The Fuel Cell World

- Matsushita's approach for fuel cell co-generation -

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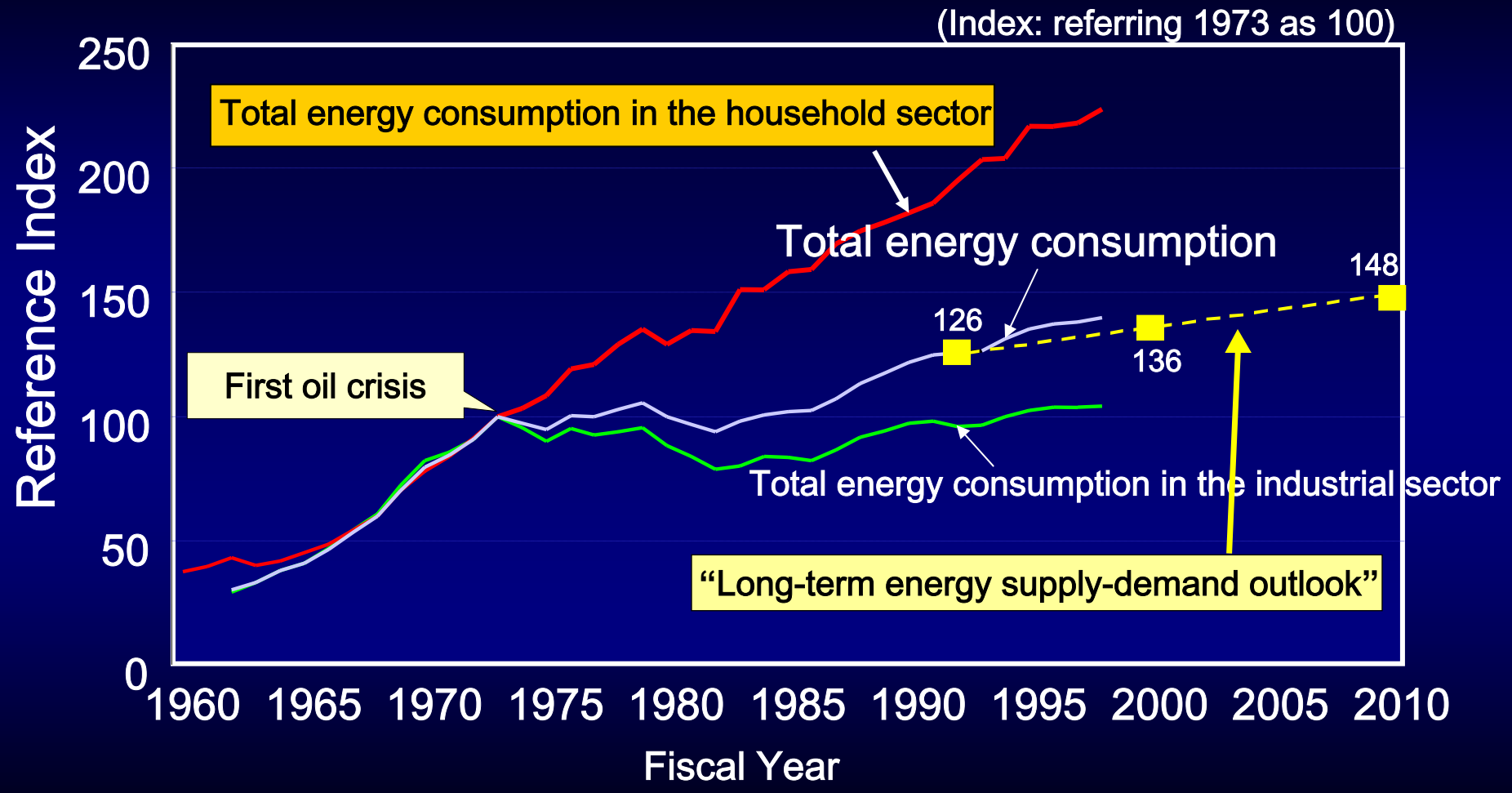
Contents

Energy Consumption in Japan

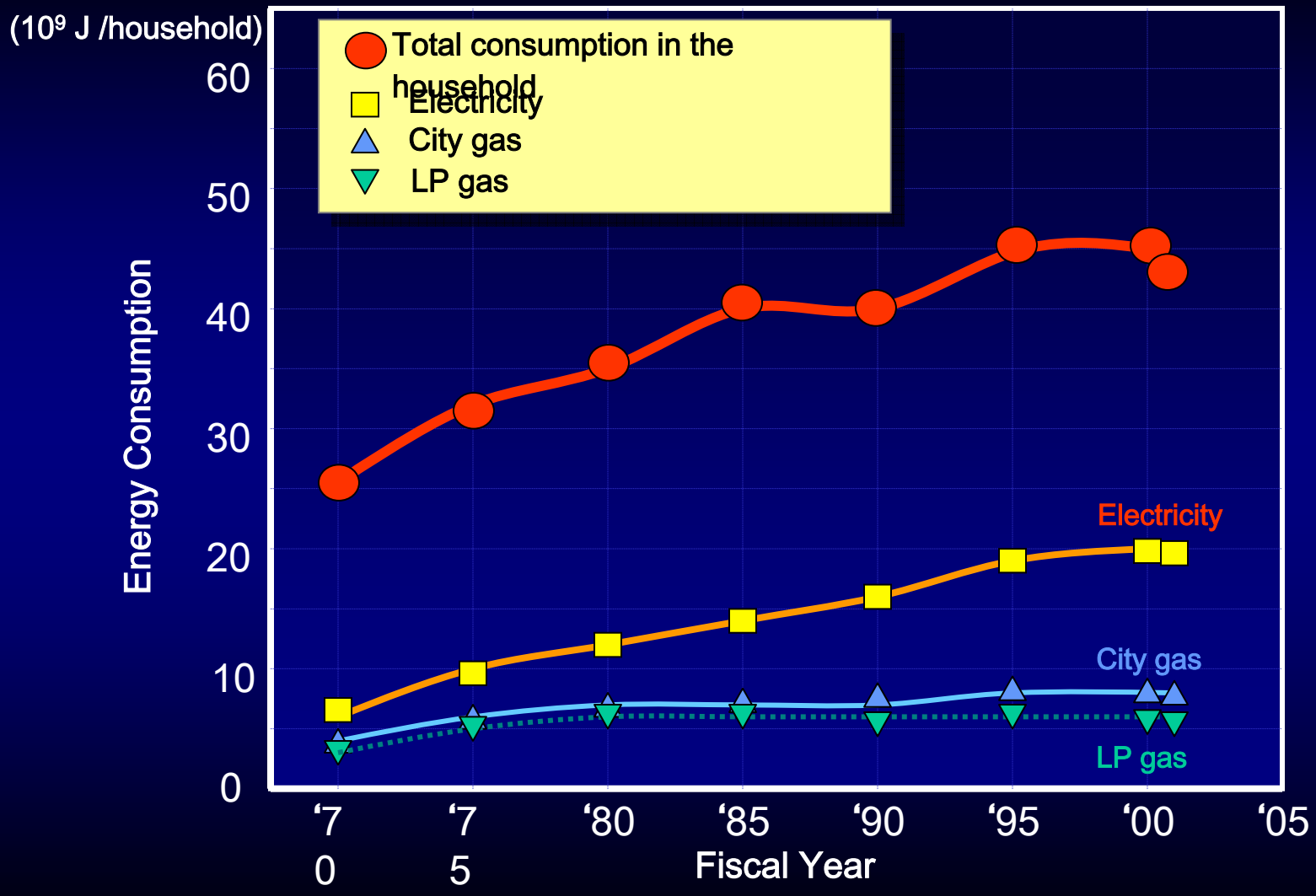
Increasing energy consumption in the household



