INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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50X1-HUM

C-O-N-F-I-D-E-N-T-I-A-L

COUNTRY	USSR	REPORT	[redacted]
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THIS IS UNEVALUATED INFORMATION

[redacted]

[redacted] the following Soviet papers on Hydroelectric Power Plants in the USSR: 50X1-HUM

a. Bratsk Hydroelectric Station, Moscow 1962 (in English)

b. Kremenchugskaya Gidroelektrostantsiya (Kremenchug Hydroelectric Station) (in Russian). 50X1-HUM

[redacted]

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GROUP 1
Excluded from automatic downgrading and declassification

STATE		ARMY		NAVY		AIR		FBI		AEC			

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INFORMATION REPORT INFORMATION REPORT

CONTROLLED DISSEM NO DISSEM ABROAD [redacted]

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Днепр по своей величине является третьей рекой в Европе (после Волги и Дуная).

Основная масса гидроэнергоресурсов (до 90%) сосредоточена на нижнем участке Днепра — от Киева (точнее от устья р. Припяти).

Вследствие резкой неравномерности стока реки исключительно важное значение приобретает создание на Днепре крупных водохранилищ, способных зарегулировать сток.

Наиболее крупным явится водохранилище Кременчугской ГЭС, строительство которой было начато в 1954 г. Водохранилище будет иметь длину 185 км, площадь зеркала 2 250 км² и полезный объем порядка 9 млрд. м³. Такой объем позволит осуществить годовое (с переходом на многолетнее) регулирование стока, благодаря которому увеличится энергоотдача всех нижерасположенных гидроэлектростанций каскада, а также увеличатся судоходные глубины на Днепре от Киева до Днепропетровска. Кроме того, водохранилище Кременчугской ГЭС даст возможность оросить до 3,5 млн. га засушливых земель.

Створ сооружений гидроузла имеет протяженность 12,6 км.

Основанием бетонных сооружений служат граниты. Земляные плотины расположены на песках.

Компоновка сооружений гидроузла, начиная с правого берега, следующая: земляная плотина, шлюз, здание ГЭС, водосливная и земляная плотины. Земляные плотины длиной 10,72 км занимают 97% общей протяженности напорного фронта (12,4 км). По гребню плотины проведены однопутная железная дорога нормальной колеи, автодорога и линии электропередачи 330 кв. Верховые откосы укреплены в нижней части до промежуточной бермы каменной наброской толщиной 0,5—0,7 м. Выше бермы откос укреплен железобетонными плитами на щебеночном фильтре.

Судоходный шлюз — однокамерный, с распределительной системой питания, с наполнением и опорожнением камеры посредством водопроводных галерей, начинающихся в верхней голове. Конструктивной особенностью шлюза является отказ от башен с расположением механизмов в головах. Перед шлюзом путем устройства дамбы волнолома длиной 2,5 км образуется аванпорт для отстоя судов. Нижняя голова шлюза совмещена с осью створа для пропуска железнодорожного пути.

За шлюзом идет низовой подходный канал с бетонной причальной стенкой.

Между шлюзом и зданием ГЭС расположена земляная вставка длиной 360 м.

Здание ГЭС принято без машинного зала с установкой генераторов под специальными колпаками, выполняемыми заводом — поставщиком генераторов. Конструкция генератора дает возможность производства ряда ремонтных работ без снятия колпаков. Для этого предусмотрены средства так называемой «малой механизации», при помощи которой могут быть вынуты полюсы ротора, стержни обмотки статора, воздухоохладители и сегменты пят.

Монтажная площадка принята закрытой, но с разборной кровлей и с низким расположением пола. Основным краном на здании ГЭС является козловой кран грузоподъемностью 500 т, который подавал на монтажную площадку крупные детали — ротор генератора, рабочее колесо турбины и т. п. Отдельные узлы в пределах монтажной площадки перемещались мостовым краном грузоподъемностью 30,5 т.

Гидроэлектростанция оборудована 12 поворотнолопастными турбинами с диаметром рабочего колеса 8,0 м. Генераторы — трехфазные, вертикальные напряжением 13,8 кв с ионным возбуждением.

Установленная мощность Кременчугской ГЭС 625 Мвт.

Среднегодовая выработка электроэнергии составляет 1,5 млрд. квт·ч. Благодаря регулирующему влиянию Кременчугского водохранилища на 0,5 млрд. квт·ч увеличится выработка на нижележащих ГЭС. Передача энергии Кременчугской ГЭС производится на напряжениях 154 и 330 кв.

