

Iceland: Transcending global challenges

The small Atlantic nation is a powerful role model for the rest of the world

SHUTTERSTOCK: OLEG SENKOV



The uniquely colorful city of Reykjavik is just a few hours from both mainland Europe and the U.S.'s east coast

In the midst of a pandemic and global investor jitters, this May the Icelandic government issued bonds to the value of nearly \$600 million that were oversubscribed seven times. Why is there such confidence in the country and its ability to overcome the COVID-19 crisis quickly?

“We have a good history of rebounding fairly strongly,” Bjarni Benediktsson, Minister of Finance and Economic Affairs replies. He’s being too modest: after 2008’s financial crisis, when its three biggest banks collapsed in a matter of days and 80 percent of its stock market was wiped out overnight, Iceland staged one of the fastest economic regenerations ever recorded.

Once again in 2020, it has responded to challenge with a sense of community and resilience, backed by the wealth of experience it gained a little over a decade ago. “Since then, we’ve seen really strong, long-term growth by international standards but had learned the importance of building buffers for the future. When COVID hit, we had a shrunken public debt level, sustainable household and corporate debt, ample currency reserves and well-capitalized banks. That put us in a good position,” Benediktsson explains.



Bjarni Benediktsson
Minister of Finance and Economic Affairs



Gudlaugur Thór Thórdarson
Minister of Foreign Affairs and International Development Cooperation

equally effective due to the rapid deployment of a substantial test, track and trace program. Collaborating on this are health authorities, the National University Hospital of Iceland and local biopharmaceutical firm deCODE genetics, one of many innovative companies Iceland has nurtured in order to build an economy focused on green industries, sustainable fishing, knowledge-based sectors and tourism.

The government has helped foster these businesses by ensuring nearly half of the young population is tertiary educated through the nation’s industry- and research-focused universities. As a result, Icelanders have wide-ranging advanced skill sets. “The country is at the global forefront in terms of the workforce’s technical and engineering capabilities, for instance,” says Eyjólfur Magnús Kristinsson, CEO of Advania Data Centers, a leader in one booming sector taking advantage of Iceland’s abundant renewable energy.

Businesses also benefit from the economy’s openness and flexibility, plus an extensive network of international partnerships. “Iceland is in the middle of the Atlantic Ocean and has a small population of 360,000. We rely heavily on trade. The U.S. is our largest trading partner but we have access to European markets through our memberships of the European Economic Area and the European Free Trade Association, as well as bilateral agreements covering the majority of the world,” notes Gudlaugur Thór Thórdarson, Minister of Foreign Affairs and International Development Cooperation.

The founding member of NATO also plays a significant role in other international bodies, states Thórdarson. “Even though Iceland isn’t big, we see it as our duty to make our voice and values regarding issues like human rights, rule of law and democracy heard. We participate proactively in the United Nations, for example, especially in the Human Rights Council. In the international arena, other nations welcome our experience in areas like gender equality, sustainable fisheries and renewable energy.” The country’s innovative approach to sustainability overall sets an example for others, adds Benediktsson. “Iceland has much to offer, not just regarding environmental protection but also in terms of public finances and the way we run our society.”

“We’ve seen really strong, long-term growth by international standards but had learned the importance of building buffers for the future.”

Bjarni Benediktsson, Minister of Finance and Economic Affairs

He summarizes Iceland’s economic response to the crisis: “We have extended support to the labor market, provided loan guarantees to viable companies, offered compensation to businesses that were required to close their doors, and increased public investment plus research and development funding.” These measures have been successful: by May, it was business as normal for much of the population, with private consumption levels rising higher than they had been 12 months before. The country’s healthcare response has been

Land of fire and ice endeavors to reignite tourism

Iceland's tourism industry had enjoyed record growth before COVID-19 struck

Iceland's incredible landscapes blend some of the world's most eye-catching scenery into a stunning mosaic of mountains, volcanoes and glaciers with centuries of rich Viking culture and tradition. Despite its raw and unpredictable weather, the country has become a tourism hotspot, attracting travelers in droves as word spreads of its array of natural treasures and cordial hospitality. Tourism now generates around 10 percent of gross domestic product.

Data compiled by the Icelandic Tourist Board shows international visitor numbers surged to more than 2 million in 2019, up nearly 40 percent from just four years earlier. Like every other country popular with tourists, restrictions on foreign travel and disruption to flight schedules has reduced the number of arrivals, but the nation is well placed to bounce back when international travel patterns return to some sort of normal. Indeed, the country's remoteness and relatively small population have been key strengths during the early phases of pandemic, as they helped reduce the rate of infection.



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"We are putting more money into marketing Iceland as a tourist destination: the government has put forward an extra 1.5 billion Icelandic krona (\$10.84 million) to this end," reassures Pétur Þ. Óskarsson, CEO of Promote Iceland. "We are trying not to lose sight of the main goal or let the wind blow us off the path we know is the best for us in the long term. We are keeping with the strategy that we already formulated."

Not only is Reykjavik the attractive capital and main gateway to Iceland thanks to its modern international airport, but it is by far the most important urban area and also holds the crown as the world's most sustainable city. Many visitors spend at least a couple of nights in Reykjavik before or after touring the country's many natural wonders. Reykjavik identified tourism as one of the sectors that could lead to full employment after the economic crash of 2008. That was a successful move and the sector's growth happened so fast that infrastructure development lagged behind for a number of years," says Mayor Dagur B. Eggertsson. "For those who want to experience the northern lights, bathe in the Blue Lagoon, be close to nature, take some excursions, eat well and live the city life, Reykjavik is top of their bucket list. Over 95 percent of our guests say they would recommend Reykjavik to their closest friends."



Dagur B. Eggertsson
Mayor of Reykjavik

"Reykjavik's past has been quite green, but my ambition is for our future to be even greener. The way forward is to focus on innovation."

Dagur B. Eggertsson, Mayor of Reykjavik

In addition to tourism, the capital is leading the nationwide charge to sustainability and green energy through a heavy focus on sustainable activities and ideas, knowledge-based industries and creative enterprises, including the film industry and innovation-related enterprises to spur new growth and business opportunities. "Coming out of this crisis we need to have a very green focus on the future; from the way we manage our waste, for example, to look at it as a resource and not just something to throw away, to how we can make transportation greener using domestically generated, 100-percent green electricity as energy instead of fossil fuels," Eggertsson continues.

"Reykjavik's past has been quite green, but my ambition is for our future to be even greener. The way forward for Reykjavik is to focus on innovation, knowledge-based and creative industries. We are quite a young city with lots of students, and we like it that way."



Invest in
Iceland

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Iceland shows the world how to make energy greener and cleaner

The world's biggest green energy producer per capita, Iceland harvests an astonishing 100 percent of its electricity from hydropower and geothermal sources. Uniquely, Iceland has proved to the rest of us that it is possible to have an energy system that is totally focused on renewables. Geothermal resources provide about 27 percent of electricity and 65 percent of all energy needs, with Reykjavik Energy Group leading that sector. Its CEO, Bjarni Bjarnason, explains why the heat stored within Iceland's volcanic terrain is so important.

In the first 1,000 years of settlement in Iceland, volcanic activity was a curse to the nation, but 90 years ago we managed to turn this curse into a blessing. In 1930, we introduced geothermal heating for buildings in Reykjavik and systems have been developed all over the island since then. Today, 90 percent of the space heating in Iceland is from this resource. By 1976, we had also started producing electricity through geothermal energy and there are six relatively large power plants in the country. It has so many advantages: first of all, it's very economical. Secondly, it is green and non-polluting—in Reykjavik, we have saved 130 million tons of carbon dioxide (CO₂) emissions by heating houses this way. Geothermal energy and geothermal projects are certainly among the best things that have happened to this country.

"Our Hellisheidi plant is possibly the largest geothermal power plant on earth in a single location."

Bjarni Bjarnason, CEO, Reykjavik Energy Group

Owned by three municipalities, Reykjavik Energy operates two geothermal facilities and one hydroelectric plant. Overall, the group and three of its four subsidiaries—Veitur Utilities, ON Power and Reykjavik Fibre Network—provide a majority of the island's electricity distribution, heating, water, sewerage systems and a fiber-optic data network. How would you sum up the group's contribution, especially in relation to geothermal energy?

Reykjavik Energy is the main power and utility company on the island. We provide basic services that are the fundamentals for quality of life. In terms of geothermal energy, our Hellisheidi plant is possibly the largest geothermal power plant on earth in a single location. It produces 300MW of electricity and an additional 200MW of thermal energy for district heating in Reykjavik. Our other geothermal plant has a generation capacity of 120MW.

About 85 percent of Iceland's energy is derived from renewables, the highest level in any nation. The country wants to grow this further by reducing



fossil-fuel use in vehicles. Reykjavik Energy aims to play a role in that and is rolling out an extensive network of charging points. Has the population been persuaded to go electric?

We started installing fast-charging stations in 2014 and have constructed about 60 of them around the island so far. Iceland is probably the best country in the world for e-mobility because we have a favorable climate that is optimal for batteries, we travel short distances and we have low-price renewable power. There are only benefits to driving electric cars and little excuse not to in Iceland. We have seen a very sharp increase in the number of electric vehicles on our roads and now rank number two in the world after Norway for electric cars per capita. Our aim is to be number one.



Bjarni Bjarnason
CEO, Reykjavik Energy Group



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HS Orka's Svartsengi geothermal plant is one of six in Iceland

Reykjavík Energy is at the forefront of innovation and development on climate issues, aiming to achieve carbon neutrality by 2030. Can you tell us about your revolutionary Carbfix technology, which is recapturing and storing 35 percent of CO₂ emissions from the Hellisheidi power plant?

