GLOBAL RENEWABLES™

Global Renewables – Company Philosophy

The disposal of household and commercial solid waste is one of the most critical economic, social and environmental issues facing a consumer based society.

Traditional waste disposal methods, based largely on landfill and incineration, are not only expensive but have significant adverse environmental impacts. In the face of increasing urban waste generation, the need for society to embrace sustainable waste management solutions is becoming increasingly urgent. In Europe, landfilling of putrescible waste is being progressively banned in the period 2005 - 2010. In Germany it is banned from the end of 2004.

Inevitably, unless environmentally and commercially sustainable waste management alternatives are implemented, future generations will pay a heavy price in terms of atmospheric, land and water pollution.

It is in this context that Global Renewables was created.

Process Strategy

Global Renewables' process strategy is to separate and recover resources at their Highest Net Resource Value.

It is Global Renewables' view that the urban waste management problem needs to be addressed with a resource recovery solution in order to achieve true sustainability in consumer materials flows. It is not possible to justify a future where we continue to dig up virgin resources, consume them and dump them into either the earth, the water or the sky. This practice is unsustainable.

The first two laws of thermodynamics decree that nothing disappears and everything spreads (conservation of matter and increase of entropy). These are two fundamental constraints that must be taken into account in the design of any solution to the waste management problem. Accordingly, if we were to keep consuming and dumping, eventually there would be nothing left to consume, and pollution everywhere.

Global Renewables' approach to solving the waste management problem has been to select a suite of the world's best commercially proven resource recovery technologies and integrate them to produce the Urban Resource - Reduction, Recovery and Recycling (UR-3R) Process®. This powerful resource recovery process is the ideal vehicle for the community's journey towards a zero waste future.

The UR-3R Process® is unique in that waste resources become cleaner at every stage of the process. Shredding and mixing are minimised; separation processes are maximised using both mechanical and natural biological technologies. Waste is treated gently to enhance recovery of resources such as glass and paper. Resources that have a higher recovery cost than their current net value are inerted for either safe landfill disposal or separate storage.

UR-3R Process®

The Global Renewables waste management solution is called the Urban Resource – Reduction, Recovery and Recycling (UR-3R) Facility.

The UR-3R Facility receives and processes municipal solid waste (MSW), which includes collected household, commercial and green waste and is able to deliver a truly sustainable waste management solution by:

- **Reducing** waste generation through community education and recognition of the full life cycle cost of waste management;
- **Reducing** greenhouse gas and leachate emissions by processing the putrescible portion of the waste stream;
- **Recovering** valuable recyclables from the non-putrescible portion of the waste stream;
- **Recycling** the organic portion of the putrescible waste stream into renewable energy and high quality Organic Growth Media (OGM), thereby reducing greenhouse gas emissions and leachate, and closing the "Carbon Cycle".

The UR-3R Facility integrates world's best unit process technologies in:

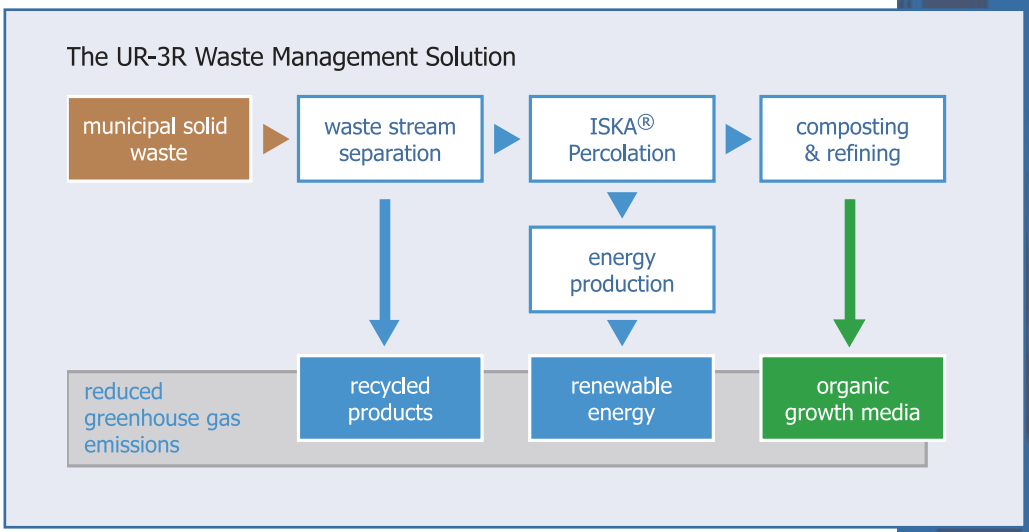
- Waste stream separation;
- ISKA® Percolation;
- Composting and refining; and
- Energy recovery.

