



# Resident's risk perception and acceptance towards the siting of waste incinerator

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## ABSTRACT

Local acceptance has appeared as a main barrier to the development of waste incinerators, especially in urban areas with high population density. To provide an understanding of resident's opposition to the waste incinerator project, this study aims to examine the resident's awareness, acceptance, and risk perception towards the siting of the waste incinerator. 326 residents had been surveyed and 271 sets of data were successfully collected via a questionnaire survey at Kepong, and it was subjected to data analysis. The results revealed that waste incinerators are perceived as high-risk facilities; thus, it is not surprising to learn that residents are skeptical towards the operation of waste incinerators as well as their safety is secured by the operator. Across the findings, the housing prices (38.8%), the probability of inhaling acidic gases (38.8%), and road damage caused by the transportation of solid waste for the incineration process (31.3%) should be highly noted. The results further indicate that there is a need for government and plant operators to reassure residents of the safety measures that can mitigate the potential risk associated with the operation of waste incinerators.

## INTRODUCTION

Leading by the advancement in technology, our world and society are growing alongside exponential progress in economics, urbanization, and population. In turn, this has contributed to a significant increase in the generation of solid waste. Most of the solid waste is generated by households, following an increase in the global population and the rising demand for food and other essentials (Alam & Ahmade, 2013).

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Concerning the growth of solid waste, Hoornweg and Bhada-Tata (2012) acknowledged that waste generated would adversely affect the environment and cause a dramatic increment in handling costs if the solid waste not being managed properly and wisely. It is agreeable that solid waste is the most common and unavoidable by-product of our urbanization and economic activities. The adverse environmental effect will affect all, regardless of the level of income, education or residing countries (Kaza et al., 2018). As shown in Figure 1, waste generated by humans has significantly increased. Such increment is expected to continue until the year 2050.

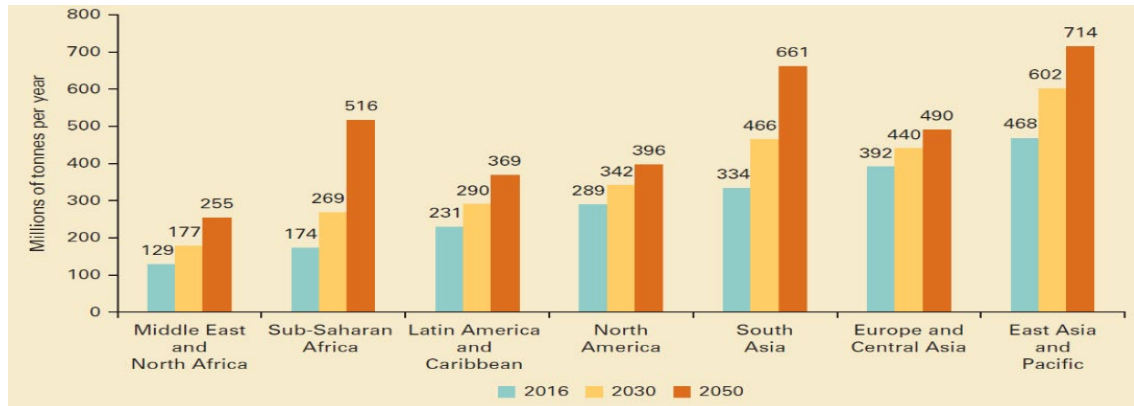


Fig. 1. Projected waste generation, by region (millions of tonnes/ years)

Sources: Kaza et al. (2018)

Solid waste has increased in terms of its quantity and its quality - the complexity of the waste. Although municipal solid waste management is a solution to reduce and minimize the volume of solid waste, many solid wastes are unable to be handled correctly. There is an alternative way to enhance municipal solid waste management and contribute to reducing the amount of solid waste – the waste incinerator (Sakai & Hiraoka, 2000). Nevertheless, waste incinerator operation will release the ashes that consist of particulate matter with low boiling temperatures and cause environmental pollution (Sakai & Hiraoka, 2000; Li et al., 2004).