Водосливная плотина имеет 10 пролетов по 16 м, рассчитанных на пропуск расхода 20 350 $м^3$/сек.

Для гашения энергии переливающейся струи сооружены водобойный колодец и прорезной порог.

Отвод воды, пропускаемой через водосливную плотину и ГЭС, осуществляется через отводящий канал, который отделяется дамбой от низового подхода к шлюзу. На этой правобережной дамбе расположены подстанция, маслохозяйство ГЭС и компрессорная.

В конце 1959 г. пущены в эксплуатацию первые три агрегата при неполном напоре, а в ноябре 1960 г. Кременчугская гидроэлектростанция вступила в строй на полную мощность.

Проспект подготовлен институтом «Гидропроект» совместно с отделом выставок МФ института «Оргэнергострой».

Т-04760. Подп. к печ. 9/V 1962 г. Бесплатно. Тир. 3 000. Зак. 2241.

Типография Госэнергоиздата. Москва, Шлюзовая наб., 10.

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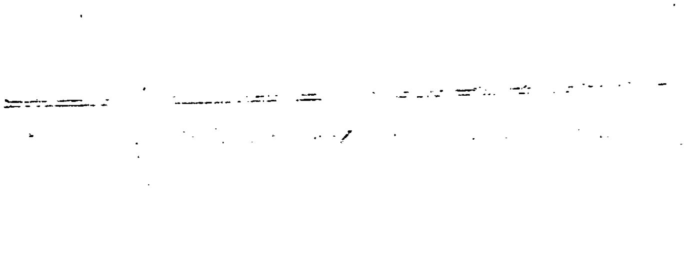
The Bratsk hydroelectric station with its 4,500,000 kW capacity and an average annual output of 22,600,000,000 kWh is the largest power project on the Angara River and in the world.

The Bratsk hydroelectric station is being constructed in the Padun Gorge, with almost vertical banks rising some 75—80 m above the water level. The total length of the water retaining structures creating the reservoir, is equal to 5,140 m. The volume of the reservoir totals 179,000,000,000 cu m, with useful capacity of 50,000,000,000 cu m and drawdown of 10 m.

At the dam site the river bed has a width of about 900 m and both banks consist of ingeous rock—diabase with weathered surface zones of a depth from 2 to 7 m.

The Angara River has a uniform flow due to the regulating influence of the immense natural lake Baikal located at the source of the river. The mean annual runoff is 92,000,000,000 cu m.



[illegible]ral view.

The design flow values are as follows: design flow with frequency of 0.1% is equal to 17,500 cu m per sec.; mean daily flow in construction period equals 12,600 cu. m per sec.

The hydroproject is being constructed in severe climatic conditions: average annual temperature is equal to 2.6° C, minimum —58° C, maximum +35° C; duration of winter season, with average monthly temperature below—15° C, is 6.5 months. Large frazil ice is formed in autumn before the freezing, and in spring, during floods there are ice jams resulting in rising of river water up to 7 m.

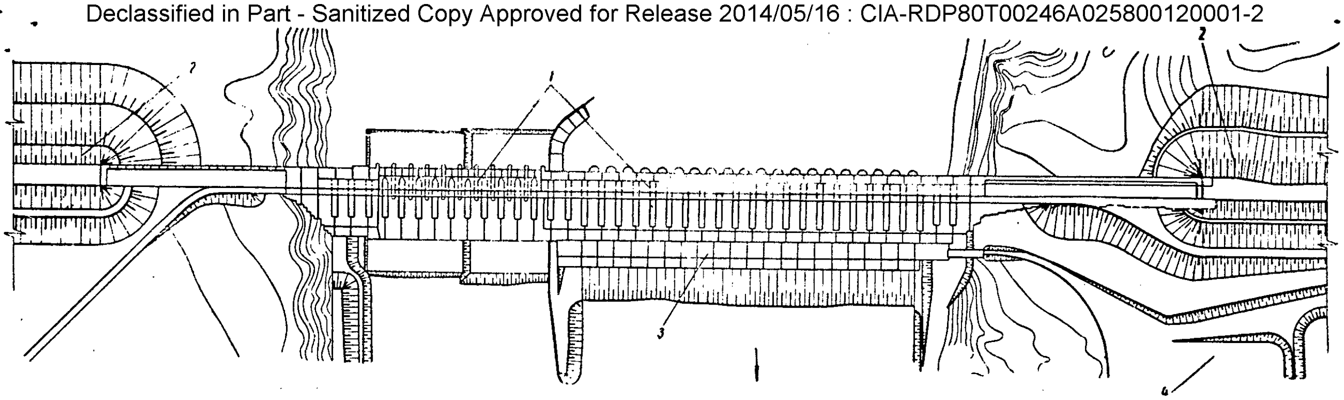
The main water retaining structure is the concrete hollow gravity dam, with crest length equal to 1,441 m and maximum construction height of 125 m. On the bank sides head is created by earth dams: left bank dam, 723 m long, and right bank dam, 2,976 m long.

