CASE

Biogas from kitchen waste for internal consumption (Wipro Employees Canteen, India)

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Supporting case for Business Model 4	
Location:	Bangalore, India
Waste input type:	Food waste, kitchen waste and sewage sludge
Value offer:	Energy for cooking using biogas from kitchen waste
Organization type:	Private
Status of organization:	Operational since 2008
Scale of businesses:	Medium
Major partners:	Mailhem Engineers Pvt. Ltd (for biogas technology, plant and O&M services)

Executive summary

Established in 1945, Wipro Ltd is a large business international conglomerate, with a revenue of over USD 7.3 billion and more than 75,000 employees in India. Wipro Ltd provides comprehensive IT solutions and services, including systems integration; information systems outsourcing; IT-enabled services; package implementation; software application, development and maintenance and research and development services to corporations globally and also produces lighting, engineering, personal and medical products. Wipro operates a large canteen catering to 5,000 to 5,500 employees in their Bangalore headquarters and generates about 1,500 kg of canteen and kitchen waste per day. As a part of its corporate social responsibility, Wipro supported the initiative to convert kitchen and food waste from the employee's canteen to biogas for cooking in the canteen.

Wipro partnered with Mailhem Engineers Pvt Ltd, a waste management technology firm, to install, operate and maintain the biogas plant capable of treating three tons per day (1,095 tons/year) of canteen waste. Mailhem has indigenously developed bio-methanation technologies with modified upward anaerobic sludge blanket technology that treat all types of solid and liquid waste having large percentage of suspended solids. About 69,300 to 74,250 m^3 of biogas is produced annually. The biogas has replaced Liquefied Petroleum Gas (LPG) as the cooking fuel, saving four 19-kg LPG cylinders per day, leading to annual fuel cost saving of USD 24,480 at price of USD 17 per 19-kg cylinder for commercial applications and an increase in brand equity along with generating employment for four people. Around 108 tonnes of bio-sludge is generated annually, which is used as manure in the gardens on Wipro's campus and 3 m^3/day of overflow water is fed to sewage treatment plant in the premises.

KEY PERFORMANCE INDICATORS (AS OF 2014)						
Land use:	300 m^2 (20 m x 15 m)					
Water requirements:	1,500–1,800 L per day					
Power consumption:	25 kWh/day					
Capital investment:	USD 100,000					
Labor:	3 full-time employees and 1 part-time employee					
O&M cost:	USD 10,320/year					
Output capacity:	210–225 m^3/day of biogas; 2 tonnes/day of sludge 1,500 kg/day of canteen waste, vegetable and fruit peels + 12 m^3 of organic sludge from the existing sewage treatment plant (STP)					
Potential social and/or environmental impact:	Jobs for 4 people created, waste reused without being discharged in municipal waste; carbon emissions offset from avoided municipal waste landfill and also replacement of LPG which otherwise would have been used for cooking; carbon emissions saved 37.26 tons CO_2/year from waste recycling and 306.77 tons CO_2/year from LPG saved					
Financial viability indicators:	Payback period:	3.5 years	Post-tax IRR:	> 51%	Gross margin:	25%

Context and background

The biogas plant was initiated by Wipro in 2008 as part of its corporate social responsibility (CSR) initiative. The immediate goal was to manage the kitchen waste in the environmentally acceptable manner with long-term goal of use of waste management initiatives to reduce the company's environmental footprint and to achieve corporate sustainability. It was financed by Wipro through its internal revenues and constructed and installed by Mailhem. Collection and cooking duties are performed by Wipro, while segregation, digestion and production services are performed by Mailhem. The plant is located, adjacent to the kitchen at Wipro's headquarters in Bangalore. The input for the plant is organic canteen and food waste with 80% moisture that is generated in the employees' canteen. Before the biogas plant, it was a tedious task for staff to pack the huge amount of waste in polyethylene bags and hand them over to the civic body almost daily. It is now easy to dump this waste into the biogas plant after some segregation.

