Pakistan Journal of Hydrocarbon Research
Vol.6, No.1&2 (January & July 1994), P.61-64, 4 Figs.

Electricity Generation from Municipal Waste: A Viable and Innovative Solution for Pakistan

Javed Iqbal[1]

ABSTRACT

Generation of electricity from garbage incineration is presented as a viable option to ease Pakistan's chronic power shortage, to conserve the scarce primary energy resources and to clean the urban environment in the process.

The technology is simple, proven and readily available. It can be easily transferred to Pakistan where the large skilled manpower base and low cost manufacturing infrastructure would make it feasible for re-export to the regional markets.

All current government incentives in the power sector are fully applicable. The required financial outlay is well within the reach of Pakistani entrepreneurs.

Small, 2-5 MW units, are recommended. These can be dedicated to major industrial complexes, industrial estates and sensitive public/defence installations. Total power generation potential for the urban population centres is 450-500 MW.

The obvious socio-economic benefits of this multi-purpose technology can also be realised through municipalities and by such public sector institutions like the HDIP (using the CNG pilot approach) and then privatized. NGO's dealing with environmental issues can also be involved.

INTRODUCTION

Disposal of urban waste (household garbage) is a universal problem in a world increasingly concerned with sound environmental management and sustainable development. Most developing countries have added problems of energy shortage and limited fiscal resources, causing severe constraints on their development planning and implementation.

Till recently, land filling was a common method of garbage disposal, even in some developed countries like Canada. Public awareness and numerous case studies of environmental damage caused by such land fills have forced increased adoptation of alternate methods. Recycling has thus emerged as the leading technology Figure 1).

[1] Javedsons International Ltd., 3323 Oakwood Drive, SW Calgary, AB., Canada T2V 4K5.

THE PROBLEM

In Pakistan, the usual garbage disposal method is simply removing it from one's own premises, without any packaging. Then it is at the mercy of the elements and a rudimentary, at best erratic public collection system. The disposal of this collected fraction is 'land dumping', usually within the same urban environment. The situation in all cities and towns is really lamentable and deteriorating, with visible damage to public health and quality of life. Another vital concern is that toxic industrial and bio-medical wastes are also being mingled in the same dumps. There were recent press reports of used disposable syringes from hospital refuse being sold in Karachi.

This is a brief review of the existing situation. It calls for immediate remedial action through viable, innovative solutions. The objective of this paper is to enlighten the public in general, and the decision makers in particular.

THE SOLUTION

Generation of electricity from incineration of unsorted municipal waste (household garbage) is an old concept, simple and proven (Figure 2). Briefly, this process is based on high temperature incineration of garbage. The resulting heat is used to produce steam which operates the turbine to generate electricity. The approximate conversion rate is: 100 tonnes of garbage incineration (4000-5000 BTU/LB) generates over 2 megawatts of electricity.

The hazardous emissions of this process used to be a major environmental concern and inhibited its widespread use. Such emissions are now being mostly neutralized with improved technology which is evolving to comply with increasingly stringent environmental regulations in the developed countries. The Pakistan National Conservation Strategy (1992) has adopted many of these regulations.

The technology has thus become environmentally more acceptable and is being commercially employed again in such developed countries as Canada, U.S.A., Germany, France, etc. It is also readily available for transfer to the developing countries.

FIGURE

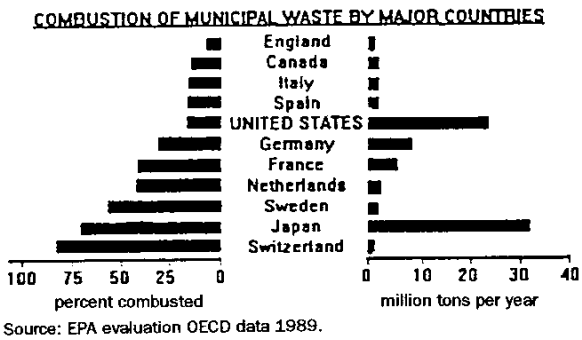

Figure 1– Combustion of municipal waste by major countries.

RATIONALE FOR PAKISTAN

There is an obvious and very significant potential for this simple, energy efficient, multi-purpose technology in Pakistan. This is based on the following facts:

1. There is chronic power shortage, reflected in frequent load shedding which causes general inconvenience to the public. More importantly, there is substantial industrial loss as well as constraints on further industrialization.

2. The country is also short of primary energy resources and the supply-demand gap is widening here also, requiring optimum conservation.

