

11 Investment

Introduction

11.1. This chapter examines AEA's investment in capital expenditure projects and its methods of investment appraisal. We first provide (paragraphs 11.3 to 11.8) a brief account of AEA's general approach to investment and the distinction it makes between 'revenue schemes', which are capital projects that arise as part of work programmes commissioned directly by customers,¹ and other capital expenditure projects. We then consider (paragraph 11.9) the level of investment expenditure by AEA during the period 1986 to 1991. AEA's procedures for approval and authorisation of capital outlays are then outlined (paragraphs 11.10 to 11.12), and its approach to future investment considered (paragraphs 11.13 to 11.16). The effects of the present funding arrangements on AEA's investment are examined (paragraphs 11.17 and 11.18), followed by the methods used by AEA for project appraisal and post-investment appraisal (paragraphs 11.19 to 11.23 and 11.24 to 11.29 respectively).

11.2. Finally we summarise a sample of case studies that we carried out on a number of investment projects undertaken by AEA in recent years (paragraphs 11.30 to 11.39). These case studies are considered in more detail at Appendix 11.1. Our conclusions and recommendations on AEA's investment are at paragraphs 11.40 to 11.68.

Background

11.3. AEA told us that until the mid-1980s its investment schemes tended to concentrate on promoting 'technical excellence' in support of its mission to develop nuclear technology; and that investment appraisal was generally regarded as an 'add-on' to support the technical assessment of the preferred technical route. Following the culture change of the late 1980s, however, AEA told us that there was now a greater emphasis on using investment appraisal as an integral part of the decision-making process.

11.4. AEA has traditionally distinguished between two main categories of expenditure on fixed and durable assets. Projects funded directly by customers, often but not exclusively DEN, are called revenue schemes by AEA (see footnote to paragraph 11.1). These currently amount to around £20 million per year, mostly within the DRAWMOPS programme, compared with around £50 million a year in the mid-1980s. AEA told us that this type of expenditure on durable assets had been subject to the same appraisal procedures as other capital projects, as defined as such by AEA.

11.5. Capital expenditure that has not been commissioned directly by particular customers is regarded by AEA as capital investment proper and has always been subject to HMT guidelines on investment appraisal procedures and criteria. Broadly speaking, these require the use of discounted cash flow techniques for evaluating costs and benefits and the use of an 8 per cent discount rate in real terms (prior to 1989 it was 5 per cent). This category of capital investment by AEA is currently around £20 million to £25 million per year. As explained further in paragraphs 11.14, 11.15 and 11.22, investment projects include expenditure on business-related assets as well as on the AEA infrastructure and on safety-related projects.

¹As defined by AEA, revenue schemes cover expenditure on hardware, plant or facilities which form integral parts of specific programmes undertaken by customers and which would be capitalised if not specifically funded by customers.

11.6. Each year, as part of the AEA Corporate Plan process, AEA prepares a capital budget which it calls a Capital Investment Memorandum and which includes AEA's proposed capital investment 'ceiling' (or budget limit) for the second year of the Plan. This is then agreed with DEn as part of the discussions on AEA's EFL. Investment projects costing over £3 million are individually evaluated and authorised by DEn.

11.7. In addition to capital and revenue scheme expenditure, there was before 1 April 1990 a small number of decommissioning schemes which were treated as 'operational' expenditure and not therefore subject to the appraisal procedures applied to capital projects. Furthermore, research projects within AEA's discretionary research programme (CIRE) are subject to special arrangements for assessment and monitoring. Some expenditure on durable assets within these research projects is included in AEA's capital expenditure figures. In 1990/91 the total value of such expenditure was under £0.5 million.

11.8. A recent (June 1991) report by DEn on DRAWMOPS expenditure expressed various criticisms of AEA's approach to, and methods of, investment appraisal. The report suggested that the culture of AEA had fostered 'appraisal optimism' in its assessments of expected benefits and that the use of investment appraisal techniques had done little to reverse this weakness. The report expressed particular concern about the fact that sensitivity and risk analysis were 'almost completely absent' in AEA's investment appraisals and that this resulted in a 'bias towards high risk projects' and unexpected escalations of project costs.

