Thermal treatment of municipal solid waste

Assessment of the 42 French facilities funded by ADEME

Document 1 of 2: Executive summary

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Executive summary

Between 1993 and 2000, Ademe provided a total of €107m in aid towards the construction of 42 municipal solid waste incinerators (MSWIs)[1], thus covering an average of 5.7% of the required investments (€1,900m).

This note outlines the lessons to be drawn from the assessment of the operation of these units, which was produced within the framework of a study steered by Ademe and carried out by Trivalor.

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AN IN-DEPTH MODIFICATION OF FRENCH FACILITIES

The 42 units aided since 1993 represent more than 40% of current capacity

Of the 42 units studied:
- 31 have now been in operation for more than one year;
- 11 are under construction (four due for start-up in 2002 and two in 2003) or have been in operation for less than one year (start-up during 2001).

The total capacity having received aid is, therefore, 4.7 Mt/yr, the total capacity of current facilities being 11.2 Mt/yr. Thus, more than 40% of facilities came into existence after 1993 and benefited from Ademe aid.

All of these units were designed within the framework of global projects as means of processing residual waste. The average rate of selective[2] collection attained by the authorities concerned stands at

[1] The five extra units (incinerators using fluidised bed technology) are not taken into account in this study.
[2] The average rate of selective collection is defined as the ratio of the tonnage collected selectively over the tonnage of residual waste.

11%, which is practically equivalent to the rate observed at national level. Overall, these rates range from 7% to 16% (over half of the sites), with a few exceptions (20% for one authority, thanks to selective collection of biowaste, and 1% for one large urban area where only glass is currently collected selectively on a voluntary drop-off basis). 27% of authorities have either grossly insufficient[3] selective collection rates or are at the start-up stage in respect of selective collection.

74% of the units are new installations, while 26% are extensions[4] of existing factories.

The average size of projects is around 110,000 t/yr (i.e. 14 t/h). Over 40% of units have a capacity of between 75,000 t/yr and 130,000 t/yr (i.e. between 10 t/h and 17 t/h). There are as many projects with capacities of less than 70,000 t/yr as with capacities in excess of 200,000 t/yr.

Taking a project from initial studies to start-up requires, on average, seven years

This project duration of around seven years (standard deviation of 18 months) may be broken down into three equal parts as follows:

- 28 months from the initial studies to the consultation with the builders or delegatees (standard deviation of 16 months): this duration depends largely on the initial date taken into account, and this preliminary phase of just over two years is necessary if the project is to be correctly planned and defined;
- 28 months from the consultation phase to the reception of authorisations (standard deviation of 13 months): encompasses definition of legal structure, miscellaneous formalities, public enquiries, etc.;
- 28 months from the start of construction work to industrial start-up (standard deviation of 7 months).

No lengthening of these procedures has been observed since 1993 (despite growing NIMBYism and now-systematic legal challenges) nor has the type of legal structure – public service delegation or public ownership – been seen to affect the duration of procedures.

As explained below in the section concerning market evolution, it is clear from the seven years required for the completion of an incineration project that the modernisation of municipal solid waste incinerators will need to continue apace in the years after 2002.

Most new units managed under a public service delegation structure

While the legal structures are spread equally in terms of sites (20 public ownership sites and 22 public service delegation sites), public service delegation represents 61% of capacity and almost two thirds of units under construction[5]. On these new sites, the average capacity of public ownership plants is 90,000 tonnes while that of public service delegation plants is 140,000 tonnes.

Plants now process a wide range of waste: not only municipal solid waste, but non-hazardous industrial waste, sludge and refuse from sorting facilities, separate collection facilities and composting facilities

While municipal solid waste incinerators are, obviously, used mainly for processing municipal waste (80% of waste incinerated), they are also diversifying to an increasing extent, in terms both of quantities processed and of types of waste accepted (see table 1).

[3] i.e. considered here as being less than 8%.
[4] Or major renovations.
[5] While DSP was by far the most popular arrangement in 1996-1998, the situation is now balancing out.

