

Underwriting Survey Report

Comprehensive Machinery Insurance

Apr. 2024

SEgreenenergy Co., Ltd.

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Chapter 1

Introduction

| | | | |
|-------------------------|---|--|--|
| Purpose of Visit | This report is risk description and assessment of the SEgreenenergy Co., Ltd. located in Hwaseong City, Korea. The report has been prepared on behalf of the Hyundai Marine & Fire Insurance to give proper information regarding to insurance coverage and estimate the Probable Maximum Loss (PML). | | |
| Account | SEgreenenergy Co., Ltd. | | |
| Site Address | 280-50, Hwagok-ro, Jangan-myeon, Hwaseong-si, Gyeonggi-do, Korea | | |
| Class of Risk | Solid Oxide Fuel Cell(SOFC) Power Plant | | |
| Survey History | Survey Visit Date - 17 Apr. 2024 Last Survey Date - 13 Apr. 2021 | | |
| Survey Attendees | <u>Risk Management Research Center, Hyundai HiLife Claims Services</u> Jang, Ye Na - Associate Risk Engineer | | |
| Site Contacts | SEgreenenergy Co., Ltd. Cho, Chang Won - Business Operation Team Choi, Jae Young - Business Operation Team Lee, Seul Bi - Business Operation Team | | |
| Disclaimers | This report does not indicate that all possible hazards have been identified, or no other hazards exist. Hyundai HiLife Claims Service Co., Ltd. does not make any warranty concerning the contents of this report or disclaims, whatsoever, for any errors or omissions in the information given or the consequences of reliance thereon. Any advice contained herein is solely for the assisting the insured regarding loss control and safety. | | |

Chapter 2 Summary

| SEgreenenergy | | | |
|---|--|--|--|
| Latitude | | 37.0545 N | |
| Longitude | | 126.8197 E | |
| <u>Property Values (M KRW)</u> | | <u>Other Insured Values (M KRW)</u> | |
| Operational Material Damage | | Machinery Breakdown | |
| Fuel Cell (66ea) 96,976 - | | N/A | |
| M&E, Instrumentation 4,664 - | | Operational Business Interruption 10,296 - | |
| Construction, Office & Its contents 2,791 - | | General Liability | |
| N/A | | | |
| Property Total 104,431 - | | <u>Loss Estimates (PML, M KRW)</u> | |
| * Based on Insured Value in 2023. | | Property Damage 39,684 - | |
| | | Machinery Breakdown | |
| | | N/A | |
| | | Business Interruption | |
| | | N/A | |
| <u>Natural Hazard Exposure</u> | | <u>Main Hazard Features</u> | |
| Earthquake | | Site condition / Layout | |
| Moderate | | Average | |
| Tsunami | | Building Construction | |
| No Hazard | | Average | |
| River Flood | | Operational Hazard | |
| No Hazard | | Average | |
| Flash Flood | | Operational Control | |
| No Hazard | | Average | |
| Windstorm | | Protection | |
| Moderate | | Below Average | |
| Hailstorm | | Management | |
| Very Low | | Average | |
| Lightning | | | |
| Moderate | | | |
| <u>Allied Perils</u> | | <u>Loss Record (within recent 5 years)</u> | |
| External F&E | | Date | |
| No Hazard | | Loss type | |
| Vehicle/Vessel Impact | | Loss (M KRW) | |
| Low | | None | |
| Strikes / Riots | | | |
| Low | | | |
| Subsidence / Landslip | | | |
| Moderate | | | |
| Overall Risk Rating | | Average | |

Chapter 3 Overviews

3.1 Site Operations Summary



[The complete view of SEgreenenergy]

SEgreenenergy (hereinafter refers as ‘SEG’) is a SPC (Special Purpose Company) jointly established by Korea South-East Power Co., Ltd and SK E&C Co, Ltd in 2012. KOEN holds a 84.8% stake, while SK E&C holds a 15.2% stake.

SEG initially intended to carry out the RPF (Refuse Plastic Fuel) power generation business. However, SEG changed its business direction to SOFC (Solid Oxide Fuel Cell) power generation in 2018 due to the conflicts with local residents and change in the government’s waste policies.

The SOFC power plant was constructed from July 2019 to June 2020 (12 months). It comprises 66 SOFC units, with a total power generation capacity of 19.8 MW (300 kW x 66 units). It will be operated for 20 years until June 1, 2040.

The plant operates using NG supplied by Samchully Co., Ltd., and the generated electric power is sold to Korea Electric Power Corporation (KEPCO). The annual sales amount reached approximately 47 billion KRW in 2023. Brief project outline and current generation status are as follows.

| Project Outline | |
|-------------------|---|
| Project | Hwaseong Fuel Cell Power Generation Business |
| Facility capacity | Solid Oxide Fuel Cells (SOFCs) 19.8 MW (300 kW x 66 units) |
| Fuel cell model | Bloom Energy Server ES5 |

| Project Outline | |
|--------------------------------|----------------------------------|
| Generation capacity | 160 GWh / year |
| Construction period | 2019.07 ~ 2020.06 (12 months) |
| Construction cost | About 140 billion Korean Won |
| Operation period | 2020.06 ~ 2040.06 (20 years) |
| EPC / Maker (LTSA) | SK E&C / Bloom Energy (20 years) |
| Current Generation Status | |
| Output | 15.9 MW |
| Annual utilization rate | 392.3% |
| Cumulative generation capacity | 1,855.15 GWh |

3.2 Recent Changes

1. The replacement of the modules began in 2022 to enhance efficiency under the LTSA (Long Term Service Agreement) with Bloom Energy. Currently, 70% of the replacements have been completed, with the remaining replacement being carried out sequentially.

One unit consists of six modules (total 396 modules), and about 280 modules have been replaced. The replacement of the module can be carried out without interrupting the operation of the entire fuel cell system.

