

Initiatives of the City Gas Industry to Combat Global Warming

The Japan Gas Association
May 14, 2008

Japan's Initiatives in Combating Global Warming

Japan's goals under the Kyoto Protocol:

Reduce greenhouse gas emissions by 6% compared to 1990

→ Government has formulated the Kyoto Protocol Target Achievement Plan

Major initiatives under the Kyoto Protocol Target Achievement Plan

1. Keidanren Voluntary Action Plan

Major industries are participating and have set CO2 emission reduction goals for each industry

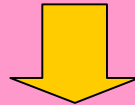
→ Strict follow-ups by the government

2. Initiatives related to city gas

promoting wider use of natural gas, natural gas cogeneration, fuel cells, natural gas vehicles and high-efficiency gas water heaters, Area-based energy use; and other measures

Developments in Japan regarding the Post-2012 Framework

G8 Summit to be held in July in Toyako, Japan, is stimulating discussions on the introduction of emissions trading systems.

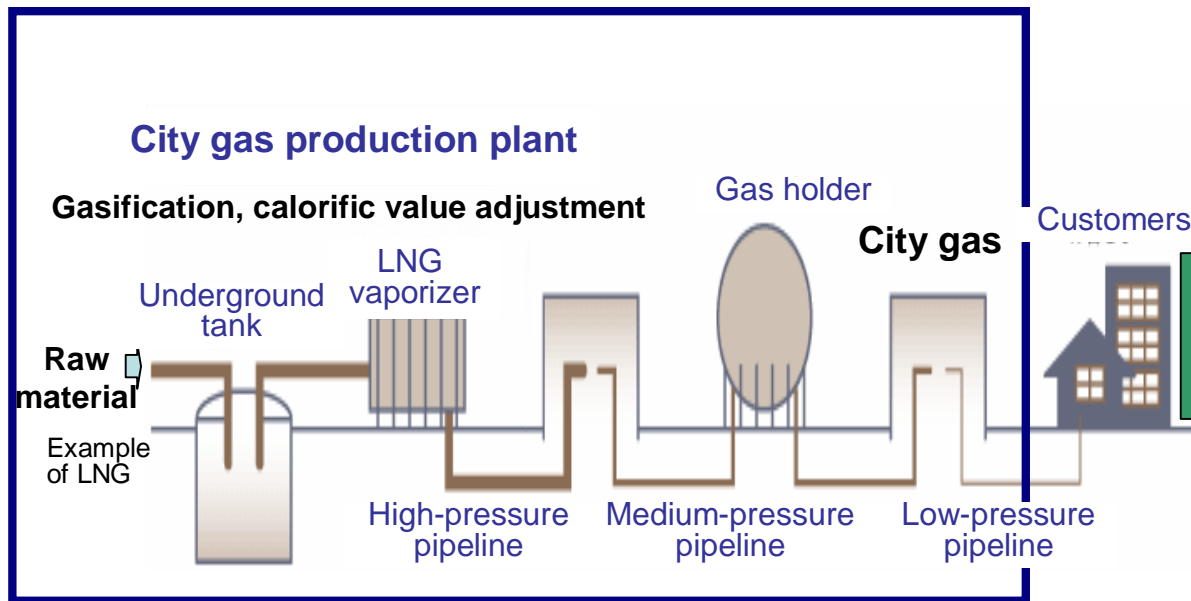


Keen interest in the EU-ETS already in operation, and the Lieberman-Warner Bill currently under consideration in the U.S.

Initiatives of the City Gas Industry to Combat Global Warming

(1) Reduce CO₂ emissions when producing and supplying city gas

Scope of Keidanren's Voluntary Action Plan on the environment



(2) Reduce CO₂ emissions at customer-side

| | |
|-------------|---|
| Residential | <ul style="list-style-type: none"> • More widespread use of natural gas • Development and introduction of high-efficiency equipment |
| Commercial | <ul style="list-style-type: none"> • Co-generation systems, fuel cells, Eco-Jozu, etc. |
| Industry | <ul style="list-style-type: none"> • Wider use of vehicles powered by natural gas |
| Transport | <ul style="list-style-type: none"> • Initiatives that will lead to a national movement • Support for environmental education, etc. |

CO₂ emissions in fiscal 2006: 380,000 t-CO₂
(Approx. 0.03% of total CO₂ emissions in Japan)

Using natural gas to reduce CO₂ emissions on both the supply and demand sides

Initiatives at the City Gas Production and Supply Stages

Initiatives at the City Gas Production and Supply Stages ①

Improve efficiency of city gas production by shifting its feedstock to natural gas
 — Entire industry promotes shift to natural gas —

Efficiency of gas production from coal: 70%

Fuel for coke ovens, etc., electricity for coal crushers, electrostatic samplers, scrubbers, pumps, etc.

Efficiency of gas production from oil: 85-98%

Fuel for reformers, oil heating furnaces, boilers, etc.
 Electricity for oil/water pumps, coolers, etc.

