TOSHIBA
Leading Innovation

Residential Fuel Cell Systems

Toshiba Fuel Cell Power Systems Corporation

November, FY2013

TOSHIBA eco style
Toshiba Group contributes to the sustainable future of planet Earth.

Introduction

High Efficiency 1kW-Class Residential Fuel Cell CHP System

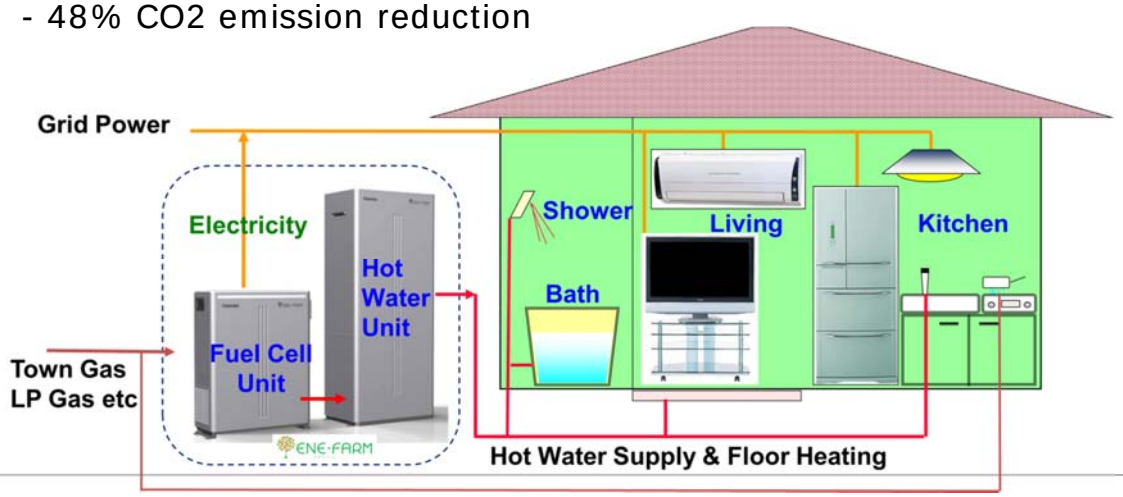
Ene-Farm

Distributed Power Supply for Domestic Use

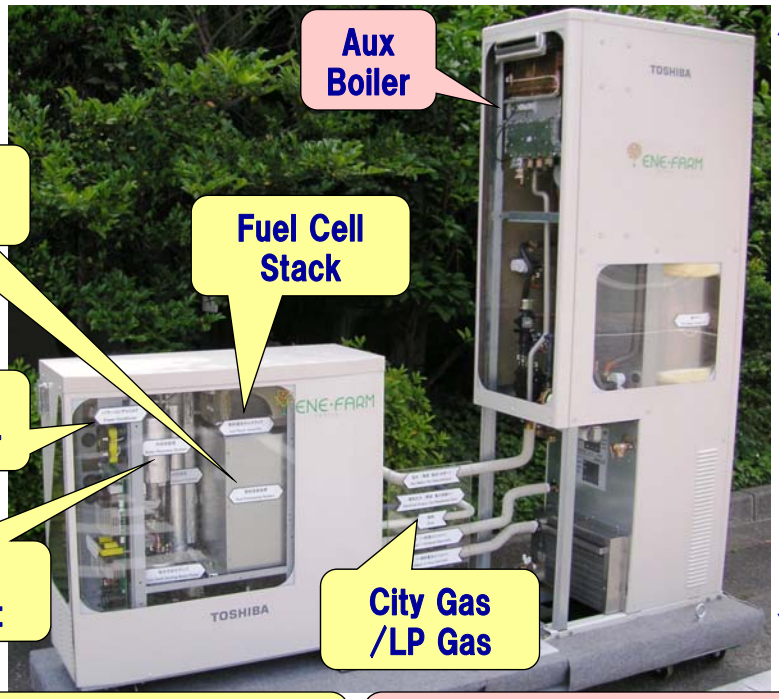
- Electricity and hot water are supplied
- Applicable to a large variety of fuels (Town gas, LP gas, etc.)
- Self-sustaining function while a grid power failure

