### 9.2.3 Comparison Study on Alternative Development Plan

(1) Reservoir Operation Study

(a) Bayram Project

The annual average inflow at the Bayram dam site is 19.2 $m^3/s$, with the snowmelt period of April to June corresponding to the high water season, 63% of the annual inflow occurring during this period. The inflow during December to February corresponding to the low water season has 9% of the annual inflow, and the seasonal variation range of inflow is not narrow. The minimum value of annual inflow is 49% of the average inflow, and the maximum value 188%. The maximum value of annual inflow is 3.8 times the minimum value.

As described above, inflows at the Bayram project site have fairly large seasonal and annual fluctuations, and a certain degree of reservoir capacity is necessary for effective utilization for power generation.

As reservoir capacity for the Bayram project, it is possible to obtain an effective storage capacity of 113 x $10^6$ $m^3$ at high water level elevation of EL. 740 m. With regulating capacity of this degree it will not be possible to completely average out inflow, but it will be possible for spillover from the reservoir to be held to a minimum.

The reservoir operation rules of Bayram reservoir have been determined for each study case, based on considerations on the following factors.

(I) The river water in a wet year is to be stored and released in a dry year, to make the firm discharge as large as possible.

(II) During a year, the reservoir is to be operated in such a way that the water in the wet season is to be stored and supplied in the dry season.

(III) The reservoir is to be operated so that the spill is as small as possible.

(IV) The reservoir is to be operated so that a stable supply of power is assured for a long period and at the same time the energy generation is large.

(b) Bağlık Project

The inflow at the Bağlık dam site will be the sum of the inflow at the Bayram dam site regulated outflow from Bayram reservoir including discharged upon power generation, the discharge from the dam spillway and the inflow from the remaining catchment area between Bayram dam and Bağlık dam.

The annual average inflow at the Bağlık dam site is 24.9 $m^3/s$. Inflow at the Bağlık dam site, in case of Bayram reservoir capacity of 113 x $10^6 m^3$, with the snowmelt period of April to June 51% of the annual inflow occurring during this period. The inflow during December to February has 15% of the annual inflow, and the seasonal variation range of inflow is not narrow. The minimum value of annual inflow is 56% of the average inflow, and the maximum value 180%. The maximum value of annual inflow is 4.09 times the minimum value.

In this way, the inflow at the Bağlık dam site will have seasonal variations and long-term variations which are both fairly large.

On the other hand, when the high water level at the Bağlık dam site is made 570 m, the dam height would be 114 m and of the same degree as the height of Bayram dam, and effective storage capacity of 30 x $10^6$ $m^3$ can be secured, which would be a large-scale change in the reservoir water level for only a slight regulating effect, and this will bring about a large variation in power generating head. as a result, the effect of regulating inflow with the reservoir will be offset by the head loss due to variation in reservoir water level, and making the size of Bağlık reservoir large will not lead to increase in power generation with the Bağlık project.

Therefore, it was decided to study a reservoir scale of securing only daily regulating capacity for the Bağlık project in addition to the scheme of a reservoir for seasonal regulation. As for reservoir operation rules, they were set up under the same principles as for Bayram reservoir.

(c) Reservoir Operation Study

The calculations of reservoir operation have been performed by an electronic computer system, and based on the monthly average inflow, for the period of 53 years from October 1942 to September 1995.

The firm discharge is defined as the discharge which can be utilized for power generation at all times during 95% of the 53 year period, and it is obtained by making it the largest with the inflow mass curve considering carry over storage. The inflow mass curve and the effective storage capacity and the firm discharge are shown in Figure 9-9 and 9-10 respectively.

In the calculation, the change of turbine and generator efficiency depending on the change of the reservoir water level has been taken into account. The maximum power discharge is limited by the rated output when the water level is higher than the rated intake water level, and the maximum power discharge is reduced by the reduction of head when the water level is below the rated intake water level.

The rated intake water level was set at an elevation which is below the high water level by 1/3 of the available drawdown.

The procedure of electric energy calculations is shown in Figure 9-11, and the Bayram reservoir operation rules in case of reservoir high water level 740 m, low water level 686 m, tail water level 530 m for the Bayram project are indicated in Figure 9-12. this operation rules curve given in Figure 9-12 was plotted based on the principles of reservoir operation given in the previously-mentioned (I) to (IV), for energy production to be maximum according to the Dynamic Program Method (DP Method) using an electronic computer.

The operation rules curves for overflow from the reservoir to be of the minimum limit prepared by the mass curve conventionally employed in general are shown in Figure 9-13.

the results of energy calculations by these two rules curves are as given below, and there is not much difference between the two. Consequently, it was decided that for the comparison studies of the various alternative plans, the electric energy calculations of the alternative plans would be made with the rules curves prepared by the DP method.

| | | by DP Method | by Mass Curve |
|---|---|---|---|
| Annual average energy production | (GWh) | 247.9 | 241.2 |
| Annual firm energy production | (GWh) | 141.4 | 141.6 |
| Firm Peak Power | (MW) | 58.0 | 58.4 |

The rules curve for Bayram reservoir by this DP method, was prepared with Bayram reservoir considered as a reservoir only for power generation in the Bayram project, and the effect on the downstream Bağlık reservoir is not considered, butfor the optimum development plan, the study was made for the operation rules curve of Bayram project to be optimum for power generation including the downstream Bağlık reservoir also as described in 9.2.3 (4).

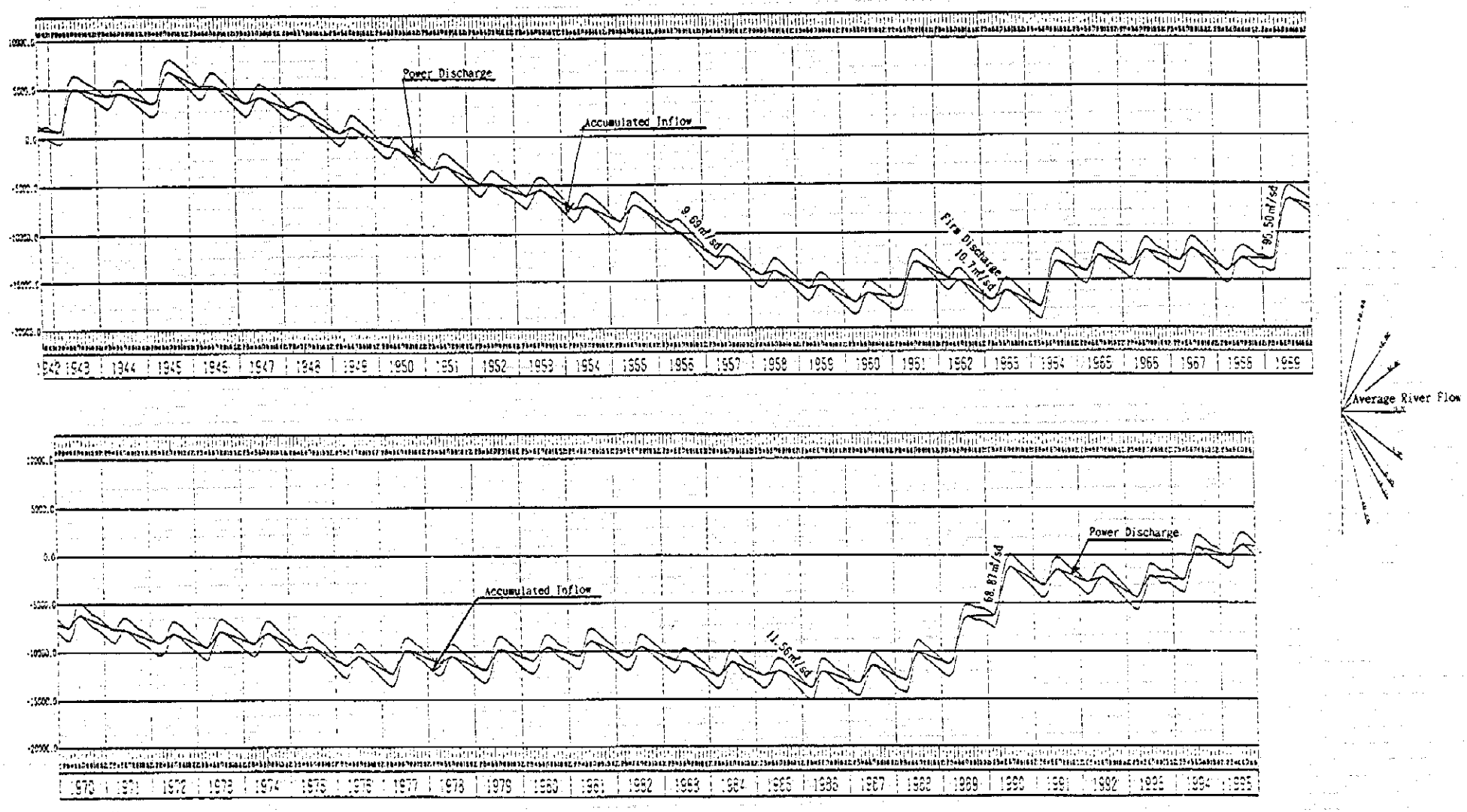



Figure 9-9 Mass Curve of Bayram Reservoir

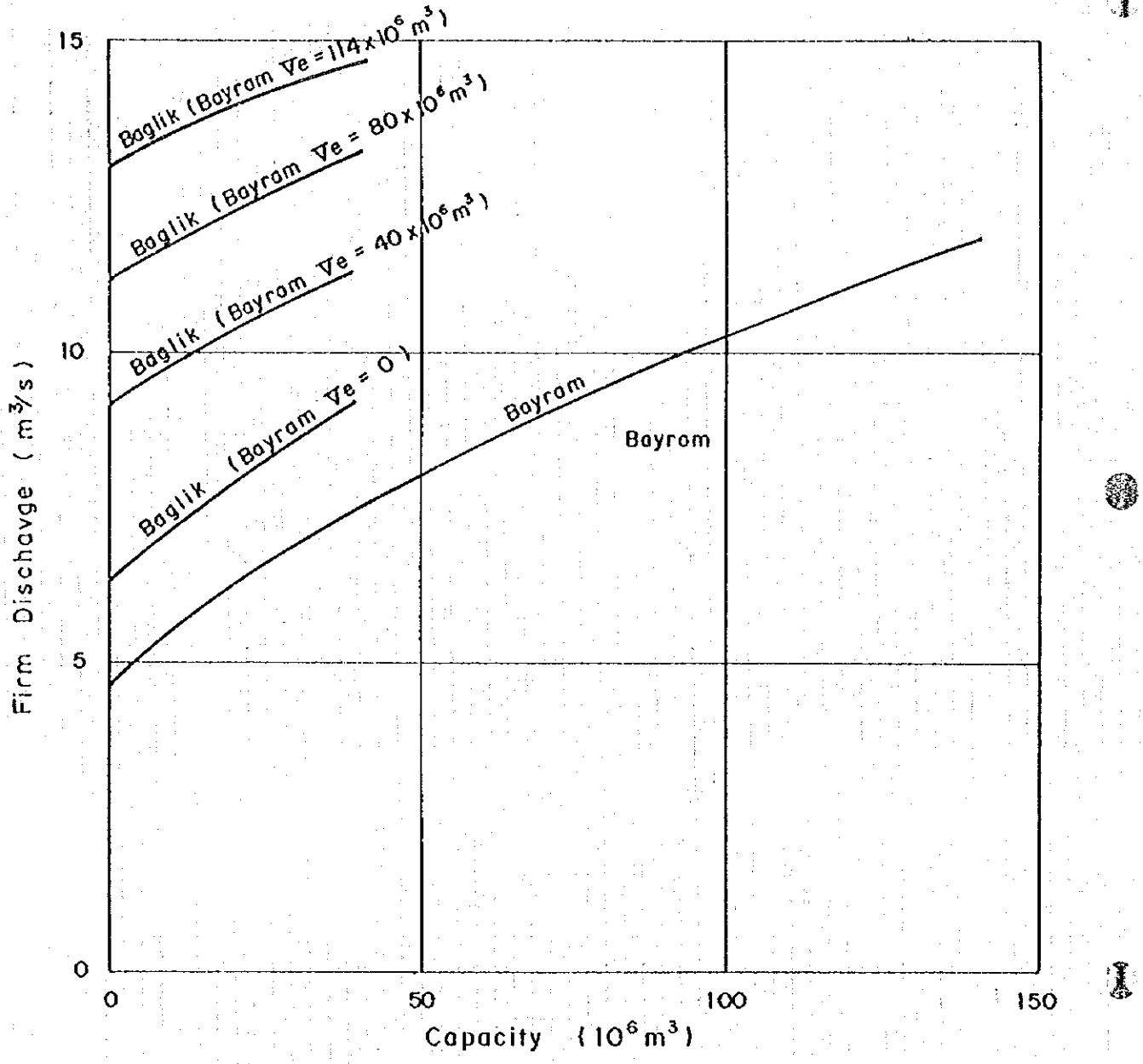



Figure 9-10 Firm Discharge of Bayram and Bağlık Reservoir

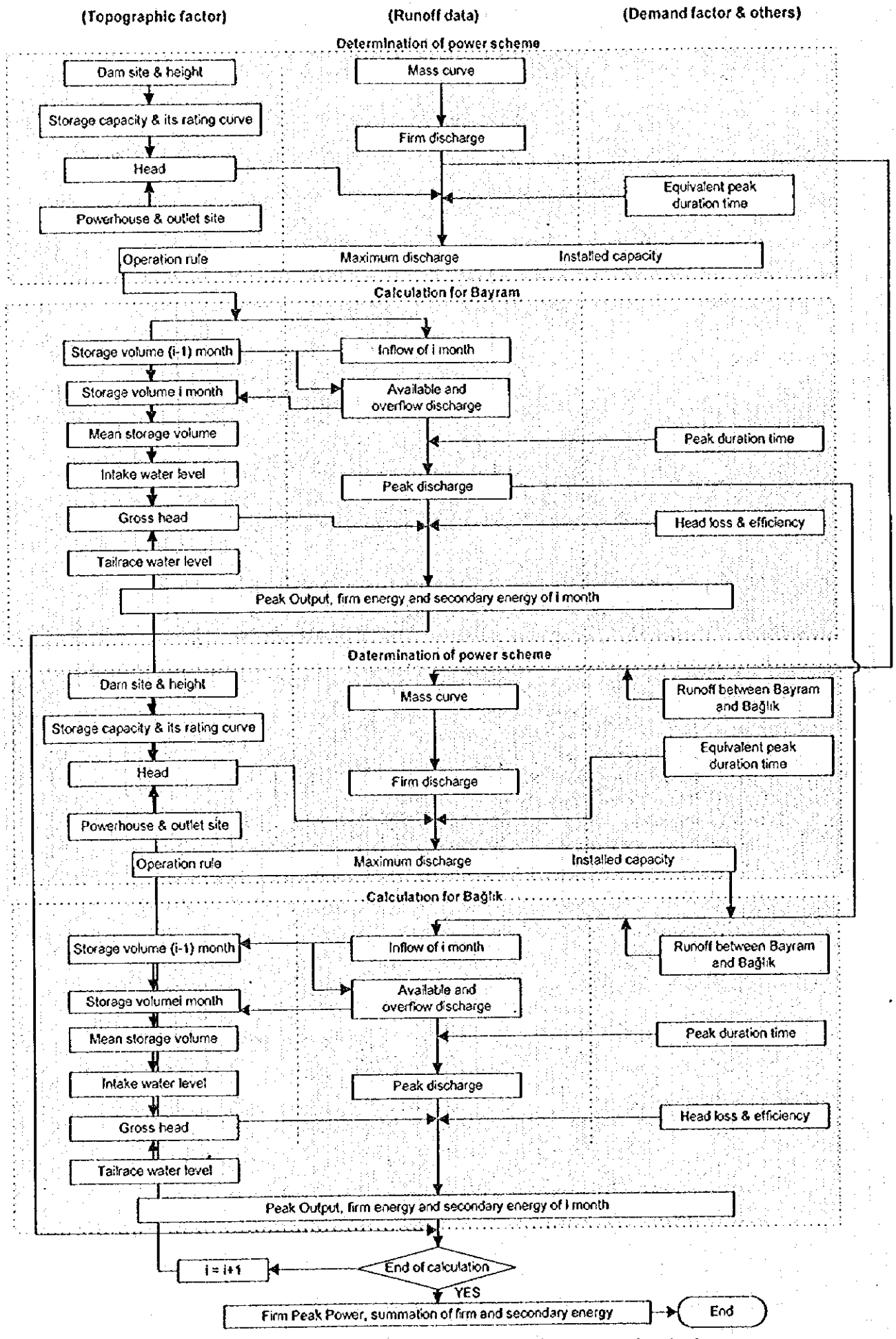
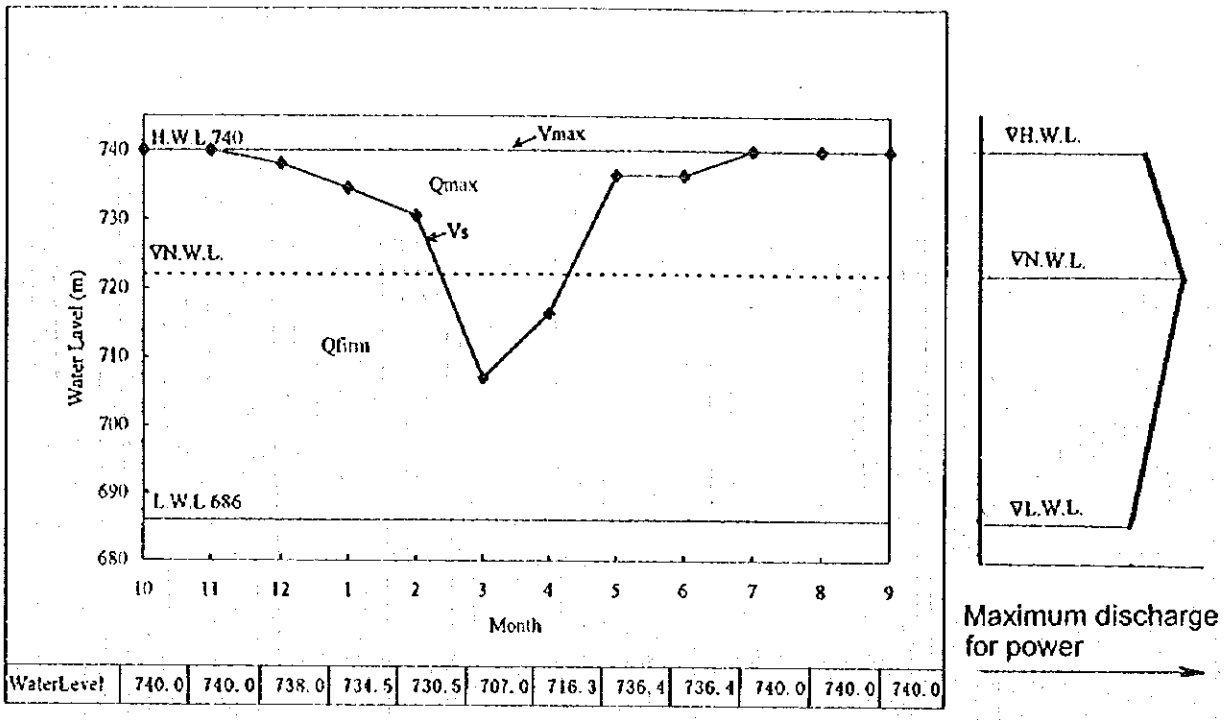



**Fig.9-11 Flow Chart of Power and Energy Calculation**




Symbols

| | | |
|---|---|---|
| Vn-1 | : | Storage at the end of previous month |
| Vn | : | Storage at the end of current month |
| Vn' | : | Temporary storage at the end of current month |
| Vmax | : | Maximum storage (effective storage capacity) |
| Vs | : | Secured storage for firm discharge |
| fn | : | Spill in current month |
| qn | : | Inflow in current month |
| Qn | : | Available discharge for power in current month |
| Qfirm | : | Firm discharge for power |
| Qmax | : | Maximum discharge for power, variable depending on water level |

Operation Rule

$V'n = Vn - 1 + qn$

1. $V'n \geq Vmax$
   - (1) $V'n - Vmax \geq Qmax \rightarrow Qn = Qmax$
   - (2) $Qmax > V'n - Vmax \geq Qfirm \rightarrow Qn = V'n - Vmax$
   - (3) $Qfirm > V'n - Vmax \rightarrow Qn = Qfirm$

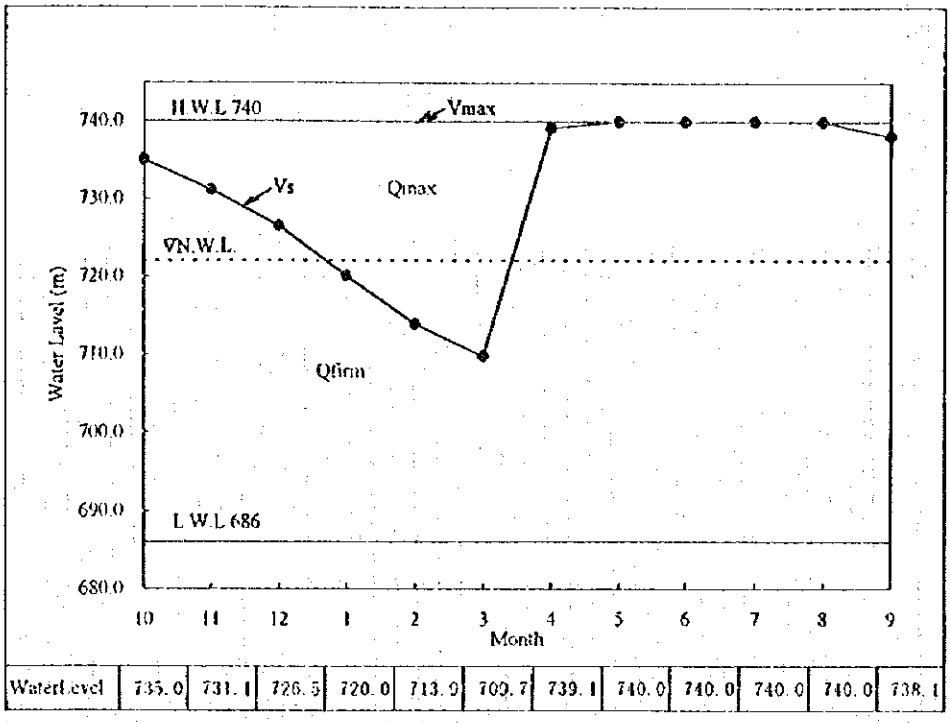
2. $Vs > V'n$
   - (1) $V'n \geq Qfirm \rightarrow Qn = Qfirm$
   - (2) $Qfirm > V'n \rightarrow Qn = V'n$

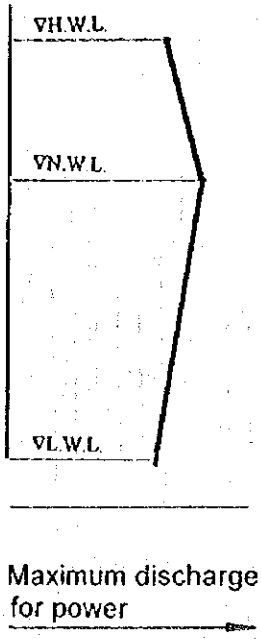
$V'n - Qn - Vmax \geq 0.0 \rightarrow fn = V'n - Vmax - Qn$

$V'n - Qn - Vmax < 0.0 \rightarrow fn = 0.0$

$Vn = V'n - Qn - fn$

**Figure 9-12 Operation Rule of Reservoir by Dynamic Program Method for Energy Maximum**




Symbols

| | | |
|---|---|---|
| Vn-1 | : | Storage at the end of previous month |
| Vn | : | Storage at the end of current month |
| Vn' | : | Temporary storage at the end of current month |
| Vmax | : | Maximum storage (effective storage capacity) |
| Vs | : | Secured storage for firm discharge |
| fn | : | Spill in current month |
| qn | : | Inflow in current month |
| Qn | : | Available discharge for power in current month |
| Qfirm | : | Firm discharge for power |
| Qmax | : | Maximum discharge for power, variable depending on water level |

Operation Rule

$V'n = Vn - 1 + qn$

1. $V'n \geq Vmax$
   - (1) $V'n - Vmax \geq Qmax \rightarrow Qn = Qmax$
   - (2) $Qmax > V'n = Vmax \geq Qfirm \rightarrow Qn = V'n - Vmax$
   - (3) $Qfirm > V'n - Vmax \rightarrow Qn = Qfirm$

2. $Vs > V'n$
   - (1) $V'n \geq Qfirm \rightarrow Qn = Qfirm$
   - (2) $Qfirm > V'n \rightarrow Qn = V'n$

$V'n = Vmax - Qn \geq 0.0 \rightarrow fn = V'n - Vmax - Qn$

$V'n = Vmax - Qn < 0.0 \rightarrow fn = 0.0$

$Vn = V'n - Qn - fn$

**Figure 9-13(1) Operation Rules of Reservoir by Mass Curve for Spilled Water Minimum**

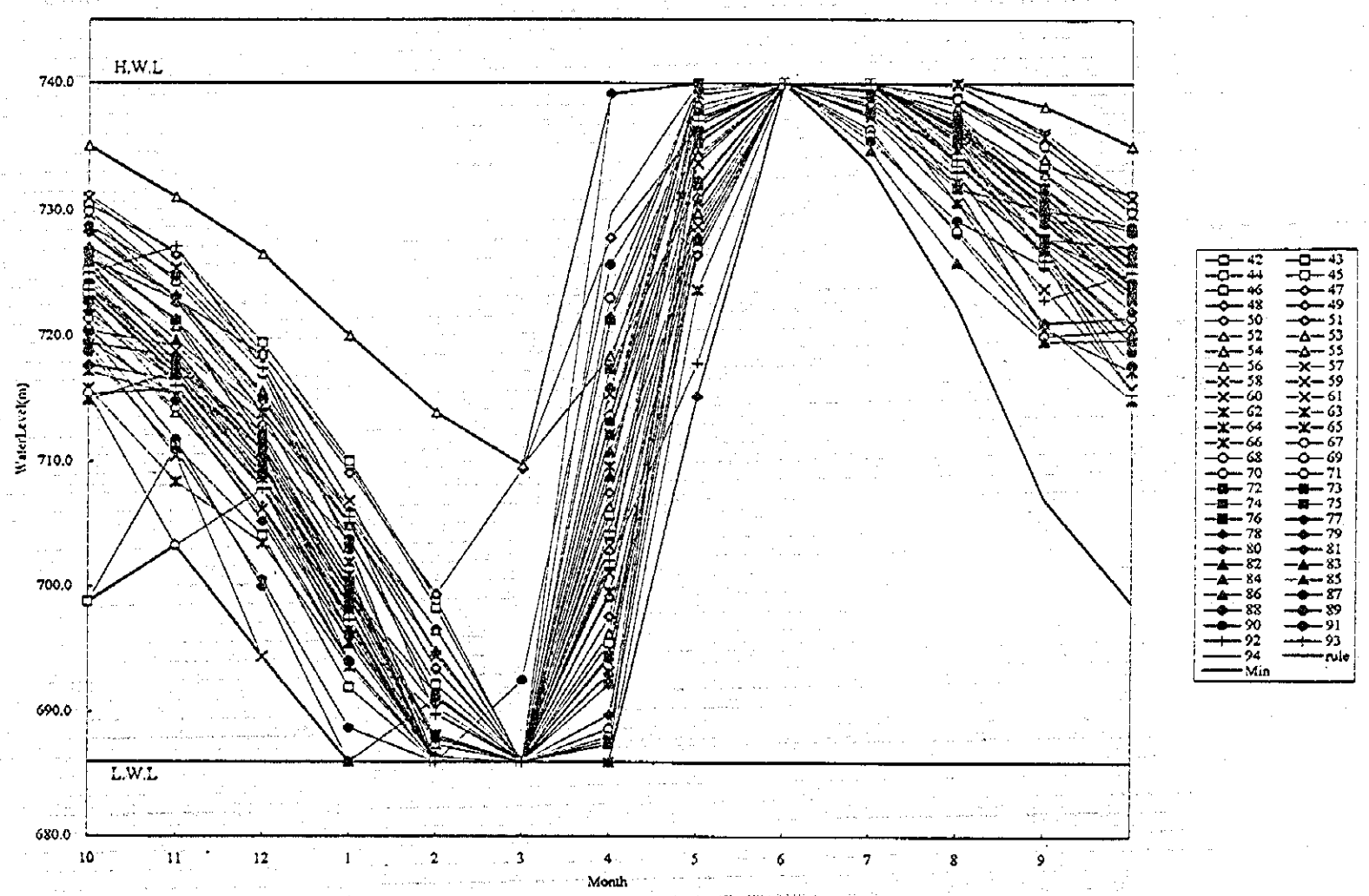



Figure 9-13(2) Operation Rules of Reservoir by Mass Curve for spilled Water Minimum

(2) Optimum Reservoir Scale

The comparison study results of alternative plans for combinations of reservoir capacities of the Bayram and Bağlık projects are shown in Figure 9-14 and Table 9-9 and 9-10.

The annual surplus benefit of the total of the Bayram and Bağlık projects will be larger the smaller the storage capacity of the Bağlık project. In the relation between the storage capacity of the Bayram project and the total annual surplus benefit, the maximum point will shift depending on the combination with the storage capacity of the Bağlık project, and the combination with the effective storage capacity of the Bağlık project of 1.0 x $10^6 m^3$ (HWL=530 m) is the maximum regardless of the size of the effective storage capacity of Bayram reservoir, while the case of effective storage capacity of Bayram reservoir being 113.0 x $10^6 m^3$ (HWL=740 m) gives the maximum of all combination.

In case of the Bayram project, as mentioned in 9.2.2(3)(b), a comparison study was made whether the optimum storage capacity and the optimum reservoir high water level would shift depending on how reservoir low water level is set up together with Bağlık project, whose effective storage capacity of 1 x $10^6 m^3$ (HWL=530 m) is taken as the optimum storage capacity.

In the Bayram project, the alternative plan for minimum water level of 686 m determined from sedimentation capacity is maximum at all times regardless of the size of effective storage capacity, and the case of high water level of 740 m, effective storage capacity 113.0 x $10.6^6 m^3$ is the maximum of all cases.

Consequently, this case is taken as the optimum for the Bayram project.

As for Bağlık project, alternative by setting of higher low water level than the minimum low water level of 527 m which determined by sediment volume and combination with Bayram project whose high water level is 740 m and low water level is 686 m. And comparison with the alternative whose high water level is 530 m and low water level is 527 m. As shown in Figure 9-16, Table 9-14 and 9-15, in case of high water level of 530 m and low water level of 527 m is confirmed as the optimum reservoir scale of Bağlık project.

(3) Power Station Scale

Factors determining the installed capacity of a hydroelectric power station are effective head and maximum available discharge as indicated in the equation below, while maximum available discharge is generally determined by firm discharge and equivalent peak duration hours.

Installed Capacity (kW) = 9.8 x Turbine-Generator Efficiency x Effective Head (m) x Maximum Discharge ($m^3/s$)

$$\text{Maximum Available Discharge} = \text{Firm Discharge } (m^3/s) \times \frac{24\ hr}{\text{Equivalent Peak Duration Hours (hr)}}$$

Of the abovementioned factors, effective head and firm discharge are determined by physical conditions such as effective storage capacity and intake and tail water levels, but equivalent peak duration hours are determined by conditions different from the above.

According to the electric power demand and supply plan, prepared by TEAŞ in 1995 the situations of the electric power system in the year 2002 when the construction of Çoruh-Berta project is scheduled to be tarted, and 2010, the last year of the demand and supply plan, will be as indicated in Table 9-16.

**Table 9-16 Demand and Supply Balance**

| Year | | | 2002 | 2010 |
|---|---|---|---|---|
| Demand | | | | |
| a. | Peak Power | (MW) | 24,360 | 43,590 |
| b. | Annual Energy | (GWh) | 151,720 | 271,450 |
| Consumption | | | | |
| Supply | | | | |
| c. | Thermal | (MW) | 19,090 | 36,970 |
| d. | Hydro | (MW) | 15,421 | 23,086 |
| e. | Total | (MW) | 34,511 | 60,056 |
| Annual Energy Production | | | | |
| f. | Thermal | (GWh) | 119,838 | 236,558 |
| g. | Hydro (Dependable) | (GWh) | 38,291 | 52,219 |
| Supply Margin (e-a) | | (MW) | 10,151 | 16,466 |
| Supply Margin Rate ((e-a)/a) | | (%) | 42 | 38 |
| Equivalent Peak Duration Hours for Hydro (g/d)/365) | | (Hour) | 6.8 | 6.2 |

According to the above table, the average equivalent peak duration times of all hydroelectric power generation in 2002 and 2010 will be 6.8 hours and 6.2 hours, but since these have been calculated with daily energy production of the maximum load day as the annual average electric energy, the actual peak duration times are thought to be somewhat longer than these. However, since the trend is for the proportion of hydroelectric power generation in the entire electric power system to decrease year by year, it is thought equivalent peak duration time will also be shortened year by year.

In the Çoruh-Berta project, similarly to most other hydroelectric power generation projects, since storage capacity is large enough that roughly the entire quantity of inflow can be used for power generation, a large increase in electric energy production cannot be expected even when equivalent peak duration time is made shorter and installed capacity larger.

Therefore, for the equivalent peak duration time of the Çoruh-Berta project, it is judged reasonable for about 6 hours, the average for all hydroelectric power generation, to be made the limit.

Examination of the optimum scale of installed capacity for the Çoruh-Berta project was made by comparisons on setting up maximum available discharges for the cases of 8 hours with 6 hours the limit for equivalent peak duration times for dependable discharge of 10.7 $m^3/s$.

The result of the comparison studies, as shown in Table 9-17 is that equivalent peak duration time of 6 hours is optimum. Therefore, maximum available discharge of 43 $m^3/s$ and installed capacity of 68 MW will be the optimum scale for Bayram project and maximum discharge of 52 $m^3/s$ and installed capacity of 59 MW will be the optimum scale for Bağlık project.

(4) Final Reservoir Operation Study

The reservoir operation study for optimization study was prepared with Bayram reservoir considered as a reservoir only for power generation in Bayram project, and effect on the downstream Bağlık project is not considered. On the other hand as final reservoir operation study, optimum reservoir operation rule is established as shown in Figure 17 by the operation study of combined of Bayram and Bağlık project which reservoir operation of Bayram project consideres effect on Bağlık project is carried out by utilizing the DP method.

Energy calculation is carried out by this rule curve. In this calculation 0.5 $m^3/s$ of constant discharges from Bayram dam and Bağlık dam to their downstream are considered to keep environment of river during the period of August to October.

(5) Optimum Development Plan

Based on results of studies of development plans made up to this point, the Çoruh-Berta Hydroelectric Development Project is to be a 2-step development scheme consisting of the Bayram project and the Bağlık project.

The Bayram project would consist of constructing a dam 145 m in height on the Berta river at the Bayram village site 2.5 km downstream from the confluence of the Meydancık river and the Şavşat river to provide a reservoir of high water level at EL. 740 m, effective storage capacity 113 x $10^6 m^3$, drawing water of a maximum 43 $m^3/s$ from an intake at the right bank of the dam, generating power of maximum output of 68 MW with an effective head of 182.9 m at an underground powerhouse immediately downstream of the intake, with the water after power generation discharge into the Berta river at the Köprübaşı village 2 km upstream from the confluence with the Karçal river by a tailrace tunnel of a length of 7.93 km, this development plan being the optimum development plan.

For the Bağlık project, the optimum development plan would consist of constructing a dam 74 m in height on the Berta river at the Arktasi village site 0.1 km downstream of the confluence with the Sungu river to provide a reservoir of high water level EL. 530 m, effective storage capacity 1 x $10^6 m^3$, drawing water of a maximum 52 $m^3/s$ from an intake at the left bank of the dam, generating power of a maximum output of 59 MW with an effective head of 130.9 m at an underground powerhouse immediately downstream of the intake, with the water after power generation discharged into the Berta river at the Arktasi village site by a tailrace tunnel of length of 4.45 km.

Table 9-18 and 9-19 show outline and cost estimate of optimum development plant of Çoruh-Berta project.

Table 9-20 and Figure 9-18 show the result of reservoir operation of Bayram project. Table 9-21, 9-22, 9-23, 9-24 and Figure 9-19 show monthly average energy production, monthly firm energy production, monthly peak power, peak power duration and energy generation of Bayram project.

Table 9-25 and Figure 9-20 show the result of reservoir operation study of Bağlık project. Table 9-26, 9-27, 9-28, 9-29 and Figure 9-21 show monthly average energy production, monthly firm energy production, monthly peak power, peak power duration and energy generation of Bağlık project.

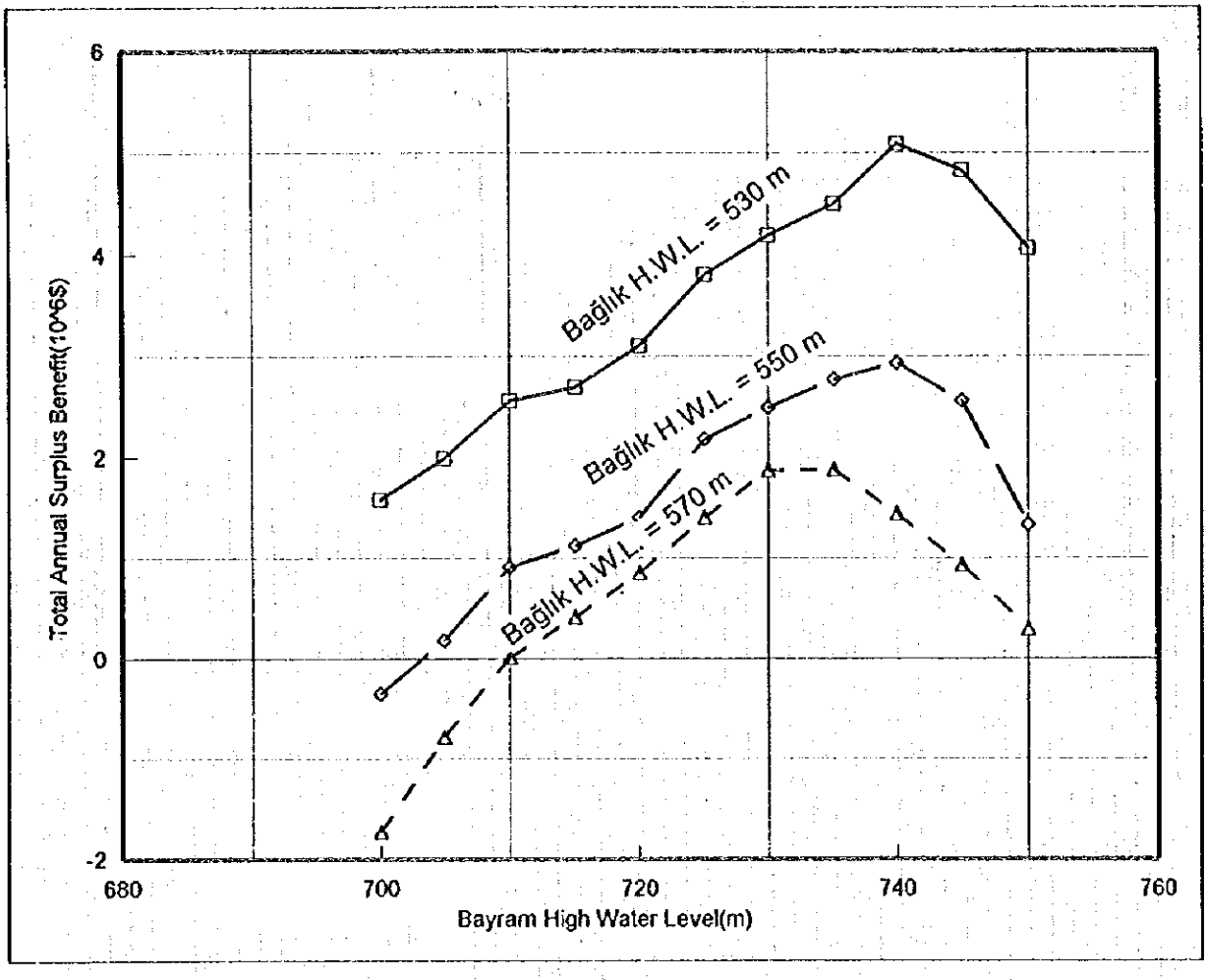



**Figure 9-14 Comparison Study on Reservoir Capacity**

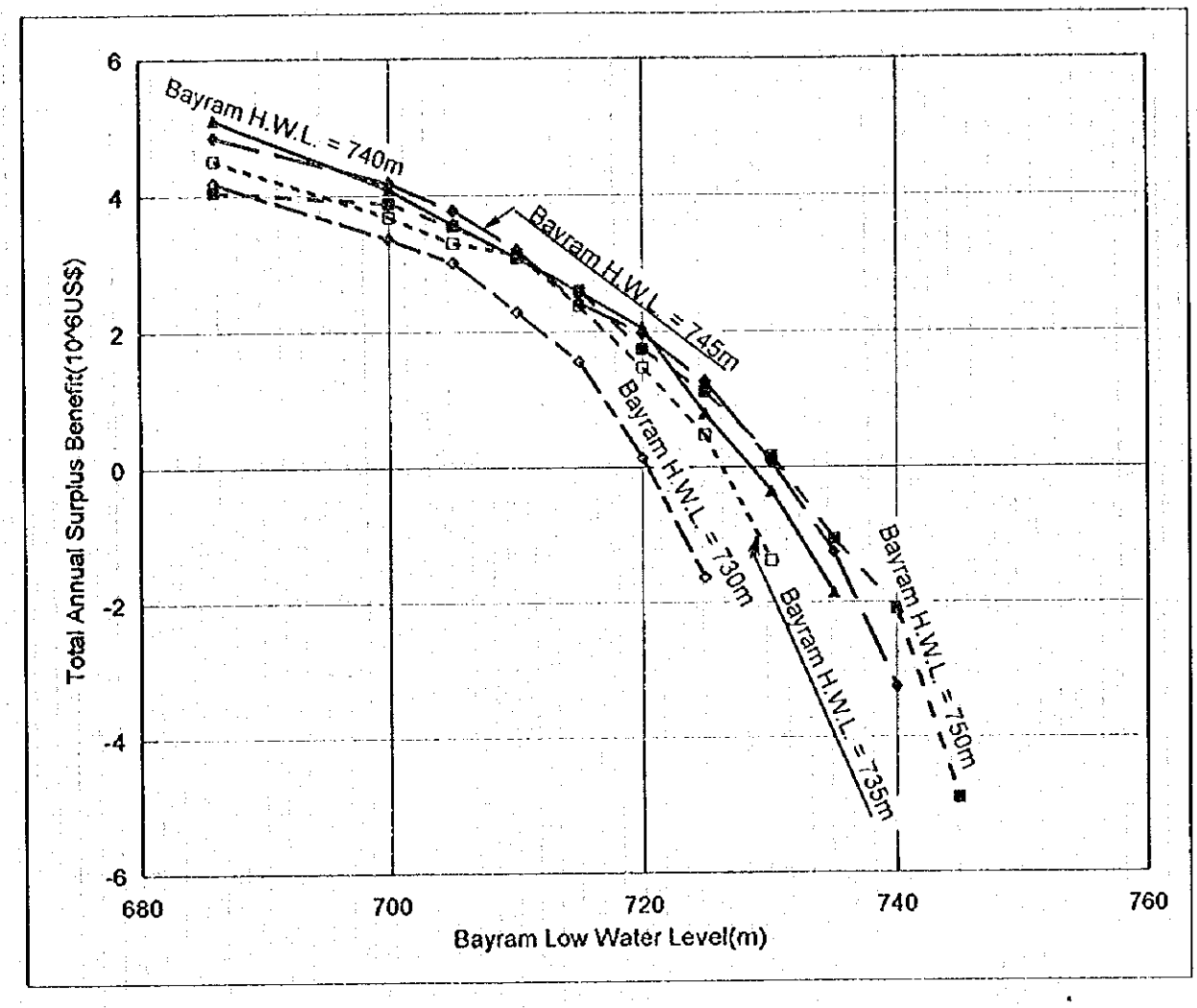



**Figure 9-15 Comparison Study on IReservoir Water Level of Bayram Project**

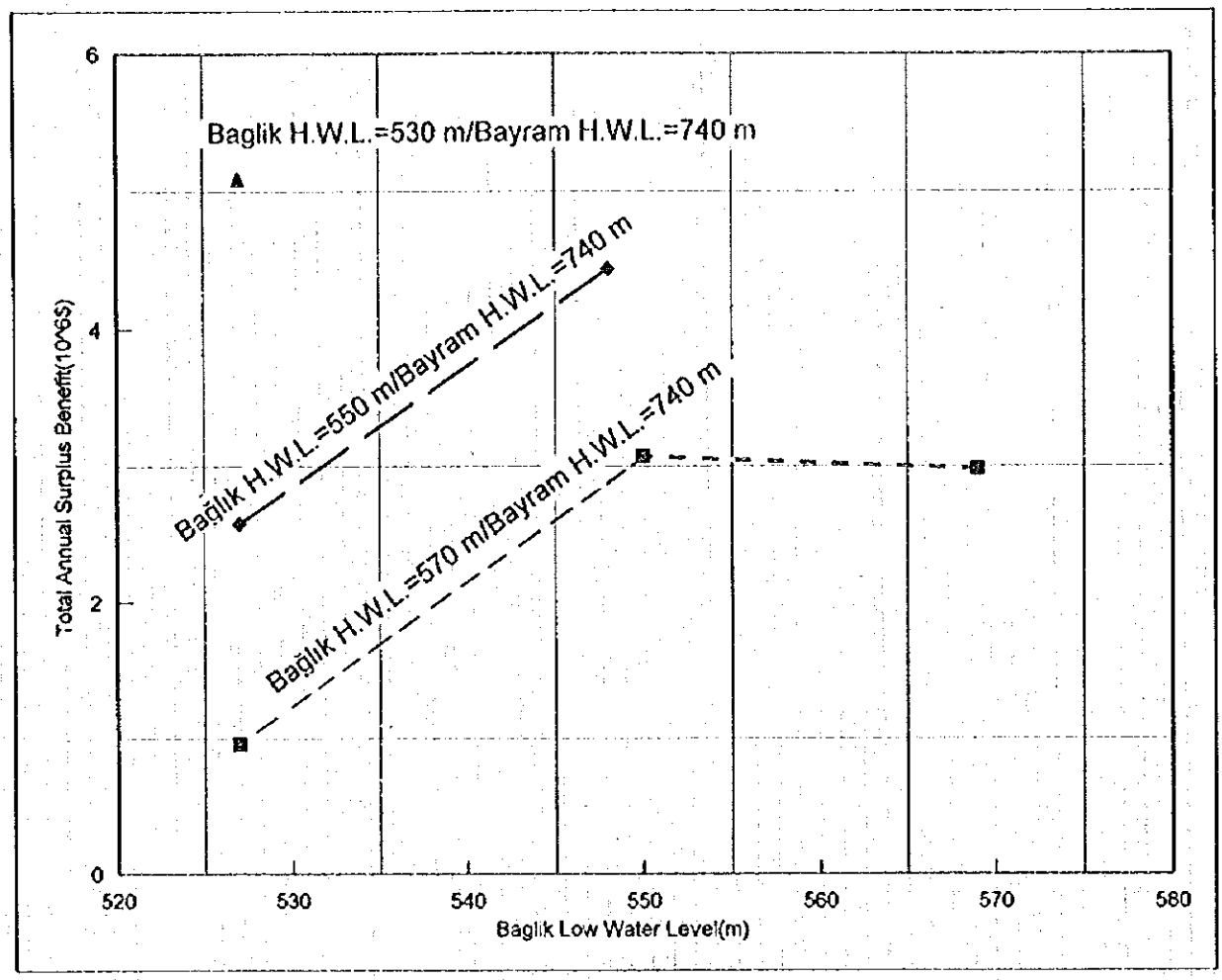
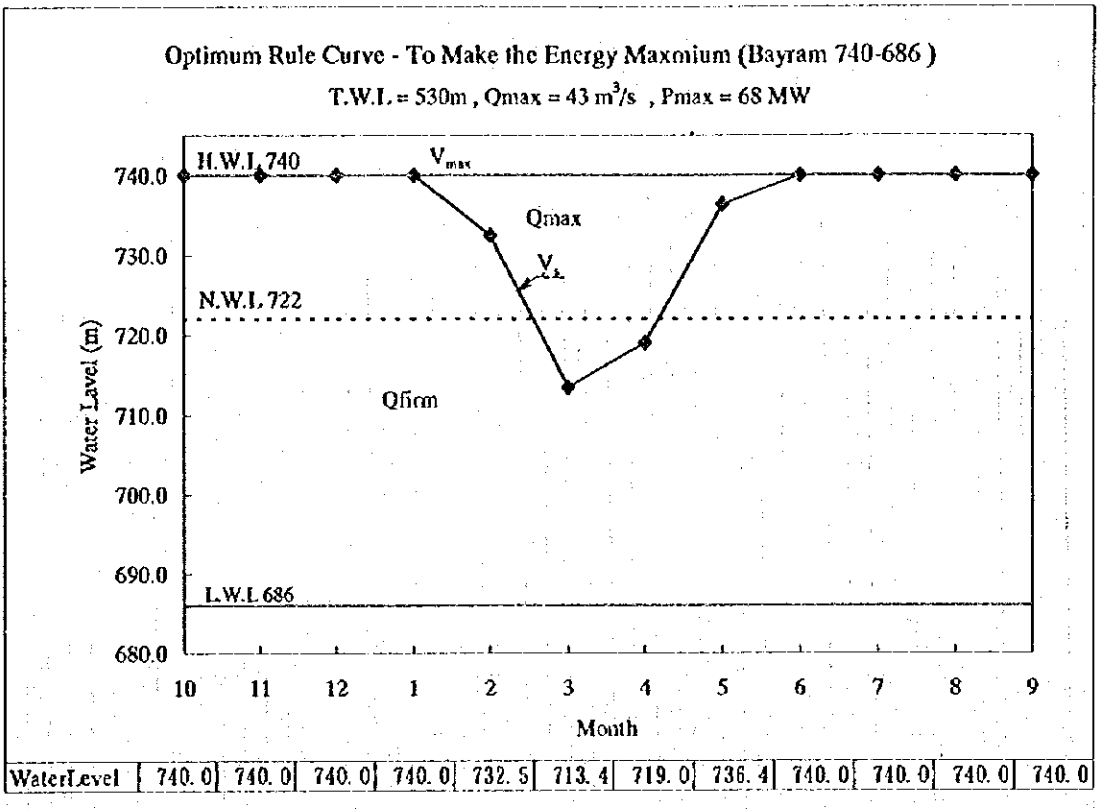



