The International CHP/DHC Collaborative

Advancing Near-Term Low Carbon Technologies

CHP/DHC Country Scorecard: Japan

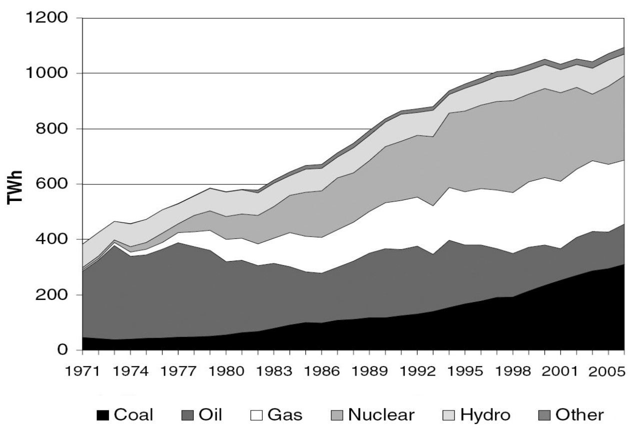
Japan is one of the most energy efficient countries in the world. The government has supported increasingly ambitious energy targets as a strategy to reduce dependency on energy imports and to address climate change. As a consequence, combined heat and power (CHP) use has increased over the past 20 years and now provides 4% of the country's electricity production. Government support has been an essential driver, with favourable subsidies and tax reductions for CHP. In addition, research and development funding has helped create a cluster of specialised technology companies that target primarily the residential CHP sector with micro-internal combustion engines and fuel cells. Finally, district heating and cooling (DHC) is also beginning to grow.

Energy Overview

Japan has one of the lowest energy intensities of the major world economies[1]. Government energy policy is based around small indigenous energy reserves and a high dependency on energy imports. In 2005, Japan imported 81% of its total fossil fuel requirement[2].

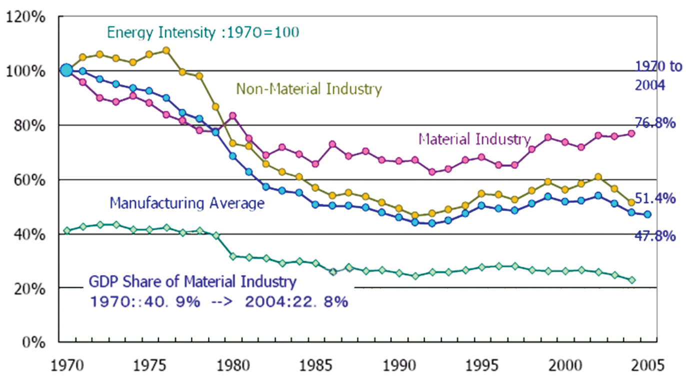
Japan's fuel supply diversification efforts aim to create a balanced energy supply based on oil, coal, natural gas and nuclear, representing 96% of total primary energy supply (Figure 1). Japan has also made substantial investments in energy technology research and development (R&D) and achieved impressive energy efficiency gains from 1970-1990, making Japanese industry among the most efficient in the world (Figure 2).

Figure 1
Japan's Electricity Generation by Source



Source: IEA Electricity Information, 2007

Figure 2
Energy Intensity in Japanese Manufacturing



Source: FEPC, 2007

1. *International Energy Agency (IEA), Energy Policies of IEA Countries: Japan (2008)*, IEA/OECD, Paris.
2. IEA, *Energy Policies of IEA Countries: Japan* (2008).

Climate Change Context

As a Party to the Kyoto Protocol under the United Nations Framework Convention on Climate Change, Japan has committed to reducing greenhouse gas (GHG) emissions 6% by 2012 from 1990s levels. Its climate change strategy depends on the promotion of technological innovation and energy efficiency, and includes the following programmes and targets:

1. The **Kyoto Protocol Achievement Plan**[3] is the main strategy. It contains 60 measures for GHG reduction, including the promotion of natural gas CHP through a 2010 target of 4 980 Megawatts (MW)[4].
2. Japan's **voluntary emissions trading system**[5] started in September 2005 with 32 participants in the first round and 59 participants in the second round. This trading scheme is a pilot experiment for a future obligatory emissions trading scheme.

The government works with industry groups and organisations representing different parts of Japanese society to implement climate change policy.

Japan also participates in international projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol. Most of the projects are located in China. The Japanese New Energy and Industrial Technology Development Organisation (NEDO) purchases GHG credits from the CDM, as commissioned by the Ministry of Environment and Ministry of Economy, Trade and Industry (METI). There is a 12.2 billion yen budget for credit purchase in the period 2007-13.

Looking ahead, Japan's **Cool Earth 50 Programme**[6] is a strategy to move beyond Kyoto and set a GHG global target for 2050.

