

# Manifa

where every grain of sand  
and every drop of water tells a story

أرامكو السعودية  
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Printed at Union Press, Bahrain

First Edition - December 2015  
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[www.saudiaramco.com](http://www.saudiaramco.com)

Published by: Public Relations Department, Saudi Aramco  
Room No. 1020, North Administration Building No. 175  
PO Box 5000 Dhahran 31311  
Kingdom of Saudi Arabia

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ISBN: 978-99958-2-154-8  
Deposit in Public Library Code: 779/ع.د.ع/2015

# Manifa

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# Manifa: An Introduction

The Manifa oil field was discovered in 1957, making it one of the oldest offshore fields in the Kingdom. The six-reservoir field, situated 255 kilometers northwest of Dhahran, measures approximately 45 km in length and 18 km in width. It lies offshore in less than 15 meters of water.

The Manifa field was brought onstream in 1964, with facilities capable of handling 125,000 barrels of oil per day (bpd). However, due to global low crude oil demand, coupled with very low prices (\$2 a barrel), production from the Manifa field was halted in 1984.

A quarter of a century later, a rise in global demand for oil and an increase in prices to unprecedented levels at that time brought about an historic change.

In accordance with the Kingdom's commitment to responding to the increasing global demands of its customers, Saudi Aramco renewed the development of the Manifa field in 2007 — one of the several developmental projects aimed at increasing our maximum capacity to 12.5M bpd.

In April 2013, the first milestone was achieved with the commissioning of the field and central processing facilities to deliver 500,000 bpd of Arabian heavy crude. By 2017, the field should reach its maximum production capacity of 900,000 bpd.

Containing 350 wells with maximum depth that reaches 32,000 feet, Manifa was developed in innovative ways, according to the best safety and environment-friendly standards in the world. Despite all of the hurdles and challenges — most important of which was the global financial crisis in 2008 — the company was successful in overcoming all obstacles to accomplish the Manifa project three months ahead of schedule.

In addition to the realization of a dream, the Manifa success story reflected the country's wisdom and leadership in preserving natural resources for the coming generations of our people by choosing the right time to capitalize on these natural resources in order to achieve heightened prosperity for the Kingdom.

The Manifa oil field is celebrated today because of its innovative design and approach to sustainable environmental preservation and oil production. The conversion of the offshore field to an onshore field involved the construction of 27 man-made islands, connected by a 41 km causeway.

Saudi Aramco pursued multiple facets in the development of the oil field. Consequently, the Manifa Bay program is energy self-sufficient, and its electrical substation cogenerates 420 megawatts of electric power — making it the first zero-flaring project in the company.

Manifa's production of heavy Arabian crude was allocated to supply the SATORP refinery in Jubail and YASREF refinery in Yanbu' — our two joint ventures with France's Total, and China's Sinopec respectively, both of which are designed to handle this kind of oil.

As the fifth largest oil field in the world and one of Saudi Aramco's most challenging fields to develop, Manifa features the utilization of the best technologies in infrastructure operations, drilling and production. The field development team also achieved nearly 80 million working hours without injury to score one of the highest global safety levels, and in 2012 it received an award as the best innovative oil project in the world.

The development of the Manifa project is also a shining example of Saudi Aramco's excellence through our 80-year history of managing mega-projects. The Manifa project has opened a whole new chapter in the field of innovation, technical and creative development.

It serves as a model exemplifying the company's basic values, especially citizenship through the careful preservation of the environment as well as the increasing rates of Saudization and localization of procurement.

In the designing, construction and operation of this giant and uniquely sophisticated project, the total of locally manufactured goods exceeded more than half of the total value of all purchases, and also featured training programs for young Saudis in the latest technologies.

All told, the Manifa project stands as a true testament to our long-standing commitment to meeting the growing energy needs of all of our customers — both in the Kingdom and around the world, while continuing to serve as a leading contributor to the development of Saudi Arabia as a whole, and its citizens.

**The region between Hormuz and Basra is characterized by the quality of its pearls. In Qatif, Bahrain, and Julfar, as well as other areas, the pearls are collected and sent to Hormuz.**

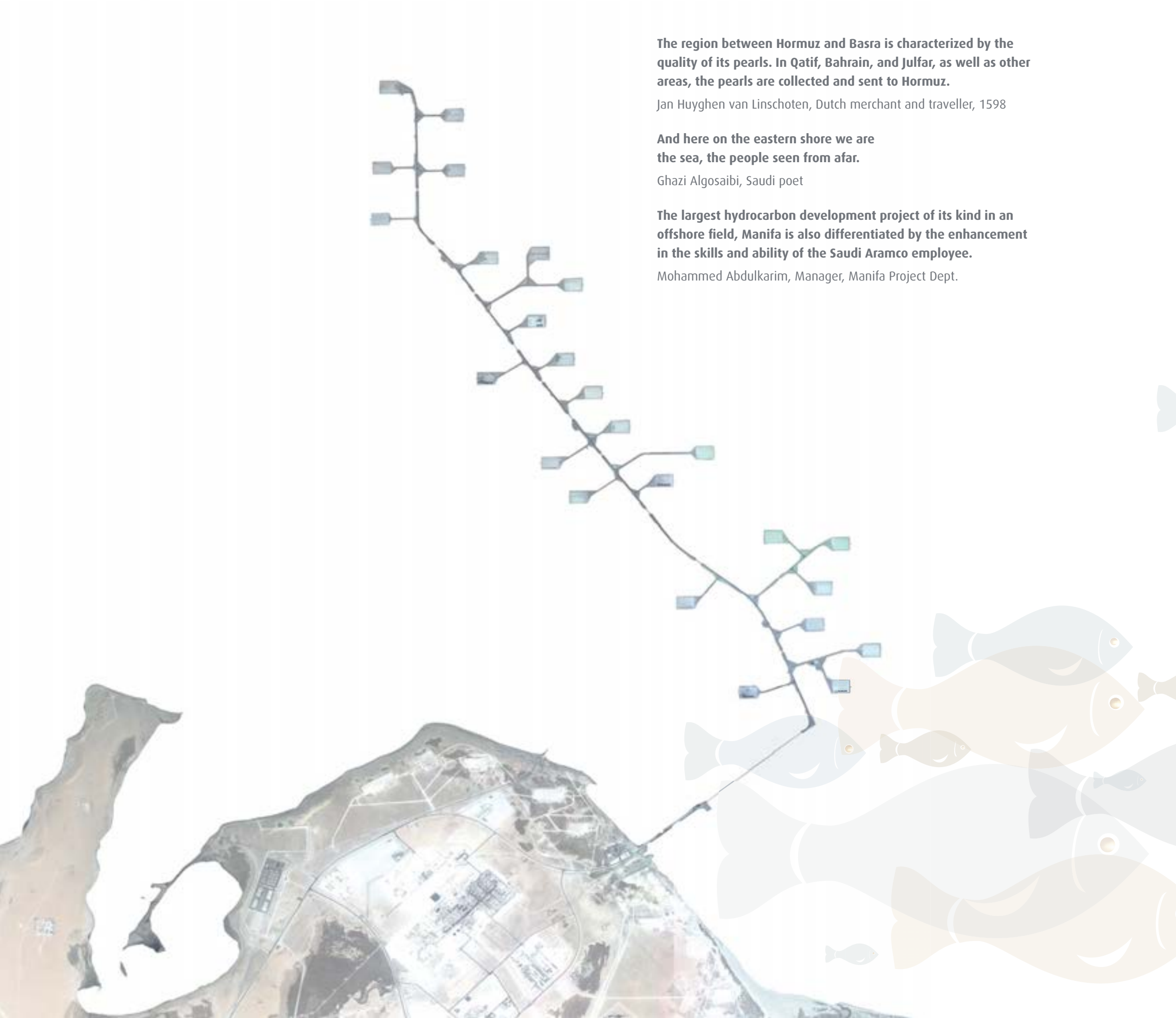
Jan Huyghen van Linschoten, Dutch merchant and traveller, 1598

**And here on the eastern shore we are the sea, the people seen from afar.**

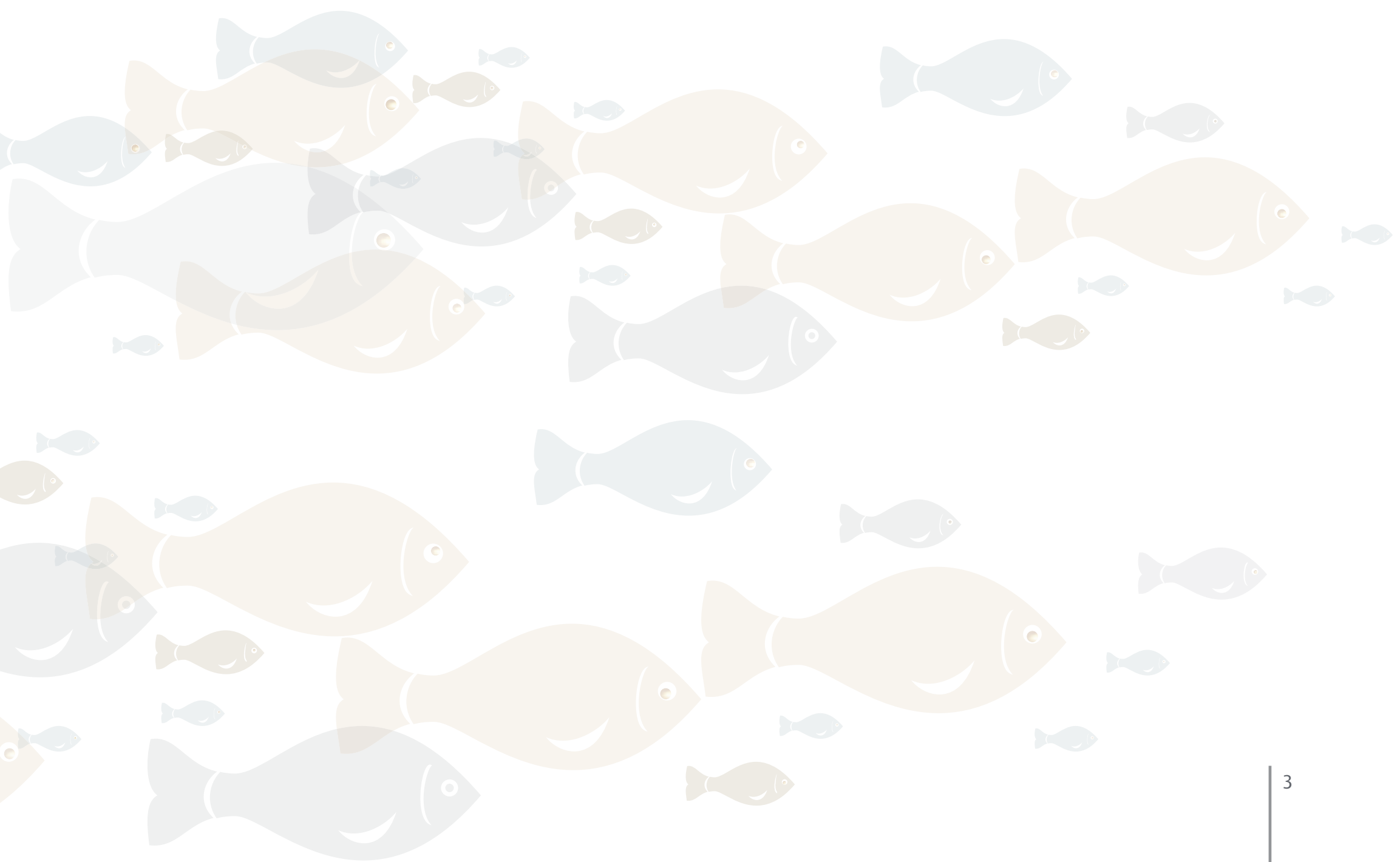
Ghazi Alghosabi, Saudi poet

**The largest hydrocarbon development project of its kind in an offshore field, Manifa is also differentiated by the enhancement in the skills and ability of the Saudi Aramco employee.**

Mohammed Abdulkarim, Manager, Manifa Project Dept.











CHAPTER I

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**PROTECTING THE ECOSYSTEM**

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A GLOBAL RESPONSIBILITY

## When Earth reveals its beauty



The Kingdom of Saudi Arabia covers most of the Arabian Peninsula, but while the bulk of its vast area is desert, its geographical terrain is rich in contrasts and diversity. From mountains, sweeping plains, and hills to spectacular coastlines along the Red Sea, Arabian Gulf, and the Gulf of Aqaba, Saudi Arabia features oases in the deserts, springs in the mountains, and coral reefs throughout the seas, in addition to agricultural land and palm plantations, which sit alongside its metropolitan cities.