**Figure 9-16 Comparison Study on Reservoir Water Level of Bağlık Project**



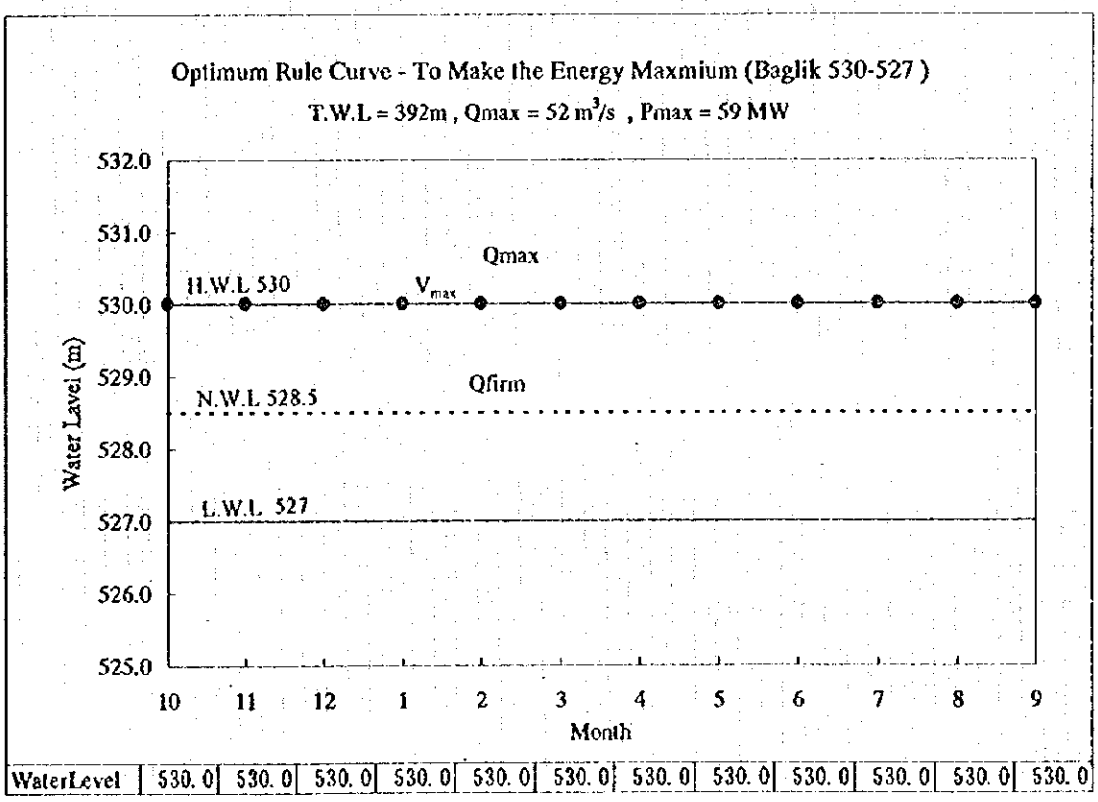




**Figure 9-17 Final Reservoir Operation Rule**

# Table 9-9(1) Cost Estimate of Alternative Plan for Reservoir Capacity

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L.=750m-700m With Baglik H.W.L.=570m — Unit:10^3US$

| Description Dam Site / Layout Type | Bayram 750M.P | Bayram 745M.P | Bayram 740M.P | Bayram 735M.P | Bayram 730M.P | Bayram 725M.P | Bayram 720M.P | Bayram 715M.P | Bayram 710M.P | Bayram 705M.P | Bayram 700M.P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 750 | 745 | 740 | 735 | 730 | 725 | 720 | 715 | 710 | 705 | 700 |
| Reservoir Area (km^2) | 3.85 | 3.68 | 3.38 | 3.11 | 2.83 | 2.58 | 2.32 | 2.10 | 1.88 | 1.68 | 1.47 |
| Dam Volume (10^6m^3) | 8,500 | 7,200 | 6,144 | 5,400 | 4,800 | 4,300 | 3,900 | 3,500 | 3,100 | 2,700 | 2,400 |
| Dam Height (m) | 155 | 150 | 145 | 140 | 135 | 130 | 125 | 120 | 115 | 110 | 105 |
| Maximum Head (m) | 180 | 175 | 170 | 165 | 160 | 155 | 150 | 145 | 140 | 135 | 130 |
| Maximum Discharge (m^3/s) | 49 | 46 | 43 | 40 | 38 | 36 | 33 | 31 | 29 | 26 | 24 |
| Relocation Road | 13,724 | 12,689 | 11,655 | 10,724 | 9,758 | 8,896 | 8,000 | 7,241 | 6,483 | 5,793 | 5,069 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,989 | 2,616 | 2,242 | 2,063 | 1,878 | 1,712 | 1,539 | 1,393 | 1,247 | 1,115 | 975 |
| Civil Work | 96,218 | 88,182 | 76,678 | 70,197 | 65,019 | 60,508 | 56,750 | 53,076 | 49,659 | 45,618 | 42,781 |
| Diversion | 2,421 | 2,885 | 2,885 | 2,885 | 2,885 | 2,885 | 2,885 | 2,885 | 2,885 | 2,885 | 2,885 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 65,412 | 55,407 | 47,281 | 41,556 | 36,938 | 33,091 | 30,012 | 26,934 | 23,856 | 20,778 | 18,459 |
| Spillway | 8,143 | 8,143 | 7,523 | 7,434 | 7,346 | 7,169 | 7,080 | 6,992 | 6,815 | 6,726 | 6,603 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,280 | 1,280 | 1,087 | 999 | 912 | 842 | 736 | 666 | 596 | 491 | 412 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 450 | 413 | 377 | 342 | 317 | 292 | 261 | 239 | 218 | 190 | 171 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 2,985 | 2,856 | 2,696 | 2,503 | 2,407 | 2,279 | 2,086 | 2,022 | 2,215 | 1,733 | 1,605 |
| Tailrace Tunnel | 9,287 | 8,937 | 8,586 | 8,236 | 7,973 | 7,710 | 7,447 | 7,097 | 6,834 | 6,571 | 6,396 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 113,731 | 102,268 | 91,374 | 83,784 | 77,455 | 71,917 | 67,089 | 62,511 | 58,189 | 53,323 | 49,625 |
| Contingency (15%) | 16,611 | 14,948 | 13,370 | 12,258 | 11,337 | 10,531 | 9,833 | 9,168 | 8,541 | 7,831 | 7,298 |
| Eng. and Admi. (10%) | 12,735 | 11,460 | 10,250 | 9,398 | 8,691 | 8,074 | 7,538 | 7,029 | 6,548 | 6,004 | 5,595 |
| Sub Total | 143,078 | 128,675 | 114,993 | 105,440 | 97,483 | 90,521 | 84,460 | 78,707 | 73,279 | 67,159 | 62,518 |
| I.D.C (9.5%/Year) | 31,447 | 26,994 | 22,974 | 21,066 | 19,476 | 18,085 | 16,874 | 15,725 | 14,640 | 13,417 | 12,490 |
| Total | 174,525 | 155,670 | 137,968 | 126,506 | 116,959 | 108,606 | 101,334 | 94,432 | 87,919 | 80,576 | 75,008 |
| Hydraulic Equipment | 4,917 | 4,722 | 4,385 | 4,135 | 3,936 | 3,754 | 3,509 | 3,338 | 3,170 | 2,843 | 2,779 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 526 | 528 |
| Intake Gate | 898 | 898 | 763 | 701 | 640 | 591 | 517 | 468 | 418 | 345 | 289 |
| Penstock | 1,979 | 1,815 | 1,656 | 1,504 | 1,392 | 1,285 | 1,149 | 1,051 | 956 | 836 | 751 |
| Draft Gate | 139 | 131 | 122 | 113 | 108 | 102 | 94 | 88 | 82 | 74 | 68 |
| Tailrace Gate | 70 | 65 | 61 | 57 | 54 | 51 | 47 | 44 | 41 | 37 | 34 |
| Pre-Subtotal | 4,470 | 4,293 | 3,986 | 3,760 | 3,578 | 3,413 | 3,190 | 3,034 | 2,882 | 2,675 | 2,526 |
| Contingency (10%) | 447 | 429 | 399 | 376 | 358 | 341 | 319 | 303 | 288 | 268 | 253 |
| Electro-Mechanical Equipment | 15,621 | 14,494 | 13,759 | 12,774 | 12,320 | 12,036 | 11,015 | 10,343 | 9,761 | 9,049 | 8,438 |
| Equipment | 14,677 | 13,804 | 13,104 | 12,166 | 11,733 | 11,463 | 10,490 | 9,850 | 9,296 | 8,618 | 8,036 |
| Contingency (5%) | 744 | 690 | 655 | 608 | 587 | 573 | 525 | 493 | 465 | 431 | 402 |
| Eng. and Admi. (10%) | 2,054 | 1,922 | 1,814 | 1,691 | 1,626 | 1,579 | 1,452 | 1,368 | 1,293 | 1,199 | 1,122 |
| Sub Total | 22,592 | 21,137 | 19,959 | 18,601 | 17,881 | 17,370 | 15,977 | 15,048 | 14,225 | 13,151 | 12,339 |
| I.D.C (9.5%/Year) | 1,215 | 1,743 | 1,645 | 1,533 | 1,474 | 1,432 | 1,317 | 1,241 | 1,173 | 1,087 | 1,017 |
| Total | 23,806 | 22,880 | 21,604 | 20,134 | 19,355 | 18,802 | 17,294 | 16,289 | 15,397 | 14,278 | 13,356 |
| Grand Total | 198,331 | 178,550 | 159,572 | 146,640 | 136,314 | 127,407 | 118,628 | 110,720 | 103,316 | 94,854 | 88,364 |

Baglik Project Tailrace Type Undergro. P/S Layout H.W.L.=570.00m With Bayram H.W.L.=750m-700m — Unit:10^3US$

| Description Dam Site / Layout Type | Baglik 750M.P | Baglik 745M.P | Baglik 740M.P | Baglik 735M.P | Baglik 730M.P | Baglik 725M.P | Baglik 720M.P | Baglik 715M.P | Baglik 710M.P | Baglik 705M.P | Baglik 700M.P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 |
| Reservoir Area (km^2) | 0.37 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 |
| Dam Volume (10^6m^3) | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 | 680 |
| Dam Height (m) | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 |
| Maximum Head (m) | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 |
| Maximum Discharge (m^3/s) | 62 | 60 | 57 | 54 | 51 | 49 | 46 | 44 | 42 | 40 | 38 |
| Relocation Road | 9,759 | 9,603 | 9,603 | 9,603 | 9,603 | 9,603 | 9,603 | 9,603 | 9,603 | 9,603 | 9,603 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 52,826 | 52,730 | 52,147 | 51,753 | 51,250 | 50,829 | 50,321 | 49,823 | 49,688 | 49,267 | 48,926 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 | 34,813 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 128 | 126 | 121 | 116 | 111 | 107 | 102 | 99 | 95 | 92 | 89 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 575 | 557 | 530 | 503 | 476 | 458 | 431 | 413 | 395 | 372 | 359 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 4,247 | 4,171 | 3,944 | 3,906 | 3,678 | 3,603 | 3,451 | 3,299 | 3,185 | 3,110 | 3,034 |
| Tailrace Tunnel | 9,805 | 9,805 | 9,481 | 9,157 | 8,914 | 8,590 | 8,266 | 7,942 | 7,942 | 7,617 | 7,374 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 60,983 | 63,731 | 63,148 | 62,754 | 62,251 | 61,829 | 61,321 | 60,824 | 60,689 | 60,268 | 59,927 |
| Contingency (15%) | 9,056 | 9,470 | 9,382 | 9,323 | 9,248 | 9,185 | 9,109 | 9,034 | 9,014 | 8,950 | 8,899 |
| Eng. and Admi. (10%) | 6,944 | 7,260 | 7,193 | 7,148 | 7,090 | 7,042 | 6,983 | 6,926 | 6,910 | 6,862 | 6,823 |
| Sub Total | 76,985 | 80,462 | 79,723 | 79,225 | 78,589 | 78,056 | 77,413 | 76,784 | 76,613 | 76,080 | 75,649 |
| I.D.C (9.5%/Year) | 19,229 | 20,098 | 19,913 | 19,789 | 19,630 | 19,497 | 19,336 | 19,179 | 19,137 | 19,003 | 18,896 |
| Total | 96,214 | 100,559 | 99,637 | 99,014 | 98,219 | 97,553 | 96,750 | 95,963 | 95,750 | 95,083 | 94,545 |
| Hydraulic Equipment | 4,148 | 4,059 | 3,913 | 3,768 | 3,622 | 3,525 | 3,379 | 3,281 | 3,184 | 3,086 | 2,988 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 543 | 535 | 514 | 492 | 470 | 456 | 434 | 420 | 405 | 391 | 378 |
| Penstock | 2,141 | 2,075 | 1,974 | 1,874 | 1,774 | 1,707 | 1,606 | 1,539 | 1,472 | 1,405 | 1,337 |
| Draft Gate | 144 | 140 | 133 | 126 | 119 | 114 | 107 | 102 | 98 | 93 | 88 |
| Tailrace Gate | 73 | 70 | 67 | 63 | 60 | 57 | 54 | 52 | 49 | 47 | 45 |
| Pre-Subtotal | 3,771 | 3,690 | 3,558 | 3,425 | 3,293 | 3,204 | 3,071 | 2,983 | 2,894 | 2,805 | 2,717 |
| Contingency (10%) | 377 | 369 | 356 | 343 | 329 | 320 | 307 | 298 | 289 | 281 | 272 |
| Electro-Mechanical Equipment | 23,392 | 22,083 | 21,528 | 20,942 | 20,368 | 20,169 | 19,477 | 18,997 | 18,493 | 17,754 | 17,455 |
| Equipment | 22,278 | 21,032 | 20,503 | 19,945 | 19,398 | 19,208 | 18,550 | 18,092 | 17,612 | 16,909 | 16,633 |
| Contingency (5%) | 1,114 | 1,052 | 1,025 | 997 | 970 | 960 | 927 | 906 | 881 | 845 | 832 |
| Eng. and Admi. (10%) | 2,754 | 2,614 | 2,544 | 2,471 | 2,399 | 2,369 | 2,286 | 2,228 | 2,168 | 2,084 | 2,045 |
| Sub Total | 30,284 | 28,756 | 27,986 | 27,181 | 26,389 | 26,063 | 25,141 | 24,506 | 23,844 | 22,924 | 22,499 |
| I.D.C (9.5%/Year) | 1,715 | 1,629 | 1,585 | 1,540 | 1,495 | 1,476 | 1,424 | 1,388 | 1,351 | 1,299 | 1,274 |
| Total | 32,010 | 30,385 | 29,571 | 28,721 | 27,884 | 27,539 | 26,566 | 25,894 | 25,195 | 24,223 | 23,773 |
| Grand Total | 128,224 | 130,945 | 129,208 | 127,734 | 126,103 | 125,092 | 123,315 | 121,857 | 120,944 | 119,306 | 118,318 |

## Table 9-9(2) Cost Estimate of Alternative Plan for Reservoir Capacity

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L.=750m-700m with Baglik H.W.L.=550.00m Unit:10^3US$

| Description Dam Site / Layout Type | Bayram 750A | Bayram 745A | Bayram 740A | Bayram 735A | Bayram 730A | Bayram 725A | Bayram 720A | Bayram 715A | Bayram 710A | Bayram 705A | Bayram 700A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 750 | 745 | 740 | 735 | 730 | 725 | 720 | 715 | 710 | 705 | 700 |
| Reservoir Area (km^2) | 3.98 | 3.68 | 3.38 | 3.11 | 2.83 | 2.58 | 2.32 | 2.10 | 1.88 | 1.68 | 1.47 |
| Dam Volume (10^6m^3) | 8,500 | 7,200 | 6,144 | 5,400 | 4,800 | 4,300 | 3,900 | 3,500 | 3,100 | 2,700 | 2,400 |
| Dam Height (m) | 155 | 150 | 145 | 140 | 135 | 130 | 125 | 120 | 115 | 110 | 105 |
| Maximum Head (m) | 200 | 195 | 190 | 185 | 180 | 175 | 170 | 165 | 160 | 155 | 150 |
| Maximum Discharge (m^3/s) | 49 | 45 | 43 | 40 | 38 | 36 | 33 | 31 | 29 | 26 | 24 |
| Relocation Road | 13,724 | 12,689 | 11,655 | 10,724 | 9,758 | 8,896 | 8,000 | 7,241 | 6,483 | 5,793 | 5,069 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,989 | 2,616 | 2,242 | 2,063 | 1,878 | 1,712 | 1,539 | 1,393 | 1,247 | 1,115 | 975 |
| Civil Work | 100,862 | 89,792 | 80,880 | 74,407 | 69,276 | 64,884 | 61,157 | 57,408 | 53,853 | 50,162 | 47,444 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 65,412 | 55,407 | 47,281 | 41,556 | 36,938 | 33,051 | 30,012 | 26,934 | 23,856 | 20,778 | 18,459 |
| Spillway | 8,143 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,280 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 | 1,192 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 545 | 501 | 456 | 417 | 387 | 358 | 321 | 295 | 269 | 236 | 212 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 3,145 | 3,081 | 2,856 | 2,664 | 2,568 | 2,439 | 2,215 | 2,086 | 2,022 | 1,829 | 1,701 |
| Tailrace Tunnel | 13,676 | 13,160 | 12,644 | 12,128 | 11,741 | 11,354 | 10,967 | 10,451 | 10,063 | 9,676 | 9,418 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 118,375 | 105,898 | 95,577 | 87,994 | 81,712 | 76,292 | 71,496 | 66,843 | 62,380 | 57,870 | 54,288 |
| Contingency (15%) | 17,306 | 15,492 | 14,000 | 12,890 | 11,975 | 11,187 | 10,494 | 9,817 | 9,170 | 8,513 | 7,997 |
| Eng. and Admi. (10%) | 13,269 | 11,877 | 10,733 | 9,882 | 9,181 | 8,577 | 8,045 | 7,527 | 7,031 | 6,527 | 6,131 |
| Sub Total | 148,953 | 133,267 | 120,311 | 110,766 | 102,869 | 96,056 | 90,035 | 84,187 | 78,584 | 72,910 | 68,416 |
| I.D.C (9.5%/Year) | 32,738 | 27,958 | 24,037 | 22,130 | 20,552 | 19,191 | 17,988 | 16,819 | 15,700 | 14,566 | 13,669 |
| Total | 181,691 | 161,225 | 144,347 | 132,896 | 123,421 | 115,247 | 108,023 | 101,006 | 94,284 | 87,476 | 82,084 |
| Hydraulic Equipment | 5,376 | 5,081 | 4,847 | 4,647 | 4,493 | 4,344 | 4,150 | 4,012 | 3,879 | 3,705 | 3,583 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 898 | 837 | 837 | 837 | 837 | 837 | 837 | 837 | 837 | 837 | 837 |
| Penstock | 2,397 | 2,202 | 2,003 | 1,833 | 1,702 | 1,575 | 1,412 | 1,295 | 1,182 | 1,037 | 934 |
| Draft Gate | 139 | 131 | 122 | 113 | 108 | 102 | 94 | 88 | 82 | 74 | 68 |
| Tailrace Gate | 70 | 65 | 61 | 57 | 54 | 51 | 47 | 44 | 41 | 37 | 34 |
| Pre-Subtotal | 4,888 | 4,619 | 4,407 | 4,225 | 4,085 | 3,949 | 3,773 | 3,647 | 3,526 | 3,368 | 3,257 |
| Contingency (10%) | 489 | 462 | 441 | 422 | 408 | 395 | 377 | 365 | 353 | 337 | 326 |
| Electro-Mechanical Equipment | 16,638 | 15,591 | 14,501 | 13,792 | 13,247 | 12,643 | 11,731 | 11,120 | 10,230 | 9,536 | 9,238 |
| Equipment | 15,846 | 14,849 | 13,810 | 13,135 | 12,616 | 12,041 | 11,172 | 10,591 | 9,743 | 9,082 | 8,798 |
| Contingency (5%) | 792 | 742 | 691 | 657 | 631 | 602 | 559 | 530 | 487 | 454 | 440 |
| Eng. and Admi. (10%) | 2,201 | 2,067 | 1,935 | 1,844 | 1,774 | 1,699 | 1,588 | 1,513 | 1,411 | 1,324 | 1,282 |
| Sub Total | 24,216 | 22,739 | 21,283 | 20,283 | 19,514 | 18,686 | 17,470 | 16,646 | 15,520 | 14,564 | 14,102 |
| I.D.C (9.5%/Year) | 1,302 | 1,223 | 1,144 | 1,091 | 1,049 | 1,005 | 939 | 895 | 834 | 783 | 758 |
| Total | 25,518 | 23,962 | 22,427 | 21,374 | 20,563 | 19,691 | 18,409 | 17,541 | 16,354 | 15,348 | 14,860 |
| Grand Total | 207,209 | 185,187 | 166,775 | 154,269 | 143,984 | 134,938 | 126,432 | 118,547 | 110,638 | 102,824 | 96,945 |

Baglik Project Tailrace Type Undergro. P/S Layout H.W.L=550.00m With Bayram H.W.L=750m-700m Unit:10^3US$

| Description Dam Site / Layout Type | Baglik 750A | Baglik 745A | Baglik 740A | Baglik 735A | Baglik 730A | Baglik 725A | Baglik 720A | Baglik 715A | Baglik 710A | Baglik 705A | Baglik 700A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 |
| Reservoir Area (km^2) | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 |
| Dam Volume (10^6m^3) | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 | 420 |
| Dam Height (m) | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 |
| Maximum Head (m) | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 | 158 |
| Maximum Discharge (m^3/s) | 59 | 57 | 54 | 52 | 47 | 45 | 42 | 40 | 38 | 35 | 33 |
| Relocation Road | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 | 8,043 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 1,115 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 38,697 | 38,677 | 38,097 | 37,798 | 37,123 | 36,706 | 36,240 | 35,745 | 35,369 | 34,946 | 34,570 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 | 21,502 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 97 | 94 | 89 | 87 | 80 | 78 | 75 | 71 | 68 | 65 | 61 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 491 | 475 | 451 | 435 | 395 | 378 | 354 | 338 | 322 | 298 | 282 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,868 | 3,868 | 3,641 | 3,603 | 3,299 | 3,223 | 3,110 | 2,958 | 2,844 | 2,692 | 2,579 |
| Tailrace Tunnel | 9,491 | 9,491 | 9,157 | 8,914 | 8,590 | 8,266 | 7,942 | 7,617 | 7,374 | 7,131 | 6,888 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 48,655 | 43,118 | 47,537 | 47,239 | 46,564 | 46,147 | 45,681 | 45,186 | 44,809 | 44,387 | 44,010 |
| Contingency (15%) | 7,131 | 7,128 | 7,041 | 6,996 | 6,895 | 6,832 | 6,762 | 6,693 | 6,632 | 6,568 | 6,512 |
| Eng. and Admi. (10%) | 5,467 | 5,465 | 5,398 | 5,364 | 5,286 | 5,238 | 5,185 | 5,128 | 5,084 | 5,036 | 4,992 |
| Sub Total | 61,253 | 60,711 | 59,976 | 59,599 | 58,745 | 58,217 | 57,628 | 57,002 | 56,525 | 55,991 | 55,515 |
| I.D.C (9.5%/Year) | 15,300 | 15,164 | 14,981 | 14,887 | 14,673 | 14,541 | 14,394 | 14,238 | 14,119 | 13,985 | 13,867 |
| Total | 76,552 | 75,876 | 74,957 | 74,485 | 73,419 | 72,758 | 72,023 | 71,239 | 70,644 | 69,977 | 69,381 |
| Hydraulic Equipment | 3,647 | 3,558 | 3,425 | 3,343 | 3,128 | 3,047 | 2,920 | 2,831 | 2,741 | 2,614 | 2,524 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 412 | 398 | 376 | 369 | 340 | 333 | 318 | 304 | 289 | 275 | 260 |
| Penstock | 1,827 | 1,767 | 1,678 | 1,618 | 1,469 | 1,409 | 1,319 | 1,259 | 1,199 | 1,109 | 1,049 |
| Draft Gate | 137 | 133 | 126 | 121 | 109 | 105 | 98 | 93 | 88 | 81 | 77 |
| Tailrace Gate | 69 | 67 | 63 | 61 | 55 | 53 | 49 | 47 | 45 | 41 | 39 |
| Pre-Subtotal | 3,316 | 3,235 | 3,113 | 3,039 | 2,844 | 2,770 | 2,655 | 2,573 | 2,492 | 2,377 | 2,295 |
| Contingency (10%) | 332 | 323 | 311 | 304 | 284 | 277 | 265 | 257 | 249 | 238 | 229 |
| Electro-Mechanical Equipment | 21,822 | 20,638 | 20,192 | 19,723 | 18,493 | 17,965 | 17,215 | 16,652 | 16,324 | 15,621 | 15,402 |
| Equipment | 20,593 | 19,655 | 19,231 | 18,784 | 17,612 | 17,110 | 16,395 | 15,860 | 15,547 | 14,877 | 14,669 |
| Contingency (5%) | 1,030 | 983 | 962 | 939 | 881 | 855 | 820 | 793 | 777 | 744 | 733 |
| Eng. and Admi. (10%) | 2,527 | 2,420 | 2,362 | 2,307 | 2,162 | 2,101 | 2,014 | 1,948 | 1,907 | 1,824 | 1,793 |
| Sub Total | 27,797 | 26,616 | 25,979 | 25,373 | 23,783 | 23,113 | 22,149 | 21,431 | 20,972 | 20,059 | 19,719 |
| I.D.C (9.5%/Year) | 1,575 | 1,508 | 1,472 | 1,437 | 1,347 | 1,309 | 1,255 | 1,214 | 1,188 | 1,136 | 1,117 |
| Total | 29,371 | 28,123 | 27,450 | 26,811 | 25,130 | 24,422 | 23,403 | 22,645 | 22,160 | 21,195 | 20,836 |
| Grand Total | 105,924 | 103,999 | 102,408 | 101,296 | 98,549 | 97,181 | 95,426 | 93,885 | 92,804 | 91,172 | 90,219 |

# Table 9-9(3) Cost Estimate of Alternative Plan for Reservoir Capacity

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L.=750m-700m with Baglik H.W.L.= 530.00m

Unit:10^3US$

| Description Dam Site / Layout Type | Bayram 750C | Bayram 745C | Bayram 740C | Bayram 735C | Bayram 730C | Bayram 725C | Bayram 720C | Bayram 715C | Bayram 710C | Bayram 705C | Bayram 700C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 750 | 745 | 740 | 735 | 730 | 725 | 720 | 715 | 710 | 705 | 700 |
| Reservoir Area (km^2) | 3.98 | 3.68 | 3.38 | 3.11 | 2.83 | 2.58 | 2.32 | 2.10 | 1.88 | 1.68 | 1.47 |
| Dam Volume (10^6m^3) | 8,500 | 7,200 | 6,144 | 5,400 | 4,800 | 4,300 | 3,900 | 3,500 | 3,100 | 2,700 | 2,400 |
| Dam Height (m) | 155 | 150 | 145 | 140 | 135 | 130 | 125 | 120 | 115 | 110 | 105 |
| Maximum Head (m) | 220 | 215.00 | 210.00 | 205.00 | 200.00 | 195.00 | 190.00 | 185.00 | 180.00 | 175.00 | 170.00 |
| Maximum Discharge (m^3/s) | 49 | 46 | 43 | 40 | 38 | 36 | 33 | 31 | 29 | 26 | 24 |
| Relocation Road | 13,724 | 12,689 | 11,655 | 10,724 | 9,758 | 8,896 | 8,000 | 7,241 | 6,483 | 5,793 | 5,069 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,993 | 2,616 | 2,242 | 2,063 | 1,878 | 1,712 | 1,539 | 1,393 | 1,247 | 1,115 | 975 |
| Civil Work | 103,704 | 92,403 | 83,113 | 76,295 | 70,884 | 66,201 | 62,266 | 58,227 | 54,253 | 50,923 | 47,318 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 65,412 | 55,407 | 47,281 | 41,556 | 36,938 | 33,091 | 30,012 | 26,934 | 23,856 | 20,778 | 18,489 |
| Spillway | 8,143 | 7,789 | 7,523 | 7,434 | 7,346 | 7,169 | 7,080 | 6,992 | 6,815 | 6,726 | 6,603 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,280 | 1,192 | 1,087 | 999 | 912 | 842 | 736 | 666 | 595 | 491 | 412 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 651 | 599 | 546 | 501 | 466 | 432 | 388 | 357 | 327 | 287 | 259 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 3,370 | 3,177 | 3,049 | 2,792 | 2,664 | 2,568 | 2,407 | 2,247 | 2,086 | 1,926 | 1,765 |
| Tailrace Tunnel | 16,187 | 15,576 | 14,965 | 14,354 | 13,896 | 13,438 | 12,980 | 12,369 | 11,911 | 11,453 | 11,147 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 121,217 | 108,508 | 97,811 | 89,886 | 83,320 | 77,609 | 72,605 | 67,661 | 62,783 | 58,030 | 54,182 |
| Contingency (15%) | 17,734 | 15,884 | 14,335 | 13,173 | 12,216 | 11,385 | 10,660 | 9,940 | 9,230 | 8,537 | 7,978 |
| Eng. and Admi. (10%) | 13,596 | 12,178 | 10,990 | 10,100 | 9,366 | 8,728 | 8,173 | 7,621 | 7,077 | 6,545 | 6,116 |
| Sub Total | 152,547 | 136,570 | 123,136 | 113,159 | 104,902 | 97,722 | 91,438 | 85,222 | 79,090 | 73,113 | 68,256 |
| I.D.C (9.5%/Year) | 33,528 | 28,651 | 24,601 | 22,608 | 20,958 | 19,524 | 18,268 | 17,026 | 15,801 | 14,607 | 13,637 |
| Total | 186,075 | 165,220 | 147,737 | 135,767 | 125,860 | 117,245 | 109,706 | 102,249 | 94,891 | 87,720 | 81,893 |
| Hydraulic Equipment | 5,889 | 5,557 | 5,203 | 4,904 | 4,659 | 4,430 | 4,123 | 3,908 | 3,698 | 3,411 | 3,206 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 898 | 837 | 763 | 701 | 640 | 591 | 517 | 468 | 418 | 345 | 289 |
| Penstock | 2,862 | 2,635 | 2,400 | 2,202 | 2,049 | 1,900 | 1,707 | 1,569 | 1,436 | 1,262 | 1,140 |
| Draft Gate | 139 | 131 | 122 | 113 | 108 | 102 | 94 | 88 | 82 | 74 | 68 |
| Tailrace Gate | 70 | 65 | 61 | 57 | 54 | 51 | 47 | 44 | 41 | 37 | 34 |
| Pre-Subtotal | 5,353 | 5,052 | 4,730 | 4,456 | 4,234 | 4,028 | 3,748 | 3,552 | 3,362 | 3,101 | 2,915 |
| Contingency (10%) | 535 | 505 | 473 | 446 | 423 | 403 | 375 | 355 | 336 | 310 | 291 |
| Electro-Mechanical Equipment | 17,482 | 16,260 | 15,780 | 14,944 | 14,250 | 13,527 | 12,713 | 12,073 | 11,375 | 10,357 | 9,805 |
| Equipment | 16,649 | 15,486 | 15,029 | 14,233 | 13,572 | 12,883 | 12,107 | 11,498 | 10,833 | 9,864 | 9,338 |
| Contingency (5%) | 832 | 774 | 751 | 712 | 679 | 644 | 605 | 575 | 542 | 493 | 467 |
| Eng. and Admi. (10%) | 2,337 | 2,182 | 2,098 | 1,985 | 1,891 | 1,796 | 1,684 | 1,598 | 1,507 | 1,377 | 1,301 |
| Sub Total | 25,707 | 23,999 | 23,082 | 21,833 | 20,799 | 19,753 | 18,519 | 17,578 | 16,580 | 15,145 | 14,312 |
| I.D.C (9.5%/Year) | 1,382 | 1,290 | 1,241 | 1,174 | 1,118 | 1,062 | 996 | 945 | 891 | 814 | 769 |
| Total | 27,090 | 25,289 | 24,323 | 23,007 | 21,917 | 20,815 | 19,514 | 18,523 | 17,471 | 15,959 | 15,082 |
| Grand Total | 213,164 | 190,509 | 172,060 | 158,774 | 147,777 | 138,060 | 129,220 | 120,772 | 112,362 | 103,679 | 96,974 |

Baglik Project Tailrace Type Undergro. P/S Layout H.W.L.= 530.00m with Bayram H.W.L.=750m-700m

Unit:10^3US$

| Description Dam Site / Layout Type | Baglik 750C | Baglik 745C | Baglik 740C | Baglik 735C | Baglik 730C | Baglik 725C | Baglik 720C | Baglik 715C | Baglik 710C | Baglik 705C | Baglik 700C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| Reservoir Area (km^2) | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dam Volume (10^6m^3) | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Dam Height (m) | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| Maximum Head (m) | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| Maximum Discharge (m^3/s) | 58 | 55 | 52 | 45 | 45 | 43 | 40 | 38 | 36 | 33 | 31 |
| Relocation Road | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 26,946 | 26,447 | 25,954 | 25,410 | 24,987 | 24,495 | 24,034 | 23,662 | 23,290 | 22,834 | 22,418 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 44 | 42 | 40 | 37 | 36 | 34 | 32 | 31 | 30 | 28 | 26 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 426 | 406 | 376 | 356 | 335 | 321 | 299 | 285 | 271 | 250 | 235 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,754 | 3,603 | 3,413 | 3,185 | 3,110 | 2,958 | 2,844 | 2,730 | 2,617 | 2,427 | 2,351 |
| Tailrace Tunnel | 9,481 | 9,157 | 8,914 | 8,590 | 8,266 | 7,942 | 7,617 | 7,374 | 7,131 | 6,688 | 6,564 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 35,103 | 34,604 | 34,141 | 33,566 | 33,144 | 32,652 | 32,191 | 31,819 | 31,446 | 30,991 | 30,575 |
| Contingency (15%) | 5,176 | 5,101 | 5,031 | 4,945 | 4,882 | 4,808 | 4,739 | 4,683 | 4,627 | 4,559 | 4,497 |
| Eng. and Admi. (10%) | 3,968 | 3,911 | 3,857 | 3,791 | 3,743 | 3,686 | 3,633 | 3,590 | 3,548 | 3,495 | 3,447 |
| Sub Total | 44,247 | 43,616 | 43,030 | 42,303 | 41,768 | 41,146 | 40,563 | 40,093 | 39,621 | 39,045 | 38,518 |
| I.D.C (9.5%/Year) | 11,052 | 10,894 | 10,748 | 10,566 | 10,433 | 10,278 | 10,132 | 10,014 | 9,897 | 9,753 | 9,621 |
| Total | 55,299 | 54,510 | 53,778 | 52,870 | 52,201 | 51,424 | 50,695 | 50,107 | 49,518 | 48,797 | 48,140 |
| Hydraulic Equipment | 3,130 | 3,023 | 2,884 | 2,774 | 2,668 | 2,594 | 2,488 | 2,418 | 2,344 | 2,237 | 2,163 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 186 | 177 | 170 | 159 | 152 | 145 | 137 | 134 | 127 | 119 | 112 |
| Penstock | 1,587 | 1,508 | 1,400 | 1,325 | 1,246 | 1,193 | 1,114 | 1,062 | 1,009 | 929 | 878 |
| Draft Gate | 135 | 128 | 121 | 112 | 105 | 100 | 93 | 88 | 84 | 77 | 72 |
| Tailrace Gate | 68 | 65 | 61 | 56 | 53 | 50 | 47 | 45 | 42 | 39 | 36 |
| Pre-Subtotal | 2,845 | 2,748 | 2,622 | 2,522 | 2,425 | 2,359 | 2,262 | 2,198 | 2,131 | 2,034 | 1,967 |
| Contingency (10%) | 285 | 275 | 262 | 252 | 243 | 236 | 226 | 220 | 213 | 203 | 197 |
| Electro-Mechanical Equipment | 20,208 | 19,723 | 19,216 | 18,176 | 17,614 | 17,028 | 16,418 | 15,223 | 15,558 | 15,015 | 14,719 |
| Equipment | 19,245 | 18,784 | 18,301 | 17,311 | 16,775 | 16,217 | 15,636 | 15,450 | 14,818 | 14,300 | 14,018 |
| Contingency (5%) | 962 | 939 | 915 | 866 | 839 | 811 | 782 | 773 | 741 | 715 | 701 |
| Eng. and Admi. (10%) | 2,334 | 2,275 | 2,210 | 2,095 | 2,028 | 1,962 | 1,891 | 1,864 | 1,790 | 1,725 | 1,688 |
| Sub Total | 25,672 | 25,021 | 24,310 | 23,045 | 22,310 | 21,584 | 20,797 | 20,505 | 19,693 | 18,978 | 18,570 |
| I.D.C (9.5%/Year) | 1,454 | 1,417 | 1,377 | 1,306 | 1,264 | 1,223 | 1,178 | 1,161 | 1,116 | 1,075 | 1,052 |
| Total | 27,126 | 26,438 | 25,687 | 24,351 | 23,573 | 22,807 | 21,975 | 21,666 | 20,809 | 20,053 | 19,622 |
| Grand Total | 82,425 | 80,949 | 79,464 | 77,220 | 75,774 | 74,231 | 72,670 | 71,774 | 70,326 | 68,850 | 67,762 |

# Table 9-10(1-1) Comparison Study on Reservoir Capacity

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L.=750m-700m With Baglik H.W.L.=570m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Layout | Bayram 750M/P | Baglik 750M/P | Total | Bayram 745M/P | Baglik 570M/P | Total | Bayram 740M/P | Baglik 570M/P | Total | Bayram 735M/P | Baglik 570M/P | Total | Bayram 730M/P | Baglik 570M/P | Total | Bayram 725M/P | Baglik 570M/P | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | m | 750.00 | 570.00 | | 745.00 | 570.00 | | 740.00 | 570.00 | | 735.00 | 570.00 | | 730 | 570.00 | | 725 | 570.00 | |
| Normal Water Level | m | 728.67 | 555.67 | | 725.33 | 555.67 | | 722.00 | 555.67 | | 718.67 | 555.67 | | 715.3333 | 555.67 | | 712 | 555.67 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686 | 527.00 | | 686 | 527.00 | |
| Available Drawdown | m | 64.00 | 43.00 | | 59.00 | 43.00 | | 54.00 | 43.00 | | 49.00 | 43.00 | | 44 | 43.00 | | 39 | 43.00 | |
| Gross Storage Capacity | m^3*10^8 | 169.00 | 36.40 | | 150.00 | 36.40 | | 133.00 | 36.40 | | 116.00 | 36.40 | | 102 | 36.40 | | 88 | 36.40 | |
| Effective Storage Capacity | m^3*10^6 | 149.00 | 30.10 | | 130.00 | 30.10 | | 113.00 | 30.10 | | 96.00 | 30.10 | | 82 | 30.10 | | 66 | 30.10 | |
| Dam Type | 0 | Rockfill | Con-Gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | |
| Dam Hight | m | 155 | 114 | | 150 | 114 | | 145 | 114 | | 140 | 114 | | 135 | 114 | | 130 | 114 | |
| Dam Volume | m^3 | 6,500 | 680 | | 7,200 | 680 | | 6,144 | 680 | | 5,400 | 680 | | 4,800 | 680 | | 4,300 | 680 | |
| Tailwater Level | m | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | |
| Effective Head | m | 152.37 | 158.17 | | 149.03 | 158.17 | | 145.70 | 158.17 | | 142.27 | 158.07 | | 138.93 | 158.07 | | 135.50 | 158.07 | |
| Maximum Discharge | m^3/s | 49.00 | 62.00 | | 46.00 | 60.00 | | 43.00 | 57.00 | | 40.00 | 54.00 | | 38.00 | 51.00 | | 36.00 | 49.00 | |
| Installed Capacity | MW | 64.00 | 85.00 | 149.00 | 59.00 | 82.00 | 141.00 | 54.00 | 78.00 | 132.00 | 49.00 | 74.00 | 123.00 | 45.00 | 69.00 | 114.00 | 42.00 | 67.00 | 109.00 |
| Firm Peak Power | MW | 52.40 | 72.50 | 124.90 | 48.80 | 70.80 | 119.60 | 44.80 | 67.60 | 112.40 | 40.70 | 67.80 | 108.50 | 37.20 | 66.20 | 103.40 | 34.50 | 62.50 | 97.00 |
| Energy Production | | | | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 215.00 | 287.00 | 502.00 | 207.60 | 285.60 | 493.20 | 198.50 | 282.13 | 480.63 | 188.20 | 279.50 | 467.70 | 176.90 | 276.30 | 455.20 | 170.90 | 269.60 | 440.50 |
| Firm Energy | GWh | 135.00 | 178.00 | 313.00 | 123.90 | 172.20 | 296.10 | 113.20 | 163.70 | 276.90 | 102.30 | 156.20 | 258.50 | 93.50 | 147.90 | 241.40 | 87.20 | 141.10 | 228.30 |
| Secondary Energy | GWh | 80.00 | 109.00 | 189.00 | 83.70 | 113.40 | 197.10 | 85.30 | 118.43 | 203.73 | 85.90 | 123.30 | 209.20 | 85.40 | 128.40 | 213.80 | 83.70 | 128.50 | 212.20 |
| Unit Benefit Value | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | US$/kW | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | US$/kWh | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | US$/kWh | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 9.02 | 12.46 | 21.49 | 8.40 | 12.18 | 20.58 | 7.71 | 11.63 | 19.34 | 7.00 | 11.67 | 18.67 | 6.40 | 11.39 | 17.79 | 5.94 | 10.76 | 16.69 |
| Firm Energy | US$*10^6 | 3.58 | 4.72 | 8.31 | 3.29 | 4.57 | 7.86 | 3.00 | 4.34 | 7.35 | 2.72 | 4.15 | 6.86 | 2.48 | 3.93 | 6.41 | 2.31 | 3.75 | 6.06 |
| Secondary Energy | US$*10^6 | 1.72 | 2.35 | 4.07 | 1.80 | 2.44 | 4.24 | 1.84 | 2.55 | 4.39 | 1.85 | 2.65 | 4.50 | 1.84 | 2.76 | 4.60 | 1.80 | 2.77 | 4.57 |
| Total | US$*10^6 | 14.32 | 19.55 | 33.87 | 13.49 | 19.20 | 32.68 | 12.55 | 18.53 | 31.08 | 11.57 | 18.47 | 30.04 | 10.72 | 18.08 | 28.80 | 10.05 | 17.27 | 27.32 |
| Investment Cost | | | | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 174.52 | 96.21 | 270.74 | 155.67 | 100.56 | 256.23 | 137.97 | 99.64 | 237.60 | 126.51 | 99.01 | 225.52 | 116.96 | 98.22 | 215.18 | 108.61 | 97.55 | 206.16 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 23.81 | 32.01 | 55.82 | 22.88 | 30.39 | 53.27 | 21.60 | 29.57 | 51.18 | 20.13 | 28.72 | 48.85 | 19.36 | 27.88 | 47.24 | 18.80 | 27.54 | 46.34 |
| Total | US$*10^6 | 198.33 | 128.22 | 326.56 | 178.55 | 130.94 | 309.49 | 159.57 | 129.21 | 288.78 | 146.64 | 127.73 | 274.37 | 136.31 | 126.10 | 262.42 | 127.41 | 125.09 | 252.50 |
| Annual Cost | | | | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 17.63 | 9.72 | 27.34 | 15.72 | 10.16 | 25.88 | 13.93 | 10.06 | 24.00 | 12.78 | 10.00 | 22.78 | 11.81 | 9.92 | 21.73 | 10.97 | 9.85 | 20.82 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 2.71 | 3.65 | 6.36 | 2.61 | 3.46 | 6.07 | 2.46 | 3.37 | 5.83 | 2.30 | 3.27 | 5.57 | 2.21 | 3.18 | 5.39 | 2.14 | 3.14 | 5.28 |
| Total | US$*10^6 | 20.34 | 13.37 | 33.71 | 18.33 | 13.62 | 31.95 | 16.40 | 13.43 | 29.83 | 15.07 | 13.27 | 28.35 | 14.02 | 13.10 | 27.12 | 13.11 | 12.99 | 26.10 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -6.02 | 6.18 | 0.16 | -4.84 | 5.56 | 0.73 | -3.85 | 5.09 | 1.25 | -3.50 | 5.19 | 1.69 | -3.30 | 4.98 | 1.69 | -3.06 | 4.27 | 1.22 |
| Benefit Cost Ratio(B/C) | | 0.70 | 1.46 | 1.00 | 0.74 | 1.41 | 1.02 | 0.77 | 1.38 | 1.04 | 0.77 | 1.39 | 1.06 | 0.76 | 1.38 | 1.06 | 0.77 | 1.33 | 1.05 |
| Unit Annual Cost (Firm) | US$/kWh | 0.151 | 0.075 | 0.108 | 0.148 | 0.079 | 0.108 | 0.145 | 0.082 | 0.108 | 0.147 | 0.085 | 0.110 | 0.150 | 0.089 | 0.112 | 0.150 | 0.092 | 0.114 |
| Unit Annual Cost (Average) | US$/kWh | 0.095 | 0.047 | 0.067 | 0.088 | 0.048 | 0.065 | 0.083 | 0.048 | 0.062 | 0.080 | 0.047 | 0.061 | 0.078 | 0.047 | 0.060 | 0.077 | 0.048 | 0.059 |

## Table 9-10(1-2) Comparison Study on Reservoir Capacity

Beyram Project Tailrace Type Undergro. P/S Layout H.W.L.=750m-700m With Begilli H.W.L.=570m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Layout | Beyram 720M/P | Begilli 570M/P | Total | Beyram 715M/P | Begilli 570M/P | Total | Beyram 710M/P | Begilli 570M/P | Total | Beyram 705M/P | Begilli 570M/P | Total | Beyram 700M/P | Begilli 570M/P | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | m | 720.00 | 570.00 | | 715.00 | 570.00 | | 710.00 | 570.00 | | 705.00 | 570.00 | | 700.00 | 570.00 | |
| Normal Water Level | m | 706.67 | 555.67 | | 705.33 | 555.67 | | 702.00 | 555.67 | | 698.67 | 555.67 | | 695.33 | 555.67 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | |
| Available Drawdown | m | 34.00 | 43.00 | | 29.00 | 43.00 | | 24.00 | 43.00 | | 19.00 | 43.00 | | 14.00 | 43.00 | |
| Gross Storage Capacity | m^3*10^6 | 76.00 | 36.40 | | 65.00 | 36.40 | | 55.00 | 36.40 | | 46.00 | 36.40 | | 169.00 | 36.40 | |
| Effective Storage Capacity | m^3*10^6 | 56.00 | 30.10 | | 45.00 | 30.10 | | 35.00 | 30.10 | | 26.00 | 30.10 | | 149.00 | 30.10 | |
| Dam Type | 0 | Rockfill | Con-gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | | Rockfill | Con-gra. | |
| Dam Hight | m | 125 | 114 | | 120 | 114 | | 115 | 114 | | 110 | 114 | | 105 | 114 | |
| Dam Volume | m^3 | 3,900 | 680 | | 3,500 | 680 | | 3,100 | 680 | | 2,700 | 680 | | 2,400 | 680 | |
| Tailwater Level | m | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | |
| Effective Head | m | 132.07 | 157.97 | | 128.73 | 157.97 | | 125.30 | 157.97 | | 121.87 | 157.87 | | 118.43 | 157.87 | |
| Maximum Discharge | m^3/s | 33.00 | 46.00 | | 31.00 | 44.00 | | 29.00 | 42.00 | | 26.00 | 40.00 | | 24.00 | 38.00 | |
| Installed Capacity | MW | 37.00 | 63.00 | 100.00 | 34.00 | 60.00 | 94.00 | 31.00 | 57.00 | 88.00 | 27.00 | 54.00 | 81.00 | 24.00 | 52.00 | 76.00 |
| Firm Peak Power | MW | 30.20 | 60.10 | 90.30 | 27.60 | 56.80 | 84.40 | 26.20 | 53.20 | 79.40 | 23.80 | 47.90 | 71.70 | 21.10 | 43.40 | 64.50 |
| Energy Production | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 158.40 | 263.10 | 421.50 | 149.80 | 257.10 | 406.90 | 139.70 | 251.30 | 391.00 | 127.30 | 243.40 | 370.70 | 117.30 | 233.30 | 350.60 |
| Firm Energy | GWh | 78.50 | 132.70 | 211.20 | 70.50 | 126.10 | 196.60 | 64.40 | 121.50 | 185.90 | 56.20 | 114.60 | 170.80 | 51.80 | 108.00 | 159.80 |
| Secondary Energy | GWh | 79.90 | 130.40 | 210.30 | 79.30 | 131.00 | 210.30 | 75.30 | 129.80 | 205.10 | 71.10 | 128.80 | 199.90 | 65.50 | 125.30 | 190.80 |
| Unit Benefit Value | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$/kW | 160,450 | 160,450 | | 160,450 | 160,450 | | 160,450 | 160,450 | | 160,450 | 160,450 | | 160,450 | 160,450 | |
| Firm Energy | US$/kWh | 0.0270 | 0.027 | | 0.0270 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | US$/kWh | 0.0219 | 0.022 | | 0.0219 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 5.20 | 10.34 | 15.54 | 4.75 | 9.77 | 14.52 | 4.51 | 9.16 | 13.66 | 4.10 | 8.24 | 12.34 | 3.63 | 7.47 | 11.10 |
| Firm Energy | US$*10^6 | 2.08 | 3.52 | 5.61 | 1.87 | 3.35 | -5.22 | 1.71 | 3.22 | 4.93 | 1.49 | 3.04 | 4.53 | 1.37 | 2.87 | 4.24 |
| Secondary Energy | US$*10^6 | 1.72 | 2.81 | 4.53 | 1.71 | 2.82 | 4.53 | 1.62 | 2.79 | 4.42 | 1.53 | 2.77 | 4.30 | 1.41 | 2.70 | 4.11 |
| Total | US$*10^6 | 9.00 | 16.67 | 25.67 | 8.33 | 15.94 | 24.27 | 7.84 | 15.17 | 23.01 | 7.12 | 14.06 | 21.18 | 6.42 | 13.03 | 19.45 |
| Investment Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 101.33 | 96.75 | 198.08 | 94.43 | 95.96 | 190.40 | 87.92 | 95.75 | 183.67 | 80.58 | 95.08 | 175.66 | 75.01 | 94.55 | 169.55 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 17.29 | 26.57 | 43.86 | 16.29 | 25.89 | 42.18 | 15.40 | 25.19 | 40.59 | 14.28 | 24.22 | 38.50 | 13.36 | 23.77 | 37.13 |
| Total | US$*10^6 | 118.63 | 123.32 | 241.94 | 110.72 | 121.86 | 232.58 | 103.32 | 120.94 | 224.26 | 94.85 | 119.31 | 214.16 | 88.36 | 118.32 | 206.68 |
| Annual Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 10.23 | 9.77 | 20.01 | 9.54 | 9.69 | 19.23 | 8.68 | 9.67 | 18.55 | 8.14 | 9.60 | 17.74 | 7.58 | 9.55 | 17.12 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 1.97 | 3.03 | 5.00 | 1.86 | 2.95 | 4.81 | 1.76 | 2.87 | 4.63 | 1.63 | 2.76 | 4.39 | 1.52 | 2.71 | 4.23 |
| Total | US$*10^6 | 12.21 | 12.80 | 25.01 | 11.39 | 12.64 | 24.04 | 10.64 | 12.54 | 23.18 | 9.77 | 12.36 | 22.13 | 9.10 | 12.26 | 21.36 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -3.21 | 3.87 | 0.67 | -3.07 | 3.30 | 0.23 | -2.80 | 2.63 | -0.16 | -2.65 | 1.69 | -0.95 | -2.68 | 0.77 | -1.91 |
| Benefit Cost Ratio(B/C) | | 0.74 | 1.30 | 1.03 | 0.73 | 1.26 | 1.01 | 0.74 | 1.21 | 0.99 | 0.73 | 1.14 | 0.96 | 0.71 | 1.06 | 0.91 |
| Unit Annual Cost (Firm) | US$/kWh | 0.155 | 0.096 | 0.118 | 0.162 | 0.100 | 0.122 | 0.165 | 0.103 | 0.125 | 0.174 | 0.108 | 0.130 | 0.176 | 0.114 | 0.134 |
| Unit Annual Cost (Average) | US$/kWh | 0.077 | 0.049 | 0.059 | 0.076 | 0.049 | 0.059 | 0.076 | 0.050 | 0.059 | 0.077 | 0.051 | 0.060 | 0.078 | 0.053 | 0.061 |

## Table 9-10(2-1) Comparison Study on Reservoir Capacity

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L.=750m-700m with Beglik H.W.L.=660.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Layout | Bayram 750A | Beglik 750A | Total | Bayram 745A | Beglik 745A | Total | Bayram 740A | Beglik 740A | Total | Bayram 735A | Beglik 735A | Total | Bayram 730A | Beglik 730A | Total | Bayram 725A | Beglik 725A | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | m | 750.00 | 550.00 | | 745.00 | 550.00 | | 740.00 | 550.00 | | 735.00 | 550.00 | | 730 | 550.00 | | 725 | 550.00 | |
| Normal Water Level | m | 728.67 | 538.50 | | 725.33 | 538.50 | | 722.00 | 538.50 | | 718.67 | 538.50 | | 715 | 538.50 | | 712 | 538.50 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686 | 527.00 | | 686 | 527.00 | |
| Available Drawdown | m | 64.00 | 23.00 | | 59.00 | 23.00 | | 54.00 | 23.00 | | 49.00 | 23.00 | | 44 | 23.00 | | 39 | 23.00 | |
| Gross Storage Capacity | m^3*10^6 | 169.00 | 17.70 | | 150.00 | 17.70 | | 133.00 | 17.70 | | 116.00 | 17.70 | | 102 | 17.70 | | 88 | 17.70 | |
| Effective Storage Capacity | m^3*10^6 | 149.00 | 11.40 | | 130.00 | 11.40 | | 113.00 | 11.40 | | 96.00 | 11.40 | | 82 | 11.40 | | 68 | 11.40 | |
| Dam Type | 0 | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Hight | m | 155 | 94 | | 150 | 94 | | 145 | 94 | | 140 | 94 | | 135 | 94 | | 130 | 94 | |
| Dam Volume | m^3 | 8,500 | 420 | | 7,200 | 420 | | 6,144 | 420 | | 5,400 | 420 | | 4,600 | 420 | | 4,300 | 420 | |
| Tailwater Level | m | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | |
| Effective Head | m | 179.67 | 141.00 | | 167.33 | 141.00 | | 163.90 | 140.90 | | 160.47 | 140.90 | | 157.13 | 140.80 | | 153.70 | 140.80 | |
| Maximum Discharge | m^3/s | 49.00 | 59.00 | | 46.00 | 57.00 | | 43.00 | 54.00 | | 40.00 | 52.00 | | 38.00 | 47.00 | | 36.00 | 45.00 | |
| Installed Capacity | MW | 72.00 | 72.00 | 144.00 | 66.00 | 69.00 | 135.00 | 60.00 | 66.00 | 126.00 | 55.00 | 63.00 | 118.00 | 51.00 | 57.00 | 108.00 | 47.00 | 54.00 | 101.00 |
| Firm Peak Power | MW | 60.40 | 65.80 | 126.20 | 55.90 | 63.00 | 118.90 | 51.40 | 59.80 | 111.20 | 46.70 | 57.80 | 104.50 | 42.60 | 55.00 | 97.60 | 38.70 | 53.00 | 91.70 |
| Energy Production | | | | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 226.69 | 256.00 | 481.69 | 233.00 | 252.90 | 485.90 | 223.30 | 250.50 | 473.80 | 213.20 | 246.80 | 459.00 | 203.30 | 240.20 | 443.50 | 194.20 | 235.20 | 429.40 |
| Firm Energy | GWh | 143.17 | 152.00 | 295.17 | 139.20 | 145.50 | 284.70 | 126.40 | 139.00 | 265.40 | 115.30 | 132.30 | 247.60 | 105.40 | 120.20 | 226.60 | 99.70 | 115.70 | 215.40 |
| Secondary Energy | GWh | 83.52 | 103.00 | 186.52 | 93.80 | 107.40 | 201.20 | 96.90 | 111.50 | 208.40 | 97.90 | 113.50 | 211.40 | 96.90 | 120.00 | 216.90 | 94.50 | 119.50 | 214.00 |
| Unit Benefit Value | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | US$/kW | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | US$/kWh | 0.0270 | 0.0270 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | US$/kWh | 0.0219 | 0.0219 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 10.39 | 11.32 | 21.72 | 9.62 | 10.84 | 20.46 | 8.85 | 10.29 | 19.14 | 8.04 | 9.95 | 17.98 | 7.33 | 9.46 | 16.80 | 6.66 | 9.12 | 15.78 |
| Firm Energy | US$*10^6 | 3.80 | 4.03 | 7.83 | 3.69 | 3.86 | 7.56 | 3.35 | 3.69 | 7.04 | 3.06 | 3.51 | 6.57 | 2.82 | 3.19 | 6.01 | 2.66 | 3.07 | 5.72 |
| Secondary Energy | US$*10^6 | 1.80 | 2.22 | 4.02 | 2.02 | 2.31 | 4.33 | 2.09 | 2.40 | 4.49 | 2.11 | 2.44 | 4.55 | 2.09 | 2.58 | 4.67 | 2.03 | 2.57 | 4.61 |
| Total | US$*10^6 | 15.99 | 17.58 | 33.57 | 15.33 | 17.02 | 32.35 | 14.29 | 16.38 | 30.67 | 13.20 | 15.90 | 29.11 | 12.24 | 15.24 | 27.48 | 11.34 | 14.76 | 26.10 |
| Investment Cost | | | | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 181.69 | 76.55 | 258.24 | 161.23 | 75.88 | 237.10 | 144.35 | 74.96 | 219.30 | 132.90 | 74.49 | 207.38 | 123.42 | 73.42 | 196.84 | 115.25 | 72.76 | 188.01 |
| Hydrau. and Ele.+Mech.Eq. | US$*10^6 | 25.52 | 29.37 | 54.89 | 20.96 | 28.12 | 52.09 | 22.43 | 27.45 | 49.88 | 21.37 | 26.81 | 48.18 | 20.56 | 25.13 | 45.69 | 19.69 | 24.42 | 44.11 |
| Total | US$*10^6 | 207.21 | 105.92 | 313.13 | 185.19 | 104.00 | 289.19 | 166.77 | 102.41 | 269.18 | 154.27 | 101.30 | 255.56 | 143.98 | 98.55 | 242.53 | 134.94 | 97.18 | 232.12 |
| Annual Cost | | | | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 18.35 | 7.73 | 26.08 | 16.28 | 7.66 | 23.95 | 14.58 | 7.57 | 22.15 | 13.42 | 7.52 | 20.95 | 12.47 | 7.42 | 19.88 | 11.64 | 7.35 | 18.99 |
| Hydrau. and Ele.+Mech.Eq. | US$*10^6 | 2.91 | 3.35 | 6.26 | 2.73 | 3.21 | 5.94 | 2.56 | 3.13 | 5.69 | 2.44 | 3.06 | 5.49 | 2.34 | 2.86 | 5.21 | 2.24 | 2.78 | 5.03 |
| Total | US$*10^6 | 21.26 | 11.08 | 32.34 | 19.02 | 10.87 | 29.88 | 17.14 | 10.70 | 27.84 | 15.86 | 10.58 | 26.44 | 14.81 | 10.28 | 25.09 | 13.88 | 10.13 | 24.02 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -5.27 | 6.50 | 1.23 | -3.68 | 6.15 | 2.46 | -2.85 | 5.68 | 2.83 | -2.65 | 5.32 | 2.67 | -2.57 | 4.96 | 2.39 | -2.54 | 4.63 | 2.09 |
| Benefit Cost Ratio(B/C) | | 0.75 | 1.59 | 1.04 | 0.81 | 1.57 | 1.08 | 0.83 | 1.53 | 1.10 | 0.83 | 1.50 | 1.10 | 0.83 | 1.48 | 1.10 | 0.82 | 1.46 | 1.09 |
| Unit Annual Cost (Firm) | US$/kWh | 0.148 | 0.073 | 0.110 | 0.137 | 0.075 | 0.105 | 0.136 | 0.077 | 0.105 | 0.138 | 0.080 | 0.107 | 0.139 | 0.086 | 0.111 | 0.139 | 0.088 | 0.112 |
| Unit Annual Cost (Average) | US$/kWh | 0.094 | 0.043 | 0.067 | 0.082 | 0.043 | 0.062 | 0.077 | 0.043 | 0.059 | 0.074 | 0.043 | 0.058 | 0.073 | 0.043 | 0.057 | 0.071 | 0.043 | 0.055 |

