Flow

PETRONAS

Issue 1, 2020

BEHIND THE WINNING CHEMISTRY: PETRONAS FLUID TECHNOLOGY SOLUTIONS™

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BEHIND THE WINNING CHEMISTRY: PETRONAS FLUID TECHNOLOGY SOLUTIONS™

For feedback, suggestions or queries, please email us at flow@petronas.com

EDITOR'S NOTE

Finding a firm footing in the new norm

Many unexpected events have taken place since we published the last issue of FLOW. We are now dealing with the double whammy of the depressed oil price and the COVID-19 pandemic. Today, as governments and international organisations are rallying resources towards combating COVID-19, deemed the worst public health crisis of our generation, PETRONAS too has stepped forward to contribute towards this cause.

The most heartening gesture came from 9,500 employees of PETRONAS who donated a portion of their salary raising RM6.4 million for the Tabung COVID-19 under the National Disaster Management Agency (NADMA). This is in addition to contributions made by PETRONAS, its business operating units, subsidiaries and associates in Malaysia and other countries where we operate. These stories and many more noble gestures are captured in this issue's centrespread story.

One thing we can learn from past crises is that the human spirit will prevail and opportunities will arise.

Thus, amid the challenges we face, FLOW continues to bring uplifting stories of passionate women and men, masters of their craft who strive to make a difference in their fields. Our cover story features the "white coats" behind the Fluid Technology Solutions™ (FTS) that played a major role in Mercedes-AMG PETRONAS Formula One Team's unprecedented six consecutive double title victory. We learn about the trials and tribulations that our scientists and chemists overcome to cement PETRONAS' position as a trusted Technical Partner as well as the new challenge presented to them to make motorsports a "greener" affair.

Our story on the New Plastics Economy (NPE) explores PETRONAS' own NPE initiative, supporting the Malaysian government's vision to create an ecosystem where plastic waste can be channelled back to the value chain infinitely, transforming plastic wastes into plastic resources.

Next, we spoke to the Managing Director and Group Chief Executive Officer of PETRONAS Lubricants International (PLI), Giuseppe D'Arrigo on the development of fluids for electric vehicles (EV). Having wrapped up the EV Symposium organised by his team in Turin last year, we learned more about the growing EV market and the potential it holds.

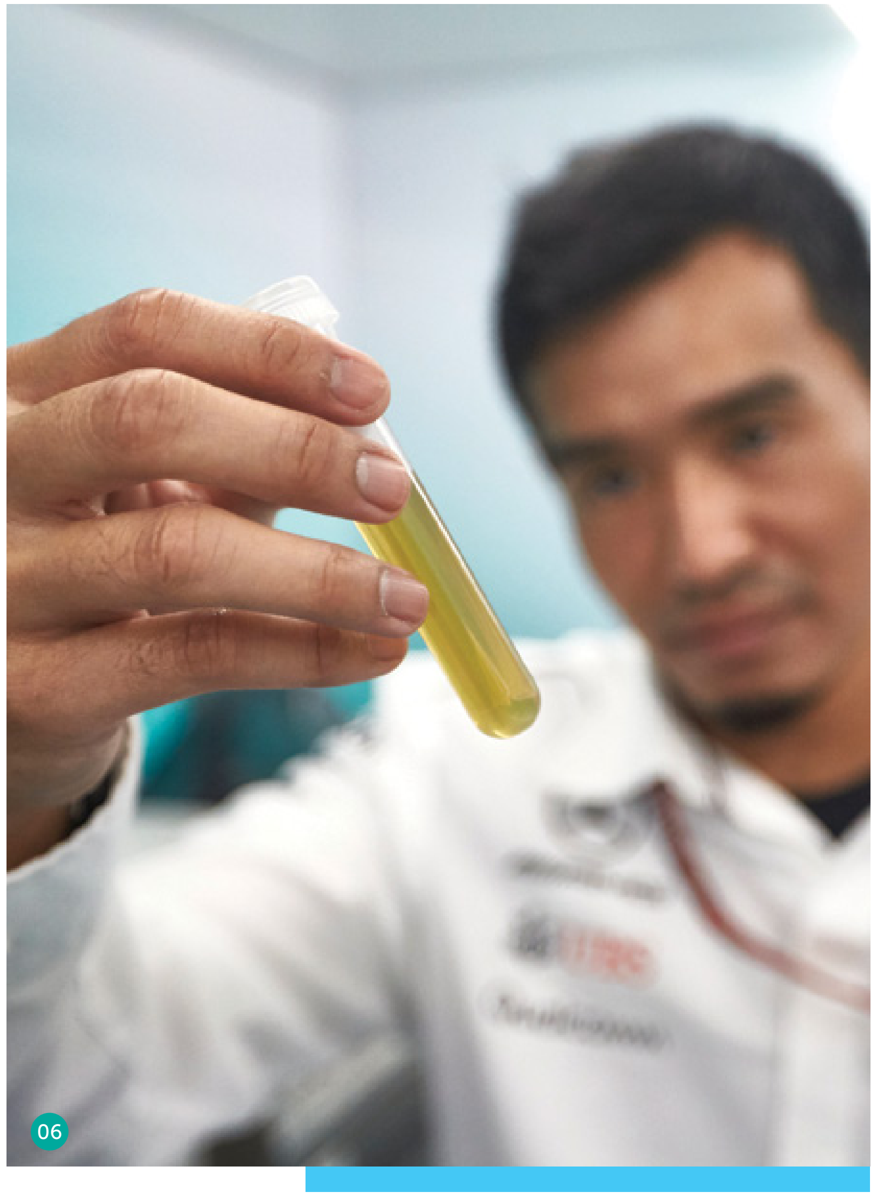
To wrap up, FLOW held a conversation with PETRONAS Vice President of Group Health, Safety, Security and Environment, Dzafri Sham Ahmad on the company's new Sustainability Agenda, discussing what PETRONAS hopes to achieve, the challenges in its way and where the energy industry is heading as sustainability takes centrestage.

As the world faces an unprecedented common threat, let's remember that we, collectively, have the strength to pull through during these difficult times. Our stories in FLOW aim to paint a picture of hope and inspiration for the coming years. As the saying goes, this too shall pass.
#WeWishYouWell

Thank you and stay safe!

EDITOR-IN-CHIEF
Zahariah (Liza) Abdul Rahman

FIND INSIDE



BEHIND THE WINNING CHEMISTRY: PETRONAS FLUID TECHNOLOGY SOLUTIONS™

Brigitte Rozario

It is no small feat to win the Formula One™ World Championship double title. Many teams have done so since the first race more than half a century ago. But none were able to achieve the historic feat that Mercedes-AMG PETRONAS Formula One™ Team pulled off, clinching both the driver's and constructor's titles six consecutive times from 2014 to 2019.

Fadhli Wong Hasan Wong
Head of PETRONAS Fluid Technology Solutions™
and Mercedes Technical Liaison

Naturally, the team's success boils down to its impressive infrastructure in Brackley and Brixworth where the chassis and power unit are respectively developed and its no-blame culture, a philosophy that runs deep within Mercedes' talented 1,300-strong workforce, be it trackside or at base.

However, what is less visible or known is how PETRONAS has been instrumental towards the Silver Arrows' success in the modern Formula One™ era through its Fluid Technology Solutions™.

It has been quite a journey getting to the point where the engine manufacturers have accepted PETRONAS as a technical partner and not just a sponsor. Today, the partnership is built upon a foundation of trust and communication. While separated by continents, Mercedes-AMG and PETRONAS hold a teleconference every month and a two-day face-to-face meeting every quarter, on top of an on-site team of expert researchers based in Turin, Italy. Through all these channels, Mercedes and PETRONAS report on developments and updates, putting everyone on the same page and ensuring that the fluids involvement is from the get-go.

This season, while pushing for that seventh double championship, the team will be testing and using PETRONAS molecules in the fluids, something that the PETRONAS Yamaha Sepang Racing Team (PYSRT) started doing last year.

Fadhli Wong Hasan Wong, Head of PETRONAS Fluid Technology Solutions™ (FTS) and Mercedes Technical Liaison, explains that it took a while to win Mercedes's trust. The relationship started out a bit more distant, with PETRONAS developing the fuels and lubricants independently and then handing it over to the team for testing.

"After a few years, we realised that the dynamics of our relationship needed to change before we could make progress. We could not continue working with such levels of secrecy.

"When Toto Wolff stepped in as the new Chief Executive Officer of the Mercedes-AMG PETRONAS F1 Team, he embarked on an integration exercise on the power unit and fluid development, among others, to increase efficiency and delivery results.

"That was when the engineers from Mercedes and the chemists from PETRONAS sat down together, enabling a greater level of cohesion between us. Mercedes began to understand our fluids, and we began to understand the technical aspects of the Mercedes engine. We started building a better relationship with more trust. The results were immediate, that was the point when the team started winning races," explains Fadhli.

Two years ago, PETRONAS launched its research and development (R&D) programme. This is when FTS was set up and the search for new chemistries began.

The push for patented components

In the last quarter of 2018, FTS began intensive work with Yamaha Motor Co Ltd (Yamaha). A team from FTS went to Japan and started the testing and validation of fluids in the Yamaha YZR-M1 engine as PETRONAS expanded its presence in MotoGP™ through the PYSRT in 2019.

While the work was stressful and intense, the fruits they sowed made it worth it. The work led to the first usage of ETRO+ base oil in a motorsports fluids formulation, something that has never been done before, displacing the previous Group IV Poly-alpha-olefin (PAO) base oil. This is a significant achievement as the Group III ETRO+ base oil produced in PETRONAS' Group III plant in Melaka has proven to be superior compared with PAO. ETRO+ is currently used in PETRONAS' commercial lubricants such as Syntium and Sprinta for MotoGP™.

"Formulation is a science and it is as important as the ingredients. Based on our experience in motorsport, I can now say we must formulate using PETRONAS proprietary chemistry."

DR ANDREA DOLFI
Head of R&D
Fluid Technology Solutions™

The "white coats" behind the winning FTS formula.

Dr Andrea Dolfi
Head of Research and Development at FTS

By June last year, PETRONAS introduced Sprinta to the PYSRT, formulated to provide performance and reliability. Prior to that, Tutela was introduced to the team, designed to provide reliability and protect the gearbox.

Both fluids were delivered ahead of the initial two-year timeline provided by Yamaha, an impressive achievement by the FTS team. Results were also immediate as Fabio Quartararo picked up seven podiums and six pole positions to win the Rookie of the Year Award, and while teammate, Franco Morbidelli consistently finished in the top 10. Ultimately, this led PYSRT to win the 2019 MotoGP™ Best Independent Team Award.

"It was the first time that we were using major components produced and engineered by PETRONAS. Motorsport fluids are very tough in terms of performance requirements. Because they serve a very high-demanding application, you need a special chemistry," explains Dr Andrea Dolfi, Head of Research and Development at FTS.

He added that he wanted to use one of the major components produced by the PETRONAS refinery in Melaka. It was a lot of work but the FTS team succeeded in delivering a fluid based on PETRONAS chemistry.

"Formulation science is not a trivial thing. It's like when you go grocery shopping where you buy a set of ingredients. The way you put them together matters a lot. With the same ingredients, you can produce a very mediocre dish or you can have a Michelin star meal.

