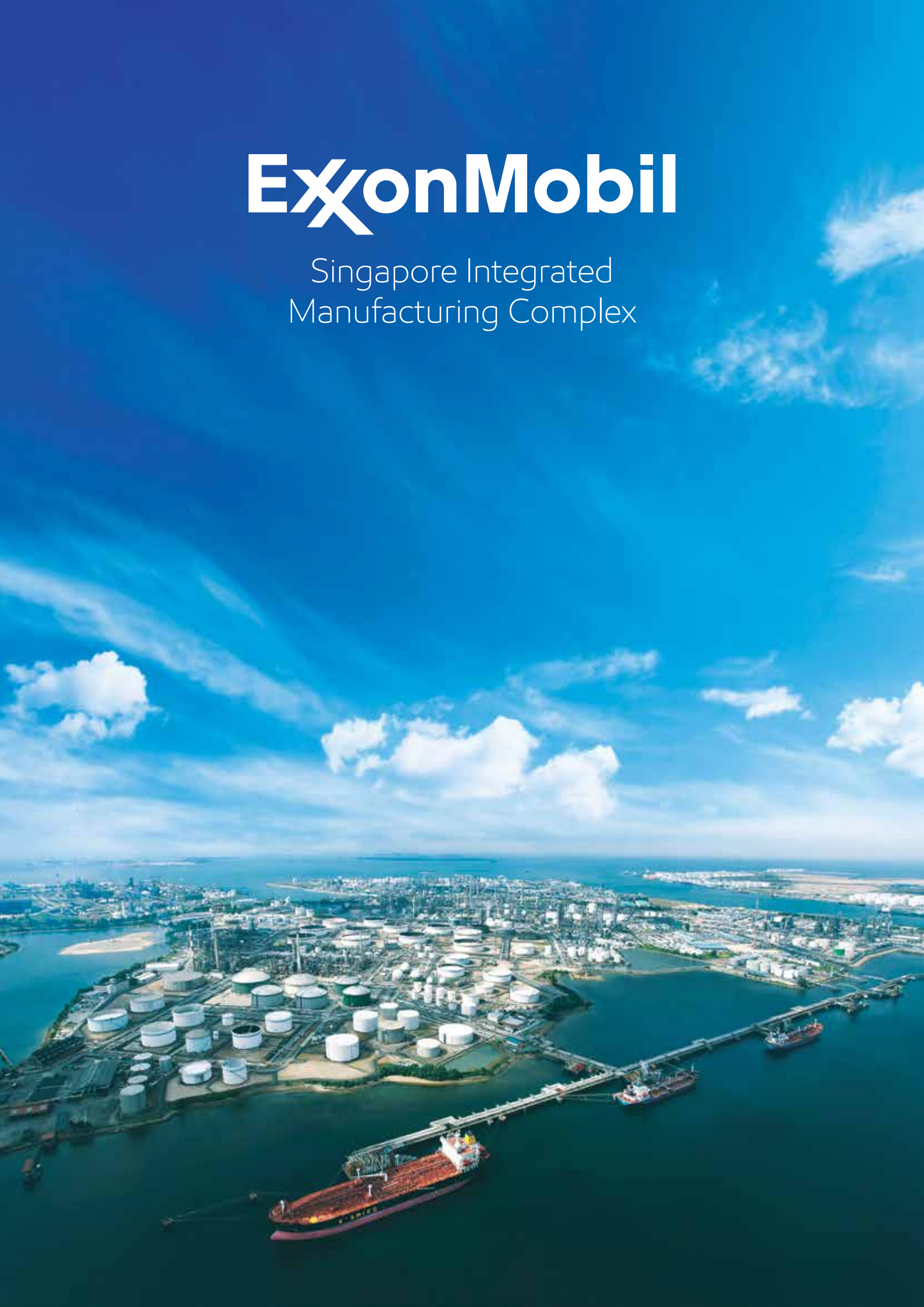
ExxonMobil

Singapore Integrated Manufacturing Complex



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Introduction

ExxonMobil has had a long presence in Singapore. What started out as a kerosene trading house in 1893 is today a multi-billion-dollar manufacturing and marketing business with over S$25 billion in fixed asset investments and a diverse workforce of more than 3,500 employees.

The Singapore Refinery is fully integrated with the Singapore Chemical Plant to form ExxonMobil's largest integrated manufacturing complex in the world. Our integration allows us to upgrade each molecule to its highest value.

