

TOSHIBA

Leading Innovation >>>

IPHE Forum Gwang-ju, Korea

Japanese ENE-FARM toward the future



Toshiba ENE-FARM

ENE-FARM is a common brand name of a residential fuel cell system in Japan.

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~Content~

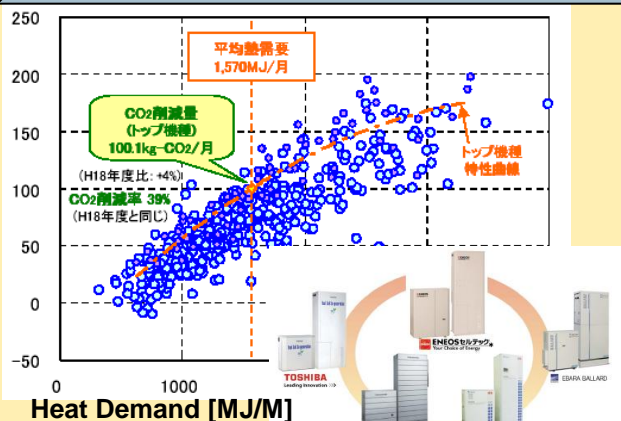
1. General Status of Japanese ENE-FARM
2. Toshiba Activities for Residential & Stationary FC
3. A Consideration for ENE-FARM Commercialization
4. Summary

How was our ENE-FARM started and expanded.

More than 150k-units is in the market as of FY2015 for 7 years with 57% of CAGR. Expecting the volume to be ca. 170k-units today. Expected SOFC future expansion besides PEMFC.

Technology demonstration

CO₂ Reduction [kg/month]



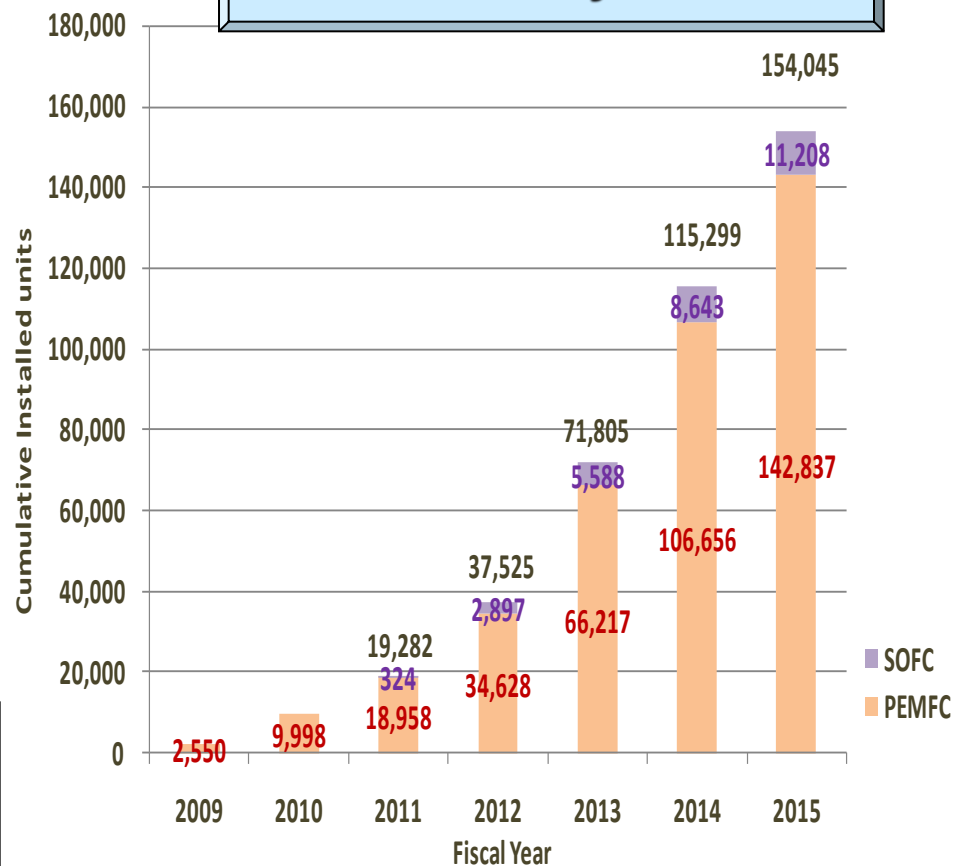
Total 3,307units
by 5 system manufacturers
for 5 years (FY2005 thru '08)

Start commercialization

Starting by the joint declaration by government and industries on January, 28, 2009.



