Scenario for the Energy System of Japan in the 21st century

– Focus on Changing Life Style and Electricity Demand in the Residential Sector –

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A scenario is a story that describes a possible future.

It identifies some significant events, the main actors and their motivations, and it conveys how the world functions.

Building and using scenarios can help people explore what the future might look like and the likely challenges of living in it.

(Scenarios: An Explorer's Guide Royal.Dutch.Shell 2003)

Concepts of our scenario

This is an analysis of the Energy demand and supply system of Japan from the long-run (toward 2050) viewpoint.

This Scenario will help us to think about how the global warming policy, technology policy and energy policy should be in the coming decades.

*** The following presentation focuses on the residential sector, selectively.**

Concepts of our scenario
- scenario drivers -

(in this presentation, we will focus on the first three topics.)

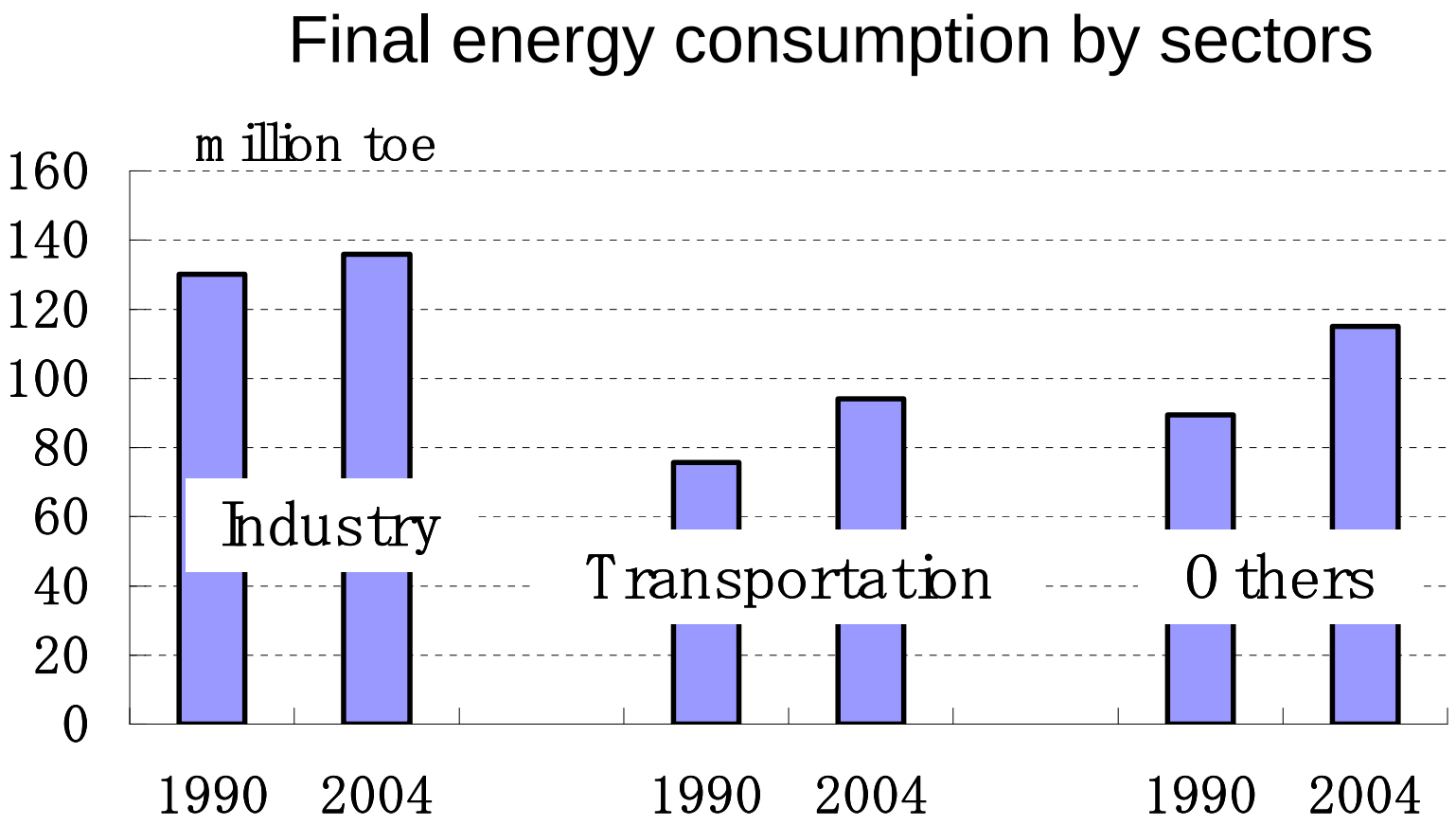
① **Demographic change toward aging society**

② **Generation change and aspiration for a better life**

③ **Technological progress of electric appliances which leads new life styles**

④ Economic growth and income increase
⑤ Not only safety but also feeling of security
⑥ Attitude on environmental conservation