Table 1. Evolution in the percentage of installations processing various types of waste

Type of waste processed	Total number of French facilities in 2000 with capacity > 3 t/h[6]	Aided units in operation	Aided units under construction
Number of installations	108	31	11
% of installations processing:			
Municipal solid waste	100%	100%	100%
Non-hazardous industrial waste	69%	77%	82%
Sewage sludge	12%	23%	36%
Healthcare waste	20%	29%	9%
Refuse from sorting or separate collection facilities	n.a.	35%	55%
Refuse from composting facilities	n.a.	19%	27%
Others (bulky waste, unsorted waste, etc.)	n.a.	29%	27%

n.a.: data not available

The following can be noted:
- greater account taken of non-hazardous industrial waste when sizing (over 80% of the latest installations),
- the proportion of sewage sludge, a category of waste for which local authorities have responsibility (concerns almost 40% of new projects);
- the more systematic factoring in of refuse from sorting and separate collection facilities (35%, and 55% in more recent cases) - or even composting - showing that energy recovery units are integrated into a global system of waste management;
- the sharp reduction in the integration of healthcare waste, which, apart from some regional exceptions, can be adequately processed using existing capacity;

Municipal solid waste incinerators now provide a better response to global and territorial needs than in 1993.

The origin of waste processed on sites varies significantly depending on the legal structure. On average, 76% of the waste processed by incineration plants comes directly from users in the plant's territory (see table 2). This rate ranges from 40%[8] to 100%.

The distinguishing factor seems to be the legal structure. On average, more than 30% of the waste accepted by public service delegation sites comes from sources other than their local authorities[9], compared with just 15% for public ownership sites. 60% of sites accept municipal solid waste from customer local authorities.

Table 2. Percentages of various types of waste incinerated in 2000 in the 32 units receiving operational aid

Type of waste processed	Aided units in operation
Municipal solid waste from local authority	68%
Municipal solid waste from customer local authorities	12%
Total municipal solid waste	*80%*

[6] Source: Aghtm/Ademe inventory 2001
[8] For a particular unit in the Paris area.
[9] i.e. mainly NHIW and MSW from customer local authorities.

Table 2. (Cont.)

Type of waste processed	Aided units in operation
Non-hazardous industrial waste and waste from operators	13.9%
Refuse from sorting facilities	2.3%
Sewage sludge	1.8%
Others (bulky municipal solid waste, unsorted waste, etc.)	1.5%
Refuse from composting facilities	1.3%
Healthcare waste	1.2%

COMPLETE MASTERY OF OPERATIONS

All plants operating at full capacity

The average load ratio[10] is 93% and, apart from two exceptions, all installations have a load ratio in excess of 80%. Once start-up has been completed, therefore, installations are not globally oversized, and facilities sometimes reach saturation point due to non-hazardous industrial waste or non-local-authority waste.

High load ratios are observed in installations with low capacities (>95% for capacities < 100,000 t/yr) and, in general, in respect of new rather than of extended installations.

It should also be noted that certain equipment used for optimising operations is now becoming commonplace in installations: examples include balers used for temporary storage in bales and bulky waste crushers.

Gas emissions in line with forecasts

Gas emissions by the 31 operating installations were analysed for the four levels of performance specified in table 3.

Table 3. Presentation of the four levels of performance selected for the analysis of gas emissions.

Performance level	Deadline for existing plants	Deadline for new plants
Ministerial order of 25/1/1991	End-1996 for installations > 6 t/h End-2000 for installations < 6 t/h	8 March 1991
Dust and acid gases as defined in the European directive of December 2000	2005	24 February 1997
Dioxins as defined in the European directive of December 2000,	2005	24 February 1997
NOx as defined in the European directive of December 2000	2005	2002

All sites respect the ministerial order of 25/1/1991 (table 4). Eight of the 31 existing plants have already improved their flue-gas treatment performances compared with the initial project terms, and have thus been granted Ademe aid as part of the Air Sources fixes programme[11].

