

Developing Landfill Gas Recovery Projects Internationally

Methane to Markets Ministerial Meeting

15 November 2004

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Onyx's Activities



From collection to waste recovery...



Onyx's Activities



From collection to waste recovery...

...also industrial outsourcing, cleaning & remediation services



Key Figures - 2003

- ***Annual Revenue : € 5.9 Billion***
- ***Operating in 33 Countries***
- ***68,000 employees worldwide***
- ***Collected 30 million tonnes of waste***
- ***Treated 50 million tonnes of waste in over 600 treatment facilities***
- ***Recovered over 6 million tonnes of waste***

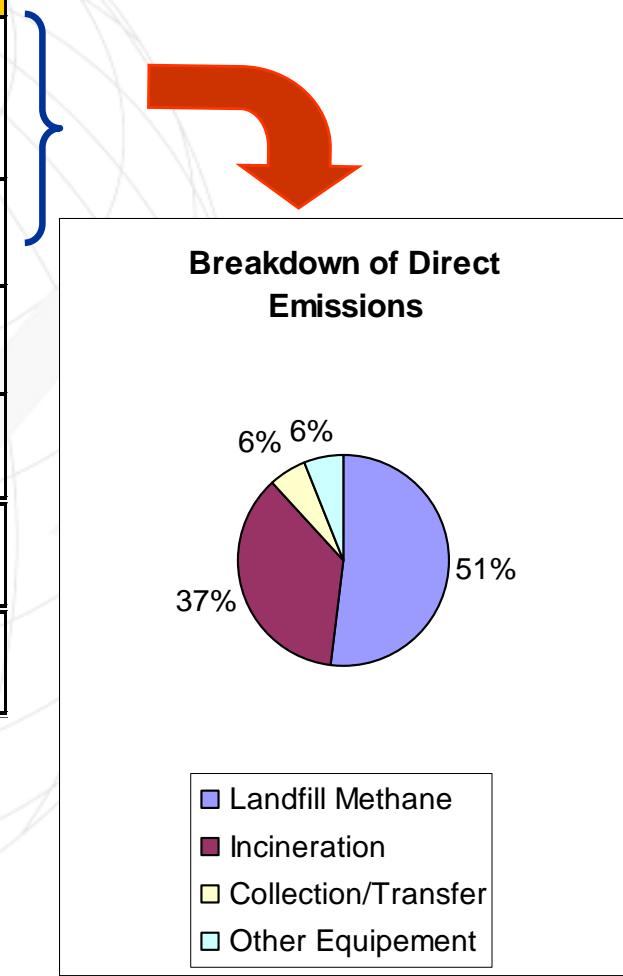
Onyx Landfill Activity



- **Onyx operates 128 non-hazardous waste landfills throughout the world (23.3 million tonnes in 2003)**
- **Strong expertise :**
 - ❖ **Group's operating subsidiaries**
 - ❖ **Internal engineering divisions**
 - ❖ **Research center (CReeD)**

Greenhouse Gas Emissions

	Unit	2001	2002	2003
1A - Direct Emissions (fuel consumption, diesel & natural gas; waste incineration)	KtCO2	4 241	4 630	4 610
1B - Direct Emissions * (landfill methane)	KtCO2eq			4 982
2 - Indirect Emissions (electricity consumption)	KtCO2	189	219	201
3 - Avoided Emissions (electricity and thermal energy sold)	KtCO2	1 481	2 016	2 177
TOTAL WITHOUT METHANE (1A+2-3)	KtCO2	2 949	2 832	2 634
TOTAL WITH METHANE (1A+1B+2-3)	KtCO2eq			7 616

