# in the know

ISWA
International Solid Waste Association

**ISWA in the know**

As an international, non-profit association dedicated to the promotion of sustainable and professional waste management practices, ISWA is ideally positioned to contribute to reducing the greenhouse gas emissions which cause climate change.

Our members already have the experience and technology in place which can transform the waste sector into a net carbon reducer. ISWA works to disseminate their knowledge, as well as supporting new research and education programmes and assessing experiences from different countries on policy, strategy and accounting.

Our aim is to provide a global foundation for improvements in waste strategies. With our know how, more countries can realise the opportunity professional waste management represents to improve their local environment and play their part in the wider campaign against climate change.

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## Waste management and recycling are proven and effective strategies to reduce greenhouse gas emissions, mitigate the causes of climate change, and advance toward sustainable development.

Stabilizing atmospheric concentrations of GHGs requires a broad portfolio of actions across all sectors. Each sector faces challenges in reducing emissions and must overcome technological, financial, regulatory, social and political obstacles in achieving carbon reduction.

While waste management contributes relatively little to climate change – only 3 - 5% of anthropogenic greenhouse gases – the sector offers an immediate, cost-effective, and fast-acting opportunity to achieve substantial cuts in global GHG emissions. Using existing technologies that can be deployed at scale in virtually all regions and markets, waste management can be transformed into a net carbon reducer. Countless examples across the globe show that this is a mitigation strategy ready for scale-up.

Over the past 50 years, the waste management sector has developed sophisticated technologies and accumulated deep expertise in building integrated systems adapted to local needs, tailoring its approach to the specific conditions of each area. Every city, region and country has a unique starting point in terms of waste composition, technologies and infrastructure, climate conditions, and economic capability, and a key advantage of waste management's GHG mitigation potential is that it can build upon existing capacity in a way that enhances overall performance while meeting environmental objectives

Key strategies in the waste management sector to reducing GHGs cut across a range of activities and areas, providing opportunities for both upstream and downstream cost savings, energy efficiency improvements, and public health and lifestyle benefits. These strategies include: waste prevention, recycling and reuse, biological treatment, energy recovery, and engineered landfilling.

### Collection and transportation

- Rationalization of collection operations and improvement of fuel efficiency
- Use of alternative fuels (e.g. biodiesel, bioethanol)
- Development of alternative means of transportation (e.g. rail and waterway transport)
- Implementation of driver training programmes

### Recycling

- Increase material recovery rate to save energy
- Recovery of substitute fuels (e.g. waste oil, refuse derived fuels)

### Waste to energy

- Generation of thermal energy and electricity from waste combustion as a [cost-competitive] substitute for conventional fossil fuels
- Recovery of metals and bottom ashes from incineration

### Biological treatment

- Increase compost production; a low emitting treatment solution
- Recovery of methane from anaerobic digestion processes

### Landfill

- Installation of active landfill gas collection and treatment systems
- Use of landfill gas as a fuel to produce electricity or thermal energy

### The EU example

Recent experience in EU countries has shown that through the combination of proven waste management technologies, comprehensive regulatory standards, and broad, multi-stakeholder coordination and communication, municipal waste management can achieve substantial, near-term reductions in GHGs.

Thus far, municipal solid waste management systems in the EU have reduced approximately 48 million tonnes of $CO_2$-equivalent on a lifecycle basis from 1995 to 2008. Another 62 million tonnes of $CO_2$-equivalent will be reduced by 2020 as the EU Landfill Directive is fully implemented in the coming decade.

"Harvesting the GHG mitigation potential of better municipal waste management can make an important contribution to combating climate change." (EEA, 2011)

**Population growth and urbanization:** More than virtually any other sector, waste management and recycling encompass every facet of modern society. As the world population continues to grow — and grow increasingly urban — waste management and recycling will play an ever larger role in improving public health, enhancing productivity, and achieving sustainability and environmental goals.

Rapid increases in population and urbanization are resulting in increased waste generation in developing countries. For the first time ever, the majority of the world's population lives in cities, and this proportion will continue to grow.

- By 2030, 6 out of every 10 people will live in a city; by 2050, this proportion will increase to 7 out of 10 people.
- By 2024 the global population is expected to reach eight billion. Projections to 2050 estimate that most of that population growth will take place in less developed regions.

