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FCH 2 JU STAKEHOLDER FORUM

Status of Japanese ENE-FARM toward the full scale commercialization

Toshiba ENE-FARM

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

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Overall Trend of Japanese ENE-FARM

As Whole Japan;
Past;
3,300units FY 2005 through 2008
under NEDO Governmental Project

As Toshiba FCP;
[Volume of 120-140]
Past;
Annual in FY2005 ✓

Commercialization in FY2009
Annual delivery 5,000units

Monthly in FY2009 ✓

Present;
Annual 38,000units in FY2014
Now; Total 140,000 units in the market
CAGR of these 6years＞60%

Present:
Daily in FY2014 ✓

Future;
Governmental Target
- 1.4million units by FY2020
- 5.3million units by FY2030

Future:

Challenge to 500 – 1、000 daily volume!!

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– Content –

1. What is ENE-FAM

2. How we, Japan, have been promoting its dissemination.

3. How was/is the business & technology development in Toshiba

4. What were the key factors of the success and how shall it be toward the future: FULL SCALE COMMERCIALIZATION!!

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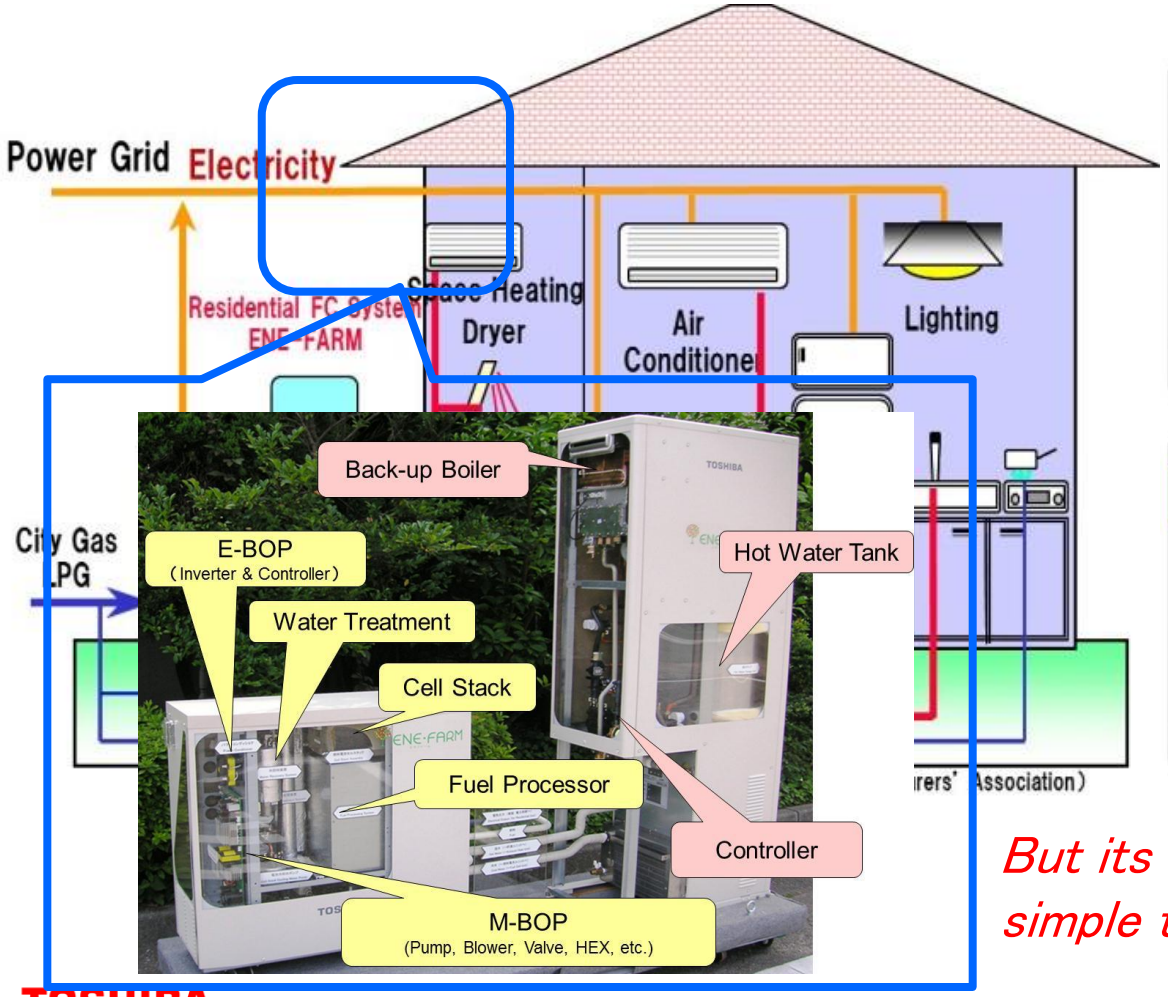
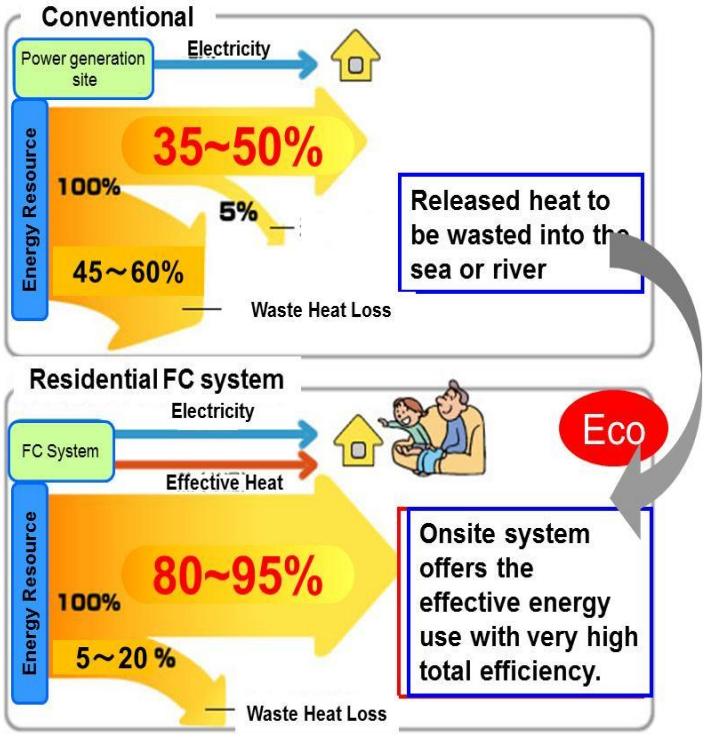
What is ENE-FARM?