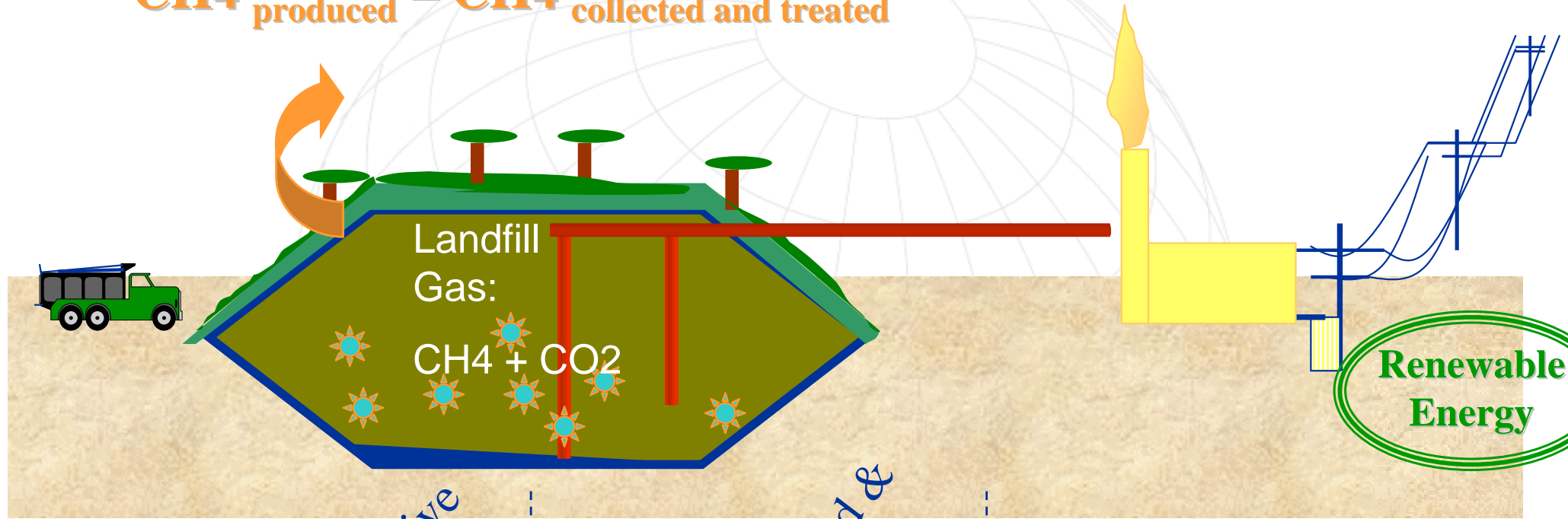


** Methane emissions estimated using national methodologies where they exist and IPCC Tier 2 method for others*

Landfill Methane Emissions



$$\text{CH}_4 \text{ produced} - \text{CH}_4 \text{ collected and treated} = \text{CH}_4 \text{ fugitive}$$