The dam of triangular section with vertical upstream face and with downstream face slope of 1 : 0.8 is cut into blocks of 22 m wide each by hollow deformation joints. The total volume of the required amount of concrete in comparison with common gravity dams is cut by 10%. The width of the hollow joints in the powerhouse, spillway and non-overflow sections of the dam is 7 m. The body of the dam is drained by vertical canals of a diameter of 300 mm spaced every 2.75 m along the length of the dam at a distance of 7.5 m from the upstream face.

In the channel and left bank concrete dam foundation [illegible]row grout curtains are provided extending to a depth of maximum 79 m.

The foundation behind the [illegible] curtain [illegible] by means of holes drilled from two drainage galleries to a depth of 30 m. The safety factor against sliding at full storage is equal to [illegible]06 at [illegible] coefficient [illegible] friction [illegible] 0.8. The main compression stresses reach 33 kg per sq cm.

The concrete dam consists of the following parts: intake dam, [illegible]40 m long [illegible] 20 [illegible] face [illegible] and pens[illegible] 7 m



Plan.

1—concrete dam in river channel; *2*—bank earthfill; *3*—powerhouse; *4*—220 kV and 550 kV switchyard.

in diameter; spillway, 242 m long, with 10 discharge openings, closed by 18 × 6 m tainter gates; two non-overflow sections adjoining the right and left bank earth dams and a non-overflow section between the powerhouse and spillway dam, with a total length of 759 m.

The maximum spillway discharge capacity at normal water elevation is equal to 5,600 cu m per sec. and, at forced water elevation, to 7,100 cu m per sec. The total volume of concrete in the dam located in the river bed is 3,990,000 cu m and in the bank dams 380,000 cu m.

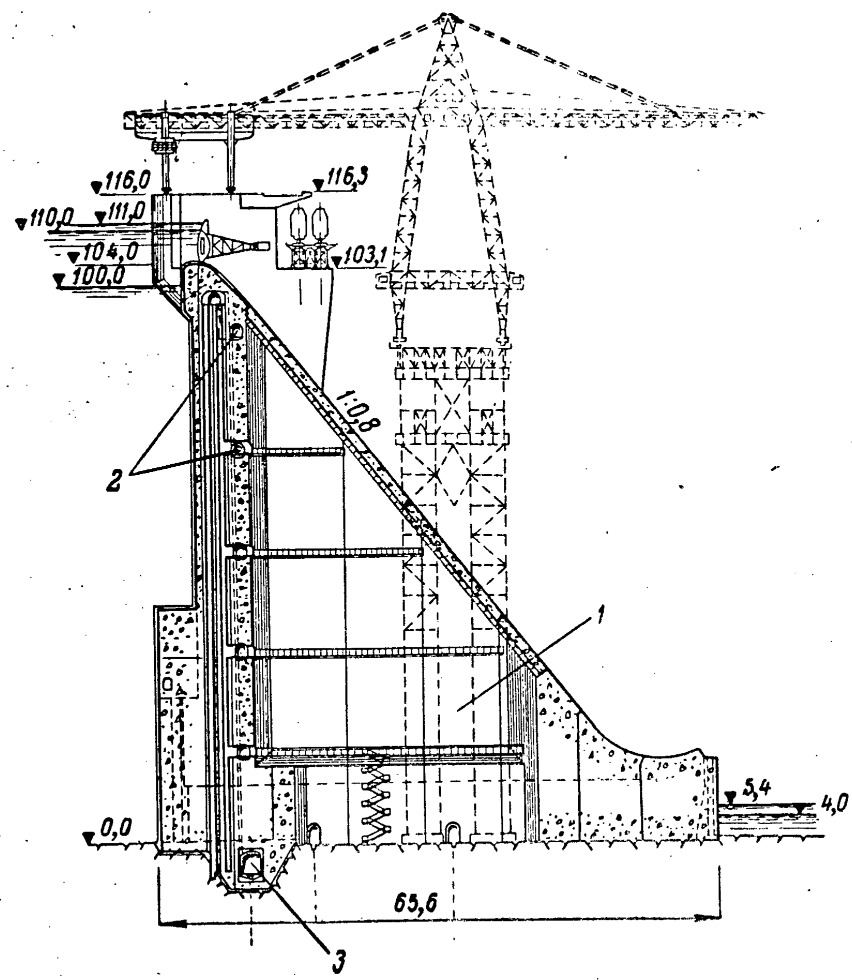
The powerhouse is located in the river bed immediately at the downstream face of the concrete dam, adjoining to the left bank. The powerhouse consists of 20 unit blocks of a length of 22 m each and two mounting bay blocks, one on the bank and the other in the channel. The switchgear premises as well as the service water supply system and oil storage facilities are located at the downstream side. At the upstream side in the space between the dam and the powerhouse are the 220 kV step-up transformers for 14 units and 500 kV transformers for six units. The main electrical connections for 14 units are of the block type (generator three-phase transformer 220/15.75 kV), and for six units—with enlarged double block (2 units switch into a series of single-phase transformers 500/15.75 kV). Connection to the switchyards accomplished for a voltage of 220 kV by oil-filled high-tension cables and for a voltage of 500 kV by air lines.

