Japan Cooperation Center, Petroleum

JCCP NEWS

No. 108 2011 January

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JCCP NEWS No. 108 January 2011

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Announcement

Sudan's Newly Appointed Ambassador to Japan Visits JCCP

On August 17, JCCP received a visit from Mr. Abdon Terkoc Matuet, Ambassador of Sudan, who was recently assigned to the Embassy of Sudan in Japan. Accompanied by Mr. Gaffar Somi, Counselor, the newly appointed ambassador enjoyed a pleasant chat with Mr. Masataka Sase, Executive Director, and Mr. Morihiro Yoshida, Managing Director, of JCCP.

Newly appointed Ambassador of Sudan to Japan (second from left in front row)

Background

JCCP implements training courses and technical cooperation projects intended mainly for Middle East and Gulf countries, which supply 90% of the crude oil that Japan imports. In addition to these countries, however, JCCP is also focusing on cultivating new cooperative partnerships with countries that are expected to make a significant contribution to the diversification of energy sources and the expansion of independently developed oil fields in the future. Toward this end, a comprehensive technical cooperation survey was launched in FY2007, and survey visits were made to Sudan in FY2008 and 2009. Through these initiatives, JCCP opened relations with Sudan National Petroleum Corporation (SUDAPET), headquartered in northern Sudan, and with the Khartoum Refinery, and implemented seminars on environmental countermeasures, catalyst technology, and energy conservation technologies in Sudan in FY2009 to promote mutual exchanges of information. Since FY2008, more than ten Sudanese engineers have participated in JCCP regular courses, and in July 2010, Mr. Masataka Sase, Executive Director of JCCP, visited the country and held policy dialogues with the heads of state-run oil companies and top officials of Sudan's Ministry of Foreign Affairs.

When JCCP made its first official visit to Sudan in January 2009, JCCP members initially paid a call on the Sudanese Embassy in Japan to introduce and gain understanding of JCCP activities, and were able to realize the visit thanks to the strong cooperation and support of the embassy in contacting and making necessary adjustments with the Sudanese side. Since then, JCCP has maintained a relationship with the embassy, keeping it informed of any advancements in its relationship with relevant organizations in Sudan and obtaining its cooperation when needed. Based on this relationship, JCCP has received a number of important visiting dignitaries from Sudan, including the recent visit by the new ambassador.

Overview of Sudan

Sudan has undergone a prolonged period of domestic confusion caused by ethnic and religious conflict, and has endured international isolation that continued for quite some time. However, after the United Nations lifted its sanctions against the country in 2001, Sudan focused its efforts on stabilizing its domestic situation and returning to the international community. The government signed a comprehensive peace agreement with South Sudan in 2005, a peace agreement with the Eastern Front in 2006, and created a unified government. Today, widespread attention is being directed to the independence referendum that Southern Sudan is scheduled to hold in January 2011 to decide whether or not it should gain independence from Sudan.

Japan began importing crude oil from Sudan in 2001. In 2008, imports from the country reached 5.7 million kiloliters (2.1% share), and have boosted Sudan to become one of Japan's important crude oil suppliers. Japan has not yet advanced into Sudan's crude oil production sector, but other Asian countries such as China, Malaysia, and India have made investments that

Inspection of the simulator facility at JCCP (Ambassador Matuet at far left)

Meeting with Mr. Masataka Sase, Executive Director of JCCP

have significantly promoted oil field development and crude oil production in the country. Sudan experienced a rapid increase in production since 2000, so that it attained a production capacity of some 500,000 b/d in 2008. Sudan principally produces a blend of crude oil called Nile Blend, which is similar in property to Indonesia's Minas crude. Japan imports Nile Blend for refining purposes and for burning as fuel by power companies.

Oil Industry in Sudan

There are presently five refineries in Sudan with a combined refining capacity of 147,000 b/d. The Khartoum Refinery is by far the largest, with a capacity of 100,000 b/d, followed by the Port Sudan Refinery, with a capacity of 25,000 b/d. The others are simple refineries that have atmospheric distillation units only, and are the El Obeid Refinery (10,000 b/d), the Shajirah Refinery (10,000 b/d), and the Ghabra Refinery (2,000 b/d).

The state-of-the-art Khartoum Refinery commenced operations in 2000 with a capacity of 50,000 b/d, but was later expanded to a capacity of 100,000 b/d in 2006. Sudanese Petroleum Corporation (SPC) and China International Sudan Refinery Ltd. (Chinese capital) each have a 50% share in it.

To further develop the country's oil industry and refineries, the Sudan is aggressively seeking the support of companies and institutions inside and outside the country, including JCCP, in developing Sudanese engineers and acquiring technical cooperation.

Ambassador Matuet's Courtesy Call on JCCP

In his interview with Mr. Sase and Mr. Yoshida, the new ambassador said that cooperation in the form of technologies and investment is strongly desired from technologically and economically advanced countries such as Japan, in order to place the country on the road to future development. The ambassador also explained that Sudan has rich oil reserves, and oil production has been increasing of late. With an abundance of other natural resources as well, there are ample business opportunities in Sudan for Japanese companies. Recognizing that the industriousness and diligence of the Japanese people have been one of the drivers of Japan's development, he emphasized that personal and cultural exchanges between the two countries would greatly benefit Sudan.

Mr. Sase made a reference to information he acquired in his talks with the president of SUDAPET held in Sudan this past July, regarding the company's future plans to build a new refinery. He stated that if another refinery or other facility that requires specific technical support is constructed, it is certainly possible for JCCP to also expand its cooperation in the future.

After meeting with the JCCP directors, the ambassador listened intently to descriptions of JCCP's training and technical cooperation programs from relevant managers, inspected the process and instrumentation simulation facilities with interest, and once again expressed his strong expectations of JCCP's support in hereafter training Sudanese engineers and improving technologies at its refineries. JCCP is presently advancing a plan for creating opportunities to visit and hold technical exchanges with SUDAPET and the Khartoum Refinery to solve issues that they face. It also intends to continue receiving Sudanese engineers to its regular courses in the effort to maintain and strengthen its relationship with Sudan that has just begun to take shape.

<by Kazuhisa Okumura, Technical Cooperation Dept.>

The 28th JCCP International Symposium Keynote Speeches
January 27 – 28, 2010

Keynote Speech 1

Energy Security and Sustainability

Mr. Nobuo Tanaka
Executive Director,
International Energy Agency (IEA)

During the two and a half years since I was appointed executive director of the IEA, the price of oil has surged to $147 per barrel, dropped to the $30 level, then rose once again to the $70 to $80 level. In the face of such volatility, it is the IEA's job to take appropriate measures to stabilize the supply of energy. In the past, we have therefore focused on securing stable supplies by establishing a mechanism for stockpiling oil under a cooperative international framework. However, in recent years, addressing global environmental issues has also become one of our important responsibilities.

Today, I would like to share with you some of my thoughts on such issues as the IEA's forecast of oil demand, impacts on the global environment, technical issues, and investments for energy development.

1. Oil demand forecast and the creeping oil crisis

1) Medium-term oil demand forecast

The IMF and other international institutions predict that the global GDP growth rate will gradually recover from the global economic crisis and return to around the 5% level by 2014. Economic growth will lead to an increase in demand for oil, but oil supplies will shrink if nothing is done to strengthen supply capacity. In fact, the world's supply capacity must be strengthened to the point where it can respond to growing demand by rates far exceeding the rate of depletion. If the economy were to grow at an annual rate of 5%, supply reserves would shrink further, and the demand-supply balance would begin facing a tight situation around 2014 to 2015.

2) Oil consumption forecast

In relation to the growing GDP, oil consumption intensity has been improving at an annual rate of 2.1% during the past 20 years. The IEA expects this improvement to continue at a rate of about 2.4% hereafter, but if it can be increased to 3.1%, it would be possible to maintain the high 5% annual GDP growth rate while also maintaining supply reserve stability. Essentially, this means that promoting energy conservation will significantly contribute to the stable supply of oil, as well as to economic growth. The IEA, recognizing that saving energy and using oil wisely is extremely important to securing stable oil supplies, is exploring various policies, as will be discussed below.

3) Forecast of primary energy demand

If governments do not establish measures for energy conservation (Reference Scenario), the IEA expects primary energy consumption to increase along with economic growth, and by 2030 to reach levels 40% higher than today. Fossil fuels, including oil, coal, and natural gas, will account for a large portion of that increase (Fig. 1). The IEA estimates that dependence on fossil fuels will only increase under the Reference Scenario, which is neither sustainable in terms of energy

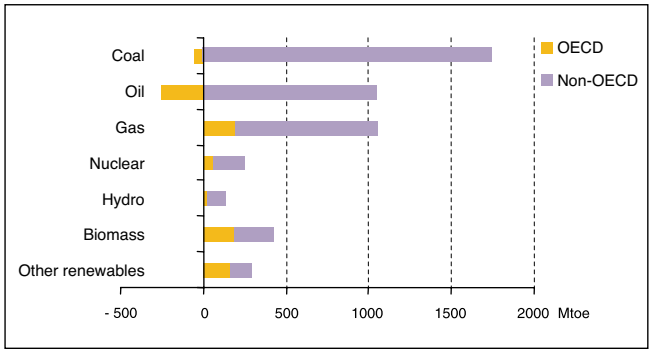


Fig. 1: Change in primary energy demand (Reference Scenario, 2007-2030)

prices, stable supply, nor the global environment.

4) Forecast of oil production

Oil production at existing fields will continue to decline under the Reference Scenario. Meanwhile, oil demand will be growing, so in order to respond to the increasing demand, new oilfields need to be developed while also supplementing waning production capacity. According to the IEA's projection, an additional production capacity of approximately 63 million b/d will be needed by 2030 if demand continues its present trend. Sixty-three million barrels is an extremely large amount, corresponding to six times Saudi Arabia's current daily production, and a sustained investment of some $5.9 trillion would be needed by 2030 to secure this output (Fig. 2).

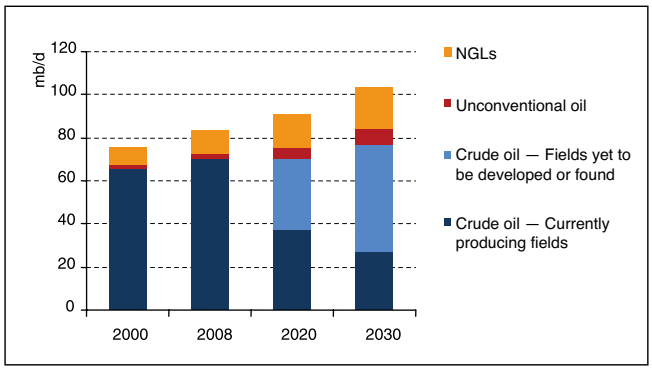


Fig. 2: Oil production (Reference Scenario)

5) Forecast for natural gas

As with oil, the increase in demand for natural gas and the decline of its production must also be offset by developing gas fields yet to be developed or discovered. Specifically, an additional capacity of 2.7 trillion m^3/year is needed by 2030. This corresponds to four times Russia's current production capacity (Fig. 3). The development of natural gas requires an investment of $5.1 trillion by 2030, and combined with the investment required for oil development, a total of some $10 trillion is needed. Since global investment in energy development currently equals approximately $26 trillion, this means that 40% of global investment must be directed to natural gas and oil development. This is certainly a mind-boggling issue.

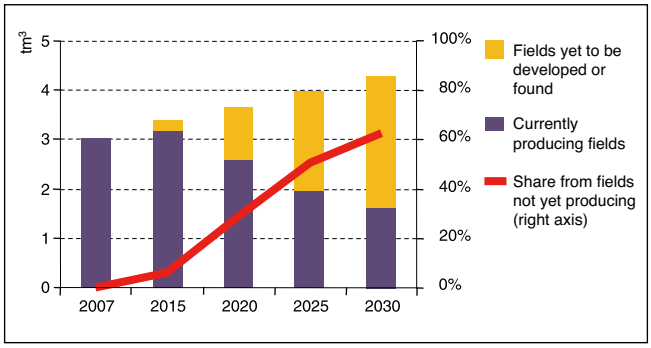


Fig. 3: Impact of decline in world natural gas production (Reference Scenario)

6) Creeping oil crisis

The amount of import spending by oil- and natural gas-consuming countries is expected to grow considerably in the future, given the rising prices and increases in demand for oil and gas. Debt burden from high import spending, which was around 1% of GDP until now, might increase to around 2% to 3%. In 2008, when the price of oil rose to $147/bbl, oil import spending increased to around 2.3% of GDP. This situation had caused great confusion. In the second oil crisis of 1979, it was 3.2%, indicating that a 2% or 3% share of GDP translates to a burden comparable to an oil crisis (Fig. 4).

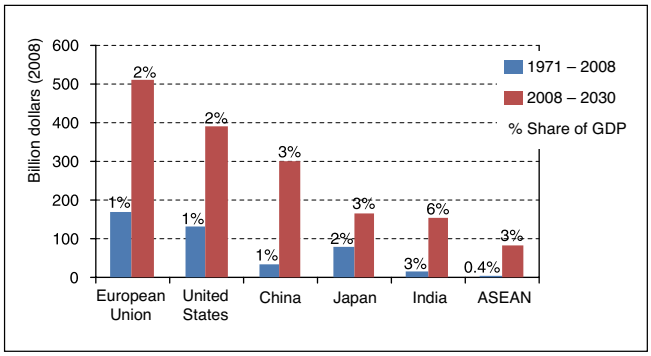


Fig. 4: Average annual expenditure on net imports of oil & gas (Reference Scenario)

Significant economic growth in China, India, and other emerging countries is expected to bring a gradual but major global impact on par with an oil crisis. This phenomenon is called "creeping oil crisis." The Reference Scenario, or the "business-as-usual" scenario, should therefore be considered a scenario that must be avoided.