Shift feedstock



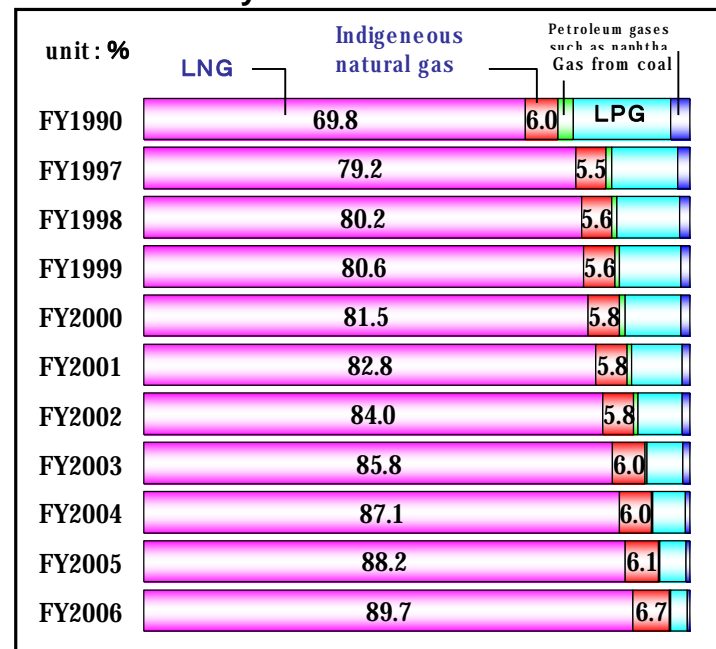
- Building the infrastructures such as LNG tanks
- Customer-by-customer adjustment of combustion for all devices
- Switch at one supplier takes up to 10 years

Efficiency of gas production from natural gas: 99%

Electricity for LNG pumps, seawater pumps for vaporizers, BOG compressors, etc.

FY2006: 9 suppliers switched
 Cumulative total: 188 suppliers switched

Raw material switch is progressing steadily



Breakdown of feedstock used to produce city gas

Initiatives at the City Gas Production and Supply Stages ②

Promoting energy conservation even at production plants that have switched to natural gas

— Further energy savings on top of high production efficiency —

More efficient equipment

- ① Reduce seawater volume by re-engineering vaporizer panels
- ② Boost efficiency by improving seawater pump impellers
- ③ Introduce seawater pump revolution control
- ④ Introduce air-fin-type vaporizers that can be used even in cold climates, etc.

Greater use of LNG cold energy

- ① Enhance cold energy power generation by optimizing coolant composition
- ② Use cold energy in refrigerated storages, etc.

Revised operating procedures

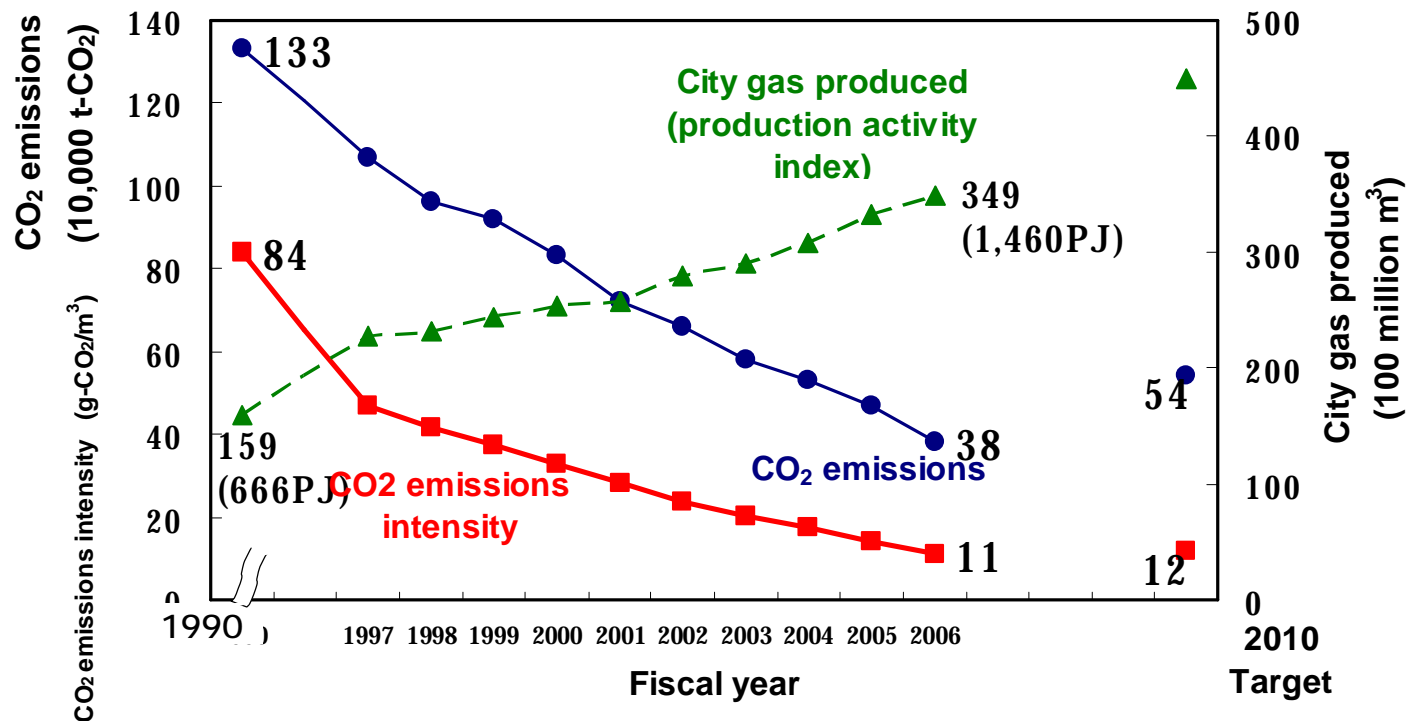
- ① Reduce vaporizer seawater spray volume
- ② Revise number of operating units
- ③ Reduce heat loss by changing vapor line steam traps, augmenting insulation, etc.