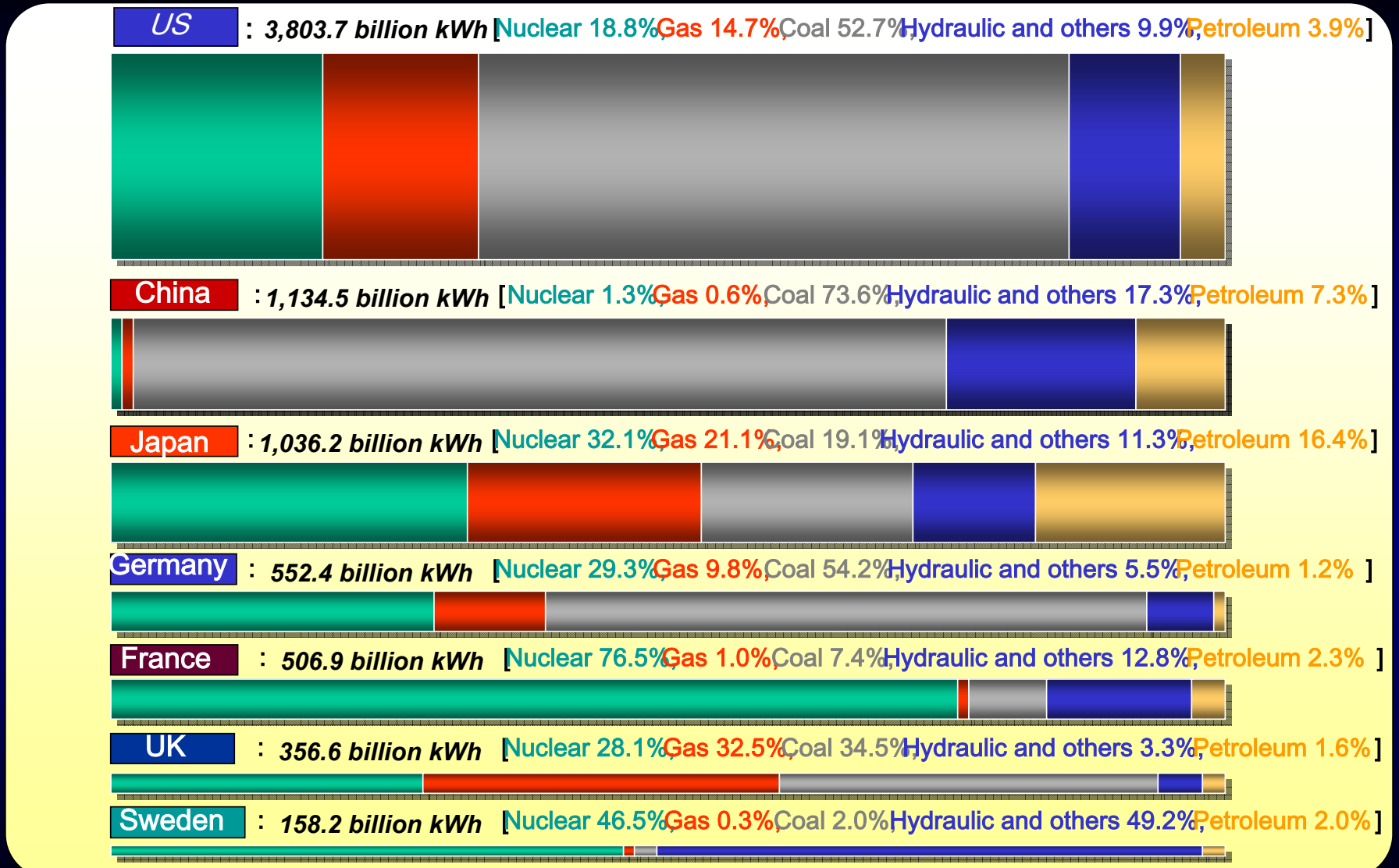
Based on the data from Japan Energy Economy Research Institute
Actual values for up to 1996, estimated values for 1997, and predicted values for 199

Energy Sources Used in the Household

(From the "Total energy statistics" of the Agency of Natural Resources and Energy, etc.)



Comparison of Electricity Output and Energy Source for Electric Power Generation



Problems and Needs Regarding the Environment and Energy

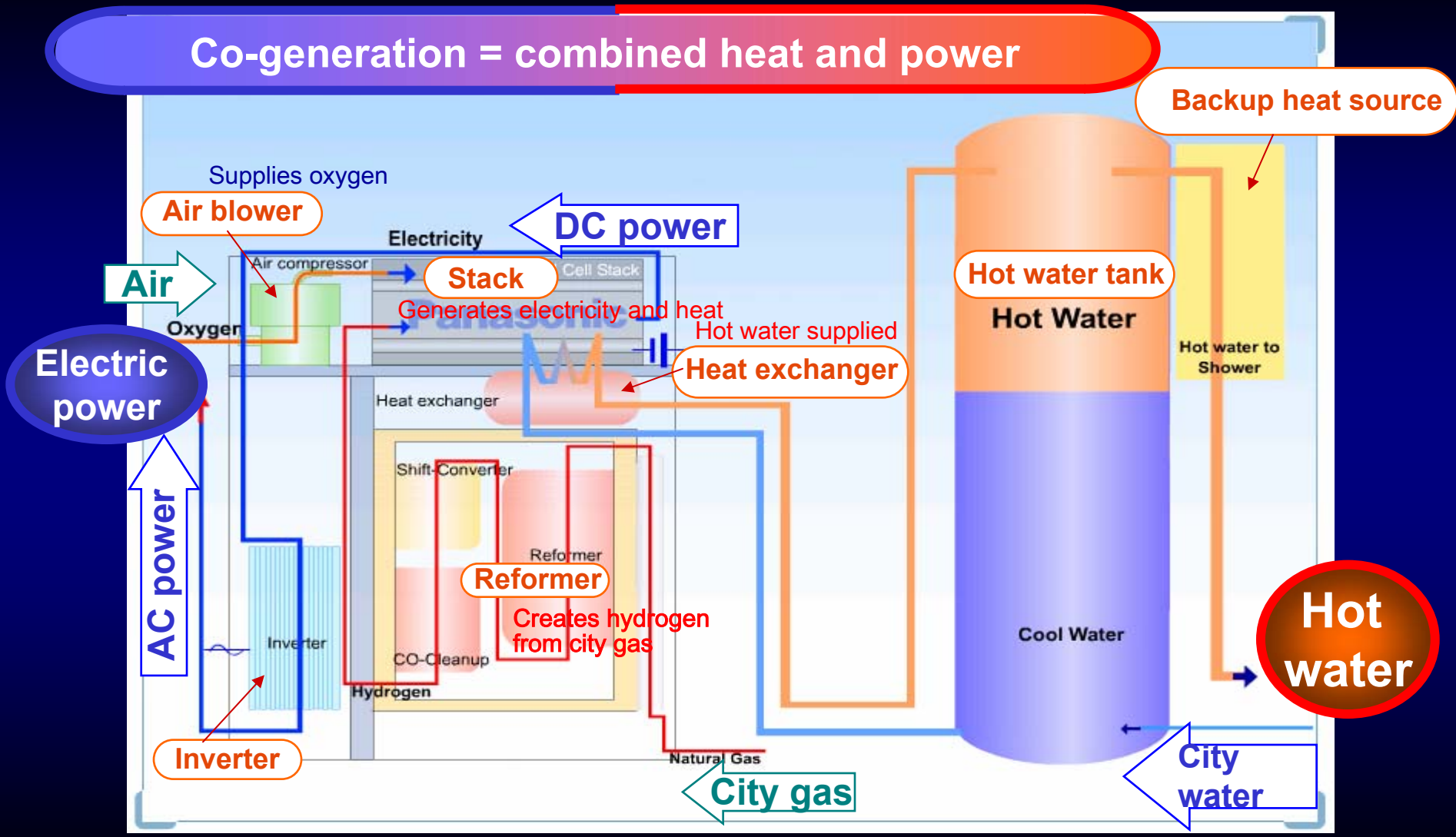
■ Contribution to the prevention of global warming (reducing CO_2 emission)

- Proactive use of clean energy (new energies) corresponding to increasing energy demand in the household

■ Offering energy sources as an alternative for petroleum, and making efficient use of such energy

- Corresponding to increasing demand for electric power and highly-efficient use of energy

The Home-use Fuel Cell Co-generation System



The Composition of Solid Polymeric Fuel Cells and How it Works

Chemical reaction of hydrogen with oxygen generates electricity and heat.