Japan's Energy and Climate Policies

Japan's energy policy puts equal importance on efficiency, environment and climate change policies. The key policies for promoting CHP technology are:

1. The **National Energy Strategy**[7] emphasizes the importance of energy conservation for energy security and climate change mitigation.
2. The **Special Measures for the Promotion of the Use of New Energy**[8] aims to support the uptake of new, efficient energy technologies.

The **New National Energy Strategy**, adopted in 2006, aims at an additional 30% increase in consumption efficiency by 2030. An ambitious target given that Japan is already one of world leaders in energy efficiency. This will contribute to achieving the second objective of reducing oil dependency. R&D priorities include fuel cells and programmes designed to contribute to the 2030 target are:

- **Japan's Research and Development Investment**, targeted at increasing energy efficiencies in residential and commercial sectors.
- **Technology Development and Commercialisation of Micro-CHP Systems** (see case study below).

CHP Status: Technology, Applications and Market Activity

Japan is among the world leaders in terms of installed CHP capacity, which has increased substantially over the last twenty years (see Figure 3). In 2006, over 8 700 MWe of CHP provided 4% of the country's electricity production.

In the Kyoto Protocol Target Achievement Plan adopted by the Cabinet in March 2008, the government set a target for additional natural gas CHP of between 4 980 and 5 030 MW by 2010. Currently this stands at about 4 500 MWe.

Three major CHP technologies are used in Japan:

- Gas Turbines – 3 770 MW
- Diesel Engines – 3 080 MW
- Gas Engines – 1 940 MW

SOURCE: JAPAN HEAT SERVICES UTILITIES ASSOCIATION

3. Japanese Prime Minister's Global Warming Prevention Headquarters, Kyoto Protocol Achievement Plan, 2005.
4. Japan Gas Association, 2007.
5. Japanese Ministry of Environment, Japan Voluntary Emissions Trading Scheme, 2008.
6. Japanese Ministry of Economy, Trade and Industry (METI), Cool Earth Innovative Energy Technology Program, 2008.
7. METI, National Energy Strategy, 2006.
8. METI, Special Measures for the Promotion of the Use of New Energy, 2008.

