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PROVISIONAL INTELLIGENCE REPORT

PRODUCTION OF DIESEL AND OIL ENGINES IN THE USSR



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CIA/RR PR-100

(ORR Project 32.216)

NOTICE

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(ORR Project 32.216)~~SECRET~~PRODUCTION OF DIESEL AND OIL ENGINES IN THE USSR*Summary

The production of diesel and oil engines in the USSR in 1954 totaled 15 million horsepower (hp), an increase of 10 percent over the 1952 Soviet production of 13.7 million hp. Comparable production of diesel and oil engines in the US during 1952 was 19.9 million hp. In 1954, Soviet production of engines for tanks totaled 4.9 million hp; of engines for motor vehicles and tractors, 7.3 million hp; and of general-purpose diesel engines, 2.8 million hp. The present maximum potential production of diesel and oil engines from existing and readily convertible facilities in the USSR is estimated at about 25 million hp.

Soviet diesel and oil engine production has, in the past, always lagged behind Soviet requirements. The levels of current output indicate that the USSR will have difficulty producing enough locomotive diesels to meet requirements in the Sixth Five Year Plan (1956-60) and enough submarine and subchaser engines even to meet requirements in 1955. In addition, demands for engines for the electrification of agriculture, for oil field operations, for powering the equipment of the rapidly growing construction and roadbuilding machinery industry, for timber operations, and for fishing and shipping, to mention the outstanding requirements, are greater than can be supplied by the Soviet diesel and oil engine industry.

The production of diesel engines in the USSR is not the responsibility of a single ministry but is contained in the operation of at least 12 ministries and is also carried on by trade cooperatives and local industry. Engine designs have been standardized by the All-Union Committee of Standards. The USSR, therefore, has a standardized engine design for every purpose, in sizes up to 2,000 hp.

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 January 1955.

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The USSR has adapted its wartime tank diesel engine to industrial and marine use and is producing these engines in large volume, thus maintaining an excellent base for the expansion of tank diesel production. Soviet engines offer nothing new in design, yet their designers make the best use of the decades of experience of foreign engine firms, and, as a result, these engines are not inferior in any important respect to foreign engines.

The history of the diesel engine industry in the USSR has been one of expanding production, of increasing labor productivity, and of mastering new designs and techniques. With one exception (the Barnaul Transport Machine Building Plant), the important diesel engine plants in the USSR are located in centers of heavy industry, which are characterized by adequate transportation facilities, a pool of industrial labor, availability of metallurgical materials and services, and adequate electric power.

I. General.

A. Description of the Industry.

1. Definition.

The diesel engine industry as defined in this report includes those facilities which produce any of three variants of the internal combustion engine -- diesel engines, crude-oil engines of low compression, and gas (not gasoline) engines. These three commodities are presented as related products of the diesel engine industry for the following reasons: (a) they are produced by similar processes and are often alternate, and sometimes simultaneous, products of certain plants identified with diesel engine building; (b) they may be substituted for one another in their application; and (c) they conserve gasoline by using less refined fuels.

Most gas engines are conversions of diesel engines and are included with figures on diesel engine production in the production tables.

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2. Types of Plants.

Diesel, oil, and gas engines are produced mainly in special, single-purpose plants which are rather widely distributed throughout the USSR. The production of some engines, however, is incidental to the production of the motor vehicles, tractors, tanks, or locomotives in which they are used.

B. Economic Significance of Diesel Engines.

Points of economic significance bearing on the desirability of producing and using diesel, oil, and gas engines are as follows:

1. The specific weight per hp output of diesel, oil, and gas engines is much greater than that for gasoline engines, and they would seldom be used were it not for their ability to conserve expensive liquid fuels.

2. Diesel engines have the lowest specific fuel consumption per unit of power output of all internal combustion engines and can burn grades of petroleum fuel which are much less refined, and therefore cheaper, than gasoline.

3. Oil engines of lower compression, though not so economical in their use of fuel as diesels, can burn very crude petroleum fuels and are less expensive to produce, as well as simpler to maintain, than are diesels.

4. Gas engines as employed in the USSR are in every case modifications of diesel, oil, or gasoline engine models and are of considerable economic importance because they can consume the generated gas from local solid fuels, such as wood, coal, peat, or sewage.

5. Aside from fuel economy, diesel and oil engines have an advantage over gasoline engines for installation in confined places, such as in ships, where there is an inherent danger of explosion from gasoline vapors.

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C. Economic Factors Dictating the Use of Diesel and Gas Engines.

The types of engines built in the USSR have a definite relationship to the ability of the USSR to produce and transport motor fuels to the place of utilization. The production of petroleum as well as refinery capacity has probably influenced the USSR in its intensive dieselization program. As total production of petroleum has been rising, the percentage of diesel fuel has been increasing. The increase in the production of diesel fuel as a percentage of total fuel is attributable to economies in the use of fuel by diesel engines and also to the fact that the production of diesel fuel instead of gasoline obviates the need for refinery capacity that would otherwise be necessary to turn the same amount of diesel fuel into gasoline by the cracking process.

Farmers in the US use gasoline instead of diesel tractors because the initial cost is much lower. On the collective farms of the USSR, however, diesel tractors are used. The tractors operate day and night, and this intensive use results in fuel savings extensive enough to compensate for the higher initial cost of the tractor. Furthermore, the Soviet refining industry produces large quantities of diesel fuel which must be used for motor fuel, since additional refinery capacity would be necessary to make gasoline. Dieselization of the tractor park provides a market for this fuel.

The USSR has vast areas remote from rail transportation which are served by river shipping during the summer months. It is difficult to supply petroleum fuel to these areas. Here, gas engines are used in conjunction with gas generators which burn whatever local fuels are available. These engines are used in river ships, timbering operations, and small electric stations.