The Singapore Refinery produces a range of fuel products including gasoline, diesel, jet fuel, liquefied petroleum gas (LPG), asphalt and lubricant basestock. It also provides the chemical plant with feedstock. The Singapore Chemical Plant in turn produces ethylene, propylene, polymers and specialty chemicals - the basic building blocks for high-performance products and consumer goods such as diapers, food packaging, solvents, cosmetics and automotive parts.

Safety, Security & Health

ExxonMobil is committed to doing business in a manner compatible with both the environmental and economic needs of the communities in which we operate, while protecting the safety, security and health of our employees, contractors and the public.

Safety is a core value and an integral part of ExxonMobil's culture. Our aim is to ensure each employee and contractor leaves work each day safe, and in good health. We remain steadfast in our goal that "Nobody Gets Hurt" and we view effective risk management and a commitment to safety as business imperatives.

Our operational risks are managed through our Operations Integrity Management System (OIMS). This framework establishes common worldwide expectations for addressing safety, security, health, environmental, and social risk in every aspect of our business, including process and personnel safety.

In addition, ExxonMobil maintains a strong emphasis on training for effective emergency response capabilities. We establish strategic emergency support groups (ESGs) around the world to develop and practice emergency response strategies and assist field responders. In Singapore, the complex periodically conducts drills and participates in joint exercises with government agencies.

Technology

We believe that technology holds the key to ensuring that we continue to meet growing energy demand, while at the same time reducing emissions. As a science and technology company with more than 2,200 Ph.D. scientists on staff, we continue to pursue technologies that benefit our company and society.

We invest in technology for operational excellence, operational flexibility and product quality. For example, by leveraging on proprietary technologies, the world-class steam cracker in Singapore can process an unprecedented feedstock range from gases to heavy liquids, including crude oil. Technology also helps us improve energy efficiency and mitigate emissions.

Milestones

ExxonMobil's history in Singapore dates back to 1893

1966
Mobil Refinery in Jurong starts up

1893
Vacuum Oil started selling kerosene

1970
Esso Refinery on Pulau Ayer Chawan starts up

1999
Merger

ExxonMobil

2001
Singapore Chemical Plant (SCP) starts up

SCP expansion starts up

Singapore Diesel Hydrotreater (SHDS) starts up

2013

2014
ExxonMobil celebrates 120 years in Singapore

Completes Singapore Butyl and Adhesion (SBA) production units

Jurong cogeneration facility starts up

Acquires world-scale aromatics facility on Jurong Island

New grease and synthetics lubricants plant starts up

2017

Jurong Island

Not drawn to scale

Singapore Refinery (PAC)

Singapore Chemical Plant

Singapore Refinery (Jurong)

Jurong Lubricant Plant

SCP Banyan Facility

Sustainability and Community Engagement

Sustainable Operations

ExxonMobil is committed to addressing the challenge of sustainability – balancing economic growth, social development and environmental protection – so that future generations will not be affected by actions taken today.

We work to expand the supplies of reliable and affordable energy needed for economic progress, while advancing effective solutions that help consumers reduce their own emissions.

Reducing Emissions and Improving Energy Efficiency

To run our refining and petrochemical manufacturing operations safely and reliably, we need both energy and water. We recognize the need to manage these resources that we use efficiently.At the Singapore manufacturing complex, we take a balanced approach by considering the impact of our operations on the economy, the community, and the environment.

ExxonMobil believes that a continued focus on enhancing energy efficiency is one of the best ways to manage climate change risks.

Our Jurong Cogeneration Plant was opened in October 2017

We achieve this focus by applying the ExxonMobil Global Energy Management System (GEMS) in our refineries and chemical plants worldwide. We have used GEMS in Singapore to identify and act on numerous opportunities to improve the energy efficiency of our operations, and between 2002 and 2016, our complex's energy efficiency improved by about 25 per cent. In terms of carbon dioxide emissions, it would be equivalent to removing over 479,000 cars from Singapore's roads.

GEMS has allowed us to be leaders in industrial energy efficiency, and we were recognized in Singapore for our excellence in energy management at the 2017 Energy Efficiency National Partnership awards given out by the Singapore government.

We have also invested in three cogeneration facilities in Singapore, which can generate more than 440 megawatts of electricity. The electricity produced by these cogeneration units provide power to the chemical plant and refinery while simultaneously generating steam that help run our operations. This has helped raise the energy efficiency of the Singapore manufacturing complex significantly.