Carbfix started as a pure research project back in 2007. Seven years later, it had already been built on an industrial scale and it's working excellently. It captures and permanently disposes of CO₂ from emissions. The CO₂ is dissolved in water and injected into underground basaltic rock formations. Within two years, natural processes transform 90 percent of it into stone. We are not taking the CO₂ and storing it in depleted oil fields, for example, like standard carbon capture storage systems do. We are turning it into stone where it will stay forever. We are taking the CO₂ out of the carbon cycle and this is unique—there is no other project like it. There are so many benefits from this technology, plus the price is low compared to other methods and the cost of European emission allowances for releasing CO₂.

The basaltic rocks on earth can store more CO₂ than all the emissions that have ever been emitted by human activity. The question now is, can Carbfix be applied in other countries and other circumstances? If we can speed up progress in this area and help cut global emissions, this will be Reykjavík Energy's most important contribution to the world. We have launched a new company, Carbfix Ltd., to share our experiences and have already received significant attention from businesses and governments worldwide. We are open and invite everyone to come and see what we are doing, what works well and what doesn't. We are also running a similar project for the poisonous hydrogen sulphide (H₂S) gas that power plants emit in small quantities. Every day, 75 percent of H₂S emissions from our power plants are captured and stored with this technology.

The group staged an incredible turnaround since it almost went bankrupt following 2008's financial crisis. How did Reykjavík Energy transform into the modern, low-debt entity it is today?

We decided to look at the crisis as an opportunity, because every crisis is an opportunity. There are so many things you can do in a crisis that are unthinkable in normal operations. A new board set up a six-year recovery plan, which delivered on its promises. Our experience put us in a good position to manage the COVID-19 pandemic. We reformed our crisis committee and have stayed one step ahead. Thanks to our excellent fiber-optics cable network, which equips every home in Reykjavík with 1 gigabit speed, we could work just as easily from home as if we were in our offices. Our best achievement in transforming Reykjavík Energy is probably our work on gender equality—55 percent of our management positions are now held by women. Determination is all you need if you want to achieve equality, it's very simple but it has to come from above.

Zero-waste energy

The geothermal industry's byproducts are powering a circular Icelandic economy

An increasing focus on recycling Iceland's natural resources is bringing economic, societal and environmental benefits. Possibly the clearest illustration of this can be found about 30 minutes south west of Reykjavík: HS Orka's pioneering Resource Park.

HS Orka, the country's third-largest energy company, is privately owned by domestic and international pension funds, including the U.K.'s Ancala Partners. The firm generates reliable, low-cost electricity and hot water for its customers through a 100-percent green energy portfolio, which contains the Svartsengi and Reykjanes geothermal power plants that have a total capacity of 174MW, as well as a 10MW hydroelectric facility. In the 1990s, it set up the unique Resource Park near its geothermal plants in order to fully and sustainably exploit their excess resources. "Our operations



Tómas Már Sigurðsson
CEO, HS Orka

"We would like to invite outsiders to come and utilize our untapped resources. The opportunities within our park are immense."

Tómas Már Sigurðsson, CEO, HS Orka

generate multiple streams: electricity, clean hot and cold water, waste water, carbon dioxide, methanol and effluent heat produced from our cooling processes. All of these can be reused and repurposed to serve a variety of industries, and we have worked closely over the years with universities, scientists and our own specialists to build a park that enables this," states Tómas Már Sigurðsson, HS Orka's CEO.

The eco-industrial park currently houses Icelandic businesses employing about 1,500 people, which are creating sustainable products in diverse, often high-tech sectors ranging from cosmetics, agriculture, aquaculture, biotechnology, data farming, bottling, fish drying and processing, to tourism and the world-famous Blue Lagoon geothermal spa. Together, HS Orka and the residents have formed a symbiotic cluster of environment-friendly innovation. "Now, we would like to invite outsiders to come and utilize our untapped resources. The opportunities within our park are immense, as we have plenty of open land, an efficient large-vessel harbor and the international airport is literally a stone's throw away," asserts Sigurðsson. He highlights two sectors with good potential: hydrogen production and the food sector, including greenhouse agriculture, food processing, on-land algae and fish farming—as HS Orka's waste resources include lava-filtered clean sea water heated to 35 degrees Celsius, using the park to cultivate tropical fish is eminently feasible.

This year, the independent energy company secured \$210 million in financing, which will be used to broaden its portfolio, boost geothermal energy production by 30MW and further develop the Resource Park. "We want to continue our success on this sustainability journey and deliver on our vision of a society without waste," Sigurðsson concludes.

A paradise for data centers

Iceland's cool and steady climate, competitive energy costs and excellent connectivity make it the ideal spot for global computing

As Heidar Guðjónsson, CEO of Vodafone Iceland points out, "The fourth industrial revolution is founded on computational power and data transfer." These have been fueling the development of the Icelandic data center industry, to the point that it now constitutes 1 percent of gross domestic product. Vodafone is the latest to join the sector, following in the footsteps of established experts like Advania Data Centers (ADC), the largest player and an early entrant in the market, Verne Global and Etix Everywhere Borealis. ADC's CEO, Eyjólfur Magnús Kristinsson, reveals some reasons why Iceland is the world's best destination for data centers.



Eyjólfur Magnús Kristinsson
CEO, Advania Data Centers

Icelandic data centers provide exceptional value to innovative global enterprises. The main benefits of the country as a location for data center infrastructure can be boiled down to three main areas. Firstly, power: the power you buy for data center operations here is green, competitively priced and lower than in most European countries. Plus, our customers can get long-term, cost-efficient power agreements, cancelling out any temporarily favorable pricing in other markets. That gives our customers total predictability in their operation costs over the lifetime of their activities here.

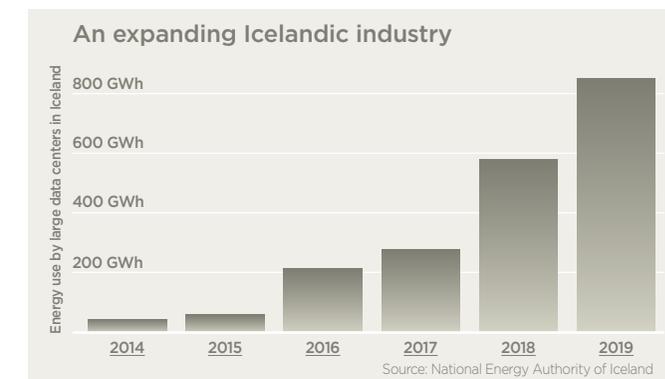
Secondly, the climate is perfect—the temperature is usually between 10 and 15 degrees Celsius during summer and rarely goes under -5 degrees in

"Cooling and operating a data center is much more efficient in Iceland. Combined with our great electricity prices, we can therefore offer the world's lowest total cost of ownership."

Eyjólfur Magnús Kristinsson, CEO, Advania Data Centers

winter. In most other European locations, this difference can be far bigger. This means that cooling and operating a data center is much more efficient in Iceland. Combined with our great electricity prices, we can offer the world's lowest total cost of ownership for data centers.

Thirdly, the sector benefits from an educated, capable workforce and the country's excellent logistics. Iceland's main data center hub is on the Reykjavík peninsula and only about five to 10 minutes' drive to Keflavik International Airport, which offers extremely good travel options to both Europe and the U.S. with numerous flights each day. This is a major advantage because it brings our centers closer to the users. One of ADC's two facilities is only a few minutes from the airport and is among Europe's largest data centers, while the other is in the Reykjavík region. I believe these advantages will ensure the industry's continued growth—the competition for attention



from other countries has increased but we believe we remain extremely strong in comparison.

Does Iceland stand out as being particularly advantageous for certain types of data services?

Icelandic data centers mostly focus on workloads requiring a lot of electricity and cooling—what is commonly referred to as high performance computing (HPC). This is the fastest-growing IT sector and includes applications such as computational fluid dynamics, computer-aided engineering and artificial intelligence, to name just a few, that can often be located far away from those using the systems. Because of the operational and cost efficiencies



Society
without waste

Excess resource streams are being used by a varied range of businesses



resourcepark.is

we deliver for applications that need a lot of energy and cooling, this is where Iceland can provide the most value. These workloads are also ADC's focuses. We basically have two products: colocation—where we sell data center space, power and cooling to customers—and on-demand HPC.

We designed most of our colocation space ourselves, utilizing smart technology to make substantial innovations that maximize sustainability and energy efficiency. Our systems have been developed with Icelandic engineering partners in order to use the country's compute-friendly climate conditions to the fullest. Our on-demand HPC services are also innovative. ADC was one of the first in the world to offer these, which we designed and developed in collaboration with leading technology companies like Hewlett Packard Enterprise and Intel. ADC is dedicated to delivering more compute to its customers. We achieve this by implementing efficient technology and conditions in our facilities. Additionally, we leverage our extensive knowledge and experience of computer system architecture, setup and operations for HPC and enterprise data center systems. This combination means that your budget gets you more compute in our data centers than it would in other European facilities.

ADC grew tenfold in the three years to 2019. What impact has COVID-19 had on your business and what is the outlook for the future?

There has been a dramatic increase in requests for our on-demand HPC service, which has been a vital asset for many of our global customers during the pandemic. We have also seen a huge requirement for these systems from international research and scientific organizations that are working on solutions related to COVID-19—those projects are incredibly rewarding for our team to service and support.



ADC runs one of Europe's largest data center facilities

Since ADC's establishment in 2010, we have experienced at least double-digit growth every year and we expect that to continue. We have built a company that already has a power capacity of over 80MW with enormous growth possibilities and potential. Our sector is expected to increase by around 15 percent each year for the next five years and we don't expect ADC to grow any less than that—there is still a lot of unused space in Iceland. However, we also want to establish a presence in other countries and are well advanced with plans to construct a \$70-million facility in Stockholm, Sweden, which is based on the same principles we have established here.