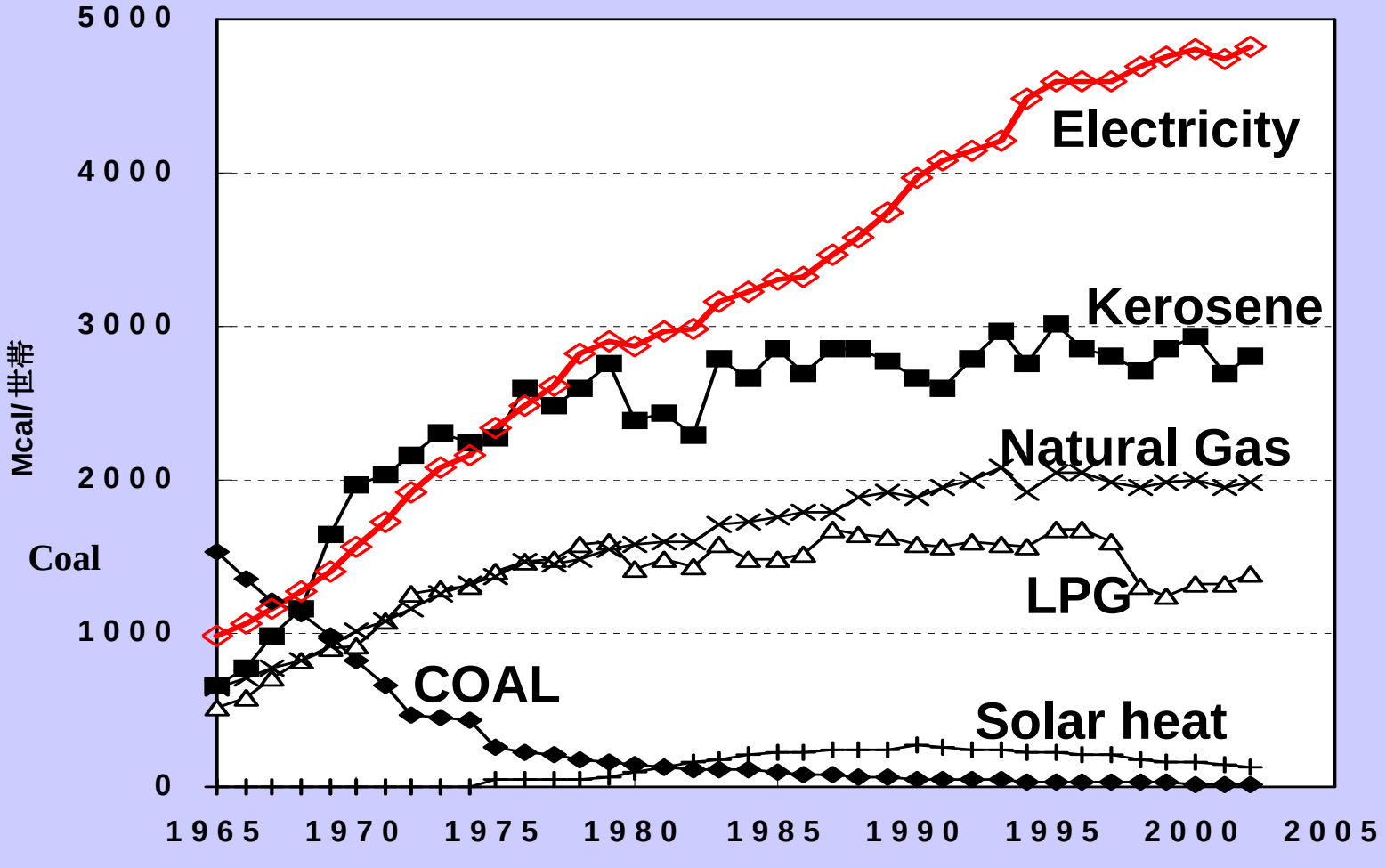
Energy use is increasing in transportation and business & residential sectors in Japan