# Table 9-10(2-2) Comparison Study on Reservoir Capacity

Bayram Project Tailrace Type Underground P/S Layout H.W.L.=750m-700m with Beglik H.W.L.=550.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Layout | Bayram 720A | Beglik 720A | Total | Bayram 715A | Beglik 715A | Total | Bayram 710A | Beglik 710A | Total | Bayram 705A | Beglik 705A | Total | Bayram 700A | Beglik 700A | Total 0.00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | m | 720.00 | 550.00 | | 715.00 | 550.00 | | 710.00 | 550.00 | | 705.00 | 550.00 | | 700.00 | 550.00 | 1,250.00 |
| Normal Water Level | m | 708.67 | 538.50 | | 705.33 | 538.50 | | 702.00 | 538.50 | | 698.67 | 538.50 | | 695.33 | 538.50 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | |
| Available Drawdown | m | 34.00 | 23.00 | | 29.00 | 23.00 | | 24.00 | 23.00 | | 19.00 | 23.00 | | 14.00 | 23.00 | |
| Gross Storage Capacity | mA3*10^6 | 76.00 | 17.70 | | 65.00 | 17.70 | | 55.00 | 17.70 | | 46.00 | 17.70 | | 36.00 | 17.70 | |
| Effective Storage Capacity | mA3*10^6 | 56.00 | 11.40 | | 45.00 | 11.40 | | 35.00 | 11.40 | | 26.00 | 11.40 | | 18.00 | 11.40 | |
| Dam Type | 0 | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Hight | m | 125 | 94 | | 120 | 94 | | 115 | 94 | | 110 | 94 | | 105 | 94 | |
| Dam Volume | mA3 | 3,900 | 420 | | 3,500 | 420 | | 3,100 | 420 | | 2,700 | 420 | | 2,400 | 420 | |
| Tailwater Level | m | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | | 550.00 | 392.00 | |
| Effective Head | m | 150.27 | 140.80 | | 146.93 | 140.70 | | 143.56 | 140.70 | | 140.07 | 140.60 | | 136.63 | 140.60 | |
| Maximum Discharge | mA3/s | 33.00 | 42.00 | | 31.00 | 40.00 | | 29.00 | 38.00 | | 26.00 | 35.00 | | 24.00 | 33.00 | |
| Installed Capacity | MW | 42.00 | 51.00 | 93.00 | 39.00 | 48.00 | 87.00 | 35.00 | 46.00 | 81.00 | 31.00 | 42.00 | 73.00 | 26.00 | 40.00 | 66.00 |
| Firm Peak Power | MW | 33.90 | 50.00 | 83.90 | 32.20 | 47.00 | 79.20 | 30.60 | 44.70 | 75.30 | 27.80 | 41.00 | 68.80 | 25.60 | 38.40 | 64.20 |
| Energy Production | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 182.70 | 227.50 | 410.20 | 171.40 | 221.00 | 392.40 | 161.00 | 214.00 | 375.00 | 146.40 | 203.50 | 349.90 | 135.40 | 196.90 | 332.30 |
| Firm Energy | GWh | 89.10 | 107.00 | 196.10 | 81.20 | 102.60 | 183.80 | 75.00 | 98.10 | 173.10 | 64.90 | 89.50 | 154.40 | 58.60 | 85.10 | 143.70 |
| Secondary Energy | GWh | 93.60 | 120.50 | 214.10 | 90.20 | 118.40 | 208.60 | 86.00 | 115.90 | 201.90 | 81.50 | 114.00 | 195.50 | 76.80 | 111.80 | 188.60 |
| Unit Benefit Value | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$/kW | 160.450 | 160.450 | | 160.450 | 160.450 | | 160.450 | 160.450 | | 160.450 | 160.450 | | 160.450 | 160.450 | |
| Firm Energy | US$/kWh | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | US$/kWh | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 5.83 | 8.60 | 14.44 | 5.54 | 8.09 | 13.63 | 5.27 | 7.69 | 12.96 | 4.78 | 7.05 | 11.84 | 4.44 | 6.61 | 11.05 |
| Firm Energy | US$*10^6 | 2.36 | 2.84 | 5.20 | 2.16 | 2.72 | 4.88 | 1.99 | 2.60 | 4.59 | 1.72 | 2.38 | 4.10 | 1.56 | 2.26 | 3.81 |
| Secondary Energy | US$*10^6 | 2.02 | 2.59 | 4.61 | 1.94 | 2.55 | 4.49 | 1.85 | 2.50 | 4.35 | 1.75 | 2.45 | 4.21 | 1.65 | 2.41 | 4.06 |
| Total | US$*10^6 | 10.21 | 14.04 | 24.25 | 9.64 | 13.36 | 23.00 | 9.11 | 12.79 | 21.90 | 8.26 | 11.89 | 20.15 | 7.65 | 11.27 | 18.92 |
| Investment Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 108.02 | 72.02 | 180.05 | 101.01 | 71.24 | 172.25 | 94.28 | 70.64 | 164.93 | 87.48 | 69.98 | 157.45 | 82.08 | 69.38 | 151.47 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 18.41 | 23.40 | 41.81 | 17.54 | 22.65 | 40.19 | 16.35 | 22.16 | 38.51 | 15.35 | 21.20 | 36.54 | 14.86 | 20.84 | 35.70 |
| Total | US$*10^6 | 126.43 | 95.43 | 221.86 | 118.55 | 93.88 | 212.43 | 110.64 | 92.80 | 203.44 | 102.82 | 91.17 | 194.00 | 96.94 | 90.22 | 187.16 |
| Annual Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 10.91 | 7.27 | 18.18 | 10.20 | 7.20 | 17.40 | 9.52 | 7.14 | 16.66 | 8.84 | 7.07 | 15.90 | 8.29 | 7.01 | 15.30 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 2.10 | 2.67 | 4.77 | 2.00 | 2.58 | 4.58 | 1.86 | 2.53 | 4.39 | 1.75 | 2.42 | 4.17 | 1.69 | 2.38 | 4.07 |
| Total | US$*10^6 | 13.01 | 9.94 | 22.95 | 12.20 | 9.78 | 21.98 | 11.39 | 9.66 | 21.05 | 10.58 | 9.48 | 20.07 | 9.98 | 9.38 | 19.37 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -2.80 | 4.10 | 1.30 | -2.56 | 3.58 | 1.02 | -2.28 | 3.13 | 0.85 | -2.32 | 2.40 | 0.08 | -2.34 | 1.89 | -0.44 |
| Benefit Cost Ratio(B/C) | | 0.79 | 1.41 | 1.06 | 0.79 | 1.37 | 1.05 | 0.80 | 1.32 | 1.04 | 0.78 | 1.25 | 1.00 | 0.77 | 1.20 | 0.98 |
| Unit Annual Cost (Firm) | US$/kWh | 0.146 | 0.093 | 0.117 | 0.150 | 0.095 | 0.120 | 0.152 | 0.096 | 0.122 | 0.163 | 0.106 | 0.130 | 0.170 | 0.110 | 0.135 |
| Unit Annual Cost (Average) | US$/kWh | 0.071 | 0.044 | 0.056 | 0.071 | 0.044 | 0.058 | 0.071 | 0.045 | 0.056 | 0.072 | 0.047 | 0.057 | 0.074 | 0.048 | 0.058 |

## Table 9-10(3-1) Comparison Study on Reservoir Capacity

Beyram Project Tailrace Type Underground P/S Layout H.W.L.=750m-700m with Beglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Layout | Beyram 750C | Beglik 750C | Total | Beyram 745C | Beglik 745C | Total | Beyram 740C | Beglik 740C | Total | Beyram 735C | Beglik 735C | Total | Beyram 730C | Beglik 730C | Total | Beyram 725C | Beglik 725C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | m | 750.00 | 530.00 | | 745.00 | 530.00 | | 740.00 | 530.00 | | 735.00 | 530.00 | | 730 | 530.00 | | 725 | 530.00 | |
| Normal Water Level | m | 726.67 | 528.50 | | 725.33 | 528.50 | | 722.00 | 528.50 | | 718.67 | 528.50 | | 715.3333 | 528.50 | | 712 | 528.50 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686 | 527.00 | | 686 | 527.00 | |
| Available Drawdown | m | 64.00 | 3.00 | | 59.00 | 3.00 | | 54.00 | 3.00 | | 49.00 | 3.00 | | 44 | 3.00 | | 39 | 3.00 | |
| Gross Storage Capacity | m^3*10^6 | 169.00 | 7.30 | | 150.00 | 7.30 | | 133.00 | 7.30 | | 116.00 | 7.30 | | 102 | 7.30 | | 88 | 7.30 | |
| Effective Storage Capacity | m^3*10^6 | 149.00 | 1.00 | | 130.00 | 1.00 | | 113.00 | 1.00 | | 96.00 | 1.00 | | 82 | 1.00 | | 68 | 1.00 | |
| Dam Type | 0 | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Hight | m | 155 | 74 | | 150 | 74 | | 145 | 74 | | 140 | 74 | | 135 | 74 | | 130 | 74 | |
| Dam Volume | m^3 | 8,500 | 195 | | 7,200 | 195 | | 6,144 | 195 | | 5,400 | 195 | | 4,800 | 195 | | 4,300 | 195 | |
| Tailwater Level | m | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | m | 189.67 | 131.00 | | 186.33 | 130.90 | | 182.90 | 130.90 | | 179.47 | 130.90 | | 176.13 | 130.80 | | 172.70 | 130.80 | |
| Maximum Discharge | m^3/s | 49.00 | 56.00 | | 46.00 | 55.00 | | 43.00 | 52.00 | | 40.00 | 48.00 | | 38.00 | 45.00 | | 36.00 | 43.00 | |
| Installed Capacity | MW | 80.00 | 65.00 | 145.00 | 74.00 | 62.00 | 136.00 | 68.00 | 59.00 | 127.00 | 62.00 | 54.00 | 116.00 | 57.00 | 51.00 | 108.00 | 53.00 | 48.00 | 101.00 |
| Firm Peak Power | MW | 67.40 | 62.90 | 130.30 | 63.00 | 59.60 | 122.60 | 58.00 | 56.40 | 114.40 | 52.40 | 52.00 | 104.40 | 48.50 | 49.00 | 97.50 | 43.60 | 47.00 | 90.60 |
| Energy Production | | | | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 266.80 | 227.00 | 493.80 | 257.70 | 224.00 | 481.70 | 247.90 | 221.40 | 469.30 | 237.00 | 215.70 | 452.70 | 227.00 | 210.60 | 437.60 | 216.60 | 206.80 | 423.40 |
| Firm Energy | GWh | 168.50 | 139.20 | 307.70 | 154.40 | 130.70 | 285.10 | 141.40 | 124.20 | 265.60 | 128.20 | 113.60 | 241.80 | 119.50 | 107.10 | 226.60 | 110.70 | 102.50 | 213.20 |
| Secondary Energy | GWh | 98.30 | 87.80 | 186.10 | 103.30 | 93.30 | 196.60 | 106.50 | 97.20 | 203.70 | 108.80 | 102.10 | 210.90 | 107.50 | 103.50 | 211.00 | 106.90 | 104.30 | 210.20 |
| Unit Benefit Value | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | US$/kW | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | US$/kWh | 0.0270 | 0.0270 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | US$/kWh | 0.0219 | 0.0219 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 11.60 | 10.82 | 22.42 | 10.84 | 10.26 | 21.10 | 9.98 | 9.71 | 19.69 | 9.02 | 8.95 | 17.97 | 8.35 | 8.43 | 16.78 | 7.50 | 8.09 | 15.59 |
| Firm Energy | US$*10^6 | 4.47 | 3.69 | 8.17 | 4.10 | 3.47 | 7.57 | 3.75 | 3.30 | 7.05 | 3.40 | 3.02 | 6.42 | 3.17 | 2.84 | 6.01 | 2.94 | 2.72 | 5.66 |
| Secondary Energy | US$*10^6 | 2.12 | 1.89 | 4.01 | 2.22 | 2.01 | 4.23 | 2.29 | 2.09 | 4.39 | 2.34 | 2.20 | 4.54 | 2.31 | 2.23 | 4.54 | 2.26 | 2.25 | 4.53 |
| Total | US$*10^6 | 18.19 | 16.41 | 34.60 | 17.16 | 15.73 | 32.90 | 16.03 | 15.09 | 31.12 | 14.76 | 14.16 | 28.92 | 13.83 | 13.50 | 27.34 | 12.72 | 13.05 | 25.78 |
| Investment Cost | | | | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 186.07 | 55.30 | 241.37 | 165.22 | 54.51 | 219.73 | 147.74 | 53.78 | 201.51 | 135.77 | 52.87 | 188.64 | 126.86 | 52.20 | 178.06 | 117.25 | 51.42 | 168.67 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 27.09 | 27.13 | 54.22 | 25.29 | 26.44 | 51.73 | 24.32 | 25.69 | 50.01 | 23.01 | 24.35 | 47.36 | 21.92 | 23.57 | 45.49 | 20.62 | 22.81 | 43.62 |
| Total | US$*10^6 | 213.16 | 82.43 | 295.59 | 190.51 | 80.95 | 271.46 | 172.06 | 79.46 | 251.52 | 158.77 | 77.22 | 235.99 | 147.78 | 75.77 | 223.55 | 138.06 | 74.23 | 212.29 |
| Annual Cost | | | | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 18.79 | 5.59 | 24.38 | 16.69 | 5.51 | 22.19 | 14.92 | 5.43 | 20.35 | 13.71 | 5.34 | 19.05 | 12.71 | 5.27 | 17.98 | 11.84 | 5.19 | 17.04 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 3.09 | 3.09 | 6.18 | 2.88 | 3.01 | 5.90 | 2.77 | 2.93 | 5.70 | 2.62 | 2.78 | 5.40 | 2.50 | 2.69 | 5.19 | 2.37 | 2.60 | 4.97 |
| Total | US$*10^6 | 21.88 | 8.68 | 30.56 | 19.57 | 8.52 | 28.09 | 17.69 | 8.36 | 26.05 | 16.34 | 8.12 | 24.45 | 15.21 | 7.96 | 23.17 | 14.21 | 7.79 | 22.01 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -3.69 | 7.73 | 4.04 | -2.41 | 7.21 | 4.81 | -1.67 | 6.74 | 5.07 | -1.57 | 6.05 | 4.47 | -1.38 | 5.54 | 4.17 | -1.49 | 5.26 | 3.77 |
| Benefit Cost Ratio(B/C) | | 0.83 | 1.89 | 1.13 | 0.88 | 1.85 | 1.17 | 0.91 | 1.81 | 1.19 | 0.90 | 1.74 | 1.18 | 0.91 | 1.70 | 1.18 | 0.89 | 1.67 | 1.17 |
| Unit Annual Cost (Firm) | US$/kWh | 0.130 | 0.062 | 0.099 | 0.127 | 0.065 | 0.099 | 0.125 | 0.067 | 0.098 | 0.127 | 0.071 | 0.101 | 0.127 | 0.074 | 0.102 | 0.128 | 0.076 | 0.103 |
| Unit Annual Cost (Average) | US$/kWh | 0.082 | 0.038 | 0.062 | 0.075 | 0.038 | 0.056 | 0.071 | 0.038 | 0.056 | 0.069 | 0.038 | 0.054 | 0.067 | 0.038 | 0.053 | 0.066 | 0.038 | 0.052 |

## Table 9-10(3-2) Comparison Study on Reservoir Capacity

Bayram Project Tailrace Type Underground P/S Layout H.W.L.=750m-700m with Beglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Layout | Bayram 720C | Beglik 720C | Total | Bayram 715C | Beglik 715C | Total | Bayram 710C | Beglik 710C | Total | Bayram 705C | Beglik 705C | Total | Bayram 700C | Beglik 700C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | m | 720.00 | 530.00 | | 715.00 | 530.00 | | 710.00 | 530.00 | | 705.00 | 530.00 | | 700.00 | 530.00 | |
| Normal Water Level | m | 708.67 | 528.50 | | 705.33 | 528.50 | | 702.00 | 528.50 | | 698.67 | 528.50 | | 695.33 | 528.50 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | | 686.00 | 527.00 | |
| Available Drawdown | m | 34.00 | 3.00 | | 29.00 | 3.00 | | 24.00 | 3.00 | | 19.00 | 3.00 | | 14.00 | 3.00 | |
| Gross Storage Capacity | m^3*10^6 | 78.00 | 7.30 | | 65.00 | 7.30 | | 55.00 | 7.30 | | 48.00 | 7.30 | | 38.00 | 7.30 | |
| Effective Storage Capacity | m^3*10^6 | 56.00 | 1.00 | | 45.00 | 1.00 | | 35.00 | 1.00 | | 26.00 | 1.00 | | 18.00 | 1.00 | |
| Dam Type | 0 | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Hight | m | 125 | 74 | | 120 | 74 | | 115 | 74 | | 110 | 74 | | 105 | 74 | |
| Dam Volume | m^3 | 3,900 | 195 | | 3,500 | 195 | | 3,100 | 195 | | 2,700 | 195 | | 2,400 | 195 | |
| Tailwater Level | m | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | m | 169.27 | 130.70 | | 165.83 | 130.70 | | 162.50 | 130.70 | | 158.97 | 130.60 | | 155.53 | 130.50 | |
| Maximum Discharge | m^3/s | 33.00 | 40.00 | | 31.00 | 36.00 | | 29.00 | 35.00 | | 26.00 | 33.00 | | 24.00 | 31.00 | |
| Installed Capacity | MW | 48.00 | 45.00 | 93.00 | 44.00 | 43.00 | 87.00 | 40.00 | 40.00 | 80.00 | 35.00 | 37.00 | 72.00 | 32.00 | 35.00 | 67.00 |
| Firm Peak Power | MW | 39.00 | 44.00 | 83.00 | 36.90 | 41.00 | 77.90 | 35.00 | 39.00 | 74.00 | 31.80 | 36.00 | 67.80 | 29.50 | 34.00 | 63.50 |
| Energy Production | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 204.90 | 200.60 | 405.50 | 193.30 | 192.60 | 385.90 | 180.80 | 185.90 | 366.70 | 167.30 | 176.90 | 344.20 | 154.40 | 170.40 | 324.80 |
| Firm Energy | GWh | 100.10 | 96.10 | 196.20 | 92.00 | 89.50 | 181.50 | 83.90 | 85.10 | 169.00 | 75.30 | 78.60 | 153.90 | 67.20 | 74.20 | 141.40 |
| Secondary Energy | GWh | 104.80 | 104.50 | 209.30 | 101.30 | 103.10 | 204.40 | 96.90 | 100.80 | 197.70 | 92.00 | 98.30 | 190.30 | 87.20 | 96.20 | 183.40 |
| Unit Benefit Value | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$/MW | 180,450 | 180,450 | | 180,450 | 180,450 | | 180,450 | 180,450 | | 180,450 | 180,450 | | 180,450 | 180,450 | |
| Firm Energy | US$/kWh | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | US$/kWh | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 6.71 | 7.57 | 14.28 | 6.35 | 7.06 | 13.41 | 6.02 | 6.71 | 12.73 | 5.47 | 6.20 | 11.67 | 5.08 | 5.85 | 10.93 |
| Firm Energy | US$*10^6 | 2.66 | 2.56 | 5.21 | 2.44 | 2.38 | 4.82 | 2.23 | 2.26 | 4.49 | 2.00 | 2.09 | 4.08 | 1.78 | 1.97 | 3.75 |
| Secondary Energy | US$*10^6 | 2.26 | 2.25 | 4.51 | 2.18 | 2.22 | 4.40 | 2.09 | 2.17 | 4.26 | 1.98 | 2.12 | 4.10 | 1.88 | 2.07 | 3.95 |
| Total | US$*10^6 | 11.62 | 12.37 | 24.00 | 10.97 | 11.65 | 22.62 | 10.34 | 11.14 | 21.48 | 9.45 | 10.40 | 19.85 | 8.74 | 9.89 | 18.63 |
| Investment Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 109.71 | 50.70 | 160.40 | 102.25 | 50.11 | 152.36 | 94.89 | 49.52 | 144.41 | 87.72 | 48.80 | 136.52 | 81.89 | 48.14 | 130.03 |
| Hydrau. and Ele.+Mech.Eq. | US$*10^6 | 19.51 | 21.97 | 41.49 | 18.52 | 21.67 | 40.19 | 17.47 | 20.81 | 38.28 | 15.96 | 20.05 | 36.01 | 15.08 | 19.62 | 34.70 |
| Total | US$*10^6 | 129.22 | 72.67 | 201.89 | 120.77 | 71.77 | 192.55 | 112.36 | 70.33 | 182.69 | 103.68 | 68.85 | 172.53 | 96.97 | 67.76 | 164.74 |
| Annual Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 11.08 | 5.12 | 16.20 | 10.33 | 5.06 | 15.39 | 9.58 | 5.00 | 14.59 | 8.86 | 4.93 | 13.79 | 8.27 | 4.86 | 13.13 |
| Hydrau. and Ele.+Mech.Eq. | US$*10^6 | 2.22 | 2.51 | 4.73 | 2.11 | 2.47 | 4.58 | 1.99 | 2.37 | 4.36 | 1.82 | 2.29 | 4.11 | 1.72 | 2.24 | 3.96 |
| Total | US$*10^6 | 13.30 | 7.63 | 20.93 | 12.44 | 7.53 | 19.97 | 11.58 | 7.37 | 18.95 | 10.68 | 7.21 | 17.89 | 9.99 | 7.10 | 17.09 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -1.68 | 4.75 | 3.07 | -1.47 | 4.12 | 2.65 | -1.24 | 3.77 | 2.53 | -1.23 | 3.18 | 1.96 | -1.25 | 2.79 | 1.54 |
| Benefit Cost Ratio(B/C) | | 0.87 | 1.62 | 1.15 | 0.88 | 1.55 | 1.13 | 0.89 | 1.51 | 1.13 | 0.89 | 1.44 | 1.11 | 0.87 | 1.39 | 1.09 |
| Unit Annual Cost (Firm) | US$/kWh | 0.133 | 0.079 | 0.107 | 0.135 | 0.084 | 0.110 | 0.138 | 0.087 | 0.112 | 0.142 | 0.092 | 0.116 | 0.149 | 0.096 | 0.121 |
| Unit Annual Cost (Average) | US$/kWh | 0.065 | 0.038 | 0.052 | 0.064 | 0.039 | 0.052 | 0.064 | 0.040 | 0.052 | 0.064 | 0.041 | 0.052 | 0.065 | 0.042 | 0.053 |

# Table 9-11(1) Cost Estimate of Alternative Plan for Bayram Reservoir Water Level

Bayram Project Tailrace Underpro. P/S Layout H.W.L.=750m L.W.L.=686.745m With Baglik H.W.L.= 530.00m Unit:10^3US$

| Description Dam Site / Layout Type | Bayram 750-686 | Bayram 750-705 | Bayram 750-710 | Bayram 750-715 | Bayram 750-720 | Bayram 750-725 | Bayram 750-730 | Bayram 750-735 | Bayram 750-740 | Bayram 750-745 |
|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 |
| Reservoir Area (km^2) | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 |
| Dam Volume (10^6m^3) | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 | 8,500 |
| Dam Height (m) | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 | 155 |
| Maximum Head (m) | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 | 220 |
| Maximum Discharge (m^3/s) | 49 | 45 | 43 | 42 | 40 | 38 | 35 | 33 | 29 | 24 |
| Relocation Road | 13,724 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,989 | 2,989 | 2,989 | 2,989 | 2,989 | 2,989 | 2,989 | 2,989 | 2,989 | 2,989 |
| Civil Work | 103,423 | 102,351 | 101,541 | 101,417 | 100,633 | 99,973 | 99,219 | 98,591 | 97,109 | 95,824 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 65,412 | 65,412 | 65,412 | 65,412 | 65,412 | 65,412 | 65,412 | 65,412 | 65,412 | 65,412 |
| Spillway | 8,143 | 8,143 | 8,143 | 8,143 | 8,143 | 8,143 | 8,143 | 8,143 | 8,143 | 8,143 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,260 | 1,052 | 964 | 885 | 824 | 736 | 631 | 544 | 421 | 272 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 651 | 600 | 574 | 561 | 535 | 509 | 471 | 445 | 393 | 328 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 3,370 | 3,177 | 3,081 | 3,049 | 2,953 | 2,856 | 2,696 | 2,632 | 2,375 | 2,054 |
| Tailrace Tunnel | 15,906 | 15,306 | 14,705 | 14,705 | 14,105 | 13,655 | 13,205 | 12,755 | 11,704 | 10,954 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 120,936 | 118,829 | 118,019 | 117,895 | 117,112 | 116,452 | 115,697 | 115,069 | 113,587 | 112,302 |
| Contingency (15%) | 17,692 | 17,376 | 17,255 | 17,236 | 17,118 | 17,019 | 16,906 | 16,812 | 16,590 | 16,397 |
| Eng. and Admi. (10%) | 13,564 | 13,322 | 13,228 | 13,214 | 13,124 | 13,048 | 12,961 | 12,889 | 12,719 | 12,571 |
| Sub Total | 152,192 | 149,527 | 148,502 | 148,345 | 147,354 | 146,519 | 145,565 | 144,770 | 142,896 | 141,270 |
| I.D.C (9.5%/Year) | 33,450 | 32,864 | 32,639 | 32,604 | 32,387 | 32,203 | 31,993 | 31,819 | 31,407 | 31,049 |
| Total | 185,641 | 182,391 | 181,141 | 180,950 | 179,741 | 178,722 | 177,558 | 176,583 | 174,302 | 172,319 |
| Hydraulic Equipment | 5,869 | 5,445 | 5,243 | 5,115 | 4,934 | 4,732 | 4,449 | 4,245 | 3,882 | 3,429 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 898 | 738 | 677 | 621 | 578 | 517 | 443 | 382 | 295 | 191 |
| Penstock | 2,862 | 2,636 | 2,523 | 2,466 | 2,352 | 2,239 | 2,068 | 1,954 | 1,726 | 1,440 |
| Draft Gate | 139 | 128 | 122 | 119 | 113 | 106 | 99 | 94 | 82 | 68 |
| Tailrace Gate | 70 | 64 | 61 | 60 | 57 | 54 | 50 | 47 | 41 | 34 |
| Pre-Subtotal | 5,353 | 4,950 | 4,767 | 4,650 | 4,485 | 4,301 | 4,044 | 3,860 | 3,529 | 3,117 |
| Contingency (10%) | 535 | 495 | 477 | 465 | 449 | 430 | 404 | 386 | 353 | 312 |
| Electro-Mechanical Equipment | 17,482 | 16,944 | 16,587 | 16,638 | 16,246 | 15,591 | 14,723 | 14,268 | 12,691 | 11,513 |
| Equipment | 16,649 | 16,137 | 15,796 | 15,846 | 15,472 | 14,849 | 14,022 | 13,589 | 12,086 | 10,965 |
| Contingency (5%) | 832 | 807 | 790 | 792 | 774 | 742 | 701 | 679 | 604 | 548 |
| Eng. and Admi. (10%) | 2,337 | 2,239 | 2,183 | 2,175 | 2,118 | 2,032 | 1,917 | 1,851 | 1,657 | 1,494 |
| Sub Total | 25,707 | 24,627 | 24,014 | 23,929 | 23,297 | 22,355 | 21,089 | 20,366 | 18,230 | 16,436 |
| I.D.C (9.5%/Year) | 1,382 | 1,324 | 1,291 | 1,287 | 1,253 | 1,202 | 1,134 | 1,095 | 980 | 884 |
| Total | 27,090 | 25,952 | 25,305 | 25,215 | 24,550 | 23,557 | 22,222 | 21,461 | 19,210 | 17,319 |
| Grand Total | 212,731 | 208,342 | 206,446 | 206,165 | 204,290 | 202,280 | 199,780 | 198,050 | 193,512 | 189,639 |

Baglik Project Tailrace Underpro. P/S Layout H.W.L.= 530.00m With Bayram H.W.L.=750m L.W.L.=686.745m Unit:10^3US$

| Description Dam Site / Layout Type | Baglik 750-686 | Baglik 750-705 | Baglik 750-710 | Baglik 750-715 | Baglik 750-720 | Baglik 750-725 | Baglik 750-730 | Baglik 750-735 | Baglik 750-740 | Baglik 750-745 |
|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| Reservoir Area (km^2) | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dam Volume (10^6m^3) | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Dam Height (m) | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| Maximum Head (m) | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| Maximum Discharge (m^3/s) | 58 | 54 | 52 | 50 | 47 | 44 | 42 | 39 | 36 | 31 |
| Relocation Road | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 26,946 | 26,326 | 25,992 | 25,863 | 25,364 | 24,903 | 24,449 | 23,912 | 23,571 | 22,456 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 44 | 41 | 40 | 39 | 37 | 35 | 33 | 31 | 30 | 26 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 426 | 398 | 384 | 370 | 349 | 328 | 313 | 292 | 271 | 235 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,754 | 3,489 | 3,413 | 3,299 | 3,148 | 3,034 | 2,920 | 2,730 | 2,555 | 2,369 |
| Tailrace Tunnel | 9,481 | 9,157 | 8,914 | 8,914 | 8,590 | 8,266 | 7,942 | 7,617 | 7,374 | 6,564 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 35,103 | 34,483 | 34,149 | 34,020 | 33,521 | 33,060 | 32,606 | 32,069 | 31,727 | 30,613 |
| Contingency (15%) | 5,176 | 5,083 | 5,033 | 5,013 | 4,938 | 4,869 | 4,801 | 4,721 | 4,669 | 4,502 |
| Eng. and Admi. (10%) | 3,968 | 3,897 | 3,858 | 3,844 | 3,786 | 3,733 | 3,681 | 3,619 | 3,580 | 3,452 |
| Sub Total | 44,247 | 43,462 | 43,040 | 42,877 | 42,245 | 41,662 | 41,088 | 40,409 | 39,977 | 38,566 |
| I.D.C (9.5%/Year) | 11,052 | 10,856 | 10,751 | 10,710 | 10,552 | 10,406 | 10,263 | 10,093 | 9,985 | 9,633 |
| Total | 55,299 | 54,318 | 53,790 | 53,587 | 52,797 | 52,069 | 51,351 | 50,503 | 49,962 | 48,200 |
| Hydraulic Equipment | 3,130 | 2,956 | 2,917 | 2,848 | 2,737 | 2,631 | 2,556 | 2,451 | 2,344 | 2,163 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 186 | 174 | 170 | 166 | 156 | 148 | 141 | 134 | 127 | 112 |
| Penstock | 1,587 | 1,482 | 1,430 | 1,377 | 1,299 | 1,220 | 1,167 | 1,088 | 1,009 | 876 |
| Draft Gate | 135 | 126 | 121 | 116 | 109 | 102 | 98 | 91 | 84 | 72 |
| Tailrace Gate | 68 | 63 | 61 | 59 | 55 | 52 | 49 | 46 | 42 | 36 |
| Pre-Subtotal | 2,846 | 2,715 | 2,652 | 2,589 | 2,489 | 2,392 | 2,325 | 2,228 | 2,131 | 1,967 |
| Contingency (10%) | 285 | 271 | 265 | 259 | 249 | 239 | 233 | 223 | 213 | 197 |
| Electro-Mechanical Equipment | 20,208 | 19,477 | 19,216 | 18,465 | 17,922 | 17,098 | 16,766 | 16,152 | 15,559 | 14,445 |
| Equipment | 19,245 | 18,550 | 18,301 | 17,586 | 17,069 | 16,284 | 15,967 | 15,383 | 14,818 | 13,757 |
| Contingency (5%) | 962 | 927 | 915 | 879 | 853 | 814 | 798 | 769 | 741 | 688 |
| Eng. and Admi. (10%) | 2,334 | 2,246 | 2,213 | 2,131 | 2,066 | 1,973 | 1,932 | 1,860 | 1,790 | 1,661 |
| Sub Total | 25,672 | 24,710 | 24,345 | 23,444 | 22,726 | 21,702 | 21,256 | 20,464 | 19,693 | 18,269 |
| I.D.C (9.5%/Year) | 1,454 | 1,400 | 1,379 | 1,328 | 1,287 | 1,229 | 1,204 | 1,159 | 1,116 | 1,035 |
| Total | 27,126 | 26,109 | 25,725 | 24,772 | 24,013 | 22,931 | 22,460 | 21,623 | 20,809 | 19,304 |
| Grand Total | 82,425 | 80,428 | 79,515 | 78,359 | 76,810 | 75,000 | 73,811 | 72,126 | 70,771 | 67,504 |

# Table 9-11(2) Cost Estimate of Alternative Plan for Bayram Reservoir Water Level

Bayram Project Tailrace Undergro. P/S Layout H.W.L.=745m L.W.L.=688-740m With Baglik H.W.L.=530.00m Unit:10^3US$

| Description Dam Site / Layout Type | Bayram 745-688 | Bayram 745-700 | Bayram 745-705 | Bayram 745-710 | Bayram 745-715 | Bayram 745-720 | Bayram 745-725 | Bayram 745-730 | Bayram 745-735 | Bayram 745-740 |
|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 745 | 745 | 745 | 745 | 745 | 745 | 745 | 745 | 745 | 745 |
| Reservoir Area (km^2) | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 | 3.68 |
| Dam Volume (10^6m^3) | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 |
| Dam Height (m) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Maximum Head (m) | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | 215 |
| Maximum Discharge (m^3/s) | 46 | 43 | 42 | 40 | 38 | 36 | 34 | 32 | 28 | 24 |
| Relocation Road | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 | 12,689 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,616 | 2,616 | 2,616 | 2,616 | 2,616 | 2,616 | 2,616 | 2,616 | 2,616 | 2,616 |
| Civil Work | 92,133 | 91,205 | 91,108 | 90,243 | 89,593 | 88,933 | 88,315 | 88,065 | 86,625 | 85,459 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 55,407 | 55,407 | 55,407 | 55,407 | 55,407 | 55,407 | 55,407 | 55,407 | 55,407 | 55,407 |
| Spillway | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 | 7,789 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,192 | 999 | 947 | 868 | 789 | 701 | 622 | 528 | 412 | 272 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 599 | 562 | 549 | 524 | 499 | 473 | 448 | 423 | 372 | 321 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 3,177 | 3,081 | 3,049 | 2,889 | 2,792 | 2,696 | 2,632 | 2,503 | 2,279 | 2,054 |
| Tailrace Tunnel | 15,306 | 14,705 | 14,705 | 14,105 | 13,655 | 13,205 | 12,755 | 12,755 | 11,704 | 10,954 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 108,238 | 107,311 | 107,213 | 106,348 | 105,698 | 105,038 | 104,420 | 104,170 | 102,730 | 101,564 |
| Contingency (15%) | 15,843 | 15,704 | 15,690 | 15,560 | 15,462 | 15,363 | 15,271 | 15,233 | 15,017 | 14,842 |
| Eng. and Admi. (10%) | 12,147 | 12,040 | 12,029 | 11,929 | 11,854 | 11,779 | 11,707 | 11,679 | 11,513 | 11,379 |
| Sub Total | 136,228 | 135,055 | 134,932 | 133,838 | 133,015 | 132,180 | 131,398 | 131,081 | 129,260 | 127,785 |
| I.D.C (9.5%/Year) | 28,579 | 28,333 | 28,307 | 28,077 | 27,905 | 27,730 | 27,566 | 27,499 | 27,117 | 26,808 |
| Total | 164,806 | 163,387 | 163,239 | 161,915 | 160,919 | 159,910 | 158,964 | 158,581 | 156,377 | 154,593 |
| Hydraulic Equipment | 5,557 | 5,211 | 5,105 | 4,912 | 4,720 | 4,521 | 4,328 | 4,121 | 3,769 | 3,395 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 837 | 701 | 665 | 609 | 564 | 492 | 437 | 369 | 289 | 191 |
| Penstock | 2,635 | 2,469 | 2,413 | 2,302 | 2,191 | 2,080 | 1,969 | 1,857 | 1,634 | 1,410 |
| Draft Gate | 131 | 122 | 119 | 113 | 108 | 102 | 96 | 91 | 79 | 68 |
| Tailrace Gate | 65 | 61 | 60 | 57 | 54 | 51 | 48 | 45 | 40 | 34 |
| Pre-Subtotal | 5,052 | 4,737 | 4,641 | 4,466 | 4,291 | 4,110 | 3,934 | 3,747 | 3,426 | 3,087 |
| Contingency (10%) | 505 | 474 | 464 | 447 | 429 | 411 | 393 | 375 | 343 | 309 |
| Electro-Mechanical Equipment | 16,260 | 15,955 | 15,995 | 15,566 | 15,155 | 14,723 | 14,057 | 13,592 | 12,364 | 11,578 |
| Equipment | 15,486 | 15,195 | 15,233 | 14,825 | 14,434 | 14,022 | 13,388 | 12,945 | 11,775 | 11,027 |
| Contingency (5%) | 774 | 760 | 762 | 741 | 722 | 701 | 669 | 647 | 589 | 551 |
| Eng. and Admi. (10%) | 2,182 | 2,617 | 2,110 | 2,048 | 1,988 | 1,924 | 1,839 | 1,771 | 1,613 | 1,497 |
| Sub Total | 23,999 | 23,283 | 23,210 | 22,526 | 21,863 | 21,157 | 20,224 | 19,485 | 17,746 | 16,471 |
| I.D.C (9.5%/Year) | 1,290 | 1,252 | 1,248 | 1,211 | 1,175 | 1,138 | 1,087 | 1,048 | 954 | 886 |
| Total | 25,289 | 24,534 | 24,457 | 23,737 | 23,038 | 22,306 | 21,311 | 20,533 | 18,700 | 17,357 |
| Grand Total | 190,095 | 187,922 | 187,696 | 185,652 | 183,957 | 182,216 | 180,275 | 179,113 | 175,077 | 171,949 |

Baglik Project Tailrace Undergro. P/S Layout H.W.L.=530.00m Bayram H.W.L.=745m L.W.L.=688-740m Unit:10^3US$

| Description Dam Site / Layout Type | Baglik 745-688 | Baglik 745-700 | Baglik 745-705 | Baglik 745-710 | Baglik 745-715 | Baglik 745-720 | Baglik 745-725 | Baglik 745-730 | Baglik 745-735 | Baglik 745-740 |
|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| Reservoir Area (km^2) | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dam Volume (10^6m^3) | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Dam Height (m) | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| Maximum Head (m) | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| Maximum Discharge (m^3/s) | 55 | 52 | 49 | 48 | 45 | 43 | 41 | 38 | 35 | 30 |
| Relocation Road | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 26,447 | 25,992 | 25,493 | 25,410 | 24,987 | 24,533 | 24,042 | 23,662 | 23,244 | 22,373 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 42 | 41 | 38 | 37 | 36 | 34 | 33 | 31 | 29 | 26 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 405 | 384 | 363 | 356 | 335 | 321 | 306 | 285 | 264 | 228 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,603 | 3,413 | 3,261 | 3,185 | 3,110 | 2,996 | 2,844 | 2,730 | 2,579 | 2,313 |
| Tailrace Tunnel | 9,157 | 8,914 | 8,590 | 8,590 | 8,266 | 7,942 | 7,617 | 7,374 | 7,131 | 6,564 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 34,604 | 34,149 | 33,650 | 33,566 | 33,144 | 32,690 | 32,199 | 31,818 | 31,400 | 30,530 |
| Contingency (15%) | 5,101 | 5,033 | 4,958 | 4,945 | 4,882 | 4,814 | 4,740 | 4,683 | 4,620 | 4,490 |
| Eng. and Admi. (10%) | 3,911 | 3,858 | 3,801 | 3,791 | 3,743 | 3,691 | 3,634 | 3,590 | 3,542 | 3,442 |
| Sub Total | 43,616 | 43,040 | 42,409 | 42,303 | 41,768 | 41,194 | 40,573 | 40,093 | 39,563 | 38,461 |
| I.D.C (9.5%/Year) | 10,894 | 10,751 | 10,593 | 10,566 | 10,433 | 10,290 | 10,134 | 10,014 | 9,882 | 9,607 |
| Total | 54,510 | 53,791 | 53,002 | 52,870 | 52,201 | 51,484 | 50,708 | 50,107 | 49,445 | 48,068 |
| Hydraulic Equipment | 3,023 | 2,919 | 2,811 | 2,774 | 2,668 | 2,594 | 2,525 | 2,418 | 2,307 | 2,130 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 177 | 172 | 163 | 159 | 152 | 145 | 141 | 134 | 123 | 112 |
| Penstock | 1,508 | 1,430 | 1,351 | 1,325 | 1,246 | 1,193 | 1,141 | 1,062 | 982 | 849 |
| Draft Gate | 128 | 121 | 114 | 112 | 105 | 100 | 95 | 88 | 81 | 70 |
| Tailrace Gate | 65 | 61 | 57 | 56 | 53 | 50 | 48 | 45 | 41 | 35 |
| Pre-Subtotal | 2,748 | 2,654 | 2,555 | 2,522 | 2,425 | 2,359 | 2,295 | 2,198 | 2,098 | 1,937 |
| Contingency (10%) | 275 | 265 | 256 | 252 | 243 | 236 | 230 | 220 | 210 | 194 |
| Electro-Mechanical Equipment | 19,723 | 19,216 | 18,430 | 18,367 | 17,813 | 17,215 | 16,863 | 16,223 | 15,433 | 14,132 |
| Equipment | 18,784 | 18,301 | 17,553 | 17,512 | 16,965 | 16,395 | 16,060 | 15,450 | 14,699 | 13,459 |
| Contingency (5%) | 939 | 915 | 878 | 876 | 848 | 820 | 803 | 773 | 735 | 673 |
| Eng. and Admi. (10%) | 2,275 | 2,213 | 2,124 | 2,116 | 2,048 | 1,981 | 1,939 | 1,864 | 1,774 | 1,626 |
| Sub Total | 25,021 | 24,343 | 23,365 | 23,278 | 22,529 | 21,790 | 21,327 | 20,505 | 19,515 | 17,889 |
| I.D.C (9.5%/Year) | 1,417 | 1,379 | 1,323 | 1,318 | 1,276 | 1,234 | 1,208 | 1,161 | 1,105 | 1,013 |
| Total | 26,438 | 25,727 | 24,688 | 24,596 | 23,805 | 23,025 | 22,535 | 21,666 | 20,620 | 18,902 |
| Grand Total | 80,949 | 79,519 | 77,691 | 77,466 | 76,006 | 74,508 | 73,243 | 71,774 | 70,065 | 66,971 |

# Table 9-11(3) Cost Estimate of Alternative Plan for Bayram Reservoir Water Level

Bayram Project Tailrace Underpro. P/S Layout H.W.L.=740m L.W.L.=686m-735m With Baglik H.W.L.= 530.00m

Unit:10^3US$

| Description Dam Site / Layout Type | Bayram 740-686 | Bayram 740-700 | Bayram 740-705 | Bayram 740-710 | Bayram 740-715 | Bayram 740-720 | Bayram 740-725 | Bayram 740-730 | Bayram 740-735 |
|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 740 | 740 | 740 | 740 | 740 | 740 | 740 | 740 | 740 |
| Reservoir Area (km^2) | 3.38 | 3.38 | 3.38 | 3.38 | 3.38 | 3.38 | 3.38 | 3.38 | 3.38 |
| Dam Volume (10^6m^3) | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 |
| Dam Height (m) | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 | 145 |
| Maximum Head (m) | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 219 |
| Maximum Discharge (m^3/s) | 43 | 40 | 39 | 37 | 36 | 33 | 31 | 27 | 24 |
| Relocation Road | 11,655 | 11,655 | 11,655 | 11,655 | 11,655 | 11,655 | 11,655 | 11,655 | 11,655 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,242 | 2,242 | 2,242 | 2,242 | 2,242 | 2,242 | 2,242 | 2,242 | 2,242 |
| Civil Work | 83,113 | 82,203 | 82,091 | 81,445 | 80,907 | 79,888 | 79,309 | 77,870 | 77,230 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 47,281 | 47,281 | 47,281 | 47,281 | 47,281 | 47,281 | 47,281 | 47,281 | 47,281 |
| Spillway | 7,523 | 7,523 | 7,523 | 7,523 | 7,523 | 7,523 | 7,523 | 7,523 | 7,523 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,087 | 982 | 947 | 912 | 877 | 754 | 666 | 386 | 281 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 548 | 512 | 500 | 475 | 463 | 426 | 401 | 351 | 314 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 3,049 | 2,889 | 2,824 | 2,696 | 2,664 | 2,568 | 2,407 | 2,215 | 2,022 |
| Tailrace Tunnel | 14,965 | 14,354 | 14,354 | 13,836 | 13,438 | 12,674 | 12,369 | 11,453 | 11,147 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 97,811 | 96,900 | 96,789 | 96,142 | 95,505 | 94,585 | 94,007 | 92,568 | 91,927 |
| Contingency (15%) | 14,335 | 14,199 | 14,182 | 14,085 | 14,004 | 13,851 | 13,765 | 13,549 | 13,453 |
| Eng. and Admi. (10%) | 10,990 | 10,886 | 10,873 | 10,799 | 10,737 | 10,619 | 10,553 | 10,387 | 10,314 |
| Sub Total | 123,136 | 121,985 | 121,843 | 121,026 | 120,346 | 119,056 | 118,324 | 116,504 | 115,694 |
| I.D.C (9.5%/Year) | 24,601 | 24,371 | 24,343 | 24,179 | 24,044 | 23,788 | 23,640 | 23,276 | 23,114 |
| Total | 147,737 | 146,356 | 146,186 | 145,205 | 144,389 | 142,842 | 141,964 | 139,780 | 138,808 |
| Hydraulic Equipment | 5,203 | 4,945 | 4,854 | 4,698 | 4,606 | 4,318 | 4,121 | 3,645 | 3,389 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 763 | 689 | 665 | 640 | 615 | 529 | 468 | 271 | 197 |
| Penstock | 2,400 | 2,252 | 2,198 | 2,089 | 2,035 | 1,872 | 1,763 | 1,544 | 1,380 |
| Draft Gate | 122 | 113 | 111 | 105 | 102 | 94 | 88 | 77 | 68 |
| Tailrace Gate | 61 | 57 | 55 | 52 | 51 | 47 | 44 | 38 | 34 |
| Pre-Subtotal | 4,730 | 4,496 | 4,413 | 4,271 | 4,188 | 3,925 | 3,746 | 3,314 | 3,063 |
| Contingency (10%) | 473 | 450 | 441 | 427 | 419 | 393 | 375 | 331 | 306 |
| Electro-Mechanical Equipment | 15,780 | 15,388 | 15,395 | 14,944 | 14,494 | 13,792 | 13,294 | 12,233 | 11,331 |
| Equipment | 15,029 | 14,655 | 14,662 | 14,233 | 13,804 | 13,135 | 12,661 | 11,650 | 10,792 |
| Contingency (5%) | 751 | 733 | 733 | 712 | 690 | 657 | 633 | 583 | 540 |
| Eng. and Admi. (10%) | 2,096 | 2,033 | 2,025 | 1,964 | 1,910 | 1,811 | 1,742 | 1,588 | 1,470 |
| Sub Total | 23,082 | 22,368 | 22,274 | 21,606 | 21,010 | 19,921 | 19,157 | 17,466 | 16,170 |
| I.D.C (9.5%/Year) | 1,241 | 1,203 | 1,198 | 1,162 | 1,130 | 1,071 | 1,030 | 939 | 869 |
| Total | 24,323 | 23,569 | 23,471 | 22,768 | 22,140 | 20,992 | 20,187 | 18,405 | 17,040 |
| Grand Total | 172,060 | 169,925 | 169,658 | 167,974 | 166,529 | 163,834 | 162,151 | 158,185 | 155,848 |

Baglik Project Tailrace Underpro. P/S Layout H.W.L.= 530.00m With Bayram H.W.L.=740m L.W.L.=686m-700m

Unit:10^3US$

| Description Dam Site / Layout Type | Baglik 740-686 | Baglik 740-700 | Baglik 740-705 | Baglik 740-710 | Baglik 740-715 | Baglik 740-720 | Baglik 740-725 | Baglik 740-730 | Baglik 740-735 |
|---|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| Reservoir Area (km^2) | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dam Volume (10^6m^3) | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Dam Height (m) | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| Maximum Head (m) | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| Maximum Discharge (m^3/s) | 52 | 48 | 46 | 44 | 42 | 40 | 37 | 34 | 30 |
| Relocation Road | 8,759 | 8,759 | 8,759 | 8,759 | 8,759 | 8,758 | 8,759 | 8,759 | 8,759 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 25,984 | 25,410 | 24,995 | 24,661 | 24,569 | 24,035 | 23,581 | 23,123 | 22,297 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 40 | 37 | 37 | 36 | 34 | 33 | 31 | 29 | 26 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 376 | 356 | 342 | 328 | 313 | 299 | 279 | 257 | 228 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,413 | 3,185 | 3,110 | 3,034 | 2,958 | 2,844 | 2,655 | 2,465 | 2,237 |
| Tailrace Tunnel | 8,914 | 8,590 | 8,266 | 8,023 | 8,023 | 7,617 | 7,374 | 7,131 | 6,564 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 34,141 | 33,568 | 33,151 | 32,817 | 32,726 | 32,192 | 31,738 | 31,280 | 30,454 |
| Contingency (15%) | 5,031 | 4,945 | 4,883 | 4,833 | 4,819 | 4,739 | 4,671 | 4,602 | 4,478 |
| Eng. and Admi. (10%) | 3,857 | 3,791 | 3,744 | 3,705 | 3,695 | 3,633 | 3,581 | 3,528 | 3,433 |
| Sub Total | 43,030 | 42,303 | 41,778 | 41,356 | 41,240 | 40,564 | 39,990 | 39,411 | 38,365 |
| I.D.C (9.5%/Year) | 10,748 | 10,568 | 10,435 | 10,330 | 10,301 | 10,132 | 9,989 | 9,844 | 9,583 |
| Total | 53,778 | 52,870 | 52,214 | 51,686 | 51,541 | 50,696 | 49,978 | 49,255 | 47,948 |
| Hydraulic Equipment | 2,884 | 2,774 | 2,705 | 2,635 | 2,562 | 2,492 | 2,392 | 2,272 | 2,130 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 170 | 158 | 156 | 152 | 145 | 141 | 134 | 125 | 112 |
| Penstock | 1,400 | 1,325 | 1,272 | 1,220 | 1,167 | 1,114 | 1,040 | 956 | 849 |
| Draft Gate | 121 | 112 | 107 | 102 | 98 | 93 | 87 | 79 | 70 |
| Tailrace Gate | 61 | 56 | 54 | 52 | 49 | 47 | 44 | 40 | 35 |
| Pre-Subtotal | 2,622 | 2,522 | 2,459 | 2,396 | 2,329 | 2,265 | 2,174 | 2,070 | 1,937 |
| Contingency (10%) | 262 | 252 | 246 | 240 | 233 | 227 | 217 | 207 | 194 |
| Electro-Mechanical Equipment | 19,216 | 18,176 | 17,871 | 17,098 | 16,756 | 16,418 | 15,949 | 15,152 | 14,004 |
| Equipment | 18,301 | 17,311 | 17,020 | 16,284 | 15,967 | 15,636 | 15,190 | 14,431 | 13,337 |
| Contingency (5%) | 915 | 866 | 851 | 814 | 798 | 782 | 759 | 722 | 667 |
| Eng. and Admi. (10%) | 2,210 | 2,095 | 2,058 | 1,973 | 1,933 | 1,891 | 1,834 | 1,743 | 1,613 |
| Sub Total | 24,310 | 23,045 | 22,634 | 21,706 | 21,260 | 20,801 | 20,175 | 19,172 | 17,747 |
| I.D.C (9.5%/Year) | 1,377 | 1,305 | 1,282 | 1,230 | 1,204 | 1,178 | 1,143 | 1,086 | 1,005 |
| Total | 25,687 | 24,351 | 23,916 | 22,936 | 22,464 | 21,979 | 21,318 | 20,258 | 18,752 |
| Grand Total | 79,464 | 77,220 | 76,129 | 74,622 | 74,005 | 72,676 | 71,296 | 69,513 | 66,701 |