Investment in the period 1986 to 1991

11.9. Because revenue schemes are not regarded as capital expenditure by AEA, it does not hold centrally details of expenditure on these projects. Expenditure on investment projects as defined by AEA for the period 1986 to 1991 is given in Table 11.1. As can be seen, the AEA capital expenditure ceiling agreed with DEn has tended to be lower than AEA's initial bid. AEA told us that these ceilings had occasionally been modified during subsequent PES discussions or later: ceilings shown in Table 11.1 are those finally agreed with DEn. The out-turn expenditure by AEA has also been consistently less than the agreed ceiling. The total underspend against ceiling by AEA over this period was £21.5 million of which over 30 per cent occurred in 1990/91. AEA told us that this consistent underspend was mainly because it had in some years needed to curtail investment expenditure in order to meet the annual EFL requirements. In the past two years, there had also been considerable uncertainty about how quickly the businesses would become established and what their capital needs would be; and much of the 1990/91 underspend had resulted from deferment of one major scheme. The effects of present funding arrangements on AEA's capital expenditure are considered further in paragraphs 11.17 and 11.18.

TABLE 11.1 AEA capital investment bids, budgets/ceilings and out-turn expenditure

	<i>£ million</i>			
	<i>Initial bid</i>	<i>Agreed budget/ ceiling</i>	<i>Out-turn</i>	<i>Underspend</i>
1986/87	19.1	19.1	18.6	0.5
1987/88	32.2	32.2	24.7	7.5
1988/89	25.6	22.8	16.2	6.6
1989/90	29.0	23.1	23.0	0.1
1990/91	24.5	25.0	18.2	6.8
1991/92	27.0	27.0	N/A	N/A

Source: AEA.

Investment approval procedures

11.10. Investment projects often require some level of pre-scheme expenditure in order to examine the technical options, the expected costs and the forecast benefits, ie to prepare a detailed investment proposal. In AEA, the procedure for authorising such expenditure is called approval of pre-tender sanctionable expenditure, although a PTSE proposal is only submitted following some pre-project work aimed at narrowing down the range of options for more detailed evaluation. The criteria and procedures applied at the PTSE stage are essentially the same as for the final approval of a project, though less detail is required and the standards of appraisal expected are less rigorous. The PTSE procedures were last revised in 1988. AEA told us that it was now aware of the danger that investment options could become unduly narrowed as a result of the pre-project and PTSE procedures, where funds could be directed toward assessment of a technically preferred option, as had occurred in the past. Details of AEA's expenditure on PTSE in recent years are given in Table 11.2.

TABLE 11.2 AEA expenditure on PTSE in the period 1986 to 1991

	Total expenditure £m	Of which abortive expenditure	
		£m	%
1986/87	2.0	0.44	22.0
1987/88	2.4	0.33	13.8
1988/89	3.5	0.23	6.6
1989/90	3.8	0.74	19.5
1990/91	<u>5.0</u>	<u>0.02</u>	<u>0.4</u>
Total	16.7	1.76	10.5

Source: AEA.

11.11. For both PTSE and the final approval of investment expenditure, the delegated level of authorisation within AEA is dependent upon the total cost of the proposed scheme. As shown in Table 11.3, Chief Executives of the businesses and Site Directors have delegated authority to approve schemes up to £1 million (limited to £500,000 at the smaller site at Windscale). Within that, individual businesses and sites are permitted to sub-delegate responsibility for project approval, though the Chief Executives and Site Directors remain accountable to their respective Managing Directors.

TABLE 11.3 AEA authorisation procedures for PTSE and investment projects

Cost of scheme	PTSE and final approval	Lists*
Up to £1m	Site Director/Business Chief Executive	Managing Director
£1m-£2m	Managing Director	AEA Chief Executive
Above £2m	AEA Board	-

Source: AEA.