Each unit process in the UR-3R Facility is proven and currently in operation around the world. The Eastern Creek UR-3R Facility is the first to fully integrate these leading technologies to provide a total solution for waste management.

Global Renewables has licensed rights to exploit each of these technologies and enjoys strong relationships with the technology providers.

Key features of the UR-3R Facility are:

- Modularised unit processes that can be tailored to suit local conditions;
- Increased recycling rates by over 100%;
- Increased diversion of waste from landfill to around 80%;
- Reduced greenhouse gas emissions by between 1t and 2t CO_2e per tonne of MSW;
- Renewable energy generation; and
- Designed to meet European emissions standards.



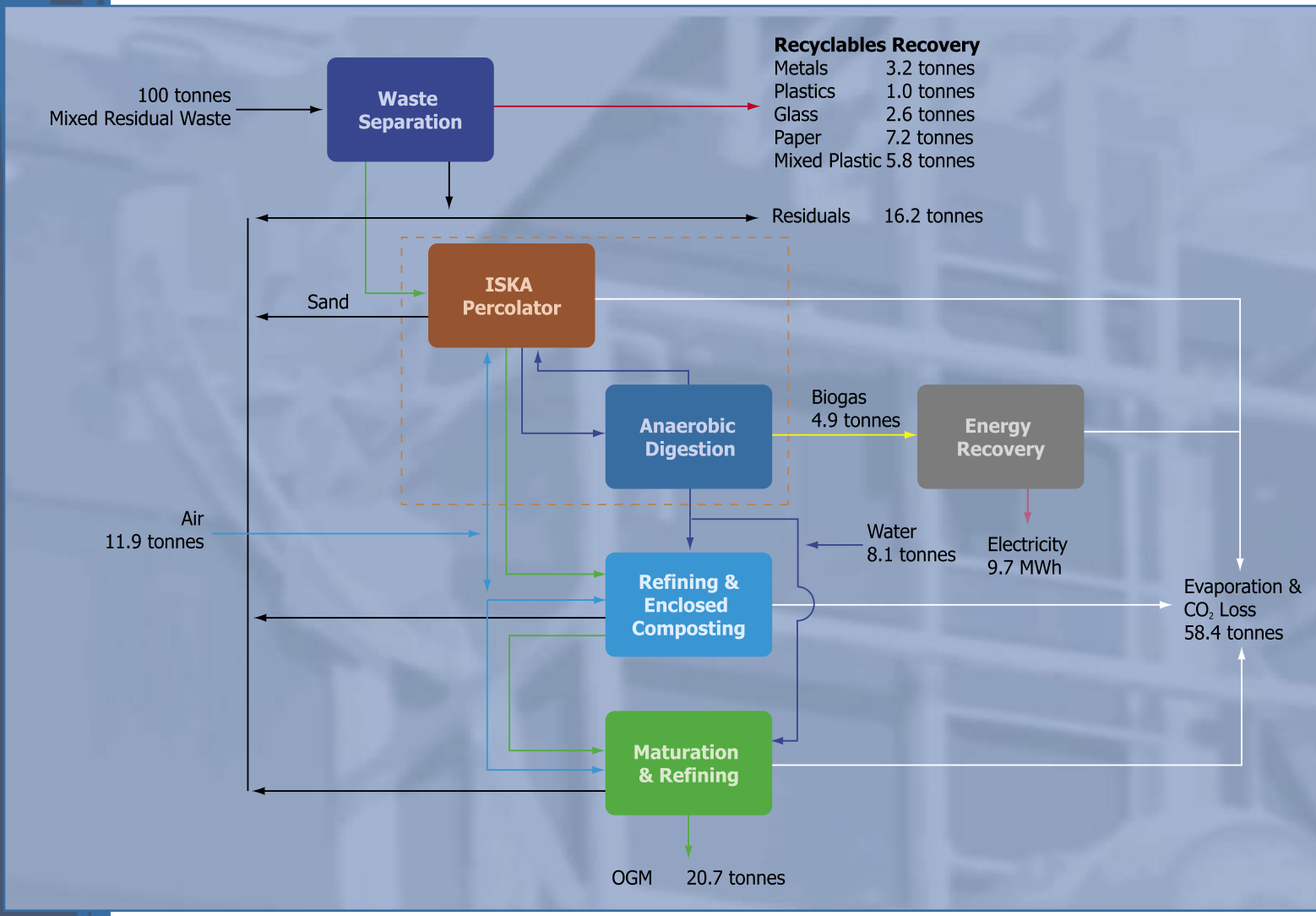
UR-3R Process® Description

Waste Delivery

The UR-3R Process® can process waste that is delivered either loose or compacted. The waste receival area is designed specifically to suit the type of trucks delivering waste to the Facility. Whilst the Facility could process waste from a single bin, in order to extract optimal value from the waste stream, Global Renewables' preference is for (at least) paper to be streamed from the household collection system, and the remainder sent to a UR-3R Facility.

Waste Receival, Separation and Sorting

After a delivery is registered at the weighbridge, all waste is delivered into the receival hall of the UR-3R Facility. The receival hall is a fully enclosed building and is maintained at negative air pressure to prevent the escape of fugitive odours.



The UR-3R Process® for separation and sorting involves loading waste into a bag opener, and then separation by reference to the key characteristics of each major component of the waste stream, i.e. size, shape, magnetism, density, emisivity, colour, rigidity, etc. Over the past three years Global Renewables has undertaken extensive characterisation of the Australian waste stream. This information is key to tailoring the design of the sorting process to enable effective and efficient resource recovery.

The products recovered during the separation process include:

- Cardboard;
- Mixed paper;
- Mixed plastics;