"Formulation is a science and it is as important as the ingredients. Based on our experience in motorsport, I can now say we must formulate using PETRONAS proprietary chemistry. That's how we ended up having ETRO+ in the MotoGP™ engine oil," he says via videoconference from the PETRONAS Global Research & Technology (GR&T) centre in Turin, Italy.

Finding the right chemistry in the lab.

PETRONAS introduced Sprinta to the PYSRT in June 2019. The fluid was formulated to provide performance and reliability to the vehicles.

Search for winning chemistry

While ETRO+ has been used in MotoGP™, it has yet to be applied in Formula One. Dr Dolfi has challenged his colleagues to address this gap and the result was a new formulation that increases performance gains.

"This is racing. All that matters is winning. To win, there are two important elements. First, you have to be quicker than your rivals. Second, you have to finish. If you break something or suffer engine failure, you lose points. Hence, it is of paramount importance that we deliver performance without compromising reliability – that is the challenge we are faced with. Particularly in Formula One™, the sweet spot is not in the base oil but in the other chemistry. That is why we did this work with this new component," says Dr Dolfi.

The new formulation was tested on the Mercedes power unit in the first quarter of last year and will be deployed in the first race this year. What you have today on the track is work from the previous year.

Formulation is an intricate science. With the same ingredients, the scientists can either come up with a mediocre fluid or a six-time double title-winning formula.

Thrill of the chase

While not all PETRONAS chemists involved in delivering fluids for Formula One™ are motorsport fans, the women and men in white coats were thrilled to come up with new formulations for fuel and lubricants for the fastest car in the world.

Dr Dolfi says that remaining glued to the TV to watch speeding cars is a job he has left to the motorsport fan in his family – his wife. "I like it but what thrills me is the technical challenge. Let's be better than our competitors. Before 2014, we had four years with Mercedes where we weren't winning anything but we did a good job. We integrated with the team.

"The R&D team feels extremely proud of the six consecutive double wins. I've been doing this since 2013. In terms of experience, I don't know what it means not to win," he says proudly in recognition of his team's hard work.

Formula One™ is a fast-paced environment and work on the fluids goes on throughout the year. There can be up to three engine upgrades in a single season. This is something FTS has and must continue to keep up with. Hence the fuel and engine lubricant need to be improved following each engine upgrade. Throughout a season there could be three different engine oil and fuel formulations.

According to Fadhli, every year, when PETRONAS presents its fluids to Mercedes-AMG, there are incremental improvements in speed. "Over the last 10 years, we delivered around 1,000 milliseconds to Mercedes. It's a big deal. Every time we deliver a fluid, we gain 10 to 30 milliseconds. What do 10 to 30 milliseconds mean in motorsports? It can determine if you are the winner or if you are last. Even 10 milliseconds means a lot." Fadhli explains.

> **"Over the last 10 years, we delivered around 1,000 milliseconds to Mercedes. It's a big deal. Every time we deliver a fluid, we gain 10 to 30 milliseconds.**
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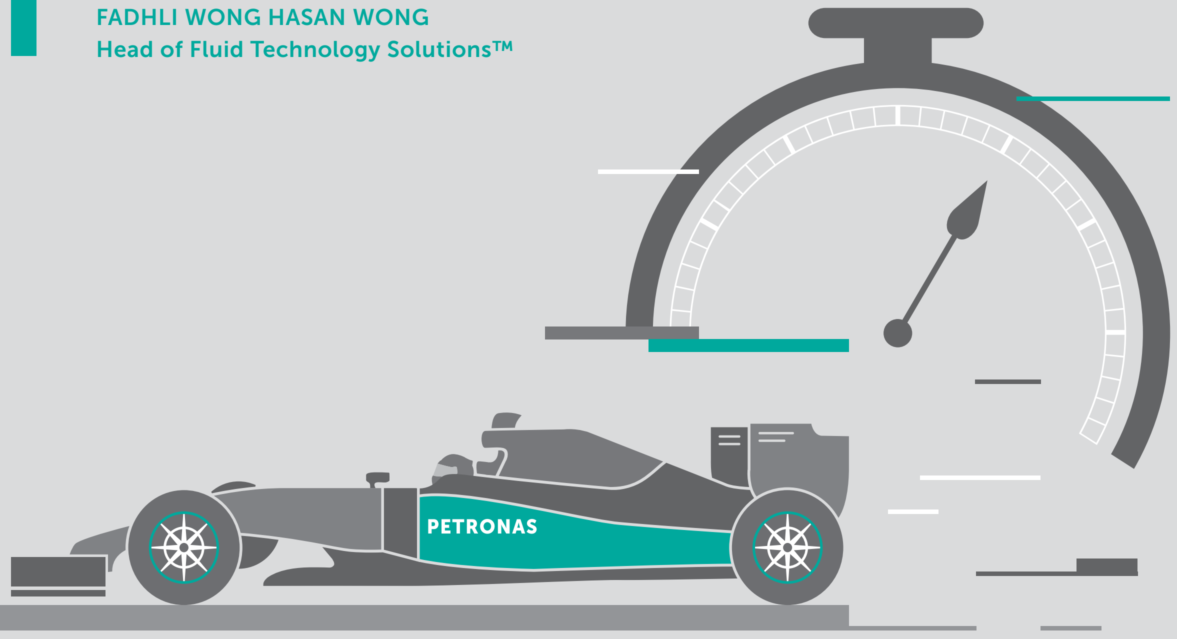
> What do 10 to 30 milliseconds mean in motorsports? It can determine if you are the winner or if you are last. Even 10 milliseconds means a lot."

FADHLI WONG HASAN WONG
Head of Fluid Technology Solutions™



> “To create biofuel you need to keep growing crops and relying on agriculture. If things progressed further, you could find yourself competing with the food industry. Even with biomass, there is a limit to how much you can do. So, instead of biomass energy and biofuel, we think that the focus should be on sustainable energy and sustainable fuel.

> That means we capture and use waste gases, industrial emissions or carbon dioxide to produce petrochemicals. That makes it a more sustainable fuel,” he explains. This is one of FTS' current R&D projects.

The call to go greener

Motorsport and, in particular, Formula One™, gives PETRONAS the chance to stay on top of the mobility industry because it's the pinnacle of motorsport. The fanciest, most unthinkable, most complicated and trickiest technologies are tried here as long as they do not infringe regulations. Whatever comes into world application today was tried and tested in Formula One™ about 10 years ago. Being involved in motorsport pushes PETRONAS to go further and achieve more in terms of performance.

There is a never-ending need to obtain more performance from the power unit and the fuel, and how the fluids react. As such, FTS is constantly looking for new ingredients and trying to create new chemistries that will boost the fluids that go into the fastest cars on the planet.

The demands, however, are not just in terms of performance; there is also the green thrust.

Formula One™ and the Fédération Internationale de l'Automobile (FIA) aim for the sport to be net-zero carbon by 2030. As a first step, Formula One™ also announced that carbon-reduction projects were to begin immediately with rules demanding that the petrol used in Formula One™ must have a biofuel content of at least 10 per cent by 2021.

To ramp up the percentage from approximately 5 per cent at the current juncture to 10 per cent in a sustainable and cost effective manner within just three years seems like a steep uphill battle.

Fadhli believes the push should also be for sustainable fuel rather than biofuel. While biofuel sounds good, it means the fuel is derived from biosources such as sugarcane, corn, oil palm, agricultural wastes and derivatives. Thus, it will be hard to sustain, not to mention costly.

“To create biofuel you need to keep growing crops and relying on agriculture. If things progressed further, you could find yourself competing with the food industry. Even with biomass, there is a limit to how much you can do. So, instead of biomass energy and biofuel, we think that the focus should be on sustainable energy and sustainable fuel. That means we capture and use waste gases, industrial emissions or carbon dioxide to produce petrochemicals. That makes it a more sustainable fuel,” he explains. This is one of FTS' current R&D projects.

According to him, biofuels and sustainable fuels are coming in big and fast. There is a huge demand especially in big cities where travel involves short distances. In such cases, greener fuels should be the way to go. “It's all about emissions and how we can have better sustainability in future mobility,” says Fadhli.

The Fluid Technology Solutions™ Track Record

700+
fluids candidates developed

1,000+
milliseconds of performance gain through the FTS development with over a decade

46
fluids introduction (F1+MotoGP™)

R&D Projects

Battery Thermal Management Fluids
Looking into ways to help electric vehicles reach maximum performance when operating at various conditions, and to prolong battery life.

Biofuel
Researching conversion of algae and other second and third generation bio-based feedstock into fuel. Exploring the possibility of turning natural rubber into fuel bio component.

Sustainable Fuel
Looking into capturing factory waste gasses and plant emissions, and feeding them to microbes to produce ethanol.

Hydrogen Fuel
Exploring ways to turn carbon dioxide into hydrogen for hydrogen fuel.

Alternative Feedstock
Trying out alternative feedstock like plastic wax or condensates to produce base oil which is used in lubricants.

Everything that PETRONAS learns from delivering performance and reliability for motorsport is applied in the delivery of mass-market products.

Right Solution at the right price

Everything that PETRONAS learns from delivering performance and reliability for motorsport is applied in the delivery of mass-market products. Though the process is not as simple as taking the fluids from the racing machines and putting it into everyday motor vehicles.

Fadhli explains that if you use Formula One™ fuel on the road, the car may not even start. If it does start, it may overheat and damage the engine because Formula One™ fuel is developed for high performance and combustion.

Instead, the learnings from motorsport are optimised for commercial products. Through its involvement in Formula One™ and MotoGP™, PETRONAS learns how to deliver the best performance for passenger and commercial cars and motorcycles.

"The beauty of working with motorsport and new chemistry is that if it works for them, it must work for everything else. The performance demand is so high that if it's good enough for Formula One™, it must be pretty good for anything else in terms of chemistry. Then, of course, you have to redeploy accordingly into different applications. That's where we go back to formulation science. You have to have the right solution for the right customer at the right price.

"When we say Formula One™ is tough, it is because the sport is the pinnacle of technology. We are trying things that nobody has ever dared try because we want to go faster. We want to go faster because we want to win. It's as easy as that.

"So, we are looking at a lot of medium- and long-term projects, and PETRONAS should and must benefit from this work because what is now niche and being researched, could be commercialised in 10 to 15 years," says Dr Dolfi.

A path fraught with challenges

Working in R&D is not as enviable and easy a job as one would think. Among the challenges Dr Dolfi faces is nurturing talents and the transfer of knowledge so that there is continuity in the culture and mindset which he believes are pivotal to the success they have been enjoying.

"We want to establish a culture of high-performance research that will serve PETRONAS well."

"We want to establish a culture of high-performance research that will serve PETRONAS well. As a senior technical leader, my key task is to transfer the way we work, think and challenge ourselves so that this culture is not lost. We want to establish something that will last for years to come so that we can sustain this level of success. We also need to nurture talents so that they are fit to take over when the time comes," he adds.

While the FTS R&D team is only about 20-people strong, Dr Dolfi believes with the right coordination, mindset, tools and managerial support, FTS can do wonders.