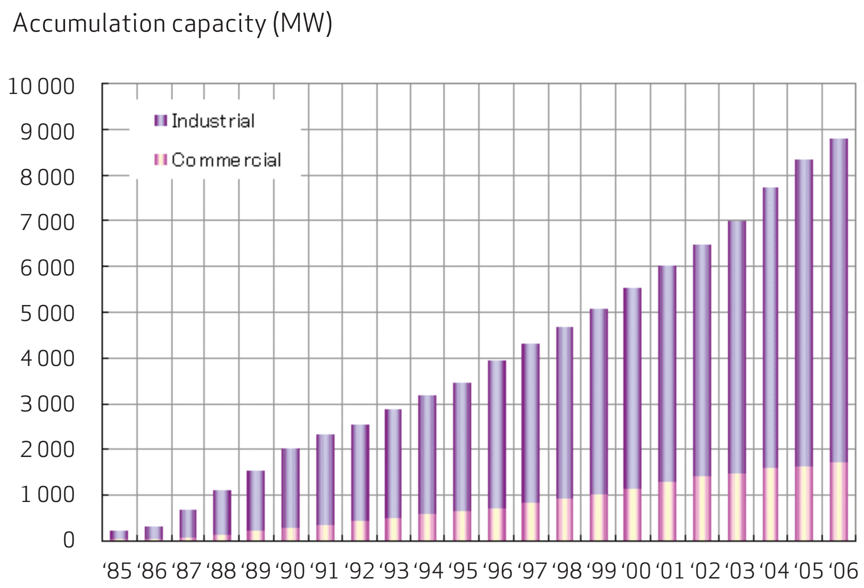


FIGURE 3
CHP GROWTH IN JAPAN, 1985-2006

SOURCE: JAPAN COGENERATION CENTER, 2007

Industrial Applications

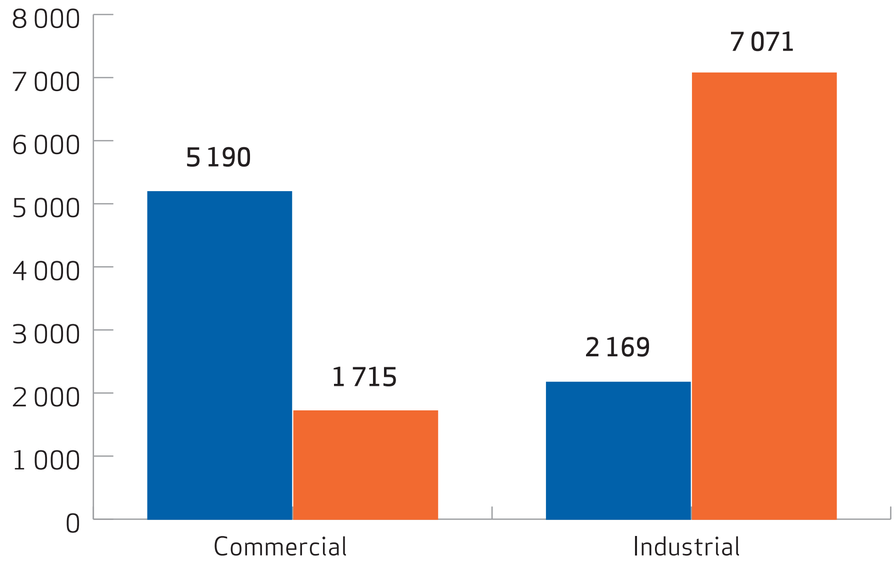
Industrial CHP installations, with an average size of 3.3 MWe, represent 80% of total installed national capacity (Figure 4). The chemical and machinery sectors lead in terms of capacity, and the food sector has the highest number of units. Market activity in the industrial sector has been limited in recent years, because high oil prices have driven up the operating costs of oil-fired CHP.

District Energy Applications

District energy is currently at a small base in Japan but is becoming increasingly important. The government is working to expand the role of district energy through **Area Energy Networks**, representing a combination of traditional small-scale district heating and cooling networks linked to existing distributed heat resources. These networks are included in Japan's Kyoto Protocol Target Achievement Plan and are incentivised through low-interest loans and subsidies.
One example of DHC expansion is the Roppongi Hills development.

FIGURE 4
CHP CAPACITY AND NUMBER OF SITES IN 2006

SOURCE: JAPAN COGENERATION CENTER, 2007



Case Study. Roppongi Hills CHP System

Roppongi Hills is a large multi-complex development located in Roppongi District, Tokyo, opened in April 2003. It comprises a series of office buildings, hotels, commercial and residential buildings, theatres and art galleries. The Mori Building Tower has a natural gas trigeneration CHP unit (38.6 MW) supplying electricity, heating and cooling to the whole area via the grid and pipeline networks. Table 1 summarizes the main power generation components of the system.

This CHP unit is around 16% more efficient than conventional alternative forms of supply.

TABLE 1

MAIN POWER GENERATION COMPONENTS OF THE ROPPONGI HILLS CHP PLANT		
Power Generators	**Installed Capacity**	**Characteristics**
Six steam injection type gas turbines	6 360 kilowatts (kW) each	These turbines adjust their power and heat output ratio according to demand
One back pressure steam turbine	500 kW	The gas turbine exhaust is used for a steam boiler which drives the steam turbine and absorption chillers
Eight absorption chiller-heaters	Six x 2 500 refrigeration tons Two x 2 000 refrigeration tons	

SOURCE: DELTA ENERGY & ENVIRONMENT, 2008

Since installing the system, the Mori Building Company and Tokyo Gas have established an energy service company, Roppongi Energy Service. This company distributes electricity to the area previously served by the Tokyo Electric Power Company (TEPCO) and the RES distribution network is still connected to the TEPCO grid for any back-up needs. Tokyo Gas supplies gas to the CHP unit, but in case of an emergency, the CHP system can operate for a limited time on kerosene.

Small Commercial and Domestic Applications

Commercial premises have 71% of the total number of CHP units in the country and 20% of the installed capacity. Retail, hospitals, hotels, office buildings and sport facilities are typical examples.

While the installed capacity is small, Japan is the world leader in the development and implementation of micro-CHP technologies at the domestic household level (see box below). Installation data is shown in Table 2.

TABLE 2

NUMBER OF INSTALLED CHP UNITS (MARCH 2008)	
CHP Unit Types	**Number of units**
1 kW Gas Engines (ECOWILL systems)	66 264
Residential Polymer Electrolyte Fuel Cell (PEFC)	2 187
Residential Solid Oxide Fuel Cell (SOFC)	29