2. Previously, there was only one P-type fire alarm control panel installed in the fire extinguish agent room of the Substation where no one is working. Currently, SEG has installed a new sub P-type fire alarm control panel in the control room of the Substation, where a site engineer from YOUNGJIN (subcontractor) is stationed. Two panels are interlocked with each other.

3. The overhaul of the fuel cell, programmable logic controller (PLC), governor stations, and electric supply system was carried out in March, 2024. The components with material degradation were replaced during the overhaul period.

3.3 Loss History

No claim loss has been reported in recent five years in SEG.

3.4 Conclusion

SEG generates electricity by operating a SOFC power plant with a total capacity of 19.8 MW. Unlike other fuel-fired power plants, there is no burning of the fuels; instead, it relies on the chemical reaction to generate electricity. Natural gas uses for the raw material. Therefore, the use of flammable gas is the main hazard regarding fire and explosion exposure. This may occur from gas piping or governor stations when large quantity of natural gas is accidentally

released into the atmosphere. The governor stations are equipped with pressure safety valves (PSVs) and gas leak detectors, interlocked by automatic shutoff valves.

Additionally, fire can result from an electrical failure in the electric room, which could trigger the explosion in the 1st governor station located near the Substation. When producing electricity through chemical reactions, temperatures reach approximately 900°C. Therefore, fire and explosion can occur due to abnormal temperature or runaway reaction.

SOFC modules are highly resistant (up to 1,000°C) to fire and explosion. Each module is equipped with its own gas leak detector, flame detector, and alarm/trip system (high/low: alarm / high-high/low-low: trip). The fuel cell system is monitored in the Central Control Room (CCR) of the Office and the control room of the Substation. Also, Bloom Energy Corporation monitors the system 24 hours a day. Preventive maintenance is periodically performed by technicians belong to Bloom Energy.

Lightning and static electricity can be an ignition source that may lead to fire. However, all facilities are earth-grounded to prevent the static electricity. The lightning protection system is also installed on the site.

Two buildings were constructed with fire proofing steel structure. Sandwich panels insulated with glass wool are used for both the exterior walls and roofs of the buildings. All building are not fire partitioned.

Main fire protection system for the fuel cell is a portable fire extinguisher. HFC-125 fire extinguishing system is installed in the electric room and control room of the Substation. Regular inspection is implemented by the subcontractor, and the public fire station is about 3.6 kilometers away from the site.

The natural hazard of the site is below the moderate level. However, the Korean peninsula typically experiences two or three typhoons annually during the summer season, which often bring torrential rain and windstorms. Although wind resistant design is applied to the fuel cells and the Substation, strong wind followed by typhoon can result in damage to the sandwich panel walls and roofs.

Based on risk assessments result that comprises a broad categories of exposure to the risk and loss mitigation measures, this site is rated to be an Average level in its risk category.

Remark

Above overall rating is mainly concerned with those perils is relevant to property damage (excluding machinery breakdown) and business interruption. In this report, we provide our opinions as to the quality of the risk on a worldwide industry basis. The following definitions apply;

| | |
|-------------------------|---|
| <i>Excellent</i> | <i>The very best current day practice in the class of industry</i> |
| <i>Good</i> | <i>Embodies some of the best practices in the class of industry</i> |
| <i>Average</i> | <i>Acceptable standards exhibited</i> |
| <i>Fair</i> | <i>Some areas below the standard of current day practice</i> |
| <i>Poor</i> | <i>Embodies few or none of the standards expected of current day practice</i> |

Chapter 4 Values & Loss Estimation

4.1 Sum Insured Value

(unit : M KRW)

| Site | Asset | Insured Value |
|---------------|-------------------------------------|---------------|
| SEgreenenergy | Fuel Cell (66ea) | 96,976 - |
| | M&E, Instrumentation | 4,664 - |
| | Construction, Office & Its contents | 2,791 - |
| Total | | 104,431 - |

※ The above value is based on the insured value in 2023.

4.2 Probable Maximum Loss

We understand the probable maximum loss, i.e. the maximum loss that might be expected, at a cautious estimate, to occur as a result of a single loss event, taking into consideration all the circumstances of the risk. Individual property damage rate, fire-fighting facilities/fire protection measures or other management features have to be left unconsidered for a PML assessment. This assumption does not include additional indirect losses like debris removal cost, and we do not take inflation factor into PML consideration.

4.3 Loss Estimates Summary

| Coverage | Scenario | Loss Estimates (M KRW) | % TSI |
|-----------------|----------|---------------------------|-------|
| Property Damage | Fire | 39,684 | 38% |

4.4 PML Scenario - Fire

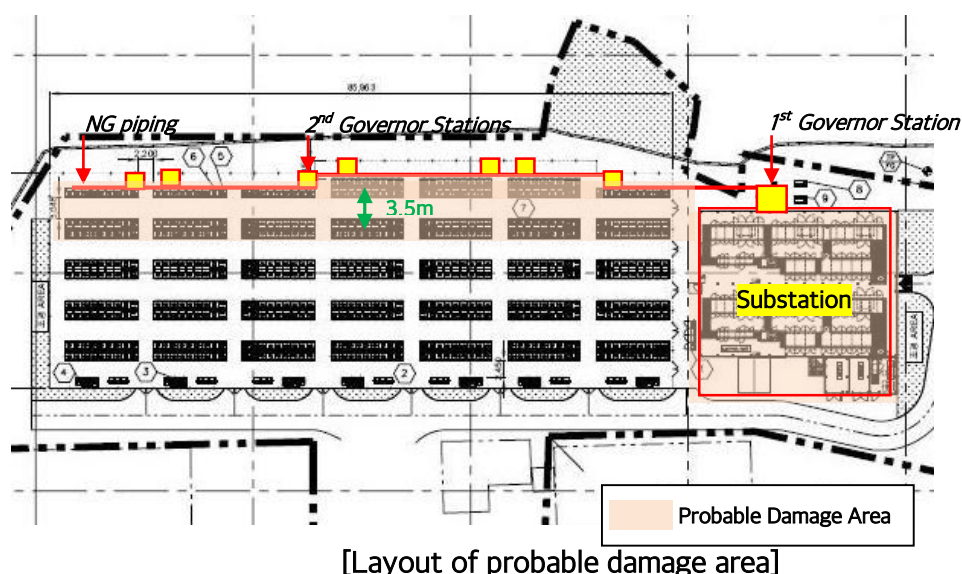
4.4.1 PML for Property Damage

Fire & explosion event is the most severe loss event in respect of Property Damage except the catastrophic disaster such as earthquake. This assumption does not include additional indirect losses like firefighting expense and debris removal cost. Loss assumption herein is based on present value, and we do not take inflation factor into PML consideration.