Global waste production is less easy to predict; however, if we take only those categories best documented at global levels – municipal waste and industrial waste – we obtain an estimate of global annual waste supply of 3.4 to 4 billion tonnes.

**Estimated world waste production and collection for 2006**

| Tonnes | Quantities produced (tonnes) | Quantities collected (tonnes) |
|---|---|---|
| World total municipal waste | 1.7 to 1.9 billion | 1.24 billion |
| Manufacturing industry non-hazardous waste | 1.2 to 1.67 billion | 1.2 billion |
| Manufacturing industry hazardous waste for a selection of countries | 490 million | 300 million |
| **Total** | **3.4 to 4 billion** | **2.74 billion** |

*Source: CyclOpe.*
*Note: The quantities of non-hazardous and hazardous construction and demolition waste produced to a selection of countries amounts to 1 billion tonnes. The quantities of waste produced by the mining, electricity and water industry (non-hazardous) in a selection of countries amount to 6.4 billion tonnes.*

In developing countries where collection rates are generally quite low, about 15 percent of waste is processed through informal and unsafe recycling (Chalmin & Gaillochet 2009). It is essential to integrate the informal sector into waste management planning, building on local practices and experience while improving efficiency, and the living and working conditions of those involved (Wilson, Velis & Cheeseman). A significant percentage of the remaining waste in low income countries is deposited in uncontrolled landfills or illegal dumping grounds, raising serious environmental and health concerns.

Implementing effective waste management systems in these regions can bring a wide range of environmental, economic and social benefits.

**Environmental benefits**

- Reduced GHG emissions generation
- Reduced environmental degradation from uncontrolled waste disposal
- Resource and energy conservation through material recovery
- Energy recovery to reduce demand on limited natural resources