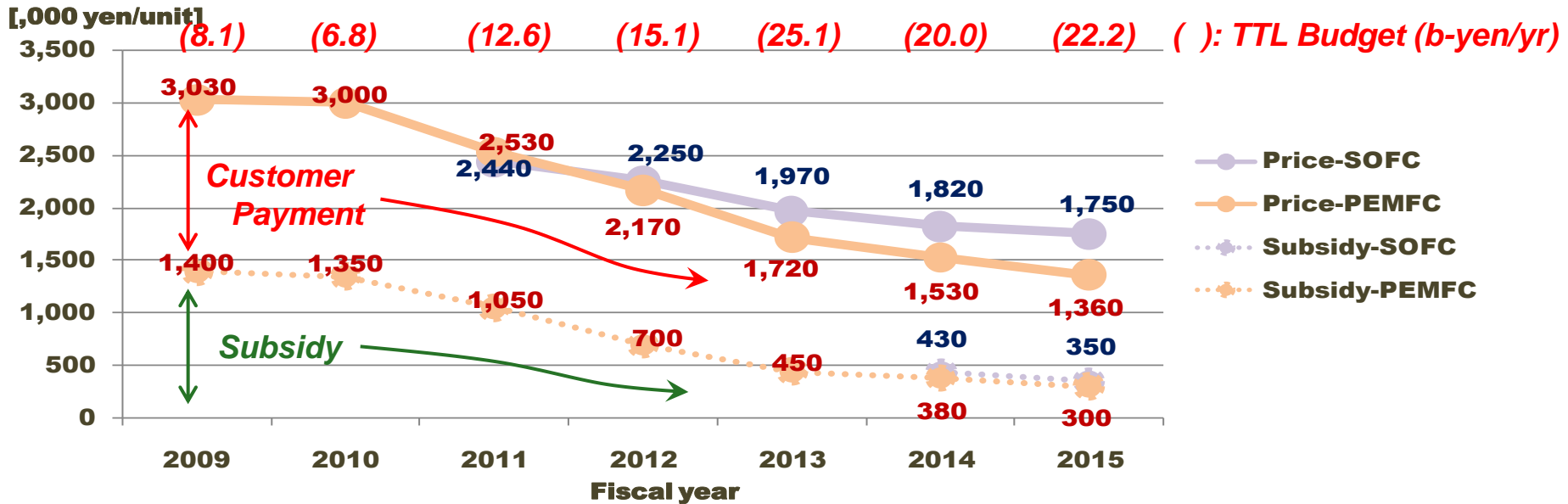
Today!



Source: Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry

How was/is our governmental support with subsidy

Gradual decrease of end customer payment under the strategic approach in governmental subsidy. Total 110b-yen (1.1b-US\$) of subsidy for 7years.



Lower the price, higher the subsidy as FY2016 strategy. Assigned higher subsidy for SOFC.

2016FY Subsidy Scheme TTL Budget = 9.5b-yen/yr

| PEMFC unit | Below base price (1,270,000 yen) | Above base price, below upper-limit price | Above upper-limit price (1,420,000 yen) |
|------------|-------------------------------------|--|--|
| | 150,000 yen/unit | 70,000 yen/unit | Not qualified |
| SOFC unit | Below base price (1,570,000 yen) | Above base price, below upper-limit price | Above upper-limit price (1,690,000 yen) |
| | 190,000 yen/unit | 90,000 yen/unit | Not qualified |

Additional subsidies

Retro-fit installation: + 30,000 yen, LPG unit: + 30,000 yen, Cold-weather unit: + 30,000 yen

How we have been promoting ENE-FARM improvement

Toshiba has been challenging ENE-FARM improvements with *the highest priority for cost reduction.*

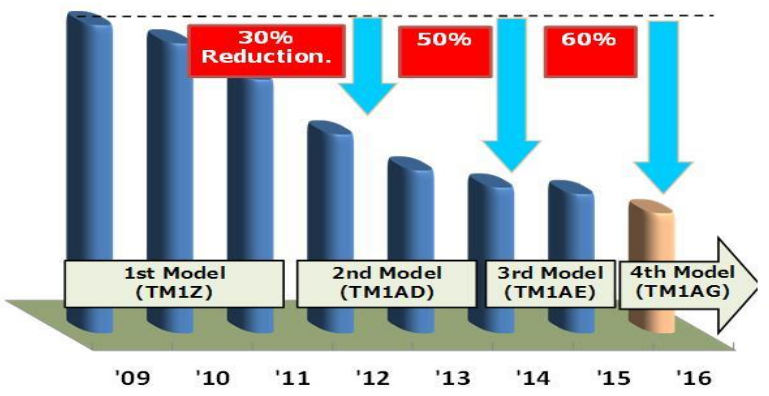


Outlook of Toshiba FY2016 model

- Lower Cost: 60% CR for 7years
- Higher eff.: 39%(Elec.) 95%(Ttl.)
- Longer durability: 88.000hrs/3700SS
- Lower noise: 37dB
- Easier maintenance: 5years interval & installation capability for narrow space
- Fuel diversity etc.