Considering the asset distribution and distance between the fuel cells and buildings, SEG is considered as single risk zone.

PML could occur due to a gas explosion from piping or gas governor stations. This could trigger secondary explosions, leading to additional fires, and cause the total loss of the Substation and some loss of ES5 modules, which are located near the piping and 2nd gas governor stations. Fire can spread to neighboring fuel cells because of the narrow distance between them (about 3.5 meters).

Based on the above loss scenario, PML is estimated about **39,684 million KRW** for property damage, about **38% of property values** (35% of Fuel cell, 90% of M&E, Instrumentation, 75% of Construction Office & Its content) of the SEG.



Chapter 5 Site Description

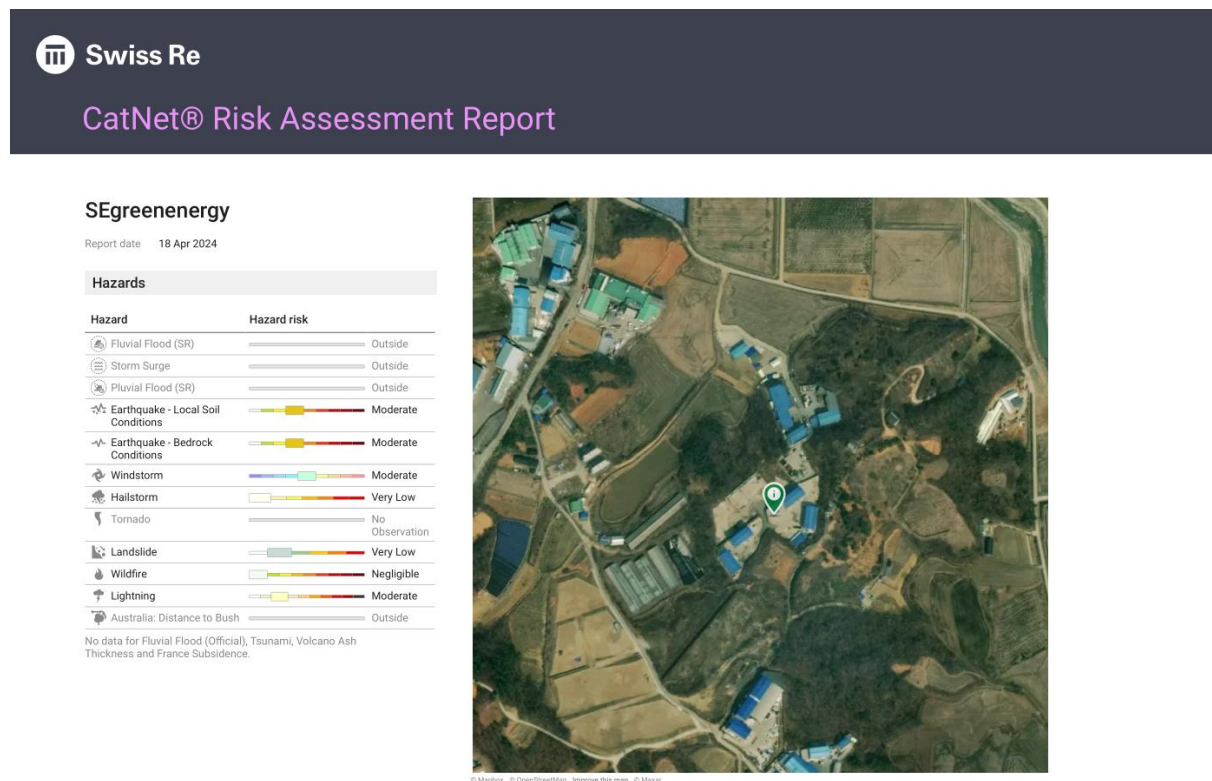
5.1 Natural Hazard Exposures

5.1.1 Metrological Data

| | | | |
|------------------------------|------------|----------------------------|----------|
| Temperature Max. | 39.3 °C | Temperature Min | -18.6 °C |
| Precipitation (24 hours) Max | 333.2 mm | Precipitation (1 hour) Max | 92.5 mm |
| Snow Fall Max. | 20.5 cm | Great Gust | 30.5 m/s |
| Annual Precipitation (total) | 1,320.3 mm | | |

Above meteorological data is based on Statistical Data of Korea Meteorological Administration - Focused on Suwon City between 1994 and 2023. There can be geological differences between actual location of the site and meteorology observation post.

