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From Research to System Application – Overview of the Current Fuel Cell Demonstration and Promotion Program in Taiwan

Alice Chia-Mei Liu[1], **Chang-Chung Yang**[1] **and Sheng-Yuan Huang**[2]

Abstract: Fuel cell technology is considered one of the hottest topics in green energy and has become an emerging green energy industry internationally. In the meantime, the development of the fuel cell industry has been recognized as one of the key rising industries in Taiwan. Since 2009, the Industrial Technology Research Institute (ITRI) has collaborated with Chung-Hua Institute for Economic Research (CIER) in implementing the fuel cell demonstration and promotion program supported by the Bureau of Energy, Ministry of Economic Affairs. This program focuses on three major areas for application of fuel cells: backup power supply, normal power & combined heat power (CHP) supply, and motive power supply for transportation applications.

Keywords: Fuel cell, demonstration, system application, Taiwan.

1 Introduction

Significant results have been achieved in all three supported application areas. Backup power supply has proven very useful in the specific situations where power supply was cut, and fuel cell became a major power supply device. In addition, general fuel cell applications and the scooter application, see Hwang(2004,2005 and 2008), in particular have been increasing in their respective sectors.

1.1 Figures

The purpose of the Demo Program is as shown in Fig.1. The status of Taiwan H2 and fuel cell is shown in Fig. 2. The Configuration of data collection and transmission system for demonstration of system operation is shown in Fig. 3. In Fig. 1, ITRI will collect the operational data from business unit and analyze them. In order to promote the early market, CIER will set up the data base and speed up

[1] NETD, ITRI, Hsinchu, Taiwan, R.O.C.
[2] FCOFFICE, CIER, Taipei, Taiwan, R.O.C.

the fuel cell industry sector. In Fig.2, a lots of company enter the fuel cell's early market, for example: Taipower, YGE, NanyaPCB, CHEM and so on. In Fig. 3, through the net work and wireless, the operational data will be collected and will do the statistical analysis.

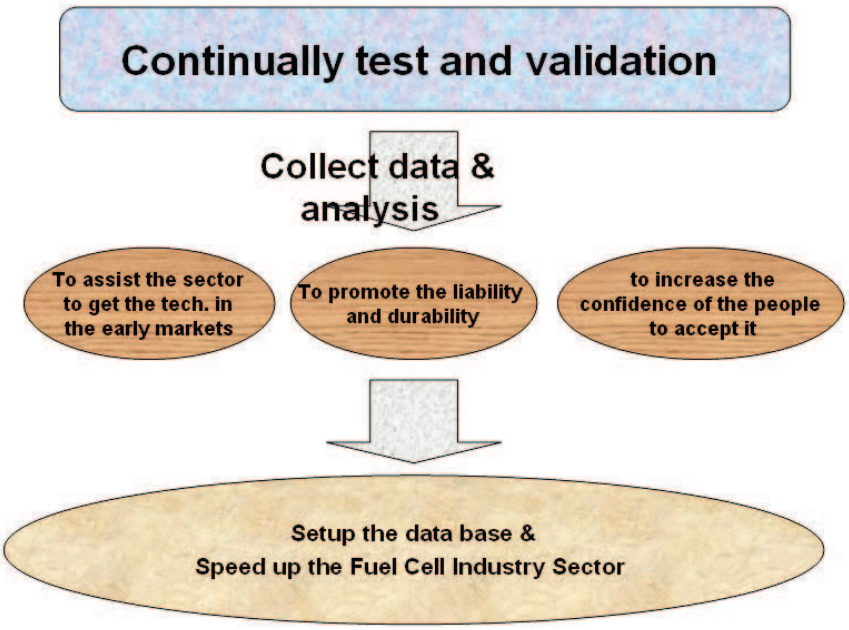


Figure 1: The Purpose of the Demo Program

2 Validation and Results

2.1 Figures

(A) One of the significant results from backup power demonstration is indicated in Fig. 4. Grid power disrupted for 12hrs and 56 minutes, during the Typhoon Fanapi , the FC backup power works at service starting from 23:27 of Sept.18 to 12:52 of Sept.19.

(B) Another notable result is shown in Fig. 5 The HyLink Project Site is in the Sorrento Bay area near Wellington, NZ. The dimension is 56x52x89cm(£¼260L);.weight is 150kg. And the rated output is 2kW ,with remote control & monitoring.