CH_4 fugitive

Collected & treated

Energy Recovery

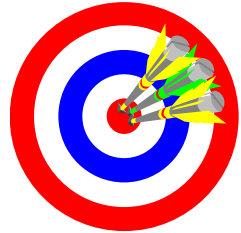
Direct Emissions

Direct Emission Reductions

Avoided Emissions

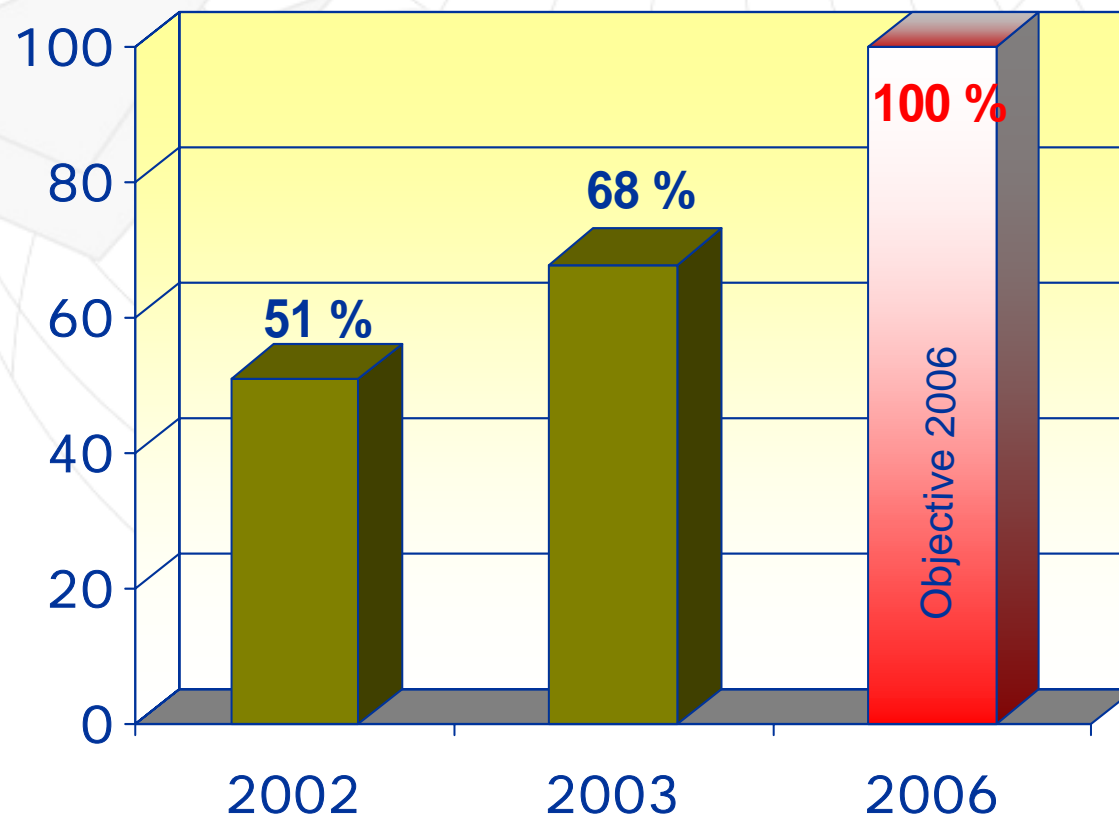


Objective : Reduce methane emissions



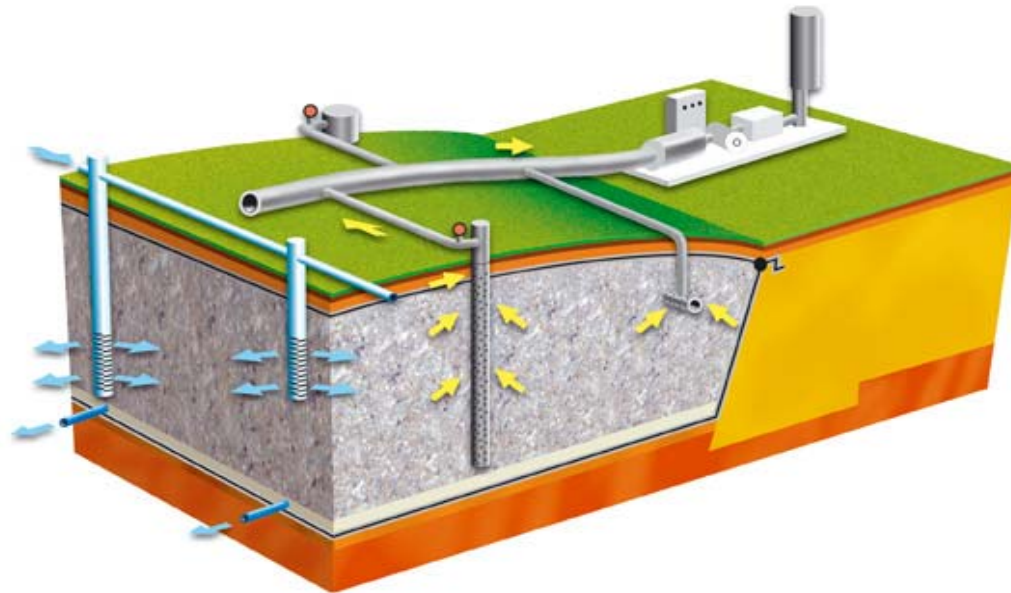
By 2006, install landfill gas collection and treatment systems at 100% of our operating landfills that accept biodegradable waste and where Onyx is responsible for investment.