Environmental-Friendly System

- Significant improvement of energy consumption & CO2 emission in household
  - High efficiency (Overall efficiency; 94%)
  - 48% CO2 emission reduction



Main Components of Residential Fuel Cell



FC Unit : Generate Electricity by Gas

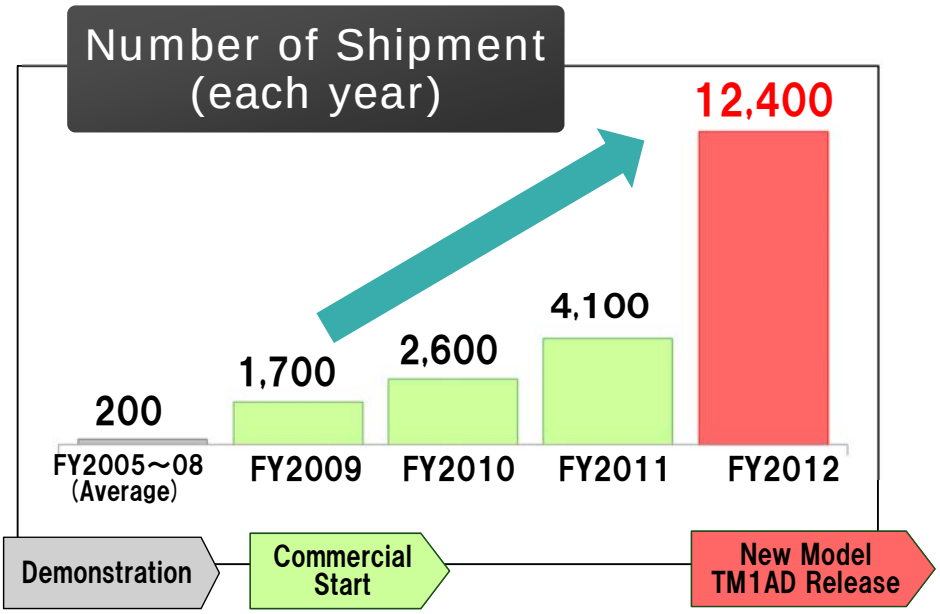
Hot Water Tank :Storage Hot Water by Exhaust Heat

Toshiba ENE-FARM Shipment in Japan

-Commercialized Ene-farm to JP market since 2009

-Over 20,000 units have been shipped for these 4 years.

