

## **SECTION – 3**

### **AUXILIARY CONSUMPTION AND TRANSFORMATION LOSSES**

#### **3.1 EXISTING PROVISION**

In the GOI Tariff Notification dt. 31.3.92 (as ammended upto 6.11.95), the Auxiliary consumption and transformation losses have been prescribed as below :

Auxiliary consumption	-	0.5% of energy generated
Transformation Losses	-	0.5% of energy generated

#### **3.2 DISCUSSIONS**

i) The Auxiliary consumption in a hydro-electric power house comprise the following:

- a) Energy consumption by the auxiliaries associated with the units termed as unit auxiliaries.
- b) Energy consumption by common auxiliaries of the power house termed as station auxiliaries.
- c) Energy consumption in other project areas

In addition excitation requirements of generator in case of static excitation equipment, has also to be considered as part of Auxiliary consumption.

ii) The Transformation losses comprise the following :

- a) Losses in Main unit step up transformers
- b) Losses in Unit auxiliary transformers
- c) Losses in Station service transformers
- d) Losses in Excitation transformers

As the MVA capacity of unit auxiliary transformers, station auxiliary transformers and static excitation transformers is very low, therefore the losses associated with these transformers are also very low and are neglected. Transformation losses thus refers to losses in Main unit step up transformers only. The single line diagram of a typical hydro-electric station indicating connection of unit auxiliary transformer, excitation transformer etc. is given at Annex-2.

- iii) The analysis of data on auxiliary consumption in 48 surface and semi underground stations (Annex-3) and 5 underground stations (Annex-4) led to the following conclusions about the energy consumption in auxiliaries of hydro plants:
  - a) Surface stations - 0.2% of energy generated
  - b) Under ground station - 0.4% of energy generated
- iv) The excitation requirements of a few stations were computed (Annex-5), which indicated that in case of plants provided with static excitation equipment, the energy consumption in excitation, on an average, could be considered as 0.3% of energy generated. For plants with rotating excitors mounted on generator shaft, energy consumption in excitation is to be considered 'NIL'.
- v) Transformation losses were also computed from the technical parameters available for a few transformers (Annex-6) which revealed that transformation losses could be considered as 0.5% of energy generated.
- vi) The auxiliary consumption data, collected subsequently for some plants in operation in UP, owned by UP Jal Vidyut Nigam, is given at Annexure-7. The perusal of the data reveals that auxiliary consumption in a surface stations varies from 0.056 % to 0.69% of energy generated. In case of Chibro under ground power

station, it is indicated to be about around 0.4%. To provide an idea about the type of auxiliaries in hydro plant, the auxiliary loads of Khodri Power Station (UP) are indicated in Annex-8.

- vii) The data on auxiliary consumption, excitation requirements in static excitation equipment and transformation losses, received from NHPC is indicated at Annexures-9, 10 and 11 respectively. NHPC have computed excitation requirements and transformation losses at 0.3% and 0.52% respectively of energy generated which matches with the computations made and indicated in sub para (iv) and (v) above. The average auxiliary consumption in case of Salal (0.13%) and Chamera underground station (0.33%) are very much within the values recommended in sub para (iii) above. For Uri, Baira Siul, Loktak and Tanakpur the values of auxiliary consumption indicated as 0.58%, 0.55% 0.41% and 0.62% respectively are high which could be due to metering errors.

### **3.3 COMPARISON WITH INTERNATIONAL PRACTICE**

The level of auxiliary consumption in power houses located in India and in power houses in other countries would not be different as the technology of designing and manufacture of hydro generating units in India is at par with the technology in vogue in other developed countries. Further, even in India the generating units at several power plants were sourced from outside India.

The information on auxiliary consumption received for Kariba South underground station, Zimbabwe placed as Annex-12 indicate average auxiliary consumption of about 0.3% of energy generated.

### 3.4 RECOMMENDATIONS

**(i) Surface hydro stations with rotating exciters mounted on the generator shaft**

Auxiliary consumption = 0.2% of energy generated

Transformation losses = 0.5% of energy generated

**(ii) Surface hydro stations with static excitation**

Auxiliary consumption = 0.5% of energy generated

Transformation losses = 0.5% of energy generated

**(iii) Underground hydro stations with rotating exciters mounted on the generator shaft.**

Auxiliary consumption = 0.4% of energy generated

Transformation losses = 0.5% of energy generated

**(iv) Underground hydro stations with static excitation**

Auxiliary consumption = 0.7% of energy generated

Transformation losses = 0.5% of energy generated