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WASTE TO ENERGY POTENTIAL IN PAKISTAN

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Sindh



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GEOGRAPHICAL LOCATION OF PAKISTAN



The Islamic Republic of Pakistan, a country located in South Asia, has a 1,046-kilometre (650-mile) coastline along the Arabian Sea and Gulf of Oman in the south and is bordered by India to the east, Afghanistan to the west, Iran to the southwest, and China in the far northeast, respectively. It is separated narrowly from Tajikistan by Afghanistan's Wakhan Corridor in the north-west, and also shares a maritime border with Oman.

Area

• Total	881,913 km ² (340,509 sq mi)
• Water (%)	2.86

Population

• 2017 census	209,970,000
• Density	244.4/km ² (633.0/sq mi)



Pakistan

- International boundary
- Province-level boundary
- ★ National capital
- ⊙ Province-level capital
- +— Railroad
- == Expressway
- Road

Azad Kashmir and the Northern Areas are administered by Pakistan but do not have provincial status.

0 100 200 Kilometers
0 100 200 Miles

Lambert Conformal Conic Projection, SP 23 15 N / 35 30 N



Arabian Sea

INTRODUCTION OF SOLID WASTE IN PAKISTAN



- Pakistan generates about 20 million tons of solid waste a year, which has been increasing more than 2 percent annually.
- The Government of Pakistan (GOP) estimates that 71,000 tons of solid waste is generated per day, mostly from major metropolitan areas.
- Karachi, Pakistan's largest city generates more than 9,000 tons of municipal waste daily.
- Solid waste generation in Pakistan ranges between 0.283 to 0.612 kg/capita/day and the waste generation growth rate is 2.4% per year.

The most common types of solid waste in Pakistan are:

Municipal solid waste

Industrial waste

Agricultural waste

Hazardous waste



SOLID WASTE GENERATION IN MAJOR CITIES OF PAKISTAN



City	Population in million	Solid waste generation/day in tons
Karachi	20,500,000	9,440
Lahore	10,000,000	6,510
Faisalabad	7,500,000	4,883
Rawalpindi	5,900,000	3,841
Hyderabad	5,500,000	3,581
Multan	5,200,000	3,385
Gujranwala	4,800,000	3,125
Sargodha	4,500,000	2,930
Peshawar	2,900,000	1,888
Quetta	600,000	326

Karachi, Pakistan's largest city, utilizes two landfill sites, while Lahore, the country's second-largest metropolis, has two. Other major cities plan to build proper landfill sites. But in many areas, solid waste is simply dumped outside the city limits.



COMPOSITION OF MUNICIPAL SOLID WASTE (MSW) IN PAKISTAN



Physical Composition of MSW by Percent

Ash, Bricks and Dirt	18%
Glass	6%
Textile	2%
Cardboard	7%
Food Wastes	30%
Leather	1%
Paper	6%
Plastic	9%
Rubber	1%
Metal	4%
Wood	2%
Yard Wastes	14%

About 60-70% of solid waste in the cities is collected. The waste collection fleet typically comprises handcarts and donkey pull-carts for primary collection; then open trucks, tractor/trolley systems, arm roll containers/trucks for secondary collection and transport.



NET POWER GENERATION CALCULATION



Energy recovery potential (ERP)	=	7561.79KWh/ton
Considering the conversion efficiency (?)	=	25%,
Therefore,		
Power generation potential (KW)	=	ERP /24 x ?
	=	7561.79/24 x0.25 = 78.77kW/ton
Total energy generated (TEG)	=	(Net Power Generation x 24)
	=	78.77x 24 = 1890.48kWh/ton
Now by considering,		
Station service allowance (SSA)	=	11% of energy generated
	=	207.9 kWh / ton
Unaccounted heat loss (UHL)	=	9% of energy generated
	=	170.14 kWh / ton
Net electric power generation	=	TEG – (SSA + UHL)
	=	1890.48 – (207.9 + 170.14)
	=	1512 kWh / ton

Typical Composition Of Solid Waste in Pakistan

Composition	%
Food Waste	8.4% to 21 %
Leaves, grass, straw, Fodder	10.2 % to 15.6 %
Fines	29.7 % to 47.5 %
Recyclables	13.6 % to 23.55 %





PAK FIRST EVER SCIENTIFIC DISPOSAL SITE



The first ever scientific disposal facility in Pakistan located at Lakhodair expanded on 52 hectares of land at a strategic location almost 5km away from Mehmood Booti dumpsite meeting all international standards required for a waste disposal site.