D. Historical Development.

In an effort to standardize designs, systematize development, and give special assignments to plants, the All-Union Diesel Trust (Soyuzdizel') was formed by the USSR in the latter half of 1931. The trust concentrated diesel engine building in the most efficient plants, eliminating from the production of diesels those plants which showed no prospect of effective development of such production. Soyuzdizel' was composed of the following units: the Russkiy Dizel' Plant in Leningrad, the Dvigatel' Revolyutsiy Plant in Gor'kiy, the Stalin Agricultural Equipment Factory in Voronezh, the Kirov Diesel Engine Plant

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(formerly Krasnyy Progress) in Bol'shoy Tokmak, the 25 Oktyabr' Machine Building Factory in Pervomaysk, the Kommunist Plant in Marks, the Mikoyan Diesel Engine Factory (formerly Pobeda) in Melitopol', and the Dzerzhinskiy Plant in Balakovo. 1/* Other plants producing diesel engines were the Kolomna Railroad Locomotive Building Plant and the Krasnoye Sormovo Plant in Gor'kiy.

In 1937, Soyuzdizel' was succeeded by Glavdizel' (Glavnoye Upravleniye Dizelestroytel'noy Promyshlennosti -- Main Administration of the Diesel Building Industry, sometimes abbreviated GUDP). To this organization the Railroad Locomotive Plant at Kolomna was added, and Krasnyy Progress (now Kirov) in Bol'shoy Tokmak was dropped. 2/

After World War II the industry was reorganized again, and new plants were brought into the production of diesel engines. The plants which are known to be producing today are listed in Appendix B.

E. Technology.

1. Production Facilities.

The technology of the production of diesel engines varies somewhat according to the size of the engine. Small-size engines can be produced in plants equipped with small- or medium-size machinery, whereas some larger engines require large machine tools and foundry flasks and must be assembled by overhead cranes. With the exception of the lightweight tank diesels, which contain large quantities of aluminum, diesels can be made in any plant capable of founding and machining cast iron. The principal forgings needed are the crankshaft, camshaft, and connecting rods, which are usually supplied by specialty plants such as Novo Kramatorsk Machine Building Plant. The most precise parts of a diesel are the fuel injection pump and the fuel injectors, which are not made by all diesel plants. Fuel injection equipment is known to be made by the Noginsk Fuel Apparatus Plant, the Leningrad Carburetor and Armature Plant, the Kolomna Railroad Locomotive Plant, the Chelyabinsk Tractor Plant, the Kommunist Plant in Marks, and the Strommashina Plant in Andizhan.

* Footnote references in arabic numerals are to sources listed in Appendix E.

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2. Physical Characteristics.

Soviet diesel engines in production today compare favorably with engines made in the US with respect to specific weight per hp output. The USSR has a standardized engine design for every purpose, in sizes up to 2,000 hp.

For power station and marine use in sizes between 300 and 2,000 hp, both 2- and 4-stroke cycle engines are available in designs which do not exceed 34 kilograms (kg) per hp yet run at the low speeds which promote long engine life. The mean piston speeds of these engines are in the range from 748 to 1,100 feet per minute.

In sizes up to 300 hp, the USSR has several designs of light, high-speed diesels of small dimensions which are suitable for use with such equipment as generators, portable drill rigs, excavators, roadbuilding machinery, shallow-draft shipping, portable air compressors, and marine auxiliaries. The V2-300 and the D6 models, which were developed from the Soviet tank engine, have aluminum heads, blocks, and crankcases, and very low specific weights per hp output, the V2-300 about 3 kg per hp, and the D6, about 6.5 kg per hp.

For motor vehicles and tractors the USSR makes both 2- and 4-stroke cycle engines in 37-, 54-, 93-, 110-, 140-, and 165-hp sizes. For some special-purpose vehicles, the V2-300 (300 hp) and the D6 (150 hp) engines are used.

The USSR is now developing a family of engines for use in construction and road machinery. These engines are to be more durable than the present lightweight engines and at the same time lighter than the present more durable engines. The Strommashina Plant in Andizhan will produce these engines in cylinder arrangements of from 1 to 12 cylinders. The 1-, 2-, and 3-cylinder variants are now in production.

A special class of high-speed, 4-stroke-cycle engines is produced for submarines and is patterned after the German MAN engines, among the most successful submarine engines ever built. Another special-purpose engine is the D50, the 1,000-hp diesel-electric locomotive engine produced at the Khar'kov Transport Machine Building Plant. This engine is a copy of the American Locomotive Company (ALCO) locomotive diesel.

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The USSR does not produce engines of original design. Instead, the best available designs are taken from foreign technology and adapted to Soviet needs. The diesel engines produced today are as modern, generally speaking, as those produced anywhere. With respect to specific weight per hp output, they compare very favorably with engines made in the US. The engine builders have heeded the admonishment of Kaganovich, who in his address to the First All-Union Diesel Conference in 1933 said: "We have for the time being to take over everything that is best that is available from abroad and graft it to our own production. One should not go for head-turning discoveries, one should not figure out some supernatural motors, but one should the more simply and realistically solve the problems of the day ... and turn out the types of diesels and crude-oil engines which we have selected." 3/

The largest engine in production today for stationary and marine use in the 8D 43/61, which develops 2,000 hp at 250 revolutions per minute (rpm) and weighs about 32.5 kg per hp.

For submarine service the USSR has the MAN-type 8ChN 43/47, which develops 2,000 hp at 470 rpm and weighs about 13.7 kg per hp, and the 8Ch 43/47, which develops 1,600 hp at 470 rpm and weighs 17 kg per hp.

For diesel locomotives the Khar'kov plant is making the 1,000-hp, supercharged ALCO engine. For stationary and marine use the USSR produces the 8D 30/50 model, which develops 800 hp at 300 rpm; the 6D 30/50, which develops 600 hp at 300 rpm; the 6CH 36/45, which develops 600 hp at 375 rpm; and the 6Ch 30/38, which develops 300 hp at 300 rpm and 400 hp at 400 rpm. These engines are all as light as comparable US models.

The USSR produces a number of diesels in the group below 300 hp. These include the 300-hp V2-300, which weighs 3 kg per hp, and the 150-hp D6, which weighs about 6.5 kg per hp. Both of these engines have aluminum crank cases, blocks, and heads and are modifications of the Soviet tank engine.

