

# ASSESSMENT ON SUSTAINABLE INDUSTRIAL WASTE MANAGEMENT FOR A CIRCULAR AND INCLUSIVE ECONOMY



Nadee Pilot Project,  
Samut Sakhon Province,  
THAILAND



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# AN OVERALL ASSESSMENT ON SUSTAINABLE INDUSTRIAL WASTE MANAGEMENT FOR A CIRCULAR AND INCLUSIVE ECONOMY

## A. INTRODUCTION

Nadee Municipality houses registered 25,962 population (Male: 12,246 and Female: 13,716). There are 276,335 migrants in Samut Sakhon, of which 88 percent are Burmese. At least 10,000 Burmese workers are in Nadee with limited education and Thai language understanding. Key climatic and geographical features are tropical, TaChin River Basin. Key economic sector is industrial. Processing and distribution of various types of food products of Nadee Sub-district are exported to the world, so called “*Kitchen of the World*”.



The National Commission on Environment has declared the province to be a pollution control zone since 1995. Nevertheless, increasing pollution has been recorded and the province remains key a pollution hot spot till present. Nadee City is characterized by a large number of factories (616), 90% SMEs (540), inefficient users of water and substantial polluters.

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is jointly implementing the project “Localizing the 2030 Agenda through a Sustainable Urban Resource Management (SURM) approach” in five pilot cities in the Asia-Pacific region – Nadee (Samut Sakhon Province) in Thailand, Ulaanbaatar in Mongolia, Battambang in Cambodia, Naga City in the Philippines, and Nasinu City in Fiji. In 2015, UN member States as part of the 2030 Agenda for Sustainable Development agreed on 17 Sustainable Development Goals (SDGs) to be achieved globally within 15 years. The objective of this project is to strengthen the capacities of local governments and other key urban stakeholders to implement the 2030 Agenda in the area of urban resource management by minimizing the negative and maximizing the positive environmental, social, and economic impacts of urban consumption and production systems. Between 2019-2021, stakeholders from different constituencies in Nadee have been working together to design and implement innovative solutions that can leverage policy and institutional change for Sustainable Urban Resource Management (SURM).

Summary of key activities and milestones for Nadee:

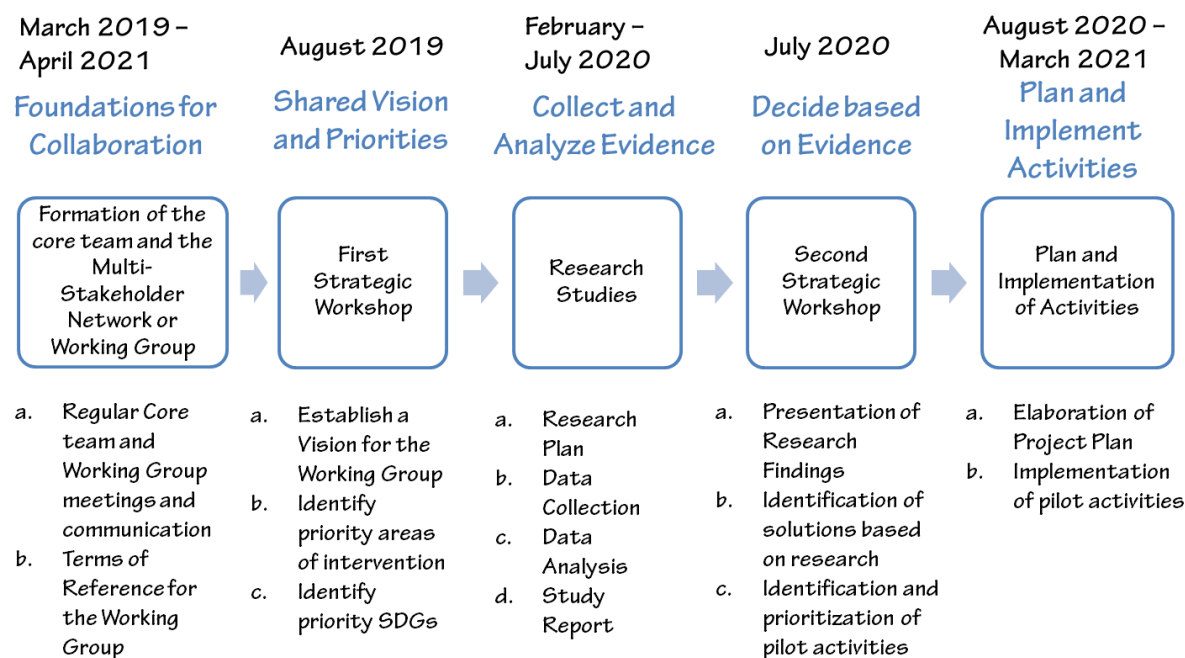
March 2019 – July 2019 Stakeholder Engagement – Formation of core team and the Terms of Reference for the Committee; Stakeholder analysis and outreach; Rapid Baseline Assessment

August 2019 First Workshop: Strategic Planning – Establish a Vision for the Working Group; Identify priority areas of interview

October 2019 – July 2020 Stakeholder Engagement – Core team and Working group meeting; Site Visit; Communication

December 2019 – July 2020 Evidence and Research Plan - developed methodologies and tools for data collection; Data Collection and Analysis

## Key Project Activities & Milestones (2019-2021)



The First Strategic Planning Workshop of the Sustainable Urban Development Committee of Nadee Sub-district provided a solid foundation for an effective public-private partnership that jointly planned and implemented innovative solutions on solid and liquid waste management in Nadee Sub-district. The first workshop had approximately 40 participants, including representatives from the city and national governments, civil society and communities, academia and research institutions, the private sector, and development partners. The representatives identified strategies on capacity development, policy and plan making, and awareness raising that can create an enable environment for sustainable urban resources management in Nadee.

### B. MULTI-STAKEHOLDER WORKING GROUP

The Multi-stakeholder Working Group for Nadee’s Sub-district Municipality has been established in July 2019. The Working Group is to facilitate greater collaboration and exchange of ideas between Nadee’s sub-district Municipality and the public with respect to water management, solid waste management, industrial pollution, and livelihoods. The first meeting of the Working Group was organized on October 9, 2019. Key resolutions of the first meeting are that (i) appropriate technology and management in waste and application of circular economy are essential for planning and implementation of pilot projects, (ii) key information/database are needed to form a baseline, identify hotspot areas of waste, and select priority areas for pilot projects.

With limited resources of the research, in response to the key resolutions of the Working Group, data collection and analysis shall be undertaken with focus on the value chain of industrial solid waste and environmental monitoring system and capacity, to provide responses for three main questions identified by the core team.

Three main questions:

(a) What is the institutional landscape regarding environmental management and monitoring support data collection on water quality and waste disposal in Nadee subdistrict area?

(b) What are barriers/problems against, and opportunities on the value chain of industrial waste in the food & beverage, cold storage and textile industries in Nadee subdistrict area within a circular economy framework?

(c) To what extent local private sector and local government agencies can manage and monitor industrial waste, and what are interventions to increase their capacity for data collection and data usage on environmental management and monitoring?

### **C. PLANNED OUTPUTS**

1) Identify policy recommendations to Nadee Municipality regarding environmental management and monitoring by the review of relevant policies, regulations, or plans, according to authorities and experts in the field;

2) Provide a clear overview of the institutions, policies, plans, or regulations affecting industrial waste management of Nadee's Sub-district Municipality, including information on main gaps.

3) Provide three examples of good practices on policy change in the Asia-Pacific Region that helped to improve industrial waste management based on the concept of circular economy;

### **D. ASSESSMENT AREAS**

The research assessment includes three main areas:

- Assessment A: Material Flow Analysis of Industrial Waste Management in Nadee City
- Assessment B: Analysis of Institutional Capacity and Needs of Private Sector and Government Agencies in Industrial Waste Management and Monitoring for Circular Economy in Nadee City
- Assessment C: Policy Analysis and Recommendations to Nadee Sub-district Municipality

## E: FINDINGS

Root of causes/ barriers/problems against the value chain of industrial waste	Management Approaches	Operational Guidelines	Recommendation on operation plan
<p>1. <b>Limited information and skills</b> to reuse, recycle industrial waste, and collection &amp; resale units for SMEs</p>	<ul style="list-style-type: none"> <li>• Developing database and information system available at Nadee City</li> <li>• Building capacity of SMEs and increase monetary incentives for waste separation</li> <li>• Information linkages with agricultural and other industrial sectors</li> </ul>	<ul style="list-style-type: none"> <li>• Developing database and information system of reuse and recycle industrial waste, collection &amp; resale units including linkage/updating system both in Nadee and beyond</li> <li>• Training/seminars/workshop on 3 R linking to circular economy within sectors (food &amp; beverage, cold storage and textile industries) targeting to SMS, organized by Nadee Municipality, private sector, industrial organizations/ agencies, and agricultural organizations and agencies. Some relevant topics include recyclable waste for plastic material and organic waste for fertilizer</li> </ul>	<ul style="list-style-type: none"> <li>• The Sustainable Urban Development Working Group for Nadee Subdistrict should follow up developing database and information system of reuse and recycle industrial waste, collection &amp; resale within 8 months</li> <li>• The Sustainable Urban Development Working Group for Nadee Subdistrict should coordinate with Nadee Municipality to organize training/seminars/workshops with Samut Sakhon Industrial Provincial Office and Samut Sakhon Agricultural and Agricultural Co-operative Provincial Office within 6 months</li> </ul>
<p>2. Lack of <b>decision-making tools and criteria</b> to select efficient and feasible skills and innovation on waste management based on 3 R for both</p>	<ul style="list-style-type: none"> <li>• Compilation of efficient and feasible skills and innovation by industrial sector</li> <li>• Consultation for each industrial sector to share information across sectors</li> </ul>	<ul style="list-style-type: none"> <li>• Developing a pilot cluster/networking of similar waste management to practice decision-making tools and criteria to select efficient and feasible skills and innovation with concrete action plan and evaluation with the support of</li> </ul>	<ul style="list-style-type: none"> <li>• The Sustainable Urban Development Working Group for Nadee Subdistrict should develop a pilot cluster/networking within 1 year.</li> <li>• The Sustainable Urban Development Working Group</li> </ul>

<p>government and private sectors</p>	<ul style="list-style-type: none"> <li>• Developing clusters/ networking of similar waste management, e.g. food &amp; beverage, cold storage and textile industries to share knowledge and experience</li> <li>• Site visits of similar waste management to learn from good practices</li> </ul>	<p>compilation and consultation as well as site visits.</p> <ul style="list-style-type: none"> <li>• Dissemination of lesson learned of a pilot cluster/networking</li> </ul>	<p>for Nadee Subdistrict should disseminate lesson learned after 1 year.</p>
<p>3. No clear, simple and timely practices and the <b>regulations’ permits and procedures guidelines</b> for enterprises to supply industrial waste to community-based organizations/ social enterprises/ agriculturists/ agricultural cooperatives for reuse/recycle waste</p>	<ul style="list-style-type: none"> <li>• Developing clear, simple and timely practices and guidelines for enterprises (different sizes due to different requirements) and community-based organizations/ social enterprises/ agriculturists/ agricultural cooperatives for reuse/recycle waste</li> <li>• Developing a specific organic waste and reuse/ recycle waste collection system and a waste transit center in Nadee City</li> <li>• Linkages between reuse/recycle industrial</li> </ul>	<ul style="list-style-type: none"> <li>• Developing a manual/guideline by Samut Sakhon Industrial Provincial Office, Nadee Municipality, and other related agencies, based on consultation meeting with enterprises and community-based organizations/ social enterprises/ agriculturists/ agricultural cooperatives for reuse/recycle waste. Nadee Municipality may enact local regulations to facilitate the flow of waste management</li> <li>• Nadee Municipality should establish a specific organic waste and reuse/recycle waste collection system, especially from SMEs and a waste transit center for community-based organizations/ social enterprises/</li> </ul>	<ul style="list-style-type: none"> <li>• Samut Sakhon Industrial Provincial Office, Nadee Municipality, and other related agencies, should develop a manual/guideline, based on consultation meeting with enterprises and community-based organizations/ social enterprises/ agriculturists/ agricultural cooperatives for reuse/recycle waste within 6 months.</li> <li>• Nadee Municipality may enact local regulations to facilitate the flow of waste management after 1 year.</li> <li>• Nadee Municipality should establish a specific organic waste and reuse/recycle</li> </ul>

