Evolution of Fuel Cell for Hydrogen Society

Dec 13th, 2017

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Panasonic Corporation

Contents

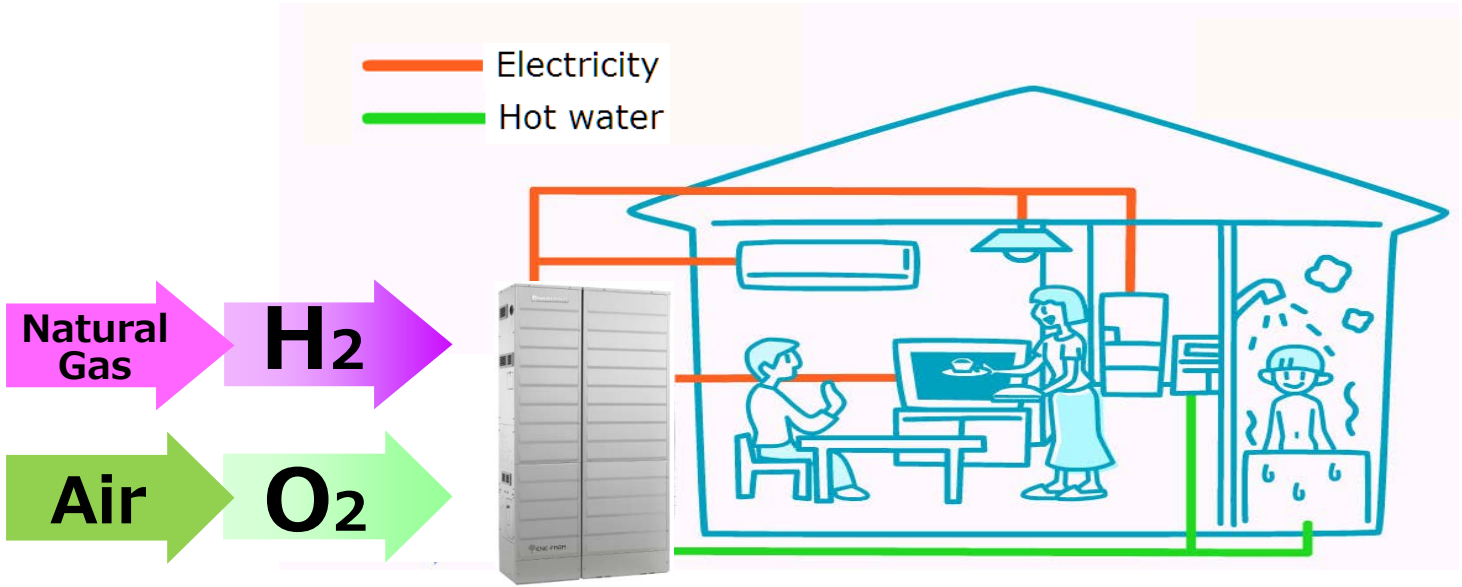
Contents

Stationary fuel cell

家庭用燃料電池コージェネレーションシステム
ENE・FARM
エネファーム

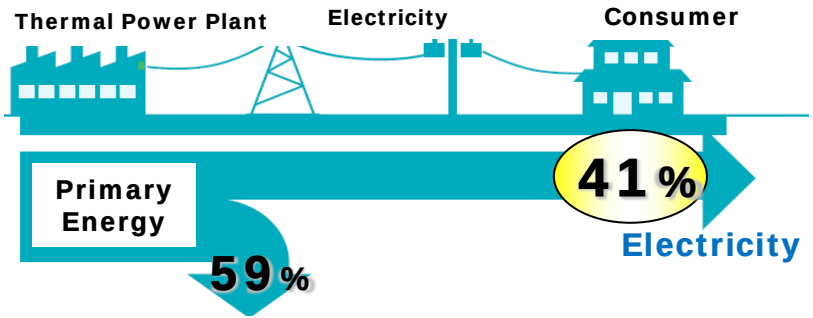
Stationary fuel cell

Fuel cell system generates electricity and hot water by chemical reaction with hydrogen and oxygen