2. Global environmental conservation and energy supply

1) The IEA's 450 Scenario

To prevent global temperature from rising more than two degrees by the end of this century, the IEA is of the view that CO_2 emissions must be curbed in each country and atmospheric CO_2 concentration limited to 450 ppm. The impact this would have on energy demand and supply is outlined in the IEA's "450 Scenario." While the Reference Scenario has been labeled unsustainable, the 450 Scenario examines what would occur if the scenario were to be made sustainable in regard to the global environment.

2) Peak dependence on fossil fuels

The Reference Scenario sees the entire world emitting 34.7 billion tons of CO_2 in 2020. To match the 450 Scenario, emissions would need to be reduced by 3.8 billion tons. This could be achieved by employing a combination of policy mechanisms. For example, domestic policies and measures implemented in each country have the potential to reduce about 1 billion tons/year; the sectoral approach, which aims to achieve the efficiency level of the country with the highest efficiency in the steel, cement, and automobile sectors, also has the potential to reduce about 1 billion tons; and the cap-and-trade scheme of the OECD developed countries could yield a further 1.8 billion tons. In this case, the OECD cap-and-trade scheme would require a CO_2 price of $50/ton. It needs to be that high to match the 450 Scenario. Furthermore, unless it is increased to $110/ton in 2030, the Reference Scenario cannot be brought to the level of the 450 Scenario.

In the 450 Scenario, demand for fossil fuels peaks in 2020 (Fig. 5). This does not signify the supply-side peak, but the peak at which the consumption of fossil fuels must be regulated to protect the global environment. However, fossil fuels will still account for 68% of primary energy sources. Therefore, even if the ambitious 450 Scenario were to be realized in 2030, dependency on fossil fuels would necessarily continue, accompanied by the need for massive investment.

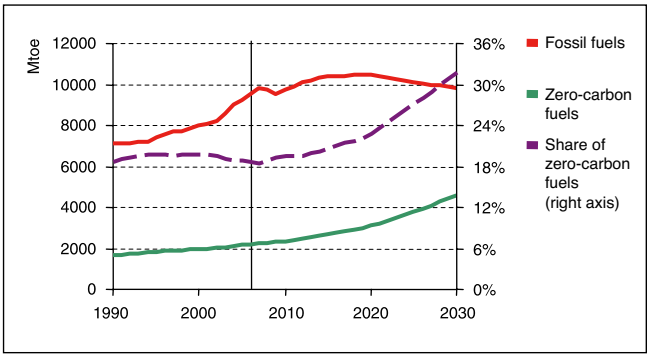


Fig. 5: Demand for fossil fuels peaks by 2020
(World primary energy demand by fuel in the 450 Scenario)

3) End to the period of low energy prices

If the 450 Scenario were to be pursued, the crude oil price in real terms would be around $90/bbl, whereas it would be around $110/bbl in the Reference Scenario. When taking inflation into consideration, the IEA estimates that nominal value would reach $200/bbl in the Reference Scenario, and up to $150/bbl even in the 450 Scenario. Adding to that the price of CO_2, the nominal price in the 450 Scenario would be something close to the Reference Scenario. The period of low energy prices has continued for a long time, but the IEA warns that, for all practical purposes, this period should be considered to have come to an end. The prerequisite in the coming period is to build a business model from the perspective of a period of high oil prices, and to consider the role of governmental policies.

In the 450 Scenario, oil demand is estimated at 90 million b/d, and is 16 million b/d lower than the Reference Scenario, but since production capacities in non-OPEC countries will be declining, OPEC countries must increase production by 14 million b/d compared to their production levels today. Thus, investment for development of oil resources in OPEC will continue to be extremely important in the future.

4) Cooperation between oil-producing and consuming countries

OPEC production will still see an increase in the 450 Scenario, and oil prices will continue to rise, so OPEC will gain much higher revenues than in the past. The IEA forecasts that, if investment based on these revenues is put to effective use, it would be possible to simultaneously protect the global environment, promote oil development, and maintain oil demand and supply in reasonably good balance. This win-win situation, the IEA believes, could presumably be realized through cooperation between oil-producing and consuming countries.

5) CO_2 emission abatement in non-OECD countries and international cooperation

The 450 Scenario assumes it would be most effective to reduce CO_2 emissions primarily in non-OECD

countries. When considering that economic growth is around 1.8% in OECD countries, 4.6% in non-OECD countries, and 3.1% on average, global emission abatement cannot be achieved unless emissions are reduced in non-OECD countries, where economic growth rates are extremely high. However, whether the OECD or non-OECD countries should incur the cost is a separate issue.

Various technologies would be employed to achieve the necessary level CO_2 emission abatement. For example, a 57% abatement could be achieved by energy conservation technologies, 23% by the utilization of renewable energies, 10% by nuclear power generation, and the remaining 10% by the CCS technology. This graph shows that CO_2 emission abatement cannot be achieved unless all possible technologies are utilized (Fig. 6).

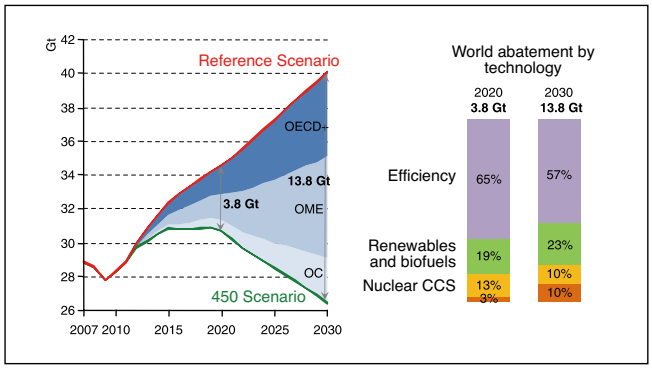


Fig. 6: World abatement of energy-related CO_2 emission (450 Scenario)

6) Significance of technology development and international cooperation

The IEA considers it most important to solve global environmental issues through technology development. In reference to technologies that are effective in reducing CO_2, including carbon capture and storage (CCS), advanced vehicles, wind power, solar photovoltaic, concentrated solar power, and other diverse technologies, the IEA is examining potential future issues and the types of international cooperation that are necessary for technology development, and creating roadmaps to the future.

If technology development is not achieved as planned, a delay of one year is estimated to cost $500 billion. Last year, the leaders of concerned countries assembled in Copenhagen and reached an agreement after intensive discussions, but it may not have provided sufficient incentive to stimulate greater investment.

3. Toward global energy supply and global environmental conservation

Japan's CO_2 abatement potential is not necessarily large, but having announced the largest abatement target in the world of 25%, it is expected to play an important role in leading the world and setting an example by its contribution to global abatement. The IEA will also contribute in diverse ways to both stabilizing global energy supply and addressing global environmental issues, by presenting technical roadmaps such as those mentioned above and forecasts in *World Energy Outlook* and other publications.

Thank you very much for the opportunity today to present to you the various results of the IEA's studies. It is our responsibility to continue to create new models in cooperation with companies in the oil industry and end-users of oil. As my final message to you, I ask that you take advantage of the IEA in your future efforts. I hope we may continue to develop our relationship of mutual cooperation. Thank you very much.

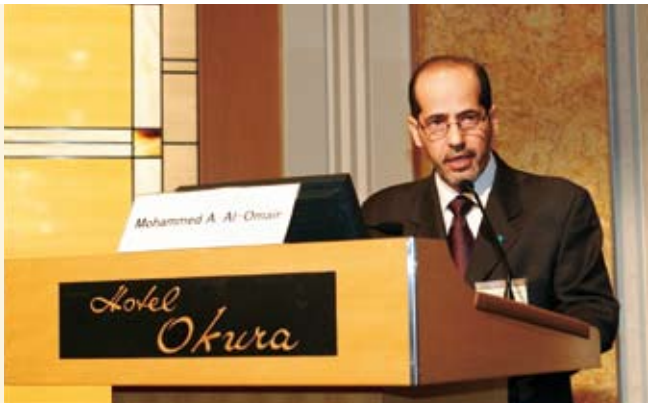
** This transcript has been produced by the JCCP Secretariat based on the speech given at the 28th JCCP International Symposium (January 27, 2010).*

** The responsibility for the wording of this transcript lies with the JCCP Secretariat.*

Keynote Speech 2

Management of Hydrocarbon Resources

Mr. Mohammed A. Al-Omair
Executive Director, Refining and NGL Fractionation, Saudi Aramco



1. Relationship between Saudi Arabia and Asia

We at Saudi Aramco highly value our longstanding and mutually beneficial relations with Japan. As a company deeply involved in the Japanese economy as a major supplier, refiner and marketer of petroleum and petroleum products, Saudi Aramco appreciates all that we share from Japan's distinctive approach, not only to economic development, but to human development in the fullest sense. This distinguished and unique center (JCCP) plays an important role in this regard, and in strengthening cooperation and relations in the very important petroleum business.

Today, Saudi Aramco is an investor in the Japanese petroleum sector, and Japan is an investor in the Saudi petroleum sector. Yet it is *not* only in the area of petroleum that our relations with Japan are clear. We enjoy many fruitful exchanges of culture, commerce and technology.

When it comes to energy trade relations, Asia accounts for more than half of our exports of crude oil, refined products and natural gas liquids. Looking ahead, Asia's demand is projected to be met mainly from supplies from Saudi Arabia and the other Gulf states. More broadly, Asia is Saudi Arabia's largest trade partner among continents, with a 45% share of our overall trade.

PetroRabigh Petroleum Refining and Petrochemical Complex (photo supplied by Saudi Aramco)

At the same time, Saudi Arabia is Asia's principal trading partner in the Middle East. Such a relationship is only natural.

The investment relationship is just as important. Today, our largest refining assets outside of Saudi Arabia are in Asia, with a total equity refining capacity of over 1.3 million barrels per day in Japan, China and South Korea. Japanese companies are also investing in Saudi Arabia. One of the largest refining and petrochemical complexes in Saudi Arabia, PetroRabigh Company, commissioned last year, is a joint venture that we are extremely proud of with Japan's Sumitomo Chemical.

2. Investment in the Oil Upstream Sector

Given our longstanding relationship, Saudi Aramco understands Japan's emphasis on achieving long-term stable supplies of energy. In fact, as a custodian of some of the world's largest hydrocarbon reservoirs, we have a vested interest in the stability and longevity of petroleum as a reliable source of energy. For this reason, Saudi Aramco places top priority and focus on the responsible management of hydrocarbon resources.

The past few years have been critical for the energy markets and their stakeholders. The world has experienced the deepest economic downturn in more than 70 years, and is only just starting to show some positive signs of economic recovery. We hope that the positive economic trends of the past few months are sustainable.

Fueling economic recovery and prosperity requires significant investments all along the oil and gas value chain and in all regions, especially Asia and the Middle East. Saudi Arabia alone has been executing investment plans totaling more than $100 billion, involving maintaining and increasing oil and gas production capacities, as well as increasing and upgrading refining

and processing facilities, both in and out of Saudi Arabia.

We have recently achieved a crude oil production capacity increase to 12 million barrels per day, which is equivalent to nearly 15% of total global demand. This was achieved by putting on line one of the largest production increments ever, the 1.2 million barrels per day Khurais field complex. This new complex is just one of our recent mega-projects.

Khurais Oil Field
(photo supplied by Saudi Aramco)

These new projects are intended to enable us to maintain a strong spare capacity to allow us to react almost immediately in the event of urgent energy demand requirements or supply disruptions. We have constantly demonstrated our capabilities in this regard and today, we are in an even stronger position to do so, thanks to all of our investments, supported by one of the most technologically advanced exploration and drilling teams in the world.

Having achieved our crude oil production increase, we also are working to expand our gas production and processing capacities by 40%, which is mainly to fuel the local needs for electricity generation, desalination plants, petrochemicals and other industries.

3. Investment in the Oil Downstream Sector

Of course, Saudi Aramco's role is much more than oil and gas production. We are also a prominent player in the downstream sector, with seven refineries in Saudi Arabia, and several more across the world, including Japan. We are executing plans to build two new refineries in Saudi Arabia, in partnerships with international oil industry, with a total capacity of 800 thousand barrels per day. We are also upgrading existing refineries with association to petrochemical complexes.

Our downstream involvement is not only in manufacutring, but also includes a cross-country product distribution network and air fueling responsibilities in Saudi Arabia, as well as a large world-class fleet of marine vessels under the Vela Corporation.

These investments in the upstream and downstream, as well as our international investments in joint venture refineries in Japan, China, South Korea and the United States highlight our overall endeavor towards global market stability, continuity and reliability. Our special commitment to the Asian market is a cornerstone of this endeavor. These investments are also complemented by our strategic commitment to reliability through operational excellence in everything we do.

Vela Corporation's state-of-the-art tanker (Saiph Star)
(photo supplied by Saudi Aramco)

4. Initiatives for Stable Oil Supply

On average, Saudi Aramco identifies new proven reserves each year at least equivalent to the amount of crude oil produced, a number that currently exceeds 3 billion barrels per year. We expect to be able to maintain this pattern for several decades, even with projected increases in demand and production.

Sustaining this level of achievement requires constant investment in new and promising technologies. We operate in an environment of smart wells employing nanotechnology for sensing, and of remote geo-steering that can navigate drill bits thousands of meters below the earth's surface from control centers located hundreds of kilometers from the wellhead. Globally, seismic technology and other sophisticated imaging and reservoir modeling technologies have dramatically increased success in finding oil and gas fields and help the industry maximize recovery levels from reservoirs.

5. Training Human Resources for the Future

Central to Saudi Aramco's success as an energy producer is human talent. For all of the wonders of technology, we recognize that all technologies are simply extensions of human ingenuity. We attach the utmost importance to our investment in training and career development for our tens of thousands of employees. Developing our people was, and continues to be, one of the key success factors of our company.