"Research by definition is agile. We sometimes compete concurrently with others on the same technologies. Everybody is competing so research is also a race. It needs a dynamic and agile environment to operate as fast as possible. In addition, nobody likes to fail but research has a high degree of failure. You try things that are new and you don't know if it will succeed. It is in the nature of research to involve failure, but a good manager knows when to take a calculated risk of failure. You try something, it doesn't work, and you try something else. The more things you try, the better chance of achieving success in the years to come.

"Formula One™, and racing in general, is a lot about pushing the boundaries. I invite everybody to challenge and try new things and dare to go beyond, but with calculated risks and putting safety first. Dare but with a scientific mindset. Every company including PETRONAS needs this attitude to move forward in a very competitive world," sums up Dr Dolfi.

NEW PLASTICS ECONOMY: WALKING THE SUSTAINABLE TALK

Sharmila Ganapathy
and Chai Li Tiing

What if plastic can be used and reused, channelled back into the value chain infinitely?

That is the core of the New Plastics Economy (NPE) movement spearheaded by the Ellen MacArthur Foundation in 2016. The NPE recognises the indelible and indispensable presence of plastics in the economy today and seeks to address plastic via concrete actions, concurrently harnessing the benefits of plastic and addressing its drawbacks.

Through the NPE, plastic will not become waste or pollution. It holds that a circular economy for plastics can be created through the elimination of unnecessary plastic items, innovation of plastic to make it reusable, recyclable or compostable, and circulating plastic items used to keep them out of the environment.

Through the NPE, plastic will not become waste or pollution. It holds that a circular economy for plastics can be created through the elimination of unnecessary plastic items, innovation of plastic to make it reusable, recyclable or compostable, and circulating plastic items used to keep them out of the environment.

The Three Key Actions of the New Plastics Economy Vision:

NEW PLASTICS ECONOMY VISION

ELIMINATE
the plastics we don't need.

INNOVATE
to ensure that the plastics we do need are reusable, recyclable, or compostable.

CIRCULATE
all the plastic items we use to keep them in the economy and out of the environment.

Source: Ellen MacArthur Foundation

Thanks to technology, the New Plastic Economy is not a mere figment of imagination, but will be soon a reality.

As one of the Malaysian corporations leading the way, PETRONAS Chemicals Group Berhad (PCG) has prioritised addressing plastic waste and pollution issues with its own NPE initiative. PCG plays a critical role as one of the founding members of the Malaysia Plastic Pact (MPP) that drives the implementation of the Circular Economy Roadmap (CER) for Malaysia, initiated by the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC), Malaysia in September 2019 to chart Malaysia's Circular Economy Roadmap.

It is not plastic but how we handle it

Plastic usage and waste have been the subject of debate for decades now. As one of the greatest innovations in human history, advocates laud the lightweight and durable material's role in advancing industries, providing an alternative to steel in the automotive and tech industry and to glass in the food packaging industry, among countless others. Opponents highlight the irreversible damage non-biodegradable plastic has done to the marine ecosystem and point to the rising number of overcrowded landfills filled with plastic waste.

Former PCG Head of Manufacturing and Project Lead for PETRONAS' NPE initiative, Mahadzir Rani has his own take on the matter. While noting that plastic has allowed for great advances in humanity in the last century, the improper handling of plastic waste has resulted in pollution with plastic waste leaching into the environment, threatening humans and the planet.

To Mahadzir, NPE is a "beautiful thing" which addresses the plastic problem in a holistic and pragmatic manner. It calls for organisations in the ecosystem to work together in driving the plastic value chain.

Mahadzir Rani
Former Project Lead of PCG NPE initiative

PCG, he says, is employing a holistic approach by focusing on four key areas in its journey under its own NPE umbrella.

"The four areas are education, clean ups, infrastructure and innovation," he explains, adding that some RM8 million has been invested in the initiative to date.

Changing the mindset of "plastic as waste" to "plastic as a resource" through the four pillars of PCG's New Plastic Economy:

EDUCATION
To impart knowledge on how we can continue to benefit from the versatility of plastic without damaging the environment by adopting proper waste management practices.

INNOVATION
To apply advanced recycling technologies to convert plastic waste that cannot be recycled using conventional methods.

INFRASTRUCTURE
To develop effective and sustainable waste recovery systems.

CLEAN-UP
To turn education into action through hands-on clean-up activities within communities.

> **Through various initiatives under the key areas, PCG targets to recover 100 per cent of plastic waste equivalent to its production volume of polymers for the Malaysia market by 2030.**

Through various initiatives under the key areas, PCG targets to recover 100 per cent of plastic waste equivalent to its production volume of polymers for the Malaysia market by 2030. According to Mahadzir, some 10 per cent of 12 million metric tonnes plastic production volume comprises polymers, where 30 per cent of this volume is for the domestic market.

"This amounts to some 360,000 metric tonnes that we want to recover and chemically recycle, channelling it into the circular economy." Putting this into perspective, it will be equivalent to reducing the carbon emission of removing 216,000 cars from Malaysian roads.

Chemical recycling changes the chemical construction of plastic waste and allows it to be converted into virgin-quality polymers.

Creating a plastic value chain

Commenting on PCG's efforts to step up innovation in order to tackle plastic waste and pollution in Malaysia, Mahadzir shares that PCG wants to build a facility of its own to do chemical recycling, as opposed to the current mechanical recycling process.

Mechanical recycling results in plastic products that are not hygienic, he explains, adding that chemical recycling changes the chemical construction of plastic waste, allowing it to be converted into virgin-quality polymers. "There's no leakage along the line, so what you produce, you consume and with chemical recycling you are able to produce plastic again."

To this end, PCG signed a memorandum of understanding (MoU) with global firm PLASTIC ENERGY Ltd (Plastic Energy) last June to construct a facility that produces crude naphtha from plastic waste as a feedstock to polymer production. Plastic Energy already has three commercial plants to its name, two currently operational in Spain and another still under construction in France.

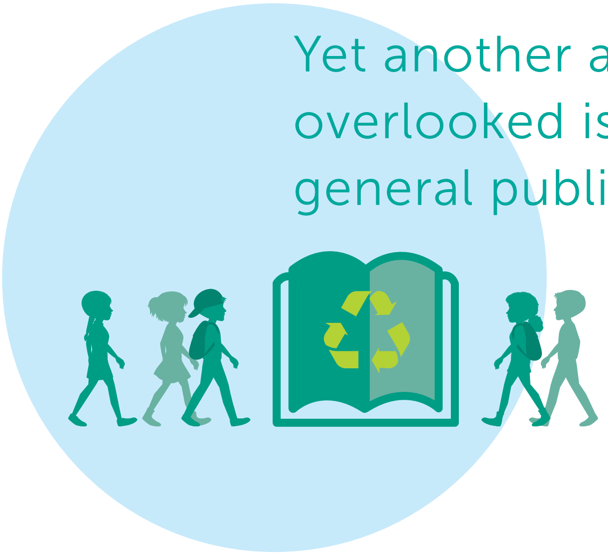
The plant, which will be located in Johor, will be the first in Southeast Asia and is expected to reach Final Investment Decision (FID) stage by end of this year.

Mahadzir explains, "The plant will employ a chemical recycling process using pyrolysis technology to produce crude naphtha from plastic waste. The end product will be fed into our crackers in Kertih or Pengerang to produce ethylene, which will in turn be channelled into the polymer plant, thereby producing virgin plastic."

Mahadzir envisions a future where the end product from a circular economy is certified and approved by an international body, International Sustainability for Carbon Certification (ISCC) in ensuring consumers of its legitimacy – akin to that of FSC-certified paper.

PCG developed a supplementary module for primary and secondary schools, sharing information on plastic waste management and the environment.

> Yet another aspect not to be overlooked is educating the general public on plastic usage.



Plastic Awareness – Starting them young

Yet another aspect not to be overlooked is educating the general public on plastic usage.

Mahadzir reveals that PCG has worked hand-in-hand with the Ministry of Education, Solid Water Corporation (SWCorp) and the Malaysian Plastics Manufacturers Association (MPMA) to develop an educational module for primary and secondary school students on plastic waste management and the environment, encompassing interactive digital learning and electronic media. To date, the syllabus has been distributed to 10,102 national schools throughout Malaysia. In 2020, the programme will be further enhanced through recycling competitions in schools nationwide under Pertandingan Kitar Semula Peringkat Kebangsaan (PERKISS) in collaboration with the Ministry of Education and SWCorp.

"We will also be conducting training programmes to coach the teachers in ensuring that the materials are being properly relayed to the students and we have plans to subtly measure the progress through nationwide competitions to gauge the understanding among the next generation," he adds.

To drive home the point in the eyes of the public, PCG launched an enhanced Be Green programme nationwide to educate stakeholders and communities through a series of talks and clean-up activities.

"We are trying to inculcate the proper practices of waste collection and segregation through the 3Rs (Reduce, Reuse and Recycle), while raising awareness on the preservation of rivers as a freshwater source. We conducted clean-up activities, starting with Sungai Langat, being the most important source of water in Klang Valley. This is then followed by Sungai Balok in Kuantan, Sungai Kemena in Bintulu and Pantai Paka in Kertih," Mahadzir explains.

River clean-up activities were conducted in Sungai Langat in Klang Valley, Sungai Balok in Kuantan, Sungai Kemena in Bintulu, and Pantai Paka in Kertih.

PCG believes that collaboration is key towards creating the circular economy, having inked MoUs with Plastic Energy and Cypark to create facilities that will enable its vision to be realised.

Collaborations are the way forward

PCG is also exploring collaboration opportunities with other organisations for waste-to-energy and waste-to-chemical initiatives. "For waste-to-energy we have signed an MoU with Cypark Resources Berhad (Cypark) in October last year to develop a Solid Waste Modular Advanced Recovery and Treatment (SMART) system for municipal waste in Malaysia."

He further notes that Cypark has had experience in the area, having pioneered the nation's first SMART plant in Port Dickson, which will soon be ready for commissioning.

This collaboration explores the establishment of a waste-to-energy plant and possibly the development of infrastructure to address the existing gaps in plastic waste recovery which paves the way for the realisation of the NPE vision in Malaysia.

Another option PCG is considering is waste-to-chemical using gasification technology, which produces carbon monoxide and eventually methanol.

"There is a plant in Canada that has achieved commercial operations. We are already in talks with them while exploring possibilities of venturing into this segment," Mahadzir shares.

On being a member of the Malaysian Plastics Pact in an effort to meet the United Nations Sustainable Development Goals (SDGs). "We are also actively participating in programmes by MESTECC via the circular economy roadmap. We've been entrusted by the government to lead the roadmap, joined by various non-governmental organisations, industries and associations," he said.

"The membership also includes brand owners and plastic converters —we have a full combination of players as part of the Pact to shape the circular economy roadmap," he said, further enthused by the involvement of companies in the Malaysian Plastics Manufacturers Association (MPMA), all of whom are also parties to the Pact.

Do we have what it takes to make this happen?

To a question on whether Malaysia's current regulations and laws support the NPE and circular economy, Mahadzir believes that the country is headed in the right direction. "We [Malaysia] are moving towards a better position to properly manage the industry," he says, highlighting that completing the roadmap is imperative to this end and will be one of PCG's key deliverables this year.