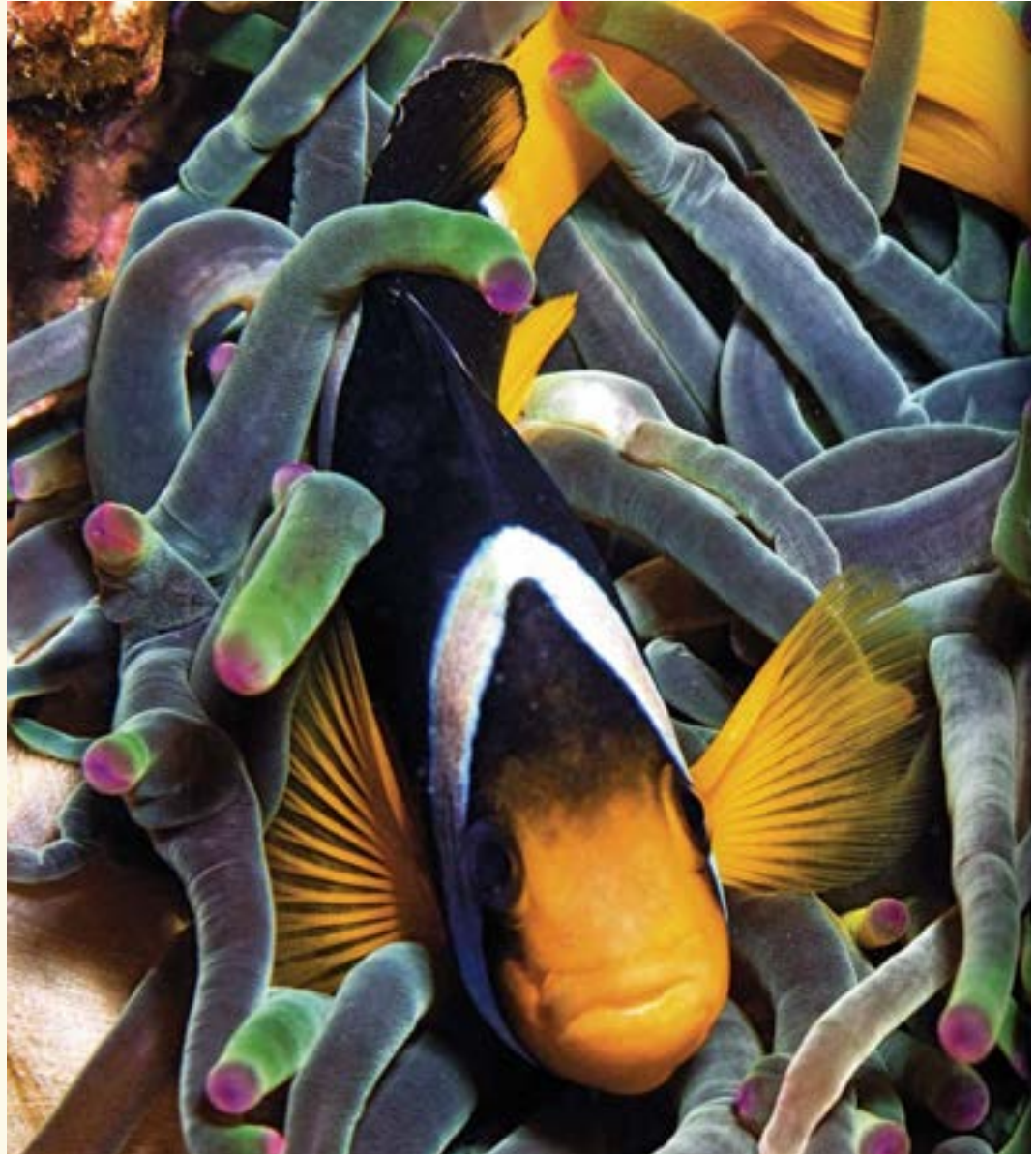






Socotra cormorant  
(*Phalacrocorax nigrogularis*)

It is this distinctive landscape that has provided the Kingdom with its unique identity and its attributes throughout the ages – a land in which the Arabian Gulf and the Red Sea collaborate to form an integral support for the country’s historical and economic relations with the world. And hidden within the seas are treasures of marine life and a vibrant ecosystem, providing a safe haven for thousands of migratory birds that flock to its atolls every year in addition to furnishing a fertile breeding ground for Socotra cormorants, terns, ospreys, herons, and seagulls.



Clark's anemonefish (*Amphiprion clarkii*)

An aerial photograph of a mangrove wetland in Saudi Arabia. The image shows a large, dark, irregularly shaped area of land surrounded by water. The sun is low on the horizon, creating a bright, glowing effect with rays of light reflecting off the water's surface. The overall color palette is dominated by deep blues and greens, with a bright white/yellow glow from the sun.

Along the coast of the Eastern Province of Saudi Arabia, swamp trees, or mangroves, are abundant. Mangroves help stabilize the shoreline and sustain coastal wetlands, essential nursing grounds for commercial fish and shrimp.

For centuries, residents of the Arabian Gulf region have depended on the rich fruits of the sea for their livelihood. Whether as seafaring voyagers or fishermen, residents have linked their livelihoods and occupations, as well as their cultural and social habits, with the sea. The Arabian waterfronts share many commonalities – sea grass beds, coral reefs, mangroves, and mudflats, all of which contribute to the productivity of the area’s marine resources and connect the area’s diverse inhabitants.



2







3



4



5



6

Indeed, the shores of the Arabian Gulf, characterized by the diversity of their coral reefs, shallow waters, temperature, and salinity, are home to over 300 species of fish, mammals, reptiles, and migrant birds. Saudi Arabia itself shelters approximately three-quarters of the world population of Socotra cormorants, and it was in recognition of this important environmental legacy that Saudi Aramco, in the years following the discovery of oil, set out to play an active role in safeguarding the surrounding ecosystem.

1. Jellyfish (*Crambionella orsini*)
2. Large herd of dugongs (*Dugong dugon*) in Gulf of Salwa
3. Corals provide shelter for marine organisms
4. Yellowfin hind (*Cephalopholis hemistiktos*)
5. Solitary sweetlips (*Plectorhinchus sp.*) among a school of five-lined snapper (*Lutjanus quinquelineatus*)
6. Bottlenose dolphins (*Tursiops sp.*)



## Dareen Port



A small village in the Qatif Governorate within the Eastern Province, located along the coastline of the Arabian Gulf, Dareen is well known throughout history for its port. Featured in ancient Greek histories, Dareen's contemporary prominence can be traced back to 1868, when it was recognized as an important port and a stop on world trading routes for the distribution and exchange of goods across the region.

In recent years, Saudi Aramco undertook a commitment to expand and modernize Dareen Port, partly to compensate local fishermen who used to sail from Manifa Bay and use its waters to catch its plentiful fish and shrimp. The company embarked upon the Dareen Port expansion before the development of Manifa Bay to protect local fishermen and their resources from any potential harm that might rise during the development and construction of the Manifa oil field. In line with the company's overarching commitment to the environment, and social development, Saudi Aramco entered into a partnership with the Ministry of Agriculture to create an artificial stable reef system and marine fish hatchery facilities on Abu Ali Island. These were designed to provide fishery resources and improve the livelihoods of local fishermen.





Ahmed Mohamed Al-Saeed



Abdullah Al-Salah



Jafer Al-Safwani



Zaki Khalaf Al-Masri



Jassim Ali Al-Saeed



Mohamed Al-Hashem

## Manifa Bay Fishermen

The history and trajectory of the entire Arabian Gulf region cannot be separated from its tanned heroes – the seafarers and fishermen of old, whose descendants continue to uphold the legacy of their forefathers, albeit in contemporary conditions, for future generations.

From early fishing techniques to modern methods and environmental responsibility – which take into consideration seasonal changes and requirements – today’s fishermen continue to base their livelihoods on the bountiful sea. Supported by Saudi Aramco’s environmental vision and initiatives planned to preserve the country’s marine life and coastline, the social standing of Saudi Arabia’s fishermen only continues to rise.

Of the Arabian Gulf’s many fish markets, the Qatif market is one of the largest in the entire Middle East, followed by Jubail, Dammam, and Manama. While these have been further developed over the years, the Manifa market has also been an important focal point for local inhabitants, including tourists and consumers who appreciate the port’s access to substantial fisheries.

Reflecting on the position and history of the bay in the living memory of the inhabitants of the area, its primary witnesses, the Manifa Bay fishermen, provide illuminating testimony. Ahmed M. Al-Saeed, a shrimp fisherman who began his experience in Manifa Bay over 18 years ago, describes the area as a beautiful focal point for local residents, highlighting its popularity in spring. Al-Saeed remembers the lush vegetation and wild rabbits and chickens that used to roam the area, noting that it remains a popular meeting place for people seeking outdoor recreation and pleasant weather conditions.

### The Fishermen’s Habitat

For fishing expert Abdullah Al-Salah, who spent many years plying the Manifa Bay waters in addition to those surrounding other Arabian Gulf ports to catch local fish, the area holds a special meaning.

“In those days,” he said, “there was a real treasure trove of fish and shrimp found in the area, unlike the catch of today. I still remember how the Al-Gosaibi boats would come back to shore laden with 30 to 40 tons of shrimp. There was a proliferation of fishermen.”

The Manifa Bay seabed is distinguished by its muddiness and the absence of coral reefs. A diverse breeding ground due to its vegetation, Al-Salah adds, “parts of the Bay are protected. In fact, the larger fishing vessels are prevented from entering zoned areas, such as Tanajib, where fishing is banned. Only hobbyists and amateur fishermen are allowed in those areas, and they can cast their fishing rods without being disturbed. This is very much in keeping with the area’s position within the local community as a community space and an environmental attraction.”

He also notes “Fishermen gather at Manifa Bay at the beginning of August every year for the opening of the shrimp season. They bring their nets and cast them deep into the seabed, enveloping the shrimp along the way.” A different color by day, shrimp are noticeably red at night and turn white in sunlight.

### The Large Shrimp Markets

The shrimp markets in the Eastern Province are rich and abundant in produce, supporting the entire Kingdom of Saudi Arabia, as well as the wider region. This was reiterated by Jaafar Al-Safwani, the Deputy Chair of the Eastern Province Fishermen’s Society, who explained, “The local fish market is an attraction to all kinds of buyers from around the Kingdom, be they merchants and businesses or local families.”

While local fishermen regularly descend on Manifa Bay, Al-Safwani notes that its waters and fishing grounds are popular among fishermen from other parts of the Eastern Province, including Jubail and Qatif. With 30 fishing boats currently assigned for hauling shrimp, he reminds people that other boats are also moored at the port for various types of fishing expeditions.

### Fishing

Zaki Khalaf Al-Masri, an established Manifa Bay fisherman, highlights the two ways in which shrimp and fish are caught in the area: shallow water versus deepwater fishing.

Making use of the tidal currents, shallow water fishing is dependent on the level of the tide and the season. During high tides, the area is completely covered with water, whereas the hard sea floor is largely uncovered during low tides.

Toward the end of summer and the beginning of the winter season, the Bay's fish tend to gather in the shallow waters, close to the shore. As a result, during high tide, the area is encircled with fishing nets, which are secured using metal pipes.

Then when the tide begins to ebb and the fish try to return to the depths of the sea, the nets prevent their escape. When all the water has gone with the low tide, the fishermen remove the trapped fish. Among the most common species caught in this manner are mullet and yellowfin seabream.

The second common fishing method involves the use of oval fish traps thrown into the sea, with the aid of a heavy stone or weight. Made with a flat base, the traps attract fish into them through a pipe-like opening, which prevents the fish from swimming back out.

These traps have hooks or hanger-style hinges, that float to the surface, allowing the fishermen to locate them. The traps are used to attract and trap hamour, rabbit fish, and grouper among others. Located to the east of Safaniyah oil field, local fishermen have to travel 24 to 32 km to capture their fare.

#### **Wildlife and Sea Life**

Overseeing the fishermen in the Faree' area, Jassim Al-Saeed offers an interesting insight into the lives and society sustaining Manifa Bay.

"My family entered into the fishing trade in Manifa Bay over 30 years ago, and we have continued to uphold the same tradition ever since... The area's attraction doesn't lie solely in its sea and produce, but also in its natural beauty and wildlife. So many people are drawn to the Manifa area, particularly in spring when grass envelops the land and plants and trees flourish, and migrant birds flock to the surrounding areas."

He adds, "In the spring, campers stay for longer periods, enjoying the good weather and occasional bursts of rainfall."

Al-Saeed observes "People may wonder why Manifa shrimp are simply the best in the region. We always tell them that Manifa shrimp are mid-sized and white.

They're clean and taste delicious because of the special marine environment in which they grow and feed."

#### **A Fisherman's Responsibility**

The abundance of fish in the sea fluctuates according to the season, explains fisherman Mohamed Al-Hashem.

"The practices of some fishermen are detrimental to sea and marine life," notes Al-Hashem.

Reflecting on the shared responsibility among the region's seafarers and fishermen toward the safety and health of the marine environment, he explains, "To preserve the sea wealth that God has bestowed upon us as the source of the fishermen's livelihood, strict laws and regulations need to be implemented to penalize those who harm sea life."

An area bursting with natural wealth – from its abundant fish and shrimp varieties that feed and support hundreds of thousands of individuals, to the black gold which flows from the deepest recesses of the sea floor – Manifa Bay contributes to the Kingdom's prosperity and meets global needs.

**People may wonder why Manifa shrimp are simply the best in the region. We always tell them that Manifa shrimp are mid-sized and white. They're clean and taste delicious because of the special marine environment in which they grow and feed.**



In an area in which oil production is inextricably linked to the surrounding marine environment, with more than 85 different fish species and some 50 species of coral, it is a global responsibility to ensure that the generous waters of the Gulf are protected. Saudi Aramco embarked on a series of critical hydrodynamic and ecological studies to determine the best possible method to drill and produce oil while maintaining and supporting the natural habitat of the area. Vital to the health of the ecosystem, the time required to recirculate the nutrient and oxygen-rich water, the flushing of 50% of the area's seawater, was determined to be 17 days. The challenge was to ensure that the health and integrity of the Manifa Bay marine system were maintained.

Saudi Aramco's extensive research led the company to develop a design that limited the flushing time to 21 days, allowing the company to continue meeting the world's energy demands while minimizing the change to the marine ecosystem. The resulting causeways, connecting the 27 man-made islands in the shallow waters, represent a scaffold for marine life, attracting birds, crabs, and other marine life to the bay.

As a crossroads in both ancient times and modern, life in Saudi Arabia in the 21<sup>st</sup> century presents a picture of great diversity juxtaposed in an interdependent cycle. An overwhelmingly youthful population lives alongside the ancient seabeds and life of the Arabian Gulf, partaking of its fruit and produce, reaping the benefits of its timeless culture and history.

Today, Manifa Bay, Saudi Aramco, and the Kingdom of Saudi Arabia itself, cannot be fully understood without appreciating the surrounding marine environment and ecosystem. Shaped by changes that occurred at the end of the Ice Age, Manifa Bay waters lie on top of abundant oil and gas, but most importantly, they contain a rich ecosystem featuring intensive algal habitats and dense beds of sea grass. As a primary source of nutrition for other marine life, Manifa Bay is the habitat for many species, including pearl oysters, hamour, sea snakes, crabs, dolphins, shrimp, and sea turtles, among which is the endangered Hawksbill turtle. The area is also a temporary home to migratory birds and represents an important source of income for the region's fishermen and inhabitants.