Several other results are shown in Fig. 6. The 10kW Backup Power system with Pillar Power is in Flora Expot of 2011, Taipei. The 6kW UPS for Telecom is in

- **A local supply chain of SMEs in formation**
- **Reputable mass production expertise and established channel network for small industrial and consumer goods**

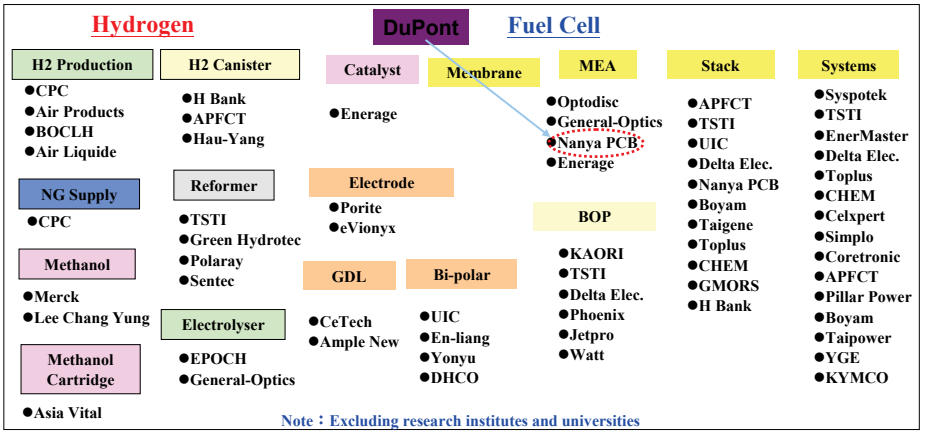
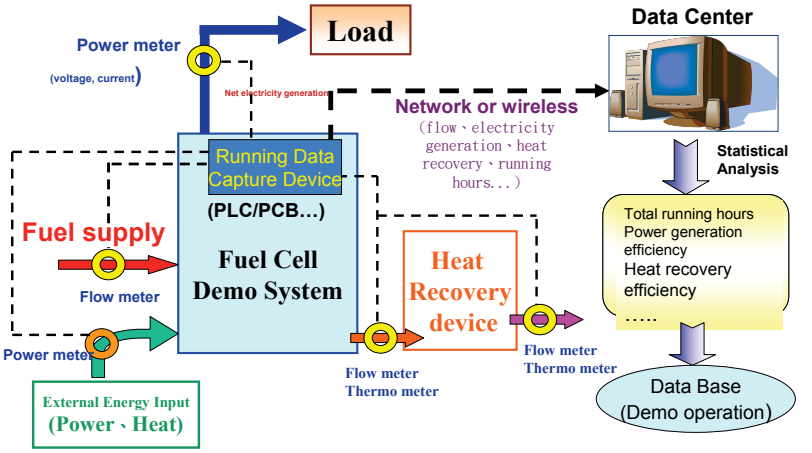


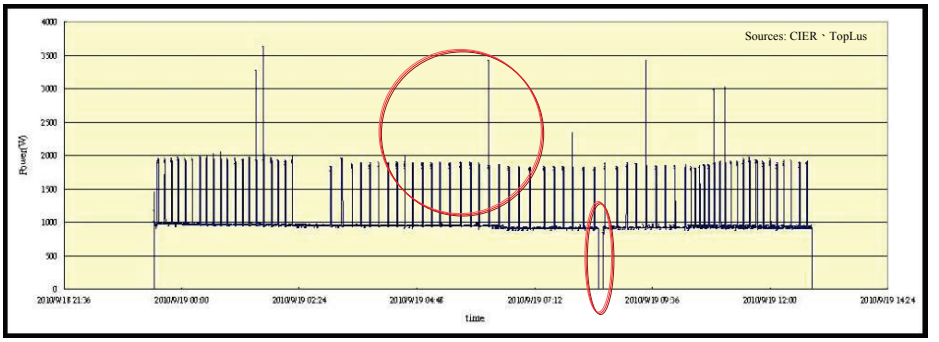
Figure 2: Status of Taiwan H_2 and fuel cell industry



**The items of data upload: running time, fuel supply, system input energy, net electricity generation system, hot water, hot water temperature

**ITRI will do the heat recovery calculation, Energy saving rate & CO_2 reduction calculation, Failure frequency and reason statistical analysis, Durability statistical analysis.

Figure 3: Configuration of data collection and transmission system

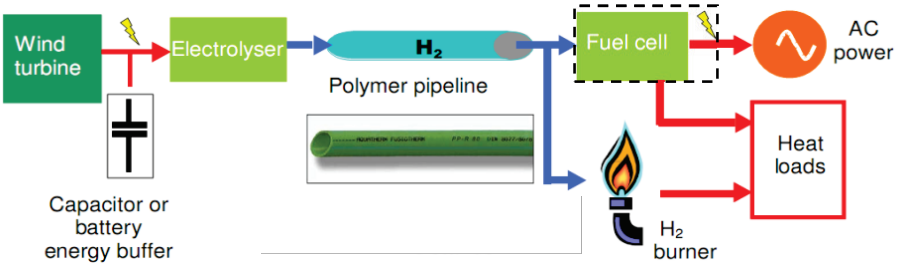


FC backup power at service during Typhoon Fanapi for Chung-Hwa Telecom

Note:
1. Grid power disrupted for 12 hrs and 56 minutes, starting from 23:27 of Sept. 18 to 12:52 of Sept. 19
2. Telecom company was spared to scramble re-routing the "through traffic" or to send rescue backup power up the mountain