Cost reduction effort

- ✓ Every effort by Technology, Purchasing and Manufacturing
- ✓ More than 60% reduction from 09 model



Cost Trend of Toshiba ENE-FARM

New ECS board 17% less foot print

220x330mm 6 layers → 185x325mm 4 layers

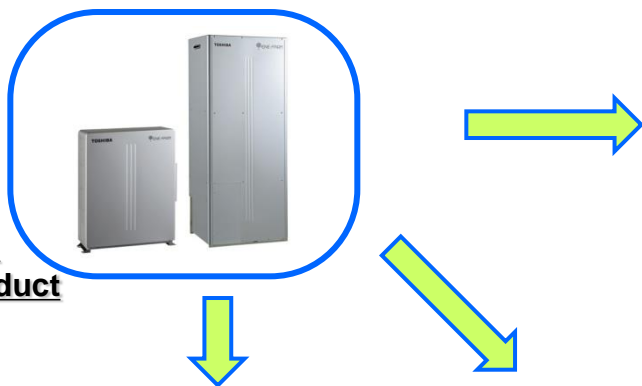
Cell Stack: Platinum Reduction 8%

Lighter Frames Plastic Pipes

CD M-BOPs CD Flowmeter CD Pumps

How we have been expanding our business chance

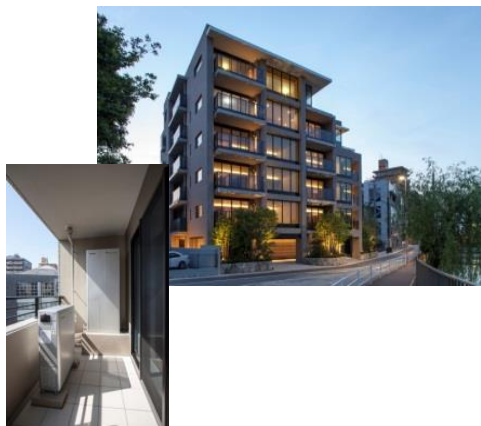
Various options or applications can offer the wider business opportunity and overseas business with ENE-FARM.



ENE-FARM
as the core product

2. Condominium installation

Two types application, balcony type and piping space type,



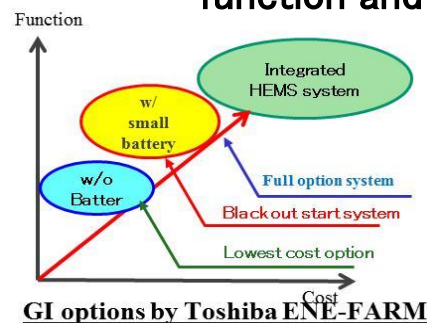
Balcony type option



Piping space type option

1. Grid Independent Options

Three kinds of GI options related to function and price.

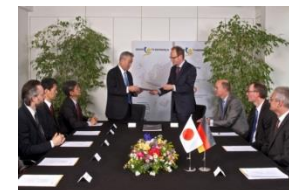


3. Oversea Business

EU can be the most promising market for CHP under the collaboration with the good partner, Korea also has some good potential.



EU FC Unit for InnoGen



Signing Ceremony
(April 2014)

~Toshiba H2 FC for Future Hydrogen Society~

- Having delivered around 87 pure H2 FC units
- Developing variety of H2 FC as Toshiba group
- Tokyo Olympic/Paralympic as the opportunity to demonstrate the possibility of future H2 society



700W unit

After 2015 Commercialization

- BCP (small scale)
- H2 Station
- Residential (close to H2 Station)
- Tokyo Olympic village
- PJ of Ministry of the Environment