Water Management

Our operations are also designed to use alternative water sources and we constantly seek opportunities to replace, reduce, reuse and recycle water, which we use mainly for steam generation and process cooling.

In Singapore, besides seawater cooling and fin fan cooling, we have also adopted the the membrane bioreactor (MBR) technology to treat wastewater so that it can be reused for cooling. We were the first to do so in ExxonMobil's global circuit of facilities when it was implemented at our chemical plant in 2013. Today, more than 55 per cent of MBR-treated water is recycled as cooling water.

ExxonMobil continually looks for innovative and sustainable options to efficiently manage energy and water use in our Singapore facilities.

Seawater cooling

reduces our freshwater demand by more than **4 million** gallons a day

That's equivalent to **6X** Olympic-sized swimming pools of water savings

Air fin fans

reduce the size of water cooling towers

Frees up almost **300m³/hour** of fresh water and treated waste water!

Membrance bioreactor (MBR) technology

treats waste water → to be reused for cooling

In 2016, **55%** of MBR-treated water was recycled as cooling water!

Our Products' Contributions

Our products play a key role in enabling the manufacture of affordable, sustainable and safe products that are helping to meet the growing demands of an increasing global population. They are moving the world forward by supporting economic growth, enhancing opportunity and improving the quality of life for people everywhere. We focus on developing solutions that can make a positive contribution to sustainable development.

Solutions include:

- **Automotive:** Lightweight plastics and high-performance tires that support the automotive industry's drive to increase fuel efficiency and lower emissions
- **Packaging:** Thin, durable packaging films that keep food fresh, helping to reduce food waste
- **Building & Construction:** House-wrap technology that improves building energy efficiency, helping to minimize greenhouse gas emissions
- **Consumer Goods:** Materials that are safe, even in sensitive consumer goods like hygiene products, medical applications and electronics

Community Relations

ExxonMobil believes in making a positive impact in every community we operate in.

In Singapore, our community outreach activities include support for education, environment, health, community welfare and the arts. For example, we have been supporting the Caring Teacher Awards together with the National Institute of Education and Ministry of Education, to acknowledge the exceptional contributions of teachers who have consistently made a significant difference in the lives of their students, in and outside the classroom.

Our annual Adopt-A-Rental-Block grocery distribution

ExxonMobil has also been a corporate partner with the South West Community Development Council since 2002. The two organizations have worked together on initiatives such as the transport bursary, which helps students from low-income families defray school-going transport expenses, and the annual Adopt-A-Rental-Block activity, which sees 300 ExxonMobil volunteers distributing groceries to low-income residents in the local community.

Around our facilities, we lead the Jurong Neighbourhood Environment Safety and Health (NESH) network and are participants of the Sakra Owners Roundtable (SORT) - platforms that allow us to actively engage the immediate community around the complex.

Our employees and their families also support community projects through their contributions and volunteer time. Every year, they participate actively in various company-organized initiatives such as in the organization of blood donation drives.

Singapore Refinery

The Singapore Refinery is a world-scale refining complex across two sites – one on the mainland (Jurong) and another on Jurong Island (Pulau Ayer Chawan or PAC). Together with the Singapore Chemical Plant, they form the largest integrated ExxonMobil manufacturing complex in the world.

This integrated refinery has a crude distillation capacity of 592,000 barrels per day, producing a wide range of fuel products, lubricant basestock, aromatics and chemical feedstock for its customers and sister plants.

Facts & Figures:

Workforce Strength

More than
1,200
employees

Total Throughput

Jurong
302,000
barrels per day

PAC
290,000
barrels per day

Products:

Fuels & Chemical Feedstock
- Liquefied Petroleum Gas (LPG)
- Motor Gasoline
- Naphtha
- Kerosene/Jet Fuel
- Gas Oil/Diesel
- Heavy Fuel Oil Residuals

Lubricants & Specialties
- Lubricant Basestocks Group I & II
- Paraffin Waxes
- Asphalt
- Hydrocarbon Fluids

Aromatics
- Paraxylene
- Benzene
- Orthoxylene
- Toluene

Fuels

ExxonMobil produces high quality fuels and these are marketed all around the world. The range of fuels is distributed through its business-to-business segments of Retail, Industrial & Wholesale, Aviation and Marine.