It's the common brand name for a residential fuel cell system in Japan.
The system is installed beside each house, and supplies both electricity and heat with higher efficiency to be 80 – 95%.

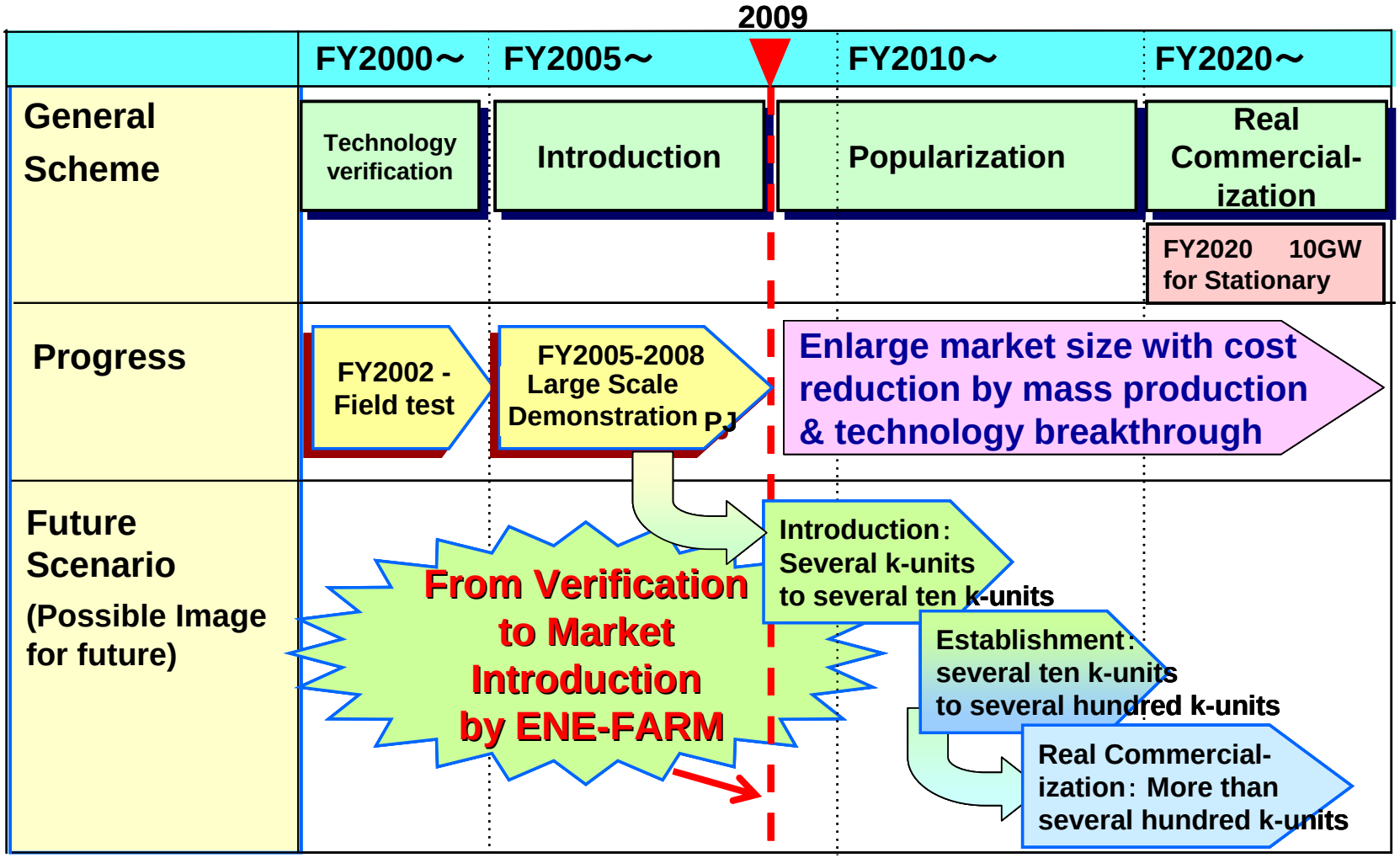




But its system configuration in not so simple to manufacture.

How we, Japan, have been promoting ENE-FARM dissemination

- After technology verification and large scale demonstration program, Japan started the commercialization of "ENE-FARM" in FY2009.
  And now, around 140,000units are operated in Japanese houses.



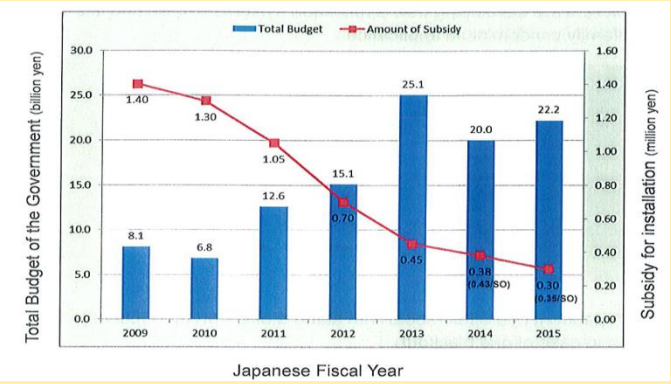
Status of ENE-FARM Dissemination: Total Trend