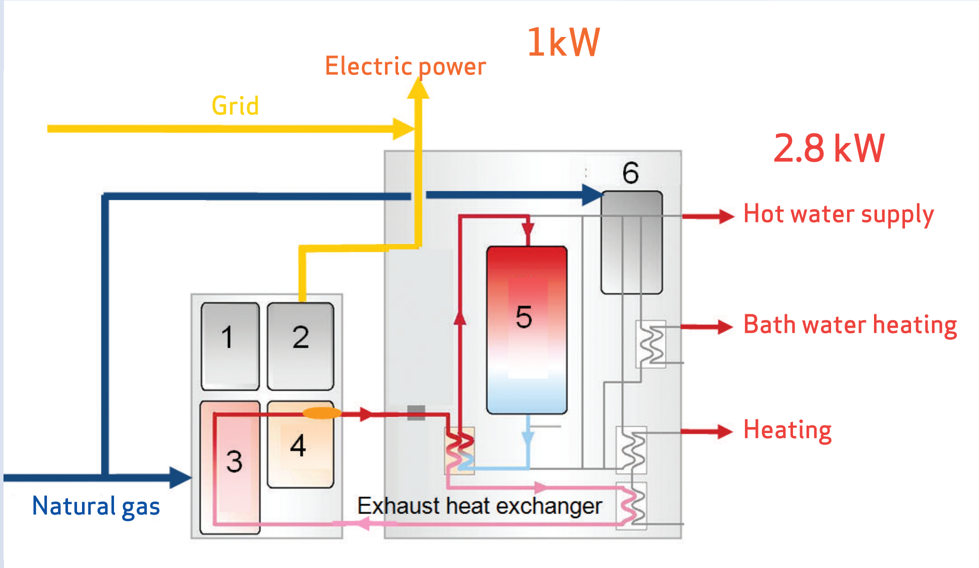
SOURCE: JAPAN GAS ASSOCIATION, 2008

Case Study. Residential Micro-CHP Applications

Micro-CHP technologies are designed for single households, and typically smaller than 10 kWe. This includes gas-engine CHP and stationary fuel cells, among others. For small commercial sector (sports facilities, public baths and restaurants), over 3 000 5kW, 6kW and 9.9kW gas engine CHP ("Genelight") have been installed as of March 2007.
Japanese gas companies have installed over 60 000 micro-CHP systems in residential applications. Figure 5 shows how these systems are integrated into the domestic energy supply.

The micro-CHP unit is integrated with the hot water supply and central heating system. The electricity generated passes through an inverter and powers appliances in the house. Micro-CHP systems are usually connected to the grid, but reverse power flow normally does not take place.
Heat is stored in a storage tank and used for space heating and hot water. Most systems are equipped with a supplementary boiler to prevent hot water shortages.

Figure 5
Integrating micro-CHP systems into residential energy systems
Source: Japan Gas Association, 2007



The Honda ECOWILL product is the most widely used system. Table 3 outlines it technical characteristics, and Figure 6 shows the system installed in a house (heating systems are traditionally located outside the house in Japan).

Table 3

TECHNICAL PERFORMANCE OF THE ECOWILL MICRO-CHP SYSTEM	
Power output/Heat output	1kW/2.8kW
Generation efficiency (LHV)	22.5%
Thermal efficiency (LHV)	63.0%
Overall efficiency (LHV)	85.5%
Dimensions (mm) (L/H/W)	380/880/580

Source: Japan Gas Association, 2008

Figure 6. ECOWILL Micro-CHP system

Government CHP Promotion Policies

Government support for CHP is important at a time of rapidly rising fuel prices. Investment subsidies and tax benefits are used as the main tools, rather than a feed-in tariff approach. Subsidies are regularly reviewed in the light of technological and economic developments, but the government is committed to continued support for CHP. The main CHP support mechanisms are described below[9].

Subsidies for High-Efficiency Natural Gas CHP (10 kW to 3 000 kW)

The **Support Programme for New Energy Users** provides subsidies for businesses that introduce qualifying new energy systems such as natural gas CHP systems and fuel cells. The fiscal year (FY) 2008 budget stands at ¥33.58 billion (US$320 million); the grant rate is up to one-third of the installation cost. The ceiling is ¥500 million (US$4.75 million) for natural gas CHP systems and ¥1 billion (US$9.5 million) for fuel cells.

The Programme for the Promotion of New Energy in Local Areas

This Programme provides subsidies for local public entities that plan to introduce qualifying new energy systems, which are close to being commercial but still have high system costs. Eligible technologies include energy efficient applications such as clean energy vehicles, natural gas fuelled CHP systems and fuel cells, as well as renewables. For FY2008, the project budget stands at ¥4.15 billion (US$40 million) and the grant can cover up to half of the installation cost.

Accelerated tax depreciation of CHP investment

The **Taxation System for the Promotion of Investment in Energy Supply-Demand** offers a 7% tax exemption for small- and medium-sized businesses or an accelerated tax depreciation of 30% of the standard acquisition value of CHP equipment.

R&D on high-efficiency natural gas CHP and fuel cells

The Japanese government also actively supports R&D, demonstration and commercialisation of gas-engine and fuel cell CHP systems for residential use (see box below).

Residential Fuel Cell Cogeneration Systems

Residential internal combustion engine CHP systems

Japan has actively pursued the development of 1 kWe residential internal combustion engine (ICE) and fuel cell micro-CHP systems. As a result, it is now the world leader in commercialization of these systems, including the ECOWILL ICE system with sales of almost 20 000 in 2007.