When asked of his confidence in the realisation of the NPE vision, Mahadzir's outlook is positive. He reiterates that on top of collaboration, projects and programmes involving plastic waste must be sustainable and profitable at the same time, "Today, sustainable business models are the way to go, and it has to be profitable. Through our partnerships and collaborations, we also hope to inspire change within the industry to drive sustainable practices for a better quality of life," he adds.

He also believes that PCG is well-positioned to lead the way and make a real difference. As more organisations join the fray, Malaysia stands a better chance of making its corner of the planet a better place, namely one that we will be proud to leave behind for our children.

NPE education has reached

35,000

internal and external stakeholders

"Plastics, Sustainability and You" is being taught in **10,102** **national schools** in Malaysia

PCG has invested

RM8 million

in NPE to date

2,700

volunteers were moved to action in our river clean-up activities in four states

2,819kg

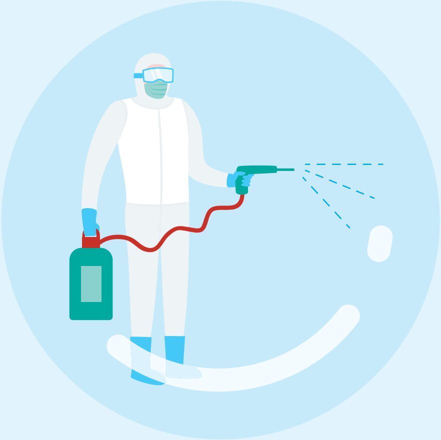
of rubbish has been collected in four clean-up locations

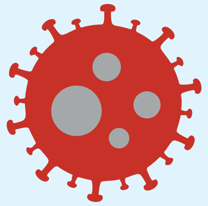
1,345kg

of the rubbish collected were recyclable

A UNITED FRONT AGAINST COVID-19

Chai Li Tiing





At the turn of the decade, an unprecedented crisis swept across the world in the form of the COVID-19 pandemic. As governments rallied to contain the fast-spreading disease, the health shock also precipitated the worst economic crisis since the Great Depression. The world watched in fear and disbelief as the number of infected rose exponentially within a few short months. Unemployment rates reached new heights and oil prices plummeted to new lows.

It is in these times of crisis that humanity shines the brightest. The noble medical frontliners saving lives working together with the law enforcers maintaining order, and the everyday women and men who gave what they could to help those whose lives were upended. These are the inspirational and aspirational stories that assure us we can overcome the crucible of COVID-19 with collective effort.

PETRONAS knows that the fight against the pandemic is our fight, too.

Collaboration and focused attention among all parties is crucial to combat the disease. Understanding that action had to be taken immediately to curb the spread, PETRONAS set up two taskforces at the enterprise level to address the current situation.

The Pandemic Preparedness Response Team (PPRT) was formed in January 2020 to deliberate and implement timely and proactive initiatives to curb the risk of transmission and safeguard the wellbeing of our staff, their families as well as contractors. The Corporate Command Centre (C3) was assembled in March 2020 to strengthen our oversight, orchestration and unified command in addressing the impacts of the pandemic and low oil price on business operations. The two multidisciplinary taskforces of experts convene daily to discuss and implement necessary measures including proactive and, above and beyond accepted best practices in ensuring sustainability of the business with priority on health and safety.

Having strengthened the response from within the organisation, PETRONAS stepped up its efforts to support national endeavours in this hour of need. From the onset, we worked closely with Majlis Keselamatan Negara and contributed to the development of the standard operating procedures (SOPs) for the Oil and Gas Sector, to restart and rebuild the Malaysian economy during the Conditional Movement Control Order (CMCO).

Our swift and resolute strategy of rigorous testing, contact tracing and quarantine of identified high risk persons was instrumental towards the successful closure of the Pengerang cluster at a total of 15 cases, with a 100 per cent recovery rate. To curb risks of the pandemic spreading, we proactively tested 630 individuals nationwide. We also made available real time avenues, including hotlines, covering areas from COVID-19 to mental and physical well-being and security advisory as well as human resources-related queries. Collectively, these were intended to provide our staff with the right facts and support in adapting to the new normal.

PETRONAS, through PPRT, is in close collaboration with the Ministry of Health (MOH) and the National Disaster Management Agency (NADMA) on health and safety matters, including crisis management. Our employees also gave a portion of their salary in a donation drive, raising RM6.4 million for NADMA, bringing PETRONAS' total COVID-19 contribution to RM37.8 million as at May 2020.

Beyond that, we launched the #WeWishYouWell campaign (see poster below) aimed at alleviating anxiety and lending emotional support. The campaign encompasses positive messages for employees including the frontliners working on site with minimal manpower and those reeling from the isolation of working from home, uplifting and inspiring stories for the public on social media platforms, and advisory information on how to deal with the new normal.

Through its efforts in supporting the government and communities, protecting the well-being of our people and delivering energy reliably, PETRONAS is throwing its full weight behind the battle against COVID-19 and the rebuilding of the economy.

Though the road ahead is still paved with challenges, we are in this together. And together, we will emerge from this stronger and sturdier.

One of the messages under the #WeWishYouWell campaign.

Supporting Our Communities

Yayasan PETRONAS contribution of medical equipment and supplies for hospitals and frontliners **RM20 million**.

Donation drive for the National Disaster Management Agency resulting in **RM6.4 million from 9,500 staff**.

PETRONAS Chemicals Group Berhad contribution of **5,000kg of polypropylene** to help production of **over 30,000 units of face shields for hospitals and clinics**.

PETRONAS Dagangan Berhad contribution of **water and food supplies and auto service facilities to frontliners** and **PETRONAS gift cards** to lower income households as part of its Sentuhan Kasih efforts.

Donation drives by Malaysia LNG Sdn Bhd, Malaysia Refinery Company Sdn Bhd, the Association of Wives and women Staff of PETRONAS (Petronita), Badan Kebajikan Islam PETRONAS (BAKIP) and Kelab Sukan dan Rekreasi PETRONAS (KSRP).

Mercedes-AMG PETRONAS F1 team worked with mechanical engineers from University College London (UCL) to **develop the CPAP breathing aid device for mass production**, approved by the National Health Service in the UK. A similar prototype is being developed for the Malaysian market.

PETRONAS Lubricants International supplied fluids for trucks delivering essential supplies for **the construction of hospitals in Wuhan** and manufactured **ethanol-based liquid and gel sanitisers for hospitals and local communities** in Italy and Brazil.

PETRONAS Upstream committed financial aid of **RM3.4 million (USD800,000)** to eight countries where it operates.

- **Financial contributions** to Azerbaijan and Brunei.
- **Personal protective equipment (PPE) for medical frontliners**, in Mexico, the Republic of South Sudan, Iraq and Canada.
- **Medical equipment to aid testing and recovery support** in Suriname and Myanmar.
- Ongoing efforts to **provide necessities and help disinfection** in communities and villages.

Total contribution of the PETRONAS Group **RM37.8 million**.

Protecting Our People

Special working arrangements for employees who can **work from home** to do so and **physical distancing** for the frontliners in operations. In close contact with **the police, Immigration and Marine Departments and state agencies** for staff movements.

Installed **thermal scanning** at the entrances of all PETRONAS buildings and **mandated health declaration forms and testing** for those under investigation.

Constant communication on personal hygiene and the #WeWishYouWell campaign to lend **emotional support** to employees as well as 24/7 hotlines to answer any queries during the crisis.

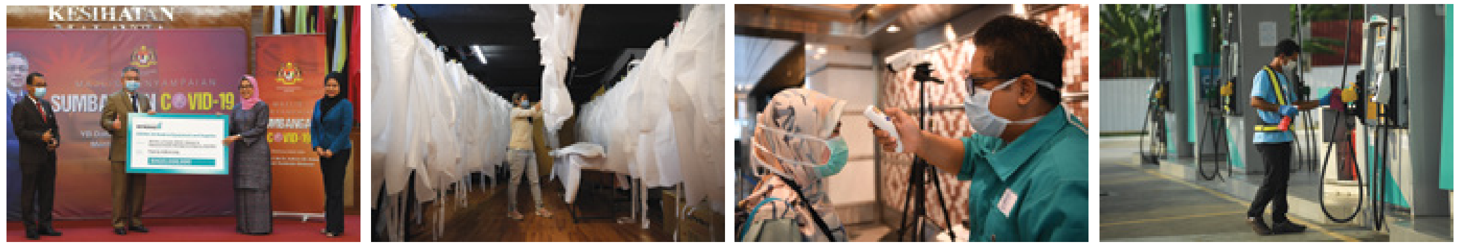
Delivering Energy Reliably

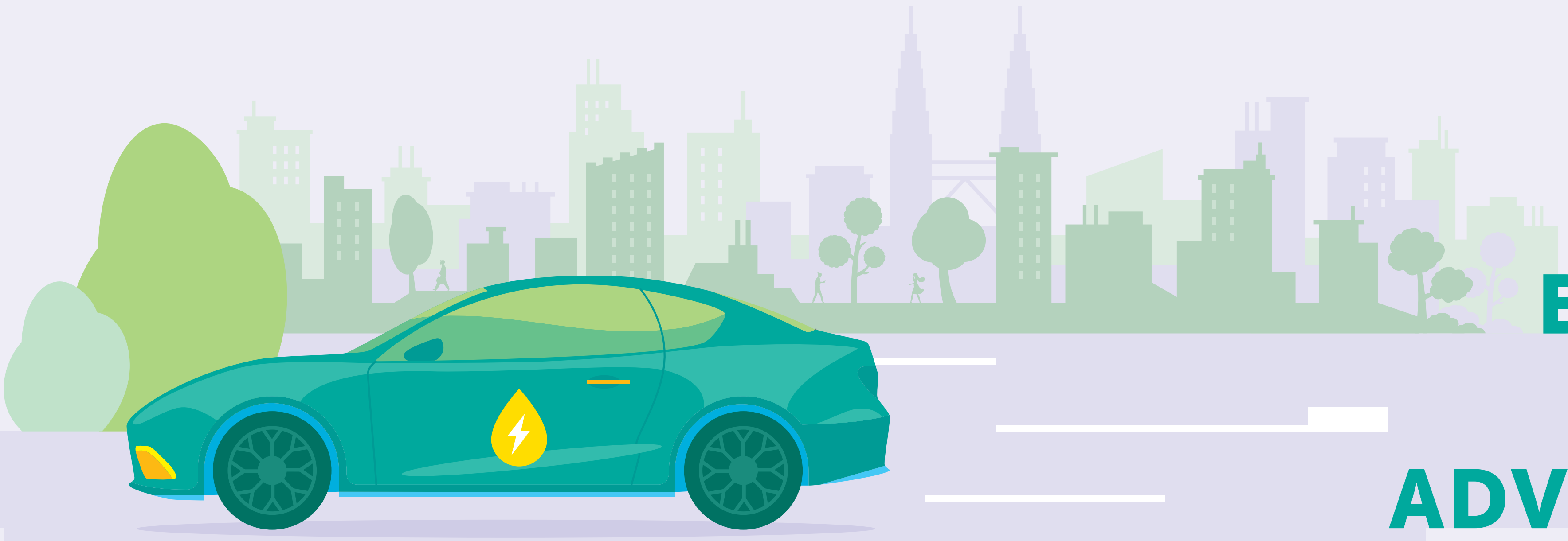
Close communication and collaboration with the Energy Commission on Malaysia's energy balance and needs to ensure **reliable delivery of energy** to support communities, businesses and governments.