[10] Ratio of tonnage processed to theoretical annual tonnage for 7,500 operating hours annually.
[11] It appears probable that around one hundred other units in the existing installed base will be upgraded to comply with the European Directive. This work, which is to be completed by 28 December 2005, represents an investment of €350m.

Table 4. Analysis of gas emissions by numbers of units and total tonnage

	Numbers of units		Total tonnage	
Performance level	Reached	Not reached	Reached	Not reached
Ministerial order of 25/1/1991	100%		100%	
Dust and acid gases as defined in the European directive of December 2000	55%	45%	67%	33%
Dioxins as defined in the European directive of December 2000,	55%	45%	50%	50%
NOx as defined in the European directive of December 2000	10%	90%	10%	90%

55% of sites (representing 67% of capacity) are operating within the limits for dust and acid gas emissions set out by the European directive. The flue-gas treatment process was not seen to have any influence in the case of those plants which had not yet reached these emission levels.

In respect of dioxins, 55% of sites (representing 50% of tonnage) had emission levels of less than 0.1 ng/Nm3. Emission levels were lower than 1 ng/Nm^3 in over half of the other units. Only one site has emissions in excess of 5 ng/Nm^3 [12]. There is a clear difference in terms of performance between the various types of flue-gas treatment used, since over 70% of sites not operating within the 0.1 ng/Nm^3 threshold use wet processes[13].

Lastly, three sites – of which one is at the delivery phase – are equipped with a NOx treatment system.

Annual pollutant emissions, with the exception of dioxin, in line with the European directive

Simulations have been carried out to answer the following question : if the 31 units were to be regarded as a single plant, would it respect the annual emission limits set out in the ministerial order of 25 January 1991 and those set out in the European directive leaving aside dioxin emissions ? The total emissions by the 31 units in operation are less than the simulated levels authorised by the ministerial order of 25 January 1991 and less than those set out in the European directive for atmospheric pollutants with the exception of dioxins (table 5).

Table 5: Comparison of annual emissions and authorised limits across the facilities studied

	Annual emissions (t/yr)	Simulated emissions derived from the ministerial order (t/yr)	Simulated emissions derived from the European directive (t/yr)
Dust and acid gases			
Dust	119	640	213
HCl	200	1,067	213
SO_2	1,020	6,400	1,067
HF	4.9	43	21
Dioxins	30 g/yr	/	2.1 g/yr
NOx	5,020	/	5,653

[12] The flue-gas treatment system is, however, being upgraded at this site.
[13]Installing dioxine treatment equipment on dry or semi-wet treatment systems already equipped with a fabric filter is a relatively simple operation and one which has already been performed in the majority of cases.

Emissions of dust and acid gases are due, mainly, to plants not respecting the European directive. Emissions by plants respecting the European directive are well below the maximum authorised levels. These emissions are 60% to 85% lower than the maximum levels authorised by the directive. The type of flue-gas treatment used also affects emission levels: installations equipped with a wet treatment system and which respect the ministerial order of 25 January 1991 perform significantly better in respect of hydrochloric acid but less well in respect of sulphur oxides than installations equipped with dry or semi-wet systems.

Over 98% of dioxin emissions are generated by plants which are not equipped to treat this pollutant. Plants operating within the limits set out in the ministerial order of 25 January 1991 and equipped with a wet flue-gas treatment system are largely responsible for these high missions[14]. Conversely, installations respecting the European directive and equipped with a dioxin treatment system generate only 0.44 g/yr of the total emissions of 30 g/yr. Moreover, this level of 0.44 g/yr is around 50% lower than the maximum authorised level of 0.83 g/yr. In other words, actual average emissions stand at 0.05 ng/Nm^3, compared with a limit of 0.1 ng/Nm^3.

"Next-generation" units respecting the new European directive of 4 December 2000

The four units already in operation and authorised following the publication of the 1997 French Environment Ministry Circular respect the emission levels set out in the European Directive (with the exception of NOx).