JCCP has been for years a solid provider of learning resources for our employees, and we will be continuing to rely on your own level of excellence in helping us to enhance the training and knowledge of our young and motivated employees well into the future.

KAUST students
(photo supplied by Saudi Aramco)

6. Future Energy Supply

Managing the hydrocarbon resources that we are so fortunate to have in our country is not only about producing, manufacturing and distributing; that aspect is required, but is relatively straightfoward. At Saudi Aramco, we also place a high and equal value on protecting the environment, health and safety of our employees and surrounding communities.

In this regard, we share Japan's emphasis, and that of the entire world, on achieving ever more efficient uses of energy. The world's leading economies, including Japan, are already more energy efficient than at any time in history. Today, the world consumes 20% less energy per $1,000 GDP as it did back in 1990. For our part, Saudi Aramco is partnering with institutions throughout the world to help optimize energy efficiency.

For example, we are partnering with our affiliate here in Japan to develop pilot plants for solar-power electricity generation in Saudi Arabia. If anyone wonders why, it is because Saudi Arabia has not only the world's largest petroleum reserves, but also an abundance of the basic requirements for solar energy power generation. We have plenty of sunshine as well as pure-silica sand to use as raw material for solar panels.

However, while there are worthy aspirations for the development of renewable and alternative sources of energy in the future, sound projections indicate that Japan, like other leading nations, will continue to rely upon petroleum for decades to come. But as realists, we need to keep sight of the fact that renewable energy sources are projected to remain complementary to our energy needs for at least the next two decades.

As a result, for the well-being of the people on this planet who will need continued access to fossil energy, both energy producers and consumers will need to work as partners to make petroleum energy more efficient and friendly to the environment. We have made improving the quality of the transportation fuels to reduce their environmental impact a key focus area. We have been investing heavily in reducing the content of sulfur, benzene and aromatics in transportation fuels with the intent of reducing the company's environmental footprint. We are also investing in research and development efforts in the areas of carbon management, whole crude oil desulfurization, and fuel reformulation.

Finally, our emphasis on safety continues to provide demonstrated results as a world-class leader amongst our peers in the industry. Although we have been recognized many times for our safety performance, we will not be satisfied until we can sustainably achieve our goal of zero incidents.

We recognize that energy enables economic and social progress like no other commodity. As the largest producer with the largest reserves in the world, Saudi Aramco uniquely contributes to energy security for Japan and the entire global market.

Arigato gozai-mashita.

** This transcript has been produced by the JCCP Secretariat based on the speech given at the 28th JCCP International Symposium (January 27, 2010).*

** The responsibility for the wording of this transcript lies with the JCCP Secretariat.*

Activity Report from Researchers Participating in the Long-Term Researcher Dispatch Program

Introduction

Over the years, JCCP has developed cooperative relationships with major counterpart institutions such as King Fahd University of Petroleum and Minerals (KFUPM) and Kuwait Institute for Scientific Research (KISR) through international joint research programs and technical cooperation projects. To further strengthen and improve these relationships, JCCP sends veteran Japanese researchers to counterpart institutions long term to provide research support and engage in direct exchanges with researchers at those institutions under the Long-term Researcher Dispatch Program.

JCCP has dispatched three honorary university professors and a corporate researcher during the three years from FY2007 to FY2009. They mainly help their host institution develop research personnel and provide detailed research assistance in response to its needs.

Three researchers have been dispatched in FY2010. These researchers were asked to share some of the local information they have obtained by staying long term in the country of their host institution and interacting with local researchers, and to also introduce their research support activities.

Briefing session at JCCP, July 14, 2010

FY2010 Researchers

■ **Dr. Hideshi Hattori, Professor Emeritus, Hokkaido University**

(1) Host institution:
Center of Refining and Petrochemicals (CRP), Research Institute (RI), King Fahd University of Petroleum and Minerals (KFUPM)

(2) Term of dispatch:
Approxmately three months each year since FY2007 (this year's schedule is being planned)

(3) Research field:
Application of solid acid catalyst and solid base catalyst to oil refining and petrochemistry

■ **Dr. Katsuomi Takehira, Professor Emeritus, Hiroshima University**

(1) Host institution:
Center of Refining and Petrochemicals (CRP), Research Institute (RI), King Fahd University of Petroleum and Minerals (KFUPM)

(2) Term of dispatch:
Approximately three months each year since FY2009 (this year's schedule is being planned)

(3) Research field:
Research of catalysts for petrochemical feedstock production by ethylbenzene dehydrogenation

■ **Dr. Hidehiro Higashi**

(1) Host institution:
Petroleum Refining Department, Petroleum Research and Studies Center (PRSC), Kuwait Institute for Scientific Research (KISR)

(2) Term of dispatch:
Approximately three months each year since FY2007 (this year's schedule is being planned)

(3) Research field:
R&D on enhancement of practical evaluation performance of pilot plant tests and improvement of refinery operations

1. Research Activities at KFUPM in Saudi Arabia

Dr. Hideshi Hattori, Professor Emeritus, Hokkaido University

King Fahd University of Petroleum & Minerals (KFUPM) is the leading university for science and technology in Saudi Arabia. It is located on a small, rocky hill that sits on a massive oil field discovered in 1938 in Dammam Dome and was previously owned by the national oil company Saudi Aramco. In addition to numerous departments, the university also has a prominent Research Institute. Headed by Dr. Sahel N. Abduljauwad, Vice Rector for Applied Research, the Research Institute is composed of six research centers run by 140 staff members. The six centers are: (1) Communication & IT (CCIT); (2) Economics & Management (CEMS); (3) Environment & Water (CEW); (4) Engineering Research (CER); (5) Petroleum & Minerals (CPM); and (6) Refining & Petrochemicals (CRP).

The Center of Refining & Petrochemicals (CRP) has 24 staff members, and belongs to the Center of Research Excellence (CoRE) in Petroleum Refining & Petrochemicals. The CoRE program was established in 2007 to promote highly focused interdisciplinary research. It is a cross-sector research group composed of the university's departments of chemistry and chemical engineering, plus a number of outside research institutions (both national and international).

As a selected member of JCCP's Long-term Researcher Dispatch Program, I visited Saudi Arabia for three months each year (one month's stay × 3) from FY2007 to FY2009. I understood that my mission was "to strengthen our mutual research foundation and promote friendly relations between Japan and Saudi Arabia by providing research guidance and deepening ties between our two countries," and have worked toward achieving this goal.

The main focus of my activities was to promote studies of solid acid and solid base catalysis and to initiate new research projects. In my first year, I submitted several research plans to KFUPM and discussed projects that would be applicable for implementation with KFUPM. One of the projects I proposed, on alkane isomerization over tungstated zirconia modified by platinum catalyst, was taken up as a theme for a student's master's thesis. The student who was placed under my charge was an excellent student, who completed his thesis in two years and received his degree in the beginning of 2009.

To acquire research subsidies needed to pursue this research project, we applied to the Ministry of Higher Education for a research grant. The following year, in 2008, our application was accepted, and we received a 24-month research grant. The objective of our research was to develop a catalyst that would deliver high performance in the skeletal isomerization of alkanes higher than C6. This skeletal isomerization is a key to producing high-octane, high-quality gasoline that contains only small amounts of aromatic compounds, and is a theme related to technologies that are certain

The center of KFUPM, sitting atop a rocky hill (from the rooftop of the RI building)

The Research Institute, a prominent building on campus
The photo insert is of Dr. Sahel N. Abduljauwad, Vice Rector for Applied Research

to become necessary in the near future, as increasingly stringent global environmental regulations require gasoline to have an ever lower content of aromatic compounds. The research also corresponds to the flow of Saudization, the general policy of implementing production activities by the hands of Saudi Arabians as much as possible.

In FY2009, my third year at KFUPM, I continued to assist in the development and continuation of the research project that was approved by the Ministry of Higher Education. I also provided advice for the projects that are being carried out or planned by CRP, as well as for the formulation of a new plan for a project on solid base catalysis.

The thesis written by the master's degree student was published as two separate papers in the international journal, *Applied Catalysis A: General*, and the subsequent research that was conducted in FY2009 was presented at the TOCAT6/APCAT5 Conference held in Sapporo in July 2010 as the only oral presentation from Saudi Arabia. A full paper of the presentation is scheduled to be included in a special issue of *Catalysis Today* dedicated to TOCAT6.

KFUPM has been receiving technical assistance and cooperation from JCCP (or PEC) since around 1990, and has implemented numerous joint studies with JCCP over many years. It also has an ongoing relationship with JCCP in sponsoring research seminars on catalyst technologies and in sending participants to JCCP courses in Japan, and has strengthened and advanced the foundation of its research centers through these cooperation schemes. As a university-affiliated research center, CRP should perhaps focus on fulfilling its original role of strengthening basic research capacities. In this regard, I feel that more emphasis should hereafter be placed on basic research, in relation to CRP's future management policy.

The master's degree student who was in the charge of Dr. Hattori and the research scientist who provided his assistance in conducting experiments

Speaking of basic research, King Abdullah University of Science and Technology (KAUST) opened last year and is gathering human resources in basic research fields from all over the world. Its research plan shows an extensive list of themes related to leading-edge scientific technologies. KFUPM is also expected to contribute to technical advancement in its specific research field. JCCP's cooperation is highly evaluated at present, but university needs constantly change. To continue to be held in high regard in the future, I believe that JCCP and KFUPM should thoroughly discuss the future vision of the university at the global level before deciding on specific cooperation and assistance measures.

The weather in Saudi Arabia has been pleasant, perhaps because I have been visiting the country in moderate seasons. At KFUPM, I live in an on-campus guesthouse, which occupies a section of a residential area for university faculty. As the area is safe and comfortable, I have never worried about physical danger. The *adhan*, or ritual call to prayer that is heard from the mosque five times a day, has become a part of my daily rhythm.

2. Research Assistance at KFUPM in Saudi Arabia

Dr. Katsuomi Takehira, Professor Emeritus, Hiroshima University

1. Introduction

I have spent three occasions in FY2009 and FY2010 providing R&D assistance on petrochemical feedstock production catalysts at the Center of Research Excellence in Petroleum Refining and Petrochemicals in King Fahd University of Petroleum & Minerals (KFUPM) located in Dhahran, Saudi Arabia. My first stay was from October 16 to November 20, 2009; the second was from January 6 to February 5, 2010; and the third was from February 19 to March 10, 2010. While JCCP's Long-term Researcher Dispatch Program began in FY2007, my participation in the program has been from FY2009.

2. Research Theme

The focus of my research in FY2009 was specifically placed on the development of a styrene production catalyst by ethylbenzene dehydrogenation. This project was sponsored and funded by King Abdullah University of Science and Technology (KAUST), a new research institution established last year on the coast of the Red Sea in Jeddah, and was implemented at KFUPM as one of several projects adopted by KAUST in various fields including the catalyst development field. For this reason, I belong to the KAUST Center in Development at KFUPM. In FY2009, I also received a request from Saudi Basic Industries Corporation (SABIC) for the development of a propylene production catalyst by propane dehydrogenation. In January 2010, I proposed a project for development of a new hydrotalcite catalyst, but received a message in June that it will not be implemented, due to the tight supply of raw propane in Saudi Arabia. Nevertheless, as worldwide demand for propylene production has been growing in recent years, KFUPM has thereafter commenced a research and development project with SABIC to address propylene production by catalytic cracking of naphtha.

With Mr. A. Khurshid in front of the styrene production reactor

3. Research Progress

With respect to the development of a styrene production catalyst by ethylbenzene dehydrogenation, I proposed to develop an oxidative dehydrogenation catalyst using air or carbon dioxide as a soft oxidant, as shown in Fig. 1. My plan was to produce a highly dispersed iron oxide catalyst derived from Mg-Al hydrotalcite and conduct an activity test using a fixed-bed gas flow reactor, at KFUPM. For catalyst characterization, I requested KFUPM to undertake the atomic absorption analysis and differential thermogravimetric analysis (Mr. A. Khurshid); the analysis of X-ray diffraction, N_2 absorption, and CO_2-TPD to Hiroshima University (Prof. T. Sano); Mössbauer absorption analysis to the University of Tokyo (Prof. K. Nomura); and TPR and XPS analyses to Ehime University (Prof. H. Yahiro). I intended to prepare different types of catalysts and evaluate their

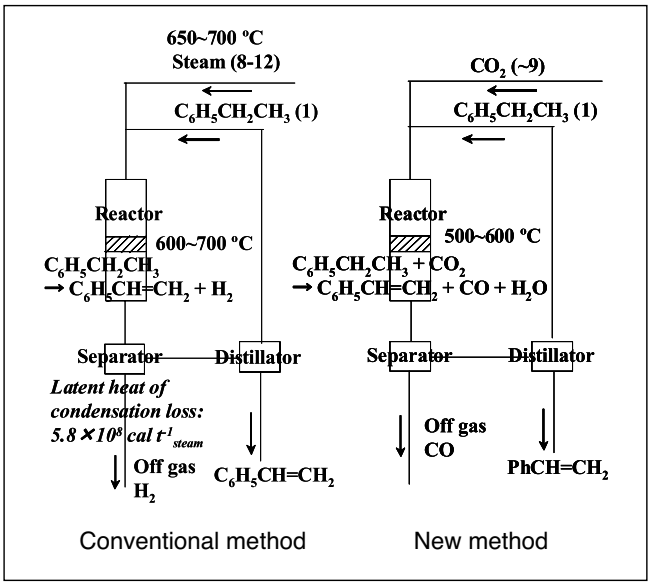


Fig. 1: New styrene production method

activities, but lacked the necessary manpower and reactor environment at KFUPM. Therefore, I shared the reactor that Prof. H. Hattori (KFUPM) was using in his research on "alkane isomerization over tungstated zirconia modified by platinum catalyst," and had Dr. R. Jermy, a post-doctoral researcher, perform the activity test. Thereafter, a third-year undergraduate student and later a master's course student (Mr. A. Al-Ali and Mr. L. Atanda) offered to help prepare the catalysts, and the research gradually began to make progress.