Reduction in volume of LPG used

Reduce volume of steam used in LPG vaporization

Results and Forecasts of Voluntary Action Plan

Substantial reductions in CO₂ emissions achieved compared to fiscal 1990, the base year

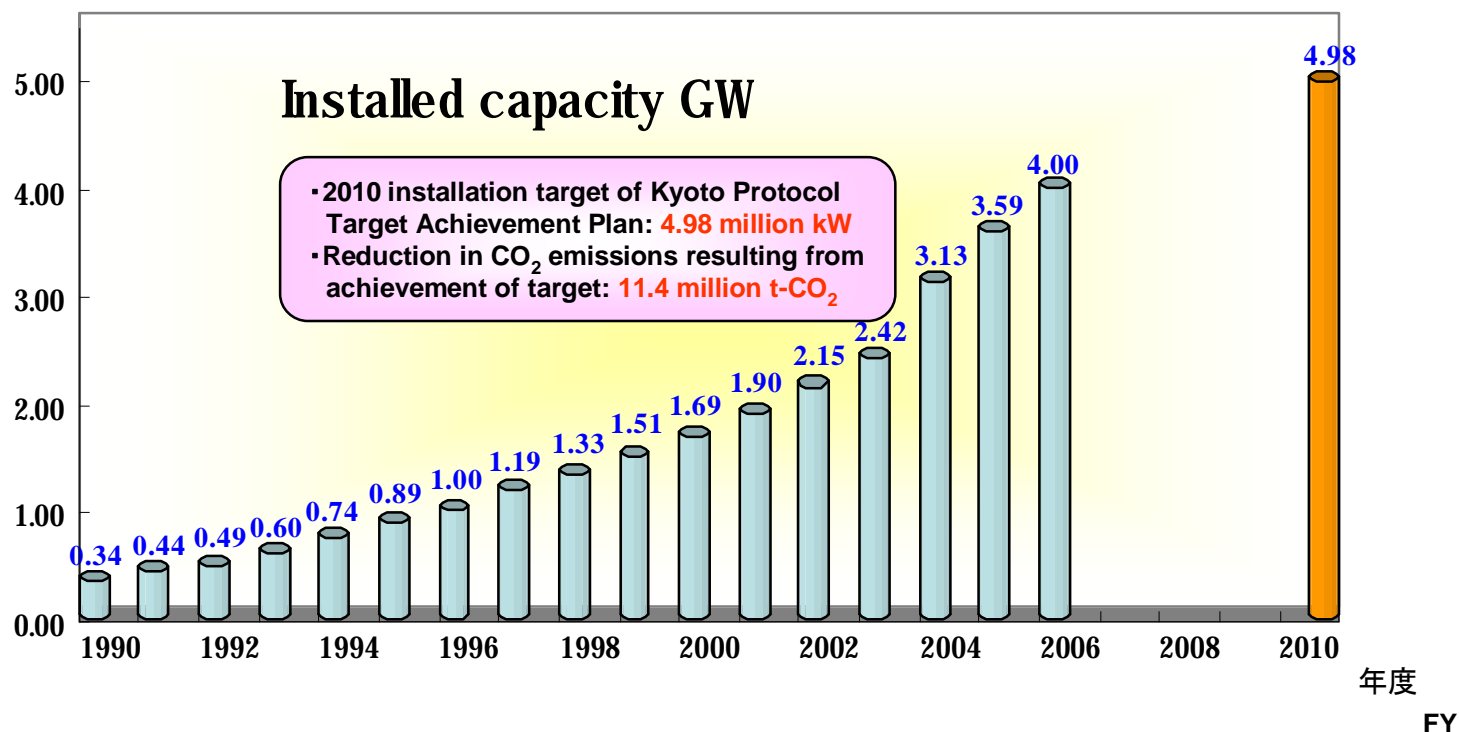


Although demand for environmentally friendly city gas is expected to increase, ongoing efforts to reduce CO₂ emissions are predicted to enable achievement of the targets⁷

