

Karnataka Waste-To-Power

Topics in Emerging Markets
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Introduction

Karnataka Waste-to-Power (KWP) is a waste management company proposed to be set up in the populous Indian state of Karnataka, which contains the city of Bangalore. Bangalore is India's fifth largest city, and has the highest industrial and commercial growth rate in the country, so it will continue to produce an increasing content of municipal solid waste in the future. Additionally, Bangalore produces the highest calorific content trash in India. The higher the calorific content of trash, the more energy it will yield when burned, which is crucial in the consideration of burning waste to produce electricity.

The project involves a large initial investment in the building of the plant that will convert solid waste into environmentally responsible and user friendly energy. Through a complex system of waste purification (essentially by creating “fuel pellets” out of municipal solid waste), all sorts of garbage are converted to electricity, thus addressing both the city’s waste problem as well as energy shortage concerns.

Karnataka Waste-to-Power’s strategy is to partner with the municipal government to become the waste removal body for the city. KWP will be able to charge the municipal government less than what they are currently paying so the city will: a) pay less for waste removal and b) KWP will be able to supplement their revenues from the fees they will charge for electricity.

This environmentally friendly solution to waste management and energy needs will end up being cost effective for end users, both commercial and individual. In addition, an entry into this business in this market now will allow such an investment to capitalize on the first-mover advantage.

The main issues for KWP are the appraisal of the financial potential of the project and the educations of prospective investors, both private and municipal, about the project risk profile in order to raise the required funds as well as educate them on the potential positive long-run environmental rewards of switching to a waste-to-energy waste management system.

Solution and Value

The Waste-to-energy case would be useful to a Senior Undergraduate student because after reading and solving the case, he/she will be in position to:

- Create and forecast cash flows for a company based on an innovative idea,
- Estimate potential initial investments for a domestic company's branch in an emerging market,
- Calculate the discount rate for a company with operations in a emerging market, considering various domestic and international factors,
- Determine profitability of an innovative company in an emerging market using sensitivity analysis of discount rate.

The ultimate goal of solving this case is to develop a keen sense about how to evaluate the profitability of a new business idea in emerging markets.

The Case

The case will introduce the company, various aspects of doing business in India, and current environmental challenges. The main content will include the following:

- Detailed company overview and strategy
- Analysis of the country
 - Financial assessment
 - Economic environment
 - Political environment
 - Demand assessment (including the impact of current waste management)
- Company specific financial analysis
 - Estimated Waste-to-energy costs and revenues
 - Exhibits to provide criteria for further valuation and analysis

Business Environment Background

In the year 2003, several major issues face developing nations trying to make headway into the world economy. How can they grow and continue to grow fast? How can they experience growth without sacrificing but rather improving their standard of living?

In India, with the fifth largest economy in the world and the third largest GDP in Asia, these are both valid concerns the Indian government faces. A solution that would enable and promote both these objectives could make a marked difference in facilitating India's desire to realize its global economic potential.

The Idea

Our business plan involves a solution that addresses both of these qualms that India faces. The basic idea is to bring waste-to-energy technology to India, starting in one major city at a time. Our pilot plant will be based in Karnataka, India. We plan to partner with the municipal government to become their one-stop waste removal medium.

Our revenue streams will then be made up of two separate components:

- from the municipal government to pay for city's waste removal
- from the individual consumers for the electricity we will supply generated from their trash.

This idea is viable for several reasons. In any rapidly industrializing nation, waste removal becomes an issue. This is especially applicable in India because with its fast growing population, waste removal is not just a nuisance, but an increasingly real obstacle. The

infrastructure for waste management is not as developed as it is in industrialized countries such as the United States. Thus, in response to India's rapid industrialization, an infrastructure for waste management must be implemented.