*This refers to who within AEA sees updated lists of individual projects likely to come forward during the year. The documentation includes details of the outline proposals, the cost of the scheme and the expected return.

11.12. AEA told us that the only exceptions to the above were for the Energy Technology Support Unit (ETSU) Extra-Mural Research Schemes undertaken for DEn, where approval authorisation was delegated to the Chief Executive of the E&E business; and for 'special amenity' schemes where levels of delegation were much lower. Total expenditure on these ETSU schemes in 1990/91 was £25.5 million; there was no expenditure on amenity schemes in that year. AEA also told us that further changes to all these arrangements were likely to be introduced in the near future, due to:

- (a) organisational changes to the sites organisation which had yet to be finalised;
- (b) proposed changes to the 'listing' arrangements which were likely to result in lower cost schemes being included; and
- (c) a move to reduce the level above which purchases were capitalised from £5,000 to £1,000.

Future investment, strategy and objectives

11.13. AEA told us that whilst the future level of capital investment and expenditure on CIRE projects was likely to be much the same as the current level, expenditure on revenue schemes had declined because many of the major projects of the 1980s had now been completed. DRAWMOPS is now the only major programme where significant capital expenditure on revenue schemes may arise during the 1990s.

11.14. AEA's proposals for future capital investment are set out in the last AEA Corporate Plan, details of which are given in Table 11.4. As can be seen, total planned expenditure on average comes to about £20 million to £25 million a year over the period covered by the Plan. Within that total, the expenditure on infrastructure projects (Category B) accounts for about half, though expenditure on business-related projects (Category A) is forecast to increase both in absolute terms and also as a proportion of the total capital budget. Safety-related projects (Category C) constitute only about 5 per cent of the total, but are accorded a high level of priority by AEA. AEA told us that these capital expenditure plans were being assessed as part of its current planning process and would need to take account of the lower levels of capital expenditure implied by the reduced EFLs agreed in autumn 1991.

TABLE 11.4 AEA proposed capital expenditure for 1991/92 to 1994/95

Category	£ million			
	1991/92	1992/93	1993/94	1994/95
A	6.0	9.4	9.1	11.1
B(a)	3.6	2.2	2.5	2.0
(b)	1.1	1.5	0.8	1.1
(c)	2.6	4.3	3.8	4.2
(d)	3.1	10.9	10.1	3.6
Total B	10.4	18.9	17.2	10.9
C	2.8	1.5	0.3	0.4
Total	19.2	29.8	26.6	22.4

Source: AEA Corporate Plan (March 1991).

Note:

Category A: Investments in equipment and facilities with a commercial justification.

Category B: Investments in new or replacement (including refurbished) general site capital, including (a) computing facilities; (b) R&D plant and equipment; (c) other plant and equipment; and (d) building and civil works.

Category C: Safety-related capital expenditure.

11.15. AEA told us that the mechanism for determining its desired capital expenditure programme was designed to integrate top-down guidance with bottom-up planning by the individual AEA businesses. The main objectives in setting the programme were described by AEA as follows:

- (a) to allow the businesses the funds necessary for implementation of their business plans;
- (b) to provide for necessary safety-related schemes; and
- (c) to allow necessary infrastructure expenditure to meet the objectives of AEA's estates strategy.

11.16. Details of investment projects recently completed and of those currently ongoing are given at Appendix 11.2; and details of AEA projects approved between April 1990 and September 1991 are given at Appendix 11.3.

Effects of funding arrangements

11.17. As explained in paragraph 11.6, AEA's capital budget is agreed each year as part of AEA's EFL for the following year. The EFL also allows for both movements in working capital and non-grant-funded restructuring costs. Once the EFL is set, AEA is permitted to rebalance or vire between the different components of the total EFL, should the need arise during the course of the year.

