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# Waste to energy: Opportunities in Asia

Over the last twelve years, Ashurst has been at the forefront of the waste market, leading the development of a number of landmark waste to energy (WtE) projects across a number of regions, as the interest in this emerging sector heats up significantly. This briefing focuses on the following:

- A highlight of developments which have been made in the management and treatment of municipal, commercial and industrial waste globally, with particular focus on Western Europe.
- An overview of the core ingredients necessary to structure a successful and bankable WtE project, wherever it may be located.
- Potential opportunities that might exist across Asia for the development of WtE projects and what has already been done and what still needs to be done by regulatory authorities and national and state governments in order to make such projects deliverable.

## What is WtE?

In very general terms, waste to energy facilities (or, as they are also known, energy from waste (EfW) facilities) create energy in the form of electricity or heat from the treatment of waste products. This is usually done by "thermally treating" (or incinerating) the waste.

Most WtE processes produce electricity or heat directly through combustion. Alternatively, they might produce a combustible fuel such as methane or methanol from the treatment of a waste product.

In addition to incineration, thermal treatment plants may instead involve gasification (producing a combustible gas) or pyrolysis (producing other products).

Non-thermal technologies include anaerobic digestion, which is ideal for treatment of vegetable matter, food waste and animal by-products, typically producing a biogas, or mechanical biological treatment (MBT), which is used primarily for dry recyclable products and solid waste.

Waste to energy plants have been used to treat and dispose of a number of waste products, but primarily are used on:

- municipal solid waste;
- commercial and industrial waste;
- food waste;
- agricultural and industrial by-products (such as bagasse produced during sugar production);
- animal by-products and animal waste (e.g. chicken droppings); and
- sewage.

## Current state of the market globally

Most waste to energy technology and the ability to extract energy from waste products are not new developments. Among the 420+ WtE plants in Western Europe and 80+ WtE plants in the United States, there are a number of large WtE facilities which have now been in operation for three to four decades. In fact, the use of solid municipal waste to produce biogas and electricity dates back to the early 20th century.

However, due to dwindling fossil fuel resources, the increasing focus on energy security, a greater awareness of the social and environmental hazards of poor waste management and an overwhelming global focus on reducing greenhouse gases, the development of WtE projects has increased significantly over the last 20-30 years.



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The development of WtE projects has varied from country to country, depending upon the local factors that have prevailed.

For example, in the UK, which has historically had access to freely available land and plentiful supplies of coal and gas reserves, there has been little reason to divert municipal waste away from landfill and towards the development of renewable energy. However, in countries such as The Netherlands (which does not have the

ability to landfill waste due to the prevailing geography) and Singapore (where there is a shortage of land), there has been an overwhelming need to develop alternative solutions to the disposal of solid waste, resulting in extensive reliance upon WtE technology.

Furthermore, those countries subject to the EU Landfill Directive have been forced by Europe's regulatory regime to develop alternative uses for municipal waste, thereby driving the demand for alternative technologies. As a result of European regulations, there is now a compelling financial justification for the development of WtE plants in most of Europe.

In other less-developed jurisdictions on the other hand (for example, in parts of Asia and in Africa), alternative and far cheaper waste management solutions than the development of expensive WtE plants have been used, as a result of greater levels of scavenging and recycling, the low cost of labour, the ready availability of landfill sites and the lack of available capital.

The development of waste management techniques and the extent to which a country's ability to more efficiently manage and treat its waste reflects the country's economic development is depicted in Figure 1.

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greater opportunities for developers, banks and equipment manufacturers in the WtE space.

## Key economic drivers for WtE projects

Whilst the *social* and *environmental* drivers for a project may seem compelling and undeniable, the same cannot always be said for the *economic* drivers for those projects.

As shown in Table 1 below, large scale WtE projects are typically inefficient at producing electricity in comparison to their thermal power plant competitors (which rely upon fossil fuels).

**Table 1: Comparative cost of generating power<sup>1</sup>**

Technology	Total System Levelized Cost (\$US per MWh)
Gas-fired combined cycle	65 – 67
Onshore wind	87
Geothermal	89
Hydro	90
Conventional coal	100
Gas-fired advanced combustion turbine	105
Advanced nuclear	108
<b>Biomass</b>	<b>111</b>
Advanced coal	123
Gas-fired conventional combustion turbine	130
Solar PV	144
Offshore wind	221
Solar thermal	261

As a result, many WtE facilities will not be affordable or bankable based entirely on the power revenues likely to be generated from the disposal of waste alone (regardless of whether the facility produces heat also).