Chemical reaction

Fuel electrode: hydrogen → hydrogen ion + electron

Air electrode: oxygen + hydrogen ion + electron → water

Total: hydrogen + oxygen → water

MEA

Membrane Electrode Assemblies

Air

Air

Current

Hydrogen

Hydrogen

Separator

MEA

e

Platinum-based catalytic agent

Carbon particles

Air

Hydrogen

H^+

Water

Electricity

Heat

(-) fuel electrode

Polymeric membrane

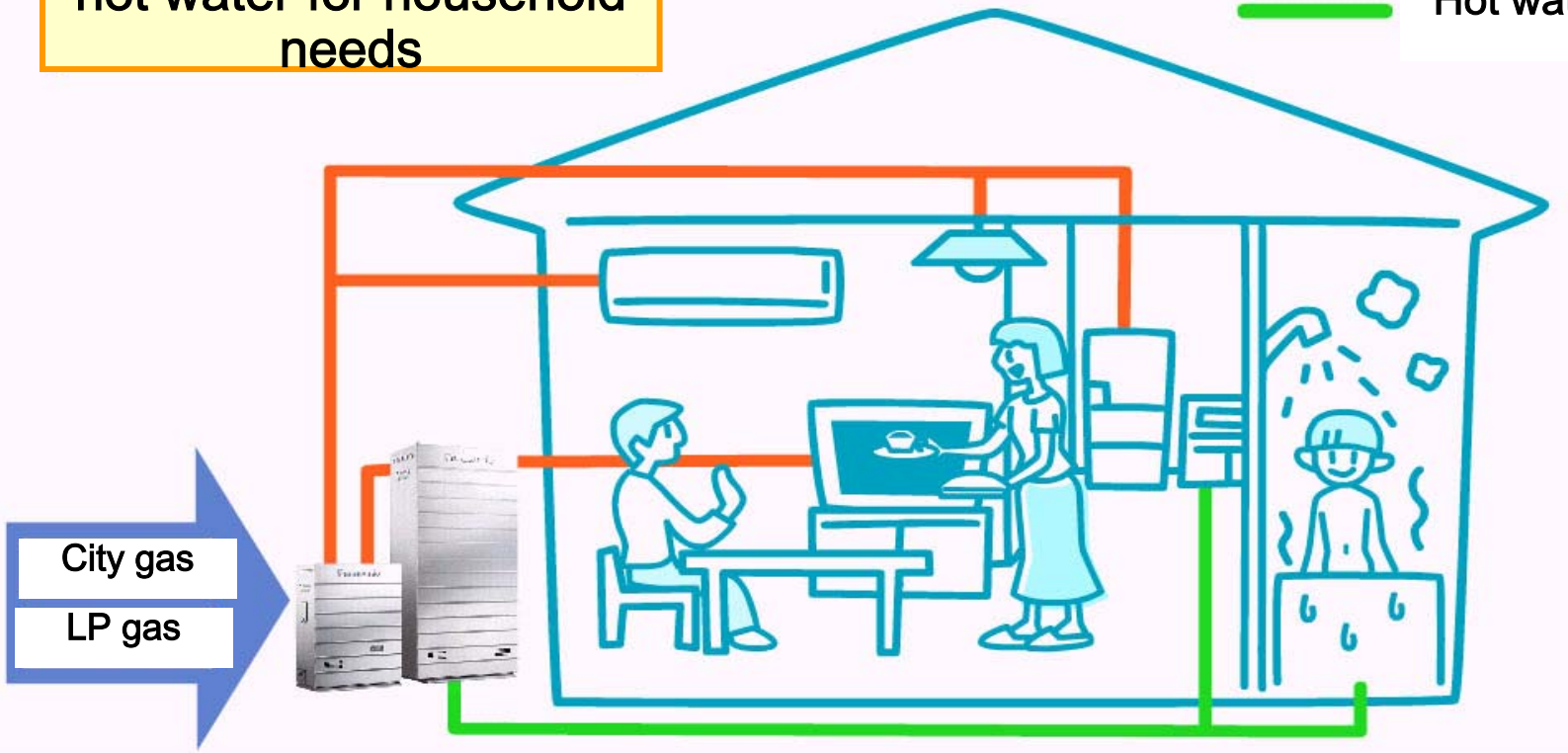
(+) Air electrode

The Fuel Cell Co-generation System

Create Energy

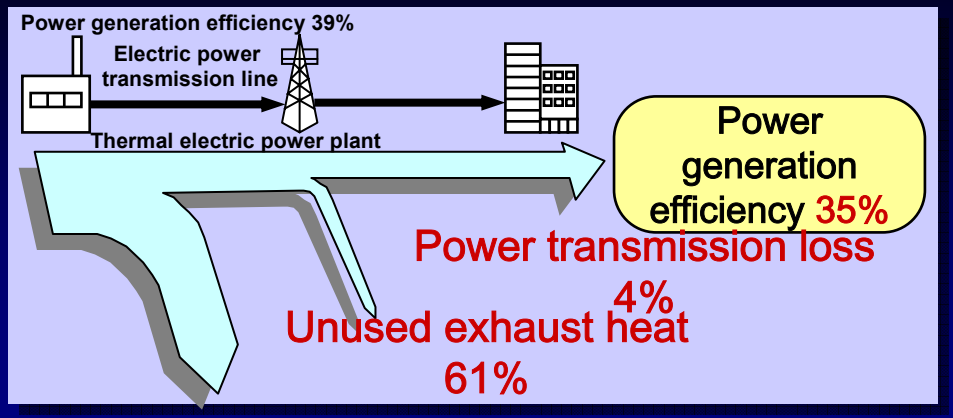
Home-use fuel cell co-generation system creates energy