# Table 9-11(4) Cost Estimate of Alternative Plan for Bayram Reservoir Water Level

Bayram Project Tailrace Underground P/S Layout H.W.L.=735m L.W.L.=686m-730m With Baglik H.W.L.= 530.00m Unit:10^3US$

| Description Dam Site Layout Type | Bayram 735-686 | Bayram 735-700 | Bayram 735-705 | Bayram 735-710 | Bayram 735-715 | Bayram 735-720 | Bayram 735-725 | Bayram 735-730 |
|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 735 | 735 | 735 | 735 | 735 | 735 | 735 | 735 |
| Reservoir Area (km^2) | 3.11 | 3.11 | 3.11 | 3.11 | 3.11 | 3.11 | 3.11 | 3.11 |
| Dam Volume (10^6m^3) | 5,400 | 5,400 | 5,400 | 5,400 | 5,400 | 5,400 | 5,400 | 5,400 |
| Dam Height (m) | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 |
| Maximum Head (m) | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| Maximum Discharge (m^3/s) | 40 | 37 | 36 | 34 | 32 | 30 | 27 | 23 |
| Relocation Road | 10,724 | 10,724 | 10,724 | 10,724 | 10,724 | 10,724 | 10,724 | 10,724 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,063 | 2,063 | 2,063 | 2,063 | 2,063 | 2,063 | 2,063 | 2,063 |
| Civil Work | 76,050 | 75,418 | 74,856 | 74,315 | 74,095 | 73,251 | 72,066 | 69,744 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 41,556 | 41,556 | 41,556 | 41,556 | 41,556 | 41,556 | 41,556 | 41,556 |
| Spillway | 7,434 | 7,434 | 7,434 | 7,434 | 7,434 | 7,434 | 7,434 | 7,434 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 999 | 982 | 947 | 912 | 877 | 754 | 666 | 386 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 501 | 455 | 453 | 429 | 404 | 380 | 344 | 295 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 2,792 | 2,664 | 2,600 | 2,568 | 2,407 | 2,311 | 2,150 | 1,958 |
| Tailrace Tunnel | 14,105 | 13,655 | 13,206 | 12,755 | 12,755 | 12,154 | 11,254 | 9,453 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 89,637 | 89,005 | 88,443 | 87,902 | 87,682 | 86,839 | 85,854 | 83,331 |
| Contingency (15%) | 13,136 | 13,041 | 12,957 | 12,878 | 12,843 | 12,716 | 12,539 | 12,190 |
| Eng. and Admi. (10%) | 10,071 | 9,998 | 9,934 | 9,871 | 9,846 | 9,749 | 9,613 | 9,346 |
| Sub Total | 112,844 | 112,044 | 111,334 | 110,649 | 110,371 | 109,304 | 107,805 | 104,867 |
| I.D.C (9.5%/Year) | 22,545 | 22,385 | 22,243 | 22,106 | 22,051 | 21,838 | 21,538 | 20,951 |
| Total | 135,389 | 134,429 | 133,577 | 132,755 | 132,422 | 131,142 | 129,343 | 125,818 |
| Hydraulic Equipment | 4,904 | 4,791 | 4,681 | 4,457 | 4,304 | 4,083 | 3,825 | 3,354 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 701 | 689 | 665 | 640 | 615 | 529 | 468 | 271 |
| Penstock | 2,202 | 2,043 | 1,990 | 1,884 | 1,777 | 1,671 | 1,510 | 1,296 |
| Draft Gate | 113 | 105 | 102 | 96 | 91 | 85 | 77 | 65 |
| Tailrace Gate | 57 | 52 | 51 | 48 | 45 | 43 | 38 | 33 |
| Pre-Subtotal | 4,458 | 4,274 | 4,192 | 4,052 | 3,913 | 3,711 | 3,477 | 3,049 |
| Contingency (10%) | 446 | 427 | 419 | 405 | 391 | 374 | 348 | 305 |
| Electro-Mechanical Equipment | 14,944 | 14,268 | 14,043 | 13,792 | 13,105 | 12,596 | 11,593 | 11,004 |
| Equipment | 14,233 | 13,589 | 13,374 | 13,135 | 12,481 | 11,996 | 11,041 | 10,480 |
| Contingency (5%) | 712 | 679 | 669 | 657 | 624 | 600 | 552 | 524 |
| Eng. and Admi. (10%) | 1,985 | 1,897 | 1,865 | 1,825 | 1,741 | 1,668 | 1,542 | 1,436 |
| Sub Total | 21,833 | 20,866 | 20,519 | 20,075 | 19,150 | 18,347 | 16,959 | 15,794 |
| I.D.C (9.5%/Year) | 1,174 | 1,122 | 1,103 | 1,079 | 1,030 | 986 | 912 | 849 |
| Total | 23,007 | 21,988 | 21,622 | 21,154 | 20,180 | 19,333 | 17,871 | 16,643 |
| Grand Total | 158,396 | 156,417 | 155,199 | 153,909 | 152,601 | 150,475 | 147,214 | 142,461 |

Tailrace Type Underground Powerhouse Layout Bayram H.W.L.=735m L.W.L.=686-730m and Baglik H.W.L.=530m Unit:10^3US$

| Description Dam Site Layout Type | Baglik 735-686 | Baglik 735-700 | Baglik 735-705 | Baglik 735-710 | Baglik 735-715 | Baglik 735-720 | Baglik 735-725 | Baglik 735-730 |
|---|---|---|---|---|---|---|---|---|
| High Water Level (m) | 530 | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| Reservoir Area (km^2) | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dam Volume (10^6m^3) | 195 | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Dam Height (m) | 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| Maximum Head (m) | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| Maximum Discharge (m^3/s) | 48 | 44 | 42 | 41 | 39 | 36 | 33 | 29 |
| Relocation Road | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 25,409 | 24,903 | 24,450 | 24,042 | 23,950 | 23,494 | 22,834 | 22,008 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 37 | 35 | 34 | 33 | 31 | 29 | 28 | 26 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 356 | 328 | 313 | 306 | 292 | 278 | 250 | 221 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,185 | 3,034 | 2,920 | 2,844 | 2,768 | 2,579 | 2,427 | 2,199 |
| Tailrace Tunnel | 8,590 | 8,266 | 7,942 | 7,617 | 7,617 | 7,374 | 6,886 | 6,321 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 33,566 | 33,060 | 32,607 | 32,199 | 32,106 | 31,651 | 30,991 | 30,165 |
| Contingency (15%) | 4,945 | 4,869 | 4,801 | 4,740 | 4,726 | 4,658 | 4,559 | 4,435 |
| Eng. and Admi. (10%) | 3,791 | 3,733 | 3,681 | 3,634 | 3,623 | 3,571 | 3,495 | 3,400 |
| Sub Total | 42,303 | 41,663 | 41,089 | 40,573 | 40,456 | 39,880 | 39,045 | 38,000 |
| I.D.C (9.5%/Year) | 10,566 | 10,407 | 10,263 | 10,134 | 10,105 | 9,961 | 9,753 | 9,492 |
| Total | 52,869 | 52,069 | 51,352 | 50,707 | 50,561 | 49,842 | 48,797 | 47,491 |
| Hydraulic Equipment | 2,773 | 2,633 | 2,560 | 2,524 | 2,447 | 2,343 | 2,237 | 2,093 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 156 | 150 | 143 | 140 | 130 | 125 | 119 | 109 |
| Penstock | 1,325 | 1,220 | 1,167 | 1,141 | 1,088 | 1,009 | 929 | 823 |
| Draft Gate | 112 | 102 | 98 | 95 | 91 | 84 | 77 | 67 |
| Tailrace Gate | 56 | 52 | 49 | 48 | 46 | 42 | 39 | 34 |
| Pre-Subtotal | 2,521 | 2,393 | 2,327 | 2,295 | 2,225 | 2,130 | 2,034 | 1,903 |
| Contingency (10%) | 252 | 239 | 233 | 229 | 222 | 213 | 203 | 190 |
| Electro-Mechanical Equipment | 18,176 | 16,906 | 16,582 | 16,504 | 16,152 | 15,402 | 14,871 | 13,714 |
| Equipment | 17,311 | 16,101 | 15,793 | 15,718 | 15,383 | 14,669 | 14,163 | 13,061 |
| Contingency (5%) | 865 | 805 | 790 | 786 | 769 | 733 | 708 | 653 |
| Eng. and Admi. (10%) | 2,095 | 1,954 | 1,914 | 1,903 | 1,860 | 1,775 | 1,711 | 1,581 |
| Sub Total | 23,044 | 21,493 | 21,056 | 20,931 | 20,459 | 19,520 | 18,819 | 17,388 |
| I.D.C (9.5%/Year) | 1,305 | 1,217 | 1,193 | 1,186 | 1,159 | 1,106 | 1,066 | 985 |
| Total | 24,349 | 22,711 | 22,249 | 22,116 | 21,618 | 20,625 | 19,885 | 18,373 |
| Grand Total | 77,218 | 74,780 | 73,601 | 72,824 | 72,180 | 70,467 | 68,682 | 65,865 |

# Table 9-11(5) Cost Estimate of Alternative Plan for Bayram Reservoir Water Level

Unit:10^3US$

Bayram Project Tailrace Undergro. P/S Layout H.W.L.=730m L.W.L=688m-725m With Baglik H.W.L.=530.00m

| Description Dam Site / Layout Type | Bayram 730-688 | Bayram 730-700 | Bayram 730-705 | Bayram 730-710 | Bayram 730-715 | Bayram 730-720 | Bayram 730-725 |
|---|---|---|---|---|---|---|---|
| High Water Level (m) | 730 | 730 | 730 | 730 | 730 | 730 | 730 |
| Reservoir Area (km^2) | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 | 2.83 |
| Dam Volume (10^6m^3) | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 |
| Dam Height (m) | 135 | 135 | 135 | 135 | 135 | 135 | 135 |
| Maximum Head (m) | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Maximum Discharge (m^3/s) | 38 | 35 | 33 | 31 | 28 | 26 | 23 |
| Relocation Road | 9,758 | 9,758 | 9,758 | 9,758 | 9,758 | 9,758 | 9,758 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 1,878 | 1,878 | 1,878 | 1,878 | 1,878 | 1,878 | 1,878 |
| Civil Work | 70,643 | 69,935 | 69,228 | 68,436 | 67,686 | 67,014 | 65,927 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 36,938 | 36,938 | 36,938 | 36,938 | 36,938 | 36,938 | 36,938 |
| Spillway | 7,346 | 7,346 | 7,346 | 7,346 | 7,346 | 7,346 | 7,346 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 912 | 754 | 649 | 579 | 473 | 403 | 263 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 466 | 431 | 407 | 383 | 348 | 324 | 288 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 2,664 | 2,600 | 2,471 | 2,375 | 2,215 | 2,086 | 1,926 |
| Tailrace Tunnel | 13,655 | 13,205 | 12,755 | 12,154 | 11,704 | 11,254 | 10,504 |
| Switchyard | 161 | 161 | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 83,079 | 82,371 | 81,664 | 80,874 | 80,122 | 79,450 | 78,363 |
| Contingency (15%) | 12,160 | 12,074 | 11,968 | 11,849 | 11,737 | 11,636 | 11,473 |
| Eng. and Admi. (10%) | 9,338 | 9,257 | 9,175 | 9,085 | 8,998 | 8,921 | 8,796 |
| Sub Total | 104,597 | 103,702 | 102,807 | 101,808 | 100,857 | 100,006 | 98,632 |
| I.D.C (9.5%/Year) | 20,897 | 20,718 | 20,540 | 20,340 | 20,150 | 19,980 | 19,705 |
| Total | 125,494 | 124,421 | 123,347 | 122,147 | 121,007 | 119,987 | 118,337 |
| Hydraulic Equipment | 4,658 | 4,351 | 4,146 | 3,968 | 3,701 | 3,522 | 3,227 |
| Spillway | 856 | 856 | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 540 | 529 | 456 | 406 | 332 | 283 | 185 |
| Penstock | 2,049 | 1,893 | 1,789 | 1,685 | 1,529 | 1,424 | 1,267 |
| Draft Gate | 108 | 99 | 94 | 88 | 79 | 74 | 65 |
| Tailrace Gate | 54 | 50 | 47 | 44 | 40 | 37 | 33 |
| Pre-Subtotal | 4,234 | 3,955 | 3,769 | 3,607 | 3,364 | 3,202 | 2,934 |
| Contingency (10%) | 423 | 396 | 377 | 361 | 336 | 320 | 293 |
| Electro-Mechanical Equipment | 14,250 | 13,759 | 13,294 | 12,596 | 11,593 | 11,426 | 10,612 |
| Equipment | 13,572 | 13,104 | 12,661 | 11,996 | 11,041 | 10,882 | 10,106 |
| Contingency (5%) | 679 | 655 | 633 | 600 | 552 | 544 | 505 |
| Eng. and Admi. (10%) | 1,891 | 1,811 | 1,744 | 1,656 | 1,529 | 1,495 | 1,384 |
| Sub Total | 20,798 | 19,921 | 19,184 | 18,220 | 16,823 | 16,443 | 15,223 |
| I.D.C (9.5%/Year) | 1,118 | 1,071 | 1,031 | 980 | 904 | 884 | 818 |
| Total | 21,917 | 20,992 | 20,215 | 19,200 | 17,727 | 17,327 | 16,041 |
| Grand Total | 147,411 | 145,413 | 143,562 | 141,348 | 138,735 | 137,313 | 134,378 |

Unit:10^3US$

Tailrace Type Underground Powerhouse Layout Bayram H.W.L.=735m L.W.L.=688-730m and Baglik H.W.L.=530m

| Description Dam Site / Layout Type | 530 730-688 | 530 730-700 | 530 730-705 | 530 730-710 | 530 730-715 | 530 730-720 | 530 730-725 |
|---|---|---|---|---|---|---|---|
| High Water Level (m) | 530 | 530 | 530 | 530 | 530 | 530 | 530 |
| Reservoir Area (km^2) | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| Dam Volume (10^6m^3) | 195 | 195 | 195 | 195 | 195 | 195 | 195 |
| Dam Height (m) | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| Maximum Head (m) | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| Maximum Discharge (m^3/s) | 45 | 41 | 40 | 38 | 35 | 32 | 29 |
| Relocation Road | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 | 6,759 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 24,697 | 24,680 | 24,034 | 23,662 | 23,244 | 22,826 | 22,064 |
| Diversion | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dam | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 | 9,983 |
| Spillway | 780 | 780 | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake | 36 | 33 | 32 | 31 | 30 | 27 | 26 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Penstock | 335 | 306 | 299 | 285 | 264 | 242 | 221 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,110 | 2,882 | 2,844 | 2,730 | 2,579 | 2,427 | 2,275 |
| Tailrace Tunnel | 8,266 | 7,617 | 7,617 | 7,374 | 7,131 | 6,888 | 6,321 |
| Switchyard | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 33,144 | 32,237 | 32,191 | 31,819 | 31,401 | 30,963 | 30,240 |
| Contingency (15%) | 4,882 | 4,746 | 4,739 | 4,683 | 4,621 | 4,558 | 4,446 |
| Eng. and Admi. (10%) | 3,743 | 3,638 | 3,633 | 3,590 | 3,542 | 3,494 | 3,409 |
| Sub Total | 41,768 | 40,621 | 40,563 | 40,093 | 39,564 | 39,035 | 38,096 |
| I.D.C (9.5%/Year) | 10,433 | 10,145 | 10,132 | 10,014 | 9,882 | 9,750 | 9,515 |
| Total | 52,201 | 50,768 | 50,695 | 50,107 | 49,447 | 48,785 | 47,611 |
| Hydraulic Equipment | 2,668 | 2,525 | 2,488 | 2,418 | 2,311 | 2,200 | 2,093 |
| Spillway | 870 | 870 | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 152 | 141 | 137 | 134 | 127 | 116 | 109 |
| Penstock | 1,248 | 1,141 | 1,114 | 1,062 | 982 | 903 | 823 |
| Draft Gate | 105 | 95 | 93 | 88 | 81 | 74 | 67 |
| Tailrace Gate | 53 | 48 | 47 | 45 | 41 | 38 | 34 |
| Pre-Subtotal | 2,425 | 2,295 | 2,262 | 2,198 | 2,101 | 2,000 | 1,903 |
| Contingency (10%) | 243 | 230 | 226 | 220 | 210 | 200 | 190 |
| Electro-Mechanical Equipment | 17,614 | 16,504 | 16,418 | 16,055 | 15,281 | 14,590 | 13,589 |
| Equipment | 16,775 | 15,718 | 15,636 | 15,290 | 14,553 | 13,895 | 12,942 |
| Contingency (5%) | 839 | 786 | 782 | 765 | 728 | 695 | 647 |
| Eng. and Admi. (10%) | 2,028 | 1,903 | 1,891 | 1,847 | 1,759 | 1,679 | 1,568 |
| Sub Total | 22,310 | 20,932 | 20,797 | 20,320 | 19,352 | 18,469 | 17,251 |
| I.D.C (9.5%/Year) | 1,264 | 1,186 | 1,178 | 1,151 | 1,096 | 1,046 | 977 |
| Total | 23,573 | 22,117 | 21,975 | 21,471 | 20,448 | 19,515 | 18,228 |
| Grand Total | 75,774 | 72,885 | 72,670 | 71,578 | 69,895 | 68,300 | 65,839 |

# Table 9-12(1) Comparison Study on Bayram Reservoir Water Level

Bayram Project Tailrace Undergro. P/S Layout H.W.L.=750m L.W.L.=686.745m With Bagik H.W.L.= 550.0m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 750-685 | Bagik 530C | Total | Bayram 750-705 | Bagik 530C | Total | Bayram 750-710 | Bagik 530C | Total | Bayram 750-715 | Bagik 530C | Total | Bayram 750-720 | Bagik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 750.00 | 530.00 | | 750.00 | 530.00 | | 750.00 | 530.00 | | 750 | 530.00 | | 750 | 530.00 | |
| Normal Water Level | 728.67 | 528.50 | | 735.00 | 528.50 | | 736.67 | 528.50 | | 738.3333 | 528.50 | | 740 | 528.50 | |
| Low Water Level | 686.00 | 527.00 | | 705.00 | 527.00 | | 710.00 | 527.00 | | 715 | 527.00 | | 720 | 527.00 | |
| Available Drawdown | 64.00 | 3.00 | | 45.00 | 3.00 | | 40.00 | 3.00 | | 35 | 3.00 | | 30 | 3.00 | |
| Gross Storage Capacity | 169.00 | 7.30 | | 169.00 | 7.30 | | 169.00 | 7.30 | | 169 | 7.30 | | 169 | 7.30 | |
| Effective Storage Capacity | 149.00 | 1.00 | | 123.00 | 1.00 | | 114.00 | 1.00 | | 104 | 1.00 | | 93 | 1.00 | |
| Dam Type | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Height | 155 | 74 | | 155 | 74 | | 155 | 74 | | 155 | 74 | | 155 | 74 | |
| Dam Volume | 8,500 | 195 | | 8,500 | 195 | | 8,500 | 195 | | 8,500 | 195 | | 8,500 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 189.67 | 131.00 | | 195.90 | 130.90 | | 197.57 | 130.90 | | 199.23 | 130.90 | | 200.80 | 130.80 | |
| Maximum Discharge | 49.00 | 58.00 | | 45.00 | 54.00 | | 43.00 | 52.00 | | 42.00 | 50.00 | | 40.00 | 47.00 | |
| Installed Capacity | 80.00 | 65.00 | 145.00 | 76.00 | 61.00 | 137.00 | 73.00 | 59.00 | 132.00 | 72.00 | 56.00 | 128.00 | 69.00 | 53.00 | 122.00 |
| Firm Peak Power | 67.40 | 62.90 | 130.30 | 66.40 | 58.00 | 124.40 | 64.10 | 56.40 | 120.50 | 62.40 | 55.00 | 117.40 | 60.20 | 51.00 | 111.20 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 266.80 | 227.00 | 493.80 | 266.00 | 223.00 | 489.00 | 265.20 | 221.90 | 487.10 | 264.50 | 219.00 | 483.50 | 263.50 | 216.50 | 480.00 |
| Firm Energy | 168.50 | 139.20 | 307.70 | 166.61 | 127.02 | 293.63 | 161.44 | 124.10 | 285.54 | 158.02 | 120.45 | 278.47 | 149.42 | 111.69 | 261.11 |
| Secondary Energy | 98.30 | 87.80 | 186.10 | 99.39 | 95.98 | 195.37 | 103.76 | 97.80 | 201.56 | 106.48 | 98.55 | 207.03 | 114.08 | 104.81 | 218.89 |
| Unit Benefit Value | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 11.60 | 10.82 | 22.42 | 11.43 | 9.98 | 21.41 | 11.03 | 9.71 | 20.74 | 10.74 | 9.45 | 20.20 | 10.36 | 8.78 | 19.14 |
| Firm Energy | 4.47 | 3.69 | 8.17 | 4.42 | 3.37 | 7.79 | 4.28 | 3.29 | 7.58 | 4.14 | 3.20 | 7.34 | 3.97 | 2.96 | 6.93 |
| Secondary Energy | 2.12 | 1.89 | 4.01 | 2.14 | 2.07 | 4.21 | 2.23 | 2.11 | 4.34 | 2.34 | 2.12 | 4.46 | 2.46 | 2.26 | 4.71 |
| Total | 18.19 | 16.41 | 34.60 | 17.99 | 15.42 | 33.41 | 17.55 | 15.11 | 32.65 | 17.21 | 14.76 | 32.00 | 16.78 | 14.00 | 30.78 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 195.64 | 55.30 | 240.94 | 182.39 | 54.32 | 236.71 | 181.14 | 53.79 | 234.93 | 180.95 | 53.59 | 234.54 | 179.74 | 52.80 | 232.54 |
| Hydrau. and Ele.-Mech Eq | 27.09 | 27.13 | 54.22 | 25.95 | 26.11 | 52.06 | 25.30 | 25.72 | 51.03 | 25.22 | 24.77 | 49.99 | 24.56 | 24.01 | 48.56 |
| Total | 212.73 | 82.43 | 295.16 | 208.34 | 80.43 | 288.77 | 206.45 | 79.52 | 285.96 | 206.17 | 78.36 | 284.52 | 204.29 | 76.81 | 281.10 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 18.75 | 5.59 | 24.34 | 18.42 | 5.49 | 23.91 | 18.30 | 5.43 | 23.73 | 18.28 | 5.41 | 23.69 | 18.15 | 5.33 | 23.49 |
| Hydrau. and Ele.-Mech Eq | 3.09 | 3.09 | 6.18 | 2.96 | 2.98 | 5.93 | 2.88 | 2.93 | 5.82 | 2.87 | 2.82 | 5.70 | 2.80 | 2.74 | 5.54 |
| Total | 21.84 | 8.68 | 30.52 | 21.38 | 8.46 | 29.84 | 21.18 | 8.37 | 29.55 | 21.15 | 8.24 | 29.39 | 20.95 | 8.07 | 29.02 |
| Annual Surplus Benefit(B-C) | -3.65 | 7.73 | 4.08 | -3.39 | 6.96 | 3.57 | -3.63 | 6.74 | 3.11 | -3.94 | 6.55 | 2.61 | -4.17 | 5.93 | 1.76 |
| Benefit Cost Ratio(B/C) | 0.83 | 1.89 | 1.13 | 0.84 | 1.82 | 1.12 | 0.83 | 1.81 | 1.11 | 0.81 | 1.79 | 1.09 | 0.80 | 1.73 | 1.06 |
| Unit Annual Cost (Firm) | 0.130 | 0.062 | 0.099 | 0.128 | 0.067 | 0.102 | 0.131 | 0.067 | 0.103 | 0.136 | 0.068 | 0.106 | 0.140 | 0.072 | 0.111 |
| Unit Annual Cost (Average) | 0.062 | 0.038 | 0.062 | 0.060 | 0.038 | 0.061 | 0.060 | 0.038 | 0.061 | 0.060 | 0.038 | 0.061 | 0.060 | 0.037 | 0.060 |

Bayram Project Tailrace Undergro. P/S Layout H.W.L.=750m L.W.L.=686.745m With Bagik H.W.L.= 530.0m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 750-725 | Bagik 530C | Total | Bayram 750-730 | Bagik 530C | Total | Bayram 750-735 | Bagik 530C | Total | Bayram 750-740 | Bagik 530C | Total | Bayram 750-745 | Bagik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 750.00 | 530.00 | | 750.00 | 530.00 | | 750.00 | 530.00 | | 750.00 | 530.00 | | 750.00 | 530.00 | |
| Normal Water Level | 741.67 | 528.50 | | 743.33 | 528.50 | | 745.00 | 528.50 | | 746.67 | 528.50 | | 748.33 | 528.50 | |
| Low Water Level | 725.00 | 527.00 | | 730.00 | 527.00 | | 735.00 | 527.00 | | 740.00 | 527.00 | | 745.00 | 527.00 | |
| Available Drawdown | 25.00 | 3.00 | | 20.00 | 3.00 | | 15.00 | 3.00 | | 10.00 | 3.00 | | 5.00 | 3.00 | |
| Gross Storage Capacity | 169.00 | 7.30 | | 169.00 | 7.30 | | 169.00 | 7.30 | | 169.00 | 7.30 | | 169.00 | 7.30 | |
| Effective Storage Capacity | 81.00 | 1.00 | | 67.00 | 1.00 | | 53.00 | 1.00 | | 36.00 | 1.00 | | 19.00 | 1.00 | |
| Dam Type | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Height | 155 | 74 | | 155 | 74 | | 155 | 74 | | 155 | 74 | | 155 | 74 | |
| Dam Volume | 8,500 | 195 | | 8,500 | 195 | | 8,500 | 195 | | 8,500 | 195 | | 8,500 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 202.47 | 130.80 | | 204.03 | 130.80 | | 205.60 | 130.70 | | 207.17 | 130.70 | | 208.53 | 130.50 | |
| Maximum Discharge | 38.00 | 44.00 | | 35.00 | 42.00 | | 33.00 | 39.00 | | 29.00 | 36.00 | | 24.00 | 31.00 | |
| Installed Capacity | 66.00 | 49.00 | 115.00 | 61.00 | 47.00 | 108.00 | 58.00 | 44.00 | 102.00 | 51.00 | 40.00 | 91.00 | 43.00 | 35.00 | 78.00 |
| Firm Peak Power | 56.61 | 48.00 | 104.61 | 54.70 | 46.00 | 100.70 | 52.10 | 42.00 | 94.10 | 48.80 | 39.00 | 87.80 | 40.30 | 34.00 | 74.30 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 259.50 | 212.00 | 471.50 | 253.90 | 206.40 | 460.30 | 245.00 | 198.00 | 443.00 | 232.70 | 186.10 | 418.80 | 199.80 | 169.00 | 368.80 |
| Firm Energy | 141.79 | 105.12 | 246.91 | 128.90 | 100.70 | 229.60 | 120.21 | 91.98 | 212.19 | 110.20 | 85.10 | 195.30 | 88.26 | 74.46 | 162.72 |
| Secondary Energy | 117.71 | 106.88 | 224.59 | 125.00 | 105.70 | 230.70 | 124.79 | 106.02 | 230.81 | 122.50 | 101.00 | 223.50 | 111.54 | 94.54 | 206.08 |
| Unit Benefit Value | | | | | | | | | | | | | | | |
| Firm Peak Power | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 10.09 | 8.26 | 18.35 | 9.41 | 7.92 | 17.33 | 8.97 | 7.23 | 16.19 | 8.40 | 6.71 | 15.11 | 6.94 | 5.85 | 12.79 |
| Firm Energy | 3.76 | 2.79 | 6.55 | 3.42 | 2.67 | 6.09 | 3.19 | 2.44 | 5.63 | 2.92 | 2.26 | 5.18 | 2.34 | 1.98 | 4.32 |
| Secondary Energy | 2.53 | 2.30 | 4.84 | 2.69 | 2.28 | 4.97 | 2.69 | 2.28 | 4.97 | 2.64 | 2.17 | 4.81 | 2.40 | 2.04 | 4.44 |
| Total | 16.38 | 13.35 | 29.73 | 15.53 | 12.86 | 28.39 | 14.84 | 11.95 | 26.79 | 13.96 | 11.14 | 25.10 | 11.68 | 9.86 | 21.54 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 178.72 | 52.07 | 230.79 | 177.56 | 51.35 | 228.91 | 176.59 | 50.50 | 227.09 | 174.30 | 49.96 | 224.26 | 172.32 | 48.20 | 220.52 |
| Hydrau. and Ele.-Mech Eq | 23.56 | 22.93 | 46.49 | 22.22 | 22.46 | 44.68 | 21.46 | 21.62 | 43.08 | 19.21 | 20.81 | 40.02 | 17.32 | 19.30 | 36.62 |
| Total | 202.28 | 75.00 | 277.28 | 199.78 | 73.81 | 273.59 | 198.05 | 72.13 | 270.18 | 193.51 | 70.77 | 264.28 | 189.64 | 67.50 | 257.14 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 18.05 | 5.26 | 23.31 | 17.93 | 5.19 | 23.12 | 17.84 | 5.10 | 22.94 | 17.60 | 5.05 | 22.65 | 17.40 | 4.87 | 22.27 |
| Hydrau. and Ele.-Mech Eq | 2.69 | 2.61 | 5.30 | 2.53 | 2.56 | 5.09 | 2.45 | 2.47 | 4.91 | 2.19 | 2.37 | 4.56 | 1.97 | 2.20 | 4.18 |
| Total | 20.74 | 7.87 | 28.61 | 20.47 | 7.75 | 28.21 | 20.28 | 7.57 | 27.85 | 19.79 | 7.42 | 27.21 | 19.38 | 7.07 | 26.45 |
| Annual Surplus Benefit(B-C) | -4.35 | 5.48 | 1.13 | -4.94 | 5.12 | 0.18 | -5.44 | 4.39 | -1.05 | -5.83 | 3.73 | -2.11 | -7.70 | 2.79 | -4.91 |
| Benefit Cost Ratio(B/C) | 0.79 | 1.70 | 1.04 | 0.76 | 1.66 | 1.01 | 0.73 | 1.58 | 0.96 | 0.71 | 1.50 | 0.92 | 0.60 | 1.40 | 0.81 |
| Unit Annual Cost (Firm) | 0.146 | 0.075 | 0.116 | 0.159 | 0.077 | 0.123 | 0.169 | 0.082 | 0.131 | 0.180 | 0.087 | 0.139 | 0.220 | 0.095 | 0.153 |
| Unit Annual Cost (Average) | 0.080 | 0.037 | 0.061 | 0.081 | 0.038 | 0.061 | 0.083 | 0.038 | 0.063 | 0.085 | 0.040 | 0.065 | 0.097 | 0.042 | 0.072 |

# Table 9-12(2) Comparison Study on Bayram Reservoir Water Level

Bayram Project Tailrace Underground P/S Layout H.W.L.=745m L.W.L.=686-740m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 745-686 | Baglik 530C | Total | Bayram 745-700 | Baglik 530C | Total | Bayram 745-705 | Baglik 530C | Total | Bayram 745-710 | Baglik 530C | Total | Bayram 745-715 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 745.00 | 530.00 | | 745.00 | 530.00 | | 745.00 | 530.00 | | 745 | 530.00 | | 745 | 530.00 | |
| Normal Water Level | 725.33 | 528.50 | | 730.00 | 528.50 | | 731.67 | 528.50 | | 733.33 | 528.50 | | 735 | 528.50 | |
| Low Water Level | 686.00 | 527.00 | | 700.00 | 527.00 | | 705.00 | 527.00 | | 710 | 527.00 | | 715 | 527.00 | |
| Available Drawdown | 59.00 | 3.00 | | 45.00 | 3.00 | | 40.00 | 3.00 | | 35 | 3.00 | | 30 | 3.00 | |
| Gross Storage Capacity | 150.00 | 7.30 | | 150.00 | 7.30 | | 150.00 | 7.30 | | 150 | 7.30 | | 150 | 7.30 | |
| Effective Storage Capacity | 130.00 | 1.00 | | 112.00 | 1.00 | | 104.00 | 1.00 | | 95 | 1.00 | | 85 | 1.00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 150 | 74 | | 150 | 74 | | 150 | 74 | | 150 | 74 | | 150 | 74 | |
| Dam Volume | 7,200 | 195 | | 7,200 | 195 | | 7,200 | 195 | | 7,200 | 195 | | 7,200 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 196.33 | 130.90 | | 190.90 | 130.90 | | 192.57 | 130.90 | | 194.13 | 130.90 | | 195.80 | 130.80 | |
| Maximum Discharge | 46.00 | 55.00 | | 43.00 | 52.00 | | 42.00 | 49.00 | | 40.00 | 43.00 | | 38.00 | 45.00 | |
| Installed Capacity | 74.00 | 62.00 | 136.00 | 70.00 | 59.00 | 129.00 | 69.00 | 55.00 | 124.00 | 67.00 | 54.00 | 121.00 | 64.00 | 51.00 | 115.00 |
| Firm Peak Power | 63.00 | 59.60 | 122.60 | 60.90 | 56.40 | 117.30 | 60.12 | 54.00 | 114.12 | 58.29 | 52.00 | 110.29 | 56.20 | 49.00 | 105.20 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 257.70 | 224.00 | 481.70 | 257.10 | 220.70 | 477.80 | 256.47 | 218.50 | 474.97 | 253.61 | 215.60 | 469.21 | 249.42 | 212.50 | 461.92 |
| Firm Energy | 154.40 | 130.70 | 285.10 | 148.92 | 123.52 | 272.44 | 154.40 | 118.26 | 269.66 | 149.79 | 113.88 | 263.67 | 139.48 | 107.31 | 246.79 |
| Secondary Energy | 103.30 | 93.30 | 196.60 | 108.18 | 97.18 | 205.36 | 105.07 | 100.24 | 205.31 | 103.83 | 101.72 | 205.55 | 109.94 | 105.19 | 215.13 |
| Unit Benefit Value | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 10.84 | 10.26 | 21.10 | 10.48 | 9.71 | 20.19 | 10.35 | 9.29 | 19.64 | 10.03 | 8.95 | 18.98 | 9.87 | 8.43 | 18.10 |
| Firm Energy | 4.10 | 3.47 | 7.57 | 3.95 | 3.28 | 7.23 | 4.02 | 3.14 | 7.16 | 3.98 | 3.02 | 7.00 | 3.70 | 2.85 | 6.55 |
| Secondary Energy | 2.22 | 2.01 | 4.23 | 2.33 | 2.09 | 4.42 | 2.26 | 2.16 | 4.42 | 2.24 | 2.19 | 4.43 | 2.37 | 2.25 | 4.63 |
| Total | 17.16 | 15.73 | 32.90 | 15.76 | 15.08 | 31.84 | 16.63 | 14.59 | 31.22 | 16.24 | 14.16 | 30.40 | 15.74 | 13.55 | 29.29 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 164.81 | 54.51 | 219.32 | 163.39 | 53.79 | 217.18 | 163.24 | 53.00 | 216.24 | 161.91 | 52.87 | 214.78 | 160.92 | 52.20 | 213.12 |
| Hydrau. and Ele.-Mech Eq | 25.29 | 26.44 | 51.73 | 24.53 | 25.73 | 50.26 | 24.46 | 24.69 | 49.15 | 23.74 | 24.60 | 48.33 | 23.04 | 23.81 | 46.84 |
| Total | 190.10 | 80.95 | 271.04 | 187.92 | 79.52 | 267.44 | 187.70 | 77.69 | 265.39 | 185.65 | 77.47 | 263.12 | 183.96 | 76.01 | 259.96 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 16.65 | 5.51 | 22.15 | 16.50 | 5.43 | 21.94 | 16.49 | 5.35 | 21.84 | 16.35 | 5.34 | 21.69 | 16.25 | 5.27 | 21.53 |
| Hydrau. and Ele.-Mech Eq | 2.88 | 3.01 | 5.90 | 2.80 | 2.93 | 5.73 | 2.79 | 2.81 | 5.60 | 2.71 | 2.80 | 5.51 | 2.63 | 2.71 | 5.34 |
| Total | 19.53 | 8.52 | 28.05 | 19.30 | 8.37 | 27.66 | 19.28 | 8.17 | 27.44 | 19.06 | 8.14 | 27.20 | 18.88 | 7.99 | 26.87 |
| Annual Surplus Benefit(B-C) | -2.36 | 7.21 | 4.85 | -2.54 | 6.71 | 4.17 | -2.65 | 6.42 | 3.77 | -2.82 | 6.02 | 3.20 | -3.14 | 5.56 | 2.42 |
| Benefit Cost Ratio(B/C) | 0.88 | 1.85 | 1.17 | 0.87 | 1.80 | 1.15 | 0.86 | 1.79 | 1.14 | 0.85 | 1.74 | 1.12 | 0.83 | 1.70 | 1.09 |
| Unit Annual Cost (Firm) | 0.126 | 0.065 | 0.098 | 0.130 | 0.068 | 0.102 | 0.127 | 0.069 | 0.102 | 0.127 | 0.072 | 0.103 | 0.135 | 0.074 | 0.109 |
| Unit Annual Cost (Average) | 0.076 | 0.038 | 0.058 | 0.075 | 0.038 | 0.056 | 0.075 | 0.037 | 0.056 | 0.075 | 0.038 | 0.056 | 0.076 | 0.038 | 0.056 |

Bayram Project Tailrace Underground P/S Layout H.W.L.=745m L.W.L.=685-740m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 745-720 | Baglik 530C | Total | Bayram 745-725 | Baglik 530C | Total | Bayram 745-730 | Baglik 530C | Total | Bayram 745-735 | Baglik 530C | Total | Bayram 745-740 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 745.00 | 530.00 | | 745.00 | 530.00 | | 745.00 | 530.00 | | 745.00 | 530.00 | | 745.00 | 530.00 | |
| Normal Water Level | 736.67 | 528.50 | | 738.33 | 528.50 | | 740.00 | 528.50 | | 741.67 | 528.50 | | 743.33 | 528.50 | |
| Low Water Level | 720.00 | 527.00 | | 725.00 | 527.00 | | 730.00 | 527.00 | | 735.00 | 527.00 | | 740.00 | 527.00 | |
| Available Drawdown | 25.00 | 3.00 | | 20.00 | 3.00 | | 15.00 | 3.00 | | 10.00 | 3.00 | | 5.00 | 3.00 | |
| Gross Storage Capacity | 150.00 | 7.30 | | 150.00 | 7.30 | | 150.00 | 7.30 | | 150.00 | 7.30 | | 150.00 | 7.30 | |
| Effective Storage Capacity | 74.00 | 1.00 | | 62.00 | 1.00 | | 48.00 | 1.00 | | 34.00 | 1.00 | | 17.00 | 1.00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 150 | 74 | | 150 | 74 | | 150 | 74 | | 150 | 74 | | 150 | 74 | |
| Dam Volume | 7,200 | 195 | | 7,200 | 195 | | 7,200 | 195 | | 7,200 | 195 | | 7,200 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 197.37 | 130.80 | | 158.93 | 130.70 | | 200.60 | 130.70 | | 202.07 | 130.60 | | 203.53 | 130.50 | |
| Maximum Discharge | 36.00 | 43.00 | | 34.00 | 41.00 | | 32.00 | 38.00 | | 28.00 | 35.00 | | 24.00 | 30.00 | |
| Installed Capacity | 61.00 | 48.00 | 109.00 | 58.00 | 45.00 | 104.00 | 55.00 | 43.00 | 98.00 | 48.00 | 39.00 | 87.00 | 42.00 | 33.00 | 75.00 |
| Firm Peak Power | 54.24 | 47.00 | 101.24 | 52.33 | 45.00 | 97.33 | 50.49 | 41.00 | 91.49 | 45.35 | 38.00 | 83.35 | 40.26 | 33.00 | 73.26 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 245.48 | 208.50 | 454.98 | 241.24 | 203.50 | 444.74 | 235.23 | 192.00 | 427.23 | 221.13 | 185.00 | 406.13 | 199.80 | 169.00 | 368.80 |
| Firm Energy | 130.66 | 102.93 | 233.59 | 124.15 | 98.55 | 222.70 | 112.43 | 89.79 | 202.22 | 99.32 | 83.22 | 182.54 | 88.17 | 72.27 | 160.44 |
| Secondary Energy | 115.82 | 105.57 | 221.39 | 117.09 | 104.95 | 222.04 | 122.81 | 102.21 | 225.02 | 121.81 | 101.78 | 223.59 | 111.63 | 96.73 | 208.36 |
| Unit Benefit Value | | | | | | | | | | | | | | | |
| Firm Peak Power | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 9.33 | 8.09 | 17.42 | 9.01 | 7.74 | 16.75 | 8.69 | 7.06 | 15.75 | 7.80 | 6.54 | 14.34 | 6.93 | 5.68 | 12.61 |
| Firm Energy | 3.47 | 2.73 | 6.20 | 3.30 | 2.62 | 5.91 | 2.98 | 2.38 | 5.37 | 2.64 | 2.21 | 4.84 | 2.34 | 1.92 | 4.26 |
| Secondary Energy | 2.49 | 2.27 | 4.77 | 2.52 | 2.26 | 4.78 | 2.64 | 2.20 | 4.84 | 2.62 | 2.19 | 4.81 | 2.40 | 2.08 | 4.49 |
| Total | 15.30 | 13.09 | 28.39 | 14.82 | 12.62 | 27.44 | 14.32 | 11.64 | 25.96 | 13.06 | 10.94 | 24.00 | 11.67 | 9.68 | 21.35 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 159.91 | 51.48 | 211.39 | 158.95 | 50.71 | 209.67 | 158.58 | 50.11 | 208.69 | 156.38 | 49.45 | 205.82 | 154.59 | 49.07 | 202.66 |
| Hydrau. and Ele.-Mech Eq | 22.31 | 23.02 | 45.33 | 21.31 | 22.54 | 43.85 | 20.53 | 21.67 | 42.20 | 18.70 | 20.62 | 39.32 | 17.36 | 18.90 | 36.26 |
| Total | 182.22 | 74.51 | 256.72 | 180.27 | 73.24 | 253.52 | 179.11 | 71.77 | 250.89 | 175.08 | 70.07 | 245.14 | 171.95 | 66.97 | 238.92 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 16.15 | 5.20 | 21.35 | 16.06 | 5.12 | 21.18 | 16.02 | 5.06 | 21.08 | 15.79 | 4.99 | 20.79 | 15.61 | 4.85 | 20.47 |
| Hydrau. and Ele.-Mech Eq | 2.54 | 2.62 | 5.17 | 2.43 | 2.57 | 5.00 | 2.34 | 2.47 | 4.81 | 2.13 | 2.35 | 4.48 | 1.98 | 2.15 | 4.13 |
| Total | 18.69 | 7.82 | 26.52 | 18.48 | 7.69 | 26.18 | 18.36 | 7.53 | 25.89 | 17.93 | 7.34 | 25.27 | 17.59 | 7.01 | 24.60 |
| Annual Surplus Benefit(B-C) | -3.40 | 5.27 | 1.87 | -3.66 | 4.93 | 1.27 | -4.04 | 4.11 | 0.07 | -4.86 | 3.59 | -1.27 | -5.92 | 2.67 | -3.25 |
| Benefit Cost Ratio(B/C) | 0.82 | 1.67 | 1.07 | 0.80 | 1.64 | 1.05 | 0.78 | 1.55 | 1.00 | 0.73 | 1.49 | 0.95 | 0.66 | 1.38 | 0.87 |
| Unit Annual Cost (Firm) | 0.143 | 0.076 | 0.114 | 0.149 | 0.078 | 0.118 | 0.163 | 0.084 | 0.128 | 0.180 | 0.088 | 0.138 | 0.200 | 0.097 | 0.153 |
| Unit Annual Cost (Average) | 0.076 | 0.038 | 0.058 | 0.077 | 0.038 | 0.059 | 0.078 | 0.039 | 0.061 | 0.081 | 0.040 | 0.062 | 0.088 | 0.041 | 0.067 |

## Table 9-12(3) Comparison Study on Bayram Reservoir Water Level

Bayram Project Tailrace Undergro. P/S Layout H.W.L.=740m L.W.L.=686m-735m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 740-686 | Baglik 530C | Total | Bayram 740-700 | Baglik 530C | Total | Bayram 740-705 | Baglik 530C | Total | Bayram 740-710 | Baglik 530C | Total | Bayram 740-715 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 740.00 | 530.00 | | 740.00 | 530.00 | | 740.00 | 530.00 | | 740 | 530.00 | | 740 | 530.00 | |
| Normal Water Level | 722.00 | 528.50 | | 726.67 | 528.50 | | 728.33 | 528.50 | | 730 | 528.50 | | 732 | 528.50 | |
| Low Water Level | 686.00 | 527.00 | | 700.00 | 527.00 | | 705.00 | 527.00 | | 710 | 527.00 | | 715 | 527.00 | |
| Available Drawdown | 54.00 | 3.00 | | 40.00 | 3.00 | | 35.00 | 3.00 | | 30 | 3.00 | | 25 | 3.00 | |
| Gross Storage Capacity | 133.00 | 7.30 | | 133.00 | 7.30 | | 133.00 | 7.30 | | 133 | 7.30 | | 133 | 7.30 | |
| Effective Storage Capacity | 113.00 | 1.00 | | 95.00 | 1.00 | | 87.00 | 1.00 | | 78 | 1.00 | | 68 | 1.00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 145 | 74 | | 145 | 74 | | 145 | 74 | | 145 | 74 | | 145 | 74 | |
| Dam Volume | 6,144 | 195 | | 6,144 | 195 | | 6,144 | 195 | | 6,144 | 195 | | 6,144 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 182.90 | 130.80 | | 182.47 | 130.90 | | 189.13 | 130.80 | | 190.70 | 130.80 | | 192.37 | 130.86 | |
| Maximum Discharge | 43.00 | 52.80 | | 40.00 | 48.00 | | 39.00 | 46.00 | | 37.00 | 44.00 | | 36.00 | 42.00 | |
| Installed Capacity | 68.00 | 59.00 | 127.00 | 64.00 | 54.00 | 118.00 | 63.00 | 52.00 | 115.00 | 61.00 | 49.00 | 110.00 | 59.00 | 47.00 | 106.00 |
| Firm Peak Power | 58.00 | 56.40 | 114.40 | 55.60 | 51.50 | 107.10 | 54.00 | 50.00 | 104.00 | 52.10 | 48.00 | 100.10 | 51.00 | 46.00 | 97.00 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 247.90 | 221.40 | 469.30 | 246.50 | 216.30 | 462.80 | 244.69 | 213.50 | 458.39 | 242.80 | 210.70 | 453.50 | 240.00 | 206.80 | 446.80 |
| Firm Energy | 141.40 | 124.20 | 265.60 | 134.60 | 113.60 | 248.20 | 130.82 | 109.50 | 240.32 | 126.30 | 104.90 | 231.20 | 122.18 | 100.74 | 222.92 |
| Secondary Energy | 106.50 | 97.20 | 203.70 | 111.90 | 102.70 | 214.60 | 114.08 | 104.00 | 218.08 | 116.50 | 105.80 | 222.30 | 117.82 | 106.06 | 223.88 |
| Unit Benefit Value | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 9.98 | 9.71 | 19.69 | 9.57 | 8.86 | 18.43 | 9.29 | 8.60 | 17.90 | 8.97 | 8.26 | 17.23 | 8.78 | 7.92 | 16.69 |
| Firm Energy | 3.75 | 3.30 | 7.05 | 3.57 | 3.02 | 6.59 | 3.47 | 2.91 | 6.38 | 3.35 | 2.78 | 6.14 | 3.24 | 2.67 | 5.92 |
| Secondary Energy | 2.29 | 2.09 | 4.39 | 2.41 | 2.21 | 4.62 | 2.46 | 2.24 | 4.69 | 2.51 | 2.28 | 4.79 | 2.54 | 2.28 | 4.82 |
| Total | 16.03 | 15.09 | 31.12 | 15.55 | 14.09 | 29.64 | 15.22 | 13.75 | 28.97 | 14.83 | 13.32 | 28.15 | 14.56 | 12.87 | 27.43 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 147.74 | 53.78 | 201.51 | 145.36 | 52.87 | 199.23 | 146.19 | 52.21 | 198.40 | 145.24 | 51.69 | 196.89 | 144.39 | 51.54 | 195.93 |
| Hydrau. and Ele.-Mech Eq | 24.32 | 25.69 | 50.01 | 23.57 | 24.35 | 47.92 | 23.47 | 23.92 | 47.39 | 22.77 | 22.94 | 45.70 | 22.14 | 22.46 | 44.60 |
| Total | 172.06 | 79.46 | 251.53 | 169.92 | 77.22 | 247.15 | 169.66 | 76.13 | 245.79 | 167.97 | 74.62 | 242.60 | 166.53 | 74.01 | 240.53 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 14.92 | 5.43 | 20.35 | 14.78 | 5.34 | 20.12 | 14.76 | 5.27 | 20.04 | 14.67 | 5.22 | 19.89 | 14.58 | 5.21 | 19.79 |
| Hydrau. and Ele.-Mech Eq | 2.77 | 2.93 | 5.70 | 2.69 | 2.78 | 5.46 | 2.68 | 2.73 | 5.40 | 2.60 | 2.61 | 5.21 | 2.52 | 2.56 | 5.08 |
| Total | 17.69 | 8.36 | 26.05 | 17.47 | 8.12 | 25.58 | 17.44 | 8.00 | 25.44 | 17.26 | 7.83 | 25.10 | 17.11 | 7.77 | 24.87 |
| Annual Surplus Benefit(B-C) | -1.67 | 6.74 | 5.07 | -1.92 | 5.97 | 4.05 | -2.22 | 5.75 | 3.53 | -2.44 | 5.49 | 3.05 | -2.55 | 5.11 | 2.56 |
| Benefit Cost Ratio(B/C) | 0.91 | 1.81 | 1.19 | 0.89 | 1.74 | 1.16 | 0.87 | 1.72 | 1.14 | 0.86 | 1.70 | 1.12 | 0.85 | 1.66 | 1.10 |
| Unit Annual Cost (Firm) | 0.125 | 0.067 | 0.096 | 0.130 | 0.071 | 0.103 | 0.133 | 0.073 | 0.106 | 0.137 | 0.075 | 0.109 | 0.140 | 0.077 | 0.112 |
| Unit Annual Cost (Average) | 0.071 | 0.038 | 0.056 | 0.071 | 0.038 | 0.055 | 0.071 | 0.037 | 0.055 | 0.071 | 0.037 | 0.055 | 0.071 | 0.038 | 0.056 |

