



Evaluations Accompanying Introduction of Fuel Cell System

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1. Introduction

Installing Fuel Cell Facilities into Radio Relay Stations

- Already examples in Japan but a first in Yokohama



For that reason...

- Is power supply stable?
- What is the fuel consumption like?



Implementing Evaluation Tests

2. Issues with long-term power blackouts

Current Situation and Issues

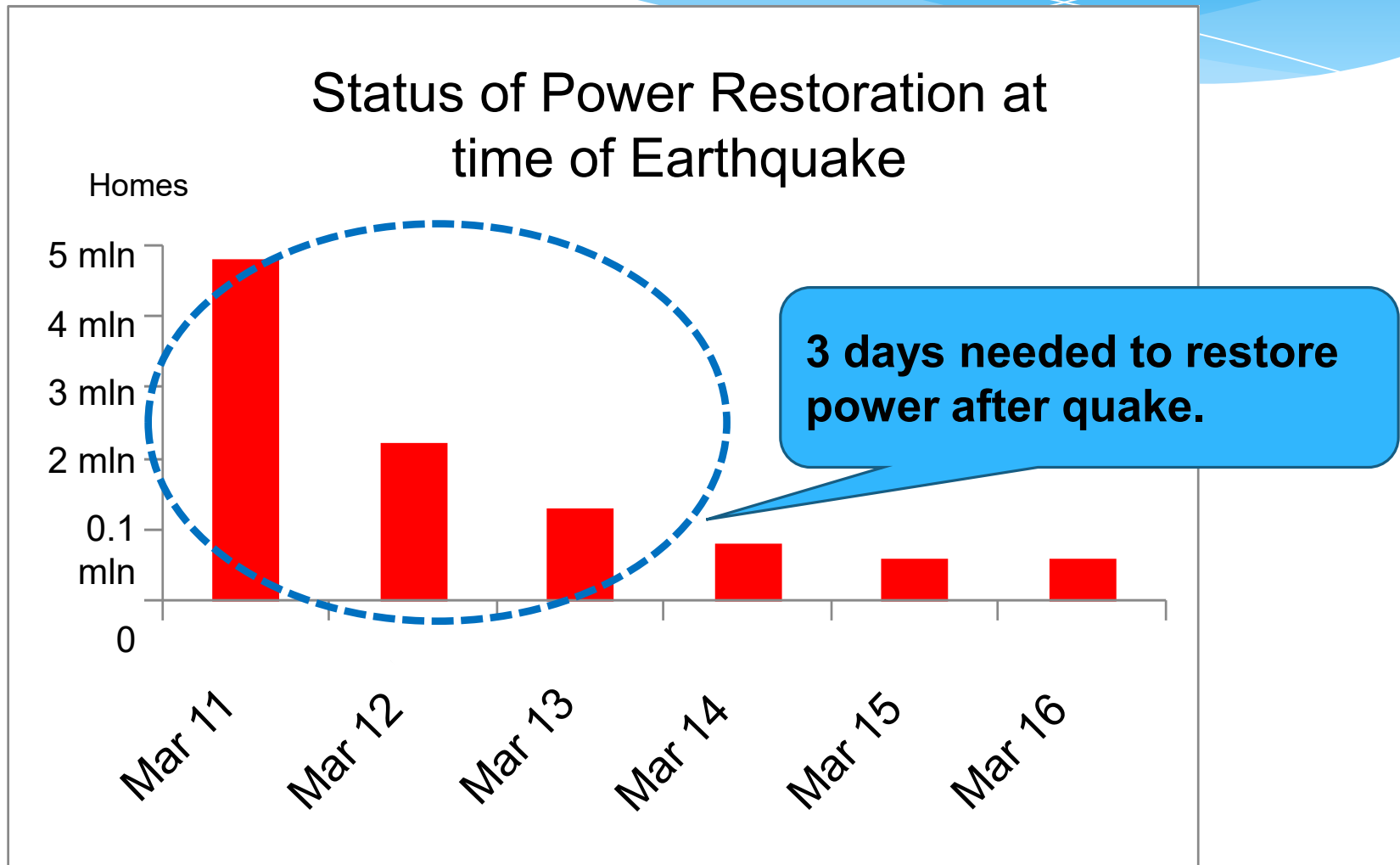
- Uninterrupted power supply (UPS) during blackout is 4 hours
- 3 or 4 hours before emergency workers arrive on scene



If UPS runs out

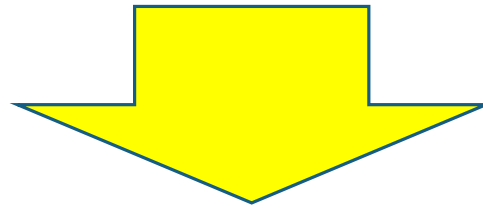
- Monitoring/control not possible
- Communication about pressure and flowrate not possible
- Swift recovery of water distribution becomes harder

Damage Status at time of Great East Japan Earthquake



Based on such knowledge...

