environmental events such as the Cape Town water shortage have led to socially responsible businesses rethinking their solutions and plans for sustainable growth and success."

Joe Higgins, Technical Director,
Veolia Ireland

Smarter ways to use space

Increasing urbanisation will mean a significant squeeze on space, affecting where and how we grow and manufacture. Growing cities will need industries to find more efficient ways of managing and moving urban water, energy and waste.

“The issue of waste management is critical for our industry. We are seeing population growth, increasing consumption and urbanisation which is increasing per capita waste generation – we play an important role in driving innovation to help find efficient ways of managing water, energy and waste.”

Virginie Helias, VP Global Sustainability, P&G

Did you know

Denser populations within cities will need smart solutions. Japan is experimenting with innovative underground farming. A single 25,000 sq ft site currently produces 10,000 heads of lettuce every day. These space efficient farms use 40% less power, create 80% less food waste and use 99% less water than current practices.

Changes in healthcare

An ageing population, growing costs of treatment and new medical technology will shape the future of healthcare. It is possible that in the next 35 years, artificial and lab-grown organs will create a more permanent solution for transplants. This means patients will no longer have to wait for life-sustaining organs. Scientists are already trying to grow human organs inside pigs in an attempt to tackle a shortage of donors.

How will advancing technology create new demands on manufacturing and resourcing?

Trend #2

Advancing technology

New technology deliverables will be accelerated by more powerful computers, enabling us to find previously impossible solutions.

“We are now moving past human self-sufficiency and are becoming more reliant on machine learning and artificial intelligence in our everyday operations. With Internet of Things and the power of data working alongside us, we can and will change how we monitor industrial activities to additionally reduce, reuse and recover our resources.”

Fergus Elebert, Regional Director, Veolia Ireland

3D printing and nanotechnology

3D printing will become embedded into supply chains by 2050. The combination of nanotechnology and novel materials will lead to bespoke production lines. Today, tooling and production mobilisation accounts for 70% of production costs and this could be reduced to 10%.

“3D printing is a genuinely disruptive technology. Currently, we see it as a way of replacing spare parts, but it will eventually be used for finishing operations”

Steve Evans, Director of Research, University of Cambridge

New skills in the workforce

Robotics and the rise of artificial intelligence will replace many low skill and repetitive job roles. The wider industry impact will see human workforces reskilling and upskilling for the workplace, but the question remains: how will advancing technology create new demands on manufacturing and resourcing?

“Autonomous machines will be able to handle more complicated decisions and be able to think more quickly and effectively than humans. They may be able to learn from and self-correct mistakes but will still require humans to interact with them.”

Brian Quin, COO of Labs, Intel

Smarter solutions

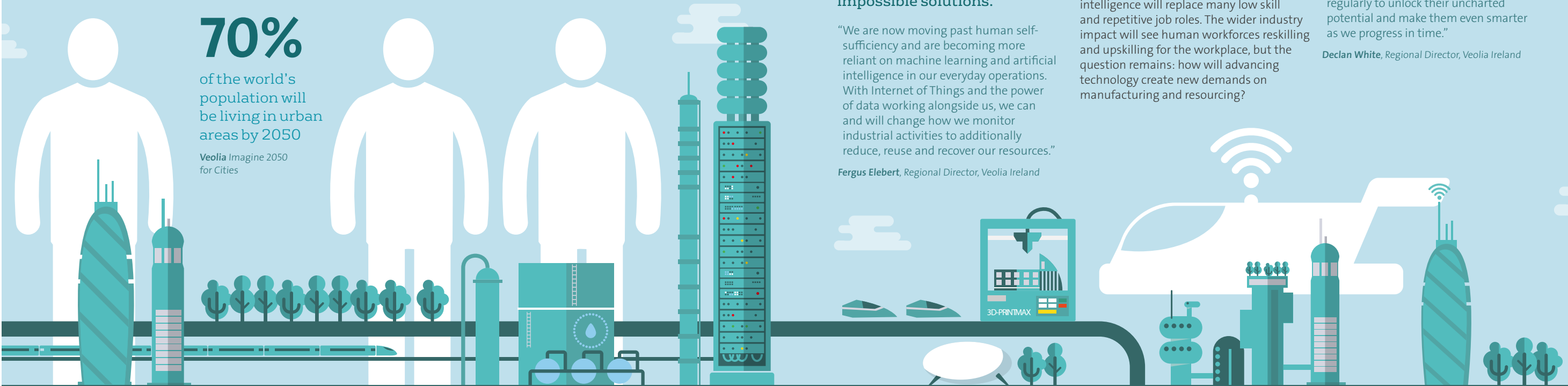
Smart utility metering will be taken to a new level, with more intelligent and responsive systems.