Source: IEA energy balance table, 2006

Historical Trends of Energy Demand per household -after Tokyo Olympic (1964)-

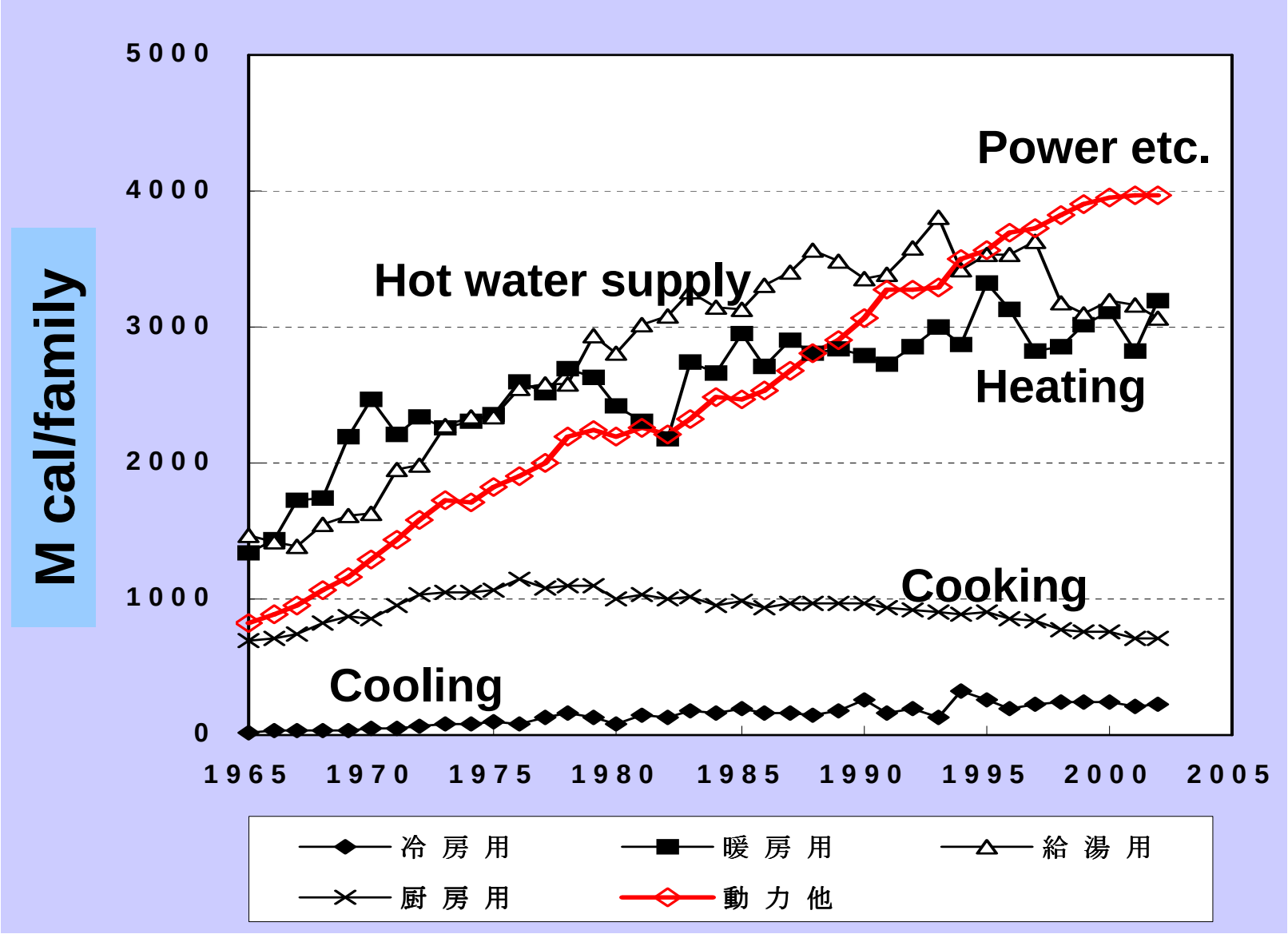
million cal/family



By energy source

Source: IEEJ（2004）

Historical Trends of Energy Demand per household -after Tokyo Olympic (1964)-



By application

Source: IEEJ（2004）

Examples of “power etc. (IEEJ definition)”