**Uninterrupted operation of equipment
at time of disasters needs to be
strengthened**



As a result...

Introduction of a fuel cell system capable
of supplying power for prolonged period of time

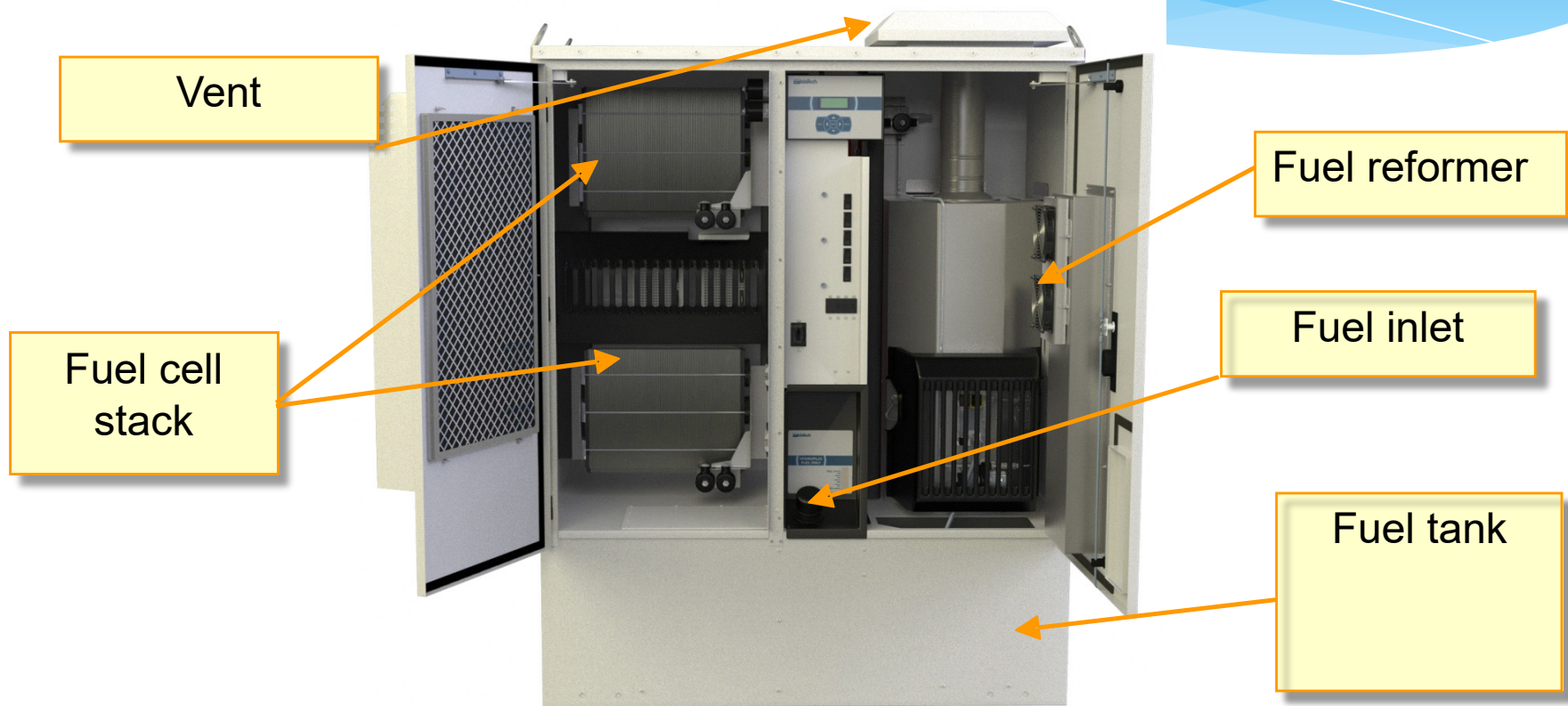
3. Details of fuel cell use

- More than 150 systems installed in major cities in Japan.
- Systems introduced to radio relay stations from 2013 (NTT Docomo).
- Our systems are the first to be introduced in Yokohama.