Customer-Side Initiatives

Promoting Natural Gas Cogeneration

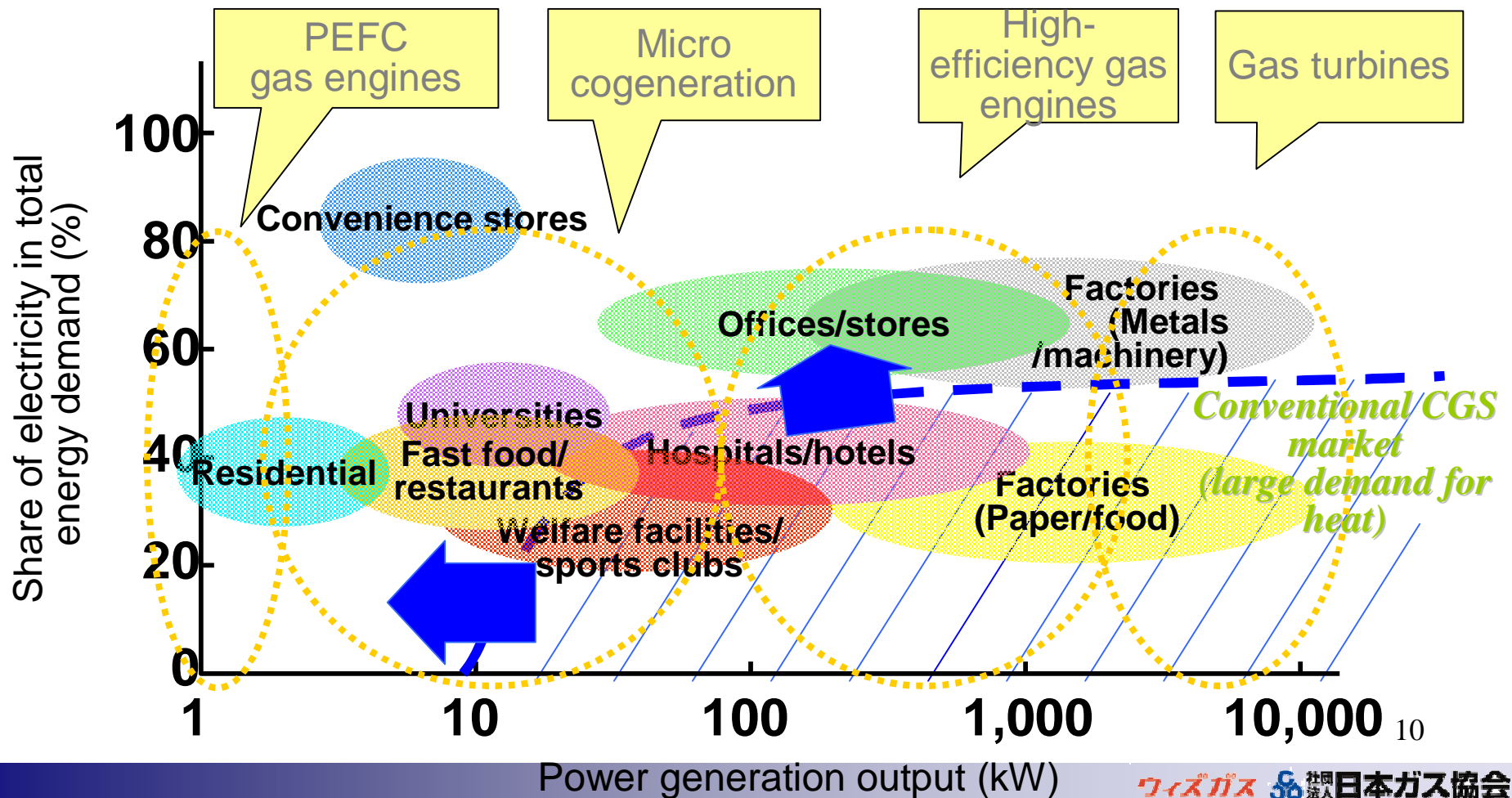
Total installed kW figures are rising steadily—on track to achieve 2010 target set forth in Kyoto Protocol Target Achievement Plan



Ongoing promotion of cogeneration and introduction of more efficient equipment

Wider use of cogeneration systems through a broader lineup, etc.

- Exhaust heat from power generation used for water heating, space heating and cooling, steam, and other purposes
- Improved power generating efficiency and development of compact units made an efficient use of natural gas cogeneration possible in areas where it had been difficult to introduce co-generation systems.



Development and Use of High-Efficiency Equipment & Systems

High-Efficiency Water Heaters

Promote widespread use of latent heat recovery water heaters and gas engine water heaters, which conserve energy and reduce CO₂ emissions. Greater use of such equipment is part of the Kyoto Protocol Target Achievement Plan.