Having said that, anyone looking for data center or HPC services and solutions should look at Iceland. With its long-term power pricing, competitive costs, operational efficiency and 100-percent renewable energy, you can be sure your data center footprint in Iceland is both future proof and future friendly.



Can a digital globe meet its climate change goals?

By turning to Iceland's sustainable power, the answer is yes



The amount of data flowing around the world is rising astronomically. Just five years ago, around 10 billion devices were connected to the internet to create or use digital information, today there are 50 billion, by 2025 there are expected to be at least 100 billion. All of that data needs to be processed or stored in data centers.

“On the consumer side, the current level of global digital media consumption was totally unexpected a decade ago—there's a consistently growing requirement for video content from organizations such as Netflix, for example,” explains Dominic Ward, CEO of Verne Global, one of the leading players in the Nordic data center sector. “Businesses and other organizations also have vast data processing needs and are now using intensive high performance computing (HPC) applications like machine learning, deep learning and artificial intelligence,” he adds.

This ongoing exponential increase in data volume and computing workload presents challenges, not least that they demand huge amounts of power. “Five years ago, global data center usage was thought to be about 1 percent of total energy consumption. Today, it's estimated that they consume over 3 per-

cent of data centers. Importantly, it has the perfect mix of renewable power generation. It is the only European country that generates 100 percent of its energy from sustainable resources, just 10 percent of which are thought to have been tapped to date. Iceland's power generation is from hydroelectric and geothermal sources that are consistent, predictable and are not reliant on the sun shining or the wind blowing. For power intensive uses, such as data centers, that's ideal,” Ward explains.

Iceland also answers other concerns of data center users. It is located between North America and Europe, with three submarine data connections to those continents and a fourth being prepared. Once on land, digital information is passed through an advanced and extensive fiber-optic network with plenty of excess capacity. Its electricity transmission infrastructure is the third-most reliable in the world, according to the World Economic Forum. Additionally, the country's typically fridge-like temperature allows energy-efficient natural cooling of computing operations and its fixed, ultra-low power pricing systems can save customers over 80 percent on power bills.

“Verne Global customers benefit from everything Iceland has to offer: tremendous environmental benefits from its climate and uniqueness as the only country that generates 100-percent renewable energy, as well as significant financial savings—two attributes that don't often go hand in hand. On top of that, they gain from Verne Global's fantastic efficiency of operations and our world-class customer service team, as well as from solutions that are tailored to high-intensity and HPC requirements,” asserts the CEO.

Those clients include prestigious international names with supercomputing needs from a wide range of industries, he notes. “We have customers from financial services to engineering, life and earth sciences, and scientific research—the list is long. We stand out in the industry because we differentiate ourselves through our pure focus on sustainable and efficient high-intensity compute for enterprise customers. We've been focused on that philosophy from the very beginning.”

Verne Global has seen its business grow by an average of about 30 percent every year and, with Iceland standing out in its ability to fulfill the rising demand for sustainable data center services, it continues to boost the capacity of its facilities. Having just finished one expansion, it is planning to start another next year, and has secured \$27 million in funding for this from existing and new customers. “We live in a world where we assume that the photo that we just took on our phone will be backed up automatically in the cloud or that we can stream the latest TV show when we want. The ability to do that without having a negative impact on the world's environment is what really excites Verne Global,” Ward concludes.



Dominic Ward
CEO, Verne Global

“Iceland can play a very significant role in solving some of the challenges of data centers. Importantly, it has the perfect mix of renewable power generation.”
Dominic Ward, CEO, Verne Global

cent of the world's energy and that is forecast to double in the next 10 years,” states Ward. Compounding this issue is the fact that the world's governments and businesses are starting to pay attention to the carbon footprint of data centers and computing generally, he adds. “Companies have to think about their credentials—not just in terms of cost and efficiency, which they have always focused on, but their green credentials are becoming really important. Organizations need to make careful choices about where they house their compute and how efficient and green their compute solutions are.”

Very few places offer this combination of efficiency and sustainable power at a guaranteed low price. Prior to establishing the company, Verne Global's founders searched the world to find the optimal location for an industrial-scale HPC and colocation data center based on these criteria. The answer was Iceland. In 2012, operations started at its substantial, secure campus on a former NATO base that is close to Keflavik International Airport and 30 minutes drive from Reykjavik. As a sector pioneer, Verne Global built infrastructure and systems focused on high-intensity computing workloads and HPC from the ground up. In the process, it helped create an entirely new industry in the country.

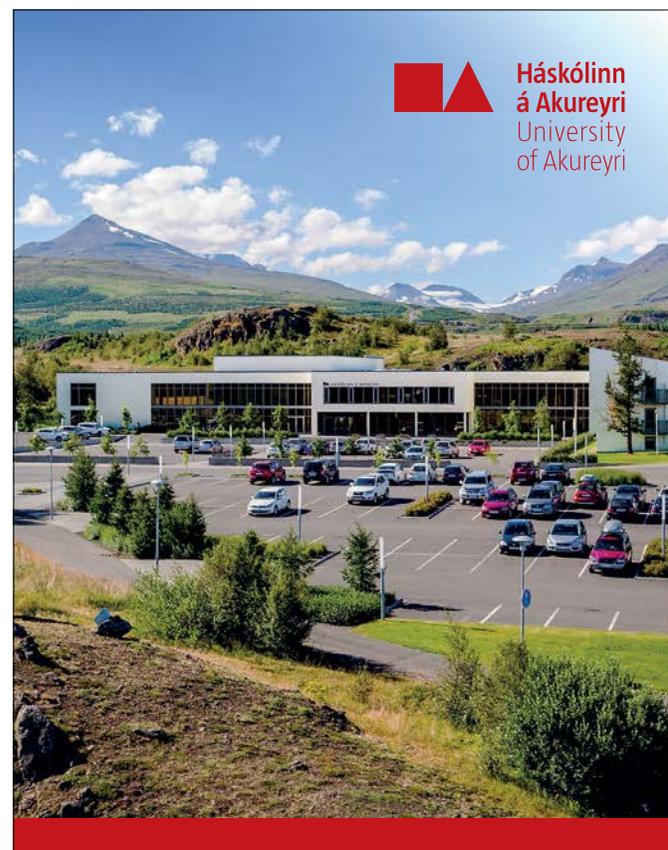
“Iceland can play a very significant role in solving some of the challenges

A secure and reliable platform in the Arctic

Iceland's unique location makes it even more attractive for computing

By tapping into Iceland's completely renewable energy, data centers become entirely green and sustainable. As Björn Brynjúlfsson, CEO of Etix Everywhere Borealis underlines, "Iceland has a competitive advantage for running sustainable data center solutions." As international clients increasingly look for sustainable solutions, expansion of a robust industry on Icelandic soil appears inevitable. Etix is one of the leading players in this industry and a key global high performance computing provider. We asked Brynjúlfsson what services and technologies the firm offers that make it stand out from the competition.

Mostly we are providing compute and data storage services. The campus that we built in the northern part of Iceland aims to utilize to the full extent the ambient conditions that we have in the country. This is very cost effective and directly connected to the high voltage transmission network, allowing us to provide the benefit of a robust Icelandic value proposition to our customers. We deliver sustainable solutions as well as high reliability,



Háskólinn á Akureyri
University of Akureyri



without over-expensive infrastructure. As the country continuously ranks top in the world with regard to electrical transmission and delivery, we are able to bring unique value to our clients.

Etix also operates data centers throughout Sweden. What makes Iceland a competitive place for data centers compared to other countries like Sweden and what are its unique selling points?

Comparing both locations, Iceland offers excellent operating conditions due to its mild winters and relatively cold summers. In addition, it is logical to have large-scale data centers closer to the sources of energy and, if we take that further, closer to sources of renewable power. Another benefit is the geographical location of Iceland between the U.S. and continental Europe. International travel to Iceland is convenient and straightforward.

Could you share with us some key figures to illustrate your company's growth, performance and significance in the market?

For two years in a row we have seen a tenfold increase in terms of our capacities. We went from around 0.5MW to 5MW in 2017, and then we made another substantial jump to 50MW of data center capacity between 2018 and 2019. Today, we have about 10MW at our Fitjar site and 40MW at our Blönduós center, both of which are fully operational.

"International studies have rated Iceland as one of the most secure and reliable data center locations on the planet."
Björn Brynjúlfsson, CEO, Etix Everywhere Borealis

Iceland is a country that punches well above its weight when it comes to scientific innovation, as it spends about 2.2 percent of gross domestic product on research and development. How innovative is Etix Everywhere Borealis?

International studies have rated Iceland as one of the most secure and reliable data center locations on the planet. The strong value proposition that Iceland offers allows Etix to take a different approach, avoiding the traditional ways of doing things to achieve the same reliability. Going a step further, we are collaborating on a project to reuse the residual heat from the data center. We are also working on a project that is intended to make Etix more of an active participant in the country's power system.



Björn Brynjúlfsson
CEO, Etix Everywhere Borealis

Fishing: Engrained in Iceland's DNA

For as long as it has existed, Iceland has harvested the bounty of the sea

Blessed with some of the world's finest fishing waters, Iceland has over the years developed a successful, competitive and exemplary fisheries industry, positioned as the global benchmark for the sourcing of sustainable seafood. The introduction of a quota system in 1983, timed with substantial investment in food and fish processing plants and technologies, laid the foundation for an efficient sector and encouraged consolidation among market players.

The quota format means no company can own more than 12 percent of the annual catch, and revolves around three core principles: sustainable harvest, responsible fishing and protection of the marine ecosystem. The Icelandic seafood model also places a large emphasis on technology, quality and greater utilization of seafood products, with local fishing participants investing significantly in revolutionary systems and ways to freeze, transport and process fish, promoting zero waste in the industry. Indeed, in front of countries with very different wage structures and labor welfare, the industry is a great source of income and pride in Iceland, but needs to strengthen its competitiveness.