11.18. As stated in paragraph 11.9, AEA has consistently underspent its agreed capital budget in order to meet its EFL commitments. AEA told us that after conclusion of its negotiations with DEn for this year's EFL (ie for 1991/92), AEA had subsequently 'capped' its planned capital expenditure at a level below the agreed ceiling by cancelling or deferring a number of projects planned for 1991/92, in order to accommodate higher restructuring costs than had been previously forecast and thereby keep within its EFL. AEA also told us that Category B or infrastructure projects were the most likely to be cancelled or deferred in these circumstances.

Project appraisal

11.19. Before expenditure on an investment project is finally authorised a full appraisal is required. AEA's Financial Manual incorporates the guidelines for both PTSE and final investment appraisal, supplemented by a series of Financial Memoranda which are issued periodically in order to update the Manual. The main guidelines, in the form of a 'check-list' for use with scheme proposals, were incorporated in a new Memorandum issued in April 1990; and these were updated again in August 1991, when the main change was the inclusion of new QA procedures.

11.20. The internal guidelines currently adopted by AEA broadly follow and are consistent with the published Treasury Guidelines,¹ albeit that they are less detailed. They provide a check-list of points to be included in the appraisal, including delay and do-nothing options and the need for sensitivity analysis. A common format for presenting investment appraisals is not yet applied, however, though AEA told us that it planned to introduce such a format in the near future. For each project, a safety case is prepared (see Chapter 15), though AEA has not generally applied a formal risk assessment of costs to be incurred. AEA told us that it recognised that safety assessments and financial risk analysis of safety had not been sufficiently well integrated into its investment appraisals.

11.21. As indicated above, AEA previously gave particular weight to the technical aspects and technological merit of investment proposals and investment appraisal was seen as a supplement to the technical assessment. The recent updating of the guidelines was directed toward raising the standards of appraisals. AEA told us that standards had indeed improved over the past year or so, but that it intended to issue further guidance in the near future on the treatment of infrastructure projects, because this was an area of appraisal which it considered to be still less than fully satisfactory.

11.22. The main categorisation of investment schemes used by AEA is broadly as follows:

- *Category A:* Investment in equipment and facilities with a primarily commercial justification.
- *Category B:* Investment in new or replacement general capital (including refurbishment), primarily required to maintain AEA's infrastructure.
- *Category C:* Expenditure to ensure continued safe execution of programmes of work, meeting all relevant regulations.

11.23. AEA told us that of the 12 capital and revenue schemes over £500,000 put forward for approval between April 1990 and September 1991 none was rejected, though more information was requested on one of them (Rationalisation of advanced engineering materials) before final approval was given.

¹ISBN 0 11 560034 5.

Post-investment appraisal

11.24. AEA has two formal procedures for assessing completed investment projects, namely Post Project Process Reviews (PJPRs), and Post Project Evaluations (PPEs). It also commissions more *ad hoc* Specific Inquiries (SIs) where appropriate (see paragraphs 11.28 and 11.29). PJPRs are rather general post-job appraisals aimed at showing how well (or badly) a job has been done and identifying areas where there is scope for improving work practices. They are not therefore directed specifically toward investment projects and may cover a wide range of different job activities. Some 20 PJPRs were undertaken in 1990/91, of which only two or three involved investment projects. Even where they are applied to such a project, PJPRs are not intended to review the validity of the original investment appraisal and the approval decision.

11.25. AEA told us that the objective of PPEs was to assess the success (or otherwise) of investment schemes in meeting the financial and technical parameters envisaged in the original proposals. The recommended 'check-list' of points to address in a PPE includes reference to the accuracy of the original estimates of costs and benefits and the appropriateness of the economic assumptions made.

11.26. Nonetheless, these PPEs have not usually sought to question the decision to approve the investment and the number of PPEs undertaken in recent years has also been relatively small. In 1990/91 only three PPEs were carried out, the details of which were provided to us by AEA. These reviews indicated problems of cost overruns, mis-specification of technical requirements, construction delays and failures to consider a sufficiently wide range of options or to undertake an appropriate sensitivity analysis.

11.27. AEA accepts that the PPE process is potentially valuable and that it has been under-used in recent years. AEA told us that it intended to 'relaunch' the PPE process later in the current financial year, with a greater emphasis on applying these reviews to a wider range of investment schemes, including smaller schemes below the current limit of £500,000.