4. Research Results

It has already been confirmed that Mg/Fe/Al oxide catalysts derived from a hydrotalcite precursor (Fig. 2) display high activity.[1)] Since gas analysis was not possible with the reactor we used, we could not examine oxidative dehydrogenation reaction using air or carbon dioxide, but we examined the simple dehydrogenation activity of ethylbenzene by preparing Mg/Fe/Al oxide catalysts with a part of the Fe replaced with Cu, Zn, Cr, Mn, Co, or Ni. Because iron catalysts were used in the presence of hydrogen, the activity test was conducted under the inert gas atmosphere of He and not N_2, to avoid producing NH_3. Among the metal species added, Co displayed the best effect as an additive, followed by Ni, while the other metals showed negative effects (Fig. 3). Then, we tried to clarify the factors improving catalytic activity by Co addition in comparison with the effect of Ni. As the result, the high activity of the $Mg_3Fe_{0.25}Co_{0.25}Al_{0.5}$ catalyst seemed to be promoted by the reduction-oxidation between Fe^{3+} and Fe^{2+} and by the stabilization of Fe^{3+}/Fe^{2+} by the formation of Fe-Co binary system. Moreover, a part of Mg^{2+} in $Mg_3Fe_{0.5}Al_{0.5}$ mixed oxide was replaced with Zn^{2+} to test the effect of MgO as the support. We found that catalyst activity declines with an increase in Zn replacement (Fig. 4). It was concluded that the dehydrogenation of ethylbenzene was initiated by the β-H^+ abstraction to form an electron rich intermediate on $Mg^{2+}O^{2-}$ basic sites, followed by α-H^- abstraction on Fe^{3+} acid sites to produce styrene. As previously mentioned, this research was pursued as a project commissioned by KAUST, a new research university which has just recently opened. KFUPM has also begun to show strong interest in our academic research and new findings in recent years. Based on this situation, we compiled and contributed the results we

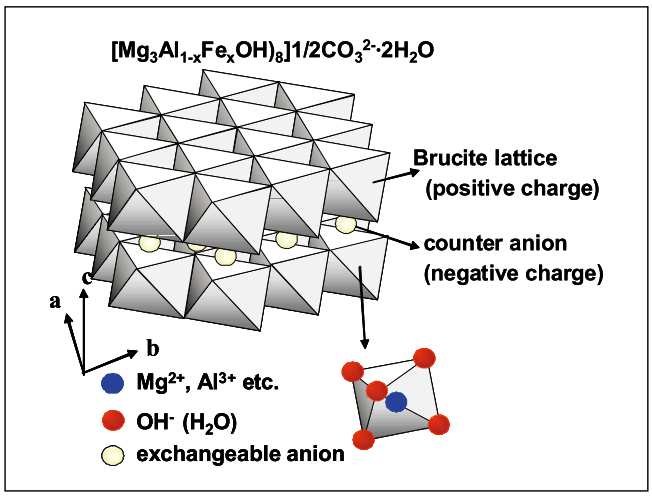


Fig. 2: Hydrotalcite

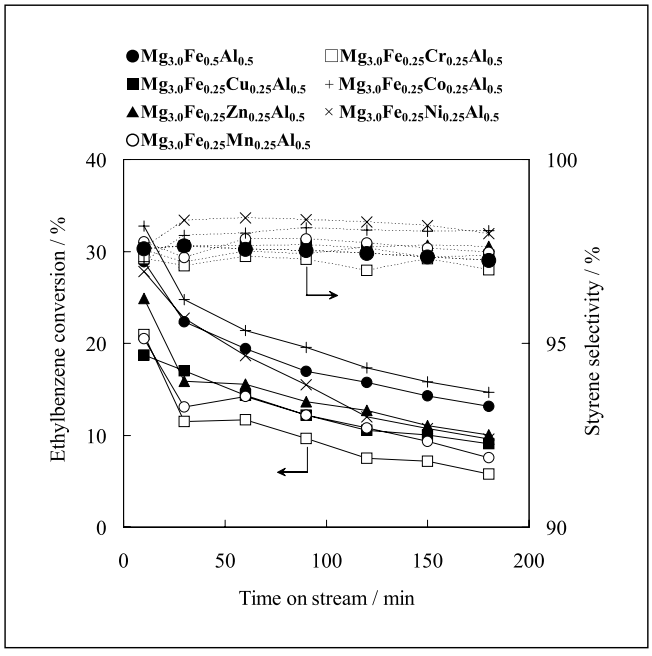


Fig. 3: $Mg_3Fe_{0.25}Me_{0.25}Al_{0.5}$ catalyst activity

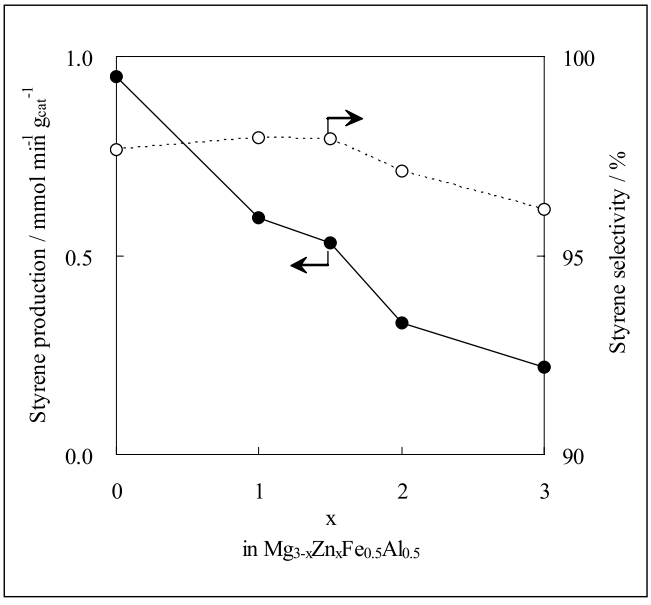


Fig. 4: $Mg_{3-x}Zn_xFe_{0.5}Al_{0.5}$ catalyst activity

obtained in the following three papers: (1) "Ethylbenzene dehydrogenation over binary FeO_x-MeO_y/Mg(Al)O catalysts derived from hydrotalcites"; (2) "Ethylbenzene dehydrogenation over FeO_x/(Mg,Zn)(Al)O catalysts derived from hydrotalcites: Role of MgO as basic sites"; and (3) "Ethylbenzene dehydrogenation over $Mg_3Fe_{0.5-x}Co_xAl_{0.5}$ catalysts derived from hydrotalcites: Comparison with $Mg_3Fe_{0.5-y}Ni_yAl_{0.5}$ catalysts."

5. Research Summary

The research progressed smoothly in FY2009, and the KFUPM researchers and I were able to compile our results in three papers, as mentioned above, to be submitted to international journals under our joint names. We intend to continue with the research, and to apply ourselves to the development of oxidative dehydrogenation catalysts. The results we have achieved so far will be presented at the KCC Symposium on Catalysis on 7-9 December 2010 by Dr. Sulaiman S. Al-Khattaf, Director of the KFUPM Center of Refining & Petrochemicals and leader of this project. An additional piece of information worthy of note in regard to this research is that the Mg-Al hydrotalcite that we used in preparing our catalysts is garnering attention for its possible application to the PSA separation of CO_2. In fact, KFUPM has just recently received an inquiry about it from Saudi Aramco. The widespread application of the hydrotalcite not only to catalysts, but also to separators and diverse other purposes, can be expected in the future.

I received support from many people in implementing my one-year research project at KFUPM. With the cooperation of the people at KFUPM, we were able to compile the results of our research in the three papers mentioned above in a relatively short period of time. Many researchers at KFUPM's research center have been to Japan as participants of training programs, and are friendly and cooperative with Japanese people on the whole. Even aside from the research, I have enjoyed spending time with them. To enhance the potential of the research center even more in the future, it is perhaps necessary to install a new reactor that is compact enough to ensure mobility, and to maximize the operations of various analysis equipment for catalyst characterization. KFUPM prides itself on its long history, but it is at a time when it needs to further improve its standing as a university originally devoted to basic research areas, particularly given the opening last year of KAUST, a new global-scale graduate university. In this regard as well, it seems that publishing research results in international academic journals is becoming increasingly important.

Reference
1) Y. Ohishi, T. Kawabata, T. Shishido, K. Takaki, Q. Zhang, Y. Wang, K. Nomura, and K. Takehira, *Appl. Catal. A: General* 288 (2005) 220-231.

3. Research Assistance at KISR in Kuwait

Dr. Hidehiro Higashi

Kuwait Institute for Scientific Research (KISR) was my host institution under the JCCP Long-term Researcher Dispatch Program. It was established approximately 40 years ago, and is the only public research institution in Kuwait. KISR's precursor was a research center founded by Arabian Oil Company Limited, which had a concession agreement to develop the Khafji Oil Field. The company later donated the research center to the Kuwaiti government, where it was placed under the control of the Ministry of Higher Education and given a greater scope of research and personnel. Today, it is headed by Dr. Naji Mohamed Al-Mutairi, Director General, and is headquartered in Al-Shuwaik, Kuwait City. Studies in areas other than petroleum, which are primarily related to environmental issues, are based in the headquarters, and studies related to petroleum are conducted at the Petroleum Research & Studies Center (PRSC) in Ahmadi, under the directorship of Dr. Abdulhameed A. Al-Hashem. With approximately 800 researchers under its wing at present, 65 to 70% of whom have an academic degree, KISR is one of the most respected scientific institutes in the Middle East. The Kuwaiti government places large expectations on KISR, and is presently considering making further expansions. From 2009 to the present, I have made three brief stays at PRSC, each about one month long, to provide research guidance on hydrotreating catalysts mainly to Dr. Hamza Albazzaz, Senior Researcher, under the general supervision of Dr. Meena Marafi, Manager. I have also provided research guidance on the characterization of aspahltene contained in residual oil (generally defined as an n-heptane insoluble matter; the main material used to make road-pavement asphalt), which has never been the focus of studies in this area before, and on its impact on catalytic reactions.

Kuwait owns and operates a national oil company called Kuwait Petroleum Corporation (KPC) under the direct management of the Ministry of Energy. KPC has ten affiliated companies (wholly owned subsidiaries) under its umbrella, to attend to all aspects of the oil business, including the exploration, development, production, refining, shipment, marketing, and overseas investment of crude oil and natural gas. Kuwait National Petroleum Company (KNPC) is one of KPC's subsidiaries specializing in oil refining. KNPC currently operates three refineries with a combined refining capacity of 900,000 b/d: the Mina Al-Ahmad Refinery (MAA), Mina Abdullah Refinery (MAB) and Shuaiba Refinery. It also has a plan to construct a fourth refinery with a capacity of 600,000 b/d, although the plan has been suspended for the time being due to various circumstances. Because KNPC does not have a research center, studies and assessments requested by its refineries are outsourced to PRSC at cost. To PRSC, therefore, KNPC is a customer who provides research funds. Kuwait produces mainly heavy crude oil, and reduced crude, which is used as fuel, contains as much as 4% sulfur. If this reduced crude is burned as it is and used to generate electricity, large amounts of

Inspection of research facilities at KISR (Sept. 2007)

With hydroplant engineers and operator

SOx would be released into the atmosphere as a source of air pollution. For this reason, KNPC has a number of direct desulfurization units to remove the sulfur content of reduced crude using catalysts. They include two UOP units with two trains, a Chevron unit with two trains, and a UOP unit with one train, which provide a total processing capacity of 300,000 b/d. KNPC is the only refinery in the world heavily equipped with so many direct desulfurization units. It is worth noting that the fixed-bed direct desulfurization unit was demonstrated for the first time in the world approximately 40 years ago in Japan. The many types of direct desulfurization units that have been constructed and exist throughout the world today have followed on the heels of this successful demonstration. Over many years, Japan has also continued to research and improve hydrodesulfurization catalysts for use in desulfurization units, and has provided technical support for development of the catalyst and operational technologies of the unit to overseas oil-producing countries with JCCP's cooperation.

Precisely because KNPC operates so many direct desulfurization units, it is strongly seeking to optimize its catalyst selection technology for those units and to further increase operational efficiency. KNPC seeks the expertise of KISR-PRSC in many issues.

It is understood that KISR has consistently and accurately addressed KNPC's needs for technical support and research and development through the years. In the future, it will probably be expected to improve the evaluation precision of practical catalyst performance and to cultivate even more advanced catalyst selection technology as well as other development technologies. Under this Long-term Researcher Dispatch Program, I hope to apply my many years of experience in the catalyst R&D field to providing cooperation and assistance to KISR in response to such new needs.

Within the cooperative research in the refining field, Dr. Hamza Albazzaz and I proposed to implement a research project under a joint framework of KNPC, KISR-PRSC, and the licensor who designed the units. Spanning a period of three years, the project would aim to analyze and improve the operation of refinery units by creating a cold flow reactor model that is large enough to observe the flow of catalysts, gas, and oil inside the reactor, and also to examine the impacts of asphaltene on catalyst activity by constructing a pilot unit for high-pressure testing which could also be used for catalyst evaluation. The cost of implementing the project was proposed to be borne by KNPC and KPC as the project beneficiaries. As a result, KPC/KNPC gave their approval, and agreed to launch the project in FY2010. I believe that this three-party project would improve relationships between KNPC and KISR-PRSC and would create a golden opportunity for KISR-PRSC researchers to familiarize themselves with actual units. PRSC's Dr. Meena Marafi appointed Dr. Hamza Albazzaz as project leader, but I will also be providing my full support, as it is an important and large-scale project.