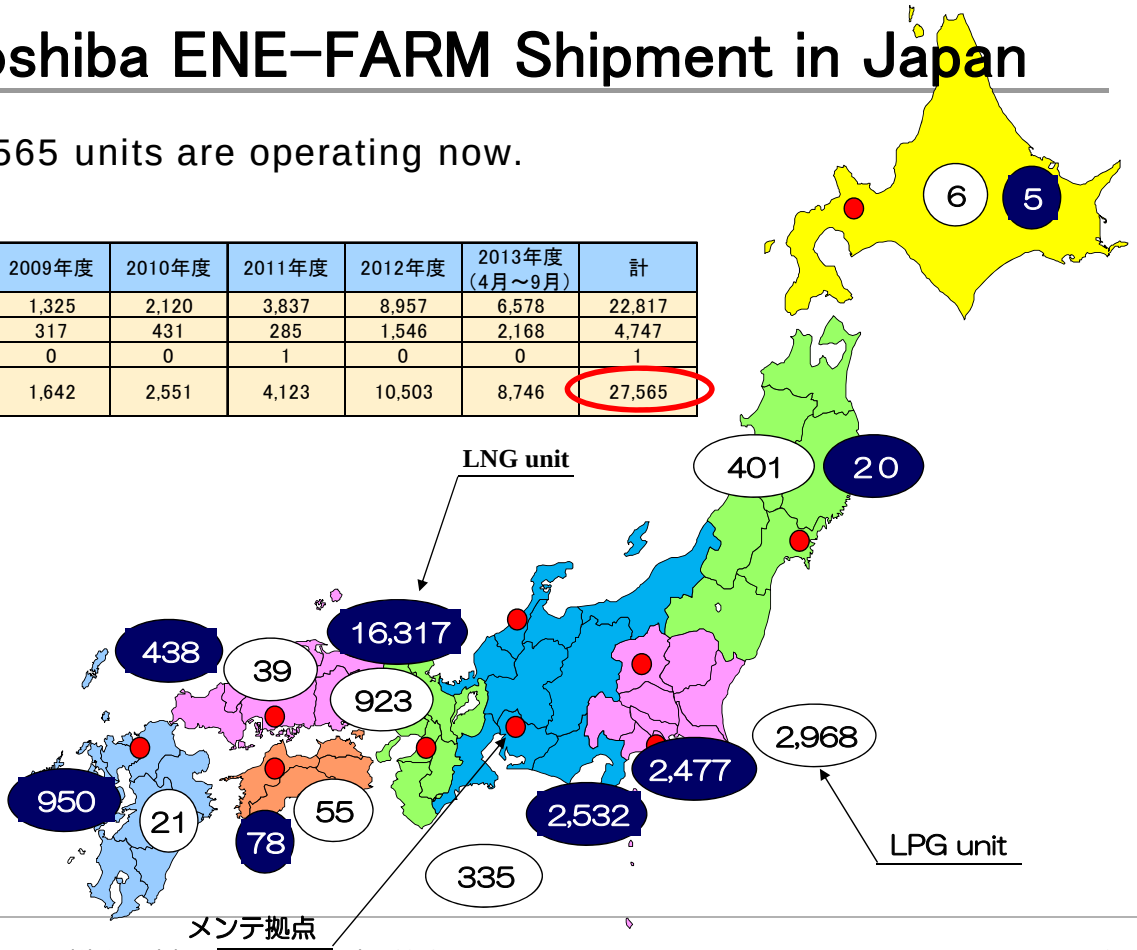
-20,000 units will be shipped at FY2013



Toshiba ENE-FARM Shipment in Japan

-27,565 units are operating now.

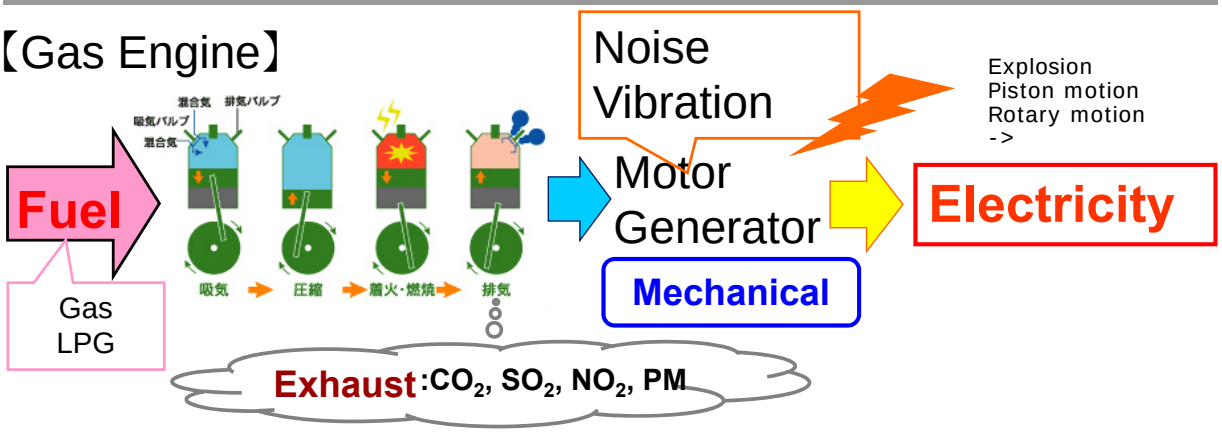
種別	2009年度	2010年度	2011年度	2012年度	2013年度（4月～9月）	計
都市ガス用	1,325	2,120	3,837	8,957	6,578	22,817
LPガス用	317	431	285	1,546	2,168	4,747
その他	0	0	1	0	0	1
計	1,642	2,551	4,123	10,503	8,746	27,565