For automotive use the Yaroslavl' Motor Vehicle Plant produces the YaAz-204 and YaAz-206 engines, which are copies of the GMC Series 71 engines, the automotive diesels made in greatest quantity in the US. These engines are installed in trucks made by the Yaroslavl'

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and Minsk Motor Vehicle Plants, in the ZIS-154 bus, on air compressors, and in military tracked vehicles.

Only the two smallest tractors, of 12- and 22-hp, do not have diesel engines at this time, and diesels are being developed for these two. At the present time, diesel tractors are made with 35, 54, 93, and 140 hp. Moreover, these engines have been adapted to power winches, cranes, graders, locomotives, paving equipment, portable electric sets, and the like. For easy starting in cold weather, the USSR has adopted a gasoline-starting engine for each tractor diesel. Although satisfactory for tractor use, the Soviet tractor diesels are a little too heavy for many of the other installations to which they are now being applied. The Andizhan Plant of the Ministry of Construction and Road Machine Building, therefore, has begun production of the 63-hp, 3-cylinder T-113, the first of a family of high-speed, lightweight engines for construction machinery, which are intended eventually to include other models up to the TU-12 of 360 hp with 12 cylinders.

3. Crude-Oil Engines.

For many purposes, crude-oil engines are satisfactory. This type of engine is widely produced and used in the USSR in sizes from 6 to 50 hp and is used chiefly in agriculture for such purposes as pumping water, generating electricity, or driving threshing machines and saws. They are also widely used in the oil fields and in small fishing boats. Crude-oil engines are cheaper than diesels to maintain. They are more durable in the hands of unskilled operators and burn cheaper grades of fuel than do diesel engines. They are, however, heavier than diesels for the same power output and burn large quantities of fuel. All the crude-oil engines in current production are of designs which are 20 or more years old and are produced in small plants, some of which do not have modern equipment.

4. Standardization of Engine Designs and Interchangeability of Parts.

Standardization has made it possible for the USSR to provide a diesel engine for every purpose, up to 2,000 hp, with only 40 different models of diesels and 8 different models of oil engines.*

* An April 1953 estimate lists 912 different models of diesel engines which are made in the US.

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Such extreme standardization is possible only in a country where the national economy is controlled by a state plan. Very important advantages to the economy are contained in the savings in inventories made possible by having a small variety of parts for a few models instead of a large variety of parts for many models. Savings are effected in the training of mechanics to understand the maintenance of a few rather than many types of engines. The concentration of production on a few models permits savings from large series production of parts and components.

Along with standardization to reduce the number of models, the USSR has employed, where possible, unification of design between two or more models to effect the interchangeability of parts for those models. This practice usually results in economies of production, maintenance, and parts inventories, just as in standardization. In the case of the V2 tank engine, however, this practice has special significance.

The V2 tank engine comprised virtually all of the production of diesel engines in the USSR in World War II. After the war, with its power reduced from 500 and 600 hp, at 1,800 and 2,000 rpm, respectively, to 300 hp at 1,500 rpm (for longer life), the V2 engine was produced by the Barnaul Transport Machine Building Plant* for industrial and marine use. Also, the D6, a 150-hp engine, was developed from the V2, using one 6-cylinder row of the 12 cylinders of the V2. By these adaptations the USSR obtained a family of commercial engines which were interchangeable with tank engines. The plant which made the engines could produce tank engines without any delay in conversion. The parts for commercial or tank engines could be issued through the same supply system if need be, and mechanics trained in maintaining the commercial engines could be readily integrated into the military forces. To obtain these advantages, the USSR had to pay a price. The crankshafts in the 150- and 300-hp engines are the same expensive (machined all over) shafts as are required to transmit 600 hp in the V2-600 engine. The expensive lightweight aluminum crankcase, block, and head of this type of engine are a lost advantage when the engine is installed in a locomotive or excavator. Because of its comparatively short life (acceptable in a tank engine), it is expensive to maintain.

* This plant produced the tank-engine version during World War II.

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S-E-C-R-E-TF. Organizational and Administrative Structure.

The Soviet plants which build diesel engines, heavy-oil engines, and gas engines are under the administrative jurisdiction of a number of ministries and other administrative organizations, not all of which are primarily concerned with industrial production. Appendix A lists the engine plants by ministry according to the ministerial organization of the USSR in 1952.

Glavlokomobil'dizel' of the Ministry of Heavy Machine Building and Glavdizel' of the Ministry of Transport Machinery are the two most important groups engaged in producing diesel, heavy-oil, and gas engines. The plants of these glavs produce engines for the whole economy. In addition, some ministries produce engines for their own purposes, and some local industries produce engines for local distribution.

Standardization of engines probably is effected through the All-Union Committee of Standards of the Council of Ministers of the USSR. The consumers make their needs known through their ministries, and the available designs are examined to see how well they match the needs. For example, the Technical Council of the Ministry of the River Fleet determined the requirements for standard types of river tugs and barges. This permitted the Ministry of Shipbuilding to standardize on a minimum number of vessel types for mass production and to determine the requirements for standard types of engines. The All-Union Committee of Standards then established GOST's* on these engines. ^{4/} When it is necessary for Glavlokomobil'dizel' to develop a new engine model to meet customer demand, the task of development is assigned to NIDI (Nauchno-Issledovatel'skiy Dizel'nyy Institut -- Diesel Scientific Research Institute). NIDI is under the jurisdiction of Glavlokomobil'dizel'. ^{5/} In developing new models, NIDI keeps in mind the desirability of universal application of the engine to the purposes of all the customers (such as ships, stationary power plants, and oil-well drilling). Whenever possible, new designs are achieved by modification of old designs by adding cylinders, increasing speeds, or improving operating characteristics in order to hold the number of models to a minimum and reduce the repair-parts problem. NATI (Nauchno-Issledovatel'skiy Avtotraktorny Institut -- Automobile and Tractor Scientific Research Institute) collaborates with NIDI in performing fundamental research on engine design and develops diesel engines for the motor vehicle and

* GOST is the abbreviation for Gosudarstvennyy Obshchesoyuznyy Standart (All-Union State Standards).

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tractor industry. NATI is subordinate to the Ministry of Automobile, Tractor, and Agricultural Machine Building. The All-Union Committee of Standards probably authorizes the development of new engine designs.