In Europe, we have seen a range of measures employed in order to drive forward the development of WtE projects. These measures include:

- feed-in tariffs;
- the availability of green certificates (in a variety of forms);
- renewable heat incentives;

*"Investors and banks will inevitably look for a legal framework which facilitates the resolution of disputes and the enforcement of any awards or decisions which arise."*

- enhanced capital allowances and other tax incentives; and
- the imposition of landfill taxes and landfill allowance trading schemes.

The majority of these incentives and subsidies treat WtE projects as simply another form of renewable energy generation and focus on energy and heat production rather than

the waste supply side of the equation.

### Other revenue streams

This lack of focus on the waste supply side of the equation has proved to be problematic in financing long-term WtE projects in a number of jurisdictions.

Most significant WtE projects have relied heavily on the revenue arising from its waste disposal activities, typically charged on the basis of a "gate fee" or "tipping fee" per tonne of waste. In the context of WtE projects developed in Western Europe, it is not uncommon for the vast majority (often over 70 per cent) of all revenues to be derived through the waste gate fee, payable by the relevant municipal authority responsible for the disposal of waste.

Given the volatility of energy prices and the fickleness of most government subsidies, most lenders to WtE projects welcome the stable long term revenue stream which derives from waste gate fees, particularly when such payment arrangements benefit from:

- strong counterparty credit ratings;
- fixed gate fee rates per tonne of waste (indexed);
- guaranteed minimum waste volumes (usually structured on a "put or pay" or "deliver or pay" basis);
- maximum waste volumes with regular forecasting mechanism; and
- some form of protection in respect of changes to waste composition.

### Waste volume risk

A key problem for the development and project financing of WtE projects arises from the tension between two key policy objectives of any government: reducing the overall volume of waste produced and maximising renewable energy production.

For the successful development and financing of WtE projects, it is important that waste flows are maximised (not minimised) in order to fuel these facilities. Due to the inherent nature of the waste feedstock for WtE projects (and various international regulations which prevent or regulate the transnational shipment of solid waste products) waste typically cannot be transported over long distances, as compared to coal, oil or gas, without incurring significant and prohibitive costs.

Therefore, in assessing and developing WtE projects (regardless of whether these are financed through equity or debt), much of the focus by investors and financiers is on the waste supply side of the project.

### Core ingredients for a successful WtE project

#### Favourable investment regime

As is the case for any energy development, WtE projects are best developed where favourable or (at the very least) acceptable investment regimes prevail.

Investors and banks will inevitably look for a legal framework which facilitates the resolution of disputes and the enforcement of any awards or decisions which arise. The legal processes of the country should always be transparent and the rule of law and respect for the sanctity of contractual commitments should prevail.

Investors also need to be mindful of the fact that even jurisdictions with very stable investment regimes and legal systems can throw up some surprises. As government policymakers juggle climate change and other environmental concerns with security of energy supply issues, and seek to meet various self-imposed and external targets, there are likely to be some policy U-turns, leading to regulatory changes such as changes to incentive mechanisms. It is therefore important for investors to always consider not only the existing regulatory regime, but also to keep a close eye on policy developments.

#### Other factors

In the context of WtE projects, there are a number of additional characteristics which any investor will inevitably look for, to ensure that the legal and commercial framework for these projects is attractive for both foreign investors and commercial and multilateral lenders.

Key ingredients of any WtE project will include:

- a **regulatory system** which is supportive of the thermal treatment of waste (surprisingly, such regulatory systems may be more prevalent in

developing markets than in more sophisticated markets, e.g. Ireland and the UK);

- an **organised waste collection** and regulatory regime which facilitates the centralised collection of municipal and commercial waste and discourages illegal, unregulated or ad hoc disposal (e.g. fly-tipping) of such waste;
- the **ownership by municipal authorities of the waste stream** (this is typical where the relevant municipal authorities have a statutory duty to collect and dispose of waste within the relevant region);
- **creditworthy long-term suppliers of waste** (which may comprise municipal authorities/local government or, alternatively, financially stable and technically proficient corporate entities);
- **securing sufficient feedstock**. As highlighted above, this has traditionally been a problematic area for WtE projects. For this reason, a significant amount of up-front legal, regulatory and commercial due diligence often needs to be carried out on the waste supply side of any WtE project in order to determine the viability and bankability of any such deal;
- a **significant need** (on a regional or national level) **for new energy generation** and readily available offtakers for any new energy produced (e.g. existing industrial users of heat and power or an established electricity grid system.);
- **creditworthy long-term power and/or heat offtakers** (which may be public utilities or corporate offtakers with sufficient balance sheet strength);
- a **transparent licensing and planning regime** which is capable of enabling all key consents and permits to be obtained in a way which is both efficient and incapable of subsequent challenge;
- **appropriate government authorities** prepared to shoulder the political risk associated with WtE projects (which risks may be managed through the power purchase agreement, waste concession or government support agreements); and
- **low or negligible levels of organised or political resistance** to the development of thermal waste treatment facilities.