	<p>waste with local producers/students/others</p> <ul style="list-style-type: none"> <li>• Linkages between industrial waste management of Nadee City and other nearby cities</li> <li>• Developing performance indicators related to waste management</li> </ul>	<p>agriculturists/ agricultural cooperatives</p> <ul style="list-style-type: none"> <li>• Promotion of regular online markets/applications to link between sources/types of reuse/recycle industrial waste with local producers/ students/ others</li> <li>• Nadee Municipality considers signing MOU on industrial waste management with nearby local government agencies and enterprises</li> <li>• Nadee Municipality and the Multi-stakeholder Working Group should develop key performance indicators (KPIs), monitoring and evaluation related to waste management (align to the national action plan between 2016-2022). Key indicators should include per centage of standard waste collection, per centage of treated waste in the sanitation way, per centage of separated waste from sources, and per centage of treated industrial waste.</li> </ul>	<p>waste collection system, especially from SMEs within 10 months.</p> <ul style="list-style-type: none"> <li>• The Sustainable Urban Development Working Group for Nadee Subdistrict should promote regular online markets/applications to link between sources/types of reuse/recycle industrial waste with local producers/ students/ others within 1 year.</li> <li>• Nadee Municipality considers signing MOU on industrial waste management with nearby local government agencies and enterprises within 2 years.</li> <li>• Nadee Municipality and the Multi-stakeholder Working Group should develop key performance indicators (KPIs), monitoring and evaluation related to waste management (align to the national action plan between 2016-2022) within 1 year.</li> </ul>
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## **F. FINDINGS ON GENDER EQUALITY AND PRO-POOR AS CROSS-CUTTING ISSUES**

Cross cutting issues are taken into account because the Rapid Baseline Assessment Study conducted by UN-ESCAP and Local Coordinator in 2019 pointed out that there are 293,577 remaining international migrant workers in Samut Sakhon Province. 238,678 people (81.30%) were legal immigrants and 54,899 illegal immigrants (18.70%) (Data from 31 Dec. 2017). The labour demand in Samut Sakhon Province is an important factor that attracts migrant workers. The province is one of the nation's most important fishing business centres. The work is considered physically demanding, dirty and smelly. Employment is usually engaged on a subcontracting or seasonal basis, leading to a high turn-over rate and labour shortages. As a consequence, the government has allowed illegal migrant workers from Burma, Laos, and Cambodia a temporary stay in the province since 1996. These workers include those with a good standard of occupational safety and health together with a good welfare system, as well as those with little or no standard of cleanliness and social welfare.

- **GENDER EQUALITY**

Due to the type of labour intensive enterprises, enterprises require unskilled and semi-skill migrant workers. Project Consultants and Researchers have observations and interviews with enterprises in relation to gender equality in July 2020. They pointed out that most enterprises prefer to hire and train male workers for any work or task related to machinery. Thus, male workers tend to get higher wages than female workers. However, male workers encounter higher risks from machinery work/task than female workers.

Female workers show higher interest in waste management. Female workers have been trained in recycled handicraft or organic fertilizer from industrial waste, they may earn more additional income than male counterparts. In addition, they have better knowledge and skill to apply on community garbage separation, reuse, and recycle. These participation and contribution of female workers at factory and community have been taken for granted without recognition and reward.

Therefore, Project Consultants and Researchers suggest holding further discussions with both male and female workers. Some activities such as garbage bank, growing vegetables for cooking, handicraft of recyclable waste should be developed in order to provide recognition and reward for female workers. These activities will promote their female profile by earning additional income for household and by new leading roles in environmental conservation in the factory and in the community. After the success of these activities, the Municipality can establish environmental volunteer groups of female migrant workers so they will become community leaders and key change agent for policy change on waste management in Nadee city later.

At management and skilled level, most office-based task/work such as administrative and human resource predominantly are for Thai female workers. Most mechanical and technology-based work/tasks predominantly are for Thai male workers. Thus, most high-level management positions are predominantly male workers and there is a gap of wage between female and male workers. The detailed study needs to confirm this observation.

- **PRO-POOR on MIGRANT WORKERS**

According to the database conducted by EARTH Foundation and supported by Canada Fund Local Initiatives (CFLI) in 2019, most migrant with low skills and education workers cannot read and write Thai and have very limited free time. Some migrants directly expose to contamination of industrial pollution

at workplace and reside in sub-standard rental units with minimal sanitation and facilities. Their concerned health risks included long standing working condition, heavy lifting, exposure to metal melting, crowded living environment and limited rest time.

Project Consultants and Researchers made observations and gave interviews with enterprises in relation to migrant workers in July 2020. They found that Myanmar foreman or head of unit/task can play a role of interpreter and leader on waste management and safety practices. They have general knowledge and understanding on garbage separation and participate in this activity with their companies. Thus, regular training of master trainers for Myanmar foreman or head of unit/task will be essential to increase knowledge/practices for Myanmar migrant workers. Material both hard copy and online will be good reference for their practices. Incentives in the form of additional income and acknowledgement of their work in their companies can be introduced. The detail discussion with Myanmar foreman or head of unit/task should be held to confirm the observations and to identify their needs and condition.

- **RESILIENCE OF COMMUNITY**

Nadee City has occasionally faced flooding in some small parts of the City in some years so Nadee Municipality and multi-stakeholders do not take it seriously and consider it to be a significant problem.

### **G. FINDINGS ON RELEVANT SURM-RELATED SDGs ALIGNMENT**

This preliminary finding is analyzed from the perception survey to measure the level of contribution of the company/organization in achieving select Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. The questionnaire and the interview have been used to understand the perception of the national government, regional and provincial government and the private sector in Nadee city.

The respondents from different sectors showed the different level of perception in terms of rating their contributions to relevant SURM-related SDGs Alignment. Each stakeholder responded based on his/her scope of work, authority, and resources of his/her department/ministry/office only without integration and collaboration with other related offices and multi-stakeholders as details discussed in the study on Policy Change. The detailed respondents are as follows:

(i) *Private sector* - the food, beverage, cold storage, and textile industries in the Nadee Sub-district Municipality

<u>Target Goal No.3</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 3.3	Treat wastewater before emit to environment effect to reduce water-borne diseases and other communicable diseases.	significant and moderate contribution

Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 3.4	Prevention and treatment solid waste/ wastewater and promote mental health and well-being.	moderate contribution
<u>Target Goal No. 6</u>		
Target Goal No. 6.3	Participation and support the reduction of industrial wastewater, as well as promoting water quality / water resources	high and very high contribution
Target Goal No. 6.4	Improving water use efficiency and reducing water use.	significant and moderate contribution
<u>Target Goal No. 9</u>		
Target Goal No. 9.4.1	Implementation of this goal, especially the change in the use of renewable energy in reducing CO <sub>2</sub> emission  However, they still lack technical, knowledge and funds.	moderate contribution
<u>Target Goal No. 14</u>		
Target Goal No. 14.1	Implementation of wastewater reduction and solid waste reduction from land-based activities, contributing to the reduction of pollution emission into the sea/oceans	moderate contribution
<u>Target Goal No. 11</u>		
Target Goal No. 11.6.1	Reducing solid waste generation and increasing recycling practices	very significant and significant contribution
Target Goal No. 11.6.2	Reduction of dust or fine particulate matter in cities, such as the use of energy in production process that generates less amounts of dust	moderate contribution

Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 11.7	Provision of universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.	no contribution because it will not comply to the standard of exporting food industry
<u>Target Goal No. 12</u>		
Target Goal No. 12.4.2	Reduction of hazardous waste	significant contribution
Target Goal No. 12.5.1	Increase of recycling rate and material recycled such as waste separation and waste disposal by 3Rs	very significant contribution
Target Goal No. 12.6.1	publishing the sustainability reports. Only few of large-scaled firms have this contribution.	Limited contribution

(ii) Local government agency: Nadee sub-district Municipality, Samut Sakhon province

<u>Target Goal No. 3</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 3.3	Policy and implementation to reduce water-borne diseases and other communicable diseases.	significant contribution
Target Goal No. 3.4	Policy and implementation to prevention and treatment solid waste/ wastewater and promote mental health and well-being.	significant contribution
<u>Target Goal No. 6</u>		
Target Goal No. 6.3	Support of the reduction of industrial wastewater	significant contribution
Target Goal No. 6.4	Improving water use efficiency and reducing water use	moderate contribution
<u>Target Goal No. 9</u>		
Target Goal No. 9.4.1	Regular monitoring the factories and responses to people/community's complaint, as well as promoting water quality / water resources in reducing CO <sub>2</sub> emission	moderate contribution

<u>Target Goal No. 14</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 14.1	Implementation of wastewater reduction and solid waste reduction from land-based activities has contributed to the reduction of pollution emission into the sea/oceans	moderate contribution
<u>Target Goal No. 11</u>		
Target Goal No. 11.6.1	Reducing solid waste generation and increasing recycling practices, such as to promote waste separation in communities / schools, project to promote composting from vegetables, vegetables, and fruits	very significant contribution
Target Goal No. 11.6.2	Reduction of air pollution in cities, through to raise awareness about environmental participation and pollution reduction.	moderate contribution
<u>Target Goal No. 12</u>		
Target Goal No. 12.4.2	Reduction of hazardous waste	moderate contribution
Target Goal No. 12.5.1	Increase of recycling rate and material recycled such as waste separation and waste disposal by 3Rs	moderate contribution
Target Goal No. 12.6.1	Publishing the sustainability reports	No contribution

(iii) *Provincial agency:* Provincial Office for Natural Resources and Environment Samut Sakhon,

<u>Target Goal No. 3</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 3.3	Support implementation to reduce water-borne diseases and other communicable diseases.	moderate contribution

Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 3.4	Support implementation to prevention and treatment solid waste/ wastewater and promote mental health and well-being.	moderate contribution
<u>Target Goal No. 6</u>		
Target Goal No. 6.3	Support the reduction of solid wastewater such as setting up a committee for water quality management in Samut Sakhon province, promoting water quality/ water resources i.e. establishing a network for water quality surveillance/ public relations campaigns and promoting a community-based wastewater treatment system.	significant contribution
Target Goal No. 6.4	improving water use efficiency and reducing water use	moderate contribution
<u>Target Goal No. 9</u>		
Target Goal No. 9.4.1	reducing CO <sub>2</sub> emission	Moderate contribution
<u>Target Goal No. 14</u>		
Target Goal No. 14.1	Campaigning to reduce waste from the beginning using the 3R principle, also supporting academic information on solid waste management in order to reduce waste emissions into the oceans	Very significant contribution
<u>Target Goal No. 11</u>		
Target Goal No. 11.6.1	Reducing solid waste generation and increasing recycling practices	very significant contribution
Target Goal No. 11.6.2	Working as a secretary of the provincial committee including monitoring and reporting on the results of air pollution quality control	very significant contribution

Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 11.7	Provision of universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	no contribution
<u>Target Goal No. 12</u>		
<i>Target Goal No. 12.4.2</i>	<i>Reduction of hazardous waste by for providing/contributing knowledge about the separation of community hazardous waste</i>	<i>significant contribution</i>
<i>Target Goal No. 12.5.1</i>	<i>Increase of recycling rate and material recycled waste</i>	<i>significant contribution</i>
<i>Target Goal No. 12.6.1</i>	<i>Publishing the sustainability reports</i>	<i>No contribution</i>

*(iv) Regional agency, Regional Environmental Office 5, Ministry of Natural Resources and Environment*

<u>Target Goal No. 3</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
<i>Target Goal No. 3.3</i>	<i>Reduce water-borne diseases and other communicable diseases.</i>	<i>No contribution</i>
<i>Target Goal No. 3.4</i>	<i>Prevention and treatment solid waste/ wastewater and promote mental health and well-being.</i>	<i>No contribution</i>
<u>Target Goal No. 6</u>		
<i>Target Goal No. 6.3.1</i>	<i>Reducing wastewater pollution by monitoring the sewerage of pollution sources and enforcing compliance with the National Environmental Quality Act, 1992 on the promotion and conservation of water. Also establishing guidelines and technical advice on wastewater treatment, including relevant laws for enterprises and local government organizations.</i>	<i>Significant contribution</i>

<i>Target goals</i>	<i>Perception of target goals</i>	<i>Rating his/her contribution to relevant SURM related SDGs alignment</i>
Target Goal No. 6.3.2	Promoting water source quality by monitoring and assessing water quality in the Tha Chin River and its tributaries, including critical water resources including a real-time water pollution alerts and supporting information for water quality management at the local level	Very significant contribution
Target Goal No. 6.4	improving water use efficiency and reducing water use.	No contribution
<u>Target Goal No. 9</u>	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	No contribution
<u>Target Goal No. 14</u>	Conserve and sustainably use the oceans, seas and marine resources for sustainable development.	No contribution
<u>Target Goal No. 11</u>		
Target Goal No. 11.6.1	Reducing solid waste generation and increasing recycling practices by supporting the local administrative organizations at the regional level in accordance with the national roadmap for solid waste and hazardous waste management, as well as supporting according to the national master plan for solid waste and hazardous waste management	significant and moderate contribution
Target Goal No. 11.6.2	Reduction of dust or fine particulate matter in cities	moderate contribution
Target Goal No. 11.7	Provision of universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	moderate contribution
<u>Target Goal No. 12</u>		
Target Goal No. 12.4.2	Reduction of hazardous waste	No contribution
Target Goal No. 12.6.1	Publishing the sustainability reports	No contribution



Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 12.5.1	Increase recycling rate and material recycled waste	moderate contribution

(v) *National agency*, Office of Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment

<u>Target Goal No. 3</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 3.3	Reduce water-borne diseases and other communicable diseases.	No contribution
Target Goal No. 3.4	Prevention and treatment solid waste/ wastewater and promote mental health and well-being.	No contribution
<u>Target Goal No. 6</u>		
Target Goal No. 6.3.1	Improving water quality by reducing pollution, such as establishing the standards for industrial sewerage control, and monitoring the wastewater treatment system together with the community, and the regional environment Offices	significant contribution
Target Goal No. 6.3.2	Preparing action plans for river basin water quality enhancements in line with the 20-year water resource management master plan of Thailand in 25 watersheds.	significant contribution
Target Goal No. 6.4	Promoting water-use efficiency	No contribution
<u>Target Goal No. 9</u>		
Target Goal No. 9.4.1	Reduction of CO <sub>2</sub> emission	No contribution
<u>Target Goal No. 14</u>		
Target Goal No. 14.1	Reducing marine pollution through the roadmap for plastic waste management	moderate contribution

<u>Target Goal No. 11</u>		
Target goals	Perception of target goals	Rating his/her contribution to relevant SURM related SDGs alignment
Target Goal No. 11.6.1	Defining national indicators such as percentage of waste generated to properly disposed'; cooperating with local administrative organizations in the target areas, formulating an action plan to solve pollution from solid waste or incorrect waste management; and establishing of national waste management master plan (2016 - 2021)	significant contribution
Target Goal No. 11.7	Provision of universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	Limited contribution
<u>Target Goal No. 12</u>		
Target Goal No. 12.4.2	Reduction of hazardous waste related by establishing environmental management measures for waste products, electrical appliances and electronic equipment, including the determination of measures and conditions for importing electronic waste and scraps of plastic	significant contribution
Target Goal No. 12.5.1	Promotion of material recycling such as preparation of a Roadmap for plastic waste management (2018 – 2030), and (draft) action plan for plastic management phase 1 (2020-2022).	Very significant contribution



# Findings on Material Flow Analysis of Waste Management in Nadee City

# Material Flow of Industrial Waste Management in Nadee City

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## A. OBJECTIVES OF THE STUDY:

- 1) To collect baseline data on waste disposals from industrial sectors, including (a) waste types, (b) quality, (c) quantity, (d) current solution.
- 2) To evaluate a possibility of waste management/solutions applicable to private sectors in the value chain of in the food & beverage, cold storage and textile industries in Nadee city for circular economy

## B. METHODOLOGY:

(i) The data of wastes was collected from Samut Sakhon Provincial Industrial Office. The secondary data is an averaged value from 3-year data (1 Jan. 2017 – 1 Jan. 2020). Although the Ministry of Industry has categorized wastes to 19 groups, the wastes in Nadee district were in only 17 groups, excluding code 09 (photographic industry) and code 18 (human and animal health care). Based on the recorded data by 683 industries, most industries generated wastes from packaging process. Factories generating packaging wastes were 223 industries or 32.7% (Figure 1). However, the highest number of industries generating wastes from packaging process did not contribute to the largest amount of wastes among total industrial wastes in Nadee.

(ii) Composition, types and waste disposal and management were summarized from interviewed factories.

There are 14 Respondents factories from private sectors in the food & beverage, cold storage and textile industries in Nadee city. For the interview, there are 2 factor owner, 13 factor managers or assistant managers or foreman, 6 factory workers was being interviewed.

## C. ASSESSMENT FINDINGS:

The data of industrial wastes was collected from Samut Sakhon Provincial Industrial Office. The present data is an averaged value from 3-year data (1 Jan. 2017 – 1 Jan. 2020). Although the ministry of industry has categorized wastes to 19 groups<sup>1</sup>, the industrial wastes in Nadee district were 17 groups, excluding code 09 (photographic industry) and code 18 (human and animal health care). Based on the recorded data by 683 industries<sup>2</sup>, most industries generated wastes from packaging process. The number of industries who generated packaging wastes was 223 industries or 32.7% (Figure 1). However, the

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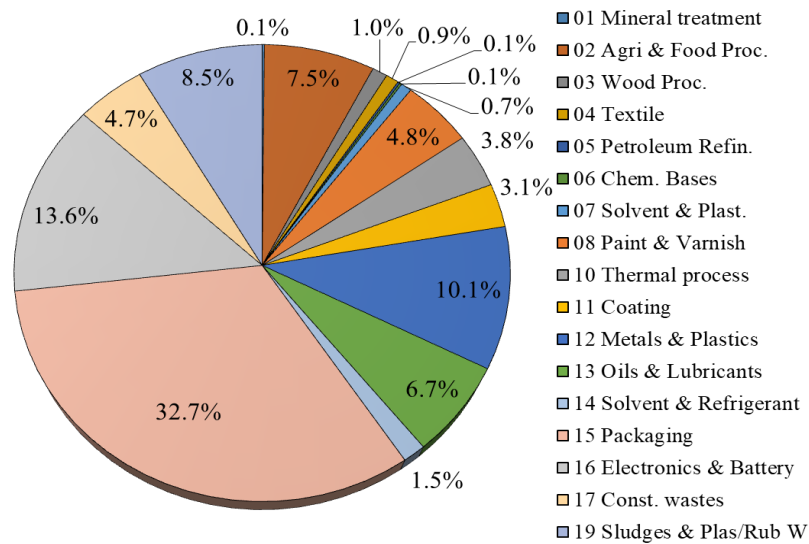
<sup>1</sup> Department of Industrial Works ([www.diw.go.th/iwmb](http://www.diw.go.th/iwmb))

<sup>2</sup> Appendix 1

highest number of industries generating wastes from packaging process did not contribute to the largest amount of wastes among total industrial wastes in Nadee.

The total quantity of wastes was annually 93,585.86 ton<sup>3</sup>. The amount of wastes from food processing (i.e., code 02) was highest, responsible for 65,119.87 ton/y. The wastes from food processing were accounted for 69.6% of the total wastes (Figure 2). The second highest was wastes from shaping and treatment of metals and plastics, responsible for 8,346.27 ton/y or 8.9% of the total wastes. The third type was wastes from waste management facilities such as wastewater treatment processes. Wastes from waste management facilities contributed to 7.3% of the total wastes. Others were less than 5%.

Among 8 methods for industrial waste management defined by the Department of Industrial Works (DIW)<sup>4</sup>, the method of waste management in Nadee district was 7 methods, including sorting, reuse, recycle, recovery, treatment, disposal, and others. There were two major methods, others and recycle, that were mostly used for waste management (Figure 3). Most of wastes were used as raw materials for production of soil amendment and animal feed, in which classified as other methods. This method was used for handle of wastes by 41.2% of the total wastes. The secondly popular method was recycle, which the fraction was 40.2%. For the recycle method, wastes were used for other beneficial purposes and blending fuel.



**Figure 1** Fraction of industrial numbers generating wastes in Nadee District

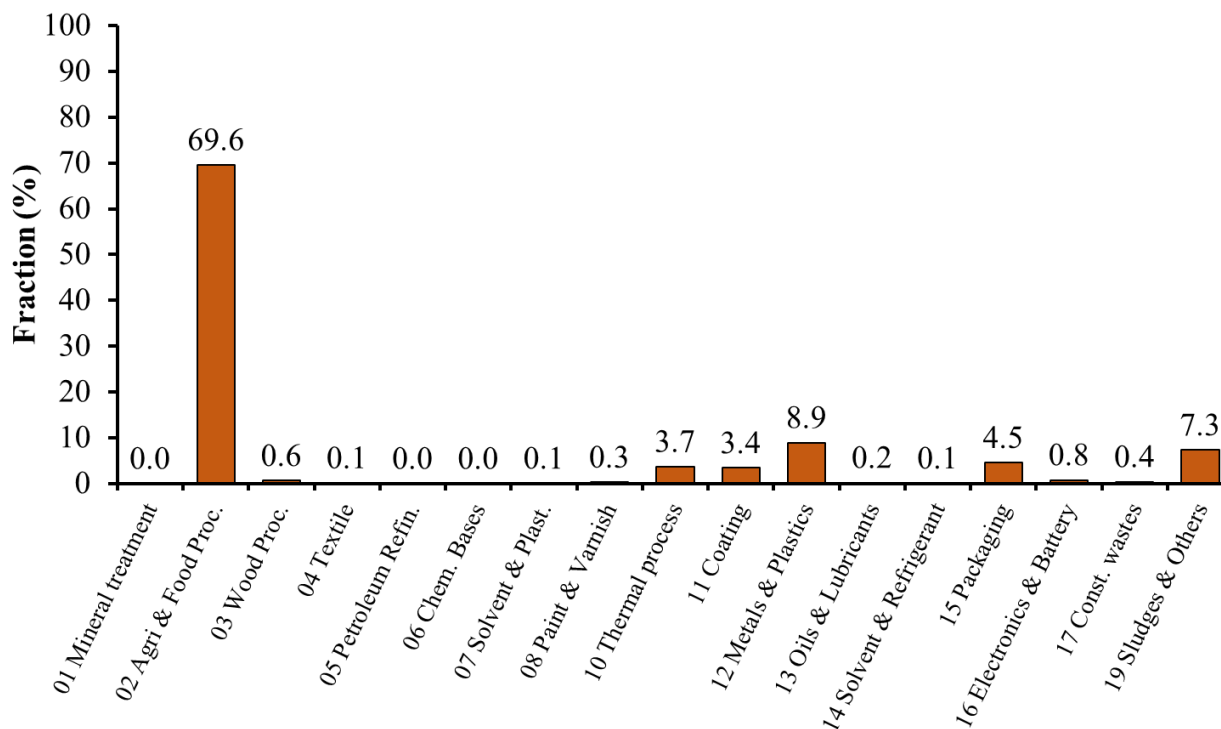
(Average data from 1 Jan 2017 – 1 Jan 2020)

Source: Samut Sakhon Provincial Industrial Office, 2020

<sup>3</sup> Appendix 2

<sup>4</sup> A handout of permission for industrial waste transport

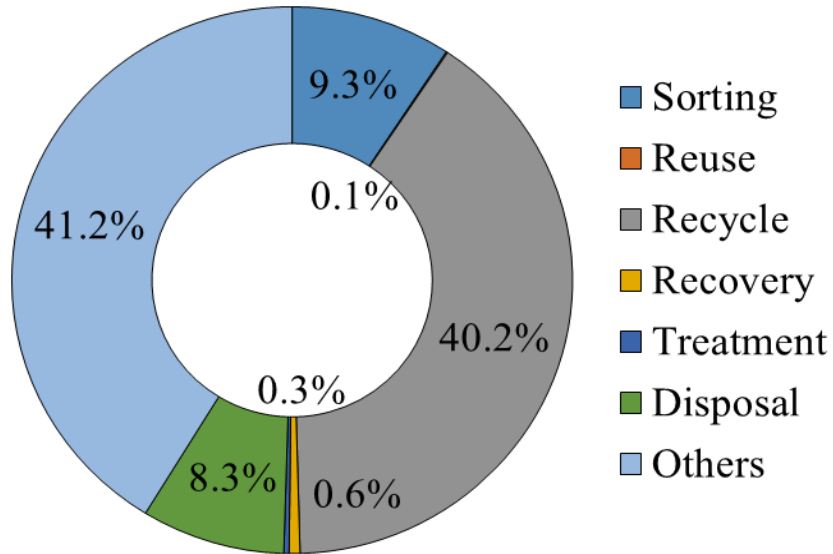
(<https://www.diw.go.th/km/factory/pdf/%E0%B8%84%E0%B8%B9%E0%B9%88%E0%B8%A1%E0%B8%B7%E0%B8%AD%E0%B8%AD%E0%B8%AD%E0%B8%99%E0%B8%B8%E0%B8%8D%E0%B8%B2%E0%B8%95%E0%B8%99%E0%B8%B3%E0%B8%81%E0%B8%B2%E0%B8%81.pdf>)



**Figure 2** Wastes fraction from Nadee Sub-District (Average data from 1 Jan 2017 – 1 Jan 2020,

Source: Samut Sakhon Provincial Industrial Office, 2020

The annually disposed waste was 7,649.5 ton, in which 84% of this fraction was transported to sanitary landfill (6,420.46 ton). Since sanitary landfill induces not only dissatisfaction of neighborhoods but also loss of land use for food crops, the Ministry of Industry (Thailand) has encouraged an industry to minimize this fraction several years. In addition, most of wastes in sanitary landfill can be utilized as raw material for other beneficial application, if the wastes are handled properly. The top three waste types were sludge from effluent treatment, ash from combustion plant, and biological sludge without hazardous substances. The summation of the three wastes was 4,537.76 ton, which accounted for 71% of total wastes transported to sanitary landfill. **Therefore, principle of 3Rs (Reduce, Reuse, Recycle) should be promoted in order to serve the circular economy.**



**Figure 3** Fraction of waste management

**D. CURRENT PRACTICES OF WASTE MANAGEMENT ACCORDING TO 3R PRINCIPLES BY 14 INTERVIEWED FOOD, BEVERAGES, COLD STORAGE AND TEXTILES INDUSTRIALS IN JULY 2020**

A survey on a current practice of waste management was conducted with industrial groups of food, beverages, cold storage and textile sectors. The summary of waste management is shown in Table 1 in Section D.