The All-Union Scientific Research Institute of Construction and Road Machine Building has a power-engineering laboratory which recently engaged in design and research connected with the development of a new family of diesels for construction and road machines. The production of these engines has been assigned to the Andizhan Strommashina Plant of the Ministry of Construction and Road Machine Building. 6/ In the Ministry of Transport Machinery, it appears that the plants do their own development work but may receive some help from NIDI. Several plants of the Ministry of Shipbuilding were assigned engine-building tasks immediately before World War II. There has been no postwar reference to engine production in particular plants of the Ministry of Shipbuilding, but a reference has been found to the production of Model 2Ch, 40-hp engines of the Ministry of Shipbuilding. 7/ Engines of this description were produced by the Kirov Plant in Bol'shoy Tokmak, known before the war as Plant 175, under the Ministry of Shipbuilding.

One of the biggest producers of engines in terms of annual hp output is the Ministry of Automobile, Tractor, and Agricultural Machine Building. Because most of the engines are installed in motor vehicles and tractors, the number of engines available for incorporation in the products of other ministries is extremely limited. One of the strongest reasons motivating the Ministry of Construction and Road Machine Building to initiate production of its own engines was the difficulty of obtaining engines from plants of the Ministry of Automobile, Tractor, and Agricultural Machine Building.

II. Supply.

A. Total National Production.

1. 1928-41.

During the period of the first three 5-year plans the Soviet diesel engine production base was created in terms of both

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facilities and trained manpower. The main effort of the engine plants during the First Five Year Plan (1928-32) was devoted to mastering the production of engines of modern design and to increasing productivity through improvements in engine design and in production processes. 8/ The changeover to improved engine designs continued during the Second Five Year Plan (1933-37), and the mean specific weight was reduced by 1937 to 15 to 20 kg per hp for two-thirds of the total hp output and to 35 to 80 kg per hp for the remainder of the output. 9/ Some expansion was accomplished -- notably at the Kolomna Railroad Locomotive Plant and at the Russkiy Dizel', Kommunist, and Dvigatel' Revolyutsiy Plants -- and labor productivity was increased. 10/

New engine designs were introduced during 1937-41, but large-scale production was disrupted by World War II. These were the designs which were later hailed as new postwar models and for which some Stalin prizes were awarded. The V2 tank engine was also developed.

2. 1942-45.

The V2 tank engine was produced in enormous quantities during 1942-45. Production was concentrated in three plants -- the Ural Turbine Plant in Sverdlovsk (Factory 76), the Chelyabinsk Tractor Plant (Factory 75), and a newly constructed tank-engine plant in Barnaul (Factory 77). 11/ The V2 engines of this type had a specific weight of about 1.5 kg per hp, there being a slight difference between the 500-hp and the 600-hp variants. The highest priority was given to equipping and staffing these plants, and production of engines in terms of hp was sharply increased compared with prewar production. About 29,400 V2-type engines were produced in 1944, of which 20 percent were of 600 hp and 80 percent of 500 hp, a total production of approximately 15.3 million hp.

3. 1946-54.

Following the war, tank engines were produced at a reduced rate, thus making production capacity for engines of this type available to the general economy. The Barnaul Transport Machine Building Plant in particular has converted to making commercial engines which are adapted from the V2 tank engine. 12/ Traditional engine plants were converted or reconstructed to take

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up the production of those engine models which they had intended to produce in 1941. An important exception to this was the Stalin Plant in Voronezh, which had converted to aircraft component production during the war. It was reconverted to the production of agricultural equipment in 1946. 13/

The Krasnoye Sormovo Plant in Gor'kiy, never an efficient engine producer, did not take up diesel production after the war. At present it is engaged in shipbuilding on a high-production basis.

Considerable new machinery has been received by the engine plants. Over-all capacity for producing diesel and oil engines (not including tank, motor-vehicle, or tractor engines) has been increased by the addition of several important plants which did not previously engage in engine production. These include the Borets Plant in Moscow, the Strommashina Plant in Andizhan, the Khar'kov Transport Machine Building Plant, and the Barnaul Transport Machine Building Plant. Also several small plants have been mentioned in the postwar Soviet press as producers of diesel and oil engines, chiefly for agriculture.

The annual production of diesel engines for tanks during 1952-54 is estimated at 4.9 million hp. The Ural Turbine Plant in Sverdlovsk and the Voroshilov Plant in Leningrad are the major producers of tank diesel engines.

The annual production of Soviet diesel tractors by model during 1952-54 has recently been estimated. 14/ Annual tractor diesel engine production in hp is derived from these tractor production estimates. Tractor diesel engine production was 5,311,000 hp in 1952, 5,515,000 hp in 1953, and 6,201,000 hp in 1954. The annual production of diesel engines for trucks during 1952-54 is estimated at 1.13 million hp.

In the case of plants for which production data are not available, estimates are based on the probable size of the plant and on the size of the market. The 1954 rounded total production of diesel and oil engines other than for tanks, tractors, and motor vehicles is 2.84 million hp.

The annual production rate of diesel and oil engines other than for tanks, tractors, and motor vehicles may have in-

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creased by about 10 percent per year during 1953 and 1954. This estimate takes cognizance of the requirements for an increase in diesel engine production in keeping with the growth of the industries which require diesel engines. These industries include shipbuilding, building of diesel locomotives, and production of construction and road machines and of oil field equipment.

The Fifth Five Year Plan provides that in 1955 the launching of oceangoing tankers and freighters will increase by 290 percent over that of 1950, river passenger vessels by 260 percent, and fishing vessels for the fishing fleet by 380 percent.

The production of diesel-electric locomotives was 33 percent higher in 1953 than in 1952. 15/ A similarly high rate of growth of production of diesel-electric locomotives is necessary in 1954 if the announced goal of the Sixth Five Year Plan is to be realized. This goal is the production during 1956-60 of 2,000 TE-3 diesel-electric locomotives of 2,000 hp each, which is an average annual output of 0.8 million hp per year of this model, compared with the 1952 output of about 350,000 hp of all models.