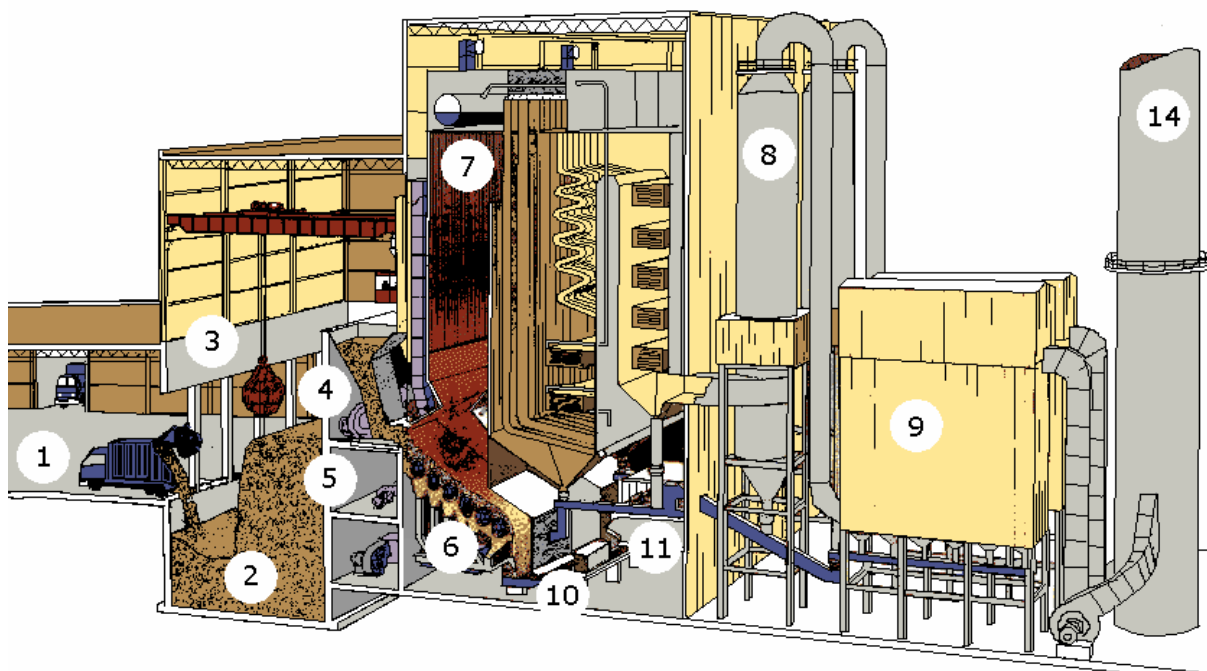
Secondly, developing nations need a wealth of energy in order to industrialize as quickly as the demand requires. Also, in years of rapid growth, it is important to sustain the excitement and energy that momentum brings. In a geographically enormous region such as India, energy consumption can be a huge restraint in determining the country's overall rate of growth. With a waste-to-energy system, India could potentially solve two of its major impediments at the same time. Creating a waste removal system that produces environmentally friendly and domestically produced energy would allow India to eliminate waste completely as opposed to burying it in landfills which is what they currently do. This is obviously a short term solution because although India does possess a lot of land, there will eventually be a point of saturation. With complete removal, landfill saturation will be less of a concern.

Having a domestic source of energy would reduce dependence on oil imports, which could increase India's global bargaining power in the world market. This competitive advantage could grow to be quite important as India develops and grows stronger relative to other developing and developed nations.

How Waste is Converted to Energy

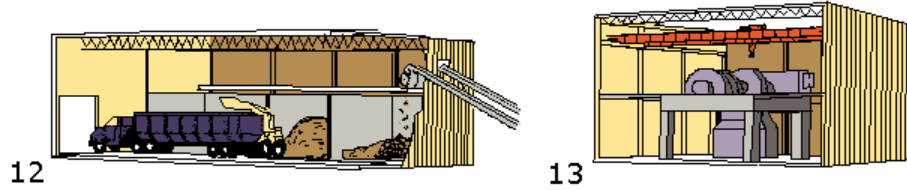
How can garbage contribute to the national power grid? Following the actual collection of the waste, the fleet of collection trucks bring waste to the power plant, where it will begin the waste-to-energy conversion process.

The following is a step-by-step description of the conversion process. Please refer to the diagram below as well:



1. Collection trucks enter the power plant site through a computer-controlled weigh station. The trucks are directed to an enclosed *tipping hall*, where the trucks “tip” their loaders to unload their contents.
2. The waste is unloaded into the *refuse bunker*.
3. The *overhead refuse crane*, which is located right above the *refuse bunker*, then mixes the waste, transfers it from the bunker to drop it into the *waste charging hopper*.
4. The *charging hopper* holds a ready supply of waste in order to charge the *grate system*.