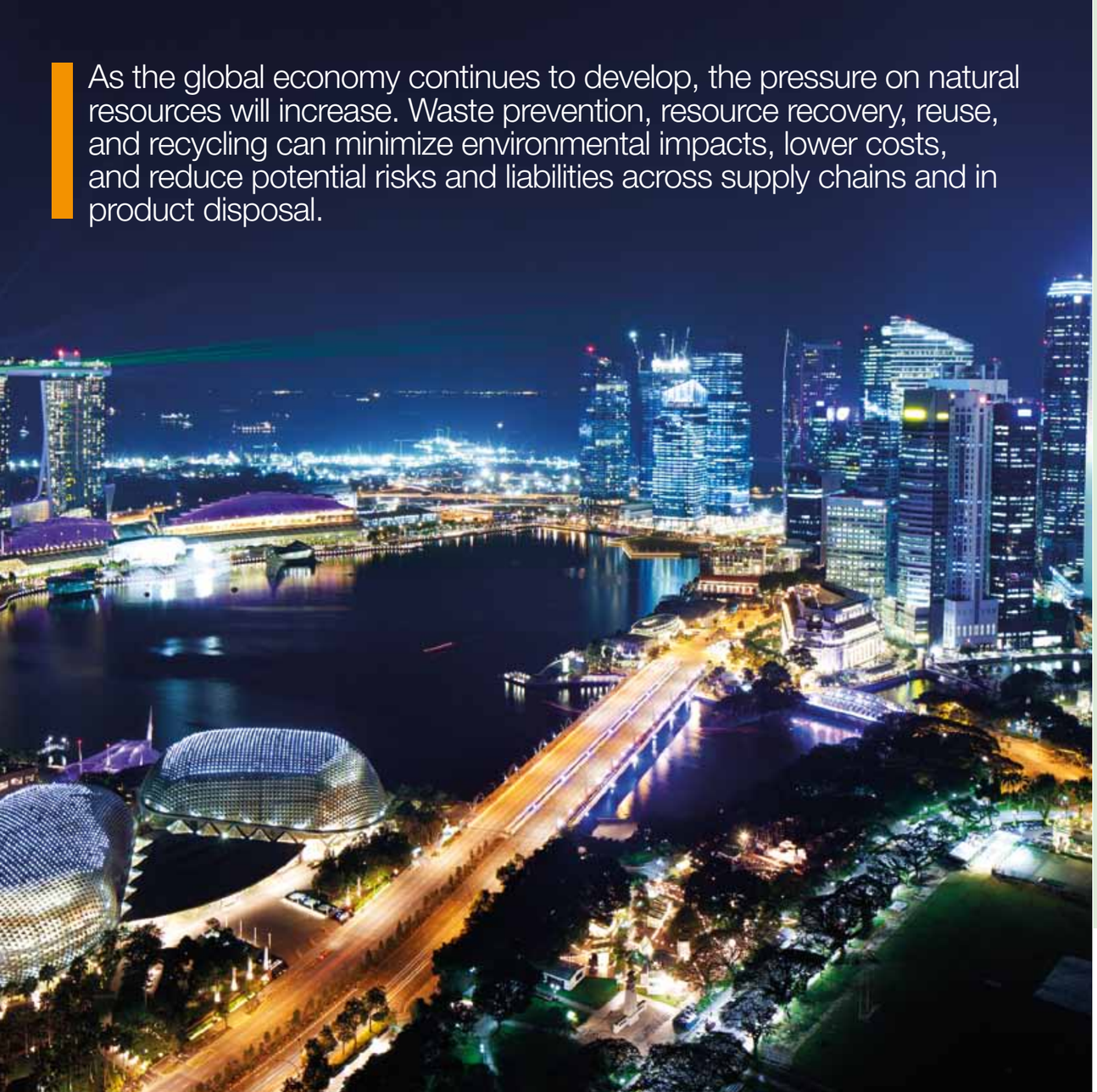
**Economic benefits**

- Access to international financing
- Revenues from the sale of carbon reduction credits, recovered energy, and materials
- Technical expertise and training to facilitate technology transfer and build capacity

**Social benefits**

- Improved sanitary and health conditions
- New jobs from construction of new facilities and projects
- Training and capacity building in support of waste management modernization
- Contribution to equity and poverty eradication

As the global economy continues to develop, the pressure on natural resources will increase. Waste prevention, resource recovery, reuse, and recycling can minimize environmental impacts, lower costs, and reduce potential risks and liabilities across supply chains and in product disposal.



Of the 4 billion metric tons of waste currently generated globally, only about 1 billion is recovered and recycled. As demand for virgin raw materials intensifies and energy demand continues to accelerate, the capacity to recover, reuse, and recycle key materials — as well as prevent waste in the first instance — is essential to promoting economic development and maintaining competitiveness.

Globally, the prospect of rising costs and increased risks associated with raw materials and other core manufacturing inputs raises new questions over the economic and social impacts of resource scarcity. With secondary raw material production generally seen as inadequate or unavailable in the short term in many regions, waste management is increasingly viewed as a critical bridge to more sustainable resource production and use, placing a premium on waste prevention, reuse, recovery, and recycling.

Importantly, developing long-term waste prevention, reuse, recovery, and recycling programmes requires high level commitments from policymakers, domestic regulators, and key stakeholders across supply chains and among sectors and industries.

### Turning waste into a resource

As waste management systems continue to evolve, they are now characterized by a “cradle to cradle” approach that encompasses waste prevention, reuse, recovery, and recycling across the life cycle of a product. This has spurred innovative new technologies and approaches to optimizing material use and recoverability, decreasing material use in consumption, and improving the collection and recovery of materials.

As such, waste prevention, reuse, recovery, and recycling form the basis for a more holistic solution and key driver of climate mitigation and sustainability — resource management.

As opposed to just waste management, a truly comprehensive approach to resource management starts at the very beginning of the supply chain at the design stage and extends down through manufacturing, use, and end-of-life recovery stages of a product’s lifecycle. By definition, resource management requires broad and dynamic coordination among designers, manufacturers, consumers, and waste management and recycling enterprises. When supported by appropriate regulatory standards and properly capitalized by both public and private sources, waste management can thus transform into resource management — and play a critical role in global efforts to decarbonize the global economy in balance with economic development.


### Recycling and resource efficiency

Recycling, re-use and waste minimisation represent an important and growing opportunity for indirect reduction of GHG emissions through the conservation of raw materials, improved energy efficiency, and fossil fuel avoidance.