Hazardous waste

Types of waste	Waste disposal methods	Current practices of waste management	Recommendation
Empty containers contaminated with chemicals	Reuse	- reuse the container, refilled	A silo container should be used in order to minimize the use of chemical containers
Rag contaminated chemicals	Recycle	- fuel blending	A good practice/management may be implemented in a production process in order to minimize amount of wastes.

Non-Hazardous waste

Types of waste	Waste disposal methods	Current practices of waste management	Recommendation
Used vegetable oil	Recycle	- use as fuel substitution or combustion for energy recovery	The reduce practice should be prioritized to implement for reducing amount of oil. The used oil may also recycle for production of soap. However, the quality of used oil should be monitored, and a permission document should be applied to the Department of Industrial Works (DIW)
Used engine oil	Recycle	- use as fuel substitution or combustion for energy recovery - other recycle methods	The reduce practice should be prioritized to implement for reducing amount of oil. The used engine oil can also be used as raw material for asphalt production.
Flour crumb, bread crumb, vegetable crumb	Reduce	- design of production process to minimize waste	Example: setting target of maximum waste loss in the production line
	Reuse	- animal feed in agriculture sector	
	Recycle	- use as raw material for animal feed industries	
Meat fragments such as fish fillets, fish scraps, shrimp crust	Reduce	- design of production process to minimize waste	Example: setting target of maximum waste loss in the production line, designing table or tools for slicing meat to minimize loss
	Reuse	- animal feed in agriculture sector	
	Recycle	- use as raw materials for animal feed factories (fish meal), other types of food factories	
Malt scrap	Reuse	- animal feed in agriculture sector	Current management is good enough since the product quality has to maintain



Types of waste	Waste disposal methods	Current practices of waste management	Recommendation
Plastic/plastic scrap	Reduce	- sorting - design of production process to minimize waste	Example: changing plastic packaging to minimize wastes, redesign the process to minimize loss
	Recycle	- recycle and manufacture into other products	
Used rubber gloves	Reduce	- sorting - reduce with management procedures	Use the glove with only a necessary hand that contacts a food product. Also, the single-side-hand glove can be purchased when ordering the large amount. This purchasing management will reduce the amount of gloves and expenses.
	Recycle	- recycle and manufacture into other products	
Paper box/Paper scrap	Reduce	- sorting - reduce with management procedures	Purchasing the A4 paper without the box container can reduce the paper waste.
	Recycle	- recycle and manufacture into other products	
Broken glass	Recycle	- use as co-material in cement kiln or rotary kiln	The source of broken glass should be monitored and developed to reduce the waste.
Damaged power cord / telephone cord	Reduce Recycle	- sorting	A container to separate scrap should be provided in the production process.
Steel scrap		- recycle and manufacture into other products	
Copper scrap			
Stainless steel scrap			
Bottle cap	Reduce	- sorting	The sorting method should be promoted in order to reduce the contaminated bottle cap.
	Recycle	- recycle and manufacture into other products	
Vehicle tires	Reduce	- sorting	The sorting method should be promoted
	Recycle	- recycle and manufacture into other products	The tires can be used as raw material for asphalt production.

Rag or glove contaminated with oil treatment systems	Recycle	- fuel blending	Current management is good enough
Types of waste	Waste disposal methods	Current practices of waste management	Recommendation
Oil filter	Recycle	- fuel blending	Current management is good enough
Beverage glass bottle	Reuse	- reuse container; to be refilled	The sorting method should be promoted
	Disposal	- secure landfill	- use as co-material in cement kiln or rotary kiln
Rope scrap	Reuse	- reuse to be other products	The sorting method should be promoted
Non hazard rag	Disposal	- sanitary landfill	- reuse to other products
Sludge from wastewater treatment systems	Recycle	- composting or soil conditioner	A drying process should be applied to reduce the amount of sludge
Fat sludge from wastewater	Recycle	- use as raw materials for animal feed factories	The source of fat in wastewater should be investigated to minimize the contamination. Also, the wastewater treatment system can modify to reduce the sludge volume.
Sludge/ ash	Disposal	- sanitary landfill	The sludge/ash can be used for composting/soil conditioner. However, the quality should be monitored.

## E. KEY RECOMMENDATIONS:

Principle of 3Rs<sup>5</sup> should be implemented to minimize amount of wastes that goes through sanitary landfill. The 3Rs principle is similar to the waste hierarchy that is the evaluation process of waste (resource) management from most favorable to least favorable actions. Among 3Rs, a step of waste reduction (Reduce) is highest preferential, followed by Reuse and Recycle, respectively. To apply 3Rs principle for management of Nadee's industrial wastes, each step is recommended as below:

### 1) Reduce

Public participation in the waste reduction should be prioritized in order to minimize an amount of wastes. Also, a production or on-site activity may be modified in order to reducing quantity of sludge and ash. An example, practice can be minimization of waste loading to the effluent treatment plant,

<sup>5</sup> A handout of 3Rs for industrial waste management

([http://www2.diw.go.th/iwmb/form/iwd040\\_%E0%B8%9C%E0%B8%99%E0%B8%A7%E0%B8%81%20%E0%B8%84%E0%B8%84%E0%B8%B9%E0%B9%88%E0%B8%A1%E0%B8%B7%E0%B8%AD3Rs.pdf](http://www2.diw.go.th/iwmb/form/iwd040_%E0%B8%9C%E0%B8%99%E0%B8%A7%E0%B8%81%20%E0%B8%84%E0%B8%84%E0%B8%B9%E0%B9%88%E0%B8%A1%E0%B8%B7%E0%B8%AD3Rs.pdf))

optimization of effluent treatment technology, use of less-silica fuel for combustion plant, reduction of sludge mass by evaporation.

### 2) *Reuse*

Some of wastes (i.e., casting cores and molds) can be reused or reprocessed. Also, some of metal chip or scrap can be reused or reprocessed. However, a feasibility study of current technology for reprocessing should be carried out. In addition, an optimization of composition fraction and the property of reused products should be investigated. Finally, an economical tool (e.g., payback period, internal rate of return) should be evaluated.

### 3) *Recycle*

Sludge and ash can be used as raw materials for production of soil amendment or composting. However, this approach requires collaboration from several sectors such as agricultural sector, industrial sector (both generators and waste disposers), and government sector. Thus, a survey or consultation on agricultural requirement should be carried out. Also, information on application site, frequency and quantity demand should be included in the list. In addition, a transit center should be provided for the small and medium enterprises (SMEs) in order to encouraging SMEs to enroll the program. The transit center can play a role on resource balance between waste generators and waste utilizers (agriculturists) and learning center for waste composting.

The main duty of transit center can divide to 3 parts: 1) data collection, 2) resource balance, and 3) an establishment of a learning center. To collect information on demand (from agriculturists) and supply (from industries), a survey should be conducted via questionnaires and on a google form. Because the data can be accessed through internet, this automatically updated data can serve and balance the requirement for both agriculturists and industries. The transit center can play as an intermediary between agriculturists and industries to arrange and qualify the resources (e.g., sludge). In addition, the transit center can be a learning center for composting from municipal/industrial wastes. To be the legitimate transit center, a permission document should be applied to the Department of Industrial Works (DIW). An operating budget can be obtained from a member's fee, service fee, and sales of compost. This establishment of transit center can provide benefits to not only industrial and agricultural sectors, but also a community as the transit center promoting a job and better environment.

Regarding distribution, a receiver (e.g., agriculturist) can be either local people in Nadee or outer utilizers. However, local people are preferential than outers due to shorter transportation, resulting in less time consumption and lower fuel requirement. Furthermore, this shorter distance transport causes lower emission of greenhouse gas (i.e., carbon dioxide).

Another good example for waste management is from one of the interviewees. The industry has annually several tons of durian peels, which classified as organic wastes. Because durian peel can be decomposed to minerals, the industry has changed the management method from dumping in a sanitary landfill to producing composting. The end product, compost, can distribute to agriculturists for promoting a Corporate Social Responsibility (CSR) project in order to enhance a relationship between a community and the Factory. Also, this management can decrease an expense of waste disposals since a unit cost of waste disposal by landfill (including transport and disposal costs by the Factory and by local government

agencies or industrial estates) is more expensive than a cost for composting. Other examples of good practice for waste management can be found in a handout of 3Rs for industrial waste management.<sup>6</sup>



Findings on  
 Analysis of  
 Institutional  
 Capacity and  
 Needs of Private  
 Sector and  
 Government  
 Agencies in  
 Industrial Waste  
 Management and  
 Monitoring for  
 Circular Economy  
 in Nadee City

# **Analysis of Institutional Capacity and Needs of Private Sector and Governmental Agencies in Industrial Waste Management and Monitoring for Circular Economy in Nadee**

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By Rutmanee Ongsakul, PhD, In-house Consultant, EARTH Foundation

## **A. OBJECTIVES OF THE STUDY:**

To develop assessment tools for local private sector and government agencies and examine:

- i) the extent of their current roles and practices in carrying out and monitoring industrial waste management that aligned with the 2030 Agenda and Thai legislations; and
- ii) the areas of capacity needs for them.

## **B. METHODOLOGY:**

Targeted groups:

Selected private sector in food and beverage, cold storage, and textile industry (large industry as well as small and medium-sized enterprises: SMEs) and concerned government agencies in Nadee Sub-district.

Methods employed:

The study investigated the capacity of local private sector and government agencies in Nadee based on 3Rs principle in industrial waste management which is in accordance with the 2030 Agenda and Thai legislations. To examine the extent of their current roles and practices in managing and monitoring industrial waste management, the investigation covered four major processes, including:

- (i) reducing waste at sources;
- (ii) sorting and storing waste;
- (iii) reuse, recycle, and recovery waste; and
- (iv) waste treatment and disposal.

To identify the areas of capacity needs of local private sector and government agencies in carrying out and monitoring the four aforementioned processes, the study examined:

- (i) explicit and implicit organizational policies, plans, and programmes as well as roles, responsibilities and targets;
- (ii) staff capacity in terms of knowledge and experiences;
- (iii) resources availability including technology (both in-house and external technical assistance) as well as budget and financial assistance; and
- (iv) technical networking and coordination with multi-stakeholders.

The investigation was carried out mainly through survey and semi-structured interviews. Different survey questionnaires for different targeted respondents were developed and disseminated for their initial review and responses. Semi-structured interviews or focused group discussions with some selected

respondents or groups of respondents were carried out following the survey responses or along the survey. There were the total of 35 respondents as follows:

Respondents	Types and scale of industry	Number of respondents	Tools	
			Survey	interview /FGDs
<b>local private sector in food and beverage, cold storage, and textile industry *</b>				
1. M.K. Cold Storage Co., Ltd.	cold storage, medium-sized	1	*	
2. Intersia Co., Ltd.	cold storage, medium-sized	1	*	
3. Bangkok Seafood Co., Ltd.	cold storage, large-sized	1	*	
4. N&N Co., Ltd.	F&B, large-sized	4	*	*
5. Tepkinsho Co., Ltd.	F&B, large-sized	4	*	*
6. UBR Frozen Food Co., Ltd.	F&B, medium-sized	1	*	*
7. Seamaster by Dimare Co., Ltd.	F&B, small-sized	1	*	*
8. Thaiexpress Textile Co., Ltd.	Textile, large-sized	2	*	*
9. Thai Union Group Co. PCL.	F&B, large-sized	1	*	*
10. Red Bull Distillery (1998) Co.Ltd.	F&B, large-sized	9	*	*
11. TPK Interfood Co., Ltd.	F&B, medium-sized	1	*	
12. Southeast Asian Packaging and Canning Ltd.	F&B, large-sized	1	*	
<b>Concerned government agencies</b>				
1. Regional Environmental Office		1	*	
2. Natural Resources and Environment Office		1	*	
3. Internal Security Operations Command of Samut Sakhon		1		*
4. Provincial Industrial Works Office		1		*
5. Provincial Community Development Office		1		*
6. Provincial Agricultural Office		1	*	*
7. Muang District Agricultural Office		1		*
8. Division of Public Health and Environment, Nadee Sub-district Municipality		1	*	

### C. KEY ASSESSMENT FINDINGS:

Three groups of findings could be assessed, that are: 1) the extent of the respondents' current roles and practices in 3Rs in industrial waste management; 2) major constraints and potential motivations for 3Rs implementation; and 3) the areas of capacity needs for them to enhance their roles and practices in 3Rs in industrial waste management. Key points of each are summarized as follows.