Development of fuel cell CHP technology

Japan's governmental funding for R&D and demonstration projects has been a major driver for fuel cell CHP technologies for residential use. METI's Large Scale Stationary Fuel Cell Demonstration Project offers utilities subsidies toward the purchase of these units. These can be up to ¥2.2 million (US$ 21 000) per unit for Polymer Electrolyte fuel cells. Utilities then lease the micro-CHP units to households for a fixed period. NEDO and the New Energy Foundation (NEF) are responsible for implementing the programme. Figure 7 summarises its targets.

Demonstration of Polymer Electrolyte Fuel Cells (PEFC)

PEFC CHP systems are firmly in the demonstration phase, with about 2 200 units installed as of March 2008, including a high-profile installation at the Japanese prime minister's residence in 2005.

In 2005, the government conducted demonstration projects using natural gas-type and LPG-type systems. In 2006 it launched a similar scheme for kerosene-type systems. Based on the demonstration projects, NEF collects the material data necessary for market introduction and commercialisation, including seasonal energy demand balances, summarised in Figure 8. Commercialisation may take place as early as 2009.

R&D support for Solid Oxide Fuel Cells

METI aims to replicate its PEFC success with SOFC systems, with NEDO running the Demonstrative Research on SOFC projects. 29 units had been installed by the end of March 2008.

Energy savings achieved through fuel cell CHP

Based on 2007 data, the average rate of primary energy savings (as compared to separate heat and power) was about 20% for fuel cell systems, up from 14% in 2006. In light of these achievements, the government has promoted further demonstration projects to achieve a target of 3 300 demonstration sites in 2008.

9. METI, 2008.

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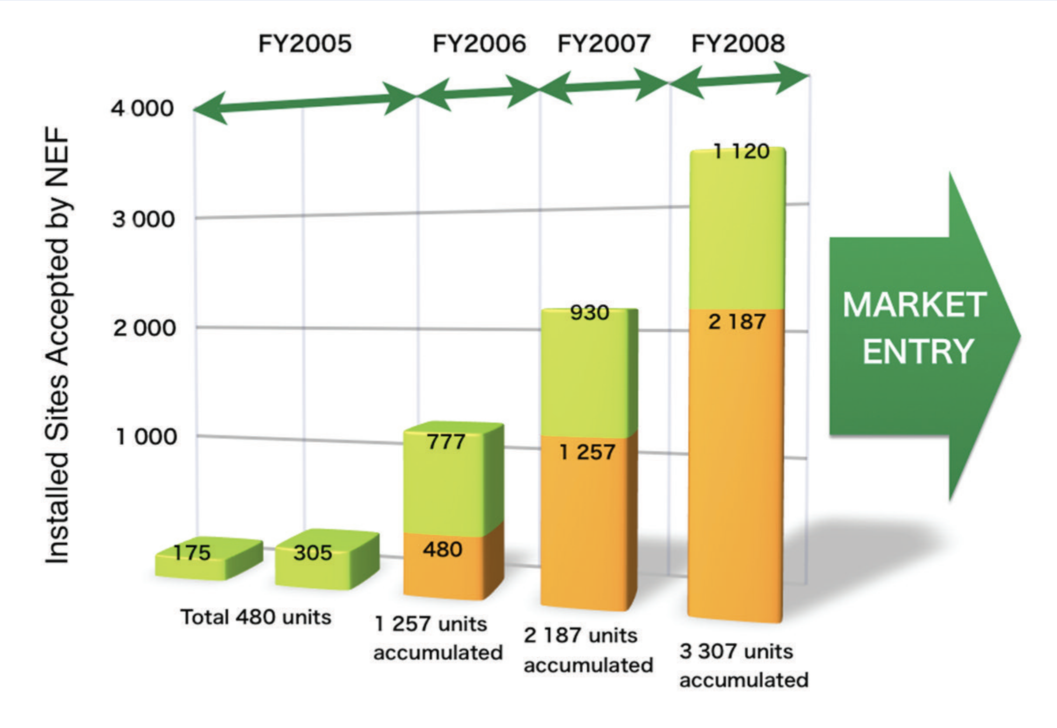

FIGURE 7
STATIONARY FUEL CELL DEMONSTRATION PROJECT

SOURCE: METI, 2008 (2008 DATA IS PROJECTED)