H2 Station



3.5kW unit

After 2015

- BCP (middle scale)
- H2 Station
- Institutional use



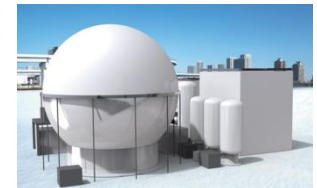
H2One



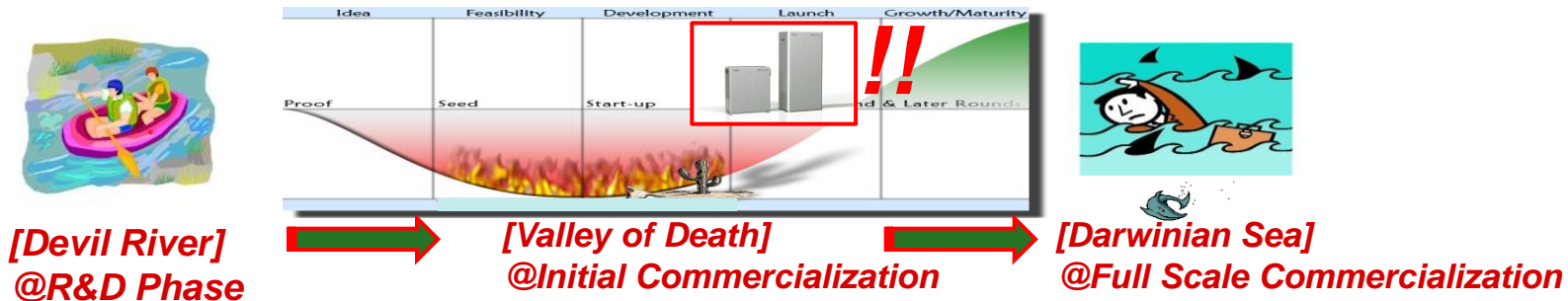
100kW unit

After 2017

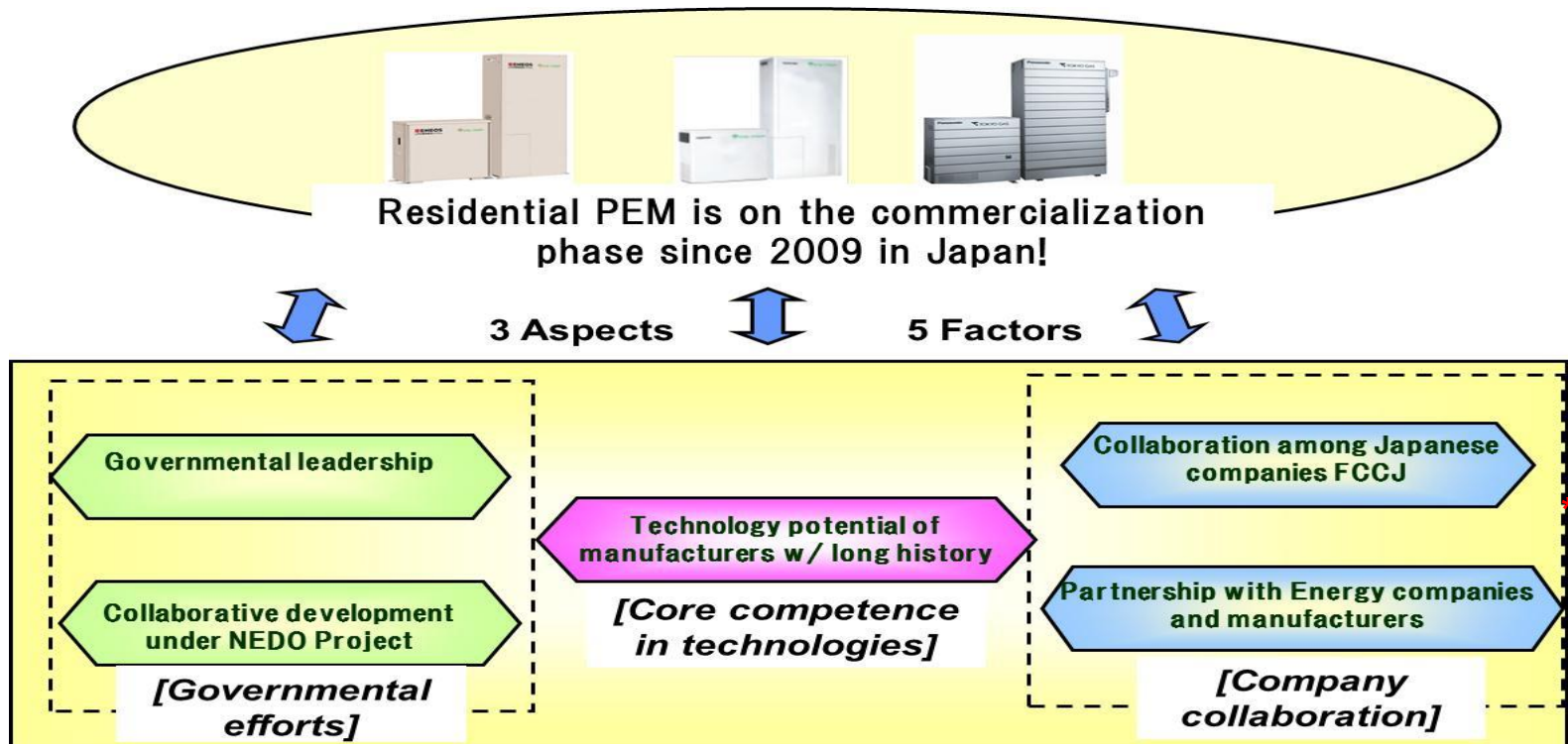
- PJ of Ministry of the Environment
Kyusyu, Hokkaido, Olympic etc.