One of the oldest and most reputed groups in the sector, Brim has witnessed many changes in the national fisheries over the 120 years of its existence. The company operates nine large fishing vessels, which source various species for processing at three modern plants. Brim also handles catches from other sources and, thanks to its extensive network of sales and marketing companies, has a significant international reach through the distribution of fish in Europe, Africa, Asia and the Americas.

"In 1983, Iceland implemented a quota system limiting the input factors in the form of ships and machinery, actually embarking on a journey of increased sustainability through reducing waste in input factors—capital, vessels and plants," explains Brim chairman, Kristján Davíðsson. "This has led to increased sustainability but also to more consolidation, in part because it has enhanced the potential for specialization and improved economies of scale. We participate in the global sustainable seafood initiative and are working toward a cleaner value chain in the seafood industry; always trying to minimize our environmental footprint—our impact on the environment. The limitations imposed by the quota system force Brim to take new paths and create new growth opportunities in all parts of the business. Iceland's seafood resources are sustainable, but only as long as the fishing is done responsibly. You have to comply with rigorous regulations that aim to secure the sustainability of our resources for the next generations, so they can continue to enjoy the productivity of these resources."

Another iconic player in Iceland's fishing and seafood world is Vísir. Family owned and with a formidable position in the sector courtesy of more than 50 years' valuable experience, Vísir offers a rich variety of premium products. The company's innovative fleet of long-line vessels is a key asset that enables the firm to deliver on its long-term vision of sustainability and protection of the



Kristján Davíðsson
Chairman, Brim



Fish in Icelandic waters is caught with various types of fishing gear

environment. "In the past few decades, the Icelandic fishing industry managed to build up fish stocks around the country through the implementation of the quota system, resulting in a strong position today," states Vísir general manager, Pétur Hafsteinn Pálsson.

"We are working to prepare for the challenging economic outlook caused by the COVID-19 crisis and are ready to show what the fishing industry in Iceland is made of: our strength and capacity to adapt. By continuing our focus on quality, innovation and sustainability, we look forward to feeding future generations. In addition to having various certifications around sustainability, equality and food processing standards, we are continuously focused on increasing our utilization and improving our efficiency. We aim to minimize our carbon footprint while reaching 100-percent utilization of our catch."

The fisheries sector receives vital support from the government and various associated bodies to ensure its performance remains best in class. "We know

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have the quality products, but understand we are often competing with countries with very different wage structures and labor welfare,” notes Thor Sigfusson from the Iceland Ocean Cluster, an organization that connects entrepreneurs, businesses and knowledge in the marine industries. “To strengthen our competitiveness further, we need to act and act quickly by investing in more automation and focusing on full utilization of our catch,” he emphasizes.



Pétur Hafsteinn Pálsson
General Manager
Vísir

When local and foreign companies look to invest in cutting-edge chilling and food processing technology systems for increased freshness, better yield, faster processing times and maximum efficiency, they often turn to Skaginn 3X. The award-winning company is a major flag flyer for Icelandic innovation and talent, as illustrated by its recent signing of major pre-engineering contracts with Russian and South Korean companies wishing to modernize and automate their fish processing operations. The firm’s state-of-the-art on-board or onshore Sub-Chilling patented technology gives fish a longer shelf life at less cost by keeping it chilled, ice free and fresher for several more days than previously thought possible. “We came up with the Sub-Chilling technique when we were looking at how to reduce the transport weight and extend the shelf life of our products further,” explains Ingólfur Árnason, CEO of Skaginn 3X. “This new technology enabled us to extend our product shelf life by five to seven days, while at the same time reducing our transport weight by 10-15 percent by skipping the ice. Sea water has a freezing point of -1 degree Celsius, so we take the water inside the fish slightly below that temperature and start



Icelandic fish products are marketed all over the world

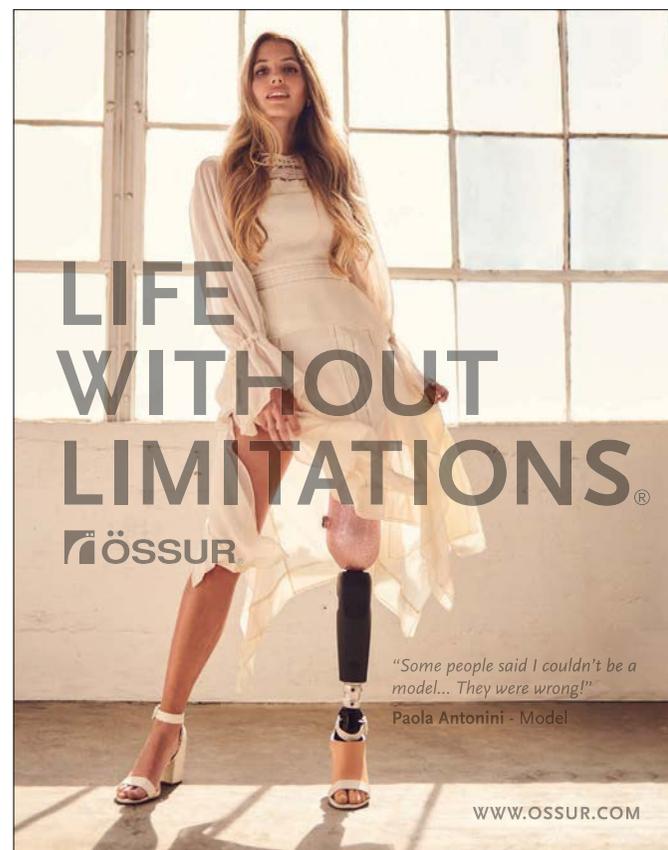
“By continuing our focus on quality, innovation and sustainability, we look forward to feeding future generations.”

Pétur Hafsteinn Pálsson, General Manager, Vísir

the freezing process without damaging the fish. The water inside the fish is like the cooling medium, instead of the exterior ice. This enables us to get the same cooling efficiency as the ice and reduce the weight.”

Árnason, who is committed to reducing food waste globally, adds: “More than 10 percent of our turnover is spent on research and development activities; we aim to design the best processes for the best quality of products. Iceland’s challenging location has always forced us to find the smartest way to bring fish to the market so that we can compete in the global marketplace. We are very lucky to be so close to our producers, so close to nature and with fresh fish in abundance.”

To further boost efficiency, the Icelandic fishing industry also bets on a zero-waste approach to fully utilize the potential of its resources. Even the biotech industry is casting an eye on industry sub-products and has found ways to leverage the extraordinary powers of fish. The firm Kerecis, for example, is using fish skin—high in Omega 3—to repair and heal damaged human tissue. “We have been in the U.S. market for five years, treated tens of thousands people and prevented thousands of amputations,” says Gudmundur Fertram Sigurjonsson, founder, chairman, president and CEO of Kerecis. “We are growing rapidly, we have been Iceland’s fastest or second-fastest growing company for three years in a row, and have doubled or tripled our revenue every year.” Lately, the firm has been working on a spray to reduce the risk of catching COVID-19, showing the world the endless potential of fish.



Taming a challenging environment

To boost self-sufficiency, Iceland needs to find ways to conquer Mother Nature

Iceland’s impressive and almost unmatched portfolio of natural resources is ripe for sustainable development projects, once the challenge of an unpredictable climate and tough terrain has been overcome. The COVID-19 pandemic has prompted the government to set aside substantial funds for agricultural initiatives that boost self-sufficiency in a drive to reduce the country’s dependency on imported foods.



Andri Björn Gunnarsson
Founder and CEO
Vaxa

As part of the COVID response, the Ministry of Fisheries and Agriculture launched a \$3.6-million fund dedicated to increasing innovation in domestic food production and hiking local food output 25 percent by 2023. This ambitious strategy aligns with the long-term pledge of a carbon-neutral Iceland by 2040, which is designed to reduce global greenhouse gas emissions and prevent global warming.

Spearheading the development of sustainable food production is precisely Vaxa’s mission. “As a remote island in the middle of the North Atlantic Ocean, we have very little sunlight for a large part of the year and it’s also quite cold, so we can’t grow a lot of things here,” says Andri Björn Gunnarsson, founder and CEO of Vaxa. “Historically, we’ve only been able to grow certain varieties that are either suitable for cold weather or greenhouses. Iceland is quite dependent on imports and with the increased consumption of grains and healthy foods, local production has declined versus imports in recent years.”

“The vertical farming sector in general has plenty of growth potential. Iceland has got what it takes to become a leading country when it comes to sustainability.”

Andri Björn Gunnarsson, Founder and CEO, Vaxa

Over the last decade, domestic production has probably declined to less than 50 percent in certain varieties, he says. “There hasn’t been enough innovation in this sector and as a result of the pandemic, many countries and people now realize the importance of sustainability. The world needs to produce more food with less space in the future—in order to feed a larger global population—and with certain finite resources. I put all this together and came up with the idea of vertical farming. I quickly came to the conclusion Iceland would be the ideal place for such technology to grow. Iceland has an educated workforce that can take technology like this, develop it and take it to the next level.”



Vaxa’s state-of-the-art vertical farming facilities near Reykjavik

After securing the necessary investment, Gunnarsson set up the country’s first vertical farm and planted the initial seeds at the end of 2018. “We’ve run a substantial operation now for almost two years and in global terms we’ve got a lot of experience already,” he continues. “The vertical farming sector in general has plenty of growth potential and there are locations beyond Iceland where it could work and make sense. Iceland has got what it takes to become a leading country when it comes to sustainability. If our plans work and we achieve our goals, this technology can benefit other countries and areas, as there’s a lot of potential to export this business model outside of Iceland.”