% Landfills equipped with landfill gas collection and treatment systems

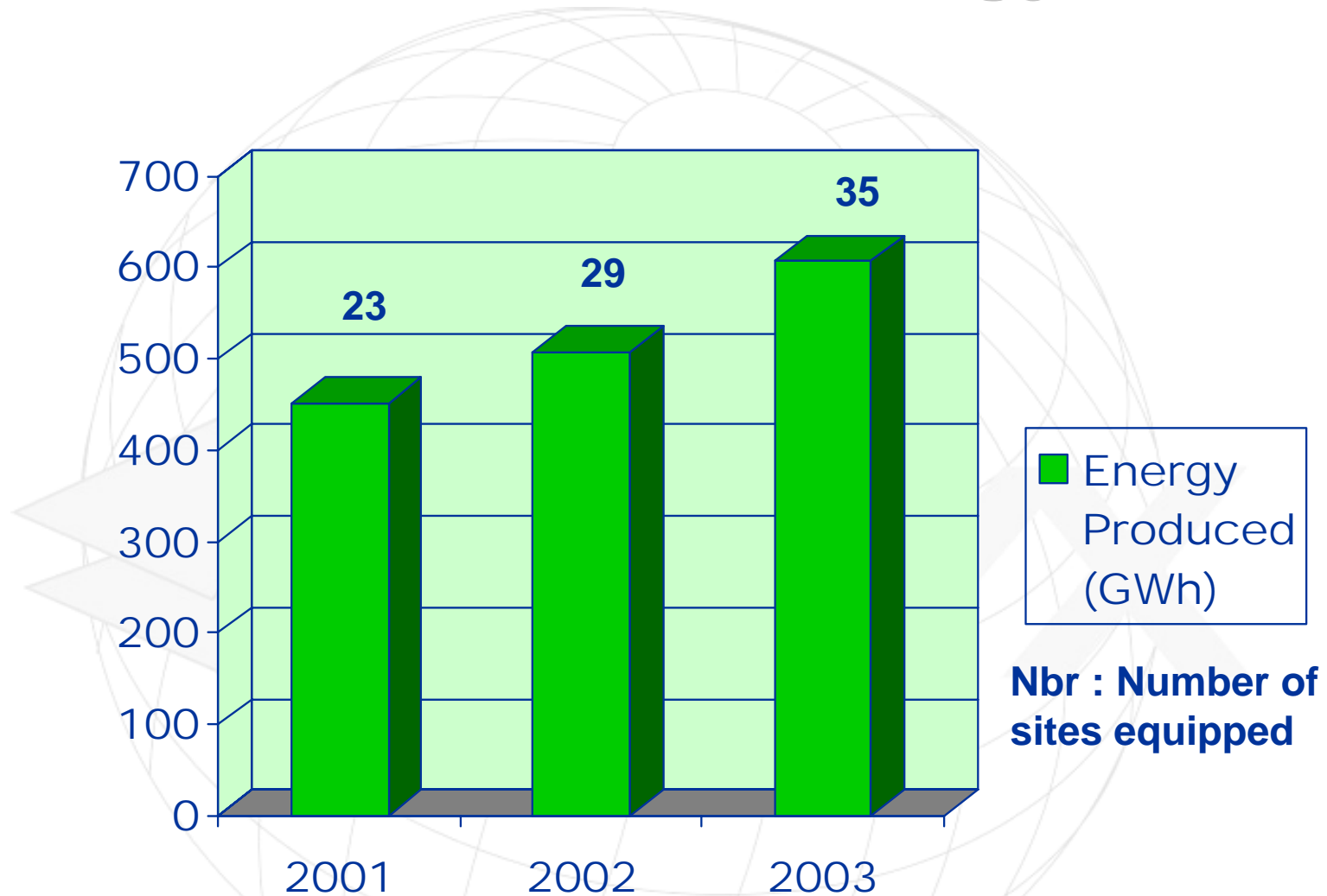


Landfill Gas Management

- ***Ongoing technical and research projects include the following subjects:***
 - **Refining landfill gas production model**
 - **Maximising landfill gas capture rates**
 - **Improving energy recovery equipment performance**
 - **Evaluating advanced landfill « Bioreactor » technology**