Paper provides an example of how improved waste management can achieve better resource efficiency. In 2006, approximately 67% of waste paper from EU municipal solid waste (MSW) was recycled. This recycled quantity covered 24% of the total consumption (not only by households) of paper products in the same year.

If 90% of all paper from MSW were recycled, then 32% of consumption of paper products could be generated from recycled paper. This increased recycling would also reduce landfilling and incineration, yielding additional GHG savings of about 1.73 million tonnes of $CO_2$-equivalent in the EU.

It is estimated that approximately 250 million tonnes of recovered cellulose fibres are recycled annually. Using a conservative emission factor, the recycling of paper, cardboard and other fibrous materials equates to a global potential of approximately 100 million tonnes of $CO_2$ in avoided emissions.

Abundant, affordable and accessible energy is vital to increasing economic development, reducing poverty, and raising standards of living. Technologies such as the capture of methane from landfills, waste to energy and anaerobic digestion can deliver a reliable, worldwide supply of clean energy using existing, low-cost solutions.

More than 70% of GHG emissions are due to fossil fuel combustion (EREC). Reducing emissions from energy use, while still meeting future energy demand and alleviating energy poverty, requires the development of new sources of clean, reliable energy.

Waste is a significant renewable energy resource whose energy value can be exploited through thermal processes such as incineration and industrial co-combustion, utilisation of landfill gas, and use of anaerobic digester biogas.




### Landfill Gas to energy

Commercial scale landfill gas recovery and utilization systems directly reduce the largest single source of GHG emissions from waste.

- Europe's gross electricity output from landfill gas was 9358 GWh in 2009, a 3.4% increase from 2008. (Biogas Barometer) This corresponds to the electricity use of 1,631,000 Europeans.
- In 2008 landfill gas utilization projects in the US alone offset 84.3 Mt $CO_2$ eq, which is equivalent to the emissions from 15.5 million passenger vehicles. (USEPA)

Since landfills remain the most widely used waste solution in developing countries, landfill gas utilization projects offer a practical, efficient method of reducing GHG emissions across the globe.

### Waste to Energy

Controlled combustion of solid waste in modern furnaces, equipped with up to date pollution controls, is an effective method of converting waste into energy while reducing volumes of residual waste to be sent for disposal.

Where it is technically and economically feasible, incineration processes can provide very high energy efficiencies and associated GHG emission reductions, by using the power generated for electricity and heat and thereby reducing consumption of fossil fuels.

Globally, more than 130 million tonnes of waste are incinerated every year at over 600 waste-to-energy plants, producing over 1000PJ of electricity per annum. This would be sufficient to provide electricity to some 10 million average European consumers (100GJ per annum).

### Refuse derived fuels (RDF)

Refuse derived fuels are substitute fuels produced by shredding and dehydrating non-hazardous waste. RDF is generally made from plastic, paper, cardboard and wood and complements traditional recycling techniques by recovering materials which would otherwise go to incineration or landfill facilities.

They can be used in a variety of ways to produce electricity; in waste to energy plants and as fuel substitutes in industrial processes — all of which can displace GHG emissions from fossil fuel combustion, contribute to energy security and independence, and conserve non-renewable resources.

### Anaerobic digestion

Anaerobic digestion (AD) is used as a treatment option for various liquid or solid organic wastes including food waste. AD produces a biogas composed of methane and carbon dioxide which is captured to produce electric energy and heat, and used to enhance digester processing.

The by-product, a digestate or residual organic waste, can be used in the agricultural industry, often after composting. The process can extract between 50 – 70% of the energy contained in organic matter and the biogas may be used for electricity production with an efficiency rate of 35%.

Fifty-two percent of the energy produced from biogas in Europe is associated with anaerobic digestion plants treating varied organic wastes.

Waste management and recycling possess the unique ability to catalyze action across economies and within all industrial sectors and, in so doing, achieve significant and lasting reductions in greenhouse gas emissions. As such, waste management and recycling are essential and enabling components of national, local, and corporate strategies for mitigating climate change and meeting greenhouse gas reduction commitments, requirements, and pledges.

Waste policies and legislation which contain precise intermediate and long-term targets, aimed at better handling of waste, act as important drivers for the reduction of GHG emissions. Such regulations vary widely according to local circumstances, but increasingly they are focused on treating waste as a secondary material or an energy source.