“By 2050, these systems will be more intelligent and will take corrective measures by themselves to optimise utility usage. It will then be our role to continuously improve these systems and test them regularly to unlock their uncharted potential and make them even smarter as we progress in time.”

Declan White, Regional Director, Veolia Ireland

70%
of the world's
population will
be living in urban
areas by 2050

Veolia Imagine 2050
for Cities



Advanced new materials and narrowing gaps in international labour costs will create a level playing field for innovation.

Manufacturing Industry

“

The same factory might be able to produce an automobile, followed by a washing machine, followed by a dishwasher, followed by an industrial crane. That all comes from the concept of 3D printing.”

Richard Worzel, Senior Futurist, Futuresearch



How can businesses adapt to bring about new efficiencies?

Trend #1

Hyper-efficient business models

Manufacturing businesses will need to be increasingly adaptive to prosper, thinking harder about how, where and what they make.

Relocating around customers and resources

Businesses will need to think about resource use, consumption and transport costs. Manufacturers will have to decide whether to be closer to raw materials to guarantee supply, or closer to customers to meet demand.

“While our customers will always come first, we generally try to work collaboratively with them from the beginning to design innovative solutions that are in budget, scope and can also be delivered in line with their specifications. An important part of that is marrying our historical data with measured machine learning to manage all parties’ risks and ensure feasibility.”

Sinead Patton, Regional Director, Veolia Ireland

Adaptable production lines

Factories will increasingly be able to create a range of different products by physically reconfiguring to meet changing demand.

Selling benefits, not products

A circular economy requires keeping resources in use for as long as possible, before deconstructing and re-engineering them to create new products. Today, manufacturers only monitor products for the warranty period. In the future, more manufacturers will retain ownership and responsibility for their products and their ongoing performance. Customers will buy the benefits, not the product.





What will the leaner and greener materials of the future mean for innovation?

Trend #2

New generation materials

Today's technologies are limited by old materials. Future materials will be lighter, stronger and greener, providing new opportunities for innovation.

Biological materials

The need for greener products that are cheap, strong and plentiful will lead to new perspectives on naturally sourced materials. Manufacturing cars uses significant resources, expensive tooling and excessive energy.



Did you know

Phoenix, a concept car designed by Albrect Birkner and Kenneth Cobonpue, challenges convention by using lightweight and natural materials, such as bamboo, on a frame that is built by hand using minimal tools and energy.

Technological alternatives

Research and development will lead to more lightweight yet durable materials, providing manufacturers with the opportunity to produce structures using less material and energy.

“Graphene and nanotubes are several times stronger than steel and will be fairly cheap by 2050. They'll help us make structures much more elegant, and use far less material.

Ian Pearson, Futurologist, Futurizon

Waste as a tradeable asset

The concept of waste will be radically different in 2050. Manufacturers will see by-products as something of value that they can sell to other businesses or exchange for credit.

“We are likely to see community pooled waste, where manufacturers trade materials that are not useful to them with other businesses. This might take the form of a credit system based on the value of these materials.”

Richard Worzel, Senior Futurist, Futuresearch



How should Irish manufacturers implement disruptive robotics?

Trend #3

Rise of robotics

Industrial robots are on the verge of revolutionising manufacturing. As they become smarter, faster and cheaper, they'll be called upon to do even more.

A new era of efficiency

As humans move off the production lines and into new engineering roles, factories will be able to operate longer, faster, more safely and with less waste – making way for greater productivity and quality assurance.

Connected thinking

Through the Internet of Things (IoT), data capture will greatly benefit the industry. Advanced analytics platforms will enable manufacturers to evaluate big data sourced from connected robotics to improve processes. Sensors will transmit data to alert and initiate preventative maintenance and adjust production speeds according to the market.

