

The DHL logo is positioned in the top right corner of the yellow header. It consists of the letters 'DHL' in a bold, italicized, sans-serif font, with three horizontal lines to the left of the 'D'.

Delivered.

THE GLOBAL LOGISTICS MAGAZINE

ISSUE 04/2016

BUSINESS

AHEAD OF THE CURVE

Discover how Oman is diversifying its economy

SOLUTIONS

OUT OF AFRICA

Learn why China is outsourcing to developing African countries

VIEWPOINTS

SHE MEANS BUSINESS

Find out what makes Hind Bahwan one of the Middle East's most powerful entrepreneurs

FOCUS

THE WINDS OF CHANGE

How the global energy industry is meeting the demands of a volatile market





DEAR READER,

The energy industry is undoubtedly in one of its more turbulent phases. Price volatility means exploration activities have been cut back and companies are looking hard at ways to save cost and increase profitability. On the other side of the scale, renewables are coming into their own – so much so that industry body REN21 described the year 2015 as “an extraordinary one for renewable energy.” Our Energy Focus explores this changing industry landscape and finds out how companies are consolidating supply chain resources to tackle short-term volatility.

With finite fuel reserves, Oman is looking to shore up its income through the development of other industry sectors. Will the country manage to use its strategic location and bring logistics to the fore as a key contributor to safeguarding the prosperity of future generations?

China meanwhile is looking toward countries rather than sectors, to diversify. As the world’s former “factory” is facing increasing wages on its home ground, it’s turning to Africa, where it has been involved in infrastructure development for years, to outsource its light manufacturing.

The list of Hind Bahwan’s accolades is a long one. In this issue of *Delivered*, the formidable business woman reveals how she became a leading tech sector entrepreneur who is equally at home in the energy business.

Enjoy your read!

Sincerely,

Bill Meahl
Chief Commercial Officer, DHL

Cover photo: Billy Hustace/Getty Images



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EXPANDING EAST AND WEST

The global B2C e-commerce market for shipments crossing borders is growing at a massive rate. Indeed, it is estimated that one billion people will shop online and across borders by 2020, with e-commerce sales increasing from \$400 billion today to a total global volume of \$1 trillion. With this in mind, DHL is expanding its infrastructure in two major e-commerce markets: the U.S. and China. Last year, DHL Global Forwarding opened a \$35 million distribution center in Chicago and DHL eCommerce its first order fulfillment center in Columbus, Ohio, followed by a similar facility in Los Angeles. Further DHL eCommerce regional fulfillment centers are to be established in New Jersey and other locations in 2017. Additionally, DHL Express has opened a new \$1.3 million service center facility in Chicago to meet heavy demand from e-commerce customers. With the company announcing its intention to make \$137 million of investments in the U.S. in the next years, this infrastructure will provide merchants

with the opportunity to place inventory closer to consumers to speed up delivery. China accounted for more than 40 percent of global retail e-commerce sales in 2015, thanks to a growing middle class, which will reach 630 million people by 2022. The demand for logistics solutions continues to soar, which is why DHL eCommerce plans to grow its overall presence in the country by more than 50 percent this year. It has already opened a new Shenzhen Distribution Center that can handle up to 18 million shipments annually and will also expand existing centers in Shanghai and Hong Kong to handle up to 48 million and 71 million shipments respectively on an annual basis. "There is barely any other industry that provides such a promising outlook as the e-commerce business," says Charles Brewer, CEO DHL eCommerce. "With our investments, we are laying the foundation for expanding our leading role in cross-border e-commerce logistics."

WIN!

Andris Nelsons has been announced the designated Gewandhauskapellmeister of the world-famous Gewandhausorchester, taking up the baton in the 2017/2018 season. DHL is its Official Logistics Partner, and *Delivered.* has two pairs of tickets to give away to see

the Gewandhausorchester in concert. **All you have to do to be in with a chance of winning is to estimate the value of the shipments (in euros) when the Gewandhausorchester is on tour.**

Information on how to enter – as well as details about the date and location of the concert – can be found online at:



bit.ly/orchestra-tickets



Don't miss our story about Andris Nelsons on page 40-41.

120

The number of countries involved in an international solar alliance, announced by India's prime minister Narendra Modi at the Paris COP21 climate summit in 2015

ADIDAS REBOOTS ITS GERMAN OPERATIONS

German sportswear maker Adidas is set to open its first factory in Germany two decades after shifting manufacturing to Asia. The new plant will not mean a return to traditional manufacturing though – shoes will be produced by robots. The prototype automated “speed factory” in Ansbach will allow shoes to be made faster and closer to their sales outlets, the company says, and it expects the first test pairs to be made later this year, moving to full production in 2017.



bit.ly/speed-factory



GAME-CHANGING TECH

What's the similarity between the all-conquering Pokémon GO and DHL? Well, the Pokémon app is powered by augmented reality – a type of virtual reality technology that DHL has been applying in the logistics industry. To read more about “Augmented Reality in Logistics” and download a trend report from DHL, please visit:



bit.ly/dhl-augmented-reality

SAFE SPACE

Space... the final frontier. And, it seems, a bit of a junkyard. According to the European Space Agency (ESA), there are some 29,000 large “human-made objects” orbiting the Earth – the flotsam and jetsam of 60 years of expeditions into the unknown. These pieces of astro-rubbish – all larger than 10 centimeters – pose a considerable threat to active satellites. If a single one-centimeter object were to hit a satellite, says the ESA, it would do so with the force “of an exploding hand grenade.” This could create more debris and – potentially – more collisions. Which is why the ESA is developing a “debris hunter” called e.Deorbit. Its test mission will be to capture a derelict satellite in low orbit “and safely burn it up in a controlled re-entry.”



bit.ly/cleaning-space



WE'RE GOING TO NEED A BIGGER BOX...

DHL recently transported Eliska, a three-year-old female Eastern black rhino, from her birthplace in the Czech Republic to a conservation project in her natural homeland, Tanzania. Eliska – all 900 kilograms of her – was flown in a dedicated Boeing 757-200 cargo plane to ensure her journey was as comfortable and as quick as possible. It's hoped she will help increase the endangered black rhino population, which is thought to number just 800 worldwide.



THE STORY

LOVE YOUR LEFTOVERS

Ever wonder where those leftovers from your airline meal end up? Although packaging can be recycled (under stringent rules), any leftover food is usually destined for the bin. But no longer, as DHL EnviroSolutions has come up with a way to turn waste sandwiches into energy.

DHL provides the supply chain for in-flight meals for more than 95,000 British Airways flights a year from its Flight Assembly Centre (FAC) in Colnbrook, not far from Heathrow Airport – and has the job of removing post-flight waste. But under the new system, all organic food waste taken from the planes is first sorted to remove any stray metal or plastic, before it is being power-dried and then used as biomass fuel – for instance, to supply heat or hot water. It means that the FAC at Colnbrook is now a zero waste-to-landfill facility and will save about 1,500 tons of carbon dioxide over the course of the company's 10-year contract with BA.



www.dhl.co.uk/envirosolutions





MAKING CONNECTIONS

DHL Freight is expanding its network by linking Asian overland and intermodal transport operations with Europe and North Africa via its increasingly important hub in Duisburg, Germany. In a further move, it is also offering a rail service for groupage transport. For companies unable to fill a container on their own, there is an option to consolidate shipments at the hub, giving them the chance to design uncomplicated intercontinental supply chains and enjoy the time and cost benefits of transport by rail.

Some 400 trains a week now connect Duisburg with more than 80 direct destinations in Europe and Asia, so the port "offers an ideal starting point for dispatching rail transports directly on site," said Duisburger Hafen AG Chief Executive Erich Staake. And DHL Freight customers are taking advantage of these fixed departures between Duisburg and the coastal centers of China. "We already have customers whose commodity flows can be processed from China via Europe to Tunisia through the multimodal combination of road, rail and short-sea," said DHL Freight CEO Amadou Diallo.



COME FLY WITH ME

The U.S. Federal Aviation Administration has introduced new operational rules governing the commercial use of drones in a bid to make the routine flying of unmanned aircraft systems safer. U.S. transportation secretary Anthony Foxx said the move opened up a new era in aviation. Experts claim the move could generate \$82 billion for the U.S. economy and create more than 100,000 jobs over the next 10 years.



THE BIRTH OF E-COMMERCE?

The first item ever purchased on the internet – a copy of a Sting CD sold by 21-year-old American Dan Kohn via his website to a friend in August 1994 – was bought for \$12.48. Last year, retail e-commerce sales reached \$1.67 trillion.

 bit.ly/internet-statistic

LIVING RESPONSIBILITY



CARBON-CONSCIOUS

Reducing their carbon footprint is a priority for many businesses and DHL's new online Carbon Calculator gives its customers a free, convenient way to monitor theirs. The new online Carbon Calculator uses data from DHL's carbon accounting and controlling department to work out the transport-related emissions for almost all shipment sizes and modes of transport. This includes the route to the nearest airport or port, the main leg by air and sea and the last mile in the destination country. Customers simply enter the sender's and receiver's locations, the weight and

volume of the shipment and their preferred mode of transport. Katharina Tomoff, Vice President Shared Value, DPDHL Group, said the calculator means customers "can determine in advance the exact environmental impact of their shipment – at any time, from any place and free of charge." For registered users, the calculator also includes expanded versions of DHL tools such as Track & Trace, and the Carbon Report and Dashboard.

 www.dhl-carboncalculator.com

TRUNK CALLS

This fall, DHL and Smart – the maker of compact cars for urban environments – will be trialling a service in Stuttgart, Germany, where owners of Smart cars can use their vehicles as mobile addresses for car drops. The service will later be expanded to Bonn, Berlin and Cologne. The customer specifies their Smart car as the delivery address when making the order – and then an app informs the courier of the preferred delivery location, giving time-limited access to the trunk of the recipient's car.



BRIDGING THE AUTONOMOUS GAP

Deutsche Bahn has started planning for the autonomous future with a pilot project for a driverless train on a test track in the Ore Mountains near the Czech border. Plans have also been revealed to make self-driving cars a possibility for bridging the gap between train stations and homes. "I estimate that by 2021 or so, we will be able to have a portion of our network that drives completely automatically," Deutsche Bahn Chairman Rüdiger Grube said in an interview.



ROBOTS TAKE THE STRAIN

They were once the stuff of science fiction, but robots have transformed many parts of our working lives – and at DHL Supply Chain, they are now providing a helping hand in a warehouse for the first time. A pilot scheme has seen pickers in the warehouse in Unna, Germany, followed along their route by a fully automated robo-cart called EffiBOT. Where previously the pickers would have to push a heavy cart, this French-made robot simply trundles through the warehouse at a moderate seven kilometers per hour, allowing them to work hands-free. When the cart is full, the picker can simply send it to its drop-off location, while another empty cart takes its place. EffiBOT has a built-in obstacle avoidance system that allows it to navigate its own way through the warehouse. Its capacity of 300 kilograms means a picker can pack multiple orders into a single trolley load.

 bit.ly/EffiBot



The number of 3D-printed pieces Airbus now use in their A350 XWB aircraft



NEW CARGO DELIVERY

Elbe Flugzeugwerke (EFW), the joint venture of ST Aerospace and Airbus Group, will convert four Airbus A330-300 passenger aircraft for DHL Express to a 26-pallet cargo configuration, capable of carrying up to 61 metric tons of payload. The first aircraft are scheduled for delivery by the end of 2017 and are expected to bring added flexibility and capacity to DHL Express's operations, while helping to improve fuel efficiency for every kilo of cargo carried within the company's air network.

FOLLOWS
PICKER



SPEED 7
KM/H



OBSTACLE
AVOIDANCE



MAX. LOAD
300 KILOS

EASY TO USE



ENERGY: THE CHANGING TIDE

As it grapples with short-term volatility, the global energy industry is also preparing itself for long-term structural change.





NEW NAVIGATION:

In volatile times, oil producers have had to find ways to keep wells pumping while slashing costs and shoring up profitability.

**FIRE BREAK:**

Drivers with firefighting supplies to tackle the vast wildfire at Fort McMurray in Canada that hit oil production.

The oil price isn't the only thing that's moving in the energy sector. In January 2016, with oil trading at less than \$30 a barrel, the industry was two years into the steepest, deepest and most prolonged price drop in its recent history. Influential analyst the International Energy Agency (IEA) warned that "unless something changes, the oil market could drown in oversupply."

Change duly came. By the middle of the year, a series of unexpected production outages – including wildfires in Canada, violence in Nigeria and technical problems in Ghana – had helped the oil price bounce back to more than \$50, double its lowest for the year.

For energy companies, volatility is nothing new. Around the world, oil producers have kept their wells pumping, hoping that rivals will crack first under sustained price pressure. But behind the scenes, they've also been working hard to slash costs and shore up profitability. Supply contracts have been renegotiated, jobs cut and capital investments delayed or cancelled.

Companies have cut back on exploration activities, too. At 2.8 billion barrels, new oil discoveries in 2015 were the lowest for 60 years. That isn't going to make much of a difference in the short term – oil supply is expected to continue to exceed demand until 2017 at the earliest. But if the current trend continues, the world could face significant supply shortages by 2035, analysts say.