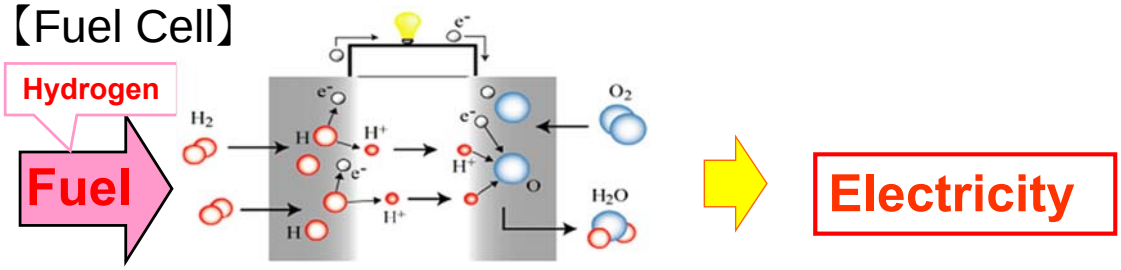
What is Fuel Cell?

Fuel cell system : Clean & High efficiency

【Gas Engine】



【Fuel Cell】

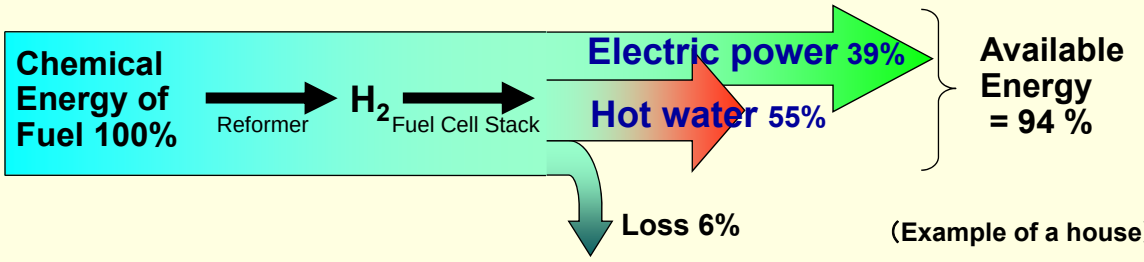


FC : Clean/Quiet/ High Effi. → Environmental Friendly

Advantage of FC (CHP)

High Energy Efficiency & Environmental Friendliness by Combined Heat and Power Supply