** All natural hazard data below are based on the 'CatNet Risk Assessment Report' from Swiss Re.*

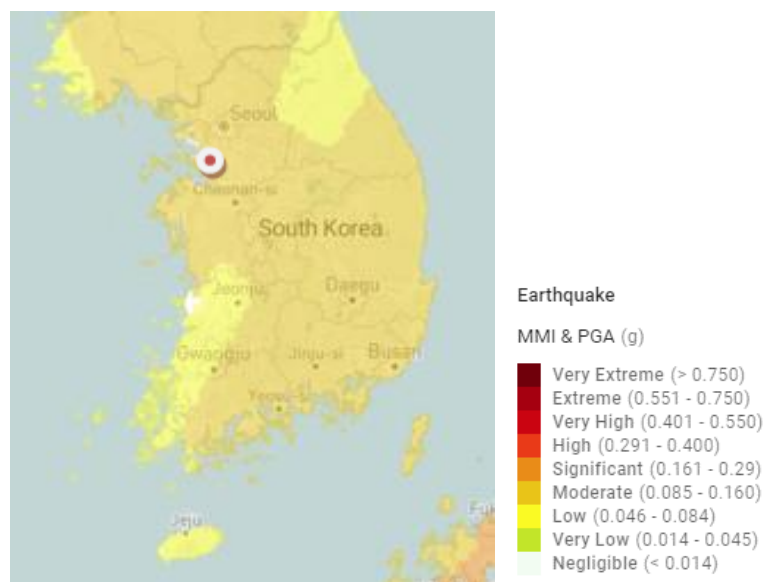


[Swiss Re CatNet Natural Perils Risk Assessment Report]

5.1.2 Earthquake / Tsunami

According to the Swiss Re "CatNet Risk Assessment Report", the pseudo spectral acceleration (PSA) of this area is 0.10g, with a seismic intensity of 3.56 for the return period of 475 years. It is classified as a moderate seismic risk zone.

The Office is applied an earthquake-resistant design with seismic capacity rating of VII-0.229g on the MMI scale. The fuel cells are also earthquake-resistant. Since its operation, there haven't been any significant seismic or tsunami events at the site.



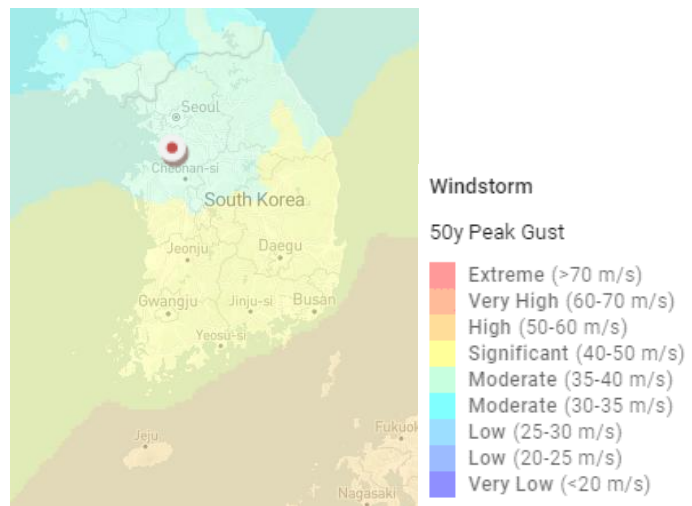
[Swiss Re World Map of Natural Hazard "Seismic"]

5.1.3 Typhoon / Flood

According to the Swiss Re "CatNet Risk Assessment Report", the peak gust generated in the site for 50 years is 38m/s with an intensity of 4.07, classifying it as a moderate windstorm risk zone.

The Korean peninsula typically experiences two or three typhoons annually during the summer season, which often bring torrential rain and windstorms. Wind resistant design is applied to the fuel cells and the Substation. However, strong wind followed by typhoon can result in damage to the sandwich panel walls and roofs.

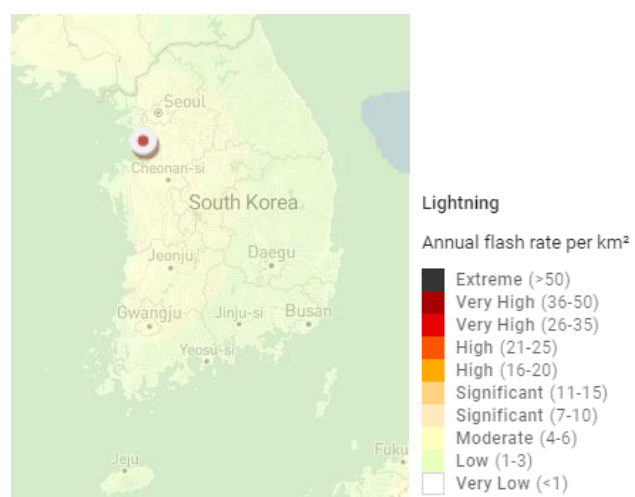
Additionally, the site is not classified as a flood risk zone according to the Swiss Re "NatCat Risk Assessment Report". The fuel cells and Substation are situated about 10 meters higher than the adjacent main road. Furthermore, there is no history of natural hazards in the past five years.



[Swiss Re World Map of Natural Hazard “Windstorm”]

5.1.4 Lightning

According to the Swiss Re "CatNet Risk Assessment Report", annual flash rate/km² in this area is 4 flashes and it is classified as moderate lightning risk zone. The site is equipped with an adequate lightning protection system. Lightning rods are installed on the lighting poles and are bonded through ground electrodes.



[Swiss Re World Map of Natural Hazard “Lightning”]

5.2 Geographic Conditions / Layout

SEG is located at the rural area in Hwaseong City, which is approximately 80 kilometers southwest of Seoul City. Global location of SEG is latitude 37.0545°N & longitude 126.8197°E. The site has an average elevation of approximately 10 meters above the sea level and the Yellow sea is located about 4 kilometers west of the site.

The site occupies a lot area of 6,966 square meters and is situated on flat ground. The surface is paved with a well maintained asphalt compound and cement paste. Moreover, there have been no significant signs of subsidence or collapse in the buildings, and no recorded losses related to them. The ground condition is considered stable and rigid.