The Fifth Five Year Plan also requires the complete mechanization of roadbuilding work, which would mean an increase in the fleet of excavators of 250 percent; scrapers and bulldozers, 300 to 400 percent; and mobile cranes, 450 percent. Production of excavators in 1953 increased by 12 percent over 1952, and in the first half of 1954 it increased by 17 percent over the first half of 1953.

The production of diesel engines other than for tanks, tractors, and motor vehicles therefore is estimated at 2,585,000 hp in 1953 and 2,843,000 hp in 1954, based on an increase of 10 percent per year since 1952. The production of the diesel engine industry of the USSR in 1952-54 is shown in Table 1.*

The production of diesel and oil engines in the USSR by plant in 1952 -- except for tanks, motor vehicles, and tractors -- is shown in Table 2.**

* Table 1 follows on p. 15.

** Table 2 follows on p. 16.

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Table 1

Production of Diesel and Oil Engines in the USSR a/
1952-54

<u>Engine Application</u>	<u>Thousand Horsepower</u>		
	<u>1952</u>	<u>1953</u>	<u>1954</u>
Tank	4,900	4,900	4,900
Tractor	5,311	5,515	6,201
Motor vehicle	1,130	1,130	1,130
Other	2,350	2,585	2,843
Totals	<u>13,691</u>	<u>14,130</u>	<u>15,074</u>

a. Probable accuracy of the totals is plus or minus 25 percent.

B. National Capacity.

The maximum potential production of all existing and readily convertible diesel and oil engine manufacturing plants could probably* reach the following annual rates:

<u>Engine Application</u>	<u>Horsepower</u>
Tank	16,650,000
Motor vehicle and tractor	6,750,000
Other	1,725,000
Total	<u>25,125,000</u>

The estimated maximum potential production of tank engines in the USSR in 1954 by plant is shown in Table 3.** These figures are based on World War II production data, plant studies of plants rebuilt after the war, and estimates of tank-building capacity. 16/

* Assuming no delay in the receipt of supplies from vendors, and operations based on a 24-hour day.

** Table 3 follows on p. 17.

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Table 2

Production of Diesel and Oil Engines in the USSR
 Except Engines for Tanks, Motor Vehicles, and Tractors
 by Plant a/*
 1952

Plant b/	Thousand Horsepower Production
Russkiy Dizel' Plant	55
Dvigatel' Revolyutsiy Plant	65
Mikoyan Diesel Engine Factory	75
Kommunist Plant	36
25 Oktyabr' Machine Building Factory	25
Dzerzhinskiy Plant	12
Khar'kov Transport Machine Building Plant	350
Kolomna Railroad Locomotive Plant imeni Kuybyshev	200
Barnaul Transport Machine Building Plant	1,200
Kirov Diesel Engine Plant (Bol'shoy Tokmak)	30
Kazan' Machine Building Plant	12
Budennyy Engine Factory	30
Saratov Mekhanicheskii Diesel Engine Plant	12
Rybsudomotor Plant	12
Borets Pump Factory	80
Strommashina Plant	20
Riga Machine Construction Factory	6
Gorlovskiy Mine Equipment Factory imeni Kirov	25
Bel'tsy Engine Factory	2.5
Petrozavodsk Metal Factory	1.5
Krasnyy Metallist Industrial Artel	3
Krasnodar Zapchast Plant	7
Engel's Machine Building Plant imeni Ordzhonikidze	6
Kirov Machine Building Factory (Tiraspol')	12
30th Anniversary of the Komsomol' Factory	12
Tambov Mekhanicheskii Diesel Engine Plant	13.5
20th Anniversary Turkmen SSR Machinery Factory	6
Instrument Factory (Frunze)	6
Molotov Plant (Khabarovsk)	36
Total	<u>2,350</u> c/

* Footnotes for Table 2 follow on p. 17.

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Table 2

Production of Diesel and Oil Engines in the USSR
 Except Engines for Tanks, Motor Vehicles, and Tractors a/
 by Plant
 1952
 (Continued)

- a. Includes gas (not gasoline) engines.
 b. Data are not available for the Chelyabinsk Tractor Plant and for automobile plants subordinate to the Ministry of Automobile, Tractor, and Agricultural Machine Building.
 c. Total is rounded. Estimated range of error, plus or minus 25 per cent.

Table 3

Maximum Potential Production of Tank Engines in the USSR
 by Plant
 1954

Plant	Engine Type	Engines	Annual Horsepower (Million)
Barnaul Transport Machine Building Plant	V2-500	6,000	3.0
Chelyabinsk Tractor Plant	V2-600	12,000	7.2
Voroshilov Engine Factory	V2-600	5,400	2.7
Ural Turbine Plant	V2-500	5,000	2.5
Khar'kov Transport Machine Building Plant	V2-500	3,000	1.25
Total		<u>31,400</u>	<u>16.65</u>

Production of Soviet motor vehicle and tractor engines rose from an estimated output of 4.94 million hp in 1953 to an estimated output of 5.63 million hp in 1954. 17/ An increase of 20 percent over the 1954 figure can be achieved and would increase national capacity to 6.75 million hp. In a period of capacity output of tank diesel engines -- that is, during total war -- production of tractor and industrial engines would obviously decrease.

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C. Future Expansion.

New facilities are probably under construction at the Strommashina Plant in Andizhan and also are apparently intended for the Khar'kov Transport Machine Building Plant. The Strommashina Plant is building a new family of engines in sufficient quantity for the entire construction and roadbuilding machinery industry. The production of diesel engines for locomotives must also be expanded to meet the goal of the Sixth Five Year Plan for 2,000 TE-3 diesel-electric locomotives. Each locomotive requires a 2,000 hp engine of a new model. Thus the Plan requires that an average annual output of 800,000 hp of these engines alone be produced during 1956-60. The 1952 production of locomotive diesels of all types is estimated at 350,000 hp.

III. Consumption by Major Industry.

A. Motor Vehicle and Tractor Industry.

The motor vehicle and tractor industry of the USSR for the purposes of this report consists of the plants under the Ministry of Automobile, Tractor, and Agricultural Machine Building (see Appendix A) and the Chelyabinsk Tractor Plant. A few diesel engines for 25-ton MAZ-S25 dump trucks are also produced in the Barnaul Transport Machine Building Plant. The industry is a net supplier of diesel engines.