Produces electricity and hot water for household needs

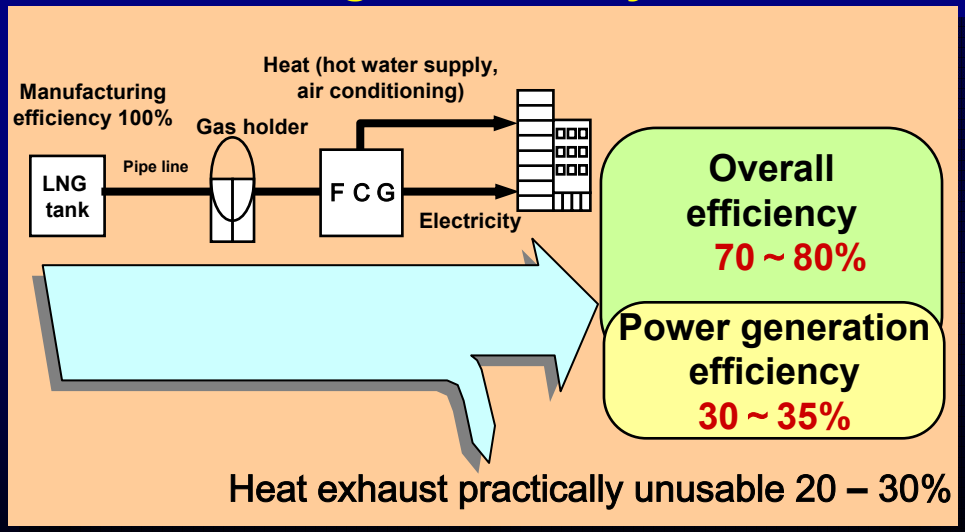


Advantages of the Co-generation System

- **Conventional power generation system**



- **Fuel cell co-generation system**



Results of simulation

(vs. thermal power generation)

Energy conservation	Reduced by 15 – 30%
CO_2 emission	Reduced by 30 – 40%
NOx emission	Reduced by 60 – 90%

From the 21st Century Energy Vision of MITI

Toward the Realization of Our Corporate Vision

Matsushita's Target Vision

Realization of a ubiquitous networking society

Coexistence with the global environment

A fuel cell is "a symbol of an environment-oriented company"

Coexistence with the Global Environment

■Harmonious coexistence with the global environment, connecting energy-saving, water-saving and HFC-free appliances, with our "entire life"

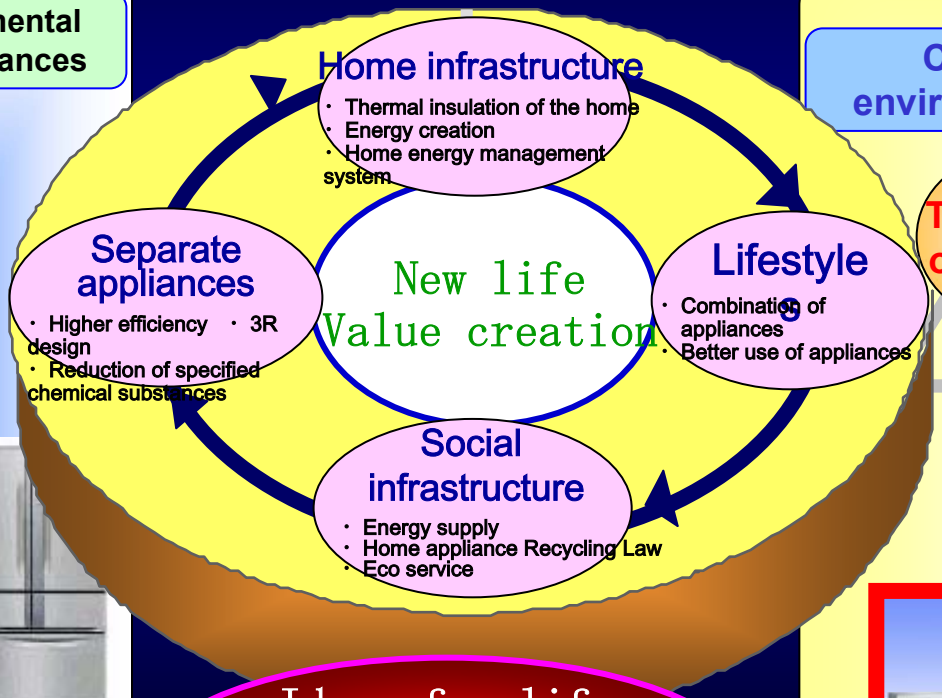
Efforts in the past

Reducing environmental burdens of all appliances

Energy-saving

Water-saving

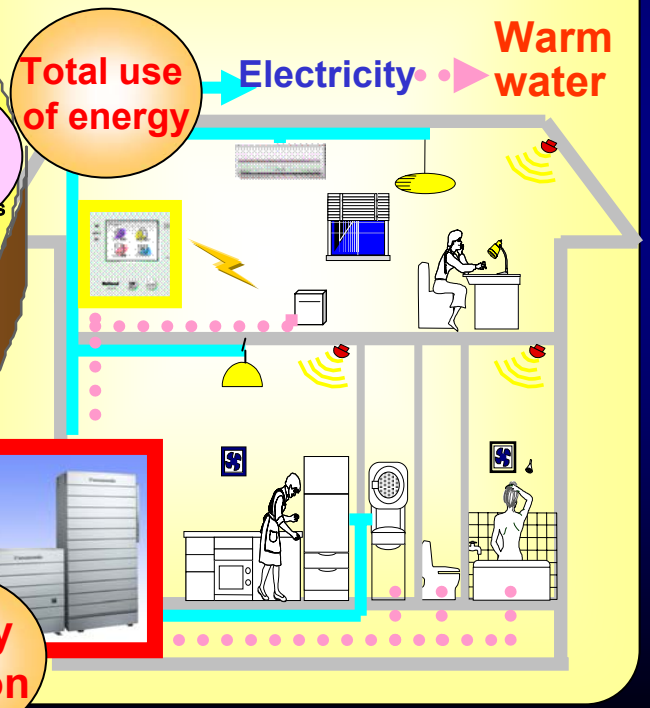
HFC-free



Ideas for life achieved by FC co-generation

Target image

Coexistence with the global environment involving the entire life



Efforts in Realizing Home-use Fuel Cells

Schedule

Basic technology advancements

- *1999 World's first operation of cogeneration*
- *2000 A hot water supply efficiency of 40% achieved*
- *2002 A power generation efficiency of 32% achieved*

Establishment of basic performances

05/4

Monitoring businesses

- *2005~ City gas companies introduced into market*

phase change

Fuel Cells Commercialization Project

Becoming a full-scale operation

- *2008~ Matsushita HA to operate fully-fledged business*

Promotion System

President Nakamura Project

FC Technology
Living Environment Development Center

Manufacturing
Matsushita Home Appliances Company

Development
Matsushita Electric Works

Process Corporate Manufacturing Innovation Division

Development of Matsushita's Fuel Cells






196 1 ..... 1999 2000 2001 2002 2003 2004

History of fuel cells

- 4th International Trade Fair
- Sample product Power source for marine buoys
- FC laboratory established
- FC business development office established
- Fuel cell task force established
- Exhibition at the World Gas Meeting
- Tokyo Gas chose fuel cell suppliers
- Commercialization project established
- Tokyo Gas new products exhibition
- Prime Minister Koizumi visited our P center
- Collaboration with Matsushita Electric Works established
- Installed in Prime Minister's official residence
- Delivered to Tokyo Gas and placed on sale

2003/6
World Gas Meeting

2004/2
Tokyo Gas new products exhibition

2004/5 Prime Minister Koizumi visited our Panasonic center

2005/2 The first fuel cells installed in the Prime Minister's new official residence

Our First Fuel Cell Co-generation System was Installed in the Prime Minister's New Official Residence

May 10, 2004 Prime Minister Junichiro Koizumi visited our Panasonic center

"Fuel cells are the key to opening the door to a new era"
(from Prime Minister Junichiro Koizumi's policy speech of February 2002)

Prime Minister's new official residence

Installation ceremony at the Prime Minister's new official residence, April 8, 2005