In 2014, a diesel hydrotreater was opened at the Singapore Refinery to produce ultra-low sulfur diesel. Completion of this new unit increased the facility's low-sulfur diesel capacity to around 25 million liters a day, more than 10 million liters of which can meet ultra-low sulfur diesel specifications.

ExxonMobil also operates a fuels terminal and liquefied petroleum gas (LPG) bottling plant in Jurong from which products are loaded for delivery to our customers and distributors.

The terminal serves as an interface between the refinery and the service stations, and our wholesale customers. It has eight fuels loading racks and three LPG loading racks, through which bulk trucks are loaded with gasoline (petrol), diesel, light fuel oil and LPG before they head out.

The LPG bottling plant fills cylinders with LPG that then go to our distributors.

Production:

- Fuels: 427 KBD

What is KBD? This refers to the volume rate of Thousand Barrels per Day.

Products and Their End Uses:

Liquefied Petroleum Gas (LPG)

Uses: Clean fuel for heating and cooking.

Naphtha

Uses: Feedstock for motor gasoline and petrochemical industry such as the production of aromatics and ethylene.

Motor Gasoline

Uses: Fuel for motor vehicles. Also called petrol.

Kerosene (Jet Fuel)

Uses: Domestic heating and to manufacture solvents. This refined middle distillate version is used as jet fuel.

Gas Oil/Diesel

Uses: Motor fuel for compression ignition engine in heavy vehicles and marine vessels. Light heating oil for industrial and commercial purposes.

Heavy Fuel Oil Residual

Uses: Heating and processing purposes in power plants, commercial buildings and industrial factories. Also used to power marine vessels.

Basestocks, Specialties and Lubricants

Lubricants are specially blended from basestocks, refinery products and additives to give them their unique strengths and properties. The Singapore Refinery manufactures basestocks which are then processed into finished lubricants and greases at a nearby plant. This plant was opened in 2017, and is the only location in Asia Pacific to manufacture Mobil 1™, the world's leading synthetic engine oil brand.

ExxonMobil's Lubricants and Specialties business offers its consumers leading lubricant products carrying the brands of Mobil 1, Mobil SHC™, and Mobil Delvac™ for consumer and industrial uses. Its premium engine oil, Mobil 1, delivers significant fuel economy benefits while maintaining outstanding engine protection and lower emissions.

Production:

- Lubricant Basestock: 44 KBD

Products and Their End Uses:

Basestocks Groups I & II

Group I basestocks are conventional lubricants made using a solvent refining technique while Group II are derived from hydrocracking and hydro-isomerisation technology.

Uses: Industrial greases and oils, automotive lubricants and sealants.

Hydrocarbon Fluids

Hydrocarbon fluid streams specially tailored for various applications.

Uses: Adhesives, metal working, water treatment, consumer products.

Paraffin Waxes

The pale yellow or white waxes are residues extracted from Group I Basestock Lubricants.

Uses: Food packaging, water proofing of paper and fabrics, candles and cosmetics.

Asphalt

This solid to semi-viscous hydrocarbon is resistant to most chemicals and weather conditions.