Bringing it back home

The advancement of robotics may reinvigorate manufacturing in Ireland, making local production more cost-effective than importing. Robotics developments will level the playing field and reduce the advantage enjoyed by China and other low-cost markets.

The short truth

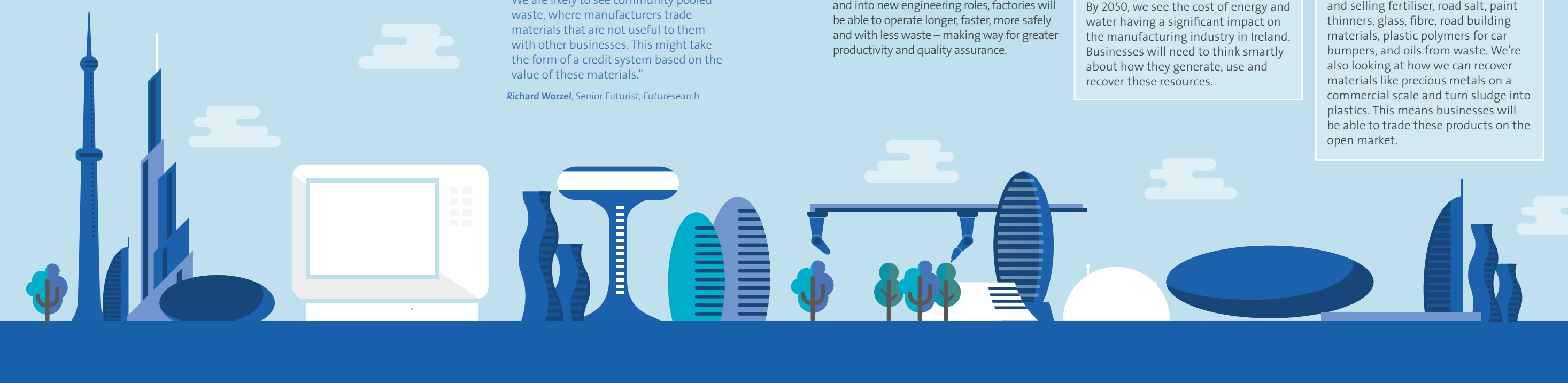
By 2050, we see the cost of energy and water having a significant impact on the manufacturing industry in Ireland. Businesses will need to think smartly about how they generate, use and recover these resources.

Tangible solutions for now

Our Hubgrade smart monitoring centres already monitor heat, electricity and gas usage in real-time. Central control centres remotely adjust systems to ensure constant optimisation, and customers can also be identified, prioritised and notified when improvements could be paid for by cost efficiencies.

The miniaturisation of waste treatment systems may also reduce centralised plants to facilities, processing rubbish onsite. Smaller businesses can potentially see shared facilities installed and combined with rapid advances in extraction from waste, this may help all businesses achieve a 100% recovery rate.

Globally, we're already extracting and selling fertiliser, road salt, paint thinners, glass, fibre, road building materials, plastic polymers for car bumpers, and oils from waste. We're also looking at how we can recover materials like precious metals on a commercial scale and turn sludge into plastics. This means businesses will be able to trade these products on the open market.





The pharmaceutical industry will ensure better quality healthcare and the chemical industry will become a key enabler of emission reductions, with both industries enabling wider positive change across other sectors.

“

“Biotechnology will radically change both industries. For chemicals, it will have a significant impact by creating kinder fertilisers and pesticides for the food industry. In pharma we’ll see drugs that can cure rather than treat serious illnesses.”

Dr Linda Hilton, Innovation Process

Can new business models subvert expectations?

Trend #1

New dynamics

Traditional ways of working will give way to more dynamic operations and models. This will include increased collaboration across both industries and reimagining how products are manufactured and sold in order to create new efficiencies.

Collaboration and convergence

The convergence of technologies will create opportunities to partner with competitors, customers and businesses in other sectors, leading to more innovative products.

Shifted value

Within the pharmaceutical industry, increasing costs and declining healthcare investment are creating a squeeze. We expect a growing number of alternative business models like pay-for-performance emerging to forge a closer link between value and effectiveness.

Localised production

Advances in 3D printing technology might make it possible for the pharmaceutical industry to stop manufacturing entirely, instead focusing on blueprints and leaving most production to chemists.