電気冷蔵庫

電気洗濯機

照明

ホームエレベーター

家庭用サウナ

電気乾燥機

ジャーポット

温水洗浄便座

食器洗浄機

テレビジョン

ファックス

マッサージ機

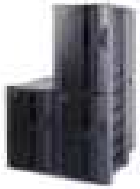
掃除機

アイロン

ビデオ

ドライヤー

防犯カメラ



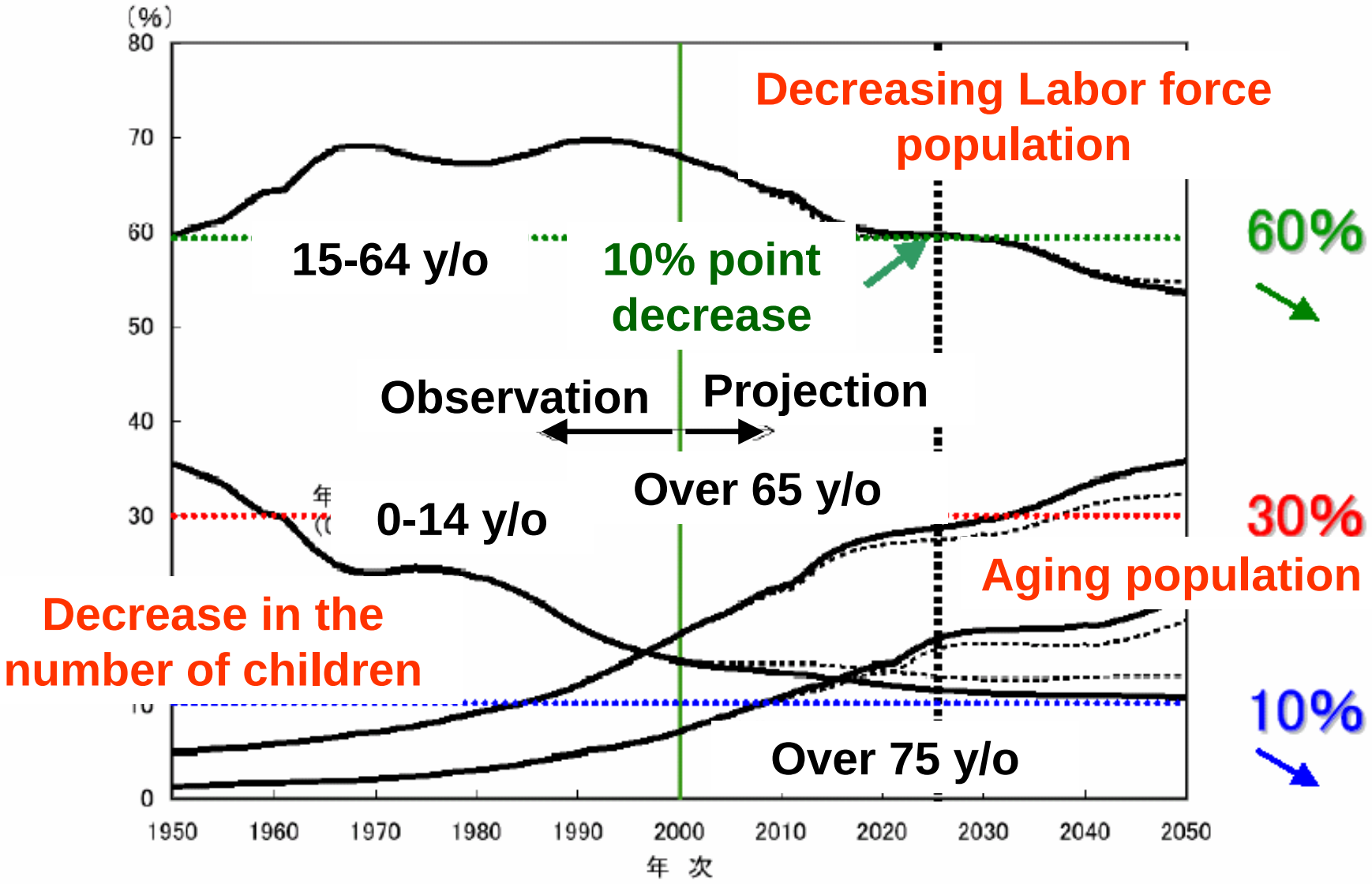
サーバー

パソコン

ルーター

Scenario Drivers:

Demographic Change toward Aging Society



Source: Middle Estimate, National Institute of population and social security research(2002)

Scenario Drivers: Generation Change (Cohort)

Life style change and promotion of all-electric housing

Difference of elderly people's life style between now and the year 2030

	Current 65 y/o（born in 1940）	Current 40 y/o (born in 1965)
Air tightness	low (open-type houses)	high
cooling	rarely used	constantly used
heating	used for only parts of the house (stove, "kotatsu") It's freezing in bathroom!!	used for the whole house (central heating for 24/7)
Cloth drying	dried in the sun	with cloth drier
Dish Washing	wash by hand	use dish washing machine
Communication/ amusement	stand chatting, neighborhood association, Japanese Chess	internet, e-mail, television game
transportation	walk, public transportation, automobile, bed-bound	mobile robot
Open Flame usage	use	not used in the house for safety. dislike heating oil because of its smell

Scenario Drivers: Technological progress of electric appliances which leads new life styles

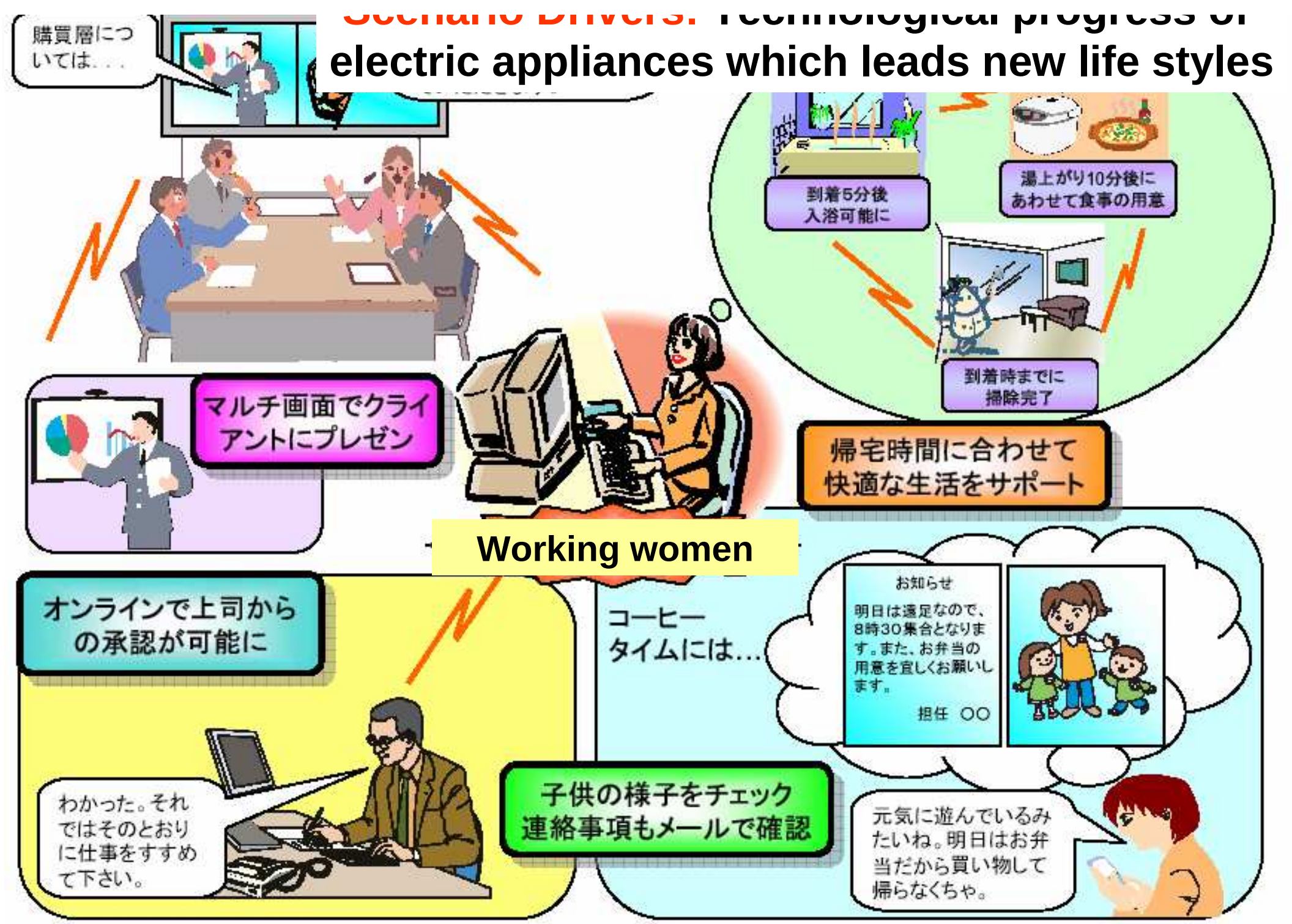


Image of Future Life Style from the Concept of Ubiquitous-Japan, Source: round-table conference for Ubiquitous-Japan（2004）

What kinds of appliances emerge in the future?