B. Shipbuilding Industry.

The requirements of the shipbuilding industry of the USSR for diesel and oil engines in 1952-55 are shown in Table 4.*

C. Locomotive Building Industry.

Diesel locomotives are built at Khar'kov and at Kaluga. The diesel locomotives of the Khar'kov Transport Machine Building Plant use the D50 1,000-hp diesel, also produced by that plant. All of the engines produced, which total 350,000 hp, are used by the locomotive industry. The Kaluga Machine Building Plant produces the TM-24 switching locomotive, 18/ which uses the 2D6, 150-hp diesel produced by the Barnaul Transport Machine Building Plant. 19/ Production totals and requirements for this engine by the Kaluga Plant are not known.

* Table 4 follows on p. 19.

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Table 4

Requirements of the Shipbuilding Industry for Diesel and Oil Engines
in the USSR ^{20/}
1952-55

<u>Fleet and Type</u>	<u>Thousand Horsepower</u>			
	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>
Naval ^{a/}				
Submarines (long-range)	48.0	104.0	164.0	184.0
Subchasers	90.0	90.0	90.0	90.0
Minesweepers (coastal)	30.0	30.0	30.0	30.0
Subtotal	<u>168.0</u>	<u>224.0</u>	<u>284.0</u>	<u>304.0</u>
Merchant	86.0	102.5	110.9	116.0
Total	<u>254.0</u>	<u>326.5</u>	<u>394.9</u>	<u>420.0</u>

a. Requirements for motor torpedo boats are not available.

D. Armaments Industries.

The tank and self-propelled gun plants have adequate V2 engine supplies, and the V2 engine plants have a considerable reserve capacity. Horsepower output of V2 tank engines can be derived from estimates of tank production in 1951. ^{21/} In 1951 the tank industry consumed 6,100 V2-500 engines, totaling 3.05 million hp, and 3,050 V2-600 engines, totaling 1.83 million hp, or a grand total of 4.88 million hp.

Other industries which use diesel and oil engines are the construction and road machine building, lumber, petroleum, agriculture, and electric power industries. It is not possible, however, to make an estimate of the engines consumed in these industries.

IV. Inputs.

Diesel and oil engines are composed primarily of five materials -- cast iron, steel (mostly forged), aluminum, bronze, and babbitt. The

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cast iron is usually found in frames, crankcases, blocks, cylinder heads, pistons, and flywheels and in small castings such as pump bodies, brackets, and covers. The steel component is usually found in crankshafts, connecting rods, piston pins, camshafts, bolts and nuts, valves and valve gear, and injection pumps and injectors. Aluminum is usually confined to pistons in certain medium-speed and high-speed engines and to a few lightly loaded castings. Aluminum comprises a very large part of the V2-type engine, however, being found in the crankcase, block, heads, gear covers, and clutch housing. Bronze is contained in all engines in the form of piston-pin bushings and other bushings. Babbitt is used for connecting-rod and main bearing material in many of the low-speed engines.

Inputs for the production of engines for motor vehicles, tractors, and tanks are usually included in reports on these industries. The inputs for the 1952 Soviet production of 2.35 million hp of diesel engines other than for motor vehicles, tractors, and tanks are as follows:

Labor*	30,000 man-years
Iron castings	40,000 metric tons
Steel	27,000 metric tons
Aluminum	3,000 metric tons
Bronze	1,500 metric tons
Babbitt	135 metric tons

V. Location.

A. Geographical Distribution of Production.

In Appendix B, total Soviet production for 1952 has been itemized by plant and plant location (economic region** and geographical coordinates). Table 6*** lists the location of the plants

* Labor inputs represent total labor consumed -- that is, both direct (production workers') and indirect (nonproduction workers') labor.

** The economic regions referred to in this report are those defined and numbered on CIA Map 12048.1, 9-51 (First Revision, 7-52), USSR: Economic Regions.

*** Table 6 follows on p. 27.

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producing diesel and oil engines for the general purposes of the economy, and Table 7* lists the locations of the plants producing engines for motor vehicles, tractors, and tanks. This information is summarized by economic region in Table 5.

Table 5

Summary of Regional Distribution of Diesel and Oil Engine Production
in the USSR
1952

Economic Region	Thousand Horsepower		
	General-Purpose Engines	Motor Vehicle, Tractor, and Tank Engines	All Engines
Ia	56	1,100	1,156
IIa	6	0	6
IIb	0	148	148
III	561	1,707	2,268
IV	7	0	7
VI	93	1,350	1,443
VII	358	1,100	1,458
VIII	0	4,974	4,974
IX	1,200	810	2,010
Xb	32	0	32
XII	36	0	36

B. Economic Significance.

After World War II, diesel and oil engine production was resumed in the same plants which had produced engines during the Third Five Year Plan, thereby utilizing the skills of the local population as well as the available economic and technological support of the areas. Other plants began the manufacture of diesel engines because other enterprises of their ministries needed engines which could not otherwise be obtained. The Borets Plant is an example of this type

* Table 7 follows on p. 29.

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of engine production. It began building engines for oilfield work in the postwar period when the Ministry of the Petroleum Industry could not obtain sufficient engines for drilling and pumping work elsewhere.

VI. Intentions.

The USSR intends to expand its use and production of diesel engines. The increased production of diesel fuel in the USSR indicates this trend. By 1955 it is expected that more petroleum will be consumed as diesel fuel in the USSR than as either gasoline or kerosene. In 1950, less than 8 percent of all petroleum consumed in the USSR was diesel fuel, whereas by 1955 approximately 22 percent of all petroleum consumed will be diesel fuel. 22/ One goal of the Fifth Five Year Plan is to have all agricultural tractors built with diesel engines. 23/ The output of heavy, diesel-engined trucks has been accelerated. Furthermore, it has already been announced that during the Sixth Five Year Plan the USSR will produce 2,000 Model TE-3 diesel-electric locomotives, each of which requires a 2,000 hp diesel engine as compared with the planned output during the Fourth Five Year Plan of 865 diesel locomotives none of which was larger than 1,000 hp.