All 11 of the sites under construction have been designed to operate within the limits set out in the European directive (except in respect of NOx), and seven of the 11 have been designed to generate NOx emissions of less than 200 mg/Nm^3. In respect of certain pollutants, guaranteed levels are well within the requirements of the European Directive.

Installations continue to optimise energy recovery

All sites having received aid recover energy generated during waste incineration[15]. The 42 units studied may be broken down as follows:
- 2 units, representing 2% of capacity, engage in "all-thermal" energy recovery,
- 16 units, representing 45% of capacity, engage in combined heat and power (CHP) energy recovery,
- 24 units, representing 53% of capacity, engage in "all-electric" energy recovery,

CHP energy recovery is more common in extensions to existing sites. For new projects, which are often located far from potential users, the breakdown is 33% CHP recovery and 66% electric recovery.

Energy recovery ratios are in line with forecasts:
- In respect of thermal recovery, forecast and actual energy recovery ratios are in excess of 90%;
- In respect of CHP recovery, the average forecast energy recovery ratio is 58%, compared with an average actual ratio of 54% (with a maximum of 80% for one unit);
- In respect of "all-electric" recovery, the average forecast energy recovery ratio is 22.5%, compared with an average actual ratio of 21.8% (with a maximum of 26%).

A more detailed analysis based on 80% of the tonnage processed in the 32 operating units having received aid shows the following:

[14] There are two possible reasons for this trend: (1) The technique required in the case of dry or semi-wet processes, where there is already a fabric filter, is simpler and less costly in terms of investment than that required in the case of wet processes (2) Installations equipped with wet treatment systems have the greatest capacities, and the attendant investments and challenges are proportionally great.

[15] Notwithstanding the fact that a MUNICIPAL SOLID WASTE INCINERATOR's primary function remains the proper processing of waste.

- Electricity production: 967 GWh, i.e. 53% of the electricity produced[16] by incineration plants;
- Sale of thermal energy: 1,049 GWh, i.e. 29% of the total thermal energy recovered by facilities[17].

Tables 6 and 7 compares the performances of units in receipt of aid with those of facilities as a whole.

Table 6. Energy recovery performances of all-electric facilities (in kWh/t)

	Total number of French facilities in 2000 with capacity > 3 t/h[18]	Average aided units in operation	Forecast figures for units under construction
Total production	368	418	528
Of which own use	83	89	98
Of which sold	285	329	430

A significant improvement in energy recovery can be observed. On certain existing sites, an all-electric recovery ratio of 550 kWh per tonne of waste incinerated is sometimes reached. Moreover, four other sites have ratios in excess of 480 kWh per tonne of waste incinerated. In respect of installations under construction, the average forecast recovery ratio reaches 25%. Parameters explaining this phenomenon include increased net calorific value for the 'mix' incinerated, improved turbine efficiency in the power range in question and optimised exploitation.

Table 7. Energy recovery performances of combined heat and power facilities(in kWh/t)

	Total number of French facilities in 2000 with capacity > 3 t/h[19]	Average aided units in operation	Forecast figures for units under construction
Total energy recovery	815	992	1,326
Of which heat for own use	101	153	366
Of which heat sold	546	629	578
Of which electricity for own use	61	71	82
Of which electricity sold	107	139	300

An overall improvement in energy recovery can, thus, be observed. This trend is also confirmed by the latest figures, which show an increase in the forecast average energy recovery ratio.

Local Commissions for Information and Monitoring, or CLISs *(commissions locales d'information et de surveillance)* becoming increasingly widespread

For 35 units in respect of which information is available, it was noted that:
- 2/3 of the units have a CLIS,
- 1/6 plan to establish a CLIS,
- 1/6 do not have a CLIS.

ECONOMIC CONDITIONS IN THE SECTOR

Costs mentioned include neither tax nor subsidies.