Latent heat recovery water heaters

Easy to install in all dwellings, including existing homes

ECOエース



Energy saving rate: **13%**
CO₂ reduction rate: **13%**

Gas engine water heaters for household use

Home power generation + water heating using exhaust heat

エコウィル
ECOWILL



Energy saving rate: **22%**
CO₂ reduction rate: **32%**

Note: Energy saving rate and CO₂ reduction rate are comparisons with conventional products (Sources: Tokyo Gas, Osaka Gas)

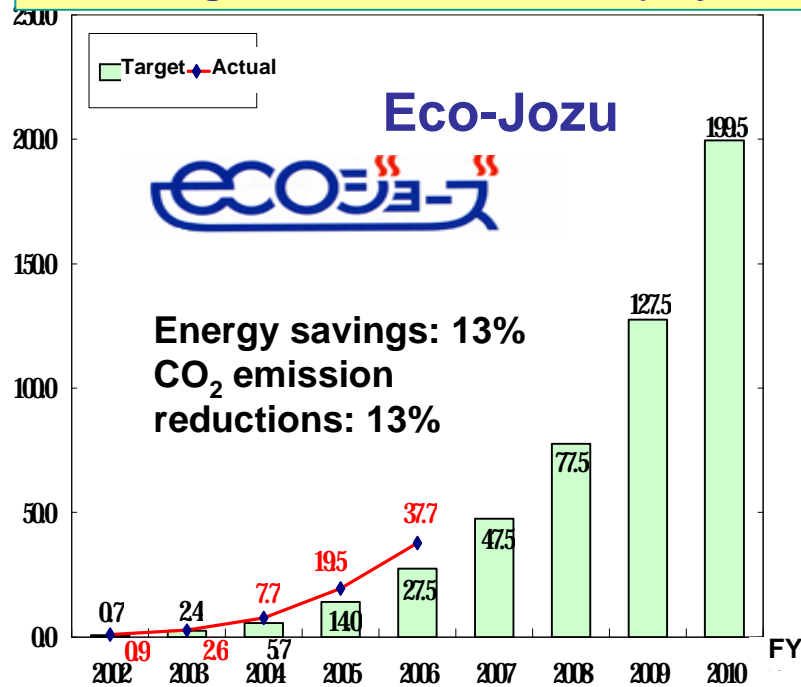
Introduction of More Efficient Equipment

- Promoting Widespread Use of High-Efficiency Water Heaters -

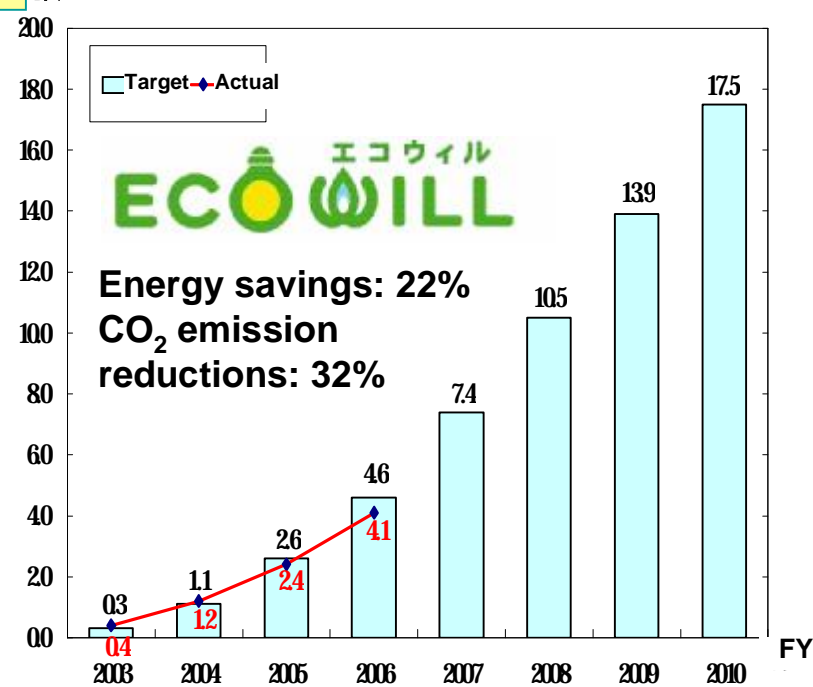
Installation of high-efficiency water heaters is steadily increasing thanks to active promotion—on track to reach 2010 targets for total number of units installed

10,000 units

2010 Targets and Actual Results (City Gas Only)



10,000 units



The High-Efficiency Gas Water Heater De Facto Standard Study Group was established in November 2007 with the aim of making high-efficiency water heaters the de facto standard **by 2015**.

Development and Use of High-Efficiency Equipment & Systems

Residential Fuel Cells

Aim for further reduction of CO₂ emissions over the medium to long term by promoting the development and introduction of household-use fuel cells, the next step in home power generation.

Residential fuel cell (PEFC*) initiatives



Generation efficiency rate: 37%

Energy saving rate: 32%

CO₂ reduction rate: 45%

*Polymer Electrolyte Fuel Cell (LHV standard)

Initiatives to improve power generation efficiency (SOFC*)



Residential use (actual): 45%
Industrial use (target): 67%
(combined with GT)

*Solid Oxide Fuel Cell (LHV standard)

Large-scale trial project for fixed fuel cells (2005-2008)