Matsushita's Fuel Cell Co-generation System

Specifications

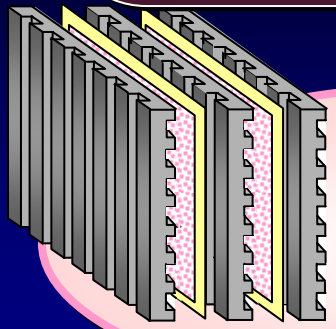
Items	Specification and/or description
Electric output	1 kW (power at transmission end)
Operation mode	DSS - continuous
Load response control	Available
Type of electrical use	System combination
Type of thermal use	Heat storage in a layered hot water reservoir

Performance

Items	Performance
Power generation efficiency	33% or higher (rating)
Hot water supply efficiency	45% or higher (rating)
Hot water supply temperature	60℃ or higher
Operation noise	44 dB or less

Superiority of Matsushita's Products

What is required of a home-use cogeneration system is practical efficiency (economic efficiency) and reliability (stability and durability)



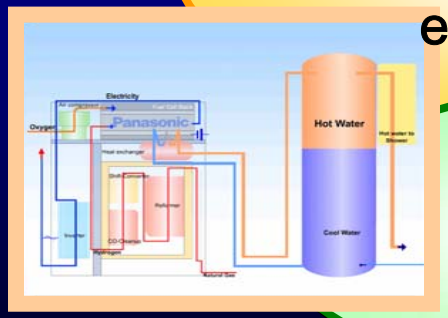
- Feature 1 -
High-stacking stability

Operation life : 13,000 hours (verified)

Deterioration rate :
Continuous operation → nearly zero
Intermittent operation → 7 μV / operation or less

- Feature 2 -
Superior energy efficiency

Energy reduction rate
⇒Max. 25%
Energy saving during summer realized
(when corrected to the primary energy)



- Feature 3 -
High system reliability and stability

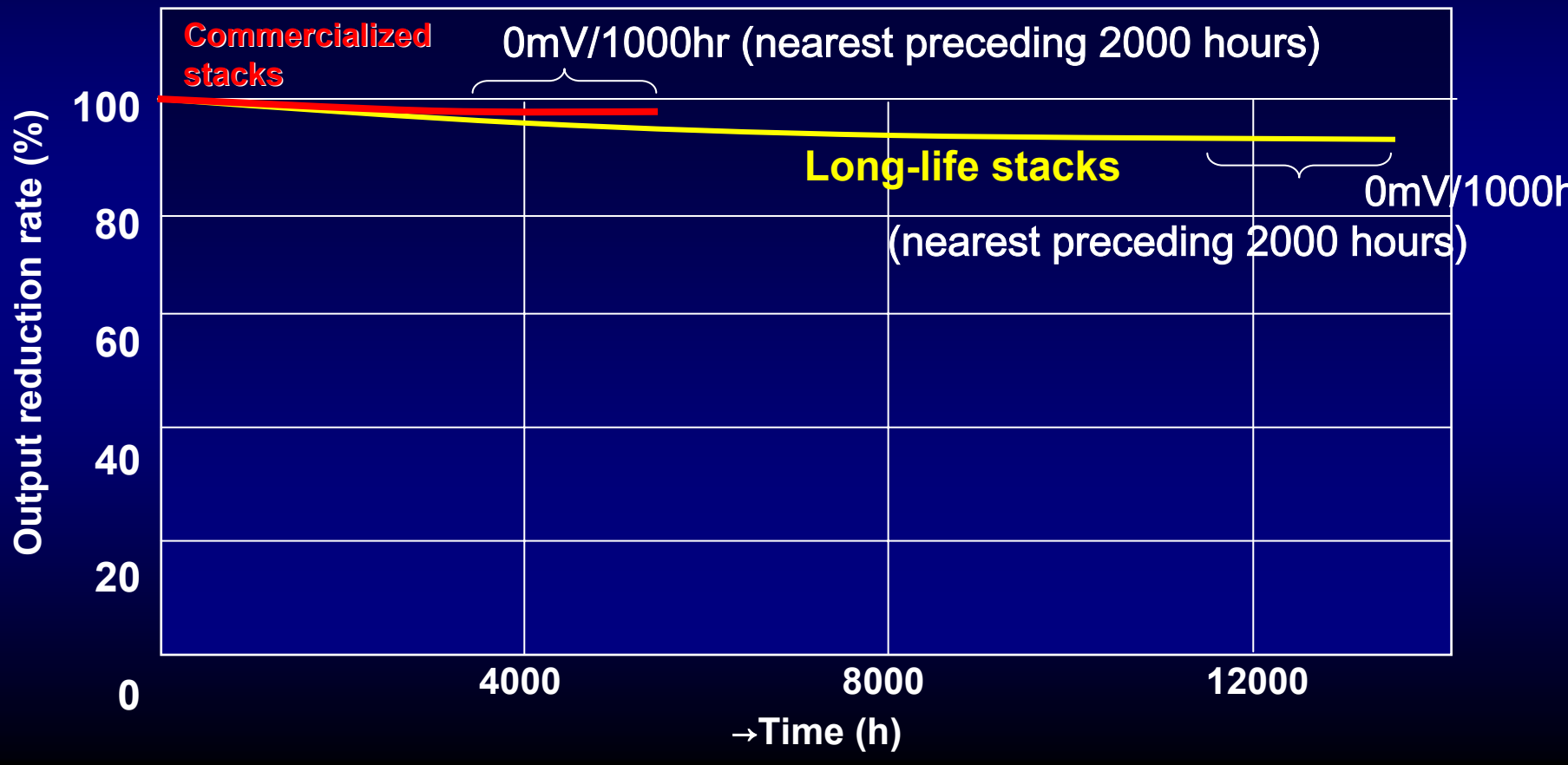
Ambient temperature :
-5℃ to 40℃ guaranteed
Operating duty : 100% to 30% guaranteed
Operation modes :
continuous and DSS modes available

Feature 1: High-Stacking Stability

Output voltage fluctuation is restricted to nearly zero

⇒After the initial fluctuation, an output reduction rate of zero is maintained.

(Both long-life stacks and commercialized stacks are fully-stacked)