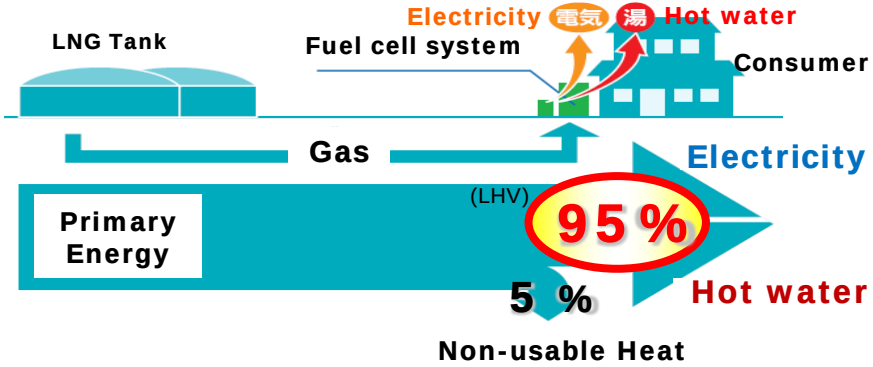


Advantage of fuel cell

Thermal Power Plant



Fuel cell system

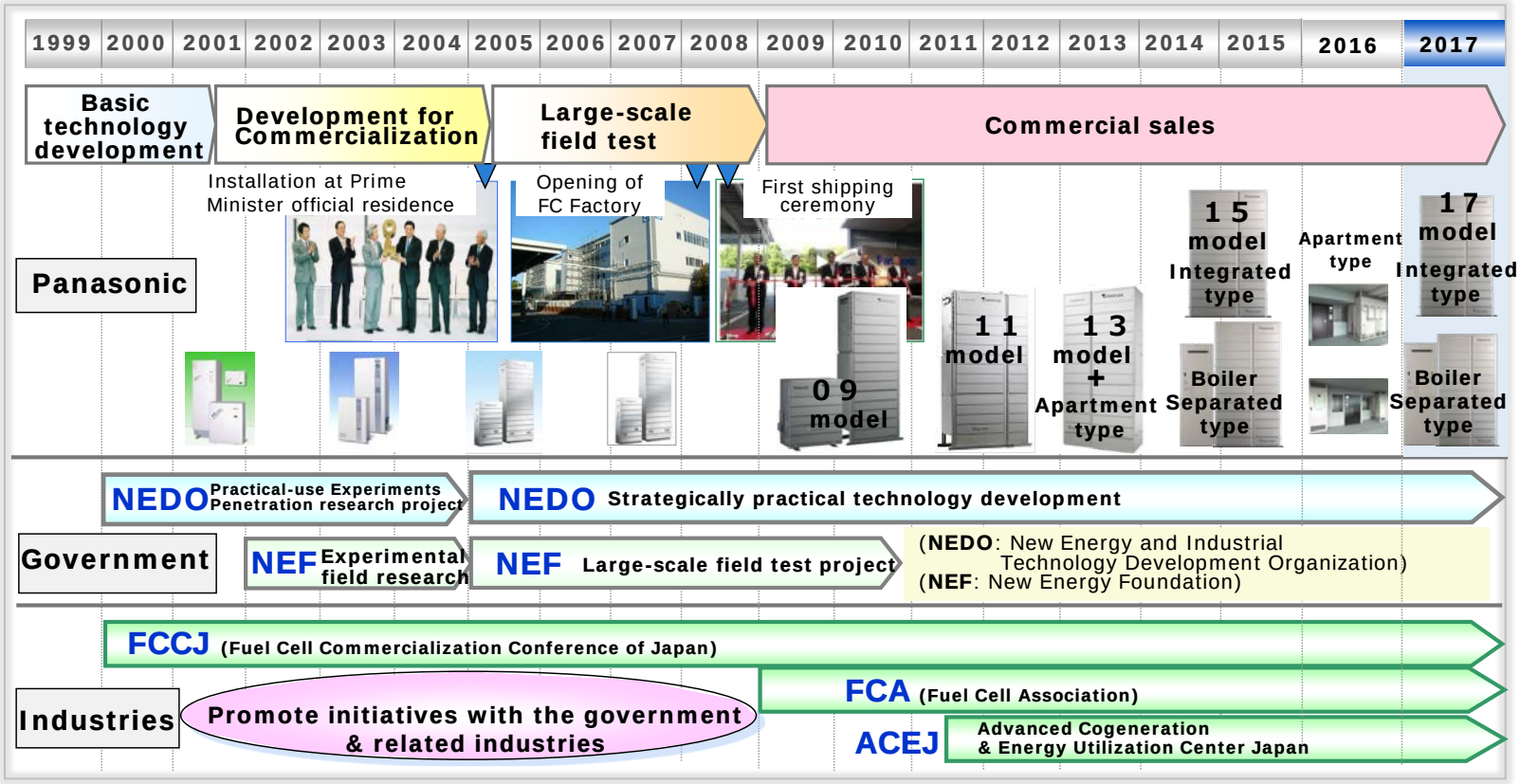


Reduction of CO2 emissions
: 1.3t / year

Energy cost saving
: 600～900 US$ / year