Start commercialization

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

Governmental support

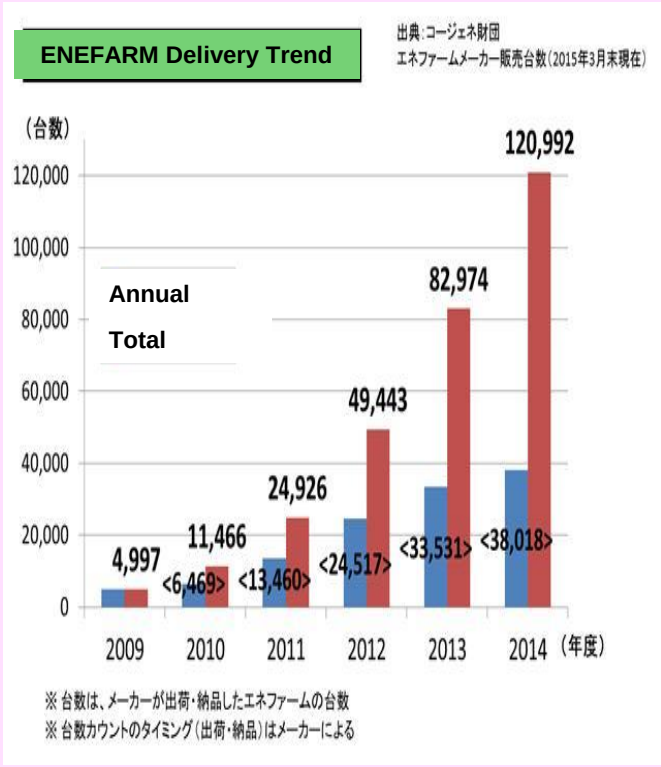
- Increasing total budget with decreasing subsidy per unit.
- Total support for 6years,FY2009 to 2014, up to **88b-yen(650m-euro), and another 22b-yen(160m-euro) in FY2015**



Trend of sales volume

The sales volume has been increased year by year. The accumulated volume reached to 120,000 units in the end of FY2014.

[Annual volume]