A thrilling explosion of color and life beneath the reflections of light at the surface, this biodiverse ecosystem is sensitive to overfishing and pollution. Therefore, while Saudi Aramco works to raise awareness of the importance of sustainability among fishermen and the area's inhabitants, the preservation and conservation of this underwater "museum" was critical to the company's corporate and community objectives as it embarked on technologically innovative drilling techniques in the shallow waters of Manifa Bay.









CHAPTER II

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**ACHIEVING THE DREAM**

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# THE MANIFA PROJECT



## Manifa: A Project of Extraordinary Vision

With the setting sun, the gleaming lights of the Manifa causeway and its branches are more easily discernible, showcasing an intricate web of roads, oil pipelines, and towering rigs – an extraordinary network of continuous work and production.

Over the years, Saudi Aramco has conducted a broad range of technical studies to achieve the best possible results while maintaining the ecological integrity of the project's environs.

## Reflections on the Manifa Project



“The achievement at Manifa will be recognized for decades to come as a model oil and gas project to follow, and from which to learn, because of its associated successes and creative solutions.”

HE Khalid A. Al-Falih, Chairman of the Board,  
Saudi Aramco



“The Manifa project was entirely designed, constructed and operated by Saudis. It was accomplished ahead of time and under budget. The project’s team succeeded in overcoming many challenges and problems during the different phases of the project, from design to construction, until the completion of the whole project. This is something to be proud of.”

Amin Nasser, President and CEO,  
Saudi Aramco



In developing Manifa Bay, Saudi Aramco actively pursued a multifaceted approach to its environmental and technical studies in line with the company's values and its corporate social responsibility strategy, as well as its trademark of excellence and commitment to the highest standards of safety.

And so it was that in 2006, the new development program for Manifa was launched for further advancement of the Kingdom's economic and social development vision. Marking the world's largest hydrocarbon production increment in a single phase, it was vital to safeguard the area's ecosystem and environment through conservation and protection policies, execution of air pollution controls, and coastal and marine protection.

A multidisciplinary environmental strategy was developed for construction of the central processing facility, gas-oil separation plants, and 15 offshore platforms for oil production and water injection. As the second largest oil facility in the Kingdom, the ingenuity of the project developed by Saudi Aramco lies in the innovative and responsible solutions sought and executed, which led

to conversion of more than 70% of the offshore field into an onshore field through the formation of 27 man-made islands, linked by a 41-km causeway. In its early beginnings in 2007, six drilling rigs were in use, but at the project's peak, 30 drilling rigs were fully operational.

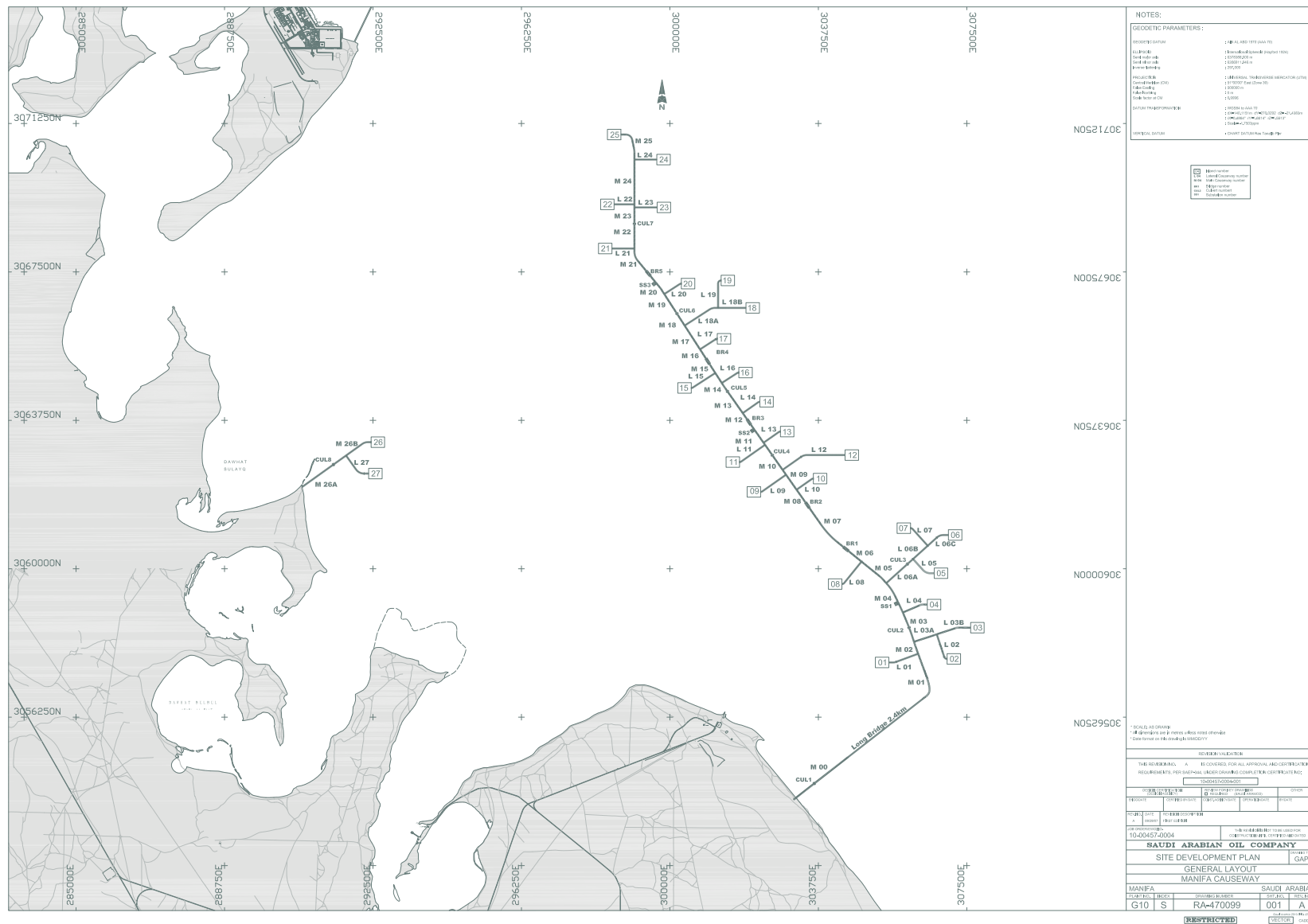
One of the objectives in developing the Manifa oil field was to produce 900,000 bpd of Arabian Heavy crude oil. By July 2013, the project's first milestone of 500,000 bpd was achieved. With more than 350 wells, and the use of water injection wells to provide peripheral water injection as a pressure maintenance scheme to support oil production, the company reached a production level of 800,000 bpd in 2015 – its target of 900,000 bpd was deferred to 2017.

This pioneering feat was accomplished through a variety of research and technical cooperation programs from across the world, but most importantly, with an emphasis on the growth of Saudi expertise in the area. The resulting investment in Saudi talent and knowledge transfer cannot be underestimated. The Manifa oil field project serves as a testament to Saudi Aramco's commitment to the Kingdom, the environment, and global oil market stability.



**While global oil supply was boosted by the Manifa oil field development, Saudi Aramco worked to ensure responsible environmental stewardship of the area in addition to cultivating local talent across all stages of the project, from conceptualization and exploration to completion and the delivery of hydrocarbons throughout the world. The company's impressive efforts have been applauded internationally across industry publications, including the *Journal of Petroleum Technology (JPT)* and *RIGZONE*, while the likes of *National Geographic* have visited the site and filmed its work and impact.**

# Economic Value of the Manifa Bay Development



The development of the Manifa oil field brought with it great benefit to the local economy, and this can be shown in different aspects, most important of which are:

- Creating thousands of direct and indirect job opportunities throughout the Kingdom.
- Supplying 3 oil refineries with their need of crude oil. These refineries are:

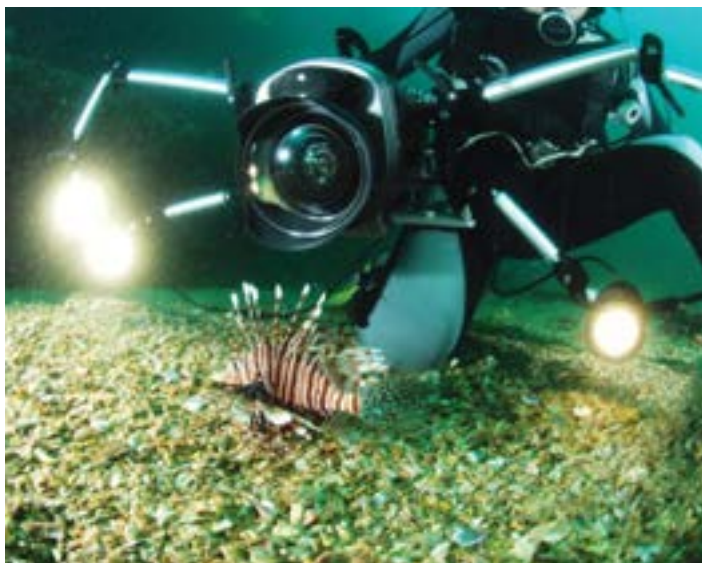
1- SATORP, a world class refinery marking a partnership between Saudi Aramco and TOTAL.

2- YASREF, a joint venture between Saudi Aramco and China Petrochemical Corporation (Sinopec).

3- Jazan Refinery, wholly owned and operated by Saudi Aramco.

In turn, these refineries will provide thousands of direct and indirect job opportunities for the Saudi youth.

As for the project's future, it is very promising as Manifa is expected to reach its maximum production capacity of 900,000 bpd by the end of 2017, promising further growth and development.



The objective in developing the Manifa oil field was to produce 900,000 bpd of Arabian Heavy crude oil. By July 2013, the project's first milestone of 500,000 bpd was achieved.

In Manifa's sea a bridge was built  
That can be compared with no other  
It was erected by ambitious hands  
That achieved the impossible together

Abdulwahab Bozaid







The treasures of Manifa Bay lie in its environment – its sea life and vibrant ecosystem. Manifa Bay is home to thousands of migratory birds that return year after year.





*Abdulrahman Qahtani*  
*Operations Division Head*

“The story of Manifa is very close to my heart and holds an undisputed place in both my professional and family lives. The outcome of a long journey with Saudi Aramco’s Production and Project Management team, it played a central role in my personal development over the last eight years. I talked about it so much that Manifa became a common term in my wife and childrens' vocabularies. I feel very proud and honored with this stage of my life and this innovative project, that was like a sixth son of mine. Although the global financial crisis in 2008 represented a setback for the Manifa project, Saudi Aramco’s unwavering vision and economic foresight helped us see the program through, and in July 2008, three design contracts were awarded. By the end of 2010, we had reached the construction phase and in October 2012, we were honored by the presence of HE Ali I. Al-Naimi, the Minister of Petroleum and Mineral Resources, who inaugurated the Manifa Water Injection Plant. This was a particularly memorable occasion as I attended the first board meeting that followed. It was a day that will linger in my memory as long as I live.”

An initiative that had a tremendous national and global impact, some of the most important attributes of the Manifa Bay development lie in generating diverse employment opportunities for thousands of individuals across Saudi Aramco. This is most evident in the development of the Manifa Central Processing Facility, which has three identical gas-oil separation plants (GOSPs) to process 900,000 bpd of Arabian Heavy crude oil. Each of these is designed to treat 300,000 bpd for export to other refineries in the Kingdom – YASREF, Yanbu', and Jazan. Thousands of work opportunities have also been created for Saudi citizens in different areas of the Kingdom. In fact, 80% of the workforce represented new hires, from Professional Development Program (PDP) engineers to apprentice graduates in Operation and Maintenance.





Four highways were constructed in 2009 at the crossroads of Manifa, Nu'ayriah, Ras Tanajib, and Safaniyah to ensure safe passage for Saudi Aramco employees.







A highly skilled team of Saudi engineers oversaw the design and development of the mega-project from its very outset until its launch in April 2013.



In line with Saudi Aramco's human capital development program and investment in Saudi talent, new and young Saudi staff are trained by expert employees in dedicated workshops for the operation and maintenance of the oil field's machinery. The varied training programs and courses include specialized training workshops with equipment manufacturers abroad.





Manifa has held a special place in the hearts of the inhabitants of Saudi Arabia's Eastern Province for centuries due to their relationship with the sea and the wealth it has provided them, from fisheries to a lucrative pearl trade and more recently, the treasure of its black gold.

Saudi Aramco's highest priority remains to support the Kingdom's development. With a strong sense of responsibility for environmental preservation, execution of the Manifa oil field development involved the support of numerous specialized departments – from the initial project

conceptualization to its planning, design, and implementation phases. It is envisioned that Manifa oil production will have a tremendous impact on the world energy market, in addition to supporting domestic suppliers to reach a wider international network.


Saudi talent  
actively involved  
in Manifa  
development





A sense of environmental responsibility and stewardship underscored Saudi Aramco's approach to the development of Manifa Bay and its positioning in the world market for hydrocarbon production.