3. The government is offering special incentives on a priority basis in the power sector, to encourage and facilitate local as well as foreign private investment (Govt. of Pakistan, 1994). These incentives are fully

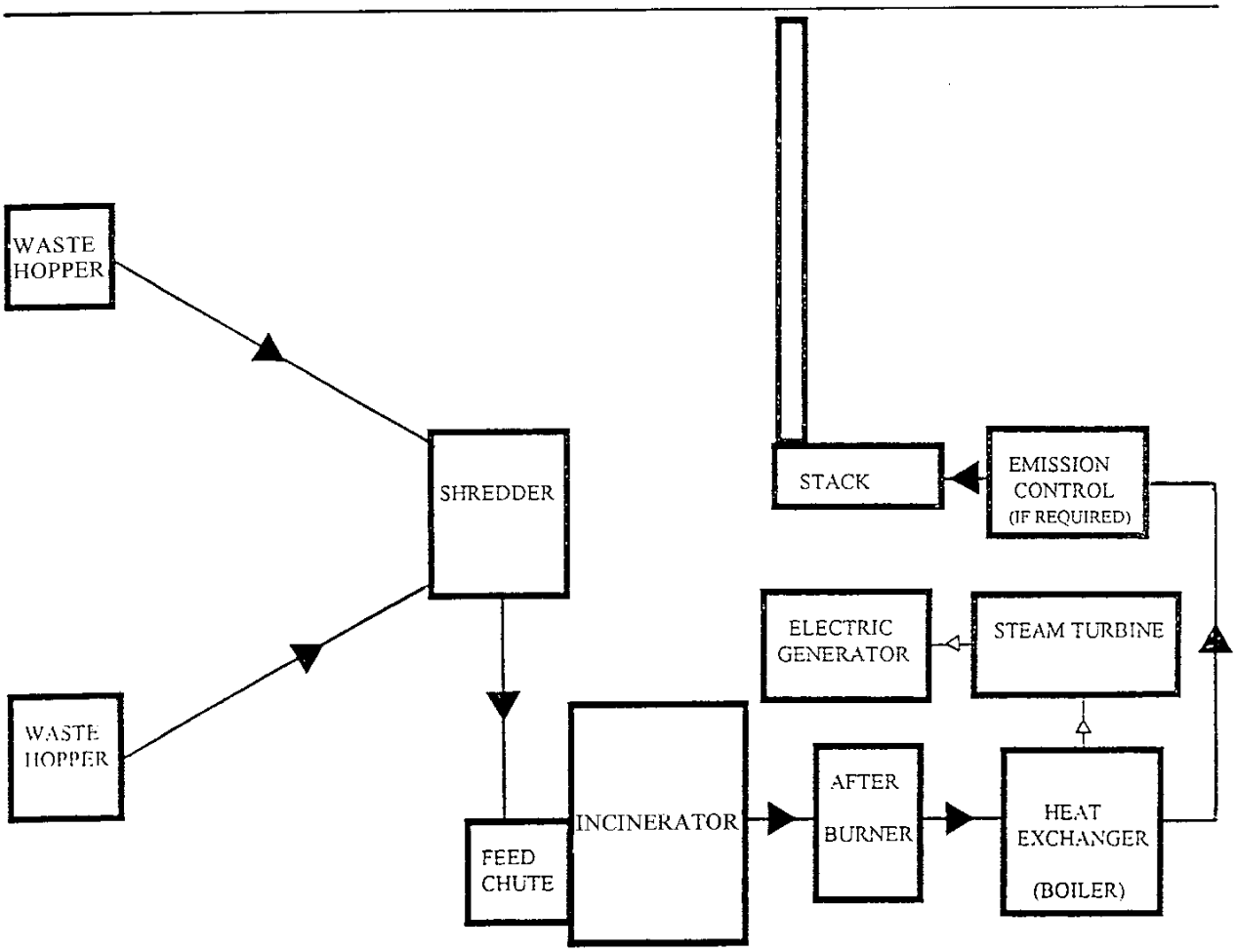

Figure 2– Typical energy from waste (EFW) flow diagram.

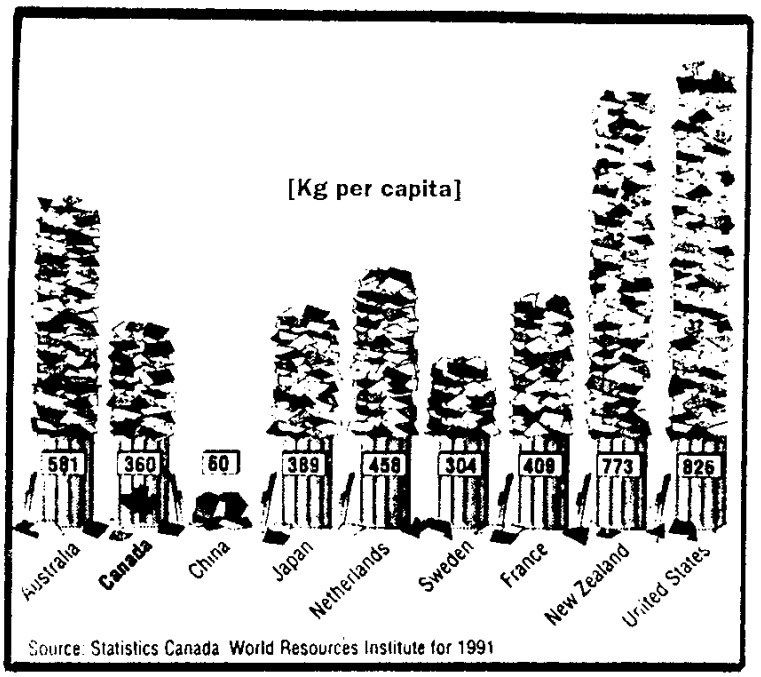

Figure 3– Annual urban solid waste in major countries (kg per capita).

applicable for such unconventional and innovative technologies.