Functioning of initial two cells are helping 2000 to 2500 tons waste daily for about 10 years with no repercussions over underground water or atmosphere



CURRENT ACTIVITIES AND PROJECTS



According to the United Nations Environment Program, there are six current activities and plans taking place towards an efficient Waste Management System. These current activities are as follows:

1. Solid Waste Management Guidelines (draft) prepared with the support of Japan International Cooperation Agency (JICA), Japan.
2. Converting waste agricultural biomass into energy/ material source – project by UNEP, IETC Japan.
3. North Sindh Urban Services Corporation Limited (NSUSC) – Assisting the district government in design and treatment of water supply, sanitation and solid waste management



CURRENT ACTIVITIES AND PROJECTS



4. The URBAN UNIT, Urban Sector Policy & Management Unit P & D Department, Punjab. Conducting different seminars on awareness of waste water, sanitation & solid waste management etc.
5. Lahore Compost (Pvt.) Ltd. only dealing with the organic waste with the cooperation of city district government Lahore, Pakistan. The company is registered as a CDM project with UNFCCC.
6. Different NGOs are involved at small scale for solid waste collection, and recycling.



KARACHI WASTE SOURCES AND POTENTIAL



Municipal Solid Waste

Household / Industrial

Total generation 9,440 TPD

Recycled
1,275 TPD

Landfill
3,000 TPD

5,165 TPD

Left on street corners
Left in open drains, rivers
and suspended to Arabian Sea

Animal Feces

Total generation
5000 TPD

Landhi Biogas
Plant
500 TPD

4,500 TPD

Left in open drains, rivers
and suspended to Arabian Sea

Sewerage / Sludge Waste Water

Four Wastewater
Treatment Plants
But none are operational

Nearly 400 million
gallons per day of
untreated waste goes
into the Arabian Sea



NEPRA announces upfront tariff for municipal solid waste power plants

Considering environmental issues, most of the countries in the region have already announced the generation tariff for Municipal Waste Power Plants and are getting dual benefits – disposing garbage and generation of electricity through garbage.

The leveled tariff of US Cents 10/kWh based on 25 years operational period has been announced with overall capacity cap of 250 MW wherein share of each province and Federal Territory have been kept at 50 MW each. For protection from environmental hazards, the power producer shall obtain necessary approvals from the relevant government agencies. The upfront tariff will be in field for one year.



POWER PLANTS STARTED SINCE 2015



Pakistan is now working on generating power from renewables and more innovative methods

2015			2016			2017		
Plant Names	Fuel Type	Installed Capacity (MW)	Plant Names	Fuel Type	Installed Capacity (MW)	Plant Names	Fuel Type	Installed Capacity (MW)
RYKML	Bagasse	30	APOLO SOLAR	Solar	100	Fatima	Coal/Bagasse	120
FWEL-I	Wind	50	Best Green Solar	Solar	100	Hamza	Bagasse	15
QUAID AZAM	Solar	100	Crest Energy Solar	Solar	100	Bhiki	Gas	760
NANDIPUR	Furnance Oil	425	Younus	Wind	50	Dawood Wind	Wind	50
SAPPHIRE	Wind	50	Metro	Wind	50	Sachal Wind	Wind	50
CHINIOT	Bagasse	62	Tapal	Wind	30	TOTAL		995
TOTAL		717	Master	Wind	50			
			Tenaga	Wind	50			
			Gul Ahmed	Wind	50			
			Chashnupp-III	Nuclear	340			
			TOTAL		919			

WASTE TO POWER PROJECTS IN PIPELINE



35 MW Power Plant at Lahore

The Government of Punjab has initiated the development of a Waste-to-Energy power plant of 35 Mw capacity, fueled by municipal solid waste. The project will be managed by Lahore Waste Management Company (LWMC), a special purpose company established

- to develop projects for collecting, processing and disposing of MSW
- to produce electricity, heat, and recyclable materials

Project total cost	14 billion Pak Rupees (\$140 million)
Land area	25 acres (101,000 square meters)
MSW processing capacity	2,000 tons per day (TPD); 600,000 tons/year
Power generation capacity	35 MW
Water requirement	36.3 TPD for steam generation
Source of water	Reprocessed and municipal supply



12 MW Mardan Solid Waste Management Power Project

It has the technology to convert organic fraction in MSW into combustible gases.

The conversion shall be conducted in two ways:

1. Biological conversion for converting easily degradable wastes into energy rich gas (methane, CH₄).
2. Gasification of other organics to become synthetic gases at a limited amount of oxygen.

The objective of the project is to create a sustainable metropolitan municipal solid waste management system that supports GHG emission reduction.



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THANK YOU



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