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ENVIRONMENTAL, SOCIAL AND GOVERNANCE IMPACT STATEMENT

of a Waste-to-Energy Power Plant

School of Technology
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Energia- ja ympäristötekniikka

TIIVISTELMÄ

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Tutkimuksen tehtävänä oli tehdä ympäristön, sosiaalisten ja hallinnollisten vaikutusten raportti jätteenpolttolaitoksen toiminnasta. Tutkimuksen taustalla oli WOIMA Corporationin tarve valmiille raportille näistä vaikutuksista, mitä he voivat hyödyntää tehdessään yhteistyötä kehittyvien maiden kanssa.

Tutkimus keskittyi jätteenpolttolaitoksen ympäristöllisiin, sosiaalisiin ja hallinnollisiin vaikutuksiin. Tärkeänä tekijänä näiden vaikutusten arvioinnissa toimii lait ja määräykset. Tutkimuksessa käytettiin tieteellistä materiaalia sekä WOIMAn omaa materiaalia aiheeseen liittyen.

Ympäristönvaikutusten arvioinnissa jätteenpolttolaitoksen kannalta keskeistä on jätteet, päästöt, kasvihuonekaasut, metsän häviäminen ja ilmastonmuutos. Sosiaalisten vaikutusten arvioinnista keskeistä on työntekijän suhde työnantajaan, erilaisuus, työolosuhteet, paikalliset yhteisön turvallisuus, työturvallisuus sekä konfliktit. Hallinnollisten vaikutusten arvioinnissa keskeistä on hyvä hallinnointi, yritystoiminta, korruptio, lahjonta sekä yrityksen yhteiskuntavastuu.

Avainsanat	jätteenpolttolaitos, ympäristövaikutukset, sosiaaliset vaikutukset, hallinnolliset vaikutukset

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ABSTRACT

Author	Riikka Siimesvaara
Title	Environmental, Social and Governance Impact Statement
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The aim of this thesis was to make an environmental, social and governance impact statement of a waste-to-energy power plant. The objective was to make a report that WOIMA Corporation could utilize when working to build power plants with developing countries.

The thesis focused on the environmental, social and governance impacts of a waste-to-energy power plant. Legislations and requirements are the main part to consider when making an impact statement. Scientific articles and the material provided by WOIMA Corporation were used to make this thesis.

The central factors of environmental impacts are waste and pollution, resource depletion, greenhouse gas emissions, deforestation and climate change. The central factors of social impacts are employee relations and diversity, working conditions, local communities, health and safety and conflict. The central factors of governance impacts are corporate governance, corporate behavior, corruption and bribery as well as corporate social responsibility.

Keywords	Waste-to-energy, environmental impact, social impact, governance impact and impact statement

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LIST OF ABBREVIATIONS

CSR	Corporate Social Responsibility
EIA	Environmental Impact Assessment
EPA	United States Environmental Protection Agency
ESG	Environmental, Social, Governance
ESGIS	Environmental, Social, Governance Impact Statement
EU	European Union
GHGs	Greenhouse gases
MSW	Municipal Solid Waste
SDGs	Sustainable Development Goals
SIA	Social Impact Assessment
SPV	Special Purpose Vehicle
UN	United Nations
W2E	Waste-to-energy

1 INTRODUCTION

Waste-to-Energy power plants help to decrease the amount of landfill deposited municipal solid waste (MSW), provide a reliable and free fuel source that will not run out, reduces greenhouse gases (GHGs) and creates local job opportunities. While developing a waste-to-energy (W2E) power plant, companies can utilize assessments, such as environmental impact assessment (EIA), social impact assessment (SIA) and environmental, social and governance impact statement (ESGIS) to help recognize possible risks and help prevent and mitigate them.

The assignment of the thesis was to make an Environmental, Social and Governance Impact Statement (ESGIS) for an incineration plant. The assignment for the thesis was given by WOIMA Corporation. WOIMA Corporation's projects increase well-being in emerging countries by delivering best-in-class circular economy solutions that mitigate environmental, social and health problems caused by waste. The mission of WOIMA Corporation is to improve the quality of life both locally and globally as well as empowering people to utilize waste as a commodity. /1/

1.1 WOIMA Corporation

WOIMA Corporation was established in 2017 with a mission to increase economic, environmental and social welfare in developing countries by delivering quality waste-to-energy solutions and services. The experts behind WOIMA have over 20 years of international project and site management experience. /2/

Waste-based power generation solution is the core of WOIMA. They can utilize municipal solid waste, wastewater sludge, industrial, commercial and institutional waste as well as agricultural waste and engineered waste fuels. WOIMA aims to protect the environment and create local jobs while helping investors, waste management companies and independent power producers realize the potential in waste. /2/

WOIMA provides a comprehensive information package to support their customers that covers all aspects of environmental impact assessment, social impact assessment, feasibility studies, project profitability and the technical solution. The solutions are always up to date with the strictest technical and environmental standards. The solutions will provide decades of uninterrupted power. /2/

1.2 Research Objectives

The objective of this research was to make an ESGIS for WOIMA Corporation that could be utilized in future projects in developing countries.