2.8
BILLION

The number of barrels of new oil discoveries in 2015 – the lowest for 60 years

The energy landscape may look very different by then. Beyond the industry's current challenges, long-term trends are gradually reshaping the world's appetite for energy. Among the most important, and interrelated, are carbon dioxide and economic rebalancing.

After two decades of negotiations, international cooperation in the battle against climate change passed an important milestone in December 2015 when 195 countries signed the Paris Agreement, a commitment to limit global warming to "well below" 2 degrees Celsius. Since fossil fuels generate the vast majority of the carbon dioxide that contributes to the greenhouse effect, meeting those commitments will require countries to make significant changes in the way they produce and consume energy. Those changes will affect emerging economies as much as mature ones, as their size and rapid growth mean China and India have joined the U.S., EU and Russia in the global top five greenhouse gas emitters.

Not all about oil

The first major casualty in the world's attempts to clean up its energy production is likely to be coal, and its decline is already underway. The fuel that powered the industrial revolution is also the dirtiest, producing 40 percent more carbon dioxide than oil for the same energy output. The U.K. has pledged to close its remaining coal-fired power stations by 2025. Global coal consumption fell by 1.8 percent in 2015, driven by a steep decline in the U.S. (-12.7 percent) and a smaller, but significant fall in China (-1.5 percent). Last year's trends seem to be accelerating. Major U.S. rail operator Union Pacific reported that shipments of coal on its network had fallen by 34 percent in the first quarter of 2016 compared with the same period a year earlier.

The biggest winner should be the renewable energy sector – and it does seem to have plenty to be happy about. Industry body REN21 (Renewable Energy Policy Network for the 21st Century) described the year 2015 as "an extraordinary one for renewable energy." The world added around 147 gigawatts of renewable electricity generation capacity last year, and 38 gigawatts of heat, with biofuel production also growing. Despite low conventional fuel prices, new renewable capacity investments were higher than those in fossil fuel power generation for the sixth year in a row.

Within the world of renewables, wind and solar photovoltaic (PV) power saw the largest increases last



DIGGING IN:

Mining for coal has been declining in many countries, yet the fuel is central to the energy plans of emerging economies.

year. Global wind power generating capacity increased by 17 percent in 2015 to a total installed capacity of 433 gigawatts. Solar PV installations increased by a quarter, bringing their worldwide capacity to 227 gigawatts. The cost of these technologies is falling rapidly, too. Between 2008 and 2015, onshore wind energy costs have fallen by more than a third, and solar PV costs have dropped by 80 percent.

Significantly, renewable energy isn't just being installed in mature economies. Wind energy was the second largest source of new power capacity in China last year, which was also one of the top three markets worldwide for solar PV. There is also increasing activity in large-scale concentrating solar thermal power installations, which store heat collected from the sun, allowing electricity production to continue overnight. Many of the newest installations of this type of technology are happening in emerging countries like South Africa, Morocco and Chile, an indication that these regions may develop energy infrastructures that look very different from those of the past. 2015 was the first year that developing economies spent more on renewable energy than their developed counterparts.

Interest in other renewable energy sources continues to grow steadily, too. The U.K. gave planning approval for the construction of a tidal lagoon in Swansea Bay, South Wales, last year, and a new pilot site for the evaluation of tidal stream turbine technologies is under development off the Isle of Wight. While the scale of these investments remains relatively small, the potential of these technologies is significant, with the U.K. Department for Energy and Climate Change estimating that wave and tidal energy could eventually meet up to 20 percent of the country's power requirements.

Fossil fuels: not done yet

Are the traditional energy companies reaching the end of the line? Far from it. While renewable energy has made dramatic strides, even REN21 admits that it still accounts for less than 20 percent of global primary



WELL PRESERVED:

Workers on a rig in Norway repair a faulty pump.

FEELING THE HEAT:

A worker installs polycrystalline silicon solar panels as a photo-voltaic power project gets under way in Guanshui Town in the Muping District of China.



energy use. Strip out the use of biomass for cooking and space heating in traditional stoves and open fires, and modern renewable technologies make up just over 10 percent.

Renewable energy has certainly made huge strides in recent years. Wind power fulfils more than 40 percent of total electricity demand in Denmark for example, and on the 8th of May this year, wind and solar power briefly provided 90 percent of Germany's total grid power – an all-time record. In the same month, Portugal powered its electricity grid using only renewable energy for more than 100 hours. However,

even in developed markets, renewables are a long way from providing a complete solution. The intermittent nature of supply, combined with the lack of large-scale energy storage, means that even countries with lots of renewables rely on generated or imported fossil fuel and nuclear power to maintain output. With future investments in nuclear capacity in doubt, countries like Germany don't yet have a viable alternative to coal powered electricity. Coal is central to the energy plans of some major emerging economies, like India and Indonesia. And renewable energy is yet to have a significant impact in shipping, road or air transportation.



WIND POWER:

The WPD Butendiek offshore wind project has a total of 80 wind turbines.



“Instead of running many separate supply chains, companies are looking for ways to combine them, co-locating materials in central storage hubs, for example.”

Steve Harley, President, Energy, DHL

The economics of all forms of energy remain highly dependent on national and regional government policies too. Despite falling costs, the business case for most renewable investments still depends on the availability of subsidies or price guarantees, and in some cases these have proved fragile. Spain's withdrawal of generous support for its solar industry following the 2008 financial crisis created significant problems for operators, for example, while employment in the U.K. solar energy industry has fallen by more than half after the government accelerated the closure of several schemes.

Forecasters at BP say global CO₂ emission growth has slowed dramatically, with no increase at all in 2015, although they expect that fossil fuels will still provide 80 percent of total energy in 2035. Indeed, the current glut of cheap oil saw it reach a third of total energy consumption (32.9 percent) – an increase of 1.9 million barrels per day, and the first rise in oil's share of global energy production since 1999. Gas consumption also increased significantly in 2015 over the previous year, although the 1.7 percent rise was well below the 10-year average of 2.3 percent.

The good news coming out of the annual BP report is that renewable energy generation accounted for 2.8 percent of global consumption in 2015. In fact, renewable energy output grew by 15.2 percent – a record increase of 213 terawatt-hours, roughly equal to the entire increase in global power generation. Wind energy, up 17.4 percent, remains the largest source of renewable electricity, accounting for just over half of the total, while solar power generation grew by 32.6 percent.

**2.8
PERCENT**

The amount of global energy generation provided by renewables in 2015

fuels. During the recent period of low oil prices, for example, the price of many products, from gasoline to chemicals, has not fallen as far as crude oil. That temporarily increased the margins of downstream refining and manufacturing operations, providing a useful cash boost to oil companies.

In some sectors, notably chemicals, the availability of cheap oil and gas has transformed commercial dynamics. Low-cost shale gas has made the U.S. one of the most competitive places in the world for chemicals production, for example. Royal Dutch Shell is set to build a large-scale polyethylene plant in Pennsylvania to take advantage of low-cost ethane from nearby shale gas fields. The investment is one of the biggest approved by any oil company in the past two years.

Traditional energy companies are becoming significant renewables players, too. Offshore wind provides obvious opportunities for the industry to transfer the capabilities it developed building and operating production platforms in challenging marine environments. French energy company Total has made big investments in renewable energy, with the development of large-scale solar facilities in Africa, the Americas and the Middle East. The industry also wants to play a role in solving future renewable energy challenges. Norway's Statoil is developing a pilot project to store electricity from offshore wind turbines in a one megawatt lithium battery bank, for example, while Total is buying battery maker Saft for just under \$1.1 billion.

Supply chains matter more

For energy companies, this combination of downturn and diversification has significant implications for all aspects of their operations, and logistics is no exception. With fewer capital megaprojects underway, companies are still looking for opportunities to cut costs and improve efficiencies in their current operations, while also

The diversity opportunity

The major energy companies are making a variety of short- and long-term investments they hope will allow them to profitably meet society's future requirements for energy, and for other products derived from fossil

retaining the capabilities, and the flexibility, they need to capture new opportunities.

According to Steve Harley, President DHL Energy Sector, they are pursuing different routes to this end. “Over the past two years, we’ve seen some energy companies broadening their logistics supplier base, as they look for lower prices across all their activities,” he says. “Others have taken the opposite approach, increasing the scope of the logistics services they outsource and entering global agreements and LLP arrangements with service providers.”

The drive to support more activities more cost effectively is encouraging companies to look at ways of consolidating supply chain resources. “Instead of running many separate supply chains to support their operations, companies are looking for ways to combine them, co-locating materials in central storage hubs, for example,” says Harley.

As they continue to diversify, Harley suggests that further supply chain consolidation across many different types of operation – upstream and downstream, conventional and renewable – is likely. “Energy companies are starting to recognise there are benefits to be gained from looking across their operations,” he says. “The planning and implementation you need for large-scale wind and solar projects are similar to those required for upstream oil and gas.” ■ *Jonathan Ward*

FUELED UP:

Petronas fuel tanker trucks park at the Klang Valley Distribution Terminal (KVDT) in Dengkil outside Kuala Lumpur.



1 MEGAWATT

The size of a lithium battery bank being built by Norway's Statoil to store electricity from offshore wind turbines

3 QUESTIONS FOR

Steve Harley,
President,
Energy, DHL



1. How has the extended period of low prices changed the energy sector's approach to logistics?

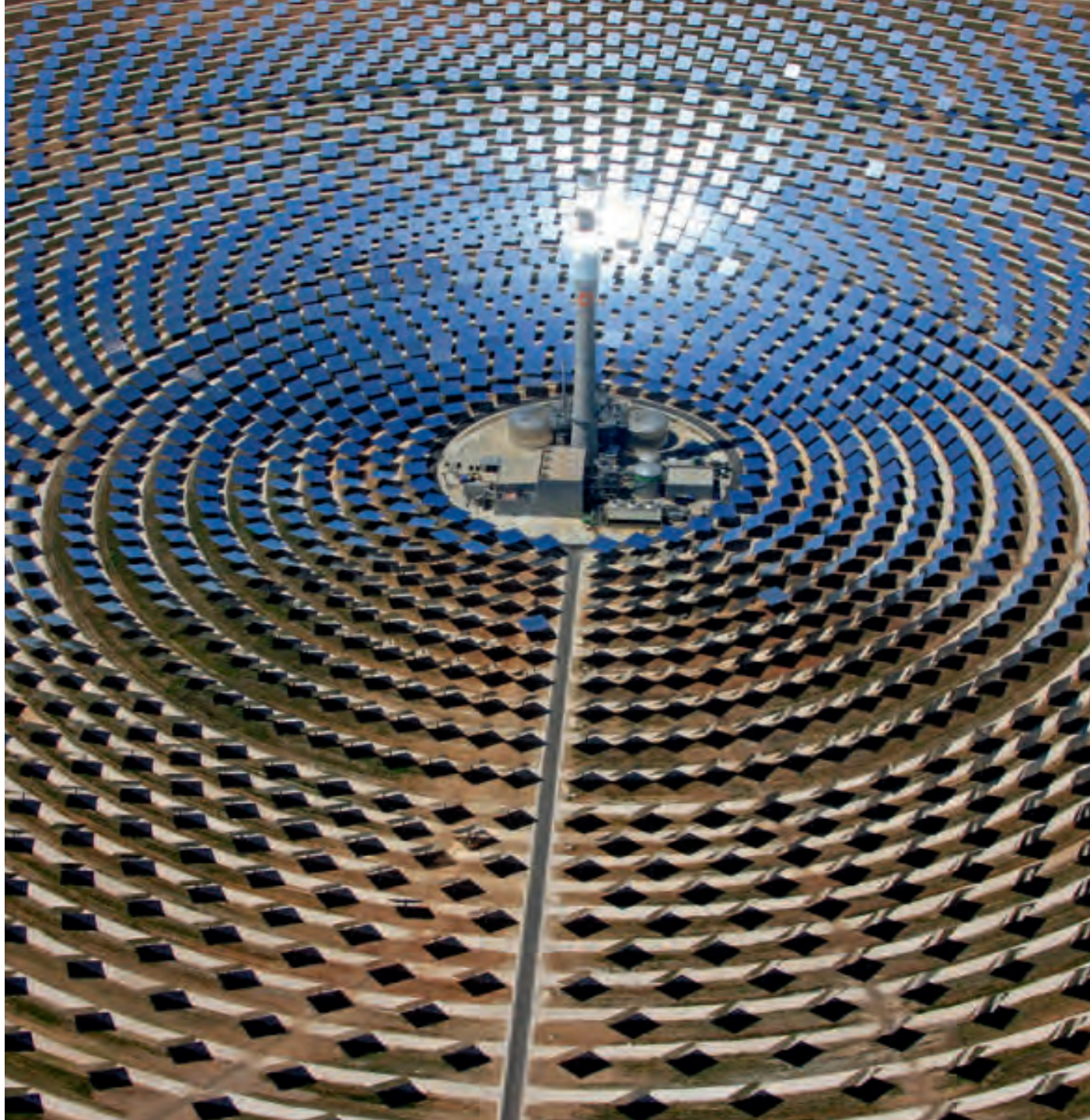
Costs are still under intense scrutiny, but companies are also looking at ways logistics and supply chain activities can add value to their operations. That's particularly true in the downstream sector, which is growing in importance. Oil companies are making additional efforts to build their brands and satisfy their customers. Logistics can play an important role there, with the development of new go-to-market models and final-mile delivery solutions that provide a better customer experience.