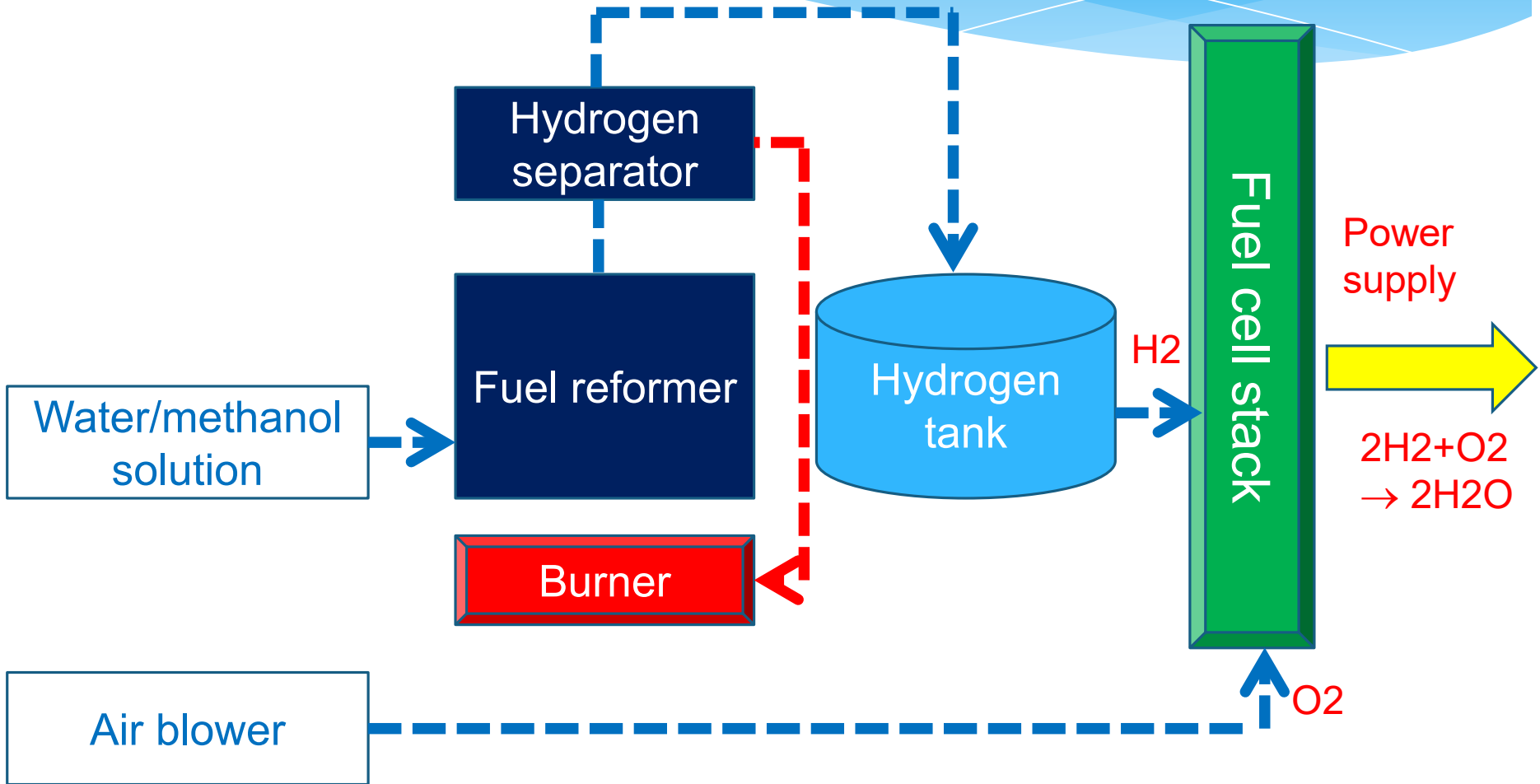


Fuel cell system

Fuel Cell System Configuration



Power Generation System



Features of Fuel Cell System

Features