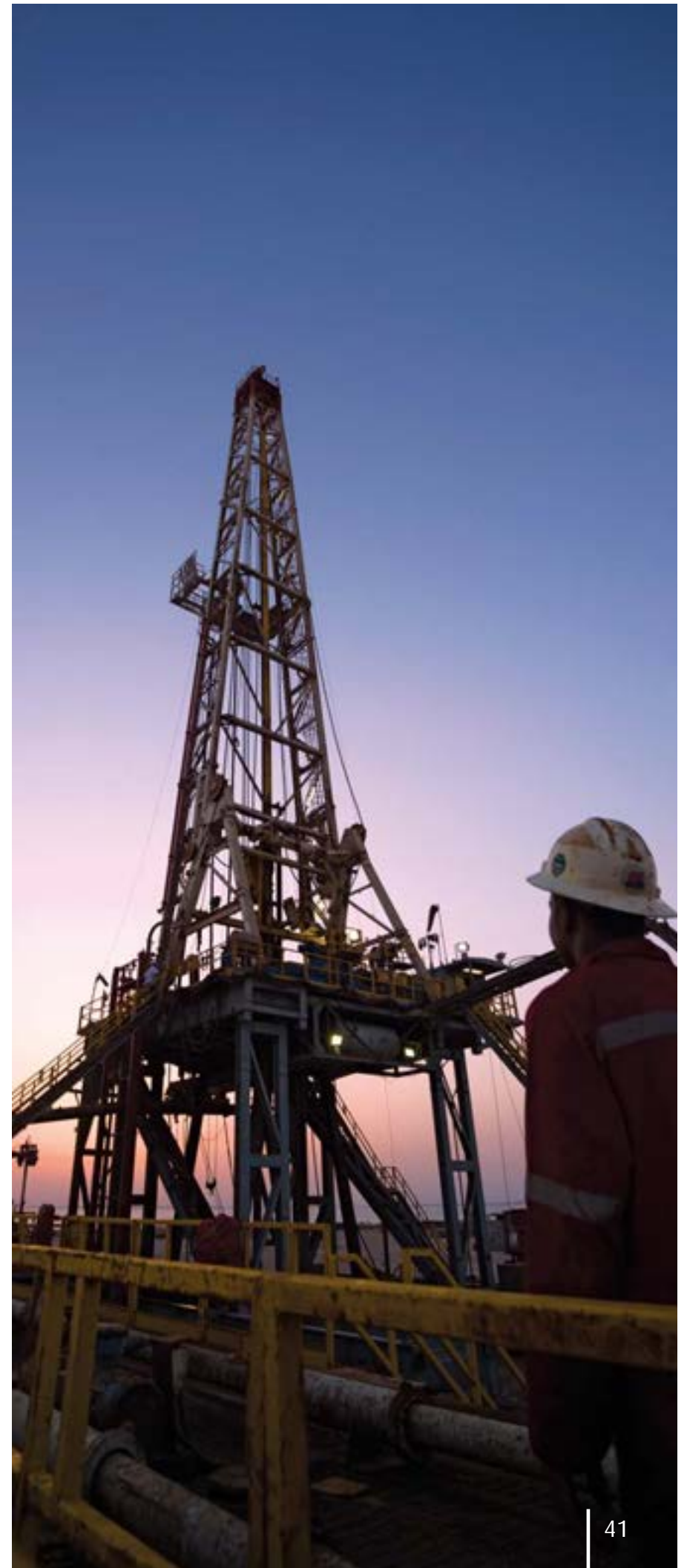
A large yellow offshore oil rig structure is shown against a clear blue sky and sea. The rig features a prominent yellow tower with a red and white striped section near the top. The structure is complex, with various platforms, ladders, and pipes. In the background, the blue sea extends to the horizon, with a few distant ships visible. The overall scene is bright and clear, suggesting a sunny day.

Saudi Aramco uses its extensive resources to undertake activities that support the infrastructure development of the Kingdom, as well as the personal and professional growth of Saudi citizens, in addition to environmental stewardship and the development of a knowledge-based economy





Throughout time inhabitants of the Gulf region have lived in continuous harmony with their marine environment. Whether trading in fish or the sea's shallow treasure of pearls, the relationship with the surrounding sea has always been strong. It was only with the decline in the world pearl trade that the region's oil was explored and brought flowing to the surface.





## The Commitment to Excellence and Superior Standards

The triumph of the Manifa oil field development project, felt within Saudi Arabia and throughout the rest of the world – is a result of the serious dedication of Saudi Aramco and its partner companies to the fostering of a culture of awareness about health, safety, and environment, as well as a commitment to uphold the highest standards in those areas.

This national mega-project, as it has come to be known, was devised in line with the Kingdom's economic

direction – the diversification and further development of national revenue sources while enhancing the country's primary source of wealth. Subsequently, Saudi Aramco embarked on an immense human capital development program, marking its responsibility and fundamental role within the country's economy for future generations.











CHAPTER III

**MANIFA: WEAVING INSPIRATION AND DISTINCTION**



Beauty in the depths of the Arabian Gulf





## Facts and Figures

# 9,000

kilometers of pipes and cables used in the project's development, both above and under water

# 80

million construction man-hours dedicated to the project's development, without a lost-time injury

# 213

kilometers drilled in the oil field, equivalent to the distance from Manifa Bay to Dhahran

# 30

rigs built and operated to drill the wells for the Manifa oil field development

# 35,000

feet in length, marking the longest horizontal well Saudi Aramco has ever drilled

# 27

man-made drilling islands, distinguishing the Manifa oil field development on the world stage

# 45

million cubic meters of sand reclaimed from environmentally nonsensitive locations along the seabed during the construction of the causeway

# 21,000

people representing 25 different nationalities constituting the workforce during its peak

# 17

lead contractors participating in the development

# 4

intersecting bridges constructed between Manifa, Nu'ayriah, Tanajib, and Safaniyah to ensure safe passage of people

# 11

million tons of rock safely transported to Manifa from quarries in the Riyadh area, more than 600 km away, without significant highway disruption

# 246

cranes used in the construction phase of the project

# 136,149

engineering drawings and plans developed for the project

# 1,000

trucks on the road at any given time during the project's development

# 159

buildings erected for the project

## Manifa: Weaving Inspiration and Distinction



For Saudi Aramco, the Manifa Bay development was a long-running project whose intricacies and technological innovation resemble a work of art for all its participants. Although the field was closed down in 1984 due to low global demand for Arabian Heavy crude oil, this marked only the beginning of another innovative journey for the oil industry.

The feasibility studies undertaken by the oil giant indicated that the field's development required a new approach that took into consideration the importance of

environmental preservation and the limitations of the shallow water conditions of the Arabian Gulf. Therefore, in 2006, a new development program was undertaken for Manifa Bay with an initial investment of \$10 billion, in which the area's design and environmental planning took on a new meaning.

The evaluation examined various scenarios for optimizing output while taking into consideration the area's needs. It was found that the development of reclaimed islands with a connecting causeway would be the best technical, financial, and environmental solution. By creating a causeway, offshore platforms and extensive dredging would be avoided and Manifa Bay would be converted into a partially onshore field, cutting costs significantly for Saudi Aramco. The models developed for the area indicated that a primary 20 km causeway and 25 islands would have to be built, linked through an array of lateral causeways measuring 21 km in total length.

Over 70% of the field was thus converted to an onshore field. The converted field had 27 drilling islands (each the size of ten soccer fields), a 2,400-meter bridge as well as five 150-meter and eight 50-meter bridges connected to the main causeway to maintain tidal flow and water circulation, critical requirements for the preservation of marine life. A vital contributor to the production of hydrocarbons, the Manifa oil field

development now included vast onshore facilities: a central facility for processing of oil and gas; a water network; water injection facilities; and extensive pipelines to transport the product.

However, the global economic crisis was to impact the Manifa program as in 2008, prices and demand for crude oil fell considerably. This led Saudi Aramco to apply a temporary freeze on project procurement activities to reduce capital costs. In addition, contractor agreements were re-negotiated and a new partnership strategy developed whereby both the contractors and Saudi Aramco could share overall savings, substantially decreasing costs. In this way, the global recession did not prevent the project from progressing. And in 2013, production at Manifa Bay commenced three months ahead of schedule and more than \$1 billion under budget. Completion of this mega-project in Manifa marked the world's largest hydrocarbon production increment in a single phase.

Outstanding facets of the Manifa Bay facility:

- 27 man-made drilling islands, interconnected by a causeway reaching 41 km in length
- 13 offshore platforms for water injection and oil production
- A central processing plant including facilities





for gas-oil separation, gas treatment facilities, a laboratory for water injection, and cogeneration plants.

- Extensive crude oil gathering and water injection pipelines, built into the offshore platforms, the causeway, and Manifa and Tanajib drill sites, in addition to water injection pipeline systems.
- Downstream pipelines transporting stabilized crude to the Ju'aymah tank farm, and gas and condensate to the Khursaniyah Gas Plant for further processing.
- An energy self-sufficient facility, with an electrical substation cogenerating 420 megawatts of electric power and steam.



In 2007, an extensive evaluation was launched to develop an effective solution for extracting oil from the shallow offshore field. This led to the award of 30 major prime contracts, which included international and national construction firms.



“We set so many challenging goals, important caveats, and benchmarks. There was a lot of innovation. We looked at ways and means to challenge ourselves, and, in the end, the program was accomplished under budget.”



**Mohammed Abdulkarim**  
*Manager, Manifa Project Dept.*



A project woven together with utmost creativity  
and excellence in pursuit of a singular vision.







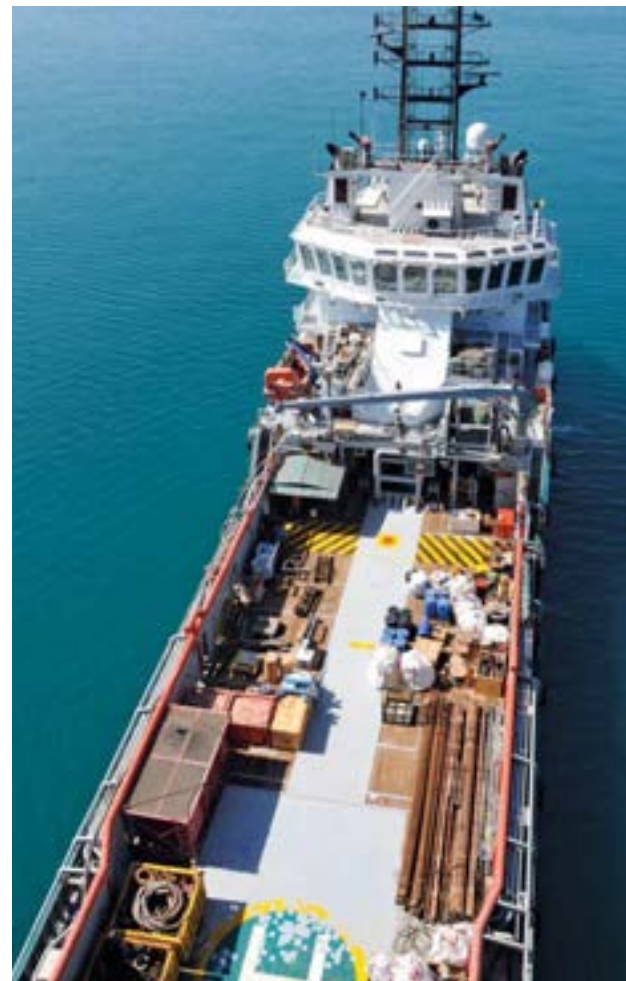
What mighty hands, what endless glory  
Could build such splendid monument  
Together they sought to write a story  
That filled the eye with astonishment

Abdulwahab Bozaid



## Remote Power Automation Introduced

For the first time in a Saudi Aramco mega-project, the Manifa program implemented Power System Automation, a human/machine interface that integrates the key functions of power and equipment monitoring, protection, and control into one safe, reliable, and intelligent platform with lower life-cycle costs for all power distribution systems. It is monitored and controlled remotely by the Dhahran Power Control Center.







## Oil Reservoirs in Manifa

Saudi Aramco engineers found that they had to develop a specially tailored approach for oil extraction due to the deep oil reservoir in the shallow water bay of Manifa. The strategy developed was based on Saudi Aramco's simulation models and required that field production take place from the outer boundaries to the center, utilizing peripheral water injection. Accordingly, water injectors were placed above the tar mat layer to maximize oil recovery. However, the solution had to take into consideration the irregular shape and distribution of the tar mat layer across the field.

Saudi Aramco's Advanced Research Center developed a Nuclear Magnetic Resonance tool capable of detecting the tar irregularities on a real-time basis while drilling. The result was that wells could be placed accurately and steered above the tar, placing injectors that were not too high and that prevented the loss of oil, while ensuring that they were also not too low to maintain pressure transmissibility. Therefore, the number of rigs increased significantly, from six at the outset of the project in 2007 to 30 at its height.

By April 2013, Saudi Aramco was successfully achieving its objectives in Manifa as 500,000 bpd of heavy Arabian crude oil were being produced from a total of about 350 wells. This paved the way for the project's maximum capacity of 800,000 bpd, a milestone accomplished by the end of 2015.

"This mega-project marks a departure for Saudi Aramco, as new technologies were developed and solutions were custom-designed. Technologies were applied at all stages of development, from a newly developed Nuclear Magnetic Resonance tool for accurate well placement, to drilling mega-reach wells beyond 37,000 feet and placing the world's longest cemented 17-cm liner, to world-record well intervention, with the use of the world's first application of tandem slim tractors."



**Nabilah Al-Tunisi**  
Chief Engineer, Saudi Aramco



## Safety Initiatives

Committed to the highest safety standards and loss prevention, Saudi Aramco put forward a number of key initiatives to ensure the safety of both personnel and operations. High concentrations of lethal hydrogen sulfide ( $H_2S$ ) gas in the crude oil meant that an extensive qualitative risk assessment would be undertaken to identify potential hazards and how to minimize them, including assignment of "No Go" zones identified for each drill site as an emergency precaution in case of gas release. Similarly, an intensive awareness program was carried out in which all employees (some 45,000 staff) were trained in the potential risks associated with  $H_2S$  gas and the emergency and safety measures required to mitigate those risks.

Emergency precautions and standards were undertaken through a Site Specific Emergency Response Plan. Among its precautionary measures was performance of emergency drills on a regular basis and the use of evacuation boats, if deemed necessary due to wind direction. Staff safety is a vital feature of Saudi Aramco's operations. In addition to monthly safety meetings in which safety practices and dangerous activities or behaviors are analyzed, staff members are always updated about emergency channels, meeting points, and any hazards.





Manifa Producing Department Administration building

"I firmly believe that this was a collaborative effort as a team – a team that worked hard with a firm belief in the company's core values. Leading the business group of Manifa made me proud of our project control staff and their efforts in building rigorous project control, which continuously ensures that our work processes and procedures are implemented effectively to meet the overall project objective."