* Data by ACEJ

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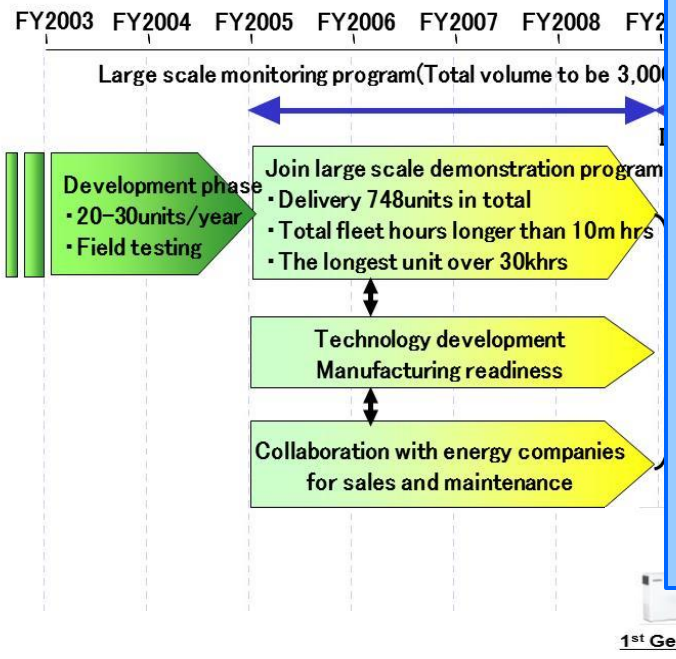
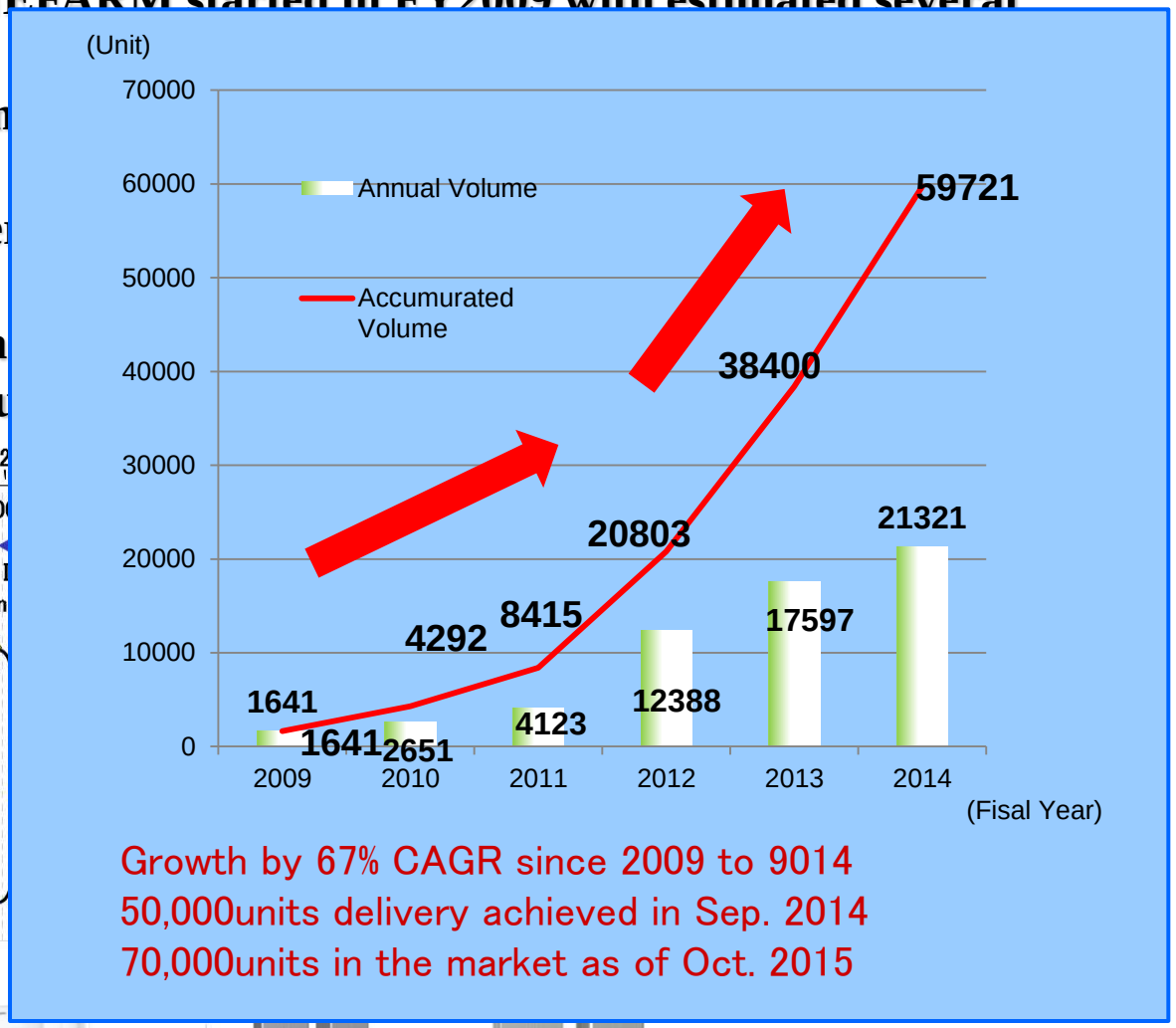
How was/is the business & technology development in Toshiba

- Joined to " Large scale demonstration program" since FY2005 throughFY2008. Delivered 748 units for four years.
- Initial commercialization of ENEFARM started in FY2009 with estimated several thousands of annual volume.
- Selling volume around 8,000 un through 2011.
- Expanding business by 2nd gene FY2012 and 2013.
- Expanding manufacturing capa
- New 3rd generation units was ju