With Dr. Hamza Albazzaz, Senior Researcher

Recently, there has been another new development. That is, it has been decided that KPC/KNPC will launch its own research center this coming spring. The new research center is likely to advance along the path of oil-related studies and applied research. If it does, it may become the same as PRSC, which also engages in oil-related studies, but I understand that KISR has plans to shift its focus to basic research to avoid the overlap. In the case where KISR does choose to pursue basic research, I am thinking to provide assistance to make certain that everyone fully understands the importance of collecting basic data steadily over time. In consideration of all the above, JCCP can probably expect to receive requests for cooperation from both the new KPC/KNPC research center and from KISR, and may need to further extend its technical cooperation program to adequately respond to their needs.

For Greater Practicality of JCCP Courses

JCCP courses provide practical training with the cooperation of oil companies and other JCCP member companies, and are widely acknowledged in oil-producing countries, as can be seen by the fact that twice as many applications as openings are received for each course.

However, changes are taking place in oil industries throughout the world, including a trend toward the privatization of national oil companies, and the Middle East countries in particular have gradually begun to voice their needs for even more practical JCCP courses as they pursue greater efficiency and safety in oil operations. In response to these mounting expectations, we are currently exploring measures toward strengthening the practical nature of JCCP courses, as outlined below.

1. Review of Present Situations

First of all, we have assessed present situations and needs based on knowledge acquired from our numerous visits to oil-producing countries in the past and on information obtained from participants who have come to Japan.

As a result, we found that aside from minor differences according to country, the following situations were common to all Middle East countries.

(1) Oil companies in oil-producing countries are shifting their corporate structure to one that prioritizes profitability and are pursuing efficient operations.
(2) Due to frequent occurrences of refinery accidents, there is strong interest in safety measures.
(3) There is a strong inclination toward the integration of refineries and petrochemistry.
(4) Efforts are being directed to the development of human resources in a post-petroleum era, by promoting labor nationalization policies, regulating the rapid influx of foreign laborers, and creating greater employment for national citizens.
(5) The construction, expansion and modernization of refineries is a pressing issue.

Based on awareness of the above, we spent more than half a year internally discussing how we might make JCCP courses more practical than before, and ultimately established future action guidelines after also consulting with JCCP's Working Group for Country-specific Action Plan, a committee composed of outside members.

2. Future Action Guidelines

The future action guidelines are composed of four policies, including responses to common needs in oil-producing countries and responses to specific needs, based on the Country-specific Action Plan.

They also include improvement measures, organized according to their urgency: those that need to be promptly implemented; those that should be implemented with a medium-term perspective; and those that should be implemented after the necessary institutional changes are made.

As the action guidelines cover more ground than can be introduced here, we will simply present the main points below.

(1) Measures for prompt implementation

We will shift the focus of our basic approach to training from "teaching" to "learning together," and aim to offer courses that not only provide unilateral lectures but also encourage interactive discussions and exchanges of views among participants in small groups, and that not only teach technical skills but also thinking skills.

We will also devise methods of imparting Japanese-style operational know-how regarding management practices.

Furthermore, we will propose and implement special programs designed in response to specific needs in oil-producing countries through consistent visits and communication.

(2) Measures for implementation with a medium-term perspective

We will aim to provide more depth to offsite training at refineries by incorporating plant tours and discussions with engineers.

We are also giving consideration to offering special courses for groups composed of members from multiple Middle East countries.

(3) Measures for implementation after making the necessary institutional changes

We will examine how we can more effectively

Discussion and presentation session held after improvements were made to special courses

respond to requests for the long-term dispatch of experts to oil-producing countries and requests for participation in courses in Japan. We will also consider introducing new courses, such as on petrochemical topics.

3. Implementation of the Action Guidelines

We are implementing the action guidelines beginning with items that are more readily feasible.

The examples below show some of the improvements that have been made so far.

(1) Example of improvement in regular courses

Regular courses are held in Japan with the participation of a group of ten to twenty members composed of one to two members each from different countries. JCCP offers more than 20 regular courses each year, as the core of JCCP-initiative programs.

A significant number of regular courses require participants to give a presentation, depending on the feature topic of the course. Previously, it was a one-sided exercise where each participant simply delivered a presentation through to the end and responded to questions afterward. However, we made these presentation sessions interactive, by having participants engage in mutual discussions within small groups before giving a summary presentation to the other participants.

This change allowed participants to engage in deep discussions beyond a surface-level question-and-answer process and gain greater understanding of various presentation topics.

(2) Example of improvement in special courses (customized programs)

Special courses are held in response to individual needs of oil-producing countries, and are implemented either in the relevant country or in Japan.

In a special course implemented in Saudi Arabia last year, we incorporated a group discussion session for the first time in a special course held in an oil-producing country. In the session, the participants were instructed

to "discuss ideals in their workplace and the gap (problem) between those ideals and reality." They spent the morning hours in small groups, identifying common issues, discussing the reality and ideals of those issues, and deriving an action plan for solving them, and then gave group presentations in the afternoon.

This type of discussion, based primarily on the difficult task of identifying common issues among participants, cannot be achieved in regular courses in which participants are from different countries and companies. It is possible, however, in special courses, precisely because all participants are from the same company and can openly discuss any topic related to their company.

This first attempt at holding a group discussion in a special course was extremely well received by the participants, and elicited requests to hold similar workshops in the future.

(3) Implementation of new, long-term special courses

As a new initiative for responding to oil-producing countries' requests for long-term training, we launched a new type of special course that spans an extended period of roughly two months. The course was offered to participants from Saudi Arabia and Iran from the end of May 2010, and received favorable reviews stating that it provides deeper training compared to regular courses.

(4) Implementation of a new information exchange program for young engineers

Another new initiative we launched in FY2010 is a program that contributes to the development of young personnel in oil-producing countries and Japan by inviting young engineers to make reciprocal visits to each other's country. This year, the program was offered in May and June to young engineers in Saudi Arabia and Japan, and was appreciated by all participants as a meaningful program that has allowed them to gain understanding of situations in each other's country, acquire insight that is beneficial to their respective duties, and create a new network of relationships.

4. Future Efforts

To offer training programs that are more practical than ever before, we will make gradual improvements based on our future action guidelines, with the cooperation of all partner companies and organizations in consideration of the degree of feasibility of each measure.

At the same time, JCCP lecturers will continue to make consistent visits to oil-producing countries to directly assess their needs in even more detail and to respond to those needs based on the PDCA cycle.

<by Shigeyoshi Takahashi, Training Dept.>

New JCCP Training Initiative: Implementation of a Long Course

"Practical Training for Young Instrumentation and Control Engineers"

JCCP launched a long course called "Practical Training for Young Instrumentation and Control Engineers" this fiscal year as a new initiative in training. Intended for young engineers in the instrumentation and control fields in Middle East oil-producing countries, the course was designed to provide practical training through a systematic program that covers a broad range of topics, from basic to applied technologies in the two fields, with a main focus on hands-on learning.

For successful implementation, the course required a net number of 39 days. Including weekends, it spanned a total of 53 days, from May 25 (Tue) to July 16 (Fri), 2010. An overview of the course is provided below.

Course participants

1. Background to Implementation of the Course

Since last year, we at JCCP have been contriving ways to enhance the practicality of our courses in order to offer training that more closely responds to the needs and requests of oil-producing countries and is even more beneficial than before. Particularly in the instrumentation and control fields, regular course participants have voiced strong requests for systematic training on wide-ranging topics, from basic to applied technologies. The said long course was formulated under this situation, after much trial and error.

Our main concern was in designing a program that ensures both systematic and practical implementation. While basing it on a regular course program, we also needed to take steps to prevent obsolescence, by featuring the latest technologies, maintaining a high level of specialty, and incorporating hands-on training in addition to lectures. Toward this end, we obtained full cooperation from multiple Japanese companies related to instrumentation and control, and began designing the program roughly a year ago, around summer 2009.

Another major issue we faced was in the selection of countries and companies that are interested in participating in a long course and that could afford to send participants to Japan over such a long period of time. With the cooperation of JCCP's various departments, we spent many occasions making a careful selection of potential countries mainly among the Middle East oil-producing countries. Throughout this selection process, Iran and Saudi Arabia, which have consistently supported JCCP's efforts since the very beginning, have taken strong interest in the new course as having potential to produce significant results, by offering various suggestions and requests. Therefore, in the end, we designed a long customized course for a group of participants from two countries, Iran and Saudi Arabia.

2. Course Overview

(1) Participants

The course was offered to Iran and Saudi Arabia, and was attended by a group of nine participants, four from Iran (NIORDC) and five from Saudi Arabia (ARAMCO). Members from the two countries included one leader and one middle-level engineer each from different refineries. The engineers were aged 35 and above on average (Iranian participants were between the ages of 35 and 41; Saudi Arabian participants were between 27

and 39), and equally represented the instrumentation and control fields.

It was evident in their every action that the participants came to the training filled with enthusiasm as selected representatives of their countries. Although they may have felt some worries about leaving their workplace responsibilities for close to two months, they displayed a high degree of determination to make the most of the training opportunity and take home all the necessary knowledge and experience. For example, while they gave unstinting applause to lectures they felt were particularly satisfying and agreeable, when they had a question, they continued to seek clarification of the issue until they were fully satisfied. Many of the Saudi Arabian participants were especially quick to ask questions whenever a lecturer presented even the slightest information they did not understand. At the same, however, they also warned each other when they felt that their questions were interrupting a lecture for too long, and maintained a good balance among the group. The Iranian participants, on the other hand, tended to ask relatively few questions during the lectures but saved them until the end so as not to interrupt the flow of the lectures. The lecturers noted with interest this difference between participants from the two countries.

The two-country makeup of the group, with each country's members coming from different refineries and regions in their countries, seemed to have a positive effect on the participants themselves during their prolonged stay in a foreign country. It allowed them to mutually share and gain a different perspective on specific workplace issues while also providing a sense of reassurance in number. Members from the same country tended to stay together as a group outside of the course, but during hands-on exercises and practical training, they actively communicated with each other and worked in a concerted manner irrespective of nationality.

(2) Selection of Program Topics

The course was designed to provide knowledge of basic to applied technologies in the instrumentation and control fields in a practical fashion, as mentioned above. Under the two large headings of "instrumentation" and "control," four categories of topics were organized according to basic and applied technologies.

For example, for the control field, the "basic" part included lectures on controller tuning theory and practice using a simulator, which is also a popular topic in JCCP regular courses, and an overview of advanced control; the "applied" part featured a lecture on model predictive control (MPC), a representative method of advanced control, and practical training on a method of optimization combining MPC and a process model. For the instrumentation field, the "basic" part provided lectures on basic measurement principles for flow rate, temperature, pressure, and other such parameters, and the "applied" part covered equipment maintenance, practical training on relevant tasks from the formulation of basic design to onsite construction, the advanced technology of field bus designing, and loop designing based on process control characteristics.

Details of each program are provided in the following section under "Control-related training provided at JCCP," "Instrumentation-related training provided at JCCP," and "Offsite training." Offsite training focused on providing first-hand knowledge of applied and new technologies in instrumentation and control through visits to refineries and plants.

The programs were specifically developed with tremendous cooperation from nine major companies related to instrumentation and control in Japan. A total of 29 programs were developed, including ten control-related programs provided at JCCP, nine instrumentation-related programs provided at JCCP, and ten offsite training programs. Of these programs, more than 60%, or 19 programs to be exact, were new programs offered for the first time (12 JCCP programs and seven offsite programs). The nine cooperating companies agreed to dispatch 67 employees as lecturers, and to implement ten of the offsite training programs over a period of 16 days.

The number of cooperating companies, the names of companies that provided offsite training, and the number of lecturers are as follows.

1) Name of companies by field: 9 companies

(i) Instrumentation and control device manufacturers (4 companies):
- Yokogawa Electric Corporation
- Yamatake Corporation
- Emerson Japan, Ltd.
- Oval Corporation

(ii) Engineering companies (3 companies):
- JGC Corporation
- Toyo Engineering Corporation
- Chiyoda Corporation

(iii) Oil companies (2 companies):
- JX Nippon Oil & Energy Corporation
- Idemitsu Kosan Co., Ltd.

2) Offsite training: 10 programs

A total of 10 programs (7 new programs) were implemented at 9 sites of 6 companies, including 2 oil companies. JX Nippon Oil & Energy Corporation implemented 2 programs.

(i) JX Nippon Oil & Energy Corporation
(ii) Yamatake Corporation, Niigata Operational Training Center (Niigata)
(iii) Idemitsu Kosan Co., Ltd., Tokuyama Refinery and Training Center (Tokuyama)
(iv) Emerson Japan, Ltd., Solutions Center (Kurashiki)
(v) Yokogawa Electric Corporation, Mitaka Head Office (Mitaka)
(vi) Yokogawa Electric Corporation, Kofu Plant
(vii) Oval Corporation, Yokohama Operation Center (Yokohama)
(viii) Yamatake Corporation, Shonan Plant (Chigasaki)
(ix) Yamatake Corporation, Fujisawa Techno Center (Fujisawa)
(x) JX Nippon Oil & Energy Corporation, Oita Refinery

* New programs were implemented at sites (i), (ii), (iv), (vi), (vii), (ix), and (x).

At the Niigata Operational Training Center

3) Lecturers

Lectures and offsite training were conducted by four JCCP lecturers and a total of 67 specialist employees from cooperating companies. At offsite locations, 45 engineers provided training, assisted by large numbers of plant personnel and staff members who facilitated equipment maintenance exercises and the smooth implementation of lectures.

The following is a list of the number of lecturers by company.

(i) Yokogawa Electric Corporation:
23 + plant personnel
(ii) Yamatake Corporation:
15 + plant personnel
(iii) Emerson Japan, Ltd.:
5 (including 4 engineers dispatched from abroad)
(iv) Oval Corporation:
2 + plant personnel
(v) JGC Corporation:
4
(vi) Toyo Engineering Corporation:
7
(vii) Chiyoda Corporation:
4
(viii) JX Nippon Oil & Energy Corporation:
5 + refinery staff
(ix) Idemitsu Kosan Co., Ltd.:
2 + refinery staff

(3) Main Details of Programs

Most of the programs were well accepted by the participants, but since not all details can be provided, the following is a general summary of programs that successfully embodied our goal of providing "training that is more practical than before."