5. Next, the *ram feeder* pushes the waste onto a set of rollers.
6. The constant rotation of the set of rollers tumbles and distributes the waste evenly along the downward slope of the *roller grate* to promote thorough *combustion*. The speed of the rollers, the quantity of combustion air provided and the speed of the *ram feeder* are individually controlled to maintain optimum furnace conditions.
7. The heat generated by burning the waste in these furnace conditions produces steam in the *waterwall boiler*.
8. After cooling in the boiler, combustion gases pass through a *scrubber* for removal of acid gases.
9. The air flow continues through a particulate collection system.
10. After combustion of the solid waste on the roller grate, the remaining ash falls off the final roller into the water-filled *ash quench trough*.
11. There is a control room that houses the computerized central monitoring and control network for the facility.
12. A conveyer then carries the ash to further processing for ferrous and other materials recovery (if needed) and then to the ash storage area. A front-end loader (truck) is used to remove and load the ash into trucks in an enclosed building.
13. Approximately 10 percent of the energy produced by the turbine generator is used to operate the plant and the balance is sold to the energy customer.
14. The cleansed gases are then dispersed to the atmosphere through the smoke stack.



Additional materials and pollution abatement subsystems may be incorporated in the facility as required.¹

¹ Our Process. 2003. *American Ref-Fuel*. <<http://www.ref-fuel.com>>.

Profitability Analysis

In our analysis of the profitability of our venture, we examined several variables of both cost and expenses. Building a waste-to-energy plant in India would cost relatively the same as it would in U.S. Though this may seem counter-intuitive because it would seem as though costs in India would be relatively cheaper, the actual costs of land and the plant itself are all relatively comparable; the fact that most of the expensive (and often heavy) equipment must be imported, rather than produced locally, offsets many of the lower costs. The smaller expenditures would be transportation (important for calculating the cost of waste pick-up and drop-off) as well as labor (important for determining general operating expenses).

The revenues would also differ slightly because generally the profitability structure of waste-to-energy plants in the US. depends on consumers' willingness to pay extra for energy from an environmentally responsible source; our energy would have to be sold at the going market rate in that market. However, in India, that may be impossible, as energy is relatively expensive and much less widely used. Therefore, our profitability structure includes supplements from the municipal government from fees for trash pick-up. Those plus the opportunity cost of possibly having to incur huge costs in the future to clean up saturated landfills are enough to prove that KWP is a practical business idea.

In our discounted cash flow analysis, we experimented with different costs for the different elements of our operations. We conducted different scenarios to answer each of the following questions:

- What are the different costs of trucking the garbage to and from the plant for different levels of waste?

- How much would our operation's revenues and costs grow with different annual garbage growth rates?
- How much electricity would we produce with different garbage growth rates?
- What are appropriate fees to charge the municipal government so that it is profitable for them as well as to implement these plants?

Please see our valuation in the appendix as the basis of our pitch to educate investors on the profitability of Karnataka Waste-to-Power.

Local Market Risks Sovereign Risks

Economic Performance- MEDIUM HIGH

India boasts the fifth largest economy in the world as well as the third largest Gross Domestic Product in Asia. Impressive leaps in economic investment and productivity prove that economic performance in India can be expected to increase in the near as well as the distant future.

Law and order tradition- MEDIUM LOW

There is extensive poverty, which can lead to civil unrest. Also, there is the problem of decreasing funds for education, but the government is currently working to implement proposals for increasing educational programs. Once these programs come into place, Indian kids and future generations will be better educated and more suitable for higher level positions. Inevitably, this will lead to a surge in the middle class population, and ultimately, to an increase in disposable income and consumption. In addition, India suffers from problems of periodic floods, droughts, and other natural disasters which can oftentimes disrupt the process of law and order.

Internal Conflicts/ National Tensions/ Criminality- MEDIUM HIGH

The ongoing dispute with Pakistan over Kashmir, ethnic and religious strife, overpopulation, environmental degradation all are factors which put India in a category of fairly high sovereign risk. Investors may choose not to venture into a territory where the lives of their personnel and their families are at risk. Travel advisories have become very common, as seen in the media, such as CNN or BBC World. These broadcasts bring India's troubles right into the living rooms

of investors all over the world. Investors may be apt to hold on to their money, and wait for all the tension to die down.