Vaxa’s advanced growing technology has generated plenty of interest from possible international partners and third parties interested in exploring new opportunities and collaborations. “If you want to enter any new market, it’s important to have the right partners with you when it comes to both financing and having access to market distribution,” Gunnarsson adds. “I’ve had discussions with key players in markets we’re looking at. There’s room for collaboration and growth, whether it’s purely in distribution, in energy, in other parts of the supply chain or even in the growth technology.”

Vaxa is certainly blazing the trail other young Icelandic companies and innovative startups wish to follow, with one such example being fast-growing health food enterprise Good Good. Founded by three friends in 2015, the firm provides a wide variety of healthy, sugar-substitute products containing stevia, including jams and snack bars. “The COVID-19 crisis has strengthened the food sector: local farmers were pressured to produce more and we needed to cut our imports,” says Garðar Stefánsson, CEO of Good Good.

“In the long term, it will strengthen Icelandic companies by inducing them to create food locally. This is a perfect time to reflect, look internally, and find new ways to innovate our food system and create something. One good thing to come out of the pandemic is the global community is standing together; we’ve never had such a common denominator connecting us all.”

Where necessity sparks innovation and creativity

Iceland's tough weather gave birth to unparalleled technical apparel brands

Inspired by the Icelandic fishermen who continue to brave the challenging conditions of the North Atlantic Ocean daily, 66°North manufactures high-performance and fashionable outdoor clothing, starting with the production of oil-borne canvas anoraks almost a century ago. Renown for their quality and durability, 66°North's products remain popular not just with demanding fishermen—for whom no compromise on quality is acceptable, given the incredibly tough working conditions.



Helgi Rúnar Óskarsson
CEO, 66°North

This quest for quality, combined with Icelanders' passion for seeking out the latest trends and fashions, makes the nation the ideal test market for apparel. Now the second-largest clothing retailer in the country, 66°North is looking to become Iceland's most successful global brand, while also a symbol of sustainability and social responsibility. The company derives its name from the latitudinal line of the Arctic region that touches Sugandafjordur where the company was founded in 1926. The firm has enjoyed a lot of success overseas and is currently focused on three key markets: the U.S., the U.K. and Germany.

"What differentiates us from other outdoor clothing manufacturers like Patagonia or the North Face is where we come from and how the company has developed—that makes us stand apart," says 66°North CEO, Helgi Rúnar Óskarsson. "We have been forced to think a bit differently to other brands, which can allow themselves the luxury of, for example, producing 16 different types of ski jackets. We have never been there. We're all about multipurpose, durability and performance. Other companies were started by people who were enthusiastic about mountaineering, climbing, hiking and other such activities.

"We come from a very small nation where the weather influences how we make garments. We also have to produce clothing that appeals to people in different industries, fishermen, search and rescue and so on, as well as for the general public. As a result, our clothing has always been multipurpose, so people don't need to buy 10 different jackets—one for skiing, one for hiking and so on. We just want to make one jacket that you can use for different purposes.

"More than 95 percent of households in Iceland own at least one piece from us. The Icelandic customer is extremely demanding when it comes to garment performance, and follows fashion and style trends very closely. As such, if we make something and Icelanders don't like it, we simply stop producing it. We are well known in the U.K., where 25 percent of the market knows us, and in the U.S., where the figure is 22 percent. Our net promoter scores in these markets and in Germany see us average 70



66°North's multipurpose clothing is designed to last a lifetime

points, which is best in class. This shows our customers are quite pleased with 66°North's offering."

Given the company's core commitment to sustainability and holistic approach, all its apparel is designed to last a lifetime, with repair and recycling of its garments an integral part of the company's business model. The label's repair shop received more than 4,000 garments in 2019, saving customers money and the planet from unnecessary production processes and logistics costs. "When we develop clothing, we think very much from a sustainability point of view," Óskarsson continues. "We are firm believers that a garment should last; we don't want a customer to buy a biodegradable jacket every year for the next 10 years. We want them to buy one jacket that will last for the next 10 years. If you take everything into consideration, that jacket is going to be less polluting than the biodegradable one, due to the environmental burden of manufacturing.

"We want to be a leading brand known for its sustainability, that's what we are aiming for. Our goal is to build the first global consumer brand from Iceland. We believe that, with the history and heritage that 66°North has, our brand should resonate very well with people who care about environmental responsibility. This durability and sustainability thinking is

"Our clothing has always been multipurpose, so people don't need to buy 10 different jackets. We are firm believers that a garment should last."

Helgi Rúnar Óskarsson, CEO, 66°North

something that has always been a part of the company's key values and it's also very much part of the Icelandic way of thinking."

The dynamic executive is proud to see 66°North clothing worn by national rescue teams, which the firm began equipping in 1928. Iceland has around 18,000 volunteers that rescue travelers from the wilderness, should they be unfortunate enough to find themselves lost on mountains and glaciers in bad weather. "Because the rescue teams go out in the most extreme weather conditions, we can't compromise on quality," he states. "We have been a manufacturing company from day one: we've always manufactured and own the manufacturing ourselves—even if we also use contractors now because we don't have the capacity. We have 240 people on payroll to ensure we can stick to this promise of quality and durability."



Made for Life

66°North combines the Icelandic virtues of resilience, making things that last and harmony with nature to create a brand which is carbon neutral and circular. A new (yet also very old) kind of sustainable company.

Keeping Iceland warm since 1926

Shop at [66north.com](https://www.66north.com)

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A strong innovator for Europe

The EU's Innovation Scoreboard for 2020 ranks Iceland as a 'Strong Innovator', praising its innovation-friendly environment and attractive research systems

The Icelandic economy was focused on just a few industries before 2008's financial crash. But since then, the innovative spirit that has always been at the core of Iceland's development has targeted a much wider range of sectors, explains Pétur Þ. Óskarsson, CEO of Promote Iceland, the public-private national investment promotion agency.

The Icelandic economy has diversified. 40 to 50 years ago, investments were focused on energy. More recently, we have seen diversification into areas like information and communication technologies, life sciences, aquaculture and services including tourism. Today, there are standout Icelandic companies in various sectors and we have raised exciting startups that are doing well. A good example in genetical research and development (R&D) is deCODE; its rapid-response COVID test has been key in the crisis. Other flagship front-runners are Össur that has grown to become a worldwide leader in high-tech prosthetics and Marel, which with its advanced food processing technologies helps the poultry and pork industries to create more value from their raw materials. In the financial sector, early stage startup Monerium was the first blockchain company in Europe with a license to practice banking; and my final illustration would be Meniga, which has developed a personal finance management system for online banking. It currently serves customers in over 30 countries and has more than 70 million users worldwide. Those are just



some examples. The government is pushing further diversification and we are on the right track for this.

As well as domestic entrepreneurs, international firms have chosen to base themselves in Iceland. It has abundant land, cheap green energy, good infrastructure and one of Europe's lowest corporate tax rates. What else makes it attractive for innovation and entrepreneurship?

Iceland has a very unique strategic location between North America and Europe, two of the world's biggest markets. We are only 5 hours from the east coast of the U.S. by plane and 2.5 hours from mainland Europe. This is a strong advantage and has been key to drawing in investors. Iceland is also a safe place to live and raise a family, while its educated workforce, high salaries and great quality of life are further factors working in our favor. We offer multiple tax incentives, such as a 25 percent reimbursement for R&D expenditure, which goes up to 35 percent for small and early startups. This not only boosts bigger scale-ups but provides a stimulus for smaller companies too. The government has been increasing such measures since the pandemic emerged in order to reignite investments and R&D operations. We have also been working on new initiatives to diversify exports that are more focused in areas like R&D and software. We hope to attract more businesses, investors and experts, and the prospects are very bright. We have all the elements in place that they are looking for.

What part does Promote Iceland play in advancing the economy?

It's broad. Our primary role is to create a forum for cooperation between business interest groups, institutions and government on policies and actions to increase export revenues and economic growth. Secondly, we work to attract tourists to Iceland—we run the Visit Iceland website and marketing campaigns. Thirdly, we provide services and consultation for trade across all export sectors. We also incentivize foreign investment through outreach and by extending information on Iceland's many advantages. Additionally, we support the promotion of Icelandic culture through projects and services abroad.

As diversification continues, what sectors show the most promise?

In 2019, we developed a long-term strategy for Iceland. We have earmarked six promising sectors: energy and green solutions, innovation and technology, arts and creative industries, tourism, fisheries, and specialized foods and natural products. The common thread in all of our current predominant sectors—like tourism, energy, fisheries, manufacturing and life sciences—is a constant commitment to sustainable development. It's a central focus of Iceland as a society, we aim to be recognized as a global leader in sustainability and this is the main strategy guiding our exports. Sustainability is and will continue to be one of the driving forces in adding value in the years and decades ahead. We are not changing direction following the COVID-19 crisis and will stay on the same path that we set forth on last year.



Pétur Þ. Óskarsson
CEO
Promote Iceland

Innovation that is truly life-changing

Iceland is now a global leader in state-of-the-art prosthetic and orthopedic equipment thanks to one business



If there is one company in Iceland that has innovation flowing through its veins and deserves global recognition and reward, it is Össur. Poised to celebrate its 50th anniversary in 2021, Össur is one of the country's largest and most respected enterprises thanks to its innovative, state-of-the-art prosthetic and orthopedic equipment utilized by physically disabled people around the world. Under the careful control of president and CEO Jon Sigurdsson, who has been at the helm for 24 years, Össur has grown into a global champion in prosthetics. The fast-growing firm manufactures a wide range of non-invasive orthopedic items, including prosthetics, bracing and support products that greatly contribute to mobility and subsequently improve patients' quality of life immeasurably.