11.28. SIs are put in hand when a significant project has clearly failed or where it appears likely to fail or fall short of its objectives in some significant way; this is thus a form of 'disaster review'. In recent years, five such inquiries have been undertaken on the following cases:

- The COMPASS fusion experiment; £9.9 million project (1987); completed one year late in March 1991.
- The PLUTO Test Loop Project; nearly £20 million project (1982); has never been used operationally.
- The CRAY-2 Supercomputer; £10 million project (1985); see Appendix 11.1.
- The Winfrith Radwaste Store; £9.8 million project (1987); project delayed, but on-site work completed in November 1991 (still financially incomplete).
- The Winfrith Radwaste Plant; £9.7 million project (1985); completed in February 1991; both the Radwaste Store and the Plant are currently non-operational (but following a review by AEA they are expected to be used operationally in the future).

11.29. The main sources of weakness identified in these SIs were poor project management, insufficiently specified technical requirements, inadequate risk assessment (ie in the original appraisal) and poor risk management during the course of the project. AEA accepts that in each of these cases there were major shortcomings amounting either to a failure of the initial appraisal and subsequent project management, and/or a failure adequately to meet customer requirements.

Case studies of investment projects

11.30. We carried out a number of case studies of AEA investment appraisals (some 15 in total). Summaries of five follow, dealing with both major revenue schemes and capital projects, as defined by AEA. Further detail on each of these projects is given at Appendix 11.1.

Major revenue schemes

MTR Radwaste Plant at Dounreay (1983)

11.31. This project involved the building of an £11.5 million treatment plant to deal with radwaste arising from AEA's MTRs. The appraisal was confined almost entirely to an assessment of technical factors and the feasibility of the preferred technical route. Other options were not considered and no sensitivity analysis was undertaken. The basis of the original scheme was substantially undermined by the subsequent closure of AEA's major MTRs in 1990. AEA told us that the appraisal would not meet its current standards of appraisal because of the limited range of options considered.

Electron Beam Vaporiser (1987)

11.32. No formal investment appraisal was carried out on this scheme, though a technical proposal was approved by AEA in 1986 for a £1.3 million project. DEn declined to fund it as a Programme Letter project. Subsequently, BNFL agreed to pay for a revised project costing £2.4 million.

11.33. The possible benefits from the scheme were never quantified and it appears to have been driven entirely by technology-push. Alternative options were not considered by AEA and no sensitivity analysis was carried out. Whilst completed to cost, the project was subject to delays in commissioning.

Capital investment projects

'Europa' project at Aberdeen (1989)

11.34. This project concerned the building of a testing facility for nuclear well-logging technology. The original proposal was costed at £0.7 million and kept open the options of siting the plant at either Winfrith or Aberdeen. In the subsequent revised proposal, costs had increased to £3.1 million; the option of a Winfrith location was eliminated without assessment in the documented appraisal; and the forecast return was predicated on uncertain funding of £0.6 million from the EC Commission, though in the event this was provided.

11.35. The decision to locate the project at Aberdeen does not appear to have been made primarily on economic criteria. The project seems to have been driven by technology-push and the objective of increasing research opportunities for AEA, the benefits of which were not quantified. Only limited sensitivity analysis was carried out. Costs have escalated marginally above budget.

CRAY-2 Supercomputer (1985)

11.36. In 1985, AEA concluded on the basis of a technical review of its computing needs that it wished to purchase the most powerful computer then available, which was a £10 million CRAY-2 supercomputer. Although the option of a lower-capacity machine was considered, AEA favoured the CRAY-2 because it forecast substantial revenue from external sales of computer time. A limited sensitivity analysis was carried out which suggested that the project would be successful in all foreseeable circumstances.