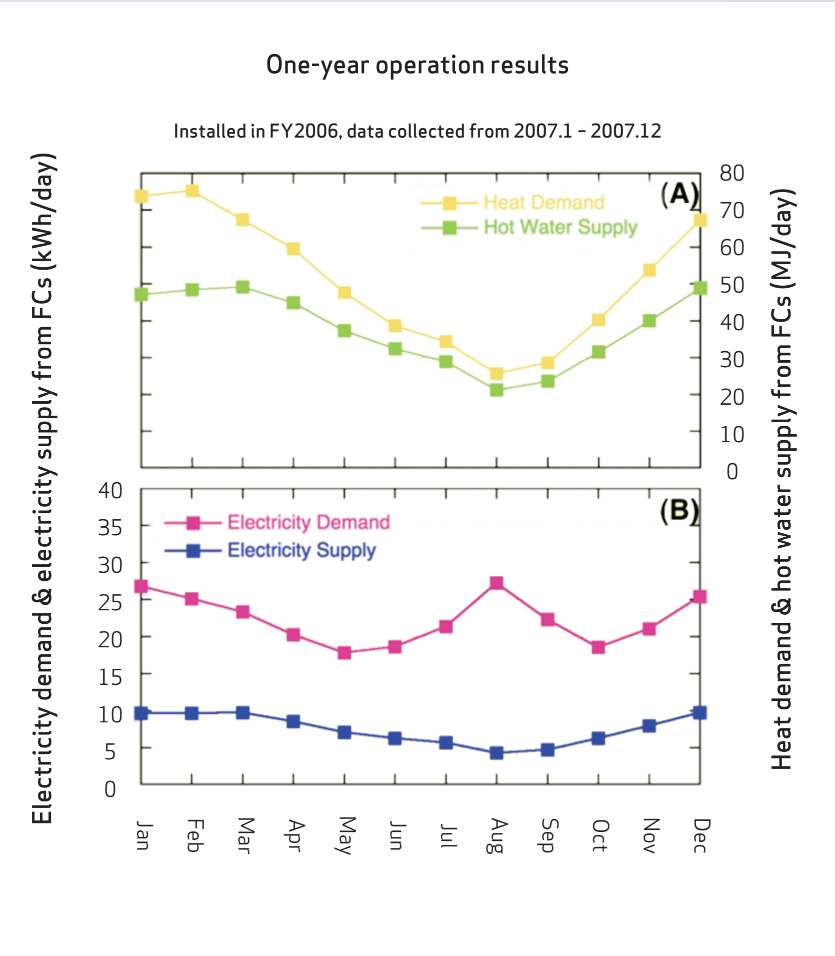

FIGURE 8
ELECTRICITY AND HEAT SUPPLY FROM FUEL CELLS

SOURCE: METI, 2008 – (A) HEAT (B) ELECTRICITY

Administrative procedures for grid connection

The government has introduced special procedures for grid connection of CHP systems. This includes the development of guidelines for the administrative arrangements required for electricity supply to third party. While a move in the right direction, some critics have argued that the guidelines require excessively technical specifications, artificially raising the cost of CHP in the marketplace.

Residential CHP systems still have to meet technical standards for grid connection, but do not require on-site inspection by the utility. Simplified network access is particularly important for supporting the emerging market for small and micro-CHP systems to avoid prohibitive administrative overheads during the installation.

Low-interest loans for district energy

This loan scheme provided by the Development Bank of Japan consists of low-interest loans for DHC projects. The objective is to reduce costs and accelerate investment in DHC. The scheme targets electricity utilities in particular.

Japan's Gas Utility Support for CHP

Japan's major gas utilities represent one of the most important driving forces for CHP market development, as they offer targeted programmes designed to advance CHP.

Micro-CHP lease programmes

Tokyo Gas, a gas utility, has introduced leasing arrangements to facilitate the installation of fuel cell micro-CHP systems for their residential customers. Tokyo Gas customers, for example, can test a fuel cell CHP unit for 4 years by paying ¥100 000 (US$ 973) per year.
In addition, NEDO provides subsidies for these schemes, similar to the solar support program implemented in the late 1990s and early 2000s. ECOWILL gas-engine systems were eligible for a ¥152 000-¥138 000 (US$1 450) subsidy in 2007-08, and PEM fuel cell units get a ¥2.2 million (US$21 000) installation grant. The systems must meet waste heat usage criteria to be eligible for this support.

Reduced natural gas tariffs

Several gas utilities have also introduced a reduced tariff for residential CHP users to ease the burden of operating costs. Generally, residential CHP users receive a 15% to 20% reduction on their gas tariffs compared to the normal tariff. On average, households can save approximately ¥30 000 (US$ 287) per year on their energy cost.

Stakeholders

Government

The **Ministry of Economy, Trade and Industry** is responsible for CHP in Japan, and has a range of documents and resources available on its website. The **New Energy and Industrial Technology Development Organisation** is responsible for the government's programmes on new CHP technology development and promotion, such as fuel cells.