Progress in reducing GHG emissions in the EU between 1990 and 2007 was made through policy and regulations based on the Waste Hierarchy, which prioritizes waste prevention, then re-use, recycling, other recovery such as energy recovery, and finally disposal. This legislative framework included specific targets and directives regarding packaging waste and diversion of organic waste from landfill. By 2020, a total of around 1.2 billion tonnes – more than 40% – will be regulated by binding EU requirement targets for recycling and recovery.

In the US, landfill methane emissions decreased 11% between 1990 and 2007 due to increased landfill gas recovery, driven by economic incentives, policies, and regulations.

In developing countries, waste management systems can play an important role in meeting both environmental and public health goals, while also promoting economic development and attracting new investment. It is critical to develop regulatory regimes in a practical and sustainable manner and tailor initiatives to account for local waste composition and quantities, infrastructure, preferences, economic resources, and climate.

A number of legislative instruments addressing waste management have played an important role in reducing GHG emissions:

| Actions related to | Examples of policy and regulation instruments |
|---|---|
| Waste generation and collection | Producer responsibility<br>"Full cost" collection tariffs<br>Separate collection schemes for specific waste types |
| Material recycling sector | Strategies and precise targets for recycling of specific waste streams<br>Producer responsibility<br>Landfill tax<br>Tax exemption for recyclable materials<br>Green Public Procurement to stimulate demand for recycled products |
| Incineration and anaerobic digestion sector | Co-ordination with energy planning<br>Subsidies for construction<br>Landfill ban of biodegradable waste<br>Secure sufficient waste to the plants<br>Tax exemptions for energy generated<br>Emissions limitations |
| Landfill sector | Strategies for phasing out old landfills<br>Landfill ban on biodegradable waste or untreated waste<br>High technical standards in general and especially for performance to reduce GHG emissions by capture and utilization of the energy<br>Landfill tax |

Establishing clear waste policy and regulations will help to leverage both public and private financial resources in support of further progress in waste technology and infrastructure, particularly in developing countries.

## Monitoring, reporting and verification

The effectiveness of a waste management regulatory regime and its ability to meet key economic and environmental goals hinges on the use of sound monitoring, reporting, and verification (MRV) standards. The accurate tracking of waste, emissions, and other inputs and outputs is fundamental to enhancing performance and attracting and maintaining adequate financial and technical support. Precise measurement of GHG emissions is critical in order to achieve GHG emissions reduction targets at all levels.

MRV methodologies for waste management currently exist and form a valuable foundation for assessment of GHG emissions from waste activities, and a number of reliable reporting and quantification tools of GHG emissions from waste management activities are already in use, featuring different objectives, parameters and scopes. However, more sophisticated and ambitious programmes will require enhanced approaches to MRV, particularly with respect to lifecycle accounting up value chains.

MRV is essential to help the waste management industry and other stakeholders to evaluate and compare how the sector can reduce GHG emissions and increase savings. These tools can be helpful in the development of baseline calculations and on-going monitoring.

**Reporting mechanisms for GHG emissions in waste management**

| Reporting Methods | Reporting Level | Purpose | Examples |
|---|---|---|---|
| Mandatory national reporting of GHG emissions | National | National GHG reporting for the Nations who signed the UNFCCC | IPCC (Intergovernmental Panel on Climate Change) Methodologies |
| Mandatory/ Regulatory annual reporting for regulated facilities covering numerous parameters including GHG | Installation | Regulations for integrated pollution prevention and control. These reporting requirements help to improve public access to information on the environment<br><br>Reporting specific to GHG emissions in the framework of cap and trade systems | Pollutant Release and Transfer Register (PRTRS) – (Europe)<br><br>ETS directive (guidelines for monitoring and reporting GHG emissions from covered installations) |
| Annual Reporting Protocols to prepare GHG inventory for companies, local governments, or facilities (often on a voluntary basis) | Company/local government organisation | Regular GHG reporting on the organisational level | GHG Protocol (WRI / WBCSD) EpE Waste Sector Protocol (2007) ISO 14064 |
| Life Cycle Analysis used in decision making or planning support | Various (National, regional, local) | LCA modelling of waste management systems is carried out in order to form a technical and environmental platform for decision making | ISO 14048 |
| Carbon Trading Project Mechanisms | | Different project-based flexible mechanisms are operational. The estimation of their emission reductions is obtained through a “baseline versus project” approach | CDM approved methodologies Voluntary project standards Offset protocols (CCX, RGGI…) CCAR landfill protocol… GHG Protocol for Project Accounting |

By sharing knowledge and best practices, attracting new investment in basic infrastructure, and promoting the establishment of clear and enforceable regulatory standards, the waste management sector can drive economic development and achieve sustainability and environmental goals — particularly reductions in greenhouse gas emissions.