Political Inconsistencies- MEDIUM HIGH

Political risk is an issue that most investors take quite seriously. Initially, one may think India represents a safe place to invest assets, because it is a democracy and will most likely remain a democracy for quite some time. However, what causes investors to be skeptical and reluctant to invest in India lies in the fact that there are numerous political parties and no one is quite sure how long each party will govern for. For instance, the shutdown of Parliament for several days, the threat of destabilization, and the fall of governments in rapid succession (1996, 1998, 1999) makes investors flat out timid. This sentiment among investors could have a negative impact on our project, because we depend on them to eventually see the skill set and developments among India and its people, and make considerable investments. If these investors chose to avoid India, their emergence from poverty may not come as soon as we expected.

Policy Risk- MEDIUM LOW

Policy risk is an issue that we must be prepared to face in India. Stability in taxation policies, as well as export policies, is not something we should expect in India. Recently, the finance ministry promised an export-friendly environment and then taxed export profits. It later re-introduced the tax on dividends when it was generally believed the debate on the subject had ended. The Finance Ministry, the Ministry of Power, petroleum, civil aviation, and telecommunications councils have all been cited in the past for being guilty of policy muddles. This is a very relevant risk that our company must be exceptionally aware of.

Regulatory Risk- HIGH

Another relevant risk that surfaces from doing business in India is regulatory risk. Many regulatory bodies have been established to “regulate” the players in different sectors. For example, CERC and SERC regulate the power sector, TAMP for ports, IRDA for insurance, and so on. However, many of their recent decisions have been scrutinized as being bizarre. There is question as to how much expertise exists within the membership of these regulating bodies. This is perhaps because the bodies are comprised of retired judges and retired civil servants. Indian governments have not come to terms with independent regulation, and are hesitant to give up some of their control. As of now, these regulatory bodies are not regarded as truly independent so it becomes difficult to trust or even speculate the types of decisions they may make in the future. Naturally, this presents a risk to companies doing business in India.

Local Market Potential

The Potential of Emerging Markets

Clearly, investing in emerging markets and particularly India represents a great deal of risk. Sovereign risk, political risk, regulatory risk, policy risk, and political risk are all relevant factors an investor must consider before choosing to invest in India.

However, one must not ignore the great potential that Emerging Markets currently have. Consider Figure 1 below, and the apparent mismatch between production and population.

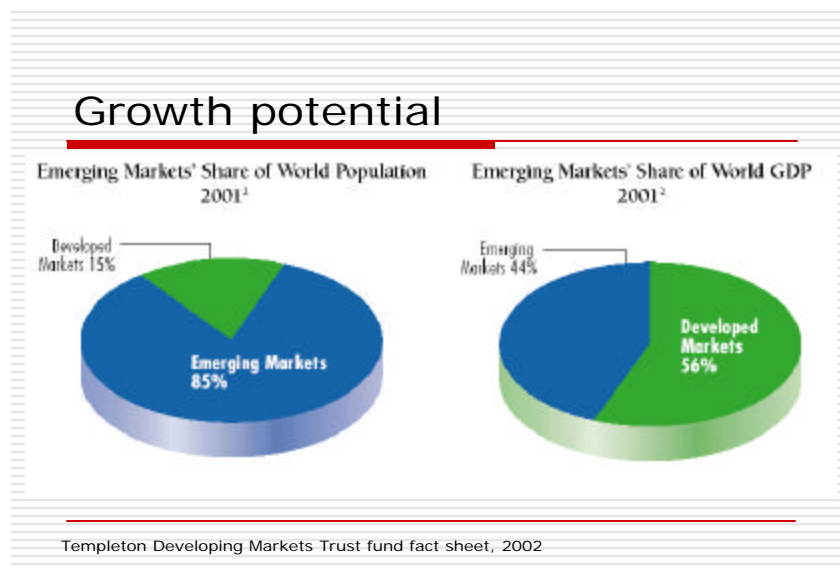


Figure 1

Emerging markets represents eighty-five percent of the world's population, while their GDP represents a mere forty-four percent of the world's GDP. However, if the average disposable income grows as the rate we

expect it to in India, the contribution to the World's GDP could be significant.