Market environment

As Wipro provides the inputs and uses the product within campus, there are no external dependency for the project. Since the project uses canteen and food waste, which otherwise needs to be disposed of, there is no cost of inputs to the project. The product, biogas, is consumed within the campus saving the cost of LPG for cooking. The price of LPG for commercial users is around USD 17 per 19 kg cylinder. LPG for corporations are not subsidized in India, and that is an additional factor motivating Wipro to invest in the technology and generate its own cooking fuel.

Macro-economic environment

There is an emerging focus on green technology in India. CSR also called corporate conscience, corporate citizenship or responsible business is a form of corporate self-regulation integrated into a business model. CSR policy functions as a self-regulatory mechanism whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards and national or international norms. With some models, a firm's implementation of CSR goes beyond compliance and engages in "actions that appear to further some social good, beyond the interests of the firm and that which is required by law." The aim is to increase long-term profits through positive public relations, high ethical standards to reduce business and legal risk, and shareholder trust by taking responsibility for corporate actions. CSR strategies encourage the company to make a positive impact on the environment

and stakeholders including consumers, employees, investors, communities and others. Wipro's primary motivation for this venture is to showcase the company's corporate social responsibility efforts, better manage its kitchen and food waste, produce biogas and use it on site to reduce its LPG consumption for cooking.