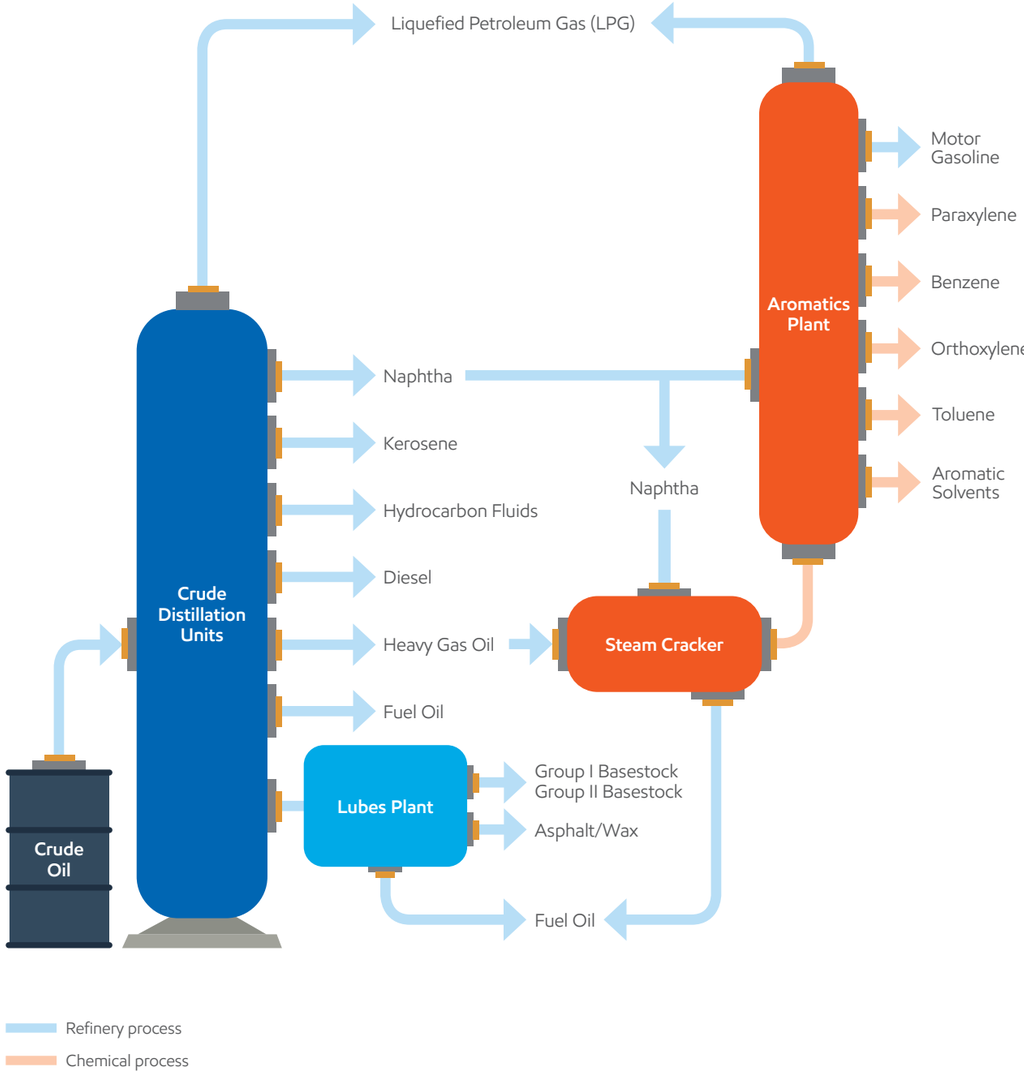
Uses: Road surfaces, roofing.

Technology Feature:

Proprietary Catalytic Innovation

ExxonMobil's state-of-the-art Group II lubricants plant boasts a proprietary catalyst which produces lubricants with attractive characteristics like greater thermal, volatility and oxidation stability. These lubricants are intended for a market that requires fuel economy, sustained emissions performance, extended lubricant life and greater engine protection.