Working closely with the Ministry of International Trade and Industry on SOPs and requirements during MCO/CMCO period while exercising strict compliance with HSSE standards and best practices.

Continue to **drive operational efficiency and commercial excellence** and strengthen mitigation strategies in all our businesses and operations.

PETRONAS is a member of the newly formed Energy Core Group (ECG) alongside Ministry of Energy and Natural Resources, Tenaga Nasional Berhad and the Energy Commission **to sustain security of power, gas and petroleum products in Malaysia**. Also working closely with the **Economic Affairs Council**, providing inputs on initiatives and incentives for Malaysia's economic turnaround.





BANKING ON FIRST-MOVER ADVANTAGE

Premilla Mohanlall

Giuseppe D'Arrigo, speaking at the symposium in Turin, Italy that included elaborate sharing by experts on topics including EV technology trends and the role of fluids in the evolution of e-transmission and battery technology.

At the 2018 Geneva Motor Show in March, PETRONAS Lubricants International (PLI) became the first player in the lubricants sector to announce a clear commitment statement on sustainability. "We pledged to double our investments and dedicate 75 per cent of our research and development budget to carbon reduction projects," says Managing Director and Group CEO Giuseppe D'Arrigo.

"The following year, at the 2019 Geneva Motor Show in March, we again broke new ground by becoming one of the first companies to announce e-fluid technologies with the PETRONAS iona range of products," he adds.

Then in November 2019, PLI made another counter industry move. It presented its findings of the industry's first global study in electric vehicles (EV) technology and fluids focusing on electric drive units and batteries at a symposium in Turin, Italy that saw a large gathering of original equipment manufacturer (OEM) players and Tier-1 suppliers, research scientists and the media.

"What the industry found interesting," says D'Arrigo, "is that PLI was entering the challenge of finding the right e-fluid technology with an open mind. We clearly did not have all the answers. Instead, we began by asking the right questions based on assumptions backed by solid research."

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The symposium saw elaborate sharing by experts on topics ranging from EV technology trends and market relevance to the role of fluids in the evolution of e-transmission and battery technologies. The feedback, particularly from OEM participants, was encouraging, with some declaring the brainstorming had triggered them to reconsider their existing approach and solutions.

These high-profile outings have made known PETRONAS' sustainability goals on the world stage. They also reaffirmed PLI's credentials as a leading technology player in the lubricants space. The symposium, meanwhile, has proven to be a catalyst for knowledge sharing, and led to several collaborations targeting co-engineered e-fluid solutions. E-fluids play a critical role in increasing the performance and life span of EVs with their protection and preventive properties.

PLI, meanwhile, looks forward to long-term gains from these first-mover advantages. "Our early entry creates many opportunities. It helps position us as thought leaders and strengthen our brand appeal. It also means we can choose the best partners for collaboration. Eventually, we expect our pioneering efforts to create a strong space for our products and solutions in the future," says D'Arrigo.

Sustaining the momentum

A buzz has been created and now PLI needs to sustain this momentum. "We are progressing well in this regard," says D'Arrigo. "Despite the COVID-19 lockdown, our activities have not stopped. We are launching projects as we speak. Our laboratories are working in a mutual environment with top OEMs and Tier-1 suppliers on several ongoing EV fluid technology development projects.

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"Among them is a collaboration with one of the largest drivetrain manufacturers in the world. This project involves developing a particular fluid for electric drive units (EDU) as required by OEMs and automakers.

"We have already started production of these e-fluids to be tested by two leading Japanese OEMs and one Korean OEM. It will be the first application of our iona product range. We are also working with some German OEMs on specific collaborations for the development of fluids for the thermal management of batteries and EDUs. EDU is a new concept where the electric motor is put into the same housing as the gear mechanism. The e-fluid has to protect and cool both parts at the same time. This is a new challenge, and we have already started developing solutions," adds D'Arrigo.

PLI has also planned a second symposium to be held in China in November this year. Like many big gatherings, this is subject to the COVID-19 lockdown restrictions.

D'Arrigo says, "PLI's e-fluids journey of discovery started in Europe where we have our R&D Centre of Excellence in Turin. We now want to engage with China, considered the main EV market of today and also the future."

Giuseppe D'Arrigo,
Managing Director and CEO
PETRONAS Lubricants International

The Impact of COVID-19 Pandemic

"Overall, we expect an economic slowdown caused by COVID-19 lockdowns. Industry will thus need to refocus in the face of declining demand.

In our industry, we are seeing OEMs and industry players reconsidering some of their investment priorities. There is already talk of delay in carbon emission restriction targets in some countries because the industry just cannot cope with the heavy investments they require.

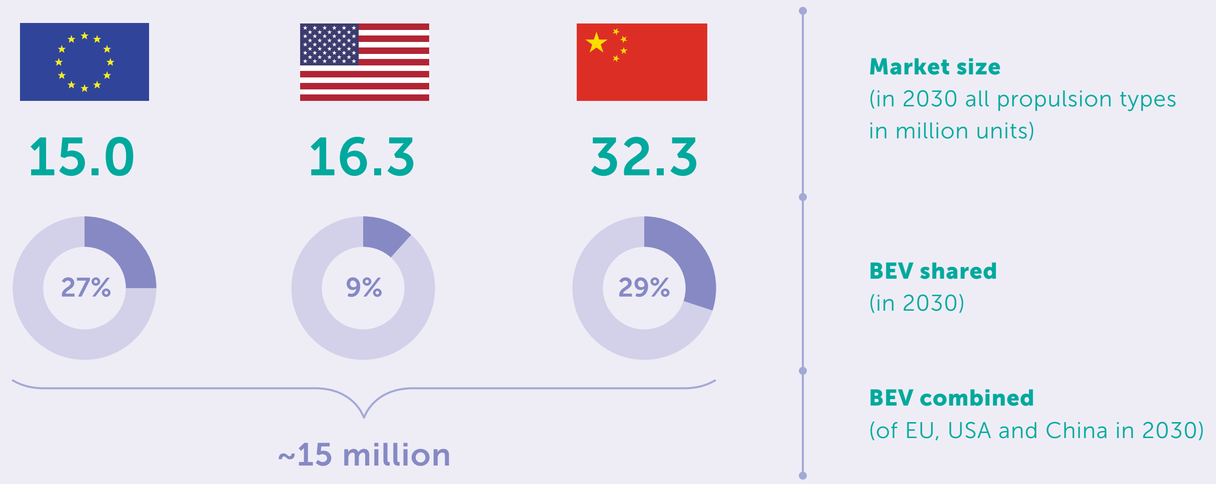
What this means is that the EV timetable is likely to be delayed. Instead, we expect to see an increased demand for fluids that will extend the lifetime and performance of existing machinery, be it industrial equipment, agricultural and construction machinery or automotives. New machinery and replacements will be delayed.

At PLI, we expect to experience a fall in demand for lubricants for new equipment as well as a decline in investments by OEMs in EV technologies. This, however, will be balanced out by a rise in demand for fluids for existing businesses. We thus need to ramp up efforts to make our fluids even more relevant in these circumstances.

The delayed pick up of the economy can also be viewed as an opportunity for PLI to prioritise and select partners who are the best fit for its e-fluid ambitions."

Giuseppe D'Arrigo,
Managing Director and CEO
PETRONAS Lubricants International

Roughly **~15 million** battery electric passenger vehicles (BEVs) will be sold in the three main automotive markets by 2030 with China as the largest contributor.



Lubricants to drive efficiency improvements and emission reduction

About half of the world's lubricant demand comes from the automotive industry, says a 2015 McKinsey Energy Insights in an article entitled "Impact of Electric Vehicles on Lubricant Demand". Lubricants perform a crucial function in making vehicles safer and more efficient; they also help lower fuel consumption during production and use on the road. This helps in the overall reduction in carbon emissions by vehicles.

Lubricating the internal combustion engine (ICE), however, is quite different from lubricating an EV motor. The ICE needs oil to minimise engine friction and transmission fluid. Engine oils account for the larger part of lubricant demand in ICE vehicles; other lubricants are transmission oil, hydraulic oil, wheel bearing and chassis grease.

EV motors require several fluids: oil for the reduction gear that is the EV's transmission unit and oils specifically for the electric motor if the oil cooling is used for the motor. There is also a need for thermal management fluid for the battery and power electronics to support fast charging and strong acceleration in order to increase range and ensure safety. Typically, e-fluids must protect key components while preventing short circuits.

The electrification of road passenger transport is likely to gain traction over the next decade as more countries and municipalities around the world implement measures to reduce carbon, particulate and other emissions, reports McKinsey Energy Insights. The 2016 Paris Agreement, along with rising air quality concerns and the diesel emissions scandal, have intensified diesel and fossil fuel restrictions. France will ban all gasoline and diesel vehicles by 2040, while Athens, Madrid, Mexico City announced plans to ban all diesel cars and vans by 2025. China and India are also considering electric vehicle targets, the report adds.

D'Arrigo says it will take some years before the world sees a mixed fleet of efficient, electrified vehicles moving people and goods across the globe. He adds, "The EV infrastructure is still not there yet, the technology is not ready and there are no economies of scale for mass production."

By 2030, the number of EVs or other types of electrified vehicles is estimated at about 200 million globally, up from the current five to six million. In comparison, there will 1.8 billion ICE vehicles, an increase of 80 per cent. The intermittent period will continue to be dominated by ICE vehicles, says D'Arrigo.

Short and long-term investment returns

PLI has a two-pronged investment strategy. "One is to direct engineering and R&D efforts towards upgrading existing internal combustion engine (ICE) and hybrid technologies to do more for less, achieve high returns for relatively small investments. Two, is to focus on EV-specific fluid technologies, especially for electric driving units and battery thermal management.

The latter saw the trailblazing symposium in Turin that have led to collaborations with a number of universities, as well as several OEMs and Tier-1 players. "These numbers continue to increase and we are working with multiple players and applying different approaches while retaining clarity about what we want to achieve," says D'Arrigo.

"We must bear in mind that what we are working on today may not be the final technology to be used. It is about learn-and-emerge. Our target is the application of the "emerge" technology to produce our iona e-fluids. And it must deliver best-in-class in terms of efficiency and economies of scale.

"I am confident of PLI's capabilities in this regard. We are, after all, recognised as one of the best, if not the best, in lubricants R&D in the world. PLI products are among the most visible in the world. Thirty million consumers see our brands every day globally. Besides, our investments are above the industry average, and we have more than 250 scientists, engineering talent and researchers working on developing various types of lubricants in different parts of the world.

"It is important for us to be at the forefront of the Group's technology drive. This is our competitive advantage in the business."