*1US$=110JPY ,Data by Panasonic

Development history



Contents

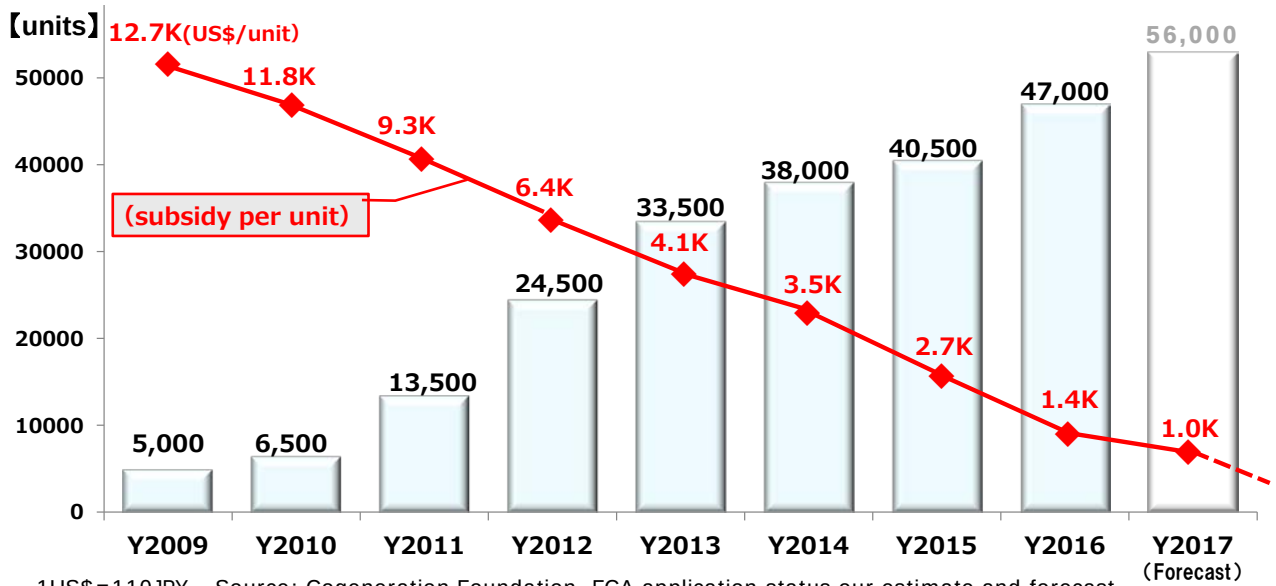
Progress of Panasonic fuel cell

Since 2009, Panasonic has introduced new model every 2 years to get more acceptance from the market.