11.37. AEA told us that HMT was highly critical of the proposal and particularly the forecast growth of AEA's computing needs, though it subsequently authorised the project on the basis of a revised appraisal. In the event, the CRAY-2 has been substantially underutilised since it was commissioned. AEA accepts that the project has been a failure and that the original appraisal had a number of weaknesses. It did not consider a sufficiently wide range of options and the sensitivity analysis was inadequate.

Seaweed Barrier at Dounreay (1986)

11.38. This scheme involved building a £1.9 million permanent barrier to prevent seaweed fouling the water intake for the PFR at Dounreay. Other options were not evaluated in detail. The main benefits were seen by AEA to be associated with the experimental work of the PFR, though these were not quantified, and the appraisal sought to justify the project on the basis of higher electricity sales. DEn critically questioned the proposal and particularly the limited attention paid to the fact that the PFR was out of action periodically in any event for other technical reasons.

11.39. The project appears to have driven by technology-push; other options were not examined fully; and the possible benefits were evaluated only partially. The possibility of the plant being closed down in the early 1990s was not considered: AEA expected the PFR to continue operation through to the late 1990s. It is now scheduled to cease operations in 1994. The sensitivity analysis carried out was limited.

Conclusions and recommendations

Introduction

11.40. In its expenditure on fixed durable assets, AEA draws a distinction between those projects that are directed toward meeting the needs of a particular customer-in AEA jargon 'revenue schemes' funded by 'recovered expenditure'-and projects which have a wider customer application, which it regards as capital expenditure proper. In some cases, this distinction may be somewhat arbitrary. AEA drew our attention, for example, to the Winfrith Radwaste Store which it originally classified as a capital project because it was thought to have a use for a number of customers. This has not proved to be the case, however, and AEA told us that it now considers that this project should probably have been treated as a revenue scheme from the outset.

11.41. It is inevitable in our view that each individual project needs to be assessed on its own merits as to whether it is a revenue or a capital project; and that this should form part of the normal negotiations between AEA and its customers. The area of work now most affected is the DRAWMOPS Programme Letter where DEn is the customer; and it is for AEA and DEn between them to decide on how to treat expenditures on fixed assets within the agreed programme of work.

11.42. Both types of scheme are subject in principle to the same assessment and approval procedures, though revenue schemes are generally specified in accord with the needs of a particular customer; and because they do not form part of the capital expenditure budget, they are outside AEA's EFL. We consider that the allocation of expenditure between capital and recovered expenditure is a matter primarily for negotiation between AEA and its customers, and most particularly DEn.

Budget control of capital expenditure

11.43. AEA's current expenditure on capital investment projects is around £20 million to £25 million a year, of which nearly half is required for maintaining and developing AEA's ageing infrastructure. A further important objective is the development of capital facilities required for commercial activities.

11.44. We note that AEA has consistently underspent against the capital expenditure budget negotiated annually with DEn and that the cumulative underspend over the past five years, at £21.5 million, is equivalent to the out-turn expenditure in a typical year. AEA argued that this is in part driven by the practical consequences of the present PES/EFL system, where the capital budget is negotiated a year in advance of the expenditure taking place. It also commented, however, that because the capital programme is a relatively large element of the EFL, it may need to underspend on investment in order to carry on with what it considers to be other high priority activities such as its restructuring programme.

11.45. We recognise that such constraints exist, but nevertheless consider that under the present arrangements AEA's annual capital expenditure budget lacks credibility. We are concerned that this leads to worthwhile and indeed necessary capital projects being deferred or cancelled in order to meet short-term cash flow difficulties; and that this may harm the commercial prospects of the businesses.

11.46. Such a persistent underspend on the capital expenditure budget agreed with DEn may be more a reflection of a lack of clear commitment by AEA to its investment programme than the effects of the EFL system or other financial targets set by the Government.

11.47. The recommendations we have made to improve both AEA's control of working capital and its financial management should reduce the need for AEA to underspend on its capital budget on a regular basis. In addition, we recommend that AEA should in future give greater emphasis and management commitment to achieving the annual targets set within its capital investment programme agreed with DEn.

