CHAPTER 1
INTRODUCTION

One of the early and frequently quoted definition of Sustainable Development is from ‘Our Common Future: Report of the World Commission on Environment and Development’, also known as the Brundtland Report (World Commission on Environment and Development, 1987):

‘Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and

- The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.’

The concept of sustainable development views the world as a system that connects both space and time. When air pollution from one country affects air quality in another, it acknowledges the world as a system that links spaces. Similarly, when decisions made by one generation on how to farm land affect the agricultural practices of another generation, the link with time is also visible. Thus, the decisions made today to pollute a geographical area not only affect another geographical area in the current time dimension but also affect the future generations in the same area.
Sustainability depends to a great extent on the interrelationship between economic progress, environmental management and individual well-being, which is increasingly being recognized by not only the general public but also by decision-makers, environmentalists, and medical researchers (Goosen, 2012). Economic growth is limited by the finite natural resources and their efficient utilization. At the same time, it is also dependent on nature’s ability to absorb the waste generated. When the amount of waste exceeds the natural absorption capacity, the environmental quality decreases leading to harsh policy measures that could inhibit growth. Growth could also be reduced due to the irreparable damage caused to the environment that leads to a less productive and lower steady state (Brock and Taylor, 2005). In the past, the world’s ecosystems were able to absorb the ecological damage that resulted from extensive industrialization and development. As population of the world increased, there have been two major impacts. Firstly, the need for basic necessities such as clean water, air and living conditions has multiplied. Secondly, the increase in population has also led to an increase in industrialization which has further increased the pressure on natural resources. As a result, the earth is no longer able to maintain a healthy and balanced ecosystem and there is a need to balance the aspects of economic, environmental and social progress (Tietenberg and Lewis, 2012).

In order to tackle this situation, many organizations and their stakeholders are looking at a sustainable development model, where performance is judged based on economic, environmental and social development (Elkington, 1994). This model has also been absorbed into the corporate world as the Triple Bottom Line or ‘3Ps’\(^1\). The Triple Bottom Line approach can help improve the environment, lead to sustainable growth and development and also, improve the overall health of the society in which we live. Sustainability requires a balance between these three sets

\(^1\) 3Ps refers to the concept of ‘People, Planet and Profits’ under the Triple Bottom Line’ framework
of goals. The interrelationship amongst these factors is such that social stability can be achieved after economic sustainability, which in turn is dependent on ecological sustainability. To achieve the primary target of ecological sustainability, the concepts of pollution and environmental degradation need to be studied in greater detail.

Pollution is generally understood as the adverse change in the natural environment due to the introduction of contaminants, which could be in the form of chemicals, or energy, or both. The widely recognized forms of pollution are air, land and water pollution. A further classification looks at the aforementioned three forms along with noise, thermal, light and visual pollution. Most industries produce environmental waste or pollution as a by-product. In this context, waste management is critical in regard to the pollution of natural resources such as air, water and land due to the negative externalities created by this waste, which leads to contamination of the soil and water and also, creates air pollution by releasing harmful and toxic greenhouse gases. This environmental degradation can translate into economic effects as observed by Panayotou (1989):

- On the one hand, there is a scarcity of resources coexisting with the same scarce resource being inefficiently used, overused or wasted. An example is water for irrigation - some farm lands suffer from salinization of the soil due to excess water usage, whereas some farm lands do not have adequate and reliable supply of water.

- Scarce resources are put to inferior and unsustainable uses, even though superior and sustainable uses exist. An example of this situation would be the use of land to grow cash

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2 Negative externalities occur when the price paid for a product or service is less than the cost incurred. This is typically visible in environmental context where the consumer only pays for the explicit cost of the good or service and not for the cost of environmental damage caused during production. This leads to market inefficiencies as well as environmental degradation, which in turn reduces the quality of living (Kolstad, 2006).
crops in certain climatic regions. This practice leads to yield decline and degradation of soil. There exists an option to grow perennials, which could prove to be sustainable.