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APPENDIX A

MINISTERIAL SUBORDINATION OF DIESEL, OIL, AND GAS ENGINE BUILDING PLANTS
IN THE USSR IN 1952

(Legend: D = diesel engine, O = oil engine,
G = gas engine)

1. Ministry of Heavy Machine Building.

Russkiy Dizel' Plant, Leningrad, D.
Dvigatel' Revolyutsiy Plant, Gor'kiy, D, G.
Mikoyan Diesel Engine Factory, Melitopol', D.
Kommunist Plant, Marks, D.
Dzerzhinskiy Plant, Balakovo, O.
25 Oktyabr' Machine Building Factory, Pervomaysk, G.

2. Ministry of Transport Machine Building.

Khar'kov Transport Machine Building Plant, Khar'kov, D.
Kolomna Railroad Locomotive Plant imeni Kuybyshev, Kolomna, D.
Chelyabinsk Tractor Plant, Chelyabinsk, D.
Barnaul Transport Machine Building Plant, Barnaul, D.
Voroshilov Engine Factory, Leningrad, D.
Ural Turbine Plant imeni Kirov, Sverdlovsk, D.

3. Ministry of the Automobile and Tractor Industry.

Altay Tractor Plant imeni Kalinin, Rubtsovsk, D.
Khar'kov Tractor imeni Ordzhanikidze, Khar'kov, D.
Lipetsk Tractor Plant, Lipetsk, D.
Minsk Tractor Plant, Minsk, D.
Stalingrad Tractor Plant imeni Dzerzhinskiy, Stalingrad, D.
Yaroslavl' Motor Vehicle Plant, Yaroslavl', D.

4. Ministry of Shipbuilding.

Kirov Diesel Engine Plant, Bol'shoy Tokmak, D.

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5. Ministry of Agriculture.
Kazan' Machine Building Plant, Kazan', D.
Budenny Engine Factory, Voroshilovgrad, D.
6. Ministry of State Farms.
Saratov Mekhanicheskiy Diesel Engine Plant, Saratov, O.
7. Ministry of the Fish Industry.
Rybsudomotor Plant, Astrakhan', O.
8. Ministry of Construction and Road Machine Building.
Strommashina Plant, Andizhan, D.
9. Ministry of the Petroleum Industry.
Borets Pump Factory, Moscow, O, D.
10. Ministry of the Meat and Dairy Industry.
Riga Machine Construction Factory, Riga, O.
11. Ministry of the Coal Industry.
Gorlovskiy Mine Equipment Factory, Gorlovka, O.
12. Moldavian SSR Ministry of Local Industries.
Bel'tsy Engine Factory, Bel'tsy, O.
13. Trade Cooperatives.
 - a. Karelo-Finnish SSR Administration of Industrial Cooperatives.
Petrozovodsk Metal Factory, Petrozavodsk, D.
 - b. Astrakhan' Oblast Administration of Industrial Cooperatives.
Krasnyy Metallist Industrial Artel, Astrakhan', O.

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14. Local Industry.

Kabardinskaya ASSR. Office of Krasnodar'skiy Kray Local Industry.
Krasnodar Zapchast' Plant, Krasnodar, O.

15. Plants of Unknown Subordination.

Engel's Machine Building Plant imeni Ordzhonikidze, Engel's, D.
Kirov Machine Building Factory, Tiraspol', O.
30th Anniversary of the Komsomol' Factory, Melitopol', O.
Tambov Mekhanicheskii Diesel Engine Plant, Tambov, O.
20th Anniversary Turkmen SSR Machinery Factory, Ashkhabad, O.
Instrument Factory, Frunze, O.
Molotov Plant, Khabarovsk, O.

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APPENDIX B

GEOGRAPHIC DISTRIBUTION OF PLANTS

Table 6

Geographic Distribution of Plants in the USSR Producing Diesel and Oil Engines
 Except Engines for Motor Vehicles, Tractors, and Tanks
 1952

<u>Economic Region</u>	<u>City</u>	<u>Plant</u>	<u>Geographic Coordinates</u>	<u>Annual Output (Thousand Horsepower)</u>
Ia	Petrozavodsk	Petrozavodsk Metal Factory	61°47'N-34°21'E	1.5
Ia	Leningrad	Russkiy Dizel' Plant	59°56'N-30°20'E	55.0
IIa	Riga	Machine Construction Factory of the Myasomolmash Trust	56°59'N-24°09'E	6.0
III	Bel'tsy	Bel'tsy Engine Factory	47°46'N-27°56'E	2.5
III	Bol'shoy Tokmak	Kirov Diesel Engine Plant	47°14'N-35°44'E	30.0
III	Pervomaysk	25 Oktyabr' Machine Building Factory	48°03'N-30°48'E	25.0
III	Voroshilovgrad	Budenny Engine Factory	48°34'N-39°20'E	30.0
III	Khar'kov	Transport Machine Building Plant	49°58'N-36°15'E	350.0
III	Tiraspol'	Kirov Machine Building Factory	46°50'N-29°37'E	12.0
III	Melitopol'	30th Anniversary of the Komsomol' Factory	46°50'N-35°22'E	12.0
III	Melitopol'	Mikoyan Diesel Engine Factory	46°50'N-35°22'E	75.0
III	Gorlovka	Gorlovskiy Mine Equip- ment Factory imeni Kirov	48°18'N-38°02'E	25.0
IV	Krasnodar	Krasnodar Zapchast' Plant	45°01'N-38°59'E	7.0
VI	Engel's	Engel's Machine Building Plant imeni Ordzhonikidze	51°30'N-46°05'E	6.0

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Table 6

Geographic Distribution of Plants in the USSR Producing Diesel and Oil Engines
 Except Engines for Motor Vehicles, Tractors, and Tanks
 1952
 (Continued)