2. What are the implications of an increasingly diversified energy industry?

For decades the energy industry has relied on a contracting model in which services like logistics are split and tendered separately project by project. Historically, that has produced fragmented supply chains and underutilized assets. Now there's growing interest in approaches that allow those assets to be shared between projects, business units and even between competitors. Doing that calls for new commercial models to ensure the benefits of greater efficiency are also shared.

3. How is DHL supporting the industry's diversification?

As our energy customers review their approaches to the supply chain, we are involved in consulting studies to explore and develop new models and options. And there's growth in outsourcing, both of assets like warehousing and of supply chain management, as companies have trimmed their in-house capabilities to focus on core activities. As the sustainability agenda becomes increasingly important, we are also beginning to collaborate with our energy customers in other ways, working with them to support the development and testing of a range of new technologies from electric vehicles and solar panel installations on warehouses to biofuels in aviation.



HARNESSING THE POWER OF THE SUN

The world's first industrial-size solar power plant was built in 1913, but it's only in the past few years that large-scale installations have started to appear around the world.

Now solar power is rapidly gaining traction, thanks to new technologies and a major drop in costs. SolarReserve's massive 110-megawatt Crescent Dunes project in Nevada uses 10,000 mirrors to heat molten salt and generate electricity day and night – enough to power 75,000 homes.

Meanwhile in Morocco, King Mohammed VI pressed the button to start the world's largest concentrated solar power plant this February. Half a million crescent-shaped solar mirrors now produce 160 megawatts of electricity in Ouarzazate on the northern edge of the Sahara desert.

So far the city with its roughly 75,000 inhabitants has been known for movies such as “Lawrence of Arabia”

WHITE HOT:

SolarReserve's revolutionary Crescent Dunes project in Nevada is the world's first utility-scale solar farm to use molten salt to both generate and store energy.

and blockbusters such as the “Game of Thrones” series that were shot nearby.

Now it looks as if Ouarzazate will become famous for the Noor solar power plant. Three more installations are slated to follow between now and 2020, which will together provide enough power for one million homes and occupy the same amount of space as the Moroccan capital Rabat.

Falling costs

That is a milestone not just for Morocco, which so far has had to import 97 percent of its energy needs. It is also the final breakthrough for a concept 30 years in the making: in just six hours, the deserts of the Earth receive more energy from the sun than humankind uses in a year. What could be more obvious than to harness that power – especially in developing nations?

The main reason for the solar boom is the rapidly falling cost of photovoltaic cells – the industry saw a price drop of nearly 80 percent in just four years from 2008 to 2012. In the mid-1970s, it took \$96 to install one watt of solar energy. Nowadays that cost is just 68 cents, according to data from Bloomberg New Energy Finance. Indeed, in May this year, Dubai set a new world record for solar power costs with the unveiling of bids as low as 3 cents per kilowatt hour for its new 800-megawatt Sheikh Maktoum Solar Park Phase III.

China is currently the big leader in solar energy – in 2013 the country became the largest global installer, and it is now also the largest producer of solar power, with 43 gigawatts of installed capacity.

Given solar energy’s huge potential for off-grid electricity, it’s little wonder that developing nations are racing

**80
PERCENT**

The fall in the cost of photovoltaic cells in just four years from 2008 to 2012

to embrace the technology. Nearly half of India’s rural population, 80 million households, have little or no access to electricity. The nation’s solar industry is expected to grow 250 percent this year, and the government has just approved a plan to develop 50 solar cities.

In sub-Saharan Africa, 66 percent of the population lives in areas where connection to the grid is not economically viable, and countries are racing to embrace solar as the perfect solution – often helped by large development grants and loans from the West. Figures from Bloomberg New Energy Finance’s (BNEF) show that more renewable energy capacity will be added to Africa’s pipeline in 2016 than the total that has come online since 2000.

Even oil-rich nations such as Saudi Arabia have discovered the power of the sun. Veteran oil minister Ali al-Naimi recently told the Financial Times the kingdom wants to become a “global power in solar.”

Logistics

The logistics challenges of solar are less in terms of equipment size compared with wind, oil and gas, but there are still a lot of similarities, according to Gert Van Dijk, Global Head of Sector Strategy at DHL Energy.

“The energy sector is a high capital-intensive industry, regardless of energy type, and equipment often needs to be transported to remote places,” he says. “For larger projects, this requires logistics capabilities such as infrastructure planning, route surveys and coordination of a large pool of containers.

“Customs clearance in more remote geographies is often a challenge. This requires some expertise specific to the industry, but also to the geography the project is taking place in. Also, ensuring product integrity requires

BRIGHT IDEA

A worker walks in front of a solar array at Morocco’s giant project in Ouarzazate.



adequate packaging. As the cargo is sensitive to shocks, packaging should protect products, and sensors can monitor products while in transit.”

Chernobyl accident

The concept of solar power was born as long ago as 1913 when the American engineer Frank Shuman built the first solar thermal power plant. The “No. 1 Sun Engine” was installed 24 kilometers outside Cairo to pump Nile water for agricultural use, using mirrors to heat water and power a steam engine. Although he managed to get the well-known magazine *Scientific American* to write two stories about the new technology, World War I, with its need for energy that could be transported, paved the way for the dominance of oil in the 20th century.

The Chernobyl nuclear accident in 1986 gave another push to the solar dream. German particle physicist Gerhard Knies was sitting on his veranda when he heard about the disaster on the radio. A big fan of nuclear power, he was shocked that such an accident could happen. Aghast, he went into his house and looked into his physics books. On the back of an envelope, it was he who first came up with the calculation that six hours of sun in the deserts of the world could meet global energy needs for a whole year. And just three-thousands of the roughly 40 million square miles of desert land worldwide would be needed to site the solar panels.

Knies pushed his idea with the help of the Club of Rome, until it ultimately gave rise to the Desertec project. In July 2009, two dozen blue-chip companies announced they wanted to invest €400 billion in building solar power plants, mainly in the Sahara. A large part of the energy produced was to be exported to Europe, and Desertec was slated to supply up to 15 percent of the power used in the European Union by 2050.

Political turmoil

Once Desertec started to work, however, it quickly became obvious the companies had vastly different motivations. Some wanted to sell their machinery, others were interested in project finance. The biggest stumbling block for the idea was the political turmoil in North Africa after the start of the Arab spring in 2010.

Big investments in countries as unstable as Libya, Tunisia and Algeria were seen as major risks. Only Morocco managed to escape this investor sentiment. Plans for the thermal solar plant in Ouarzazate at that point were far advanced, the pilot studies sound. When Desertec collapsed in 2013, the Noor plant was on its way, financed by, among others, the World Bank and the European Investment Bank and backed by Moroccan state guarantees.

Since then tumbling prices for solar power have paved the way for the current boom. It is not so much the deserts of the world where new plants are being built, but sites close to the fast-growing cities of the developing world, which have huge energy needs. This won't change

POWERED UP:

A field of solar panels in the desert at Zhongwei in China – the country is now the world's largest producer of solar power.



TAKING THE SUN:

The solar power plant at Ouarzazate in Morocco.

any time soon. Although China has a project to generate 200 megawatts in the Gobi desert – enough to power one million homes – the cost of transporting the electricity with high-voltage lines is still quite high.

This – together with political instability – will probably hinder energy exports from Africa to the European Union. Again, Morocco might be an exception as there is an existing underwater cable linking the country to Spain. As of now, however, the kingdom needs all the energy it produces for itself. Morocco has even more ambitious plans for the future – by 2020, a third of its energy needs are to come from solar, wind and hydro. It looks as if King Mohammed VI still has quite a few buttons to push. ■ Margaret Heckel



GOING CIRCULAR IN OMAN

Oman's Petroleum Development Company (PDO) is tapping into the circular economy by putting in place programs that make its operations more sustainable while reducing costs and increasing waste transport efficiencies.

Extracting and refining oil is dirty work – and, like most industrial processes, produces wastes, both hazardous and non-hazardous. In the oil and gas industry these wastes range from equipment contaminated with naturally occurring radioactive material (NORM) to items as simple as tea bags from rig workers' dining halls.

In the current “low oil price” environment, energy companies are increasingly focused on a dual strategy of reducing costs associated with managing their waste and trying to recover value from it while also minimizing their environmental impact. PDO, Oman's largest producer of oil and gas and a global leader in Enhanced Oil Recovery, has a number of initiatives in place. Sulaiman Shaqsi, Logistics Manager, PDO, explains: “Our environmental effort includes programs such as ‘Bea’tona’ (Our Environment), and strategic plans to use best international practices to implement the waste management hierarchy within our operations – i.e. to prevent, reuse, recycle, and then dispose of waste that can't be recovered in any other way.” Shell, PDO's main joint venture partner,

recently highlighted its commitment to sustainability at its Annual General Meeting in 2016. For Shell, sustainability starts with running a safe, efficient, responsible and profitable business.

Bahwan DHL (BDHL), DHL's Supply Chain arm in the Sultanate, has been engaged by PDO to run the company's waste transport operations. Through its fourth party logistics (4PL) operations, Bahwan DHL manages the collection and transportation of PDO's non-hazardous and hazardous waste from the point of origin to the company's waste management yard or other approved waste disposal sites.

Kevin Bennett, Account Director, Bahwan DHL, comments: “Through our Envirosolutions business and our expertise in Health, Safety, Security and the Environment (HSSE), our focus for PDO's waste transport is to reduce costs whilst also ensuring we achieve the required standards as set out by PDO and Oman's Ministry of Climate and Environmental Affairs (MECA). Our remit not only includes introducing ways in which PDO's waste can be transported more efficiently and effectively, but also identifying innovative methods of

waste disposal that are not just more environmentally friendly but help PDO reduce costs as well.”

Sulaiman Shaqsi believes that the circular economy model must be an integral part of PDO’s environmental efforts: “If waste material can be used as a feedstock for another industrial process, this reduces the amount of waste to be disposed of and helps PDO create a circular economy within its operations. The Envirosolutions product from Bahwan DHL provides us with international best practice and expertise and offers us an integrated approach to waste, recycling, energy and environmental compliance, which helps save money and meet environmental targets.”

Two examples of how PDO and BDHL are working together to reduce waste and drive a circular economy in Oman are:

1. Waste oil-based mud (OBM) cuttings to cement production

When drilling with oil-based mud (OBM), wet OBM drill cuttings are generated at the rig site. These cuttings are then transported by BDHL subcontractors to PDO’s waste management yards, where they are stored and dried before being treated in a traditional process that is both expensive and energy intensive. In future, BDHL will be transporting semidried OBM drill cuttings to the coast near Muscat, where they will be processed by the Oman Cement Company (OCC) factory and turned into cement for use in Oman.

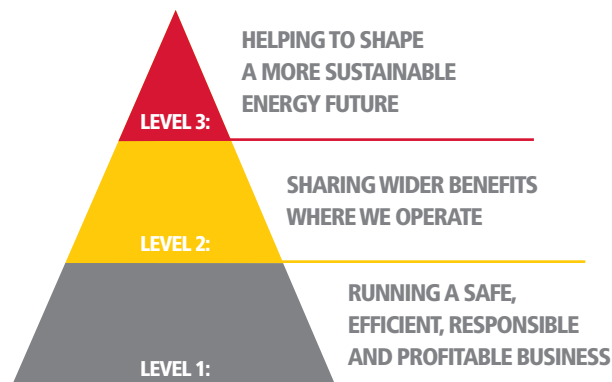
2. Gas condensate

PDO currently flares (or burns) the gas well condensate produced during the gas well drilling process. However, in order to improve its environmental performance, the company wants to reduce this flaring and, once the gas condensate is captured and stabilized, transport it to the production stations where it can enter PDO’s hydrocarbon production stream. This is in line with the World Bank’s initiative to reduce global gas flaring. BDHL is currently studying how best to load, transport and unload the gas well condensate to help deliver these new operations.

Further improvements

Experience gained through its Envirosolutions business has led Bahwan DHL to believe that there are significant opportunities for reducing costs and generating revenue through improved management and increased recycling of PDO’s non-hazardous waste. A study is currently underway to see how this could be done. In future, it should be possible to include plastic, cardboard and even food waste in PDO’s circular economy. ■ *Michelle Bach*

SHELL’S APPROACH TO SUSTAINABILITY



bit.ly/shell-sustainability

Examples of hazardous waste

- Oily wastes
- Oil-contaminated soil from oil spill/leak cleanup
- Oil-based mud cuttings from drilling activities
- Underbalanced drill cuttings
- Oily sludge and sand from storage tanks, vessel cleaning activities and pigging operations
- Waste/spent lubricants
- Equipment and sludge contaminated with naturally occurring radioactive material (NORM)
- Chemical wastes
- Mercury (including mercury-contaminated soil, sludge, PPE, gas filters and plastics) from gas maintenance activities
- Other wastes (e.g. batteries, medical waste, tires, oil filters, e-waste)

Examples of non-hazardous waste

- Domestic waste
- Kitchen waste
- Office waste
- Waste paper and cardboard, plastic bottles and cups
- Steel and aluminium cans
- Printer toner cartridges
- Empty non-hazardous metal and plastic drums
- Industrial non-hazardous waste
- Wood waste
- Construction debris
- Non-hazardous chemicals such as sodium chloride and calcium carbonate
- General scrap metal, drilling scrap metal and electrical cables





FUTURE-PROOFING

Oman looks to its strategic location and logistics as a key contributor to future prosperity.