1) The grow in size of electric appliances: ex. Television

2) Robot : mobile suit, for senior to youth, for household use to rode communication

Picture: Panasonic Center in Tokyo

two-way communication equipment using full page of wall surface

ロボットスーツ

鳥脚型ロボット

Note. Far left shows robot suit for assisting the elders or handy capped persons. It can detect the myoelectric activity and rotate motors based on the detected data.(Tsukuba University), bird type robot is for human mobility(TOYOTA, 2005 Expo held in Japan)

掃除ロボット

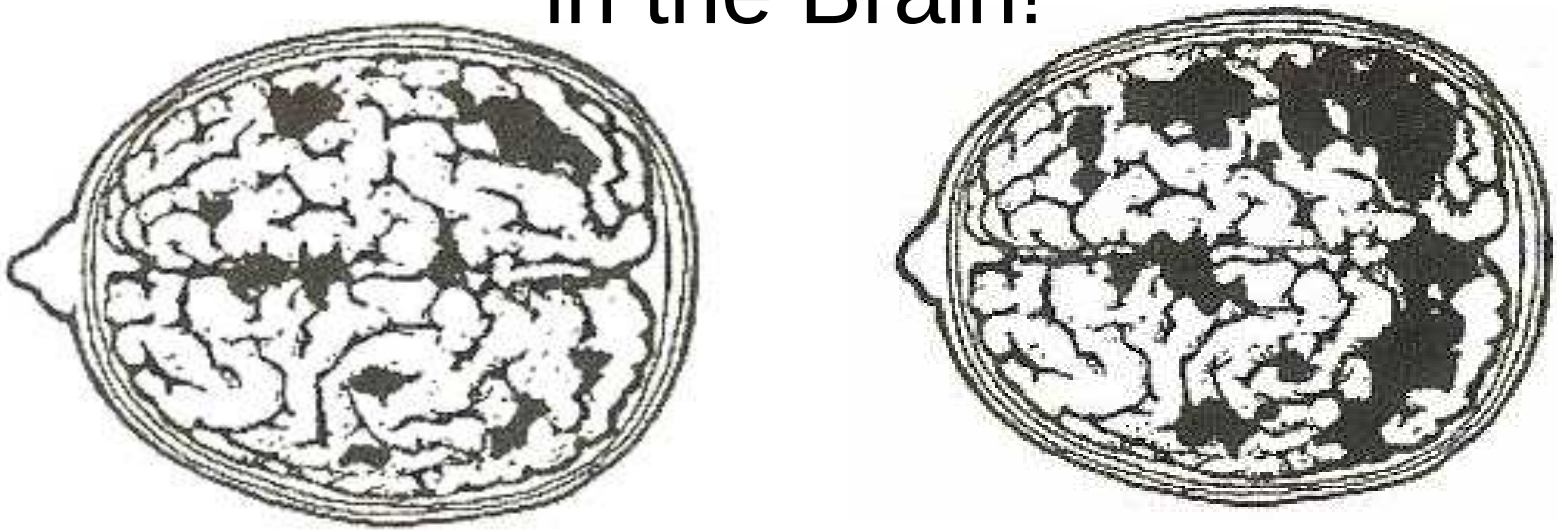
食事支援ロボット

人間型ロボット

アミューズメントロボット

リハビリ支援ロボット

What is the fundamental driver of energy demand in the Brain!