Economic Region	City	Plant	Geographic Coordinates	Annual Output (Thousand Horsepower)
VI	Marks	Kommunist Plant	51°42'N-46°46'E	36.0
VI	Kazan'	Kazan' Machine Building Plant	55°47'N-49°08'E	12.0
VI	Saratov	Saratov Mekhanicheskiy Diesel Engine Plant	51°32'N-46°01'E	12.0
VI	Balakovo	Dzerzhinskiy Plant	52°03'N-47°48'E	12.0
VI	Astrakhan'	Rybsudomotor Plant	46°21'N-48°02'E	12.0
VI	Astrakhan'	Krasnyy Metallist Industrial Artel	46°21'N-48°02'E	3.0
VII	Gor'kiy	Dvigatel' Revolyutsiy Plant	56°18'N-44°02'E	65.0
VII	Moscow	Borets Pump Factory	55°40'N-37°37'E	80.0
VII	Kolomna	Railroad Locomotive Plant imeni Kuybyshev	55°06'N-38°47'E	200.0
VII	Tambov	Tambov Mekhanichesky Diesel Engine Plant	52°43'N-41°27'E	13.5
IX	Barnaul	Transport Machine Building Plant	53°20'N-83°48'E	1,200.0
Xb	Andizhan	Strommashina Plant	40°47'N-72°20'E	20.0
Xb	Ashkhabad	20th Anniversary Turkmen SSR Machinery Factory	37°57'N-58°24'E	6.0
Xb	Frunze	Instrument Factory	42°53'N-74°35'E	6.0
XII	Khabarovsk	Molotov Plant	48°28'N-135°05'E	36.0
Total				<u>2,350.5</u>

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Table 7

Geographic Distribution of Plants in the USSR
Producing Diesel and Oil Engines for Motor Vehicles, Tractors, and Tanks a/
1952

<u>Economic Region</u>	<u>City</u>	<u>Plant</u>	<u>Geographic Coordinates</u>	<u>Annual Output (Thousand Horsepower)</u>
Ia	Leningrad	Voroshilov Engine Factory	59°56'N-30°20'E	1,100
IIb	Minsk	Minsk Tractor Plant	53°54'N-27°33'E	148
III	Khar'kov	Khar'kov Tractor Plant imeni Ordzhonikidze	49°58'N-36°15'E	1,107
III	Khar'kov	Transport Machine Building Plant	49°58'N-36°15'E	600
VI	Stalingrad	Stalingrad Tractor Plant imeni Dzerzhinskiy	48°42'N-44°30'E	1,350
VII	Yaroslavl'	Yaroslavl' Motor Vehicle Plant	57°38'N-39°51'E	1,100
VII	Lipetsk	Lipetsk Tractor Plant	52°37'N-39°36'E	222
VIII	Chelyabinsk	Chelyabinsk Tractor Plant	55°10'N-61°25'E	4,524 <u>b/</u>
VIII	Sverdlovsk	Ural Turbine Plant imeni Kirov	56°50'N-60°36'E	450
IX	Rubtsovsk	Altay Tractor Plant imeni Kalinin	51°31'N-81°14'E	810
Total				<u>11,311</u>

a. Tank engines are produced at the Khar'kov Transport Machine Building Plant imeni Voroshilov, Chelyabinsk Tractor Plant, and the Ural Turbine Plant. 24/

b. This figure includes both tank and tractor engines, of which tractor engines amount to 1,674,000 hp.

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APPENDIX C

METHODOLOGY

The production of diesel and oil engines in the USSR during the post-war period was obtained by an examination of plant studies and of the requirements for diesel and oil engines in the Soviet economy. No analogy to US practice has been used anywhere in the development of the statistical results in this report. Some research in US practice was made in order to evaluate the technological level of the Soviet industry. The methodology employed in making quantitative determinations in various sections of the report and in the appendixes is described in the text.

The original contribution of this report consists of the estimates of output of diesel and oil engines for the general purposes of the economy. The total output of diesel and oil engines is also presented by introducing into the report, from the work of others, the output of diesel engines in the motor vehicle, tractor, and tank industries.

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APPENDIX D

GAPS IN INTELLIGENCE

Information on the production of oil and diesel engines in the USSR has not been made available by official announcements for many years. Even Plan figures and percentage fulfillments are lacking since the 1941 Plan.

More information is needed on certain critical plants such as the Kolomna Plant, which produces submarine engines; the Khar'kov Plant, which produces locomotive diesels; the Barnaul Plant, which produces almost 50 percent of the total national output of industrial diesels; and the Borets Plant, which produces diesels for the oil industry.

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[REDACTED] would permit an estimate of the quantity of industrial diesels produced by the motor vehicle and tractor industry, in addition to an estimate of the total number of engines mounted in the chassis of trucks and tractors.

25X1B

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APPENDIX E

SOURCES

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This report is based on a direct study of the Soviet diesel engine industry as described in Soviet books and periodicals. One major problem was to identify the engine models in current production and the plants which produce them. Identification of engines in current production was made primarily by a study of Soviet books and magazines in the Library of Congress. The correlation of the engine models to the producing plants was also largely accomplished from these sources. FBIS extracts, [REDACTED] and CIA FDD translations were also useful in connecting engine models with producing plants and in determining which plants were producing engines in the postwar period. A study of Soviet textbooks alone appeared to credit engine production to some plants which on further study proved not to have resumed engine production after the war.

References to intelligence reports are extremely few. In determining the Soviet capacity to produce tank engines, reference was made to a CIA report on the production of tanks. For tractor engines, similar use was made of a CIA report on the production of tractors: ONI estimates of naval shipbuilding in the USSR were used.

Evaluations, following the classification entry and designated "Eval.," have the following significance:

<u>Source of Information</u>	<u>Information</u>
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff

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officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

25X1A

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4. CIA FDD, Translation U-3318, 17 Apr 1953, A.A. Kokhtev, Standard River Tugs and Barges, Moscow, 1948. C. Eval. Doc.
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20. CIA/RR PR-25, op. cit.
21. Ibid.
22. CIA/RR Research Aid, Civil Consumption of Petroleum Products in the USSR, 1945-55, 27 Sep 1954. S, US OFFICIALS ONLY.*
23. Pravda, 30 Jun 1953. U. Eval. RR 2.
24. CIA/RR PR-25, op. cit.
CIA/RR PR-37, op. cit.

STATSPEC

* Although this US OFFICIALS ONLY source is cited, none of the data used from it bears a US OFFICIALS ONLY restriction.

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