*Talal Al-Hareky*  
*Business Manager*



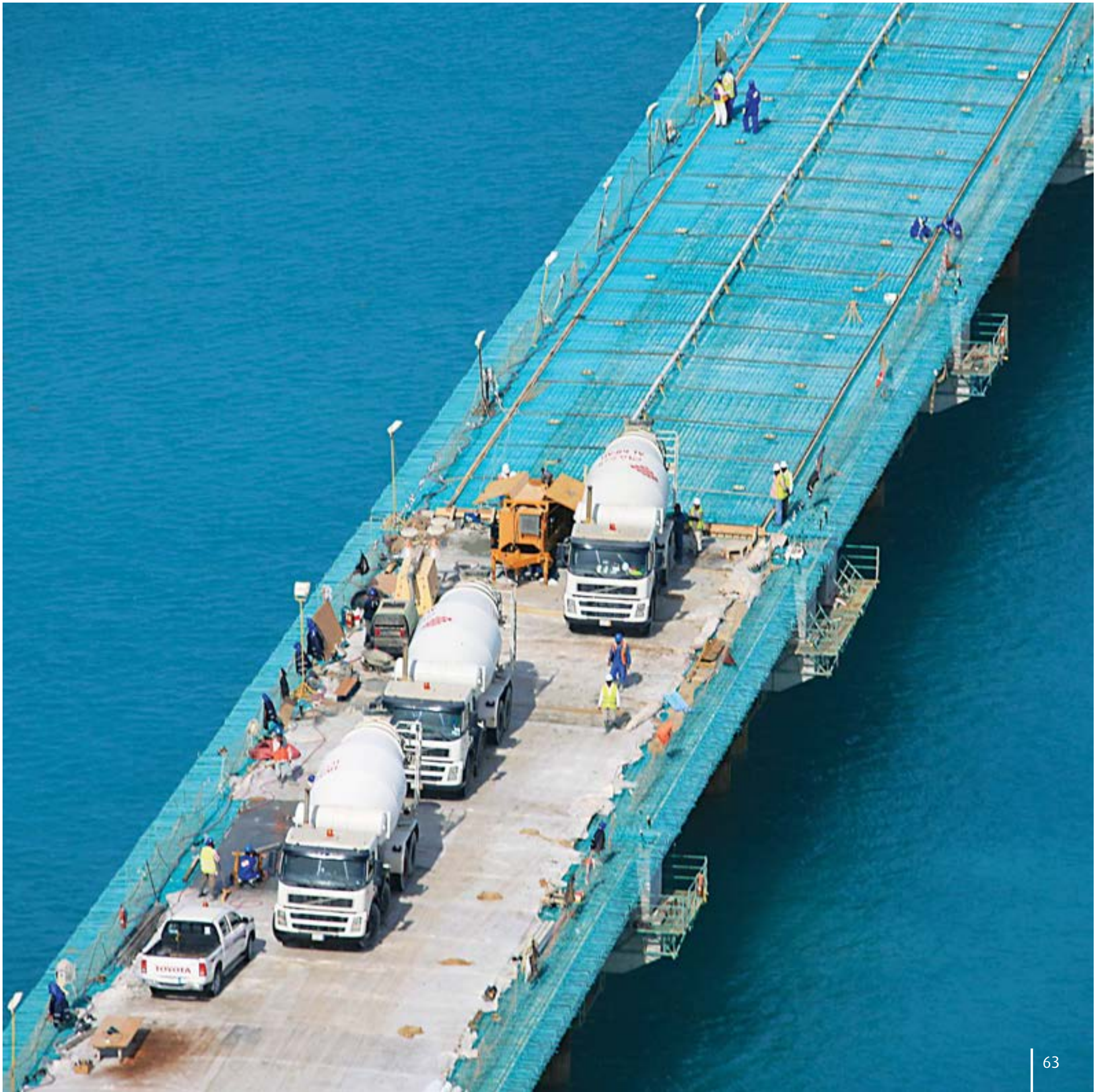
## A 100% Saudi Development

A specially tailored career program for the attraction and development of Saudi talent was created and launched by Saudi Aramco. It led to the successful enrolment and training of young Saudis by technical experts in their respective fields. With a focus on a commitment to quality and safety, graduates of the program supported the final phases in the Manifa Bay project until the facilities were launched by a 100% Saudi workforce.

“We were committed to the highest safety and quality standards in the management of the project and the production of Arabian Heavy crude oil while preserving the environment. At the same time, our commitment to the training and development of our personnel underpinned all our efforts.”



*Azib Al-Qahtani  
Manager, Manifa Producing Dept.*



# Challenges

All projects of this magnitude are bound to face myriad difficulties and obstacles, but Saudi Aramco has proven itself capable of handling and indeed benefiting from the challenges encountered along the way. The company has used its strategic abilities and management resources to manage many mega-projects in the past, and this was the approach undertaken when the global financial crisis threatened the region and energy market.

Therefore, by the time production began from the Manifa oil field, 79.2 million man-hours had been completed over a period of 613 days without any injuries. The high degree of safety and security is astounding considering the enormous nature of the project.

The funding of the Manifa project began in 2007 with an investment of US\$ 11.7 billion. However by 2008, the global economic crisis led to a drastic fall in market demand and consequently prices for crude oil suffered, leading to a questioning of the economic sustainability of the Manifa project. Saudi Aramco approached these developments cautiously, reducing capital costs without impeding the functionality and course of the project.



Saudi Aramco took advantage of the market's contraction and reduced costs by entering into an alliance with the contractors. Major contracts were renegotiated, and procurement deals ensured that substantial savings were assured for both Saudi Aramco and its contractors. Plant systems and processes were optimized so that the Manifa project continued to progress despite the recession. By 2010, Saudi Aramco had recorded a savings of US\$ 1.1 billion on the Manifa Bay project.

This approach continued, and Saudi Aramco made more changes during the early stages of the project's construction, leading to further cost reductions. During 2012, approximately US\$ 750 million of the total costs were decreased, bringing the total savings to US\$ 1.7 billion, almost 15% of the initial capital cost.



At the same time, the project development had to take into careful consideration the risks and threats associated with H<sub>2</sub>S gas hot spots in the area. Saudi Aramco safety contingencies included the maintenance of a control room to monitor wind speed and a digital map marking potential H<sub>2</sub>S zones. While all contractors were required to meet stringent safety standards, emergency evacuation plans were developed and regularly rehearsed. Moreover, the mega-project's workforce of 45,000 employees were all trained in H<sub>2</sub>S awareness.

"Everybody involved, from engineers to designers and operators, gave their maximum efforts to bring the Manifa project to its successful completion."



**Hussain A. Al-Obaid**  
Superintendent, Manifa Field  
Service Division

## Progress and Development



### The steps taken toward production:

#### 2006

As the Manifa Bay project was being considered, 2006 marked the beginning of an intensive planning phase to develop the field in the most economical and environmentally friendly manner. Taking into consideration the shallow waters and associated ecology of the bay, the designers and engineers decided to convert over 70% of the field into an onshore field. This conversion required construction of 27 man-made islands, each the size of ten soccer fields and all connected with a 41-km causeway. To this end, 15 offshore platforms were needed for the field's deeper water locations.

#### 2007

To determine the most effective method to produce oil from a shallow, offshore oil field, Saudi Aramco undertook an extensive evaluation exercise. This included detailed design and environmental studies. The evaluation exercise concluded that an innovative approach was needed to answer the combined economic, environmental,

and technical requirements, namely the construction of reclaimed islands with a connecting causeway. This solution avoided having over 30 offshore platforms that would require extensive dredging to allow the operation of offshore rigs. In fact, the island solution would convert Manifa Bay from an offshore to a semi-onshore oil field, resulting in significant cost savings and environmental benefits. Saudi Aramco awarded 30 prime contracts to national and international companies for the project's construction. Therefore, project engineering, procurement, and fabrication activities occurred around the clock in several locations around the globe.

#### 2008

The global economic crisis led to a sharp fall in crude oil prices and a severe decline in demand projections, testing the economic sustainability of the Manifa project. As a result, Saudi Aramco decided to reduce capital costs without hindering the program's functionality. A temporary freeze on project procurement activities was





implemented while a partnership was formed between the contractors and the company to lower costs. Saudi Aramco renegotiated major contracts, introduced a Limited Open Book strategy with the contractors, and undertook an assessment of the program's facilities. The partnering strategy sought to capture market price reductions from the contractor's uncommitted material and construction procurement activities, after contract award. Saudi Aramco obtained substantial savings on the project, shared the savings with the contractors, and optimized several plant systems and processes. These initiatives maintained the Manifa program's progress throughout the recession.

#### **2009**

Cost reduction measures were implemented, allowing resumption of procurement activities and extending the program completion schedule by two years due to changing prospects. Given the size and complexity of the central processing facility, three main contractors with over 5,000 interface points were hired and successfully

managed by the program team and contractors. Manifa Program interfaces were optimized by structuring the construction packages carefully, and they were managed through alignment sessions with all stakeholders.

#### **2010**

The construction of the islands and causeway was completed. During construction, more than 45 million cubic meters of sand were reclaimed from the seabed. In addition, the design stage for the central processing facility was completed. This consumed over 4 million man-hours, and resulted in the development of more than 136,149 engineering drawings.

#### **2011**

The 13 offshore platforms for water injection and oil production were completed and installed. Over 9,000 km of pipes and cables were used – greater than the flight distance between Dhahran and Houston. More than 600 major pieces of equipment including pumps, compressors,

vessels, heat exchangers, electrical transformers, and switchgears were used to complete the main electrical substation that year.

#### **2012**

The water injection facilities were completed and operational on schedule. As a prerequisite to this event, the common utilities, central control building, all electrical substations, and raw water supply plants were commissioned.

#### **2013**

Oil production began three months ahead of schedule and more than US\$ 1 billion under budget. With a commitment to quality, Saudi Aramco staff conducted more than 5,000 visits to vendors and manufacturers to ensure the quality of the project's materials.







The coral reefs in the Arabian Gulf tolerate extreme variances in temperature that occur throughout the year, from the high summer temperatures to the cold winter climate.





The development and building of bridges has always been closely intertwined with human civilization, from the very early use of tree trunks for crossing rivers to the construction of bridges which was known first in Mesopotamia, and then by the ancient Indians, to the grand aqueducts and city landscapes of the ancient Romans.

It is the design and construction of a causeway and interlinked bridges that makes the Manifa field development stand out from among the world's offshore oil fields. Aesthetically pleasing and a viable solution for the area's environmental needs – with a 41-km causeway that crosses the Arabian Gulf to connect 27 man-made islands – the development ensured that the 30 drilling wells did not harm their natural surroundings.

“Although the production of Arabian Heavy crude oil at Manifa has reached 800,000 bpd, there are no traces of burning gas. The Manifa project was the first Saudi Aramco project in which there is no gas flaring whatsoever due to the technologies used in its operation. Annual maintenance programs have ensured that there are no technical problems, which confirms the quality of the material and methods applied. We don't expect there to be any technical problems for the next 10 years.”



**Khalid K. Al-Onaizi**  
*Superintendent, Manifa Maintenance  
Division*



## A Jewel in the Crown

As Manifa is located in a coastal and ecologically sensitive area, Saudi Aramco marine specialists were involved in the project from the outset to reduce the developmental footprint on the marine environment. The causeway and its route selection were designed to avoid disturbing the coral reefs and dense sea-grass meadows while taking into consideration the shallow water variances, as well as the deeper water locations for the extraction of oil and building of the islands.

Described by HE Khalid A. Al-Falih, Chairman of the Board of Saudi Aramco, as the “jewel in the crown” of the company’s operations, the design and construction of the Manifa field has been widely heralded. Although Saudi Aramco has developed a number of mega-projects, the Manifa Bay development was the first time the company adopted the approach of building and connecting man-made islands.







What differentiated the designs of the Manifa Bay development was the commitment to the environment, which ensured that causeway and island construction supported the protection of the area's marine life.



The Manifa Bay project is the first of its kind for the company in which cogeneration of electricity not only allows for self-sufficient operations but also provides a power surplus. Moreover, oil production at Manifa provides the energy equivalent to meeting the needs of 100 million people around the world.



*Osama Al-Saleh*  
Project Engineer

“Throughout my time as a member of the Manifa development team, I was confident of the success of the project due to the broad array of technical expertise involved and the general air of determination that all parties shared in its execution.

The team had to connect the oil wells in Manifa with those in Tanajib, and at the same time develop water injection wells to provide peripheral water injection as a pressure maintenance scheme to support oil production.”



The Manifa oil field development represents the first such Saudi Aramco project in which there is no gas flaring, in line with the company's environmental and community support mandate.



The project's impact was wide-ranging, as the areas surrounding Manifa also prospered with a rise in employment, private sector business, and national economic growth. A number of local contractors are involved in Manifa trade and related activities, while residents of the surrounding areas have seen local infrastructure and services improve.



**A magical industrial tapestry of pipes distinguishes the Manifa facility.**



The Manifa project has had a significant impact on the Saudi economy. During the execution phase alone, more than 21,000 jobs were created, impacting thousands of families both directly and indirectly across the Kingdom and beyond.



# Saudi Female Geologists



## **Basmah Al-Mustafa** (right)

I was exposed to the Manifa project in 2011, immediately after graduating from the University of Liverpool. The project was in an advanced development stage, especially on the well drilling side, with an objective to reach its assigned production capacity of 900,000 barrels per day of Arabian Heavy crude oil. I joined the Manifa team as a Field Geologist to handle the Well Planning, WAPING (Well Approval Package), and Operations tasks.

Well Planning involved collecting and analyzing reservoir data from the designated location to be drilled within the Manifa project area. This was not an easy task as Manifa Bay has a sophisticated reservoir environment. After analyzing the data, I would create the draft drilling map using Open Works (OW), a specialized software application. This is a challenging exercise as the drilling paths have to be examined carefully through the various ground layers to ensure maximum operational efficiency.