1 Environmentally friendly power generation method

2 Low noise, compact system

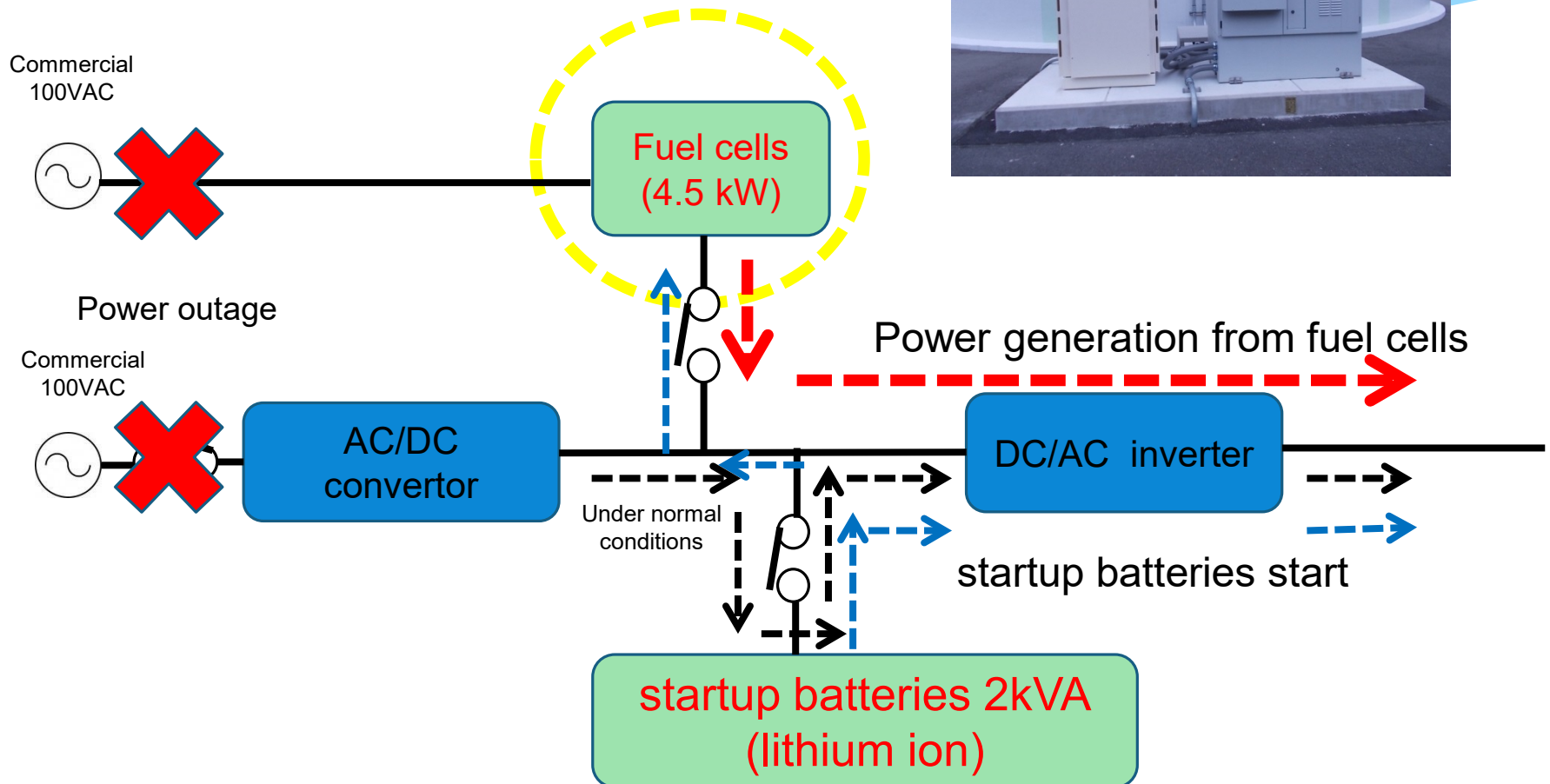
3 Safe

- Methanol diluted to 60% concentration is not deemed a dangerous substance.