Control of pre-project expenditure

11.48. Prior to a capital project (or revenue scheme) being approved or undertaken, some expenditure is usually incurred under current AEA procedures through the PTSE arrangements and also, though to a lesser extent, at the pre-PTSE stage. Such expenditures may account for a significant proportion of the total capital expenditure figure.

11.49. Where the procedures for such expenditure are not well specified or controlled, there is a danger either that a proportion of this expenditure will be wasted or that the commitment of the expenditure will drive the decision process from an early stage toward a particular technical option. We note that AEA's procedures have not been revised in recent years to match both its new business structure and the other measures taken (and in the process of being taken) to integrate investment appraisal more fully into the decision-making process. As discussed further below, we note also that an excessive narrowing of options for capital investment has been a particular weakness in AEA's approach to capital investment projects.

11.50. We conclude that AEA's pre-project expenditure arrangements (ie for both PTSE and pre-PTSE expenditure) are unsatisfactory and could be improved.

11.51. We therefore recommend that AEA should, by June 1992, introduce more tightly specified guidelines, including guidance on the need to evaluate a full range of options associated with a particular project, for the authorisation of PTSE and pre-PTSE expenditure; and in due course these guidelines should be incorporated into an updated Financial Manual (see paragraph 11.56).

Project appraisal procedures

11.52. In addition to capital expenditure of around £20 million to £25 million, AEA incurs expenditure of around £20 million a year on fixed assets under the revenue scheme arrangements.

11.53. Investment appraisal should take account of the nature, amount and timing of expenditure on fixed assets, including both capital projects and revenue schemes. AEA fully accepts that investment appraisal has in the past been regarded as an 'add-on' to the technical assessment of projects rather than an integrated part of the decision-making process. This has resulted in a number of weaknesses in the way particular projects, both capital investments and revenue schemes, have been selected. As shown by the case studies of particular projects, the range of options considered has often been too narrow; variations in the presentation of appraisals have made it difficult to compare one project with another or to apply consistent selection criteria; and sensitivity analysis has rarely been carried out satisfactorily.

11.54. Moreover, the guidelines applying both to infrastructure projects, where the costs and benefits may be especially difficult to determine accurately, and to revenue schemes have been inadequate to prevent wide variations in the approach adopted in AEA project appraisals. AEA recognises these weaknesses and said that it intended to review and strengthen these guidelines in the near future. AEA also pointed out that, particularly since the business structure was established in April 1990, it had taken a number of steps to integrate investment appraisal more fully into the decision-making process, though it accepts that further improvements are both necessary and desirable.

11.55. We conclude that:

- (a) AEA gives insufficient attention to the range of feasible options associated with meeting a particular project objective and that 'do-nothing' and 'delay' options in particular have rarely been dealt with satisfactorily;
- (b) the variation in the way investment projects are presented indicates (and contributes to) a lack of effective control by AEA which in turn undermines the effectiveness of its expenditure authorisation procedures;
- (c) AEA investment guidelines applying to revenue schemes and infrastructure projects are inappropriate and unsatisfactory;
- (d) AEA pays insufficient attention to the use of 'sensitivity analysis' in its investment appraisals, particularly in the larger projects costing in excess of £1 million; and
- (e) AEA's Financial Manual should be revised in order to strengthen the basis for appraisal.

11.56. We therefore recommend that AEA should fully update its Financial Manual and other internal guidelines on investment appraisal by September 1992 in order to:

- (a) give greater emphasis to identifying and evaluating the full range of feasible options available;
- (b) introduce a more standardised format for the presentation of investment cases by the businesses to ensure that investment priorities can be determined more effectively;
- (c) standardise the appraisal methods and criteria used for evaluating the costs and benefits of infrastructure projects and revenue schemes, having due regard to the views of external customers; and
- (d) include all the following for projects over £1 million and those considered most appropriate for smaller projects:
 - (i) sensitivity analysis for all benefits claimed for revenue and infrastructure projects; and for net income flows under commercial investment projects;
 - (ii) sensitivity analysis of all costs based on the estimated reliability of the cost data;
 - (iii) sensitivity analysis on the main underlying assumptions used, particularly those relating to expectations of major revenue contributions by public sector organisations and large private sector customers; and
 - (iv) sensitivity analysis of a combination of factors, especially where such factors are likely to vary together, including where possible the probability of such variations.