•FY2005: 480 units FY2006: 777 units FY2007: 930 units

Results of large-scale trial project: LHV standard

Generation efficiency rate: 37% Energy saving rate: 27% CO₂ reduction rate: 41%



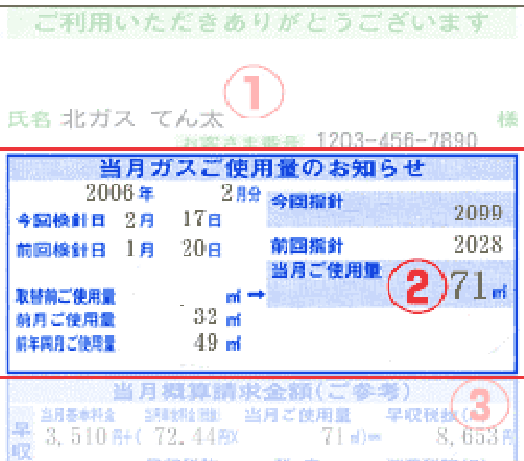

(Source: New Energy Foundation)

SOFC Trial/Research Project (from 2007)

• Trial/research project launched following on from PEFC project, aimed at rapid commercialization

full-scale Introduction after 2009
Aiming to \$5,000/kW by 2015

Initiatives Leading to a National Movement -Providing Information on Energy Conservation

| Energy-saving information via website/pamphlets | Energy-conservation checks |
|---|---|
|  <p>Energy-saving information provided on “Hints for Smart Living” section of website.</p> <p>30,000 copies of <i>Ultra Energy-Saving Book</i> distributed, outlining energy-saving behavior/appliances and reduction of CO₂ emissions.</p> <p>860,000 leaflets produced and distributed for widespread use throughout the gas industry.</p> <p>(All in Japanese)</p> |  <p>System whereby users can register for monthly emissions data, comparisons with similar households, etc. Approx. 30,000 members.</p> <p>Green monitoring scheme for remote gathering of energy usage data from offices, hotels, etc. and feedback to users.</p> |
| Information on monthly gas meter reading slips | Support for energy-saving operation of equipment |
|  <p>Monthly meter reading slips include data on gas usage in the previous month and the same month of the previous year</p> |  <p>Introduction of “energy-look” control panels for Eco-Will and Eco-Jozu systems, fuel cells, etc. Energy-saving navigation function helps users to efficiently conserve energy and gives daily/monthly data on matters such as volume of power generated.</p> <p>ØAccording to a survey of Eco-Will users, some 70% of customers think the panels have raised their awareness of energy conservation</p> |

High-efficiency equipment promoted in conjunction with the Team Minus 6% campaign aimed at encouraging energy consumers to reduce CO₂ emissions by 1 kg per person per day.

Support for Environmental Education -

Promoting eco-cooking

Recommending environmentally friendly food culture covering all aspects from shopping to cooking and disposing of waste



Sample initiatives

- I Example of sessions run by gas utilities: 1,123 in fiscal 2006, with approx. 31,100 participants
- I Tokyo Gas and JGA cooperating to expand the initiative through measures such as running instructors' courses open to other gas utilities

Supporting environmental and energy lessons in schools

Lessons on environmental and energy issues offered by guest instructors



Sample initiatives

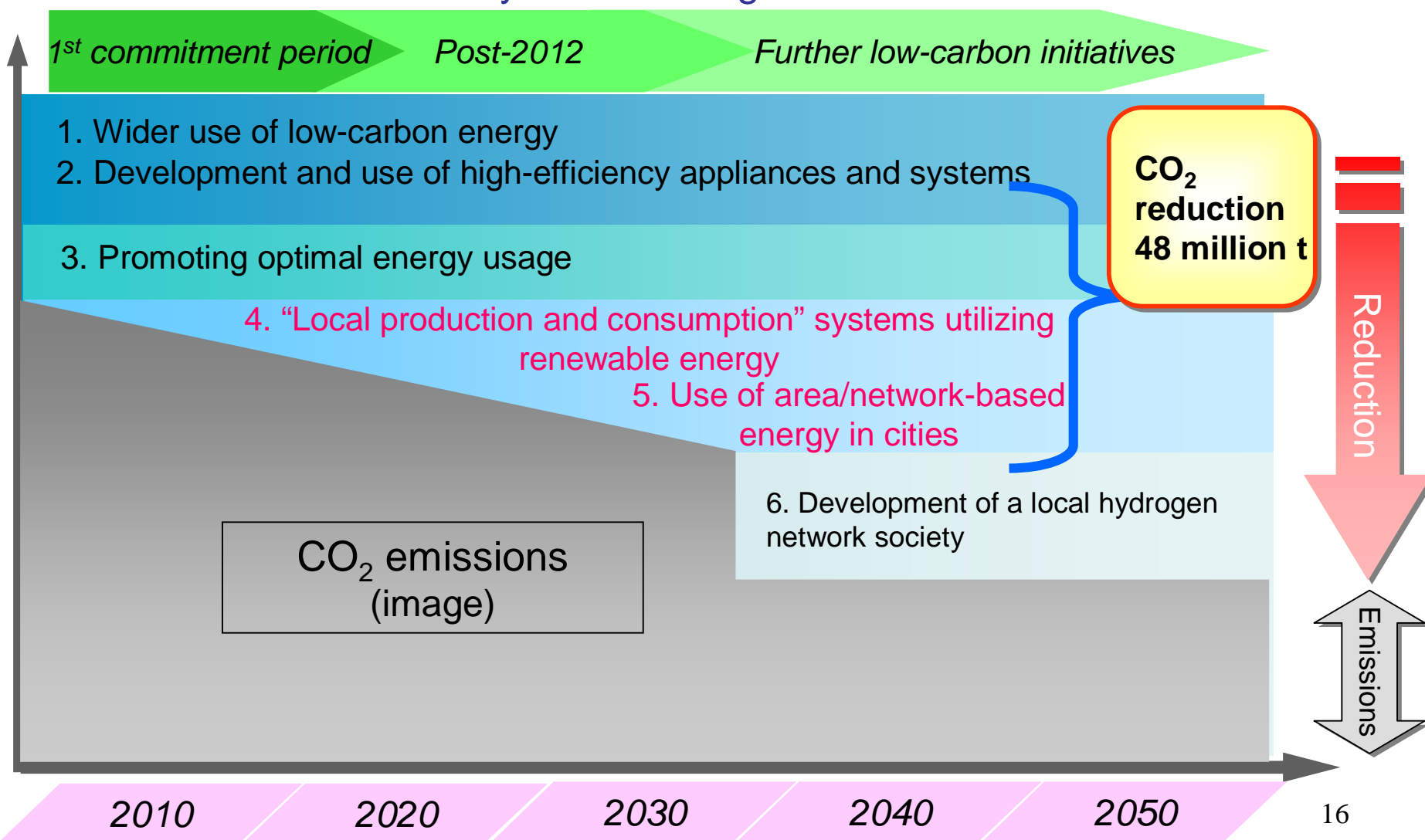
- I Example of lessons offered by gas utilities: 3,813 in fiscal 2006, with 114,390 students taking part
- I “Earth-friendly seminars” based on noodle-cooking lesson
- I Production of educational support materials for gas utilities in order to expand the initiative

