Building Techno Commercially Feasible Facilities: From Waste to Energy

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India is one of the world's fastest-growing economies, with rising urbanization and an expanding middle class. India's energy profile continues to be heavily dominated by fossil fuel–based sources: by 2040, 42% of the new demand will be met by coal compared to 60% as on date and the country is projected to be among the largest oil consumers. Thus, India contributed 2.48 billion tons of carbon dioxide (CO2) in 2019, which amounted to 7% of global CO2 emissions. The Paris Agreement aimed to tackle this problem by keeping the global temperature below 2-degree Celsius relative to pre-industrial levels. To meet this goal, India has set a target of producing 175 gigawatts (GW) of renewable energy by 2022, with 100 GW coming from solar, 60 GW from wind, 10 GW from biomass energy, and 5 GW from small hydropower.

As of date, waste to energy accounts for nearly 495 MW of the total energy mix. India has significant potential to expand its renewable energy production from waste by using the vast quantities of organic waste generated by the

agricultural sector as well as a growing amount of municipal solid waste, used cooking oil and wastewater.

Ion Exchange Experience & Expertise

Ion Exchange has installed the INDION Integrated Waste to Energy – Resource Recovery System (ANDICOS) at Akshaya Patra Foundation's Kitchen in Hyderabad, Telangana, which provides meals to underprivileged students under the Midday Meal Scheme and is one of the largest fully automated kitchens in India.

Using state-of-the-art Advanced Bio-methanation process, the INDION Integrated Waste to Energy – Resource Recovery System (ANDICOS) is an innovation which provides the perfect solution to address the crucial problem of disposal of large quantities of organic kitchen waste produced by Akshaya Patra's kitchen.

The plant treats organic kitchen waste to produce Renewable Green Energy and Rich Organic Fertilizer thus reducing the burden of waste management and recovering valuable by products in the process.

The system has been integrated with a Biological Odour Control Unit which eliminates foul odour. The biofiltration process which does not use energy, is practically maintenance-free and results in complete decomposition of the pollutants without creation of hazardous byproducts. The odour control system which is integrated with the Waste to Energy plant is a significant innovation as the Waste to Energy plant sits next to the centralised kitchen of Akshaya Patra.

It can easily be replicated in converting biomass, agro residues and complex industrial organic waste into energy. In the case of the latter, Ion Exchange has already deployed this technology successfully and commercially in industries like – paper, brewery, FMCG

W2E Integration with INDION IPC MBR technology	
▪ Use case	▪ Treat Liquid waste (Sewage/Sullage)
▪ Water Recovery	▪ 90%
▪ Capacity	▪ 950 kg/day (organic kitchen waste)
	▪ 2 – 6 m^3 of sewage sludge /day
▪ Energy Output	▪ 20 kW/h per day
▪ Byproduct	▪ 1.35 tonnes of rich organic fertilizer

and is implementing one of the biggest projects in a petrochemical complex.

International success story/ ies – business model that may be emulated in our country

India can adapt advanced waste to energy models from developed economies. Apart from technology adoption, we can also adopt their framework to commercialize them on vast scale in India.

- The European Waste to Energy Plants reported that in the year 2018, Germany converted 31% of their total MSW generated into Waste to Energy, while during the same year in Sweden, Finland, Norway, and Denmark, the conversion reached more than 50%
- In the USA, for example, modern regulated landfills collect approximately 2.6 million tons of methane-producing heat and electricity with a capacity of up to 50 MW turbine generator
- China, the largest developing country globally, has also attained massive progress in waste to energy development in the past decade. 259 waste to energy mass-burn plants have been built in China as of 2016 with a total capacity of 280,000 TPD
- In the UK, there are now 661 digesters in use (Foster et al., 2021). It provides biomethane (102 plants) and electricity (583 plants) to the national grid as well as local heating (42 plants). Between 2008 and 2017, 255 new anaerobic digesters with a total capacity of 193,354 kW were erected in the UK.

Ion Exchange has successfully deployed these technologies with select industries like breweries, paper, food & beverage, chemicals etc. to convert complex effluents into energy. Further, it has invested in commercial scale plants (Akshaya Patra) to demonstrate a model concept to convert municipal waste into resources (clean water, green energy, and rich organic fertilizer).

Investment scenario

Central Financial Assistance (CFA) in the form of back-ended subsidy is provided for installation of Waste to Energy projects for recovery of energy in the form of Biogas or Bio-CNG or Power from Urban, Industrial, Agricultural Waste / Residues and Municipal Solid Waste.

Despite large government investments, India's energy sector relies on the private

sector more than ever as public-sector resources are more directed toward public health and sustaining livelihoods. Therefore, to attract private investment, the government has encouraged the participation of nonfinancial banking companies, launched a new investment fund, initiated the rationalization of tariffs, released subsidies, and improved the bankability of power purchase agreements in Indian Renewable Energy Market.

Challenges for EPC industry to build techno commercially feasible facilities to produce waste to energy

The waste to energy concept is at a very nascent stage, particularly for converting Municipal solid waste to energy. EPC's, particularly in municipal sector (municipal waste) face several challenges like:

- **Highly fragmented market** with near majority of participants from unorganized and startup sectors
- **Cost Competitiveness:** Waste to energy plants must be cost competitive which means the price of energy produced by the waste to energy facility must be competitive in energy market. In India, the electricity produced from WTE plant needs to be competitive vis-à-vis that coming from other renewable sources / traditional thermal sources in order to compete for Merit Order Dispatch (MOD)
- **Limited Technology Players** with a bandwidth-scale to promote the concept with technology, design, quality of components with optimum levels of control and automation plus odour control / VOC abatement technology integration in the design of the waste to energy plant.
- **Off taker risk:** Off takers are primarily state-owned public-sector distribution companies or Urban Local Bodies. Given the poor financial health of both, there is a risk of lagged or incomplete payments
- **Lack of infrastructure:** Inefficiencies from the lack of infrastructure to collect, segregate, technological solutions for MSWs and then generate and distribute electricity are a key barrier to foreign investment.
- **Waste to energy lies outside traditional investments** and potential investors are often wary because of their limited understanding of the sector in India. Domestic institutional investors typically invest in less risky

securities and prefer more liquid assets with good credit ratings, which are not available in Waste to Energy projects.

Building the ecosystem to accelerate adaptation by industries & integration in energy ecosystem

- **Demand side reforms** such as reducing goods and services taxes on WTE Plants and promoting different WTE Technologies like Bio methanation, CBG, Torrefaction will encourage industry / consumers to opt for these concepts / technologies.
- **Effective implementation of RECs and RPOs** (which complement each other) could be a major factor in driving WTE market segment. Incentivizing power generated from WTE sources through subsidies or rate cuts, while simultaneously disincentivizing fossil fuels, will also be important.
- **Tapping financial resources** through financial intermediaries and instruments for the renewable energy sector is also important. Following the Covid-19 pandemic, green bonds may be attractive to investors as countries prioritize a green recovery from the recession.
- **Reducing energy intensity** will be important for managing demand. India can look to China for successful areas for improvement. China has reduced energy intensity and CO2 emissions by renovating old coal-burning facilities and incorporating ultra-low emissions technology into 80% of its coal-fired energy capacity as of 2019
- **Developing reliable vendor base** for different upcoming WTE Technologies like Bio methanation / Torrefaction etc.
- **Demonstrating the concept** as Ion Exchange has done, by setting up reference plants that can then be multiplied or scaled up. ■