Male Female

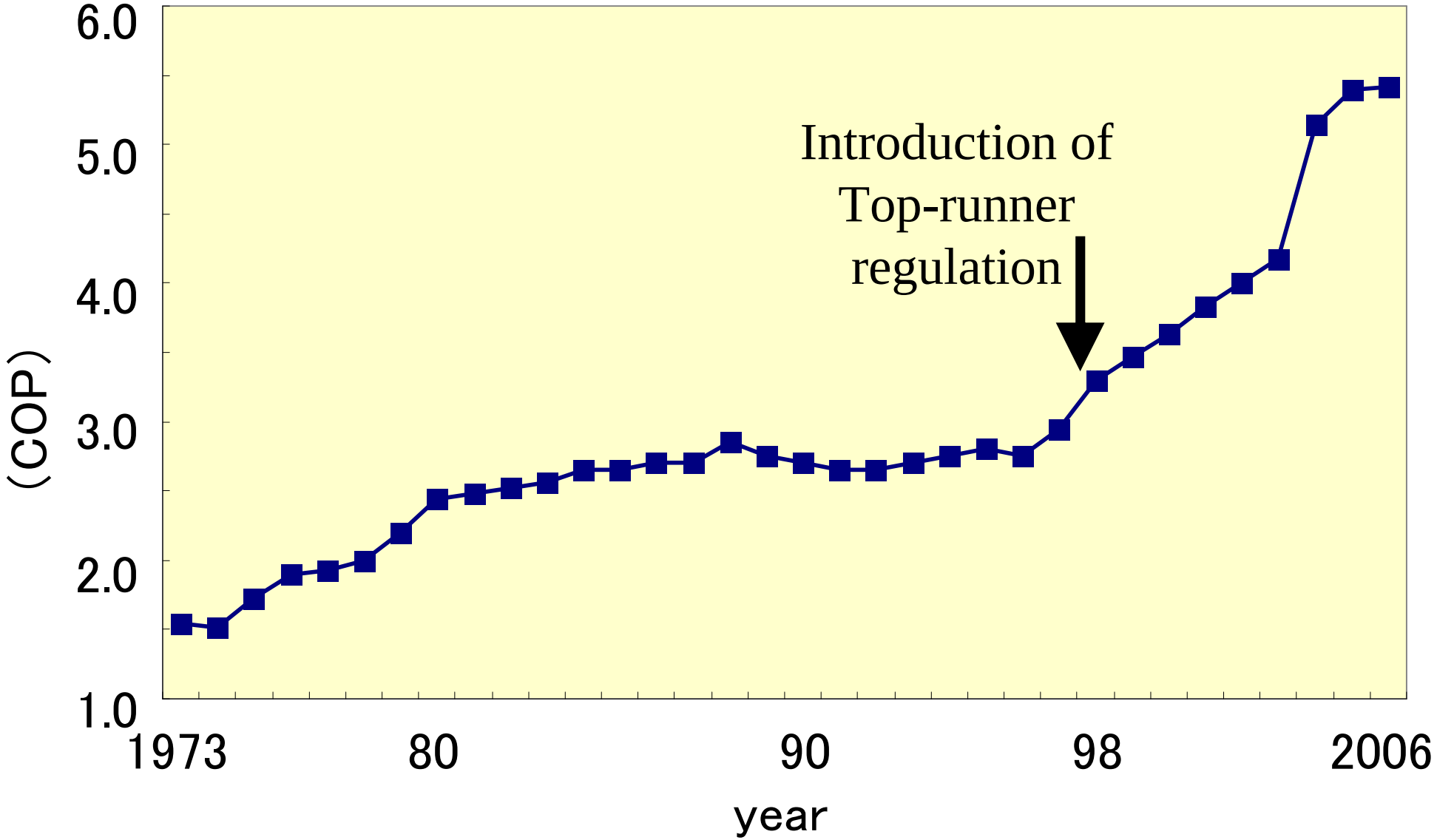
”Brain Wiring Patterns” scanned by MRI (Magnetic Resonance Imaging) , Source Institute of Psychiatry (1999), in Pease and Pease（2001）

The dark area (above chart) is specific for speech and language. That area of female (right) is larger than male (left). This can tell that female is superior to male in linguistic competence, and they have a love for chat. On the other hand, male find a delight in driving a car.

In a similar way, aspiration for a better life is essential for human being. This is another important driver of energy demand.

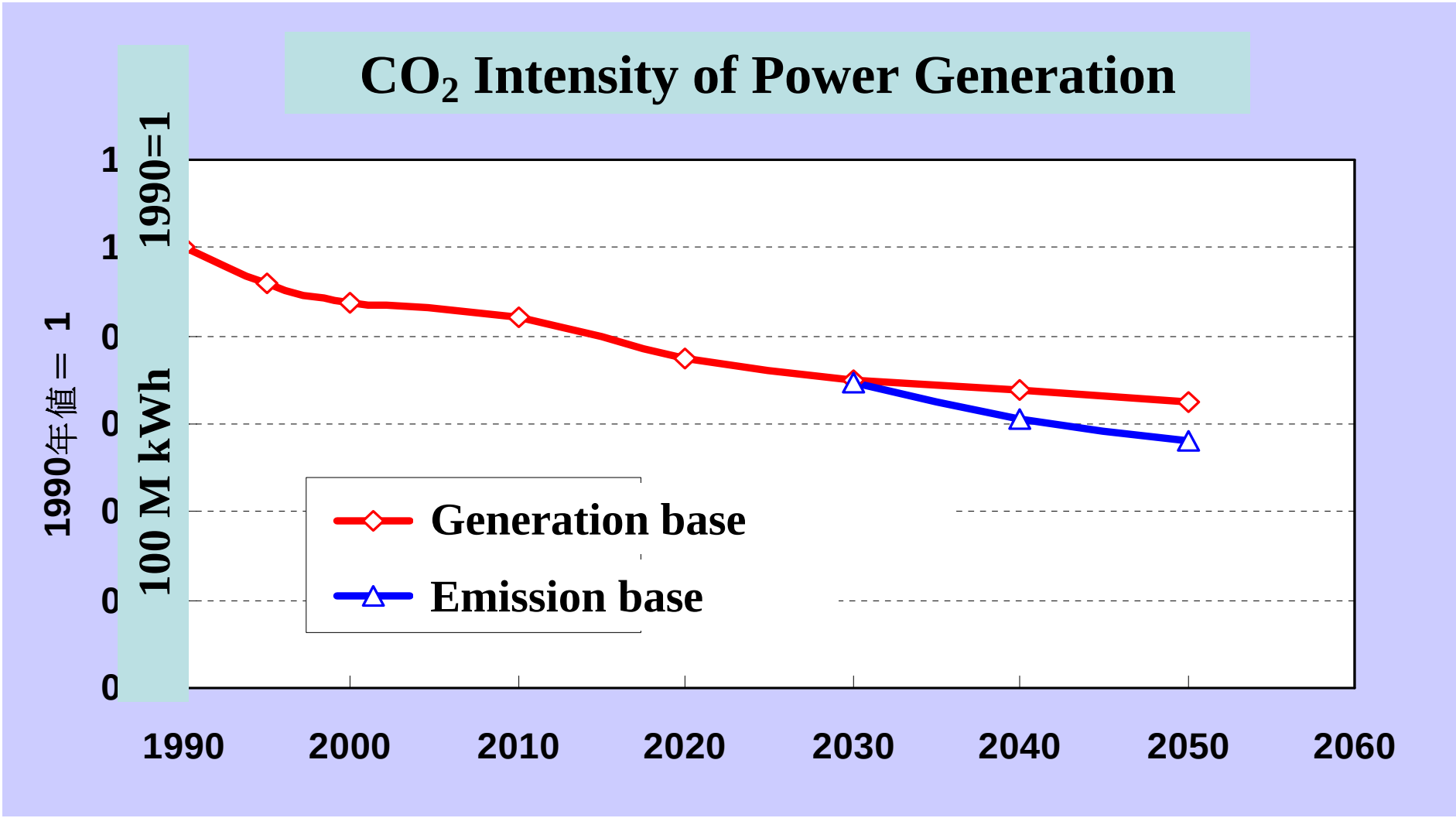
Potential of Efficiency Improvement of Electric Appliances : very large

