HEAVENN

Preliminary engineering designstudy at Bytesnet Datacenter

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Clean Hydrogen Partnership

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1 Design specifications

1.1 Introduction

together with H2Tec and technical advisor from BIA, investigated the following specifications. Our preliminary conclusions the project is feasible

1.2 Emergency backup power vs auxiliary power

The use of the unit has been examined to see which way best suits Bytesnet.
The power of the unit is not sufficient to provide the entire data center with power, in addition, the electricity network in the Netherlands is of such a quality that it is not desirable to use the unit as an emergency power supply. The resources required for installation and maintenance compared to the low frequency of use is not cost-effective.
By using the unit as an additional power supply to the power grid, we disconnect the power of unit from the power of the datacenter site. The frequency of use can be set by Bytesnet. The frequency of use is dictated by the fueling requirements.
Continues net synchronization is a necessity for the auxiliary use.

1.3 Fuel requirements

The best fit regarding site requirements for Bytesnet is a 500 KG H2 storage. A 500 Kg storage is not subject to strong regulation and licensing requirements. Bytesnet aims to refuel once a week which can be done by a freight trailer or tank truck.

1.4 Frequency of use

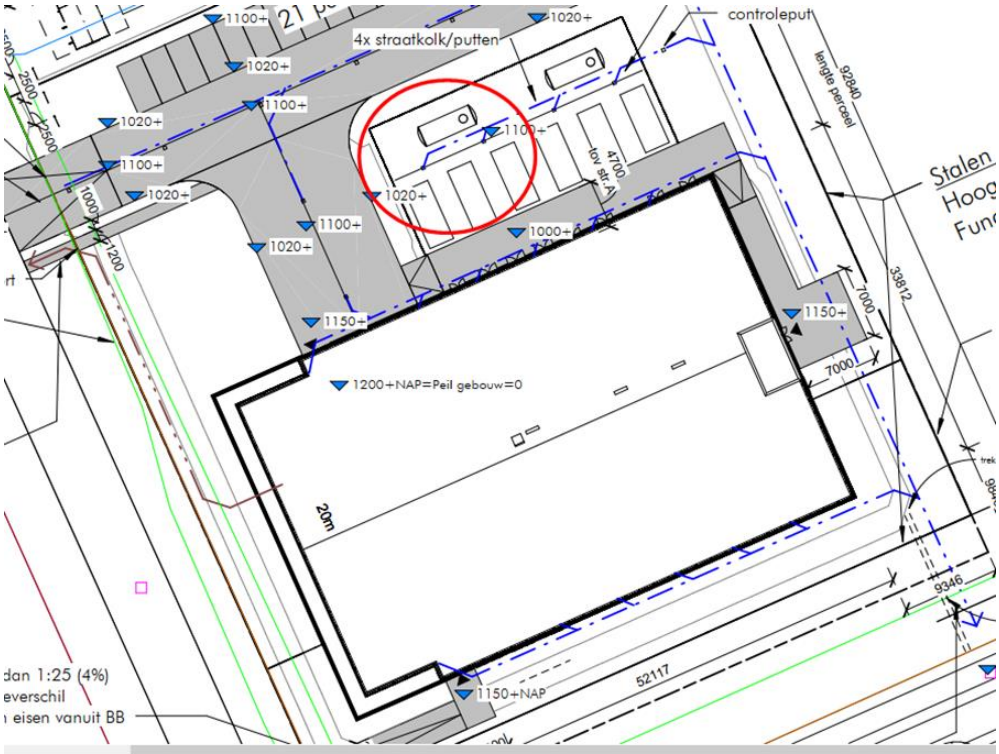
Based on aforementioned principles we can use de unit during peak hours. Via automatic power control the unit will be automatically powered on and off. This way the user of the unit is economically more viable

1.5 Grounding

a. Size/power fuel cell: 100kW
b. Desirable refueling frequency: Weekly
c. Running period: office hours 09:00-17:00
d. Storage capacity demand: 500 Kg
e. Storage size: 40 foot module
f. Control via BMS: Bacnet of Modbus protocol
g. 6kW of utility power is needed for heating of the fuel cell
h. Grounding on the concrete plate is sufficient.

2 Site Lay-out and design

The current positioning resides on the concrete plate which is designed for emergency backup diesel generators. The concrete plate is strong enough to carry the H2 unit and H2 storage. Earthing/Grounding conditions are sufficient, as well as the accessibility for refueling.

