

論 文 要 旨

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学位論文題目 Air Pollution, Petrochemical Industry, and Future Energy Policy Change in Asian Cities: A Retrospective Pattern Case Study of Yokkaichi Air Pollution with Tianjin SO₂ Pollution Abatement (英訳又は和訳:「アジア都市における大気汚染、石油化学工業およびエネルギー政策転換: 四日市公害と中国天津市二酸化硫黄汚染問題における石油化学工業都市の大気汚染と対策事例のパターン研究」)			
<p>When taking a reviewing aspect towards the past, it is easy to realize that tackling environmental issues has always been harder than human awareness. Yokkaichi Air Pollution has been one of the primal examples of Asian countries for abating industry related heavy pollutions. From the start point to the peak of Yokkaichi Air Pollution took no longer that a decade, but the abating process has lasted more than half a century. It is obvious that Yokkaichi Air Pollution is not an isolated case. More needed to be done around the world.</p> <p>After entering the 21st century, the urgency of countermeasures against pollution, climate change has become a consensus amongst the scientists and well accepted by most of the governments around the world, to lead to a more dignified, sustainable future. However, with the overdependence on fossil fuels, negative impacts are evidently unable to be ignored. Among those negative impacts, “How to” are constantly asked and discussed. For industry, how to reduce pollution from the whole industrial procedure? For governments, how to balance environmental governance with national economic growth? How to find a substitute energy source but still maintaining stabilized? How to limit substitute energy and pollution disposing cost while achieving pre-set environmental aims? How to decide between a plausible fossil fuel based stable economy, and a choppy possibility with renewable energies as the gain? For individuals, how is our everyday life affected by the countermeasures against fossil fuels? Some could be answered through analyzing the past cases.</p> <p>Thus, in this dissertation, the author chooses Yokkaichi Air Pollution as the representative for the past exemplary case to support an empirical study on petrochemical industrial cities. From the past experiences in Yokkaichi, Japan, the observations on how Yokkaichi Air Pollution started in Yokkaichi City, how Yokkaichi</p>			

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City started and continued to reduce and control SO₂ pollution are conducted, and a 4-stage model for understanding Energy – Pollution – Industry – Economy situations in petrochemical city better.

As mentioned in Yokkaichi, for decades, the petrochemical industry development has been deteriorating the environment with its by-product, sulfur dioxide (SO₂). Tianjin, in this case, was one of the most heavily polluted industrial cities in Northern China. With a long history of developing the petrochemical industry, there are some similarities exist in its past and present with Yokkaichi City. Therefore, in this dissertation the 4-stage model from Yokkaichi is adopted in Tianjin to verify its feasibility. Under the 4-Stage model, in which consisting of Early Stage – Second Stage – Third Stage – Fourth Stage (After Pollution Stage), the author believes that Yokkaichi is at Stage 4, after the pollution stage, whereas Tianjin is currently in Stage 3. The drivers of SO₂ pollution in Yokkaichi and Tianjin are summarized through a retrospective approach by comparing common features of Yokkaichi and Tianjin.

Through an extended *STIRPAT* model, both cities' drivers for environmental impacts, (in this research, *i.e.*, SO₂ annual concentration), including population, production, GDP/GDP per capita, energy efficiency, citizens' behavior are all taking into consideration as part of the indexes for a description of petrochemical industrial cities' development. The author believes that the efficacy of regional environmental policies in Yokkaichi related to SO₂ pollution can help clarify the pollution pattern in Tianjin. In the meantime, northern China's regional integration policy will be re-examined for its long-term effects in Tianjin. As vicinity cities of Tianjin are all under the influence of the integration policy, the geographical relations between Tianjin and its vicinity indicates that optimizing energy source structure in northern China is more than important in the next 2 to 3 decades. However, energy structure and energy policies are highly depended on a national level of the government's decision. Therefore, in this dissertation, the energy policies of China and Japan will also be discussed.

To achieve the 2030 Sustainable Development Goals (SDGs), solidarity is essential. Learning from Yokkaichi's past, understanding Tianjin's present, it will help more Asian cities in fighting for its sustainable and affluent future.

Keywords: SO₂ pollution; Petrochemical industry; Asian cities; Energy structure; Sustainable development