Electrical System Design Status of PEFP

In Taek Song, Kyeong-Jun Mun, Jun Yeon Kim
Proton Engineering Frontier Project, Korea Atomic Energy Research Institute
Daeduk-Daero, 989-111, Dukjin Dong, Yuseong-Gu, Daejon, 305-353, Korea
**Corresponding author: itsong@kaeri.re.kr*

1. Introduction

Proton Engineering Frontier Project (PEFP) has been developing a 100 MeV proton linear accelerator. Also, PEFP has been designing the Proton Accelerator Research Center in Gyeong ju. In site, we installed GIS (Gas Insulated Switchgear) to receive 154kV electric power and 154kV/3.3kV transformer[1]. For the energy saving scheme, we are now installing solar power system, automatic lighting control system and maximum control power system of PEFP.

In this paper, we described electrical power system of PEFP.

2. Electrical Power System of PEFP

2.1 154kV Substation Facilities

154kV substation facilities are composed of 154kV incoming line, 170V gas insulated switchgear (GIS), transformer. 154kV power transmission cable (XLPE cable, 1C 400sq, 3 lines) for 154kV substation facilities, which has sufficient capacity to receive electrical power required, will be installed between substation and GIS of PEFP.

154kV substation is outdoor type, 170kV totally enclosed gas insulated switchgear. It includes gas insulated buses (GIB), power circuit breakers, disconnect switches, current transformer, voltage transformers, earthing switches, surge arrestors, compressed air system with local pipes and fittings.

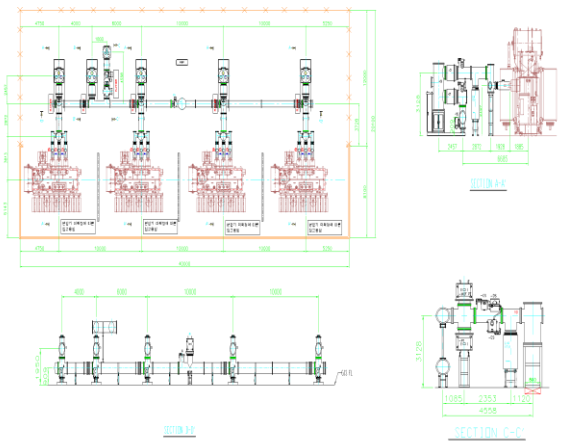

Fig. 1 GIS Configuration of PEFP

154kV switchyard consists of one bus and one breaker. For gas insulated bus, aluminum tubular bus is adopted. It is capable of withstanding the expected maximum short circuit current at rated voltage. Fig. 1 describes the GIS configuration of PEFP.

3.3kV switchgear system consists of RF power supply system (A system) and conventional facilities (B system), which is described in Fig. 2.

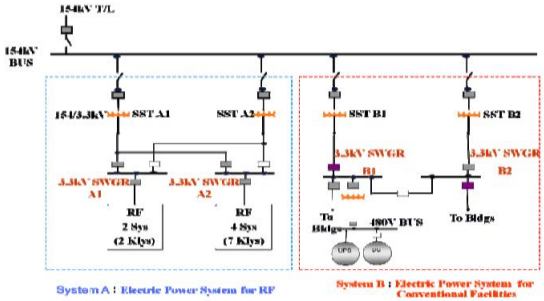

Fig. 2 3.3kV Switchgear System of PEFP

2.2 Solar Power System of PEFP

Solar cell module consists of solar cells and base plate. It converts sunlight directly into electric energy. To generate more electricity from solar power system, more solar cells should be installed. Nowadays, solar power generation capabilities tend to be enlarged by installing more solar cells. In proton accelerator research center of PEFP, 250W solar cell is introduced.

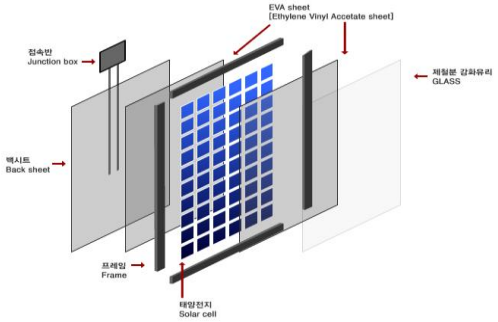

Fig 3. Component of Solar Module

Power inverter converts the solar power generation device; it generated from the solar array DC power into AC power frequency and voltage. In Proton Accelerator Research Center of PEFP, 2 110kW-inverter will be installed. Fig. 4 described Solar generator installed area of PEFP.