Bayram Project Tailrace Undergro. P/S Layout H.W.L.=740m L.W.L.=686m-735m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 740-720 | Baglik 530C | Total | Bayram 740-725 | Baglik 530C | Total | Bayram 740-730 | Baglik 530C | Total | Bayram 740-735 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 740.00 | 530.00 | | 740.00 | 530.00 | | 740.00 | 530.00 | | 740.00 | 530.00 | |
| Normal Water Level | 733.33 | 528.50 | | 735.00 | 528.50 | | 736.67 | 528.50 | | 738.33 | 528.50 | |
| Low Water Level | 720.00 | 527.00 | | 725.00 | 527.00 | | 730.00 | 527.00 | | 735.00 | 527.00 | |
| Available Drawdown | 20.00 | 3.00 | | 15.00 | 3.00 | | 10.00 | 3.00 | | 5.00 | 3.00 | |
| Gross Storage Capacity | 133.00 | 7.30 | | 133.00 | 7.30 | | 133.00 | 7.30 | | 133.00 | 7.30 | |
| Effective Storage Capacity | 57.00 | 1.00 | | 45.00 | 1.00 | | 31.00 | 1.00 | | 17.00 | 1.00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 145 | 74 | | 145 | 74 | | 145 | 74 | | 145 | 74 | |
| Dam Volume | 6,144 | 195 | | 6,144 | 195 | | 6,144 | 195 | | 6,144 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 193.93 | 130.76 | | 195.50 | 130.70 | | 197.07 | 130.60 | | 198.53 | 130.50 | |
| Maximum Discharge | 33.00 | 43.00 | | 31.00 | 37.20 | | 27.00 | 34.00 | | 24.00 | 30.00 | |
| Installed Capacity | 55.00 | 45.00 | 100.00 | 52.00 | 42.00 | 94.00 | 46.00 | 38.00 | 84.00 | 41.00 | 33.00 | 74.00 |
| Firm Peak Power | 49.00 | 44.00 | 93.00 | 46.50 | 40.00 | 86.50 | 42.90 | 37.00 | 79.90 | 39.30 | 33.00 | 72.30 |
| Energy Production | | | | | | | | | | | | |
| Average Energy | 235.20 | 201.00 | 436.20 | 225.82 | 192.60 | 418.42 | 212.60 | 180.80 | 393.40 | 193.83 | 169.50 | 363.33 |
| Firm Energy | 116.00 | 96.10 | 212.10 | 107.83 | 87.60 | 195.43 | 97.40 | 80.80 | 178.20 | 86.07 | 72.27 | 158.34 |
| Secondary Energy | 119.20 | 104.90 | 224.10 | 117.99 | 105.00 | 222.99 | 115.20 | 100.00 | 215.20 | 107.77 | 97.23 | 205.00 |
| Unit Benefit Value | | | | | | | | | | | | |
| Firm Peak Power | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | |
| Firm Peak Power | 8.43 | 7.57 | 16.00 | 8.00 | 6.88 | 14.89 | 7.38 | 6.37 | 13.75 | 6.76 | 5.68 | 12.44 |
| Firm Energy | 3.08 | 2.55 | 5.63 | 2.86 | 2.33 | 5.19 | 2.59 | 2.14 | 4.73 | 2.28 | 1.92 | 4.20 |
| Secondary Energy | 2.57 | 2.26 | 4.82 | 2.54 | 2.26 | 4.80 | 2.48 | 2.15 | 4.63 | 2.32 | 2.09 | 4.41 |
| Total | 14.08 | 12.38 | 26.46 | 13.40 | 11.47 | 24.87 | 12.45 | 10.66 | 23.11 | 11.37 | 9.69 | 21.06 |
| Investment Cost | | | | | | | | | | | | |
| Civil Facilities | 142.84 | 50.70 | 193.54 | 141.96 | 49.98 | 191.94 | 139.78 | 49.25 | 189.03 | 138.81 | 47.95 | 186.76 |
| Hydrau. and Ele.-Mech Eq | 20.99 | 21.98 | 42.97 | 20.19 | 21.32 | 41.50 | 18.40 | 20.29 | 38.68 | 17.64 | 18.75 | 35.29 |
| Total | 163.83 | 72.68 | 236.51 | 162.15 | 71.30 | 233.45 | 158.18 | 69.51 | 227.70 | 155.85 | 66.70 | 222.55 |
| Annual Cost | | | | | | | | | | | | |
| Civil Facilities | 14.43 | 5.12 | 19.55 | 14.34 | 5.05 | 19.39 | 14.12 | 4.97 | 19.09 | 14.02 | 4.84 | 18.86 |
| Hydrau. and Ele.-Mech Eq | 2.39 | 2.51 | 4.90 | 2.30 | 2.43 | 4.73 | 2.10 | 2.31 | 4.41 | 1.94 | 2.14 | 4.08 |
| Total | 16.82 | 7.63 | 24.45 | 16.64 | 7.48 | 24.12 | 16.22 | 7.28 | 23.50 | 15.96 | 6.98 | 22.94 |
| Annual Surplus Benefit(B-C) | -2.74 | 4.76 | 2.01 | -3.24 | 3.99 | 0.76 | -3.77 | 3.38 | -0.39 | -4.59 | 2.71 | -1.88 |
| Benefit Cost Ratio(B/C) | 0.84 | 1.62 | 1.08 | 0.81 | 1.53 | 1.03 | 0.77 | 1.46 | 0.98 | 0.71 | 1.39 | 0.92 |
| Unit Annual Cost (Firm) | 0.145 | 0.079 | 0.115 | 0.154 | 0.085 | 0.123 | 0.166 | 0.090 | 0.132 | 0.185 | 0.097 | 0.145 |
| Unit Annual Cost (Average) | 0.072 | 0.038 | 0.056 | 0.074 | 0.039 | 0.058 | 0.076 | 0.040 | 0.060 | 0.082 | 0.041 | 0.063 |

# Table 9-12(4) Comparison Study on Bayram Reservoir Water Level

Bayram Project Tailrace Underpass P/S Layout H.W.L.=735m L.W.L=686m-730m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 735-685 | Baglik 530C | Total | Bayram 735-700 | Baglik 530C | Total | Bayram 735-705 | Baglik 530C | Total | Bayram 735-710 | Baglik 530C | Total | Bayram 735-715 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 735.00 | 530.00 | | 735.00 | 530.00 | | 735.00 | 530.00 | | 735 | 530.00 | | 735 | 530.00 | |
| Normal Water Level | 718.67 | 528.50 | | 723.33 | 528.50 | | 725.00 | 528.50 | | 726.6667 | 528.50 | | 728.3333 | 528.50 | |
| Low Water Level | 686.00 | 527.00 | | 700.00 | 527.00 | | 705.00 | 527.00 | | 710 | 527.00 | | 715 | 527.00 | |
| Available Drawdown | 49.00 | 3.00 | | 35.00 | 3.00 | | 30.00 | 3.00 | | 25 | 3.00 | | 20 | 3.00 | |
| Gross Storage Capacity | 116.00 | 7.30 | | 116.00 | 7.30 | | 116.00 | 7.30 | | 116 | 7.30 | | 116 | 7.30 | |
| Effective Storage Capacity | 96.00 | 1.00 | | 78.00 | 1.00 | | 70.00 | 1.00 | | 61 | 1.00 | | 51 | 1.00 | |
| Dam Type | Rockfill | Con-Gra. | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 140 | 74 | | 140 | 74 | | 140 | 74 | | 140 | 74 | | 140 | 74 | |
| Dam Volume | 5,400 | 195 | | 5,400 | 195 | | 5,400 | 195 | | 5,400 | 195 | | 5,400 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 179.47 | 130.90 | | 184.03 | 130.80 | | 185.70 | 130.80 | | 187.27 | 130.70 | | 188.93 | 130.70 | |
| Maximum Discharge | 40.00 | 48.00 | | 37.00 | 44.00 | | 36.00 | 42.00 | | 34.00 | 41.00 | | 32.00 | 39.00 | |
| Installed Capacity | 82.00 | 54.00 | 116.00 | 58.00 | 49.00 | 107.00 | 57.00 | 47.00 | 104.00 | 55.00 | 46.00 | 101.00 | 52.00 | 41.00 | 96.00 |
| Firm Peak Power | 52.40 | 52.00 | 104.40 | 50.46 | 48.00 | 98.46 | 49.59 | 45.00 | 95.59 | 49.50 | 45.00 | 94.50 | 47.32 | 42.00 | 89.32 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 237.00 | 215.70 | 452.70 | 235.08 | 210.10 | 445.18 | 233.19 | 207.20 | 440.39 | 228.93 | 203.20 | 432.13 | 233.33 | 197.50 | 430.83 |
| Firm Energy | 128.20 | 113.60 | 241.80 | 110.51 | 105.12 | 215.63 | 108.60 | 100.74 | 209.34 | 108.41 | 98.55 | 206.96 | 103.63 | 91.98 | 195.61 |
| Secondary Energy | 108.80 | 102.10 | 210.90 | 124.58 | 104.98 | 229.56 | 124.59 | 106.46 | 231.05 | 120.53 | 104.65 | 225.18 | 129.70 | 105.52 | 235.22 |
| Unit Benefit Value | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 9.02 | 8.95 | 17.97 | 8.68 | 8.26 | 16.94 | 8.53 | 7.92 | 16.45 | 8.52 | 7.74 | 16.26 | 8.14 | 7.23 | 15.37 |
| Firm Energy | 3.40 | 3.02 | 6.42 | 2.93 | 2.79 | 5.72 | 2.88 | 2.67 | 5.56 | 2.88 | 2.62 | 5.49 | 2.75 | 2.44 | 5.19 |
| Secondary Energy | 2.34 | 2.20 | 4.54 | 2.68 | 2.26 | 4.94 | 2.68 | 2.29 | 4.97 | 2.59 | 2.25 | 4.85 | 2.79 | 2.27 | 5.06 |
| Total | 14.76 | 14.16 | 28.92 | 14.30 | 13.31 | 27.61 | 14.10 | 12.88 | 26.98 | 13.99 | 12.61 | 26.60 | 13.68 | 11.94 | 25.63 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 135.39 | 52.87 | 188.26 | 134.43 | 52.07 | 186.50 | 133.58 | 51.35 | 184.93 | 132.76 | 50.71 | 183.48 | 132.42 | 50.56 | 182.98 |
| Hydrau. and Ele.-Mech.Eq. | 23.01 | 24.35 | 47.36 | 21.95 | 22.71 | 44.70 | 21.62 | 22.25 | 43.87 | 21.15 | 22.12 | 43.27 | 20.16 | 21.62 | 41.80 |
| Total | 158.40 | 77.22 | 235.61 | 156.42 | 74.78 | 231.20 | 155.20 | 73.60 | 228.80 | 153.91 | 72.82 | 226.73 | 152.60 | 72.18 | 224.78 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 13.67 | 5.34 | 19.01 | 13.58 | 5.26 | 18.84 | 13.49 | 5.19 | 18.68 | 13.41 | 5.12 | 18.53 | 13.37 | 5.11 | 18.48 |
| Hydrau. and Ele.-Mech.Eq. | 2.62 | 2.78 | 5.40 | 2.51 | 2.59 | 5.10 | 2.45 | 2.54 | 5.00 | 2.41 | 2.52 | 4.93 | 2.30 | 2.46 | 4.76 |
| Total | 16.30 | 8.12 | 24.41 | 16.08 | 7.85 | 23.93 | 15.96 | 7.72 | 23.68 | 15.82 | 7.64 | 23.46 | 15.68 | 7.57 | 23.25 |
| Annual Surplus Benefit(B-C) | -1.53 | 6.05 | 4.51 | -1.79 | 5.46 | 3.68 | -1.86 | 5.16 | 3.30 | -1.83 | 4.97 | 3.14 | -1.99 | 4.37 | 2.38 |
| Benefit Cost Ratio(B/C) | 0.91 | 1.75 | 1.18 | 0.89 | 1.70 | 1.15 | 0.88 | 1.67 | 1.14 | 0.88 | 1.65 | 1.13 | 0.87 | 1.58 | 1.10 |
| Unit Annual Cost (Firm) | 0.127 | 0.071 | 0.101 | 0.146 | 0.075 | 0.111 | 0.147 | 0.077 | 0.113 | 0.146 | 0.078 | 0.113 | 0.151 | 0.082 | 0.119 |
| Unit Annual Cost (Average) | 0.069 | 0.038 | 0.054 | 0.068 | 0.037 | 0.054 | 0.068 | 0.037 | 0.054 | 0.069 | 0.038 | 0.054 | 0.067 | 0.038 | 0.054 |

Bayram Project Tailrace Underpass P/S Layout H.W.L.=735m L.W.L=686m-730m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 735-720 | Baglik 530C | Total | Bayram 735-725 | Baglik 530C | Total | Bayram 735-730 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 735.00 | 530.00 | | 735.00 | 530.00 | | 735.00 | 530.00 | |
| Normal Water Level | 730.00 | 528.50 | | 731.67 | 528.50 | | 733.33 | 528.50 | |
| Low Water Level | 720.00 | 527.00 | | 725.00 | 527.00 | | 730.00 | 527.00 | |
| Available Drawdown | 15.00 | 3.00 | | 10.00 | 3.00 | | 5.00 | 3.00 | |
| Gross Storage Capacity | 116.00 | 7.30 | | 116.00 | 7.30 | | 116.00 | 7.30 | |
| Effective Storage Capacity | 40.00 | 1.00 | | 28.00 | 1.00 | | 14.00 | 1.00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 140 | 74 | | 140 | 74 | | 140 | 74 | |
| Dam Volume | 5,400 | 195 | | 5,400 | 195 | | 5,400 | 195 | |
| Tailwater Level | 530.00 | 392.00 | | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | 190.50 | 130.70 | | 192.07 | 130.50 | | 193.43 | 130.50 | |
| Maximum Discharge | 30.00 | 36.00 | | 27.00 | 33.00 | | 23.00 | 29.00 | |
| Installed Capacity | | 40.00 | 40.00 | 44.00 | 37.00 | 81.00 | 38.00 | 32.00 | 70.00 |
| Firm Peak Power | 46.66 | 39.00 | 85.06 | 43.12 | 36.00 | 79.12 | 37.62 | 31.00 | 68.62 |
| Energy Production | | | | | | | | | |
| Average Energy | 215.76 | 189.50 | 405.26 | 204.78 | 180.00 | 384.78 | 184.73 | 166.00 | 350.73 |
| Firm Energy | 100.87 | 85.41 | 186.28 | 94.45 | 78.84 | 173.27 | 82.38 | 67.89 | 150.28 |
| Secondary Energy | 114.88 | 104.09 | 218.97 | 110.35 | 101.16 | 211.51 | 102.34 | 98.11 | 200.45 |
| Unit Benefit Value | | | | | | | | | |
| Firm Peak Power | 180.450 | 180.450 | | 180.450 | 180.450 | | 180.450 | 180.450 | |
| Firm Energy | 0.027 | 0.027 | | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | 0.022 | 0.022 | | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | | | |
| Firm Peak Power | 7.93 | 6.71 | 14.64 | 7.42 | 6.20 | 13.62 | 6.47 | 5.33 | 11.81 |
| Firm Energy | 2.68 | 2.27 | 4.94 | 2.51 | 2.09 | 4.60 | 2.19 | 1.80 | 3.99 |
| Secondary Energy | 2.47 | 2.24 | 4.71 | 2.38 | 2.18 | 4.55 | 2.20 | 2.11 | 4.32 |
| Total | 13.08 | 11.22 | 24.30 | 12.30 | 10.47 | 22.77 | 10.86 | 9.25 | 20.11 |
| Investment Cost | | | | | | | | | |
| Civil Facilities | 131.14 | 49.84 | 180.98 | 129.34 | 48.80 | 178.14 | 125.82 | 47.49 | 173.31 |
| Hydrau. and Ele.-Mech.Eq. | 19.33 | 20.63 | 39.96 | 17.87 | 19.89 | 37.76 | 16.64 | 18.37 | 35.02 |
| Total | 150.47 | 70.47 | 220.94 | 147.21 | 68.68 | 215.90 | 142.46 | 65.86 | 208.33 |
| Annual Cost | | | | | | | | | |
| Civil Facilities | 13.25 | 5.03 | 18.28 | 13.06 | 4.93 | 17.99 | 12.71 | 4.80 | 17.50 |
| Hydrau. and Ele.-Mech.Eq. | 2.20 | 2.35 | 4.56 | 2.04 | 2.27 | 4.30 | 1.90 | 2.09 | 3.99 |
| Total | 15.45 | 7.39 | 22.83 | 15.10 | 7.20 | 22.30 | 14.60 | 6.89 | 21.50 |
| Annual Surplus Benefit(B-C) | -2.37 | 3.83 | 1.46 | -2.80 | 3.27 | 0.47 | -3.74 | 2.36 | -1.38 |
| Benefit Cost Ratio(B/C) | 0.85 | 1.52 | 1.06 | 0.81 | 1.45 | 1.02 | 0.74 | 1.34 | 0.94 |
| Unit Annual Cost (Firm) | 0.153 | 0.086 | 0.123 | 0.160 | 0.091 | 0.129 | 0.177 | 0.102 | 0.140 |
| Unit Annual Cost (Average) | 0.072 | 0.039 | 0.056 | 0.074 | 0.040 | 0.058 | 0.079 | 0.042 | 0.061 |

## Table 9-12(5) Comparison Study on Bayram Reservoir Water Level

Bayram Project Tailrace Underpro. P/S Layout H.W.L.=730m L.W.L.=685m-725m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 730-685 | Baglik 530C | Total | Bayram 730-700 | Baglik 530C | Total | Bayram 730-705 | Baglik 530C | Total | Bayram 730-710 | Baglik 530C | Total | Bayram 730-715 | Baglik 530C | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Water Level | 730 00 | 530 00 | | 730 00 | 530 00 | | 730 00 | 530 00 | | 730 | 530 00 | | 730 | 530 00 | |
| Normal Water Level | 715 33 | 528 50 | | 720 00 | 528 50 | | 724 67 | 528 50 | | 723 3333 | 528 50 | | 725 | 528 50 | |
| Low Water Level | 685 00 | 527 00 | | 700 00 | 527 00 | | 705 00 | 527 00 | | 710 | 527 00 | | 715 | 527 00 | |
| Available Drawdown | 44 00 | 3 00 | | 30 00 | 3 00 | | 25 00 | 3 00 | | 20 | 3 00 | | 15 | 3 00 | |
| Gross Storage Capacity | 102 00 | 7 30 | | 102 00 | 7 30 | | 102 00 | 7 30 | | 102 | 7 30 | | 102 | 7 30 | |
| Effective Storage Capacity | 82 00 | 1 00 | | 64 00 | 1 00 | | 56 00 | 1 00 | | 47 | 1 00 | | 34 | 1 00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 135 | 74 | | 135 | 74 | | 135 | 74 | | 135 | 74 | | 135 | 74 | |
| Dam Volume | 4,800 | 195 | | 4,800 | 195 | | 4,800 | 195 | | 4,800 | 195 | | 4,800 | 195 | |
| Tailwater Level | 530 00 | 392 00 | | 530 00 | 392 00 | | 530 00 | 392 00 | | 530 00 | 392 00 | | 530 00 | 392 00 | |
| Effective Head | 176 23 | 130 80 | | 180 80 | 130 70 | | 182 37 | 130 70 | | 183 93 | 130 70 | | 185 50 | 130 80 | |
| Maximum Discharge | 38 00 | 45 00 | | 35 00 | 41 00 | | 33 00 | 40 00 | | 31 00 | 38 00 | | 28 00 | 35 00 | |
| Installed Capacity | 57 00 | 51 00 | 108 00 | 54 00 | 46 00 | 100 00 | 52 00 | 45 00 | 97 00 | 49 00 | 43 00 | 92 00 | 44 00 | 39 00 | 83 00 |
| Firm Peak Power | 48 50 | 49 00 | 97 50 | 46 30 | 45 00 | 91 30 | 43 00 | 44 00 | 89 00 | 43 60 | 41 00 | 84 60 | 42 40 | 38 00 | 80 40 |
| Energy Production | | | | | | | | | | | | | | | |
| Average Energy | 227 00 | 210 60 | 437 60 | 223 90 | 204 00 | 427 90 | 221 00 | 200 00 | 421 00 | 215 40 | 193 30 | 408 70 | 208 50 | 183 00 | 389 50 |
| Firm Energy | 119 50 | 107 10 | 226 60 | 110 80 | 98 30 | 209 10 | 107 10 | 96 36 | 203 46 | 103 20 | 89 50 | 192 70 | 97 06 | 83 22 | 180 28 |
| Secondary Energy | 107 50 | 103 50 | 211 00 | 113 10 | 105 70 | 218 80 | 113 90 | 103 64 | 217 54 | 112 20 | 103 80 | 216 00 | 109 44 | 99 78 | 209 22 |
| Unit Benefit Value | 0 00 | 0 00 | | 0 00 | 0 00 | | 0 00 | 0 00 | | 0 00 | 0 00 | | 0 00 | 0 00 | |
| Firm Peak Power | 180 45 | 180 45 | | 180 45 | 180 45 | | 180 45 | 180 45 | | 180 45 | 180 45 | | 180 45 | 180 45 | |
| Firm Energy | 0 0270 | 0 0270 | | 0 0270 | 0 0270 | | 0 0270 | 0 0270 | | 0 0270 | 0 0270 | | 0 0270 | 0 0270 | |
| Secondary Energy | 0 0219 | 0 0219 | | 0 0219 | 0 0219 | | 0 0219 | 0 0219 | | 0 0219 | 0 0219 | | 0 0219 | 0 0219 | |
| Benefit | | | | | | | | | | | | | | | |
| Firm Peak Power | 8 35 | 8 43 | 16 78 | 7 97 | 7 74 | 15 71 | 7 74 | 7 57 | 15 32 | 7 50 | 7 06 | 14 56 | 7 30 | 6 54 | 13 84 |
| Firm Energy | 3 17 | 2 84 | 6 01 | 2 94 | 2 61 | 5 55 | 2 84 | 2 56 | 5 40 | 2 74 | 2 38 | 5 11 | 2 58 | 2 21 | 4 78 |
| Secondary Energy | 2 31 | 2 23 | 4 54 | 2 43 | 2 28 | 4 71 | 2 45 | 2 23 | 4 68 | 2 42 | 2 23 | 4 65 | 2 36 | 2 15 | 4 50 |
| Total | 13 83 | 13 50 | 27 34 | 13 34 | 12 63 | 25 97 | 13 04 | 12 36 | 25 40 | 12 66 | 11 67 | 24 32 | 12 23 | 10 90 | 23 13 |
| Investment Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 125 49 | 52 20 | 177 70 | 124 42 | 50 77 | 175 19 | 123 35 | 50 70 | 174 04 | 122 15 | 50 11 | 172 25 | 121 01 | 49 45 | 170 45 |
| Hydrau and Ele -Mech Eq | 21 92 | 23 57 | 45 49 | 20 99 | 22 12 | 43 11 | 20 22 | 21 97 | 42 19 | 19 20 | 21 47 | 40 67 | 17 73 | 20 45 | 38 18 |
| Total | 147 41 | 75 77 | 223 19 | 145 41 | 72 88 | 218 30 | 143 56 | 72 67 | 216 23 | 141 35 | 71 58 | 212 93 | 138 73 | 69 89 | 208 63 |
| Annual Cost | | | | | | | | | | | | | | | |
| Civil Facilities | 12 67 | 5 27 | 17 95 | 12 57 | 5 13 | 17 69 | 12 48 | 5 12 | 17 58 | 12 34 | 5 06 | 17 40 | 12 22 | 4 99 | 17 22 |
| Hydrau and Ele -Mech Eq | 2 50 | 2 69 | 5 19 | 2 39 | 2 52 | 4 91 | 2 30 | 2 51 | 4 81 | 2 19 | 2 45 | 4 64 | 2 07 | 2 33 | 4 35 |
| Total | 15 17 | 7 96 | 23 13 | 14 96 | 7 65 | 22 61 | 14 78 | 7 63 | 22 39 | 14 53 | 7 51 | 22 03 | 14 24 | 7 33 | 21 57 |
| Annual Surplus Benefit(B-C) | -1 34 | 5 54 | 4 20 | -1 67 | 4 98 | 3 36 | -1 72 | 4 74 | 3 01 | -1 87 | 4 16 | 2 29 | -2 01 | 3 57 | 1 56 |
| Benefit Cost Ratio(B/C) | 0 91 | 1 70 | 1 18 | 0 89 | 1 65 | 1 15 | 0 88 | 1 62 | 1 13 | 0 87 | 1 55 | 1 10 | 0 86 | 1 49 | 1 07 |
| Unit Annual Cost (Firm) | 0 127 | 0 074 | 0 102 | 0 135 | 0 078 | 0 108 | 0 138 | 0 079 | 0 110 | 0 141 | 0 084 | 0 114 | 0 147 | 0 088 | 0 120 |
| Unit Annual Cost (Average) | 0 067 | 0 038 | 0 053 | 0 067 | 0 037 | 0 053 | 0 067 | 0 038 | 0 053 | 0 067 | 0 039 | 0 054 | 0 069 | 0 040 | 0 055 |

Bayram Project Tailrace Underpro. P/S Layout H.W.L.=730m L.W.L.=685m-725m With Baglik H.W.L.= 530.00m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Bayram 730-720 | Baglik 530C | Total | Bayram 730-725 | Baglik 530C | Total |
|---|---|---|---|---|---|---|
| High Water Level | 730 00 | 530 00 | | 730 00 | 530 00 | |
| Normal Water Level | 726 67 | 528 50 | | 728 33 | 526 50 | |
| Low Water Level | 720 00 | 527 00 | | 725 00 | 527 00 | |
| Available Drawdown | 10 00 | 3 00 | | 5 00 | 3 00 | |
| Gross Storage Capacity | 102 00 | 7 30 | | 102 00 | 7 30 | |
| Effective Storage Capacity | 26 00 | 1 00 | | 14 00 | 1 00 | |
| Dam Type | Rockfill | Con-Gra | | Rockfill | Con-Gra | |
| Dam Height | 135 | 74 | | 135 | 74 | |
| Dam Volume | 4,800 | 195 | | 4,800 | 195 | |
| Tailwater Level | 530 00 | 392 00 | | 530 00 | 392 00 | |
| Effective Head | 187 07 | 130 80 | | 188 53 | 130 50 | |
| Maximum Discharge | 26 00 | 32 00 | | 23 00 | 29 00 | |
| Installed Capacity | | 36 00 | 36 00 | 37 00 | 32 00 | 69 00 |
| Firm Peak Power | 39 48 | 35 00 | 74 48 | 36 26 | 31 00 | 67 26 |
| Energy Production | | | | | | |
| Average Energy | 187 80 | 171 70 | 359 50 | 160 00 | 152 00 | 312 00 |
| Firm Energy | 87 30 | 76 40 | 163 70 | 79 41 | 67 89 | 147 30 |
| Secondary Energy | 100 50 | 95 30 | 195 80 | 80 59 | 84 11 | 164 70 |
| Unit Benefit Value | | | | | | |
| Firm Peak Power | 180 450 | 180 450 | | 180 450 | 180 450 | |
| Firm Energy | 0 027 | 0 027 | | 0 027 | 0 027 | |
| Secondary Energy | 0 022 | 0 022 | | 0 022 | 0 022 | |
| Benefit | | | | | | |
| Firm Peak Power | 6 79 | 6 02 | 12 82 | 6 24 | 5 33 | 11 57 |
| Firm Energy | 2 32 | 2 03 | 4 34 | 2 11 | 1 80 | 3 91 |
| Secondary Energy | 2 16 | 2 05 | 4 22 | 1 74 | 1 81 | 3 55 |
| Total | 11 27 | 10 10 | 21 38 | 10 08 | 8 95 | 19 03 |
| Investment Cost | | | | | | |
| Civil Facilities | 119 99 | 48 78 | 168 77 | 118 34 | 47 61 | 165 95 |
| Hydrau and Ele -Mech Eq | 17 33 | 19 52 | 36 84 | 16 04 | 18 23 | 34 27 |
| Total | 137 31 | 68 30 | 205 61 | 134 38 | 65 84 | 200 22 |
| Annual Cost | | | | | | |
| Civil Facilities | 12 12 | 4 93 | 17 05 | 11 95 | 4 81 | 16 76 |
| Hydrau and Ele -Mech Eq | 1 56 | 2 22 | 4 20 | 1 83 | 2 08 | 3 91 |
| Total | 14 09 | 7 15 | 21 25 | 13 78 | 6 89 | 20 67 |
| Annual Surplus Benefit(B-C) | -2 82 | 2 95 | 0 13 | -3 70 | 2 06 | -1 64 |
| Benefit Cost Ratio(B/C) | 0 80 | 1 41 | 1 01 | 0 73 | 1 30 | 0 92 |
| Unit Annual Cost (Firm) | 0 161 | 0 064 | 0 130 | 0 174 | 0 101 | 0 140 |
| Unit Annual Cost (Average) | 0 075 | 0 042 | 0 059 | 0 085 | 0 045 | 0 066 |

# Table 9-13 Outline of Alternative Plan for Bağlık Reservoir Water Level

Bayram Project Tailrace Type Undergro. P/S Layout H.W.L.=740m L.W.L=686m With Baglik L.W.L=527-589m

| Reservoir | Damsite Layout | Bayram 740M/P | Bayram 740M/P | Bayram 740M/P | Bayram 740A | Bayram 740A |
|---|---|---|---|---|---|---|
| Catchment Area | KM^2 | 1,159 | 1,159 | 1,159 | 1,159 | 1,159 |
| Annual Inflow | M^3/S | 19.20 | 19.20 | 19.20 | 19.20 | 19.20 |
| High Water Level | M | 740.00 | 740.00 | 740.00 | 740.00 | 740.00 |
| Normal Water Level | M | 722.00 | 722.00 | 722.00 | 722.00 | 722.00 |
| Low Water Level | M | 686.00 | 686.00 | 686.00 | 686.00 | 686.00 |
| Available Drawdown | M | 54.00 | 54.00 | 54.00 | 54.00 | 54.00 |
| Gross Capacity | 10^6M^3 | 133.00 | 133.00 | 133.00 | 133.00 | 133.00 |
| Effective Capacity | 10^6M^3 | 113.00 | 113.00 | 113.00 | 113.00 | 113.00 |
| Dam | | | | | | |
| Type | | Rockfill | Rockfill | Rockfill | Rockfill | Rockfill |
| Height from Found. | M | 145 | 145 | 145 | 145 | 145 |
| Crest Length | M | 415 | 415 | 415 | 415 | 415 |
| Volume | 10^3M^3 | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 |
| Headrace Tunnel | | | | | | |
| Type | | | | | | |
| Diameters | M | | | | | |
| Length | M | | | | | |
| Penstock | | | | | | |
| Type | | Tunnel | Tunnel | Tunnel | Tunnel | Tunnel |
| Diameters | M | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |
| Length | M | 268 | 268 | 268 | 294 | 294 |
| Powerhouse | | | | | | |
| Type | | Undergr. | Undergr. | Undergr. | Undergr. | Undergr. |
| Tailrace Tunnel | | | | | | |
| Type | | Non-Pre. | Non-Pre. | Non-Pre. | Non-Pre. | Non-Pre. |
| Diameters | M | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 |
| Length (Tunnel) | M | 4,550 | 4,550 | 4,550 | 6,700 | 6,700 |
| (Channel) | M | | | | | |
| Firm Discharge | M^3/S | 10.70 | 10.70 | 10.70 | 10.70 | 10.70 |
| Maximum Discharge | M^3/S | 43.00 | 43.00 | 43.00 | 43.00 | 43.00 |
| Tail Water Level | M | 570.00 | 570.00 | 570.00 | 550.00 | 550.00 |
| Gross Head | | | | | | |
| Maximum Head | M | 170.00 | 170.00 | 170.00 | 190.00 | 190.00 |
| Normal Head | M | 152.00 | 152.00 | 152.00 | 172.00 | 172.00 |
| Minimum Head | M | 116.00 | 116.00 | 116.00 | 136.00 | 136.00 |
| Loss of Head | M | 6.40 | 6.40 | 6.40 | 8.10 | 8.10 |
| Effective Head | | | | | | |
| Maximum | M | 163.60 | 163.60 | 163.60 | 181.90 | 181.90 |
| Normal | M | 145.60 | 145.60 | 145.60 | 163.90 | 163.90 |
| Minimum | M | 109.60 | 109.60 | 109.60 | 127.90 | 127.90 |
| Installed Capacity | MW | 54 | 54 | 54 | 60 | 60 |
| Firm Peak Power | MW | 44.8 | 44.8 | 44.8 | 51.4 | 51.4 |
| Annual Energy | | | | | | |
| Average | GWh | 198.5 | 198.5 | 198.5 | 223.3 | 223.3 |
| Firm | GWh | 113.2 | 113.2 | 113.2 | 126.4 | 126.4 |
| Secondary | GWh | 85.3 | 85.3 | 85.3 | 57.7 | 57.7 |

Baglik Project Tailrace Type Underground Powerhouse Layout

| Reservoir | Damsite Layout | Baglik 740M/P | Baglik 740M/P | Baglik 740M/P | Baglik 740A | Baglik 740A |
|---|---|---|---|---|---|---|
| Catchment Area | KM^2 | 1,509 | 1,509 | 1,509 | 1,509 | 1,509 |
| Annual Inflow | M^3/S | 24.90 | 24.90 | 24.90 | 24.90 | 24.90 |
| High Water Level | M | 570.00 | 570.00 | 570.00 | 550.00 | 550.00 |
| Normal Water Level | M | 555.67 | 563.33 | 569.50 | 536.50 | 549.00 |
| Low Water Level | M | 527.00 | 550.00 | 569.00 | 527.00 | 548.00 |
| Available Drawdown | M | 43.00 | 20.00 | 1.00 | 23.00 | 2.00 |
| Gross Capacity | 10^6M^3 | 36.40 | 36.40 | 36.40 | 17.70 | 17.70 |
| Effective Capacity | 10^6M^3 | 30.10 | 18.70 | 1.00 | 11.40 | 1.00 |
| Dam | | | | | | |
| Type | | Con-gra. | Con-gra. | Con-gra. | Con-gra. | Con-gra. |
| Height from Found. | M | 114 | 114 | 114 | 94 | 94 |
| Crest Length | M | 284 | 284 | 284 | 240 | 240 |
| Volume | 10^3M^3 | 680 | 680 | 680 | 420 | 420 |
| Headrace Tunnel | | | | | | |
| Type | | | | | | |
| Diameters | M | | | | | |
| Length | M | | | | | |
| Penstock | | | | | | |
| Type | | Tunnel | Tunnel | Tunnel | Tunnel | Tunnel |
| Diameters | M | 3.8 | 3.7 | 3.6 | 3.7 | 3.6 |
| Length | M | 213 | 213 | 213 | 213 | 213 |
| Powerhouse | | | | | | |
| Type | | Undergr. | Undergr. | Undergr. | Undergr. | Undergr. |
| Tailrace Tunnel | | | | | | |
| Type | | Hosesho. | Hosesho. | Hosesho. | Hosesho. | Hosesho. |
| Diameters | M | 5.1 | 5.0 | 4.9 | 5.0 | 4.9 |
| Length (Tunnel) | M | 4,454 | 4,454 | 4,454 | 4,454 | 4,454 |
| (Channel) | M | | | | | |
| Firm Discharge | M^3/S | 14.30 | 13.80 | 13.00 | 13.50 | 13.00 |
| Maximum Discharge | M^3/S | 57.00 | 55.00 | 52.00 | 54.00 | 52.00 |
| Tail Water Level | M | 392.00 | 392.00 | 392.00 | 392.00 | 392.00 |
| Gross Head | | | | | | |
| Maximum Head | M | 178.00 | 178.00 | 178.00 | 158.00 | 158.00 |
| Normal Head | M | 163.67 | 171.33 | 177.50 | 146.50 | 157.00 |
| Minimum Head | M | 135.00 | 158.00 | 177.00 | 135.00 | 156.00 |
| Loss of Head | M | 5.50 | 5.60 | 5.60 | 5.60 | 5.60 |
| Effective Head | | | | | | |
| Maximum | M | 172.50 | 172.40 | 172.40 | 152.40 | 152.40 |
| Normal | M | 158.17 | 165.73 | 171.90 | 140.90 | 151.40 |
| Minimum | M | 129.50 | 152.40 | 171.40 | 129.40 | 150.40 |
| Installed Capacity | MW | 78 | 79 | 77 | 66 | 63 |
| Firm Peak Power | MW | 67.6 | 75.5 | 75.0 | 59.8 | 67.6 |
| Annual Energy | | | | | | |
| Average | GWh | 282.1 | 290.4 | 288.6 | 250.5 | 252.1 |
| Firm | GWh | 163.7 | 163.7 | 164.3 | 139.0 | 147.9 |
| Secondary | GWh | 118.4 | 126.7 | 124.4 | 111.5 | 104.2 |

## Table 9-14 Cost Estimate of Alternative Plan for Bağlık Reservoir Water Level

Bayram Project Tailrace Type Underground P/S Layout H.W.L.=740m L.W.L=688m With Bağlık L.W.L=527-559m Unit:10^3US$

| Description Dam Site Layout Type | Bayram 740M P | Bayram 740M P | Bayram 740M P | Bayram 740A | Bayram 740A |
|---|---|---|---|---|---|
| High Water Level (m) | 740 | 740 | 740 | 740 | 740 |
| Reservoir Area (km^2) | 3.38 | 3.38 | 3.38 | 3.38 | 3.38 |
| Dam Volume (10^6m^3) | 6,144 | 6,144 | 6,144 | 6,144 | 6,144 |
| Dam Height (m) | 145 | 145 | 145 | 145 | 145 |
| Maximum Head (m) | 170 | 170 | 170 | 190 | 190 |
| Maximum Discharge (m^3/s) | 43 | 43 | 43 | 43 | 43 |
| Relocation Road | 11,655 | 11,655 | 11,655 | 11,655 | 11,655 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 2,242 | 2,242 | 2,242 | 2,242 | 2,242 |
| Civil Work | 76,180 | 76,180 | 76,180 | 80,512 | 80,512 |
| Diversion | 2,421 | 2,421 | 2,421 | 2,421 | 2,421 |
| Care of River | 1,082 | 1,082 | 1,082 | 1,082 | 1,082 |
| Dam | 47,281 | 47,281 | 47,281 | 47,281 | 47,281 |
| Spillway | 7,523 | 7,523 | 7,523 | 7,523 | 7,523 |
| Outlet Works | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Intake | 1,087 | 1,087 | 1,087 | 1,087 | 1,087 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 |
| Penstock | 377 | 377 | 377 | 458 | 458 |
| Acces Tunnels | 3,980 | 3,980 | 3,980 | 3,980 | 3,980 |
| Power House | 2,664 | 2,664 | 2,664 | 2,856 | 2,856 |
| Tailrace Tunnel | 8,586 | 8,586 | 8,586 | 12,644 | 12,644 |
| Switchyard | 161 | 161 | 161 | 161 | 161 |
| Pre-Subtotal | 90,878 | 90,878 | 90,878 | 95,209 | 95,209 |
| Contingency (15%) | 13,295 | 13,295 | 13,295 | 13,945 | 13,945 |
| Eng. and Admi. (10%) | 10,193 | 10,193 | 10,193 | 10,691 | 10,691 |
| Sub Total | 114,366 | 114,366 | 114,366 | 119,845 | 119,845 |
| I.D.C (9.5%/Year) | 22,849 | 22,849 | 22,849 | 23,944 | 23,944 |
| Total | 137,215 | 137,215 | 137,215 | 143,789 | 143,789 |
| Hydraulic Equipment | 4,385 | 4,385 | 4,385 | 4,779 | 4,779 |
| Spillway | 856 | 856 | 856 | 856 | 856 |
| Outlet Works | 528 | 528 | 528 | 528 | 528 |
| Intake Gate | 763 | 763 | 763 | 763 | 763 |
| Penstock | 1,656 | 1,656 | 1,656 | 2,015 | 2,015 |
| Draft Gate | 122 | 122 | 122 | 122 | 122 |
| Tailrace Gate | 61 | 61 | 61 | 61 | 61 |
| Pre-Subtotal | 3,986 | 3,986 | 3,986 | 4,345 | 4,345 |
| Contingency (10%) | 399 | 399 | 399 | 434 | 434 |
| Electro-Mechanical Equipment | 13,956 | 13,956 | 13,956 | 14,501 | 14,501 |
| Equipment | 13,291 | 13,291 | 13,291 | 13,810 | 13,810 |
| Contingency (5%) | 665 | 665 | 665 | 691 | 691 |
| Eng. and Admi. (10%) | 1,834 | 1,834 | 1,834 | 1,928 | 1,928 |
| Sub Total | 20,175 | 20,175 | 20,175 | 21,268 | 21,268 |
| I.D.C (9.5%/Year) | 1,085 | 1,085 | 1,085 | 1,140 | 1,140 |
| Total | 21,259 | 21,259 | 21,259 | 22,348 | 22,348 |
| Grand Total | 158,474 | 158,474 | 158,474 | 166,137 | 166,137 |

Bağlık Project Tailrace Type Underground Powerhouse Layout Unit:10^3US$

| Description Dam Site Layout Type | Bağlık 740M P | Bağlık 740M P | Bağlık 740M P | Bağlık 740A | Bağlık 740A |
|---|---|---|---|---|---|
| High Water Level (m) | 570 | 570 | 570 | 550 | 550 |
| Reservoir Area (km^2) | 1.23 | 1.23 | 1.23 | 0.69 | 0.69 |
| Dam Volume (10^6m^3) | 680 | 680 | 680 | 420 | 420 |
| Dam Height (m) | 114 | 114 | 114 | 94 | 94 |
| Maximum Head (m) | 178 | 178 | 178 | 158 | 158 |
| Maximum Discharge (m^3/s) | 57 | 55 | 52 | 54 | 52 |
| Relocation Road | 9,603 | 9,603 | 9,603 | 8,043 | 8,043 |
| Camp Facilities | 800 | 800 | 800 | 800 | 800 |
| Land Acquisition | 598 | 598 | 598 | 598 | 598 |
| Civil Work | 52,185 | 51,810 | 51,402 | 38,098 | 37,783 |
| Diversion | 0 | 0 | 0 | 0 | 0 |
| Care of River | 0 | 0 | 0 | 0 | 0 |
| Dam | 34,813 | 34,813 | 34,813 | 21,502 | 21,502 |
| Spillway | 780 | 780 | 780 | 780 | 780 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 |
| Intake | 121 | 89 | 26 | 90 | 34 |
| Headrace Tunnel | 0 | 0 | 0 | 0 | 0 |
| Surge Tank | 0 | 0 | 0 | 0 | 0 |
| Penstock | 530 | 512 | 495 | 451 | 435 |
| Acces Tunnels | 2,478 | 2,478 | 2,478 | 2,478 | 2,478 |
| Power House | 3,982 | 3,692 | 3,906 | 3,641 | 3,641 |
| Tailrace Tunnel | 9,481 | 9,157 | 8,914 | 9,157 | 8,914 |
| Switchyard | 0 | 0 | 0 | 0 | 0 |
| Pre-Subtotal | 63,186 | 62,811 | 62,403 | 47,539 | 47,224 |
| Contingency (15%) | 9,388 | 9,332 | 9,271 | 7,041 | 6,994 |
| Eng. and Admi. (10%) | 7,198 | 7,155 | 7,108 | 5,398 | 5,362 |
| Sub Total | 79,771 | 79,298 | 78,781 | 59,979 | 59,580 |
| I.D.C (9.5%/Year) | 19,925 | 19,807 | 19,678 | 14,982 | 14,882 |
| Total | 99,697 | 99,105 | 98,460 | 74,960 | 74,462 |
| Hydraulic Equipment | 3,913 | 3,681 | 3,269 | 3,432 | 3,097 |
| Spillway | 870 | 870 | 870 | 870 | 870 |
| Outlet Works | 0 | 0 | 0 | 0 | 0 |
| Intake Gate | 514 | 378 | 112 | 383 | 145 |
| Penstock | 1,974 | 1,908 | 1,807 | 1,678 | 1,618 |
| Draft Gate | 133 | 126 | 121 | 126 | 121 |
| Tailrace Gate | 67 | 65 | 61 | 63 | 61 |
| Pre-Subtotal | 3,558 | 3,346 | 2,971 | 3,120 | 2,815 |
| Contingency (10%) | 356 | 335 | 297 | 312 | 282 |
| Electro-Mechanical Equipment | 21,528 | 21,747 | 22,513 | 20,450 | 20,669 |
| Equipment | 20,503 | 20,712 | 21,441 | 19,476 | 19,685 |
| Contingency (5%) | 1,025 | 1,036 | 1,072 | 974 | 984 |
| Eng. and Admi. (10%) | 2,544 | 2,543 | 2,578 | 2,388 | 2,377 |
| Sub Total | 27,986 | 27,971 | 28,360 | 26,271 | 26,142 |
| I.D.C (9.5%/Year) | 1,585 | 1,584 | 1,606 | 1,488 | 1,481 |
| Total | 29,571 | 29,555 | 29,966 | 27,759 | 27,623 |
| Grand Total | 129,268 | 128,660 | 128,426 | 102,719 | 102,085 |

## Table 9-15 Comparison Study on alternative Plan for Bağlık Reservoir Water Level

Bayram Project Tailrace Type Underground P/S Layout H.W.L.=740m L.W.L=688m With Bağlık L.W.L=527.56m by Mixed Alternative Thermal Power Plant

| Description Dam Site | Legend | Bayram 740M/P | Bağlık 740M/P | Total | Bayram 740M/P | Bağlık 740M/P | Total | Bayram 740M/P | Bağlık 740M/P | Total | Bayram 740A | Bağlık 740A | Total | Bayram 740A | Bağlık 740A | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hight Water Level | m | 740.00 | 570.00 | | 740.00 | 570.00 | | 740.00 | 570.00 | | 740 | 550.00 | | 740 | 550.00 | |
| Normal Water Level | m | 722.00 | 555.87 | | 722.00 | 563.33 | | 722.00 | 569.50 | | 722 | 538.50 | | 722 | 549.00 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 550.00 | | 686.00 | 569.00 | | 688 | 527.00 | | 688 | 548.00 | |
| Available Drawdown | m | 54.00 | 43.00 | | 54.00 | 20.00 | | 54.00 | 1.00 | | 54 | 23.00 | | 54 | 2.00 | |
| Gross Storage Capacity | $m^3*10^6$ | 133.00 | 36.40 | | 133.00 | 36.40 | | 133.00 | 36.40 | | 133 | 17.70 | | 133 | 17.70 | |
| Effective Storage Capacity | $m^3*10^6$ | 113.00 | 30.10 | | 113.00 | 18.70 | | 113.00 | 1.00 | | 113 | 11.40 | | 113 | 1.00 | |
| Dam Type | D | Rockfill | Con-gra | | Rockfill | Con-gra | | Rockfill | Con-gra | | Rockfill | Con-gra | | Rockfill | Con-gra | |
| Dam Hight | m | 145 | 114 | | 145 | 114 | | 145 | 114 | | 145 | 94 | | 145 | 94 | |
| Dam Volume | $m^3$ | 8,144 | 680 | | 8,144 | 680 | | 8,144 | 680 | | 8,144 | 420 | | 8,144 | 420 | |
| Tail Water Level | m | 570.00 | 392.00 | | 570.00 | 392.00 | | 570.00 | 392.00 | | 550.00 | 382.00 | | 550.00 | 382.00 | |
| Effective Head | m | 145.60 | 158.67 | | 145.60 | 165.73 | | 145.60 | 171.90 | | 163.90 | 140.90 | | 163.90 | 151.40 | |
| Maximum Discharge | $m^3/s$ | 43.00 | 57.00 | | 43.00 | 55.00 | | 43.00 | 52.00 | | 43.00 | 54.00 | | 43.00 | 52.00 | |
| Installed Capacity | MW | 54.00 | 78.00 | 132.00 | 54.00 | 79.00 | 133.00 | 54.00 | 77.00 | 131.00 | 60.00 | 66.00 | 126.00 | 60.00 | 68.00 | 128.00 |
| Firm Peak Power | MW | 44.80 | 67.60 | 112.40 | 44.80 | 75.46 | 120.26 | 44.80 | 75.00 | 119.80 | 51.40 | 59.80 | 111.20 | 51.40 | 67.58 | 118.98 |
| Energy Production | | | | | | | | | | | | | | | | |
| Average Energy | GWh | 198.50 | 282.13 | 480.63 | 198.50 | 290.40 | 488.90 | 198.50 | 288.62 | 487.12 | 223.30 | 250.50 | 473.80 | 223.30 | 252.15 | 475.45 |
| Firm Energy | GWh | 113.20 | 163.70 | 276.90 | 113.20 | 163.70 | 276.90 | 113.20 | 164.25 | 277.45 | 126.40 | 139.00 | 265.40 | 126.40 | 147.94 | 274.34 |
| Secondary Energy | GWh | 85.30 | 118.43 | 203.73 | 85.30 | 126.70 | 212.00 | 85.30 | 124.37 | 209.67 | 96.90 | 111.50 | 208.40 | 96.90 | 104.21 | 201.11 |
| Unit Benefit Value | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | US$/kW | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | US$/kWh | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | | 0.0270 | 0.0270 | |
| Secondary Energy | US$/kWh | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | | 0.0219 | 0.0218 | | 0.0219 | 0.0219 | | 0.0219 | 0.0219 | |
| Benefit | | | | | | | | | | | | | | | | |
| Firm Peak Power | US$*10^6 | 7.71 | 11.63 | 19.34 | 7.71 | 12.99 | 20.70 | 7.71 | 12.91 | 20.62 | 8.85 | 10.25 | 19.14 | 8.85 | 11.82 | 20.47 |
| Firm Energy | US$*10^6 | 3.00 | 4.34 | 7.35 | 3.00 | 4.34 | 7.35 | 3.00 | 4.36 | 7.38 | 3.35 | 3.69 | 7.04 | 3.35 | 3.93 | 7.28 |
| Secondary Energy | US$*10^6 | 1.84 | 2.56 | 4.39 | 1.84 | 2.73 | 4.56 | 1.84 | 2.68 | 4.51 | 2.09 | 2.40 | 4.49 | 2.09 | 2.24 | 4.33 |
| Total | US$*10^6 | 12.55 | 18.53 | 31.08 | 12.55 | 20.06 | 32.61 | 12.55 | 19.94 | 32.49 | 14.29 | 16.38 | 30.67 | 14.29 | 17.79 | 32.08 |
| Investment Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 137.21 | 99.70 | 236.91 | 137.21 | 99.10 | 236.32 | 137.21 | 56.46 | 236.67 | 143.79 | 74.96 | 218.75 | 143.79 | 74.46 | 218.25 |
| Hydro and Ele-Mech Eq | US$*10^6 | 21.26 | 29.57 | 50.83 | 21.26 | 29.56 | 50.81 | 21.26 | 29.97 | 51.23 | 22.35 | 27.74 | 50.13 | 22.35 | 27.62 | 49.97 |
| Total | US$*10^6 | 158.47 | 129.27 | 287.74 | 158.47 | 128.66 | 287.13 | 158.47 | 128.43 | 286.90 | 166.14 | 102.72 | 268.86 | 166.14 | 102.08 | 268.22 |
| Annual Cost | | | | | | | | | | | | | | | | |
| Civil Facilities | US$*10^6 | 13.86 | 10.07 | 23.93 | 13.86 | 10.01 | 23.87 | 13.86 | 9.94 | 23.80 | 14.52 | 7.67 | 22.20 | 14.52 | 7.52 | 22.04 |
| Hydro and Ele-Mech Eq | US$*10^6 | 2.42 | 3.37 | 5.79 | 2.42 | 3.37 | 5.79 | 2.42 | 3.42 | 5.84 | 2.55 | 3.16 | 5.71 | 2.55 | 3.15 | 5.70 |
| Total | US$*10^6 | 16.28 | 13.44 | 29.72 | 16.28 | 13.38 | 29.66 | 16.28 | 13.36 | 29.64 | 17.07 | 10.74 | 27.81 | 17.07 | 10.67 | 27.74 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -3.73 | 5.09 | 1.36 | -3.73 | 6.68 | 2.95 | -3.73 | 6.58 | 2.85 | -2.78 | 5.65 | 2.86 | -2.78 | 7.13 | 4.34 |
| Benefit Cost Ratio(B/C) | | 0.77 | 1.38 | 1.05 | 0.77 | 1.50 | 1.10 | 0.77 | 1.49 | 1.10 | 0.84 | 1.53 | 1.10 | 0.84 | 1.67 | 1.16 |
| Unit Annual Cost (Firm) | US$/kWh | 0.144 | 0.062 | 0.107 | 0.144 | 0.062 | 0.107 | 0.144 | 0.061 | 0.107 | 0.135 | 0.077 | 0.105 | 0.135 | 0.072 | 0.101 |
| Unit Annual Cost (Average) | US$/kWh | 0.082 | 0.048 | 0.062 | 0.082 | 0.046 | 0.061 | 0.082 | 0.046 | 0.061 | 0.076 | 0.043 | 0.059 | 0.076 | 0.042 | 0.058 |

## Table 9-17 Comparison Study on Optimum Installed Capacity

Tailrace Type Underground Powerhouse Layout Bayram H.W.L.=735m L.W.L.=686m-730m and Baglik H.W.L.=530m

| Description Dam Site | Layout | Bayram 6h Peak | Baglik 6h Peak | Total 6h Peak | Bayram 8h Peak | Baglik 8h Peak | Total 8h Peak |
|---|---|---|---|---|---|---|---|
| High Water Level | m | 740.00 | 530.00 | | 740.00 | 530.00 | |
| Normal Water Level | m | 722.00 | 528.50 | | 722.00 | 528.50 | |
| Low Water Level | m | 686.00 | 527.00 | | 686.00 | 527.00 | |
| Available Drawdown | m | 54.00 | 3.00 | | 54.00 | 3.00 | |
| Gross Storage Capacity | m^3*10^6 | 150.00 | 7.30 | | 133.00 | 7.30 | |
| Effective Storage Capacity | m^3*10^6 | 130.00 | 1.00 | | 113.00 | 1.00 | |
| Dam Type | 0 | Rockfill | Con-Gra. | | Rockfill | Con-Gra. | |
| Dam Hight | m | 145 | 74 | | 145 | 74 | |
| Dam Volume | m^3 | 6,144 | 195 | | 6,144 | 195 | |
| Tailwater Level | m | 530.00 | 392.00 | | 530.00 | 392.00 | |
| Effective Head | m | 182.90 | 130.90 | | 182.60 | 130.70 | |
| Maximum Discharge | m^3/s | 43.00 | 52.00 | | 32.00 | 39.00 | |
| Installed Capacity | MW | 68.00 | 59.00 | 127.00 | 50.00 | 44.00 | 94.00 |
| Firm Peak Power | MW | 58.00 | 56.40 | 114.40 | 43.10 | 41.60 | 84.70 |
| Energy Production | | | | | | | |
| Average Energy | GWh | 247.90 | 221.40 | 469.30 | 225.59 | 201.47 | 427.06 |
| Firm Energy | GWh | 141.40 | 124.20 | 265.60 | 141.40 | 124.20 | 265.60 |
| Secondary Energy | GWh | 106.50 | 97.20 | 203.70 | 84.19 | 77.27 | 161.46 |
| Unit Benefit Value | | 0.00 | 0.00 | | 0.00 | 0.00 | |
| Firm Peak Power | US$/kW | 180.45 | 180.45 | | 180.45 | 180.45 | |
| Firm Energy | US$/kWh | 0.027 | 0.027 | | 0.027 | 0.027 | |
| Secondary Energy | US$/kWh | 0.022 | 0.022 | | 0.022 | 0.022 | |
| Benefit | | | | | | | |
| Firm Peak Power | US$*10^6 | 9.98 | 9.71 | 19.69 | 7.42 | 7.16 | 14.58 |
| Firm Energy | US$*10^6 | 3.75 | 3.30 | 7.05 | 3.75 | 3.30 | 7.05 |
| Secondary Energy | US$*10^6 | 2.29 | 2.09 | 4.39 | 1.81 | 1.66 | 3.48 |
| Total | US$*10^6 | 16.03 | 15.09 | 31.12 | 12.98 | 12.12 | 25.10 |
| Investment Cost | | | | | | | |
| Civil Facilities | US$*10^6 | 147.74 | 53.78 | 201.51 | 146.60 | 49.07 | 195.67 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 24.32 | 25.69 | 50.01 | 20.06 | 22.21 | 42.27 |
| Total | US$*10^6 | 172.06 | 79.46 | 251.52 | 166.66 | 71.28 | 237.93 |
| Annual Cost | | | | | | | |
| Civil Facilities | US$*10^6 | 14.92 | 5.43 | 20.35 | 14.81 | 4.96 | 19.76 |
| Hydrau. and Ele.-Mech.Eq. | US$*10^6 | 2.77 | 2.93 | 5.70 | 2.29 | 2.53 | 4.82 |
| Total | US$*10^6 | 17.69 | 8.36 | 26.05 | 17.09 | 7.49 | 24.58 |
| Annual Surplus Benefit(B-C) | US$*10^6 | -1.67 | 6.74 | 5.07 | -4.11 | 4.63 | 0.52 |
| Benefit Cost Ratio(B/C) | | 0.91 | 1.81 | 1.19 | 0.76 | 1.62 | 1.02 |
| Unit Annual Cost (Firm) | US$/kWh | 0.125 | 0.067 | 0.098 | 0.121 | 0.060 | 0.093 |
| Unit Annual Cost (Average) | US$/kWh | 0.071 | 0.038 | 0.056 | 0.076 | 0.037 | 0.058 |