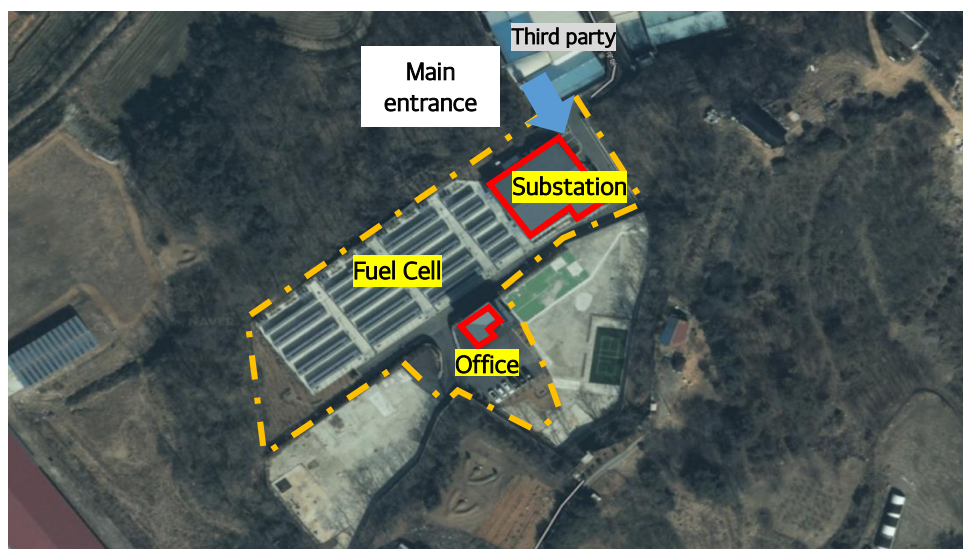
The fuel cells and Substation are located on the north side of the site, while the Office is located on the south side. There is a slight ground level difference between the north and south of the site, with the south being 5 meters higher than the north.



[Ground level difference]

SEG has only one entrance gate near the Substation, which can be directly accessed via a 6-meter road. Thus, the general accessibility to the site is considered to be good.

Three sides of the site, excluding the north, are surrounded by hillocks. The nearest third-party, an incineration plant, is located about 10 meters north of the Substation. Therefore, there is a risk of fire spreading to each other.



[The layout of SEgreenenergy]

5.3 Buildings & Constructions

There are two buildings, Substation and Office, in the site and total floor area is 859.02 square meters. Two buildings were constructed with fire proofing steel structure. Sandwich panels insulated with glass wool are used for both the exterior walls and roofs of the buildings. All building are not fire partitioned.

The Substation is a single-story building divided into five sections; the electric room, control room, fire extinguishing agent room, storage, and toilet. The electric room occupies the majority of the Substation's space.

The Office is a two-story building, with both floors used as office space. The Central Control Room (CCR) is located on the first floor.

Summary of buildings in the site is as follow;

| No | Name of Building | Structure | | | Floor | Fl. Area (㎡) |
|----|------------------|-----------|-----------|-------|-------|--------------|
| | | Column | Ext. Wall | Roof | | |
| 1 | Substation | STL | SP | SPOST | 1F | 624.15 |
| 2 | Office | STL | SP | SPOST | 2F | 234.87 |

*** Abbreviation**

STL : Steel

SP : Sandwich Panel

SPOST: Sandwich Panel On Steel Truss



[Substation]



[Office]

5.4 Manufacturing Processes & Facilities

5.4.1 SOFCs Power Generation Introduction

SEG is 19.8 MW SOFC power plant, and the generated electric power is sold to KEPCO. The SOFC modules, called 'Energy Server 5 (ES5)', are installed at the plant in compliance with various safety standards. Bloom Energy, the manufacturer of the SOFC modules, manages all aspects of the operation and maintenance of the fuel cell system. Brief fuel cell system is as follows.

| Fuel Cell System | |
|---------------------|---|
| Project | Hwaseong Fuel Cell Power Generation Business |
| Facility capacity | Solid Oxide Fuel Cells (SOFCs) 19.8 MW (300 kW x 66 units) |
| Fuel cell model | Bloom Energy Server ES5 |
| Fuel Gas | Hydrogen separated from NG |
| Voltage | AC 480V |
| Electric Efficiency | 56% |
| Power Supply | KEPCO's Joam Substation |

5.4.2 Raw Material / Product

Methane, the principal component of natural gas (NG), is converted into hydrogen through internal reforming within the module of ES5. NG is supplied by the Samchully through pipelines. There is no bypass line other than a main and spare line.

NG is distributed to the modules through a two-stage governor system. The 1st governor station regulates NG from 8 bar to 2 bar and 2nd governor stations regulate NG from 2 bar to 0.75 bar. The modules are arranged in seven rows, with seven 2nd governor stations installed in each row. The 1st governor station is located north of the Substation.

The generated electricity is transmitted to KEPCO's Joam Substation about 5.2 kilometers away by both underground and overhead lines.