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How we have been promoting ENE-FARM improvement

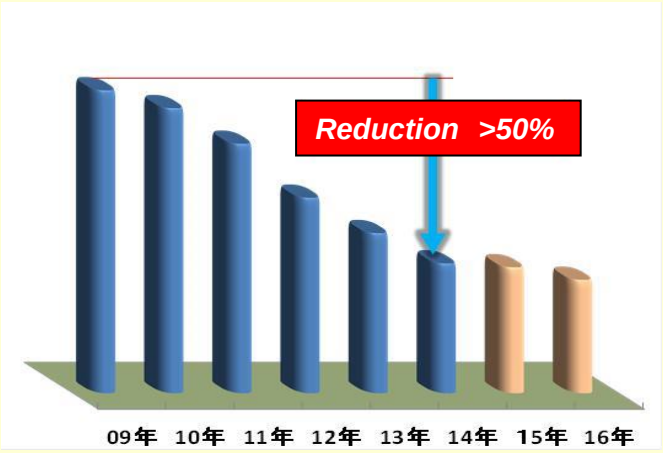
Toshiba has been challenging ENE-FARM improvements with *the highest priority for cost reduction*.

- **Lower Cost: more than 50% CR for 5years**
- **Higher eff.: 39%(Elec.) 95%(Ttl.)**
- **Longer durability: 80.000hrs/4000SS**
- **Lower noise: 37dB**
- **Easier installation for narrow space**
- **Fuel diversity etc.**

Major improvements in Toshiba ENE-FARM (FY2014 model)

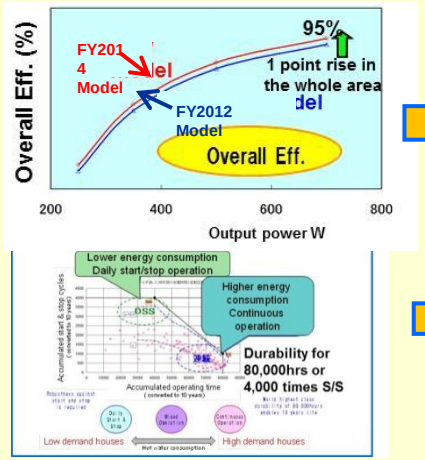
Cost reduction

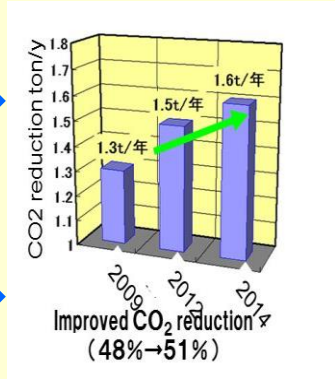
・Every effort by Technology, Purchasing and Manufacturing
・"Reduce" as CR Concept
⇒Result：More than 50% reduction from 09 model



Enviromental Performance

・Higher efficiency and availability lead higher environmental contribution
⇒The CO2 reduction increased to 1.6t/y





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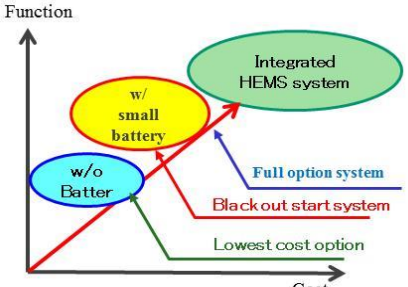
How we have been expanding our business chance

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

ENE-FARM
as the core product

①Grid Independent Options

Three kinds of GI options related to function and price.



GI options by Toshiba ENE-FARM

② Condominium installation

Two types application, balcony type and piping space type,

Balcony type option

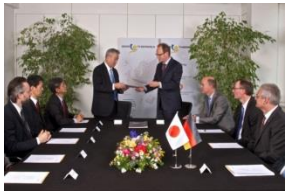
Mockup for design confirmation

Piping space type option

③ Oversea Business

EU can be the most promising market for CHP under the collaboration with BDR group.