- **Effective utilization of energy (94% of fuel energy is available)**



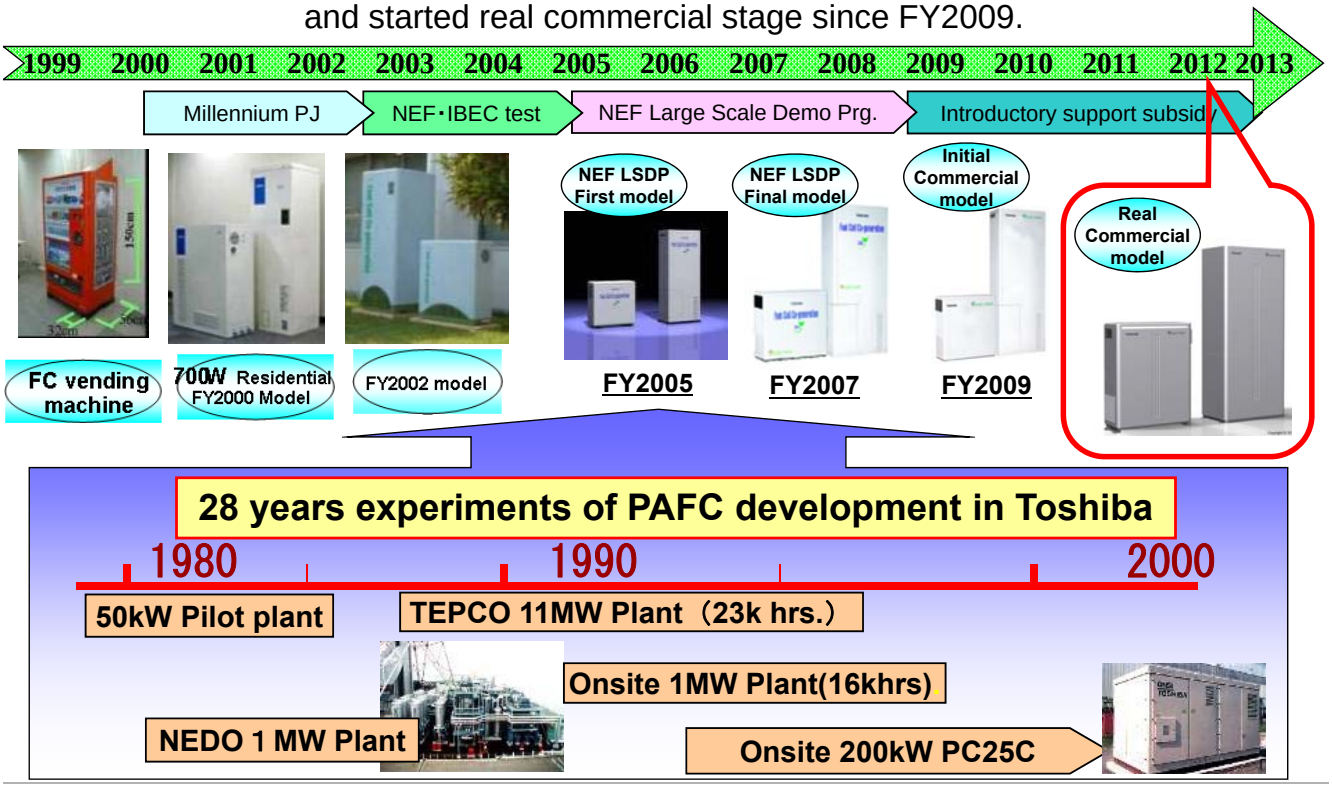
- **High CO_2 Emission Reduction (48% of CO_2 reduction)**

Residential Fuel cell

(Ene-Farm)

History of Stationary Fuel Cell in Toshiba

Toshiba has started PEFC development since FY2000,
and started real commercial stage since FY2009.



Toshiba ENE-FARM TM1AD (2012 Model)

The model shows much higher product property than the initial model in terms of performance, durability and cost.

The model is also high value-added model with various options.

