

Co-benefit situation for mercury and CO₂ emissions from energy sector in Minamata area

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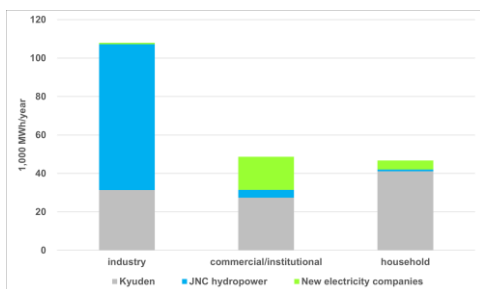
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[Introduction]

Minamata City, experiencing Minamata disease caused by the unprecedented pollution in the course of economic development in Japan, has been undertaking rigorous environmental measures. In 2020, Minamata City was selected as one of the SDGs Future Cities in Japan, which integrate economy, society and environment into their basic development plans to create new values towards sustainable development. It is recognized that certain measures on sound mercury management also bring other environmental benefits. This study explores the concrete examples of such co-benefits and quantifies these benefits as much as possible.

[Methods]

One of the significant measures in Minamata area is hydropower use, from which the emission reductions of both mercury and CO₂ are expected. Data on the electricity consumption and energy mix from the industry sector, households and municipal facilities are obtained from existing research works. Mercury emission is estimated by assuming that the hydropower replaces the electricity supplied by the conventional electricity company (Kyuden), thus reduces the amount of coal used by Kyuden. CO₂ emission is estimated from the electricity consumption and emission factor by each energy mix component.



[Figure 1] Hydropower consumptions in Minamata area

on an MoU. In addition, the study made a survey with the municipal facilities on the electricity suppliers in the recent years, to find a growing introduction of renewable electricity.

[Results and discussion]

Two results are obtained from this study. First, approximately a half of public electricity in Minamata area is supplied by hydropower, with a notable contribution in the industry sector as shown in [Figure 1] due largely to the development of hydropower by the JNC group companies (“JNC hydropower” in Figure 1). The hydropower supply is used by not only the JNC group, but also the local industries. Furthermore, with the recent deregulation of electricity supply in favor of renewable energy sourced from the local communities, the excess JNC hydropower is supplied to the Minamata city office based

Secondly, the effect of such rigorous introduction of renewable energy is quantitatively evaluated in terms of mercury and CO₂ emissions, as a result of information gathering as shown in [Tables 1 and 2]. To estimate mercury emission, the activity data is calculated as the coal used by Kyuden, relative to the proportion of the electricity from Kyuden out of the overall electricity consumption in Minamata area. The mercury emission factor for coal-fired power plant is obtained from the national mercury inventory. To estimate CO₂ emission in Minamata area, the electricity consumption according to the supplier and each supplier’s emission factors are used. Following the mercury and CO₂ emission estimations, the study attempts to analyze the status from the point of an objective view, i.e. the Minamata area’s emissions from the national and global contexts on a per-person basis. The data used for the analysis is shown in [Tables 3 and 4].

[Conclusion]

In conclusion, the study illustrates in a quantitative manner the significance of the efforts to shift towards renewable energy in Minamata area as shown in [Figures 2 and 3]. A comparison of mercury emissions per person among Minamata area, Japan and the world illustrates that, the mercury emission in Minamata area was smaller than the national level, which was about one-fourth from the global level. Regarding CO₂, Minamata area, which has historically used its local hydropower, went far ahead of the national decarbonization in the 2010s, and even greener than the average developed countries in 2019 as far as the public electricity supply was concerned. Those are the important findings from the quantification exercise of the study.

[Table 1] Data related to mercury emission in Minamata area

Data	Value and unit (data year)	Source
Total electricity generated by Kyuden	72,200,000.00 MWh (2018)	[Kyuden]
Electricity supplied by Kyuden etc. ^(note)	145,944.47 MWh (2018)	[Tanaka]
Amount of coal used by Kyuden to generate the total electricity	4,930,000 t-Coal (2018)	[Kyuden]
National mercury emission factor of coal-fired power plants in Japan	11,726.50 μgHg/ton-Coal (2016)	[MOEJ(a)]

(Note) The amount includes the electricity supplied by the conventional electricity company (Kyuden) and also the new electricity companies for staying on the conservative side, since the details of the new electricity companies were not available as to estimate the coal consumption.

[Table 2] Data related to CO₂ emission in Minamata area

Electricity supplier	Electricity consumption in Minamata area by supplier (2019)[Tanaka]	CO ₂ emission factors [MOEJ (2021)]
JNC	80,790 MWh/year	0 t-CO ₂ /MWh
Kyuden	100.630 MWh/year	0.000344 t-CO ₂ /MWh
New electricity companies ^(note)	22,641 MWh/year	0.000470 t-CO ₂ /MWh

(note) "New electricity companies" include power purchase arrangement (PPA), power producer and supplier (PPS), etc.

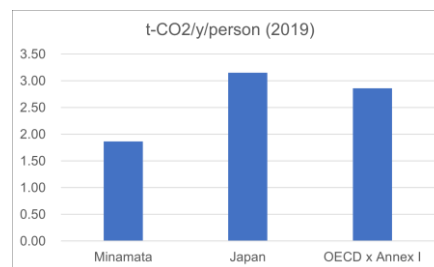
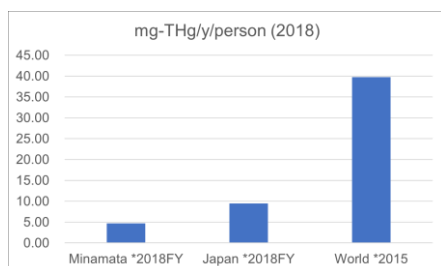
[Table 3] Data related to mercury emissions and population in Japan and the world

	Mercury-related data	Population data [World Bank Data]
Japan	Data on coal power plant [MOEJ(b)]: Emission to air; 1.30 t-Hg (2016) Coal consumption; 110,860 kt (2016)	126,529,100 (2018)
World	Data on Hg air emission from coal power plants [UNEP (2019)]: 282 t-Hg (2018)	7,339 billion (2015)

[Table 4] Data related to CO₂ emissions and population in Japan and the world

	CO ₂ -related data [UNFCCC]	Population data [OECD]
Japan	396,430.91 kt-CO ₂ /year	125.71 million
World ^(note)	3,160,849.24 kt-CO ₂ /year	1,104.72 million

(note) "OECD x Annex I" means 32 developed countries which are members to OECD and parties to the UNFCCC Annex I at the same time.



Figures 2 and 3 The comparison of mercury and CO₂ emissions per person among Minamata area, Japan and the world [References]

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