Some five millennia ago, the legendary city of Ubar prospered with a commodity as precious as gold – frankincense. Modern-day Oman, where ancient Ubar is said to have been located, is still a source of the world's best frankincense. But it is another resource that has been responsible for the country's growth in the past 45 years: oil.

Oil propelled its growth from a remote backwater to a modern and prosperous nation. However, Oman is not as rich in fossil fuels as many of its neighbors in the Arabian Gulf region, such as the U.A.E. and Saudi Arabia. With an estimated 5.3 billion barrels of oil, Oman ranks 23rd, and it is 25th in terms of natural gas reserves,

which are estimated at 24,3 trillion cubic feet. Due to its varied and often challenging terrain, the Sultanate uses almost all methods of enhanced oil recovery. The country stands out for the technical expertise applied in recovery and is currently one of the few countries engaged in major energy exploration projects.

Logistics strategy

Oman is a high-income economy and needs to ensure the continued affluence of a growing and very young population, around 50 percent of which is between 20 and 40 years old. So, in an effort to diversify its economy, the government is now looking to use the country's strategic location and bring logistics into play as one of the key sectors supporting the national economy. A 2040 Logistics Strategy (SOLS 2040) is due shortly, and the Oman Global Logistics Group established this June as a government holding company is to implement the national logistics strategy and manage Oman's investments in ports, rail, maritime and land transport, as well as free zones. In addition, its role is to activate the private sector in any future developments.

RUGGED TERRAIN:
The Western Hajar Mountains
in the Sultanate of Oman.



PORT OF CALL:
Oman's port at Salalah is an important
hub between Europe and Asia.

ON THE ROAD:
The Omani government is investing heavily in key
infrastructure to make road freight more efficient.



Arabian Supply Chain reported Dr. Ahmed bin Mohammed Al Futaisi, Minister of Transport and Communications, as saying the Oman Global Logistics Group would synchronize investment and development objectives to maximize the return on investment.

The 2015 GCC Supply Chain & Logistics Conference was held in the Sultanate under the title "Oman's Strategic Role as the GCC's Gateway and Indian Ocean Rim Hub." The Oman Observer quoted Dr. Ahmed Al Futaisi, Minister of Transport and Communications, as saying at the conference that "the government is striving to place the logistics sector as a major source of national income, thereby enabling the Sultanate to position itself on the international logistics map. We assure you that in the next five years we will display our determination to provide trade facilitations in terms of the laws governing transportation and goods movement to ensure seamless and speedy movement of goods to and from the Sultanate."

He commented that over the past two years the Sultanate had made great strides in complementing the logistics sector infrastructure, with the ministry con-

OMAN

Population:

3,286,936 (2015)*

GDP: \$171.4 billion*

**World Economic Forum's
Global Competitiveness Index:**
62nd out of 140

**Group's Ease of Doing Business
Index:** 70th out of 189

**DHL Global Connectedness
Index:** 44th out of 140

*CIA World Factbook 2015 estim



structing five four-kilometer-long runways at the airports in Muscat, Salalah, Sohar, Duqm and Ras Al Hadd and at the time preparing the opening of Salalah Airport, the second largest airport in the Sultanate in addition to work on the passenger and cargo terminals and at Muscat and Salalah airports being completed.

According to Ali Thabet, DHL Express Country Manager Oman, continued strong government support for key projects such as the infrastructure transformation is key to diversification. He comments: "DHL Express was the first express company in Oman. We have grown alongside the country for 36 years now and were a part of its transformation into a modern and prosperous state under His Majesty Sultan Qaboos. We are keen on being a partner to business and government as the Sultanate takes its next and important step, diversifying away from oil into other sectors. Logistics is our core business and we believe in Oman's potential in that area, especially once all infrastructure projects have been completed."

Thabet believes the country's human resources are also key to its success: "Its people are one of Oman's strongest assets, and we are proud that our local operations consist primarily of local talent. It already makes up over 70 percent of our workforce and our aim is to further grow these numbers. The Omani government is keen on nourishing local talent, and from our side it is great to have a growing talent pool of local experts who we can groom with our global knowledge in the express and logistics fields."

Major investments in infrastructure

Located on the south-eastern coast of the Arabian Peninsula, Oman has a strategically important position on the Arabian Gulf and Indian Ocean, and shares land borders with the U.A.E., Saudi Arabia and Yemen and marine borders with Iran and Pakistan, including the Strait of Hormuz. This opens up possibilities for transporting goods by land and sea from a number of ports that the Sultanate has developed in the past decade, including Sohar, Salalah and, most recently, Duqm.

The Omani government is investing heavily in key infrastructure projects to the tune of around several billion per annum. Total state investment spending has risen from 5.5 percent from 2014 to \$7.3 billion in the first 11 months of 2015, even as the government ran a deficit, according to Arabian Business. Infrastructure investments include the modernization of airports with key focus on freight handling capacity, and the Duqm Special Economic Zone, some 550 kilometers to the south of Oman's capital Muscat – the single largest economic development project in Oman's history.

A national railway, part of the GCC-wide railways project, is also foreseen as part of a multimodal offering, though timing is currently under review due to delays with the overall GCC rail project. According to Arabian Supply Chain, Oman has just completed the preliminary design of its entire planned rail network, which

WELL CONNECTED:
The port at Duqm.



LOOKING UP:
LNG facilities at the port of Duqm. LNG is vital for Oman's transition from an oil-based economy.

ROADS WORK:
A road-building program is underway in Oman.





AL DUQM – CREATING A MAJOR TRANSIT HUB

Conceptualized as a major transit hub, Al Duqm – situated to the south of Oman on the Indian Ocean – features a refinery, petrochemical transfer facilities, a dry dock and a container port, which could potentially connect GCC states to the Indian Ocean, bypassing the Strait of Hormuz.

With its deep draft, long quay walls, and expansive basin, the Port of Duqm is intended to become an integrated, multi-modal logistics hub comprising sea, road, air and rail modes of transportation. An airport is under construction and the proposed rail freight and passenger network will eventually link Duqm with a national and GCC-wide rail system. The Port of Duqm is a 50:50 joint venture between the Omani Government and the Consortium Antwerp Port (CAP).

Duqm Special Economic Zone comprises several developments: Duqm Port, an industrial area, a new town, a fishing harbor, a tourist zone, a logistics center and an education and training zone. With a land area of 2,000 square kilometers and 70 kilometers of coastline along the Arabian Sea, Duqm Special Economic Zone (SEZ) is the largest in the MENA region, also ranking among the largest in the world.



www.duqm.gov.om/

PLANT LIFE:
The LNG facilities
at Duqm.



LNG – A STRATEGIC PILLAR

Liquefied natural gas (LNG) is a key economic sector currently accounting for some 20 percent of national revenues. Its continued growth will also enable Oman's transition from an oil-based economy.

Proven gas reserves amount to some 24.3 trillion cubic feet, but domestic demand is outpacing supply. As part of the pan-GCC "Dolphin project," Oman imports natural gas supplies from Qatar, enabling the Sultanate to produce and sell LNG to overseas markets. The country is also just completing a major export deal with Iran. In a recent interview with Reuters, Minister of Oil and Gas Dr. Mohammed Al Rumhy stated that Oman and Iran have finalized the export route of Iranian gas to the Sultanate. Tehran will export its gas to Oman through a pipeline running under-sea, connecting Iran's massive gas reserves to the Omani market and the country's LNG plants, which will re-export the gas. In 2013, the Sultanate and Tehran signed a \$60 billion gas export contract for a duration of 25 years and, according to Rumhy, bids for engineering and construction of the project could still commence in 2016. Meanwhile, BP has signed a contract for the development of shale gas in Oman's Khazzan field, which may raise the Sultanate's natural reserves by some 40 percent. As Oman begins importing Iran's natural gas and developing shale from Khazzan, it will be in a strong position to export more LNG to the Far East and European markets.



FACES OF THE FUTURE: Boys at the Sultan Qaboos grand mosque, Muscat.

ENHANCED OIL RECOVERY – GOING SOLAR

Oman's rugged terrain makes it especially beautiful. When it comes to oil exploration, however, the terrain is challenging and over time, the Sultanate has used all major methods of extraction and is recognized as one of the global leaders in Enhanced Oil Recovery (EOR) technologies. Since 2007, it has successfully reversed field decline and increased its oil production to near record levels through steam injection and other advanced EOR solutions. Petroleum Development Oman, Oman's largest oil and gas producer has partnered with solar steam company Glasspoint to build the Middle East's first solar EOR project, operating a successful pilot since late 2012, proving that solar EOR presents a viable alternative to burning natural gas for steam.

By using solar to generate steam, Oman can save up to 80 percent of the gas currently used for EOR. The gas saved can be exported as LNG, boosting Oman's export revenue. Miraah will be one of the largest solar plants in history, producing 1,021 MW of peak thermal energy, using concentrating sunlight to generate 6,000 tons of solar steam each day. The steam will feed directly to PDO's existing thermal EOR operations, providing a substantial portion of the steam required at the Amal oilfield in Southern Oman. Miraah will save 5.6 trillion Btus of natural gas each year and once completed will comprise 36 glasshouses over an area of 3 square kilometers. Steam generation from the first glasshouse module projected to begin in 2017.



www.glasspoint.com/markets/oman/



aims to link the ports, economic, industrial and commercial areas, as well as areas with potential urban growth so that these assets can yield their full economic potential.

According to Frost& Sullivan, the logistics industry in Oman, which accounted for \$ 8.81 billion of Oman's GDP in 2015, is likely to grow at a compound annual growth rate (CAGR) of 6.9 percent between 2015 and 2020. The company predicts overall logistics growth in Oman at 7 percent. In 2016, with sea transport as the predominant mode, sea freight is likely to grow by 4.8 percent. Sea freight currently accounts for over 80 percent of freight in the Sultanate handled by Sohar and Salalah ports.

Road freight is currently driven by domestic economic activities to meet local demand and land-based trade with other GCC countries. It will be made much more efficient with the opening of a 450-kilometer (279-mile) road through the Empty Quarter desert, Rub al Khali, between Oman and Saudi Arabia and is currently undergoing border checks.

Roy Scaria, Country Manager DHL Global Forwarding, is optimistic about developments in Oman's logistics market. "Once fully completed and synchronized, the infrastructure developments currently underway will significantly enhance both transit speed and efficiency, and they will help Oman add weight to its logistics ambition. In partnership with the Bahwan Group, we are engaged in several key energy projects in the country, and for us as freight forwarders, developments at ports and airports are key enablers, as are developments in road transport, as they in turn enable us to deliver excellence to our customers. We are currently operating from offices in Muscat, Salalah and Sohar, but are looking to add Al Duqm soon."

Overseas investment

As low oil and gas prices have dented Oman's income, private investment is more than welcome, and investors from China have reportedly been found for a 1,172-hectare industrial park at Duqm, with planned investments said to include an oil refinery, a cement plant, a factory making pipes for the petroleum industry, an automobile assembly plant, and a one-gigawatt solar power generation facility. Meanwhile the government of Iran is said to be ready to invest \$4 billion in Duqm and will also implement a number of other megaprojects in the Sultanate, according to a report in the Oman Observer. The automotive sector could even get a further boost – Arabian Business reports that an Omani sovereign wealth fund and Iran's biggest automaker, Khodro, have agreed to study a proposal for a \$200 million auto plant in Duqm.

Competitive environment

Oman's road to industry diversification might prove to be just as rugged as some of its stark mountainous terrain. Many pieces of the logistics puzzle still need to be put into place, key among them is the rail connection, which would allow the Sultanate to connect its ports and other

GCC countries. Oman Rail has plans for a \$11 billion rail network, due to be built in four segments and connecting to the GCC mainline rail across the Arabian Gulf. With delays to GCC rail, the country is moving ahead, evaluating business cases for some of the sections, but only a GCC-wide network would allow for seamless onward transport of sea freight by rail to serve the Gulf States.

Oman has a strategic advantage due to its location, which enables shipments to bypass the Strait of Hormuz, and with a multimodal setup, its logistics offering could become very strong. Competition is fierce from the U.A.E., which has transformed itself into a sleek regional logistics hub with global ambition and the infrastructure and processes to match. The final development of Dubai South, including Al Maktoum, Dubai's second international airport, and its logistics corridor comprising Jebel Ali Port and Freezone, are a hard act to follow. Then there is Saudi Arabia, poised to make it to the top ranks of the global logistics index, with investments to be fuelled by the forthcoming Saudi Aramco IPO (see page 29).