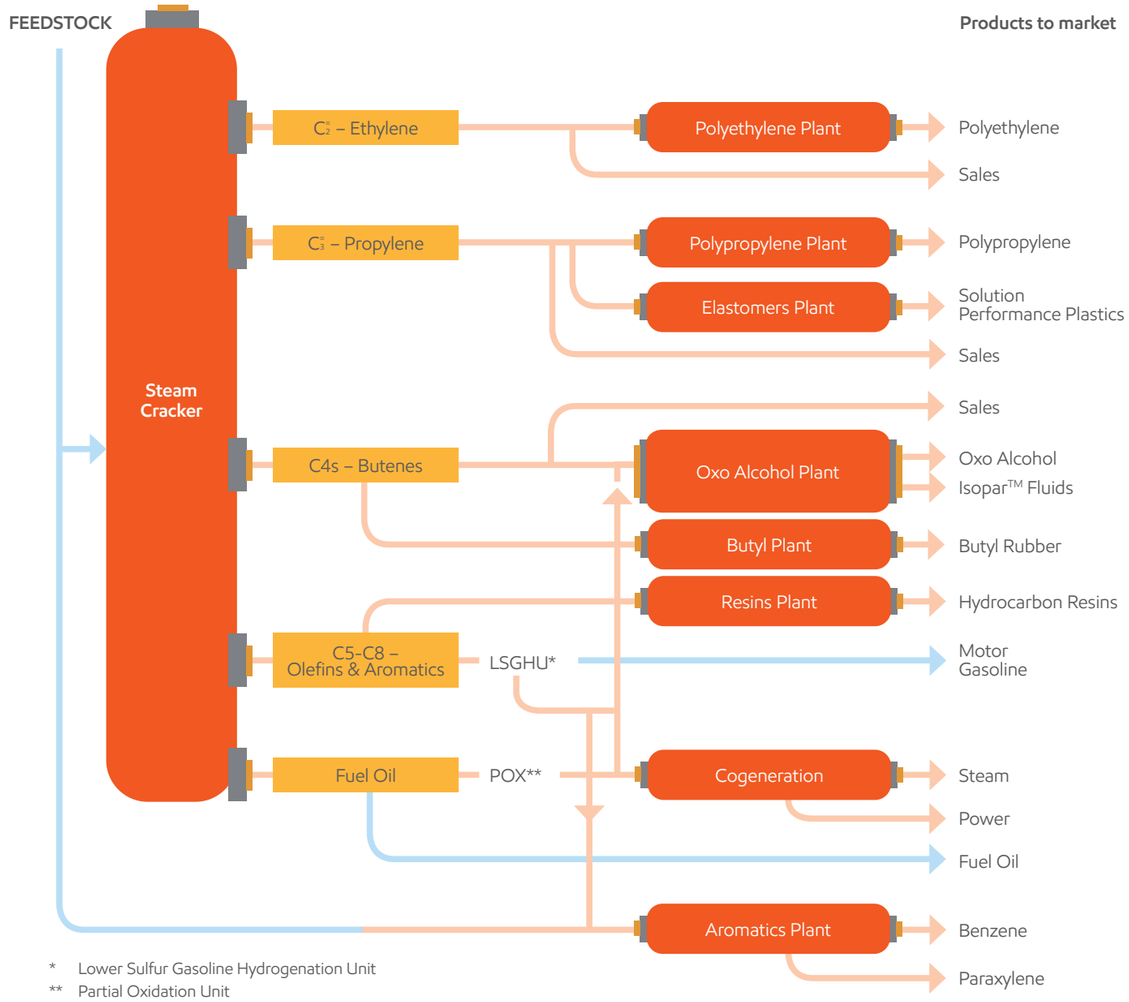
Singapore Integrated Complex



Refinery process

Chemical process

Manufacturing Process Overview



* Lower Sulfur Gasoline Hydrogenation Unit

** Partial Oxidation Unit

Singapore Chemical Plant

The Singapore Chemical Plant (SCP) is ExxonMobil's largest integrated petrochemical complex in the world.

The plant employs state-of-the-art chemical processing technologies for high performance manufacturing in today's competitive global chemicals market. It is fully integrated with the refinery, which also provides feedstock to the steam crackers.

Facts & Figures:

Workforce Strength

More than **1,300** employees

Products:

- Ethylene
- Propylene
- Butene-1
- Butenes
- Motor Gasoline
- Polyethylene
- Polypropylene
- Performance Polymers
- Oxo alcohol
- Isopar Fluids
- Benzene
- Paraxylene
- Toluene
- Orthoxylene
- Butyl Rubber
- Tackifying Resins

Singapore Olefins Plant

An olefin, or alkene, is an unsaturated chemical compound containing at least one carbon-to-carbon double bond. It is a basic ingredient in many chemical and polymer products.

Production:
- Ethylene: 1,900 KTA
- Butene-1: 100 KTA
- Butenes: 450 KTA
- Motor gasoline: 950 KTA

Products and Their End Uses:

Ethylene
It is a basic building block for making a wide variety of chemical and polymer products, including polyethylene.
Uses: Detergent, plastic bags, film, paint, cosmetics.

Propylene
It is a basic building block for making polypropylene, polymers and other chemicals.
Uses: Carpets, upholstery, thermal underwear, yachts and polymer banknotes.

Butenes
Butenes are used as a feedstock in the synthesis of intermediate alcohols.
Uses: Wiring, cabling, vinyl flooring.

Technology Feature:

The Steam Crackers
The heart of the chemical plant are two world-scale steam crackers that use proprietary technology to process hydrocarbon feed molecules into basic building blocks such as ethylene propylene, and butene-1. These are subsequently fed into polymers plants to produce polyethylene, propylene and specialty elastomers. Butene serves as a feedstock to the oxo alcohol plant to produce iso-nonyl alcohol and also to the polymers plants as a co-monomer feed. Benzene, which is produced from the steam cracker, is recovered at the aromatics plant. Other by-products from the steam crackers are sent to the cogeneration units to generate steam and electricity for use by the chemical plant. This makes the plant an energy-efficient manufacturing facility.

Singapore Polyethylene Plant

Ethylene from the Singapore Olefins Plant is the main feedstock for producing polyethylene and performance polyethylene polymers through a polymerization process.