**Table 9-18 Outline of Optimum Development Plan of Çoruh-Berta Project**

| | Unit | Bayram Project | Bağlık Project | Total |
|---|---|---|---|---|
| Reservoir | | | | |
| Catchment Area | $km^2$ | 1,159 | 1,509 | |
| Annual Inflow | $m^3/s$ | 19.20 | 24.90 | |
| High Water Level | m | 740.00 | 530.00 | |
| Normal Water Level | m | 722.00 | 528.50 | |
| Low Water Level | m | 686.00 | 527.00 | |
| Available Drawdown | m | 54.00 | 3.00 | |
| Gross Capacity | $10^6m^3$ | 133.00 | 7.30 | |
| Effective Capacity | $10^6m^3$ | 113.00 | 1.00 | |
| Surface Area | $10^6m^2$ | 3.38 | 0.37 | |
| Dam | | | | |
| Type | | Rockfill | Con-Gra | |
| Height from Foundation | m | 145 | 74 | |
| Crest Length | m | 415 | 190 | |
| Volume | $10^3m^3$ | 6,147 | 195 | |
| Penstock | | | | |
| Type | | Tunnel | Tunnel | |
| Diameters | m | 3.3 | 3.6 | |
| Length | m | 321 | 213 | |
| Powerhouse | | | | |
| Type | | Underground | Underground | |
| Tailrace Tunnel | | | | |
| Type | | Horseshoe | Horseshoe | |
| Diameters | m | 4.6 | 4.9 | |
| Length (Tunnel) | m | 7,930 | 4,454 | |
| Tail Water Level | m | 530.00 | 392.00 | |
| Gross Head | | | | |
| Maximum Head | m | 210.00 | 138.00 | |
| Normal Head | m | 192.00 | 136.50 | |
| Minimum Head | m | 156.00 | 135.00 | |
| Loss of Head | m | 9.10 | 5.60 | |
| Effective Head | | | | |
| Maximum | m | 200.90 | 132.40 | |
| Normal | m | 182.90 | 130.90 | |
| Minimum | m | 146.90 | 129.40 | |
| Firm Discharge | $m^3/s$ | 10.70 | 13.00 | |
| Maximum Discharge | $m^3/s$ | 43.00 | 52.00 | |
| Installed Capacity | MW | 68 | 59 | 127 |
| Number of Unit | | 1 | 1 | |
| Firm Peak Power | MW | 57.60 | 56.2 | 113.8 |
| Annual Energy | | | | |
| Average | GWh | 250.4 | 225.8 | 476.2 |
| Firm | GWh | 144.9 | 128.4 | 273.3 |
| Secondary | GWh | 105.5 | 97.5 | 203.0 |
| Investment Cost | ($10^6$US$) | 172.1 | 79.5 | 251.5 |
| Annual Surplus Benefit | ($10^6$US$) | -1.66 | 6.82 | 5.15 |
| Benefit - Cost Ratio | | 0.91 | 1.82 | 1.20 |
| Unit Energy Cost | (US$/kWh) | 0.071 | 0.037 | 0.055 |

**Table 9-19 Cost Estimate of Optimum Development Plan of Çoruh-Berta Project**

Unit: $10^3$US$

| Description | Bayram Project | Bağlık Project | Total |
|---|---|---|---|
| Relocation Road | 11,655 | 6,759 | |
| Camp Facilities | 800 | 800 | |
| Land Acquisition | 2,242 | 598 | |
| Civil Work | 83,113 | 25,984 | |
| Diversion | 2,421 | 0 | |
| Care of River | 1,082 | 0 | |
| Dam | 47,281 | 9,983 | |
| Spillway | 7,523 | 780 | |
| Outlet Works | 1,018 | 0 | |
| Intake*-1 | 1,087 | 40 | |
| Headrace Tunnel | 0 | 0 | |
| Surge Tank | 0 | 0 | |
| Penstock*-2 | 546 | 376 | |
| Access Tunnels*-3 | 3,980 | 2,478 | |
| Power House*-4 | 3,049 | 3,413 | |
| Tailrace | 14,965 | 8,914 | |
| Switchyard | 161 | 0 | |
| Pre-Subtotal | 97,810 | 34,141 | |
| Contingency (15%) | 14,335 | 5,031 | |
| Eng. and Admi. (10%) | 10,990 | 3,857 | |
| Sub Total | 123,136 | 43,030 | |
| I.D.C. (9.5%/year) | 24,601 | 10,748 | |
| Total | 147,737 | 58,778 | 206,515 |
| Hydraulic Equip. | 5,203 | 2,884 | |
| Spillway | 856 | 870 | |
| Outlet Works | 528 | 0 | |
| Intake Gate | 763 | 170 | |
| Penstock | 2,400 | 1,400 | |
| Draft Gate | 122 | 121 | |
| Tailrace Gate | 61 | 61 | |
| Pre-Subtotal | 4,730 | 2,622 | |
| Contingency (10%) | 473 | 262 | |
| Electro-Mechanical Equip.*-5 | 15,780 | 19,216 | |
| Equipment | 15,027 | 18,301 | |
| Contingency (5%) | 751 | 915 | |
| Eng. And Admi. (10%) | 2,098 | 2,210 | |
| Sub Total | 23,082 | 24,310 | |
| I.D.C. (9.5%/year) | 1,241 | 1,377 | |
| Total | 24,323 | 25,867 | 50,190 |
| Grand Total | 172,060 | 79,464 | 251,524 |

*-1: including Intake Adit
*-2: including Penstock Adit
*-3: including Cable Tunnel and Tailrace Adit
*-4: including Drainage Tunnel, Surge Chamber and Surge Chamber Access Tunnel
*-5: including Transmission Line

## Table 9-20 Reservoir Operation of Bayram Project

Unit $10^6 m^3$

| | Year | Inflow | Evaporation | Power Discharge | Environment Discharge | Spill | Total Outflow |
|---|---|---|---|---|---|---|---|
| 1 | 1942 | 998.64 | 2.82 | 719.10 | 3.97 | 243.33 | 969.22 |
| 2 | 1943 | 549.41 | 2.73 | 551.56 | 3.97 | 0.00 | 558.27 |
| 3 | 1944 | 803.53 | 2.70 | 636.47 | 3.97 | 154.57 | 797.71 |
| 4 | 1945 | 457.91 | 2.65 | 468.71 | 3.97 | 0.00 | 475.32 |
| 5 | 1946 | 525.01 | 2.58 | 502.90 | 3.97 | 0.00 | 509.46 |
| 6 | 1947 | 406.79 | 2.57 | 430.93 | 3.97 | 0.00 | 437.47 |
| 7 | 1948 | 512.54 | 2.51 | 486.49 | 3.97 | 0.00 | 492.98 |
| 8 | 1949 | 389.08 | 2.49 | 397.35 | 3.97 | 0.00 | 403.82 |
| 9 | 1950 | 464.57 | 2.46 | 450.70 | 3.97 | 0.00 | 457.13 |
| 10 | 1951 | 458.18 | 2.57 | 442.51 | 3.97 | 0.00 | 449.05 |
| 11 | 1952 | 557.13 | 2.68 | 552.22 | 3.97 | 0.00 | 558.87 |
| 12 | 1953 | 463.30 | 2.54 | 450.80 | 3.97 | 0.00 | 457.31 |
| 13 | 1954 | 628.09 | 2.66 | 598.47 | 3.97 | 19.74 | 624.83 |
| 14 | 1955 | 296.56 | 2.39 | 338.58 | 3.97 | 0.00 | 344.94 |
| 15 | 1956 | 421.05 | 2.35 | 382.20 | 3.97 | 0.00 | 388.52 |
| 16 | 1957 | 478.52 | 2.49 | 470.73 | 3.97 | 0.00 | 477.19 |
| 17 | 1958 | 471.40 | 2.52 | 464.70 | 3.97 | 0.00 | 471.18 |
| 18 | 1959 | 552.19 | 2.56 | 534.24 | 3.97 | 0.00 | 540.77 |
| 19 | 1960 | 895.78 | 2.83 | 712.87 | 3.97 | 173.19 | 892.86 |
| 20 | 1961 | 369.76 | 2.48 | 404.57 | 3.97 | 0.00 | 411.02 |
| 21 | 1962 | 551.52 | 2.42 | 518.96 | 3.97 | 0.00 | 525.36 |
| 22 | 1963 | 914.65 | 2.65 | 666.12 | 3.97 | 223.16 | 895.90 |
| 23 | 1964 | 617.20 | 2.67 | 599.86 | 3.97 | 24.67 | 631.17 |
| 24 | 1965 | 643.13 | 2.64 | 651.25 | 3.97 | 1.82 | 659.68 |
| 25 | 1966 | 614.92 | 2.61 | 595.66 | 3.97 | 7.20 | 609.44 |
| 26 | 1967 | 571.85 | 2.51 | 523.54 | 3.97 | 14.44 | 544.46 |
| 27 | 1968 | 1,139.87 | 2.85 | 740.53 | 3.97 | 389.40 | 1,136.75 |
| 28 | 1969 | 571.95 | 2.65 | 578.12 | 3.97 | 24.88 | 609.62 |
| 29 | 1970 | 476.69 | 2.55 | 461.20 | 3.97 | 0.00 | 467.72 |
| 30 | 1971 | 600.41 | 2.66 | 583.48 | 3.97 | 0.00 | 590.11 |
| 31 | 1972 | 642.03 | 2.67 | 614.86 | 3.97 | 12.66 | 634.16 |
| 32 | 1973 | 567.68 | 2.63 | 573.73 | 3.97 | 3.29 | 583.62 |
| 33 | 1974 | 472.67 | 2.50 | 465.15 | 3.97 | 0.00 | 471.63 |
| 34 | 1975 | 519.29 | 2.50 | 517.89 | 3.97 | 0.00 | 524.36 |
| 35 | 1976 | 690.13 | 2.56 | 597.28 | 3.97 | 72.54 | 676.35 |
| 36 | 1977 | 535.96 | 2.64 | 532.77 | 3.97 | 0.00 | 539.38 |
| 37 | 1978 | 683.62 | 2.64 | 618.08 | 3.97 | 54.10 | 678.78 |
| 38 | 1979 | 618.21 | 2.63 | 603.55 | 3.97 | 14.11 | 624.26 |
| 39 | 1980 | 635.32 | 2.69 | 592.24 | 3.97 | 39.33 | 638.23 |
| 40 | 1981 | 579.29 | 2.60 | 524.79 | 3.97 | 38.54 | 569.90 |
| 41 | 1982 | 455.55 | 2.63 | 454.67 | 3.97 | 0.00 | 461.27 |
| 42 | 1983 | 583.47 | 2.57 | 595.99 | 3.97 | 0.00 | 602.53 |
| 43 | 1984 | 552.32 | 2.56 | 530.36 | 3.97 | 0.00 | 536.90 |
| 44 | 1985 | 577.63 | 2.55 | 523.51 | 3.97 | 54.25 | 584.28 |
| 45 | 1986 | 677.79 | 2.64 | 646.56 | 3.97 | 26.28 | 679.45 |
| 46 | 1987 | 720.80 | 2.60 | 570.16 | 3.97 | 131.83 | 708.55 |
| 47 | 1988 | 975.42 | 2.77 | 700.15 | 3.97 | 245.93 | 952.83 |
| 48 | 1989 | 992.47 | 2.87 | 698.96 | 3.97 | 320.75 | 1,026.55 |
| 49 | 1990 | 593.79 | 2.51 | 560.00 | 3.97 | 24.35 | 590.83 |
| 50 | 1991 | 524.41 | 2.56 | 519.39 | 3.97 | 0.00 | 525.92 |
| 51 | 1992 | 643.85 | 2.48 | 560.75 | 3.97 | 61.61 | 628.80 |
| 52 | 1993 | 861.65 | 2.82 | 685.73 | 3.97 | 172.86 | 865.37 |
| 53 | 1994 | 601.54 | 2.70 | 605.54 | 3.97 | 1.95 | 614.15 |
| | Total | 32,106.39 | 138.15 | 29,206.82 | 210.64 | 2,550.77 | 32,106.37 |
| | Ave. | 605.78 | 2.61 | 551.07 | 3.97 | 48.13 | 605.78 |
| | Max. | 1,139.87 | 2.87 | 740.53 | 3.97 | 389.40 | 1,136.75 |
| | Min. | 296.56 | 2.35 | 338.58 | 3.97 | 0.00 | 344.94 |

## Table 9-21 Total Energy Production of Bayram Project

Unit: GWh

| NO. | YEAR | < OCT > | < NOV > | < DEC > | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1942 | 13.12 | 16.85 | 16.39 | 14.46 | 27.76 | 46.05 | 48.96 | 50.59 | 48.96 | 27.83 | 14.00 | 13.34 | 338.31 |
| 2 | 1943 | 13.72 | 13.31 | 15.18 | 13.79 | 19.37 | 33.09 | 31.46 | 36.09 | 32.06 | 20.46 | 13.79 | 13.21 | 255.53 |
| 3 | 1944 | 13.46 | 12.88 | 13.19 | 13.02 | 11.60 | 33.18 | 30.58 | 50.59 | 48.96 | 38.55 | 13.82 | 13.30 | 293.14 |
| 4 | 1945 | 13.58 | 12.98 | 13.22 | 12.91 | 11.32 | 12.30 | 22.02 | 32.56 | 38.01 | 19.55 | 13.73 | 13.03 | 215.19 |
| 5 | 1946 | 13.13 | 12.40 | 12.43 | 12.04 | 10.50 | 11.28 | 19.93 | 37.06 | 46.95 | 25.24 | 14.77 | 13.29 | 227.04 |
| 6 | 1947 | 13.66 | 13.16 | 13.42 | 13.18 | 12.12 | 35.94 | 27.95 | 12.86 | 13.08 | 13.69 | 13.49 | 12.71 | 195.23 |
| 7 | 1948 | 12.76 | 12.16 | 12.39 | 12.01 | 10.48 | 11.16 | 19.67 | 36.45 | 46.94 | 16.97 | 13.73 | 13.08 | 217.81 |
| 8 | 1949 | 13.26 | 12.56 | 12.63 | 12.12 | 10.43 | 11.10 | 11.13 | 28.08 | 25.74 | 13.77 | 13.57 | 12.81 | 177.19 |
| 9 | 1950 | 12.87 | 12.03 | 11.89 | 11.22 | 9.40 | 10.03 | 20.88 | 36.45 | 26.73 | 18.00 | 13.72 | 12.99 | 196.19 |
| 10 | 1951 | 13.15 | 12.55 | 12.71 | 12.32 | 11.09 | 11.51 | 23.16 | 24.27 | 34.41 | 17.23 | 13.73 | 13.10 | 199.23 |
| 11 | 1952 | 13.51 | 13.15 | 13.50 | 13.30 | 11.85 | 28.32 | 40.79 | 32.92 | 35.03 | 23.95 | 13.76 | 13.11 | 253.19 |
| 12 | 1953 | 13.22 | 12.45 | 12.43 | 11.85 | 10.14 | 10.57 | 11.28 | 34.87 | 37.39 | 20.72 | 13.76 | 13.18 | 201.87 |
| 13 | 1954 | 13.40 | 12.72 | 12.85 | 12.44 | 10.87 | 12.77 | 40.24 | 50.59 | 48.96 | 31.32 | 13.81 | 13.25 | 273.21 |
| 14 | 1955 | 13.47 | 12.78 | 12.90 | 12.48 | 11.18 | 11.52 | 11.33 | 12.80 | 13.09 | 13.55 | 13.18 | 12.27 | 150.54 |
| 15 | 1956 | 12.01 | 10.87 | 9.99 | 3.78 | 5.37 | 7.65 | 10.89 | 23.29 | 36.03 | 19.30 | 13.71 | 12.99 | 165.69 |
| 16 | 1957 | 13.05 | 12.21 | 12.03 | 11.28 | 9.41 | 10.38 | 17.68 | 33.53 | 41.73 | 19.94 | 13.72 | 13.01 | 207.97 |
| 17 | 1958 | 13.10 | 12.33 | 12.33 | 11.78 | 10.09 | 10.87 | 19.90 | 34.87 | 37.39 | 17.49 | 13.70 | 13.00 | 206.84 |
| 18 | 1959 | 13.12 | 12.37 | 12.40 | 11.94 | 10.66 | 11.16 | 24.02 | 45.95 | 47.93 | 23.89 | 13.79 | 13.20 | 240.23 |
| 19 | 1960 | 13.50 | 12.99 | 13.27 | 13.22 | 23.86 | 50.59 | 48.96 | 50.59 | 48.96 | 32.09 | 14.00 | 13.28 | 335.32 |
| 20 | 1961 | 13.46 | 12.75 | 12.84 | 12.34 | 10.57 | 11.22 | 20.37 | 22.57 | 24.74 | 13.72 | 13.39 | 12.47 | 180.45 |
| 21 | 1962 | 12.27 | 11.22 | 11.06 | 10.43 | 6.80 | 10.65 | 38.07 | 42.78 | 37.02 | 18.39 | 13.70 | 12.98 | 225.58 |
| 22 | 1963 | 13.10 | 12.38 | 12.44 | 12.07 | 10.97 | 11.57 | 47.62 | 50.59 | 48.96 | 50.59 | 21.36 | 13.31 | 304.98 |
| 23 | 1964 | 13.58 | 12.95 | 13.14 | 12.86 | 11.36 | 20.88 | 43.98 | 50.59 | 48.96 | 18.91 | 13.73 | 13.07 | 273.99 |
| 24 | 1965 | 13.37 | 12.85 | 13.19 | 13.06 | 11.57 | 38.03 | 47.40 | 50.59 | 48.96 | 21.75 | 13.65 | 12.81 | 297.24 |
| 25 | 1966 | 13.00 | 12.67 | 13.09 | 12.95 | 11.65 | 29.32 | 40.68 | 50.59 | 43.65 | 17.36 | 13.67 | 12.88 | 271.32 |
| 26 | 1967 | 12.88 | 11.69 | 11.56 | 10.63 | 4.98 | 9.06 | 12.48 | 50.59 | 44.58 | 36.87 | 15.16 | 13.33 | 234.02 |
| 27 | 1968 | 13.63 | 13.06 | 18.84 | 16.01 | 25.36 | 49.14 | 48.96 | 50.59 | 48.96 | 34.80 | 16.06 | 13.36 | 348.79 |
| 28 | 1969 | 13.75 | 13.22 | 13.56 | 13.34 | 11.76 | 30.36 | 45.40 | 50.59 | 31.95 | 13.76 | 13.51 | 12.71 | 263.90 |
| 29 | 1970 | 13.02 | 12.60 | 12.82 | 12.55 | 11.13 | 21.67 | 42.33 | 24.15 | 15.32 | 13.77 | 13.57 | 12.86 | 205.81 |
| 30 | 1971 | 13.26 | 12.90 | 13.24 | 13.04 | 12.03 | 34.43 | 28.17 | 50.59 | 45.23 | 16.84 | 13.80 | 13.16 | 266.69 |
| 31 | 1972 | 13.29 | 12.65 | 12.94 | 12.75 | 11.25 | 18.89 | 48.69 | 50.59 | 48.96 | 25.24 | 13.75 | 13.18 | 282.20 |
| 32 | 1973 | 13.48 | 12.90 | 13.13 | 12.83 | 11.40 | 21.00 | 29.26 | 48.39 | 48.96 | 24.47 | 13.71 | 12.97 | 262.50 |
| 33 | 1974 | 13.05 | 12.38 | 12.53 | 12.11 | 10.44 | 11.50 | 17.78 | 49.60 | 28.84 | 13.76 | 13.51 | 12.85 | 208.35 |
| 34 | 1975 | 13.05 | 12.26 | 12.20 | 11.64 | 10.31 | 10.88 | 43.87 | 36.45 | 36.40 | 14.00 | 13.66 | 12.87 | 227.59 |
| 35 | 1976 | 13.00 | 12.31 | 12.28 | 11.75 | 10.14 | 11.15 | 41.14 | 50.59 | 48.96 | 29.76 | 13.75 | 13.12 | 267.96 |
| 36 | 1977 | 13.43 | 12.92 | 13.15 | 12.86 | 11.30 | 17.39 | 29.15 | 46.44 | 40.12 | 19.68 | 13.73 | 13.06 | 243.24 |
| 37 | 1978 | 13.26 | 12.64 | 12.79 | 12.38 | 10.90 | 19.34 | 44.74 | 50.59 | 48.96 | 28.21 | 13.79 | 13.17 | 280.79 |
| 38 | 1979 | 13.33 | 12.65 | 12.84 | 12.62 | 11.68 | 22.35 | 34.09 | 50.59 | 48.96 | 29.12 | 13.76 | 13.08 | 275.08 |
| 39 | 1980 | 13.21 | 12.75 | 13.26 | 13.16 | 11.72 | 34.07 | 48.96 | 50.59 | 34.20 | 13.83 | 13.71 | 13.00 | 272.45 |
| 40 | 1981 | 13.14 | 12.51 | 12.71 | 12.39 | 10.84 | 12.08 | 23.99 | 38.77 | 48.96 | 26.66 | 13.76 | 13.14 | 238.95 |
| 41 | 1982 | 13.36 | 12.73 | 13.01 | 12.85 | 11.40 | 17.08 | 32.23 | 31.95 | 17.68 | 16.97 | 13.75 | 13.08 | 206.08 |
| 42 | 1983 | 13.27 | 12.70 | 12.85 | 12.44 | 11.23 | 20.78 | 46.60 | 50.59 | 46.53 | 15.29 | 13.62 | 12.72 | 268.64 |
| 43 | 1984 | 12.78 | 12.40 | 12.85 | 12.56 | 11.02 | 25.18 | 34.86 | 38.16 | 29.33 | 22.40 | 13.74 | 13.03 | 238.31 |
| 44 | 1985 | 13.02 | 12.17 | 12.07 | 11.43 | 9.72 | 11.02 | 48.96 | 50.59 | 25.82 | 13.74 | 13.47 | 12.77 | 234.79 |
| 45 | 1986 | 13.20 | 12.87 | 13.24 | 13.07 | 11.67 | 34.16 | 47.86 | 50.59 | 48.96 | 24.47 | 13.65 | 12.84 | 296.58 |
| 46 | 1987 | 12.90 | 12.10 | 11.96 | 11.37 | 10.69 | 11.83 | 48.96 | 50.59 | 48.96 | 13.75 | 13.55 | 12.96 | 259.62 |
| 47 | 1988 | 13.24 | 12.61 | 12.80 | 12.57 | 11.32 | 45.67 | 48.96 | 50.59 | 48.96 | 34.42 | 17.74 | 15.32 | 324.20 |
| 48 | 1989 | 22.74 | 19.18 | 17.29 | 13.79 | 21.09 | 50.59 | 48.96 | 50.59 | 48.96 | 15.42 | 13.64 | 12.83 | 335.09 |
| 49 | 1990 | 12.92 | 12.15 | 12.08 | 11.40 | 9.57 | 10.82 | 37.69 | 50.59 | 43.45 | 21.23 | 13.67 | 12.90 | 248.49 |
| 50 | 1991 | 13.02 | 12.52 | 12.88 | 12.58 | 11.41 | 30.86 | 46.49 | 22.12 | 28.09 | 15.16 | 13.69 | 12.90 | 231.71 |
| 51 | 1992 | 12.88 | 11.93 | 11.71 | 11.01 | 8.81 | 9.99 | 34.69 | 45.22 | 48.96 | 23.30 | 13.77 | 13.15 | 245.43 |
| 52 | 1993 | 15.98 | 24.68 | 13.78 | 13.68 | 16.39 | 39.99 | 48.96 | 50.59 | 48.96 | 22.66 | 13.74 | 13.08 | 322.49 |
| 53 | 1994 | 13.22 | 12.78 | 13.33 | 13.24 | 11.89 | 45.12 | 48.96 | 50.59 | 30.57 | 13.79 | 13.62 | 12.86 | 279.97 |
| | TOTAL | 711.20 | 688.07 | 688.61 | 654.88 | 631.84 | 1167.52 | 1832.16 | 2224.02 | 2093.02 | 1147.44 | 742.17 | 691.99 | 13272.91 |
| | AVE | 13.42 | 12.98 | 12.99 | 12.36 | 11.92 | 22.03 | 34.57 | 41.96 | 39.49 | 21.65 | 14.00 | 13.06 | 250.43 |
| | MAX | 22.74 | 24.68 | 18.84 | 16.01 | 27.76 | 50.59 | 48.96 | 50.59 | 48.96 | 50.59 | 21.36 | 15.32 | 348.79 |
| | MIN | 12.01 | 10.87 | 9.99 | 3.78 | 4.98 | 7.65 | 10.89 | 12.80 | 13.08 | 13.55 | 13.18 | 12.27 | 150.54 |

## Table 9-22 Firm Energy Production of Bayram Project

Unit: GWh

| NO. | YEAR | < OCT > | < NOV > | < DEC > | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1942 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| 2 | 1943 | 12.65 | 12.24 | 12.65 | 12.65 | 11.83 | 12.65 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.71 |
| 3 | 1944 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.35 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.00 |
| 4 | 1945 | 12.65 | 12.24 | 12.65 | 12.65 | 11.32 | 11.98 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.53 |
| 5 | 1946 | 12.65 | 12.24 | 12.42 | 11.87 | 10.18 | 10.79 | 11.16 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 143.73 |
| 6 | 1947 | 12.65 | 12.24 | 12.65 | 12.65 | 11.83 | 12.42 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 149.47 |
| 7 | 1948 | 12.65 | 12.16 | 12.36 | 11.82 | 10.15 | 10.63 | 11.00 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 143.20 |
| 8 | 1949 | 12.65 | 12.24 | 12.63 | 11.97 | 10.09 | 10.55 | 10.75 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 143.29 |
| 9 | 1950 | 12.65 | 12.00 | 11.64 | 10.71 | 8.68 | 9.11 | 10.61 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 137.82 |
| 10 | 1951 | 12.65 | 12.24 | 12.65 | 12.25 | 10.85 | 11.11 | 11.29 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 145.46 |
| 11 | 1952 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.62 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.27 |
| 12 | 1953 | 12.65 | 12.24 | 12.42 | 11.59 | 9.69 | 9.83 | 10.68 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 141.53 |
| 13 | 1954 | 12.65 | 12.24 | 12.65 | 12.43 | 10.70 | 11.64 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 146.34 |
| 14 | 1955 | 12.65 | 12.24 | 12.65 | 12.48 | 10.98 | 11.13 | 11.02 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 145.57 |
| 15 | 1956 | 11.79 | 10.37 | 9.47 | 3.78 | 5.37 | 7.45 | 10.42 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 121.07 |
| 16 | 1957 | 12.65 | 12.21 | 11.85 | 10.79 | 8.70 | 9.58 | 10.91 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 139.11 |
| 17 | 1958 | 12.65 | 12.24 | 12.27 | 11.49 | 9.62 | 10.23 | 10.99 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 141.92 |
| 18 | 1959 | 12.65 | 12.24 | 12.37 | 11.72 | 10.25 | 10.83 | 11.20 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 143.47 |
| 19 | 1960 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| 20 | 1961 | 12.65 | 12.24 | 12.65 | 12.29 | 10.28 | 10.71 | 11.08 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 144.31 |
| 21 | 1962 | 12.16 | 10.85 | 10.49 | 9.64 | 6.80 | 10.22 | 11.46 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 134.04 |
| 22 | 1963 | 12.65 | 12.24 | 12.43 | 11.90 | 10.68 | 11.21 | 11.91 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 145.45 |
| 23 | 1964 | 12.65 | 12.24 | 12.65 | 12.65 | 11.34 | 12.02 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.59 |
| 24 | 1965 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.26 | 11.86 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.15 |
| 25 | 1966 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.47 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.11 |
| 26 | 1967 | 12.65 | 11.80 | 11.19 | 9.92 | 4.98 | 9.06 | 10.49 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 132.50 |
| 27 | 1968 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| 28 | 1969 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.44 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.09 |
| 29 | 1970 | 12.65 | 12.24 | 12.65 | 12.55 | 11.08 | 11.94 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.15 |
| 30 | 1971 | 12.65 | 12.24 | 12.65 | 12.65 | 11.83 | 12.38 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.43 |
| 31 | 1972 | 12.65 | 12.24 | 12.65 | 12.65 | 11.25 | 11.97 | 12.17 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.01 |
| 32 | 1973 | 12.65 | 12.24 | 12.65 | 12.65 | 11.40 | 12.18 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.80 |
| 33 | 1974 | 12.65 | 12.24 | 12.53 | 11.95 | 10.10 | 11.10 | 11.48 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 144.48 |
| 34 | 1975 | 12.65 | 12.24 | 12.09 | 11.29 | 9.76 | 10.25 | 11.10 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 141.81 |
| 35 | 1976 | 12.65 | 12.24 | 12.20 | 11.45 | 9.68 | 10.63 | 11.26 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 142.52 |
| 36 | 1977 | 12.65 | 12.24 | 12.65 | 12.65 | 11.30 | 11.99 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.52 |
| 37 | 1978 | 12.65 | 12.24 | 12.65 | 12.35 | 10.75 | 11.75 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 146.43 |
| 38 | 1979 | 12.65 | 12.24 | 12.65 | 12.62 | 11.68 | 12.09 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.97 |
| 39 | 1980 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.46 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.73 |
| 40 | 1981 | 12.65 | 12.24 | 12.65 | 12.36 | 10.67 | 11.61 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 146.22 |
| 41 | 1982 | 12.65 | 12.24 | 12.65 | 12.65 | 11.40 | 12.09 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.72 |
| 42 | 1983 | 12.65 | 12.24 | 12.65 | 12.43 | 11.04 | 11.57 | 11.66 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 146.67 |
| 43 | 1984 | 12.65 | 12.24 | 12.65 | 12.56 | 10.92 | 11.76 | 11.62 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 146.82 |
| 44 | 1985 | 12.65 | 12.17 | 11.90 | 11.00 | 9.11 | 10.45 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 141.96 |
| 45 | 1986 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.44 | 11.97 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.45 |
| 46 | 1987 | 12.65 | 12.10 | 11.75 | 10.92 | 10.29 | 11.57 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 143.96 |
| 47 | 1988 | 12.65 | 12.24 | 12.65 | 12.57 | 11.32 | 12.20 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.28 |
| 48 | 1989 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| 49 | 1990 | 12.65 | 12.15 | 11.91 | 10.97 | 8.92 | 10.17 | 11.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 140.43 |
| 50 | 1991 | 12.65 | 12.24 | 12.65 | 12.58 | 11.30 | 11.77 | 11.63 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 147.23 |
| 51 | 1992 | 12.65 | 11.66 | 11.39 | 10.43 | 8.43 | 9.06 | 10.66 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 136.90 |
| 52 | 1993 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| 53 | 1994 | 12.65 | 12.24 | 12.65 | 12.65 | 11.42 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| | TOTAL | 668.99 | 646.00 | 655.31 | 632.93 | 555.06 | 604.39 | 611.51 | 670.34 | 648.72 | 670.34 | 670.34 | 648.72 | 7680.62 |
| | AVE | 12.62 | 12.15 | 12.36 | 11.94 | 10.47 | 11.40 | 11.54 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 144.92 |
| | MAX | 12.65 | 12.24 | 12.65 | 12.65 | 11.83 | 12.65 | 12.24 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 148.92 |
| | MIN | 11.79 | 10.37 | 9.47 | 3.78 | 4.98 | 7.45 | 10.42 | 12.65 | 12.24 | 12.65 | 12.65 | 12.24 | 121.07 |

## Table 9-23 Peak Power of Bayram Project

Unit: MW

| NO. | YEAR | < OCT > | < NOV > | < DEC > | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < AVE > |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1942 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| 2 | 1943 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.72 |
| 3 | 1944 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.39 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.58 |
| 4 | 1945 | 68.00 | 68.00 | 68.00 | 68.00 | 67.39 | 64.41 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.36 |
| 5 | 1946 | 68.00 | 68.00 | 66.76 | 63.79 | 60.61 | 58.02 | 61.98 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.63 |
| 6 | 1947 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.76 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.61 |
| 7 | 1948 | 68.00 | 67.56 | 66.46 | 63.56 | 60.42 | 57.15 | 61.12 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.39 |
| 8 | 1949 | 68.00 | 68.00 | 67.88 | 64.36 | 60.04 | 56.71 | 59.73 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.43 |
| 9 | 1950 | 68.00 | 66.68 | 62.57 | 57.58 | 51.64 | 48.99 | 58.92 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 62.93 |
| 10 | 1951 | 68.00 | 68.00 | 68.00 | 65.88 | 62.35 | 59.75 | 62.70 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.24 |
| 11 | 1952 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.83 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.70 |
| 12 | 1953 | 68.00 | 68.00 | 66.76 | 62.34 | 57.69 | 52.83 | 59.35 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 64.62 |
| 13 | 1954 | 68.00 | 68.00 | 68.00 | 66.81 | 63.69 | 62.56 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.82 |
| 14 | 1955 | 68.00 | 68.00 | 68.00 | 67.11 | 63.12 | 59.81 | 61.22 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.29 |
| 15 | 1956 | 63.37 | 57.59 | 50.89 | 20.31 | 31.98 | 40.07 | 57.90 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 55.28 |
| 16 | 1957 | 68.00 | 67.82 | 63.69 | 58.02 | 51.76 | 51.51 | 60.61 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 63.52 |
| 17 | 1958 | 68.00 | 68.00 | 65.94 | 61.78 | 57.27 | 55.02 | 61.08 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 64.80 |
| 18 | 1959 | 68.00 | 68.00 | 66.48 | 63.09 | 58.91 | 57.15 | 62.21 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.33 |
| 19 | 1960 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| 20 | 1961 | 68.00 | 68.00 | 68.00 | 66.05 | 61.17 | 57.60 | 61.55 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.90 |
| 21 | 1962 | 65.36 | 60.29 | 56.39 | 51.85 | 40.49 | 54.96 | 63.65 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 61.21 |
| 22 | 1963 | 68.00 | 68.00 | 66.85 | 63.97 | 61.40 | 60.25 | 66.18 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.23 |
| 23 | 1964 | 68.00 | 68.00 | 68.00 | 68.00 | 67.48 | 64.66 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.39 |
| 24 | 1965 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.89 | 65.87 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.65 |
| 25 | 1966 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.02 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.63 |
| 26 | 1967 | 68.00 | 65.57 | 60.14 | 53.32 | 28.61 | 48.71 | 58.25 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 60.34 |
| 27 | 1968 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| 28 | 1969 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.88 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.62 |
| 29 | 1970 | 68.00 | 68.00 | 68.00 | 67.48 | 65.95 | 64.19 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.19 |
| 30 | 1971 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.54 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.59 |
| 31 | 1972 | 68.00 | 68.00 | 68.00 | 68.00 | 66.97 | 64.38 | 67.64 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.58 |
| 32 | 1973 | 68.00 | 68.00 | 68.00 | 68.00 | 67.84 | 65.46 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.49 |
| 33 | 1974 | 68.00 | 68.00 | 67.39 | 64.26 | 60.12 | 59.68 | 63.80 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.97 |
| 34 | 1975 | 68.00 | 68.00 | 64.99 | 60.72 | 56.10 | 55.09 | 61.69 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 64.57 |
| 35 | 1976 | 68.00 | 68.00 | 65.60 | 61.56 | 57.63 | 57.12 | 62.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.08 |
| 36 | 1977 | 68.00 | 68.00 | 68.00 | 68.00 | 67.26 | 64.48 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.36 |
| 37 | 1978 | 68.00 | 68.00 | 68.00 | 66.40 | 64.01 | 63.16 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.86 |
| 38 | 1979 | 68.00 | 68.00 | 68.00 | 67.84 | 67.12 | 65.02 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.38 |
| 39 | 1980 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.98 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.91 |
| 40 | 1981 | 68.00 | 68.00 | 68.00 | 66.46 | 63.49 | 62.44 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.77 |
| 41 | 1982 | 68.00 | 68.00 | 68.00 | 68.00 | 67.84 | 65.01 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.45 |
| 42 | 1983 | 68.00 | 68.00 | 68.00 | 66.84 | 63.47 | 62.20 | 64.80 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.79 |
| 43 | 1984 | 68.00 | 68.00 | 68.00 | 67.53 | 64.97 | 63.24 | 64.54 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.04 |
| 44 | 1985 | 68.00 | 67.63 | 64.00 | 59.16 | 54.20 | 56.16 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 64.81 |
| 45 | 1986 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.91 | 66.50 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.78 |
| 46 | 1987 | 68.00 | 67.20 | 63.15 | 58.69 | 59.15 | 62.23 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 65.55 |
| 47 | 1988 | 68.00 | 68.00 | 68.00 | 67.59 | 67.37 | 65.57 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.71 |
| 48 | 1989 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| 49 | 1990 | 68.00 | 67.52 | 64.05 | 58.96 | 53.07 | 54.68 | 62.43 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 64.12 |
| 50 | 1991 | 68.00 | 68.00 | 68.00 | 67.61 | 64.97 | 63.27 | 64.59 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 67.05 |
| 51 | 1992 | 68.00 | 65.90 | 61.21 | 56.07 | 50.17 | 48.72 | 59.21 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 62.51 |
| 52 | 1993 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| 53 | 1994 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| | AVE | 67.86 | 67.50 | 66.48 | 64.21 | 61.81 | 61.31 | 64.10 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 66.13 |
| | MAX | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 |
| | MIN | 63.37 | 57.59 | 50.89 | 20.31 | 28.61 | 40.07 | 57.90 | 68.00 | 68.00 | 68.00 | 68.00 | 68.00 | 55.28 |

## Table 9-24(1) Peak Power Duration of Bayram Project

| No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 68.00 | 41 | 68.00 | 81 | 68.00 | 121 | 68.00 | 161 | 68.00 | 201 | 68.00 | 241 | 68.00 | 281 | 68.00 |
| 2 | 68.00 | 42 | 68.00 | 82 | 68.00 | 122 | 68.00 | 162 | 68.00 | 202 | 68.00 | 242 | 68.00 | 282 | 68.00 |
| 3 | 68.00 | 43 | 68.00 | 83 | 68.00 | 123 | 68.00 | 163 | 68.00 | 203 | 68.00 | 243 | 68.00 | 283 | 68.00 |
| 4 | 68.00 | 44 | 68.00 | 84 | 68.00 | 124 | 68.00 | 164 | 68.00 | 204 | 68.00 | 244 | 68.00 | 284 | 68.00 |
| 5 | 68.00 | 45 | 68.00 | 85 | 68.00 | 125 | 68.00 | 165 | 68.00 | 205 | 68.00 | 245 | 68.00 | 285 | 68.00 |
| 6 | 68.00 | 46 | 68.00 | 86 | 68.00 | 126 | 68.00 | 166 | 68.00 | 206 | 68.00 | 246 | 68.00 | 286 | 68.00 |
| 7 | 68.00 | 47 | 68.00 | 87 | 68.00 | 127 | 68.00 | 167 | 68.00 | 207 | 68.00 | 247 | 68.00 | 287 | 68.00 |
| 8 | 68.00 | 48 | 68.00 | 88 | 68.00 | 128 | 68.00 | 168 | 68.00 | 208 | 68.00 | 248 | 68.00 | 288 | 68.00 |
| 9 | 68.00 | 49 | 68.00 | 89 | 68.00 | 129 | 68.00 | 169 | 68.00 | 209 | 68.00 | 249 | 68.00 | 289 | 68.00 |
| 10 | 68.00 | 50 | 68.00 | 90 | 68.00 | 130 | 68.00 | 170 | 68.00 | 210 | 68.00 | 250 | 68.00 | 290 | 68.00 |
| 11 | 68.00 | 51 | 68.00 | 91 | 68.00 | 131 | 68.00 | 171 | 68.00 | 211 | 68.00 | 251 | 68.00 | 291 | 68.00 |
| 12 | 68.00 | 52 | 68.00 | 92 | 68.00 | 132 | 68.00 | 172 | 68.00 | 212 | 68.00 | 252 | 68.00 | 292 | 68.00 |
| 13 | 68.00 | 53 | 68.00 | 93 | 68.00 | 133 | 68.00 | 173 | 68.00 | 213 | 68.00 | 253 | 68.00 | 293 | 68.00 |
| 14 | 68.00 | 54 | 68.00 | 94 | 68.00 | 134 | 68.00 | 174 | 68.00 | 214 | 68.00 | 254 | 68.00 | 294 | 68.00 |
| 15 | 68.00 | 55 | 68.00 | 95 | 68.00 | 135 | 68.00 | 175 | 68.00 | 215 | 68.00 | 255 | 68.00 | 295 | 68.00 |
| 16 | 68.00 | 56 | 68.00 | 96 | 68.00 | 136 | 68.00 | 176 | 68.00 | 216 | 68.00 | 256 | 68.00 | 296 | 68.00 |
| 17 | 68.00 | 57 | 68.00 | 97 | 68.00 | 137 | 68.00 | 177 | 68.00 | 217 | 68.00 | 257 | 68.00 | 297 | 68.00 |
| 18 | 68.00 | 58 | 68.00 | 98 | 68.00 | 138 | 68.00 | 178 | 68.00 | 218 | 68.00 | 258 | 68.00 | 298 | 68.00 |
| 19 | 68.00 | 59 | 68.00 | 99 | 68.00 | 139 | 68.00 | 179 | 68.00 | 219 | 68.00 | 259 | 68.00 | 299 | 68.00 |
| 20 | 68.00 | 60 | 68.00 | 100 | 68.00 | 140 | 68.00 | 180 | 68.00 | 220 | 68.00 | 260 | 68.00 | 300 | 68.00 |
| 21 | 68.00 | 61 | 68.00 | 101 | 68.00 | 141 | 68.00 | 181 | 68.00 | 221 | 68.00 | 261 | 68.00 | 301 | 68.00 |
| 22 | 68.00 | 62 | 68.00 | 102 | 68.00 | 142 | 68.00 | 182 | 68.00 | 222 | 68.00 | 262 | 68.00 | 302 | 68.00 |
| 23 | 68.00 | 63 | 68.00 | 103 | 68.00 | 143 | 68.00 | 183 | 68.00 | 223 | 68.00 | 263 | 68.00 | 303 | 68.00 |
| 24 | 68.00 | 64 | 68.00 | 104 | 68.00 | 144 | 68.00 | 184 | 68.00 | 224 | 68.00 | 264 | 68.00 | 304 | 68.00 |
| 25 | 68.00 | 65 | 68.00 | 105 | 68.00 | 145 | 68.00 | 185 | 68.00 | 225 | 68.00 | 265 | 68.00 | 305 | 68.00 |
| 26 | 68.00 | 66 | 68.00 | 106 | 68.00 | 146 | 68.00 | 186 | 68.00 | 226 | 68.00 | 266 | 68.00 | 306 | 68.00 |
| 27 | 68.00 | 67 | 68.00 | 107 | 68.00 | 147 | 68.00 | 187 | 68.00 | 227 | 68.00 | 267 | 68.00 | 307 | 68.00 |
| 28 | 68.00 | 68 | 68.00 | 108 | 68.00 | 148 | 68.00 | 188 | 68.00 | 228 | 68.00 | 268 | 68.00 | 308 | 68.00 |
| 29 | 68.00 | 69 | 68.00 | 109 | 68.00 | 149 | 68.00 | 189 | 68.00 | 229 | 68.00 | 269 | 68.00 | 309 | 68.00 |
| 30 | 68.00 | 70 | 68.00 | 110 | 68.00 | 150 | 68.00 | 190 | 68.00 | 230 | 68.00 | 270 | 68.00 | 310 | 68.00 |
| 31 | 68.00 | 71 | 68.00 | 111 | 68.00 | 151 | 68.00 | 191 | 68.00 | 231 | 68.00 | 271 | 68.00 | 311 | 68.00 |
| 32 | 68.00 | 72 | 68.00 | 112 | 68.00 | 152 | 68.00 | 192 | 68.00 | 232 | 68.00 | 272 | 68.00 | 312 | 68.00 |
| 33 | 68.00 | 73 | 68.00 | 113 | 68.00 | 153 | 68.00 | 193 | 68.00 | 233 | 68.00 | 273 | 68.00 | 313 | 68.00 |
| 34 | 68.00 | 74 | 68.00 | 114 | 68.00 | 154 | 68.00 | 194 | 68.00 | 234 | 68.00 | 274 | 68.00 | 314 | 68.00 |
| 35 | 68.00 | 75 | 68.00 | 115 | 68.00 | 155 | 68.00 | 195 | 68.00 | 235 | 68.00 | 275 | 68.00 | 315 | 68.00 |
| 36 | 68.00 | 76 | 68.00 | 116 | 68.00 | 156 | 68.00 | 196 | 68.00 | 236 | 68.00 | 276 | 68.00 | 316 | 68.00 |
| 37 | 68.00 | 77 | 68.00 | 117 | 68.00 | 157 | 68.00 | 197 | 68.00 | 237 | 68.00 | 277 | 68.00 | 317 | 68.00 |
| 38 | 68.00 | 78 | 68.00 | 118 | 68.00 | 158 | 68.00 | 198 | 68.00 | 238 | 68.00 | 278 | 68.00 | 318 | 68.00 |
| 39 | 68.00 | 79 | 68.00 | 119 | 68.00 | 159 | 68.00 | 199 | 68.00 | 239 | 68.00 | 279 | 68.00 | 319 | 68.00 |
| 40 | 68.00 | 80 | 68.00 | 120 | 68.00 | 160 | 68.00 | 200 | 68.00 | 240 | 68.00 | 280 | 68.00 | 320 | 68.00 |

## Table 9-24(2) Peak Power Duration of Bayram Project

| No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 321 | 68.00 | 361 | 68.00 | 401 | 68.00 | 441 | 68.00 | 481 | 66.76 | 521 | 64.54 | 561 | 62.34 | 601 | 57.69 |
| 322 | 68.00 | 362 | 68.00 | 402 | 68.00 | 442 | 68.00 | 482 | 66.68 | 522 | 64.54 | 562 | 62.23 | 602 | 57.63 |
| 323 | 68.00 | 363 | 68.00 | 403 | 68.00 | 443 | 68.00 | 483 | 66.54 | 523 | 64.54 | 563 | 62.21 | 603 | 57.60 |
| 324 | 68.00 | 364 | 68.00 | 404 | 68.00 | 444 | 68.00 | 484 | 66.50 | 524 | 64.54 | 564 | 62.20 | 604 | 57.59 |
| 325 | 68.00 | 365 | 68.00 | 405 | 68.00 | 445 | 68.00 | 485 | 66.48 | 525 | 64.54 | 565 | 61.98 | 605 | 57.58 |
| 326 | 68.00 | 366 | 68.00 | 406 | 68.00 | 446 | 68.00 | 486 | 66.46 | 526 | 64.54 | 566 | 61.78 | 606 | 57.27 |
| 327 | 68.00 | 367 | 68.00 | 407 | 68.00 | 447 | 68.00 | 487 | 66.46 | 527 | 64.54 | 567 | 61.69 | 607 | 57.15 |
| 328 | 68.00 | 368 | 68.00 | 408 | 68.00 | 448 | 68.00 | 488 | 66.40 | 528 | 64.54 | 568 | 61.55 | 608 | 57.15 |
| 329 | 68.00 | 369 | 68.00 | 409 | 68.00 | 449 | 67.88 | 489 | 66.39 | 529 | 64.48 | 569 | 61.54 | 609 | 57.12 |
| 330 | 68.00 | 370 | 68.00 | 410 | 68.00 | 450 | 67.84 | 490 | 66.18 | 530 | 64.41 | 570 | 61.40 | 610 | 56.71 |
| 331 | 68.00 | 371 | 68.00 | 411 | 68.00 | 451 | 67.84 | 491 | 66.05 | 531 | 64.38 | 571 | 61.22 | 611 | 56.39 |
| 332 | 68.00 | 372 | 68.00 | 412 | 68.00 | 452 | 67.84 | 492 | 65.96 | 532 | 64.36 | 572 | 61.21 | 612 | 56.16 |
| 333 | 68.00 | 373 | 68.00 | 413 | 68.00 | 453 | 67.83 | 493 | 65.94 | 533 | 64.26 | 573 | 61.17 | 613 | 56.10 |
| 334 | 68.00 | 374 | 68.00 | 414 | 68.00 | 454 | 67.82 | 494 | 65.90 | 534 | 64.19 | 574 | 61.12 | 614 | 56.07 |
| 335 | 68.00 | 375 | 68.00 | 415 | 68.00 | 455 | 67.64 | 495 | 65.89 | 535 | 64.05 | 575 | 61.08 | 615 | 55.09 |
| 336 | 68.00 | 376 | 68.00 | 416 | 68.00 | 456 | 67.63 | 496 | 65.88 | 536 | 64.01 | 576 | 60.72 | 616 | 55.02 |
| 337 | 68.00 | 377 | 68.00 | 417 | 68.00 | 457 | 67.61 | 497 | 65.87 | 537 | 64.00 | 577 | 60.61 | 617 | 54.94 |
| 338 | 68.00 | 378 | 68.00 | 418 | 68.00 | 458 | 67.59 | 498 | 65.60 | 538 | 63.97 | 578 | 60.61 | 618 | 54.68 |
| 339 | 68.00 | 379 | 68.00 | 419 | 68.00 | 459 | 67.56 | 499 | 65.57 | 539 | 63.80 | 579 | 60.42 | 619 | 54.20 |
| 340 | 68.00 | 380 | 68.00 | 420 | 68.00 | 460 | 67.53 | 500 | 65.57 | 540 | 63.79 | 580 | 60.29 | 620 | 53.32 |
| 341 | 68.00 | 381 | 68.00 | 421 | 68.00 | 461 | 67.52 | 501 | 65.46 | 541 | 63.69 | 581 | 60.25 | 621 | 53.07 |
| 342 | 68.00 | 382 | 68.00 | 422 | 68.00 | 462 | 67.48 | 502 | 65.36 | 542 | 63.69 | 582 | 60.14 | 622 | 52.83 |
| 343 | 68.00 | 383 | 68.00 | 423 | 68.00 | 463 | 67.48 | 503 | 65.02 | 543 | 63.65 | 583 | 60.12 | 623 | 51.85 |
| 344 | 68.00 | 384 | 68.00 | 424 | 68.00 | 464 | 67.39 | 504 | 65.01 | 544 | 63.56 | 584 | 60.04 | 624 | 51.76 |
| 345 | 68.00 | 385 | 68.00 | 425 | 68.00 | 465 | 67.39 | 505 | 64.99 | 545 | 63.49 | 585 | 59.81 | 625 | 51.64 |
| 346 | 68.00 | 386 | 68.00 | 426 | 68.00 | 466 | 67.37 | 506 | 64.97 | 546 | 63.47 | 586 | 59.75 | 626 | 51.51 |
| 347 | 68.00 | 387 | 68.00 | 427 | 68.00 | 467 | 67.26 | 507 | 64.97 | 547 | 63.37 | 587 | 59.73 | 627 | 50.89 |
| 348 | 68.00 | 388 | 68.00 | 428 | 68.00 | 468 | 67.20 | 508 | 64.80 | 548 | 63.27 | 588 | 59.68 | 628 | 50.17 |
| 349 | 68.00 | 389 | 68.00 | 429 | 68.00 | 469 | 67.12 | 509 | 64.64 | 549 | 63.24 | 589 | 59.35 | 629 | 48.99 |
| 350 | 68.00 | 390 | 68.00 | 430 | 68.00 | 470 | 67.11 | 510 | 64.59 | 550 | 63.16 | 590 | 59.21 | 630 | 48.72 |
| 351 | 68.00 | 391 | 68.00 | 431 | 68.00 | 471 | 67.02 | 511 | 64.54 | 551 | 63.15 | 591 | 59.16 | 631 | 48.71 |
| 352 | 68.00 | 392 | 68.00 | 432 | 68.00 | 472 | 66.98 | 512 | 64.54 | 552 | 63.12 | 592 | 59.15 | 632 | 40.49 |
| 353 | 68.00 | 393 | 68.00 | 433 | 68.00 | 473 | 66.97 | 513 | 64.54 | 553 | 63.00 | 593 | 58.96 | 633 | 40.07 |
| 354 | 68.00 | 394 | 68.00 | 434 | 68.00 | 474 | 66.91 | 514 | 64.54 | 554 | 62.70 | 594 | 58.92 | 634 | 31.98 |
| 355 | 68.00 | 395 | 68.00 | 435 | 68.00 | 475 | 66.88 | 515 | 64.54 | 555 | 62.57 | 595 | 58.91 | 635 | 28.61 |
| 356 | 68.00 | 396 | 68.00 | 436 | 68.00 | 476 | 66.85 | 516 | 64.54 | 556 | 62.56 | 596 | 58.69 | 636 | 20.31 |
| 357 | 68.00 | 397 | 68.00 | 437 | 68.00 | 477 | 66.84 | 517 | 64.54 | 557 | 62.54 | 597 | 58.25 | | |
| 358 | 68.00 | 398 | 68.00 | 438 | 68.00 | 478 | 66.81 | 518 | 64.54 | 558 | 62.44 | 598 | 58.02 | | |
| 359 | 68.00 | 399 | 68.00 | 439 | 68.00 | 479 | 66.76 | 519 | 64.54 | 559 | 62.43 | 599 | 58.02 | | |
| 360 | 68.00 | 400 | 68.00 | 440 | 68.00 | 480 | 66.76 | 520 | 64.54 | 560 | 62.35 | 600 | 57.90 | | |