## 1) Current roles and practices in 3Rs in industrial waste management

### Private sector

#### Overview of current practices in industrial waste management

- In overview, most responded firms have to some extent been circulating waste into other uses particularly recyclable waste for selling to recycle factory and waste from food processing to composting and animal feeding.
- Most responded firms have waste management guidelines/procedures for staff. Some firms have policy on environmental responsibility and/ or waste minimization and/ or recycling.
- Large-sized firms have specific section in charge of waste management while SMEs mainly carry out the tasks by the administrative section who records waste data and manages selling of recyclable waste. Waste separation however is normally a mutual task for all staffs in all sizes of firms.

#### Collection of waste data, and waste sorting and storing

- Most responded firms collect waste data daily, especially the food and beverage industry where food waste is generated daily.
- Waste data is generally sorted by 1) total waste amount, 2) recyclable waste and 3) hazardous waste (if any).
- The main reason the firms collect waste information is to comply with the regulations, following by using the data for improvement of the production process in order to control material costs. SMEs, in particular make waste record only if the waste is sold.
- It was clear that if the waste can be sold, they will be sorted and their data will be recorded. It is therefore a need to identify current and “potential” salable waste from the targeted industry in Nadee.
- There were also differences between large firms and SMEs in waste selling. While the large firms usually transfer their waste as materials to affiliated firms of the companies or have regular firms in the supply chain collecting their waste from the factories, most SMEs have to find the buyers and bear the cost of waste transportation by themselves since the amount of waste from each SME is too little to worth the collection cost (Figure 1). These differences are due mainly to larger financial and technical resources supported from headquarters for larger firms.
- In this regard, some large firms interviewed stated that they could extend their resources and knowledge to support SMEs, for instance, sharing experiences and guidance on waste management including circular economy practices for same types of industries and providing some materials to support waste management activities.
- Major gaps found based on the analysis of the current practices in industrial waste sorting for selling therefore are 1) **the knowledge on waste that has not yet known their use** (not yet considered as ‘salable waste’) and 2) **the recipient factories/ communities** (‘potential users’) **to collect waste particularly from SMEs.**



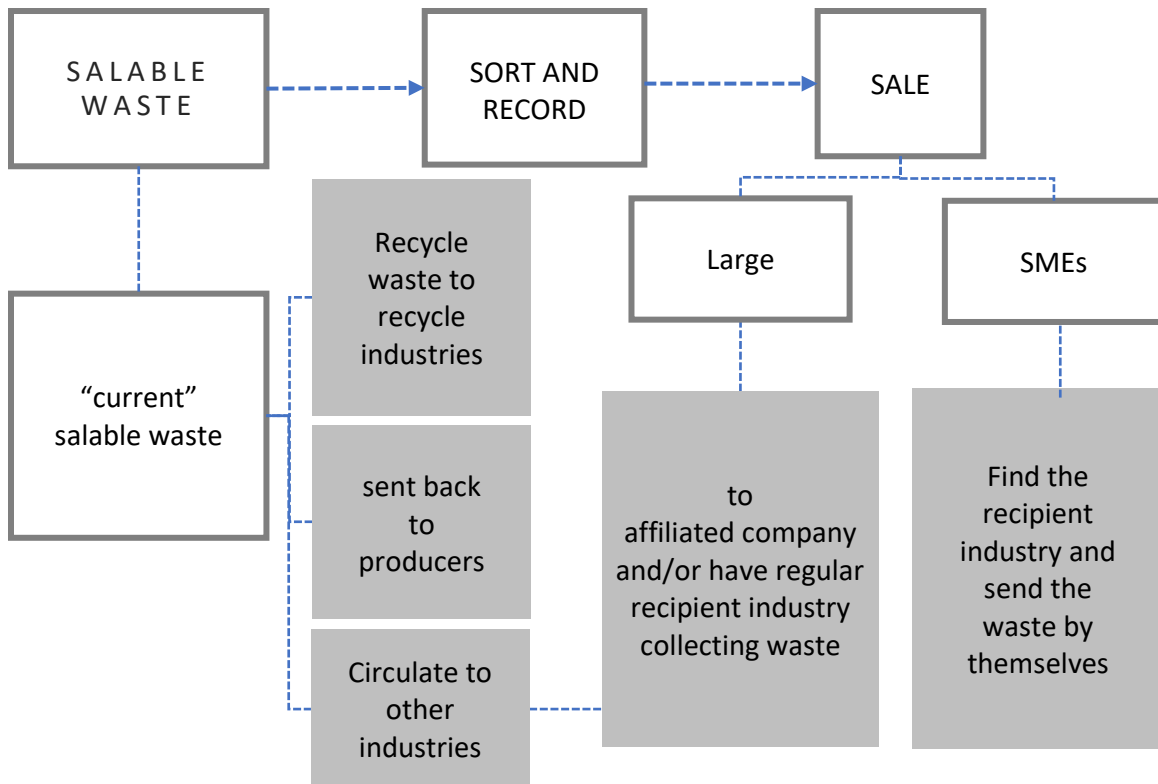


Figure 1. current practices in industrial waste sorting for selling

#### Waste reduction at source, waste reuse and recycling

- Most firms have measures to reduce waste particularly in raw materials and production process but not much through product design or production technology which could be an area to be strengthened.
- In addition to industrial waste management, other areas of environmental management that have been implementing by most firms in Nadee are water quality and water saving (including water reuse), energy conservation, air quality management, and corporate social responsibility activities with the neighboring communities.

#### Waste disposal

- Waste that is not sold are normally taken by the registered waste processors (WPs).
- Some WPs are in Samut Sakhon and there is possibility that waste is taken into circular process (need to further investigate the waste flow after taken by WPs).
- Some firms in Nadee are interested in making use of the final waste (e.g. sludge to composting) or considering changing management methods if it is worthwhile (e.g. use waste as fuel substitution or burn for energy recovery) (need therefore to create enabling environment).

#### **Public sector**

- In overview, only two agencies, i.e. the Provincial Industrial Works Office and the Division of Public Health and Environment, Nadee Sub-district Municipality are directly in charge of monitoring industrial waste management. The two agencies however have limited number of officials and therefore have limited active activities in supporting 3Rs principles in the industrial firms.

- Other agencies viewed the industrial waste management as irrelevant to their mandates but has policies and programs related to waste reduction, reuse and recycle in communities and in agricultural production which may potentially be linked. Yet, further discussion on policy cohesion is needed.

## 2) Major constraints and potential motivations:

The results of the survey on constraints and motivations in 3Rs practices are as follows.

Internal constraints	
#1	Unclear organizational policies, plans, and programs on the approach
#2	Inadequate knowledge on improving management process for waste reduction and on technology/ innovations for reuse, recycle, and recovery waste
#3	Inadequate budget for implementation
No problems identified on	Inadequate staff to carry out the tasks/ communication problems with the Burmese workers.

Institutional constraints	
-	Uncertainties on regulations e.g. to circulate usable waste to communities or local farmers.
-	Lack of technical information and payback period for alternative waste management.

- Major internal constraints particularly for SMEs are inadequate capacity of staff in terms of knowledge and experiences specifically on technology/ innovations for reuse, recycle, and recovery waste and limited budget for implementation.
- Major institutional constraints are uncertainty of the regulations' permits and procedures to enable extension of 3Rs practices. For instance, to allow circulation of industrial waste to communities or to construct incinerators to burn waste as fuel substitution.

Incentives	
-	Reducing management costs and generate income
-	Upgrading products and enhancing good images to customers and surrounding communities
-	Networking among local enterprises and partnerships among government-communities-and private sector.

- Major motivation is **financial benefits**. The waste which is likely to be sorted, recorded, and brought into the circular economy process is the waste that can generate income. Other main motivation identified is good reputation to the customers and surrounding communities. Suggestions for incentives therefore include, for instance, identifying appropriate approaches to

generate income from waste, providing tax reduction for firms implementing 3Rs, developing manual for product upgrading (including circular economy implementation), and providing certificates and public relations for the firms joining the circular economy network.

**Public sector**

- Major internal constraints for the local government agency are **limited officials** especially with expertise in waste monitoring and auditing and limited budget.
- Major institutional constraint identified is lack of coordination and policy alignment among various government agencies.

**3) Areas of capacity needs to enhance the roles and practices in 3Rs in industrial waste management**

The results of the survey on areas of capacity needs are as follows.

Supports needed for implementing 3Rs principles	
#1	Seminar and trainings on innovations for waste reuse, recycle, and recovery
#2	Seminar and trainings on 3Rs in industrial waste management Access to collection of good practices in 3Rs in similar types of factories
#3	Supporting consultants for analysis and recommendations for improvement
#4	Partial financial supports for improvement Access to internet sources for self-learning
#5	Formal or informal exchange learning across industries in Nadee and/or other areas Instruction and training materials in Burmese

- Most responded firms agreed to the need for supports to strengthen their implementation of 3Rs principles to various degrees of importance. The identified supports included **seminar and trainings** on 3Rs in industrial waste management, **access to collection of good 3Rs practices** in similar types of factories, formal or informal **exchange learning** across industries in Nadee and/or other areas, **consultants providing analysis and recommendations** for improvement, and **partial financial supports** for tools and equipment improvement.
- In addition, as a major constraint identified by many interviewed firms were **uncertainties on regulations** (for instance, whether it possible to circulate usable waste to communities or local farmers or what procedures required to request for permission in circulating waste to other users), concerned government agencies such as the provincial office of industrial works could play an important role in supporting clear rules and regulations enabling private sector’s efforts in circular economy.
- Another important knowledge area identified that could strengthen efforts of circular economy in Nadee is the **technical information on payback period for alternative waste management** that could support decision-making by the firms’ executives and could be supported by concerned government agencies and local academia.

- The responded agencies also agreed to the need for technical supports to both the factories and the officials. Key success identified was to put the circular economy approach into practice through a persistent collaborative work throughout planning and implementation.

The results of the survey on promising (further) actions by private and public sector are as follows.

Promising actions under the program: private sector	
#1	Dedicate staff time for training
#2	Participate in program for consultants' analysis
#3	Join a network of circular economy industrial firms in Nadee
#4	Invest financial resource to implement recommendations
Promising actions under the program: public sector	
#1	Dedicate staff time for collaboration with private sector and other government agencies
#2	Provide relevant data/information for baseline and analysis
#3	Provide technical expertise supporting 3Rs methods and provide resources to implement pilot projects
#4	Dedicate staff time for collaboration with private sector and other government agencies

#### D. Key recommendations:

Based on the above assessment, the study recommends four approaches to enhance capacity and support needs of private sector and governmental agencies in effective industrial waste management and monitoring for circular economy in Nadee, that are:

- Support income generation from industrial waste. As major motivation for waste recycling in Nadee is financial benefits for the firms, it is a need therefore **to identify as many types of waste possible to be able to be sold to various chains and promote circular economy through its advantage in reduction of waste management costs for the industry.** Another possible approach is through tax reduction in substitute of the government's investment in waste management.
- Knowledge sharing among large-scaled firms and SMEs in similar industries in Nadee. **Capacity enhancement is needed particularly for SMEs whereas there are large-scaled firms having financial and technical resources in waste management.** It would be possible therefore to match large-scaled firms and SMEs in similar industries that could help extending resources and/or sharing knowledge to support SMEs in waste management including circular economy practices.
- Support salable waste collection and waste selling of SMEs. As identified by the interviewed SMEs in the Study, a key constraint for a number of small-scaled firms in Nadee is that their potential waste that could be sold and circulated to other uses have small amount so that buyers are not interested to come to collect. **Approach for waste collection services for SMEs** should therefore be discussed. This could include, for instance, providing salable waste collection service along the

regular waste collection routes of the municipality, developing database on supply and demand for SMEs' waste, and having transit waste center to collect SMEs waste.

- **Eliminate institutional constraints.** A number of institutional constraints particularly **permits of regulations and procedures in controlling industrial waste** needed to be discussed and consulted with concerned government agencies to explore more possibilities to circulate and recycle waste among different sectors in Nadee.