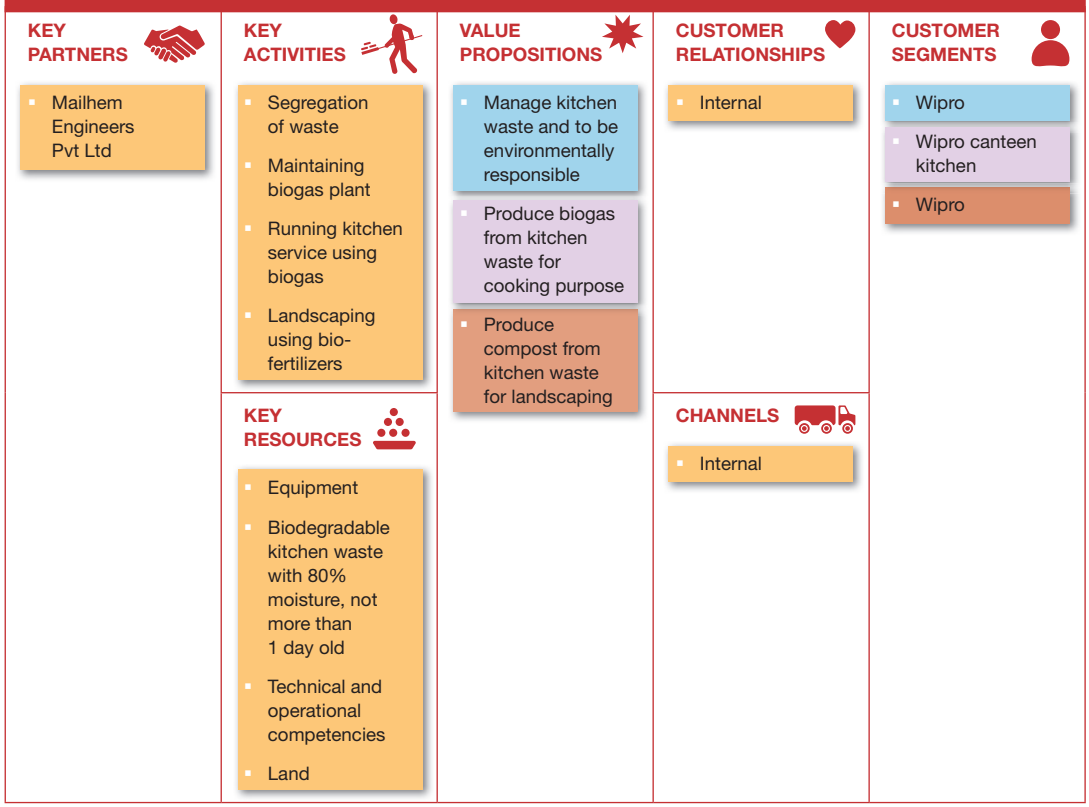
Business model

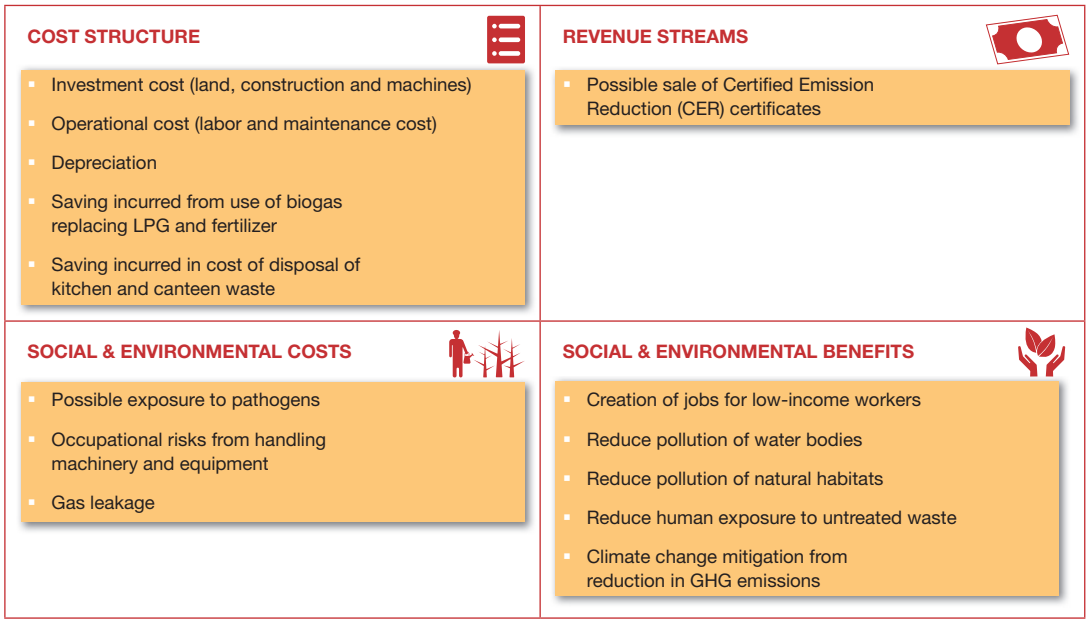
The value proposition for Wipro (Figure 44) is to minimize cost and to better manage its waste and be environmentally responsible. Wipro serves as both the customer and the producer since it is the supplier of waste and consumer of end products. The key activities include the production of biogas from food waste for use in its kitchen and produce organic compost to be used in landscaping within its campus and the key resources are land, equipment, biogas technology and sourcing of the waste. The produced biogas has resulted in substantial savings from avoided LPG purchase, has created jobs for four individuals and contributed towards reducing pollution of water bodies and natural habitats. In the event of surplus biogas and compost produced, Wipro could sell the energy to neighbouring households and compost to urban households to use them in their garden or to urban farmers. Wipro also would qualify to sell the carbon offset from this investment.

Value chain and position

The value chain consists of collection and segregation of kitchen and food waste, digestion of waste in biogas digester, production of biogas and finally the use of biogas in the kitchen for cooking and use