## Table 9-25 Reservoir Operation of Bağlık Project

Unit $10^6 m^3$

| | Year | Inflow | Evaporation | Power Discharge | Environment Discharge | Spill | Total Outflow |
|---|---|---|---|---|---|---|---|
| 1 | 1942 | 1,216.32 | 0.34 | 921.08 | 3.97 | 289.92 | 1,215.32 |
| 2 | 1943 | 717.37 | 0.35 | 713.05 | 3.97 | 0.00 | 717.37 |
| 3 | 1944 | 1,003.39 | 0.35 | 811.68 | 3.97 | 187.40 | 1,003.39 |
| 4 | 1945 | 610.83 | 0.35 | 606.53 | 3.97 | 0.00 | 610.85 |
| 5 | 1946 | 659.85 | 0.35 | 655.51 | 3.97 | 0.00 | 659.83 |
| 6 | 1947 | 563.73 | 0.35 | 559.70 | 3.97 | 0.00 | 564.01 |
| 7 | 1948 | 640.77 | 0.35 | 636.17 | 3.97 | 0.00 | 640.48 |
| 8 | 1949 | 523.52 | 0.34 | 519.21 | 3.97 | 0.00 | 523.53 |
| 9 | 1950 | 592.58 | 0.34 | 588.80 | 3.97 | 0.00 | 593.11 |
| 10 | 1951 | 585.26 | 0.35 | 580.41 | 3.97 | 0.00 | 584.73 |
| 11 | 1952 | 718.18 | 0.35 | 713.86 | 3.97 | 0.00 | 718.18 |
| 12 | 1953 | 593.43 | 0.34 | 589.12 | 3.97 | 0.00 | 593.43 |
| 13 | 1954 | 796.40 | 0.35 | 762.55 | 3.97 | 29.54 | 769.40 |
| 14 | 1955 | 443.75 | 0.34 | 440.44 | 3.97 | 0.00 | 444.75 |
| 15 | 1956 | 514.93 | 0.34 | 509.64 | 3.97 | 0.00 | 513.95 |
| 16 | 1957 | 615.99 | 0.34 | 611.68 | 3.97 | 0.00 | 615.99 |
| 17 | 1958 | 608.88 | 0.34 | 604.54 | 3.97 | 0.00 | 608.86 |
| 18 | 1959 | 696.67 | 0.35 | 692.35 | 3.97 | 0.00 | 696.67 |
| 19 | 1960 | 1,121.07 | 0.35 | 913.10 | 3.97 | 203.65 | 1,121.07 |
| 20 | 1961 | 524.73 | 0.34 | 521.42 | 3.97 | 0.00 | 525.73 |
| 21 | 1962 | 680.86 | 0.34 | 675.55 | 3.97 | 0.00 | 679.86 |
| 22 | 1963 | 1,122.23 | 0.35 | 847.99 | 3.97 | 269.93 | 1,122.23 |
| 23 | 1964 | 799.51 | 0.35 | 760.10 | 3.97 | 35.10 | 799.51 |
| 24 | 1965 | 834.53 | 0.34 | 814.16 | 3.97 | 17.06 | 835.53 |
| 25 | 1966 | 779.58 | 0.34 | 755.43 | 3.97 | 19.84 | 779.58 |
| 26 | 1967 | 701.94 | 0.34 | 668.23 | 3.97 | 28.41 | 700.94 |
| 27 | 1968 | 1,406.78 | 0.35 | 941.80 | 3.97 | 460.66 | 1,406.77 |
| 28 | 1969 | 767.65 | 0.34 | 720.05 | 3.97 | 44.29 | 768.65 |
| 29 | 1970 | 609.22 | 0.34 | 603.90 | 3.97 | 0.00 | 608.22 |
| 30 | 1971 | 758.38 | 0.34 | 744.36 | 3.97 | 10.70 | 759.38 |
| 31 | 1972 | 809.96 | 0.34 | 776.41 | 3.97 | 28.23 | 808.96 |
| 32 | 1973 | 742.95 | 0.35 | 732.46 | 3.97 | 6.70 | 743.48 |
| 33 | 1974 | 610.06 | 0.34 | 597.04 | 3.97 | 8.17 | 609.53 |
| 34 | 1975 | 671.35 | 0.34 | 660.99 | 3.97 | 6.89 | 672.18 |
| 35 | 1976 | 858.65 | 0.34 | 761.76 | 3.97 | 91.74 | 857.81 |
| 36 | 1977 | 692.61 | 0.35 | 688.29 | 3.97 | 0.00 | 692.61 |
| 37 | 1978 | 861.40 | 0.35 | 785.73 | 3.97 | 71.36 | 861.40 |
| 38 | 1979 | 794.73 | 0.35 | 766.36 | 3.97 | 24.58 | 795.26 |
| 39 | 1980 | 811.01 | 0.35 | 743.44 | 3.97 | 62.73 | 810.49 |
| 40 | 1981 | 731.18 | 0.35 | 683.37 | 3.97 | 43.48 | 731.16 |
| 41 | 1982 | 616.21 | 0.34 | 612.90 | 3.97 | 0.00 | 617.21 |
| 42 | 1983 | 801.04 | 0.34 | 748.12 | 3.97 | 48.61 | 801.04 |
| 43 | 1984 | 724.86 | 0.34 | 720.55 | 3.97 | 0.00 | 724.86 |
| 44 | 1985 | 781.64 | 0.34 | 653.61 | 3.97 | 122.73 | 780.64 |
| 45 | 1986 | 911.06 | 0.34 | 818.53 | 3.97 | 89.22 | 912.06 |
| 46 | 1987 | 954.90 | 0.34 | 725.47 | 3.97 | 224.12 | 953.90 |
| 47 | 1988 | 1,288.18 | 0.35 | 908.33 | 3.97 | 375.54 | 1,288.18 |
| 48 | 1989 | 1,367.41 | 0.34 | 906.57 | 3.97 | 457.53 | 1,368.41 |
| 49 | 1990 | 800.34 | 0.34 | 732.95 | 3.97 | 63.08 | 800.34 |
| 50 | 1991 | 699.94 | 0.34 | 687.48 | 3.97 | 8.15 | 699.94 |
| 51 | 1992 | 854.63 | 0.34 | 739.07 | 3.97 | 110.25 | 853.63 |
| 52 | 1993 | 1,170.14 | 0.35 | 901.59 | 3.97 | 264.23 | 1,170.14 |
| 53 | 1994 | 801.02 | 0.34 | 755.10 | 3.97 | 42.64 | 802.05 |
| Total | | 41,563.74 | 18.19 | 37,588.42 | 210.64 | 3,746.50 | 41,563.73 |
| Ave. | | 784.22 | 0.34 | 709.22 | 3.97 | 70.69 | 784.22 |
| Max. | | 1,046.78 | 0.35 | 941.98 | 3.97 | 460.66 | 1,406.77 |
| Min. | | 443.75 | 0.34 | 440.44 | 3.97 | 0.00 | 444.75 |

## Table 9-26 Total Energy Production of Bağlık Project

Unit: GWh

| NO. | YEAR | < OCT > | < NOV > | < DEC > | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1942 | 12.19 | 17.27 | 14.34 | 12.72 | 22.24 | 35.31 | 42.48 | 43.90 | 42.48 | 23.68 | 12.49 | 11.65 | 293.73 |
| 2 | 1943 | 12.21 | 12.32 | 13.46 | 11.88 | 15.56 | 26.77 | 30.96 | 35.22 | 28.15 | 17.70 | 12.03 | 11.24 | 227.50 |
| 3 | 1944 | 11.70 | 11.69 | 11.79 | 11.54 | 10.65 | 29.28 | 30.14 | 43.90 | 42.48 | 32.31 | 12.29 | 11.40 | 258.96 |
| 4 | 1945 | 11.53 | 11.49 | 11.19 | 11.08 | 9.97 | 11.37 | 22.28 | 32.23 | 32.95 | 17.02 | 11.52 | 10.75 | 193.38 |
| 5 | 1946 | 11.19 | 10.83 | 11.11 | 11.45 | 10.03 | 11.88 | 22.13 | 35.99 | 38.57 | 21.63 | 13.17 | 11.15 | 209.14 |
| 6 | 1947 | 12.38 | 11.41 | 11.36 | 11.36 | 10.87 | 31.48 | 27.74 | 14.78 | 13.47 | 11.87 | 11.11 | 10.71 | 178.53 |
| 7 | 1948 | 11.07 | 11.91 | 11.37 | 11.28 | 10.27 | 11.36 | 22.49 | 35.48 | 40.14 | 14.88 | 11.52 | 11.16 | 202.93 |
| 8 | 1949 | 11.36 | 10.92 | 11.08 | 10.98 | 9.74 | 11.26 | 13.72 | 29.37 | 23.02 | 11.78 | 11.19 | 10.75 | 165.16 |
| 9 | 1950 | 11.11 | 10.72 | 10.94 | 10.61 | 9.73 | 11.85 | 25.02 | 35.48 | 23.85 | 15.65 | 11.35 | 10.69 | 187.00 |
| 10 | 1951 | 11.55 | 11.16 | 11.28 | 11.11 | 10.47 | 11.79 | 24.65 | 25.23 | 30.05 | 15.05 | 11.52 | 11.24 | 185.11 |
| 11 | 1952 | 12.90 | 11.90 | 11.62 | 11.45 | 10.65 | 23.59 | 39.40 | 32.57 | 30.55 | 20.52 | 11.69 | 10.91 | 227.75 |
| 12 | 1953 | 11.11 | 10.72 | 10.98 | 10.61 | 9.73 | 10.93 | 15.31 | 34.20 | 32.45 | 17.96 | 11.78 | 11.32 | 187.09 |
| 13 | 1954 | 11.36 | 11.08 | 11.08 | 11.01 | 10.11 | 13.24 | 38.90 | 43.90 | 42.48 | 26.50 | 12.20 | 11.24 | 243.10 |
| 14 | 1955 | 11.36 | 10.91 | 11.11 | 11.01 | 10.16 | 11.09 | 13.22 | 15.63 | 13.05 | 11.19 | 10.88 | 10.11 | 139.73 |
| 15 | 1956 | 10.45 | 10.11 | 10.26 | 4.84 | 6.63 | 9.00 | 15.13 | 24.57 | 31.38 | 16.76 | 11.35 | 10.75 | 161.24 |
| 16 | 1957 | 11.04 | 10.46 | 10.44 | 10.27 | 9.81 | 12.70 | 20.85 | 33.09 | 35.92 | 17.27 | 11.44 | 10.75 | 194.05 |
| 17 | 1958 | 11.10 | 10.83 | 11.08 | 10.93 | 9.81 | 11.85 | 22.67 | 34.20 | 32.45 | 15.22 | 11.27 | 10.91 | 192.32 |
| 18 | 1959 | 11.19 | 10.83 | 11.19 | 11.19 | 10.34 | 12.33 | 25.83 | 43.43 | 40.89 | 20.35 | 12.03 | 11.15 | 220.77 |
| 19 | 1960 | 12.04 | 11.57 | 11.45 | 12.65 | 21.35 | 42.66 | 42.48 | 43.90 | 42.48 | 27.18 | 12.49 | 11.07 | 291.32 |
| 20 | 1961 | 11.27 | 10.83 | 11.08 | 10.66 | 9.58 | 11.18 | 22.80 | 23.86 | 22.20 | 11.35 | 10.71 | 9.95 | 165.47 |
| 21 | 1962 | 10.36 | 10.35 | 11.10 | 11.11 | 8.50 | 14.38 | 37.71 | 40.78 | 32.20 | 15.99 | 11.27 | 10.91 | 214.67 |
| 22 | 1963 | 11.19 | 10.92 | 11.28 | 11.37 | 10.95 | 12.22 | 42.48 | 43.90 | 42.48 | 43.90 | 18.55 | 11.32 | 270.55 |
| 23 | 1964 | 11.61 | 11.08 | 11.36 | 11.19 | 10.19 | 19.47 | 42.29 | 43.90 | 42.48 | 16.42 | 11.52 | 10.99 | 242.51 |
| 24 | 1965 | 12.30 | 11.24 | 12.22 | 11.36 | 10.26 | 34.13 | 42.48 | 43.90 | 41.72 | 18.72 | 11.04 | 10.13 | 259.50 |
| 25 | 1966 | 12.02 | 12.40 | 11.71 | 11.88 | 11.19 | 25.26 | 39.32 | 43.90 | 36.24 | 15.14 | 11.04 | 10.53 | 240.62 |
| 26 | 1967 | 10.44 | 9.95 | 10.44 | 10.27 | 5.96 | 10.76 | 16.77 | 43.90 | 37.15 | 31.03 | 13.43 | 11.57 | 211.67 |
| 27 | 1968 | 11.61 | 11.66 | 17.83 | 14.00 | 20.23 | 40.96 | 42.48 | 43.90 | 42.48 | 29.32 | 14.19 | 11.61 | 300.48 |
| 28 | 1969 | 12.04 | 11.57 | 11.79 | 11.04 | 9.94 | 26.13 | 42.48 | 43.90 | 27.06 | 11.69 | 11.01 | 10.50 | 229.16 |
| 29 | 1970 | 12.44 | 11.33 | 11.45 | 11.45 | 10.80 | 20.48 | 40.80 | 25.14 | 14.51 | 11.78 | 11.27 | 11.08 | 192.53 |
| 30 | 1971 | 13.37 | 11.68 | 11.79 | 11.36 | 11.19 | 30.34 | 27.99 | 43.90 | 38.63 | 14.71 | 12.12 | 10.61 | 237.37 |
| 31 | 1972 | 11.17 | 11.16 | 11.96 | 11.37 | 10.34 | 17.75 | 42.48 | 43.90 | 42.48 | 21.63 | 11.69 | 11.65 | 247.59 |
| 32 | 1973 | 11.70 | 11.41 | 11.28 | 11.11 | 10.88 | 18.90 | 28.98 | 43.90 | 42.48 | 20.95 | 11.35 | 10.69 | 235.63 |
| 33 | 1974 | 11.01 | 11.21 | 11.37 | 11.08 | 9.95 | 12.84 | 18.95 | 43.90 | 25.59 | 11.61 | 11.07 | 11.53 | 190.09 |
| 34 | 1975 | 11.08 | 10.69 | 11.01 | 10.95 | 10.17 | 12.44 | 42.48 | 35.48 | 31.62 | 12.40 | 11.04 | 10.58 | 209.94 |
| 35 | 1976 | 11.17 | 10.83 | 11.04 | 10.98 | 9.94 | 12.77 | 41.42 | 43.90 | 42.48 | 25.30 | 11.69 | 11.07 | 242.69 |
| 36 | 1977 | 12.38 | 11.33 | 11.36 | 11.11 | 10.26 | 16.26 | 28.81 | 43.85 | 34.68 | 17.10 | 11.52 | 10.91 | 219.60 |
| 37 | 1978 | 11.70 | 11.16 | 11.11 | 11.08 | 10.69 | 19.06 | 42.48 | 43.90 | 42.48 | 24.02 | 12.03 | 10.91 | 250.62 |
| 38 | 1979 | 11.36 | 11.16 | 11.45 | 11.62 | 11.43 | 20.51 | 33.36 | 43.90 | 42.48 | 24.71 | 11.78 | 10.69 | 244.44 |
| 39 | 1980 | 11.21 | 12.48 | 12.22 | 11.54 | 10.50 | 29.62 | 42.48 | 43.90 | 28.88 | 12.20 | 11.35 | 10.75 | 237.12 |
| 40 | 1981 | 11.53 | 11.25 | 11.54 | 11.19 | 10.27 | 12.64 | 24.10 | 37.45 | 42.48 | 22.74 | 11.69 | 11.16 | 218.02 |
| 41 | 1982 | 11.53 | 11.16 | 11.71 | 11.45 | 10.03 | 15.53 | 34.02 | 35.48 | 17.24 | 15.14 | 11.52 | 10.61 | 195.42 |
| 42 | 1983 | 11.34 | 11.25 | 10.71 | 10.69 | 9.86 | 21.56 | 42.48 | 43.90 | 42.20 | 13.60 | 10.28 | 9.54 | 237.38 |
| 43 | 1984 | 11.10 | 13.15 | 11.36 | 11.08 | 9.97 | 25.39 | 36.67 | 41.38 | 27.65 | 19.92 | 11.44 | 10.37 | 229.48 |
| 44 | 1985 | 10.02 | 10.27 | 10.27 | 10.27 | 9.66 | 14.13 | 42.48 | 43.90 | 23.01 | 11.35 | 10.79 | 10.80 | 206.96 |
| 45 | 1986 | 13.41 | 11.82 | 11.79 | 11.28 | 10.73 | 30.47 | 42.48 | 43.90 | 42.48 | 21.80 | 10.82 | 10.02 | 260.80 |
| 46 | 1987 | 10.69 | 10.11 | 10.27 | 10.52 | 12.81 | 12.73 | 42.48 | 43.90 | 42.48 | 11.44 | 11.27 | 11.65 | 230.35 |
| 47 | 1988 | 11.45 | 11.00 | 11.19 | 11.54 | 11.58 | 43.67 | 42.48 | 43.90 | 42.48 | 30.69 | 15.99 | 13.84 | 289.80 |
| 48 | 1989 | 20.41 | 17.06 | 15.36 | 11.88 | 16.94 | 43.90 | 42.48 | 43.90 | 42.48 | 13.77 | 10.53 | 10.18 | 288.88 |
| 49 | 1990 | 10.36 | 10.19 | 10.44 | 9.94 | 9.43 | 13.29 | 41.69 | 43.90 | 42.48 | 19.07 | 11.07 | 10.49 | 232.34 |
| 50 | 1991 | 10.69 | 12.28 | 11.62 | 10.79 | 10.19 | 30.59 | 42.48 | 24.62 | 29.64 | 14.11 | 11.01 | 9.85 | 218.06 |
| 51 | 1992 | 9.86 | 10.43 | 10.44 | 9.77 | 8.32 | 12.19 | 42.48 | 43.90 | 42.48 | 22.57 | 11.10 | 10.97 | 234.52 |
| 52 | 1993 | 19.24 | 23.01 | 13.16 | 11.53 | 14.44 | 34.29 | 42.48 | 43.90 | 42.48 | 20.43 | 11.78 | 10.91 | 287.65 |
| 53 | 1994 | 10.29 | 11.13 | 11.28 | 11.19 | 10.03 | 38.92 | 42.48 | 43.90 | 27.56 | 12.55 | 11.11 | 10.11 | 240.55 |
| | TOTAL | 621.93 | 616.46 | 613.11 | 587.64 | 585.33 | 1097.48 | 1775.74 | 2042.68 | 1834.29 | 993.63 | 623.23 | 577.62 | 11969.12 |
| | AVE | 11.73 | 11.63 | 11.57 | 11.09 | 11.04 | 20.71 | 33.50 | 38.54 | 34.61 | 18.75 | 11.76 | 10.90 | 225.83 |
| | MAX | 20.41 | 23.01 | 17.83 | 14.00 | 22.24 | 43.90 | 42.48 | 43.90 | 42.48 | 43.90 | 18.55 | 13.84 | 300.48 |
| | MIN | 9.86 | 9.95 | 10.26 | 4.84 | 5.96 | 9.00 | 13.22 | 14.78 | 13.05 | 11.19 | 10.28 | 9.54 | 139.73 |

## Table 9-27 Firm Energy Production of Bağlık Project

Unit: GWh

| NO. | YEAR | < OCT > | < NOV > | < DEC > | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1942 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 2 | 1943 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| 3 | 1944 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 4 | 1945 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 5 | 1946 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 6 | 1947 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| 7 | 1948 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 8 | 1949 | 10.97 | 10.62 | 10.97 | 10.97 | 9.74 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.04 |
| 9 | 1950 | 10.97 | 10.62 | 10.96 | 10.61 | 9.73 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 128.63 |
| 10 | 1951 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| 11 | 1952 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 12 | 1953 | 10.97 | 10.62 | 10.97 | 10.61 | 9.73 | 10.90 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 128.59 |
| 13 | 1954 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 14 | 1955 | 10.97 | 10.62 | 10.97 | 10.97 | 10.13 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.88 | 10.11 | 128.83 |
| 15 | 1956 | 10.45 | 10.11 | 10.26 | 4.84 | 6.63 | 9.00 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 116.08 |
| 16 | 1957 | 10.97 | 10.46 | 10.44 | 10.27 | 9.75 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 127.66 |
| 17 | 1958 | 10.97 | 10.62 | 10.97 | 10.93 | 9.75 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.01 |
| 18 | 1959 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| 19 | 1960 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 20 | 1961 | 10.97 | 10.62 | 10.97 | 10.68 | 9.58 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.71 | 9.95 | 127.64 |
| 21 | 1962 | 10.36 | 10.35 | 10.97 | 10.97 | 8.50 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 126.92 |
| 22 | 1963 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| 23 | 1964 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 24 | 1965 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.13 | 128.72 |
| 25 | 1966 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.53 | 129.12 |
| 26 | 1967 | 10.44 | 9.95 | 10.44 | 10.27 | 5.96 | 10.76 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 122.61 |
| 27 | 1968 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 28 | 1969 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.48 | 129.07 |
| 29 | 1970 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 30 | 1971 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.61 | 129.56 |
| 31 | 1972 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 32 | 1973 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 33 | 1974 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 34 | 1975 | 10.97 | 10.62 | 10.97 | 10.93 | 10.14 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.56 | 129.33 |
| 35 | 1976 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 36 | 1977 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 37 | 1978 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 38 | 1979 | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| 39 | 1980 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 40 | 1981 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 41 | 1982 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.61 | 129.20 |
| 42 | 1983 | 10.97 | 10.62 | 10.71 | 10.69 | 9.84 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.28 | 9.54 | 126.82 |
| 43 | 1984 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.37 | 128.96 |
| 44 | 1985 | 10.02 | 10.27 | 10.27 | 10.27 | 9.66 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.79 | 10.62 | 126.07 |
| 45 | 1986 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.62 | 10.02 | 128.25 |
| 46 | 1987 | 10.69 | 10.11 | 10.27 | 10.52 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 127.62 |
| 47 | 1988 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 48 | 1989 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.53 | 10.18 | 128.33 |
| 49 | 1990 | 10.36 | 10.19 | 10.44 | 9.94 | 9.43 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.49 | 125.98 |
| 50 | 1991 | 10.69 | 10.62 | 10.97 | 10.79 | 10.14 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 9.85 | 128.21 |
| 51 | 1992 | 9.86 | 10.43 | 10.44 | 9.77 | 8.32 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 124.58 |
| 52 | 1993 | 10.97 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.21 |
| 53 | 1994 | 10.29 | 10.62 | 10.97 | 10.97 | 9.91 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.11 | 128.02 |
| | TOTAL | 576.02 | 559.76 | 577.07 | 569.12 | 518.63 | 579.36 | 562.86 | 581.62 | 562.86 | 581.62 | 579.58 | 557.09 | 6803.57 |
| | AVE | 10.87 | 10.56 | 10.89 | 10.74 | 9.75 | 10.93 | 10.62 | 10.97 | 10.62 | 10.97 | 10.96 | 10.51 | 128.37 |
| | MAX | 10.97 | 10.62 | 10.97 | 10.97 | 10.27 | 10.97 | 10.62 | 10.97 | 10.62 | 10.97 | 10.97 | 10.62 | 129.56 |
| | MIN | 9.86 | 9.95 | 10.26 | 4.84 | 5.96 | 9.00 | 10.62 | 10.97 | 10.62 | 10.97 | 10.28 | 9.54 | 116.08 |

## Table 9-28 Peak Power of Bağlık Project

Unit: MW

| NO. | YEAR | < OCT > | < NOV > | < DEC > | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < AVE > |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1942 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 2 | 1943 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 3 | 1944 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 4 | 1945 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 5 | 1946 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 6 | 1947 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 7 | 1948 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 8 | 1949 | 59.00 | 59.00 | 59.00 | 59.00 | 57.98 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.92 |
| 9 | 1950 | 59.00 | 59.00 | 58.81 | 57.03 | 57.93 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.73 |
| 10 | 1951 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 11 | 1952 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 12 | 1953 | 59.00 | 59.00 | 59.00 | 57.06 | 57.93 | 58.59 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.72 |
| 13 | 1954 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 14 | 1955 | 59.00 | 59.00 | 59.00 | 59.00 | 58.24 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.49 | 56.17 | 58.66 |
| 15 | 1956 | 56.19 | 56.18 | 55.16 | 26.02 | 39.48 | 48.41 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 53.01 |
| 16 | 1957 | 59.00 | 58.13 | 56.13 | 55.24 | 58.04 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.29 |
| 17 | 1958 | 59.00 | 59.00 | 59.00 | 58.77 | 58.04 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.91 |
| 18 | 1959 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 19 | 1960 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 20 | 1961 | 59.00 | 59.00 | 59.00 | 57.40 | 57.03 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 57.58 | 55.26 | 58.28 |
| 21 | 1962 | 55.72 | 57.52 | 59.00 | 59.00 | 58.60 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 57.98 |
| 22 | 1963 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 23 | 1964 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 24 | 1965 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 56.27 | 58.78 |
| 25 | 1966 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.49 | 58.96 |
| 26 | 1967 | 56.14 | 55.25 | 56.16 | 55.24 | 34.28 | 57.84 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 55.83 |
| 27 | 1968 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 28 | 1969 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.22 | 58.94 |
| 29 | 1970 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 30 | 1971 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.96 | 59.00 |
| 31 | 1972 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 32 | 1973 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 33 | 1974 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 34 | 1975 | 59.00 | 59.00 | 59.00 | 58.74 | 58.25 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.66 | 58.89 |
| 35 | 1976 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 36 | 1977 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 37 | 1978 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 38 | 1979 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 39 | 1980 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 40 | 1981 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 41 | 1982 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.97 | 59.00 |
| 42 | 1983 | 59.00 | 59.00 | 57.58 | 57.47 | 58.58 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 55.27 | 52.99 | 57.75 |
| 43 | 1984 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 57.61 | 58.89 |
| 44 | 1985 | 53.89 | 57.04 | 55.23 | 55.23 | 57.48 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.00 | 59.00 | 57.56 |
| 45 | 1986 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 57.08 | 55.67 | 58.56 |
| 46 | 1987 | 57.49 | 56.14 | 55.24 | 56.58 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.11 |
| 47 | 1988 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 48 | 1989 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.83 | 56.57 | 58.60 |
| 49 | 1990 | 55.69 | 56.59 | 56.13 | 53.44 | 56.16 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 58.25 | 57.52 |
| 50 | 1991 | 57.48 | 59.00 | 59.00 | 58.03 | 58.30 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 54.71 | 58.38 |
| 51 | 1992 | 53.00 | 57.95 | 56.14 | 52.54 | 49.54 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 56.89 |
| 52 | 1993 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| 53 | 1994 | 55.30 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 56.19 | 58.45 |
| | AVE | 58.43 | 58.68 | 58.54 | 57.73 | 57.53 | 58.77 | 59.00 | 59.00 | 59.00 | 59.00 | 58.79 | 58.40 | 58.58 |
| | MAX | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 | 59.00 |
| | MIN | 53.00 | 55.25 | 55.16 | 26.02 | 34.28 | 48.41 | 59.00 | 59.00 | 59.00 | 59.00 | 55.27 | 52.99 | 53.01 |

## Table 9-29(1) Peak Power Duration of Bağlık Project

| No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 59.00 | 41 | 59.00 | 81 | 59.00 | 121 | 59.00 | 161 | 59.00 | 201 | 59.00 | 241 | 59.00 | 281 | 59.00 |
| 2 | 59.00 | 42 | 59.00 | 82 | 59.00 | 122 | 59.00 | 162 | 59.00 | 202 | 59.00 | 242 | 59.00 | 282 | 59.00 |
| 3 | 59.00 | 43 | 59.00 | 83 | 59.00 | 123 | 59.00 | 163 | 59.00 | 203 | 59.00 | 243 | 59.00 | 283 | 59.00 |
| 4 | 59.00 | 44 | 59.00 | 84 | 59.00 | 124 | 59.00 | 164 | 59.00 | 204 | 59.00 | 244 | 59.00 | 284 | 59.00 |
| 5 | 59.00 | 45 | 59.00 | 85 | 59.00 | 125 | 59.00 | 165 | 59.00 | 205 | 59.00 | 245 | 59.00 | 285 | 59.00 |
| 6 | 59.00 | 46 | 59.00 | 86 | 59.00 | 126 | 59.00 | 166 | 59.00 | 206 | 59.00 | 246 | 59.00 | 286 | 59.00 |
| 7 | 59.00 | 47 | 59.00 | 87 | 59.00 | 127 | 59.00 | 167 | 59.00 | 207 | 59.00 | 247 | 59.00 | 287 | 59.00 |
| 8 | 59.00 | 48 | 59.00 | 88 | 59.00 | 128 | 59.00 | 168 | 59.00 | 208 | 59.00 | 248 | 59.00 | 288 | 59.00 |
| 9 | 59.00 | 49 | 59.00 | 89 | 59.00 | 129 | 59.00 | 169 | 59.00 | 209 | 59.00 | 249 | 59.00 | 289 | 59.00 |
| 10 | 59.00 | 50 | 59.00 | 90 | 59.00 | 130 | 59.00 | 170 | 59.00 | 210 | 59.00 | 250 | 59.00 | 290 | 59.00 |
| 11 | 59.00 | 51 | 59.00 | 91 | 59.00 | 131 | 59.00 | 171 | 59.00 | 211 | 59.00 | 251 | 59.00 | 291 | 59.00 |
| 12 | 59.00 | 52 | 59.00 | 92 | 59.00 | 132 | 59.00 | 172 | 59.00 | 212 | 59.00 | 252 | 59.00 | 292 | 59.00 |
| 13 | 59.00 | 53 | 59.00 | 93 | 59.00 | 133 | 59.00 | 173 | 59.00 | 213 | 59.00 | 253 | 59.00 | 293 | 59.00 |
| 14 | 59.00 | 54 | 59.00 | 94 | 59.00 | 134 | 59.00 | 174 | 59.00 | 214 | 59.00 | 254 | 59.00 | 294 | 59.00 |
| 15 | 59.00 | 55 | 59.00 | 95 | 59.00 | 135 | 59.00 | 175 | 59.00 | 215 | 59.00 | 255 | 59.00 | 295 | 59.00 |
| 16 | 59.00 | 56 | 59.00 | 96 | 59.00 | 136 | 59.00 | 176 | 59.00 | 216 | 59.00 | 256 | 59.00 | 296 | 59.00 |
| 17 | 59.00 | 57 | 59.00 | 97 | 59.00 | 137 | 59.00 | 177 | 59.00 | 217 | 59.00 | 257 | 59.00 | 297 | 59.00 |
| 18 | 59.00 | 58 | 59.00 | 98 | 59.00 | 138 | 59.00 | 178 | 59.00 | 218 | 59.00 | 258 | 59.00 | 298 | 59.00 |
| 19 | 59.00 | 59 | 59.00 | 99 | 59.00 | 139 | 59.00 | 179 | 59.00 | 219 | 59.00 | 259 | 59.00 | 299 | 59.00 |
| 20 | 59.00 | 60 | 59.00 | 100 | 59.00 | 140 | 59.00 | 180 | 59.00 | 220 | 59.00 | 260 | 59.00 | 300 | 59.00 |
| 21 | 59.00 | 61 | 59.00 | 101 | 59.00 | 141 | 59.00 | 181 | 59.00 | 221 | 59.00 | 261 | 59.00 | 301 | 59.00 |
| 22 | 59.00 | 62 | 59.00 | 102 | 59.00 | 142 | 59.00 | 182 | 59.00 | 222 | 59.00 | 262 | 59.00 | 302 | 59.00 |
| 23 | 59.00 | 63 | 59.00 | 103 | 59.00 | 143 | 59.00 | 183 | 59.00 | 223 | 59.00 | 263 | 59.00 | 303 | 59.00 |
| 24 | 59.00 | 64 | 59.00 | 104 | 59.00 | 144 | 59.00 | 184 | 59.00 | 224 | 59.00 | 264 | 59.00 | 304 | 59.00 |
| 25 | 59.00 | 65 | 59.00 | 105 | 59.00 | 145 | 59.00 | 185 | 59.00 | 225 | 59.00 | 265 | 59.00 | 305 | 59.00 |
| 26 | 59.00 | 66 | 59.00 | 106 | 59.00 | 146 | 59.00 | 186 | 59.00 | 226 | 59.00 | 266 | 59.00 | 306 | 59.00 |
| 27 | 59.00 | 67 | 59.00 | 107 | 59.00 | 147 | 59.00 | 187 | 59.00 | 227 | 59.00 | 267 | 59.00 | 307 | 59.00 |
| 28 | 59.00 | 68 | 59.00 | 108 | 59.00 | 148 | 59.00 | 188 | 59.00 | 228 | 59.00 | 268 | 59.00 | 308 | 59.00 |
| 29 | 59.00 | 69 | 59.00 | 109 | 59.00 | 149 | 59.00 | 189 | 59.00 | 229 | 59.00 | 269 | 59.00 | 309 | 59.00 |
| 30 | 59.00 | 70 | 59.00 | 110 | 59.00 | 150 | 59.00 | 190 | 59.00 | 230 | 59.00 | 270 | 59.00 | 310 | 59.00 |
| 31 | 59.00 | 71 | 59.00 | 111 | 59.00 | 151 | 59.00 | 191 | 59.00 | 231 | 59.00 | 271 | 59.00 | 311 | 59.00 |
| 32 | 59.00 | 72 | 59.00 | 112 | 59.00 | 152 | 59.00 | 192 | 59.00 | 232 | 59.00 | 272 | 59.00 | 312 | 59.00 |
| 33 | 59.00 | 73 | 59.00 | 113 | 59.00 | 153 | 59.00 | 193 | 59.00 | 233 | 59.00 | 273 | 59.00 | 313 | 59.00 |
| 34 | 59.00 | 74 | 59.00 | 114 | 59.00 | 154 | 59.00 | 194 | 59.00 | 234 | 59.00 | 274 | 59.00 | 314 | 59.00 |
| 35 | 59.00 | 75 | 59.00 | 115 | 59.00 | 155 | 59.00 | 195 | 59.00 | 235 | 59.00 | 275 | 59.00 | 315 | 59.00 |
| 36 | 59.00 | 76 | 59.00 | 116 | 59.00 | 156 | 59.00 | 196 | 59.00 | 236 | 59.00 | 276 | 59.00 | 316 | 59.00 |
| 37 | 59.00 | 77 | 59.00 | 117 | 59.00 | 157 | 59.00 | 197 | 59.00 | 237 | 59.00 | 277 | 59.00 | 317 | 59.00 |
| 38 | 59.00 | 78 | 59.00 | 118 | 59.00 | 158 | 59.00 | 198 | 59.00 | 238 | 59.00 | 278 | 59.00 | 318 | 59.00 |
| 39 | 59.00 | 79 | 59.00 | 119 | 59.00 | 159 | 59.00 | 199 | 59.00 | 239 | 59.00 | 279 | 59.00 | 319 | 59.00 |
| 40 | 59.00 | 80 | 59.00 | 120 | 59.00 | 160 | 59.00 | 200 | 59.00 | 240 | 59.00 | 280 | 59.00 | 320 | 59.00 |

## Table 9-29(2) Peak Power Duration of Bağlık Project

| No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) | No. | Peak Power (MW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 321 | 59.00 | 361 | 59.00 | 401 | 59.00 | 441 | 59.00 | 481 | 59.00 | 521 | 59.00 | 561 | 58.74 | 601 | 56.19 |
| 322 | 59.00 | 362 | 59.00 | 402 | 59.00 | 442 | 59.00 | 482 | 59.00 | 522 | 59.00 | 562 | 58.66 | 602 | 56.19 |
| 323 | 59.00 | 363 | 59.00 | 403 | 59.00 | 443 | 59.00 | 483 | 59.00 | 523 | 59.00 | 563 | 58.59 | 603 | 56.18 |
| 324 | 59.00 | 364 | 59.00 | 404 | 59.00 | 444 | 59.00 | 484 | 59.00 | 524 | 59.00 | 564 | 58.49 | 604 | 56.17 |
| 325 | 59.00 | 365 | 59.00 | 405 | 59.00 | 445 | 59.00 | 485 | 59.00 | 525 | 59.00 | 565 | 58.49 | 605 | 56.14 |
| 326 | 59.00 | 366 | 59.00 | 406 | 59.00 | 446 | 59.00 | 486 | 59.00 | 526 | 59.00 | 566 | 58.30 | 606 | 56.14 |
| 327 | 59.00 | 367 | 59.00 | 407 | 59.00 | 447 | 59.00 | 487 | 59.00 | 527 | 59.00 | 567 | 58.25 | 607 | 56.14 |
| 328 | 59.00 | 368 | 59.00 | 408 | 59.00 | 448 | 59.00 | 488 | 59.00 | 528 | 59.00 | 568 | 58.25 | 608 | 56.14 |
| 329 | 59.00 | 369 | 59.00 | 409 | 59.00 | 449 | 59.00 | 489 | 59.00 | 529 | 59.00 | 569 | 58.24 | 609 | 56.14 |
| 330 | 59.00 | 370 | 59.00 | 410 | 59.00 | 450 | 59.00 | 490 | 59.00 | 530 | 59.00 | 570 | 58.22 | 610 | 56.13 |
| 331 | 59.00 | 371 | 59.00 | 411 | 59.00 | 451 | 59.00 | 491 | 59.00 | 531 | 59.00 | 571 | 58.13 | 611 | 56.13 |
| 332 | 59.00 | 372 | 59.00 | 412 | 59.00 | 452 | 59.00 | 492 | 59.00 | 532 | 59.00 | 572 | 58.04 | 612 | 55.72 |
| 333 | 59.00 | 373 | 59.00 | 413 | 59.00 | 453 | 59.00 | 493 | 59.00 | 533 | 59.00 | 573 | 58.04 | 613 | 55.69 |
| 334 | 59.00 | 374 | 59.00 | 414 | 59.00 | 454 | 59.00 | 494 | 59.00 | 534 | 59.00 | 574 | 58.03 | 614 | 55.67 |
| 335 | 59.00 | 375 | 59.00 | 415 | 59.00 | 455 | 59.00 | 495 | 59.00 | 535 | 59.00 | 575 | 58.00 | 615 | 55.30 |
| 336 | 59.00 | 376 | 59.00 | 416 | 59.00 | 456 | 59.00 | 496 | 59.00 | 536 | 59.00 | 576 | 57.98 | 616 | 55.27 |
| 337 | 59.00 | 377 | 59.00 | 417 | 59.00 | 457 | 59.00 | 497 | 59.00 | 537 | 59.00 | 577 | 57.95 | 617 | 55.26 |
| 338 | 59.00 | 378 | 59.00 | 418 | 59.00 | 458 | 59.00 | 498 | 59.00 | 538 | 59.00 | 578 | 57.93 | 618 | 55.25 |
| 339 | 59.00 | 379 | 59.00 | 419 | 59.00 | 459 | 59.00 | 499 | 59.00 | 539 | 59.00 | 579 | 57.93 | 619 | 55.24 |
| 340 | 59.00 | 380 | 59.00 | 420 | 59.00 | 460 | 59.00 | 500 | 59.00 | 540 | 59.00 | 580 | 57.84 | 620 | 55.24 |
| 341 | 59.00 | 381 | 59.00 | 421 | 59.00 | 461 | 59.00 | 501 | 59.00 | 541 | 59.00 | 581 | 57.61 | 621 | 55.24 |
| 342 | 59.00 | 382 | 59.00 | 422 | 59.00 | 462 | 59.00 | 502 | 59.00 | 542 | 59.00 | 582 | 57.58 | 622 | 55.23 |
| 343 | 59.00 | 383 | 59.00 | 423 | 59.00 | 463 | 59.00 | 503 | 59.00 | 543 | 59.00 | 583 | 57.56 | 623 | 55.23 |
| 344 | 59.00 | 384 | 59.00 | 424 | 59.00 | 464 | 59.00 | 504 | 59.00 | 544 | 59.00 | 584 | 57.52 | 624 | 55.16 |
| 345 | 59.00 | 385 | 59.00 | 425 | 59.00 | 465 | 59.00 | 505 | 59.00 | 545 | 59.00 | 585 | 57.49 | 625 | 54.71 |
| 346 | 59.00 | 386 | 59.00 | 426 | 59.00 | 466 | 59.00 | 506 | 59.00 | 546 | 59.00 | 586 | 57.48 | 626 | 53.89 |
| 347 | 59.00 | 387 | 59.00 | 427 | 59.00 | 467 | 59.00 | 507 | 59.00 | 547 | 59.00 | 587 | 57.48 | 627 | 53.44 |
| 348 | 59.00 | 388 | 59.00 | 428 | 59.00 | 468 | 59.00 | 508 | 59.00 | 548 | 59.00 | 588 | 57.47 | 628 | 53.00 |
| 349 | 59.00 | 389 | 59.00 | 429 | 59.00 | 469 | 59.00 | 509 | 59.00 | 549 | 59.00 | 589 | 57.40 | 629 | 52.99 |
| 350 | 59.00 | 390 | 59.00 | 430 | 59.00 | 470 | 59.00 | 510 | 59.00 | 550 | 59.00 | 590 | 57.08 | 630 | 52.54 |
| 351 | 59.00 | 391 | 59.00 | 431 | 59.00 | 471 | 59.00 | 511 | 59.00 | 551 | 59.00 | 591 | 57.06 | 631 | 50.60 |
| 352 | 59.00 | 392 | 59.00 | 432 | 59.00 | 472 | 59.00 | 512 | 59.00 | 552 | 59.00 | 592 | 57.04 | 632 | 49.54 |
| 353 | 59.00 | 393 | 59.00 | 433 | 59.00 | 473 | 59.00 | 513 | 59.00 | 553 | 59.00 | 593 | 57.03 | 633 | 48.41 |
| 354 | 59.00 | 394 | 59.00 | 434 | 59.00 | 474 | 59.00 | 514 | 59.00 | 554 | 59.00 | 594 | 57.03 | 634 | 39.48 |
| 355 | 59.00 | 395 | 59.00 | 435 | 59.00 | 475 | 59.00 | 515 | 59.00 | 555 | 59.00 | 595 | 56.63 | 635 | 34.28 |
| 356 | 59.00 | 396 | 59.00 | 436 | 59.00 | 476 | 59.00 | 516 | 59.00 | 556 | 59.00 | 596 | 56.59 | 636 | 26.02 |
| 357 | 59.00 | 397 | 59.00 | 437 | 59.00 | 477 | 59.00 | 517 | 59.00 | 557 | 58.97 | 597 | 56.58 | | |
| 358 | 59.00 | 398 | 59.00 | 438 | 59.00 | 478 | 59.00 | 518 | 59.00 | 558 | 58.96 | 598 | 56.58 | | |
| 359 | 59.00 | 399 | 59.00 | 439 | 59.00 | 479 | 59.00 | 519 | 59.00 | 559 | 58.81 | 599 | 56.57 | | |
| 360 | 59.00 | 400 | 59.00 | 440 | 59.00 | 480 | 59.00 | 520 | 59.00 | 560 | 58.77 | 600 | 56.27 | | |