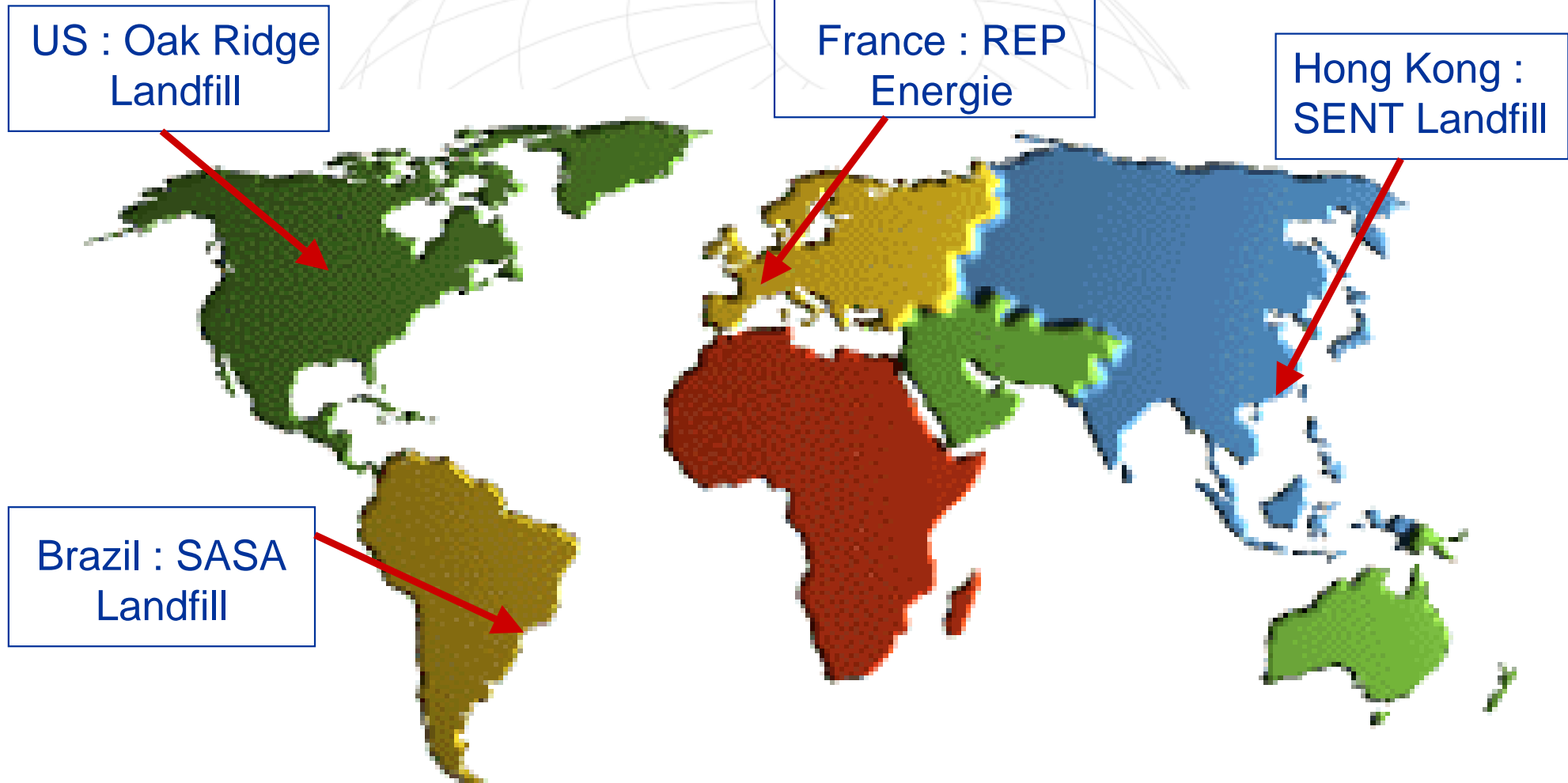
Landfill Gas to Energy



Our electricity output from landfills increased by 20% in 2003 and is equivalent to the annual household consumption of 145,000 Americans.

Landfill Gas to Energy Projects

Examples :



Landfill Gas to Energy Projects

- **Site : OAK RIDGE LANDFILL**
- **Location : Missouri, US**
- **Technology :**
 - **Direct Use – methane serves as boiler fuel at DaimlerChrysler plant**
 - **LFG is compressed, filtered and dried at onsite compressor station; delivered via 4.5 mile pipeline**
- **Benefits :**
 - **Conservation of fossil fuels**
 - **Fuel cost savings**
 - **Greenhouse gas reductions for displaced fuels (25,000 tCO₂ / year)**



Landfill Gas to Energy Projects



- **Site : SENT LANDFILL**
- **Location : Hong Kong**
- **Technology :**
 - Two (2) 970 kW reciprocating engines / gensets for onsite electricity requirements
 - LFG also utilized in the thermal catalytic unit (for ammonia destruction) in leachate treatment plant
- **Benefits :**
 - Reduced greenhouse gas emissions
 - Avoided energy costs
 - Developed other projects in China using engines / gensets



Landfill Gas to Energy Projects



- **Site : REP ENERGIE**
- **Location : Plessis- Gassot, France**
- **Technology :**
 - 3 high pressure boilers
(each with a steam capacity of 30 t/hr)
 - 1 steam turbine (11 MW)
- **Benefits :**
 - Reduced greenhouse gas emissions
 - 85,000 MWh per year sold to Electricité de France (consumption equivalent to 10,000 households)



Landfill Gas to Energy Projects

- **Site : SASA LANDFILL**
- **Location : Brazil**
- **Technology :**
 - Leachate Evaporator
 - Will treat up to 19m³ / day of leachate using LFG as fuel for evaporator
- **Benefits :**
 - First carbon transaction !
 - Developed as a Clean Development Mechanism (CDM) project
 - Emission reductions estimated at 700,000 tCO₂e over 10 years



Conclusions

- ***Landfill gas emission reduction and LFGTE is aligned with VE / Onyx Policy***
 - ✓ Resource conservation
 - ✓ pollution prevention
 - ✓ alternative energy production
- ***Revenues from emission credits or energy supply can contribute to the development of environmentally sound waste disposal facilities.***
- ***Onyx supports efforts to promote these projects and to remove development barriers***