

[The Evolution of Ene-Farm]

[Activity for the Market Expansion]

MR. Toshiki SHIMIZU

Head of Fuel Cell Business

Smart Energy System Business Division

Appliances Company

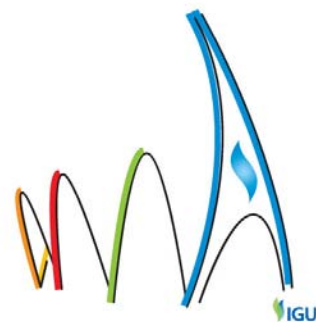
Panasonic Corporation

Japan

WGCPARIS2015

WORLD GAS CONFERENCE

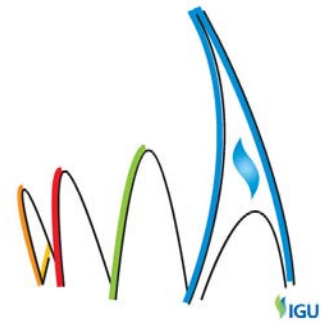
"GROWING TOGETHER TOWARDS A FRIENDLY PLANET"



26th World Gas Conference | 1-5 June 2015 | Paris, France

Table of Contents

Table of Contents	1
Background	2
Aim	2
Methods.....	3
Results	4
Conclusions.....	5
References	6



Background

The Great East-Japan Earthquake which hit Japan on the 11th March 2011 killed nearly 16,000 people and still more than 2,500 people are officially missing (1). Since this Earthquake, which is more well-known for the "Fukushima" nuclear plant issue, the energy policy of Japan has changed drastically. With the strong push from public opinion, the government decided to stop all the nuclear plants until the safety of each plant is secured. Consequently, the proportion of power from nuclear plants, which was approximately 30%, was reduced drastically. At present, the share of fossil fuels (oil, LNG and coal) in the energy mix of Japan has risen up to 88% compared to 62% before the Earthquake (2).

The change of this energy mix caused many side-effects for the Japanese environment and economic situation. The first point is CO₂ emission; the emission of CO₂ increased 14% against last year and it reached a record-high in 2013 due to the increase of fossil fuel power generation (3). Also from the economic point of view, the balance of trade became negative to the value of 13.8 trillion yen in 2013 because Japan needs to import a huge amount of fuel to supplement its extremely low energy self-sufficiency rate.

From this background, the government re-defined its energy policy in April 2014.

- Nuclear power as the "important base load power"
- Necessity to increase the renewable energy
- Power configuration will be indicated by assessment
- Energy market reform and realization for hydrogen society
- Deregulation of the retail business for electricity and natural gas

The Japanese government set a very ambitious target to install 1.4 million fuel cells by 2020, and 5.3 million fuel cells by 2030 (both cumulative targets).

Aim

Fuel cell is a co-generation technology which produces power and heat by chemical reaction at the place of energy consumption. It contributes to primary energy saving by its high efficiency. In the conventional power system, only 40% of primary energy can be utilised because approximately 60% will be lost as heat at the power plant or as losses during the power transmission. On the other hand, fuel cells enable use of 95% of primary energy with its local generation of power and heat. This results in a 1.3 ton reduction of CO₂ emissions and 60,000 JPY reduction in the running cost annually (compared to a house in Tokyo area which uses a gas boiler).(4)



26th World Gas Conference | 1-5 June 2015 | Paris, France

The market launch of the Japanese fuel cell market was in 2009. With the strong subsidy and development support from the Japanese government, the installation to the market started up quickly. The cumulative installation reached 100,000 units in September 2014 (5). However the subsidy has been gradually reduced every year, and it will drop to 300,000 JPY in 2015.

The support from government is planned to stop by the end of fiscal year 2015. In order to be a self-sustained business, big cost-reduction is still required from fuel cell manufacturers and we need to continue our challenge to create and enlarge the fuel cell market.

Methods

To achieve this goal, Panasonic has updated the model every 2 years. We have recently released a new model (4th generation) fuel cell in April 2015.

We achieved in driving down the end user price to 1.6 million JPY. This is a 300,000 JPY reduction from the previous model, and a 50% reduction compared to the first model released in 2009.

Also, compared to the previous model, the number of components has been reduced by 15% and also the weight of the total system is reduced by 15% (from 90kg to 77kg).

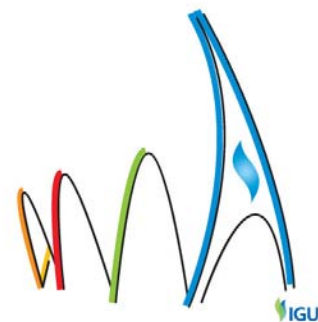
There is a 20% reduction in the rare-metal Platinum used for the stack (the component used for power generation from hydrogen).

