

关于长寨水电项目设计参数的说明

1. 坝址的流量计算

长寨电站采用草坪头水文站作为参考站进行设计。草坪头水文站的面雨量为 1307.5mm, 流域面积为 425km², 多年平均降雨量 6.2 m³/s; 长寨坝址以上面雨量为 1443.8mm, 流域面积为 277km²:

$$Q_{\text{设}} = \frac{F_{\text{设}}}{F_{\text{全}}} * \frac{H_{\text{设}}}{H_{\text{全}}} * Q_{\text{全}}$$

式中: $Q_{\text{设}}$ 、 $Q_{\text{全}}$ ——坝址断面和全流域流量 (m³/s)

$F_{\text{设}}$ 、 $F_{\text{全}}$ ——坝址断面和全流域面积 (km²)

$H_{\text{设}}$ 、 $H_{\text{全}}$ ——坝址断面和全流域的多年平均降雨量 (mm)

$$\text{即: } Q_{\text{设}} = \frac{277\text{km}^2}{425\text{km}^2} * \frac{1443.8\text{mm}}{1307.5\text{mm}} * 6.2\text{m}^3/\text{s} = 4.46\text{m}^3/\text{s}$$

2. 装机容量的计算

长寨电站属于引水式电站, 设计流量为 9.03 m³/s, 根据装机容量计算公式:

$$N_y = A \bar{Q} H_{\text{设}}$$

式中: N_y ——装机容量 (KW)

A ——系数 (本电站采用 8.5)

\bar{Q} ——设计流量 (m³/s)

$H_{\text{设}}$ ——计算水头 (m)

$$\text{即: } N_y = 8.5 * 9.03 \text{ m}^3/\text{s} * 194 \text{ m} = 14890.47\text{kw} \approx 15\text{MW}$$

3. 年运行小时数

电站利用坝址流域的水量进行发电, 其中会损失一部分水能, 根据水能平衡计算公式:

$$\bar{Q} * h = Q_{\text{设}} * 365 * 24 * \eta$$

式中: \bar{Q} ——设计流量 (m³/s)

$Q_{\text{效}}$ ——坝址断面的流量 (m^3/s)

h ——年运行小时数

η ——水能系数 (本电站在 0.9-0.95 之间)

$$\text{即: } h = Q_{\text{效}} * 365 * 24 * \eta / \bar{Q} = 4.46 * 365 * 24 * (0.9/0.95) / 9.03 = 3893\text{h} - 4110\text{h}$$

因此本项目年运行小时数 4078h 是合理的。

4. 厂用电率:

- 1) 贵州省长寨水电站为引水式电站, 并不是坝后式电站, 厂房渗水很少, 站内设计有积水井, 可以存储积水, 抽水泵工作时间很短;
- 2) 长寨电站从压力钢管取冷却水, 很少使用冷却泵;
- 3) 长寨电站设计为电脑监控、少人值守, 员工消耗电力少。

鉴于上述原因, 设计时厂用电率选取 0.2%。



The Explanation about Design Parameters of Changzhai

Hydro Power Project

1、 The Calculation of Flow Rate of Dam Site

Caopingtou Hydrological Station was adopted as permanent reference stations for designing Changzhai Plant. This station drainage area is 425km² with multi-year average rainfall 1307.5mm. The flow rate is 6.2m³/s. The dam controlled drainage area is 277 km². The multi-year average rainfall above the dam site is 1443.8mm.

$$Q_{\text{设}} = \frac{F_{\text{设}}}{F_{\text{全}}} * \frac{H_{\text{设}}}{H_{\text{全}}} * Q_{\text{全}}$$

Where:

$Q_{\text{设}}$ ——Flow rate of dam site section (m³/s) ;

$Q_{\text{全}}$ ——Flow rate of station (m³/s) ;

$F_{\text{设}}$ —— Drainage area of dam site section (km²) ;

$F_{\text{全}}$ ——Drainage area of station (km²) ;

$H_{\text{设}}$ ——Multi-year average rainfall above the dam site section (mm) ;

$H_{\text{全}}$ —— Multi-year average rainfall of the total drainage area (mm) .

$$Q_{\text{设}} = \frac{277\text{km}^2}{425\text{km}^2} * \frac{1443.8\text{mm}}{1307.5\text{mm}} * 6.2\text{m}^3 / \text{s} = 4.46 \text{ m}^3/\text{s}$$

2、 The Calculation of Installed Capacity

Changzhai Hydro Power Project is a diversion type power station. The design flow rate is 9.03 m³/s according to the calculation formula of installed capacity:

$$N_y = AQH_{\text{设}}$$

Where:

N_y ——Installed capacity (KW) ;

A ——coefficient (adopting 8.5 for this project) ;

Q ——Design flow rate (m³/s) ;

$H_{\text{计}}$ —— Calculated waterhead (m)

3、 The calculation of annual operation hours

Hydro power projects uses water flow in drainage area of dam site to generate electricity, which will loss a part of hydro energy. According to the calculation

formula of hydro energy balance:

$$\bar{Q} * h = Q_{\text{设}} * 365 * 24 * \eta$$

Where:

\bar{Q} —— Design flow rate (m³/s) ;

$Q_{\text{设}}$ —— Flow rate of dam site section (m³/s) ;

h —— Annual operation hours (hour) ;

η —— The coefficient of hydro energy (Adopting 0.9-0.95 for this project)

$$h = Q_{\text{设}} * 365 * 24 * \eta / \bar{Q} = 4.46 * 365 * 24 * (0.9/0.95) / 9.03 = 3893\text{h} - 4110\text{h}$$

As a result, the annual operation hours of this project is reasonable which is 4078h.

4、 House consumption rate:

- 1) Unlike the power station after dam, this project is a diversion type power station with less water seeping into the power house. The ponding well was built in the station used for storing water, so the water pumping is just working for a short time.
- 2) The cooling water was adopted from steel penstock so that the cooling pump was rarely used.
- 3) Changzhai plant is nearly managed by computers with few operator bringing a less power consumption used by staffs.

As a result 0.2% was adopted as the house consumption.

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