- Plastic containers (mainly PET and HDPE);
- Glass containers;
- Ferrous metals;
- Non ferrous metals.

The residual organic rich stream is transferred to the ISKA® Percolation section of the Facility.

ISKA® Percolation

The Percolator and associated equipment, including the anaerobic digester, sand separator, sludge screen and water denitrifier form part of the patented ISKA® Percolation unit process. The ISKA® Percolation process design is based on many years of research and development effort and now boasts two operational facilities in Germany, with three further facilities under construction.

ISKA® Percolation achieves five key outcomes:

- Reduces the odour profile of the organic waste;
- Reduces the mass of the organic waste;
- Recovers energy from the organic waste;
- Cleans the organic waste of contaminants (such as fine glass, sand, silt, ceramics, etc.);
- Homogenises the waste stream (organic).

- Oxygen/Air
- Biogas
- Recyclables
- Residuals
- ISKA Percolation
- Water
- Organics
- Evaporation & CO_2 Loss

The organic rich stream from separation and sorting is transported to the ISKA® Percolation area and is fed into the Percolators. The Percolator operates in a semi-continuous fashion loading fresh material and discharging solid residue (SNAP) during the operating schedule of the sorting facility. The Percolator cycles through this regime using wash water from the digester.

The wash water is sprayed over the organic material in the Percolator. As the solution percolates through the stirred bulk waste, the volatile organic component of the MSW, colloidal material and sands are discharged to the sand washing section. After passing through the sand washing and sludge removal circuits, the percolate solution is processed through the anaerobic digestion circuit. This produces biogas and excess water which is then used in the composting operation.

Anaerobic Digestion

Anaerobic digestion is a very effective way to treat high chemical oxygen demand organic streams, such as that generated from MSW during the ISKA® Percolation process. ISKA® Percolation includes an anaerobic, packed bed digester for conversion of the liquefied and soluble volatile solids in the circulating water into biogas.