But while it might be more modest and much lower key than many of its neighbours, Oman moves to its own beat – a strategy, combined with a diplomatic path set by its ruler, H.M. Sultan Qaboos, that has served the country well. And Qaboos, who created a modern Oman and put it on the map of the modern world, is nothing if not determined when it comes to making his country a success:

“Our determination to move forward with confidence toward the broader horizons of comprehensive, sustainable development remains undiminished. While committed to preserving our own values and identity, we are enthusiastic about developing international relations to reinforce the advances already made. Further progress, we believe, can best be achieved through hard work and the pursuit of knowledge, which will prepare Oman and its citizens for dealing with the emerging realities of the modern age.” ■ *Michelle Bach*

BP Statistical Review of World Energy (June 2016):

 bit.ly/bp-report



Crude oil – proven reserves in barrels (billions)



REFORMER, LEADER, DIPLOMAT – H.M. SULTAN QABOOS BIN SAID AL SAID

In 2010, the United Nations Development Programme (UNDP) ranked Oman as the most improved nation in the world in terms of development during the preceding 40 years. The reason: the country's ruler, Qaboos bin Said, who, after coming to power, turned his country from a literal backwater into a prosperous and highly developed nation. 45 years ago, Oman had only three primary schools teaching some 900 boys, and no secondary schools at all. The country had one hospital and just ten kilometers of paved road. Today it is a modern and thriving nation with an affluent and educated population. In 2010, after four decades under Qaboos' rule, 98 percent of Oman's children attended primary school and the literacy rate among young adults was at 98 percent. Oman was ranked first out of 191 countries for "health care system performance and outcome" by the WHO and in 2010, the UNDP judged Oman to be the "most improved nation" since 1970, with a life expectancy of 76 as compared to the OECD average of 80. Widely admired by his citizens, Sandhurst-educated Qaboos has ruled Oman with great skill. He has managed to create a modern country while preserving traditions and masterfully navigated regional and global politics, embedding the country firmly in the Gulf Cooperation Council (GCC) while keeping diplomatic channels open with countries such as Iran. Oman has sponsored peace talks between many states in the region, including during the Iran-Iraq War (1980-1988). A private visit by Qaboos to Iran in 2013 during which he met senior Iranian officials aimed to promote bilateral cooperation and an exchange of viewpoints about various regional and international issues. This was followed by a visit from Iranian president Hassan Rouhani to Oman in 2014. As sanctions ease, Oman looks set to benefit from those relationships, with Iranian investors poised to invest in Duqm, a gas pipeline to be built from Tehran to the Sultanate and other collaborations currently said to be under discussion.

**\$11
BILLION**

The cost of a new rail network planned for Oman

IN SEARCH OF THE HOLY GRAIL...

Entrepreneur Vivek Ramaswamy talks about his plans to revolutionize pharma R&D – and being at the forefront of the biggest IPO in U.S. biotech history.



Vivek Ramaswamy modestly describes himself as “an accidental entrepreneur.” Born and raised in Cincinnati, Ohio, he studied molecular biology at Harvard, expecting to become a physician or scientist. Fate, however, had other ideas. While at college he started a small tech company for budding entrepreneurs and discovered a taste for business, and after graduating he became a hedge fund manager with QVT Financial, where he was responsible for biotech investments. He continued working for QVT part-time while studying for a second degree, this time in law, at Yale – a subject he had always been interested in. Since then, his success has been extraordinary.

In 2014, Ramaswamy launched a company called Roivant Sciences with a mission to rescue promising developmental drugs that, for reasons unrelated to their scientific merit, had been forgotten or ignored by big pharma. The first drug in its portfolio was intepirdine, an experimental treatment for Alzheimer’s disease, bought from GlaxoSmithKline for a reported \$5 million. In 2015, Roivant formed a spin-off company called Axovant to develop the drug, which raised more than \$300 million in a record-breaking IPO (Initial Public Offering) – the biggest IPO in U.S. biotechnology history. By the end of the first day’s trading, Axovant had a market capitalization of \$2.8 billion.

Ramaswamy’s stock shot up with the media, too – he has since appeared on the front cover of *Forbes* magazine – although he remains level-headed about his rising profile. “If we’re doing important things that interest people, I’m OK with that,” he says. “It attracts a broader range of people in the scientific community to our story.”

And that story is remarkable, but to Ramaswamy it’s not about money. It’s about improving the efficiency with which R&D is conducted in the pharma sector, thereby making a positive difference to people who need treatment for diseases such as dementia. “On average, it can take around \$2 billion and more than 10 years to deliver a drug to market,” he says. “By focusing on a pool of drug candidates that have either stalled or been forgotten, we think we can make that process more efficient and deliver R&D in a more intelligent way.”

Why did you want to get involved with developing a treatment for dementia?

My mother was a geriatric psychiatrist who treated Alzheimer’s patients for years. When I was a child I used to play the piano in many of the nursing homes where she practiced and saw the devastating effects of this disease on the patient, and also on family members and caregivers. That’s a really motivating force: to be able to make a difference.

What are your thoughts on being the biggest IPO in U.S. biotech history?

It was a symbol of investor enthusiasm that was great for us and for the field more generally. But, for me, the most im-

portant events of last year were the start of our Alzheimer’s study and our acquisition of a second drug to develop contemporaneously with intepirdine that addresses other aspects of dementia, such as hallucinations, sleep disturbances, or violent disturbances.

Why did you see promise in intepirdine where others didn’t?

It’s the only drug we’re aware of that has demonstrated significant improvements on cognition and function in Alzheimer’s patients in clinical trials. To be fair, I think the people who worked on this compound at GSK could see its promise; but, because of circumstances external to the drug, it was unable to reach the final stages of its development.

How does GSK stand to benefit if it goes to market?

We have a creative deal that’s a win-win for both of us. We take on the future development of the drug – a phase three study is ongoing as we speak – and, if we are successful, we’ll share the upside with GSK through milestone payments and a royalty on the revenues of the product we generate.

Why would intepirdine be such a breakthrough?

There hasn’t been a new drug for the treatment of Alzheimer’s disease approved in a decade or more, so intepirdine would be an important milestone. Firstly, it would be a way to delay – or even avoid – significant costs in the healthcare system resulting from nursing home placements of elderly dementia patients. Secondly, it would show that Alzheimer’s disease is a tractable problem. When do we hope it will come to market? We’ll have to see how things unfold but, if you do the math, the implication is around 2018.

How important is it to have a healthy respect for failure in your business?

We haven’t had a prominent failure yet, but I’m sure at some point in our lifecycle we will. We’re in a business which consciously takes significant scientific risks, but it’s only by doing so that we’ll be able to advance. We have to be bold while remaining humble and acknowledging the possibility of failure. And if and when we fail, it’s important that we do it quickly and cheaply, and act decisively. That’s a big change from the way things have worked in pharma before, where good money has often been thrown after bad.

What’s the best thing about your job?

It’s something that I truly enjoy and I’m approaching it with the same drive that I get from playing sport. I consider myself to be a competitive person. I’m an avid tennis player, for instance, and I like to win. The business I’m involved in is not a game, but the stakes are high because our success can mean real benefit to people who are in need of it. That sharpens my competitive instincts and gives me a lot of satisfaction. ■ *Tony Greenway*

**\$300
MILLION**

The amount raised by Axovant’s IPO after it bought Alzheimer’s disease drug from GSK for \$5 million

**\$2.8
BILLION**

Axovant’s market capitalization at the end of its first day of trading



WHAT YOU CAN LEARN FROM VIAGRA'S SUPPLY CHAIN

Pfizer's direct-to-consumer e-commerce offering shows how life sciences companies can use their brand strength to build a new kind of relationship with customers and patients.

Business-to-consumer (B2C) e-commerce is fast, dynamic and booming. Between 2015 and 2019, global e-commerce sales are expected to more than double from \$1.7 trillion to \$3.6 trillion, according to market research firm eMarketer. E-commerce is expected to account for 12.4 percent of total retail sales in 2019, up from 7.3 percent in 2015.

Companies in the life sciences and healthcare sector understand the potential of B2C e-commerce, too. At the DHL Global Life Sciences & Healthcare Conference in 2015, we asked more than 140 life sciences logistics professionals to outline the main reasons for engaging in "owned brand" B2C e-commerce (i.e. with manufacturer-branded web shop and fulfillment). The benefits they described are clear:

- 44 percent – patient convenience
 - 40 percent – business model differentiation
 - 30 percent – reduction in product counterfeiting
 - 18 percent – patient privacy
- (percentages refer to share of responses)

However, the B2C e-commerce adoption rate is low in life sciences – only 5 percent of respondents described their company as being "very active" in e-commerce today. This slow uptake is due to a number of barriers, notably:

- 39 percent – prescription process
 - 36 percent – channel conflict
 - 30 percent – cost competitiveness
 - 16 percent – limited value case
- (percentages refer to share of responses)

Pfizer's viagra.com stands out in the global list of B2C e-commerce cases from life sciences companies. By leveraging its brand property and partnering with a pharmacy chain with mail-order capabilities in the United States, viagra.com enables patients to purchase Viagra – one of the most counterfeited drugs globally – from a trusted online source (viagra.com) in a convenient and discreet way.

We believe that B2C e-commerce will be increasingly important for life sciences companies, but the exact path remains unclear. Taking the perspective of a product and supply chain professional in a life sciences manufacturing company, there are some key questions to be considered:

- Do we want to manage e-commerce ourselves, or are we happy to leave it to others, including counterfeiters?
- How much of our brand should we "throw in" to building an e-commerce presence and a direct-to-consumer relationship?
- How will we operate our B2C e-commerce supply chain: run it in house, outsource to several providers (web shop, order to cash, warehousing/ pick & pack, transportation, etc.) or outsource to a single provider with an integrated offering?

Viagra.com has shown just what is possible when a life sciences company uses the strength of its brand to establish a direct-to-consumer/patient relationship. Other companies in the sector should take note. ■

Eugene Teh & Michael Terhoeven

KINGDOM ON THE MOVE – FAST FORWARD

In 2014, *Delivered.* reported from the Kingdom of Saudi Arabia (KSA), the Middle East's largest economy, with an extensive review of the country's plans for diversification of key industry sectors and investments in infrastructure and logistics. Following the recent announcement of Saudi's Vision 2030 and, at its heart, the impending IPO of less than 5 percent of state-owned oil giant Saudi Aramco and the establishment of a \$2 trillion sovereign wealth fund, the Kingdom is now on the move again – this time looking to fast-forward into a future beyond fossil fuels.

Nevertheless, energy is also still high on the agenda. Khalid Al-Falih, the Kingdom's new minister for energy, and chairman of Aramco, told media on the sidelines of OPEC's Vienna meeting: "We have a lot of global investments in downstream. Post-IPO and even as we prepare for the IPO, you will find Aramco quite interested into going into international upstream." According to Al Arabiya, international gas will be of particular interest.

The ambitious plans under Vision 2030 include a rise in the share of non-oil exports in non-oil GDP from 16 to 50 percent. In addition, Saudi Arabia wants to move from its current 25th place to become one of the top 10 countries on the Global Competitiveness Index and raise its global ranking in the Logistics Performance Index from 49 to 25, as well as ensuring the Kingdom is a regional leader in the sector.

"Saudi Arabia is one of our biggest markets and essential to our growth in MENA," says Nour Suliman, CEO MENA, DHL Express. "We are currently activating our resources in line with the Kingdom's future plans. DHL Express has already invested heavily in expanding our business in the Kingdom with a new \$25 million facility at Riyadh's King Khalid International Airport and work currently underway on a new facility in Jeddah, which is expected to go live this year. The new facility will considerably improve our transit time to KSA and have a huge impact on our performance in the Kingdom." ■ Michelle Bach



bit.ly/saudi-vision

\$267 BILLION

The target for boosting non-oil revenues, from a base of \$43.5 billion

\$1 TRILLION

The expected return on sales of state-owned real estate and industrial areas

\$2 TRILLION

The estimated value of Saudi Aramco under plans for an IPO of less than 5 percent of the company

65 PERCENT

The target for private sector share of GDP by 2030 – currently 40 percent



SOLUTIONS

OSCAR WINNER – THE WORLD'S BIGGEST FREIGHTER

Just when you thought cargo ships couldn't get any bigger, along came Oscar – the first in a fleet of 20 mammoth container vessels ordered by the Mediterranean Shipping Company (MSC) to ply the East-West trade route from Asia to Europe.

The 45,300-ton behemoth was built by Daewoo in South Korea at a cost of \$140 million. It is 395 meters long – slightly more than the height of the Empire State Building – and 59 meters wide, with a draft of 14.5 meters.

Oscar's deck is the size of four football pitches and capable of carrying a total of 19,224 standard 6.1-meter containers – 11,258 on deck and 7,999 in the hold. Within that total, there is scope to carry 1,800 refrigerated containers, or "reefers." The monster ship has a fully laden weight of 193,000 tons, a cruising speed of 22.8

knots and a range of 48,707 kilometers – enough to circumnavigate the earth.

Named after the son of Diego Aponte, MSC's President and CEO, Oscar features a super-efficient new engine design. At just over 15.5 meters high, 25 meters long and 11 meters wide, the 83,800 horsepower diesel engine is the size of a small house.

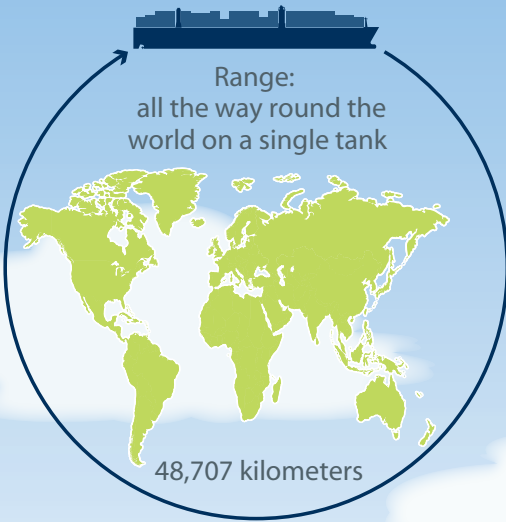
Oscar's auxiliary engine generates 16 megawatts of electrical power – the equivalent of 8,000 household kettles.