### Structuring a bankable project

Once the viability of the project is established, in order to ensure the success of any WtE project, it will also be necessary to ensure that the other key commercial ingredients exist for a successful and bankable project, including:

- strong sponsor support;
- demonstrable knowledge and track record by the sponsors of project-financing infrastructure developments;

- a strong and experienced advisory team (with both waste and energy experience);
- an EPC contractor with an established track record of developing WtE projects utilising proven technology;
- recognised and reliable equipment suppliers for the chosen technology;
- an appropriate security package from the EPC contractor which reflects the nature and extent of EPC risks involved in the project; and
- an acceptable strategy for the disposal of all ash residue and other by-products.

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It is only with these core ingredients that WtE projects may be financed and delivered in the current global market.

## The Asian perspective

### Drivers for WtE projects

Rapid economic growth in developing Asia has resulted in many countries facing serious challenges in waste management, both in rural and urban areas. Governments in the region are increasingly aware of the risks of uncontrolled disposal of untreated or inadequately treated waste, including health and sanitation issues and environmental pollution such as contamination of groundwater and surface water by leachate and air pollution from uncontrolled burning of waste.

Growing populations and urbanisation are also putting pressure on land space thereby encouraging governments and municipalities to consider ways of reducing landfill waste.

At the same time, the more positive developments of industrialisation and modernisation have given rise to:

- greater volumes of municipal, commercial and industrial waste;
- waste of a different complexity and composition, such as different types of plastics, agro wastes and residues (such as that generated by the production of palm oil or sugar) and electrical and electronics equipment; and
- increasing demands for energy.





Governments in the region are increasingly aware of the risks of uncontrolled disposal of untreated or inadequately treated waste.

This rapid economic growth in developing Asia is expected to continue with Asia expected to nearly double its current share of global GDP from 28% in 2010 to 52% by 2050<sup>2</sup>. This continued growth will inevitably lead to ever greater pressures on energy supply and waste management, forcing governments to consider how best to support the WtE and waste management sectors.

## Positive Developments

Recently, there has been a number of notable developments across Asia which have combined to create a favourable climate for the development of new waste management infrastructure in the region.

These factors include:

- **a generally more stable investment climate**, as exemplified by the recent upgrade of the Philippines to investment grade by both Fitch and Standard & Poor's. This more stable investment climate has led to more active involvement in project financing by regional/local banks, who have funds available to lend and development banks (such as ADB and JBIC);
- **a greater focus by governments** on renewable energy including the setting of ambitious national targets for renewable energy production, including from WtE projects;
- the development of **more sophisticated laws and regulations relating to the development and incentivisation of renewable energy projects** allowing for greater certainty for developers;
- the development of **more cohesive incentive schemes**, including favourable tariffs, tax relief and renewable energy credits as described further below;
- **continuing concerns over energy security and supply in the region, coupled with significant**

- **increases in energy demand**, ensuring that the generation of renewable energy will be welcomed;
- **a shortage of effective and modern waste infrastructure** together with rapid urbanisation, justifying investment into the sector;
- increasing use of **public, private partnerships (PPPs)** to deliver economic and social infrastructure; and
- **a greater focus on Asia** by internationally recognised and experienced developers keen to develop new markets. This includes European developers such as B&W Volund and MARTIN GmbH and successful Asian-based developers, such as Singapore's Keppel Infrastructure and Hong Kong's C&G Environmental Protection Holdings.

## Incentive schemes for WtE projects

Thailand was one of the early-adopters of such incentive schemes in developing Asia, with a feed-in-tariff structure in place since 2006. Malaysia on the other hand, introduced its incentives for renewable energy generation only in 2011 but is considered to have one of the most structured tariff systems in place in Asia. Feed-in tariff mechanisms also operate in countries such as the Philippines, Japan, South Korea, India and China where the feed-in tariff for electricity generated from WtE projects was increased last year to almost double the tariff received by coal-fired producers

Other incentives used to bolster investment in WtE in Asia include government subsidies, tax holidays and tax exemptions (for example, on import customs duties on equipment), government guarantees of utility company obligations under power purchase agreements and renewable energy certificates (for example, in India)<sup>3</sup>.