The powerplant has 20 units with Francis turbines of 230,000 kW capacity each, with design head $H = 100$ m, operating at 125 rpm, with runner of 5.5 diameter; generator capacity, power factor of 0.85, is equal to 225,000 kW. The switchyards for 220 and 500 kV are on the left bank.

The superstructure is made mainly of prefabricated reinforced concrete with walls assembled of three-layer panels. The roofing is of prestressed reinforced concrete T-beams.

The remoteness of the construction site of the Bratsk project from the industrial centres of the country, sparse settled surrounding areas and poor transport communication in the initial period necessitated creating local building industry and extensive construction of settlements and roads.

During the preparatory period of 2 years (1955—1957), the following was accomplished: about 100 km of access roads were constructed: 650 km transmission line was built from the Irkutsk hydroelectric station to Bratsk, with substations; local construction industry was set up including plants preparing building materials, and repair and maintenance works; storage facilities and specialized mounting-construction bases were organized; thus a total of 2,650,000 cu m of construction interprises



Spillway section.
1—deformation joint hollow; 2—inspection galleries; 3—grouting galleries.

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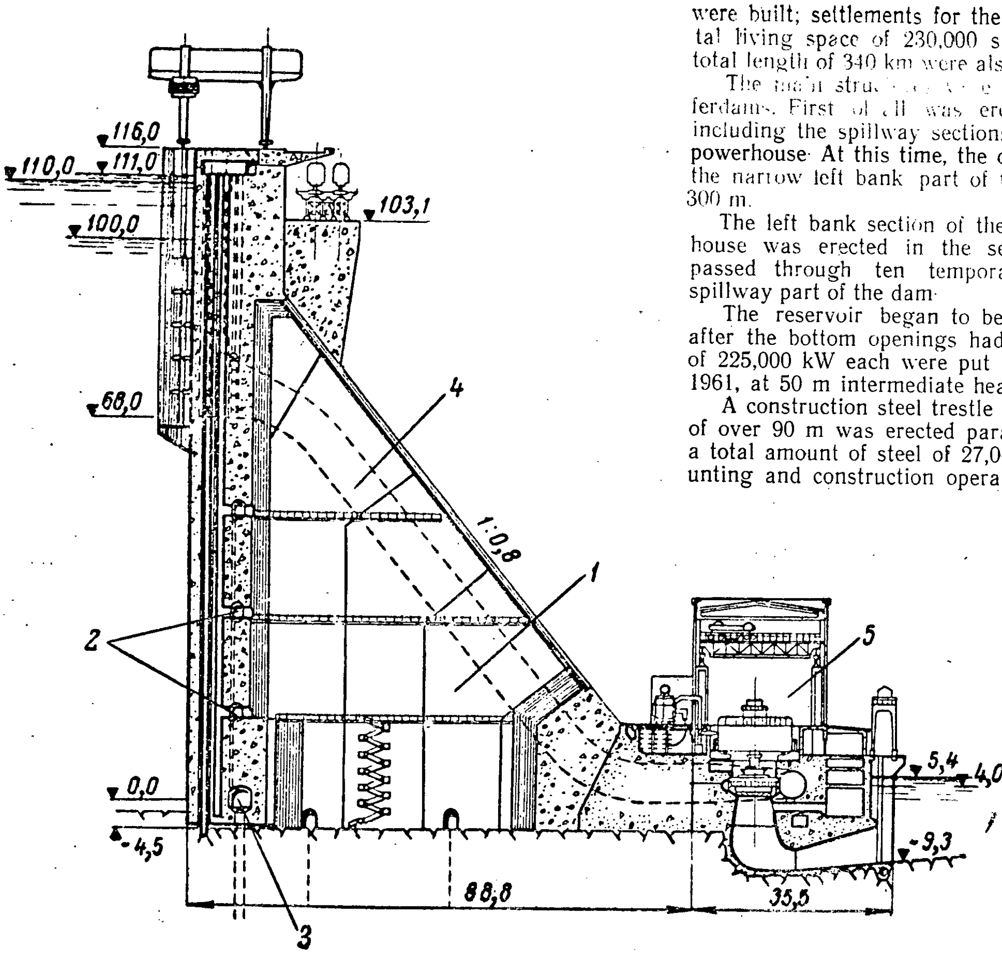