With concern for the environment a top priority, Oscar features a double-hull design to reduce the risk of fuel-oil spills in the event of an accident. ■

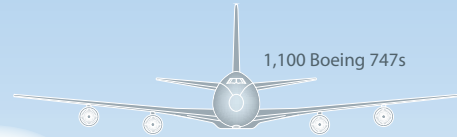
 bit.ly/oscar-ship



The world's largest container ship is 395.4 meters long, the equivalent of four soccer fields.



To transport the capacity of the MSC Oscar
you would need:



11,400 heavy trucks



Service speed 22.8 knots



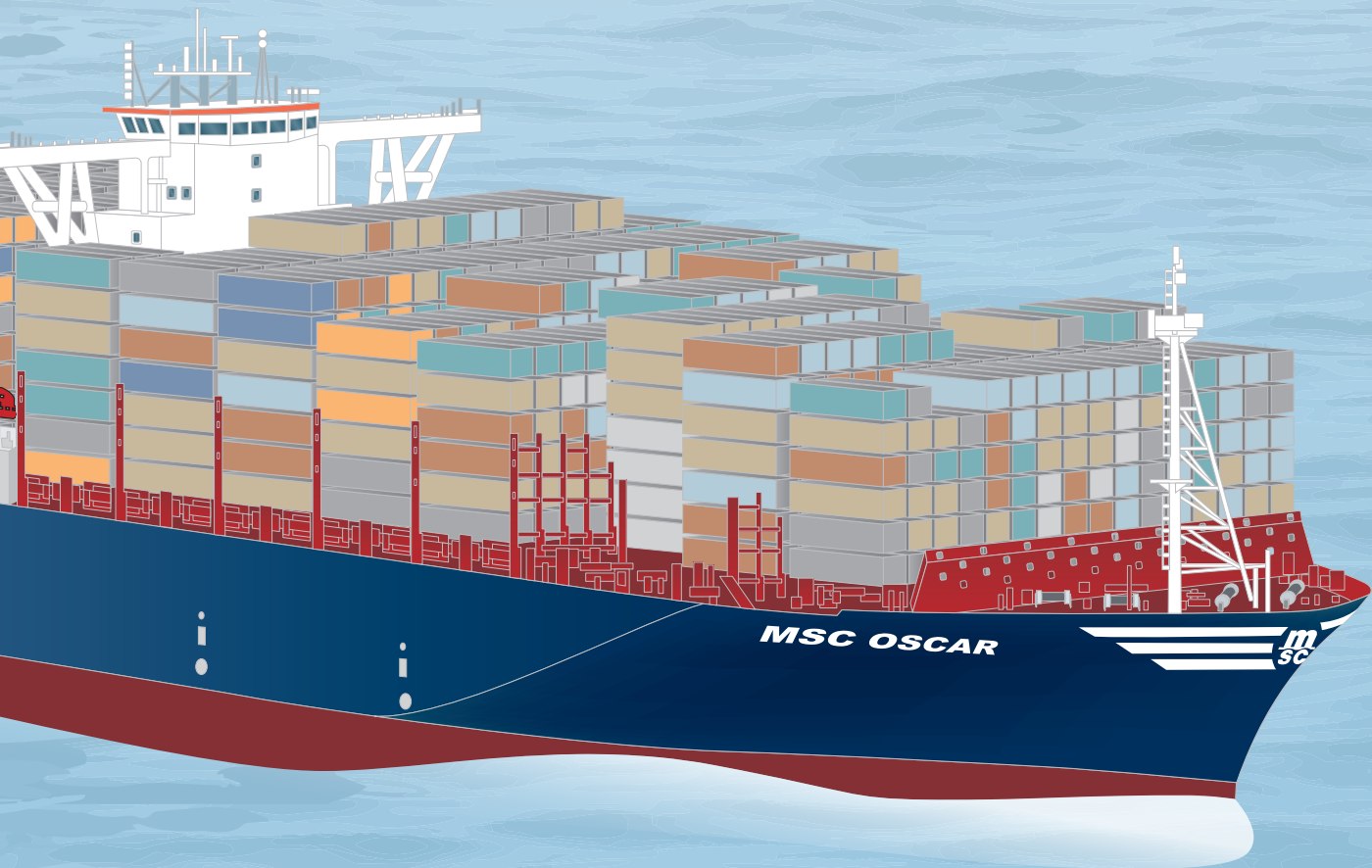
Gross tonnage .. 193,000 tons



Capacity 19,224 TEU

Power..... **kW** **MCR** **62,500 kW**

1 meter = 3.28 feet 1 kilometer = 0.621 miles



STARSHIP DELIVERS THE GOODS

Autonomous vehicles are being tested for deliveries – with big potential for businesses, and offering speed and convenience for consumers.

Robotic delivery vehicles will be coming to a street near you in the very near future if Skype co-founders Ahti Heinla and Janus Friis have anything to do with it.

Their new company, Starship Technologies, believes its fleets of small robots will revolutionize the last mile of the delivery process, with cost savings of up to 40 percent. The small, autonomous vehicles are just big enough to take two bags of shopping. They trundle along the sidewalk at walking pace (around four miles per hour) and use as much electricity as a light bulb.

They may not look quite as cute as R2-D2, but they have been designed to be extremely appealing to humans. They can even talk to you – at least, their overseers can.

No accidents

The vehicles are equipped with nine cameras, which constantly scan the area around them to avoid any obstacles in their way. Meanwhile, back at the delivery hub, human operators monitor their movements, ready to take control if necessary, and can use the built-in microphone and speakers to talk to people.

Twenty-five vehicles have been trialed in 15 cities and large-scale pilot schemes with commercial partners are now underway, with full commercial rollout planned within 12-16 months in key cities around the world. Eventually, the company plans for just one human controller at a delivery hub for every 100 robots.

The Starship concept was born when Heinla and Friis were looking to create a new startup in an industry that had not yet been disrupted by technology. Heinla had taken part in a NASA contest to design a robotic vehicle to bring back samples from Mars. Automating last-mile delivery – the three to four miles from hub to door – seemed an obvious choice.

Delivery time slots

On top of the cost savings, part of the appeal lies in the fact that it offers a viable solution for the critical last mile at a competitive cost. Consumers will be able to choose from a selection of short delivery time slots, with a fixed delivery cost of just \$1.

“With e-commerce continuing to grow, consumers expect to have more convenient options for delivery – but

at a cost that suits them,” says Heinla. “The last few miles often amount to the majority of the total delivery cost. Our robots are purposely designed using the technologies made affordable by mobile phones and tablets – it’s fit for purpose, and allows for the cost savings to be passed on to the customer.”

There is still one major hurdle to be overcome – at least in some countries – and that’s licensing. While robot-friendly nations such as Austria, for instance, will allow the Starship robot to operate straight away, others such as the U.S. and U.K. require regulatory approval before they can roam the sidewalks. In the U.S., each state must rubber-stamp their use, while in the U.K. they must be approved by each individual local council – that’s 32 boroughs in London alone.

Theft and vandalism do not appear to be an issue, however – so far, at least. With its nine cameras, anyone trying to steal or damage a vehicle will be instantly identified, and any potential thief would have their every movement tracked.

“We can alert the authorities immediately to exactly where they are to within an inch,” says Henry Harris-Burland, Marketing and Communications Manager, Starship.

“Another thing is no-one would know what they are stealing... they could go to all that effort and find they’ve got some milk and eggs or a book.”

But what do pedestrians think as the Starship robot passes them on the sidewalk? Not much, according to Harris-Burland.

“The vast majority of people actually ignore the robot,” he says. “It’s fascinating to see how it’s integrated into daily life almost immediately. People just get on with looking at their phone and walking. The rest have been overwhelmingly positive. The public love the robot and only have good things to say about it.”

As well as leasing the system to logistics companies and supermarkets, Starship also plans to offer deliveries to small-scale food outlets – who knows, your late-night food delivery could one day arrive in a Starship robot. ■

Richard Reed



www.starship.xyz/



bit.ly/starship-robot

4
MPH

The speed of Starship – roughly equivalent to walking pace (6.4km/h)

0

The number of accidents so far in its journeys around the world's streets

2

The number of shopping bags the robot can carry

300,000

The number of encounters with humans by Starship robot during its initial trials

1

LIGHT
BULB

The robot's approximate energy consumption on one trip

3,500
MILES

The distance traveled in a total of 15 cities around the world (5,632 kilometers)



AFRICA: CHINA'S CHINA?

China used to be the place where Western companies outsourced their manufacturing – but as China becomes increasingly prosperous, the country is now increasingly outsourcing its own production to Africa.

Take a night-time drive down Addis Ababa's main thoroughfare Bole Road and you can't help noticing the multiplying number of Chinese restaurants, distinctive illuminated Chinese characters on signs bright against the Ethiopian night and signaling Chinese interest in developing markets.

A significant Chinese presence in Ethiopia – as across much of Africa – has resulted from investment in massive infrastructure projects. But now Chinese firms are increasingly outsourcing production to African countries in the face of China's (and Asia's) steadily mounting average wage bill. Hence the likes of Ethiopia, which, with a population predicted to exceed 100 million by 2018, offers a massive potential factory workforce. Plus, factory wages in Ethiopia can be about \$40 a month, less than 10 percent the level in China. And it's a huge market for Chinese goods. Millions of outsourced manufacturing jobs have already moved from China to Vietnam and Bangladesh, while sub-Saharan Africa is well placed to also take advantage of this trend if the required infrastructure is put in place, observers say. In addition to Ethiopia, African countries such as Tanzania, Rwanda and Senegal are vying to become production bases for labor-intensive products.

"China is now at a stage like that of Japan in the 1960s and the four Asian Tigers in the 1980s, to begin relocating its light manufacturing to other countries because of its rapidly rising labor costs," says Helen Hai, chief executive of the Made in Africa initiative and a United Nations industrialization ambassador. "Africa can become the next manufacturing hub for global markets."

Previously Hai was at the vanguard of Chinese manufacturing coming to Ethiopia when serving as vice president of Chinese footwear manufacturer Huajian Group, which in January 2012 opened a huge factory on the edge of the Ethiopian capital Addis Ababa. The factory now employs 4,000 Ethiopians, with the intention of employing 40,000 by 2022. The light manufacturing zone around its factory could eventually create 100,000 jobs. Such industrialization, those such as Hai claim, can allow African countries to escape entrapment in the ebb and flow of the global commodities cycle. "By capturing this opportunity, Africa will achieve sustainable, dynamic and inclusive growth," Hai says.

Chinese investment comes of age

"Now more experienced abroad, Chinese businesses can advance into operating investments, not just constructing them," says Kai Xue, a Beijing-based lawyer and Africa expert at DeHeng Law Offices.

China's investment stock in the manufacturing sector in Africa accounted for 15 percent of Chinese foreign direct investment in 2013, according to the World Bank. And at last year's Forum on China Africa Cooperation in Johannesburg, an eye-watering \$60 billion of Chinese



financial support – including \$35 billion of preferential loans and export credits – was pledged, much of it to manufacturing, part of a global shift toward focusing on economic transformation in developing countries.

“For Africa, over \$100 billion in roads, telecom, water, power and light industry has been financed by China over the last 15 years,” Kai says. “This lending has been a critical component of the African economic renaissance.”

Ethiopia has ambitious plans to turn the country into Africa’s biggest car manufacturer over the next 20 years. Chinese carmakers based in Addis Ababa and the northern city of Mekelle already produce around 8,000 vehicles a year from kits, assembling brands such as Geely, FAW, BYD and Lifan.

South Africa has also proved particularly popular for Chinese investment. Hisense Co., a Chinese multinational white goods and electronics manufacturer, chose to shift some manufacturing to Cape Town in 2013. Chinese carmakers FAW and Automotive Industry Holding Co. have plans to establish manufacturing plants in South Africa, while Foton Motor Group has already set up shop in Kenya. Nigeria has also seen significant numbers of private Chinese factory investors relocate from the coastal regions of the mainland such as Zhejiang, Shandong and Jiangsu.

But as more Chinese investors come to Africa they are likely to also become more discerning in their choices. “Poor energy reliability, weak transport and logistics infrastructure, and a difficult regulatory environment obliterate most of the labor wage advantages that manufacturing investors would get in a market like Nigeria,” says Elias Schulze of Africa Group, an advisory and venture capital firm focused on economic growth and investment across Africa. “There is a different and much more positive story in a market like Ethiopia, where the government has made a definitive effort to attract global manufacturing firms for the purpose of manufacturing goods.”

Infrastructure investment not going away

China isn’t giving up on infrastructure projects yet – aptly evidenced in Ethiopia, where Chinese involvement in infrastructure expansion is close to omnipresent. Even Ethiopia’s ruling party’s authoritarian one-party developmental state style of leadership is heavily influenced by China’s governance model.