4 Capable of providing prolonged power supply



Flow of Events in Switchover to Fuel Cell System

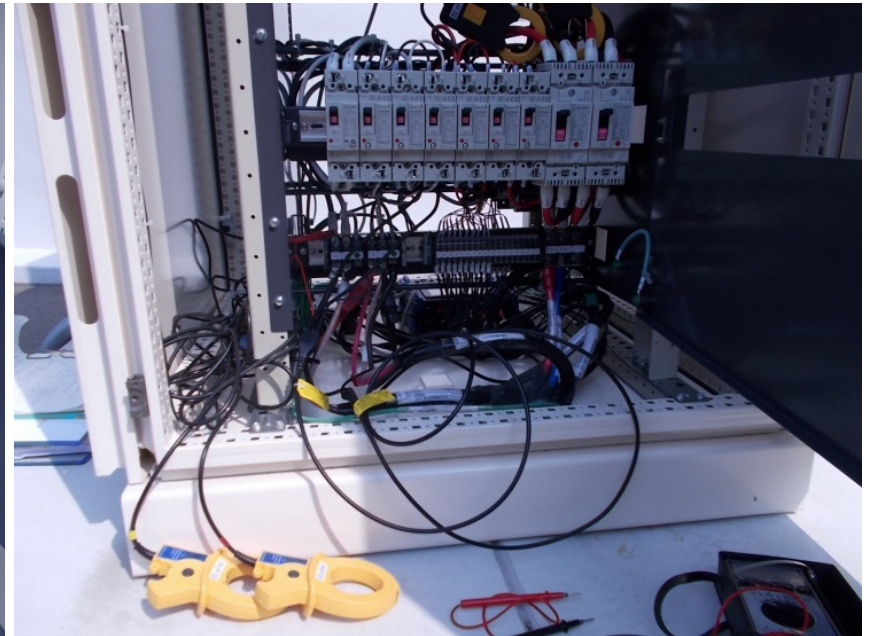
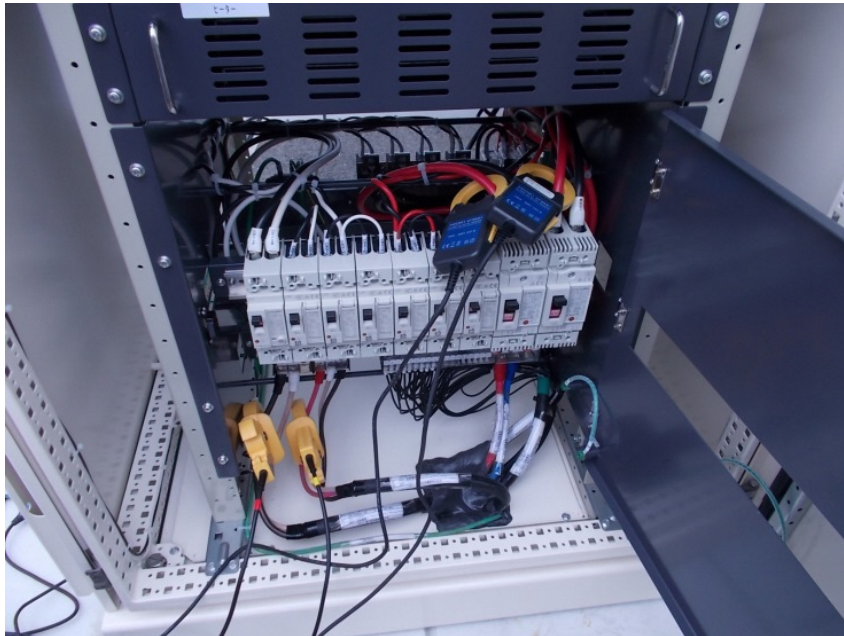


4. Evaluation tests

Purpose of evaluation tests

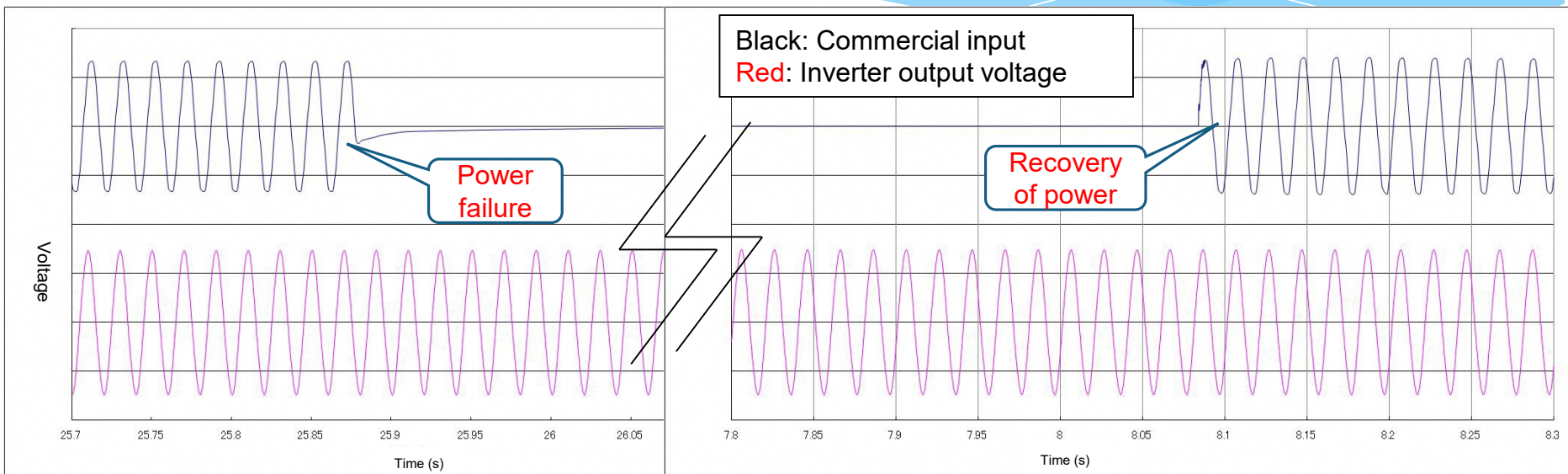
System continuously operated for one hour and 15 hours

