

Hydrogen-based Autonomous Energy Supply System

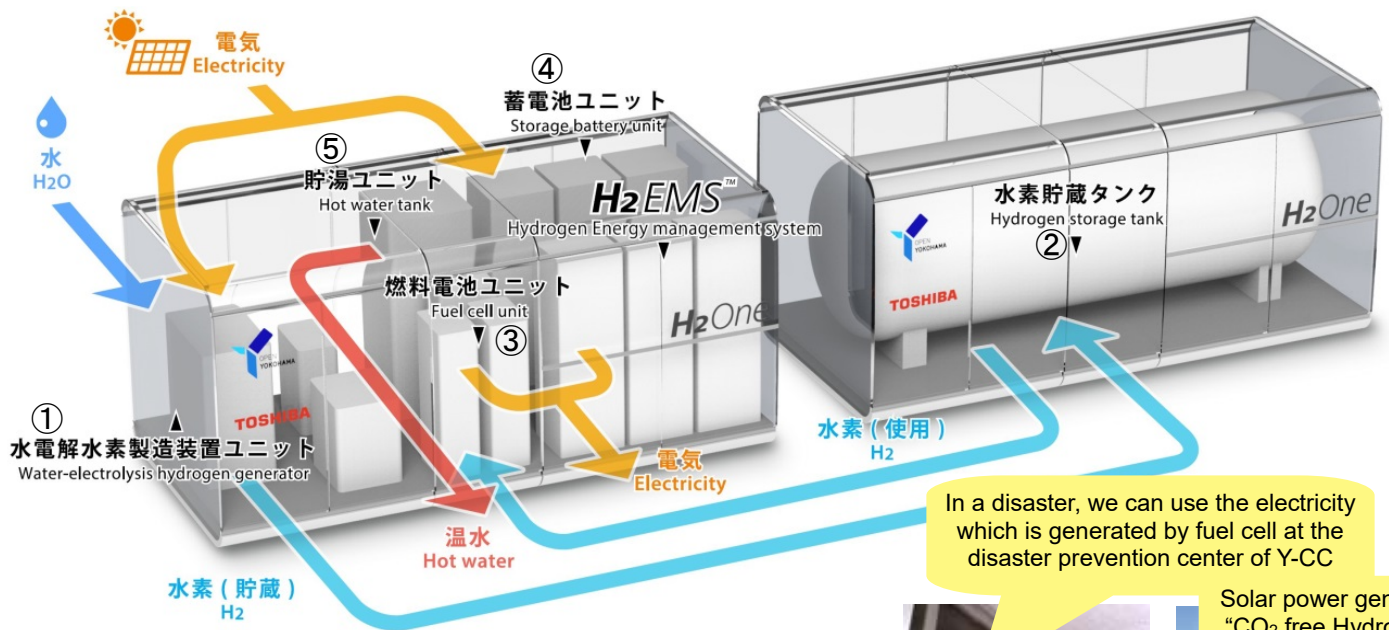
1 Introduction



“Smart Port in Yokohama”, which includes the concept of improving energy efficiency, low carbonization and securing the business continuity in case of disasters, has been defined by Master Plan of the Port of Yokohama (revised on Dec. 2014). Hydrogen-based Autonomous Energy Supply System has been set in Yokohama Port Cargo Center (Y-CC) for a demonstration experiment in an energy management and usage energy in case of disasters.

2 The system summary

“Hydrogen-based Autonomous Energy Supply System” integrates (1) a Water-electrolysis hydrogen generator, (2) a hydrogen storage tank, (3) a fuel cell unit for generating electricity from hydrogen, (4) a storage battery unit and (5) a hot water tank. Hydrogen energy management system (H₂ EMS) controls overall operation.



In a disaster, we can use the electricity which is generated by fuel cell at the disaster prevention center of Y-CC

Solar power generate “CO₂ free Hydrogen”



Left : Emergency plug sockets in the disaster prevention center
Right : Solar panels on the roof of cargo terminal building

[TOSHIBA H2One™ Hydrogen Based Autonomous Energy Supply System]

① Water-electrolysis hydrogen generator	Tap water is electrolyzed by using solar power, and hydrogen gas is formed.
② Hydrogen storage tank	Hydrogen gas to maintain communications for as long as 72 hours in a disaster is stored.
③ Fuel cell	The fuel cell generates electricity and heat by a chemical reaction between hydrogen and oxygen. It is pure hydrogen model which is more efficient than city gas conversion model.
④ Storage battery	Charged by electricity that is generated by fuel cell and solar power, and supply electricity as necessary.
⑤ Hot Water tank	The tank holds hot water (up to 200ℓ) that is generated by fuel cell.

