Petroleum refining in 1961 continued to be very active. Against the production of 28,075,000 kl in 1960, the production in 1961 was 34,048,000 kl, an increase in 21.3%. The consumption of petroleum products was 35,429,000 kl of which 14.6% or 5,194,000 kl was imported fuel oil. Petroleum products exported were 3,666,000 kl of which mostly were bunker fuel 2,303,000 kl, and gasoline 648,000 kl.

At the year end, however, the unfavorable economic condition and tendency of over supply have caused a drop in the price of refined oil.

Construction and enlarging of refining facilities have been carried out also actively. The estimated amount invested for 1961 is about 100 billion yen. The total refining capacity has increased to 1,076,000 BPD with some new refineries going on stream. For the future, with the expected liberalization of trade in 1962, numerous plans for new construction of refineries have been announced of which mostly are linked with big electric power plants or petrochemical complex.

**Situation of Crude Oil**

The total crude petroleum refined last year was 36,932,000 kl of which the imported crude totaled 36,254,000 kl or 98% and the domestic crude 678,000 kl or only 2%. The quantity of imported crude increased 21% over the year 1960 of which 79% was Middle East crude. This proportion, however, has decreased compared to 80% of the total crude imported in 1960. Also the ratio of crude from South East Asia has decreased slightly from 15.6% in 1960 to 14.0%. Against this decrease the Russian crude has shown a substantial increase from 4.0% to 6.6% or 2.34 million kl. The first shipment of 11,000 kl of Russian crude was imported into Japan on the same year the initial Japan-Soviet trade agreement was concluded in 1958. Its import have suddenly increased after the conclusion of the third Japan-Soviet trade agreement in March 1960 and has continued to increased with each year. From the percentage of 0.1% of the total crude imported in 1958, the import of Russian crude has jumped to 0.5 in 1959 and to 4% in 1960. Because of the lower sulfur content, better grade than the Middle East crude, and cheaper price, the import of Russian crude is expected to increase in the future. However, in view of the political situation involved, it seems that its import entail some problems. In 1961 the Khafji crude of Arabian Oil Co. was brought into Japan and refined for the first time. The significance of Khafji crude, a product of Middle East area lies in the fact that it is the first crude from the oversea field developed and produced by Japanese capital. Although in 1961 its production was 812,000 kl, the goal for the production in 1964 is said to be 10,000,000 kl, and it is expected that it will have a big influence on the future of crude oil market in our country. The North Sumatra Oil Development Cooperation Co. which has been established to cooperate with Indonesian Government in developing oil fields in North Sumatra will have its first shipment to Japan in 1962.

The quantity of Kuwait crude imported was 10,250,000 kl and holds the largest percentage or 28% of the total import, next comes Iraq, 3,580,000 kl or 9.8%. When the import of 1961 is compared with that of 1960, the percentage of Kuwait crude has decreased by 6.1% and that of Iraq has decreased by 4.0%. In general, it could be said that the nature of imported crude oils changed from the light type to the heavy. This trend has lowered the average price of imported crude from 1.62 per bbl. in 1960 to 1.48 per bbl. in 1961.

All of the domestic crudes are refined by the refineries along the coast of Japan Sea and the total crudes refined in 1961 were 678,000 kl as...
compared to 533,000 kl in 1960, showing 27% increase. However, because of the higher production costs of indigenous crude oil, coupled with higher transport costs due to inconvenient location of the fields, its price is much higher than the imported crude. For this reason, the liberalization of trade in the future will confront a number of problems.

**On Petroleum Products**

Table 1 is showing the change in the production of petroleum products. It will be noted from comparison to gasoline that the production of gas oil and heavy fuel oil have considerably increased, an increase of 24% and 23% respectively. This trend is believed to continue in the future. The naphtha as feed stock for petrochemical plants has increased 61.9% over last year or 1,334,000 kl, indicating the big development in the petrochemical industry. From 1961 the naphtha used for the production of city gas was exempted of tax which has made possible the commercial production of city gas using naphtha. The increase of LPG production form refinery gas is also remarkable. The big consumption for LPG is for the domestic fuel and its demand is expected to increase with each year. The import of LPG from Middle East will be realized in large scale with the completion of LPG tankers unloading facilities. Already at the end of 1961, the first LPG tanker built in Japan has returned with about 5,000 of the cargo on board.

Concerning improvement of quality of products, raising the octane value of gasoline for automobile can be seen. For premium gasoline the Research octane rating of 99 has appeared in the market. Previously, Motor method of octane rating was applied in Japanese standard specifications but as of January 1962 the Research Method has been adopted. As an additive for anti-knocking of automobile gasoline, with the aim of improving the road performance tetra methyl lead is being used by some companies.