Did you know

Google has partnered with Swiss pharmaceutical firm Novartis to develop its smart contact lenses. Novartis wants to develop alternatives that include the possibility of ‘intraocular lenses’ – contacts that are inserted permanently into the eye to correct vision.



Did you know

Johnson & Johnson has started to introduce pay-for-performance drugs within Europe. In the UK, they have agreed to reimburse Britain’s National Health Service when patients don’t respond to their blood-cancer drug, Velcade. Other companies such as GSK and Roche have also been discussing these models.

As for the chemical industry, they are pioneering the concept of chemical leasing. This means shifting from selling chemical goods to selling chemical services. This idea has received renewed interest and support from the United Nations Industrial Development Organization.



What impact will personal health have on the pharmaceutical industry?

Trend #2

Personalised health

In 2050 we expect a shift from generic drugs to customised treatments designed around the patient, rather than the illness.

Did you know

Bio3D produce advanced robotic 3D printing systems suitable for research and scientific applications, such as printing cells, bacteria, proteins, bio-gels, polymers and food materials. Their aim is to bring affordable and reliable 3D printing and bioprinting to every researcher, scientist, doctor, engineer, educator and student.

In 2015, the FDA approved the first 3D-printed drug, Spritam, from Aprelia Pharmaceuticals, showing that the technology exists but that regulations will have to change for it to be implemented.

Data will drive customisation

We'll see a considerable increase in the volume and sophistication of data, particularly through wearable devices, such as today's Fitbit and Apple Watch, which will bring about more tailored treatment plans. The testing and launch of new drugs may also speed up through access to live patient data, reducing dependence on long and costly clinical trials.



What are the challenges and opportunities to biotechnology?

Trend #3

Biofuture

Biotechnology is a different way of producing chemicals and pharmaceuticals, harnessing the power of living cells and getting them to work in predictable and controllable ways.

An evolving opportunity

McKinsey claims that biopharma is growing at more than double the rate of conventional pharma and this is expected to continue into the foreseeable future. We also expect to see companies, particularly those related to food and agriculture, focus on the types of molecules that exist within their waste. These could ultimately be sold to the pharma industry.

The short truth

By 2050, we see the pharmaceutical and chemical industries facing increasing regulation around how they use and dispose of resources. These industries need to design efficiency into products from a concept stage – rather than just treating the generated waste at the end.

Tangible solutions for now

By taking a holistic view towards infrastructure, we can enable a circular economy by connecting various nearby operations to use a single treatment plant for waste disposal, ensuring optimal tonnage capacities are met and transport costs and carbon emissions are reduced. Depending on the stream, the sources can be consolidated, transformed and reused as fuel for other manufacturing processes. For example, Veolia is already extracting glucose from organic waste to be used as feedstock for production, and this reduces costs by avoiding the need to grow and harvest crops.

In addition, with recent advances in sensor technology, it is possible for local health authorities to monitor their municipal water supplies to detect early signs of contamination and disease, and also share this data externally to ensure preventative treatments are available by keeping pharmaceutical companies one step ahead of illness.



We need to revolutionise the way we source, produce and consume food to feed a growing population.

Food and beverage

30%

of the world's population already eats insects as part of their diet

Food and Agriculture Organization of the United Nations

What happens when our appetite for meat exceeds supply?

Trend #1

Food, but not as we know it

The types of food we consume may not change, but where it comes from will be radically different.