At the international level, the waste management sector is well-positioned to promote sharing of technologies and to collaborate with both developed and developing country governments to craft projects and initiatives capable of attracting public and private financial support. These and other efforts are critical to overcoming the common barriers waste management faces as a sector to maximizing its GHG mitigation potential in tandem with the economic and social benefits it can deliver.

As part of its efforts internationally, the waste management sector has been well represented among methodologies available under the Kyoto Protocol's Clean Development Mechanism (CDM) for the accrediting of emission reduction projects. More recently, the waste management sector also has been active in the development of Nationally Appropriate Mitigation Actions (NAMAs) proposals for developing countries.

**Financial support**

Investing in a greener waste sector requires substantial financial resources for both capital expenditures and operation. These may be found from private investments, international funding, cost recovery from users and other innovative financing mechanisms. The waste management sector's ability to deliver substantial near-term GHG emission reductions make it an ideal target for both public and private investment in 'green' technologies and initiatives.

**Private investment**

Private-sector involvement, often in the form of public-private partnerships (PPPs), can be an efficient funding mechanism, delivering improved services while reducing the fiscal pressure on government budgets. Cost comparisons indicate that tendering can yield savings of between 34 and 45%.

Developing countries are now beginning to see the benefits of PPPs (Ahmed and Ali 2004). In projects in China, Colombia, and India, among others, municipalities have worked in partnership with waste management companies to develop infrastructure and provide equipment in support of more sustainable approaches to waste collection and resource management.

**Financial support under the international climate change regime**

Waste management has attracted considerable investment under the CDM, with revenues from the sale of Certified Emission Reductions (CERs) serving as an important source of new capital.

Waste management projects have also proved an attractive target for funding and financing from multilateral development banks and other international institutions, including, once it is fully operational, the Green Climate Fund. For example, about 199 waste-related projects worth US$15.7 billion were supported by the World Bank in various regions in 2009 (UNEP, 2011).

**Clean Development Mechanism**

CDM serves as an international carbon offset facility, available both to countries attempting to meet compliance obligations under the Kyoto Protocol and private entities subject to regional or domestic emission trading systems, such as the European Union Emission Trading System (EU ETS).

The waste management sector is well represented, accounting for 14 percent of registered projects and expected to deliver 237 million tons in emission reductions by the end of 2012.

Despite this successful track record in attracting private investment, the CDM is not sufficient as a financing mechanism to reap the full GHG mitigation potential of the waste management sector. In particular, project development under CDM can involve lengthy approval periods and contains both registration and performance risks. As efforts continue to reform the CDM, addressing these and other barriers is expected to facilitate the utilization of CDM revenues within the sector.

Additionally, the approved waste-related projects do not address the full range of possible GHG emission reduction or avoidance opportunities available within the waste management sector.

Most solid waste management projects have centred on landfill gas recovery. There is significant potential for additional CDM projects focusing on recycling systems, composting, incineration and anaerobic digestion. For example, recycling avoids the emissions caused by the use of virgin materials, and composting offers a substitute for chemical fertilizers and peat-based soil conditioners as well as binding carbon in soil.

The CDM Executive Board has made a number of changes over the past year to make the CDM more efficient. It will take more time to see the benefits of the more recent actions. Since the inception of the CDM over two hundred municipal solid waste projects (landfill gas recovery, compost, anaerobic digestion and thermal treatment) around the world have been registered. These projects have contributed to the improvement in waste management practices in developing countries. However, there is still an enormous potential to scale-up these efforts in many developing countries.

## NAMAs

Nationally Appropriate Mitigation Actions or NAMAs first appeared within the international climate change negotiations in the Bali Action Plan in 2007. NAMAs were defined as "actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner."