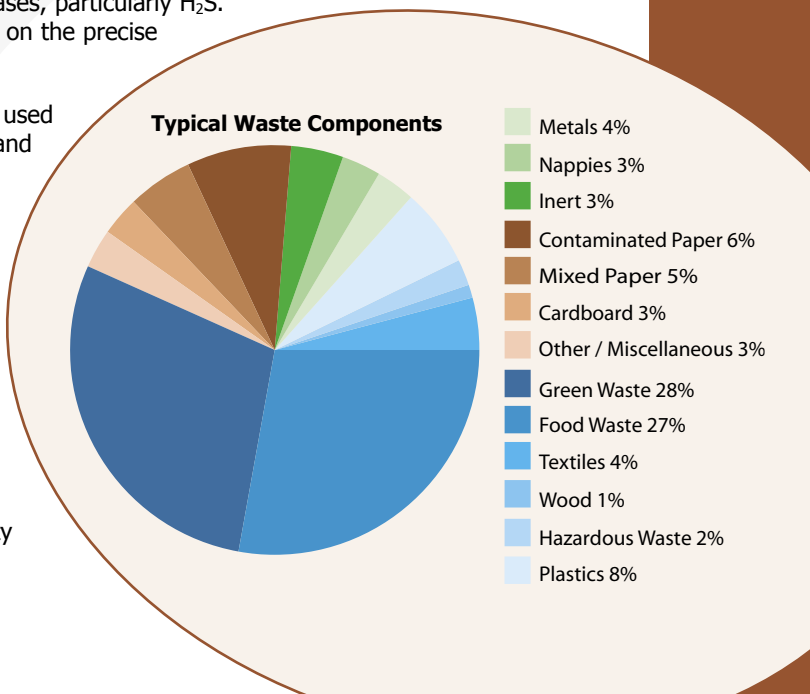
The hybrid upflow anaerobic digester design has been adopted to provide a high biological conversion capacity under a range of variable feed conditions. Methanogenic bacteria are immobilised on an inert support with granular accretions of bacteria populating above and below the filter bed.

The solution, high in volatile solids, is recirculated through the digester filter bed with fresh feed from the Percolator. The large recirculating load allows the biomass to absorb shock loadings in volatile solid concentration. The volatile solids are metabolised by the bacteria to produce additional biomass, CO_2 and methane. The biomass is ultimately recirculated to the Percolator where the acidic environment releases the volatile solids for re-digestion.

Biogas

The anaerobic digester produces biogas during anaerobic conversion of the volatile solids in the percolate solutions. The biogas will typically contain 70% methane and 30% CO_2 and a range of contaminant gases, particularly H_2S. Occurrence of H_2S will depend on the precise nature of the MSW processed.

The biogas produced is cleaned to remove the H_2S prior to being used for electricity generation in a purpose-designed power station and for process heat generation in gas fired water heaters.



SCT Composting

The SCT composting unit process achieves the following objectives:

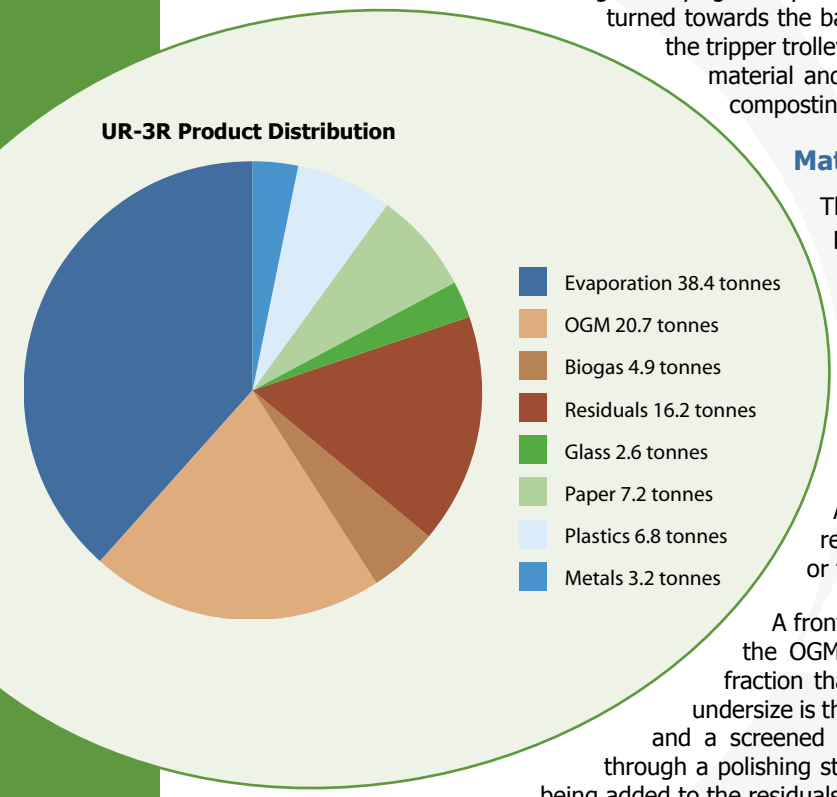
- Pasteurises the material, killing pathogens and weed seeds;
- Reduces the mass and volume of the material;
- Provides an area for rehydration of the organics, achieved by recycling water from other processes within the facility; and
- Transforms putrescible organic matter into high quality OGM.