1.3 Environmental, Social and Governance Impact Statement

An Environmental, Social and Governance (ESG) Impact Assessment is a broad report of considerations that may impact the ability of companies executing their business strategies and creating value over the long term. /3/ The ESGIS takes into consideration ethical, sustainable and corporate government issues such as managing the corporation's carbon footprint. /4/

The main criteria to consider while making an ESGIS are environmental, social and governance criteria. Environmental criteria concentrate on waste and pollution, resource depletion, greenhouse gas emissions, deforestation and climate change. Social criteria concentrate on employee relations and diversity, working conditions, local communities, health and safety and conflict. Governance criteria concentrate on corporate governance, corporate behavior, corruption, bribery and corporate social responsibility. /4/

WOIMA directly supports the environmental and social criteria. WOIMA will help the special purpose vehicle (SPV) that is responsible for the W2E plant operations with the governance criteria. /4/

2 WASTE-TO-ENERGY POWER PLANT

2.1 WasteWOIMA® Waste-to-energy Power Plant

The wasteWOIMA® modular waste-to-energy power plant produces 17 tons of steam/h, gross electricity 3.3MWe and net electricity 2.5MWe or 2MWe net electricity and 10MWt thermal energy out of 150-200 tons of municipal solid waste per day. /5/

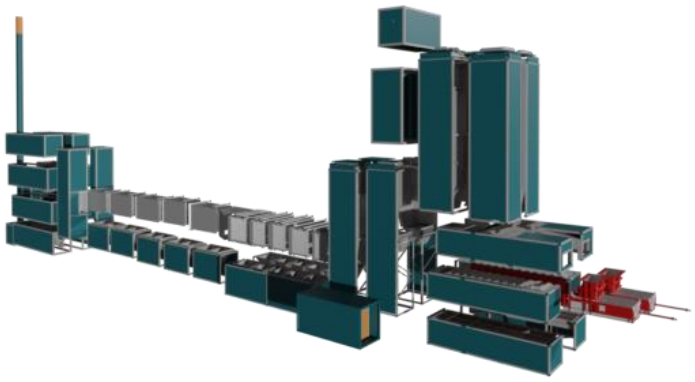


Figure. wasteWOIMA® Modular W2E Power Plant /5/

2.1.1 Waste Incineration

After the waste has been fed through the fuel feed, it will carry on to the combustion chamber where the waste will go through the following phases: drying, pyrolysis and char combustion. To support full combustion, the primary air is being fed through the grate while also acting as a cooling media for the grate. Incineration capacity varies from five to seven tons per hour, depending on the composition and the calorific value of the waste. /5/

The bottom ash, which is the burn residues will fall into a cooling pool. After the bottom ash is cool enough, it is transported to an ash processing system where excess water is removed and returned to the cooling pond. The remaining ash can be utilized in infrastructure construction, cement production or it will be compacted for landfilling. /5/

Figure 1. Waste Incineration of wasteWOIMA® /5/

2.1.2 Heat Radiation and Cooling

From the middle, the furnace will open to the adiabatic combustion chamber where the gasified fractions of the incinerated waste burn. To help ignite and ensure full combustion of the gases, secondary and tertiary air will be injected to the upper combustion chamber. After the gases will flow into radiation/cooling channel where steam/water absorbs the heat. /5/

The European Union standards require a residence time (2 sec @ 850°C) to fully burn out furans and dioxins in the flue gas. This phase of the incineration plant guarantees that the standard is met. /5/

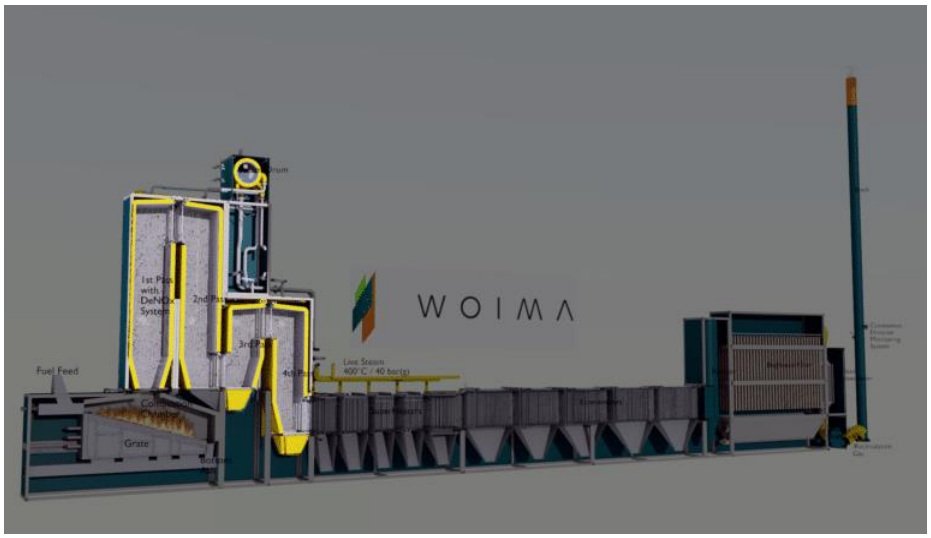


Figure 2. The Heat Radiation and Cooling Process of wasteWOIMA® /5/

2.1.3 Waste Heat Recovery

Waste heat is collected in the recovery boiler where a superheater, evaporator, economizer and air preheater are located. They are designed to collect the remaining heat through convection. The superheater and evaporator convert the steam into superheated saturated steam for the steam genset. The water will be preheated by the economizer in the water tank from where the water will travel to the steam drum, where the air preheater will heat the primary, secondary and tertiary air to improve incineration efficiency. /5/

Figure 3. Waste Heat Recovery Process of wasteWOIMA® /5/

2.1.4 Air Pollution Control

The wasteWOIMA® power plant air pollution control is based on a dry APG-system which satisfies the World Bank Air Pollution Guidelines and EU Emission Standards. /5/

Figure 4. Air Pollution Control of wasteWOIMA® /5/

2.1.5 Power Generation

The steam is fed to a turbine-generator set, where the saturated and superheated steam will be transformed into electricity. /5/

