Facilitating, Enabling, and Triggering Sectoral Transitions: Japan

Technology Support Policies

Case Study 8. Industrial Energy Efficiency in Japan

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Decarbonizing the industrial sector (steel, cement, chemicals, aluminum, and other manufacturing) is vital for achieving net zero emissions. In 2019, the industrial sector accounted for 38 percent of global final energy use and 26 percent of global GHG emissions (IEA 2021a). To date, there has been limited progress in reducing emissions from the sector, which is considered hard to abate due to the cost and complexity of delivering decarbonized high-temperature process heat and capturing process emissions. Fossil fuels still account for 68 percent of the sector's energy mix, and there has been limited adoption of low carbon technologies such as green hydrogen and carbon capture and sequestration. Most industrial decarbonization progress has been made through energy efficiency measures such as waste heat recovery, combined heat and power, and process optimization. In the years ahead, the demand for industrial goods is projected to rise, largely driven by population growth and urban development (Bocca and Ashraf 2022). As a result, industrial emissions create a pressing challenge to global warming, creating a pressing challenge for governments to develop and implement policies that can support and advance industrial decarbonization.

Japan, the world's third-largest producer of industrial goods, is implementing plans and policies for industrial decarbonization. In 2019, industry added $1.46 trillion to Japan's economy (World Bank 2022e) as well as 189 tCO_2e (IEA 2020c). The country has made progress in reducing these emissions by 28 percent since 1990, largely through energy efficiency improvements, which led to an 18 percent decrease in final energy consumption between 2000 and 2019. Further reductions are in the pipeline: as the government has announced its aim to achieve net zero emissions by 2050 and released the "Green Growth Strategy through Achieving Carbon Neutrality in 2050" (IEA 2021c).

Context

Due to its advanced economic development and limited natural resource endowments, Japan has had to develop innovative decarbonization strategies. With the world's third-largest GDP and the fifth-largest volume of GHG emissions (ClimateWatch 2022; World Bank 2022e), it is a densely populated island nation with minimal domestic reserves of conventional energy sources, such as coal, oil, and gas (Cheng et al. 2022). It has no international gas pipelines or electricity connections and has been troubled by

natural disasters affecting domestic energy supplies, creating challenges to both energy security and sufficiency. This has led Japan's Ministry of Economy, Trade and Industry to create innovative energy efficiency policies that have provided emissions reduction cobenefits to the industrial sector.

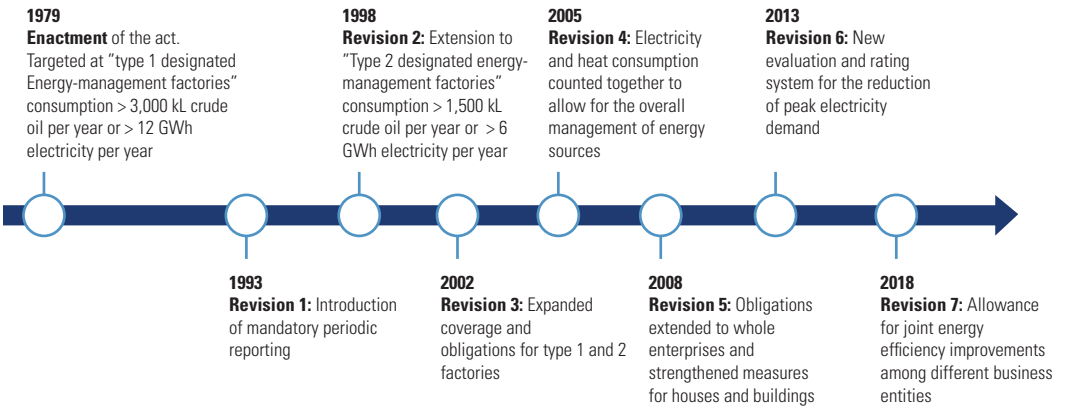
Policy

The country's domestic energy challenges have catalyzed widespread energy efficiency measures. The 1979 Act on the Rational Use of Energy laid the groundwork for Japan to become one of the world's most energy-efficient economies. Implemented in response to the 1979 energy crisis and oil shock, the act has undergone seven major revisions, allowing it to expand and improve over time (figure 3.8; IEA 2017). It sets energy performance standards and energy reporting and management requirements for factories and workplaces that consume more than 1,500 kiloliters of oil equivalent energy each year (IEA 2021c; LSE 2022), representing approximately 70 percent of energy consumption across the industrial sector. The act also sets out energy efficiency benchmarking indicators, which companies are obliged to submit progress reports on, and a nonbinding 1 percent reduction target. In 2018, the government boosted support through a new tax system that allows energy-efficient companies to benefit from accelerated depreciation of their energy efficiency investments.

Results and Impacts

Japan has achieved one of the world's highest energy efficiency levels, but the pace of improvement is slowing. The Act on the Rational Use of Energy and other government incentives have helped some industrial subsectors stimulate energy efficiency improvements of more than 1 percent per year. However, a combination of a modest