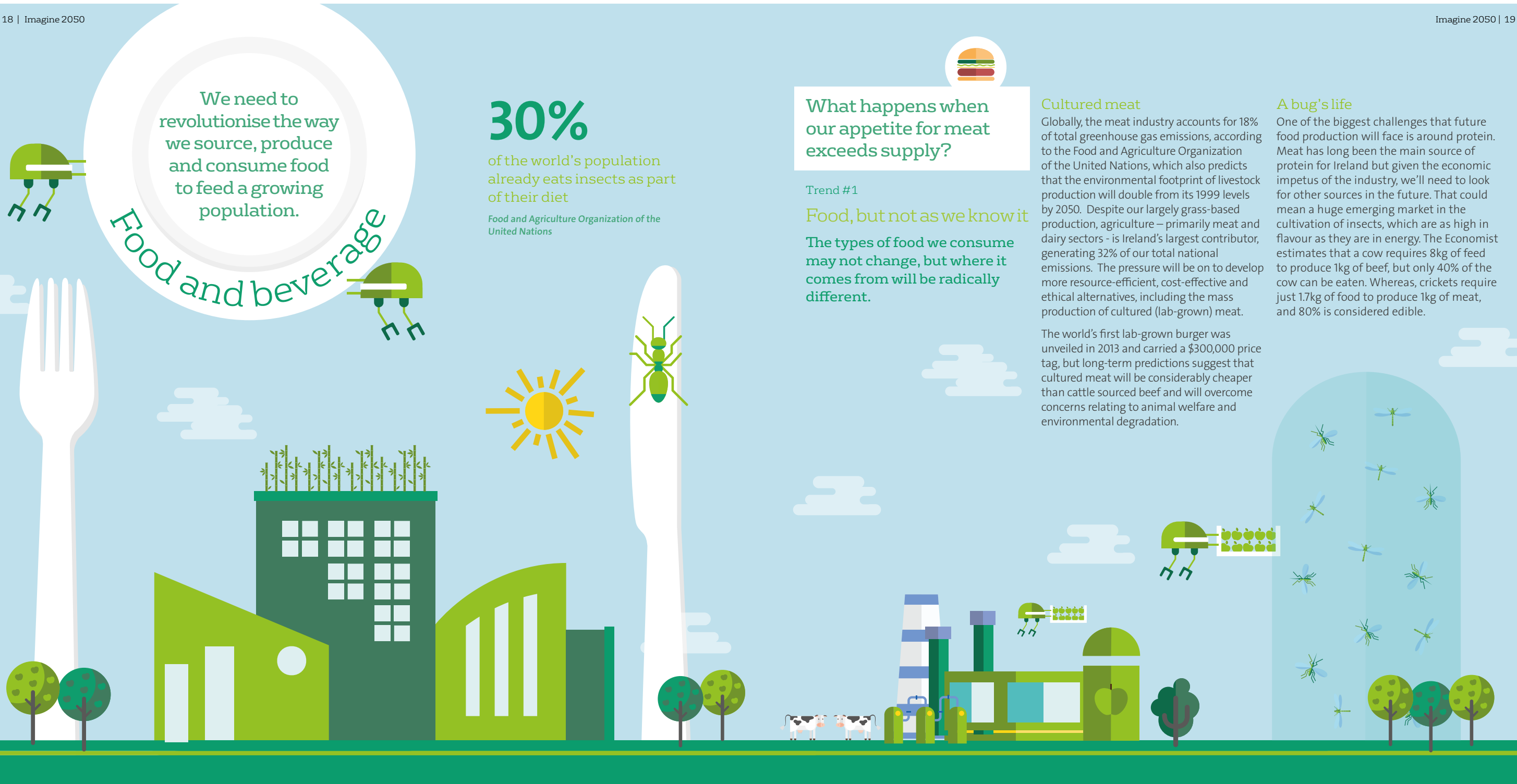
Cultured meat

Globally, the meat industry accounts for 18% of total greenhouse gas emissions, according to the Food and Agriculture Organization of the United Nations, which also predicts that the environmental footprint of livestock production will double from its 1999 levels by 2050. Despite our largely grass-based production, agriculture – primarily meat and dairy sectors - is Ireland's largest contributor, generating 32% of our total national emissions. The pressure will be on to develop more resource-efficient, cost-effective and ethical alternatives, including the mass production of cultured (lab-grown) meat.

The world's first lab-grown burger was unveiled in 2013 and carried a \$300,000 price tag, but long-term predictions suggest that cultured meat will be considerably cheaper than cattle sourced beef and will overcome concerns relating to animal welfare and environmental degradation.

A bug's life

One of the biggest challenges that future food production will face is around protein. Meat has long been the main source of protein for Ireland but given the economic impetus of the industry, we'll need to look for other sources in the future. That could mean a huge emerging market in the cultivation of insects, which are as high in flavour as they are in energy. The Economist estimates that a cow requires 8kg of feed to produce 1kg of beef, but only 40% of the cow can be eaten. Whereas, crickets require just 1.7kg of food to produce 1kg of meat, and 80% is considered edible.