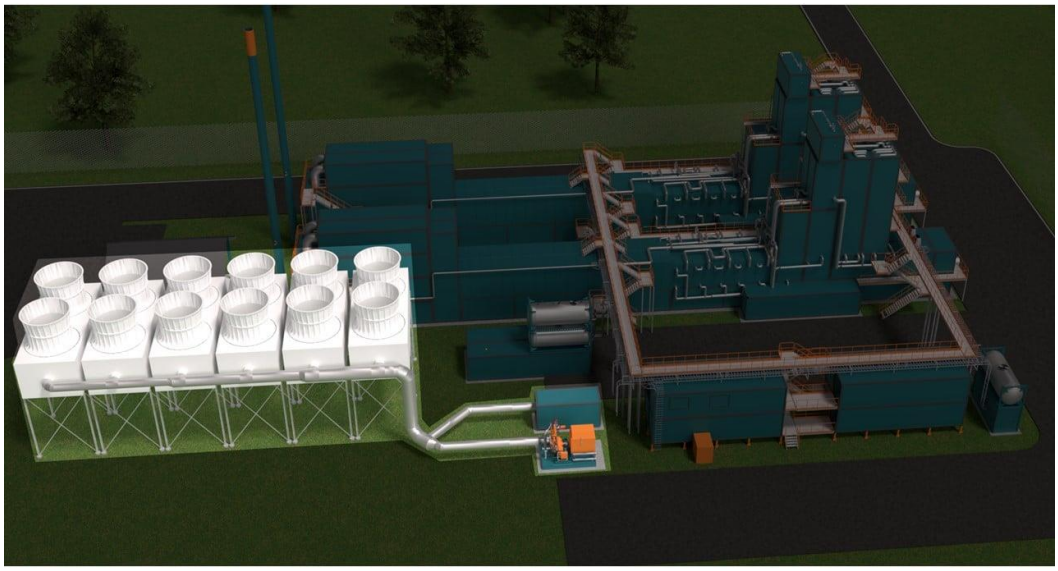


Figure 5. Power Generation Process of wasteWOIMA® /5/

2.2 Implementation Plan of a Waste-to-energy plan

Generally, implementing a waste-to-energy power plant has three main phases: feasibility study, project preparation and project implementation. /6/

2.2.1 Feasibility Phase

During the feasibility phase, a prefeasibility study and feasibility study are made. These two study similar issues but the prefeasibility study is often based on existing data and literature, which can be used to consider whether the area in question meets the requirements for waste incineration. After the prefeasibility study is done, a political decision will be made to decide whether it is necessary to build a waste incineration plant. If the project gets a green light, then the feasibility study can begin. During the feasibility study, an in-depth investigation will be made consid-

ering waste quantities, calorific values, capacity, location, energy sale, organization, costs and financing in detail. After the feasibility studies, a political decision will be made to proceed the implementation of the plant. The whole feasibility phase lasts around one year and nine months. /6/

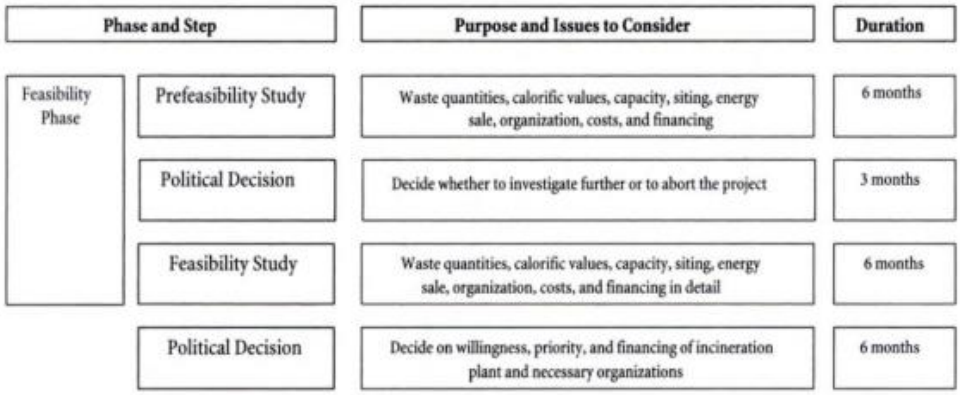


Figure 6. Feasibility Phase of the Implementation Plan /6/

2.2.2 Project Preparation

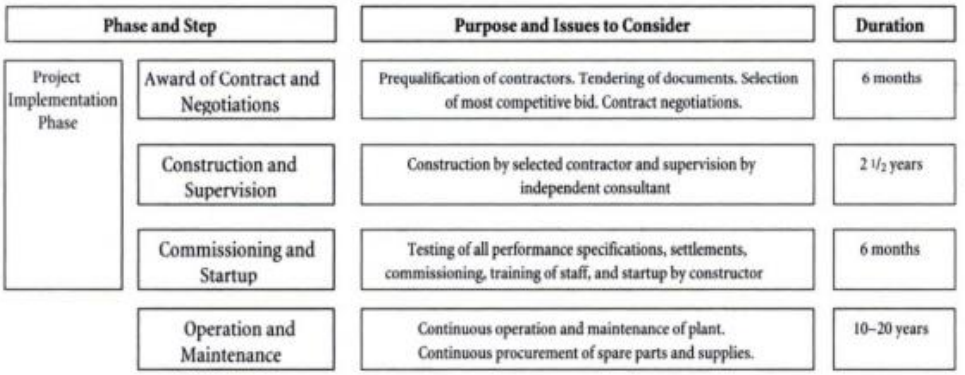
The objective of the project preparation phase is to make all the studies made in the feasibility study to materialize. All the fundamental decisions will be made during the project preparation phase thus making the phase highly political. The project preparation phase can be categorized in three categories: establishment of an organization, tender and financial engineering and preparation of tender documents. After all the preparation phases are completed, a political decision will be made to give the final go-ahead to the project. The project preparation phase lasts around one and a half years. /6/