Our findings suggest that the potential for growth in India is very high. For example, In India the information technology industry currently represents just over 1% of the country's \$200 billion economy. A joint study by Nasscom and McKinsey and Co. shows the industry has the potential to earn revenue worth \$87 billion by 2008. This reflects expectations that Internet usage in India will expand at one of the fastest rates in Asia, boosting knowledge and ultimately income.

We are optimistic that based on our findings, this will occur and Indian civilians will have a considerable amount of disposable income, and a much larger amount of waste as a result. Hence, our services will not only be needed to contribute to a more economically safe environment in India, but they will also be needed to help India sustain its remarkable growth by delivering the necessary energy they will need in the future.

Investment Potential in India (specific)

It seems as though with growing waste being a problem in all developing countries, the question arises: “Why India?”

The answer is manifold. On the surface, it is obvious that as fourth largest economy in the world with the second largest GDP among developing countries, India is a country that can support such an investment. Moreover, many factors make India an attractive place to invest. Due to the implementation of an economic reform process that began in October 1999, the government has been wholeheartedly supporting and encouraging investment and technology inflows, and actively promoting and facilitating greater private sector participation in all sectors of the economy. With respect to a project in waste management, such a lucrative environment calls for advances in urban development and infrastructure. With India’s long tradition of an established legal and accounting system with independent judiciary as well as a strong sense of entrepreneurship, we think this is the optimal environment to introduce an innovative, profitable idea.

Although commercial risks exist in business in any country, we feel that commercial risks are severely minimized in terms of our product fitting into the situation India faces. Commercial

risks are a result of ill-fitting supply and demand, and such is not the case in a waste to energy project in India. The demand for a cheaper, more environmentally aware energy source is demanded, and at the cost structure we have outlined, KWP can supply it.

Also, foreign direct investment faces some limitations in India, but can be accomplished through one of four ways: through financial collaborations, through joint ventures and technical collaborations, through capital markets via Euro issues, and through private placements or preferential allotments. Since we will be partnering with the municipalities in financial collaborations, KWP should not face an obstacle in trying to accomplish foreign direct investment.

Beyond those two minor impediments, India has a host of other benefits that outweigh them. On a lesser scale, India as opposed to another emerging market such as Korea is a good place for investment for logistical reasons.

India has a long history of stable parliamentary democracy which prevents the threat of sovereign risks. The rupee, the Indian currency, is a convertible currency on current account at a market determined rate so there is decreased currency risk. It is a market in which English is widely understood and spoken. It is an environment that is very friendly towards investments in terms of tax purposes. There is a complete exemption from customs duty on industrial inputs which is very beneficial since parts for the factories will be imported from the States. The corporate tax applicable to the foreign companies of a country, with which agreement for avoidance of double taxation exists, can be one which is lower between the rates prevailing in any one of the two countries and the treaty rate, which also prevents deflation of profits. Finally,

in terms of future growth, there is a vibrant capital market which will facilitate expansion into our cities after the pilot venture in Karnataka.²

² Business India: Doing Business in India, 2002. *IndiaServer.com*
<<http://www.indiaserver.com/biz/dbi/dbi.html>>.

The Proposal and Why It Will Work

Approximately one million tons of garbage is collected every day in India, 95% of which is dumped on land. Rapid population growth, urbanization, economic development, and improving living standards are among the reasons as to why India's present day sanitation situations have degraded.

India recently surmounted the 1 billion person mark, and unlike China, which has somewhat successfully curbed its population growth, India's attempts to do so have been futile. India is in fact expected to surpass China's population in 50 years. This not only puts a strain on India's natural resource base, but puts stress on the sanitation system.

Also, almost 30% of India's population (300 million people) live in urban areas, and these areas are the ones with the worst management of waste. Because of the buildup of filth in these cities, diseases such as cholera, tuberculosis, and malaria have become more common, and are becoming yet another problem for the cities and country to have to deal with.

The 1990's carrying in to the twenty-first century has been a time of unprecedented growth in GDP in India, and this growth has had several effects on different facets of the Indian economy, including the rise of the middle class and a greater distribution of wealth. This has led to greater rates of consumption among India's huge population, which in turn has led to greater amounts of total waste produced.