Once the draft was completed, we would meet with the engineers to discuss the map and apply any needed modifications. After agreeing on all changes, we would then test the plan on Open Works (OW) and start creating the prognosis and formation tops of the well. Following this stage, the plan would be sent to the Well Approval Package (WAP) for final approval. Finally, the drilling team would execute the plan. At that stage, my duty would include monitoring the drilling path and advising the Field Engineers of any restrictions or modifications that need to be applied based on the actual situation.

I am proud to have been part of the team that worked on the fifth largest oil field in the world and was delighted to witness its first commercial production in April 2013. It was a great start to my career in Saudi Aramco and an inspiring experience.

None of this would have been possible without the assistance and guidance of the Manifa team members.

## **Thanaa Abdulmohsen** (left)

As a geologist, I helped the engineers in designing and planning the new wells to be drilled. They needed our help to place the well path into the targeted reservoir. I also monitored the drilling of many wells to ensure that drilling successfully reached the targeted reservoir without encountering any major issues. Importantly, I worked alongside my mentor to enhance the structure of the Manifa field based on the data obtained from the drilled wells.

I am immensely proud to have been a member of the amazing team that led to the success of the Manifa oil field project. This unique project is a testimony to the company's values, particularly its environmental stewardship. It is very dear to my heart because it was both the first and one of the biggest projects that I worked on since joining the company in 2011.









Self-sufficiency in generating electricity to power the operating plants through cogeneration is an important component of Saudi Aramco's energy efficiency strategy. The Manifa facility cogenerates 420 megawatts of electric power together with steam. In addition, 3 million standard cubic feet per day of flare gas is recycled.

The Manifa project causeway design was intended to cater to both energy market production needs and environmental preservation for the Bay's distinct ecosystem.

Manifa Bay is a seascape of several environments, from intensive algae habitats and dense kelp beds to scattered coral reefs, contributing to its biodiversity. A significant percentage of the Kingdom's Gulf fishery is dependent on the bay, so its vitality could not be overlooked when planning the Manifa production facilities. At every step of the process, Saudi Aramco environmental and project engineers ensured that the facilities would not adversely impact the important ecosystem of the Gulf shallows.

Marine scientists from the Environmental Protection Department worked to ensure that needed facilities could be built without causing undue harm to the environment.







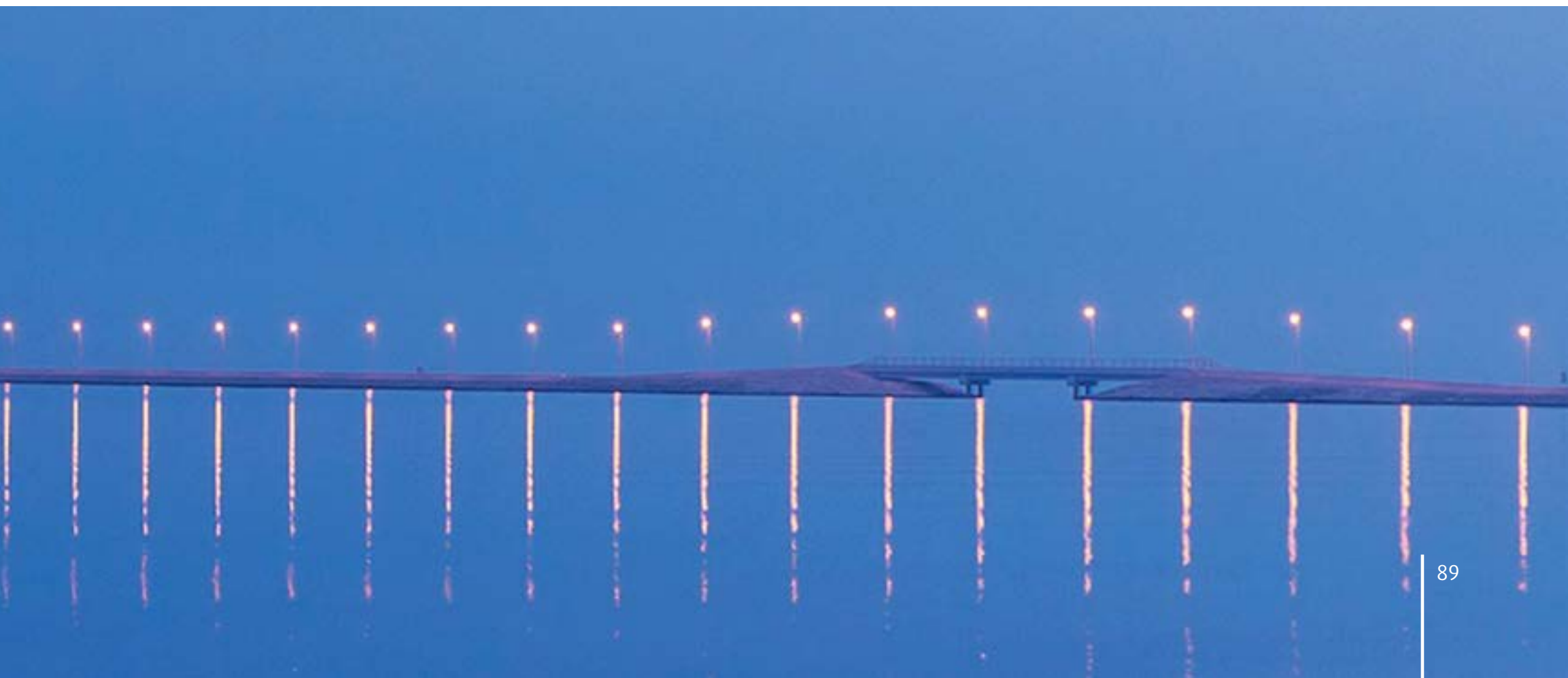
## Dedication to Development, Environmental Preservation



As Saudi Aramco made preparations to harvest the oil far below the shallow seabed of Manifa Bay, the company took precautions to maintain the bounty of its marine life and the varied sea floor environments. Therefore, the Manifa program followed strict environmental policies enforcing many drilling, land, and air protection measures.

Since Manifa is in a coastal and ecologically sensitive area, Saudi Aramco marine specialists were involved at the conceptual stage to reduce the developmental footprint on the marine environment. This led to special protective measures, and the route selection of the causeway and the islands was designed to avoid disturbing coral reefs and dense sea-grass meadows.

Project execution continued throughout the market downturn of 2008, which ensured continuous sources of revenue for international and national vendors. Four million man-hours were spent in the detailed design phase, which was carried out in multiple international locations such as Italy, Spain, the UK, Japan, and the UAE, as well as various locations within Saudi Arabia. The execution phase provided jobs for a multinational workforce that numbered approximately 21,000 at project peak. This had a direct positive impact on the welfare of the multinational workforce, including a strong percentage of Saudi nationals, in addition to the international and Saudi vendors who participated.



The challenges faced in the development of Manifa Bay were dealt with successfully by the different teams involved, by creating responsive strategies, that also supported the training of Saudi human capital in varying disciplines.







Approximately 213 km were drilled to reach the oil reservoirs in Manifa Bay

No one disputes the fact that, when it comes to developing young people – particularly new engineering graduates – Saudi Aramco sets the bar. The company's three-year Professional Development Program has molded young Saudi graduates into efficient employees. As such, 95% of the technicians at Manifa are graduates of either the company's Apprenticeship Program or Saudi and foreign universities.



"The combination of new technologies and young talented engineers and operators supported the development and success of the Manifa project. I have no doubt that the Manifa example will set the benchmark for all similar plans and projects in the future due to its superior approach and execution of safety and operation standards. The Saudis involved in the project have all learned important life skills and technical know-how."



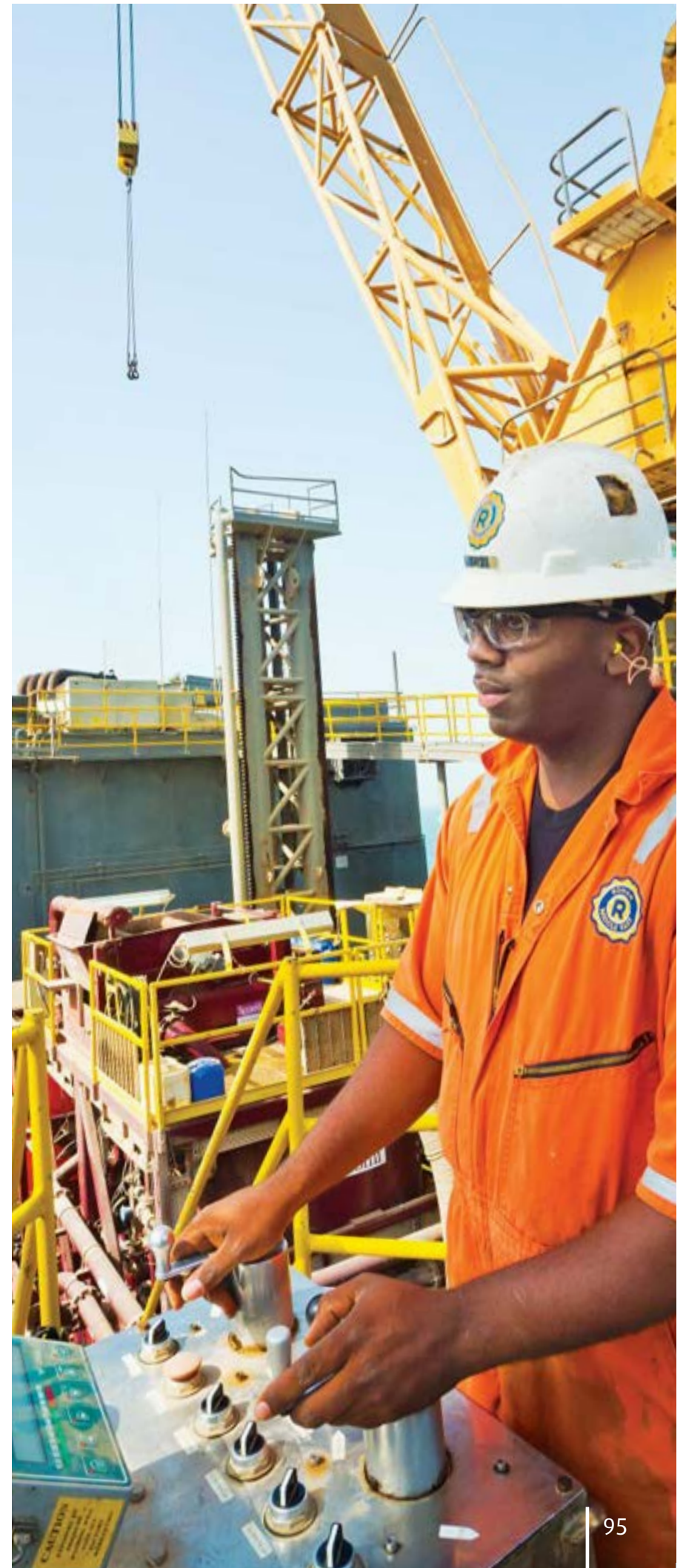
**Ahmed S. Al-Besher**  
*Acting Superintendent for Manifa's  
Operation Division*



## Safety Training of 45,000 Employees

The Manifa program featured simultaneous operations, with construction activities and drilling operations working in close proximity to one another. Due to the high concentration of H<sub>2</sub>S in the crude oil, the fully staffed Emergency Control Center operated 24 hours per day. This Emergency Control Center formed part of the mitigation measures taken to enhance safety for construction employees. In addition, the Manifa program trained more than 45,000 people on the dangers of, and response to, an H<sub>2</sub>S release. A Centralized Emergency Meeting Point system was developed with signs and flags to denote the emergency meeting locations, and a site-specific GPS system was created to guide individuals and emergency vehicles to the corresponding emergency location.

The Manifa program implemented innovative solutions that led to contractor partnering, a strong Health and Safety Environment (HSE) culture, and an exemplary environmental awareness and conservation approach, all resulting in a successful project that positively impacted Saudi Arabia, the wider region, and the world.



The visit of HE Ali I. Al-Naimi, Minister of Petroleum and Mineral Resources, as well as members of the Board of Directors of Saudi Aramco, to Manifa in April 2013, to mark the commencement of operations at the facility, was a strong boost to the Saudi workforce and aspiring young talent who uphold the Citizenship, Excellence, Accountability, Integrity and Safety values of Saudi Aramco.







When the plans and studies, for a certain mega project such as Manifa, involve Saudi Aramco's Executive Management, then it follows that the huge execution operations require a work force with a great sense of responsibility and experience in this kind of projects in order to overcome all the challenges and difficulties, and obtain and ensure success.

"The launch of operations was an amazing experience with no real problems faced by the technicians. This is largely because of the detailed design process and solutions that examined and answered the natural challenges posed by the field. Additionally, the use of technical experts to train and guide young Saudi employees helped to ensure a smooth production process."



*Fahad T. Al-Dossary*  
Superintendent (A), Manifa Engineering  
Division







## Awards

- The Saudi Aramco program for health and safety was awarded the International Corporate Health and Productivity Prize by the Institute for Health and Productivity Management in 2013 for building and successfully implementing an integrated health and productivity management model.
- Arabian Seas awarded Saudi Aramco first prize for technical excellence in environmental technology.
- The Manifa engineering design for oil production and environmental care was nominated for a UNESCO Environmental Responsibility Award.

For the 25<sup>th</sup> consecutive year, Saudi Aramco was ranked first in Petroleum Intelligence Weekly's Annual Ranking of the World's Top 50 Oil Companies in 2014.







Nearly all of the 200 people who work in the Manifa Maintenance Department participated in the facility's launch. Responsible for the upkeep of the tanks, pipes, and separation plants, the extensive training undergone by these young employees has

provided them with the equivalent of seven years of experience and technical ability. Saudi Aramco's dedicated training programs are intensive, including both theoretical and practical training courses for small groups.