- To confirm stable power supply
- To confirm fuel consumption



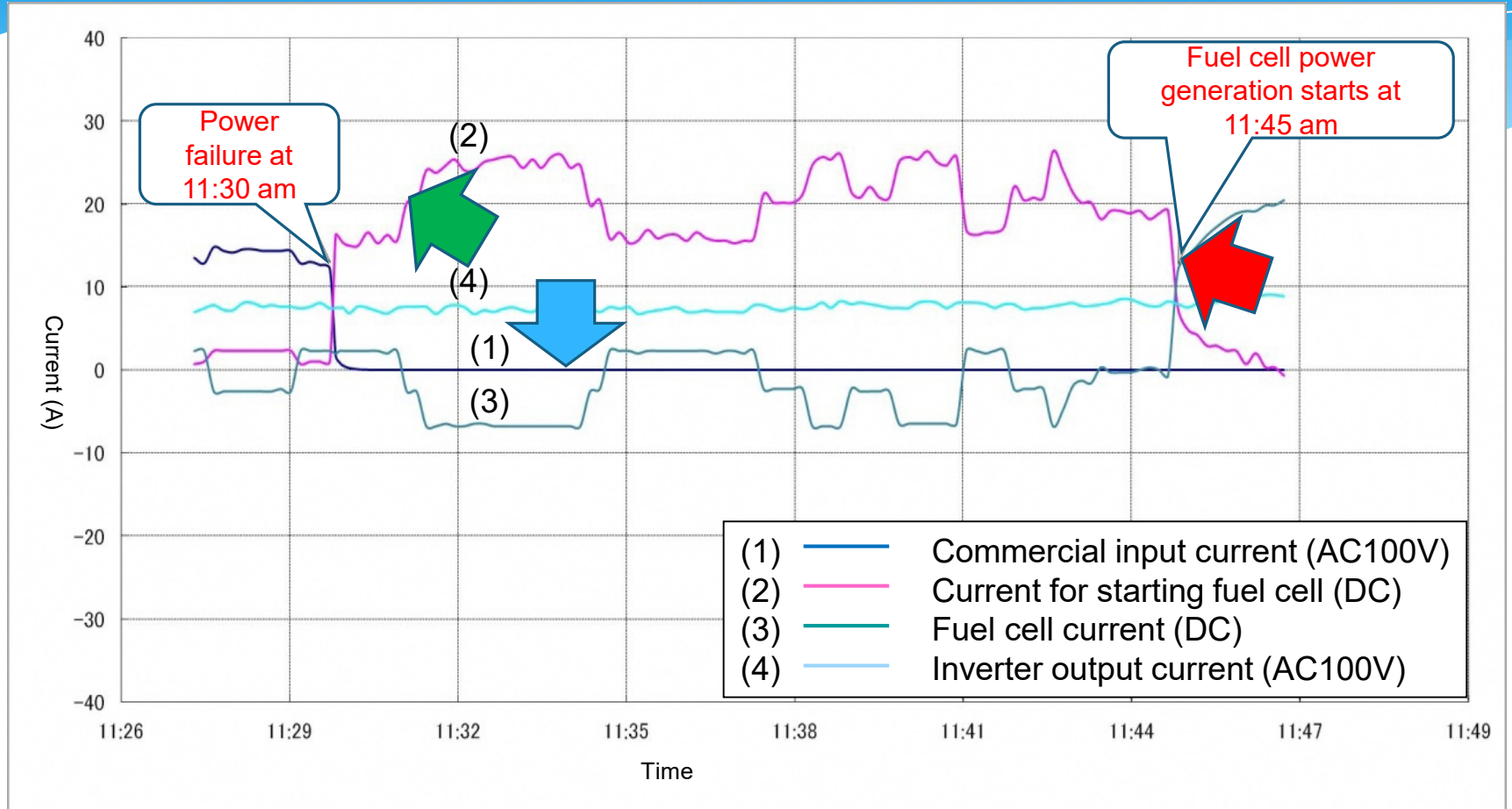
5. Results of evaluation tests

Current & Voltage Tests