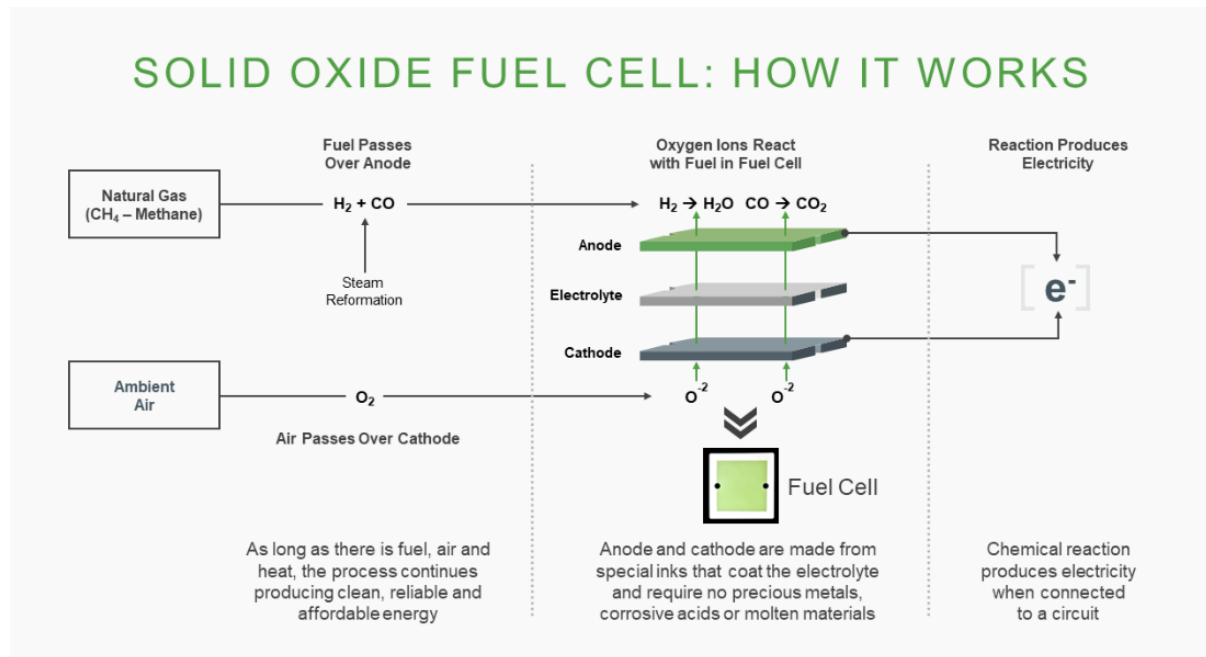
[1st governor station]



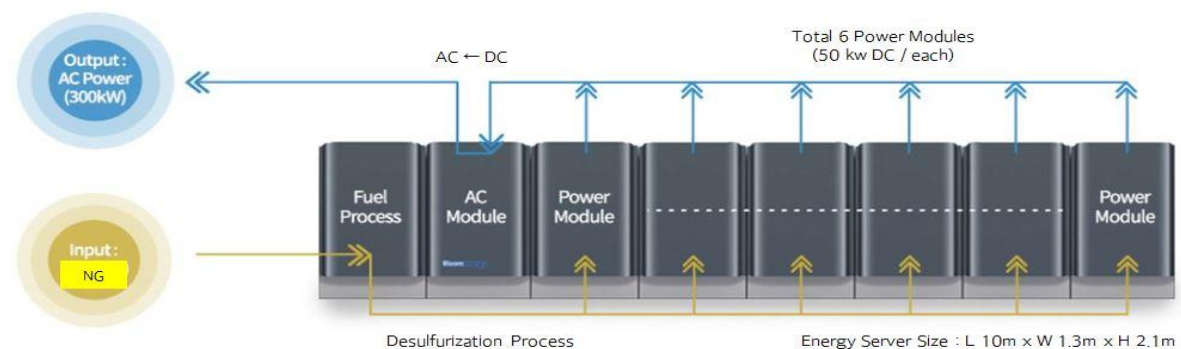
[2nd governor station]

5.4.3 Process Description

The electrolyte in SOFCs is solid ceramic material. The anode and cathode electrodes in Bloom Energy's fuel cells are special inks that coat the electrolyte. Unlike other types of fuel cells, Bloom Energy's SOFCs do not require precious metals, corrosive acids, or molten materials. Operating at high temperatures (about 900 degree Celsius) inside the ES5, ambient air enters the cathode side of the fuel cell. Meanwhile, steam mixes with fuel (NG) entering through the anode side to produce reformed fuel. As the reformed fuel (hydrogen), crosses the the anode, it attracts oxygen ions from the cathode. The oxygen ions then combine with the reformed fuel to generate electricity, steam, and carbon dioxide.



[Process flow of SOFC]



[Components of ES5]

The steam produced during the reaction is recycled to reform the fuel. Due to this recycling process, Bloom Energy's fuel cells do not require water during normal operation. The electrochemical process also generates heat, maintaining the fuel cell's temperature and driving the reforming reaction process. As long as fuel and air are supplied, the fuel cells continue converting chemical energy into electrical energy, providing an electric current directly at the fuel cell site. SOFCs are the first (and smallest) component manufactured for the ES5. The SOFCs are then combined into a fuel cell stack, and multiple stacks create the

ES5. One 300kW ES5 unit in the site consists of six modules. The distance between the units is about 3.5 meters.



[Components of ES5]

Following table is a specification of ES5(ES5-YA8AAN) installed in the Hwaseong plant of SEG.

| Energy Server 5 | Technical Highlights (ES5-YA8AAN) |
|--|---|
| Outputs | |
| Nameplate power output (net AC) | 300 kW |
| Load output (net AC) | 300 kW |
| Electrical connection | 480V, 3-phase, 60 Hz |
| Inputs | |
| Fuels | Natural gas, directed biogas |
| Input fuel pressure | 10-18 psig (15 psig nominal) |
| Water | None during normal operation |
| Efficiency | |
| Cumulative electrical efficiency (LHV net AC) ¹ | 65-53% |
| Heat rate (HHV) | 5,811-7,127 Btu/kWh |
| Emissions² | |
| NOx | 0.0017 lbs/MWh |
| SOx | Negligible |
| CO | 0.034 lbs/MWh |
| VOCs | 0.0159 lbs/MWh |
| CO ₂ @ stated efficiency | 679-833 lbs/MWh on natural gas; carbon neutral on directed biogas |
| Physical Attributes and Environment | |
| Weight | 15.8 tons |
| Dimensions (variable layouts) | 18'94" x 8'8" x 7'0" or 32'11" x 4'5" x 7'5" |
| Temperature range | -20° to 45° C |
| Humidity | 0% - 100% |
| Seismic vibration | IBC site class D |
| Location | Outdoor |
| Noise | < 70 dBA @ 6 feet |
| Codes and Standards | |
| Complies with Rule 21 interconnection and IEEE1547 standards | |
| Exempt from CA Air District permitting; meets stringent CARB 2007 emissions standards | |
| An Energy Server is a Stationary Fuel Cell Power System. It is Listed by Underwriters Laboratories, Inc. (UL) as a 'Stationary Fuel Cell Power System' to ANSI/CSA FC1-2014 under UL Category IRGZ and UL File Number MH45102. | |
| Additional Notes | |
| Access to a secure website to monitor system performance & environmental benefits | |
| Remotely managed and monitored by Bloom Energy | |
| Capable of emergency stop based on input from the site | |