[16] Which breaks down as 72% of the "all-electric" installed base and 36% of the CHP installed base.
[17] The Syctom Paris plants, which represent a large proportion of heat sales, were built prior to 1993 and have, therefore, not received aid from Ademe; this explains the low level of heat sales in our sample.
[18] Source: Aghtm/Ademe inventory 2001
[19] Source: Aghtm/Ademe inventory 2001

Rising investment cost: €3.60m/(t/h)

A significant rise in investment costs has been observed in recent years. Average investment stood at €3.60m/(t/h) for the 10 latest units, compared with €2.65m/(t/h) in 1993.

This increase is due, mainly, to increased civil engineering costs and architectural constraints, to the development of plant automation and to the introduction of new equipment and facilities (for temporary storage in bales, sewage sludge and crushing of bulky waste)[20].

Moreover, in view of the number of mergers and acquisitions among the construction players concerned and of the relatively small number of projects in France, it is important to remain vigilant with regard to the evolution of investment costs over the coming years.

Average operating cost of around €32/t excl. tax with significant differences from one unit to another

The operating cost may be broken down into three main items:
- operating expenses proper (personnel, insurance, consumables, heavy maintenance and replacement, etc.), which represent an average of €33/t (standard deviation of €4.6/t) for operating installations;
- residue removal expenses, which include, essentially, the removal of APC residues[21] and bottom ash[22], and represent an average of €13/t (standard deviation of €5/t);
- energy earnings[23], which amount, on average, to €14/t (standard deviation of €4/t).

The resultant average operating cost (average total expenses + residues – earnings) then comes to €32/t (standard deviation of €8.4/t).

In respect of the sample studied, there is a wide range of resultant operating costs per tonne (standard deviation of €8.4/t):
- the lowest cost is €18/t;
- 30% of units have a cost per tonne more than 20% lower than the average (i.e. < €25/t);
- 20% of units have a cost per tonne more than 20% higher than the average (i.e. < €39/t);
- the highest cost is €42/t;

Unlike investment costs, the evolution of operating costs in existing plants could not be clearly explained by detailed item-by-item analysis of spending. The size of units, in particular, does not seem to affect operating costs.

In other words, variations in operating costs are due mainly to local conditions affecting the sale of by-products and energy.

Concerning this last point, it appears possible to distinguish two families: (1) plants with an average operating cost of between €20/t and €25/t; (2) plants with an average operating cost of between €35/t and €42/t;

[20] N.B.: the "Flue-gas treatment" item has remained more or less unchanged despite the acquisition of extra equipment for the treatment of NOx (SNCR) and dioxins.
[21] APC residue removal costs, on average, €256 per tonne of APC residue treated, or €8 per tonne incinerated. This cost can vary depending on the type of flue-gas treatment used (from €6.70/t incinerated for wet treatment to €11.10/t incinerated for dry treatment.
[22] bottom ash removal costs are highly variable and depend on the following parameters: destination, distance between the MSWI and the maturation platform, bottom ash quality and rejection level, and economic conditions for sale or elimination. The cost level most commonly observed is around €4/t incinerated.
[23] The average purchase price of the heat is 1.4 cents/kWh delivered; average purchase prices of the electricity are 4 cents/kWh (CHP recovery) and 4.3 cents/kWh ("all-electric" recovery).

This has led to the following findings:
- 80% of plants with operating costs of less than €25/t excl. tax have lower-than-average residue disposal costs.
- 80% of plants with operating costs of more than €35/t excl. tax have higher-than-average residue disposal costs.
- For the remaining installations, earnings from energy recovery are the key parameter, outweighing residue disposal costs in importance.

A total average cost of €78/t excl. tax for operating units

In view of the above results, global cost can be calculated on the following basis:
- Investment (on the basis of €3.6m/(t/h), borrowed for 15 years at 6%, for a plant operating 8,000 h/yr), i.e. €46/t;
- Operation (average total expenses + residues – earnings), i.e. €32/t.

i.e. a global cost of €78/t excl. tax.