(Jointly produced with the Information Center for Energy and Environment Education)

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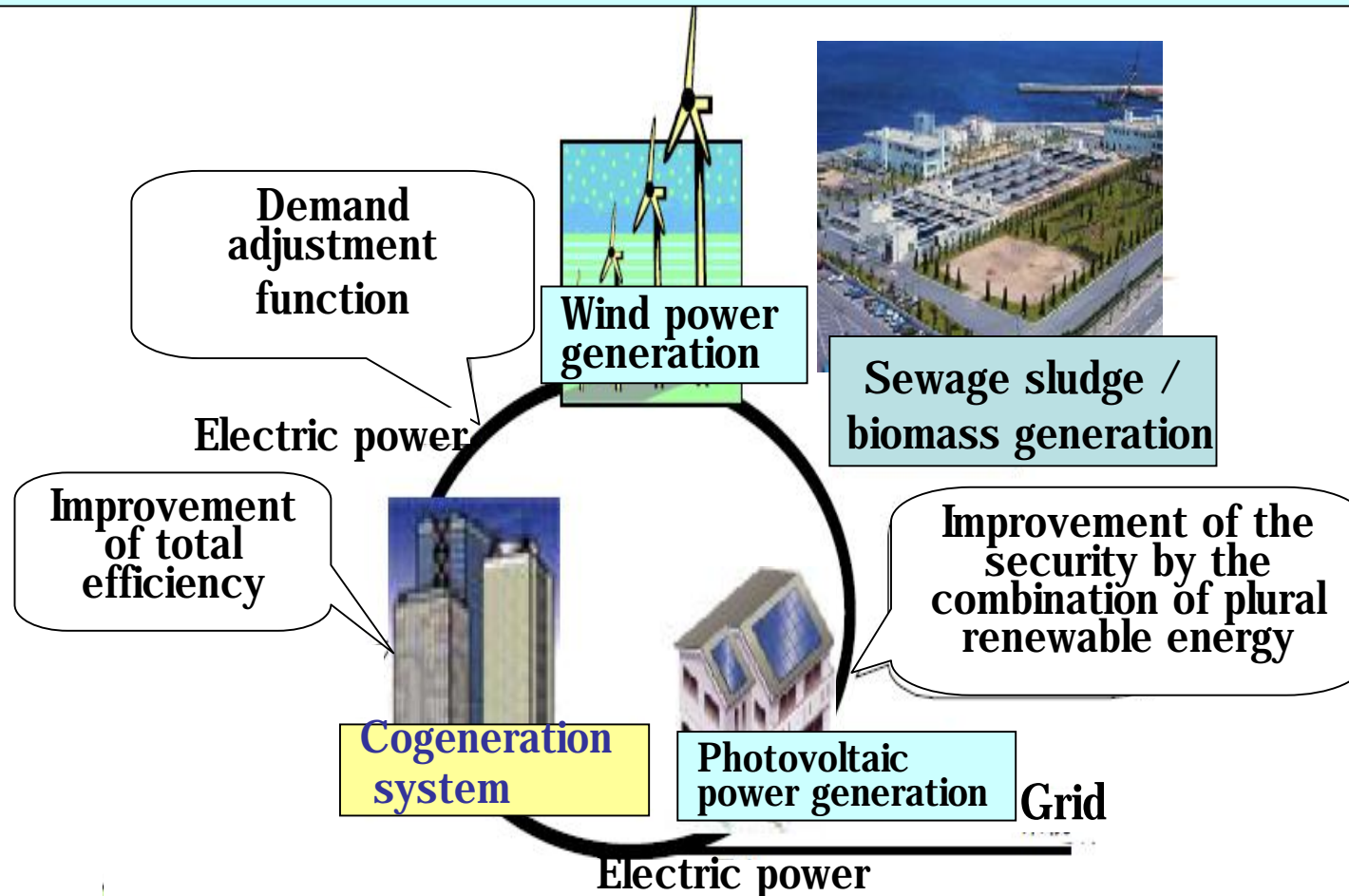
— Gas Vision 2030 —

Aim to realize the potential for reducing 48 million t-CO₂ by the following initiatives.