## The First Unit of Its Kind: Manifa Operations Efficiency Engineering Unit

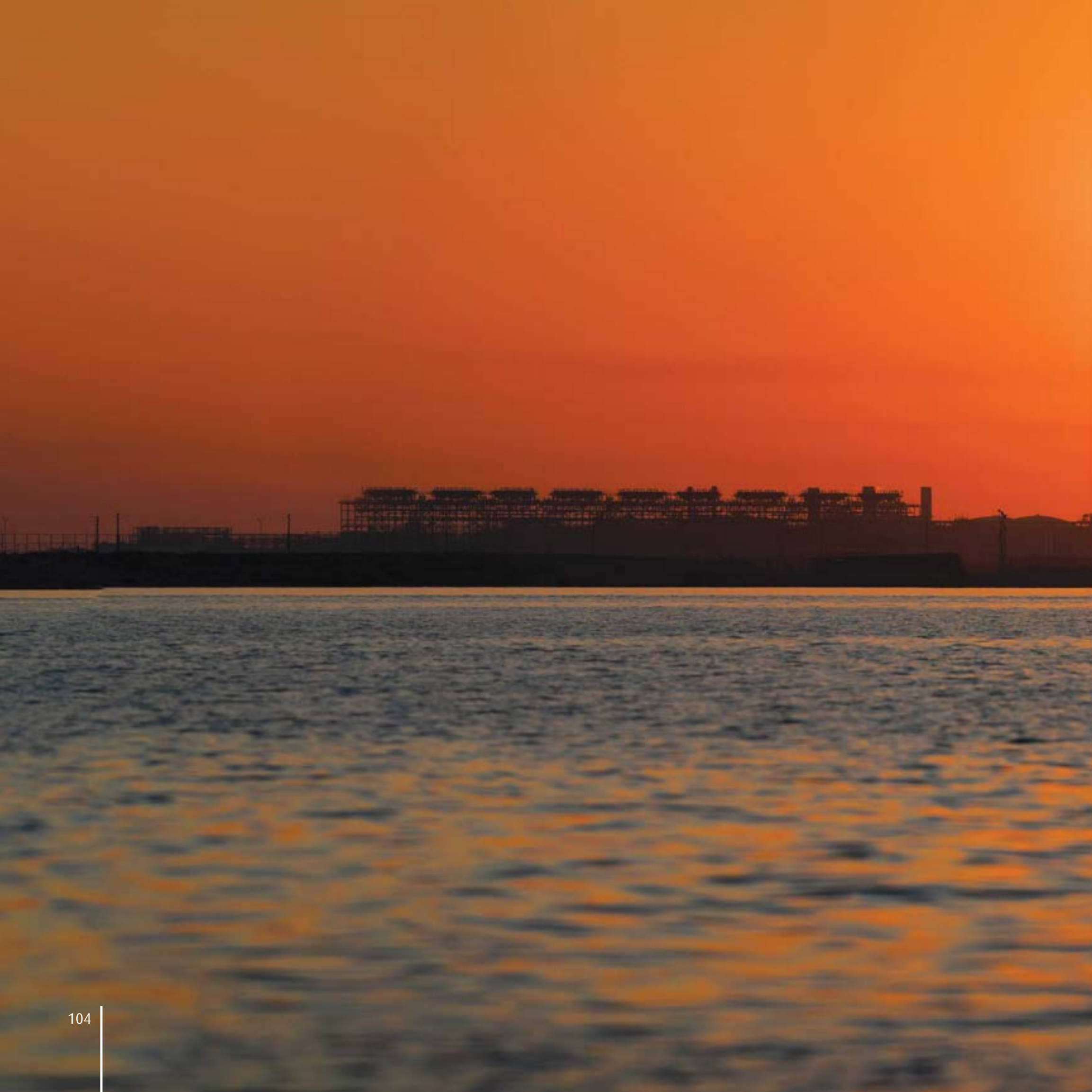
In pursuit of the highest operational efficiency and successful outcomes, Saudi Aramco decided to establish the first Operations Efficiency Engineering Unit in Manifa.

With energy conservation and environmental protection underlying its goals, the unit's primary objectives were to build a specialized team to ensure excellence in operations and nurture a culture of efficiency and innovation. Team members were encouraged to explore new technologies that could contribute to operations enhancement. Overall, the unit was created to develop a wide range of engineers and equip them with the required skills and talents to improve their capabilities in this challenging oil field.

Reflecting on energy consumption patterns and best approaches for efficient usage, the unit examined lighting usage in Manifa offices. Motion sensors were installed, which led to a reduction in the consumption of energy in relation to light usage – from 365 days a year to the equivalent of 80 days. Likewise, a filtering system was installed for office air-conditioning units, which ensured an energy saving of 5-15% on consumption.

Striving for continuous improvements and system optimization, by the end of 2014, the unit had been recognized as the highest contributor to energy conservation initiatives in Manifa.











A photograph of an industrial facility, likely a refinery or chemical plant, featuring a complex network of pipes, walkways, and structural steel. The image is heavily tinted with a yellow and blue color scheme. The pipes are a bright yellow, while the structural elements and background are a muted blue. The perspective is from an elevated position, looking down into the facility.

CHAPTER IV

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**THE TALE OF MANIFA**

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With the discovery of the country's hidden treasure, its black gold, everything changed irreversibly for the Peninsula and its inhabitants.



Aerial view of construction of the northern access road, a 120 km two-lane asphalt stabilized highway designed to give easier access to the offshore producing areas of Safaniyah and Manifa. Safaniyah, November, 1958.

Photo by E. E. Seal

# 1957

## Oil in the Kingdom of Saudi Arabia

Success accompanies great discoveries, providing endless inspiration for storytellers who never tire of relaying the many associated narratives.

The discovery of oil in the Kingdom of Saudi Arabia and the surrounding Gulf region led to a unique journey in the area's social and economic development, which was amplified by the emergence of national oil companies whose presence penetrated daily life routines, supporting the nation-building process. The model of modernity they presented instilled new beliefs and practices about systems of work, living patterns, and community relationships.

Saudi Aramco was pioneering in this regard. Emerging at the time that contemporary education systems were being introduced, Saudi Aramco aided social development across the Kingdom. Domestic human capital and technical expertise were cultivated in the pursuit of modern growth backed by oil production. From its early beginnings until the evolution of Saudi technical expertise in the field, the company has left an indelible mark on every sector of the national demographic.

The Arabian Gulf region has been blessed with an abundance of trade and commodities, which have traversed its seas for centuries. Yet, it was only in the 20<sup>th</sup> century that the region's modern financial power was unleashed. With the discovery of black gold – namely oil from Well No. 7 – in 1938 in Dammam, Saudi Arabia, scientists and geologists began the complex journey in world petroleum economics that has characterized the Kingdom since.

Prior to the discovery of oil, Saudi Arabia's economy was shaped by the historic trading routes of its Bedouin caravans, as well as by the traditional agricultural methods practiced in its villages and rural areas. Its major cities, ranging from Mecca and Madina to Jeddah and Riyadh, all engaged in limited and irregular economic activities resulting from handmade production and a reliance on the trade input of the annual pilgrimage. The overarching economic objective of all commercial practice at the time was based on the inhabitants' daily needs, as well as the necessity to ensure their survival.

In 1933, when the Kingdom was not even a year old, King 'Abd al-'Aziz, seeking greater opportunities for his people, granted a concession to Standard Oil of California (Socal) to explore for oil. The Concession Agreement, signed by His Excellency Shaykh 'Abd Allah as-Sulayman, Saudi Finance Minister, and Mr. Lloyd N. Hamilton, lawyer and negotiator for Socal, in the Khuzam Palace in Jeddah on May 29, heralded a new era of openness and optimism.

Then, with the discovery of the country's hidden treasure, its black gold, everything changed irreversibly for the Peninsula and its inhabitants. Its social and economic landscape was altered throughout the 1940s as the country's oil enterprise oversaw national growth and development.

Ranked first in Petroleum Intelligence Weekly's annual ranking of the world's top 50 oil companies for 25 consecutive years, the Saudi Arabian Oil Company, or Saudi Aramco as it is better known, is a story of almost unbelievable success. Responsible for the world's largest

proven crude oil reserves, as well as the largest daily oil production, Saudi Aramco develops the energy resources of the country while maintaining a responsible outlook on global economic, societal, and environmental needs.

As of the end of 2015, Saudi Aramco, from its headquarters in Dhahran in the Eastern Province, employed a total workforce of 65,266; 54,666 Saudis and 10,600 expatriates from various countries. Managing conventional crude oil and condensate reserves of 261.1 billion barrels and gas reserves of 294 trillion standard cubic feet, this world leader in hydrocarbons exploration, production, refining, distribution, and marketing has no equal.

Although company operations cover the entire Kingdom, catering to domestic demand for automotive and aviation products, Saudi Aramco's reach is truly global. With offices and important partnerships across the world, from China to Egypt and from the U.S. to the Netherlands, international downstream integration is successfully achieved while profits from the exploration, production, and sale of hydrocarbons are maximized.

Committed to the world economy and the international community, Saudi Aramco is expanding its capabilities to discover, produce, process, and transport natural gas for domestic energy, for powering seawater desalination plants and other industries, and as a vital feedstock for its growing petrochemical industry.

The story of Saudi Aramco is not that of the growth of a national company. It is the tale of the development of the Saudi energy industry.



Saudi Aramco's innovative and creative approach to economic and national growth has earned the Kingdom wide recognition across the world.

Aramco's mobile drilling platform no. 1 in use in the offshore Manifa field. Roughly triangular, it measures 28 meters in length and 31 meters in width with three retractable open truss legs, spaced derrick, and operating barge. It is capable of drilling in water 19 meters deep. November, 1958.

Photo by E. E. Seal





Guide cementing head at Manifa rig no. 11. Manifa, March, 1963.  
Photo by B. H. Moody

## The Tale of Manifa

1957

Oil is discovered in the offshore Manifa field, 200 km northwest of Dhahran. The field, located in the Arabian Gulf, has a depth ranging from 1.8 meters to 11 meters.

1964

Sustainable production of Arabian Heavy crude oil is underway from the Manifa oil field, Saudi Aramco's second heavy oil producing field (26° to 29° API). Measuring approximately 41 km in length and 17 km in width, by 1964, crude oil production reached 40,000 bpd.

1966

Oil production from Manifa reaches 113,000 bpd.

1967

Oil production averages 48,432 bpd.

1977

By this time, 17 offshore platforms for oil production and water injection had been completed and oil production reaches a capacity of 140,000 bpd.

1984

Due to the world economic downturn and low demand for Arabian Heavy crude oil, the Manifa oil field is closed down.

2006

The investment challenge.



Aerial view of Manifa onshore rig, 1962.  
Photo by B. H. Moody



Expert supervises cementing operation at Manifa no. 11, March, 1963.  
Photo by B. H. Moody

A wellhead supported by an offshore platform is serviced by offshore operators. Crude oil from the wellhead flows into submarine flow lines connected to an underwater gathering system, which delivers the oil to the Safaniyah gas oil separator plant. Manifa, 1962.

Photo by T. F. Walters





Moonlight view of new Manifa plant area showing storage tanks and spheroid under construction. Manifa, November, 1963.

Photo by B. H. Moody





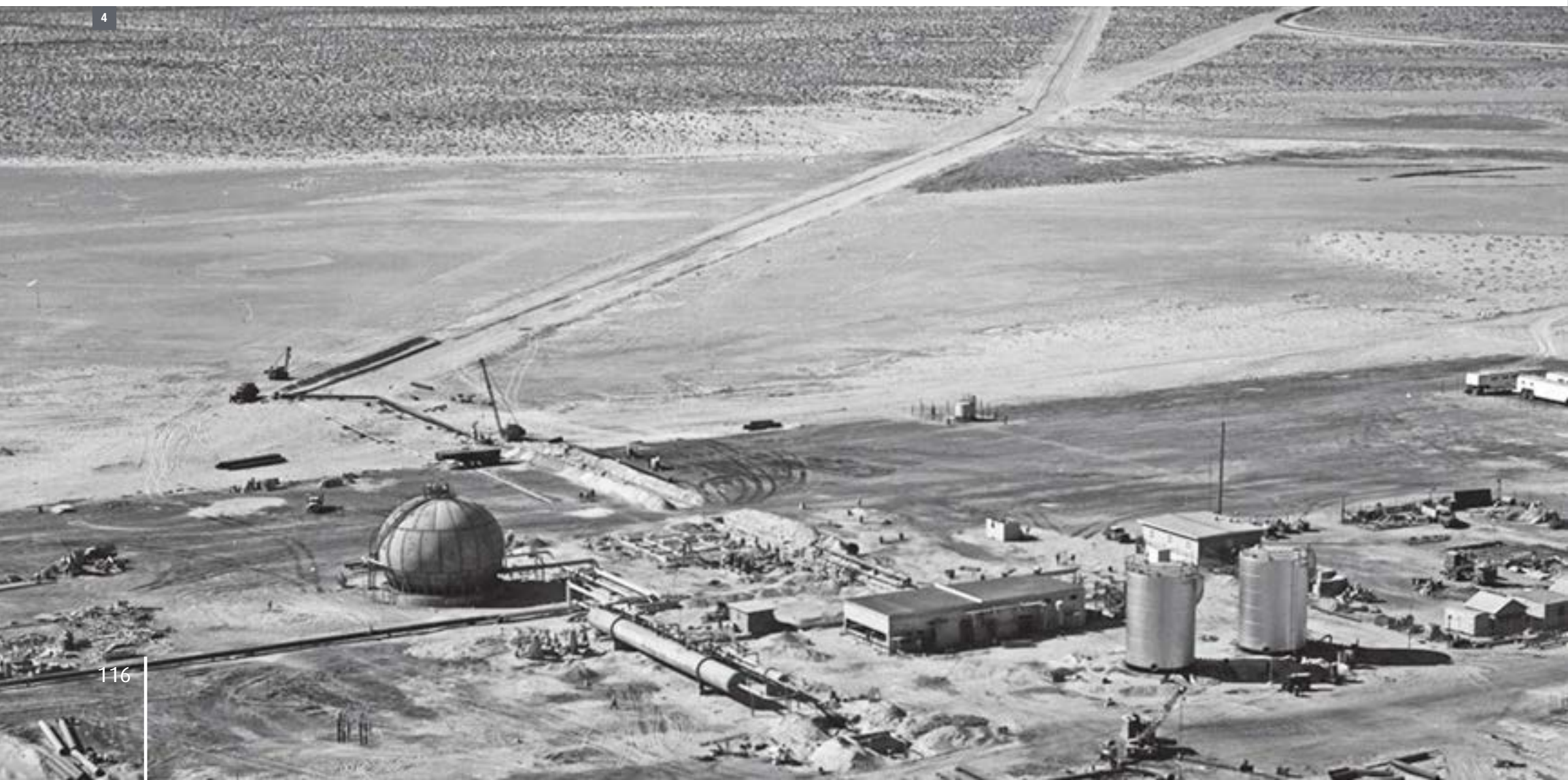
Inserting collar prior to cementing at Manifa no. 11. Manifa, March, 1963.