Municipal solid waste has become one of the important issues concerning all countries. Various methods have been suggested to address this pressing issue. Among others, landfill is not a long-term solution to solve solid waste. This is because those landfills create significant impacts on global warming, ecosystem, ground and surface water, human health, land value and land availability (Danthurebandara et al., 2012). Moreover, landfill requires a large volume of land to bury the solid waste, but land is limited in its capacity. Therefore, landfill is not a long-term solution compared to incinerators. Sreenivasan et al. (2012) acknowledged that Kuala Lumpur is on the path to reducing its dependence on landfills via the introduction of waste incinerators. However, the siting of incinerators is difficult due to population density- especially within urban areas. According to Performance Management and Delivery Unit (2015), currently, the usage of landfill methods in Kuala Lumpur is estimated at 89% and is targeted to be minimised to 60%. Therefore, incinerator has a better advantage and are perceived as long-term solutions, compared to the landfill method.

The waste incinerator contributes to reducing the volume of solid waste issue and converts it into energy with the waste-to-energy concept. However, incinerators are still confronting difficulties to be implemented in Malaysia. Yong et al. (2019) mentioned that incinerators had been greatly introduced to society via their viability and feasibility in terms of technology and economics, but not from the domain of

community acceptance. Community acceptance can emerge as the main hurdle to the implementation of waste incinerators, such as the waste incinerator project at Kepong (Ibrahim, 2017). As community acceptance is reflected by the resident's risk perception towards the siting of the waste incinerator project, this study aimed to disclose the resident's perception towards the waste incinerator project in gauging the community acceptance of the waste incinerator. On top of that, the result of the findings will be going to include the resident's awareness and prerequisites for accepting waste incinerators will be disclosed later. It was expected that findings from this study will contribute to the discussion on community acceptance issues surrounding the implementation of waste incinerators.

The remainder of this paper will be arranged in sections. It started with literature reviews on relevant concepts of risk perception, followed by research method, findings presentation and discussion before a conclusion was drawn.

## **LITERATURE REVIEW**

There were several definitions of risk perception, but there was a common way to define it which was an individual will experience the effect of danger (Short, 1984). After many studies on the theory of risk perception, uncertain outcomes or situations with unknown outcomes are mostly related to risk perception (Sjöberg & Rundmo, 2004). Thus, it became an important method of psychology to research how people react to certain uncertainty research, and waste incinerators were one of them. Lima (2004) also mentioned that the variable of risk perception significantly affects people's reactions and behaviour toward the waste incinerator through the effects of annoyance. It was because they were able to sense and feel the danger of the environmental changes. The development of waste incinerators could create an opportunity for job development or environmental protection. However, the local communities still believe it will cause pollution and damage to the environment (Subiza-Pérez et al, 2020; Catalán-Vázquez et al., 2018).

Furthermore, the local community strongly rejected the construction of waste incinerators in their neighbour's vicinity as they perceive that their health will be affected by the adverse environment caused by the operation of waste incinerators (Bena et al., 2019). Besides that, Xu and Lin, (2020) revealed that three main reasons contribute to the rejection of waste incinerators. These were concerned over its impact towards underaged or young children in their family members. They also believed the waste incineration plants would impact their lives daily. The last reason was because the price of electricity will increase when combined with electricity. For example, the electricity bills will be increased to 133 from 105 per month while an estimated 0.60 yuan/kWh more for the existing electricity price.

Ren et al. (2016) also did similar research studies regarding the community acceptance towards the waste incinerator. In their result, they found that respondents with high-risk perceptions tend to protest incinerators. Additionally, Sun et al. (2019) studies also supported that risk perception was significantly affecting the local communities, amplified by the distance between their home and the waste incinerators. Additionally, the residents will feel more insecure and have a negative attitude if the operator fails to let them understand the operation of the incinerator and ensure a safe operation (Lin et al., 2018). Following this, risk perception has an evident role in shaping community acceptance and local opinion on the construction of the waste incinerator. Therefore, it should be strongly recommended and suggested to consider analysing and identifying the community acceptance while the policymakers plan to develop a construction of incinerators.

## **RESEARCH METHOD**

A survey form had been administered for data collection. Due to the outbreak of COVID-19 and movement control measurements undertaken by the government, it is difficult for the researchers to conduct face-to-face surveys. Thus, we decided to collect the data via an online survey platform by sending an email to

respective parties or individuals to get the data and information. In this data collection, we used the convenient sampling method for those respondents who were recruited. In general, 326 respondents in the Kepong area replied to the survey, and 271 data sets were successfully collected. After eliminating incomplete surveys, surveys that were responded to using the same scale for all survey items, and suspicious responses, the remaining 240 data were subjected to the subsequent data analysis using IBM Statistical Package for Social Science (SPSS) software.