At what point will food become personal?

Trend #2

Emotional investment

The expectation that we will have complete value chain transparency will lead to new production models and enhanced consumer relationships.

Deeper consumer connections

We can already see consumers increasingly demand transparency on how our food is grown, sourced and made. This is likely to evolve into a new type of relationship, where the traditional boundaries of businesses and customers blur.



Consumers will have a personal investment in products and food. Purchasing will be even more about relationship and trust."

Dr Morgaine Gaye, Food Futurologist, Bellwether Food Trends

Technology enabling bespoke nutrition

Data and advances in precision farming mean that it's increasingly possible to grow, cultivate and produce products that are unique to individual customers. The challenge will be how this is delivered without having a negative impact on the environment.

Technology is already enabling the beginnings of bespoke nutrition.



Did you know

Nima is a portable sensor that quickly tests liquid and solid foods for the presence of gluten. The device connects with a user's smartphone to display the amount of gluten that's present within the food, giving them more control over what they eat.

"We've already got tractors which know exactly where they are on the field, and exactly how much fertiliser each square metre of land needs. But what will happen is that this becomes linked to an individual customer. They will have a few square metres of field, growing their wheat or barley, based on their particular needs."

Ian Pearson, Futurologist, Futurizon



How will what we throw away today become something we savour tomorrow?

Trend #3

From waste to want

30-50% of all food currently produced is lost before reaching a human mouth. Current practices waste up to 50% of all food produced. To feed a population of over 9 billion by 2050, we need to get smart about food waste today.*

*Source: The Institution of Mechanical Engineers

From by-product to new product

In addition to the food waste reuse and recovery processes we see today, we expect to see highly innovative new uses for by-products.



Did you know

Piñatex is a natural and sustainable non-woven textile made from pineapple leaf fibre that looks and acts like leather. A by-product of converting the leaves into textile is a biomass which can be converted into fertiliser, giving additional income to the farmers.

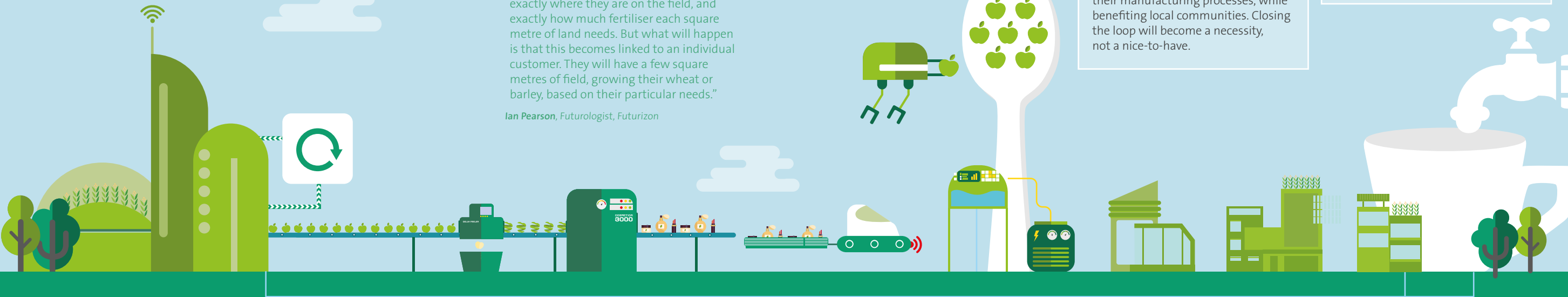
The short truth

By 2050, we see the food and beverage industry needing to focus on the recovery and redistribution of the energy and water used throughout their manufacturing processes, while benefiting local communities. Closing the loop will become a necessity, not a nice-to-have.

Tangible solutions for now

By designing water and wastewater treatments plants that are flexible in their source intake, a site's longevity can be substantially improved, enabling continuous production of food-related products to keep up with consumer demand without any disruptions. In some cases, the treated water may be reused for other onsite manufacturing processes as well as cooling.