Phase and Step		Purpose and Issues to Consider	Duration
Project Preparation Phase	Establishment of an Organization	Establishment of an official organization and an institutional support and framework	6 months
	Tender and Financial Engineering	Detailed financial engineering, negotiation of loans or other means of financing, and selection of consultants	3 months
	Preparation of Tender Documents	Reassessment of project, specifications, prequalification of contractors and tendering of documents	6 months
	Political Decision	Decision on financial package, tendering of documents and procedures in detail and final go-ahead	3 months

Figure 7. Project Preparation Phase of the Implementation Plan /6/

2.2.3 Project Implementation

The final phase of the implementation plan is the project implementation, which lasts around three and a half years. First, the tendering will take place which should be carried in two stages: prequalification of eligible contractors and tendering the selected. After selecting the most competitive bid, the contract will be negotiated. After contracts are made, the construction can begin with an independent consultant supervising the project. After about two and a half years, the plant is constructed, and the commissioning and startup phase can begin. All the performance specifications will be tested, staff will be trained, and startup will be performed by the constructor. After the startup, the plant is ready for the operation and maintenance phase. The plant can continuously operate 10-20 years. /6/



Phase and Step		Purpose and Issues to Consider	Duration
Project Implementation Phase	Award of Contract and Negotiations	Prequalification of contractors. Tendering of documents. Selection of most competitive bid. Contract negotiations.	6 months
	Construction and Supervision	Construction by selected contractor and supervision by independent consultant	2 1/2 years
	Commissioning and Startup	Testing of all performance specifications, settlements, commissioning, training of staff, and startup by constructor	6 months
	Operation and Maintenance	Continuous operation and maintenance of plant. Continuous procurement of spare parts and supplies.	10–20 years

Figure 8. Project Implementation Phase of the Implementation Plan /6/

3 LEGISLATIONS

3.1 Environmental Legislations

Finland has been a member of the European Union (EU) since 1995 and is following the waste legislations based on the EU legislations. Some of the legislations in Finland have stricter standards and limits than the EU legislation requires. Some of Finland's legislations have yet not been covered by the EU. /7/

Waste policies in Finland aim to promote sustainable use of natural resources and ensure that waste does not cause hazards to health nor the environment. /8/

The following key principles have been adopted in the Finnish waste legislation and the European Union waste policies:

- Reducing and preventing the production and harmful impact of waste
- Whoever produces waste will take responsibility for the costs of waste management except for certain product types in which case the manufacturers and importers bear responsibility when their products become waste
- Anticipation of risks and preparing for potential risks in waste management
- Disposing of waste near their source
- All the member states of the European Union need to remain self-sufficient regarding their disposal of waste /8/

European Union's waste management approach follows a waste hierarchy, which sets the following order to waste policies and waste management: prevention, reuse, recycling, recovery and disposal. /9/

The following are the priority objectives for waste policy in the European Union:

- Reducing the amount of waste generated
- Maximizing recycling and re-use
- Limiting incineration to non-recyclable materials
- Phasing out landfilling to non-recyclable and non-recoverable waste

- Ensuring full implementation of the waste policy targets in all member states /9/

The European Union has set targets for the member states, such as a target for recycling 65% of municipal waste by 2030, target for recycling 75% of packaging waste by 2030 and a binding landfill target to reduce landfill to maximum of 10% of municipal waste by 2030. /10/

3.2 Social Legislations

In Finland, the social and health legislations aim to promote welfare, health and security. The Constitution of Finland protects every citizen's right to income and to care in case he /she is unable to manage sufficiently. /11/

The following are the main objectives of social and health legislations considering ESGIS in Finland:

- Social Welfare Act
- Child Welfare
- Health Care Act
- Occupational Health Care Act /11/

The European Union legislations are seeking to increase employment and worker mobility, to improve the job quality and working conditions, to inform and consult workers, to battle poverty and social exclusion, to promote equal opportunities and battle discrimination and to modernize social protection systems. /12/

There are 20 principles called The European Pillar of Social Rights that affect the social legislations in the EU. These principles aim to deliver new and more effective rights for citizens. The principles can be put in three categories: equal opportunities and access to the labor market, fair working conditions and social protection and inclusion. /13/

The following are the main principles of called The European Pillar of Social Rights considering ESGIS in the EU:

- Gender Equality
- Equal Opportunities
- Active Support to Employment
- Secure and Adaptable Employment
- Wages
- Information about employment conditions and protection in case of dismissals
- Social dialogue and involvement of workers
- Healthy, safe and well-adapted work environment
- Minimum income /13/

Figure 9. The European Pillar of Social Rights /14/

3.3 Governance Legislations

The corporate governance in Finland is primarily based on the legislation Finnish Companies Act.2 that regulates the governance of companies. This includes points such as the role of the board directors. The legislation Finnish Securities Markets Act.3 is also important, and it considers points such as disclosure and transparency issues of listed companies. /15/

Companies will also have to follow the rules of Nasdaq Helsinki Ltd (the Helsinki Stock Exchange), the regulations and guidelines of the Finnish Financial Supervisory Authority. The European Union legislations are also applicable in Finland as well as the European Securities and Markets Authority guidelines and technical standards. /15/

The European Union has not set a set of rules for corporate governance, instead it has a principles-based regime for member state-based corporate governance codes. /16/

3.4 United Nations

In 2015, all 193 member states of the United Nations had to adopt the 2030 agenda for sustainable development no matter whether they are developed or developing countries. The agenda has 17 sustainable development goals (SDGs), such as quality education, climate action and life on land. These goals aim to stop climate change and preserve oceans and forests. The first goal "No poverty" will go together with improving health and education, reducing inequality and spurring economic growth. /17/