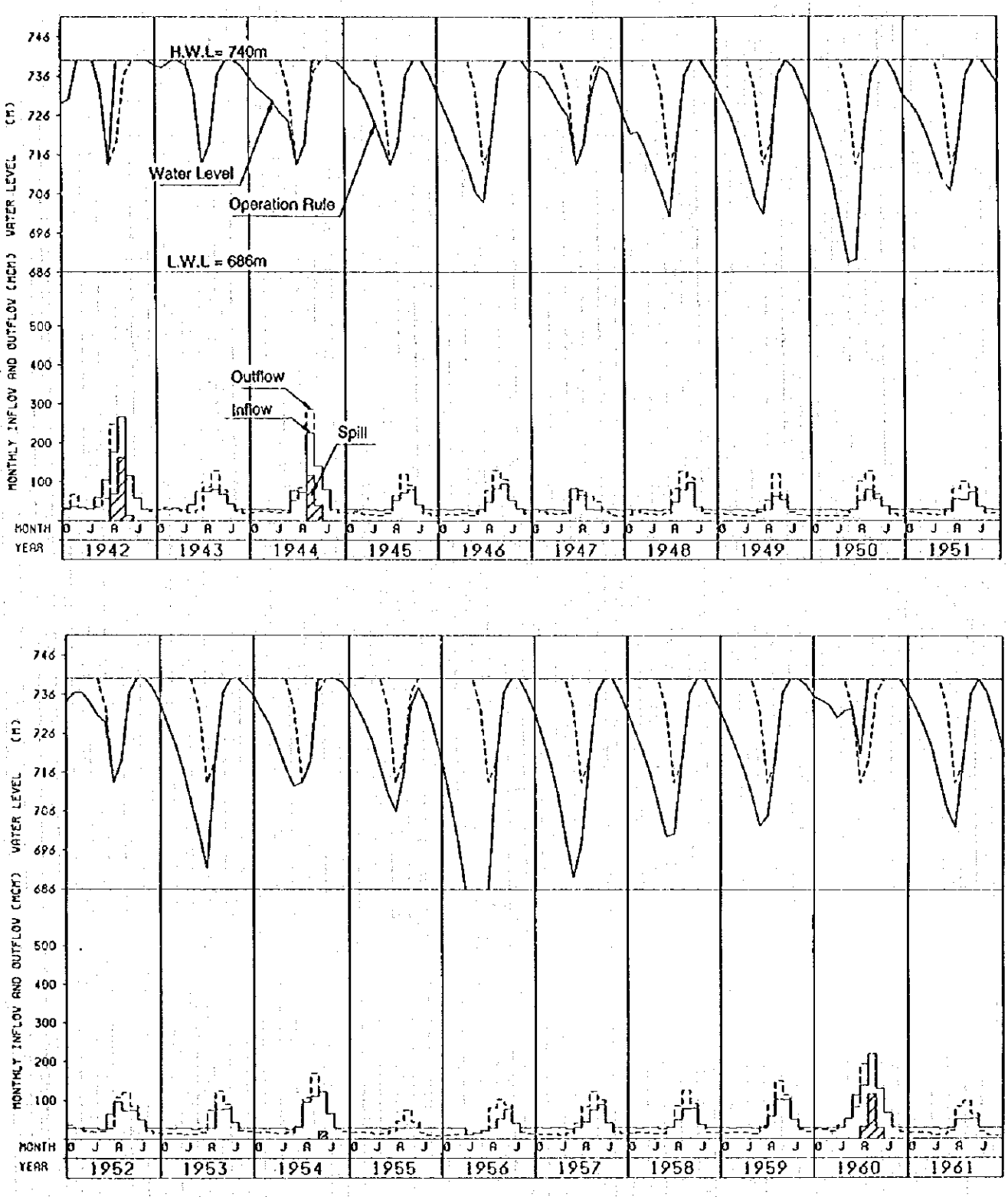



**Figure 9-18(1) Reservoir Operation of Bayram Project**

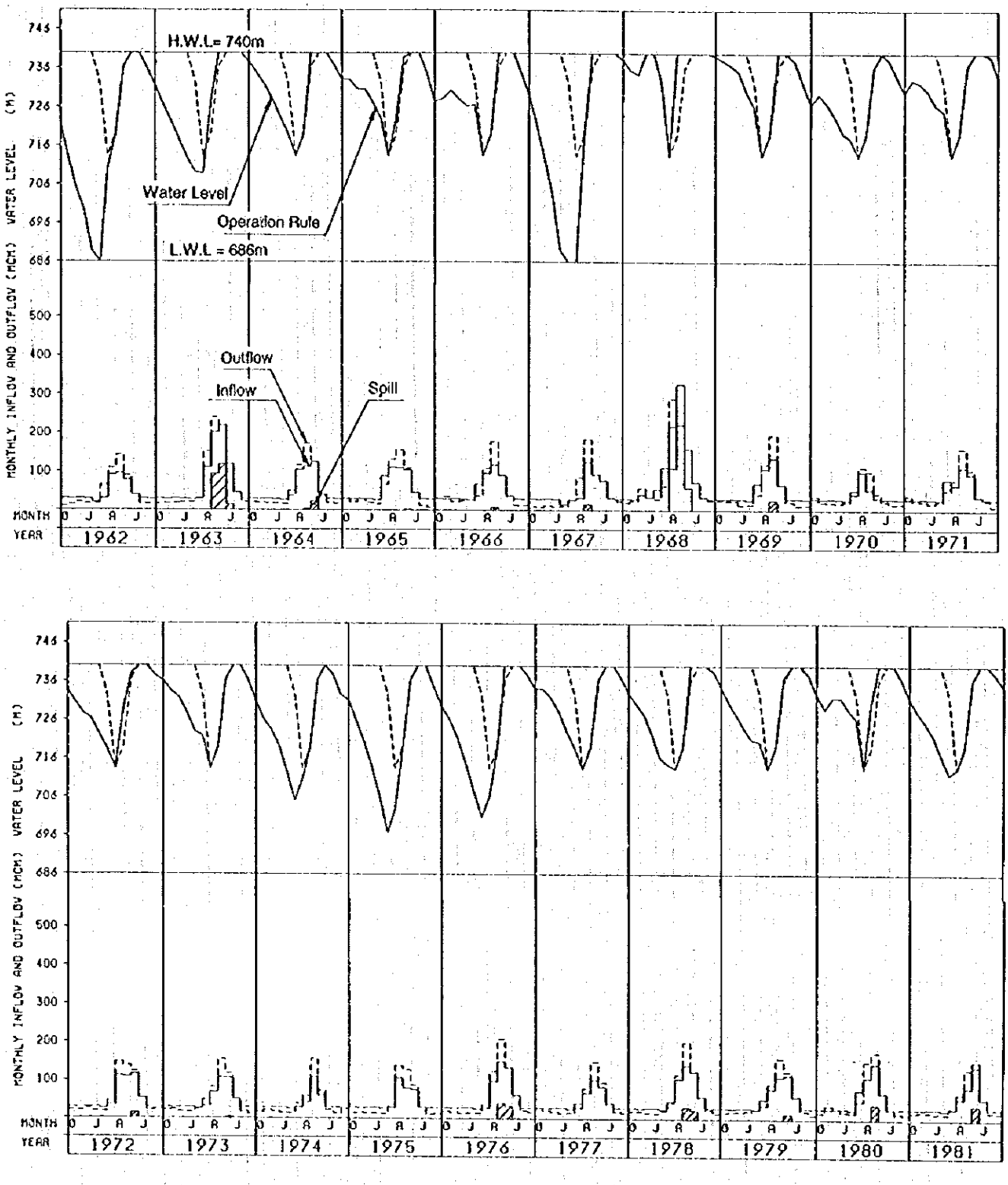



**Figure 9-18(2) Reservoir Operation of Bayram Project**

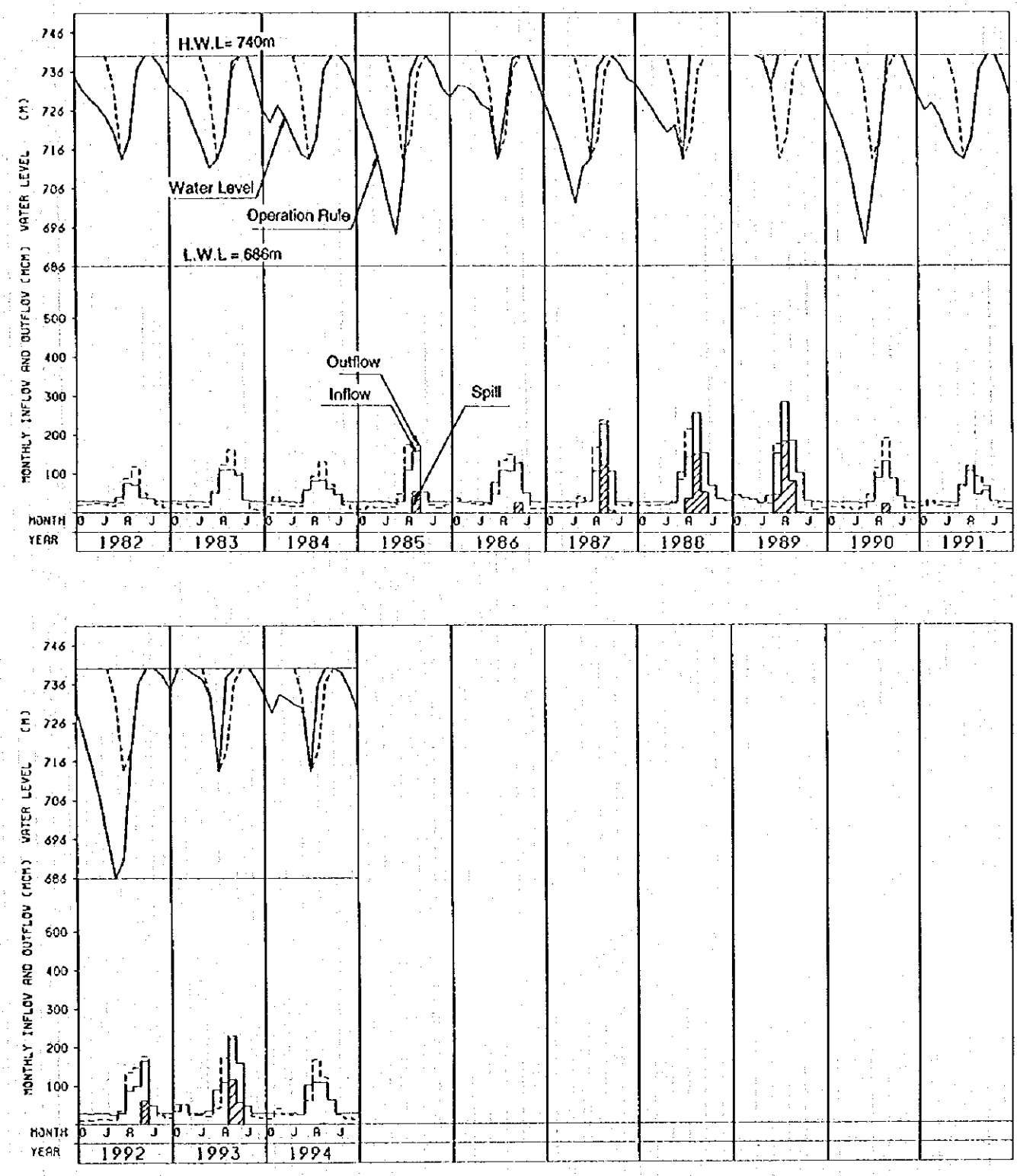



**Figure 9-18(3) Reservoir Operation of Bayram Project**

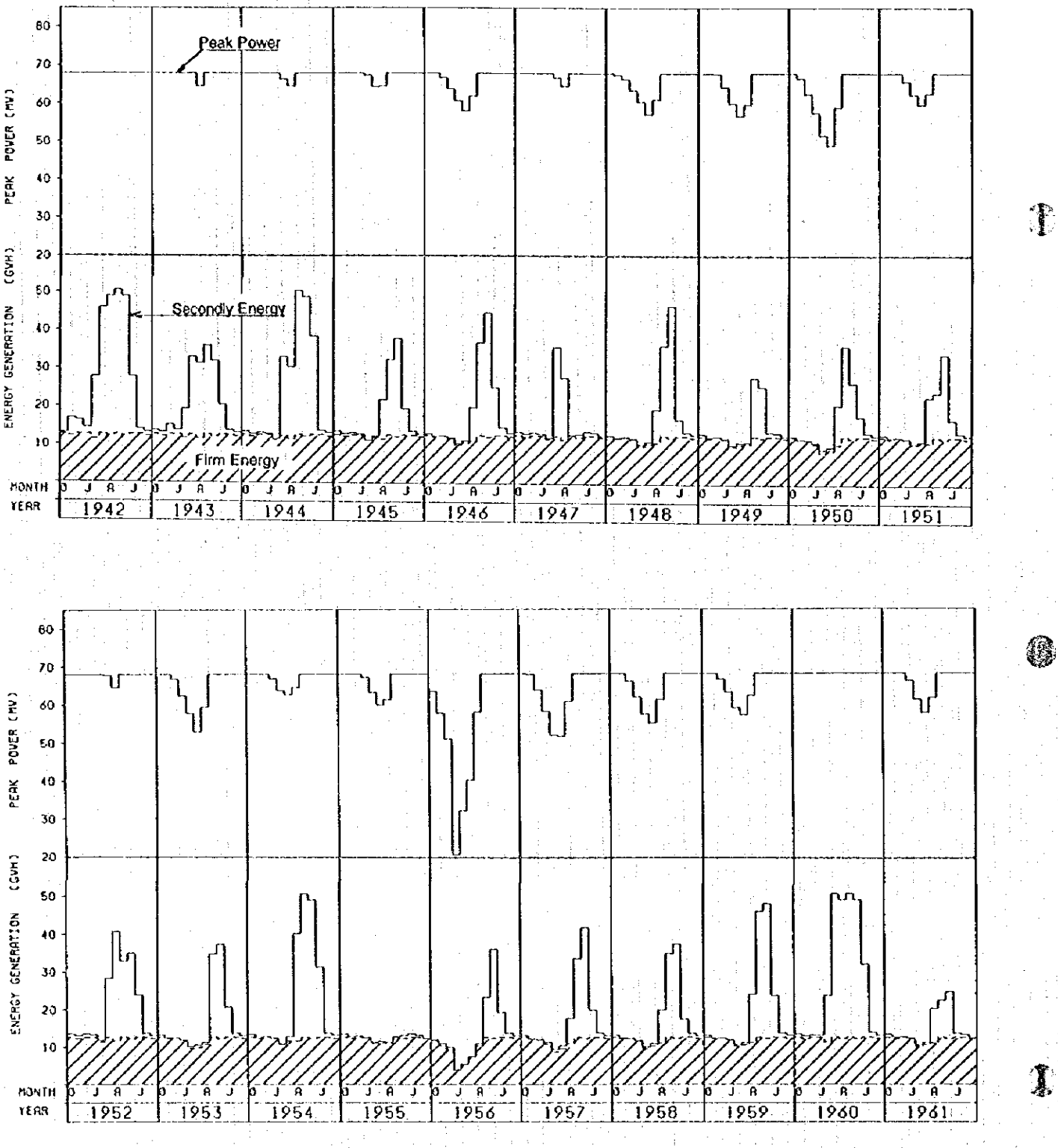



**Figure 9-19(1) Energy Generation of Bayram Project**

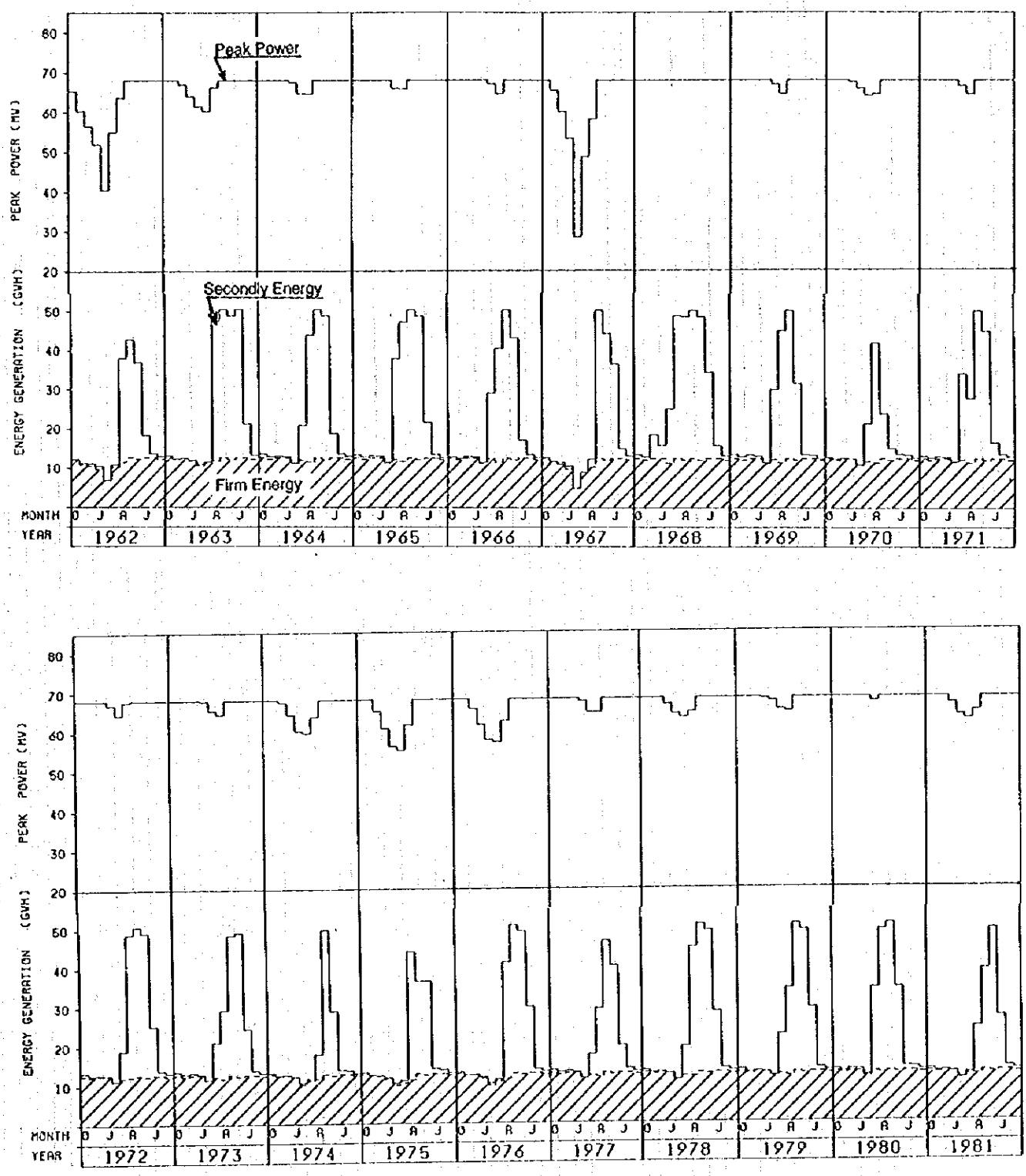



**Figure 9-19(2) Energy Generation of Bayram Project**

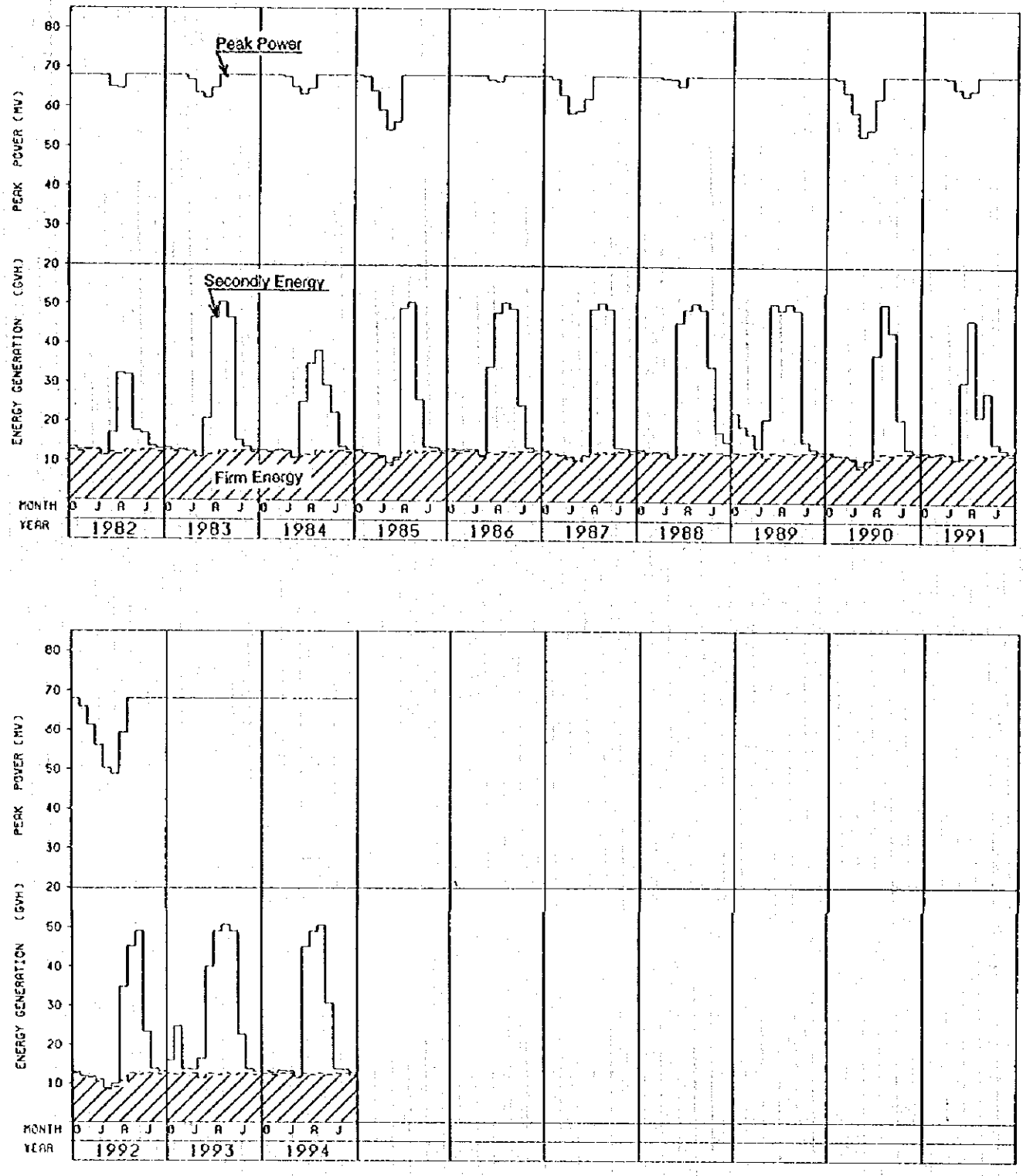



**Figure 9-19(3) Energy Generation of Bayram Project**

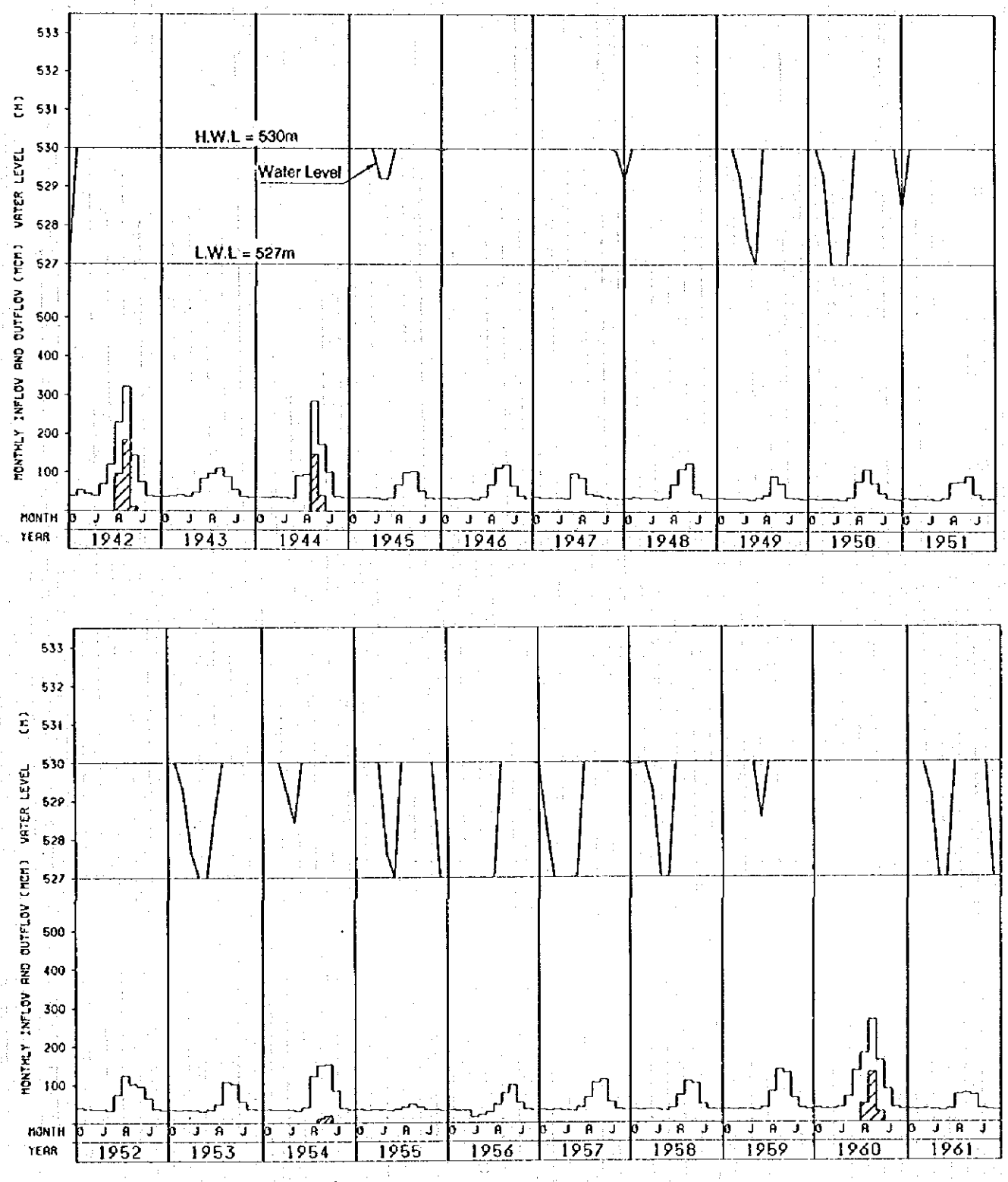



**Figure 9-20(1) Reservoir Operation of Bağlık Project**

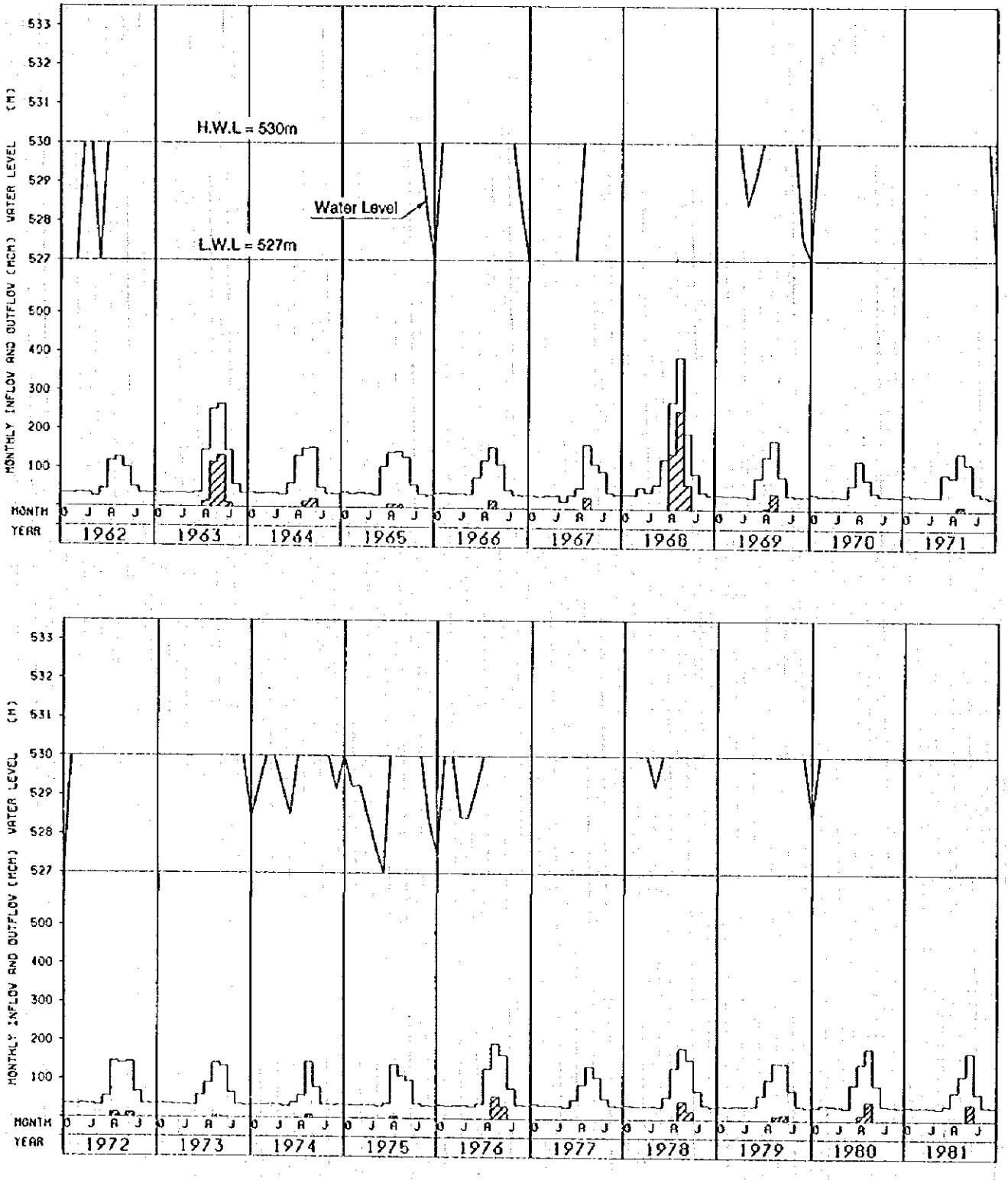



**Figure 9-20(2) Reservoir Operation of Bağlık Project**

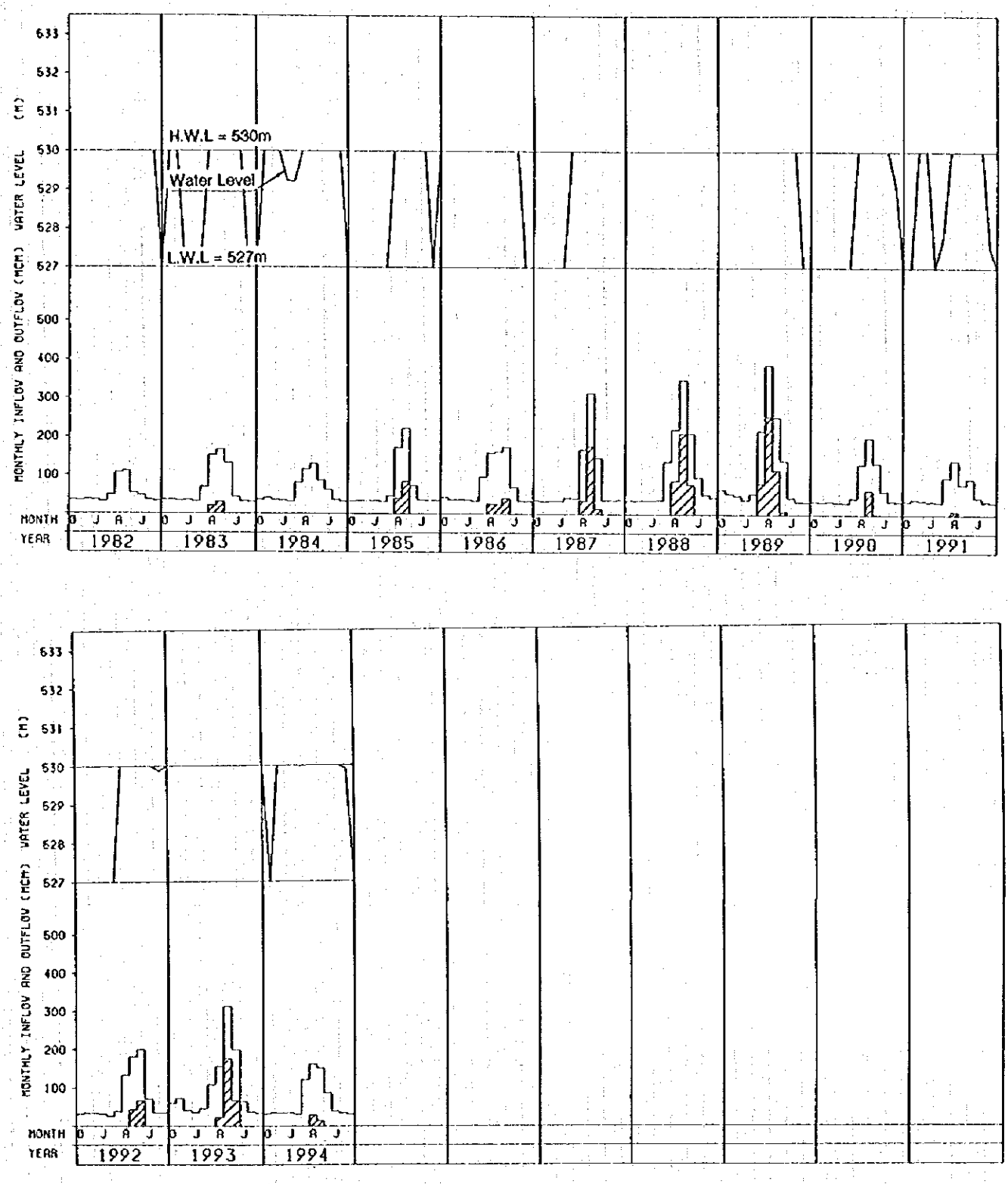



**Figure 9-20(3) Reservoir Operation of Bağlık Project**

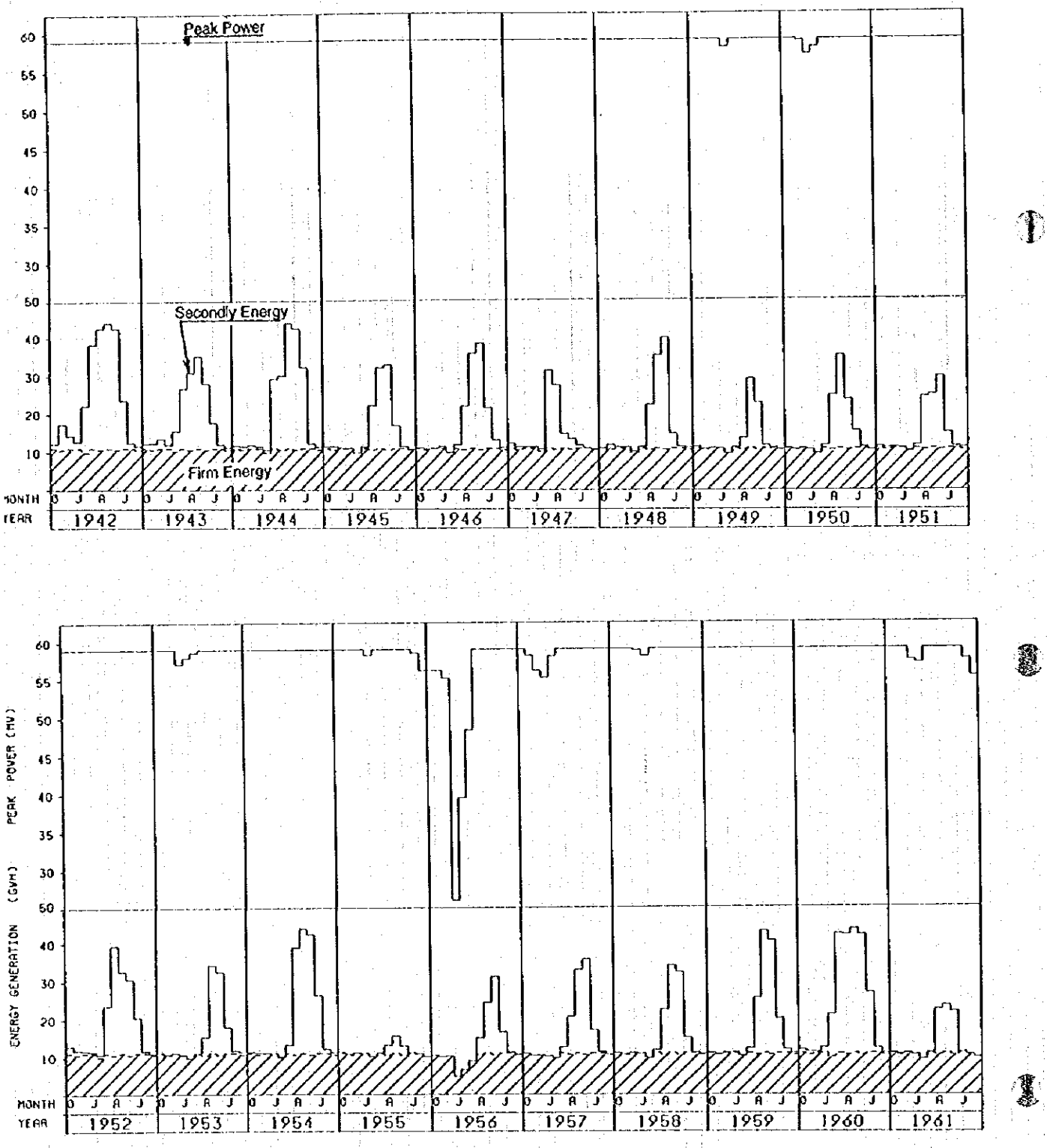



**Figure 9-21(1) Energy Generation of Bağlık Project**

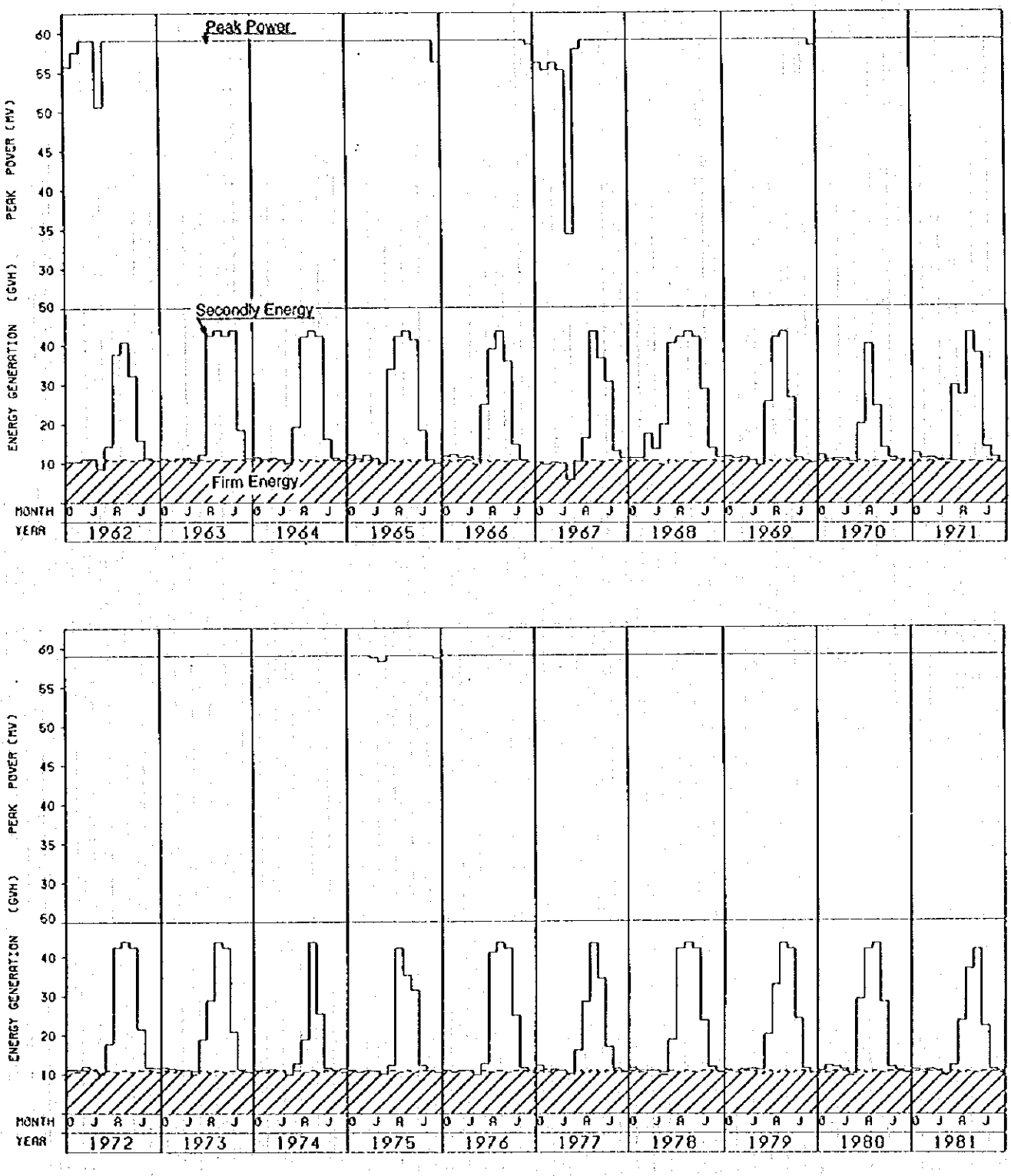



**Figure 9-21(2) Energy Generation of Bağlık Project**

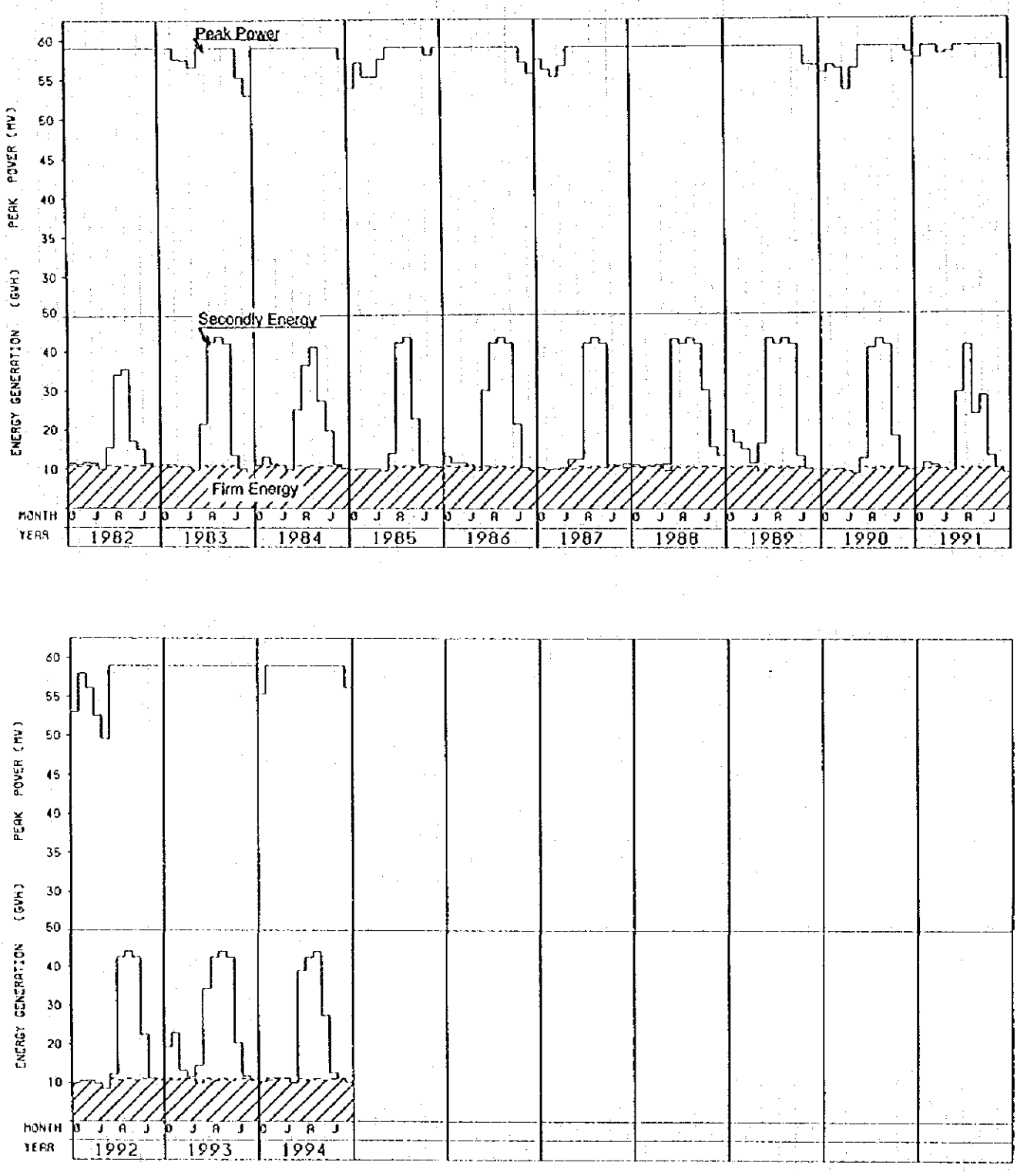



**Figure 9-21(3) Energy Generation of Bağlık Project**

# CHAPTER 10 TRANSMISSION LINE AND POWER SYSTEM ANALYSIS

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# CHAPTER 10 TRANSMISSION LINE AND POWER SYSTEM ANALYSIS

## 10.1 Summary of Power System

The transmission system in Turkey comprises 380 kV of primary system and 154 kV of secondary system. In addition, 66 kV and 34.5 kV form the lower voltage systems. The total distance of transmission lines at the end of 1994 is 10,717 km for 380 kV and 24,832 km for 154 kV and for below 66 kV 1,190 km.

Power plants newly developed are generally connected to classified systems in response to their plant sizes, that is, large power plants are connected to 380 kV systems, medium and small power plants to 154 kV or 66 kV systems. According to the long term program of TEAŞ, expansion plans of 380 kV transmission lines are formulated taking into account network conditions for 10 years, in a future, and 154 kV lines taking into account these for 5 to 7 years.

TEAŞ has expansion plan of 380 kV power system until 2010 which was prepared in 1994. Figure 10-1 shows expansion plan of eastern power system which will be connected with Berta project.

From this plan, new power plants of eastern power system will be connected with 380 kV power system which will be commissioning in 2005 and this new 380 kV power system will be connected with existing 380 kV power system.

On the other hand, according to the master plan of EİE, transmission lines route of Berta project is indicated as Figure 10-2. This plan is that Bağlık project will be connected with Artvin Substation.

From switchyard plan of Deriner project which is now preparing, Deriner project has two switchyards with 380 kV and 154 kV. 380 kV switchyard will be connected with 380 kV power system which will be commissioning in 2005. Oltu project (including Olur project and Ayvali project) which will be commissioning in 2005 and 2006, branch of existing 154 kV line and Berta project will be connected with 154 kV switchyard of Deriner project. (refer to Figure 10-3)

## 10.2 Route Survey of Transmission Line

The route survey for the planned transmission line was conducted as to the following two routes.

(1) Bayram project → Bağlık project

(2)-(a) Bağlık project → Connection based on EİE master plant (Artvin substation)

-(b) Bağlık project → 154 kV Switchyard of Deriner project

(1) From Bayram project to Bağlık project

Judging from geographical condition and existing transmission lines, it was fund there are no technical restriction which may obstruct construction.

(2)-(a) From Bağlık project to Artvin substation

In the view of EİE master plan, there are two plans consist of new 154 kV transmission line and using existing 154 kV transmission line (Artvin-Ardahan). As the result of survey, the capacity of existing 154 kV transmission line is only 60 MVA and this means it is impossible to use existing 154 kV transmission line. The measurement for this is replacing the transmission line. And except this replacing work, new transmission line with above 12 km from Bağlık project to existing 154 kV transmission line is necessary.

Furthermore, Artvin substation which will be connected with transmission line from Bağlık project locates narrow mountains district and slope area. So there is no place to install additional equipment.

(2)-(b) From Bağlık project to 154 kV Switchyard of Deriner project.

There is only new transmission line with 25 km between Bağlık project and 154 kV switchyard of Deriner project.

Because plan (2)-(a) has a lot of restriction and the construction cost estimated more expensive, JICA Study Team recommend plan (2)-(b).

In conclusion, transmission line route is from Bayram project to 154 kV switchyard of Deriner project via Bağlık project.

Figure 10-4 shows outline of transmission system of Berta project.

Before construction, topographical profile of this route should be measured and optimum route should be prepared.

## 10.3 Survey of Switchyard

JICA Study Team carried out site survey of switchyard for 154 kV transmission line.
In the case of Bayram project, it is confirmed that space for switchyard is ensured at the foot of Dam. Next, in the case of Bağlık project, as a result of site survey, this area is so narrow slope that there is no space to install switchyard. For this situation, power transformer and 154 kV power plant equipment will be installed in powerhouse and outside there will be only outgoing structures.

## 10.4 Transmission Line Plan for Berta Project

The design condition of transmission line project consists of, to send power demand user economically, to plan based on power system plan of TEAŞ, in accordance with Turkey's standard and to operate safely if accident occurs. Based on these condition, transmission line plan for Berta project is designed as follows.

(1) Transmission Line Voltage

From above mentioned, transmission line for Berta project will be connected with 154 kV switchyard of Deriner project. So transmission line voltage is 154 kV.

(2) Number or Circuits

(a) Bağlık - Bayram : 1 cct
(b) Bağlık - Deriner : 2 cct

(3) Length and Conductor Size

From topographical map, length of transmission line shows as follows.

(a) Bağlık - Bayram : 12 km
(b) Bağlık - Deriner : 25 km

Conductor size is taken for ACSR477MCM (aluminum conductor steel reinforced) out of the standard sizes currently used by TEAŞ.

## 10.5 Power System Analysis

(1) Purpose of Calculation and Contents

A power system analysis was conducted to verify the characteristics of the power system near the Bayram project and Bağlık project.
The contents of the calculation are as follows:

- Power flow calculation
- Stability calculation
- Short-circuit current calculation

(2) Target Year of Calculation and Range of Simulation

The target year of calculation is presumed to be around 2010 around the operation of the Bayram project and Bağlık project will be commissioned. Since the planned output of the Berta Project is consumed in the nearby 154 kV system, the range of calculation is only limited to the 154 kV system. Figure 10-5 shows scope of calculation. Here Berta project is assumed to be connected with bus of Artvin substation.

(3) Power Flow Calculation

Power flow and voltage calculation was conducted by presuming the operational conditions of the power system as follows:

| | |
|---|---|
| System voltage being maintained: | 95 to 105% |
| Operating voltage of generator: | 100 ±5% |
| Operation power factor of generator: | Above 0.85 |
| Tap ratio of transformer: | 1.00 ±0.10 P.U. |

The result is shown as Figure 10-6, and there is no problem.

(4) Stability Calculation

In power system stability study after commissioning the Berta project, a three-phase-ground- fault is applied as the system disturbance on the 154 kV transmission lines and the fault is cleared in 6 cycles (100 ms). The result of simulation study is presented in Figure 10-7. The system is stable from this result.

(5) Short Circuit Capacity Calculation

Study condition is that all generators are connected to the system. Subtransient reactance X'd is used for calculation.

Three-phase short circuit current capacity at bUs of Artvin Substation is 13KA. This shows no problem.

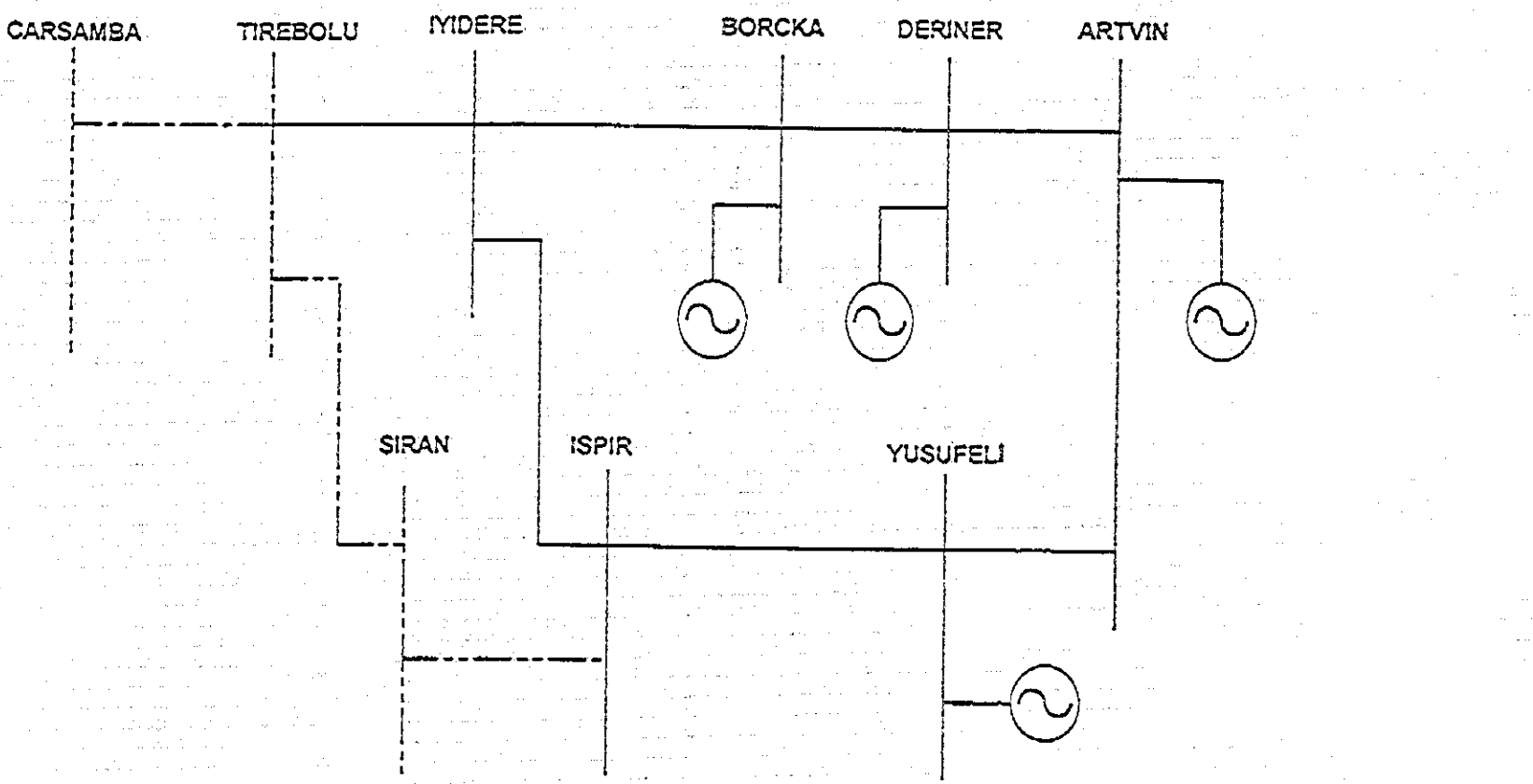


Figure 10-1 TEAS 380 kV Transmission Line Expansion Plan

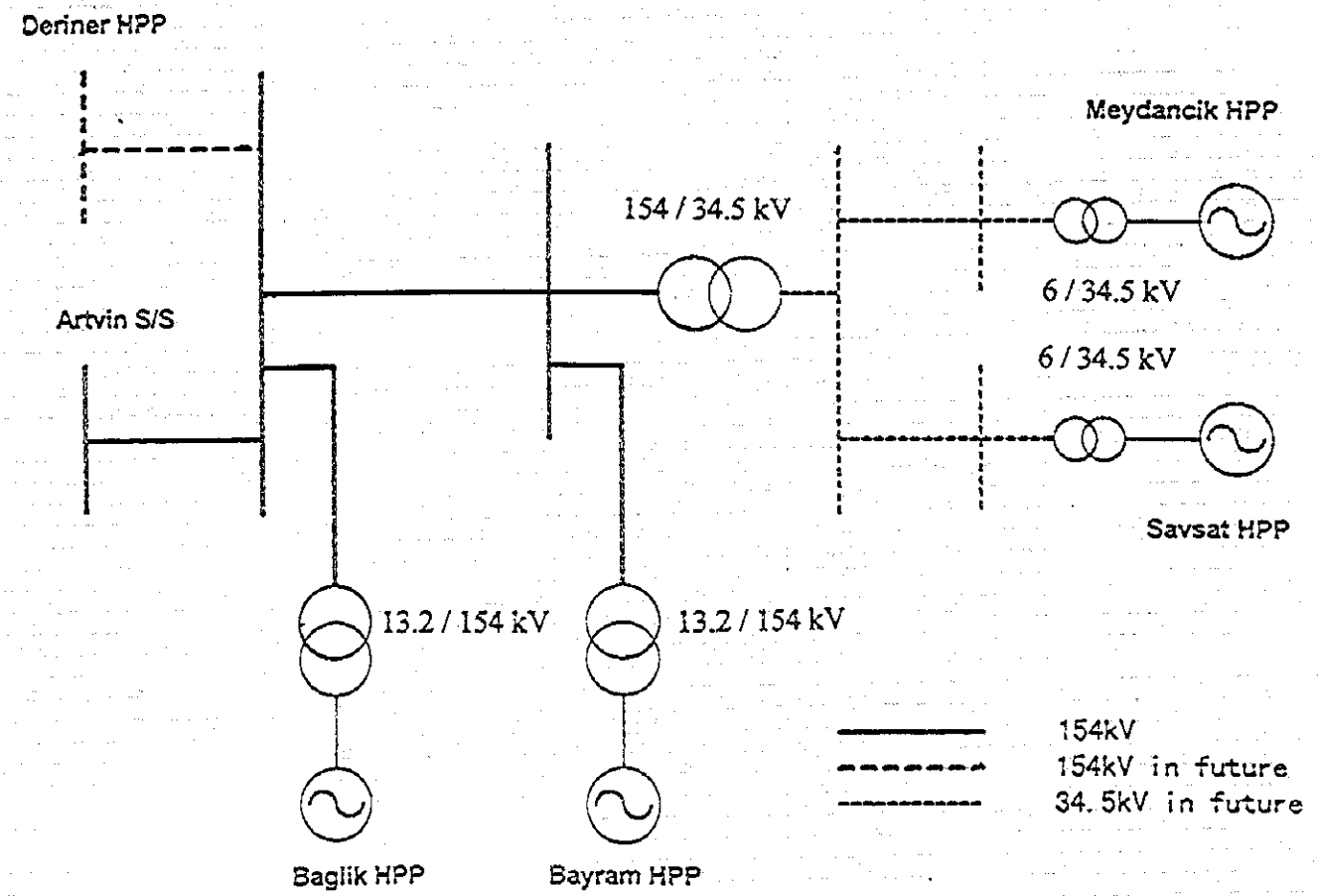


Figure 10-2 EİE Transmission Line Expansion Plan

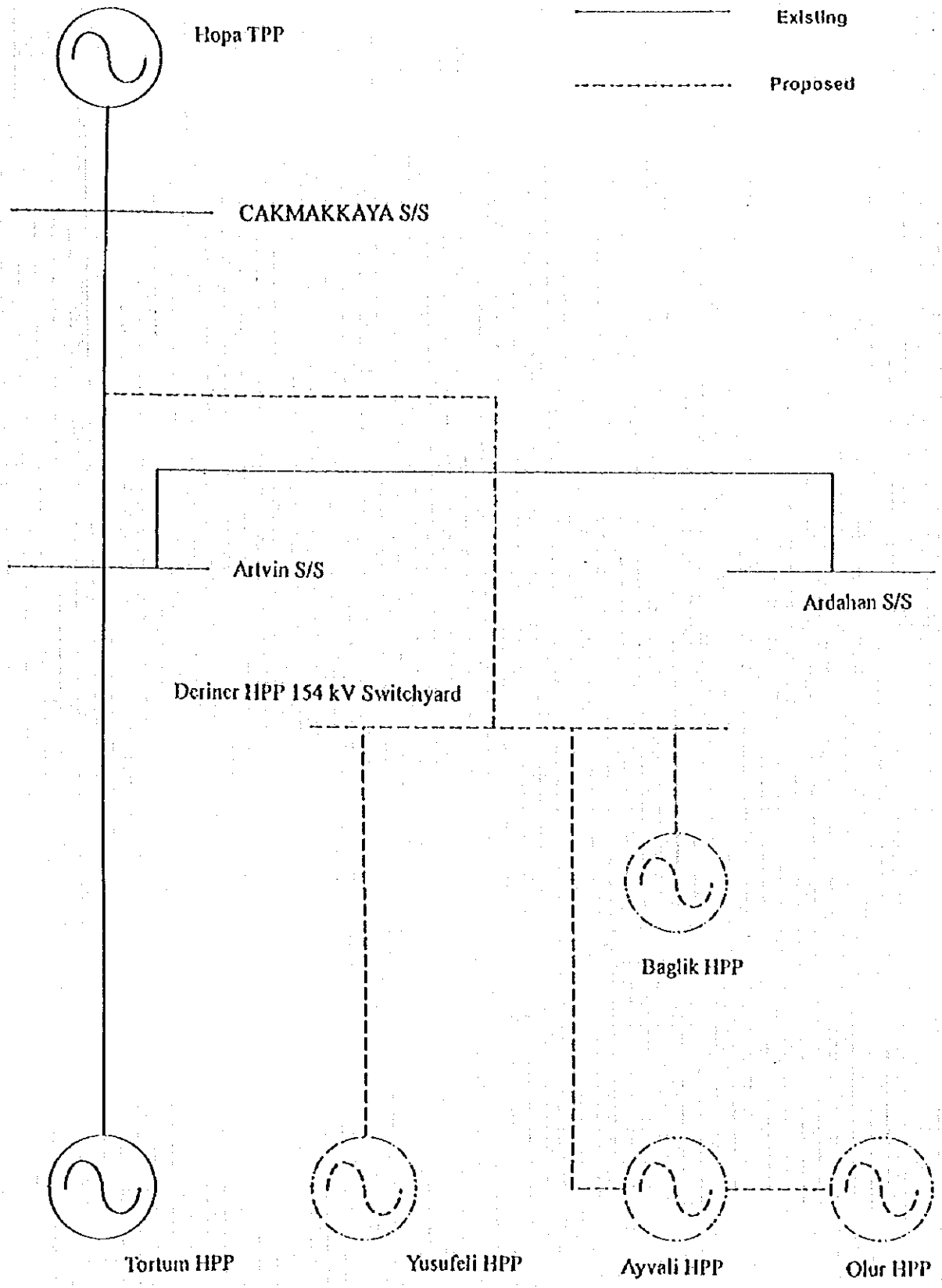


**Figure 10-3 TEAS 154 kV Transmission Line Expansion Plan**