As in Europe, the incentives have to date focused on the renewable energy production side of the equation although given the pressures to reduce landfill in some jurisdictions, there has also been some increasing attention given to the waste supply and waste reduction side.

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## Challenges

Challenges remain for prospective developers and financiers of WtE projects in Asia with some of the "core ingredients" referred to above still missing in some jurisdictions. Prospective developers and financiers will therefore have to choose projects and regions of focus carefully.

These challenges include:

- **grid connection for offtake:** in large parts of developing Asia, the lack of an established transmission system continues to be an issue. However, governments are recognising this as a challenge and some have incorporated incentive schemes and/or imposed statutory obligations on utility companies to ensure that transmission systems are installed for new clean energy projects;
- **waste collection:** in parts of developing Asia, waste collection remains a major issue. For example, it was recently reported that in Delhi, 85% of the city doesn't have a formal door-to-door collection system<sup>4</sup>;
- **low cost of waste disposal:** in large parts of Asia, waste disposal is still carried out at no cost to the local population and at little cost to the relevant municipal authority, particularly where waste can be landfilled or dumped and there are no overriding policies or macroeconomic drivers to avoid landfill. However, this is changing and certain countries in Asia, including China and Malaysia, now charge gate fees (although some argue that these are still at too low a level to be effective) and/or have passed legislation establishing mechanisms and incentivising municipal solid waste management at the local government level;
- **uncertainty in carbon markets:** WtE projects in

*"The clean development mechanism has helped to encourage private investment in the WtE sector in Asia and has importantly helped to increase the development of industry knowledge and expertise in the region."*

Asia have in the past been able to rely on revenue from the sale of Certified Emission Reduction certificates (or "CERs") where a project has been able to obtain registration under the clean development mechanism. However, following falls in CER prices, confidence in the sale of CERs as a long-term stable

revenue stream, has fallen. The clean development mechanism has, however, helped to encourage private investment in the WtE sector in Asia and has importantly helped to increase the development of industry knowledge and expertise in the region. Further, a number of countries in the region are now setting up or planning to set up their own emissions trading schemes which could help stimulate investment in this sector;

- **untested regulations:** as we highlighted earlier, there have been some great strides forward across Asia in recent years in relation to the development of investment regimes and legal frameworks to encourage the development of WtE and other renewable energy projects. However, the implementation of these relatively new regulations is still untested in some countries. Change in law risk also remains a concern for investors;
- **permits, land and local resistance:** while attempts have been made by some government authorities to streamline the permit process, developers in some jurisdictions still face long delays in obtaining the relevant permits for the development of WtE projects. In addition, some projects, especially those that are incineration based, have been delayed or have stalled due to resistance from local residents and environmentalists and there is growing concern over the operating standards and environmental practices of WtE plants installed in countries such as China.

## Recent WtE developments in Asia

Examples of some recent and proposed WtE developments in the Asia region include:

- the Hong Kong government has issued a new 10-year solid waste management plan that includes construction of organic waste treatment facilities and integrated waste management and WtE facilities (although we note that current proposals for a large scale waste-to-energy incinerator have been held up by a judicial review);
- the Brihanmumbai Municipal Corporation proposes to build at least ten WtE plants to process the 8,000 metric tonnes of garbage generated by the city every day;
- earlier in the year, the Yangon City Development Committee in Myanmar issued a call for bids to build and operate two WtE projects. Ten domestic and international companies (including companies from South Korea, Japan and Malaysia) have been shortlisted, and winning submissions are expected to be announced before end of the year;
- the government in Bangladesh recently signed an agreement with an Italian firm for the construction of the two WtE plants;

- the municipality of Batam in Indonesia recently launched the procurement process for a large solid waste management PPP which may include a WtE incinerator;
- a tender for a sixth incineration and waste management plant in Singapore with a capacity of at least 2,400 tonnes per day is expected to be issued this year (a tender for consultants to manage the project was issued in August 2013);
- Ho Chi Minh City has been calling for investment in WtE plants in the city but so far progress has been slow; and
- an international tender process is expected to be launched soon for a new WtE project near Kuala Lumpur, Malaysia.