Jon Sigurdsson,
President and CEO
Össur

The company serves an extensive range of medical professionals and has close connections with leading research and educational bodies. Among its many accolades, Össur is honored to be recognized by the World Economic Forum as a "Technology Pioneer". As true advocates of the philosophy "life without limitations," the Reykjavik-headquartered company also works closely with individuals, clinicians and diverse communities.

"Össur has been an innovation leader in this industry for a number of years. We were the first company in the prosthetic industry to offer bionic solutions: products that have embedded sensors, artificial intelligence (AI) and other sophisticated technology that adapts to the user," says Sigurdsson. "We have a defined culture and more than 4,000 employees who are aligned on defined goals. Our company's values of honesty, frugality and courage are embedded in our culture and embody our behavior toward each other and our customers."

The senior executive notes how before the turn of the millennium, the industry was very fragmented, with few big players and technology levels that were low. Products were very basic and did little for amputees, so the upgrading of such technology was imperative. "The issue we faced was the lack of critical mass, which you need if you want to trade your technologies," he explains. "In 2000, we acquired two companies—Flex-Foot and Century XXII—which offered us a complete solution. They also had well-established distribution systems that helped us gain critical mass in the market. From there, we started to develop many more sophisticated products and solutions with AI on board. Össur has made more than two acquisitions per year for more than 20 years. These are an important part of our strategy because they enable us to grow our critical mass."

Sigurdsson is particularly proud of Össur's technology platforms and its specialized manufacturing materials, many of which are not widely used in the industry. He also cites biomechanics as another unique selling point, where

rigid structures are adapted to the body. Not only is such technology difficult to design, it adds to the cost. "The type of product that we sell is much more expensive than other products as the devices are technologically very advanced and sophisticated, which requires considerable research and development investment. "As a result, we must also convince the reimbursement systems of the health economic benefits for the user and society as a whole. We place emphasis on conducting studies that prove the clinical benefits of our products and the importance of keeping amputees mobile for better quality of life, but also for reduction of other co-morbidities."

A pioneer in brain research programs and powered, intelligent and energy efficient bionic solutions, Össur's most recent breakthrough innovation was a mind-controlled, bionic prosthetic leg. The design and technology were so successful, the company is now embedding AI and other technologies in its new generation of upper and lower limbs. "Our bionic products offer computer-controlled solutions that measure what the user is doing, then anticipate and calculate what the user is going to do next, and then react accordingly in real time," Sigurdsson explains. "For example, our knees are able to predict with certainty a split second beforehand what the brain wants to do and it adjusts, whether it is using stairs, kneeling or accelerating. We are in clinical trials of mind-controlled prosthetics where a sensor is embedded in the muscle

"Our bionic products offer computer-controlled solutions that measure what the user is doing, then anticipate and calculate what the user is going to do next, and then react in real time."
Jon Sigurdsson, President and CEO, Össur

of the residual limb, picks up signals and sends them to our bionic products in real time. It's the closest thing to simply thinking what you want to do and the artificial leg reacting to that thought."

Össur enjoys a strong sales and marketing presence in the largest healthcare markets, and has increasing direct contact with payers and prescribers. One important challenge it faces is on the reimbursement side.

Even as market leader, it can be difficult to get its sophisticated—and so more costly solutions—accepted and recognized by medical professionals and payers in the industry. "The customer base within the orthopedic and prosthetic industry is relatively small versus other sectors," Sigurdsson notes. "In most markets, the end user is not the payer, so our challenge is to ensure that they and their family ask for our products and solutions when they go and see their medical professionals. End users are becoming more aware and want more of a say in the products and solutions they are fitted with. We are placing more emphasis on reaching and educating them and their networks about the options available to them."

Stunning Icelandic scenery seduces film producers from across the world

Action claps are resonating through the country's breathtaking backdrops with increasing frequency

When this year's hit Netflix comedy *Eurovision Song Contest: The Story of Fire Saga* tumbled onto TV screens across the world, it was more than just lead characters Will Ferrell and Rachel McAdams who received positive reviews and generated lots of headlines. Featuring scenes shot in the traditional Icelandic town of Husavik on the north coast, the well-received movie was the latest production to have been recorded in the country in the past decade.



Laufey Guðjónsdóttir
Director, Icelandic Film Centre

From *Game of Thrones* to *Star Wars* or *James Bond*, productions crews from the largest international studios are flocking to take advantage of what Iceland has to offer—not just the fantastic backdrops, but also generous tax rebates and incentives from the government. Netflix spent around \$4 million on the location shoot of *Fire Saga*, with the treasury handing over around a quarter of that amount as part of a campaign to develop creative industries. The reimbursement initiative is complimented by the high standard of local movie and sound technicians, who are well versed in working in challenging outdoor conditions.

Popular movies shot in Iceland over the past decade include *The Secret Life of Walter Mitty*, *Oblivion*, *Interstellar*, *Prometheus*, *Noah*, *Rams* and *Thor: The Dark World*. Renowned Hollywood director Christopher Nolan was left in no doubt that Iceland was the perfect place to shoot one of his films. "Iceland truly represents the beautiful extremes that nature has to offer," he said following the shooting of sci-fi blockbuster *Interstellar*. The local crew—both experienced and professional—warned us the wind could blow the asphalt off the road, and they weren't exaggerating; we witnessed it first hand."

Such impressive feedback from one of the world's most successful directors of modern times is music to the ears of Laufey Guðjónsdóttir, director of the Icelandic Film Centre (IFC). Her organization plays a key role in the vibrant and fast-growing Icelandic film industry, through its financial support scheme, international promotion of Icelandic cinema, and related initiatives designed to boost filmmaking and film culture nationwide.

"Iceland offers a great variety of landscapes and extremely skilled crews and artists," Guðjónsdóttir says. "The Icelandic film industry is relatively young; we did not literally start regular film production until the 1980s, that's when we got financing from the film fund put in place. It took us about a decade to acquire all the technical expertise and put the industry in place. Since 2000, the industry has developed really quickly with more and more talented people.

"We have ever growing numbers of films and TV productions now in the best festivals and on international markets. The movie *Rams* by Grímur



The award-winning movie *And Breathe Normally* by Ísold Uggadóttir

Hákonarson was an important tool for the Icelandic film scene in recent years. It was selected for the official competition at Cannes, gained huge attention and a lot of success, and since then we have had an Icelandic film in at least one of the main sections of most major festivals."

According to IFC statistics, the film and TV production sector now employs around 3,000 people, with the small screen rapidly gaining a larger slice of the market. "The TV side has been growing very fast for the past five years or so," Guðjónsdóttir confirms, highlighting Netflix's increasing presence. "It's been a very positive spiral effect. One of the major series was *Trapped*, which was totally produced here in Iceland, but pre-sold to all

"Iceland offers a great variety of landscapes and extremely skilled crews and artists. Since 2000, the industry has developed really quickly with more and more talented people."

Laufey Guðjónsdóttir, Director, Icelandic Film Centre

major TV stations in Europe and elsewhere. That was very successful and they are already shooting the third season.

"There's also *The Valhalla Murders* that was bought by Netflix and Netflix is also now producing a major series called *Katla* [named after a large volcano in the south of the country]. We have a lot more, and not only crime stories although they tend to dominate a bit. Last year, we also had a very refreshing production set from a woman's point of view that was really successful. So it's a mixed bag, but definitely going in the right direction."

With some die-hard movie and TV fans eager to travel to the exact locations of their favorite films or series, the success of Iceland's film industry has also given a further boost to the tourism sector. The nation hopes to repeat the success of New Zealand and Northern Ireland, which launched special tours of sites featured in the Oscar-winning *Lord of the Rings* trilogy and *Game of Thrones*, respectively. "We've had extremely positive attention and many questions from the international community about this," Guðjónsdóttir adds. "There's definitely interest in doing something."

Iceland's gaming industry on a high

A sector in full bloom has attracted global capital from top-tier partners

Now 17 years into a successful interplanetary voyage with its hugely popular science fiction adventure and massively multiplayer online (MMO) game *EVE Online*, video game developer CCP Games is probably the best example of Icelandic creative genius. The award-winning company was acquired by Korean gaming giant Pearl Abyss in 2018 for \$245 million, in a move CCP Games CEO, Hilmar Veigar Pétursson, hails as an exciting industry development, as he explains.



Hilmar Veigar Pétursson
CEO, CCP Games

How does CCP Games stand out in this competitive and lucrative market, and what have been its major milestones?

There is a lot going on, but our main business is taking care of the wonderful world of New Eden, in which the *EVE Online* experience takes place. That has surpassed all of our expectations when it comes to longevity, player impact and developer motivation. It's an endless source of insight and inspiration for the future of mankind.

What recent developments have there been in the *EVE Online* world?

Right now, we're very focused trying on bringing more and more people into the game. For example, this year we had 1 million new players. In April, we released our special Chinese version of the game, increasing our customer base by nearly 50 percent. In August, we debuted our mobile version of the game, called *EVE Echoes*. We have had a significant collaboration with a Chinese company, NetEase, that also develops MMO games like us. Demand for the game is strong, as there were close to 4 million pre-registered players.

Innovation characterizes CCP Games, so can you guide us through some of the most groundbreaking concepts you've introduced?

EVE Online allows every player to meet with others and interact. Players can become friends and enemies, which is a unique proposition for a game. This is based on an extremely strong network effect that drives the game, where the game becomes more valuable to each player as more new players join; the more people playing, the better the experience. Our unique approach allows players to control the world a lot more than they are allowed to in any other game. Each player can fundamentally change the game.

How has the new shareholding structure with Pearl Abyss changed your strategic direction and what synergies have you developed with them?