Chinese banks are providing \$3.4 billion in funding for landlocked Ethiopia’s new 750-kilometer (466-mile) railway from Addis Ababa to the port in neighboring Djibouti. The line, due to open this year, is being built by Chinese contractors. Expansion of Addis Ababa’s Bole International Airport is also being financed and constructed by Chinese banks and companies, as will a planned new airport to increase capacity further. And while Ethiopia is self-funding construction of its Grand Ethiopian Renaissance Dam (GERD) – Africa’s largest upon completion – the Export-Import Bank of China is providing about \$1 billion in financing for a 619-kilometer (385-mile) transmission line from the dam to Ethiopia’s capital.

\$3.4
BILLION

The amount of cash Chinese banks are providing to build a new railway in Ethiopia

\$1
BILLION

The cost of the transmission line built for Ethiopia’s new dam with Chinese money

lometer (385-mile) transmission line from the dam to Ethiopia’s capital.

“There are concerns that lending has created too large a debt burden for Africa, but since the borrowed sums go toward the most critical projects for economic growth, I don’t think increased debt has been much of a drawback,” Kai says.

GERD’s predicted 6000 megawatts of hydroelectricity generated by the abundant waters of Ethiopia’s Blue Nile could guarantee the country’s energy security, many say.

Major Chinese infrastructure projects elsewhere in Africa include the likes of the Anhui Foreign Economic Construction Company’s more than \$100 million expansion of Maputo International Airport northwest of the center of Maputo, the largest city and capital of Mozambique. China is also funding a \$700 million new airport for Khartoum in Sudan – among others around the continent.

And don’t forget Djibouti, receiving more than \$12 billion of investment from Beijing for new ports and airports rising from the sands, and what is being touted as the biggest and most dynamic free trade zone in Africa being developed over the next 10 years.

Chinese investment bulldozer

But the narrative of China dominating investment in Africa oversimplifies the reality, according to some – the EU is still the continent’s largest investor.

“European companies and banks have also been doing infrastructure – there are British, French, German and Portuguese companies involved in building things across Africa,” says Deborah Bräutigam, director of the China Africa Research Initiative at Johns Hopkins University in the U.S. “So they’ve gotten the head start, it’s the Chinese who have been catching up.”

Perhaps. Either way, the Chinese certainly aren’t going about it half-heartedly. Recently China grabbed headlines by beginning construction in Djibouti of its first-ever overseas military base, a means of force projection to help secure those billions of dollars of investment throughout East Africa and beyond.

But there are limits to the appeal of African countries like Ethiopia. Although Huajian stands as an apparently conspicuous success story, the bureaucratic complexity of Ethiopia makes it difficult for other companies to follow its lead. Ethiopia is ranked 146th out of 189 economies by the 2016 World Bank Group’s Ease of Doing Business survey. And true manufacturing success for Huajian will depend on trade volumes increasing, not helped by Ethiopia’s lack of membership of the World Trade Organization. Hence, despite China’s apparent commitment to Ethiopia and Africa, neither should be taken for granted.

“The challenge for Africa is to remain an appealing place for China to lend and invest considering the launch of the One Belt, One Road initiative, which aims to direct the lion’s share of state-backed lending and investment resources toward connecting Asia and Europe,” Kai says. “Africa could become a low priority.” ■ James Jeffrey

VIEWPOINTS

A close-up portrait of Hind Bahwan, a woman with dark hair, wearing a beige and teal headscarf and a pearl earring. She is seated in a brown leather chair, looking slightly to the side with a thoughtful expression. The background features light-colored curtains.

DELIVERED. GETS TECH SAVVY WITH...

HIND BAHWAN

She's one of Oman's foremost business women, an entrepreneur in the tech sector whose company most recently took over NOOK from Barnes & Noble, and also highly knowledgeable in the energy sector. No wonder then that Forbes has added Harvard alumni Hind Bahwan to its list of "Most Powerful Arab Women."

Having founded software products and solutions provider Bahwan CyberTek (BCT) in 1999, Hind went on to become chairperson of several joint ventures – including Bahwan DHL, which delivers a range of supply chain and logistics services to Oman's energy industry. She quickly made a name for herself as a young entrepreneur, and success and recognition were swift to follow.

Among her many accolades, Hind was named "e-Achiever of the Year" by Arabian Business, "IT Women of the Year 2002" by UNDP, and received the "Global Leaders for Tomorrow" award of the World Economic Forum. *Delivered.* caught up with Hind to discuss her ongoing success and visions for the future.

Could you explain a bit about the idea behind Bahwan CyberTek, its beginnings and most recent successes?

In the years leading up to 1999, we realized that industry needed to bring technology and innovative software to the core of its business models and that there was a gap in the regional market. As such the idea of Bahwan CyberTek was conceived and a hybrid company that married technology with future-proofing business models and thought leadership was established and a market pioneer was created across multiple industries.

Today and through its core areas of expertise – real-time predictive analytics, upstream oil and gas supply chain management, power and utilities solutions, Track and Trace, Smart Government Payments, social media monitoring and Internet of things (IoT) – BCT continues to lead the transformation agenda across multiple sectors and businesses.

BCT was among the first companies globally to be assessed at Capability Maturity Model Integration (CMMI) Level 5 Version 1.3 for its Process and Delivery Excellence, and BCT was instrumental in winning the Petroleum Development of Oman fourth party logistics (4PL) contract in 2004, which has since evolved into a reference point for industry best practice. With the support of 2,000 + industry experts, BCT has delivered solutions in 20 countries across North America, the Middle East, the Far East, Africa and Asia. BCT excels in product development, supply chain transformation, middleware and integration, business process management, systems integration, business intelligence, business process outsourcing, SAP consulting services, independent testing, training, consulting and infrastructure management.

Most recently and despite strong competition from global players, BCT has been awarded a \$35 million contract by Barnes & Noble to take over its NOOK technology services, including cloud management and development support for NOOK software. We are also extremely proud of the leading role that BCT, as the majority shareholder in

20

The number of countries in which BCT has delivered solutions

\$35
MILLION

The size of a contract with Barnes & Noble to take over its NOOK technology service

Bahwan DHL, continues to play in upstream oil and gas supply chain transformation and value delivery.

You started the first digital society in Oman. Was it a success – and has it been growing?

Success is not a milestone but a continuous evolution. We are on track but there is still much to do and opportunities are emerging continually.

Oman is looking to diversify its industry sectors and is also investing heavily in infrastructure. Where do you see the country's advantages and opportunities as it starts to look at a future beyond oil & gas?

While it is well recognized that Oman requires a major diversification of its economy away from the oil and gas sector, innovation opportunities in the oil and gas sector will continue to present themselves, for example new, enhanced oil recovery technologies and developing a digital oil and gas ecosystem. These innovations will be complemented by the continued development of associated downstream industries. With its geographical position and investment in infrastructure, Oman is ideally situated to transform itself into a major global logistics hub for supporting both domestic industrialization and international trade.

Oman is a globally connected hub with a rich heritage, abundant natural beauty, excellent facilities and welcoming people; as a result, its tourism sector continues to evolve and Oman is increasingly being recognized as a leading global destination.

With the government looking toward the private sector to drive diversification, the emergence of special economic zones is successfully attracting international investment, whilst a broader framework for public-private partnership is currently being formulated.

With a young population, the need to build capacity through training and development in Oman will continue to grow. This is an area that I am passionate about.

What is your recipe for business success?

Clear strategy, customer focus, excellent people, hard work, collaboration and the ability to foresee opportunity.

Would you say being a woman in business has been an advantage or a challenge?

I would say that being a woman in business is undoubtedly an advantage. But what is most important to me is that I hope any successes I may have achieved will encourage more women to follow their entrepreneurial intuition and pursue a career in business.

What is your personal passion?

Building organizations with global reach that enable customer business transformation across multiple verticals.

Away from business, how do you relax?

Any time I can spend with family and friends is very precious. ■ Michelle Bach

Delivery 2020 – where will technology take us?

Advanced technology is just arriving in the delivery space, and by 2020 it will be in full swing. What will it look like, and how can we prepare?



AN ESSAY BY DR MICHAEL LIEROW

Michael Lierow is a partner at Oliver Wyman in Munich. Within the transportation and retail practices, Michael supports postal, parcel and logistics companies, retailers and other multinational companies in the European market. He specializes in strategy, operations, supply chains and multichannel retailing.

Drones, Amazon Flex, Uber, crowd delivery, in-store production, 3D printing, driverless vehicles, digitalization industry 4.0... Did I miss any of the recent buzzwords that are currently swamping the tech blogs when it comes to delivery innovation? Will delivery in 2020 really be that different from how it is in September 2016? Let's have a look at what we know and what we don't know and connect the dots.

It's all about the consumer: 2B and 2C consumers will drive delivery volumes in the future. 2B in terms of, for example, spare parts for cars, IT servers, machines; and 2C of course largely driven by ever-newer segments of e-commerce coming online. And even if some segments are showing the first signs of slowing growth, there are others that are just about to come online and fuel delivery in 2020 (such as fresh), while more enhanced

touch-and-feel techniques will further drive the online purchase of non-commodity goods.

Customer convenience

Even more so, it's about customer convenience. And customer convenience can be driven by many dimensions, such as different delivery speeds and locations, customer-defined delivery times, return options and packaging. It also includes product dimensions, like individualization of a running shoe, installation of a TV or hi-fi set, seamless replenishment, or recycling an old washing machine.

These changes imply not only ultimate speed, like Amazon's 90-minute deliveries, but also more customized, value-added services like "collect all parcels and send them to me Saturday morning when I am at home with the family," or "install the TV in the morning to ensure I don't miss the afternoon soccer game."

Thus, it's about the customer use cases that will drive delivery, the upstream supply chain, and even production. In 2020, we will see a much more integrated – some say digitalized – delivery chain, where each good or parcel chooses its path through the supply chain, and in particular through different delivery options to best (1) fulfill the customer use case and reduce its hassle and (2) align with the customer's willingness to pay.

It's all about technology and data: Why did all of this not happen 10 years back? Besides the Internet and online players, important new elements have come into play, including the availability of customer data (e.g. through connected devices), knowing and digitalizing the consumer's current need, processing the data, and routing goods accordingly. For example, machine-learning algorithms can now help predict and discover patterns that can then be used to steer delivery more precisely.

It's a journey from batch processing to real-time predictive forecasting and analytics. By 2020, mobile devices are likely to know when and where the consumer will be, and machine-learning algorithms will not only offer suggestions on when/where goods should best meet consumers, but also suggest how much the consumer would be willing to pay for the service.

Increasing options

For Delivery 2020? If we take only the two elements of (i) 2B and 2C customer convenience and (ii) digitalization as our likely underlying drivers, we can already see significant implications:

- **Increasing options.** The range of delivery modes will increase, especially in cities and urban areas. The rationale is simple: as long as it further reduces the hassle for a relevant customer use case and the customer is willing to pay, it makes sense. Keep in mind that the “willingness to pay” part does not look at the cost of delivery alone, but at connected costs and prices: It's the lifecycle of the consumer, including the lock-in, that counts. Thus, yes, we will see more drone delivery, more integrated solutions of drones and parcel stations, more AmazonFlex-like services that allow for high service levels at low fixed costs, but also still the classic road-based, door-to-door service, e.g. collecting parcels for a few days and delivering them on Saturday morning when the whole family is at home.
- **Network response.** It's all about connecting the different supply chain and delivery options to a seamless supply chain network, which will replace the current (nearly) one-size-fits-all approach. Customized running shoes might find their way to the consumer via a direct injection into a drone depot parcel locker. The empty pack of diapers gets replenished by pressing the Dash button, while a predictive algorithm 24 hours earlier triggered fulfillment and put the parcel in the delivery truck.

The sales and operations sides will thus be interlinked more than ever before, boundaries will blur, and we will see a shift in value pools. Organizations need to start thinking early on not only about where to place their bets and how to position themselves, but also how to further develop culture, decision-making and the organization accordingly.

- **Joint value creation.** Are the current “owners” of delivery the best and most likely “owners” in 2020? That's not impossible, but will require more innovation and change management than before. Value pools will shift toward data management, analytics, and further development of platforms and interfaces. New technologies like managing a fleet of drones or exchanging batteries in self-driving vehicles at service locker stations are just two examples. At the end of the day, it's a fair and strategic question as to which elements delivery companies should seek to control and where partnerships and a joint value creation approach would be more useful. Does Amazon need to become a delivery provider from its perspective? Certainly not from a cost perspective, but maybe yes from the perspective of end-to-end customer control.

Who will win?

Who will win and who will lose, and what should companies do in 2016 to prepare for 2020? Let's close the loop on the buzzwords from the beginning of the article, but now with enriched meaning:

- **Understand 2B and 2C consumers and their use cases.** Much of it is about owning consumer data, connecting the dots, and drawing the right conclusion from multiple data points. Delivery players who understand this should grab land quickly, as it won't be up for grabs for not much longer than the coming six to 12 months.
- **Develop delivery solutions jointly with horizontal and vertical partners,** from the consumer perspective of reducing hassles.
- **Think in terms of platforms and place your bets.** Be prepared to own only a few selected parts, control others, and allow for a free flow of additional value-added solutions on your platform.
- **Be fast and a lot more flexible than in the past.** Don't think in terms of fixed budgets, but of trial and error and rapid testing of new ideas. Failure is not in abandoning 90 percent of your ideas, but in having tried only the wrong ones.