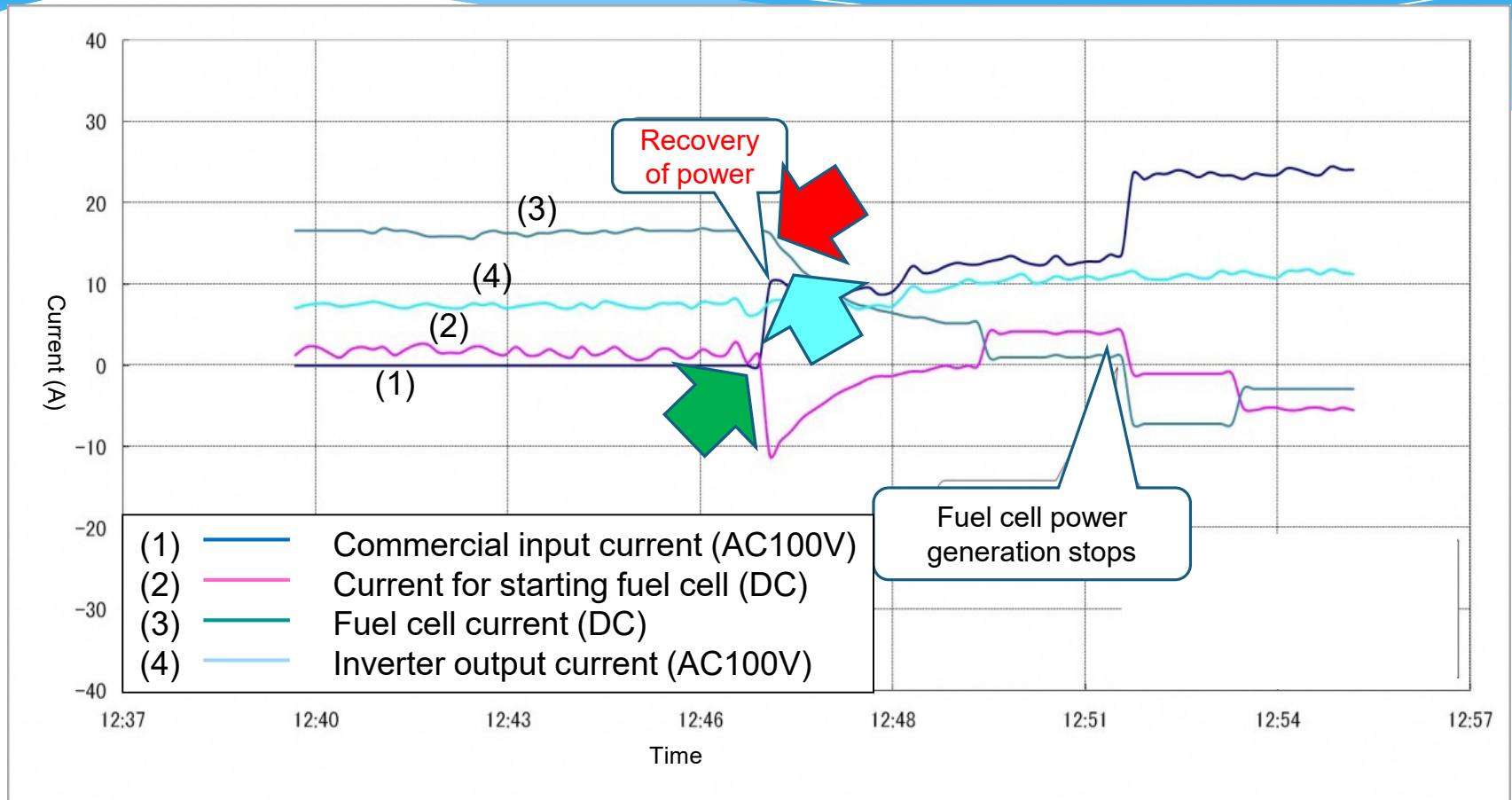
Voltage is supplied stably as fuel cell system's output voltage waveform shows no disarray either after power failure or after recovery of power.