# Findings on

Policy Analysis and  
 Recommendations  
 to Nadee Sub-  
 district  
 Municipality

# Policy Analysis and Recommendations to Nadee's Sub-district Municipality, Samut Sakhon Province

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By Mr. Uthai Chantavit, Consultant to KMUTT

## A. OBJECTIVES OF THE STUDY:

- 1) Identify recommendations by a review of relevant policies, regulations, or plans, according to authorities and experts in the field;
- 2) Provide a clear overview of the institutions, policies, plans, or regulations affecting industrial waste management of Nadee's Sub-district Municipality, including information on main gaps;
- 3) Provide three examples of good practices on policy change in the Asia-Pacific Region that helped to improve industrial waste management based on the concept of circular economy;

## B. METHODOLOGY:

- 1) Review of Institutional Landscape: some issues to be reviewed: Which governmental departments are approaching the issues of environmental monitoring, industrial pollution control, and water quality? What are their mandates? What are the overlaps?; And interview the representative of policy maker of government departments
- 2) Review of Policies and summarize description of each policy (year, government bodies, main building blocks, etc.), and analysis based on interviews and literature review (how the policy is being communicated, Monitoring and evaluation, Enforcement and compliance, overlaps with other policies, weakness or gaps, strengthens, impact in Nadee/Samut Sakhon, Incentives, Review cycles, mechanisms, and opportunities); At national level such as Green Industry Incentive project of Department of Industrial Work, the National Environmental Pollutant Strategic Plan, 2018-2021 of Pollution Control Department, Strategic Plan, 2019-2021 of Department of Industrial Promotion. At local level such as Development Plan, 2018-2021 of Nadee Sub-district Municipality/Samut Sakhon
- 3) Review of good practices – examples of good policies from other countries and in Thailand

## C. ASSESSMENT FINDINGS:

- This study conducted an interview with seven departments: Department of Public Works and Town & Country Planning, Department of Industrial Works, Department of Environmental Promotion Samut Sakhon, Provincial Administrative Organization, Department of Pollution Control, Department of Provincial Administration, and Department of Industrial Promotion. And the Consultant interviewed Acting Mayor of Nadee Municipality.
- At policy level, the Office of the National Economic and Social Development Board (NESDB) is in charge of the preparation of the National Economic and Social Development Plan as a framework and guideline for national development in each period of 5 years. NESDB also is responsible to

analyze and evaluate plans and development projects of government agencies and state enterprises. The 20-year National Strategy (2018 - 2037) developed by NESDB consists of 6 strategies, with Strategy 5 Being a strategy on building growth on the quality of life that is environmentally friendly. Also, the 12th National Economic and Social Development Plan (2017 - 2021) consists of 10 strategies, with Strategy 4 Green Growth for Sustainable Development, has set Goal No. 3 to create good environmental quality, reduce pollution, and reduce health impact of people and ecosystems. Priorities are to promote solid waste and hazardous waste management, to restore the quality of the country's water sources, and to solve the haze/air pollution crisis. The indicators are defined as follows: Indicator 3.1 The proportion of municipal solid waste has been properly managed and utilized at least 75%, properly less than 30% of municipal hazardous wastes that have been properly disposed, and 100% of hazardous industrial wastes enter to the management system; Indicator 3.3 Air quality in haze/air pollution crisis areas has been solved and within the standard.

- Planning implementation is in the line command of related government agencies. The Pollution Control Committee consists with related government agencies by working together to meet the national strategy, developing and improving environmental standards in terms of management and standards of environmentally friendly products and services, including solutions to urgent environmental problems and presenting to the National Environment Board chaired by the Prime Minister. The Committee is also in charge of developing operational guidelines at various levels up to the level of legislation.
- Many government agencies have developed performance indicators on waste management. However, their benchmark does not reflect the efficiency and effectiveness and lead to expected outcomes relevant to the national strategy. At the national level, there is no clear set of national targets and there is no relevance between indicators and targets of the department at the operational level. Thus, only outputs have been achieved without significant expected outcomes. This also causes the activity and project unsustainability. In addition, there is no result-based and outcome-oriented evaluation.
- For example, the Department of Industrial Promotion, is in charge of industrial management, marketing as well as product development. But the Department's environmental management approach has not yet been integrated into industry promotion activities. The Department of Public Works and City Planning has not yet applied the Eco Industrial Town Guidelines of the Department of Industrial Works in the development of city planning at the policy level. In which various departments view industrial waste management as a duty of the Department of Industrial Works, whereas municipal waste management is a duty of the Pollution Control Department, without seeing a picture of how the mission of their own agency is concerned or connected with solid waste and waste management.
- Furthermore, the Department of Local Administration has established a specific local environment division. However, the environmental management approach is still a type of using budget for solid waste management, there is no concrete value creation by applying the principles of circular economy. The Department of Pollution Control has been implementing the policy and project and clearly saw the results from the policy on banning plastic bags, and a project on Green Basket to promote environmental products.
- However, it was found that the roles and duties of the Pollution Control Department in many parts were similar to the Department of Environmental Promotion of Ministry of Natural Resources and Environment, and the Eco Industry Development Division of the Department of Industrial Works,



the scope of work is separated that the Pollution Control Department and the Department of Environmental Promotion provide knowledge to the community, whereas Department of Industrial Works providing knowledge to the industry. Therefore, when it comes to implement a sustainable city, which requires cooperation from all sectors in the same direction, is difficult because each department has different priorities both policy and implementation level, also indicators. In addition, there is a lack of online databases that collect all departments' information as one to measure whether meet the goal of the national strategy or not.

- Major barriers to pursuit the 3 R Principle and the circular economy include lack of knowledge about feasible and appropriate technology and management. Therefore, we found only successful projects in separately implemented by factories or communities. There are completely lack of linkage of waste flow in accordance to the circular economy.
- With resources and technology, Samut Sakhon Provincial Administrative Organization (PAO) can play a significant role to support local government agencies, especially sub-district administrative organizations and municipalities. However, due to the national decentralization policy, PAO can't overrule juristic management of these local government agencies. The PAO must prepare a cluster development plan benefiting in supporting the capacity of more than 1 sub-district administrative organization or the municipality and receiving their consensus, finally approving by provincial governor. This process takes time and is complicated.
- According to the decentralization policy, PAO should be involved in general environmental management, especially centralized or cluster waste disposal system and wastewater treatment system. On the other hand, according to the revised Factory Act, 2019 (No. 3) which empowers local authorities, only sub-district administrative organizations and municipalities are in charge in environmental investment, excluding PAO. It is contradicting policy and direction.

#### **D. REVIEW OF GOOD PRACTICES:**

- **Muang Klaeng sub-district Municipality, Rayong Province, the East, Thailand**

Waste management project of Muang Klaeng sub-district Municipality in 2015<sup>6</sup>, which has the following methods:

- 1) Food waste and organic waste will be separated to make fertilizer and fermented to create biogas to be used instead of LPG, the use of waste to make energy. In addition, some organic waste is used as a food to feed the earthworm, in order to transfer into fertilizer to nourish the soil
- 2) E.M. (Effective Microorganism) water from fruit and vegetable scraps/waste left behind from houses and markets, to reduce transportation to landfills. The E.M. water will be used in the office to deodorize the bathroom. And drip down the sewer pipe of the municipality to treat the water before going into the Prasae River.
- 3) The food waste left over from the restaurant is used to feed the pig, then use the ferment gas from pig droppings. The objective of raising pigs is to eliminate vegetables, fruits and food scraps from households. The by-products are manure fertilizer and bio-gas fermentation.

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<sup>6</sup> Source: [http://thaigreenurban.onep.go.th/greencity/eventDetail.aspx?id=99&city\\_id=210301](http://thaigreenurban.onep.go.th/greencity/eventDetail.aspx?id=99&city_id=210301)

The success factor is good management and planning, among the municipality and multi-stakeholders including relevant organizations, so they can manage waste completely in the waste flow and in the sanitation way. Moreover, the choice of appropriate technology is important for the implementation to process waste without letting waste to loss during the process, as well as the participation of the people that truly contribute to the development of the city and the environment.

Key indicators of achievement are to reduce the amount of food waste in the community, to generate additional income of the sale of energy and biogas. Other indicators include that the community has a sanitation management system, and people in the community participate in the development of the community and the environment.

Klaeng sub-district Municipality is a role model for waste management of local government agencies. Klaeng sub-district Municipality achieved the disposal and reduction of waste from various sources. The complete cycle of management involves every actors and implementation; producers of waste from each source, waste collectors of municipal employees, vehicles and good management services. Significant outcomes are reducing waste before disposal to landfills, reducing waste transportation cost and time and increasing timespan for using the landfill of the municipality.

- **Japanese Act 2000**

Japan enacted '*the Promotion of Effective Utilization of Resources Law*' in 2000. This Law contributed extremely successful waste management. Only 5 percent of waste from production and consumption that is not recycled. This Law enforces waste management at the beginning of the waste process from garbage separation at source, supporting consumers for simple garbage separation, collection of electronic waste collector fees including the purchase price of the product, and forcing private owners to be co-owners of waste management infrastructure at the community level, and so on<sup>7</sup>.

On the other hand, the recycle and reuse resources can be utilized to create a worthwhile income, by using local wisdom to create into new products or services that integrate innovation, creativity, and rely on self-reliance principle, such as the "One Village One Product, OVOP" project, which is successful and well-known around the world from local products and tourism. OVOP products have 3 requirements, which are (1) Quality must be durable; (2) Product quality must be consistent and replicable because OVOP has technology/innovation between basic industries and advanced/high standard industries; (3) OVOP meets standard certification because OVOP must be saleable in the market at least 2-3 years. While, OVOP tourism is required to meet criteria; visiting history, study trip, and cultural exchanges in order to create opportunities for visitors to experience local way of life and culture and generate income distribution in the community<sup>8</sup>.

- **Circular Economy in the Netherland by 2050**

The Netherlands is located below sea level. The Government has implemented circular economy policy since September 2016. This policy promotes reusing all raw materials in 2050 and set a long-term goal to reduce volumes of the gross raw materials around 50% of by 2030. The key factor is promotion of smart product design by using less substrates (Smart Design: Fewer Resource), a long last service life product to reduce the amount of waste in the world (Extend Product Life) and recycling used recyclable and reused products (More Better Reuse: Waste as Raw Material).By 2023 the circular economy in the Netherlands

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<sup>7</sup> Source: <https://library2.parliament.go.th/ebook/content-issue/2562/hi2562-010.pdf>

<sup>8</sup> Source: <https://thestandard.co/movin-on-2018-by-michelin/> Memagazine

will create a market worth more than \$ 7.3 billion a year, and more than 54,000 jobs. Product prices are set at the actual cost, i.e. products and services must be priced at the actual cost. The policy starts from five main business groups: organic and food, plastics, manufacturing, construction and consumer products. In addition, there is a fund set up to improve waste management methods and sort waste for concrete reuse, whether it is used as an alternative energy and others to eliminate waste. It also promotes innovation in manufacturing and improve the recycling process.

For the Netherlands, the full participation of everyone has been taken into account, at all levels. Thus, the Netherlands government has initiated the Holland Circular Hotspot project as part of its Circular Economy policy by 2050. This project is a platform that open to stakeholders, all sectors, including the state, private sector, and institutions work together to enhance knowledge about circular economy, by enabling them to participate in a circular economy and to strengthen coordination around the world. The Government has also begun to charge bags, which may not be much expensive but incentivize people to reduce the use of plastic bags. The results were positive in a wide angle across the country. The convenience stores themselves have to turn to the campaign to ban plastic bags. Which ultimately, it will become a habit of the people themselves. The current organic products, consumers have to realize that it's good, and they pay more for a good product <sup>9</sup>

- **German Act 1996**

Germany enacted '*the German Closed Substance Cycle and Waste Management Act*' in 1996. A waste management system in circulating economic operations has been prepared and implemented. Later, there was an amendment to add the Circular Economy Policy in 2000, which allowing Germany to recycle waste from the production process up to 14% and waste management industry has become an high value industry which create an employment increase of 200,000 people and create working capital in the economy of over 40 billion euros in 2016<sup>10</sup>.

- **Circular economy policy of China**

China began referring to the Circular Economy in 1996 to help control pollution, until 2008 the Circular Economy Law of the People's Republic of China was adopted but was not yet successful, due to unclear goals as well as lack of cooperation from the people. This led to the establishment of a Circular Economy Development Strategy and the Recent Action Plan in 2013 focused on Clean Production, Eco-Industrial Park and Eco-cities, with the central government being an investor in infrastructure and ask for cooperation from the private sector and the public<sup>11</sup>.