- Renewable resources, which are capable of sustainable management are overexploited. A forest can be mined for timber in a sustainable manner by planning for its regeneration at the same rate of the mining. However, most forests are mined without concern for their regeneration, thus leading to short-term gains but a complete destruction of the resource for future generations. Also, the forests are viewed only as timber yielding resources when they could be used for multiple purposes such as timber (in sustainable quantities), non-timber goods, water and soil conservation, biological diversity, etc., which could yield a perpetual stream of income at a higher net present value.

- Investments in the protection and enhancement of the resource base, like in the soil conservation programmes to reduce erosion, are not done. If done, this could generate a benefit by increasing productivity and enhancing sustainability.

- Local communities, local tribals and other groups, who have specialized knowledge, tradition and self-interest can be the best managers of resources like forests. However, these groups are displaced and deprived of their customary rights of access to resources, leading to the degradation of the particular resource.

- Waste and by products are often not recycled, when such recycling would generate both economic and environmental benefits. Examples are household or agricultural solid wastes, which have multiple uses (compost and energy) but are instead chosen to be landfilled.
• Unique sites, habitats, flora and fauna go extinct when the existence of the same could have resulted in economic benefit as in the case of wildlife parks.

The Organization for Economic Cooperation and Development (OECD), in the *OECD Environmental Outlook to 2050*’s baseline scenario has forecast that about 40% of the world’s GDP and 50% of the world’s greenhouse gas emissions will be accounted for by the BRIICS\(^3\) countries by 2050 (Marchal et al., 2012). The World Health Organization (WHO) estimated that outdoor air pollution was the main reason behind premature death of 3.7 million worldwide in 2012 (WHO, 2014). Water resources are also expected to come under severe pressure in the near future for many regions, including Africa, Australia, some parts of South America, Southern Europe, and the United States (Sauvage, 2014). In this context, governments are increasingly encouraging and promoting the market for environmental goods and services that minimize or prevent damage to the environment.

**SOLID WASTE AND ITS MANAGEMENT**

Solid waste is understood as the non-liquid material that holds no value to the generator of the waste. It is also known as trash, garbage or refuse. Waste is created by human activities and this waste needs to be collected, stored and finally disposed in a manner which is not detrimental to the environment or to public health. The manner of handling and disposing solid waste that tries to minimize health and environmental impact is known as solid waste management (SWM). In urban areas of developing economies, problems and issues related to municipal solid waste management (MSWM) take precedence over other governance issues mainly due to the possible

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\(^3\) BRIICS - Brazil, Russia, India, Indonesia, China and South Africa
high impact on public health. Due to the rapid population growth, the capacity of most municipal and local authorities to provide even the most basic services such as MSWM sometimes falls short. A survey by the United Nations Development Programme (UNDP) of 151 cities from around the world revealed that insufficient solid waste disposal is ranked as the second most serious problem faced by urban residents after unemployment (UNDP 1997).

In India, an average of about 40-50% of the waste generated is not collected and this uncollected waste finds its way on the roads and drainage systems. This in turn leads to flooding, breeding of insects and disease spreading pests and so on. The composition of municipal solid waste in India is shown in table 1.

Table 1: Composition of municipal solid waste in India

<table>
<thead>
<tr>
<th>Waste category</th>
<th>% of total waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>8.13</td>
</tr>
<tr>
<td>Plastic</td>
<td>9.22</td>
</tr>
<tr>
<td>Metal</td>
<td>0.5</td>
</tr>
<tr>
<td>Glass</td>
<td>1.01</td>
</tr>
<tr>
<td>Rags</td>
<td>4.49</td>
</tr>
<tr>
<td>Inerts</td>
<td>25.16</td>
</tr>
<tr>
<td>Compostable material</td>
<td>47.43</td>
</tr>
<tr>
<td>Others</td>
<td>4.06</td>
</tr>
</tbody>
</table>

(Source: Zhu et al., 2008)

A large portion of the waste is organic in nature and provides food and shelter to rodents and disease spreading insects. The organic fraction of waste also leads to foul odour and spoiling of the aesthetic beauty of the surroundings. The collected waste is sometimes disposed in an unscientific manner by burying in landfills or through open burning, thus leading to pollution of
land, water and air. This deficiency in service and infrastructure usually affects the lower strata of society owing to their proximity to areas where waste is stored. This leads to increase in health hazards and further social marginalization.