Example: Efficiency Improvement of room air-conditioner



(2.8kW Class, Source: Home Electric Appliances Association(1995)、Nakagami(2005), etc.

CO_2 Intensity of Power Generation



Conclusions-1

-Changing Life Style and Electricity Demand in Residential Sector-

1) In the residential sector, aging population, generation change and IT (information technology) will be the major drivers for future increase of electricity demand.

* for example, electricity will fulfill the demand of the mobility for in-house and neighborhood. That mobility can be realized by robots!

2) Aspiration for a better life is essential for human being. This is another important driver of energy demand.

Conclusions-2

-Changing Life Style and Electricity Demand in Residential Sector-

In order to overcome the global warming problem,

4) “technology development and diffusion of energy efficient appliances”
3) “electrification with de-carbonizing electricity”
for ex. In order to decrease CO_2 intensity of power generation,
(1) inter-fuel substitution (fuel switch to natural gas)
(2) efficiency improvement
(3) nuclear power
(4) renewable energy
(5) clean coal technologies (IGCC,CCS, etc.)
5) “technology transfer to developing countries “

are very important.

Appendix-1: Calculating the Energy consumption of residential sector (Aggregation of factor technology)

Energy Consumption =
[number of household] × [service volume per household] × [technology diffusion ratio] ÷ [technology efficiency]

Assumptions

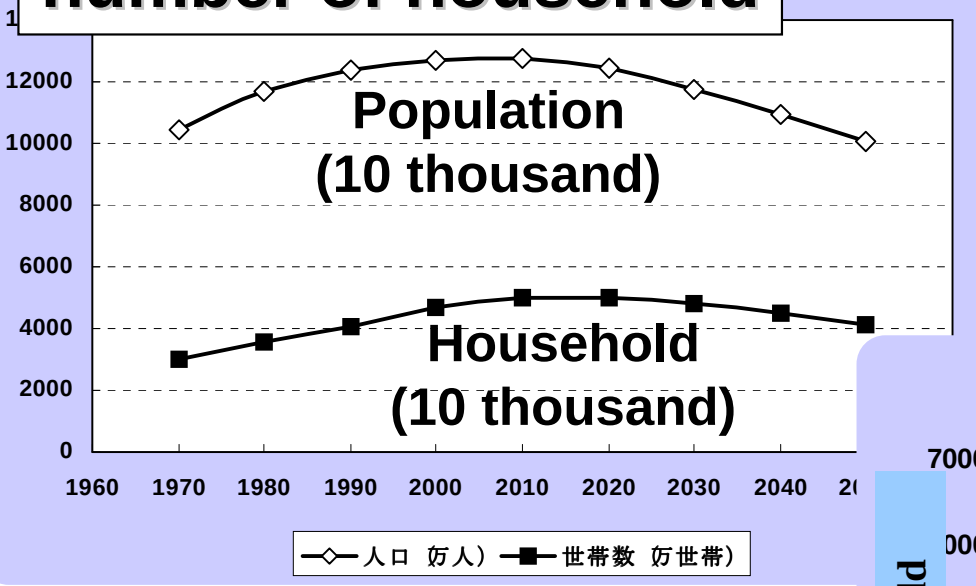
- Efficiency improvement of heating
  (50% up in Air conditioner in 2030)
- Diffusion ratio of electric heat pump type hot water supply will be 33% in 2030

* IH cooking heater will become popular in 2030
(diffusion ratio: 60% in 2030)