Figure 4: Back up power demo and validation

Case: A Renewable Distributed Energy Application of Hydrogen (ITRI and IRL/NZ)



- **H_2 as an energy carrier/storage buffer option for wind energy**
- **H_2 is then consumed near by in the following ways:**
  - **by a fuel cell to produce electricity and hot water**
  - **by a burner and/or kitchen appliance**
- **The short pipeline also acts as a make-shift H_2 container**

Figure 5: Hylink collaboration

Toplus corp. The Backup Power Tied with Renewables is in CHEM corp. The LEV is in APFCT corp.

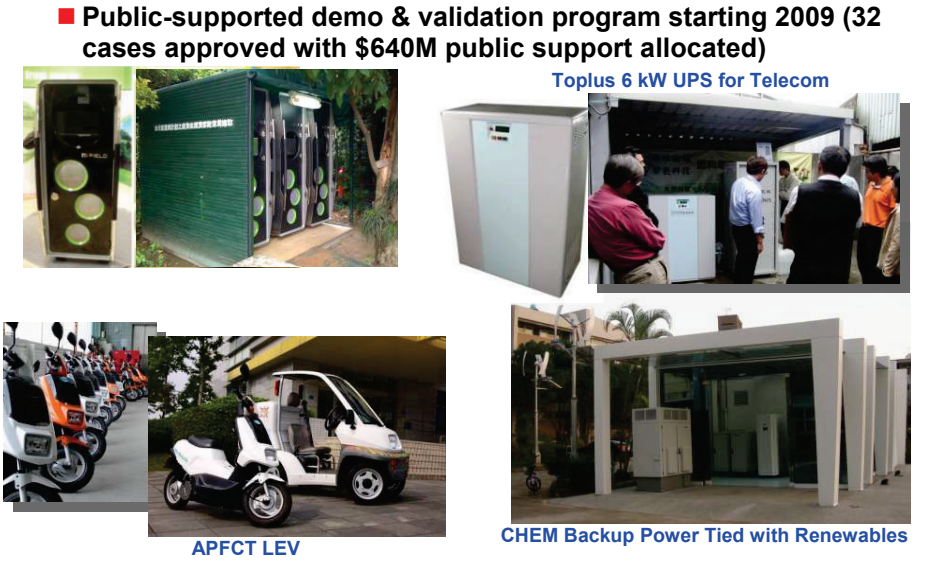


Figure 6: Technology demonstration and validation

(D) Technology Demonstration & Validation by ITRI is shown in Fig.7.: In ITRI, we have 1.5 kW backup power on field-trial,H2 infrastructure tech. validation site, and 3kW PEMFC CHP(NG) Long-term Testing, see Chu, Tsau, Yan, Hsueh, and Chen (2008); Chi, Yen, Jeng, Ko, and Lee (2010) .

3 Challenges

Overall, there are several challenges for Taiwan fuel cell development. First, hydrogen production, supply and storage might impose several technical barriers. Second, Taiwan should establish a standard certification system in the future and industry experts must participate, as much as possible, in the relevant international standard or specification committees for enhancing fuel cell safety. Third, fuel cell applications are different from wind or solar thermal energy systems in their costly maintenance and much expensive manufacturing. Fourth, Taiwan is still at an early stage of fuel cell market development, and therefore our capabilities can still be improved significantly compared with more advanced countries. Fifth, the general public still has some doubts about fuel cell system safety and the Government should increase technical promotion and guidance in this area.

Figure 7: ITRI technology demonstration and validation

Based on the last two-year experience of the fuel cell demonstration and promotion program, Taiwan government and industry have agreed on the following issues: First, the subsidies provided by the government need to increase continuously, and the scope of subsidies should be expanded. Second, in order to promote our industry development, several key components and materials should be developed from coordinated national research and development. Third, fuel cell producers with demonstrated track records should be assisted intensively, if not preferentially, and new products should be supported. In addition, the cost reduction as well as the large scale production targets should be promoted for the final fuel cell commercialization.

4 Conclusions

Finally, the authors would like to provide the following recommendations:

First, in order to be aligned with global development trends towards environmental protection, the government should increase fuel cell R&D budgets as soon as possible. Second, the government should pay attention to the most recent international development trends in order to design appropriate strategies. Third, it is necessary to speed up the process of setting up a testing laboratory using international specifi-

cations and/or standards on fuel cell systems in order to decrease product deviations or system complications for comprehensive fuel cell market diffusion.

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