**The SWM System**

The factors that are important in the designing of a SWM system include:

1. The quantity and composition of waste, which affects its transportation options. Domestic waste in developed countries typically includes a larger amount of inorganic waste such as plastic, glass, metals and some paper. This leads to a reduced density of the waste. The composition pattern of waste in developing countries displays a larger fraction of wet waste such as kitchen waste and also a high level of inert material like sand, dust, stone and ash. This makes the density of waste higher, which creates a basic difference in the vehicles used for transport of such waste as compared to developed countries. Further, the method of treatment of waste depends on the composition. Waste with higher moisture and inert material does not lend itself easily to incineration or similar disposal techniques. One needs to look for different techniques, which includes segregation at source, which in turn, enables similar types of waste to be treated effectively.

2. One of the most crucial aspects that determine the success of a SWM system is public awareness of waste and attitude towards the same. SWM systems include activities such as household waste storage and segregation, recycling, collection, willingness to pay for services, and cooperation for treatment and disposal facilities. The efficient performance of a SWM system depends on public awareness and participation.
3. Legislative and infrastructural support is the backbone of a successful SWM system. Not only are the legislations expected to be adequate and future oriented, their implementation is required to be equally strict and effective. Some legislation may even limit the options of regular businesses, which is something that lawmakers need to address by balancing both the needs - environment and business.

In a developing economy, the basic SWM usually consists of the following elements:

- Generation of waste and its storage;
- Sweeping of roads and maintaining cleanliness at public places;
- Segregation at the household level - removal for reuse and recycling;
- Primary waste collection and transport to a transfer station or community bin from the balance waste;
- Managing the input and storage at the transfer station or community bin;
- Secondary collection from the transfer stations and transport to the waste disposal site;
- Disposal of waste on landfills; and
- Managing recyclables at all points (collection, storage, transport, and disposal).

The above elements pertain to the physical handling of solid waste and recyclables, which is one aspect of the SWM activity. A successful SWM system also requires the following:
• Passing legislation and policies to ensure the smooth functioning of the SWM system and also includes setting and enforcing standards, and regulations on creation of pollution;
• Data collection and evaluation on waste generation patterns and characterization for planning and adapting system elements;
• Training and capacity development of workers and staff;
• Creating awareness through public outreach and education campaigns;
• Identifying financial mechanisms, economic instruments and cost-recovery systems and also implementation of the same; and
• Involving different stakeholders such as the private sector and NGOs in the SWM system.

Waste Collection Strategies

A large number of municipal corporations in urban areas are unable to provide services to the entire urban population under their jurisdiction. Usually, it is the low income section of the population that is left unserviced in terms of MSWM. The increasing urban population coupled with lesser municipal resources lead to a reduction in the effectiveness of the SWM system. In order to fill the gap, there is an increasing trend of involving private companies in the various activities of the SWM. However, the key factor in obtaining positive contributions from the private sector is the way the contract between the municipal authorities and private companies is articulated and implemented. The important elements of a successful contract are competition, transparency and accountability.
Another advantage of including private players in the SWM activities is their ability to reach out to areas where waste is collected, which are difficult for municipal corporations to access such as narrow roads and slums. Private players can access these areas which include microenterprises and community-based organizations, by using simple equipment and labour intensive techniques.

**Recycling**

Recycling refers to the process of converting waste into reusable material or returning the waste to an earlier form which is capable of being reused. While recycling traditionally has been considered the domain of the informal sector, it is equally relevant to the large manufacturers. The importance of recycling for municipal authorities often gets relegated due to more immediate issues. The important factors that could impact the resource recovery include the cost of segregating the recyclable material, the quality of the material, the quantity as well as the place where it is available. The cost of storage and transportation are related factors that could also affect the possibility of recycling.

**Disposal**

In developing countries, the disposal of solid waste is as much of a concern as its collection. The most common method employed by municipal corporations is to dump it on an open piece of land in an uncontrolled manner and allow slow fires to burn the waste in the open air. This open dumping and slow-burning fires create pollution through strong odour and smoke, which can be hazardous to the health of people living in the vicinity. This method also results in environmental degradation and encourages the growth and spread of pests and vermin, which contribute to spreading diseases. Due to the hazards associated with these dumping grounds, there is a constant opposition to the creation of more such grounds from
the locals near the potential sites. Tackling this issue through legal means takes away time and resources of the municipal corporations. Choosing a site that is free of objections and opposition could mean a site that is far from the city, which increases the cost of transportation and requires more infrastructure in the form of roads. In addition to inefficient site planning, other factors that can lead to inadequate disposal are non-compliance of existing guidelines with regard to design and operations of new landfills.