Treatment of safety-related projects

11.57. The need to maintain adequate levels of safety, particularly where nuclear material is involved, has always been given a high priority by AEA in its assessment of investment projects, whether capital or revenue schemes. Nonetheless, AEA's approach has been to address primarily the technical and regulatory aspects of safety requirements rather than the financial implications of different technical options, where these exist. AEA has therefore not usually undertaken any financial risk analysis of safety; and there is a danger that this may have resulted in a greater commitment of resources in some instances than would have been the case had such an analysis been carried out.

11.58. AEA accepts that safety assessments and financial risk analysis of safety elements have not been a sufficiently well integrated part of its investment appraisal process. It pointed out to us, however, that the need for risk analysis will vary from case to case; and also that nuclear safety is now most likely to be associated with revenue schemes, particularly DRAWMOPS, where customer views are important.

11.59. We conclude that AEA's treatment of safety elements in investment proposals, despite (and to some extent because of) its comprehensive technical coverage, has tended not to be sufficiently well integrated into the investment appraisal process, with the possibility that this could result in the commitment of greater resource costs than would be fully justified were an adequate assessment of the relevant financial risks undertaken.

11.60. We therefore recommend that henceforth a financial 'risk analysis' of safety features should be considered, taking into account the views of appropriate external customers:

- (a) on all projects over £1 million where radiation safety is a relevant but subsidiary consideration; and
- (b) on smaller projects where safety improvements are the main objective.

Post-investment appraisal

11.61. We consider that regular and systematic checking of completed investment projects is an essential means of ensuring that appraisal procedures are working satisfactorily. Where projects go wrong for some reason, the lessons learned can in this way be used constructively in the appraisal of future cases. We note, however, that AEA's PPE procedure has been applied to only relatively few cases in recent years. Where PPEs have been used, they have usefully highlighted problems of cost overruns, mis-specifications of technical requirements and failures to consider a sufficiently wide range of options or to undertake an appropriate sensitivity analysis.

11.62. AEA accepts that the PPE procedure is potentially valuable and that it has been underused in recent years. In AEA's view, the main problem with the existing procedures is one of application rather than content. Nevertheless, it also told us that it intends to 'relaunch' the PPE process later in the current financial year, with a revised procedure and with greater emphasis on applying these reviews to a wider range of schemes, including smaller projects below the current limit of £500,000.

11.63. We conclude that AEA has recognised that its procedures for PPE (ie post-investment appraisal) are not being satisfactorily applied and that remedial action is required.

11.64. We therefore recommend that the existing PPE format should be revised by June 1992 to focus more directly on the soundness of the original appraisal; and that at the same time, PPE procedures should be 'relaunched' and applied to all projects over £1 million and to smaller schemes where appropriate.

Technical bias in investment decisions

11.65. In the past, AEA's objective of pursuing 'technical excellence' has resulted in project assessments being focused primarily on the technical merits of a particular case. Although technical excellence is still regarded by AEA as important to maintaining a competitive advantage, it recognises the need for a sound financial appraisal of investment projects and the dangers arising from 'technical bias' in pursuing its commercial objectives.

11.66. We conclude that AEA has tended to give greater weight in its appraisal of investment projects to technical aspects than it does to financial aspects, ie that 'technical bias' has been an important distorting influence. AEA has recognised that this has been a weakness and is taking steps to remedy it.

11.67. We recommend that AEA should introduce by September 1993 appropriate measures to remedy 'technical bias' at all stages of the appraisal procedure, from the guidelines issued through to the criteria applied by the authorising committees.

11.68. More widely, we also recommend that AEA should introduce by September 1993 whatever additional procedures are necessary to ensure that the recommendations we have made on investment procedures are carried out in full.