In this research, we are going to do the study and investigation through the demographic profile of the locals in Kepong. Besides that, we are going to look over the pre-requisite for residents to allow the sitting of waste incinerators to be constructed in their neighbourhood which is within 5km. Finally, we also use the Likert scaling methodology to understand the lists of resident's risk perceptions towards the sitting of waste incinerators in Kepong.

## FINDINGS

There are 240 data being analysed. Figure 2 presents the respondents' profiles. The majority of respondents (52.5%) are female, while male respondents account for 47.5%. Besides that, most of the respondents are within the range of 21-30 (87.5%) while others are 11.7% (aged between 30 – 40) and 0.8% in the age group of 41 – 50. Moreover, most of the respondents are having less than 6 household sizes (71.3%). For the education level, most of the respondents currently have at least tertiary education (85.4%). The average income level indicates majority are those who earned less than RM 2,000 (47.1%) and RM 2,001 – RM 5,000 (31.3%). According to this demographic data, we noticed that the range of age falls under 21 - 30 which could be says that most of our respondents are young generation. The young generation's understanding of their perception is deemed important although this data seems to focus on the young respondents. However, it is understood their perspective and attention on this project are the future pillars and will decide the future development pathway of waste incinerators.

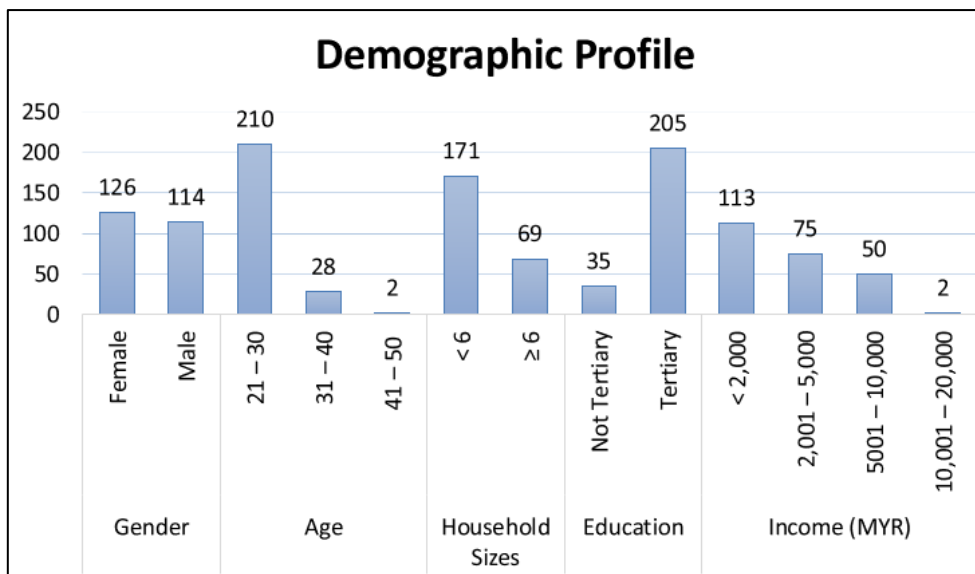


Fig. 2. Demographic Profile in Kepong

Sources: Own findings

Additionally, only 58% acknowledged that they are aware of the existence of waste incinerators. In terms of respondents' understanding towards waste incinerators, most of the respondents believe that the purpose of the waste incinerator is to burn waste (40.8%), 27.1% believe it is an alternative to landfills with a very minimal of 3.3% acknowledged the concept of waste-to-energy and still, 28.8% have no idea about the waste incinerator.

When being asked for pre-requisite conditions in supporting waste incinerators, 49.58% of respondents will reject waste incinerators if the facility is located within their vicinity. It is important to acknowledge that a trustworthy operator is evident in promoting the community acceptance of waste incinerators (n=143, 57.20%). Nevertheless, there are respondents who are likely to seek compensation for allowing the sitting of waste incinerator projects within their neighbourhood (n=125, 52.08%). In terms of concern over environmental pollution and potential health concerns, it is interesting to learn that those who agreed to ensure minimal environmental and health impact are as similar as those who disagreed. Such a result can be attributed to the fact that residents perceive a trustworthy operator will act on local benefits in minimising the impacts. Another plausible explanation is the agreement on compensation in which those who receive compensation may move out of the neighbourhood. In other words, residents may look for high compensation from them to move away from their current accommodation and neighbourhood. Figure 3 below presents the results in detail.