A safe option to this method of disposal is by operating a sanitary landfill where solid wastes are filled into a carefully selected site, which is constructed and maintained using modern engineering techniques. This method greatly reduces all forms of pollution and does not pose a threat to people and wildlife. Trained personnel, adequate financing options and infrastructural resources would also help in the disposal of waste.

**Bio-medical and Hazardous Waste**

Bio-medical or healthcare waste arises from the activities related to the practice of medicine in hospitals and similar sources. Some of the waste from hospitals and healthcare centres is general in nature and is similar to domestic solid waste. The remaining waste, which is typical to the healthcare activity is called hazardous healthcare waste due to its physical, chemical and biological nature.

The commonly used method for disposal of such waste includes incineration or burning in a controlled environment. The machines and treatment plants for such disposal are quite expensive and increase the financial burden of hospitals. Further, when these machines break
down, they are difficult to repair and end up lying as junk. The risk of contamination exists even before the waste reaches this level, i.e. at the level of collection and transportation.

Hazardous waste other than healthcare waste includes chemical waste, which is equally difficult to manage. It requires stronger enforcement, financing and legal support to ensure that there are lesser fallouts on the environment and population.

**Integrated Solid Waste Management (ISWM)**

This is a more holistic and systematic approach to SWM. It focuses on the urgent planning requirements of environmental, legal, socio-cultural, institutional and political aspects of the SWM. It also gives importance to the role of stakeholders such as rag pickers, informal recycling entrepreneurs, small-scale industries and small waste generators. In addition, it considers the aspects of reuse and recycle, reduction of waste generated, collection, street sweeping and disposal.

ISWM is a sustainable practice and is considered to be an integral part of good governance at the local level. Its importance is accentuated by the fact that it is one of the most visible factors that influence perception of local governance. It is supposed to include transparency and accountability to discourage corrupt practices and political interference. As it provides at least the minimum level of acceptable public hygiene services, it involves the principle of equity, where even the lower strata of society are benefitted and higher payments are taken from consumers who desire better services and are able and willing to pay for the same. Since willingness to pay is affected by the perception of the quality of service, there is a higher focus on keeping all stakeholders informed and involved in the processes. This helps build public cooperation with the services.
As the stakeholders include women, lower sections of the society as well as microenterprises, there is an element of economic and social upliftment inbuilt into the nature of ISWM. It focuses on flexibility of services desired by the consumer’s safety and well-being of staff, clear collection routes and measurable outputs in terms of tasks and projects. It involves the integration of Management Information Systems (MIS) to enable cost effectiveness and performance monitoring.

ISWM involves decentralizing and bundling of services, comprehensive cost analysis and data analysis to improve services and customizing the selection of equipment as per local requirements. The revenue sources in this system are fees for the services, local taxes and incomes from recycling, and recovery of resources including energy from the process. The levels of fee are based on the ability to pay, level of services and the amount of waste generated.

This system, which is sustainable, minimizes wastage of resources and impact on the environment. It involves indigenization of equipment used for services. The vehicles, machinery and other equipment are expected to be locally produced and sourced. It also incentivizes the good practices of waste minimization, resource recovery at source and recycling activities of waste generators. This system contributes to the development of markets and industries related to recycling since it encourages segregation at source.

The introduction of a new waste management facility under this system is preceded by assessment of its process with regards to its environmental effect and ensuring adherence to environmentally acceptable standards. Overall, ISWM helps improve institutional functioning and capacity. Municipal corporations are provided with adequate autonomy and
authority to enable good governance, self-sustaining financing ability and recovery of invested resources.