Pearl Abyss is an extremely competent MMO developer, operating the game *Black Desert Online* for over 10 years. Working together has allowed us to compare notes and share knowledge on how we can both improve in regard to our own craft of creating MMOs.



Reykjavik is home to a strong community of game developers

What makes Iceland an ideal location for the filming and gaming industry? What are the nation's key competitive advantages?

We have a very educated population and a very small society, where people of various backgrounds can easily connect with each other. We see teams of people that come together to innovate. Iceland, with its high education level and diverse background, is able to play a role in this, especially as we also see a naturally high entrepreneurial spirit.

How has the company's gaming developer community and ecosystem evolved in recent years?

When the 2008 financial crisis emerged, we helped create the Gaming Industry Association of Iceland. There were a lot of startups that began developing games in the first wave, but very few have managed to survive. There is a good base of gaming companies here and we now have the most gaming firms per capita in the world! Making games is really hard and the odds of success are usually low. The first wave came and went, but now the second wave is bringing even more successful products into the market.

"Our unique approach in *EVE Online* allows players to control the world a lot more than they are allowed to in any other game. Each player can fundamentally change the game."

Hilmar Veigar Pétursson, CEO, CCP Games

What are some of the markets you are currently locking targets on, and are you exploring potential partnerships for development?

We want to go further into other markets, with Asia being a great prospect for us. Mobile games are another expansion area with *EVE Echoes*, we even made a mobile connection to the PC game via the *EVE Portal* companion app. We are also busy developing a new online sci-fi shooter game in London.

As an outstanding success story of the Icelandic gaming industry, how do you see your role as an ambassador for the country?

I've a lot of connections in the industry, granting access to various cycles for upcoming talent or funding. In other words, I have been trying to pay more attention to internal works, rather than external projection of the country's game development scene.

A highly educated versatile workforce

Talented young Icelanders have the skill sets needed by the labor market

Iceland's education statistics are impressive by any standards. It boasts the world's third-highest literacy rate, almost half the population is tertiary educated and the government spends a whopping 7.3 percent of gross domestic product on the sector. According to Eurostat's latest data, that's more than any other European administration.

"We have an amazing education system," concurs Lilja Dögg Alfreðsdóttir, Minister of Education, Science and Culture. "Human capital is a nation's most important asset and countries that realize this are the ones that will be the most competitive going forward. That's why I, as a politician, focus so much on the whole academic system—we need our young people to be able to compete globally with the best."

To encourage even more of its population to enter or return to higher education, the government has recently approved a new student loan facility that funds a proportion of study costs. This is proving hugely popular, with universities being bombarded with up to 33 percent more applications this year, according to Alfreðsdóttir. "It's an incentive for citizens to study again if they need to do so and it's also aimed at closing the gap within our labor market."

Offering a broad range of programs, Iceland's seven, modern universities stand up well in international rankings. Students from other countries are welcomed: many courses are taught in English and Iceland follows Europe's Bologna system, making study at its institutions compatible with education elsewhere. As well as providing high-quality education, Icelandic universities are highly focused on research and development (R&D)—another priority of the government, which supports this through funding schemes it has created for innovation and technology.

When it comes to boosting R&D, the government's main strategy is to stimulate private sector investment, Alfreðsdóttir explains. "As a small and open economy, we need to focus on creating jobs around innovation, because we have a high level of education and a lot of university graduates. We are accelerating our innovation industry, which has become a strong pillar in our economy, and have a very holistic vision for achieving this." As part of this vision, the government has expanded its R&D tax credit policy this year so that large companies can request 25 percent rebates on expenditure up to \$7.8 million, while smaller companies can claim 35 percent. It has also set up a new \$20-million venture capital fund.

In order to exploit the country's research strengths in areas like science to the commercial maximum, Icelandic universities work closely with the high-tech, innovative industrial companies that will be creating many of their students' future jobs and adding value to the economy. A major hub for this collaboration is the science park at the University of Iceland—known as Reykjavik Science City—where domestic and multinational firms in fields such as biotechnology, genetics, pharmaceuticals, computer science and ICT are located, as well as the National University Hospital of Iceland and Reykjavik University.

"Human capital is a nation's most important asset and countries that realize this are the ones that will be the most competitive going forward."

Lilja Dögg Alfreðsdóttir
Minister of Education, Science and Culture

One resident is Alvotech, the fully integrated Icelandic biopharmaceutical company. Only founded in 2013, the firm has already become a global leader in biosimilar medicines and operates from a new, state-of-the-art manufacturing and research facility in the park. "We are based right next door to the University of Iceland and cooperate closely with it. In fact, this year we have started running a master of science degree in biotechnology with the university," says Mark Levick, Alvotech's CEO. He confirms that Iceland punches above its weight in terms of its education standards and the business-ready skillsets of its graduates. "You've got a lot of well-educated, smart and talented people emerging from university here. There is also a certain mindset in Iceland that is focused on entrepreneurship, plus substantial support for R&D-based enterprises. It's a great environment to be in."



Lilja Dögg Alfreðsdóttir
Minister of Education, Science and Culture



The University of Iceland's main building in central Reykjavik

A research and education hub

Icelandic universities greatly contribute to the national push for R&D and take a growing global role

Dedicated to research and innovation, the University of Iceland is the country's largest and most rooted higher education institute, while also being highly active in the international scientific and academic communities. Based in the capital Reykjavik, the public research facility counts more than 13,000 students who can choose from over 400 study and research programs offered by 26 faculties—split across five schools—on subjects as diverse as social science, humanities, law, medicine and engineering.

International students are welcome to attend the University of Iceland as, while the primary language of instruction is Icelandic, several study programs are taught completely in English. Unlike in many European countries, students pay only a one-off registration fee to access courses, rather than substantial sums each year. To further its offering, the university is building the nation's first science park, where established, knowledge-based firms, startup centers, and university operations will coexist.

"I'm very proud of the many ways in which the University of Iceland stepped up and has been a valuable player in the country's battle with the COVID-19 pandemic."

Jón Atli Benediktsson
Rector and President, University of Iceland

"The University of Iceland is a good reflection of Icelandic society; our strongest research areas traditionally relate to Icelandic society, history and culture, as well as health sciences, medicine and pharmaceuticals," explains Jón Atli Benediktsson, rector and president, University of Iceland. "Iceland has a lot of volcanoes and earthquakes, and therefore we have developed quite a strong expertise in everything related to geosciences—glaciology and volcanology. We are very competitive in this field and also very strong in terms of remote sensing, image analysis and related areas. Researchers in Iceland are global leaders when it comes to medicine and genetics. We are also very strong in big data and data processing, and rank among the strongest in the world in



The university is renowned for its strong expertise in sciences

these fields. If you look at the pockets of strength here, we are doing extremely well and this is a remarkable achievement for a nation of 360,000 people."

Iceland has bounced back very strongly from the 2008 financial crash, Benediktsson notes, highlighting the importance of the much more concentrated focus on supporting innovation from the public and private sectors. Universities, including his establishment, have benefited from this change and it has also propagated into society. "During the last 12 years, there has been a significant change in the push for increased innovation and I expect people to better understand the connection between innovation, education and research as we go forward," Benediktsson adds. "Research and innovation have greatly gained in importance during the last decade and a half."

Given the university's excellent track record in research, it was no surprise to see it play an important role in the nationwide battle against COVID-19. Early in the outbreak, the University of Iceland formed a multidisciplinary team of researchers, which was responsible for providing scientifically valid information to policy makers and the public. "I'm very proud of the many ways in which the university stepped up and has been a valuable player in Iceland's battle with the pandemic," says Benediktsson. "The statistical model developed here for COVID-19 testing has been significant in helping authorities make decisions to contain the virus. At the start of the outbreak, the model estimated 1,800 cases, which was only slightly out from the final number in the first wave. Another recent achievement is in the area of carbon emissions: a new firm called Carbfix has been set up and is developing an innovative method to recapture carbon dioxide, which could be a very promising approach in tackling climate change."

In addition to overseas students, the University of Iceland has a number of international cooperation agreements in place and is growing its strategy to trigger new alliances, generate more student and research exchanges, and forge new partnerships with corporations and research institutions. "We embrace collaboration," states Benediktsson. "For us, a small island in the North Atlantic, international collaboration is vital. We rank very highly in terms of international collaboration—it's one of our biggest strengths—and we are an attractive collaborator in terms of research. The University of Iceland has been gaining strength in terms of research and innovation. We are improving, we are strong and we plan to continue growing. We are looking for opportunities to strengthen international collaborations even further."



Jón Atli Benediktsson
Rector and President
University of Iceland

Arctic research: A priority focus

Iceland plays a key role in advancing environmental, social and economic studies in the polar region

Evoking mental images of stark, glacial emptiness, the Arctic is actually home to over 4 million people. An intergovernmental forum, the Arctic Council, is responsible for promoting cooperation, coordination and interaction among the eight countries whose borders cross the region and its indigenous populations. Currently chairing the council, Iceland also hosts the leading center of Arctic research and education expertise: the University of Akureyri (UNAK). Its rector, Eyjólfur Guðmundsson, introduces a public institution situated in a stunning northern city that provides around 2,500 students with a wide range of undergraduate and graduate courses.

UNAK was established in 1987. It was the first modern Icelandic university to be located outside Reykjavik and one of the reasons it was set up was to provide higher-level education to people that didn't live in the capital. As a new university, we were able to do things that traditional universities couldn't do at the time. For example, we started pioneering distance-learning programs very early. Today, as well as educating students on campus, all our programs are online—an approach that has enabled us to increase access to education.

We have increased our student population by 40 percent since 2014 without adding any additional facilities. This has been possible because we offer high-quality online programs—our students are satisfied, which is an important factor. The COVID-19 crisis has shown that universities need to change and that a university's education is more important than its location. UNAK has been at the forefront of this change and will continue to bring its students new knowledge in diverse ways.