Clarification of Degradation Mechanism in Basic Research

Clear up degradation mechanism

▼

Abundant data utilizing evaluation equipment

▼

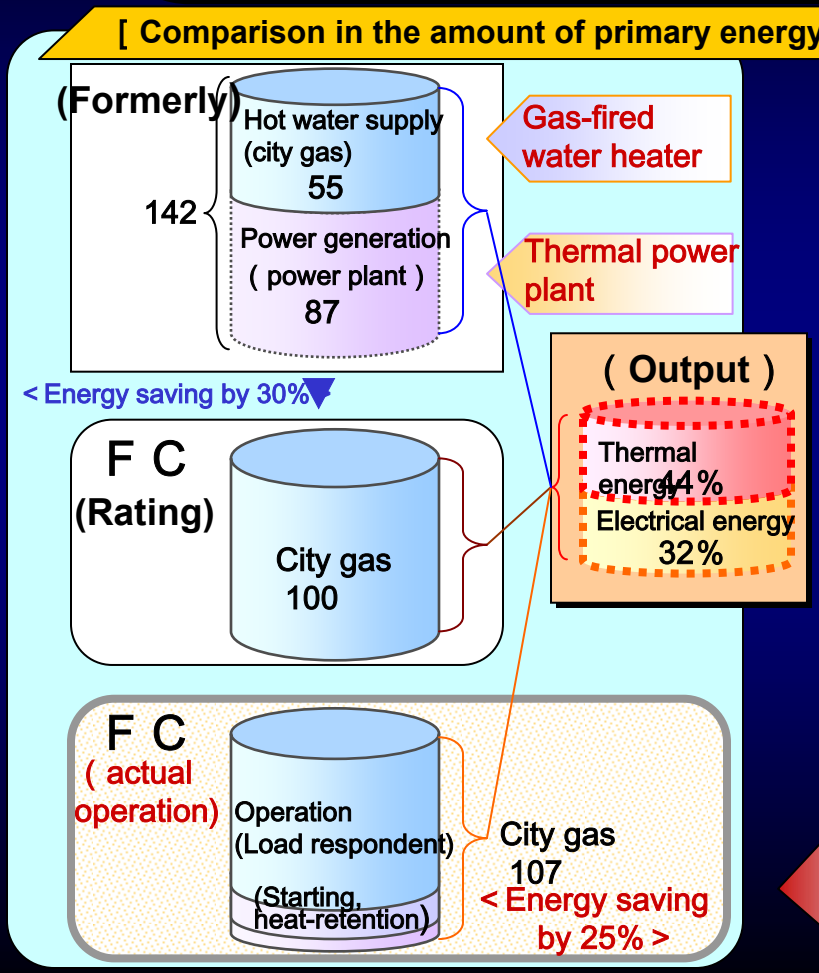
Highly durable stack

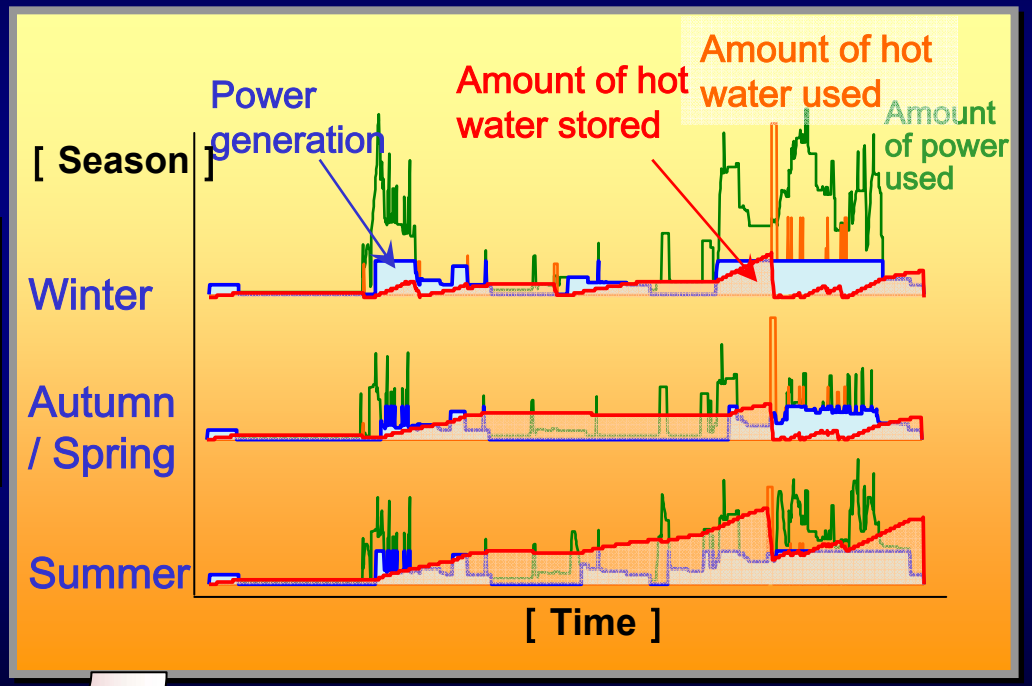
Degradation Mechanism Web

Feature 2: Superior Energy Efficiency

A primary energy reduction rate of 25% (max.) has been achieved in an in-house verification test in the real-life house

[Comparison in the amount of primary energy used]

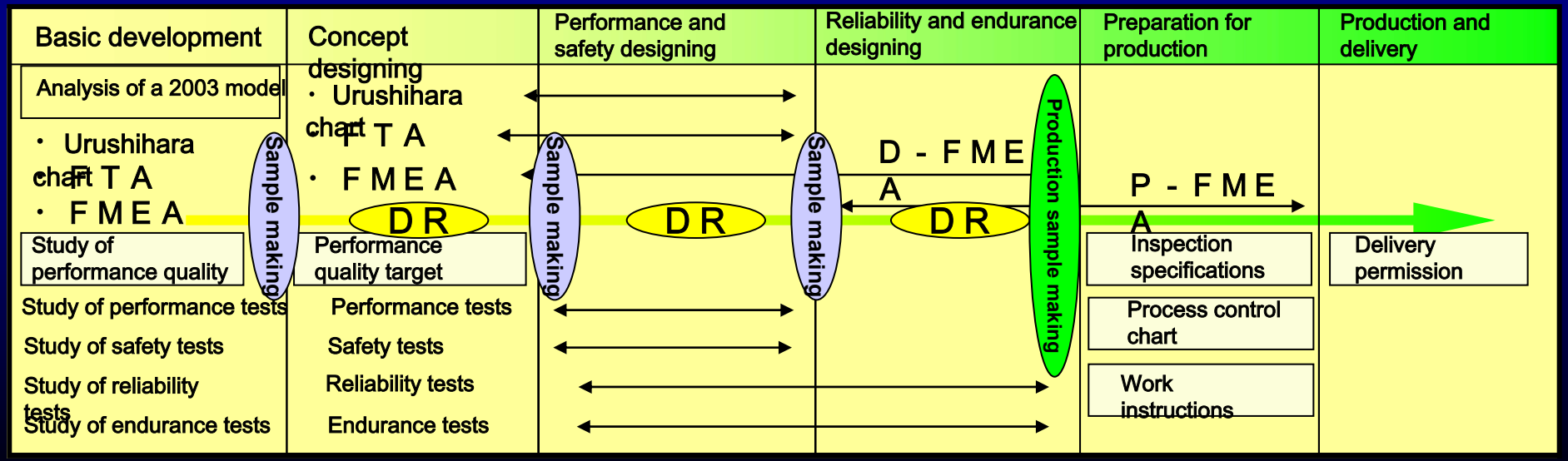




Feature 3: Guaranteed System Reliability and Stability

Design engineering and quality know-how accumulated in extensive mass production of home appliances and systems products

Highly reliable and stable
Co-generation system



Technical Challenges and Future Efforts

Challenges: Realization of "Durability and Low Cost" enabling Full-Scale Usage

Durability

- expanding life span of MEA/stack
- expanding life span of system components

Degradation mechanism project

- Accumulated material and processing technology
- Joint development with material makers