Intake dam.

1—hollow of deformation joint: 2—inspection galleries; 3—grouting galleries; 4—penstock; 5—powerhouse.

were built; settlements for the construction personnel with a total living space of 230,000 sq m and construction roads of a total length of 340 km were also built.

The main structures were erected in two stages behind cofferdams. First of all was erected the dam on the right bank, including the spillway sections and a series of blocks of the powerhouse. At this time, the diversion flow was passed through the narrow left bank part of the river bed of a width of about 300 m.

The left bank section of the dam with the rest of the powerhouse was erected in the second stage. The diversion flow passed through ten temporary bottom openings left in the spillway part of the dam.

The reservoir began to be filled early in September, 1961, after the bottom openings had been closed. The first two units of 225,000 kW each were put into operation late in November, 1961, at 50 m intermediate head.

A construction steel trestle connecting both banks at a height of over 90 m was erected parallel to the dam centre line, with a total amount of steel of 27,000 tons, for placing concrete, mounting and construction operations and to maintain continuous

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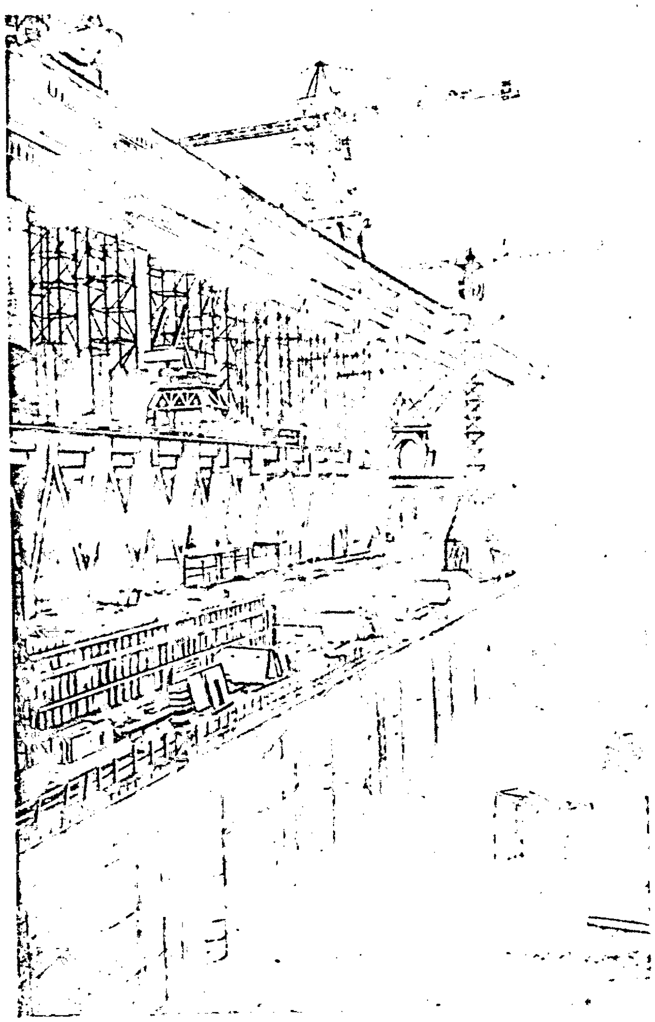

railroad traffic on Taishet--Lena railroad when filling the reservoir. The lower floor of the trestle is a railroad and highway bridge. On the upper floor of the trestle are crane runways and railroad tracks with six 22-ton travelling hammerhead cranes [illegible] placing [illegible]. The concrete is delivered to the cranes by trucks in 6.4 cu m buckets placed on the truck platforms.