FIGURE 3.8 Timeline of Japan's 1979 Act on the Rational Use of Energy



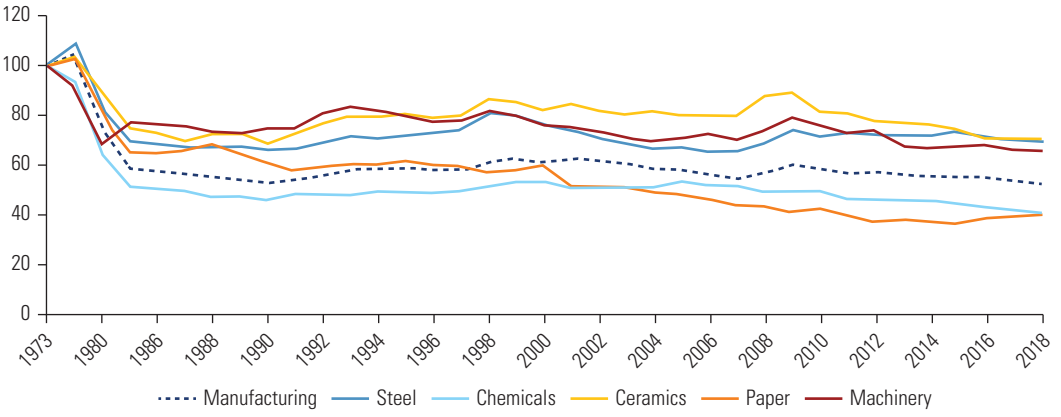
Source: Adapted from International Energy Agency 2017.

Note: The figure only includes the updates that are most relevant to industrial energy consumption. GWh = gigawatt hours; kL = kiloliter.

benchmarking target and voluntary compliance has stalled recent progress. In 2019, no more than 38 percent of companies in any single industrial subsector were reaching the government's energy efficiency benchmarks (Ezawa 2021). Improvements in steel production have notably plateaued (figure 3.9), with only 16 percent of electric furnace steel producers meeting the benchmarks. The energy intensity benchmarks are comparable to the EU's ETS, indicating that increased enforcement and compliance of existing policies could bring about further improvements (IEA 2021c).

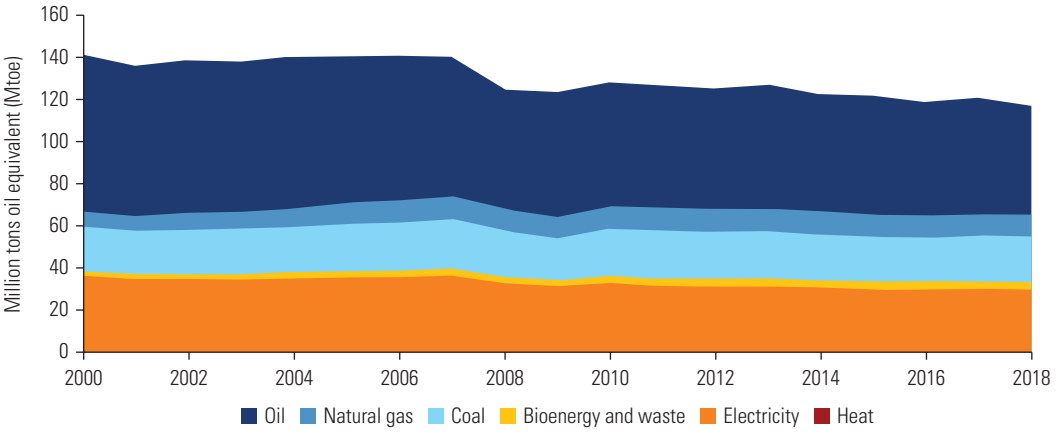
Energy efficiency measures have helped cut energy intensity (figure 3.10), but further measures are needed for deep decarbonization. Japan's industrial emissions have decreased by 28 percent since 1990, despite the carbon intensity of its industrial energy consumption decreasing by only 4 percent. Although energy efficiency measures have

FIGURE 3.9 Energy Intensity Index in Japan, by Industrial Subsector, 1973–2018



Source: Ezawa 2021.

FIGURE 3.10 Total Final Consumption in Japanese Industry, by Source, 2000–18



Source: International Energy Agency 2021c.

Note: Includes nonenergy consumption.

helped Japan decrease industrial energy consumption by 18 percent since 2000, the country will need to go beyond energy efficiency measures to transition to cleaner fuels, decarbonizing power-sector emissions fuels, and upscaling carbon capture and sequestration projects. It is making progress in these areas through targeted research and development spending, the world's first basic hydrogen strategy, and green public procurement initiatives. These initiatives benefit from Japan's strong institutional arrangements, including the New Energy and Industrial Technology Development Organization, which helps optimize the results of research and development spending by fostering collaboration between the private sector, academia, and government.

Key Takeaways

Energy efficiency measures can help decrease energy consumption, operating costs, and emissions. Although Japan's energy-saving initiatives were originally targeted toward energy security challenges, they have also provided cobenefits in emission reductions and resource productivity.

Energy efficiency policies may need to adapt as technologies evolve and ambitions increase. Japan's Act on the Rational Use of Energy has had seven major revisions, expanding its coverage and improving the methodology standards used. Despite these revisions, energy efficiency improvements in some industrial subsectors have declined over time. This may be the result of diminishing marginal returns, highlighting the need for additional support or compliance measures once results begin to plateau.

Deep decarbonization requires wide policy support. Japan's example has shown that no single policy is enough on its own to achieve complete industrial decarbonization. Rather, a range of policy measures is needed to support the supply of low-carbon technologies and the demand for low-carbon industrial goods.

Looking to the Future

Improvements in industrial energy efficiency could help address global energy security concerns. The Russian invasion of Ukraine has sparked a global energy crisis (IEA 2022f). Decreasing energy consumption in the industrial sector could help decrease the severity of this crisis and provide long-term benefits through continued emissions savings.

International collaboration could help accelerate industrial decarbonization. Global cooperation and best practice sharing could drastically reduce the time required to implement decarbonized industrial supply chains. Japan has demonstrated international leadership in low-carbon cooperation, through its international research and development advancements, contributions to multilateral climate funds, and international partnerships, such as the Joint Crediting Mechanism. Addressing the energy and climate crises will require further international collaboration.