1) Control-related training provided at JCCP: 10 programs

(i) The nine programs in the control field provided a verification of basic theories and technologies related to process control, but the content sufficiently satisfied and captured the attention of the technically advanced participants of the course.
(ii) Among these programs, the combination of skillful lecture techniques and hands-on simulator training seemed to be especially valid

Simulator training at JCCP

in the practical training on DCS (distributed control systems) related to offsite training at JX Nippon Oil & Energy Corporation's Niigata Operation Training Center and the practical training on classic control theories.

(iii) A lecture on Kaizen was provided in response to a strong request from the participants. Although it was not directly related to the theme of the course, the request reflected the participants' high level of interest in Japanese-style operational improvement practices, and offered a perspective for observing various initiatives implemented at the sites of offsite training provided by cooperating companies.

2) Instrumentation-related training provided at JCCP: 9 programs

(i) Beginning with a basic lecture on measurement principles for instrumentation devices, three major engineering companies in Japan were asked to conduct programs on equipment maintenance, tasks from basic designing to onsite construction work, and the flow of operations in an actual project. As all programs were newly developed for this course, we took care so that the lectures by the three companies do not overlap each other.

(ii) Each cooperating company applied creative ideas to their lectures and hands-on training, and provided an understanding of the significance of "designing," a concept with which the participants were not necessarily familiar. Furthermore, combined with hands-on training at an instrumentation device manufacturer using actual devices, the program proved to be highly effective.

3) Offsite training: 10 programs

(i) JX Nippon Oil & Energy Corporation and Yamatake Corporation, Niigata Operational Training Center (Niigata): May 31 (Mon.) – June 2 (Wed.)

- As these two companies utilize their idle refinery production facilities for hands-on operational training, they were asked to implement two new programs that use those facilities.
- One of the themes of the new programs was to provide practical training using actual facilities on the functions and maintenance procedures for DCS and instrumentation devices at Yamatake Corporation. The other was to provide a series of operational training from the startup of standalone equipment to emergency countermeasures at JX Nippon Oil & Energy Corporation.
- The programs implemented by these two companies composed an integral part of the systematic, practical training that included computer simulation at JCCP, mini plant operations, and actual plant operations at oil companies.
- It seems that most of the participants had already received training in instrumentation and control in their countries or at a training center in Europe, but they nevertheless showed interest in the Niigata Training Center's training methods, mostly owing to the lecturer's high teaching skills. They seemed particularly interested in its methods of providing skills for handling instrumentation devices in an actual plant and operational control techniques through training.

Training using an actual plant

(ii) Idemitsu Kosan Co., Ltd., Tokuyama Refinery and Training Center (Tokuyama): June 14 (Mon.) – June 15 (Tue.)

- The Tokuyama Refinery uses an independently developed advanced process control system in its actual operations, and provided the participants with an invaluable opportunity to observe first-hand a control application in operation in an instrument room.
- The participants had many questions about the refinery's maintenance system prior

to making the visit and asked even more detailed questions in the instrument room about the division of roles among the officers and their daily routines and tasks. Refinery engineers responded to each and every question with sincerity, and created an extremely favorable impression among the participants.

At the Tokuyama Refinery

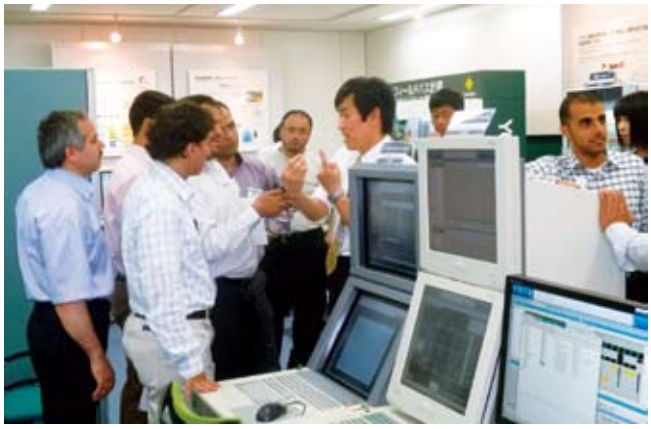
(iii) Emerson Japan, Ltd., Solutions Center (Kurashiki): June 16 (Wed.) – June 17 (Thu.)

- In response to the participants' strong request to study the latest instrumentation technologies, Emerson Japan provided thorough training on a wireless instrumentation system by bringing in an expert engineer from abroad and using a specially built demonstration unit.
- As a result of the participants' strong interest in wireless instrumentation coupled with the company's effective presentation of the topic, the program was highly appreciated and well received by all participants.

Placing special emphasis on new technologies

(iv) Yokogawa Corporation, Mitaka Head Office (Mitaka) and Kofu Plant (Yamanashi): June 21 (Mon.) – June 23 (Wed.)

- Yokogawa Corporation provided a highly motivating program covering many new technologies as requested by the participants, and also provided a tour of its instrumentation device plant in Kofu for the first time.
- The participants rated the program highly, as it covered products that they familiar with, while also emphasizing new technologies.
- The visit to the Kofu Plant not only provided an engaging look at Japanese-style management, including the 6S+S (5S + safety + sense) concept and practice, but also allowed the participants to witness the scenic beauty of Japan as they traveled to the plant, located at some distance from Tokyo.



Participants displayed strong interest in new technologies

(v) Oval Corporation, Yokohama Operation Center (Yokohama): June 25 (Fri.)

- We asked Oval Corporation to organize a new offsite training program, because the company is well known in some of the oil-producing countries as a manufacturer of flow meters, and also because it is able to provide training in the disassembly and maintenance of independent devices at its facility.
- Since the participants had already studied the structure and functions of instrumentation devices in advance, the program provided at the company's Yokohama Operation Center focused on hands-on disassembly, maintenance, and assembly of actual devices. Learning about relevant devices

and at the same time acquiring knowledge and practice in actually disassembling and assembling those devices in a single training program seemed to be a new experience even to the instrumentation engineers of the course. With perspiration glistening on their foreheads, they happily applied themselves to the disassembly/assembly exercise.

Participants practicing the disassembly and assembly of instrumentation devices

(vi) Yamatake Corporation, Shonan Plant (Chigasaki) and Fujisawa Techno Center (Fujisawa): July 5 (Mon.) – July 7 (Wed.)

- Yamatake Corporation had organized a program centered on the maintenance of DCS and instrumentation devices (control valves), but in response to the participants' request, we asked them on short notice to allot some time to providing training on DCS and safety instrumentation systems.
- A well-balanced training on the maintenance of control valves was achieved through the combination of a detailed introduction of the product manufacturing process at Shonan Plant, and lectures and disassembly/maintenance practice of independent devices at Fujisawa Techno Center.
- The participants possessed extensive theoretical knowledge about instrumentation to begin with, but the program provided a valuable and highly meaningful experience by offering the opportunity to confirm the functions of a device while actually disassembling it.

(vii) JX Nippon Oil & Energy Corporation, Oita Refinery: July 12 (Mon.) – July 13 (Tue.)

- We asked JX Nippon Oil & Energy Corporation to provide a training program at its Oita Refinery for the first time, because it is advanced in the digitization of documents (specifications, systematic diagrams, etc.) and has a well-established maintenance system in place.
- The refinery had just completed major periodical repairs in June, immediately prior to providing the offsite training program, and had little time for preparation. Nevertheless, the staff were kind and patient in responding to the participants' many questions with detailed answers.
- The opportunity for direct exchanges with refinery engineers was also a significant factor of the program to the participants.

Participants practicing maintenance

At the Oita Refinery

3. Observations

Initially, we intended for the course to be attended by young engineers with around three years' experience in instrumentation and control, but the participants who actually took part in the course were middle-level engineers specializing in the two fields. To match their high level of technical expertise, we had all of our lecturers modify their originally planned programs, and were thus concerned until the very end as to whether the participants would find the course to be satisfactory on the whole.

Upon completion of the course, we were relieved to find that all nine participants evaluated the course as almost entirely satisfactory, and that we had achieved our goal of providing courses that are "more practical than before." While we are proud of having designed an optimum course, we also owe the successful implementation of the course to the outstanding quality of the participants and to the generous cooperation of highly advanced Japanese companies.

Despite spending close to two months attending an extended training course in a foreign country, an Iranian participant noted that he never once felt homesick. We are glad, and hope that other participants also felt this way owing to the fact that they were with other members from their country, and also to the Japanese people who interacted with them in a friendly manner.

It is particularly worth mentioning that the group of middle-level engineers who participated in this course displayed a high level of expertise and knowledge, an enthusiastic attitude toward training, and a strong sense of responsibility as a representative of their country and company, not to mention mature traits and qualities. Furthermore, they possessed the necessary attitudes and abilities to adjust to living in a foreign country for close to two months, and maintained high conscientiousness from the beginning to the end of the course. They were so well adjusted by the end of the course that some of the Saudi Arabian participants noted that they would like to adopt the good customs and aspects of the Japanese, such as punctuality, and even had one participant saying, "We are Japanese now."

The contribution and cooperation of all companies that provided specialized programs centered on practical training was especially instrumental to the successful completion of the course. They consistently acted in a positive and sincere manner, which demonstrated the qualities and corporate culture of the Japanese people aside from their technical capabilities. They also showed flexibility and broadness in changing and improving their program content to accommodate participants' requests (mainly for advanced levels of training), even in the midst of implementing their program.

Lastly, JCCP takes pride in having planned sufficiently in advance for the two-month-long course, having established a cooperative framework that cuts across all relevant departments, and in having ensured the basic requirements for the participants' extended stay in Japan, all toward bringing the course to successful completion.

<by Teruhiko Sasaki, Training Dept.>

Personnel Exchange

Toward a Future Renewal of JCCP Courses

JCCP consistently takes action to play a central role in ensuring that Japan has stable supplies of oil and energy, and to contribute to mutual economic development with oil-producing countries. Offering training courses is one of our core functions in strengthening friendly relations between oil-producing countries and Japan. They are a means for helping oil-producing countries achieve technical and management improvements in the oil downstream sector, and for promoting mutual exchanges between the oil industries/institutions in oil-producing countries and Japan. Engineers, middle-level managers, and logistics/marketing managers in the oil downstream sector in oil-producing countries are invited to attend training courses in Japan to acquire Japan's technologies and knowledge and upgrade their capacities, as well as to deepen their understanding of Japan. We also send Japanese experts to provide training programs in oil-producing countries with the aim of introducing

Japan's technologies, knowledge, and experience, and of achieving mutual development.

Recently, however, some of our counterpart oil-producing countries have noted that the JCCP regular course program has not changed much over the past five years. Furthermore, the number of participants has begun to decrease in recent years, and a conspicuous difference has emerged in the participation between the GCC countries and other oil-producing countries. This indicates that a difference has evolved between what participants seek and what the management seeks in JCCP courses. Under this situation, the GCC countries are requesting JCCP to offer courses that are more practical than before.

In response to the above views and requests, we began a comprehensive review of our training courses last fiscal year, and are currently working toward strengthening their practicality.

Given the diversification of needs in each country today, it is become ever more important to assess the problems facing each country and to offer training courses that provide as much help as possible in solving those problems. Based on this awareness, we decided to supplement our conventional survey activities with surveys conducted by the lecturers themselves who organize the training courses. The lecturers will meet directly with relevant personnel at counterpart organizations to hear their requests and suggestions concerning JCCP courses and course content. We will use the information obtained from these surveys to confirm whether the direction we are taking to improve the practicality of our courses is valid, and to explore how JCCP should cooperate in addressing the needs and issues of counterpart organizations in the future. Furthermore, in order to implement the PDCA* cycle to improve JCCP courses based on the survey results, we will be formulating a medium-term plan toward renewal of the content of the courses.

An outline of the survey is as follows. The results of the survey will be presented in future issues of *JCCP News*.

* PDCA: Plan-Do-Check-Action

1. Survey Method

- Survey teams: Teams headed by lecturers from the Training Department will conduct the surveys.
- Targets of the surveys: Executive managers and the management of training departments
- Survey regions and period:
  (1) GCC region A (Saudi Arabia, Qatar, Oman)
  September
  (2) GCC region B (UAE, Kuwait, Iraq)
  September
  (3) Central Asia (Kazakhstan, Uzbekistan, Turkmenistan)
  November
  (4) North Africa (Sudan, Libya)
  December

2. Focus of Surveys

(1) How are JCCP training programs regarded?
- Expectations of JCCP courses
- Purpose and expectations of sending participants to JCCP courses
- How do participants put the training experience to use after returning to their workplace?
- How are participants evaluated after they return to their workplace?

(2) What types of course programs are sought?
- Regular courses
- Customized programs
- Countries that have a previous record of participation in JCCP training programs: Evaluation and future expectations
- Countries that do not have a previous record of participation in JCCP training programs: Desired topics and content

(3) Method of evaluation of participants
- Participant selection criteria, etc.
- Views, requests and suggestions concerning JCCP's current evaluation method
- Each country's reaction
- Improvement of evaluation system
- Aspect of participant evaluation considered most important

3. Reporting

The results of the surveys will be reported to the Committee for the Survey of Downstream Trends in Oil-producing Countries and compiled into a final survey report, an overview of which will be featured in JCCP News. The results will also be utilized in formulating the medium-term plan for renewal of JCCP's training program.