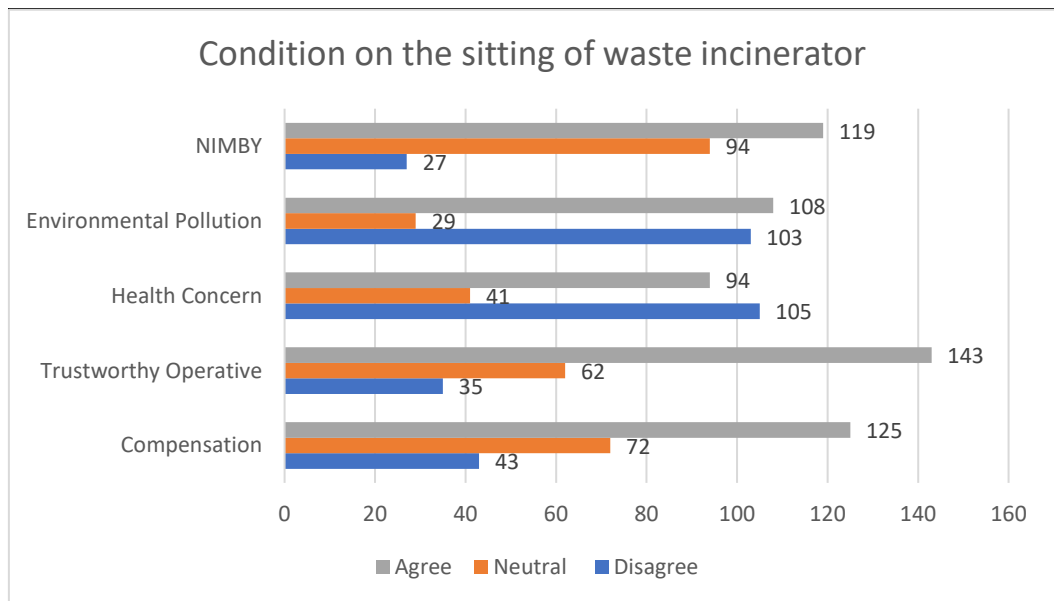


Fig. 3. Pre-requisite for residents to allow the sitting of waste incinerator

Sources: Own findings

Resident's risk perception towards the sitting of waste incinerators is tabulated in Table 1. Among others, three important concerns raised by local residents are the effect of the sitting of the waste incinerator on housing prices (38.8%), the probability of inhaling acidic gases (38.8%), and road damage that caused by the transportation of solid waste for incineration process (31.3%). For the effect on the housing price in the local residential area, respondents were concerned about their housing price for it might experience a decrease in value after the incinerators are built. It is because they believe the incinerators will cause

environmental pollution. Following this, it will have a negative impact on the resident's health, moving away from the potential buyers, and thus, experiencing a decline in their housing value. Furthermore, respondents were concerned about the potential road damage incidents. There will be more frequent waste transportation trucks using the road to transport solid waste to facilities, and it might have potential damage to the road.

Some of the nearby residents might be facing illnesses such as cancer and respiratory symptoms because of long-term exposure to the potentially hazardous emissions from the operation of waste incinerators (Sharma et al., 2013). Based on the findings, we can confirm that environmental pollution and health impact are the main concerns of respondents in shaping their risk perception towards the sitting and operation of waste incinerators.

Table 1. The lists of Resident's Risk Perception towards the Sitting of Waste Incinerator