This amount is exclusive of subsidies and self-financing, for an installation with characteristics equivalent to the average of those observed among the sample of 31 installations in operation. This amount is, furthermore, per tonne treated and independent of differential pricing in respect of the Local Authority and other customers.

For units under construction, the probable downward trend in operating costs, to be confirmed, would appear to point to a processing cost objective of €70/t (for Local Authority waste)

Variable operating expenses are likely to fall for the latest installations. However, this trend is based on forecasts, and will require further confirmation. Thus, for the last eight cases, the expected global cost is €65/t, with costs ranging from €57/t to €76/t).

This drop in forecast operating costs may be explained by a number of factors which are more economic than technical in nature: increasingly stiff competition; a larger proportion of non-hazardous industrial waste in waste accepted; the optimisation of energy earnings and optimised management of APC residues and bottom ash; the sharp drop in 20-year interest rates; the acceptance of sewage sludge; and the optimisation of heavy maintenance and replacement operations.

This target cost of €70/t relates to the processing of local authority waste. An arrangement sometimes observed today is the acceptance, at a higher rate, of a larger proportion of non-hazardous industrial waste in the waste processed. In one unit under construction the acceptance of a 30% proportion of non-hazardous industrial waste by the delegatee resulted in a reduction of 30 %[24] in the amount charged to the local authority.

A sector with low manpower requirements

Incineration plants generate few jobs. The 31 plants in operation generate around 0.3 jobs per 1,000 t/yr of capacity[25]. The ratio appears to be decreasing in respect of installations under construction (0.27 jobs per 1,000 t/yr). This downward trend, which will need to be confirmed when these new installations are up and running, may be due to the increasing automation of plants.

In total, the 42 units studied represent around 1,350 jobs (created or transferred). It should be noted that the level of skills required by staff has risen in line with the modernisation and growing sophistication of the processes.

[24] For a territory rich in NHIW and lacking outlets, as confirmed by prior local studies.
[25] Compared, for example, with 0.1 jobs for landfill disposal, 0.3 for composting and 2 to 4 for sorting facilities.

ANALYSIS OF ADEME SUBSIDIES

The following points are noteworthy:
Impact of the aid

- For the 42 sites, ADEME aid represents €107m in all, i.e. 5.7% of total investment.
- Overall, aid amounted to €23 per tonne of annual installed capacity (€107m for a processing capacity of 4.7 Mt/yr).
- Four projects received aid only from ADEME. In the other cases, total aid represented 23% of investment and ADEME aid 20% of total aid. Therefore, without necessarily providing major leverage, ADEME aid represents, on average, one fifth of all aid for incineration projects. Behind this average lie considerable disparities due to local politics, and average aid levels (excluding ADEME aid) vary significantly[26].
- In respect of the energy recovery premium, it should be noted that the outside third party (heat customer) can, of course, influence the actual energy use ratio. Heat purchase contracts are generally very short-term, and are, therefore, renegotiated frequently.
- The overall incidence of Ademe aid[27] remains limited: it can be estimated as representing, on average, €2.7 per tonne incinerated, i.e. around 3% of the cost per tonne.
- The incidence of the energy recovery premium on processing costs is between €0.20/t and €1.30/t, which is a relatively small amount, and does not constitute a strong economic signal (no leverage).

Examination of applications for aid

- During the present study, significant differences were noted between the price breakdown system used by ADEME and those generally used by beneficiaries. A greater degree of homogeneity would appear desirable.
- The definition and evaluation of energy recovery ratios require clarification[28].
- In respect of cases for which comparison of forecast and actual investments has been possible, there is sometimes a significant differential; this is often due to an increase in civil engineering costs or a significant modification in flue-gas treatment parameters. It should, however, be noted that actual investments are sometimes justified only within the limits of the base taken into account in the subsidy application. It would appear necessary to perform a stricter analysis of actual investment costs in future.
- The return of technical and operational information for which provision is made in the aid agreements is by no means a reality. This feedback should be performed systematically and based on existing documents (operation permit, plant delivery and annual operations reports) in order to facilitate transmission by the aid recipient.
- Merely specifying the cost per tonne in no way provides adequate information regarding the price of processing. In the analysis performed by ADEME, the cost per tonne is based on the financial data, the committed fixed costs and the contract parameters.