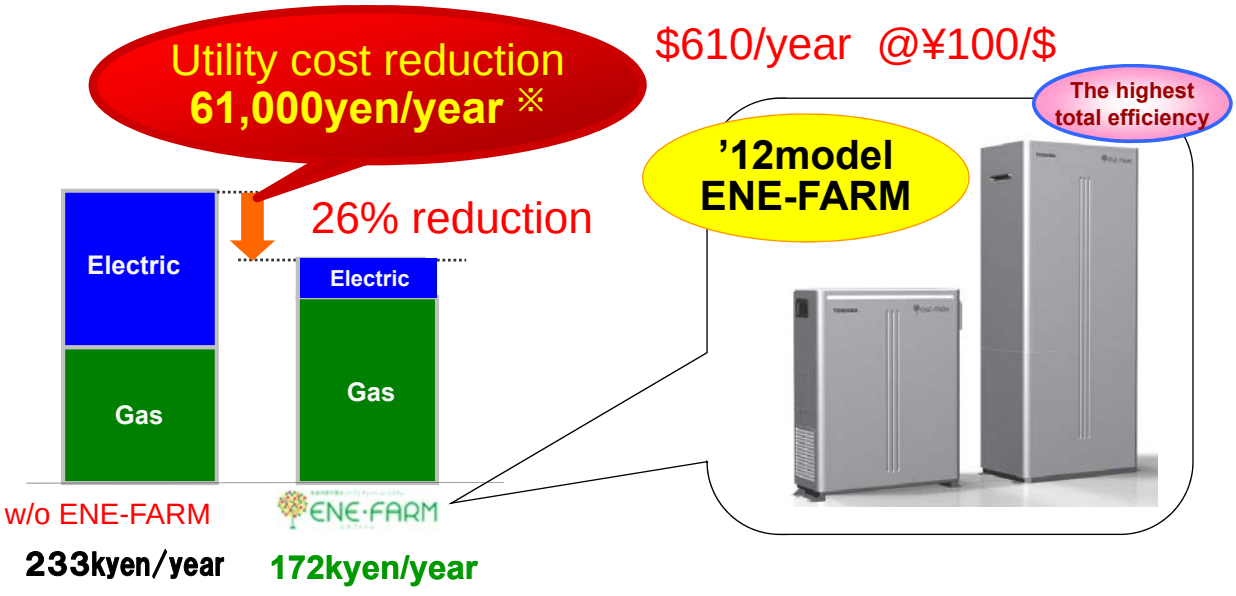
System specification of the 2012 model

Model	2012 Model (2nd generation)	2009 Model (Initial)
Electrical Power	250~700 W AC-NET	←
Electrical efficiency	> 38.5% (LHV) for City Gas > 37.5% (LHV) for LPG	36% (LHV)
Overall efficiency	> 94% (LHV)	86%
Design life of fuel cell	80,000hrs	50,000~70,000hrs
Fuel	City Gas / LPG	←
Operating noise	< 38 dB(A)	< 40 dB(A)
Operation Control	Automatic(LearningControl)	←
Hot Water Capacity	200 L	←
Package Size (W-D-H)	FC Unit: 780 x 300 x 1000 mm EHU : 750 x 440 x 1760 mm	890×300×895 mm 750 x 440 x 1900 mm
Package weight (Dry)	FC Unit: 94 kg, EHU: 100 kg	FC: 104 kg, EHU: 105 kg
Maintenance Interval	Once per 3.5 year (30 min. work during operation)	Once per 2.0 year
Cost Reduction	40% of 2009 Model	
Options		

The 2012 model is greatly improved from the 2009 model

An example of the Economic benefit of '12 model

By improving performance, the '12 model is more economical for end users, reducing annual utility cost by about $763.



*4 people model case estimation by Osaka gas

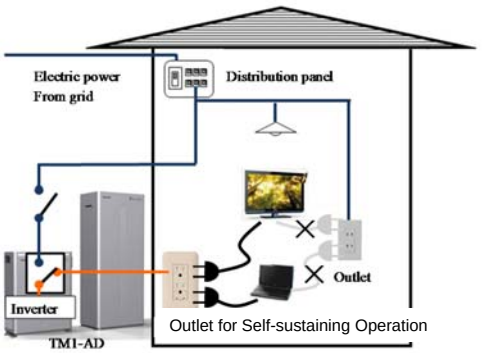
Self-Sustaining Operating Function

High value added

<Voice of Customer>
>ENE-FARM should supply power under blackouts.
>Self-sustaining operation function should be provided with low price."

Inverter control technology by Toshiba FCP

A Simple system without a battery.