Overall, delivery in 2020 will be significantly different than it is today. We are now beginning to see the start of logistics digitalization. By 2020, it will be in full swing, with new players and new forces at work, and most of all, a step change in delivery convenience. ■

WHAT'S THE STORY, MR. NELSONS?

PICKING UP THE BATON AT THE GEWANDHAUSORCHESTER

Andris Nelsons – who takes up the role of Gewandhauskapellmeister at the Leipzig Gewandhausorchester in March 2018 – reveals how he overcame shyness to become one of the most acclaimed conductors of his generation.

Music has always been a huge part of my life – and, actually, even before I was born! My parents are both musicians so when I was inside the womb I'm sure I heard music then, too. When I was a child growing up in Riga, Latvia, it was playing in our house all the time: choir music and Renaissance music, jazz, blues – and I was aware of pop. But it was mostly classical.

The turning point for me was when I was five years old and my parents took me to my first live opera: Wagner's "Tannhäuser." They had explained what was going to happen and I had listened to the music on LP. But nothing could prepare me for the atmosphere that night. I remember the lights dimming, the orchestra starting to play and the curtains opening... And the music! I remember crying because the music was so emotional and I've been in love with Wagner ever since. I also remember being fascinated by the conductor. I thought he was

making the music himself with his gestures, like some sort of magician. I can't say that was when I thought: "I want to become a conductor!," but I do think it planted the seed, subconsciously.

Complexity

I started studying piano when I was five, but even though I was fascinated by music at that age I didn't want to practise for eight hours a day because I had also discovered football. But when I took up the trumpet aged 11 – a spontaneous decision on my part – I did practice for eight hours a day. I loved it. Then I started to read about conducting and to understand its complexities. It looks easier than it actually is!

When I began to study conducting I didn't tell people about it. I remember my first time on the podium. I was playing trumpet in my high school orchestra in Riga when the conductor – who was a great conductor at Riga Opera – didn't come to rehearsal for some reason. Now, normally



I'm a very shy person. But when it looked as though rehearsals would have to be canceled I stood up and heard myself saying: "I've been studying conducting for a while and I know this piece. Let's rehearse." I couldn't believe I did it. That was the moment I knew I really wanted to study this profession properly, because I discovered that I can best express myself as a musician when I'm conducting. Standing in front of the orchestra that day I suddenly forgot I was shy. I wasn't nervous – and I thought I would be. Having said that, I can only imagine how disastrous that rehearsal was!

Now I'm very happy and fortunate to conduct music with amazing orchestras, such as the Boston Symphony Orchestra, where I am music director. My profession is mystical. Every conductor performs differently, so you can't look at any one in particular and say: "That's how you are supposed to do it."

Some people think the conductor is the "boss" or influences what the musicians are doing, but that's never been the attraction for me. Being the conductor doesn't mean I know more or I can influence more. From the first moment to the last bar, it's my job to create teamwork and atmosphere. It's not about ego or about "you." It's about the music and the greatness of these genius composers who have written such wonderful scores. But the scores are only made up of notes. As the conductor, you have to look at what's happening between the notes. What is the meaning of the music? What was the composer trying to say?

Discipline

Of course, all art forms are important. But, for me, music is higher than the others because it goes beyond the intellect. You can't explain it sometimes. You have to feel it. It's like a food for our souls and that is very special. The world is quite confused nowadays, so I think it's more important than ever.

I count myself lucky to be the new Gewandhauskapellmeister, a role I begin in March 2018. From the first moment I worked with them as guest conductor in 2011, I was so impressed with the quality of the orchestra, their sound and their great discipline. Of course, I knew then that the Gewandhausorchester was one of the best orchestras in the world with a rich tradition going back to Bach and Mendelssohn (who was music director from 1835 to 1847), so I was nervous. But then I experienced the spirit of the musicians and the special atmosphere they create.

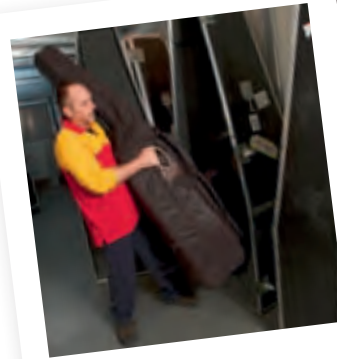
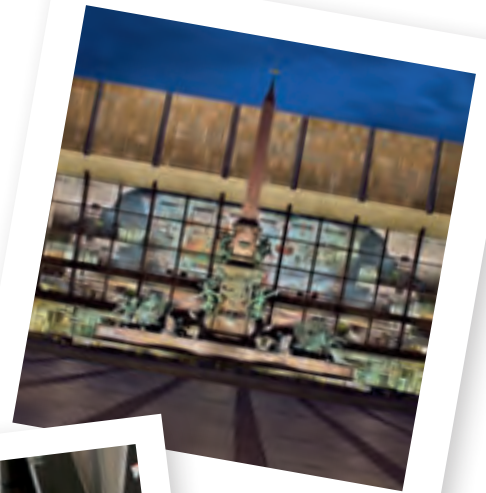
There's a real feeling of family within the whole institution, whether the people are selling tickets, working in the canteen or up on stage. So it's just a dream for me. What am I looking forward to most about working with them? Everything! But mainly making a musical and human connection with the musicians – and the audience, of course... ■ *Tony Greenway*

 bit.ly/dhl-and-orchestra

FACT: DHL is Official Logistics Partner to the Gewandhaus Orchestra. When the Gewandhaus is on tour, DHL moves everything from music stands and stools to the conductor's rostrum and wardrobe – plus highly sensitive and irreplaceable instruments in special shock-proof transport boxes that also monitor temperature.

HITTING THE RIGHT NOTES

Gewandhausorchester – the oldest municipal concert orchestra in the world – has its origins in a concert society called the Grand Concert (founded in 1743) that performed in the more spacious homes of Leipzig society. In 1781 it moved to the Gewandhaus, a textile merchants' building, and changed its name accordingly. It has performed with some of the greatest musicians of any era, including Mozart, Beethoven, Chopin and Wagner. Its Musical Directors include Felix Mendelssohn, Arthur Nikisch and, most recently, Riccardo Chailly.



185

The number of musicians in the Gewandhausorchester

2.5

The estimated value of the shipments, in euros, when the Gewandhausorchester tours

ARTIFICIAL INTELLIGENCE: ALL SYSTEMS GO!

Does the dramatic recent progress in artificial intelligence represent an opportunity or a threat to humans?

In March 2016, AlphaGo, a computer program developed by Google's London-based DeepMind subsidiary, beat leading professional Go player Lee Se-dol in four games out of five. It was a result that surprised the Go and technology communities in equal measure, and one that has been heralded as a breakthrough in artificial intelligence.

The rules of Go are simple, but the sheer number of possible moves available to the players means 2,500-year-old game is considered significantly harder than chess. IBM's Deep Blue computer beat chess champion Garry Kasparov in 1997 but, until 2015, Go programs had only managed to play as well as good amateurs.

As significant as AlphaGo's level of competence is the way it was achieved. Rather than basing its decisions on explicit rules about the relative value of different moves, as chess computers do, AlphaGo "taught" itself how to play well, running millions of game simulations against versions of itself and gradually adjusting its algorithms to achieve better results.

To some eyes, that approach is closer to the way humans learn. Indeed, the "deep neural networks" used by AlphaGo are modelled on the way our brains operate through the selective reinforcement of synaptic connections. It is also one with the potential for application to a much broader set of problems. Neural networks are already being used in a wide range of real world tasks,

from analyzing video images to optimizing process parameters in complex manufacturing operations.

These and other techniques that use computer power to search and analyse complex data have plenty of applications in the supply chain, too. Computers already find quicker, better solutions to problems like delivery route planning or optimizing the storage of items in warehouses. Google and its competitors are making great strides in the development of autonomous road vehicles – a potential boon for logistics services.

But should we be worried? The idea of intelligent machines that attempt to enslave or destroy their creators has been a mainstay of science fiction for decades. Bill Gates, Stephen Hawking and Elon Musk were among hundreds of figures from the science and technology communities who warned in an open letter last year that artificial intelligence could potentially be more dangerous than nuclear weapons.

Others believe that even advanced artificial intelligence represents an opportunity rather than a threat. Speaking at a conference on the topic, DeepMind co-founder Mustafa Suleyman told his audience that "Artificial generalised intelligence is a form of intellectual horsepower – a cheap and abundant resource to solve our toughest global problems."

Any kind of horsepower can do damage if it fails to work as expected, however. Automated share trading algorithms have been blamed for high levels of stock market volatility, for example. Earlier this year, Microsoft had to switch off Tay, a "chat-bot" designed to hold conversations on social media platform Twitter, after users persuaded it to make racist and sexist remarks.

If artificial intelligence is to reach its full potential as a tool for humanity, we will have to learn new ways of working alongside smart machines. That approach is already delivering remarkable results. Almost 20 years after Deep Blue's victory, some of the world's best chess players are "centaurs": humans playing with the help of computers. ■ *Jonathan Ward*

**\$1
BILLION**

The amount given by PayPal founders Elon Musk, Peter Thiel and others to AI research in 2016

You can find more trends in DHL's Trend Radar report and download it at:



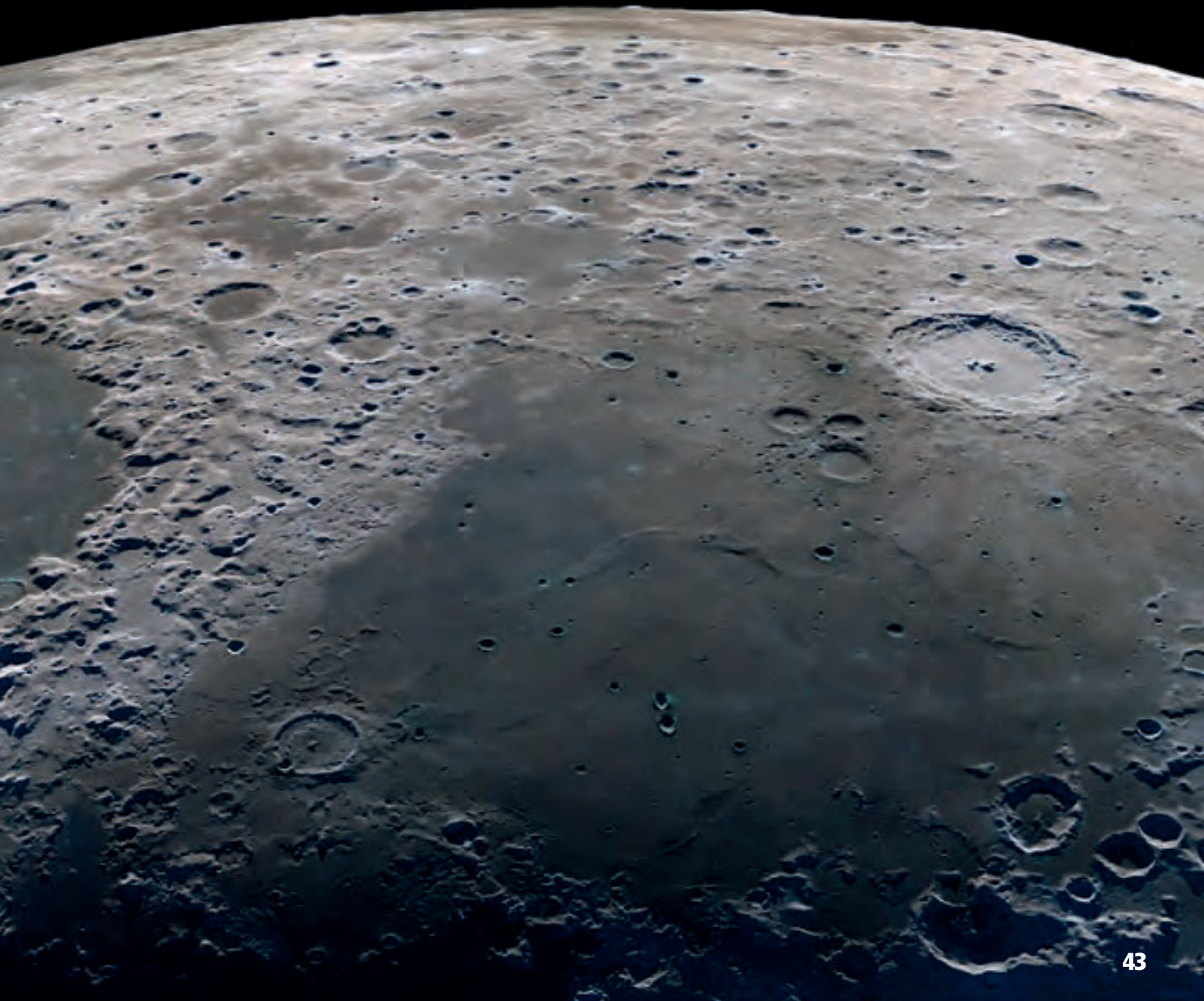
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1ST

The first shipment of goods to the moon, courtesy of DHL, which has teamed up with Astrobotic Technology to enable a regular lunar payload delivery service. Astrobotic's new Peregrine lunar lander can deliver between 35 and 265 kilograms of cargo to the surface of the moon. As the official logistics provider, DHL will ship all payloads to Astrobotics' headquarters, plus the spacecraft itself.



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