¹ 65% LHV efficiency verified by ASME PTC 50 Fuel Cell Power Systems Performance Test

² NOx and CO measured per CARB Method 100, VOCs measured as hexane by SCAQMD Method 25.3



[Fuel cell]

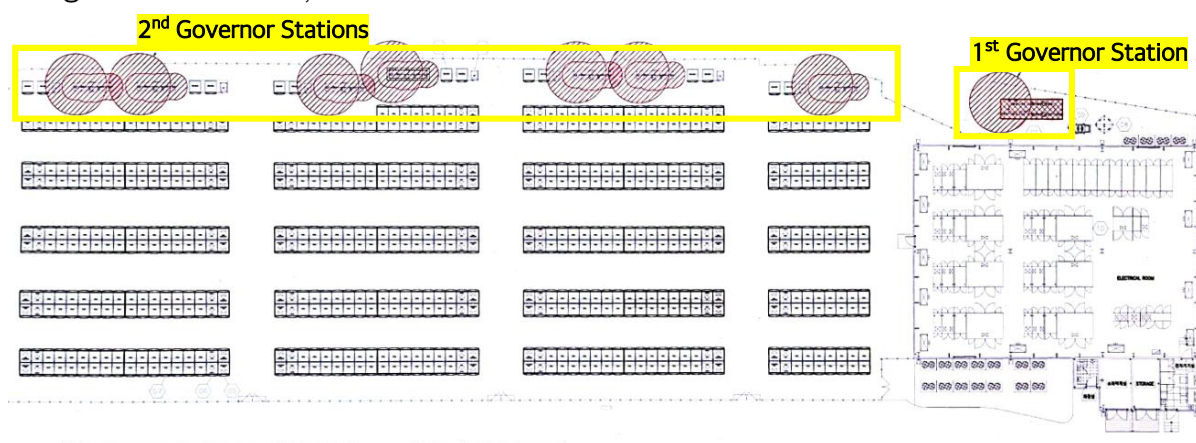


[Distance between the fuel cells]

5.4.4 Process Safety Management

All facilities are earth-grounded to prevent static electricity. The lightning protection system is also installed on the site.

Inside the enclosure of the 1st governor station is classified as a Zone 1 hazardous area. The 2nd governor stations and the pressure safety valve (PSV) vent of the 1st governor station are classified as a Zone 2 hazardous area. All electric apparatus on the stations are designed to be explosion-proof. Additionally, the 1st and 2nd governor stations are equipped with PSVs and gas leak detectors, which are interlocked to automatic shut-off valves.



[Explosion hazardous area classification]



[Ground wire]



[PSV]



[Gas leak detector]

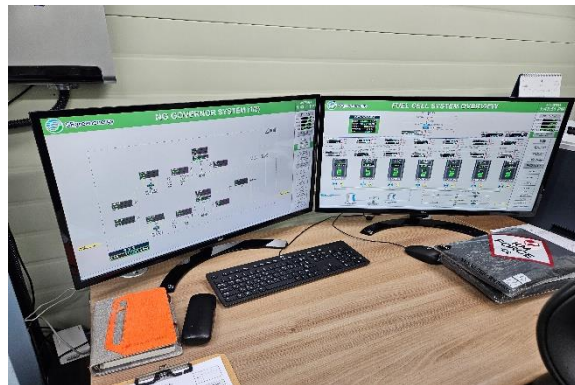


The modules are highly resistant to fire and explosion. Each module is equipped with its own gas leak detector, flame detector, and alarm/trip system. Its operation parameters such as temperature, cell voltage, gas flow, and gas pressure are monitored and displayed on the programmable logic controller (PLC).

Monitoring system is installed at the Central Control Room (CCR) in the Office and control room in the Substation. Employees from SEG are stationed in the CCR, and a site engineer from YOUNGJIN (subcontractor) is stationed in the control room. There are no employees from Bloom Energy in the site, but the fuel cell system is remotely operated and monitored 24 hours a day by Bloom Energy.



[CCR in the Office]



[Control room in the Substation]



[Gas alarm monitoring]



[CCTV monitoring]

5.5 Utilities

5.5.1 Electric Power

SEG is supplied with 22.9kV electric power from KEPCO's Joam Substation through a single feeder and stepped down to 380V/220V by the station service transformer. Mold-type transformers are installed in the Substation. The contract demand is 800kW, but peak demand has not been provided. The current electric power is stable without any unnoticed interruptions.

The generated DC power from the fuel cell is converted to AC by the inverter and stepped up to 480V through transformers of each SOFCs. Subsequently, the 480V electric power is stepped up to 22.9kV by seven main transformers. It is then transmitted to the 22.9 kV grid of Joam Substaion about 5.2 kilometers away by both underground and overhead lines. Seven main transformers are tied to each other.

| Location | Equipment | Capacity | Type | Unit | Voltage |
|------------|-----------------------------|------------------|------|--------|--------------------|
| Substation | Step-up Transformer | 4.5MVA 4.0MVA | Mold | 3 4 | 480V → 22.9kV |
| | Station service Transformer | 400kVA | | 2 | 22.9kV → 380V/220V |

All electric facilities are inspected by a subcontractor according to the maintenance schedules. A detailed inspection is conducted by the Korea Electrical Safety Corporation (KESCO) every two years.