Owner : Port & Harbor Bureau, City of Yokohama
Cooperator : Yokohama Port International Cargo Center Co., Ltd
Manufacturer : Toshiba Corporation
Construction contractor : Kajima Tatemono Sogo Kanri Co., Ltd
 Kinden Corporation (PV system)

3 System specifications

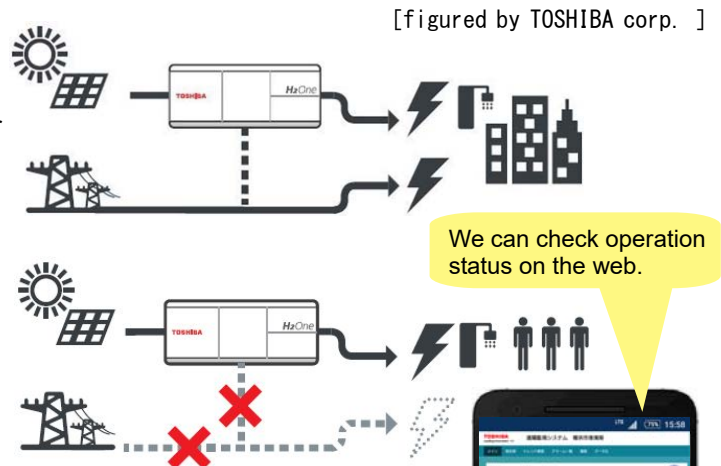
Water-electrolysis hydrogen generator	Hydrogen storage tank	Fuel cell
Solid polymer type H ₂ generation : 1N m ³ /h*1 H ₂ purity : 99.999%	Capacity : 12.8m ³ (104Nm ³ , under H ₂ pressure of 0.82MPa) Standards : Class-2 pressure vessel (Japan Boiler Association) Gross weight : approx. 10.0 tons	Rated power : 700W×3 generating efficiency : 55% Overall efficiency : 95%
Storage battery	System container	Solar panels
PCS*2 capacity : 25kW Battery capacity : 44kWh	Size : W4.95m×H2.3m×D2.4m (×2 containers) Design : suited the Port Coloring Plan Gross weight : approx. 9.5 tons	Location : roof of Y-CC Capacity : 24.5kW Wind pressure resistance : 6,000N/m ³

*1 Nm³ : gas volume under the standard reference conditions for gases (0°C, 1atm (approx. 0.1MPa)) *2 PCS : Power Conditioning System

4 Operating mode

Energy management mode

In normal everyday use, hydrogen energy management system will support peak shift, which optimizes management of hydrogen production, power generation and storage to reduce demand for main power at time of high demand.



Business continuity mode

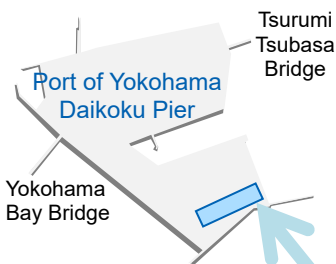
If a disaster knocks out power supply to Y-CC, the system will convert stored hydrogen to electricity, allowing Y-CC to maintain communications for as long as 72 hours, and help to secure continuity of port operations.

5 Features of hydrogen energy

- Hydrogen can be made from various materials such as oil, coal and natural gasses.
- Using electric power, electrolysis of water can generate hydrogen. Particularly, hydrogen made by using green power such as solar power or wind power is called eco-friendly “CO₂ free hydrogen”.
- Hydrogen emit no toxic substance with generating electric power.
- Hydrogen is suitable for storage and transport.



6 Yokohama Port Cargo Center (Y-CC)



Y-CC is one of the largest comprehensive logistics center in Japan with total floor space of approx. 320,000m². It is located on Daikoku Pier, one of the main piers on the Port of Yokohama.

Y-CC has been operated by publicly and privately funded Yokohama Port International Cargo Center Co., Ltd. since 1992 which was intended to activate logistics and economics in Yokohama Port.

	Cargo Terminal Building	Office Building
Structure	Precast prestressed concrete construction / 5 floors	Steel frame construction / 8 floors
Total floor space	approx. 305,450 m ²	approx. 12,700 m ²
No. of sections	55 sections (approx. 4,300m ² /section) (33 for lease/22 owned)	70 sections (approx. 72m ² /section) (lease)
facilities	4 lanes per floor(16m wide), parking area, ramp way etc.	Show-rooms, meeting rooms, a convenience store, a bank ATM etc.



7 Contact

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