4. The urban population centres are literally choking with garbage, due to the very inadequate collection and lack of environmentally sound disposal systems.

Consequently, the need and enormous socio-economic benefits of such a self-sustaining, multi-purpose system are obvious.

DATA BASE

Annual urban solid waste produced (Kg per capita) for 8 industrialized countries and China is graphically shown in (Figure 3). Usually, comparable figures for the developing countries are not readily available.

The Pakistan National Conservation Strategy (1992) documented various environmental issues and parameters, including the following statistics on solid waste (p.85).

"Pakistan generates 47,920 tonnes of solid waste per day which amounts to 17.5 million tonnes per annum. In Lahore and Karachi, waste collection and disposal accounts for 20-25% of municipal expenditures. Even then only about 55% households of the country's two biggest cities, typically the affluent sections, are served for collection purposes".

In Karachi alone, Haq et al (1987) reported 6,000 tonnes per day garbage production and projected 150 megawatts of electricity generation. That would be a significant contribution to the city's power supply, not to mention substantial foreign exchange savings in imported fuel costs for conventional thermal generation.

The perpetual environmental clean-up and resulting improvements in public health and hygiene, though obvious, cannot be financially quantified.

In Islamabad, CDA collects 300 tonnes per day (Dr. Asrar Khan, HDIP, pers.comm., 1994). This collection system is considered most efficient in Pakistan. Consequently, the above figure can be extrapolated on a per capita basis for any urban population centre in the country. Assuming 300 tonnes per day is collected from a population of 200,000, the figure for Karachi with 10 million people would be 15,000 tonnes per day. Similarly, total production for Pakistan with 120 million population would be 180,000 tonnes per day. Even a cursory visual estimate in any city or town would support these higher numbers.

Figure 4– Geographical relationship of Pakistan with Central Asiac countries.

Some interesting and significant projections can now be attempted by using the above figures:

Total Population -	120 million
Urban Population (35%) -	42 million
Total daily urban garbage production -	63,000 tonnes
Assuming 60% collected daily -	37,800 tonnes
Assuming 60% combustible -	22,680 tonnes
Power Generation @ 2 MW per 100 tonnes -	453 megawatts.

Interestingly, the Pakistan National Conservation Strategy (1992) has projected upto 500 MW cogeneration by year 2001 and 2000 MW cogeneration by 2015 (p.291). Cogeneration is to be encouraged by guaranteed market for surplus energy.

This document also proposes Energy From Waste (EFW) plants in all cities above 100,000 people by the year 2020. It also suggests installation of 12 EFW plants by municipalities in 12 cities by the year 2001 (p.295).

POTENTIAL USE

The system can be used effectively as dedicated stand-by, regular or additional power source for major industrial complexes, industrial estates and sensitive public/defence installations. It would make them independent of the usually erratic and unreliable public utility power supply.

Initially, the system can also be introduced by HDIP, using the CNG pilot approach, then privatized in stages. Municipalities and environment related NGO's can also be owner-operators.

REGIONAL MARKETING POTENTIAL

Pakistan's strategic location (Figure 4) at the cross roads of central and south Asia and her fraternal ties with the Muslim world in general (Iqbal, 1992), are an obvious advantages awaiting full exploitation for commercial and industrial cooperation.

After the initial import of a few complete systems to learn and streamline the operational process, a joint venture manufacturing base in Pakistan would have benefits for all concerned. The low labour costs here would substantially reduce prices, encouraging widespread use, even in small towns. The system would also become very competitive for re-export to the ECO markets, the Middle East and Bangla Desh, etc. Depending on the market, it can be either sold only as a solution to urban pollution, or complete with the power generation option.

ACKNOWLEDGEMENTS

This paper was written while the author was a UNDP/ National Telent Pool consultant with HDIP in July-August 1994. Mr. Riaz Ahmed, Chief Planning and Information of the Institute critically reviewed the manuscript and kindly provided the word processing facilities.

REFERENCES

Govt. of Pakistan, 1994, Policy Framework and Package of Incentives for Private Sector Power Generation Projects in Pakistan: Govt. of Pakistan Document, March 1994.

Govt. of Pakistan and IUCN, 1992, The Pakistan National Conservation Strategy, 378p.

Haq, S.M. et al, 1987, A case study for generation of electricity from refuse in Karachi.

Iqbal, J., 1992, Pakistan - Canada's gateway to central Asia: Jour. Canada-Pakistan Coop., Ottawa, Canada, v.6, no.1, p.41-49.