Industry

A number of companies are involved in the micro-CHP market. These include: Ebara-Ballard, Panasonic, ENEOS Celltech, Toshiba, Yanmar, Honda, Aisin and Toyota as manufacturers – and Tokyo Gas, Osaka Gas, Toho Gas, Saibu Gas, Hokkaido Gas, Nippon Gas, Nippon Oil, Cosmo Oil.

Non-governmental Organizations

The **Japan Cogeneration Center** and **Japan Gas Association** are the main industry bodies providing information on CHP and promoting its successful development in the future. These organisations, in cooperation with the CHP industry, launched the **CHP/DHC Promotion Consortium of Japan** in March 2008, to support the IEA CHP/DHC Collaborative at the G8 meeting in Hokkaido in July 2008.

Key Barriers to CHP Uptake

Similar to other countries, energy prices and the relative costs of CHP alternatives have an important impact on the commercial viability in Japan. In Japan, the energy sector is characterised by a dependence on primary energy imports and high fuel prices. Both of these factors increase the payback and energy efficiency benefits of CHP systems relative to power-only generation based on fossil fuels, but also increase operation costs, which are substantially higher than in other G8 countries.

The changing fuel mix plays a role. One third of current CHP capacity is petroleum-based, although gas and LNG based CHP are becoming more common, due to their cleaner environmental profiles and the high and volatile price of oil. The attractiveness of these systems will depend on Liquefied Natural Gas price trends.
In addition to these economic aspects, barriers to CHP in Japan include:

Lack of an approved method for crediting the efficiency of CHP in environmental policies

The environmental benefits, and in particular, the CO_2 emissions reduction of CHP systems, have not yet been accurately defined in Japan. This lack of an approved methodology reduces the potential impact of CHP as a GHG reduction solution.

Technology barriers for Micro-CHP

The availability of competitively priced micro-CHP units is the key barrier for the residential CHP sector. For residential fuel cells, reducing the cost and increasing the lifetime and efficiency of the units is particularly important. In March 2008, the government set targets to reduce the price to ¥400 000 (US$3 800) per kW (from ¥4 to 5 million), to double unit life and to make a 10% increase in power generation efficiency[10]. Achieving these targets will be very important if these technologies are to achieve wider use.

Barriers for Industrial CHP and Commercial CHP

Currently, prices received for electricity exported to the grid are relatively low, while other fuel costs continue to increase. Most Japanese CHP plants therefore only generate heat and power for their own consumption, even though larger benefits could be achieved if they could supply heat and power to other users or the network. The growing significance of CO_2 costs could help overcome this problem.

Barriers for District Heating and Cooling/ Energy Area Networks

The relatively high capital costs associated with DHC network development represent the main challenge. The current approach for targeting smaller heating networks, for example the Roppongi Hills project, provides one mechanism for overcoming this barrier.

CHP Potential and Benefits

METI's most recent projections, released in March 2008, suggest that 16.3 GWe of CHP capacity could be achieved by 2030, including fuel cell applications.

Government targets for CHP also reflect the potential for capacity growth. The government's CHP target aims at 4 980 MWe of new natural gas CHP by 2010 as part of its Kyoto Protocol Target Achievement Plan[11]. The IEA CHP/DHC Collaborative has estimated that CHP can generate 199 TWh per year in 2030 in Japan, if supported by a strong policy framework[12]. According to that report, which analysed the benefits of increased CHP use in the G8 and 5 other large economies, countries that invest in accelerated policies for CHP should realise the following aggregate benefits:

- a 3-7% decrease in energy investment costs between now and 2030;
- a slight decrease in consumer electricity costs; and
- up to 10% reductions in CO_2 emissions by 2030.

10. METI, Technology Development Roadmap, 2008.
11. METI, Kyoto Protocol Achievement Plan, 2005.
12. IEA, *Combined Heat and Power – Evaluating the benefits of greater global investment*, 2008.

Realising the Benefits of CHP and DHC in Japan

Building on Japan's strengths

Over a period of 20 years, Japan has had important success in realizing the benefits of CHP and district energy, by turning a non-existent CHP market into a sizeable one. The IEA believes that Japan can continue this progress, and realize sizeable additional benefits, by:

- Maintaining and expanding government support;
- Continuing to develop innovative R&D programmes, particularly to create even more efficient fuel cells; and
- Launching new programmes to support the adoption of a broader portfolio of CHP technologies, including engine and turbine systems suitable for commercial and industrial applications.