In addition, through a process similar to the body converting energy into calories, we can now turn food waste into compost and fertiliser for soil enrichment, heat for fish farming and gas to power homes. In Leeming in the UK, Veolia is transforming inedible ice cream by-product into biogas through anaerobic digestion. The plant can process up to 80,000 tonnes per year of commercial food waste to generate enough gas to supply nearly 4,000 homes a year.





The impact on us

As the percentage of the people living in cities rises every year, resource scarcity and environmental degradation will be felt most acutely in urban centres. It will also exacerbate inequalities within Ireland's cities - and between cities.

"[Dubliners] will want somewhere welcoming to live, at a reasonable location from where they work. They will want good public transport and clean urban spaces. They will want to spend more time with their family and at leisure, and spend less time in traffic."

A vision for Dublin 2050, Dublin Chamber of Commerce

What will life be like in 2050?

In reality, we expect the future to lie somewhere between two extremes of cities, which tend to be the drivers of change in most countries. One will be reliant on technologies in a circular, collaborative and dense city context, while the other will try to sustain in a linear and individualised culture within a sprawling environment.

Extreme #1

Collaborative practices in a compact city

In this scenario, the future of urban lifestyles is based on collaborative consumption. Collectivist values have led to new models of social, political and economic participation and an emphasis on shared ownership.

Mutualism and local self-reliance are the result of a concern for social equity and environmental sustainability.

The effects in our view

With strong local governance and resource prices that drive social and environmental change within the city, there is substantial emphasis on system-level planning, optimising land use, buildings, services and infrastructures to reduce demand and improve resource efficiency.

Extreme #2

Individualised materialism in dispersed spaces

In this second scenario, the future of urban lifestyles is highly materialistic and individualistic, within a hyper-mobile, globally connected and largely unregulated market economy. Short-term private consumption and ownership is prioritised over long-term communal thinking.

A preference for detached, single-family homes creates suburban sprawl and gated communities. This segregates an increasingly stratified society and private motorised transport still dominates transportation.

The effects in our view

Resource efficiency at the household level improves due to emerging technologies and intelligent control systems. However, the lack of a comprehensive policy, weak institutions and resource prices that do not take all externalities into account, mean that overall consumption of water, waste and energy remains fairly high.

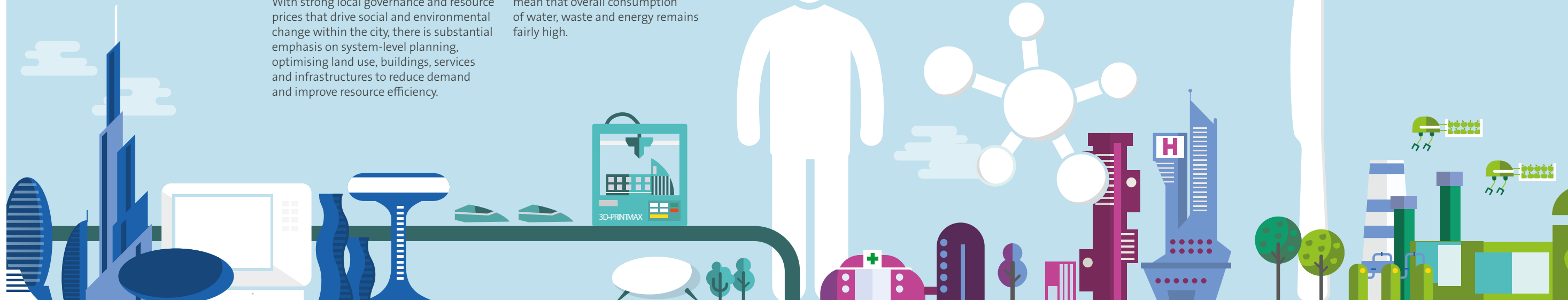
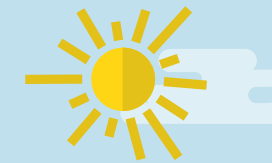
As one of the world's biggest providers of water, waste and energy services, Veolia is integral to the future of society. But this important role also comes with a position of responsibility.

That is why we are actively looking, listening and seeking out answers to some of the significant challenges that will shape the future of our world. And only by working closely with our customers, partners, people and communities can we help to make the difference.

Whatever industry you are in, whether it's manufacturing, pharmaceutical and chemical, food and beverage, or any other, speak to us today about how we can help you to get ahead in the future.

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