Considering waste management, the following key principles are the most important parts of the sustainable development goals:

- Good health and well-being: Better waste management means less pollution and better work environments
- Clean water and sanitation: Easier to achieve with a clean, renewable source of energy
- Affordable and clean energy
- Decent work and economic growth: Bringing a W2E plant in the city will open new job opportunities
- Climate action: W2E plants reduce greenhouse gases
- Life on land: W2E plants reduce the need for landfills and burning solid waste will also help clean the streets /17/

Figure 10. Sustainable Development Goals of the UN /17/

WOIMA Corporation supports the SDGs by aligning its solutions, operations and projects to support them. Their solution is an integral part in building a sustainable, inclusive and fair society where everyone can enjoy equal opportunities and face equal responsibilities. Throughout the processes, the SDGs guide WOIMA's product development, sales activities and project execution. /2/

4 ENVIRONMENTAL IMPACT

4.1 General

The environmental impact statement (EIS) is used to identify, predict, assess, evaluate and mitigate possible environmental effects of a proposed project. After the effects have been identified, the EIS will describe how they have been assessed and how they can be avoided, minimized or offset. The EIS will be assessed by an environmental consultant and local environmental authorities. /4/

4.2 Waste Pre-Sorting

The WOIMA pre-sorting process begins with the weighting of garbage trucks before they place their waste in the tipping storage. The tipping storage acts as a buffer that enables deliveries around the clock and ensures continuous waste flow. /18/

The waste will be fed from the storage to the shredder that opens the bags and crushes large objects. After the shredder, a conveyor belt, where ferrous metals will be removed by a magnet, moves the crushed waste onto a screen that separates small particles that are hard to sort manually. The small particles such as biowaste, sand, soil and ashes are all recycled or landfilled except for biogas that can be used in biogas generation or it can be composted. /18/

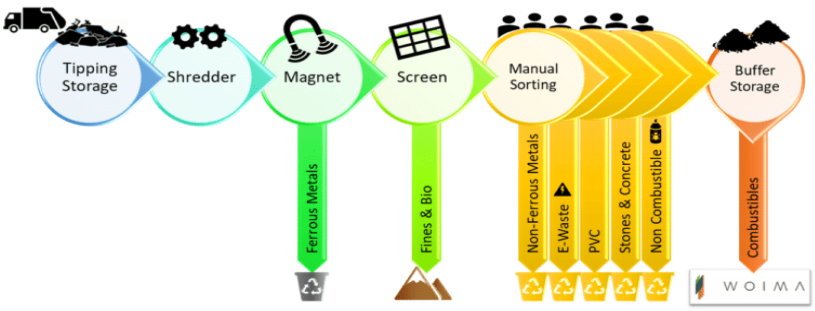


Figure 11. WOIMA Sorting Process. /18/

According to the United States Environmental Protection Agency (EPA) waste to energy facilities prevent one ton of emitted carbon-dioxide equivalent in the atmosphere because instead of the waste being at a landfill generating methane it is placed into the facility. The metals that are a part of the waste are not put into landfill but recycled. /19/

4.2.1 Air Emissions

The garbage trucks transporting the waste will be a source of dust as well as the moving of the waste into the incinerator. /20/

The dust caused by vehicular action can be mitigated by setting vehicle speed limits to the area and discouraging vehicle idling. The vehicles need to be serviced regularly. Maintaining the equipment is crucial to mitigating air emissions. Waste should be disposed regularly and appropriately to avoid decomposing at collection areas. /20/

4.2.2 Noise Emissions

The garbage trucks delivering the waste will generate noise emissions as well as the movement of the waste within the plant. If there are settlements nearby the plant the noise level needs to be maintained at recommended levels. The noise emissions also effect occupational health and safety implications and workers. /20/

The noise emissions can be mitigated by maintaining the machinery, billboards to notify the people, maintaining plant equipment, giving workers safety and protective gears and providing barriers around the plant. Noisy machinery should be in enclosures and away from sensitive environments. /20/

4.2.3 Odor Emissions

The main sources for odor come from the unloading of the waste and the buffer storage. The handling of the waste in and around the buffer storage will cause unpleasant smells. Any spillage in the general area must be cleaned and the area needs to be kept tidy to avoid odor. /6/

4.3 Incineration Plant

4.3.1 Air Emissions

The *waste*WOIMA® power has been designed to fulfil the strictest emission regulations to reduce the impact of waste incineration on the environment. /21/

The built-in non-catalytic converter (SNCR), reactor chamber and bag filters, together with the appropriate chemicals, reduce the pollutants to levels far below what is currently allowed for fossil-fuel-powered plants. /21/

4.3.2 Soil, Water and Noise Emissions

The *waste*WOIMA® power plant does not generate any soil or water emissions. /21/ Most of the equipment that a W2E plant requires are located inside the plant, which will muffle the noise emissions. Appropriate sound reduction or absorption equipment might be necessary to keep the noise from spreading via the building. /6/

4.3.3 Odor Emissions

The combustion process of the waste destroys all odor-emitting substances in the waste and after cooling the slag and fly ash are odorless. /6/

4.3.4 Light Emissions

Energy consumption can potentially be a negative impact on the environment. Energy-efficient lighting should be installed with energy-saving bulbs. Lighting can be switched off during the day. All electrical equipment not being used can be switched off. /20/

4.3.5 Skyline

A W2E plant should be locates in a zone that is dedicated for industrial activities. /6/

5 SOCIAL IMPACT

5.1 General

The social impact statement will provide information on how the project will affect social and environmental factors in the communities where the project is planned. /22/ These factors can be for example occupational health and working conditions, discrimination and human rights.