Statements	Likert Scaling						
	Strongly Disagree	Disagree	Somehow Disagree	Neutral	Somehow Agree	Agree	Strongly Agree
Decline in housing price	3 (1.3%)	4 (1.7%)	30 (12.5%)	14 (5.8%)	50 (20.8%)	46 (19.2%)	<b>93</b> <b>(38.8%)</b>
Air pollution	18 (7.5%)	0 (0%)	11 (4.6%)	17 (7.1%)	<b>81</b> <b>(38.8%)</b>	43 (17.9%)	70 (29.2%)
Illness	0 (0%)	0 (0%)	22 (9.2%)	31 (12.9%)	38 (15.8%)	68 (28.3%)	<b>81</b> <b>(33.8%)</b>
Cleanliness of neighbourhood	2 (0.8%)	0 (0%)	24 (10%)	9 (3.8%)	65 (27.1%)	<b>71</b> <b>(29.6%)</b>	69 (28.8%)
Family members concern	0 (0%)	2 (0.8%)	24 (10%)	8 (3.3%)	43 (17.9%)	<b>88</b> <b>(36.7%)</b>	75 (31.3%)
Noise pollution	0 (0%)	2 (0.8%)	8 (3.3%)	24 (10%)	71 (29.6%)	<b>80</b> <b>(33.3%)</b>	55 (22.9%)
Unpleasant smell	4 (1.7%)	4 (1.7%)	0 (0%)	16 (6.7%)	<b>80</b> <b>(33.3%)</b>	69 (28.8%)	67 (27.9%)
Traffic congestion	0 (0%)	4 (1.7%)	0 (0%)	21 (8.8%)	<b>102</b> <b>(42.5%)</b>	41 (17.1%)	72 (30%)
Damaged on road	0 (0%)	2 (0.8%)	4 (1.7%)	50 (20.8%)	57 (23.8%)	52 (21.7%)	<b>75</b> <b>(31.3%)</b>
Negative scenic view	0 (0%)	0 (0%)	2 (0.8%)	25 (10.4%)	78 (32.5%)	<b>81</b> <b>(33.8%)</b>	54 (22.5%)
Foreign labour	0 (0%)	12 (5%)	28 (11.7%)	44 (18.3%)	<b>66</b> <b>(27.5%)</b>	60 (25%)	30 (12.5%)

Notes: Own Findings

## CONCLUSION

Community acceptance is important as it will influence the incinerator's development and construction in the future. In this study, we identify what are the concerns of residents in shaping their risk perception towards waste incinerators. This study is in line with previous studies that acknowledged risk perception as one important factor to be considered in waste incinerator implementation (Sjöberg & Rundmo, 2004; Ren et al., 2016; Siegrist & Árvai, 2020; Subiza-Pérez et al., 2020).

Furthermore, Zhou et al., 2022 also mentioned that the perception of economic benefits, trust, and fairness will cause a ripple effect on the residents that were provided by the operation of the waste incinerators. A great example based on our data showed the comparison between the risk perception and trustworthiness of the operation. Although the operations were able to minimize the damage from the facilities. However, the residents unable to accept the waste incinerators is because they must have trustworthiness in the operators for the facilities to be maintained in their neighbourhood. Besides that, the issue of the NIMBY will remain as exists although the operation teams had used technical solutions to minimize it mentioned by Di Cosmo (2023). Based on Figure 3 above, they believe that the facilities will

be continuously affecting their resident's areas and caused the NIMBY effect. Thus, the issue of the NIMBY effect was playing an important role in the community acceptance of the residents in Kepong.

Waste incinerators are one of the important technologies in solid waste management, however, the residents still reject them as the facilities will bring out a hazard and multiple risks to the locals. These facilities had the benefit and opportunities for Malaysia in achieving the United Nation's Sustainable Development Goals (SDGs). Besides that, this research study is also able to help the policymakers able to decide the correct decision with an additional perspective, community acceptance. Furthermore, the operators and stakeholders of the facilities should also be concerned about the acidic gases released and control environmental pollution. It is to build trust and connection with the locals and reduce the resident's risk perception. In such a way, the local community will be more willing to accept waste incinerators to be built in their vicinity.

Finally, the waste incinerator is a greatly technical solution to resolve our municipal waste management because it can place the landfill method in Malaysia. A landfill method is not a long-term solution to solve waste management. Although the government had introduced 3Rs (Reduce, Reuse, Recycle) concepts to minimize the volume of the waste. But still, there is some complexity in solid waste around Malaysia. The waste incinerator is a great opportunity to use municipal waste management and reach the SDGs target. Therefore, the government should consider the community's acceptance towards the setting of waste incinerators.

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#### **CONFLICT OF INTEREST STATEMENT**

I agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

#### **AUTHORS' CONTRIBUTIONS**

Han Man Lau carried out the research, wrote and revised the article. Hon-Choong, Chin conceptualised the central research idea and provided the theoretical framework. Hon-Choong, Chin and Aye Aye Khin designed the research, supervised research progress; Hon-Choong, Chin and Aye Aye Khin anchored the review, revisions and approved the article submission.

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