FIGURE 44. MAILHEM WIPRO BUSINESS MODEL CANVAS





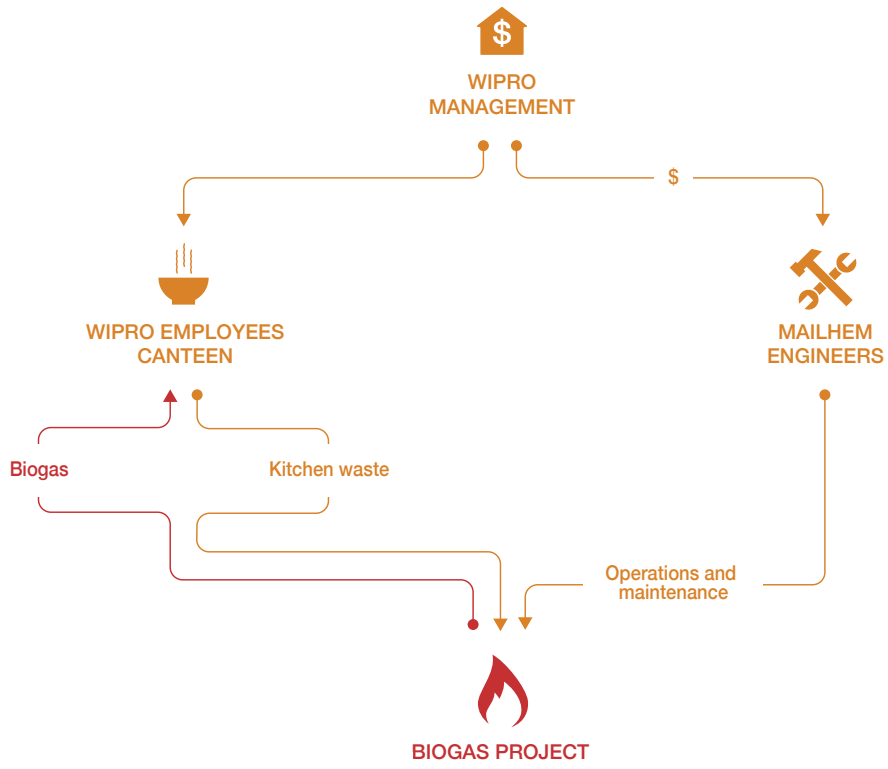
of digested slurry as organic fertilizer for landscaping in the campus. A critical relationship pertaining to the investment is with the kitchen manager and staff who make available kitchen waste with the right moisture and biodegradable content specifications and who again use the biogas for cooking food. Another important relationship is with the Mailhem engineers who supplied the technology and usually also operate and maintain the system. Wipro pays for the kitchen operation and the operation and maintenance of the system (Figure 45).

Institutional environment

In India, the concept of CSR is governed by clause 135 of the Companies Act 2013. The CSR provisions within the Act is applicable to companies with an annual turnover of USD 180 million and more, or a net worth of USD 9 million and more or a net profit of USD 0.9 million and more. The Act encourages companies to spend at least 2% of their average net profit in the previous three years on CSR activities. The government's suggested CSR activities include measures to eradicate hunger; promote education, environmental sustainability, protection of national heritage and rural sports and make contributions to prime minister's relief fund. The new rules, which will be applicable from the fiscal year 2014–2015 onwards, also require companies to set up a CSR committee consisting of their board members, including at least one independent director. The new Act requires that the board of the company shall, after taking into account the recommendations made by the CSR committee, approve the CSR policy for the company and disclose its contents in their report and also publish the details on the company's official website, if any, in such manner as may be prescribed. If the company fails to spend the prescribed amount, the board, in its report, shall specify the reasons.

While the CSR spending by the top 100 Indian companies is estimated at USD 0.86 billion per annum, the Indian Institute of Corporate Affairs anticipates that about 6,000 Indian companies will be required to undertake CSR projects in order to comply with the new guidelines, with many companies undertaking these initiatives for the first time. Some estimates indicate that the CSR spends in India could triple to USD 2.6 billion a year. This combination of regulatory as well as societal pressure has meant that companies have to pursue their CSR activities more professionally. A large number of

FIGURE 45. MAILHEM-WIPRO VALUE CHAIN



companies are reporting the activities they are undertaking in this space in their official websites, annual reports, sustainability reports and even publishing CSR reports.