Results of Current Test on 28 July (Power Failure)



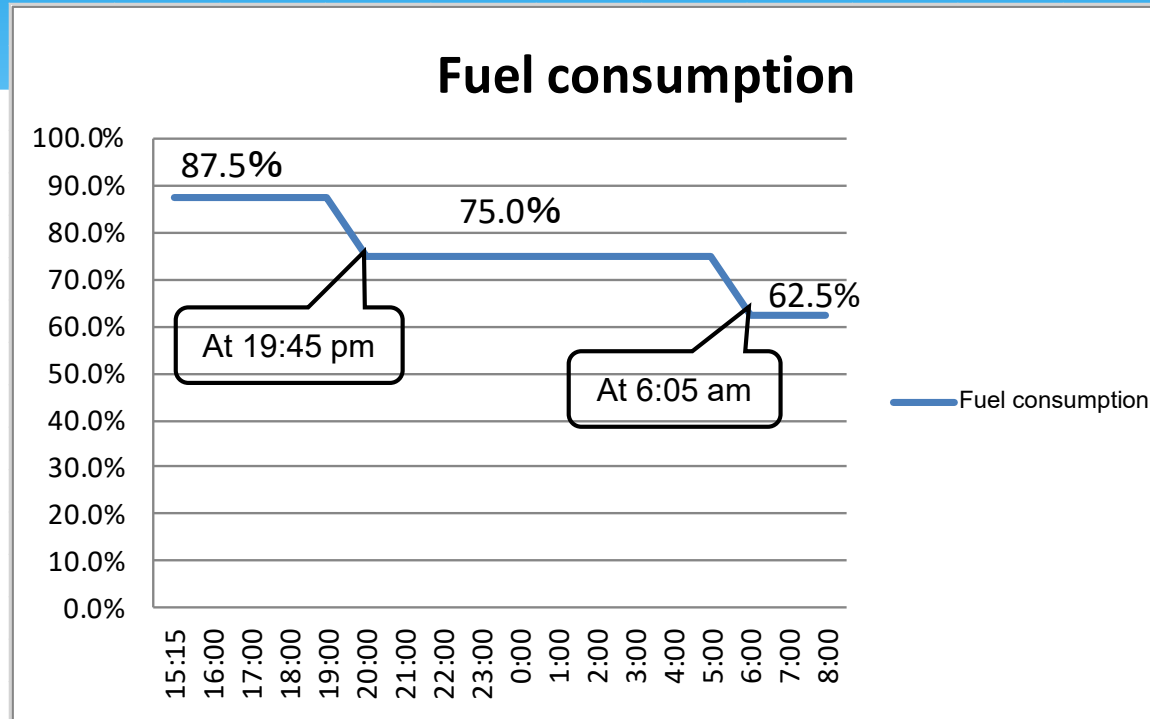
- After power failure, the output current of the fuel cell system was output from the startup batteries for about 15 minutes.
- After 15 minutes, power generation from fuel cell system took over to output current.

Results of Current Test on 28 July (Recovery of Power)



After recovery of power, startup batteries start charging and fuel cell power generation stops.

Results of Fuel Consumption Test on 3rd and 4th of December



Fuel consumption time: 10 hrs 20 mins → 12.5% reduction



Normal situation: 82 hrs 40 mins of power generation

Disaster situation: 40 hrs of power generation because of usage frequency

6. Conclusion

1 Voltage test

- Stable voltage output.

2 Current test

- After power failure, normal operation maintained by power from startup batteries
- After recovery of power, power switches from fuel cell system to commercial grid power

3 Fuel consumption

- Power supplied for 82 hours and 40 minutes from just the fuel tank

4 Maintenance

- After installation, system runs normally with no breakdowns
- Maintenance is minimal and maintenance management costs

inexpensive

7. Plans from here on

We will plan the following based on the results of the evaluation tests on the fuel cell system.

- Consideration of suitable facilities
- Scheduled installing of fuel cell facilities

Upcoming installation schedule

2017: Wireless station in Nishiya Purification Plant

2018: Chemical store in Kosuzume Purification Plant



*Thank you very much for listening.