Solid waste management is an increasing problem in India. Simultaneously, the country has a growing appetite for electrical power, particularly in the more industrial regions in which the standard of living is increasing. We have proposed that the problem of both be dealt with at once by building a municipal waste to energy plant. Due to the different types of waste produced

throughout India, such a plant would have to be built in regions that produce garbage with a high calorific content, meaning that more energy is created from the burn process. Consider Table 1 below:

Physical Characteristics of Solid Waste from some Cities in India

Cities	Paper %	Plastic %	Metal %	Glass %	Ash & Earth %	Total Compostable %
Calcutta	3.18	0.65	0.66	0.38	34.00	47.00
Delhi	6.29	0.85	1.21	0.57	36.00	35.00
Nagpur	1.88	1.35	1.33	1.34	41.42	34.81
Bangalore	4.00	2.00	-	1.00	15.00	78.00
Bombay	10.00	2.00	3.6	0.2	45.60	40.00
Source ; Background information for Conference of Mayors and Municipal Com-missioners, Urban & Industrial Energy Group, Ministry of Non- Conventional Energy Sources, New Delhi, 1996.						

Table 1

Our proposal is that such a plant would be best suited in the state of Karnataka, in which Bangalore is located. The city is currently trying to solve problems pertaining to solid waste management, as no real infrastructure exists to deal with the problem. In the city alone, 2000 tons of waste are generated daily (6000 tons within the state) and only 60% is cleared, being dumped along highways, near slums, and on the outskirts of the city. Only 200 tons per day are processed in an environmentally responsible way at a garbage treatment plant. Incineration of garbage is also extremely costly, running approximately \$40-\$60 per ton.

Our business model revolves around the state of Karnataka employing our firm as independent contractors to deal with its disposal of solid waste. We thus obtain revenue for collecting and disposing of this waste, either in a capped landfill, or by processing it for environmentally responsible burning in our waste to energy plant. Essentially, there is no way to

efficiently operate such a plant without also implementing some sort of infrastructure to deal with collection. Further, being involved with actual disposal provides the firm with an additional source of revenue needed to subsidize the costly initial construction, as well as ongoing operational costs. It also allows the firm the directly control the process of collection and processing to ensure timely and consistent delivery of waste for fuel at the power plant.

In the United States, Waste Management Inc. (NYSE:WMI), through its subsidiary, Wheelabrator Technologies, operates several waste-to-energy plants, in addition to performing collection and processing services for local municipalities surrounding these plants. This may account for at least part of the reason why prior attempts at waste-to-energy generation plants were not successful in the Indian market.

Our goal is to produce 0.5% of the region's electrical demand (100 megawatts) by burning half of its annual municipal solid waste. A waste-to-energy plant is much more efficient than a normal incinerator, in that it actually provides energy to power itself. Such a plant should reduce waste disposal costs for the municipality, and would be a positive net present value project, over a projected twenty year life span for the plant. The local municipalities will not have to deal with upgrading existing collections infrastructure by having our firm providing these services in a turnkey fashion.

Waste management is basically an issue the local governments have not actively pursued due to cost considerations and other more immediate issues in recent years. But it is slowly becoming a larger issue with the expanding middle class and urbanization. This cannot be ignored forever without an eventual environmental catastrophe, which is why we believe that today represents a good entry point for such a business in India.

If we are successful with our initial plant and collection methods, we would explore the possibility of expansion to other cities. Further, many jobs will be created in the region for the actual construction of the power plant, and in ongoing collection of waste and power generation.

The present time is an appropriate and justified entry point for the construction of a power plant. Generation from traditional sources, such as coal and oil, will dramatically increase air pollution and greenhouse gas emissions over the next fifteen years. Burning waste in a controlled setting results in the emission of fewer greenhouse gasses, along with other benefits:

- a reduction in total waste, an improvement in the quality of leftover waste to a form that is less environmentally damaging, contains less ash, and less moisture
- decreased transportation costs for waste,
- and revenue from the sale of energy to help sustain the plant.³

In addition, many Indian municipalities are presently plagued with frequent power outages and “brown outs,” so there is a growing demand for the construction of power plants. As the country continues to grow and rely on power, particularly if trends continue that would make India superpower in the technology and software development sector, the costs of power outages will become greater and greater. Moreover, the importance of reliable electricity will increase.