The Government of India provides economic incentives in the form of accelerated depreciation benefits that can be claimed to offset tax obligations of the firm that invests in renewable energy technology. The Ministry of New and Renewable Energy Sources (MNRE) takes an active part in biogas projects and researches and provides subsidy incentives towards capital costs. The laws in the state of Karnataka mandate the management of organic waste by local bodies. Municipal solid waste management is carried out by the local bodies and not the establishments which generate the waste.

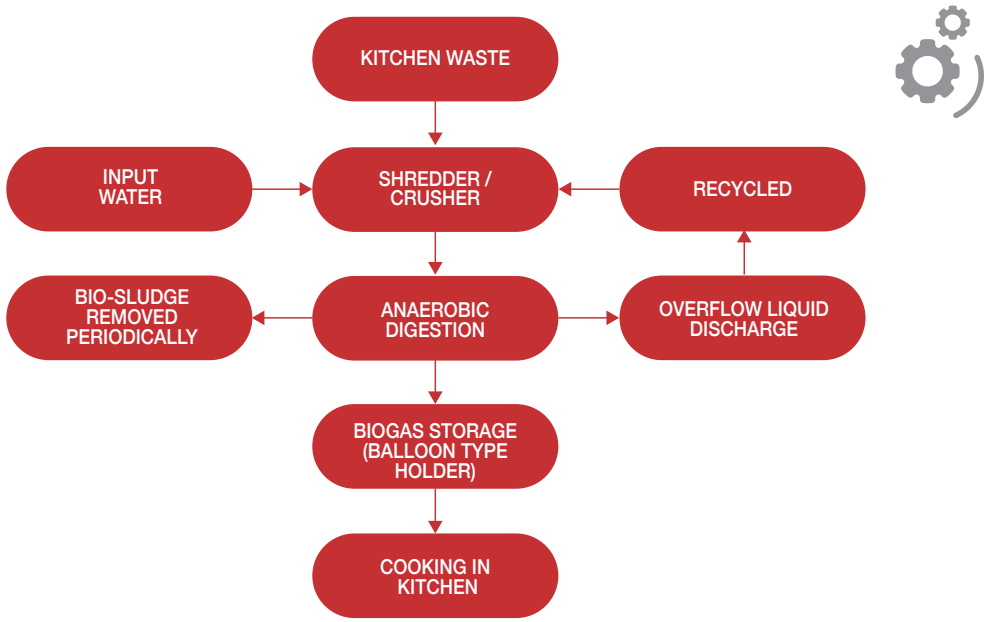
Technology and processes

Fresh (less than 1 day old) biodegradable kitchen waste with 80% moisture is used as the primary input. The facility used high-rate modified up-flow anaerobic sludge blanket (UASB) bio-methanation technology, in which the biomass is retained as a blanket and kept in suspension in the lower part of the digester. The UASB is a high-rate suspended growth in which a pre-treated raw influent is introduced into the reactor from the bottom and distributed evenly. “Flocs” of anaerobic bacteria will tend to settle against moderate flow velocities. The effluent passes upward through, and helps to suspend, a blanket of anaerobic sludge. A particular matter is trapped as it passes upward through the sludge blanket, where it is retained and digested. Digestion of the particular matter retained in the sludge blanket and breakdown of soluble organic materials generate gas and relatively small amounts of new

sludge. The rising gas bubbles help to mix the substrate with the anaerobic biomass. The biogas, the liquid fraction and the sludge are separated in the gas/solid/liquids phase separator, consisting of the gas collector dome and a separate quiescent settling zone. The settling zone is relatively free of mixing effect of the gas, allowing the solid particles to fall back into the reactor; the clarified effluent is collected in gutters at the top of the reactor and removed. Maintenance of the sludge blanket is an important factor in the efficient operation of these digesters. The plant can treat all types of solid and liquid waste having large percentage of suspended solids. The end products are biogas, organic manure and treated water for gardening. The technology is indigenously developed by Mailhem and is locally available and any component that needs to be replaced can be sourced or fabricated locally.