A comparison of the specifications of w/o battery and w/ battery

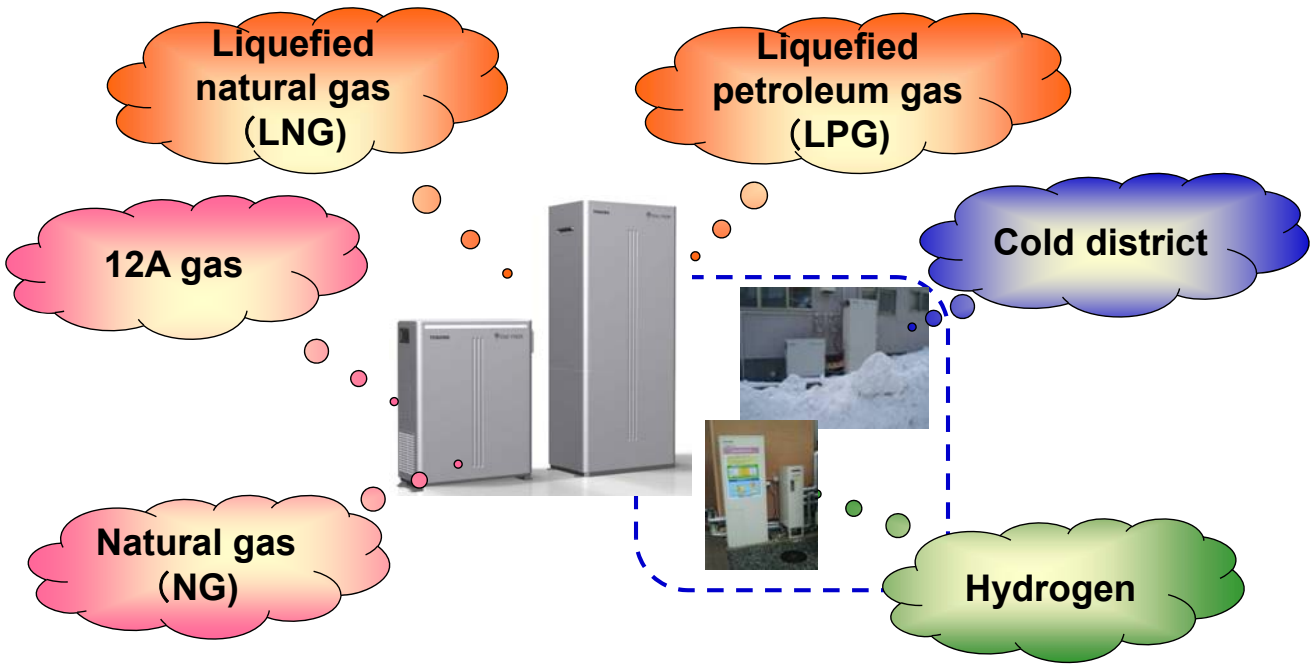
Item	Importance	Without Battery	With Battery
Cost	Very High	Excellent	Expensive
Self-sustaining operation	Very High	Fair	Fair
Duration of operation	Very High	Excellent	Fair
Switch automatically	High	Fair	Excellent
Start from blackout	High	Limited※	Fair

※ Need of External power supply

Outline of this function:
ENE-FARM can continue operation even during a blackout.

Diversity for various fuel and environment

Toshiba Ene-farm supports enough options for various fuel and environmental conditions.