5.1.1 Energy Access

Household energy requirements differ from enterprise and social institution energy requirements. Everywhere everyone needs energy for lighting, electrical equipment such as radio and for cooking. Different countries do not have much difference regarding the type and amount of electricity they need. In poor households, more than 80% of their energy are spent on cooking, lighting, information and communication. Other requirements such as heating or air conditioning are country and region specific. /23/

Still in the modern world, more than 1.3 billion people lack access to modern electricity. They cook their food on open fire and fetch their own water. 4.3 billion premature deaths occur each year because of household air pollution caused by burning animal waste in their own homes. Wood is used to create the fires, which means that forests are getting destroyed. /24/

Figure 12. Energy Access in Developing Countries /24/

Benefits of energy access are employment, health, clean water and education. A waste to energy power plant creates new job opportunities. Health is improved by having a clean fuel source for cooking and warmth instead of open fires and reducing debilitating labor. Having a clean energy source ensures that communities have access to clean water by aiding in distribution and purification. Energy access could indirectly help get children into schools instead of them having to do time-consuming household work. /23/

5.2 Job Opportunities

All around the globe there are people who make a living collecting, sorting, recycling and selling waste. These people are most often referred to as waste pickers, but also a derogatory term “scavenger” is used. Waste pickers provide the only form of solid waste collection in some countries. Work situations for waste pickers vary across countries. Most often, waste pickers search private waste bins and collect waste from streets and waterways or search dumps and landfills. Others search for necessities or collect and sell recyclables to businesses. In some countries, there are recycling warehouses and recycling plants that waste pickers can work in. /25/

Waste pickers help contribute in making a cleaner city since they clean the streets and waterways. In cities where there is a waste problem, waste pickers help reduce greenhouse gases by taking the waste off the street and recycling them. /25/

Waste pickers face many health risks daily because they may be exposed to contaminants and hazardous materials such as fecal matter. They also face ergonomic hazards by lifting and using repetitive motions. /25/

WOIMA Corporation can help the waste pickers by providing them a job at their plant. Waste pickers can for example be a part of the manual sorting phase or help collect the waste for the plant. Having a job with the company would make their occupational safety and health much better by providing proper work equipment, training and work environment. These jobs would also be suitable for all genders.

Having a clean source of electricity can attract new companies to the area, which would provide new job opportunities. Cleaner electricity would be cheaper for residents, which could inspire them to start their own businesses.

5.3 Waste Management Improvements

Waste management in developing countries is aggravated by flawed practices that improve environmental contamination and spread diseases. Waste is dumped on uncontrolled landfills or in open spaces such as streets and beaches. Dumping waste openly generates serious air pollution, soil pollution and water pollution. Openly dumped waste generates appalling smells in the cities. Waste pickers working near open dump grounds face severe health risks. Littering near water bodies increase marine litter globally which enhances environmental contamination. /26/ Dumping solid waste in open spaces also attracts vermin such as rats and insects. The dumped waste gets to open drains, which get blocked and start to overflow. /27/

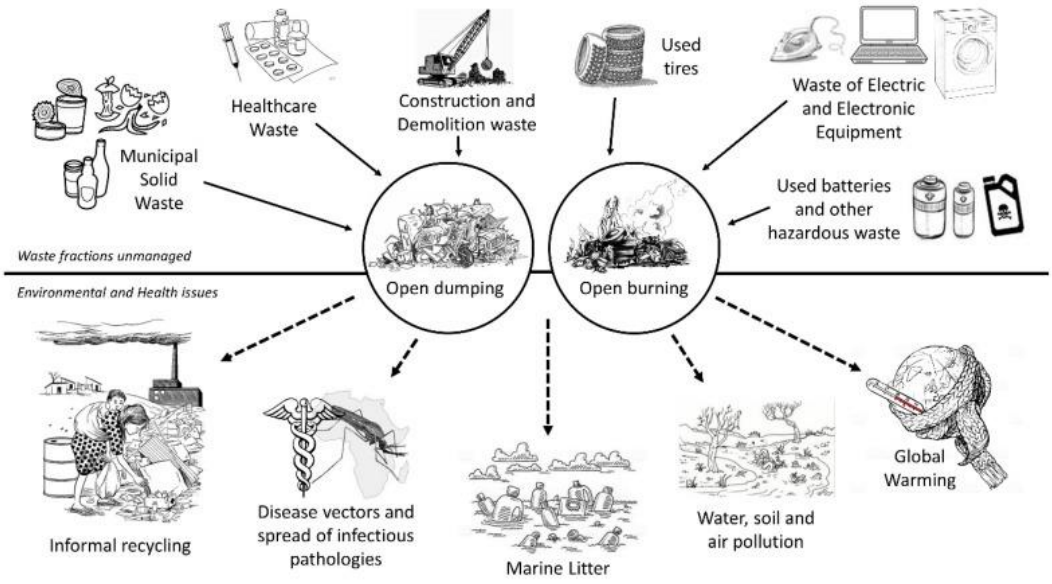


Figure 13. Poor Waste Management /26/

Overflowing landfills that are left unattended create severe risks to the environment and people. Landfills emit more than ten toxic gases, methane gas being the worst. Methane is produced by organic matter decay. The air pollution and atmospheric effects caused by landfills increase urban and global temperatures. Landfills also contaminate groundwater, which is a severe threat to the environment. Landfills cause serious health risks to people living near them by polluting the air and polluting water. Landfills destroy the soil and land of their location, which renders the land unusable. Landfills are also extremely flammable which means that once a fire is ignited it causes more air pollution. /27/

Instead of waste being thrown on landfills and other dumping grounds, it can be used in a W2E power plant. This plant significantly reduces the amount of waste left unattended. A W2E plant provides cities with a clean, renewable energy source without the pollution that landfills cause by releasing greenhouse gases and other gases. They also operate without contaminating water systems. These W2E plants can be near cities, which means that the transportation of waste is quicker. This reduces the cost of transportation but also air pollution caused by the garbage vehicles. Noise and odor pollution are minimal compared to the smell of landfills and

the explosions in landfills. Burning waste in high temperatures leaves metals untouched which then can be picked by waste pickers and recycled. /27/ The main by-product of incineration is bottom ash which can be utilized in infrastructure construction or manufacturing cement and tiles. /28/

5.4 Infrastructure Improvements

It might be necessary to build new roads if the roads are not in good condition to start with. The roads near the planned power plant will be in excessive use from developing the plant to operating the plant, which means that the roads need to be in good condition and need to stand excessive use.