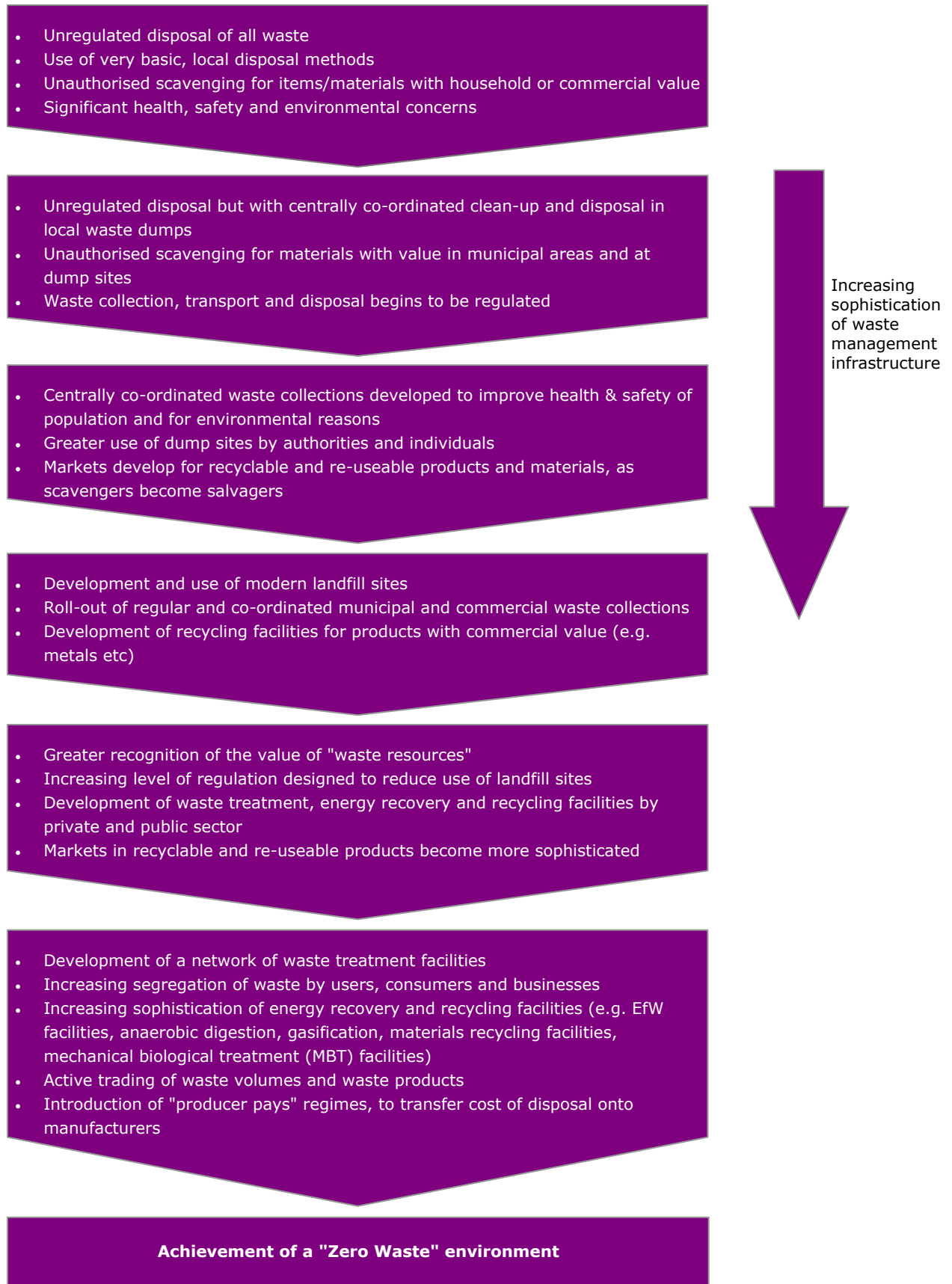
While challenges remain, these examples show that there are very real opportunities opening up for power

developers and utilities across Asia to develop this form of renewable energy technology and thereby to assist the governments in Asia to achieve their aggressive clean energy targets and address the growing issue of waste management.

Note:

- 1 Taken from the US Energy Information Administration publication headed "Levelized Cost of New Generation Resource" in the Annual Energy Outlook 2013, published in January 2013. Note that such results are heavily dependent upon the underlying assumptions used but the table gives a general idea of the respective costs of building and operating a generating plant over an assumed financial life and duty cycle.
- 2 "Asian Development Outlook 2013; Asia's Energy Challenge", Asian Development Bank, 2013
- 3 Although see also our comments regarding the ability for projects to register as clean development mechanism projects and therefore to obtain revenues from certified emission reductions.
- 4 "Delhi may drown in its own waste", Darpan Singh, Hindustan Times, April 29 2013.

**Figure 1: Evolution of waste management**





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