Production:
- Polyethylene: 1,900 KTA

Products and Their End Uses:

Polyethylene
This is a polymer of ethylene that is versatile and widely used to make plastic products.
Uses: Various flexible packaging, product secondary packaging

Enable™ and Exceed™ Performance Polymers
The Enable™ and Exceed™ performance polymers are products made with proprietary catalyst technology. Film made using Enable™ and Exceed™ Performance Polymers can contribute to reducing environmental impact through down gauging.
Uses: High integrity flexible packaging for food & non food protection, Hygiene backsheet, green house film.

Technology Feature:

ExxonMobil's Gas Phase Polyethylene Technology (GPPT)
SPE is one of the world's largest capacity polyethylene extrusion and pelletizing line that utilizes cutting-edge ExxonMobil GPPT.

Singapore Polypropylene Plant

Propylene from the Singapore Olefins Plant is the main feedstock for producing polypropylene through a polymerization process.

Production:

- Polypropylene: 930 KTA

Products and Their End Uses:

Polypropylene

This propylene polymer is a highly versatile thermoplastic that serves double duty, both as a plastic and a fiber. It is used to manufacture durable and nondurable consumer products.

Uses: Plastic containers, carpeting, car seats, sports apparel, diapers and packaging and household appliances.

Technology Feature:

ExxonMobil Polypropylene Technology

The plant is among the world's highest capacity, using the ExxonMobil Polypropylene Technology for producing homo-polymer and impact co-polymer resins. ExxonMobil also licenses this proprietary innovation, which is a pioneering integration of polypropylene slurry and gas phase technologies.

Singapore Elastomers Plant

ExxonMobil has one of the industry's broadest portfolios of performance polymers. The Singapore Elastomers Plant is the company's primary supply point of Vistamaxx™ performance polymers to customers globally.

Production:

- Solution Performance Plastics: 300 KTA

Products and Their End Uses:

Vistamaxx™ Performance Polymers

This is an elastomer with unique attributes of high elasticity, softness, toughness, flexibility, and adhesion. Vistamaxx™ is compatible with various polyolefins and is recyclable with these streams, resulting in more sustainable solutions.

Uses: Hygiene fabrics, flexible packaging, rigid containers, and toys.

Technology Feature:

ExxonMobil Process Technology

The plant uses ExxonMobil proprietary catalyst technology to ensure uniform and consistent polymers for greater strength, better sealing properties, and improved clarity.

Aromatics Plants

(Jurong Aromatics Recovery [JAR], Singapore Aromatics Recovery [SAR] and SCP Banyan Facility [SAR2])

Production:

- Paraxylene: 1,800 KTA
- Benzene: 1,300 KTA
- Orthoxylene: 406 KTA

Jurong Aromatics Recovery

Aromatics are hydrocarbons which contain one or more six-carbon benzene rings.
The name was derived from the fact that many aromatic hydrocarbons have a fragrant odor.

Products and Their End Uses:

Paraxylene

It is a feedstock used for the manufacture of polyesters and polyethylene terephthalate (PET).
Uses: Plastic bottles, clothing, transparent film packaging and screen protectors.

Benzene

It is a building block for a wide range of intermediate chemicals, such as styrene for polystyrene, phenol for polycarbonates and cyclohexane for nylon production.
Uses: Compact discs, polystyrene cups, automotive tyres and water bottles.

Orthoxylene

It is the principal precursor to phthalic anhydride, a key raw material to produce plasticizers.
Uses: Flexible PVC applications in inflatables, wires, cables and synthetic leather.

Technology Feature:

ExxonMobil Xymax℠ and TransPlus℠ Technology

JAR uses ExxonMobil state-of-the-art xylene isomerization Xymax℠ technology and heavy aromatics transalkylation TransPlus℠ technology. In addition, it also uses other advanced technologies to recover paraxylene and benzene.

Singapore Aromatics Recovery and SCP Banyan Facility (SAR2)

ExxonMobil completed the acquisition of one of the world's largest aromatics facilities on Jurong Island in August 2017. This is the Corporation's largest downstream and chemical acquisition since the merger of Exxon and Mobil. This plant is now known as the SCP Banyan Facility (SAR2).

The acquisition adds operational and logistical synergies, as well as increases ExxonMobil's Singapore aromatics production to over 3.5 million tons per year, including 1.8 million tons of paraxylene, plus an additional 65,000 barrels per day of transportation fuels capacity.