After being washed and cleaned in the ISKA® Percolation process, the solid organic material is directed to the compost bay within the SCT composting building.

Intensive composting occurs inside the fully enclosed composting building, in a negatively aerated bay. Aeration rates and moisture content are controlled to maintain aerobic conditions and high decomposition rates. The material is maintained in the thermophilic temperature range of 45°C to 75°C.

A patented auger bridge crane named "BioMax-G" runs above the composting bay. It consists of a portal bridge crane that travels on rails fixed on the ground outside of the bay containment walls for the full length of the composting bay. An auger carrying trolley runs transversely on the bridge crane.

The auger carrying trolley is fitted with 2 inclined counter rotating augers with their tips turned towards the bay loading side. The combined rotation action of the augers, the tripper trolley and the auger bridge crane translation, turns the composting material and transports it from the loading to the unloading side of the composting bay within the retention period of between 28 and 35 days.



Maturation

The product from the intensive composting stage must then pass through a maturation phase. The maturation phase begins in the thermophilic range, where all of the remaining simple sugars are broken down. After approximately 2 weeks the temperature of the pile reduces to the mesophilic range. This allows the actinomycetes and fungi to flourish and decay the lignin, hemicellulose and cellulose materials as well as allowing phytotoxins to be metabolised.

Screening and Refining

After maturation the OGM is passed through the secondary refining process to remove any remaining glass, stones, plastic or foil.

A front end loader loads the material into a feed hopper that meters the OGM into the refining facility. This stage removes an oversize fraction that can be used as composted garden mulch. The screened undersize is then processed to produce a clean OGM, a light fraction residual and a screened heavy undersize residual. The light fraction then passes through a polishing stage to capture any organic matter, with the oversize fraction being added to the residuals.

Eastern Creek

Background

During the Sydney 2000 Green Olympic Games, Global Renewables first introduced the idea of applying a 'resource recovery' approach to waste management as a means to transform Sydney into one of the most sustainable cities in the world.

By engaging GRD Minproc's international resource recovery expertise, Global Renewables identified the world's leading technologies for converting urban waste into useful (renewable) resources. Global Renewables selected natural biological processes, rather than high temperature destruction or chemical conversion processes. This was driven by the design brief - which was to minimise greenhouse gas emissions in the materials waste cycle, and to maximise the conservation of renewable resources (including energy) in the waste stream.

In 2002, Global Renewables won the right to build, own and operate a UR-3R Facility at Eastern Creek, in Sydney, for a 25 year term. Global Renewables' UR-3R Process® was selected by Waste Service NSW from an international competitive field of 101 expressions of interest. Over the following 6 months Global Renewables completed an Environmental Impact Study and Bankable Feasibility Study of the project. These documents supported the Development Consent, final contractual negotiations and later, a $130M debt and equity financing package to fund the construction of the Facility and the ongoing working capital requirements of the Global Renewables business.

The development and financing of the Facility was conducted in accordance with the NSW Government's Public Private Partnership policy framework. This required Global Renewables to liaise extensively with all NSW Government stakeholders, including local government, State Owned enterprises, regulators, authorities and State Treasury, in order to satisfy all government requirements.

In August 2003 Global Renewables commenced the construction of the Eastern Creek UR-3R Facility. Fully operational, the Facility is the largest of its kind in the southern hemisphere, diverting over 4,000,000 tonnes of MSW from landfill over its 25 year life.

Preferred by Greenpeace

Greenpeace Environmental Trust has published a Study entitled "Cool Waste Management" providing an overview of Mechanical Biological Treatment (MBT) of waste as a preferred approach over thermal processes. The Study concludes that a MBT process route almost identical to that of Global Renewables' UR-3R Process®, followed by landfill, is clearly preferable to thermal treatment in terms of:

- toxic emissions;
- climate impacts;
- material conservation; and
- energy conservation.

Greenpeace concurs with the author's conclusion that the state of the art MBT plant proposed (in the study, i.e. the UR-3R Process®), which generates all its own electricity and reduces the mass of waste requiring landfill by the same amount as a modern incinerator, is cost competitive and offers an extremely high environmental performance. For more details, refer to the Introduction, Section 4.4 and Bibliography reference 18 of Cool Waste Management.#

Desired by the Local Community

The award of a Development Consent for the Eastern Creek UR-3R Facility was unprecedented in the waste industry with not one submission to the consenting authority opposing the project, and unparalleled community support for the development (as quoted below). As a result, the Development Consent was awarded in 3 months from the time of the application.