Summary Policy Recommendations

- **Adjust subsidies to reflect changes in fuel prices for CHP.**
- **Build on successful R&D programmes to support the future uptake of fuel cell systems.**
- **Use heat and power networks to replicate achieved CHP/DHC benefits at a larger scale.**
- **Design future GHG policies to reflect the emissions savings and efficiency benefits of CHP/DHC.**
- **Support other countries in creating energy-efficient economies through CHP/DHC.**

Subsidies and tax incentives reflecting market conditions

Favourable tax laws and subsidies in Japan have made many new CHP installations economically attractive. Adjusting subsidies to reflect rising fuel costs for CHP plants, and the relatively low cost of electricity tariffs, would ensure that market growth can continue – and perhaps accelerate.

Developing and introducing new CHP/DHC technologies

The residential CHP programme is on track and promises the potential of significant future success. This will require a continuation of the fuel cell and other R&D programmes, and the development of new demonstration and commercialisation programmes as the various technologies mature.

Use energy networks to scale up the benefits from CHP/DHC

Japan has already achieved CO_2 and cost savings through CHP, and can increase these benefits by using heat and electricity networks to allow CHP technologies to be used at a larger scale. The promotion of Area Energy Networks is an excellent example of using district energy networks and power grids to provide a platform for CHP. This approach should be replicated on a larger scale by making it more attractive for CHP plants to export electricity to regional or national electricity grids at a price reflecting their benefit to the energy supply.

CHP/DHC and Climate Policy

The planned emissions trading scheme could provide a further incentive for CHP/DHC, provided it effectively recognises these technologies' GHG emissions reductions on a regional, rather than a site-by-site, basis. Japan should study experiences in Europe and the United States, where they use marginal emissions factors as their CHP environmental benefits calculation methodology, to gain insights into how to proceed.

Co-operate with other countries facing similar energy challenges

Japan's track record in advancing energy efficient technologies gives it a unique position to co-operate with other countries to support them in the development of high-efficiency CHP/DHC. There are many countries that lack indigenous energy resources that can learn from Japan's experience promoting CHP across all sectors. For example, Japan's approach to DHC/DHC, in the form of local area energy networks, offers an interesting blueprint for low-carbon developments, and holds substantial potential elsewhere for using DHC and CHP on large urban scales.

CHP / DHC Scorecard

To aid in comparing amongst countries, the IEA has developed a scorecard of national CHP/DHC policy efforts that takes into account three criteria:

- The effectiveness of past policies in developing the CHP/DHC market over the last 5 years;
- Statements and commitments of intent in respect of future CHP/DHC policy, for example through the creation of national growth targets; and
- The existence today of meaningful policy incentives that are already causing significant market growth or that are likely to do so in the near future.

Each country is given a scorecard rating as follows:

No material policy effort or intent to promote CHP/DHC. The market is not expected to grow for the foreseeable future. ★☆☆☆☆

Some minor recognition of the role of CHP/DHC, but policies are not fully effective or are otherwise insufficient to influence market development. ★★☆☆☆

There is a clear recognition of the role of CHP/DHC, accompanied by the introduction of some measures to accelerate the market, but CHP/DHC are not high priorities compared to other energy solutions. In addition, the country lacks an integrated CHP/DHC strategy. As a result, market growth is likely to be modest. ★★★☆☆

CHP/DHC is at or close to the top of the list of energy policy priorities and a series of effective policies are being implemented as part of a coherent strategy. Important growth is expected in CHP / DHC markets. ★★★★☆

A world leader in prioritising CHP/DHC, with a clear and proven strategy for bringing about significant market development and the implementation of at least one global best-practice policy measure. ★★★★★

Japan's Overall CHP Rating: ★★★☆☆

Japan's Micro-CHP/Fuel Cell Rating: ★★★★☆

The International CHP/DHC Collaborative

The International **CHP/DHC Collaborative** was launched in March 2007 to help evaluate global lessons learned and guide the G8 leaders and other policy makers as they attempt to assess the potential of CHP as an energy technology solution.

The Collaborative includes the following activities:
- collecting global data on current CHP installations;
- assessing growth potentials for key markets;
- developing country scorecards with data and relevant policies;
- documenting best practice policies for CHP and DHC; and
- convening an international CHP/DHC network, to share experiences and ideas.

Participants in the Collaborative include public and private Partner organisations and other government, industry and non-governmental organizations that provide expertise and support. The Collaborative Network, the larger group that is informed about meetings, publications and outreach, has over 350 participants.

If you are interested in participating in the Collaborative, please visit www.iea.org/G8/CHP/chp.asp.

The **IEA District Heating and Cooling Programme** (IEA DHC) is the major international research and development programme for district heating and cooling. It functions within the IEA's Framework for International Energy Technology Co-operation. The programme conducts highly effective Research and Development as well as policy analysis of District Heating and Cooling systems with low environmental impact through international collaboration. Established in 1983, IEA DHC currently has nine participant countries: Canada, Denmark, Finland, Korea, Netherlands, Norway, Sweden, UK and USA. For more information, visit www.iea-dhc.org.

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