We would sell electricity to the local utility companies via the local grid, who would in turn sell it to customers. The power system is presently moving from a monopolistic-structure to

³ Fuel Pellets from Municipal Waste. *Technology Information Forecasting and Assessment Council*. <<http://www.tifac.org.in/news/view7.htm>>.

a fragmented one with more competitors, commercial incentives, and a greater role for the private sector, resulting in many opportunities.

In addition, many power outages and “brown outs” are due to poor transmission lines, and the distance from power plants to cities. Our power plants would not be far from the cities, thus producing more power closer to where it is actually needed. As a form of “renewable” energy, our waste-to-energy plant could be in part financed by some of the incentives being offered by the federal government, which include soft loans, reduced customs duties on equipment, a 100 percent depreciation allowance, exemptions from taxes, and capital subsidies. Between twenty and fifty percent of the initial project cost might be eligible for such a subsidy.⁴

⁴ “Meeting India’s Future Power Needs: Planning for Environmentally Sustainable Development,” The World Bank, 1999.

The Valuation

Our valuation is based on several assumptions. We base the cost of opening and operating a waste-to-energy plant on the model of Wheelabrator Technologies Inc., a U.S. based subsidiary of the public firm Waste Management, Inc. that provides approximate costs for the construction and operation of its plants.

The initial purchase of a fleet of garbage trucks is based on a fleet of 500 trucks, costing \$100,000 each. We assume that we can charge the municipal government \$30/ton (the current cost to the government for waste collected) to haul waste to our plant for either sanitary disposal or to burn. This is a cost that we intend to increase 3% per year in real terms.

We intend to produce 0.5% of the energy required in the local market (approximately 100 megawatts), and increase our production by a rate of 3% annually.

Operating a sanitary disposal (a capped landfill) costs approximately \$25/ton, increasing 3% annually, and transportation costs approximately \$18/ton, also increasing 3% annually, and this represents the bulk of our expenses.

Plant operational costs grow at about 4.33% annually, representing more power generation and more management of waste required to produce electricity. Electricity is sold at the market rate, and increases at the rate of inflation each year. Given costs and revenues were estimated using present estimates of the budget for waste management, and the proportions of the current budget spent for each part of the waste management process.⁵

Since each year we project to process more waste by using it to produce electricity, the amount we need to put in a sanitary landfill for disposal actually decreases over time, even

⁵ Waste: Really? *India Together*. <<http://www.indiatogether.org/environment/articles/wastefact.htm>>.

though the actual amount of waste produced by the city actually increases during this time period.

The positive net present value of \$46,646,893.33 is based on a discount rate of 17.77%, the approximate cost of equity, over the twenty-year projected life of this illiquid investment, taking a 4.3% inflation rate into account, increasing all revenues and expenses by at least this amount. We also include a thirty percent subsidy by the Indian government for the initial construction costs of the power plant, which is being provided to companies involved in renewable energy projects.

If successful, the model could be implemented in other Indian cities, as well as other developing markets, and could hence be a very profitable venture. A real option to expand, if factored in, could increase the net present value dramatically. Further, the social benefits of managing waste responsibly would make the value-added nature of this project a worthwhile venture for the local and national government to support.

We believe that there is a strong chance that that our valuation accurately reflects the worth of this project. Unforeseen costs, such as litigation, strikes, changes in the regulatory environment, cleanup of environmental catastrophe, or inability to collect funds due for our collection services, could severely hamper our business model. Other risks to the valuation include, but are not limited to:

- high initial capital cost,
- financing issues due to lack investor confidence in a risky venture (a waste to energy plant constructed in 1994 in Delhi failed)
- Most of the technologies developed may not be suitable for the nature of Indian waste.

- Lack of financial resources at the local and state government levels.
- Lack of long term strategy and concrete policy on waste management.
- Lack of awareness of environmental issues in the culture, tempering enthusiasm for environmentally beneficial projects.⁶

In addition, our model assumes that we are the sole collector of municipal solid waste in Karnataka, and we process 100% of the waste; this is likely to occur for the foreseeable future due to the extensive start up costs to start such a business in this risky, but potentially profitable, market.

⁶ Energy Generation from Municipal Solid Waste in India. *Federation of Indian Chambers of Commerce and Industry*. < <http://www.cleantechindia.com/eicnew/techoption/energy.html>>.

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