<by Fumihiro Tone, Training Dept.>

JCCP Regular Courses Completed in September – November 2010

TR-10-10 Environmental Management for Refineries
September 28 – October 15, 2010 **Lecturer: Bunsuke Kariya**

Content: Petroleum Industry in Japan; Soil and Groundwater Remediation; Tank Sludge Treatment; Air Pollution in Refineries; Overview of Environmental Pollution Control in Japan and Japanese Refineries; Global Warming Countermeasures; Environmental Management System; Waste Water Control in Refineries; Waste Water Re-use and Desalination of Sea Water

Site visits: Kurita Global Technology Center; Cosmo Oil Co., Ltd. (Sakaide Refinery); Bannosu Eco Service Co., Ltd.; Shimadzu Co., Ltd. (Head Office, Sanjo Factory)

Country of participants: Brazil, Gabon, Indonesia, Iran, Iraq, Kuwait, Libya, Mexico, Oman, Saudi Arabia, Thailand, Vietnam, Yemen

<13 countries / 16 participants>

TR-11-10 Material Problems and Their Countermeasures
September 28 – October 15, 2010 **Lecturer: Kenji Saito**

Content: Maintenance Activities of Static Equipment; Material Selection of Refinery Equipment; The Latest Welding Technology; Case Study and Discussion; Corrosion & Deterioration Problems of Materials in a Refinery; Metallurgy of Welding; Typical Problems and Countermeasures of High Tensile Steels; Repair Technology of Tanks; Risk Based Optimization of Maintenance; Materials and Fabrication of Pressure Vessels; Total Plant Reliability Activity; Typical Case of Corrosion in Refinery; Safety & Reliability of Aged Plant in Chemical, Petroleum Process Industries

Site visits: Chiyoda Corporation (Headquarters); Taseto Co., Ltd. (Head Office); IHI Corporation (Product Engineering Center); Shinko Plantech Co., Ltd. (Head Office); The Japan Steel Works Ltd. (Muroran Plant); JX Nippon Oil & Energy Corporation (Muroran Refinery)

Country of participants: Brazil, China, Iran, Iraq, Libya, Myanmar, Nigeria, Oman, Pakistan, Philippines, Sudan, Thailand, Vietnam, Yemen

<14 countries / 15 participants>

TR-12-10 Advanced Field Devices and Control
September 28 – October 15, 2010 **Lecturer: Kazuhiro Suzuki**

Content: Petroleum Industry in Japan; Control and Information Systems in Refinery; Latest Instrument Technology; Practice on Advanced Control System; Practice on PID Tuning; Basics on Control Valves; Safety Instrument System; Basics on Instrumentation and Unit Control

Site visits: Oval Corporation (Yokohama Factory); Yokogawa Electric Corporation (Mitaka Headquarters); Shinkawa Sensor Technology, Inc.; Idemitsu Kosan Company Ltd., (Chiba Refinery); Yamatake Corporation (Shonan Factory)

Country of participants: Colombia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Mexico, Nigeria, Oman, Pakistan, Thailand, Yemen, Vietnam

<13 countries / 14 participants>

TR-13-10 Petroleum Marketing and Product Delivery
October 19 – November 5, 2010 **Lecturer: Yasuo Tabei**

Content: Petroleum Industry in Japan; Development of New Business & New Automobile Fuel; Delivery System of Oil Products & Safety Operation; Management by Rational Thinking Process; Current World Energy Situation; Production of Pipelines & Maintenance; Oil Company's Branch Office & SS Sales; Jet Fuel Facilities & Refueling; Shipping System of Refinery; Japanese Management Style and Kaizen General

Site visits: JX Nippon Oil & Energy Corporation (Head Office/ Ichikawa Oil Depot/Chugoku Branch Office/Negishi Refinery); JFE Steel Corporation (The West Works); San-ai Oil Co., Ltd.

Country of participants: Bahrain, Brazil, Cambodia, Indonesia, Iran, Kazakhstan, Kuwait, Libya, Myanmar, Nigeria, Oman, Saudi Arabia, Sudan, Vietnam

<14 countries / 16 participants>

TR-14-10 Gas Processing for LNG
October 19 – November 5, 2010 **Lecturer: Takaaki Yuasa**

Content: Outline of LNG Plant; Global LNG Market; Steel Pipe Technologies; Development and Production of LNG; Natural Gas to New Energy Development DME, GTL, IGCC; LNG Vaporizer and Compressor Technologies; Gas-Turbine Technologies; LNG Storage Tank Technologies; LNG Ship Technologies

Site visits: Kobe Steel, Ltd. (Takasago Works); The Kansai Electric Power Co., Inc. (Himeji); Osaka Gas Co., Ltd. (Himeji No. 1 Power Station); Mitsubishi Heavy Industries, Ltd. (Takasago Machinery Works); IHI Corporation (Yokohama Factory); Mitsui Engineering & Shipbuilding Co., Ltd. (Chiba Shipyard)

Country of participants: China, Indonesia, Iran, Kuwait, Libya, Nigeria, Pakistan, Philippines, Sudan, Thailand, Vietnam

<11 countries / 13 participants>

TR-15-10 Project Management for Mechanical Engineers
October 19 – November 5, 2010 **Lecturer: Fumihiro Tone**

Content: Project Management Activities in Oil Refinery in Japan; "Kaizen" General based on Japanese Management; Project Cost Management; Project Engineering for EPC Project by Utilizing IT; Project Risk Management and Contract; Recent Technologies for Turbine and Boiler; Project Management for EPC Project; Project Planning and Management in the Refinery; Tank Inspection Planning and Execution; TPM Activity; Recent Technologies for High Pressure Vessel Manufacturing; Schedule Management Practice, etc.

Site visits: Mitsubishi Heavy Industries (Yokohama Works); JGC (Headquarters); Idemitsu Kosan Co., Ltd. (Hokkaido Refinery); Hokkaido Joint Oil Stockpiling Terminal (Hokkaido Office); The Japan Steel Works (Muroran Plant); Digital Engineering and Management

Country of participants: Indonesia, Libya, Nigeria, Oman, Saudi Arabia, Sudan, Thailand, UAE, Vietnam

<9 countries / 15 participants>

FY2011 JCCP Course Schedule

In FY2011, JCCP will offer 23 courses, including 21 regular courses (TR) and 2 intensive courses (IT), as shown below.

Course No.	Course title	Period
TR-1-11	Petroleum Marketing	Apr. 5 – Apr. 22, 2011
TR-2-11	Upgrading Processes of Heavy Oil	Apr. 5 – Apr. 22, 2011
TR-3-11	DCS Fundamentals and Applications	Apr. 5 – Apr. 22, 2011
TR-4-11	Human Resource Management (HRM)	May 10 – May 27, 2011
TR-5-11	Essential Petroleum Refining for Process Engineers	May 10 – May 27, 2011
TR-6-11	Refinery Management	May 31 – Jun. 14, 2011
TR-7-11	Diagnostic Techniques and Maintenance for Rotary Machinery	May 31 – Jun. 17, 2011
TR-8-11	Safety Management for Refineries	Jun. 21 – Jul. 8, 2011
TR-9-11	Maintenance Management	Jun. 21 – Jul. 8, 2011
TR-10-11	Environmental Management for Refineries	Sep. 20 – Oct. 7, 2011
TR-11-11	Project Management for Mechanical Engineers	Sep. 20 – Oct. 7, 2011
TR-12-11	Petroleum Marketing and Oil Terminal	Oct. 11 – Oct. 28, 2011
TR-13-11	Advanced Field Devices and Control	Oct. 11 – Oct. 28, 2011
TR-14-11	Gas Processing for LNG	Nov. 1 – Nov. 18, 2011
TR-15-11	Material Problems and Their Countermeasures	Nov. 1 – Nov. 18, 2011
IT-1-11	Turnaround and Inspection (T&I)	Nov. 21 – Dec. 2, 2011
TR-16-11	Human Resource Development (HRD)	Nov. 22 – Dec. 9, 2011
TR-17-11	Information and Control Systems Utilized in Refineries	Nov. 22 – Dec. 9, 2011
IT-2-11	Petroleum Marketing and Physical Distribution	Jan. 10 – Jan. 20, 2012
TR-18-11	Energy Saving for Profitability Improvement	Jan. 17 – Feb. 3, 2012
TR-19-11	Inspection and Reliability Evaluation	Jan. 17 – Feb. 3, 2012
TR-20-11	Quality Management of Refinery Products	Feb. 7 – Feb. 24, 2012
TR-21-11	Advanced Process Control on DCS	Feb. 7 – Feb. 24, 2012

Marketing, Distribution and HRM

Refining Processes and Operation

Maintenance and Inspection

Computer and Instrumentation

Fish Reef Completion Ceremony "Application Study of Sulfur Concrete Technology in UAE"

On August 3, 2010, JCCP and the Marine Environment Research Center (MERC) of the UAE Ministry of Environment and Water held a ceremony at the JAL Hotel in the Emirate of Fujairah, UAE, to mark the completion of an artificial fish reef under the "Application Study of Sulfur Concrete Technology in UAE."

1. Project Overview

Sulfur is a refinery operation by-product that is available in surplus. This project aims to demonstrate how the application of this large supply of sulfur resources could be expanded, by creating sulfur concrete from sulfur, sand, and additives, installing artificial fish reef blocks and sewage pipes made of sulfur concrete on a trial basis, and examining their applicability in UAE. Compared to regular concrete, sulfur concrete is more salt resistant and acid resistant—properties that make it suitable for use as fish reef blocks and sewage pipes.

To examine the applicability of sulfur concrete to sewage pipes, a segment (approx. 80 m) of existing pipes in Al Ain, Abu Dhabi was replaced with sulfur concrete sewage pipes last January. The evaluation of its applicability is presently ongoing.

To examine the applicability of sulfur concrete as an artificial fish reef, sulfur concrete fish reef blocks have been installed off the coast of Umm Al Quwain last June, and off the coast of Fujairah this February. After their installation, a large colony of pearl oysters and numerous schools of fish have been confirmed. With regular concrete fish reefs, the growth of algae and shells take time, because concrete is alkaline, but since sulfur concrete is practically neutral in alkalinity, algae and shell growth was observed soon after installation.

Fish reef block covered with pearl oysters

The fish reef blocks are being checked for any outflow of substances, and the impact of any such outflow on the environment is being assessed at a MERC laboratory. So far, no outflows to the sea or impact on fishes have been observed, and the safety of sulfur concrete has been confirmed.

2. Completion Ceremony

A ceremony marking the completion of the fish reef was held to present the proven effects of the fish reef and to introduce JCCP activities to UAE parties.

Mr. Morihiro Yoshida, Managing Director of JCCP, delivering a speech

The ceremony was held with the attendance of Dr. Ebrahim Al Jamali, Manager, MERC, Ministry of Environment & Water; Mr. Soliman Al Kadem, Head of Fujairah Fisheries Society, and others on the UAE side; and H.E. Mr. Tatsuo Watanabe, Japanese Ambassador

to UAE; representatives from participating Japanese companies Penta-Ocean Construction Co., Ltd. and JX Nippon Oil & Energy Corporation; and Mr. Morihiro Yoshida, Managing Director of JCCP, on the Japanese side.

Dr. Ebrahim Al Jamali, Manager, MERC, giving a presentation on future plans for the fish reef

Following a series of speeches by the guests of honor and sponsors of the ceremony, an overview of the project was introduced, and technical presentations were given regarding the installation status of the fish reefs and the results of ensuing observations. The participating Japanese companies and MERC assumed the role of giving the presentations, and used photos and videos to visually emphasize the effects of the installed fish reefs. This produced frequent questions and comments from fishery members and other UAE participants throughout the presentations, as an indication of their strong interest in the project. The participants also engaged in active exchanges of views while browsing photographs of the fish reefs displayed along the wall at the back of the room, before and during intervals of the ceremony.

3. Ripple Effects of the Project

The global balance of sulfur demand-supply continues to trend toward considerable supply excess. In fact, the

Exchanging views while browsing a wall of photos of the project

Middle Eastern countries as a whole produce sulfur in amounts exceeding demand by more than 4 million tons/year. At present, some 2.4 million tons of sulfur are produced in UAE refineries, but this volume is expected to increase to almost 6.5 million tons by 2015.

Even from a global perspective, sulfur production is steadily growing amid an increasing need to process heavier crude oil and produce lighter, low-sulfur fuels. Given this situation, the development of large-scale sulfur applications is extremely important to refinery management, and the application of sulfur to such structures as artificial fish reefs and sewage pipes offers a potential solution as a large-scale market for sulfur.

The fish reefs that were installed in this project are of minimum scale, and the sulfur concrete blocks composing each fish reef were made using approximately 100 tons of sulfur. However, since some fish reefs are almost 1,000 times larger in reality, sulfur usage would amount to some 100,000 tons per fish reef. Besides sulfur, sand and other aggregates can also be procured in UAE, so steady technical transfer to UAE through this project would enable the demonstration of sulfur concrete as a large-scale outlet for sulfur usage, as well as creating new employment in the country. There are thus mounting expectations of this project on the UAE side.

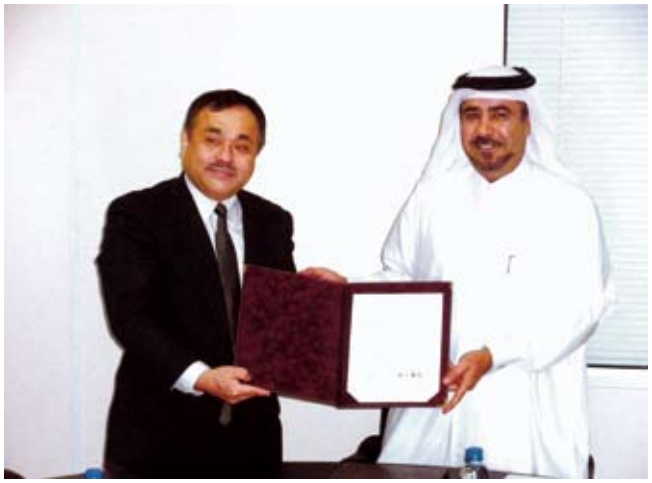
<by Hiroshi Iida, Technical Cooperation Dept.>

JCCP Launches New Project with Qatar Petroleum —New Project Signing Ceremony—

On September 22, 2010, JCCP and Qatar Petroleum (QP) held a signing ceremony for the "Study on Energy Efficiency Improvement, Corrosion and Fouling Issues at QP Refinery" at the QP Head Office. Mr. Hussain M. Al-Ishaq, Director Refining, Refining–Directorate, and Mr. Morihiro Yoshida, Managing Director of JCCP, signed the agreement under the witness of officials representing the two sides. The ceremony was attended by H.E. Mr. Yukio Kitazume, Ambassador, and First Secretary Mr. Yoshinori Satake from the Japanese Embassy in Qatar; Mr. Abdulaziz M. Al-Khoori, Operations Manager, Refining–Operations, and managers from other departments on the QP side; and Mr. Masahiko Hirajo, Director of Cosmo Engineering Co., Ltd., the project implementing company.