**On Facilities**

Because of the active construction and expansion of refining facilities in 1961, the refining capacity of the refineries in Japan increased 45% over last year and reached the figure of 1,076,000 BPD. To raise the octane rating, many catalytic reforming units were constructed. The general situation is shown in Table 2. Increase in topping capacity of 335,000 BPD has been realized. Of this increase in topping capacity 110,000 BPD is attributed to construction of 3 new refineries, 143,000 BPD to the newly constructed units in the present site and 82,000 BPD to the revamping of old units.

In 1961 two new refineries, the Mizushima Refinery of Mitsubishi Oil Co. and Mizushima Refinery of Nippon Mining Co., were constructed and have gone on stream according to the first stage of their plan. Mizushima is located facing the Japan Inland Sea and it is a very convenient location for transportation by both land and sea. The harbor facilities are being constructed to admit 100,000 ton class tankers. Because there is abundant water supply and since the electrical power plant is being constructed near the plants, this district provides favorable conditions for heavy industries and is about to develop into one of the great industrial centers in Japan.

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**Table 1 Change in the Production of Petroleum Products (Unit : 1,000 kl)**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Motor Gasoline</td>
<td>3,774</td>
<td>4,165</td>
<td>5,104</td>
<td>6,125</td>
<td>7,260</td>
</tr>
<tr>
<td>Jet Fuel</td>
<td>154</td>
<td>111</td>
<td>272</td>
<td>360</td>
<td>480</td>
</tr>
<tr>
<td>Kerosene</td>
<td>1,066</td>
<td>1,193</td>
<td>1,559</td>
<td>2,119</td>
<td>2,324</td>
</tr>
<tr>
<td>Gas Oil</td>
<td>1,003</td>
<td>1,238</td>
<td>1,680</td>
<td>2,341</td>
<td>2,899</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>6,742</td>
<td>7,351</td>
<td>10,356</td>
<td>15,855</td>
<td>19,554</td>
</tr>
<tr>
<td>Lubricating Oil</td>
<td>556</td>
<td>512</td>
<td>596</td>
<td>723</td>
<td>841</td>
</tr>
<tr>
<td>Others</td>
<td>335</td>
<td>362</td>
<td>488</td>
<td>551</td>
<td>690</td>
</tr>
<tr>
<td>Total</td>
<td>13,630</td>
<td>14,922</td>
<td>20,055</td>
<td>28,074</td>
<td>34,048</td>
</tr>
</tbody>
</table>

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Together with plans for the construction of steel mill, projects of other plants which are looking into utilizing the naphtha and waste gas of the two refineries are underway and in the future a big complex is expected to be formed.

The newly constructed Mitsubishi Oil Company’s refinery has for its site a 320,000 acres with a 40,000 BPD topping unit, a 20,000 BPD vacuum distillation unit, a 3,600 BPD reforming unit UOP Platforming, a 2,000 BPD treating unit for light gasoline (UOP Merox Type), a 7,200 BPD hydrosulfurization plant for middle distillates (UOP Unifiner Type) for refining Middle East crudes. A large scale expansion of the plant is under projection for the future and plan for the construction of a Lomax Plant (9,500 BPD) the first in our country is also underway.

Nippon Mining Co.'s new Mizushima Refinery has a topping unit (40,000 BPD), a reforming unit (6,000 BPD Houdriformer) a treating unit for light gasoline (2,500 BPD UOP Unisol Type) a hydrosulfurization unit for middle distillates (2,000 BPD UOP Unifiner Type). In the instrumentation project, data logger-scanners have been adopted. In-line blending systems are used for two grades of motor gasoline as well as for fuel oils, and the gasoline blender can blend in tetra ethyl lead, dyes and other additives automatically. It also has a central control system for utilities. For the consolidation of data and other calculations, the main office has installed computer of IBM-7070 type, showing great progress towards automation program. Fuel oil is supplied by connecting pipeline to the Mizushima plant of the Chugoko Electric Power Co. which was constructed in the adjacent site. The plant site is of 240 acres with future plan for expanding.

The newly built refinery of the Shin Asia Oil Co. located on the reclaimed land at Tsurumi Daikoku Cho with a topping unit (30,000 BPD), a electric desalter, a Unifiner-Platformer (5,000 BPD), a light gasoline treating unit (4,000 BPD Merox), a Unifiner for middle distillate (4,000 BPD) has gone on stream. The characteristic point of this refinery is that it has also adopted the most modern instrumentation. It has applied electronic system throughout the plant with a central control system together with computing loggers, scanning monitors and process gas chromatography system which is significant in the future instrumentation of oil refinery. It also has other facilities as central controlling system on oil deliveries and automatic blender for gasoline as well as for fuel oils. Other point of note is their plan to directly supply fuel oil to the adjacent Tokyo Electric Power Co.’s plant and the refinary off-gas as feed stock for city gas to Tokyo Gas Co. in Tsurumi 7 km far from the refinery through the pipeline.