“The University of Akureyri takes a different approach that is focused on the social impact of climate change on the people living in the Arctic.”
Eyjólfur Guðmundsson, Rector, University of Akureyri

The Arctic is a major focus for UNAK. It has incorporated issues related to the region into its curricula and runs unique programs, such as its master's in polar law. Around 15 research institutions and other bodies connected to the Arctic are also based at the campus, including the influential Stefansson Arctic Institute, the Icelandic Arctic Cooperation Network, and the secretariats of Arctic Council working groups concerned with the marine environment and with the region's flora and fauna. According to Eydís Sveinbjarnardóttir, dean and associate professor in UNAK's School of Health Sciences who also chairs the Arctic Council's Expert Group on Human Health, there is strong inequality and disparity within the Arctic's populations. She says the region should listen to all its people and take into consid-



Eydís Sveinbjarnardóttir and Rachael Lorna Johnstone of UNAK

eration their different cultures and needs. How are these concerns reflected in UNAK's own extensive research efforts?

Arctic issues are one of our areas of specialty. A lot of the discussions about the region today, in both research and the media, is about the natural aspects of climate change, trying to figure out how fast the Arctic is melting and so on. UNAK takes a different approach that is focused on the social impact of climate change on the people living in the Arctic. A lot of our research is not strictly about the Arctic environment, but about topics such as governance, communities, the impact on societies, health issues in rural areas, gender issues and youth perspectives. Studying the social impact is, in my opinion, just as important as the natural science.

Some of UNAK's other research specialties include fisheries, where we work directly with Iceland's fishing industry. Another interesting focus is life on other planets. Iceland has extreme hot and cold environments, and our researchers have been part of the international team looking at how you could find life in these conditions.

As UNAK professor of polar law Rachael Lorna Johnstone says, “The Arctic is unique but it's part of a global system. A lot of things we see there reflect worldwide patterns and can provide substantial knowledge to other regions as well.” To what extent is UNAK itself part of a global system?

Universities today are truly international. I don't believe there are local universities anymore—being a university means that you are part of an international network and a wide community of scientists. International cooperation and reciprocal student exchanges are an integral part of UNAK's model. We have agreements with nearly 100 universities all around the world, many of them in Europe as well as in Asia. Unsurprisingly, we are also a founding member of the University of the Arctic, a network of more than 200 universities that are focused on issues in the region.

A fertile ground for biotech

Enviably natural resources are inspiring innovation in plant-based products

Pioneering plant-based biotech company ORF Genetics is an Icelandic success story, thanks to its breakthrough unique expression system Orfeus, which uses barley grain as a vehicle for recombinant protein production. The firm was founded in 2001 by three scientists who developed a groundbreaking new method for creating biorisk-free proteins in plants, with its work utilized by enterprises focused on medical research, stem cell technology and skincare.



Liv Bergþórsdóttir
CEO
ORF Genetics

“We were the first company in the world to develop barley as a factory for proteins and to produce a portfolio of human-like growth factors in plants,” states Liv Bergþórsdóttir, CEO of ORF Genetics. “We were also the first company in the world to use plant bioengineering technology to develop and market a skincare line, Bioeffect. Entering the skincare market was a big challenge, as the company's management team didn't have expertise in the skincare industry. But they knew they had something unique on their hands, a plant-based epidermal growth factor, and they could bring a pure, plant-based anti-aging skincare line to the market.

“Bioeffect first launched in Iceland and received extremely good reviews from Icelandic women—and more than 30 percent of the Icelandic women started to use Bioeffect within 18 months of launch. This was a really important step for a small company like ours as it immediately generated revenue. Proprietary technology companies often take years before they generate any revenue streams. The strong reaction from Icelandic women and their positive feedback gave us the confidence to expand to new markets. We started in Scandinavia, then the rest of Europe and now it's sold globally.”

“Our barley is produced in an eco-friendly greenhouse in lava fields. It utilizes geothermal energy, and the plants grow in volcanic pumice and are watered with pure Icelandic water.”
Liv Bergþórsdóttir, CEO, ORF Genetics

Despite its success, the company is not resting on its laurels and is exploring new opportunities and markets, such as animal-like growth factors for the emerging cell-cultured meat industry. Also referred to as clean meat, ORF Genetics is convinced it will be the next major food-tech trend and offers massive potential and rewards. “Meat alternatives are becoming a huge interest for younger generations as we become increasingly aware of the benefits of eating less meat,” Bergþórsdóttir explains. “Our approach



Barley acts as a factory for human- and animal-like growth factors

is still the same, using barley as a factory to produce growth factors and proteins, but now expanding it to animal-like growth factors, which are essential for the cell-cultured meat industry.”

ORF Genetics has certainly harnessed the best of Iceland's natural resources, at a time when health-conscious consumers seek products grown in a sustainable way. “Iceland is a big part of our image, as Bioeffect is produced from start to finish here, from seed to skincare if you like,” Bergþórsdóttir adds. “Our barley is produced in an eco-friendly greenhouse in the middle of the lava fields of the Reykjanes UNESCO Global Geopark. It utilizes geothermal energy, and the plants grow in volcanic pumice and are watered with pure Icelandic water enriched with essential nutrients.”

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The world's most peaceful nation, but a true fighter

Iceland's committed government and resilient businesses embrace the challenge of generating a new, post-COVID growth cycle

Like all of us, Iceland is having a difficult year. But its business community is confident the future is bright. "There are great reasons for optimism as policymakers, business leaders and the public are willing and able to embrace change," says Ásta Sigríður Fjeldsted, managing director of the Iceland Chamber of Commerce, an influential bridge between public and private sectors.

What change is the chamber expecting to see in post-COVID Iceland? "We need to bet on innovation, and activate the entrepreneurial, hard-working spirit dwelling in our highly educated workforce. We must also diversify further. In the 20th century, fishing was dominant, then aluminum factories and recently tourism has fueled growth. Now, we need more diversification, which requires long-term planning from companies and government," Fjeldsted asserts. She believes there are many opportunities to grow new industries, particularly those involving sustainability or environmental friendliness. Iceland's commitment to the Paris agreements will see it reduce carbon dioxide emissions 29 percent by 2030. But the government plans to raise this to 35 percent and wants to be carbon neutral by 2040. "This makes Iceland an interesting option for investors keen to fight climate change. We're



Ásta Sigríður Fjeldsted
Managing Director
Iceland Chamber of Commerce



Lilja Björk Einarsdóttir
CEO
Landsbankinn

Education institutions will support economic advance, notes Ari Kristinn Jónsson, president of Reykjavik University, one of Times Higher Education's top 100 young universities. "We will do our part by opening opportunities for students, such as enabling study in new sectors. We intend to push even further our focus on giving students the best know-how for the modern world and the future, as well as teaching them how to innovate and be entrepreneurs. We also want to continue to help create new companies, jobs and opportunities for Icelandic businesses and society." Like other institutions, Reykjavik University works closely with the private sector to boost the impact

of its education and extensive research activities that have made it the world's most cited university. In fact, the Iceland Chamber of Commerce is majority owner of the nation's largest private university. "We are seen as a great partner to companies and a catalyst for startups," mentions Jónsson.

Having lived in the U.S.'s Silicon Valley, he agrees that Iceland is a wonderful place to live. "It's a safe, modern, advanced, beautiful country that is easily reached from the U.S. and Europe. The connections we have with the rest of the world, the quality of education and the possibilities around entrepreneurship and innovation are big. It's a fantastic place to study, innovate and work."

"Landsbankinn is also here to support the economy," says Lilja Björk Einarsdóttir, CEO of the country's largest bank. "Some companies will, unfortunately, not make it out of the current crisis but most will. It's very important to ensure they have the time and facilities to ramp up operations. As a bank, we have placed emphasis on mortgages and retail banking, which are the wheels you need to keep in motion to help key economic players continue working," she adds. Landsbankinn's ongoing transformation of its practices demonstrates how well suited the country is for a post-COVID world. "In terms of digitalization, for example, we opened the first digital bank years before anyone in the U.K. or the U.S. did. We work with a lot of fintech companies—some processes require the input of three or four providers that needs to be integrated smoothly. This is our focus, that every process works well for the customer and for us," Einarsdóttir maintains.

The bank is currently looking to service demand for sustainable financing, she discloses. "People want to feel good about how they grow their money, investments and future. Equality is also high on our agenda. Iceland is very focused on gender equality but the time has come for equality in the broader sense, especially given the opportunities we have as a country to attract people of different nationalities." Einarsdóttir is another that advocates living in Iceland. "It's an excellent destination for highly skilled professionals from around the world to raise their families. The worst thing that could happen is you might have to buy a slightly thicker coat."

"You can work from anywhere today, even from a little town in our fjords, where you can kayak in the morning before logging into your online workstation."

Ásta Sigríður Fjeldsted, Managing Director
Iceland Chamber of Commerce

seeing growing global appetite for green investments, bonds and so forth. We have abundant renewable energy and a committed government—our prime minister is a true fighter for many of the critical issues in today's world and climate change is at the top of her agenda," Fjeldsted stresses.

Foreign investment will play a role in building economic diversity, with investors finding it easy to operate in a nation rated the 26th best for doing business by the World Bank. But there are more reasons to be based in Iceland, she claims. "Other elements are just as key as our dynamic economy. We rank top in the world for peace and gender equality year after year. We are also at the head of indexes for democracy, social progress, human development, media freedom and more. We have a healthy society, with strong healthcare and education. A lot of Icelanders who move abroad end up coming home, often because of its quality of life. It's an attractive base for remote working—you can work from anywhere today, even from a little town in our fjords, where you can kayak in the morning before logging into your online workstation."