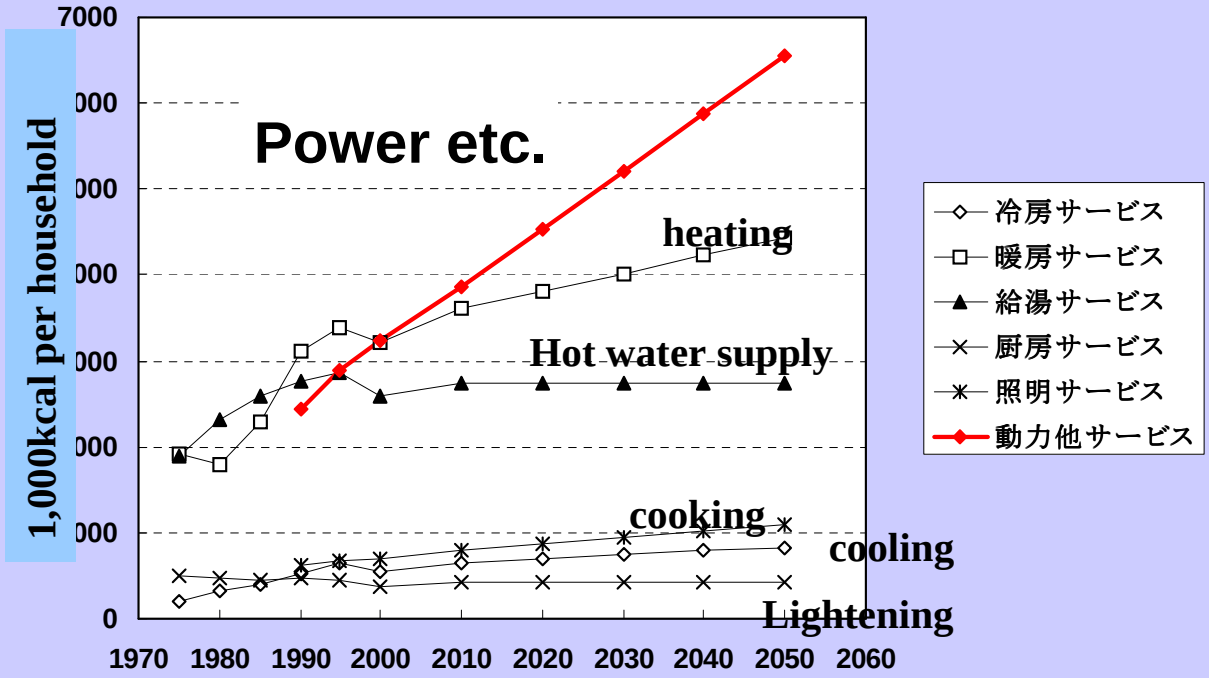
* Diffusion ratio of LED light will be 50% in 2030

Appendix-2: Calculating the Energy consumption of residential sector (some assumptions)

Assumption: number of household

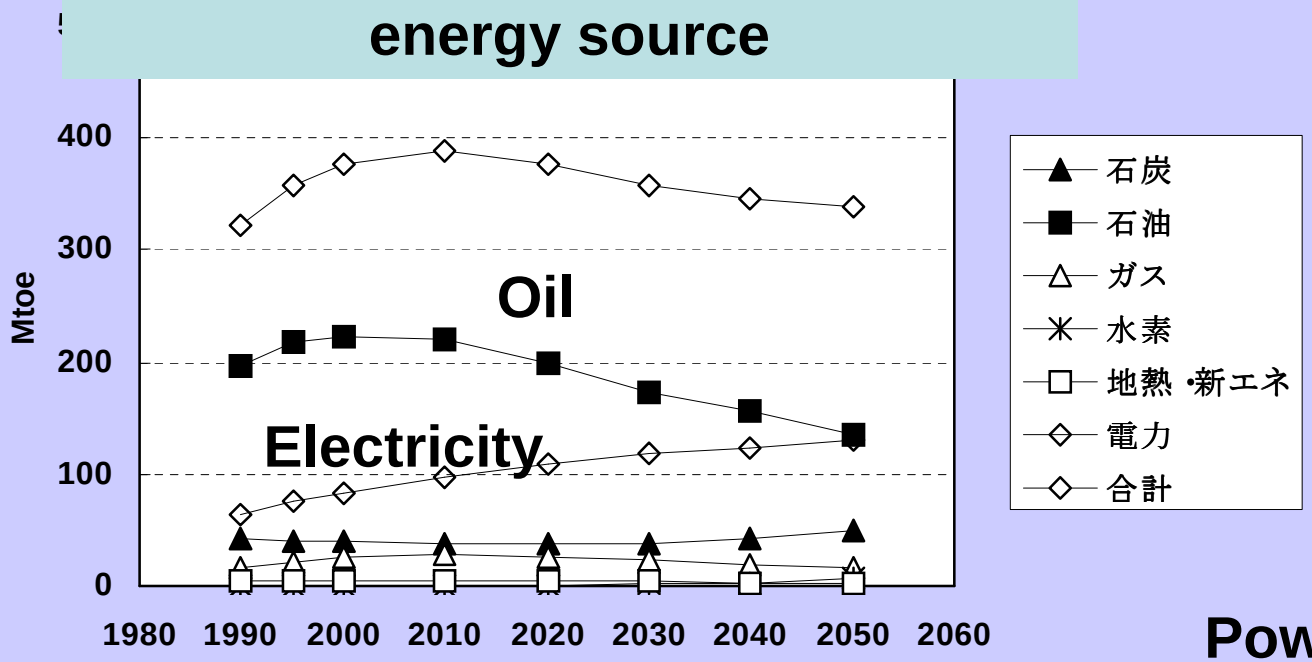


Assumption : Service Volume per household



Appendix-2: Calculating the Energy consumption of residential sector (Electricity Demand)

Total Final Consumption by energy source



Electricity Demand of residential sector