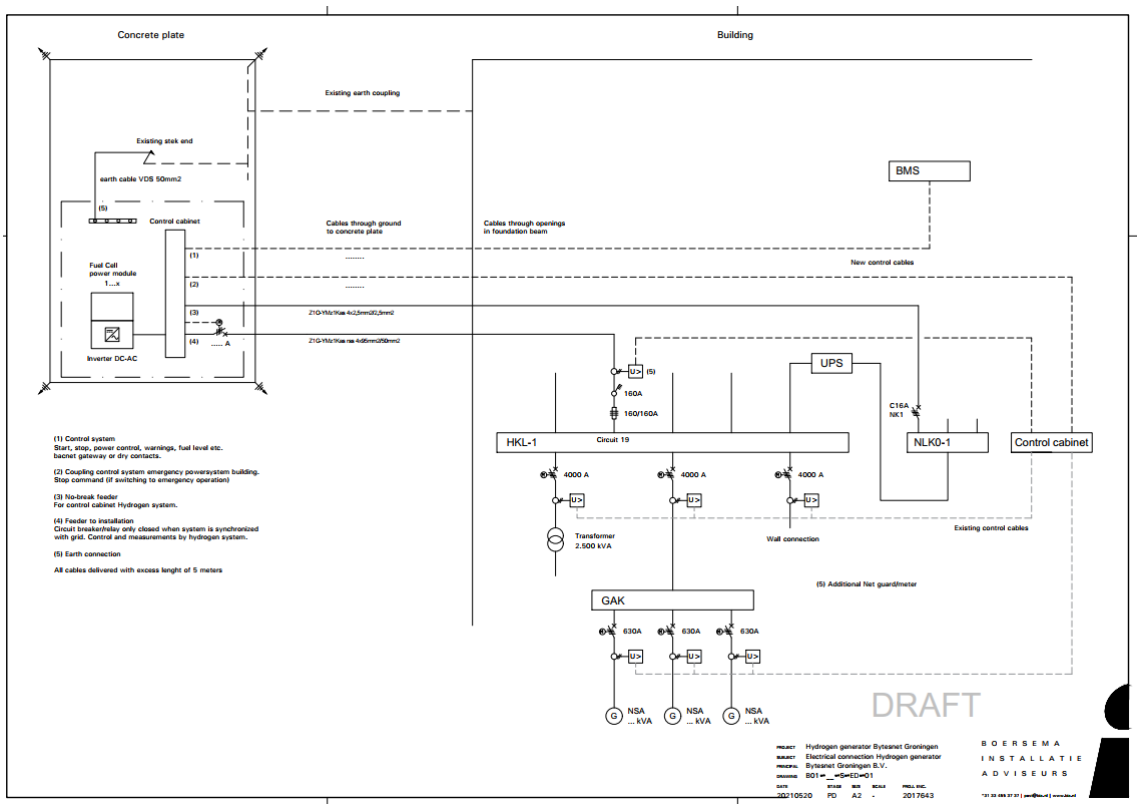


Site lay-out and design have been agreed upon between BYT, H2TEC and HTS. Detailed design will follow as soon as the specifications for the FC power system are finalized (Task 2.2.6)

3 Preliminary Electrical Design

The outline of the electrical design has been worked out by the parties involved. The electrical scheme for the connection of the fuel cell system is clear. As well, main principles for the electrical control for switching the fuel cell system on and off have been confirmed.

The schematics are build by BIA on the specifications provided by H2Tec



4 Cooling specification Fuell cell:

The cooling specifications of the H2 fuel cell have been researched to optimize integration with the datacenter cooling system and local heat grid. The preliminary conclusion is that this integration entails too many dependencies and that this can be re-evaluated at a later stage.

HEAVENN PROVISIONAL SPECIFICATIONS		
Water Drainage		
Anode	≤ 192	**mL/min**
Cathode	≤ 256	**mL/min**
Total	≤ 448	**mL/min**
Cooling System Requirements		
Maximum Thermal Load for sizing	≤ 208	**kW**
Nominal Thermal Load	120	**kW**
Coolant Flow Rate	400	**L/min**
Maximum Pressure Drop of Customer coolant system	≤ 35	**kPa**
Coolant inlet pressure	0.5 - 5	**Barg**
Coolant Supply Temp	5-35	**°C**
Coolant Outlet temperature	40	**°C**

This means the fuel cell cannot operate when outside temperatures rises above 35°C