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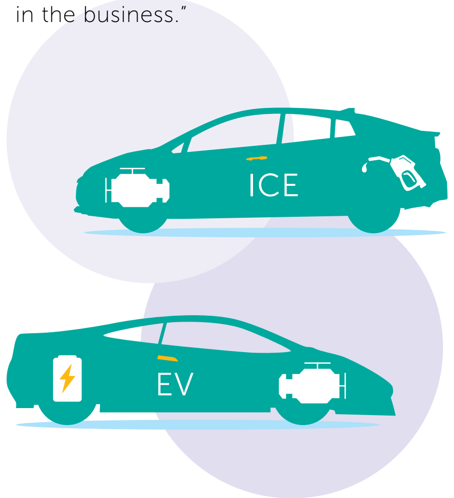
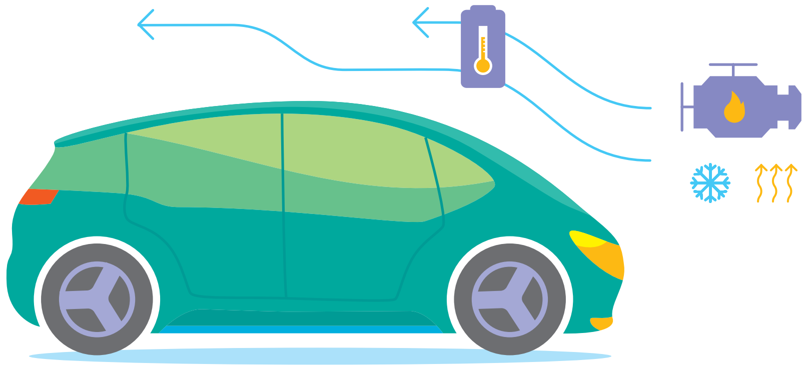




Battery Thermal Management

The symposium in Turin have led to collaborations between PLI and a number of universities, as well as several OEMs and Tier-1 players.

Building on our F1 hybrid experience

For now, PETRONAS' competitive advantage rests with three fluids that make up PETRONAS Fluid Technology Solutions™; PETRONAS Primax, PETRONAS Syntium and PETRONAS Tutela transmission fluid. These formulations leverage our experience with lubricants developed for the fastest Formula 1 hybrid car in the world – the Mercedes-AMG PETRONAS Formula One Team that has won six Constructors' and Drivers' Championships since the start of the Formula One hybrid era in 2014.

In February 2019, PLI launched upgraded the PETRONAS Syntium engine lubricants with °CoolTech™ technology. °CoolTech™ products are the first to be unveiled under PLI's carbon reduction initiatives announced at the 2018 Geneva Motor Show.

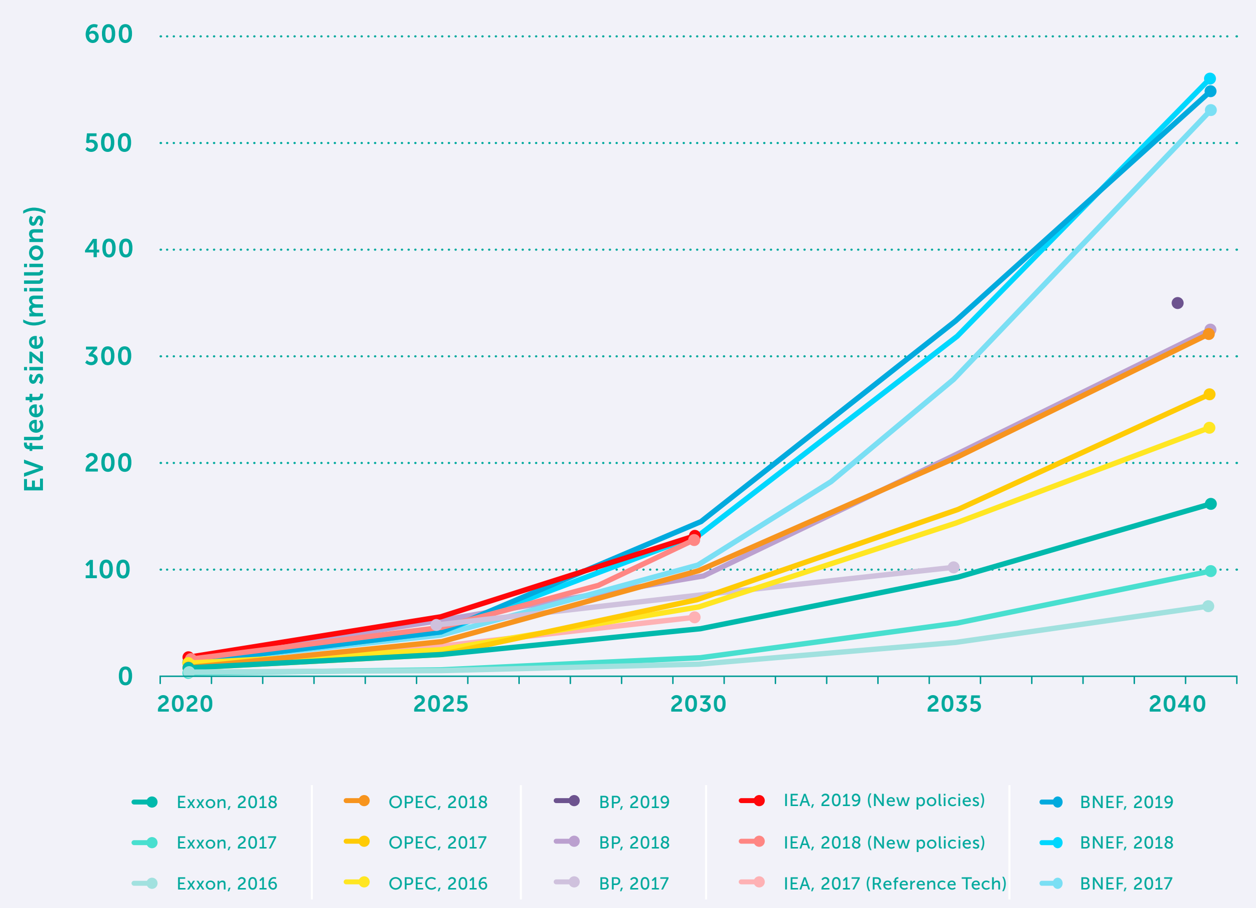
The hallmark of new Syntium range is the PETRONAS Syntium 7000 Hybrid with °CoolTech™, a new lubricant for hybrid engines. It marks the company's entry into the hybrid lubricant market. "This is a result of our technological strength and commitment to create fluids that help reduce carbon emissions," says D'Arrigo.

PETRONAS Syntium with °CoolTech™ products can help achieve up to five per cent fuel economy and significantly reduce emissions under certain test conditions, says D'Arrigo, illustrating his point with the following analogy: "When one car uses this product for one year, it can displace carbon emissions equivalent to planting five trees a year. Multiply this many times over, and it is equivalent to reforesting entire states in Malaysia every year."

“CoolTech™ technology is part of PLI’s “more for less” strategy that builds on existing technologies to enjoy quick investment returns. For e-fluids, on the other hand, the measurement of success for now will be determined by the number of collaborations, projects, and testing needed for iona product before they are commercialised. The entire process has the potential to create better knowledge, better credibility and the pre-eminence for PETRONAS to ride on the projected growth wave of e-mobility.

“I believe we have made the right moves with the industry so far. I expect us to realise our first-mover advantage when we start to shift our e-fluid focus to the consumer market in the not too distant future,” adds D’Arrigo.

EV outlooks then and now



Source: BloombergNEF, organisation websites. Notes: Some data points for BP, ExxonMobil and the IEA are BNEF estimates which assume linear growth between known data points. Latest BNEF, IEA, BP and OPEC outlooks include passenger and commercial EVs. BP only forecasted through 2035 in its 2017 outlooks and provides an estimate for 2040 in its 2019 outlook; the IEA only forecasts through 2030. All outlooks include BEVs and plug-in hybrid electric vehicles (PHEVs); Exxonmobil and IEA outlooks pre-2018 also include fuel cell vehicle (FCVs). The IEA forecasts multiple scenarios (some of which are higher than those here). Chart shows latest data available.

FLOW in Conversation with Dzafri Sham Ahmad

SUSTAINABILITY TAKING CENTRESTAGE

Chai Li Tiing

> I believe that in this time and age, sustainability is a natural prerequisite for any company that has long-term growth in mind.

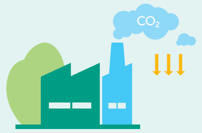
Dzafri Sham Ahmad
Vice President of Group Health, Safety, Security and Environment

Sustainable Development has been an aggressively debated topic since the term was first coined by the UN-established Brundtland Commission in its 1987 report. More than three decades later, the concept has gained considerable traction in the eyes of governments and international organisations. Sustainability emerged centrestage at the World Economic Forum in Davos earlier this year, imploring large corporations to re-examine the way they conduct their businesses and redefine their bottomline in a more holistic manner. Large corporations are now held to higher standards of accountability as the world seeks to curb unconscionable acts of profiting at the expense of the environment and the welfare of communities.

While PETRONAS has been on its sustainability journey for more than 20 years, it has recently renewed its commitment towards the cause with a new Sustainability Agenda. FLOW speaks with Dzafri Sham Ahmad, Vice President of Group Health, Safety, Security and Environment (GHSSE) to find out what the agenda hopes to achieve, the challenges it has to overcome, and also where the industry is headed with sustainability front and centre on its agenda.

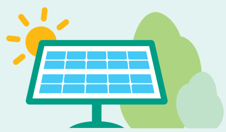
SUSTAINABILITY STORY:

What are PETRONAS' hard targets under the Sustainability Agenda?



Control emissions by **reducing overall emissions capped at 49.5 million tCO_2e** by 2024

In reducing greenhouse gas (GHG) emissions, PETRONAS continues to reduce flaring, hydrocarbon venting and drive energy efficiency improvements in our operations, while embarking on flare and vent reduction projects.



Boost cleaner energy portfolio mix and target to achieve **installed renewable energy capacity of 3,000 megawatt** by 2024

A significant move PETRONAS has made in the solar energy space is the 100 per cent acquisition of Amplus Energy Solutions Pte Ltd (M+) with its customisable and affordable solar solutions.

Project SINARAN (Solar Installation and Application on PETRONAS Rooftops and Assets Nationwide) further add to the installed capacity of solar PV systems.

Nurture future leaders by reaching out to **24,100 beneficiaries of PETRONAS Educational Programme** by 2024

Yayasan PETRONAS undertakes a variety of corporate social responsibility (CSR) activities anchored on Sentuhan Ilmu, Sentuhan Harapan and Sentuhan Alam.

The series of Sentuhan Ilmu programme is aimed at to improve the educational outcomes and provide more opportunities for underprivileged students.

1. Sustainability is a timely topic to discuss now that the world is in the midst of containing a global pandemic. While often associated with the environment and climate change, its scope is far wider. What does being sustainable mean for an organisation?

Sustainability has been a growing area of interest for many parties, its close link to climate action has a lot to do with the fact that the environment is the top agenda for many organisations, and has been advocated widely and prominently by financial institutions, activists and international organisations alike.

However, when organisations take on sustainability, we must look at it from the broader perspective as posited by the 17 United Nations Sustainable Development Goals (SDGs), which cover a lot more ground. It approaches the topic in a very comprehensive manner, touching on education, equality, well-being, and even governance.

For PETRONAS, sustainability is about conducting our business responsibly to bring benefits to society and the environment, while ensuring efficient delivery of cleaner energy through technological innovation. I believe that in this time and age, sustainability is a natural prerequisite for any company that has long-term growth in mind.

2. What was the catalyst that led to the creation of the PETRONAS Sustainability Agenda? Considering PETRONAS has been addressing sustainability for over 20 years how is this different?