Know-how of mass production maker

Cost reductions

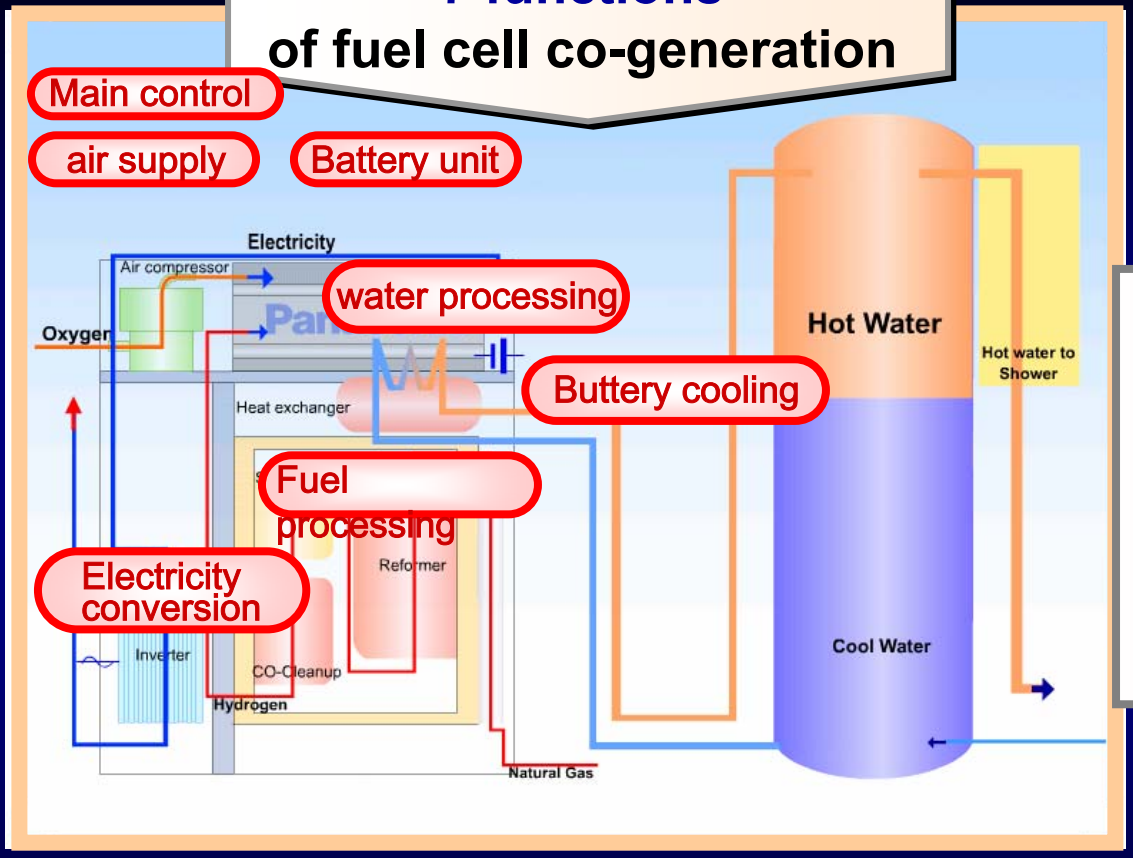
- Cost reductions in system investment
- Cost reductions in stack and fuel processing equipment
- Cost reductions in components

Cost reduction project

- Review the system from scratch
- Reduce catalyst volume
- Use general-purpose low cost parts

Low-cost / High Endurance through Matsushita Technologies

7 functions of fuel cell co-generation



Key components
such as high durability MEA/stack, fuel processing device

Key parts
such as highly efficient small inverter, low power consumption blower

Various parts and piping
for high precision control of pressure, flow volume and temperature

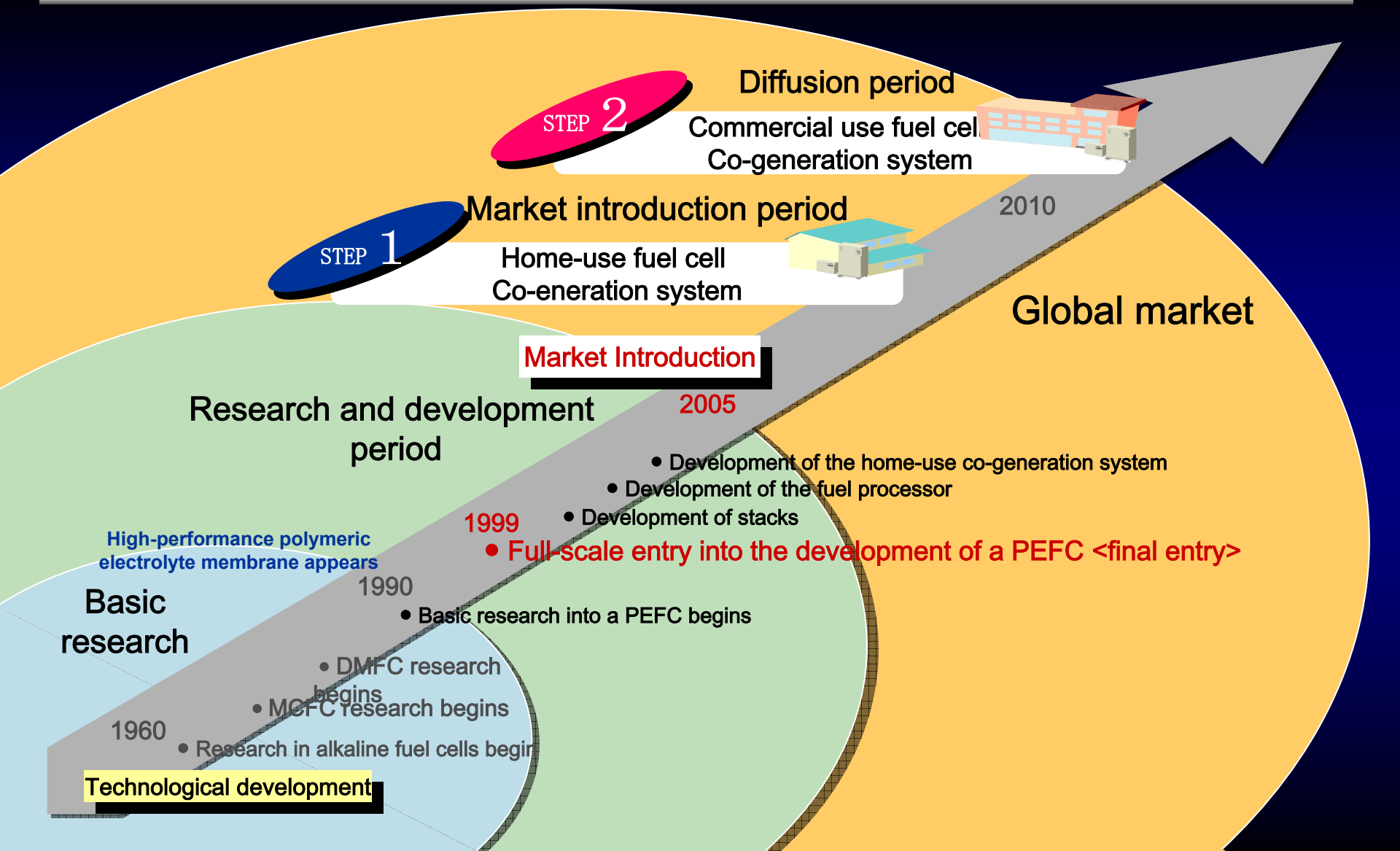
Electric components
controlling the above

Operating software
to learn and predict the habits of use at home

All system components produced in-house → **Total cost reductions across entire system**

Overall technical prowess of a home appliances maker

The Roadmap for Commercialization



Lower Fuel and Light Expenses for Our Customers

- In the case where a four-member family uses 380 liters of hot water (40℃) dail

For 3 years after the contract is concluded
Approx. 60,000 yen / year will be saved.
The 4th year and after
Approx. 30,000 yen / year will be saved.