Photo by B. H. Moody



1. Aerial view of the new Manifa GOSP area showing trailer camp (in right foreground) with pipelines under construction to handle offshore crude oil. Manifa, November, 1963.
2. Aerial view of the new Manifa plant with the main trunk line extending from the offshore wells to the Safaniyah-Ras Tanura main feeder line pipeline.
3. View of new facilities under construction at Manifa, November, 1963.
4. Low-level oblique view of Manifa plant showing crews installing valves on intake and output main crude lines. Manifa, November, 1963.

Photography by B. H. Moody



Aerial view of the construction of a 120 km asphalt stabilized highway, which was designed to give easier access to the offshore producing areas of Safaniyah and Manifa, November, 1958.



## The Investment Challenge of 2006

Saudi Aramco considered reopening and revitalizing Manifa Bay with an initial investment of \$10 billion in 2006. The new development program for the world's fifth largest oil field was extremely ambitious, and Saudi Aramco's leadership was cognizant of the fact that the new development required conversion of the offshore field into an onshore project – the largest extended-reach project of its kind in the world.

To achieve the new milestone and target delivery of 900,000 bpd of Arabian Heavy crude oil, development

of the field could not be considered separately from its surrounding environment and its real global ecological role. Therefore, in 2006, an all-encompassing evaluation exercise was embarked upon, including design and environmental studies.

By April 2013, the first phase of the development and execution had been successfully completed and Saudi Aramco's second largest plant, the Manifa Central Processing Facility, was producing 500,000 bpd of Arabian Heavy crude oil.





CHAPTER V

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**A CULTURE OF PROSPERITY AND  
FUTURISTIC DEVELOPMENT**

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Saudi Aramco's hydrocarbon production is measured not only by its outcome but also by the way in which the production processes are carried out. It is a tenet of Saudi Aramco's mission that national economic diversification be supported and that quality work and training opportunities be provided.





# Sustainable Development and Environment

## Culture and Heritage

Visitors to Manifa Bay today find themselves surrounded by the beauty and magnificence of an island-city floating within the Arabian Gulf, where old and new come together – environmental serenity amid a heavy-oil-producing infrastructure.

Since the very establishment of Saudi Aramco more than 80 years ago, the importance of flourishing and prosperous communities has been emphasized through development projects in different fields, from culture and heritage to sports, health, and the environment, supporting the organization's sense of corporate and social responsibility. Saudi Aramco shares an interest in the development and preservation of a safe and healthy surrounding environment, partnering with the government to ensure positive and sustainable growth.

At its peak, the Manifa oil field development involved more than 21,000 employees, constituting an integrated community within the larger general population of the Eastern Province and the Arabian Gulf coast. Before constructing a causeway and drilling islands, research was done to ensure normal oceanic flow to the biologically productive Manifa-Tanajib Bay. Fortunately, the coral formations of Manifa have been studied and included in Saudi Aramco environmental surveys over many years. Accurate mapping of these sensitive and important marine environments allowed for the careful positioning of the man-made causeway and islands, ensuring the continued vitality of these coral reefs.







- Up to 49% of Saudi Aramco's irrigation needs are met through the use of treated wastewater produced by the company's facilities and residential neighborhoods.
- Since 2009, some 366.5 metric tonnes of plastic, glass, and aluminum and 6,700 metric tonnes of paper, and cardboard have been recycled through office and residential programs.
- Since 2011, Saudi Aramco has sponsored the planting of 900,000 mangrove seedlings along the Saudi coastline.
- Over 700 artificial coral reefs have been deployed in 25 locations in the Arabian Gulf to support marine biodiversity and the Kingdom's fishery resources.

## The Palm Tree and the Sea

Since ancient times, the palm tree has represented a critical source of life and pride for Al-Hasa and the Eastern Province inhabitants whose ancestors labored to make the area green and abundant. Saudi Aramco has followed a determined reforestation campaign as part of its mandate to safeguard and restore coastal mangrove habitats and protect biodiversity in the Kingdom, including establishment of an annual Garden Festival. Similarly, Saudi Aramco has worked to ensure that the bird species of the Manifa Bay area are protected by erecting three nesting platforms that provide a safe haven for highly prized ospreys.

The coastal reserve within the Manifa area has been developed in a way that enhances the natural biodiversity

of the region. The revitalization of mangrove regions along the Arabian Gulf coastline has led to the planting of 250,000 trees in 2013 alone. As one of the coastal plants common to warm, tropical climates, mangroves are robust plants that can withstand difficult environmental conditions while offering a refuge for migrating birds and a nesting ground for ospreys and flamingos. These habitats are among the most productive ecosystems in the marine environment, providing important nursing grounds for many commercial fish, shrimp, and crabs – the lifeblood of the Kingdom’s fishing industry.





- Between 2012 and 2013, there was an increase in the rate of direct employment of Saudis.
- Saudi Aramco development projects and joint ventures – such as Sadara, YASREF, Jazan Refinery, and SATORP – provide 34,000 direct and indirect job opportunities.
- Of all the purchases made by Saudi Aramco, 37% of the items were manufactured in the Kingdom.
- A total of 216 employees completed the Working Woman Program.
- In the global oil market, Saudi Aramco is responsible for producing one out of eight barrels of oil per day.
- In 2013, 5.2 million man-hours of training were completed by Saudi Aramco staff.
- Through 2007, Saudi Aramco built 74 government schools for boys and 65 government schools for girls; in the years since, Saudi Aramco has been pursuing a renovation program for these schools in addition to rebuilding 51 schools constructed between 1964 and 1980.



## The Daily Routine - Work and Leisure





In addition, the Manifa camp provides employees with a full-service restaurant, a state-of-the-art sports hall, and game room. Employees are encouraged to engage in traditional Saudi and Arab games to pass their time in keeping with local heritage, while open sports fields accommodate regular soccer and volleyball tournaments.

Oil fields require a dedicated work program, unlike the challenges of office work and urban environments. Saudi Aramco employees in the Manifa Bay development may work steadily for periods of up to one week, during which they stay in the development area itself, resting within its accommodation facilities.

The accommodation camp spans an area of 217,500 square meters (m<sup>2</sup>), catering to 762 individuals at any

one time. The combined area of the accommodations and work environment at Manifa Bay reaches 435,001 square meters (m<sup>2</sup>). Saudi Aramco prides itself on the quality of its living quarters. Each lodging offers a sleek kitchenette, separate living area, and telecommunications and Internet access, as well as air conditioning.





Desert cleanup campaigns are regularly organized by Saudi Aramco, in line with its corporate social responsibility. These campaigns invite company employees and their families to join the area's residents in a bid to raise awareness of environmental and ecological responsibilities for future generations.



The Manifa mega-project represents an important milestone by which all future Saudi Aramco projects will be gauged.





Nurturing citizenship values, Saudi Aramco fosters local heritage and traditions through community events throughout the Kingdom.



## Tarut Bay Sanctuary

As part of Saudi Aramco's commitment to protect local mangroves, an important mangrove sanctuary has been developed in the Tarut Bay area. Covering a vast area of 63 km<sup>2</sup>, the mangroves planted over the years, now numbering in the hundreds of thousands, today help stabilize the shoreline and sustain coastal wetlands and essential nursing grounds for commercial fish and shrimp.

Since 2011, over 900,000 mangroves have been planted along the Kingdom's shores.



An attractive destination for local camel herders and their herds – particularly during the rainy season, when abundant greenery brightens the landscape and seems to stretch forever – Manifa also draws in tourists and residents.

Manifa is a favorite area for residents of the Eastern Province.





With an eye on global needs and sustainable development goals, Saudi Aramco has reviewed the Manifa field's development in the context of its Corporate Biodiversity Plan. Originating from the core objectives of preserving and enhancing five areas of exceptional biodiversity in the Eastern Province, the company's environmental commitments have helped provide a vital natural greenbelt for communities in the Eastern Province.

Mangroves sequester carbon dioxide, filter dust and other particulates, and provide an important refuge for migratory birds and a habitat for marine life. This is in line with the marine emphasis of the Manifa oil field development – the innovative construction of 3 km long bridges and man-made islands that take into account the migration paths of the many local marine species, maintaining a natural water flow and preserving marine nurseries.





## CHAPTER VI

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# **CORPORATE SOCIAL RESPONSIBILITY**

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## Citizenship

Corporate social responsibility at Saudi Aramco is intrinsically linked to the company's value of citizenship. Saudi Aramco uses its extensive resources to undertake activities that support development of the Kingdom's infrastructure, as well as the personal and professional growth of Saudi citizens, environmental stewardship, and development of a knowledge-based economy.

There are three key pillars of the company's citizenship strategy: the economy, the building of a knowledge-based society, and the environment. As a result, the expressions of citizenship are diverse and impactful across every sector of the country, including the

establishment of a National Industrial Training Institute (NITI), the building and renovation of public schools, the construction of the King Abdulaziz Center for World Culture, and the distribution of thousands of computers to school students. The environmental programs have been equally wide-ranging, from beach cleanups and awareness campaigns to mangrove plantation, recycling, and the establishment of water purification plants. These have been supported by the active enrolment of volunteers to manage and deliver the varied national campaigns, once more reinforcing citizenship roles and values among participants and recipients.

## King Abdulaziz Center for World Culture

One of the largest social development initiatives ever launched by Saudi Aramco, the King Abdulaziz Center for World Culture began its development in May 2008 when its foundation stone was laid by the Custodian of the Two Holy Mosques, the late King Abdullah bin Abdulaziz. Striving to support national efforts for further social and cultural development, the center located in Dhahran, only steps away from the first oil well discovered in Saudi Arabia, seeks to develop the Kingdom's human resources and foster its creative talent.



## King Abdullah Sports City Stadium

Responding to the late King Abdullah bin Abdulaziz's emphasis on sports and physical development, Saudi Aramco played an integral role in the building of the Jawhara Stadium at King Abdullah Sports City in Jeddah. Inaugurated in 2014, this stadium, and its usage plans reflect the company's efforts to inspire both citizens and residents to become more active, healthy members of society.





# The National Industrial Training Institute

Further to Saudi Aramco's emphasis on human capital development and training opportunities, the National Industrial Training Institute (NITI) was established as a nonprofit organization and a joint undertaking between Saudi Aramco and the Technical and Vocational Training Corporation in the Kingdom. The institute's vision is to transform vocational training in the country to meet the growing demand for a national workforce in the oil and gas industry. With two branches in the cities of Al-Hasa and Abqaiq, the institute caters to 3,000 and 400 trainees, respectively.





With a vision to improve the quality of life, Saudi Aramco invests heavily in its employees, their families, and surrounding communities, assuring them of a better standard of living and inspiring environmental conservation.



Saudi Aramco plans to facilitate development of an economic environment conducive to attracting, establishing, and strengthening local industries related to energy and global competitiveness, capable of creating job opportunities for Saudi nationals.

Among the key components of this vision is the development of local participation. Therefore, Saudi Aramco is working to promote what is known as the Golden Square, which is a series of integrated industrial clusters to help diversify the industrial base and achieve stronger economic growth as well as sustainable, high-quality job creation. This Saudi Aramco initiative for the establishment of a competitive energy sector has been designed to achieve the following objectives:

- An increase in locally manufactured energy-related goods and services contracted by Saudi Aramco from roughly 35% of the industries to 70% by 2021.
- Expansion of work opportunities for Saudi nationals from the current Saudization level of 20% of jobs to 70%.
- Enhancement of the sustainable development of the Kingdom.
- Development of the Saudi energy sector for global competition.
- Contributing to the creation of 500,000 domestic direct and indirect job opportunities.



## Knowledge Initiatives

One of the most successful youth initiatives was the iThra Knowledge Program, which offered interactive history, science, and energy exhibitions alongside cultural shows. Spearheaded by the King Abdulaziz Center for World Culture, the program was premised on the importance of building and cultivating a knowledge-based society. It spawned the popular educational outreach program known as iThra Youth, which in turn developed a number of inspirational programs, including iSpark, iDiscover, iRead, and the more recent iThra New Media Award.



Saudi Aramco believes in youth talent and supports the training and development of youth abilities and skills.

## Youth Energy

Representing two-thirds of the Saudi workforce, young professionals between the ages of 20 and 39 are at the crux of Saudi Aramco's corporate social responsibility program. The company's commitment to education and learning knows no bounds, as Saudi graduates and young professionals are regularly enrolled in training and academic initiatives. Similarly, the professional development of Saudi women both within and outside Saudi Aramco is supported through various training programs.



## In Pursuit of Our Dreams



# Safeguarding Our Communities



# Acknowledgement

The Public Relations Department is grateful to all the departments and individuals who supported the development of this book. In addition, this book would not have been possible without the enthusiasm and cooperation of Vahid Associates Brand Futurists in the design process. We would also like to extend our thanks and appreciation to those who provided help and assistance to the writer while working on the feature stories, which were published in Qafilah Weekly and The Arabian Sun. We could not have completed this book without the help of the different teams in Manifa, especially the Manifa Project Management Department, the Manifa Drilling Department, the Manifa Producing Department, the Heritage Gallery in the Community Services Department in the Central Area, the Media Production Division, and the Environmental Protection Department.









ISBN 978-99958-2-154-8



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