> *"In essence we have no major objection to the UR-3R proposal, in fact we welcome it and it's forward thinking methodology into today's society. We see that there could well be many positive aspects of the proposal which will benefit our community. In this regard, it would be to our benefit if the proposal was in fact allowed to operate at it's maximum possible level, to reduce as much as possible, the odour impacts [of landfill] on our community."*
>
> Councilor Peter Cork, Fairfield City Council

Eastern Creek UR-3R Facility Development Timetable

Detailed Design
August 2003 - January 2004
Construction
September 2003 - July 2004
Commissioning
June 2004 - August 2004
Ramp-up
September 2004 - Early 2005

Key Numbers

Capital Cost
$71 million

Throughput
175,000 t/a (expandable to 260,000 t/a)

Products

Plastics	1,600 t/a
Metals	5,200 t/a
Paper	12,200 t/a
Glass	4,500 t/a
OGM	23,000 t/a
Organic Fertiliser	4,000 m^3/a
Electricity	17,500 MWh/a
ERUs	285,000 tCO_2e/a
RECs	17,500/a

Diversion from Landfill
Over 4,000,000 tonnes over 25 years

Greenpeace, *Cool Waste Management - A state of the art alternative to incineration for residual municipal waste*, Greenpeace Environmental Trust, London, UK, February 2003 (http://www.greenpeace.org.au/toxics/pdfs/cool.pdf).

Technical Partners

GRD Minproc

GRD Minproc has established itself as one of Australia's leading resource and process engineering companies over the last 25 years. GRD Minproc has completed over 200 projects in 30 different countries ranging in value from $5 million to $250 million, with a total value of over $15 billion. Expertise gained in the design and construction of major resource plants around the world is applicable to MSW management and will ensure that Global Renewables has access to the world's best technology and construction methods.

Global Renewables has contracted GRD Minproc to carry out the detailed design, construction management and commissioning of the UR-3R Facilities.

ISKA GmbH (ISKA)

ISKA is a subsidiary of the German Power and Waste Management conglomerate Energie Baden Wurttemberg, and is the exclusive licence holder for the ISKA® Percolation patents.

In 1999 ISKA commenced operation of its first ISKA® Percolation facility in Buchen, Germany. Over the past four years this facility has been processing around 30,000 t/a of Municipal Solid Waste (MSW). In June 2003, ISKA announced that it had won a waste supply contract from the City of Ludwigsburg that would require the expansion of the Buchen facility to 150,000 t/a. Expansion of the Buchen facility has commenced and is due for completion in late 2004. In parallel, ISKA is also building a 100,000 t/a ISKA® Percolation facility in Heilbronn, Germany.

In 2000 Global Renewables entered into an alliance with ISKA that granted Global Renewables a licence to use, market and promote ISKA® Percolation in the Australasian and Asian region.

Since 2000, key technicians and engineers from ISKA have been working closely with GRD Minproc to ensure an effective technology transfer and smooth commencement of operations at the Eastern Creek UR-3R Facility.

Sorain Cecchini Tecno SRL (SCT)

SCT is an Italian company with specific expertise in the separation and composting of MSW. SCT is part of the Sorain Cecchini Group which, in its collective operations, handles and processes over 22,000 tonnes of waste per day.

SCT's specific capabilities include conception, development, testing and design of advanced MSW processing systems and design of waste treatments systems for worldwide application.

SCT has designed and built over 25 composting facilities in 5 different countries. SCT is currently constructing facilities in France, Spain and Australia.

The SCT Composting Process is the result of decades of development effort in engineering Italian compost facilities. The SCT process involves gentle turning and negative aeration of the compost in a fully enclosed and odour-controlled building. The UR-3R Process® employs SCT automated composting technology as one of its core treatment processes. Both the source separated organics and the residuals waste fractions are separately composted using the SCT Composting Process.

Global Renewables enjoys a strong relationship with SCT and has an exclusive licence to employ its technologies in the Asian Pacific region.

Perth
Ph (618) 9278 1888
Level 35, Exchange Plaza
2 The Esplanade
Perth WA 6000

Melbourne
Ph (613) 9650 0560
Level 7, 267 Collins Street
Melbourne VIC 3000

Sydney
Ph (612) 9223 8099
Level 3, Suite 01
105 Pitt Street
Sydney NSW 2000

www.grl.com.au