## **E. KEY PRELIMINARY RECOMMENDATIONS TO NADEE MUNICIPALITY:**

- 1) Nadee Municipality should consider changing the budget item of hiring a waste contractor from 'collect and disposal to 'collect and sorting' because waste separation will be the property of Nadee Municipality. The separated waste will be resold and distributed according to the type of waste specified from the outset when hiring.

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<sup>9</sup> <https://thaipublica.org/2018/07/scg-circular-economy-the-future-we-create/>

<sup>10</sup> Source: <https://library2.parliament.go.th/ebook/content-issue/2562/hi2562-010.pdf>

<sup>11</sup> Source: <https://library2.parliament.go.th/ebook/content-issue/2562/hi2562-010.pdf>

- 2) Before proceeding with item 1) municipality should study the type and amount of waste generated in each season of source. To avoid conflict of interest, Nadee Municipality may hire neutral agencies such as universities to conduct the study.
- 3) After getting the information from item 2), the technology that needs to be invested in converting waste into oil, RDF rods, fertilizer, or other forms of energy for sale. If it is too high for the municipality to invest, it is necessary to join venture with the private sector. The criteria of selection of potential investors needs to be developed. For example, the private sector should be able to use the products produced from the processed waste, such as converting plastic waste into oil by pyrolysis kiln.
- 4) Wastewater management should focus on planning, enforcement, and monitoring. Normally, if the industrial plants do not assemble into an industrial estate, adhere to the law of the factory, the effective management will be the on-site treatment system at the factory location. The coordination with the Wastewater Management Authority (State Enterprise status) to build a community wastewater treatment system should be an effective way to treat both wastewater from the residence and from industrial plants after the pre-treatment at the factory. Nadee Municipality will have a strong role in enforcement of discharge of wastewater.
- 5) Nadee Municipality should review the vision and mission with clear focuses on environmental management. Human resource recruitment and management can be relevant and supportive with knowledge and ability in environmental management. Importantly, the proportion and budget allocation and planning for environmental management will be enough and specified to meet the mission and vision.
- 6) Cost-recovery investment criteria should be essential in decision making on infrastructure and other services in order to avoid financial deficit

#### **F. KEY RECOMMENDATIONS TO NATIONAL GOVERNMENT AGENCIES AND RELATED DEPARTMENTS:**

- 1) Revision of outcome-oriented indicators from the national level to department levels needs to be relevant and targets to measure viability of investment and cost recovery of the project and activity. Even the seeding fund or pilot project, many good initiatives need to consider multi-stakeholders' benefit from different levels, including local communities, private sector and local government agencies. A pilot project should not be based on *one-size-fit-all* but need to consider local context and different segment of local government agencies and communities for appropriate application. Local context includes registered and actual population, types of industries that will be important factors to design and manage types and volumes of waste.
- 2) Study the cost-effectiveness of the circular economy management system at the provincial level, taking into account the benefits received from community waste management of all stakeholders, including national agencies, local authorities, public sectors, industrial sectors in the area. The prototype area should be studied in small, medium, and large areas to make it easier for the prototype to be expanded into other localities. The local size should be determined according to the population and the local industry which affects the type and amount of waste to be managed.
- 3) Dissemination of waste technology and management both from community and factory with the focus on viability and flow based on circular economy to implementing agencies and local government agencies. Roles and responsibilities of each sector from national level to local levels including political and auditing sectors should be addressed.
- 4) Higher consumer taxes for single use should be considered. On the other hand, reduction of taxes for durable and reused products should be promoted. For example, the environmentally friendly label of energy saving No. 5 or tax rebate should be upscaled to the durable and reused products.

5) The national road map on industrial and community waste should include and focus on building capacity and skill of government officials at every level and organization on efficient waste investment and their shared role and responsibility to streamline the operations.



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## APPENDIX A



### Survey questionnaires on Institutional Capacity and Needs in Industrial Waste Management for Circular Economy (for local private sector in food and beverage, cold storage, and textile industry in Nadee)

The Multi-Stakeholder Working Group for Nadee’s Sub-District Municipality has been established in July 2019 to facilitate greater collaboration and exchange of ideas between Nadee’s sub-district Municipality and the public with respect to water and wastewater management, solid waste management, industrial pollution, and livelihoods. The first meeting of the Working Group was organized on October 9, 2019 in which a key resolution was that appropriate technology and management in waste and application of circular economy are essential for planning and implementation of pilot projects in Nadee. With limited research resources, data collection and analysis are therefore undertaken to provide supports for planning. This sub-study is part of supporting inputs aiming to explain the current states of local private sector and government agencies in managing and monitoring industrial waste in compliance to circular economy approach, and to identify interventions needed to increase their capacities.

#### **Key Terminology:**

The sub-study investigates the capacity of local private sector and government agencies in Nadee in carrying out and monitoring industrial waste based on 3Rs principle in industrial waste management<sup>12</sup> which is in accordance with the 2030 Agenda and Thai legislations<sup>13</sup>. Based on the Manual for 3Rs in Industrial Waste Management of the Department of Industrial Works, **3Rs principle in industrial waste management** encompasses “all measures that minimize the amount of waste disposed of. The preferred waste management practice is to reduce waste at source, i.e. to prevent waste from being generated. Where waste generation cannot be prevented other

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<sup>12</sup> Department of Industrial Works (2012). Manual for 3Rs in Industrial Waste Management. Available online:

[http://www2.diw.go.th/iwmb/form/iwd040\\_%E0%B8%9C%E0%B8%99%E0%B8%A7%E0%B8%81%20%E0%B8%84\\_%E0%B8%84%E0%B8%B9%E0%B9%88%E0%B8%A1%E0%B8%B7%E0%B8%AD3Rs.pdf](http://www2.diw.go.th/iwmb/form/iwd040_%E0%B8%9C%E0%B8%99%E0%B8%A7%E0%B8%81%20%E0%B8%84_%E0%B8%84%E0%B8%B9%E0%B9%88%E0%B8%A1%E0%B8%B7%E0%B8%AD3Rs.pdf) (in Thai)

<sup>13</sup> Notification of Ministry of Industry Re: Industrial Waste Disposal B.E. 2548 (2005)



options such as reusing the item(s), followed by recycling of the waste should be considered in order to have less waste possible for treatment and disposal.”

According to the Notification of Ministry of Industry Re: Industrial Waste Disposal B.E. 2548 (2005)

“**Waste**” shall mean unusable materials or all types of wastes generated from industrial activity including wastes from raw material, wastes generated from production process, products that are deteriorated in quality, and effluent having hazardous constituents or hazardous characteristics.

*Note:* waste from the firm in this study cover three sources: (i) **waste from the main production process** (i.e. waste from raw materials and underqualified products) (ii) **waste from supporting process** (i.e. waste from maintenance section, wastewater treatment plant, laboratory) and (iii) **waste from offices, canteens and dormitories within the factories** (i.e. waste from office supplies, general household waste and food waste)

“**Hazardous waste**” shall mean waste having hazardous constituents, being contaminated with hazardous substance, or having hazardous characteristics as prescribed in Annex 2 annexed to this Notification.

“**Waste Management**” shall mean process of treatment, detoxification, disposal, sale, exchange, or recycle in any form, including storage for such purpose.

“**Waste generator**” shall mean a factory entrepreneur that generates wastes and has it in possession.

“**Waste collector and transporter**” shall mean a person who has wastes in possession for transport and one who has wastes in possession for storage or transfer.

“**Waste Processor**” shall mean a factory that has wastes in possession according to the Ministerial Notification regarding hazardous waste manifest system B.E. 2547 (2004), and a factory type 105 that are sorting or landfill facility.

## **Survey questionnaires**

for local private sector in F&B, cold storage, and textile industry

The questionnaire consists of four main parts: (i) general information about the firm and current roles in 3Rs in industrial waste management; (ii) examination of the firm’s current practices in managing industrial waste management aligned with 3Rs principles and Thai legislations, (iii) areas of capacity the firm needs in carrying out industrial waste management aligned with 3Rs principles; and (iv) emerging risks and needs due to COVID-19

**Part I: General information about the firm and current roles in 3Rs in industrial waste management**

**1. Basic information about your firm**

Firm Name:

.....

Factory registration number:

.....

Type of business (as cited in Permit for factory operation (Ror Ngor. 4):

.....

Address: .....

Tel: ..... Fax: .....

Operating Hours: from ..... to .....

Number of employees: Total..... Male.....

Female.....

Contact person: ..... Position: .....

Email: ..... Tel: .....

**2. Current supports and commitments in 3Rs principle**

2.1 Does your firm have waste management guidelines/procedures for staff?

Yes.  No.

2.2 Does your firm have policy on environmental responsibility and/or waste minimization and/or recycling?

Yes.  No.

If yes, please specify: .....

2.4 Does your firm have a specific section on waste management and/or particular staff in charge of this matter?

Yes.  No.

If yes, how many staff: .....

**Part II: The firm's current practices in managing and monitoring industrial waste management aligned with 3Rs principles and Thai legislations**

**3. Current practice in collecting waste information**

3.1 Does your firm collect waste information?

Yes.  No.

If yes, how often your firm collect waste information?

daily  weekly  monthly  others, please specify.....

If yes, please specify the waste information

- total waste: data collected in  total quantity  sorted by types
- recyclable waste: data collected in  total quantity  sorted by types
- hazardous waste: data collected in  total quantity  sorted by types
- process in which the waste are generated
- how each type of waste are managed
- Other information, please specify.....

If yes, what are the main reasons the firm collect waste information?

- To comply with the regulations.
- To improve the production process
- Other, please specify.....

3.2 Please provide data on waste or unused materials, sorted by importance such as quantity, cost of management

No	Items of garbage, sewage or unused materials in the firm	Quantity per year	Disposal methods	Expenses/ year (approximately)

**4. Current practices in reduction waste at sources**

4.1 Does your firm have efforts to reduce waste at sources?

- Yes.  No.

If yes, please specify the waste reduction efforts (can choose more than 1 choices).

- Reduce waste in production technology (e.g. having waste minimization aims in product design, using production technology that could lessen raw materials)
- Reduce waste in management and transport of raw materials/ products (e.g. having measures to preserve raw material quality, using first in-first out system, controlling quantity of raw materials)
- Reduce waste in production process (e.g. having records of resources utilization for process improvement)
- Others, please specify.....

**5. Current practices in sorting and storing waste**

5.1 Does your firm have efforts to sort and store waste aligned with 3R principle?

- Yes.  No.

If yes, please specify the waste sorting and storing efforts (can choose more than 1 choices).

- Conduct waste audit (structured process of identifying and quantifying the sources, amount and types of waste that is generated at the premises) or conduct waste sorting
- Sort recyclable waste for selling to factory type 105 (recycle factory)
- Have clear separated storage for hazardous waste
- Have clear labels for each type of waste
- Others, please specify.....

**6. Current practices in reuse, recycle, and recovery waste**

6.1 Does your firm have efforts to reuse, recycle, and recovery waste?

- Yes.       No.

If yes, please specify the waste reuse, recycle and recovery efforts (can choose more than 1 choices).

- Reuse (e.g. reuse as raw material substitution, reuse containers by refilling)
- Recycle (e.g. use waste as fuel substitution or burn for energy recovery, use as co-material in cement kiln or rotary kiln, or other recycle methods)
- Recovery (e.g. bringing waste into solvent reclamation/ regeneration process)
- Other methods (e.g. land reclamation, composting, animal feed)

Please elaborate the chosen methods: .....

**7. Current practices in waste treatment and disposal**

7.1 How your firm treat and dispose waste?

- done by the firm       done by Waste Processor       both

If done by yourself, please specify waste treatment/ disposal methods

- land fill       incineration
- other methods (e.g. make fertilizer, land filling, waste-to-energy)

Please specify.....

If carried out by Waste Processor, please elaborate how you choose Waste Collector/ Waste Transporter/ and Waste Processor

.....  
.....

**Part III: Areas of capacity needs for the firm in carrying out the industrial waste management aligned with 3Rs principles**

**8. Internal constraints**

8.1 What are the major internal problems and constraints that obstruct your firm from implementing 3Rs principles or make it (more) success? (can choose more than 1 choices)

- Unclear organizational policies, plans, and programs on the approach
- Inadequate capacity of staff in terms of knowledge and experiences

Please specify the knowledge gap:

- Knowledge to redesign management and/or operation processes to reduce waste
- Knowledge to redesign products or packaging to reduce waste
- Knowledge to conduct waste audit and analysis
- Knowledge on technology/ innovations for reuse, recycle, and recovery waste
- Lack of instruction materials in Burmese for Burmese employees
- Other knowledge gap, please specify.....
- Inadequate staff to carry out the tasks
- Insufficient Burmese worker leaders/ foremen and translators to communicate the issue
- Inadequate budget for implementation
- Others, please specify.....