The design and performance of anaerobic digestion processes are affected by many factors. Some of them are related to feedstock characteristics, reactor design and operation conditions. The prerequisites for production of biogas are a lack of oxygen, a pH value from 6.5 to 7.5 and a constant temperature of 35–45 °C (mesophilic) or 45–55 °C (thermophilic). The digestion period or retention period is typically between 10 and 30 days depending upon the type of digestion employed. The anaerobic digestion systems of today operate largely within the mesophilic temperature range. The operation and management of the project is handled by Mailhem and the technicians employed for O&M have been trained and supervised by Mailhem (Figure 46).

FIGURE 46. PROCESS DIAGRAM OF MAILHEM WIPRO BIOGAS PLANT



Funding and financial outlook

The facility was set up at the Wipro campus, using equity from the company's internal finances. The plant and machinery cost USD 100,000 to set up. The primary input, kitchen waste, is sourced through Wipro's internal kitchen and is free of charge. Operation and maintenance costs amount to USD 10, 320 per year (Table 15).

TABLE 15. MAILHEM-WIPRO FINANCIALS

Key capital costs	Land building	No additional charge (uses own land)
	Plant, machinery and civil construction	100,000 USD
Operating costs	Kitchen waste and sewerage sludge costs	No additional charge (from own kitchen and sewerage treatment plant)
	Operation and maintenance	10,320 USD/year
Financing options	Equity from Wipro	100,000 USD
Outputs	Biogas and digested slurry	Supplied to Wipro free of charge and internally consumed to save cost of LPG and organic fertilizers for landscaping

The major savings is from avoided cost of LPG. The investment has resulted in onsite management of waste generated in the employees' canteen and displaces 27.36 tons of LPG, which the company would have purchased otherwise at the cost of USD 24,480 in 2014 prices per year. There are minor savings in the form of avoided purchase of manure for the garden, but these are relatively small. The internal rate of return for the investment is 27.34%. Thus, the investment of USD 100,000 is recovered within less than four years.

Socio-economic, health and environmental impact

In most of cities and places, kitchen waste is disposed in landfill or discarded which causes public health hazards and diseases like malaria, cholera, typhoid. Inadequate management of wastes like uncontrolled dumping bears several adverse consequences. It not only leads to polluting surface and groundwater through leachate and further promotes the breeding of flies, mosquitoes, rats and other disease-bearing vectors. It also emits unpleasant odor and methane which is a major greenhouse gas contributing to global warming.

As the organic fraction accounts for the larger part of the municipal solid waste, anaerobic digestion thereof at its source of generation, a decentralized level, would be an appropriate solution to reduce the amount of waste dumped and/or landfilled as it minimizes transport costs and provides renewable energy and organic fertilizer. Carbon dioxide produced after the burning of methane contributes lesser to climate change than methane. The carbon emissions saved by Wipro's biogas plant is 37.26 tons CO_2/year from waste recycling and 306.77 tons CO_2/year from LPG saved.

The efficient utilization of organic waste in biogas plants creates a cycle of economic sustainability: continuously generated by-products that can be profitably employed to produce electricity, and/or heat. This reduces the accumulation of waste which production plants would otherwise have to dispose of, often at great cost. The benefit is two-fold: The impact on the environment is reduced and the value-added chain is optimized. On top of that, the campuses can use digested slurry/residues as valuable fertilizer and displace harmful chemical fertilizers.

This and other similar initiatives have resulted in a green image for Wipro's electronic city campus, and the employees consider this initiative as a positive aspect of the company's sustainability efforts. The investment has provided full-time employment to three people and part-time employment to one person.

Scalability and replicability considerations

The key drivers for the success of this business are:

- Ease of available bio-degradable waste within the campus.
- Willingness of chefs to use biogas for cooking.
- Availability of land near the canteen within the campus.
- Strong partnership with Mailhem to install, operate and maintain the plant.
- Strong financials with shorter payback period.
- Business is incentivized by green opportunities from market and showcase its corporate social responsibility.