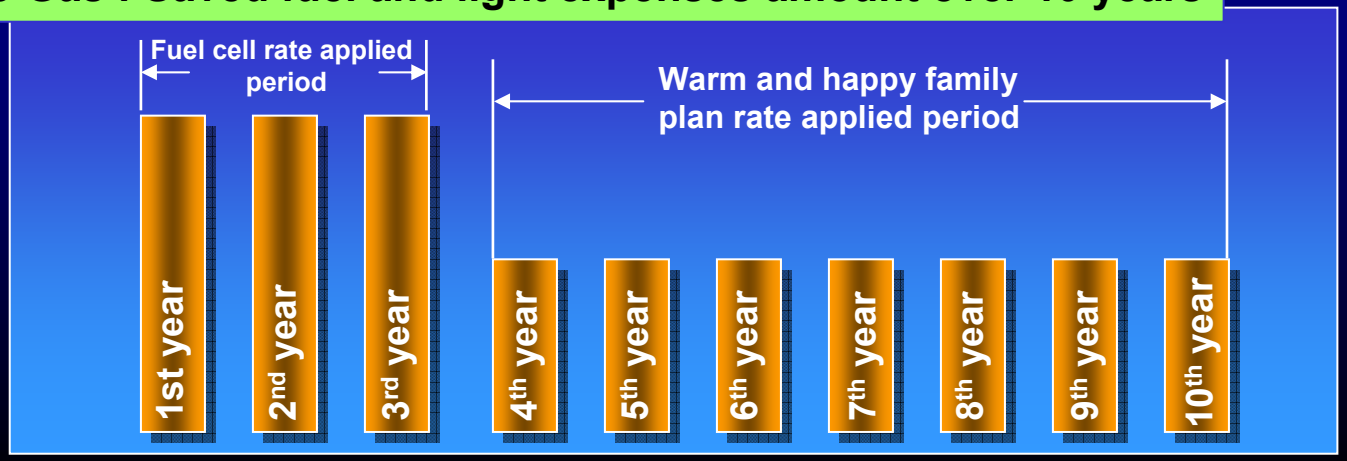
→ Approx. 380,000 yen will be saved in 10 years.

- Additionally, in the case where 200 liters of hot water (40℃) per day and 100 Kwh of electric power per month are used

For 3 years after the contract is concluded
Approx. 110,000 yen / year will be saved.
The 4th year and after
Approx. 45,000 yen / year will be saved.

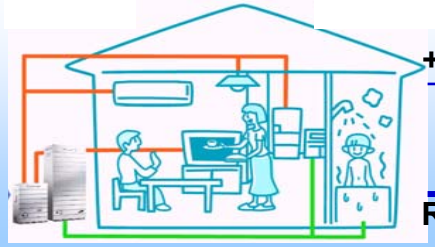
→ Approx. 640,000 yen will be saved in 10 years.

Tokyo Gas : Saved fuel and light expenses amount over 10 years



Reducing CO_2 Emission

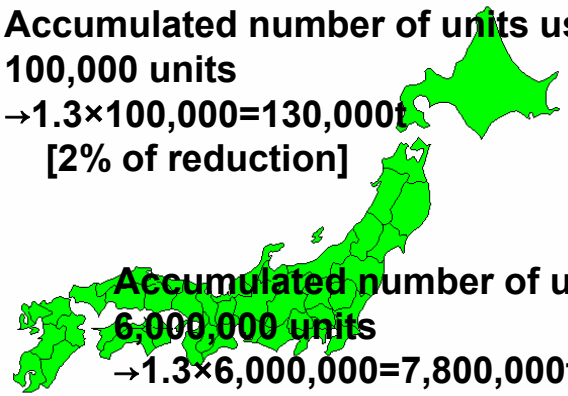
CO_2 emission reduction per household by introducing the fuel cell co-generation system



Hot water supply + power company	5.8 t
Introduction of fuel cells	4.5 t
Reduction amount	1.3 t

CO_2 emission reduction in all the households of Japan

Accumulated number of units used in 2010
100,000 units
→1.3×100,000=130,000t
[2% of reduction]



Accumulated number of units used in 2020
6,000,000 units
→1.3×6,000,000=7,800,000t
[106% of reduction]

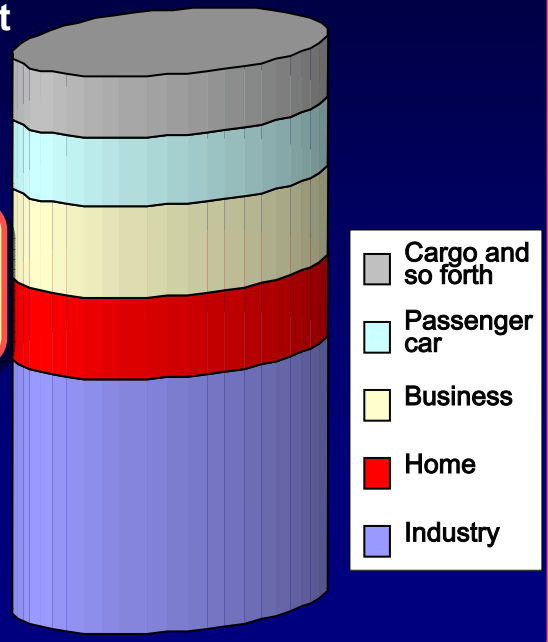
Reduction target fixed by the Kyoto Protocol

Target reduction amount of CO_2 emission 50,000,000 t

Energy consumption forecast in 2010

Energy consumption rate occupied by home appliances 14.7%

Reduction of 7,350,000 t must be made at home



CO_2 Amount reduced by our products

Panasonic

[share : 40%]

1% of target reduction in all the households of Japan in 2010

Approximately 10% of target reduction by our co-generation products in 2015

Toward the Fulfillment of “Ideas for life”

Realization of a ubiquitous network society

Contribution to people’s affluent living and life

Tying “ideas for life” with FC cogeneration

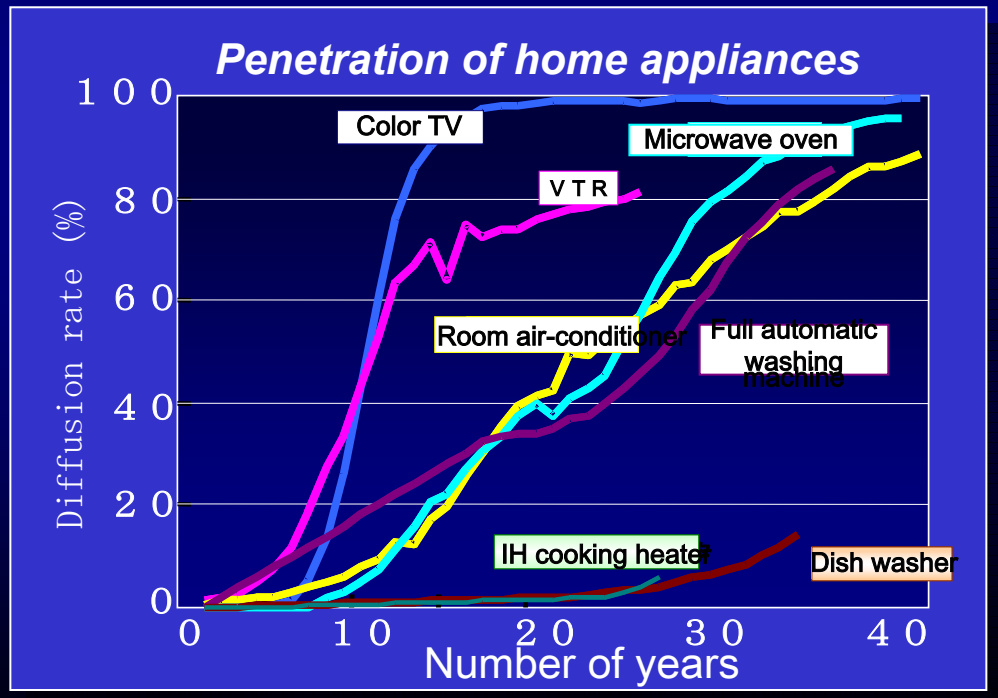
Coexistence with the global environment

Until the rose comes into full bloom

It will take a while before the system becomes popular. Until then…

"We shall proceed with passion and persistence until the rose comes into full bloom, in order to provide extreme satisfaction to our customers."

Matsushita's DNA will bring the rose into full bloom in the fuel cell cogeneration business!!



Thank you very much for your attention