EU FC Unit for InnoGen



Signing Ceremony
(April 2014)

Toshiba H2 FC for Future Hydrogen Society

- **Having delivered around 60 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**

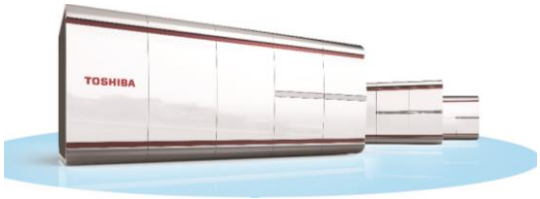
700W unit

After 2015 Commercialization
-BCP (small scale)
-H2 Station
-Residential (close to H2 Station)
-Tokyo Olympic village
-PJ of Ministry of the Environment

H2 Station

Multi kW

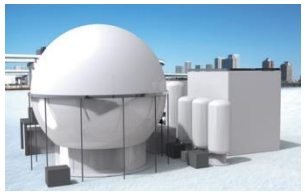
After 2015
- BCP (middle scale)
- H2 Station
- Institutional use



H2One

100kW
～MW System

After 2017
- PJ of Ministry of the Environment Kyuusyu, Hokkaido, Olympic etc.



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What were the key factors of ENE-FARM success

[Devil River]
@R&D Phase

[Valley of Death]
@Initial Commercialization

[Darwinian Sea]
@Full Scale Commercialization

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

Residential PEM is on the commercialization phase since 2009 in Japan!

3 Aspects **5 Factors**

- Governmental leadership
- Collaborative development under NEDO Project

[Governmental efforts]

- Technology potential of manufacturers w/ long history

[Core competence in technologies]

- Collaboration among Japanese companies FCCJ
- Partnership with Energy companies and manufacturers

[Company collaboration]

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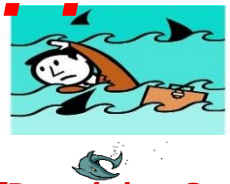
How shall it be toward FULL SCALE COMMERCIALIZATION!!

[Devil River]
@R&D Phase

[Valley of Death]
@Initial Commercialization

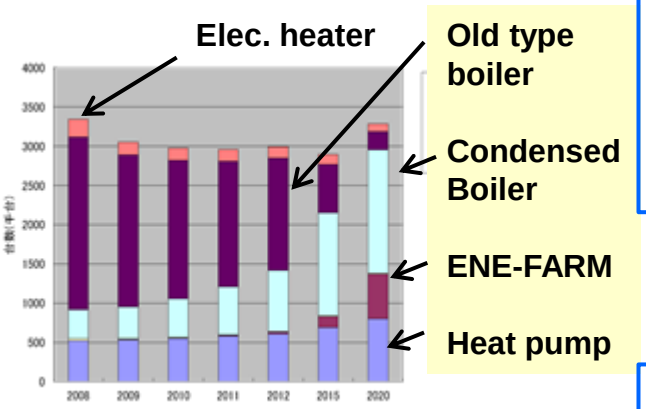
??



[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 with every effort on design, manufacturing, and purchasing.
Purchasing is even important rather than technology improvement in short term.
2.New sales channel to be explored in addition to current B2B channel

Good product with wider channel can lead the future ENE-FARM market toward 500k units as annual.

Summary

1. Dissemination result: The 88-yen (650m€) of governmental support for ENE-FARM for 6years (FY2009-2014). Another 22b-yen (160m€) in FY2015. As the results, 140,000units in now under the operation in Japan.
2. Toshiba efforts: The total volume is around 70,000units and annual volume was 21,000units in FY2015. More than 50% of cost reduction was achieved in 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". Wider application and sales channel will be also key for Full Scale Commercialization. It's really challenging, but has the reality to achieve.

   And,,,, It must be some good example for the successful commercialization in EU.

~ Thank you! ~

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