In effect, NAMAs represent an institutional platform for developing country governments to attract financial and technological assistance in organizing large-scale mitigation programmes and implementing them at national or sectoral levels, provided they meet certain performance-based criteria, as determined through various monitoring, reporting, and verification protocols. As the international climate change negotiations continue to progress toward a comprehensive global environmental governance regime for climate change, NAMAs are expected to play a critical role in enabling developing countries to meet domestic mitigation goals and pursue low carbon development pathways.

Following the 15th Session of the Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC), approximately 84 countries submitted mitigation goals for inclusion in the annex of the Copenhagen Accord, which spurred further submissions elaborating upon domestic mitigation programmes, including many NAMA-related submissions. To date, these have included both existing programmes and policies as well as new proposed regulatory regimes and other initiatives. These submissions have also highlighted areas for improvement or needs assessments for capacity building efforts. In addition, several submissions included national or sectorial emissions targets.

**Of the 47 NAMA submissions that listed specific sector actions, approximately 33% included waste-related actions.**

At the 16th Session of the Conference of the Parties to the UNFCCC, the Cancun Agreements elaborated further on NAMAs by, among other things, commencing a process to establish the Green Climate Fund, capable of channelling public and private financial resources to developing countries in support of NAMAs.

In addition to US$30 billion of fast start financing donor countries pledged in 2010-2012, the Parties are seeking to devote US $100 billion annually in new and additional support, drawn from both public and private sources, by 2020. A significant portion of the US $100 billion is expected to flow through the Green Climate Fund.

**Waste management has proven experience and capabilities in areas broadly considered to be among the foundational building blocks of effective NAMAs:**

- ✓ **Technology transfer**
- ✓ **Policy examples**
- ✓ **Sustainable development co-benefits**
- ✓ **Capacity building**
- ✓ **Monitoring, Reporting and Verification Methodologies**
- ✓ **Financing of waste management projects**

The following list identifies key actions and elements of prospective NAMAs capable of maximizing the GHG mitigation potential of the waste management sector.

1. Conduct an evaluation of current waste practices
2. Conduct assessment to understand waste quantities generated and recovered, waste composition, and trends
3. Conduct an analysis of current waste policies and regulations
4. Evaluate existing informal waste recycling sector
5. Create a Public Awareness Programme
6. Develop a (baseline) greenhouse gas inventory
7. Provide awareness training to change behaviour
8. Develop / modify national waste management and recycling strategy
9. Establish appropriate regulatory enforcement strategies
10. Improve co-operation on waste policies on all levels (national, regional, and local)
11. Conduct feasibility studies for most suitable integrated waste management and recycling systems at national, regional or city levels
12. Establish plans to improve waste collection rates
13. Define strategy to improve energy and material recovery
14. Ensure that all active landfills have proper environmental controls, including landfill gas capture and recovery
15. Conduct specific landfill site feasibility studies
16. Establish recommended monitoring, reporting and verification protocols.

As the Parties to the UNFCCC continue to elaborate institutional support mechanisms and modalities for NAMAs, the substantial, near-term potential for GHG reduction inherent in the waste management sector make it an essential, front-running element for NAMA development and Green Climate Fund support. Given that the waste management sector's climate benefits rely on existing technologies and proven methodologies, it is ready today for immediate implementation via public-private partnerships and other bilateral initiatives within developing countries, as well as on broader scales as NAMAs.

Therefore, in recognition of waste management and recycling as drivers of sustainable development and key climate mitigation strategies, the National Members of the International Solid Waste Association hereby call for swift and immediate action in furtherance of the following objectives:

**1** Recognize the climate mitigation potential of waste management and recycling;

**2** Integrate and prioritize waste management and recycling strategies in national plans and initiatives, including Nationally Appropriate Mitigation Actions; and

**3** Establish public-private partnerships, sector-based programmes, and other international channels to disseminate best practices, attract new public and private investment in basic infrastructure, and strengthen domestic regulatory standards to maximize the climate benefits of waste management and recycling on a global scale.

For further information and a more in depth look at the issues raised in this brochure please see the ISWA White Paper on Waste and Climate Change 2009.

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