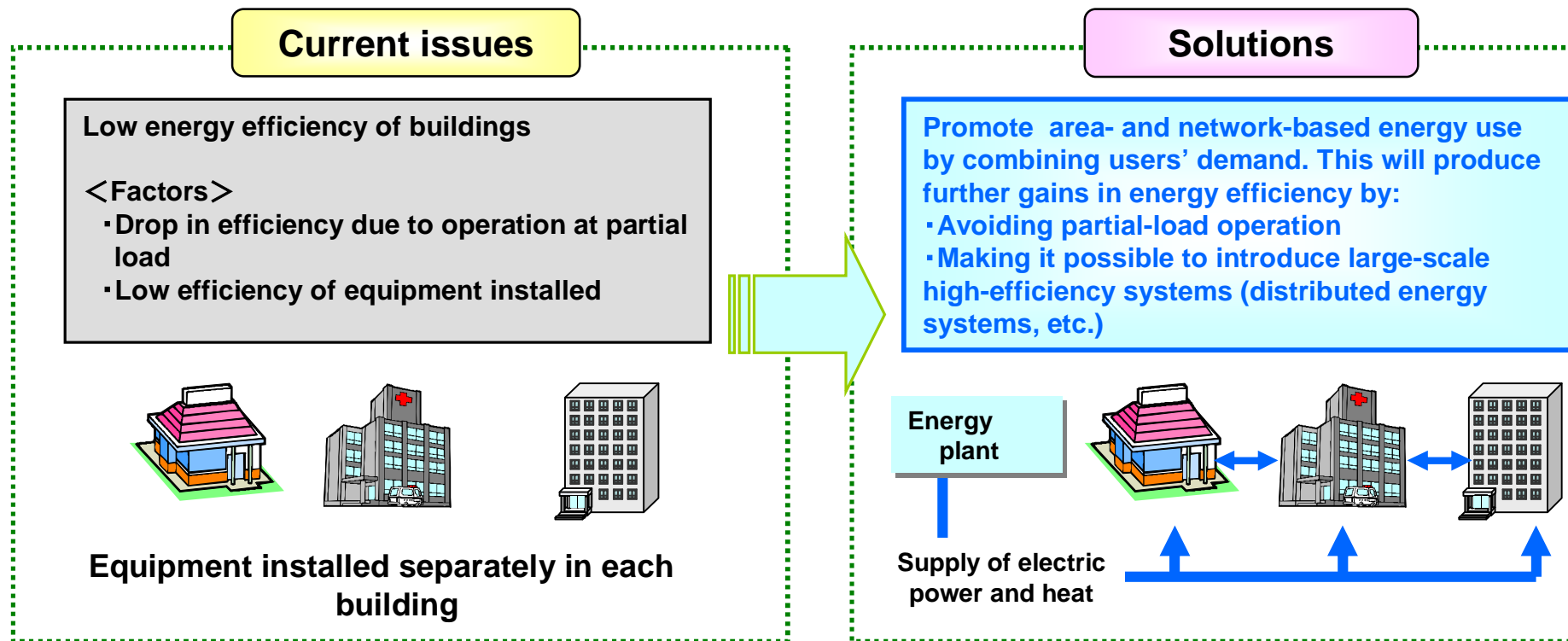
4. Local production and consumption systems utilizing renewable energy sources

- By using natural-gas cogeneration systems to compensate for fluctuations in energy output from renewable energy sources, **it is possible to promote the widespread use of local energy production and consumption systems that utilize renewable energy sources.**
(R&D and business models are very important.)



5. Area/network-based energy use in urban areas

- **Building an optimal energy system for each local community** by combining different user demand patterns, and by promoting area- and network-based electric power and heat that are used by buildings/city blocks (or groups of industrial plants) within a given district.



Summary

Initiatives at the City Gas Production and Supply Stages (Voluntary action plan on the environment)

- Work to meet targets.
- If targets are achieved, CO₂ emissions intensity will be reduced by 86% and total volume of CO₂ emissions will be reduced by 59% compared to FY1990 figures.

Customer-Side Initiatives

- Promote more widespread use of natural gas and installation of high-efficiency systems such as Eco-Jozu, Eco-Will and natural gas cogeneration.
- Commit to Gas Vision2030 and aim to realize the potential for reducing 48 million t-CO₂
- Push ahead with initiatives that generate synergy for reduction of CO₂ emissions by contributing to the national movement, such as environmental education and diffusion of information on energy conservation.

**Using natural gas as the key,
combat global warming from both the supply and demand sides**