THE ENVIRONMENTAL GOODS AND SERVICES (EGS) INDUSTRY  

The SWM industry is a component of what is commonly known as the Environmental Goods and Services (EGS) industry. Considering its environmentally-beneficial characteristics, a product may be considered environmental if:

- It is produced in a manner, which causes less environmental harm than a comparable/like product (e.g.: organic products).
- Its use or consumption has an environmentally beneficial end-effect (e.g.: bicycles).
- It contributes to cleaning up or reducing damage to the environment (e.g.: end-of-pipe pollution treatment and monitoring equipment) (Bucher et al., 2014).

The OECD and the Statistical Office of the European Commission (Eurostat) have developed the following definition of the environment industry: ‘The environment industry consists of activities which produce goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air, and soil, as well as problems related to waste, noise and eco-systems. These include cleaner technologies, products and services which reduce environmental risk and minimize pollution and resource use.’ (OECD/Eurostat, 1999)

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4 The Environmental Goods and Services (EGS) industry is also referred to as the ‘eco-industry’ or the ‘environment industry’.
5 This definition by Eurostat also divides environmental goods and services into three major groups: the pollution management group, the cleaner technologies and products group, and the resources management group.
Pollution abatement goods and services, broadly categorized under the umbrella Environmental Goods and Services (EGS) industry, are now largely supplied by a number of specialized firms. The traditional view has been that pollution abatement should focus only on polluters, based on relevant technological, regulatory or output market considerations, without the presence of any explicit market or bilateral relationship with actual suppliers (David and Sinclair-Desgagne 2005). This view is rapidly changing. The earnings of firms in the EGS industry in 1997 amounted to $350 billion, which has doubled in 2010. In some European countries, such as Germany, France and the Netherlands, they account for nearly two percent of the annual GDP (Barton 1997). The EGS industry has become a major topic for industrial, economic and environmental policy as well as for international trade discussions. While it is vital to most government bodies and policy making institutions in order to achieve green goals, research from the viewpoint of environmental economics is yet to catch up (Sinclair-Desgagne, 2008). One of the reasons for the reduced attention is the lack of clarity in some basic issues in the EGS industry.

There are inherent problems in trying to delineate the exact difference between environmental goods and services. Many environmental services need and have some environmental goods embedded in their provision. Similarly, the final sale of an environmental product usually involves inbuilt environmental services content or requires some form of associated installation, maintenance service and monitoring (Bucher et al., 2014; Gelosso Grosso 2007). In spite of these measurement constraints, environmental services have been estimated by Environment Business International at approximately 65 per cent of the EGS industry as a whole.

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6For example, in the solar panel or photovoltaic industry, it is estimated that the rooftop installation cost of solar panels accounts for 60 per cent of the total cost of purchase.
The EU eco-industry competitiveness study further distinguishes the EGS industry into two - core and connected. Waste water treatment and renewable energy sources are examples of the ‘core’ EGS industry. On the other hand, ‘eco-tourism’ whose primary purpose is tourism, would be classified as a ‘connected’ EGS industry. Connected eco-industry could also include mechanical engineering, electronic equipment, chemicals, aerospace, automotive industry, steel, metal working industries, ceramics, glass, ICT and paper (Bilsen, 2009).

The growth, competitiveness and performance of the EGS industry are strongly linked to the policy agendas and regulatory frameworks. Environmental regulations that aim to reduce negative environmental and social impacts create business opportunities that allow for development of the EGS industry (Dervoijeda et al., 2013).

**ENVIRONMENTAL REGULATIONS**

Environmental regulations have a vital objective of ensuring that firms and households internalize the environmental impacts of their decisions, and indirectly, the social impacts. For this to happen, policymakers need to choose the best regulatory instruments available to them and present these best regulatory instruments in the optimal mix. ‘Environmental regulation’ is broadly understood as the correction of an environmental negative externality, while regulatory instruments are the different means through which this correction can be done. The regulatory instruments include measures such as emission standards, ambient standards, technology requirements, liability rules, information-disclosure measures, pollution fees and taxes, and tradable emission permits. These instruments can be further classified into ‘command-and-
control’ which are prescriptive in nature, and ‘market-based’ (also called economic incentives) that allow for greater flexibility in the way private actors can abate pollution (Sauvage, 2014).