It might also be necessary to build new electrical lines, which would especially help smaller communities.

5.5 Working Conditions

The fundamental rights of workers must always be protected. A satisfied workforce is the key ingredient in the sustainability of a company. Workers must be provided with documented information that is clear and understandable regarding their rights. Worker rights include hours of work, waged, overtime, compensation and benefits upon beginning the working relationship and when any changes occur. Discrimination cannot be allowed, and the employer will not make employment decisions based on personal characteristics. The developer must take measures to prevent and address harassment, intimidation and exploitation. /29/

Children will not be used as labor force in any manner that is economically exploitative, or is likely to be hazardous or interfering with the education of a child or that is in any way harmful to the health or physical, mental, spiritual, moral or social development of a child. Children under the age of 18 will not be employed in hazardous work. National laws have provisions for the employment of minors and the developer will follow those laws. /29/

The developer will not employ forced labor. Forced labor is any work or service involuntarily performed and it is exacted from an individual under threat of force or penalty. /29/

5.6 Health and Safety

An important part of developing a W2E power plant is to ensure the safety of its employees. There are multiple different job positions in a W2E plant such as utility operators, regional maintenance workers and technicians. /30/

To ensure occupational health and safety the developer must provide a safe and healthy work environment and inherent risks and hazards in work areas must be taken into consideration as well as specific threats to women. Steps must be taken to prevent accidents, injury and disease arising from, associated with or occurring during the development. /29/

The following World Bank Group Environmental, Health and Safety Guidelines must be addressed:

i. Identification of potential hazards to workers
ii. Provision of preventive and protective measures
iii. Training of workers
iv. Documentation and reporting of occupational accidents, diseases and incidents
v. Emergency prevention, preparedness and response arrangements /29/

The community of the proposed project can be exposed to risks and impacts because of the project activities, equipment and infrastructure. If the community is already subjected to impacts from climate change, the project actions can accelerate and/or intensify those impacts. The developer is responsible for avoiding and minimizing possible risks towards the community health, safety and security that arise from project related activities. /29/

To ensure community health and safety the developer will take into consideration safety risks to third parties while planning the infrastructure and equipment design.

The developer will also avoid or minimize potential exposure to hazardous materials and substances that may be released by the project. Special care must be exercised to avoid or minimize these risks by modifying, substituting or eliminating the condition or material causing the potential hazards. /29/

WOIMA ensures that all their partners follow the well-established principles of quality, environmental, social and occupational health and safety management systems. /2/

The following are standards that all WOIMA projects follow:

- ISO 9001:2015
- ISO 14001:2015
- ISO 26000
- ISO 45001:2018 (OHSAS 18001) /2/

5.7 Conflict

The level of risks and impacts on community health, safety and security in conflict and post-conflict areas should not be overlooked since it may lead to further conflict. /29/

6 GOVERNANCE

6.1 General

The concept of “governance” depends on the level of governance, the goals to be achieved and the approach being followed. The concept is referring to the task of running a government or any other appropriate entity. The definition about governance provided by World Bank goes as follows: "Good governance is epitomized by predictable, open and enlightened policy-making, a bureaucracy imbued with a professional ethos acting in furtherance of the public good, the rule of law, transparent processes, and a strong civil society participating in public affairs. Poor governance (on the other hand) is characterized by arbitrary policy making, unaccountable bureaucracies, unenforced or unjust legal systems, the abuse of executive power, a civil society unengaged in public life, and widespread corruption." /31/

6.2 Corporate Governance

Corporate governance means the system of rules, practices and processes by which a firm is directed and controlled. It essentially involves balancing the interests of the many stakeholders of the company. Most companies strive towards high level of corporate governance. A company can demonstrate good corporate citizenship through environmental awareness, ethical behavior and sound corporate governance practices. With a good corporate governance, a transparent set of rules and controls are being made in which shareholders, directors and officers have aligned incentives. /32/

Bad corporate governance can implicate the financial health of the company by casting doubt on the reliability, integrity or obligation of the company to shareholders. There can be no tolerance for illegal activities. /32/

The following five principles are the key to good corporate governance:

i. Ethics
ii. Aligned business goals
iii. Strategy process which incorporates stakeholder value

iv. Organization structured to carry out good corporate governance

v. Reporting system that provides transparency and accountability /33/

6.2.1 Corporate Social Responsibility

Corporate social responsibility (CSR) is part of the approach to corporate governance. CSR is the commitment of the company to manage the social, environmental and economic effects responsibly and in line with public expectations. CSR is an important part of every part of the company including operations, human resources, supply chain, health and safety and more. /34/

Practicing CSR has many benefits to the company including good reputation, attracting positive attention, saving money through efficiency, minimizing environmental impacts, attracting top talent and inspiring innovation. /34/

