

Paul H. Hultman

PRELIMINARY DESIGN REPORT

FOR

KRAFLA GEOTHERMAL POWER PLANT

FOR

KRAFLA PROJECT EXECUTIVE COMMITTEE AKUREYRI, ICELAND

VOLUME 2 COST ESTIMATE

Prepared as a Joint Venture by

ROGERS ENGINEERING CO., INC.
ENGINEERS & ARCHITECTS
111 PINE STREET
SAN FRANCISCO, CALIFORNIA 94111 USA

AND

THORODDSEN AND PARTNERS
CONSULTING ENGINEERS
ARMULA 4
REYKJAVIK, ICELAND

APRIL 15, 1975

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S-74028

VOLUME 2
COST ESTIMATE

The account numbers used in the cost estimate are those established by the United States Federal Power Commission for the electric utility industry in the U.S. The purpose of this system is to assure a uniform accounting procedure for the electric utility industry.

The cost estimate includes the cost of the contractors move into the site, temporary facilities, lodging for the construction labor force and the necessary access road to the site.

Permanent housing is included for five families at Myvatn as well as one building to house operators at the power plant site; in addition, a dormitory-type building with cooking, eating and washing facilities is provided for housing 20 maintenance personnel during overhaul periods.

Also included in the estimate are all the structures and improvements, consisting of the powerhouse, cooling tower basin, grading and paving, and exterior equipment foundations. Detail costs for the turbine generating units, all auxiliaries, electrical equipment, fire protection system and control systems are shown in the following cost breakdowns. Engineering, construction management, a contingency, and interest during the construction, are shown as separate items in the cost breakdown.

The cost estimate assumes that equipment, materials and construction costs will be paid for in the normal manner which does not involve long term supplier or contractor financing. The turbine generator unit is included at contract price including spare parts. Other equipment costs shown reflect manufactures expected firm bid prices.

Labor costs are included at current labor rates and include escalation expected during the construction of the power plant. Contractor overhead, taxes, insurance and fee are included for each element of the project.

The cost of the necessary geothermal wells, the steam and hot water collection piping, steam water separators and the geothermal waste water disposal systems is not included since they are outside of the

scope of work assigned to the consulting engineers.

The total budget estimate for the project is 3,826.500 million Icelandic Kronur (\$25,510.000 U.S. Dollars). The cost per kW on the basis of the 60 MW plant rating is 63,775 Icelandic Kronur (\$425 U.S. Dollars).

KRAFLA GEOTHERMAL POWERPLANT
CIVIL AND STRUCTURAL WORK

| | Icelandic Kronur by 1000 | U.S. Dollars |
|--|--------------------------------|-----------------|
| 1. POWERHOUSE BUILDING | | |
| 1.1 Excavation | 10.500 | 70.000 |
| 1.2 Concrete | 116.900 | 779.000 |
| 1.3 Prestressed concrete | 19.900 | 132.400 |
| 1.4 External Insulation | 13.100 | 87.300 |
| 1.5 Masonry | 22.600 | 150.000 |
| 1.6 Steelwork | 8.800 | 58.600 |
| 1.7 Architectural Finishing | 2.800 | 18.600 |
| 1.8 Painting | 19.400 | 130.000 |
| 1.9 Sanitary Installation | 8.400 | 56.000 |
| 1.10 Heating and ventilation | 15.600 | 104.000 |
| 1.11 Lighting | 5.200 | 34.600 |
| 2. COOLING TOWER FOUNDATION | 15.000 | 100.000 |
| 3. STRUCTURAL WORK ON SITE | 8.500 | 56.000 |
| 4. EXCAVATION AND FILL | 22.700 | 151.300 |
| 5. CONTRACTORS MOVE-IN | 84.000 | 560.000 |
| 6. ACCESS ROAD | 63.000 | 420.000 |
| 7. PERSONNEL LODGINGS | 73.600 | 490.500 |
| TOTAL INSTALLED COST | 510.000 | 3.398.300 |
| Contingency on Equipment 5% | 8.600 | 57.400 |
| Contingency on Labor at 15% | 50.900 | 339.500 |
| Escalation on Labor at 8% | 31.200 | 208.000 |
| Sub Total | 600.700 | 4.003.400 |
| Engineering and supervision at 10% | 60.100 | 400.400 |
| Sub Total | 660.800 | 4.403.800 |
| Construction Financing at 7 1/2% | 49.600 | 330.400 |
| Total Structural Cost | 710.400 | 4.734.200 |