Traditionally, the approach to solving the environmental pollution problem has been by using controlling regulations. Lately, the framework of environmental control has been further classified to include the following factors to help attain the environmental goal:

- **Regulations and Standards** - These are also known as command and control measures, which include bans and restrictions. Due to their compulsory nature polluters tend to evade these restrictions.

- **Pollution permits** – These permits are part of a set of economic incentives that allow polluters to trade in the rights to pollute. For those who manage to pollute less, it represents a monetary benefit in the form of sale of permits. However, the continuous challenge is to set the right fee for these permits in absence of which, polluting industries would not be interested in trading.

- **Voluntary negotiations** - These happen when polluters voluntarily decide to reduce the amount of pollution on a common platform, usually provided by the government. However, these negotiations depend to a great extent on the polluters and cannot be made compulsory to all.

- **Environmental taxes/emission fees** - These are taxes or fees paid by the polluter to compensate for the marginal social cost caused due to the pollution. It increases the cost of polluting goods and if these are essential goods, then the poor tend to pay a higher amount as a percentage of their income. This makes the tax be perceived as regressive and socially unjust.
- **Incentives and Subsidies** - These include expenditures by governments to incentivize pollution reduction by polluters and also to consumers to encourage demand for non-polluting goods. The expenditures could be direct, in form of subsidies, or through the tax route, which include tax incentive provisions. Incentives and subsidies are considered to be more ineffective than environmental taxation in reducing pollution.

While each of these measures has some drawbacks, together they can form a potent force in combating the effects of pollution. An ideal environmental policy consists of a combination of command and control techniques with economic incentives.

Effective regulation would result in the optimal mix of regulatory instruments which will, among other things, encourage firms to modify their production techniques and adopt newer, more environmentally friendly equipment. Environmental regulations could lead to the development of a market for a whole range of EGS. An increased market size can have, in turn, important implications for international EGS trade (Sauvage, 2014).

In order to reap the economic and environmental benefits associated with a widespread international diffusion of EGS, policymakers in India and abroad have resorted to tariff cuts and removal of other impediments to liberalize EGS trade. In a context, where the demand for EGS is largely determined by the stringency of environmental regulation, tariff cuts as measures for trade liberalization alone may not be enough but they may go a long way in creating a holistic environmental policy (Bilsen, 2009).

Some of the policy measures implemented in India and some other countries to encourage EGS are given under the regulations in India (Bakker, 2009).
**Regulations in India**

Fiscal incentives could play an important role in encouraging the EGS industry and help reduce pollution. Some of the major provisions in India aimed at creating positive externalities are summarized as under:

1. *Accelerated Depreciation (100%)* - If specified air pollution, water pollution control equipment, solid waste control equipment or recycling and resource recovery systems are purchased, cent percent depreciation under section 32 of the Income Tax Act, 1961 (IT Act), is allowed to the taxpayer. This enhanced depreciation helps the business to reduce taxable profits in the first year and if this depreciation is more than the profits, it can be carried forward to the coming years to be set off against profits till the entire depreciation is exhausted.

2. *Accelerated Depreciation (80%)* - Renewable energy devices including solar power/wind power based equipment and other related equipment are allowed 80 per cent deduction under section 32 of the IT Act. A similar benefit as in the above case is available to the business in respect of the set off against profits.

3. *Exemption of profits for biodegradable waste management* - If a business is engaged in collecting and processing or treatment of biodegradable waste and converting into power, bio fertilizers, bio pesticides, etc., cent percent of the profits from such activities are deductible from tax under section 80JJA of the IT Act, for a period of five years from the year in which the activity commences.

4. *Exemption of compensation related to Montreal Protocol* - Section 28(va) of the IT Act allows an exemption of any compensation received by a taxpayer as reimbursement to
phase out the business of manufacture of chlorofluorocarbons and hydrochlorofluorocarbons as envisaged under The Montreal Protocol.

5. **Infrastructure business** - Section 80 IA (4)(i) of the IT Act allows cent percent deduction of profits earned from the business of any infrastructure facility being water supply project, water treatment system, sanitation and sewerage system or SWM system for a period of ten years in the block of the first 20 years of the business. Similarly, another provision in this section allows for cent percent of profit deduction from the business of power generation and/or distribution. This power can be produced from renewable as well as non-renewable sources.