	1st Gen.	2nd Gen.	3rd Gen.	4th Gen.	5th Gen.
Year	2009	2011	2013	2015	2017
			 World Highest efficiency 95% (LHV)	 Slim & Compact design	 ・Long life ・Network connection ・Remote Maintenance ・LPG model
Power	1000 – 300W	750 – 250W	750 – 200W	700 – 200W	700 – 200W
Durability	40,000h	50,000h	60,000h	70,000h	90,000h
Footprint	3.9㎡	2.0㎡	2.0㎡	1.7㎡	1.7㎡
Weight (FU unit)	125kg	100kg	90kg	77kg	65kg

Market expansion in Japan

Market is growing rapidly since 2009, Accumulated quantity achieved 200,000 units in May 2017



1US$=110JPY Source: Cogeneration Foundation, FCA application status our estimate and forecast

Achieved 200,000 units (May 2017)

Panasonic 100,000 units

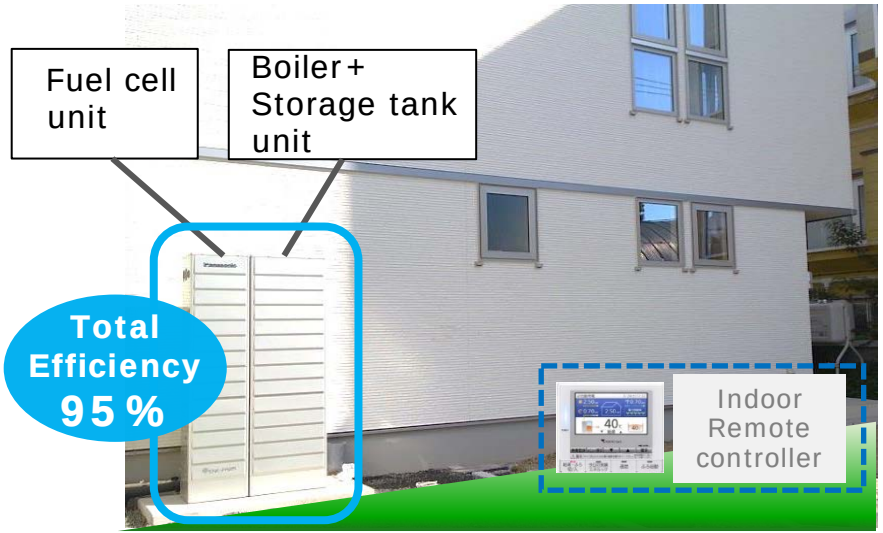
2020 Target 1.4 mil. units

2030 Target 5.3 mil. units

Latest model

Model for detached house : launched in April 2017

Installed example for detached house

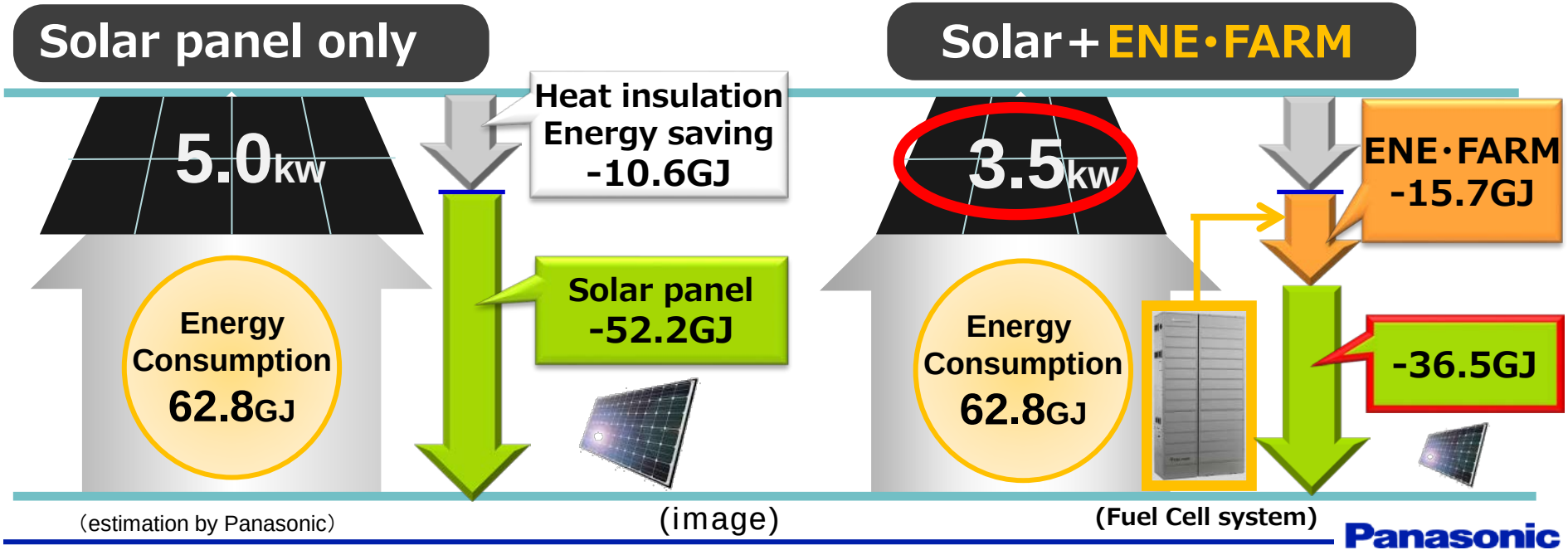


Key Features

- **90,000 hrs. lifetime**
- **Remote maintenance by network connection**
- **Continuous power supply up to 8 days at the blackout**
- **Introduction to LPG market**

Application for ZEH (Net Zero Energy House)

Reduction of the primary energy by ENE･FARM
Reduction of solar panel capacity for the house which has limited roof space in urban area



(estimation by Panasonic)

(image)

(Fuel Cell system)

Network connection

Possibility to create for new business solution by network connection

Current ➡ **Future**

Individual operation

Connected information

Electricity

Water

gas

Internet

HEMS

Visualization of energy

Plural connection
Connection to the other appliances

VPP (Virtual power plant)
DR (Demand response)

Utilization of Big Data

Expansion of New business solution

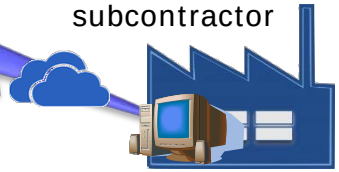
Remote Maintenance

Software down load
Remote analysis

Factory IoT

Analysis of failure
Product and process Innovation

Connection to subcontractor



HEMS: Home Energy Management System

European PEFC fuel cell