Furthermore, electric room is protected by total flooding type HFC-125 gaseous fire extinguish system.

5.5.2 UPS

While there is no emergency generator, an uninterruptable power supply (UPS) for the electric control supply is installed in the electric room. The UPS on the site can provide backup power for up to 10 hours.



[Electric room]



[UPS battery]

Chapter 6 Fire Protections

Design criteria and installation of fire protection system was based on Korean standards. Firefighting equipment undergoes monthly check by the subcontractor. The performance test for firefighting equipment is conducted annually.

6.1 Fire Extinguishers

Portable fire extinguishers are easily available throughout the entire site.



[Fire extinguisher]

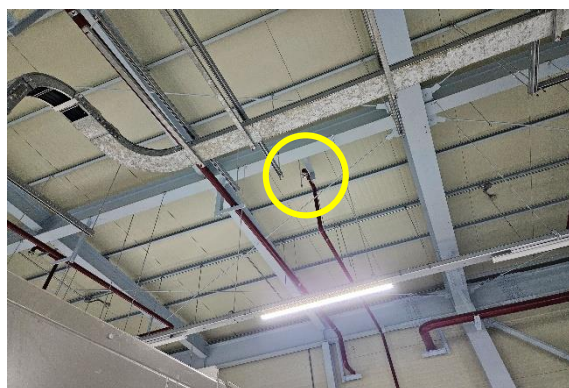


6.2 Gas Fire Extinguishing System

A total flooding type HFC-125 fire extinguish system is installed in the electric room and control room of the Substation. 19 HFC-125 bottles are installed in the fire extinguishing agent room of the Substation. This system is activated by fire detectors. Emergency manual activation panels are also installed on outside of the protected rooms.



[Agent room]



[Discharge nozzle in the electric room]



[Discharge nozzle in the control room]



[Emergency manual activation panel]

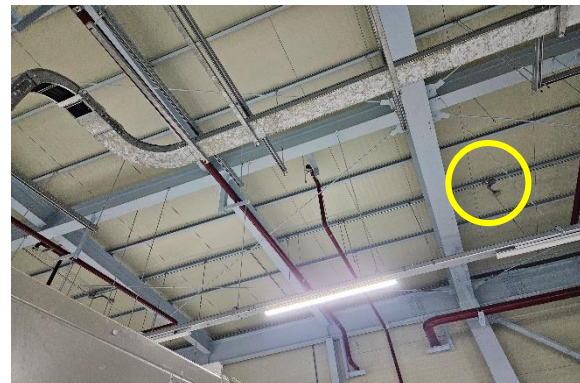
6.3 Fire detections / Alarms

Heat and smoke detectors, along with manual fire alarm push buttons are provided in the Substation. However, there are only manual fire alarm push buttons in the Office.

Previously, there was only one P-type fire alarm control panel installed in the fire extinguish agent room of the Substation where no one is working. Currently, SEG has installed a new sub P-type fire alarm control panel in the control room of the Substation, where the site engineer is stationed. Two panels are interlocked with each other.



[Manual fire alarm push button]



[Fire detector]



[Fire alarm control panel in the agent room]



[Fire alarm control panel in the control room]

6.4 Fire-Fighting Organization

Volunteer fire brigade with employees is organized, and a fire drill is held annually. The fire drill is based on the emergency evacuation scenarios such as fire and gas leak.

The closest public fire brigade to SEG is Jangan 119 Safety Center, located approximately 3.6 kilometers away from the site. They can dispatch fire engines within 11 minutes in case of the fire.

Chapter 7 Management Systems

7.1 Organization & Maintenance

7.1.1 Organization

SEG has four employees; three in the Engineer team and one in the HR team. Additionally, one site engineer from YOUNGJIN, a subcontractor, works on-site. They are working for day-duty. The Engineer Team is related to monitoring for the fuel cell system and operating only auxiliary utilities such as transformers.

7.1.2 Maintenance

Bloom Energy manages all aspects of the operation and maintenance of the fuel cell system. SEG keeps stable workforces of the Bloom Energy who have a number of experiences in overseas plants. Preventive on-site maintenance is periodically performed by them. The regular maintenance is conducted on 10 units at a time, and the total period for 66 units takes about a month to complete.

The governor stations are managed in accordance with the process safety management (PSM) system regulations developed by the Korea Occupational Safety and Health Agency (KOSHA). Spare parts are kept in the storage of the Substation and used for the repair or replacement of failed units, such as the fuel cells.

7.1.3 Long Term Service Agreement (LTSA)

There is a Long-Term Service Agreement (LTSA) for the fuel cell with Bloom Energy. The LTSA encompasses remote monitoring and operation system as well as planned maintenance service. Bloom Energy receives the operational signal in real time, and feeds technical support. The duration of the LTSA contract is 20 years.

In addition, SEG has a warranty contract with Bloom Energy regarding the utilization rate and efficiency rate of the fuel cells. The utilization rate and efficiency rate are 95% (with a warranty of 90%) and 56% (with a warranty of 54%), respectively. If these rates do meet the contracted levels, expense compensation for production decreases is provided by Bloom Energy.

7.2 Safety

Planned daily maintenance is conducted, and safety education is provided to employees. Also, SEG has emergency evacuation scenarios such as fire and gas leak. They conduct the fire drill based on the scenarios annually.

A formalized work permit system is not applied. In case of hot work such as welding and grinding work, portable fire extinguishers are placed on the worksite. Also, safety education is provided prior to starting any of hot work.

Smoking is permitted only at designated outdoor smoking area in the site. The smoking area is equipped with steel ashtrays. However, there is no fire extinguisher in this area.



[Smoking area]

7.3 Site Security

There is no security guard in the site. However, an unmanned security system and CCTV cameras are installed throughout the site area. Additionally, steel fences surround the site.



[CCTV monitoring]

Chapter 8 Appendices

8.1 Layout