CONSTRUCTION COST ESTIMATE

KRAFLA GEOTHERMAL POWER PLANT

| Account <u>No.</u> | <u>Description</u> | Icelandic Kronur <u>by 1,000</u> | <u>U.S.</u> <u>Dollars</u> |
|-----------------------|--|--|-------------------------------|
| 310 | Land & Land Rights..... | Not Included | Not Included |
| 311 | Structures & Improvments..... | 510.000 | 3.398.300 |
| 312 | Geothermal Wells Steam-Water Separators Steam & Water Gathering Piping Geothermal Water Disposal System.. | Not Included | Not Included |
| 314 | Turbine Generator Units: Bridge Crane Condenser, Ejectors & Intercondenser Cooling Tower Hot Well Pumps Aux. Cooling Water Pumps Miscellaneous Equipment Piping and Insulation Instrumentation Lighting, Power & Control Cable... | 1.974.300 | 13.162.300 |
| 315 | Accessory Electric Equipment: Startup Generator 11 kV Switchgear & Bus Duct Unit Substation w/400 V Switchgear Motor Control Centers Generator Switchboards System Ground & Batteries..... | 125.500 | 836.700 |
| 316 | Miscellaneous Power Plant Equipment: Fire & Jockey Pumps Instrument & Plant Air Compressors Maintenance Equipment Waiting Room, Office, & Change Room Furnishings Piping Instrumentation..... | 79.100 | 527.700 |
| 353 | Station Equipment: Generator Step-Up Transformer 132 kV OCB & Disconnect Switch Phase Bus Duct Switchboard for Substation Grounding & 132 kV Substation Equipment LTC for Step-Up Transformer..... | 235.300 | 1.568.800 |
| | Total Installed Cost..... | 2.924.200 | 19.493.800 |
| | Contingency on Equipment at 5%.. | 103.100 | 687.200 |
| | Contingency on Labor at 15%..... | 129.400 | 862.500 |
| | Escalation on Labor at 8%..... | 79.300 | 529.000 |
| | Sub-Total..... | 3.236.000 | 21.572.500 |
| | Engineering & Supervision 10%.. | 323.600 | 2.157.300 |
| | Sub-Total..... | 3.559.600 | 23.729.800 |
| | Construction Financing at 7-1/2% | 266.900 | 1.780.200 |
| | Total Project..... | 3.826.500 | 25.510.000 |

KRAFLA GEOTHERMAL POWER PROJECT

SCHEDULE OF PAYMENTS IN Thousand of DOLLARS

| | TOTAL <u>INVESTMENT</u> | COMMITMENT <u>1975</u> | COMMITMENT <u>1976</u> | PAYMENT <u>1975</u> |
|---|----------------------------|---------------------------|---------------------------|------------------------|
| 1. Mechanical Equipment | 16.750 | 12.190 | 4.560 | 1.219 |
| 2. Electrical Equipment | 1.130 | 800 | 330 | 80 |
| 3. Miscellaneous Power Plant Equipment | 740 | 180 | 560 | 18 |
| 4. Substation Equipment | 2.100 | 1.360 | 740 | 136 |
| 5. Civil and Structural work | 2.700 | 1.600 | 1.100 | 1.600 |
| 6. Personnel lodging | 690 | 250 | 440 | 250 |
| 7. Contractors Move-In. | 800 | 800 | | 800 |
| 8. Access Road. | 590 | 590 | | 590 |
| Thousand US \$ | 25.500 | 17.770 | 7.730 | 4.693 |
| Million Icel. kr. | 3.825 | 2.665 | 1.160 | 705 |

The above estimate is based on the same financing conditions for item 1-2-3-4 as were negotiated for the turbine/generator units i.e. 10% on order, 10% on delivery, 80% as a 7 year loan with 7,5% interest starting on the date of delivery. Items 5-6-7-8 are entered as direct payments when due.