Joint Development with VIESSMANN who is major heating company in Europe

Panasonic VIESMANN

Left：Fuel cell (Panasonic)

Right：Hot water tank and Back up boiler (VIESSMANN)

■Features

1. High efficiency
Achieved 90% (LHV) for overall Efficiency

2. Simple construction
Suitable for utility room such as basement

3. Easy to Use
Monitoring of power generation and maintenance information by mobile device

Subsidy 9,300 Euro / unit in Germany

■Specification

【Power Generation】750w（constant）
【Overall Efficiency】 90%(LHV)（Electricity 37%/heat 53%）
【Durability】 70,000 hours（10 years）, Start/Stop 4,000 times

Pilot project in France

A collaborative project of natural gas fuel cell system was started in Oct. 2014.

Pilot Site 1
House of Gymnasium

Pilot Site 2
Nursery

Pilot Site 3
Apartment

Viessmann's Vitovalor 300-P were installed at pilot sites.

Contents

Pure hydrogen FC

High efficient power generation with CO_2 Free
Out put power can be increased for bigger demand

Natural gas Fuel Cell ——— **Expansion of line up** ———

ENE･FARM
(Out put: 700W)

Pure H_2 type
(Out put: 700W)

High Power type
(Out put: 5kW)

Plural connection
(e.g. 100Kw=5Kw x 20)

Aspire to advent of Hydrogen Society

■ Field test in Yamanashi Mega Solar power plant

10Mw Solar power plant by Tokyo Electric Power Company

■ Field test in Shizuoka Hydrogen Station

Hydrogen Station by Shizuoka Gas

Activity for Tokyo Olympic & Paralympic

Smart city for athlete village will be constructed in Harumi by 2020

image

Source: Bureau of Olympic and Paralympic Games Tokyo 2020 Preparation

■ TOKYO GAS, JXTG Nippon Oil & Energy, TOSHIBA and Panasonic were decided for “Energy business enterprise for athlete village”

■ Hydrogen fuel cell will be the best solution for the energy supply at the athlete village

(Product image of Hydrogen Fuel cell)

Plural connection of 5kw type

Panasonic will contribute comfortable life

for the customer and the global environment

by the spread and expansion of Fuel Cell

A Better Life,
A Better World