QP has recently commenced an HSE (Health, Safety & Environment) Managing Program in response to the currently heightened awareness concerning global environmental improvement. The program aims to implement full-scale environmental measures, such as by promoting the 4R (refuse, reduce, reuse, and recycle) concept, the supply of green products, reduction of gas emissions and waste, and improvement of energy efficiency.

According to Solomon Associates, a company that measures the energy efficiency of worldwide refineries every other year, Qatar's Energy Intensity Index (EII) indicates that it has room for more improvement compared to other Middle East/GCC countries. QP therefore regards energy efficiency improvement as one of its priority issues.



Right: Mr. Hussain M. Al-Ishaq, Director Refining, Refining–Directorate
Left: Mr. Morihiro Yoshida, Managing Director of JCCP

The project will apply refinery technologies and advanced energy conservation technologies that Japan has cultivated over many years, to assess the energy usage situation in the Mesaieed Refinery and to explore its potential for energy conservation through waste heat utilization and refining process modifications. It will also survey the state of corrosion and fouling in refinery facilities and examine the technical issues and economic efficiency of applying Japan's proven corrosion technologies to the Mesaieed Refinery. Ultimately, it aims to establish countermeasures for reducing opportunities lost by the shutdown of operations and preventing accidents caused by problems stemming from material corrosion and fouling. In the area of operational efficiency improvement, a number of studies and projects have so far been implemented at the Mesaieed Refinery with the participation of Cosmo Engineering. They included a study of facilities to recover LPG from flare gas that is burned and released to the atmosphere from refining facilities, and studies on countermeasures for NOx contained in exhaust gas and measures for operational efficiency (maximization of throughput oil, etc.). QP is currently exploring ways of applying the results of these projects and studies to actual situations.

The new QP-JCCP joint project will be implemented as part of QP's HSE program. Prior to its signing ceremony, Messrs. Al-Ishaq and Al-Khoori articulated their appreciation of JCCP for delivering many survey achievements during the past several years through JCCP programs, and also expressed their expectation and confidence that the new project will also produce significant results. Ambassador Kitazume stated that Qatar and Japan are "linked by a relationship based on

energy supply and economic cooperation," and voiced his expectation that the new JCCP project would further deepen cooperative ties between the two countries. Meanwhile, Mr. Yoshida assured QP that JCCP will provide follow-up support of the previous project on efficiency improvement in the Mesaieed Refinery and will contribute to developing the technical capacities of refining engineers through the project, and promised JCCP's full cooperation in achieving those goals. Mr. Hirajo, as director of a subsidiary company of Cosmo Oil, which has become a QP shareholder by investing in the Laffan Refinery, asserted the Cosmo Oil Group's strong commitment "to deepen technical exchanges with QP in the future" as it engages in the new project and works to deliver consistent results.

Study on Energy efficiency improvement, Corrosion and Fouling issues at QP Refinery

Article 13.9 Results of Feasibility Study

QP will be provided with a copy of all deliverables related to the FS in a timely manner. Subject to the terms of Article 9 and Article 13.5 and without prejudice to the stipulations set forth in the first recital, JCCP shall have no claim to a continuing interest in the results of the Feasibility Study.

Article 14. Notice

Except as otherwise provided herein, any notice hereunder sent by one party to the other shall be made in writing, in English, and sent by registered mail or fax to the following address:

QATAR PETROLEUM REFINERY (QP)
P.O.BOX: 50033 Mesaieed - Qatar
Telephone:+974 - 4776206 / Fax:+ 974 - 4771266
Mr. ABDUL AZIZ M. AL-KHOORI

JAPAN COOPERATION CENTER, PETROLEUM (JCCP)
Sunshine 58F, 3-1-1, Higashi-Ikebukuro, Toshima-Ku
Tokyo 170-6058, Japan
Tel: +81-3-5396-8021
Fax: +81-3-5396-8015
Mr. Minoru Horike
General Manager/Technical Cooperation Department

IN WITNESS WHEREOF, the parties have caused this LOI to be executed by their duly authorized representatives as of the date first above written.

For and on behalf of QP : Qatar Petroleum
Husaein M. Al-Ishaq
Director, Refining
Date : 29/09/2010

For and on behalf of JCCP : Japan Cooperation Center, Petroleum
Morihiro Yoshida
Managing Director
Date : Sept 29, 2010

Project agreement

On the day after the signing ceremony, Mr. Yoshida, Mr. Hirajo, and other members of the Japanese delegation visited the Mesaieed Refinery and inspected its facilities, thus completing the agenda of the signing ceremony.

Overview of the Planned Project

1. Project implementation period
   April 1, 2010 – March 31, 2012 (two-year project)
2. Host refinery
   QP Mesaieed Refinery
3. Participating company
   Cosmo Engineering Co., Ltd.
4. Project goals
   - To examine and propose measures for energy efficiency improvement in refinery operations
   - To examine facility corrosion and fouling and propose countermeasures
5. Project details:
   - The installation of an air pre-heater in the furnace will be examined and proposed, for the recovery of heat from furnace fuel gas.
   - The processes involved in the utilization of an amine solution will be examined and proposed.
   - Measures for preventing corrosion/fouling in the condensate distillation column, diesel oil hydrodesulfurization unit, and continuous catalytic reformer will be examined and proposed.

<by Takeyoshi Haishima, Technical Cooperation Dept.>

Commencement of the TAKREER Research Centre Project, Phase II —Signing Ceremony Held in UAE—

UAE is pursuing a national policy for employment creation and human resource development of the younger generation. Under this policy, Abu Dhabi Oil Refining Company (TAKREER), an affiliate of Abu Dhabi National Oil Company (ADNOC), has been strongly seeking to establish a technology center to enable it to develop capacities to solve technical issues related to refinery management and to upgrade its oil refining technologies as a future leader in oil refining and facility management technologies among the GCC countries.

Meeting held after the signing ceremony: (from left) Mr. Jasem Ali Al-Sayegh, General Manager of TAKREER; Mr. Morihiro Yoshida, Managing Director of JCCP; Mr. Setsuo Ohmori, Japanese Minister to UAE; and Mr. Shigeki Nakashima, Managing Executive Officer of Idemitsu Kosan

The TAKREER Research Centre (TRC) Project was approved by H.E. Yousef Omair Bin Yousef, Chief Executive Officer, in FY2005, and was thereafter launched with the cooperation of Idemitsu Kosan Co., Ltd. By leveraging Idemitsu Kosan's wealth of technical expertise regarding research center operations, the project aims to provide support for the designing of R&D facilities and the installation of laboratory instruments in the research center, as well as for the establishment of the organizational framework, functions, and management technologies of the center and the development of research center personnel. Phase I of the project was launched in FY2006 and was completed at the end of March 2010, after having achieved its original objectives of formulating safety measures regarding the handling of dangerous high-pressure substances during the construction of the research center building, providing support for designing a rational equipment layout plan that takes pilot plant operations into consideration, and supporting the introduction of analytical instruments.

The subsequent stage of the project was recently launched anew as the TAKREER Research Centre Project, Phase II. Prior to kicking off the project, Mr. Jasem Ali Al-Sayegh, General Manager, and Mr. Morihiro Yoshida, Managing Director of JCCP, signed the Memorandum of Agreement (MOA) for the project on October 18, 2010 at the TAKREER Head Office. As a continuation of the previous TRC establishment project, the Phase II project will send Japanese instructors and advisors to TRC as required to help establish long-term stable operations of the pilot plant installed in the previous project, and to transfer analysis procedures for data acquired from the pilot plant and evaluation technologies for new and spent catalysts used there. Through the technical transfer, the project aims to provide technical support that would ultimately allow TRC to improve refinery operations and optimize the refinery on its own. The transfer of the necessary technologies will be conducted through on-the-job training, to also promote the development of TRC personnel.

The signing ceremony was held in stately splendor at the TAKREER Head Office, with the attendance of Mr. Al-Sayegh and the deputy general manager and executive officers under him; the director of TRC; Mr. Setsuo Ohmori, Japanese Minister to UAE; and Mr. Shigeki Nakashima, Managing Executive Officer, and Mr. Yoshikuni Yamakawa, Executive Officer, from Idemitsu Kosan. In the opening statement, the UAE side

emphasized that the human resource development of UAE workers is the country's foremost important issue, and UAE is therefore placing great expectation on the development of its personnel through the TRC project. The Japanese side noted that JCCP receives many participants from UAE to its regular courses and has implemented a number of technical cooperation projects with UAE beside this TRC project, and pledged to devote every effort to building technical capacities in refining engineers and thereby contribute to human resource development in UAE through JCCP programs.

It is hoped that the implementation of this project will further deepen friendly ties between UAE and Japan, and that the transfer of Japan's operation and evaluation technologies for oil refining equipment will contribute to the development of oil refining technologies and human resource development in UAE.

On the day after the project signing ceremony, Mr. Yoshida, Mr. Nakashima, and other members of the Japanese delegation visited the TAKREER Research Centre to inspect its laboratory facilities, thus completing the agenda of the signing ceremony.

The following is an outline of the TAKREER Research Centre Project, Phase II.

Overview of the Planned Project

1. Project implementation period:
   April 1, 2010 – March 31, 2013 (three-year project)
2. Host facility: TAKREER Research Centre
3. Participating company: Idemitsu Kosan Co., Ltd.
4. Project details:
   (1) Advisors and instructors will be dispatched to TRC to provide support for long-term stable operations of the pilot plant and operational guidance of analytical instruments (on-the-job training).
   (2) The correlation between operating data acquired from an actual unit and that acquired from the pilot plant will be established, and support will be provided for the transfer of catalyst evaluation technology for catalysts used in the pilot plant and for the creation of a reaction simulation system.
   (3) The technologies and procedures for achieving operational improvement and optimization of actual refinery units will be transferred to TRC through the transfer of catalyst evaluation technologies.
   (4) Support will be provided for human resource development and TRC operations through the above transfer of technologies.

<by Takeyoshi Haishima, Technical Cooperation Dept.>

The completed TAKREER Research Centre

- *Constructed on the site of the Petroleum Institute, located in the eastern suburbs of Abu Dhabi*
- *Building area: approx. 2,200 m², 3 stories*
- *Construction began in April 2008 and was completed in late April 2009; Ownership was transferred to TAKREER in early August 2009*

TAKREER Research Centre Project, Phase – II

If TAKREER and JCCP are unable to resolve amicably any dispute arising hereunder or in connection herewith, such dispute shall be resolved by arbitration in accordance with the Rules of Arbitration International Chamber of Commerce then in force, with arbitration to be held in London, England. The arbitration will be conducted in English.

The award thereof shall be final and binding upon the Parties hereto. Judgment upon such award may be entered in any court having jurisdiction thereof.

Article 15. Notice

Except as otherwise provided herein, any notice hereunder sent by one party to the other shall be made in writing, in English, and sent by registered mail or fax to the following address:

ABU DHABI OIL REFINING COMPANY (TAKREER)
P.O.Box 3593
Tel: +971-2-6027375
Fax:+971-2-6027500

JAPAN COOPERATION CENTER, PETROLEUM
Sunshine 56F, 3-1-1, Hisashi-Ikebukuro, Toshima-Ku
Tokyo 170-6056, Japan
Tel: +81-3-5396-8021
Fax: +81-3-5396-8015

IN WITNESS WHEREOF, the parties have caused this AGREEMENT to be executed by their duly authorized representatives as of the date first above written.

For and on behalf of
Abu Dhabi Oil Refining Company

Jasem Ali Al-Sayegh
General Manager

Date: Oct. 12. 2010

For and on behalf of
Japan Cooperation Center, Petroleum

Managing Director

Date: Oct. 18, 2010

Project agreement

Personnel Changes

	Outgoing Personnel	Incoming Personnel
Training Department	 Yasuki TAZAWA	 Shigeru MATSUI

Japan Cooperation Center, Petroleum (JCCP)

Headquarters

Sunshine 60 Building 58F, 3-1-1 Higashi-Ikebukuro, Toshima-ku, Tokyo 170-6058, Japan

- Administration Department TEL. +81-3-5396-6000 FAX. +81-3-5396-6006
- Operations Department TEL. +81-3-5396-6001 FAX. +81-3-5396-6006
- Training Department TEL. +81-3-5396-6909 FAX. +81-3-5396-6006
- Technical Cooperation Department TEL. +81-3-5396-8021 FAX. +81-3-5396-8015

Overseas Offices

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  #904, Al-Ghaith Office Tower, Hamdan St.,
  P.O. Box 51828, Abu Dhabi, U.A.E.
  TEL. +971-2-627-4410 FAX. +971-2-626-2166
- Riyadh Office
  Al Oula Building, 5th Floor, Flat No.508
  Al Mohamadiya, King Fahd Road
  P.O. Box 61356, Riyadh 11565, Kingdom of Saudi Arabia
  TEL. +966-1-207-9540 FAX. +966-1-207-9539

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