As a Group, we have been doing a lot of things under the umbrella of being a sustainable organisation, but all these efforts were executed in a bottom-up manner. Throughout our organisation, we have been carrying out a lot of CSR programmes for the community, we have also internally pursued operational excellence and efficiency in reducing flaring and venting in our plants, all orchestrated at the business and corporate level.

In 2001, we introduced the PETRONAS Corporate Sustainability Framework that had focused on the three aspects of economic, social and environmental sustainability. We also established a Sustainable Development Department to orchestrate our sustainability efforts in PETRONAS at a Group level. Subsequently, the Corporate Sustainability Council (CSC) was created to deliberate on sustainability policies and strategies with key leadership from business and corporate functions. As initial focus was more on environmental performance and maximising value, we achieved cumulative energy savings of 17.9 million MMBtu from 2006 to 2009 through an energy loss management system.

The PETRONAS Carbon Commitments and Human Rights Commitment were then introduced to give more focus and commitment to drive efforts in specific areas of climate change and social performance.

But we realised that these efforts can be orchestrated better with a wider scope and more inclusiveness. We needed to strengthen our top-down sustainability direction. A lot has been done, but the impact must be more pronounced among our employees.

Today, more than ever, we are also faced with stringent stakeholders' expectations for rigorous environment, social and governance (ESG) performance, measures and transparency in reporting.

This prompted the introduction of the PETRONAS Sustainability Agenda last October to provide a top-down direction, aimed at effectively incorporating sustainability into the businesses' strategic decision-making on growth, operational excellence and assessment of risks.

Our commitment towards sustainability comprises four (4) Sustainability Lenses namely Continued Value Creation, Safeguard the Environment, Positive Social Impact and Responsible Governance outlined in the Agenda. These lenses will help guide groupwide operations towards a balanced ESG approach as we strive to capture new opportunities, develop better solutions to respond to the risks while adding value to the lives of people. As measurements for the lenses, three key targets have been disclosed.

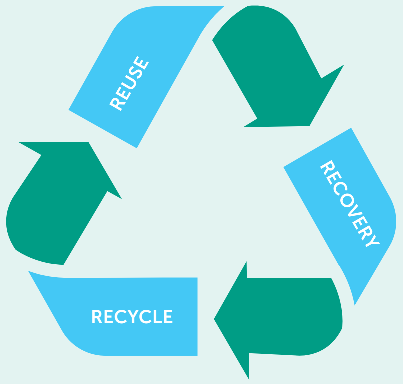
The Agenda is also anchored on seven SDGs that have been prioritised out of the 17 SDGs.

① SDG 3 (Good Health and Well-Being)
② SDG 4 (Quality Education)
③ SDG 7 (Affordable and Clean Energy)
④ SDG 8 (Decent Work and Economic Growth)
⑤ SDG 9 (Industry, Innovation and Infrastructure)
⑥ SDG 12 (Responsible Consumption and Production)
⑦ SDG 13 (Climate Action)

Our Sustainability Agenda resonates with the PETRONAS Statement of Purpose which describes our resolution to be a progressive energy and solutions partner enriching lives for a sustainable future.

HAZARDOUS WASTE:

PETRONAS focuses on maximising hazardous waste managed through Reuse, Recycle or Recovery (3R) practices, and by leveraging available technology providers and initiating new collaborations with technology partners.



3. "How does increasing Renewable Energy (RE) capacity affect PETRONAS' operations? Do you foresee the energy mix to skew towards renewables in the near future?

We have already taken steps towards RE with the establishment of the Gas and New Energy division to oversee RE and low-carbon fuels such as natural gas and liquefied natural gas (LNG).

PETRONAS is promoting the use of natural gas and LNG, a low-carbon fuel that can reduce Malaysia's national electric grid emissions. Natural gas is Malaysia's largest source of energy, providing nearly half of the fuel required for power generation and a third of the industrial sector's energy needs. The company made a significant move into the RE space with the acquisition of a leading Singapore-based company, Amplus Energy Solutions Pte Ltd (M+). M+ has a portfolio of distributed RE assets in Asia, with a total capacity of 600 megawatt under operation and development.

In Malaysia, we expanded our solar portfolio with the installation of solar photovoltaic (PV) panels with a total capacity of 207 kilowatts at the Pengerang Integrated Complex (PIC) and also Project Solar Installation and Application on PETRONAS Rooftops and Assets Nationwide (SINARAN) with identified potential for 30 megawatt - all to reduce indirect GHG emissions from electricity purchase from the grid.

In January this year, PETRONAS has also announced a 5 per cent allocation of CAPEX for RE.

With that said, fossil fuels are expected remain core to the global energy mix for some time to come. We estimate it to constitute more than 50 per cent in 2024.

However, as we experience a period of low Brent prices, compounded by the effect brought upon by the COVID-19 pandemic, energy companies would need to address the energy trilemma of ensuring affordability, security of supply, and maintaining our commitment to sustainability.

This is a challenge for all of us, and it will take a concerted effort from all parties - the government through its policies, the consumers through their choices, and the energy companies through their business activities - to make the leap towards sustainability.

4. What are the financial or profitability factor that compels companies to embrace sustainability?

There are many success stories, and studies, that have shown how sustainability in a business can create long-term value, and ultimately attract new talents, improve stakeholders' confidence and generate return on capital through sustainable products as well as ongoing operational excellence. In essence, operating responsibly and sustainably, and taking care of our employees and the environment are actions that help us build trust with our stakeholders and the community, thus giving us the license to operate.

Beyond that is having the license to grow as an organisation. An organisation does not stand a chance to continue to be profitable and relevant - or even to exist, for that matter - without embracing sustainability.

Dzafri and PETRONAS Chairman Datuk Ahmad Nizam Salleh at the launch of the Walk4Trees Challenge that saw one tree planted for every million steps taken by participants of the programme.

5. As energy companies work on reducing its carbon footprint, will their operations be affected? Will that ultimately affect revenues?

I don't think it will affect operations. Being sustainable will require organisations to make responsible decisions while striking a balance between economic benefits, the environment and community well-being. We will inevitably be presented with challenges, because GHG emissions are contributed by flaring and venting, as well as combustion of fossil fuel at plant operations. Our plants have already been operating at high levels of plant efficiency and overall equipment effectiveness (OEE). This means that our Downstream and GNE businesses' energy cost is optimised and it would be a challenge to achieve significant savings or GHG reductions.

However, there are still opportunities in Upstream to monetise the hydrocarbon gasses to reduce flaring and venting through fixing passing valves, installing recovery compressors, or even reinjection of gas for enhanced oil recovery.

Hydrocarbon flaring and venting reduction were the main contributors to overall GHG reduction when we set our GHG reduction targets at 49.5 million tCO_2e for 2024. Further to this, the target will also necessitate us to continue to review our field development programme and explore carbon capture, utilisation and storage (CCUS) technology to prevent CO_2 from entering the atmosphere.

Looking at it from another angle, improving our operational efficiency and our venture into RE are expected to contribute to new streams of revenue. By upholding sustainability through compliance with regulations and conducting businesses responsibly, we can build trust among stakeholders which will positively affect our long-term business objectives.

6. Do you foresee energy companies diverting from their Sustainability Agenda, driven by effects of the COVID-19 pandemic and low Brent prices?

I believe that sustainability will continue to be a priority, but the base targets or the pace at which we progress may be affected by the circumstances at hand.

In situations like today with the COVID-19 pandemic, companies' priorities might shift to humanitarian survival, while the environmental-focus matters become the baseline activities. It is important to be agile to react to these unforeseen circumstances so that we may survive long enough to equally make progress in other areas in the long run.

> Sustainability is no longer a choice, and for energy players like PETRONAS, transitioning to a low-carbon future requires us to strike the optimal equilibrium, providing energy in a secure, affordable and sustainable manner while contributing to economic growth and a better quality of life.

7. What was the single biggest challenge that you have faced in this journey towards sustainability?

We must make sustainable development pervasive in our organisation, and to do that, we must make sustainability a part of our organisational culture. This is a key factor for success.

In this, we have our work cut out for us because the concept of sustainability has yet to be fully embraced in the hearts and minds of people, and integrated into the way we do things. What we need is to form a culture where sustainability becomes our way of life and the way we work in this organisation. It should be at the top of everyone's mind, almost intuitive even.

People always equate sustainable development to the environment or climate change. That is the most widely talked about aspect all over the world. But what they don't realise is that everything that we are doing now contributes towards sustainable development, for example plant OEE, our CSR efforts, governance and reporting, and waste reduction. Perhaps what we need to do is to create the link and make it clearer for everyone to understand.

To achieve this, communication is key; not just any kind of communication, but one that is driven by leaders. We need to create more avenues for two-way conversations about sustainability among all levels within the organisation. Everything that we do contributes towards our Sustainability Agenda.

If we are able to shape people's attitudes towards sustainable development, I believe that it should not be too difficult to integrate sustainability into our business strategies and processes.

8. When it comes to the environmental debate, oil and gas companies are often known as the bad guys or "Big Oil". What are your thoughts on that?

Oil and gas is commonly labelled as "dirty business". GHG emissions and hazardous waste are some of the by-products of our activities when we strive to fulfil the energy demands of the world. As a responsible company, we have embedded sustainability into our business strategies, prioritising minimising our impacts to the environment, creating positive social impacts to the community while making good returns for our shareholders.

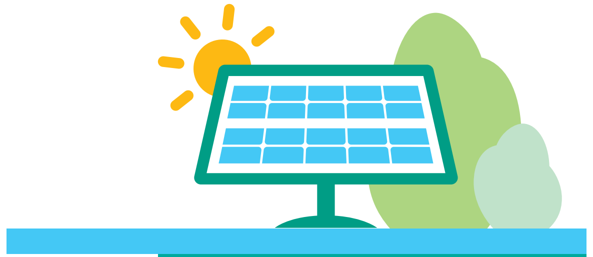
There is an increase in expectations for energy companies to safeguard the environment, seen through emerging stringent standards and legal requirements over the past decade. The energy companies have to rise to the occasion and meet these standards.

PETRONAS has been implementing internal standards for a while now, to manage GHG emissions, air quality emissions, wastewater, hazardous waste, soil and groundwater, project environmental management and use of natural resources.

These standards are benchmarked against external standards and guidelines, industrial best practices and local requirements. We trained our staff to become environment specialists to guide our business decisions.

Sustainability is no longer a choice, and for energy players like PETRONAS, transitioning to a low-carbon future requires us to strike the optimal equilibrium, providing energy in a secure, affordable and sustainable manner while contributing to economic growth and a better quality of life.

PETRONAS is boosting its cleaner energy portfolio mix and targets to achieve installed RE capacity of 3,000 megawatt by 2024.



> Where PETRONAS is concerned, we want to be known as a responsible energy company and we will prove it through our practices.

9. Is the industry, as a whole, doing enough to address these concerns? Is it on the right track?

A lot of oil and gas companies have been changing the way they do things, prioritising decarbonisation efforts in the transition to a low-carbon economy. In order to ensure that there is still enough energy to meet the demands of the world, the industry is leveraging on natural gas to strike a balance between climate changes and to sustainably produce affordable and reliable energy during this transition period.