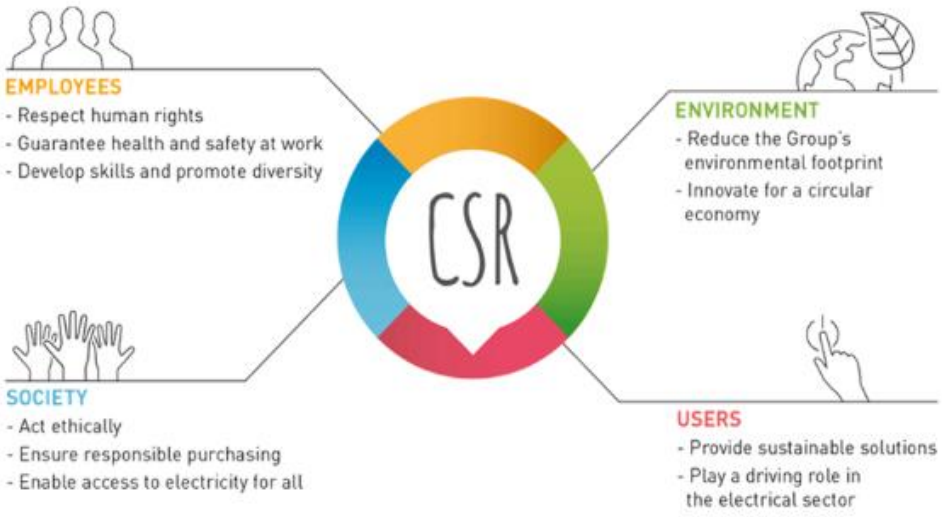


Figure 14. Corporate Social Responsibility Activities /35/

6.3 Corporate Behavior

Corporate behavior is based on legal rules, ethical codes of conduct and social responsibility principles. The key components to successful ethical corporate behavior are ethics, law and CSR. /36/

Corporate behavior has an effect on the entire economy as well as stakeholders and shareholders. For a company to be more sustainable it needs to act ethically and socially responsibly in its business decisions and strategic planning. Socially responsible corporate behavior is increasingly seen as essential to the long-term survival of companies. /36/

6.4 Corruption and Bribery

Corruption and bribery are key ingredients to bad governance. There are some countries, most often developing countries, where people are not able to access public services without having to engage in some form of bribery. /37/

A great opportunity for corruption becomes available if good governance principles are not in place. On the other hand, if there is some form of corruption in place, it can prevent good governance principles and structures from being put in action. Most strongly associated with corruption are violations of principles of transparency, accountability and rule of law. /37/

7 CONCLUSIONS

The world is globally facing an enormous waste problem, which is resulting in up to a million people dying every year. Every year, 2.12 billion tons of waste is dumped on the planet. In terms of resource use and waste generation, we are already pushing 75 percent above what the Earth can sustain in the long run. /38/

Dumping waste such as household waste, plastic waste and sewage on beaches, streets or uncontrolled landfills is wrongfully becoming a solution to the waste problem. New ideas to solve the waste problem are desperately needed since waste dumping has bad consequences, such as soil pollution, air pollution, ocean pollution, groundwater pollution and public health issues. /38/

In low-income countries, solid waste management improvements are urgently required. In these countries over 90 percent of waste is openly dumped and untreated since there often are no adequate disposal and treatment facilities. Still, a third of the world's waste is being generated in high-income countries where the waste issue must also be taken seriously. /39/

By 2050, the global waste is projected to grow to 3.40 billion tons per year. Solid waste-related emissions are anticipated to increase to 2.38 billion tons of CO_2-equivalent if no chances are made. /40/

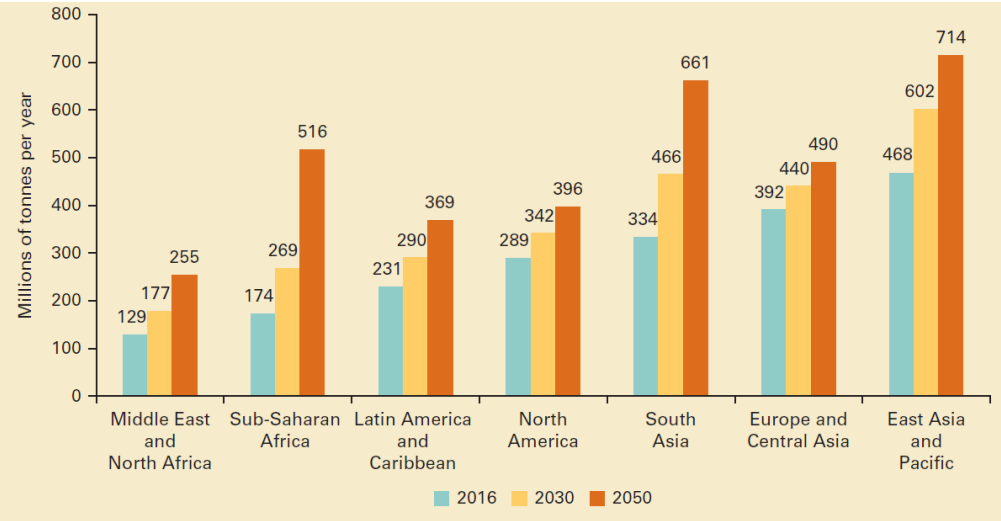


Figure 15. Projected Waste Generation by Region /40/

The wasteWOIMA® power plant is a ground-breaking solution for developing countries struggling to cope with both the growing demand for electricity and waste management challenges. One of these wasteWOIMA® power plants is perfect for a municipality or area of up to 500,000 inhabitants. For larger cities, the plant can be decentralized. The wasteWOIMA® power plant offers advantages in waste collection, waste treatment and localized electricity generation as well as significant savings. The plant can also be dismantled and erected to a new location, if needs or requirements change. /41/

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