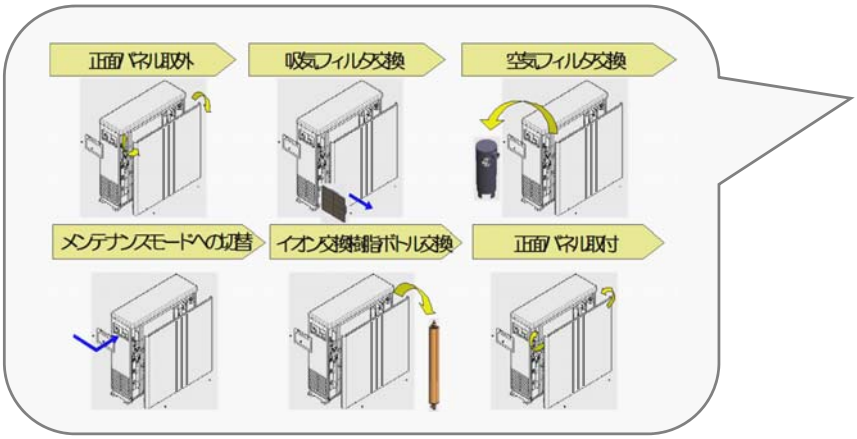
Improvement of maintainability

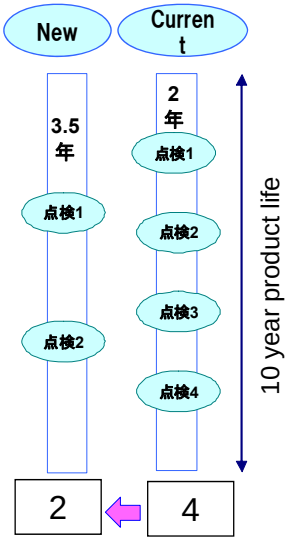
➢The interval of periodical maintenance was extended to once in 3.5 years. Required maintenance is reduced to twice during ten years product life.

➢Maintenance can be done without shut down of the system. No more than 30 minutes required for the standard work such as exchanging filters and water bottles.

●Easy and simple maintenance
Special skill is not needed.
Maintenance cost is low.

Same as current model



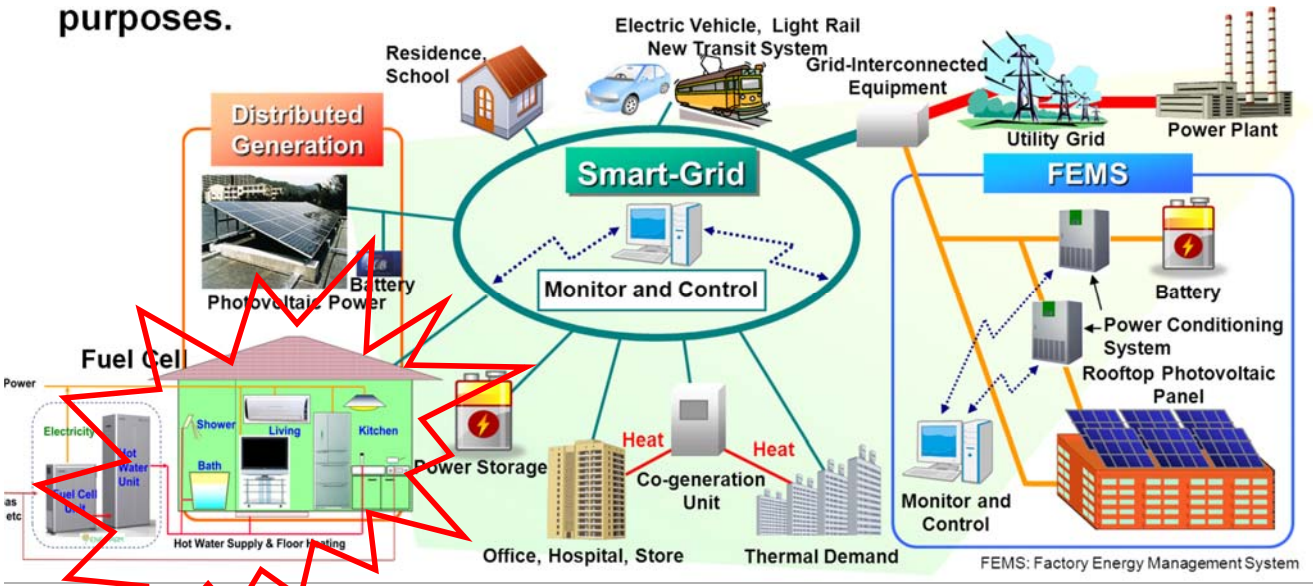


Residential FC for smart-grid control

➢Smart-grid is composed of multiple distributed generation and load, operating independently from the utility grid.

➢Energy is generated and use effectively by IT control to reduce the environmental impact.

➢Exelon may be capable to control residential FC system for these purposes.



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Thank you for your attention