Additionally, the total cost is brought down by improving the installation, commissioning and transportation. For example, installation has become easier by reducing the weight of the total system. Commissioning time is also reduced 40%, which will make the overall installation time less.

In addition to the cost reduction, we increased product durability to 70,000 hours and adopted the continuous power generation mode into the unit.

Regarding the domestic market, Panasonic is also targeting a new market for the apartments in the urban areas by development of an apartment specific model.

Additionally, Panasonic started a new challenge from April 2014. We launched a new model with the German heating appliance manufacturer, Viessmann, for the German market. Based on the bigger heat demand and cost difference between electricity and gas price, we believe that it has big market potential in European countries.



The challenge we faced for this model was the difference in gas composition and the way the fuel cell is used between Japan and Europe. While gases in Japan are imported from overseas and purified during the liquefying process, European countries import gas by pipelines from several sources such as Russia or North Sea area. This results in an unstable fluctuation of gas composition and higher ratio of impurities in the gases compared with LNG.

How the fuel cell is used was another issue to tackle. Fuel cells are installed outside of each house in Japan and the heat demand comes mainly from hot water used for bathing. Whereas in Europe, fuel cells are located inside of the house (mainly in utility rooms or kitchens) which requires more complex exhaust air system with safety controls and the heat demand mainly comes from space heating.

In order to work out these issues, Panasonic opened R&D centre in Langen, Germany (July 2011) and Cardiff, UK (September 2012). We thoroughly researched on how heating appliance are used locally and developed a dedicated model for the European market.

The key features of our European model are as following;

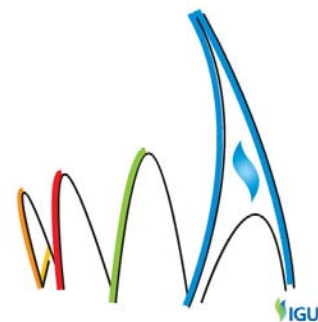
- 1) 90% total efficiency (LHV, 37% power efficiency and 53% heat collection)
- 2) Simple configuration to adapt utility room installation
- 3) Remote control and monitoring possible by iPhone/Android apps

Results

The cumulative sales of fuel cell in Japan reached 100,000 units in September 2014. As mentioned above, the market is expanding with the strong support from the government but this phase is ending in 2015. The government will stop the subsidy from 2016 onwards and the fuel cell business will need to stand on its own feet. Nevertheless, the government still has the goal of cumulative instalment of 1.4 million units by 2020, and 5.3 million by 2030. There is still a long way to go.

Here is a list of challenges we need to overcome in the coming years;

- Further cost reduction by technical innovation and mass-production with increased quantity;
- Improvement in the performance of key devices (stack, fuel processor)
- Reduction of the number for the components by simplifying the total system



- Increasing the usage of standard components
- Enlargement of the customer base; apartment segment etc.
- Improve the function as a decentralized power system
(Support of power/heat demand response, Peak-cut by local generation/consumption, Safety for emergency cases)
- Advanced development toward hydrogen society
(Fuel Cell system development for pure hydrogen energy source)

Conclusions

Panasonic is positioning the fuel cell as the key technology for Smart homes. The Fujisawa Sustainable Smart Town (SST) which opened in November 2014 introduced fuel cells to most of the houses. The concept of this town is to realize an environment-friendly, cozy and safe town using Panasonic's own unique solutions. The target is to reduce the CO2 emission by 70% of 1990 levels.

Regarding the Tokyo Olympic/Paralympics games in 2020, at the Tokyo Panasonic Centre between the 12th and 14th of February, Panasonic held an exhibition for the future life as realized by Panasonic's own technology and solutions. Fuel Cell is making a proposal to realise a carbon-free, hydrogen society at a reasonable cost. Panasonic continues to try for realization of the hydrogen society by the evolution and expansion of Fuel Cell system.

Panasonic believes that Ene-Farm has a big role with regard to energy management with high efficiency, supporting renewable energy, and the focus on local energy management using decentralized power systems. Fuel cell is the core technology to establish the hydrogen society of the future. Panasonic will continue to contribute to make a better life, a sustainable and safe society and the solution to environment issues in co-operation with global partners.

WGCPARIS2015

WORLD GAS CONFERENCE

"GROWING TOGETHER TOWARDS A FRIENDLY PLANET"



26th World Gas Conference | 1-5 June 2015 | Paris, France

References

Source:

- (1) Japan cabinet office disaster management at the 11th of September, 2014
- (2) Federation of Electric Power Companies Constitution of Power Generation amount by Power Source in the year of 2012. Based on the released information in 17th May 2013
- (3) Announcement at 14th November, 2014 by Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry of Japan
- (4) Source: Law regarding streamline of energy use and the data from Panasonic.
- (5) Panasonic's estimation from the summary of co-generation foundation regarding the shipping data between 2009 and 2014