During the first stage of concrete work, placing of the concrete mix was performed from a small construction trestle, 30 m high and comprising 7,000 tons of structural steel, installed between the downstream face and the powerhouse. The concrete was delivered by a 10-ton portal-boom crane in 3 cu m buckets. At the upstream the concrete mix was placed by 10-ton tower cranes. At present the smaller trestle is used for the construction of the powerhouse.

The concrete mix is prepared at two mixing plants: three-section plant with four 2.5 cu m concrete mixers in each, with 375 cu m per hr or 135,000 cu m per month capacity; the second one-section plant with four 2,5 cu m concrete mixers and a total capacity of 125 cu m per hr or 45,000 cu m per month. The cement storage of 8 silos holds 16,000 tons of cement, 2,000 tons in each silo.

Concrete placing in the dam is in pillar-like blocks with vertical construction joints spaced 13.8 m along the entire length; the joints are grouted after the mass concrete cools off.

Impermeable and frost-resistant concrete, grade 200, is used in the external zones of the dam and grade 100 concrete for the core.

The concrete mix is placed in lifts each 3 m high, with 50-cm layers, and compacted by pack vibrators with capacity up to 45 and 120 cu m per hr. The pack vibrators are controlled by 5-ton mobile tower cranes, which are also used for installation of the forms. Wooden cantilever forms, steel forms and concrete lining blocks (weighing 5 and 7.5 tons) are used to form the lifts.

During the summer the maximum of 135,000 cu m per month was placed with a height of about 6.5 m per month, and 86,000 cu m per month in the winter time.

Cooling of the concrete was of two-stage tubular system with 2.5-cm diameter tubes. The coolant at the first stage is the river water with a temperature not higher than +15° C, at the second stage - brine with a temperature of —5° C.

Dam under construction

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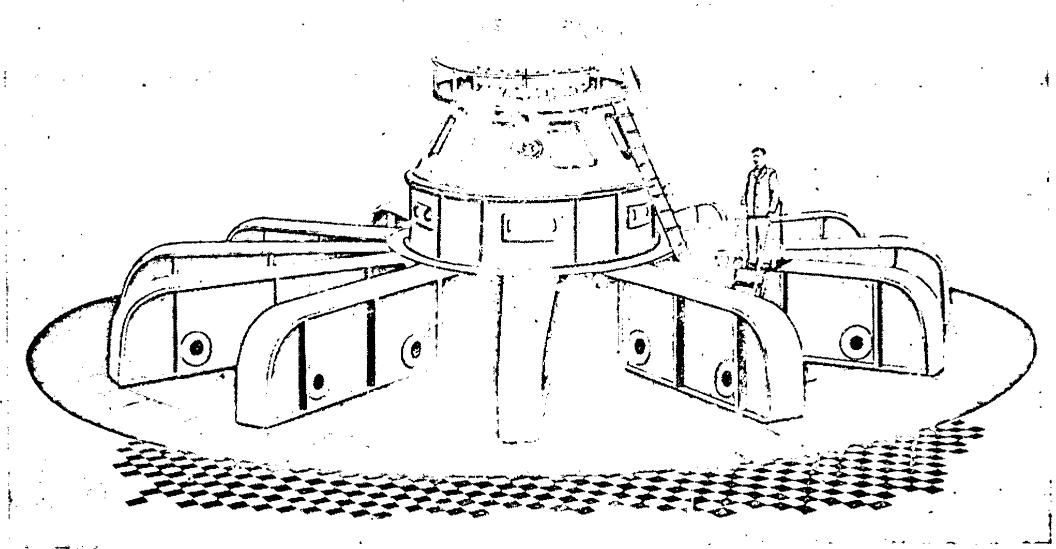

Unit 220,000 kW.

Measuring instruments and meters are provided at ten special sections of the dam for observation of displacements in the dam body, temperature regime, deformations and stresses in the concrete, stresses in of the foundation, and seepage.

The total volumes of all structures of the project are: excavation of earth and rock—3,400,000 cu m; earth fill and rock fill—9,600,000 cu m, concrete and reinforced concrete—4,800,000 cu m.

The Bratsk hydroelectric station is designed mainly for power and navigation. At the initial period of operation electric power will be transmitted to the existing and newly built industrial areas in Eastern Siberia; subsequently, after establishment of the 500 kV transmission line, Bratsk hydroelectric station will be connected to the Siberian power system.