3. A Consideration for Full Scale Commercialization



Japanese ENE-FARM just overcame the valley of death. So what were the key factors?

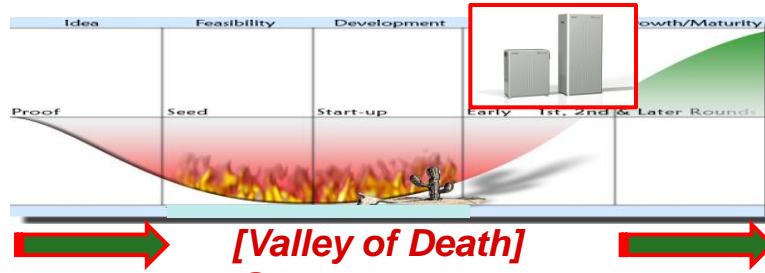


*:where Energy companies mean Gas companies

How shall it be toward FULL SCALE COMMERCIALIZATION!!



[Devil River]
@R&D Phase



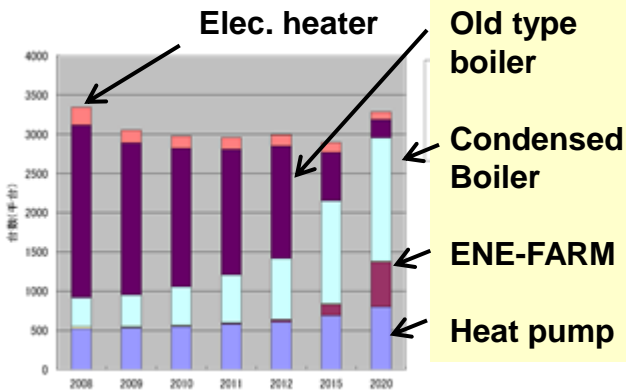
[Valley of Death]
@Initial Commercialization



[Darwinian Sea]
@Full Scale Commercialization

How shall our challenge be
toward the future **FULL SCALE COMMERCIALIZATION?**

Market potential for ENE-FARM



3million of annual sales in Japan.
Additional market is expected in EU and so on.

Key challenges for full scale commercialization

1. ENE-FARM shall be really beneficial for end-customers related to three factors
(i.e. **ecology, economy and security**)

Another 20-30% of **cost reduction** is needed by 3 factors such as design, manufacturing and purchasing.

2. New sales channel to be explored in addition to current B2B channel



Good product with wider sales channel can lead the future ENE-FARM market toward 500k annual volume. It shall be attractive and competitive enough under free market mechanism.

4. Summary

1. Dissemination result: The **110b-yen (964m€)** of governmental support for ENE-FARM for 6years (FY2009-2015). Another **9.5b-yen (88m€)** in FY2016. As the results, **ca. 170,000units** in now under the operation in Japan.
2. Toshiba efforts: The total volume is ca. 80,000units now. More than 60% of cost reduction was achieved for these 6years.
3. Factors having overcome valley of death: **1.Manufacturers technology potential, 2.Governmental leadership/support, and 3.Strong relationship in industries** leaded the good success of ENE-FARM so far.
4. Toward the future: Still need **further 20-30% of cost reduction** for “The really beneficial ENE-FARM for end customers”. **Various application and wider sales channel** will be also key for Full Scale Commercialization. **ENE-FARM shall be the strongly competitive product under “Free market mechanism” to reach the governmental target.**

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