On the project to expand the present plant, Showa Oil Co., Kawasaki Refinery, and Toa Sekiyu Co., Kawasaki Refinery have each constructed a new 30,000 BPD topping unit. Addition to the topping unit, a catalytic reforming plant, a chemical treating unit for light gasoline, and a hydrosulfurization unit for middle distillates have been completed.
Nippon Petroleum Refining Co. has newly constructed a 28,000 BPD topping unit, a 15,000 BPD vacuum distillation unit, and a 7,500 BPD catalytic cracking unit in its Yokohama Refinery. The Koa Oil Co.'s Marifu Refinery has newly constructed a 55,000 BPD topping plant and the gasoline produced is supplied to the neighboring Mitsui Petrochemical Co. as feed stock for the manufacture of olefines and aromatics.

There were seven catalytic reforming units constructed in 1961 whose total capacity is 37,600 BPD and their types are all UOP Platforming type except one which is Houdry type. When we include improvement made on the old catalytic reforming plant, the increase in capacity in 1961 was 42,850 BPD. This figure when compared to the 41,710 BPD for the end of 1961 the capacity can be said to be a great advancement. Of the five light gasoline treating units constructed last year with a total capacity of 17,500 BPD, except for the one Unisol type, the others are UOP Merox type. For the processing of middle distillates, five hydrodesulfurization units were constructed last year whose total capacity is 26,700 BPD. Of the five units, four are UOP and one E.R. & E. type. A Shell type trickle hydrodesulfurization plant is scheduled for construction this year which is the first unit in Japan.

As mentioned above, in the construction and revamping projects for gasoline making facilities last year, mostly were catalytic reforming units while only one was catalytic cracking unit. This shows that the demand for fuel oil is far greater than gasoline and there is little need to obtain gasoline by cracking. For the production of asphalt, a 6,000 ton/day semi-blown asphalt unit was completed in the Yokkaichi Refinery of Showa Yokkaichi Co. and bulk transportation of asphalt is carried out in tank cars and tank trucks equipped with heating coil.

### Investment on Facilities

As shown in Table 3, the investment made on facilities for petroleum industry last year was 99.6 billion yen which was a considerable increase compared even to the favorable economic condition of 1960. This was done in anticipation of complete removal of the present import control. The purpose is to have as much of the market as possible when complete liberalization of imports arrives. In the investment for refining facilities, the catalytic reforming plant has the largest investment with 34% of the money spent followed by topping unit with 21%, and hydrodesulfurization unit 12%. It is expected that the largest share of investment this year will be again taken by catalytic reforming unit which would be about 27%, followed by topping unit 18% and hydrodesulfurization units.

#### Table 3 Investment on Refining Enterprise (Unit: Million Yen)

<table>
<thead>
<tr>
<th></th>
<th>1959</th>
<th>1960</th>
<th>1961</th>
</tr>
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<tbody>
<tr>
<td>Refining Facilities</td>
<td></td>
<td>23,834</td>
<td>33,150</td>
</tr>
<tr>
<td>Transporting &amp; Market</td>
<td></td>
<td>29,569</td>
<td>33,709</td>
</tr>
<tr>
<td>Others</td>
<td>46,223</td>
<td>51,413</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>62,137</td>
<td>99,626</td>
<td>118,272</td>
</tr>
</tbody>
</table>

#### Table 4 The Proportion of Investment on Crude Units and Gasoline Manufacturing Facilities for the Total Investment (%)

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Unit</td>
<td>8.4</td>
<td>6.1</td>
<td>6.9</td>
<td>7.2</td>
<td>7.2</td>
</tr>
<tr>
<td>Reformer and Cracker</td>
<td>12.4</td>
<td>6.8</td>
<td>7.6</td>
<td>4.8</td>
<td>9.0</td>
</tr>
</tbody>
</table>
furization unit with 17%. The proportion of
topping unit and catalytic reforming unit as well
as catalytic cracking unit against the total invest-
ment for installations are given in Table 4. Be-
because of the comparative low price of gasoline
now in Japan, the burdensome problem of the
refiners is solving the problem of raising the
octane rating of gasoline without putting up
expensive facilities.

It is of interest to note the recent increase
in investment for plant site and harbor facilities.
The percentage of the amount spent for plant
site from the year 1953 can be given as: in
1953—2.9%, 1954—3.2%, 1955—6.8%, 1956—
9.2%, 1957—9.6%, 1958—12.3%, 1959—
13.3%, 1960—10.6%, 1961—13.3% which
clearly reveal that the last few years of economic
expansion has caused limitation of plant site
and consequently the raise in the price of land.

**Future Trend**

The demand for petroleum products will con-
tinue to increase in the future and it is expected
that by 1970 the demand will be more than
100 million kl. To meet this future demand,
many plans such as expanding the present re-
fineries and construction of new refineries have
been announced. The construction plan calls
for large refineries of above 50,000 BPD and it
is believed that these plants will be constructed
as the year goes by. In the future plan for
the construction of refineries there are other

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