At the present location, the generated kitchen waste is fully utilized by the biogas plant. The digester has the capacity to process three tonnes of waste, and around two tonnes is processed almost daily. Wipro would like to replicate this model to other campuses in the long term. 'Greening' of businesses is also rapidly becoming an important consideration in corporate India, and corporate headquarters with common kitchen facilities could be motivated to uptake such efforts. The corporations and small and medium enterprises (SMEs) can consider such endeavours in the name of CSR. Modest tax breaks or accelerated depreciation offsets offered for such projects will encourage replication, thus boosting the businesses of firms that specialize in renewable energy by providing stimulus for further development of technology. However, businesses would require land for putting up such biogas plants.

Summary assessment – SWOT analysis

The key strength of this case is the sufficient resources available to support the investment and Wipro's mandate to undertake initiatives like this under its CSR program (Figure 47). The weakness is the lack of in-house technical capability to manage biogas plant and land required for the biogas plant. Wipro's biogas plant occupies 300 m^2 of land. The investment does not have any significant threats unless in unlikely situation of heavy price subsidies on LPG for commercial use. The opportunity is huge as this can be easily replicated in other Wipro campuses and also applicable to campuses of other large business corporations and institutions.

References and further readings

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Newsweek 2012. Newsweek's green rating of 500 global companies. http://www.newsweek.com/2012/10/22/newsweek-green-rankings-2012-global-500-list.html (accessed Nov. 7, 2017).

FIGURE 47. MAILHEM WIPRO SWOT ANALYSIS

	HELPFUL TO ACHIEVING THE OBJECTIVES	HARMFUL TO ACHIEVING THE OBJECTIVES
INTERNAL ORIGIN ATTRIBUTES OF THE ENTERPRISE	**STRENGTHS** ▪ Saving in cost of transportation of waste to landfill sites ▪ Easier to maintain hygienic conditions in the premises and elimination of malodors ▪ Well-known technology ▪ Sufficient internal resources to support the waste to energy project ▪ The business model is financially attractive on the basis of avoided cost of LPG purchases ▪ Existence of a corporate sustainability strategy encouraging environment and waste management initiatives ▪ Corporate policy of having own facilities for providing food to employees responsible for central waste generation, collection, segregation and energy conversion	**WEAKNESSES** ▪ Waste management is not part of core business strategy and considerations at Wipro ▪ Lack of in-house technical capability at Wipro for managing and operating the waste to energy plant ▪ Land required for biogas plant is significant and it could be difficult during expansion of the plant if land is not easily available; replication of similar plants in other campuses are dependent upon land available ▪ Source dependent composition of waste ▪ Every biogas plant is different ▪ Negative pressure in biogas system can cause explosion ▪ High upfront cost for potential assessments and feasibility studies
EXTERNAL ORIGIN ATTRIBUTES OF THE ENVIRONMENT	**OPPORTUNITIES** ▪ Favourable policy and regulatory environment for industrial and commercial waste in India; ▪ Renewable energy policy of India ▪ Availability of technical and management expertise and support partners for waste management in India ▪ Opportunities to replicate the kitchen-linked biogas plant in other Wipro campuses as well as other corporate campuses and institutions on a business case, rather than as part of corporate sustainability efforts ▪ Mandated requirements as per Companies Act 013, as per recent amendments	**THREATS** ▪ Changes in the price for LPG directly affect the financial attractiveness of the business; however, LPG prices are unlikely to fall ▪ Lack of awareness of biogas opportunities ▪ Direct animal feeding is an equal or favoured solution to reduce the amount of organic waste (in semi-urban or rural areas)

Case descriptions are based on primary and secondary data provided by case operators, insiders, or other stakeholders, and reflects our best knowledge at the time of the assessments (2015/2016). As business operations are dynamic, data can be subject to change.