## 9. Interface with the governmental policies and regulations on industrial waste management

9.1 Which procedures of industrial waste management regulations applied to your firms? (can choose more than 1 choice)

- Store waste over 90 days (have to request permission through Sor-Kor 1 form)
- Store hazardous waste (have to follow Notification of Ministry of Industry Re: documentation controlling hazardous waste transportation B.E. 2547 (2004)
- Waste management (i.e. have to develop emergency plan, separate storage for hazardous waste, assign staff in charge of environmental control and protection)
- Waste transportation for treatment and disposal outside the firm (have to request permission through Sor-Kor 2 form, transport waste only through licensed Waste Transporter and Waste Processor/ notify the agencies of transportation data via electronic system and have transportation control documents)
- Waste treatment and disposal within the firm (have to request permission from the Department of Industrial Works (DIW) before implementation/ have waste analysis results prior to treatment and disposal/ submit annual report (Sor-Kor 5 form) to DIW)
- Reporting (submit annual report to DIW (Sor-Kor 3 form) within March 1

9.2 Do you find difficulties complying with the above regulations?

- Yes.
- No.

If yes, please specify the problems:

.....  
 .....

9.3 Have you received technical/research/development trainings, capacity building activities, sharing of good practices or other supports from any agencies?

Yes.       No.

If yes, please specify the topic/areas:

.....  
 .....

From which agency?

.....

9.4 What would you suggest for changes in regulations and/ or policy to enable effective industrial waste management and foster 3Rs practices?

.....  
 .....

9.5 What would you suggest for incentives provided to industries practicing 3Rs? (e.g. financial, technological, public recognition, networking, etc.)

.....

**10. Supports needed for implementing 3Rs principles**

10.1 What would be supports you want for implementing 3Rs principles and how importance they are? (5=highest → 1=lowest)

Supports for implementing 3Rs principles	Level of importance				
	5	4	3	2	1
<input type="checkbox"/> Seminar and trainings on 3Rs in industrial waste management Please identify the preferred training topics:.....					
<input type="checkbox"/> waste reduction at sources (redesign products/process)					
<input type="checkbox"/> waste audit and waste sorting					
<input type="checkbox"/> waste reuse, recycle, and recovery					
<input type="checkbox"/> waste treatment and disposal					
<input type="checkbox"/> Access to information sources on internet for self-learning on 3Rs in industrial waste management					
<input type="checkbox"/> Access to collection of good practices in 3Rs in similar factories					
<input type="checkbox"/> Formal or informal exchange learning across industries in Nadee and/or other areas					
<input type="checkbox"/> Consultants providing analysis and recommendations for improvement					

<input type="checkbox"/> Partial financial supports for tools and equipment improvement					
<input type="checkbox"/> Instruction and training materials in Burmese					
<input type="checkbox"/> Others, please specify: .....					

10.2 What would be the promising actions your senior management would be interested to enhance 3Rs in your firm? Please identify level of possible commitments (5=highest →1=lowest)

Promising actions	Level of commitments				
	5	4	3	2	1
<input type="checkbox"/> Dedicate staff time for training					
<input type="checkbox"/> Join a network of circular economy industrial firms in Nadee					
<input type="checkbox"/> Participate in program for consultants analysis					
<input type="checkbox"/> Invest financial resource to implement recommendations					
<input type="checkbox"/> Others, please specify: .....					

10.3 How often do you engage with other firms in Nadee for knowledge exchange?

- Regularly       Rarely       Never

10.4 Do staff and managers in your firm know what the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) are?

- Yes, and it is integrated in our work.       Yes, to some extent.  
 No, mostly not.       No, we do not know.

10.5 Do staff and managers in your firm know what circular economy and green economy are?

- Yes, and it is integrated in our work.       Yes, to some extent.  
 No, mostly not.       No, we do not know.

## Part IV: Emerging risks and needs due to COVID-19

### 11. Emerging risks for your firm due to COVID-19 pandemics

11.1 How do you perceive the impact of COVID-19 pandemics in your business and in Nadee in the next 12 months?

- increased unemployment and loss of income  
 increased anxious and mental trauma  
 limited access to supplies of necessities

- increased crimes
- others, please specify

.....

11.2 What are the measures your firm is taking to mitigate the risks, if any?

- activate no-travel/ work-from-home policies/physical-distancing-at-work measures
- support employees with financial assistance and management of stress
- monitor the pandemic evolving and communicate with employees
- prepare plans and measures to restore business operations
- others, please specify .....

**12. Needs and contributions**

12.1 What are the needs/ supports for your firm to properly adapt to this crisis?

.....

12.2 Has your firm engaged in support of COVID-19 responses in Nadee?

- Yes       No

If yes, how?.....

Additional comments/ suggestions:

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Thank you very much for your time and cooperation.



## APPENDIX B



### **Survey questionnaires on Policy and Planning for Industrial Waste Management to promote the Circular Economy in Nadee Subdistrict (For related national planning and policy agencies to industrial waste management policy)**

#### **Background**

According to the Nadee Subdistrict Municipality as a pilot city under the cooperation of UNESCAP - UN Habitat under the project of Localizing the 2030 Agenda through Sustainable Urban Resource Management (SURM). To support the implementation of Agenda 2030 in Asia and the Pacific. The project has established a working committee for sustainable city development in Na Dee Subdistrict to support collaboration and exchanging opinions between Nadee Subdistrict Municipality and related parties regarding water and wastewater management, waste management, industrial pollution, and the quality of life in Nadee Subdistrict. The 1st working was conducted in October 2019 agreed that technology and industrial waste management that is suitable for the circular economy will be an important part for the planning and implementation of a pilot project in Nadee Subdistrict. This study was therefore prepared to support the information necessary to make decisions and plans for conducting next step of the project.

This study is mainly based on the 3Rs principles of industrial waste management which is a principle that is consistent with the 2030 Agenda, also the laws and regulations of industrial waste management in Thailand. In the analysis of the current role and operation of industrial waste management relating to circular economy approach which cover for 4 steps: (1) reducing waste at sources; (2) sorting and storing waste); (3) Reuse, recycle, and recovery waste; And (4) waste treatment and disposal

#### **Description**

This collected data will be used only for the technical purposes of this research project. The data will not be distributed and utilized for other purposes and analysis and results will not reveal the name of your organization or the interviewee providing the information in anyway.

The questionnaire consists of three main parts: (i) Policy guidelines for current industrial waste management; (ii) Past Performance; (iii) Comments and recommendations on industrial waste management policies that can be implemented

#### **Part 1: Policy guidelines for current industrial waste management**

1. What is your organization's objective and policy regarding industrial waste management? Please specify names or relevant documents. And what are the specific objectives and policies regarding industrial waste management for the local private sector and local government agencies? Please specify and provide relevant documents.

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2. Do you have an industrial waste management policy to reduce or prevent waste from the source (Preventive) or not? what is your organization's role? What is your organization's authority, e.g. communication, public relations, planning, management, and monitoring related to reduction of waste?

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3. Do you have an industrial waste management policy to encourage reuse or recycling? what is your organization's role? What is your organization's authority, , e.g. communication, public relations, planning, management, and monitoring related to reuse or recycling of waste?

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4. Do you have an industrial waste management policy to collect and deliver waste in the appropriate treatment or to convert to energy? What is the role? , e.g. communication, public relations, planning, management, and monitoring related to appropriate waste treatment or to energy conversion?

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5. Do you have an industrial waste management policy by encouraging the industrial sector to proper collect and deliver waste? What is the role? What areas of authority include communications, public relations, planning, management, and monitoring?

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**Part 2 Past Performance**

1. What are the successful indicators of industrial waste management policies which issued by your organization, such as transfer grants, technology support, number of training, study visits, partnerships with universities, research and development Institute?

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2. What is your organization’s goal in implementing industrial waste management policies? which target groups?

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3. At what level does your organization evaluate the success of industrial waste management policies? What are the indicators and What are the evaluation results? please specify and provide relevant documents.

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4. How your organization experienced obstacles and limitations in promoting industrial waste management policies into practice?

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**Part 3 Comments and recommendations on industrial waste management policies that can be implemented**

1. Please give some examples on the industrial waste management that has been successfully implemented by your policies, which projects, or where?

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2. What is the key to success in driving the implementation of your organization's industrial waste management policy into the implementation for local private, and local government organizations?

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3. What is your idea of making successful industrial waste management policies that can be implemented and maintained continuous development for sustainability? especially the implementation for local private sector and local government organizations.

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4. What are your opinion on the Circular Economy? and how it can be implemented with and for local private sector, and local governments, especially through your organization planning, implementation, monitoring and evaluation?

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5. Will your organization have a policy on building capacity local government agencies to implement your policy and to effectively manage industrial waste? How?

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6. What is the direction on the industrial waste management policy issued by your organization in the future?

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Additional comments/ suggestions:

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Thank you very much for your time and cooperation.



## **APPENDIX C: Survey on Relevant SURM-related SDGs Alignment**


### **Background**

This analysis is a perception survey to measure the level of contribution that your company/organization is making in terms of achieving select Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. The 2030 Agenda for Sustainable Development was unanimously adopted at the United Nations Sustainable Development Summit on 25 September 2015 as the apex mandate for development at the global level, and member States are reporting their progress against the 17 established SDGs through the Voluntary National Reviews (VNRs). Although the goals, targets and indicators are at a higher national level, subnational entities such as local governments and companies may submit their inputs through national channels to be consolidated at the nation-level.



### **Instruction**

In the table below, please go through each of the goal, target and indicator and mark with a “v” in the box that you think is the level of your firm’s/organization’s contributions to the indicators. This is based on your perception in terms of rating your contributions. If you rate “Very significant” and “Significant”, please provide the reason and example of how your firm/organization is taking initiative with each of the relevant SDG. You may wish to highlight your policies, programmes, projects, procedures and actions that best exemplifies the commitment to improve the conditions relevant to the specific indicator. Respondents from government organizations should also provide related policies and legislations that has been formally enacted to deal with each of the issue, as appropriate.

Goals	Targets	Indicators	Thailand's National Indicators	Level of Contribution				Evidence/ Relevant Practices	
				Very Significant	Significant	Moderate	None		
<b>6</b> CLEAN WATER AND SANITATION 	Goal 6. Ensure availability and sustainable management of water and sanitation for all	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated	6.3.1 Proportion of wastewater safely treated					
			6.3.2 Proportion of bodies of water with good ambient water quality	6.3.2 Proportion of bodies of water (e.g. oceans, sea, lakes, rivers, canals or ponds) with good ambient water quality					
		6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time	6.4.1 Percentage change in water use efficiency over time. (Definition: Value added over water use, by industry).					
			6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources	6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources					
<b>9</b> INDUSTRY, INNOVATION AND INFRASTRUCTURE 	Goal 9. Build resilient infrastructure, promote inclusive and	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with	9.4.1 CO2 emission per unit of value added	9.4.1 CO2 emission per unit of value added					

Goals	Targets	Indicators	Thailand's National Indicators	Level of Contribution				Evidence/ Relevant Practices
				Very Significant	Significant	Moderate	None	
sustainable industrialization and foster innovation	increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities							
 Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1 Index of coastal eutrophication and floating plastic debris density	14.1.1 Index of coastal eutrophication and floating plastic debris density					



Goals	Targets	Indicators	Thailand's National Indicators	Level of Contribution				Evidence/ Relevant Practices	
				Very Significant	Significant	Moderate	None		
 <b>11 SUSTAINABLE CITIES AND COMMUNITIES</b>	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated					
			11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)	11.6.2 Proportion of number of days that fine particulate matter (e.g. PM2.5 and PM10) in cities are within standards.					
		11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities	11.7.1 Proportion of the built-up area of cities that is open space for public use for all (Department of Land will define 'open space for public use')					
 <b>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</b>	Goal 12. Ensure sustainable consumption and production patterns	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air,	12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment	12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment (Pollution Control Department proposed data collected by sources of waste e.g. industrial waste, community waste, infectious waste)					

<i>Goals</i>	<i>Targets</i>	<i>Indicators</i>	<b>Thailand's National Indicators</b>	<i>Level of Contribution</i>				<i>Evidence/ Relevant Practices</i>
				Very Significant	Significant	Moderate	None	
	water and soil in order to minimize their adverse impacts on human health and the environment							
	12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1 National recycling rate, tons of material recycled	12.5.1 National recycling rate, tons of material recycled (considering whether to combine data on community waste (by the Pollution Control Dept.) and industrial waste (by Dept. of Industrial Works))					
	12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	12.6.1 Number of companies publishing sustainability reports	12.6.1 Number of companies publishing sustainability Reports (using first the data of companies registered to Thailand's stock market)					