6. **Business of biotechnology in the Northeastern states** - Under section 80IE of the IT Act, cent percent of the profits of a biotechnology business set up in the Northeastern states of India, viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, for 10 years from the year of commencement of the business.

7. **Exemption of Research and Development (R&D) expenses** - Section 35 of the IT Act allows for a weighted average deduction of revenue as well as capital expenses on any scientific research ranging from 100 per cent to 200 per cent of the expenses incurred.

A few of the tax deductions or exemptions are specifically for businesses in the EGS industry, whereas most of them are for general businesses, which may also include the EGS industry. This gives little motivation for businesses to operate in the EGS industry as opposed to the conventional industries. There are no specific fiscal incentives for the EGS industry and neither are there indirect tax incentives. For example, a business that extracts fuel from plastic waste (thus creating a positive externality by taking care of waste that
would be difficult to dispose otherwise) would need to pay the same rate of excise and other indirect taxes on its output as another business that extracts petroleum in the conventional, highly polluting process.

**Other Countries**

Globally, there are different types of tax and fiscal incentives that can encourage the EGS industry. Some countries, which have been successful in dealing with their waste management problems by providing tax and fiscal benefits, have been studied. Countries such as Australia, Canada, Japan, the Netherlands, South Africa, Spain and the USA provide accelerated depreciation on assets related to environment protection. R&D credits are also provided in a general manner by countries such as Australia Canada, China, the Netherlands, Spain and the USA. Fiscal incentives and credits are available to businesses investing in environmental-friendly projects in Australia, Canada, China, the UK and the USA (Bakker, 2009).

A synopsis of the environment friendly provisions in selected economies is given hereunder:

- **Spain:** Tax credits were given till 2010 to businesses investing in fixed assets to foster use of energy sourced from urban, agrarian or industrial waste. These credits were also available for investments made in assets for treating, eliminating or reducing atmospheric pollution, water pollution or solid waste. Tax credits are currently available for investment/purchase of vehicles that reduce air pollution (complying with certain EU emission norms). In the case of community managed woodlands, credits are given for profits generated from such woodlands provided they are reinvested in the woodlands to
preserve, or improve them, or are used for infrastructural finance purposes. These forests are also exempt from municipal real estate tax along with the estate and gift tax. Corporates that exploit forest farms pursuant to a sustainable plan or reforestation programme are provided with tax exempt subsidies. Expenses on R&D activities also attract deductions/exemptions.

Excise tax is not charged on fuel used for public transport and for research for production of renewable combustibles or biofuels. Recycled oil used as fuel is exempt from excise tax. Reduced excise is charged on the use of agricultural diesel used for agriculture, farming or forestry. Taxes are levied on the use of electricity generated from nuclear power and its waste disposal. There are taxes and charges on the use of conventional fuel, electricity, water usage, landfills and disposal of waste water. These can result in an indirect encouragement to the EGS industry.

- **The United States of America**: Tax credits are available to businesses for renewable and alternative sources of power including power from municipal solid waste. Accelerated depreciation is available for certified pollution control facilities used for plants. A 50 percent additional depreciation is provided for qualified cellulosic biofuel plant property. Tax deductions are also available for expenditures for conservation of soil or water for farming land, for the cost of qualified clean fuel vehicles or clean fuel refueling properties, for compliance with highway diesel sulphur requirements and for the cost of energy efficient residential and commercial building properties. Credits are given for the use of mixed fuel, including the mixture of methanol and ethanol with regular fuel, for the use of biofuels and low sulphur diesel fuels. These fuels are also subject to indirect tax benefits in the form of reduced excise duties.
Investment by taxpayers in clean renewable energy bonds entitles them to tax rebates, where the proceeds of these bonds are to be used for qualified renewable energy facilities. Tax incentives are provided to consumers to use public transport and thus conserve energy. Extra indirect taxes are levied on certain hazardous chemicals and ozone depleting specified chemicals.

- **Germany**: Additional technology bonuses and higher tariffs are available to plants using innovative technologies for gas/electricity generation and feeding it to the main grid for installations up to 5 MW. Income from primary activities such as faring and fishing is exempted from tax. Emission rights qualify as intangible current assets, which are valued at lower of cost or market value. Indirect tax refunds are given for energy used for agricultural or forestry business, fishing and livestock business. Tax refunds are also available for biofuels and bio-heating materials. Electricity from renewable energy sources qualifies for electricity tax exemption.