WHITHER THE MARKET OVER THE NEXT TEN YEARS?

2001-2002: A sharp drop in the number of new projects due to the French Circular of 1998 and to the electoral calendar

A sharp drop was observed in the number of new invitations to tender for the construction of municipal solid waste incinerators in 2001-2002: in 2001, the only invitation to tender to be processed

[26] Around 1/3 of projects receive less than 10% in other aid. Another 1/3 receive 10% to 20%, and the final 1/3 receive more than 20%. Origin of aid: region, *département*, Europe, municipality and water agency.
[27] Basic aid + energy recovery premium
[28] (1) "energy produced" is not measured directly (what is measured is the flow of high pressure steam); (2) certain parties place bleeds for intra-cycle heating within the scope of heat for own use, which is contrary to the spirit of the definition.

in respect of construction/exploitation concerned the MSWI of Reunion Island[29], compared with an average of six per year starting in 1993.

This situation can be attributed to two main factors:
- the effects of the French Circular of 1998. The results of the modification of a number of *département* plans in 1998 and 1999 are now being felt (i.e. in line with the average lead time of 2.5 years between the initial decision and the invitation to tender);
- the local elections of 2001, and the presidential and general elections of 2002. Incineration is sometimes a key issue in election campaigns at local level.

Evaluation of new projects in 2002-2012: investment levels remain high

In 2002-2012, the market could see:
- new MSWIs in underequipped regions. Assuming a growth of 5 million tonnes in incineration needs between 2002 and 2012, around four new projects will be required annually over the period.
- the revamping of ageing installations, generating an estimated 230,000 t/yr of additional capacity, i.e. two projects annually.

There could, therefore, be a total of around six projects per year over a ten-year period (i.e. four new plants and two plants revamped), representing over 700,000 t/yr and an annual investment of €320m.

This would see development proceed at a pace quite similar to that observed in 1993-2000, which is not surprising, particularly in view of the time required for a municipal solid waste incinerator project to be brought to completion (on average, seven years elapse between the initial decision and start-up).

Deciding the role of the incineration plant in waste management

Despite preventive initiatives - which will bear fruit in the medium term - and a high degree of selective collection, alternatives to landfilling are required in order to provide the capacity needed to cope with the increase in tonnage produced. Incineration, and, more generally, thermal treatment of municipal solid waste with heat recovery, now offer significant new advantages. Recent studies show that:
- incineration performed in accordance with the terms of the European Directive of December 2000 has negligible consequences for health;
- data from studies of environmental impacts (including greenhouse effect) plead in favour of incineration performed in compliance with recent standards and associated with energy recovery as a means of processing residual municipal solid waste.

1. Emphasise the fact that the modernisation of municipal solid waste incinerators in 2002-2012 will provide **next-generation incineration plants**[30]. Such plants have already been a reality since 1997, and proponents of development - both industrial players and local authorities – have factored in this reality. To maximise acceptance at local level, this approach should also be applied to waste management policy and attention drawn to the multidisciplinary nature of the waste management sector and the importance of energy recovery.
2. Clean up the debate: put an end to the current non-compliance of 21 units with the 1991 order (representing less than 3% of French processing capacity); plan for facilities to comply with the European Directive by 28 December 2005,.
3. Develop sales of bottom ash by optimising dialogue and collaboration with users[31].

[29] This contract has just been cancelled following an interim ruling.
[30] Incineration in compliance with the European directive - as is already the case in France (with the exception of NOx) for post-1997 projects - combined with added transparency in respect of emissions, costs, impacts, etc.
[31] Supply arrangements, quality initiatives, etc. (see the summary of the study "Bottom ash management facilities for treatment and stabilisation of MSW incineration bottom ash").