Technology Feature:

SAR and SCP Banyan Facility (SAR2) use ExxonMobil's state-of-the-art xylene isomerization Xymax℠ technology and other advanced technologies to recover paraxylene and benzene.

The latest additions to the petrochemical complex are two world-scale production units for hydrocarbon resins and halobutyl rubber.

The two new facilities, completed in 2017, build on the Singapore petrochemical complex's steam-cracking capability which provide a range of feedstocks that can be further upgraded to specialty products to support growing market demand in Asia Pacific.

Singapore Resins Plant

The hydrogenated hydrocarbon resin production unit – which incorporates ExxonMobil's proprietary technology – is the world's largest at this time.

Capacity:
- Hydrocarbon resins: 90 KTA

Products and Their End Uses:

Escorez™ Tackifying Resins

Escorez™ tackifiers are hydrocarbon polymers that promote adhesion and tack in hot-melt and pressure-sensitive adhesives. Their benefits include consistent quality, thermal stability, light color, polymer compatibility and low odor properties.

Oppera™ Modifiers

These modifiers are used in the manufacturing of transparent or opaque films with added stiffness and barrier properties. They enable the production of downgauged films, reducing raw material consumption while extending shelf life and product freshness.

Oppera™ modifiers play a significant role in our daily lives from food packaging to confectionery, tea and even cosmetics wrapping.

Singapore Butyl Plant

ExxonMobil is a major supplier of halobutyl rubber to the global tire industry. This new Singapore butyl unit will add production capacity of 140,000 tons per year.

Ever since patenting butyl rubber in 1937, the company has been at the forefront of air barrier innovations. Today, that leadership position enables users to benefit from advanced tire innerliner and pharmaceutical technologies as well as supply reliability to support sustainable business growth.

Advanced air barrier technologies bring tire manufacturers the potential to introduce tires that weigh less and retain air better to improve fuel economy, handling and durability.

Capacity:
- Halobutyl rubber: 140 KTA

Products and Their End Uses:

Exxon™ Bromobutyl

Exxon™ bromobutyl rubber is derived from halogenating butyl rubber with bromine in a continuous process.

Exxon halobutyl rubber is the world's most widely used butyl rubber for advanced air barrier technology. It provides tire innerliners with the outstanding inflation pressure loss rate (IPLR) and very reliable performance that have made it the most widely used butyl rubber for innerliners.

Advanced air barrier technologies bring tire manufacturers the potential to introduce tires that weigh less and retain air better to improve fuel economy, handling and durability.

Key benefits include:
- Halobutyl rubbers (Exxon™ bromobutyl and Exxon™ chlorobutyl) can be vulcanized with other rubbers
- Low permeability
- High heat resistance
- Excellent flex cracking resistance
- Processability

Singapore Oxo-Alcohol Plant

Oxo alcohols are obtained by adding carbon monoxide and hydrogen to an olefin to obtain an aldehyde, which is then hydrogenated.

Production:

- Iso-nonyl Alcohol: 345 KTA
- Isopar Fluids: 35 KTA

Products and Their End Uses:

Iso-nonyl Alcohol

Feedstock for the manufacture of plasticizers, which provide flexibility and elasticity to many products, including PVC.
Uses: Floor and wall coverings, wire and cable insulation, synthetic leathers, automotive applications and healthcare products.

Isopar™ Fluids

Virtually odorless specialty fluids.
Uses: Process fluids, metal working, consumer products.

ExxonMobil Cobalt Flash Technology:

Fed by the butylene stream from the steam cracker the Oxo-Alcohol Plant utilizes ExxonMobil Cobalt Flash Technology to produce oxo alcohols through hydroformylation. The high-quality alcohol products are supplied to customers across Asia, including ExxonMobil's own plasticizer plants in the region, as well as exported globally.

Our People

Our people are our competitive advantage. Diversity of thought, skills, knowledge and culture helps facilitate innovation and makes us more resilient. We are committed to building a talented and diverse workforce, and to creating an environment in which every employee has the opportunity to excel based on performance.

The Singapore complex is a dynamic, exciting place to work. We hire exceptional people, and every one of them is empowered to think independently, take initiative and be innovative.

We are committed to giving our people the opportunity to learn and grow through world-class training, exciting career paths, and an outstanding development planning process with varied experiences and assignments.

ExxonMobil

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