- **Brazil**: Ten percent of corporate tax payable is allowed as rebate if invested in economic development programmes including reforestation programmes. There are multiple incentives for technological R&D, including financial advantage of operating costs for R&D, accelerated depreciation for machines and equipment for this purpose, withholding tax credit on royalties paid and exclusion of real profit and social contributions on net profits. Sale or import of machinery for transport, harbour, energy, basic sanitation and irrigation attract a tax deferral, which can later become a tax deduction. Indirect tax benefits exist for alcohol-based fuels and biodiesel. Deductions are available for production and circulation of goods related to the waste sector including waste recycling services.
- **Canada:** The Renewable Energy and Technology Programme provides incentives for improvement in renewable energy technologies. Accelerated depreciation is available for new investments and intangible assets in renewable energy and energy conservation projects. General R&D activities, which could also be for EGS industries, attract tax benefits and deductions. Financial incentives are offered for energy efficient features in commercial buildings. A refund of ten percent on mortgage insurance premiums is given for homes, which are energy efficient. In addition, there are a large number of non-tax programmes to encourage the use of and research in technology for EGS, which fund such activities and also provide indirect tax credits by virtue of such activities.

- **China:** A three-year full exemption and three-year 50 percent deduction is available for projects including public refuse treatment and development and utilization of methane gases. Tax reduction and exemptions are given for primary sector activities like agriculture, forestry, animal husbandry and fishery projects. Equipment for environmental protection, energy and water conservation attract a tax credit. Funds for ecology restoration are allowed full deductibility and income reduction is given for manufacturing products, which use resources comprehensively.

While most countries do not have a comprehensive EGS incentive programme in place, there is an indirect support for the same by the way of alternative energy programmes and municipal waste management incentives in some cases. However, most of these countries have a higher tax rate for consumption of conventional fuel so as to make it less attractive and also to encourage research in the areas of non-renewable energy (Bakker, 2009).

In the Indian context, solid waste pollution is a major factor contributing to ecological, social and economic drawbacks. While there is a scope to use this solid waste to our advantage by
converting it into a resource, it is being allowed to pollute the existing resources. The policies to deal with this problem have largely been perceived as falling short, either in terms of drafting or implementation. There are countries which have either taken care or are taking care of this problem through a combination of means including policy. This study is motivated by the need for policy support, among other tools, to convert the solid waste into a valuable resource, thus providing a boost to the environmental, social as well as economic status of the country. Considering the requirement of a stronger SWM industry, there needs to be more focused and clearer regulations aimed at encouraging this industry. Some countries have regulations in place that promote certain components of the industry but most of them do not have a clear vision and plan in place for regulating the industry as a whole. In India, while better policies are required to encourage SWM Industries, one needs to study the effectiveness of the existing policies and find out if they are achieving the desired objectives. This study looks at the existing environmental policies and possible improvements to these policies to help encourage the SWM industry.

LAYOUT OF THESIS

This thesis has been divided into seven chapters. Chapter One titled ‘Introduction’ gives an idea about the background of SWM and its linkages to the EGS Industry as well as to Environmental Regulation. Chapter Two titled ‘Review of Literature’ reviews the existing literature related to the SWM industry and its presence in India, the factors affecting the growth and development, the theoretical framework of this study and also formulates the research problem. Chapter Three titled ‘Research Methodology’ focuses on the various aspects related to the research process and design, which guided this study. The exploratory nature of this study and its impact on the research design is described in this chapter. Chapter Four provides a description of the
background and context of the sampled cases, which are SWM firms mainly from cities in the Southern and Western regions of India. Chapter Five concentrates on cross-case comparison of the findings of the study and specifically, describing the role of process techniques in the context of SWM and environmental goals, based on the findings of the case-studies. Chapter Six continues the cross-case comparisons of the case studies and focuses on the perceived environmental policy in the context of SWM and environmental progress. Finally, Chapter Seven ‘Conclusions’ addresses objectives of this research, discusses theoretical and practical implications, provides future scope for the study and discusses the limitations of the study.