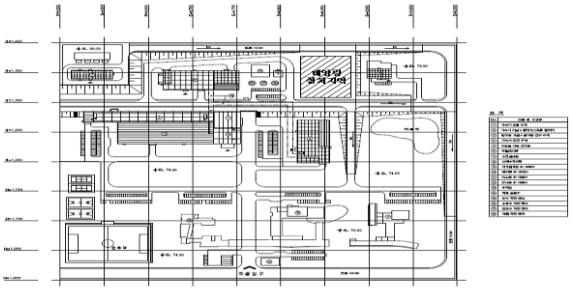

Fig 4. Install Area of Solar Generator.

2.3 Lighting Control System of PEFP

In Fig. 5, we described block diagram of lighting control system of PEFP. As shown in Fig.4, lighting system of each zone in each building is connected to the lighting control system to observe and control lighting system[2].

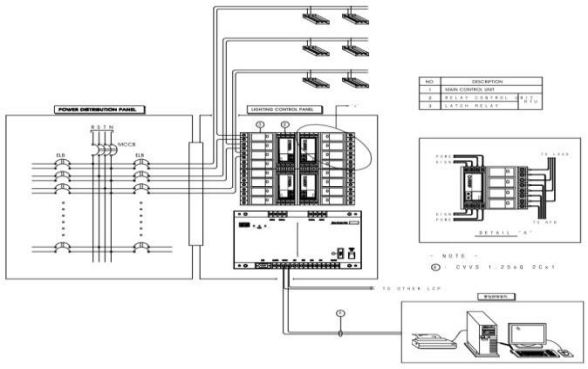

Fig 5. Lighting Control System Block diagram of PEFP

2.4 Ice Storage System of PEFP

Chilled water system in PEFP is composed of; chilled water system for accelerator component, for HVAC system including ice storage system. Fig. 3 describes the example of chilled water system of PEFP As described in Fig. 6, ice storage system is included in chilled water system. Ice storage system is the system of using a chiller to build ice during off-peak hours to serve part of or all on-peak cooling requirement.

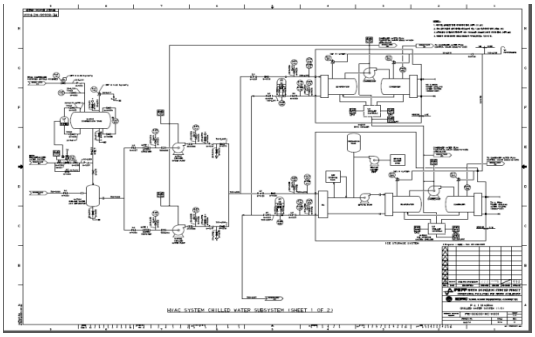

Fig 6. Chilled Water System of PEFP

2.5 Heating and Cooling Load Control of PEFP

Main reasons for considering an electric heater are ; high efficiency, quiet operating system, easy to maintain, space efficient and safe operation. For heating system of PEFP, electric heater and electric water heater system in HVAC are adopted. HVAC system of PEFP, including electric heater, is described in Fig. 7.

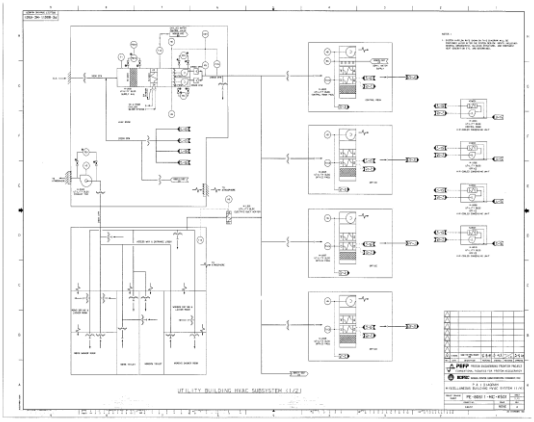

Fig. 7 HVAC system of PEFP (including electric heater)

3. Conclusions

In this paper, we described GIS (Gas Insulated Switchgear) to receive 154kV electric power and 154kV/3.3kV transformer. We are also described designing scheme of distribution system according to the electrical load changes. Additionally, we described emergency diesel generator and UPS for the electric power outage occurs. For the energy saving scheme, we are now designing solar power system of PEFP.

ACKNOWLEDGEMENT

This work was supported by the Ministry of Education, Science and Technology (MOST) of the Republic of Korea through the Proton Engineering Frontier Project.

REFERENCES

[1] Comprehensive Design Report, KOPEC, 2005, 6
[2] “Lighting control System” [joongAng Control, 2012]