According to the World Energy Outlook special report "The Role of Gas in Today's Energy Transitions", since 2010, coal-to-gas switching has saved around 500 million tonnes of CO_2 – an effect equivalent to putting an extra 200 million electric vehicles running on zero-carbon electricity on the road over the same period.

Yet another notable progress the industry has made was investment in RE projects. The "Global Trends in Renewable Energy Investment 2019" report noted that the investment will quadruple RE capacity (excluding large hydro) to 1,650 gigawatts by end-2020 from 414 gigawatts at end-2019.

So, I would say that we are all headed in the right direction. Though transition is not an easy feat, it is apparent that we are delivering results to that end.

10. What are your aspirations for PETRONAS in the area of sustainability?

Where PETRONAS is concerned, we want to be known as a responsible energy company and we will prove it through our practices, integrating the Sustainability Agenda with our businesses' strategic decision-making. As you know, our Sustainability Agenda was inspired by the company's Statement of Purpose which reflects the dynamic growth and innovation we are aspiring towards. In short, we will continue delivering sustainable energy to our stakeholders while enriching lives by creating value, providing opportunities for our own employees and ultimately helping society reach its full potential.

We believe that there is an opportunity for us to make sustainability our competitive edge – one that will propel the organisation further as we strive towards new ways of achieving distinctive business outcomes.

Moving forward, our commitment is to continue our move towards a low-carbon economy by advocating natural gas as a cleaner source of energy. We will also continue to play our role in supporting Malaysia's Nationally Determined Contribution ambition to reduce GHG emissions per the signing of the Paris Agreement, aligned with the SDGs.

BIGGER AND BETTER: PFLNG DUA

After 48 months of construction, PETRONAS' second floating liquefied natural gas (LNG) facility – the PFLNG DUA is now in its commissioning phase at the Rotan gas field, 140 kilometres offshore Kota Kinabalu, Sabah.

Construction of the PFLNG DUA began in 2014 and was completed on 18 February 2020 when it was finally homeward bound, having successfully sailed away from the Samsung Heavy Industries Shipyard in Geoje Island, South Korea.

The journey took approximately two weeks and covered 1,840 nautical miles. When it arrived at the Rotan gas field, PFLNG DUA was moored at a water depth of 1,300 metres.

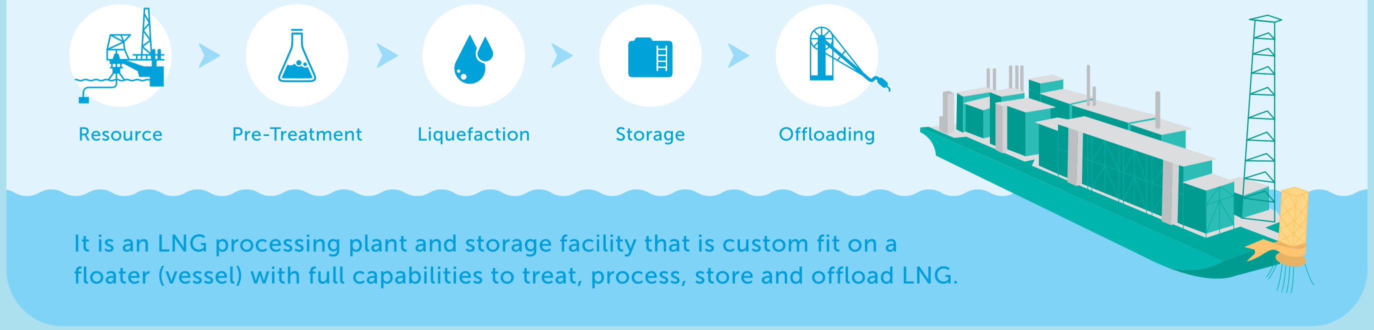
Welcoming the PFLNG DUA home with the Malaysian flag.

PFLNG DUA is planned for commercialisation by the end of 2020 which will subsequently enable PETRONAS to monetise new deep-water sources of cleaner energy.

The PFLNG DUA supports PETRONAS' portfolio of LNG facilities around the world, further establishing our position as a reliable LNG supplier in meeting global growing demand.

What is FLNG?

Basic Concept of a Floating LNG



It is an LNG processing plant and storage facility that is custom fit on a floater (vessel) with full capabilities to treat, process, store and offload LNG.

Why FLNG?

It is a key solution by **PETRONAS** to monetise stranded gas fields in a safe, economical and sustainable manner.

PETRONAS' exploration team discovered a large number of deepwater gas reserves, especially in East Malaysia.

PETRONAS FLNG facilities are **smaller, nimbler and has greater flexibility** to better access small and stranded gas fields globally.

PFLNG DUA Key Facts

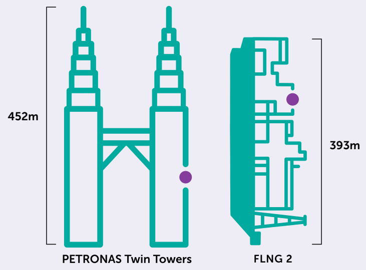
Total weight (without cargo)
146,933 tonnes
equivalent to
255 fully laden A380

Total length of cable used
1,790km approximately
distance between Singapore and Bangkok

1.5 million tonnes
LNG production capacity per annum

LNG tank **177,000m³** equivalent to more than **70 Olympic-sized swimming pools**

Capable of reaching **deepwater gas reserves** in water depths of up to **1,500m**



overall length **393m**

158 personnel
capacity on board

120
operational crew

2,800 workers
every day during peak construction

16 million
project man-hours

20 years
design life

Being the very first deepwater FLNG introduced to the market, PFLNG DUA marks another world's first achievement for PETRONAS, following the introduction of the world's first FLNG, PFLNG SATU, in 2016.

Today, PETRONAS is the only energy company to own and operate two FLNGs, further augmenting PETRONAS' position as a reliable partner and supplier of LNG to power the world.

PETRONAS AT A GLANCE

Petroliam Nasional Berhad (PETRONAS) is a global energy and solutions company, ranked among the largest corporations on Fortune Global 500®.

We seek opportunities in energy investments both in hydrocarbon and renewables across the globe and maximise value through our integrated business model. Our portfolio includes conventional and unconventional resources as well as a diverse range of fuel lubricant, and petrochemical products. This is further strengthened with a successful product delivery track record. Our customers are at the heart of everything that we do and our businesses are anchored on meeting their needs.

Our technology is our differentiator and the key to ensuring excellence in all that we offer – energy, products and solutions, as well as unlocking new business frontiers. Sustainability is at the core of everything that we do, as we believe in harnessing the good in energy to add quality to everyday lives. People are our strength and partners for growth. We believe in progressing with our partners in addressing the evolving needs in today's changing energy landscape.

UPSTREAM PRODUCTION VOLUME
2.4 MILLION BOE/D

LNG CARGOES DELIVERED
11,000+
CARGOES

LNG SALES VOLUME
30.6 MILLION METRIC TONNES

SOLAR CAPACITY
600 MW
IN OPERATION/DEVELOPMENT

6 SIX-TIME CONSECUTIVE WORLD CONSTRUCTORS' CHAMPION IN FORMULA ONE

2 OWNER AND OPERATOR OF TWO FLOATING LNG PLANTS

Source: PETRONAS Annual Report 2019

STATEMENT OF PURPOSE

A progressive energy and solutions partner enriching lives for a sustainable future.

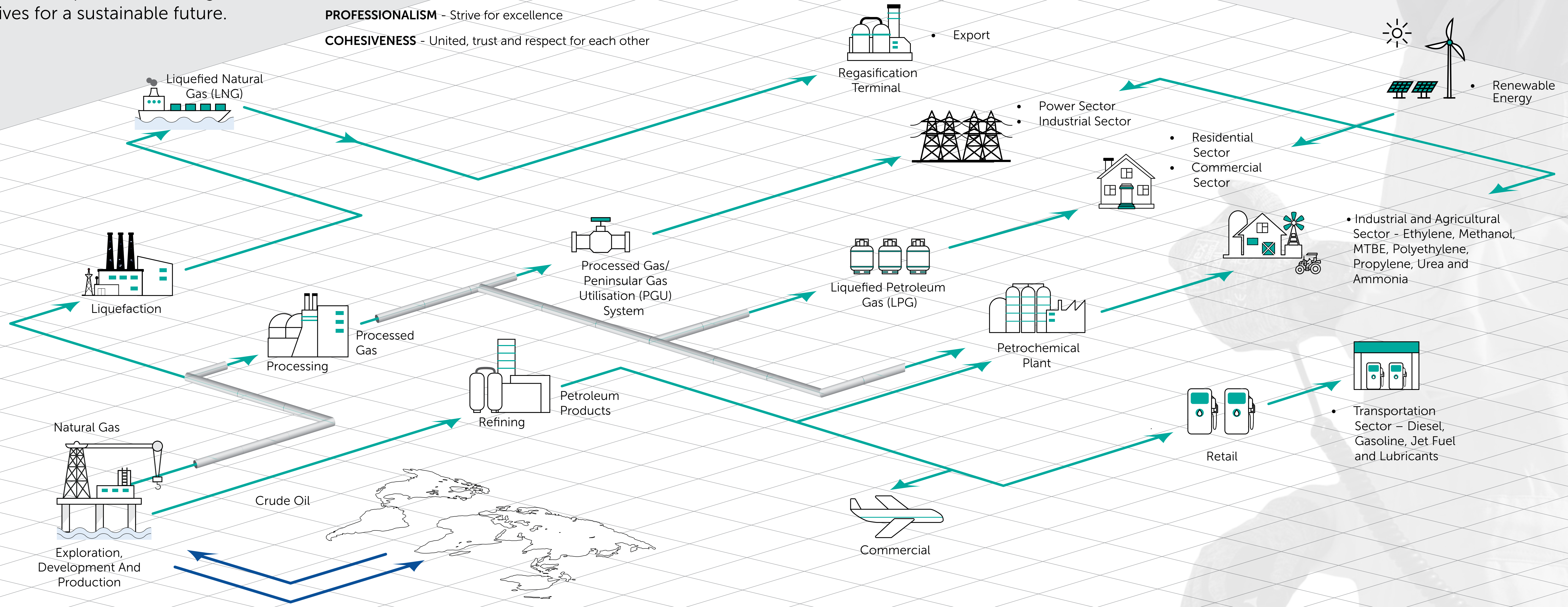
SHARED VALUES

LOYALTY - Loyal to corporation

INTEGRITY - Honest and upright

PROFESSIONALISM - Strive for excellence

COHESIVENESS - United, trust and respect for each other



Natural Gas

Exploration, Development And Production

Crude Oil

Processing

Processed Gas

Liquefaction

Liquefied Natural Gas (LNG)

Regasification Terminal

- Export

Processed Gas/ Peninsular Gas Utilisation (PGU) System

- Power Sector
- Industrial Sector

Liquefied Petroleum Gas (LPG)

- Residential Sector
- Commercial Sector

Refining

Petroleum Products

Petrochemical Plant

- Industrial and Agricultural Sector - Ethylene, Methanol, MTBE, Polyethylene, Propylene, Urea and Ammonia

Commercial

Retail

- Transportation Sector – Diesel, Gasoline, Jet Fuel and Lubricants

- Renewable Energy

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