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Strategic planning for research reactors

Guidance for reactor managers

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Strategic planning for research reactors

Guidance for reactor managers

INTERNATIONAL ATOMIC ENERGY AGENCY IAEA

April 2001

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FOREWORD

The purpose of this publication is to provide guidance on how to develop a strategic plan for a research reactor. The IAEA is convinced of the need for research reactors to have strategic plans and is issuing a series of publications to help owners and operators in this regard. One of these covers the applications of research reactors. That report brings together all of the current uses of research reactors and enables a reactor owner or operator to evaluate which applications might be possible with a particular facility. An analysis of research reactor capabilities is an early phase in the strategic planning process.

The current TECDOC provides the rationale for a strategic plan, outlines the methodology of developing such a plan and then gives a model that may be followed. While there are many purposes for research reactor strategic plans, this report emphasizes the use of strategic planning in order to increase utilization. A number of examples are given in order to clearly illustrate this function.

The IAEA officer responsible for this publication was B. Dodd of the Division of Physical and Chemical Sciences.

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Part 1

GUIDELINES

1.1. Introduction

Research reactor operating organizations are facing increasing pressures to become more commercially responsive and above all to increase utilization of their facilities. This is due in part to the maturing technology, changing public awareness and increasing concern about nuclear issues, especially with regard to the environment. Another cause of the pressure on research reactors in some countries is the increasing privatization of previously government-lead and funded endeavours.

Whatever the reasons, there is a need for a change in mindset from the research reactor facility just 'being available' to taking control of the facility's destiny by pro-actively seeking out new users and applications. To this end, facility managers need a straightforward and cost-effective approach to both increasing utilization and managing efficiently. This report will show that the preparation of a strategic plan is a useful tool for these purposes. It provides the rationale for the future of a facility and is a worthwhile exercise for all facilities, irrespective of mission, complexity, power or size. A strategic plan provides a framework for increasing utilization, while helping to create a positive safety culture, a motivated staff, a clear understanding of real costs and a balanced budget.

A strategic plan should be seen as an essential tool for a responsible manager of any research reactor, from the smallest critical facility to the largest reactor. In fact, not only is it a document that can provide justification for the operational funding required for the facility, but it is also a powerful means of management control for all activities relating to the facility. The production of a strategic plan should not be regarded as a time-consuming academic exercise, but rather as an investment that will provide ongoing benefits to the facility management. However, it should be recognized that the application of a strategic plan is a dynamic process, and therefore the plan will require monitoring and regular update to be truly successful.

In the preparation of a strategic plan using this document, each manager should apply good judgement to emphasize applicable sections and to address the issues and questions that are appropriate to his or her facility, providing proportionate detail in those areas.

Some of the information included in a strategic plan will be commercially sensitive and intended for internal use only. Hence it should be stated that the International Atomic Energy Agency (IAEA) does not expect general publication of plans or public disclosure of the information contained therein. However, the IAEA policy with regard to research reactors states that the IAEA will only support requests for new facilities or equipment for research reactor utilization if they are accompanied by a strategic implementation plan clearly demonstrating that the items requested are necessary to achieve the objectives of the plan.

1.2. Background

1.2.1. Document outline

This publication has been divided into two major parts:

Part 1 – Guidelines: The purpose of this part is to put the formulation of a strategic plan into perspective, to provide a rationale for the development of a strategic plan and to give an overview of the process.

Part 2 – A Model Strategic Plan: The second part of the document is a more detailed guide. It gives a suggested format for the plan and describes the considerations and content of each section. Selected question sets are used which aim at assisting the facility management in tailoring the plan to meet its needs.

1.2.2. Rationale for a strategic plan

There are increasing demands for many research reactor facilities to justify their continued operation. The development of a multi-purpose strategic plan by the facility management provides a way of handling these changing pressures which are being felt by operating organizations today. Some of the key reasons for writing a strategic plan are that:

- It provides a logical way to try and increase utilization.
- It provides a justification for continued operation.
- It allows for appropriate commercialization of the facility.
- It is a means to effectively manage a change in culture.
- It communicates the priorities of a facility's management and can thereby show the importance of such issues as the minimization of radioactive material releases, employee and public doses.
- It helps secure budgets, and justifies recruitment of staff and infrastructure upgrades.
- It enables stakeholders to see the benefits and need for external support.

Examples of other drivers that might influence the need for the production of a strategic plan might be:

- Loss of links to nuclear research and or teaching groups that may have increased the isolation of the facility.
- Loss of research or analytical groups complementary to the reactor that may have reduced the attractiveness of the facility.
- Aging and imminent retirement of a number of experienced staff threatening the corporate knowledge of the facility.
- A shrinking user base, including the loss of major reactor customers, resulting in a large percentage of time when the reactor is not operating.
- A major change in the public or governmental support of nuclear facilities.
- A drive to reduce costs or conversely to increase funding being needed in order to balance the budget or make up for reduced state support.
- Awareness of liability issues related to the back end of the fuel cycle, such as fuel return, spent source disposal, contaminated soil, decontamination and decommissioning having sigificantly increased.

All of these can be addressed in a well thought out strategic plan. Alternatively, strategic planning could also be called upon if a facility were required to consider decommissioning.

1.2.3. Utilization

The strategic plan addresses how to increase utilization by asking two simple questions, which this report will expand upon:

— What can I do?
— What should I do?

The impact of the answers to the questions "What can I do?" and "What should I do?" may be best explained by reference to Fig. 1, which shows that there is a certain degree of synergy between current capabilities, future abilities and customer requirements. It is the responsibility of the facility manager to identify the intersection (shaded area) and to expand on this by matching and improving abilities of the facility with increasing stakeholder requirements. This report will describe ways of expanding both circles, such that the future utilization factor is greater. In Fig. 1, the arrows to the right reflect expanding reactor capabilities to meet more user needs, while the arrows to the left indicate increasing customers for current applications.

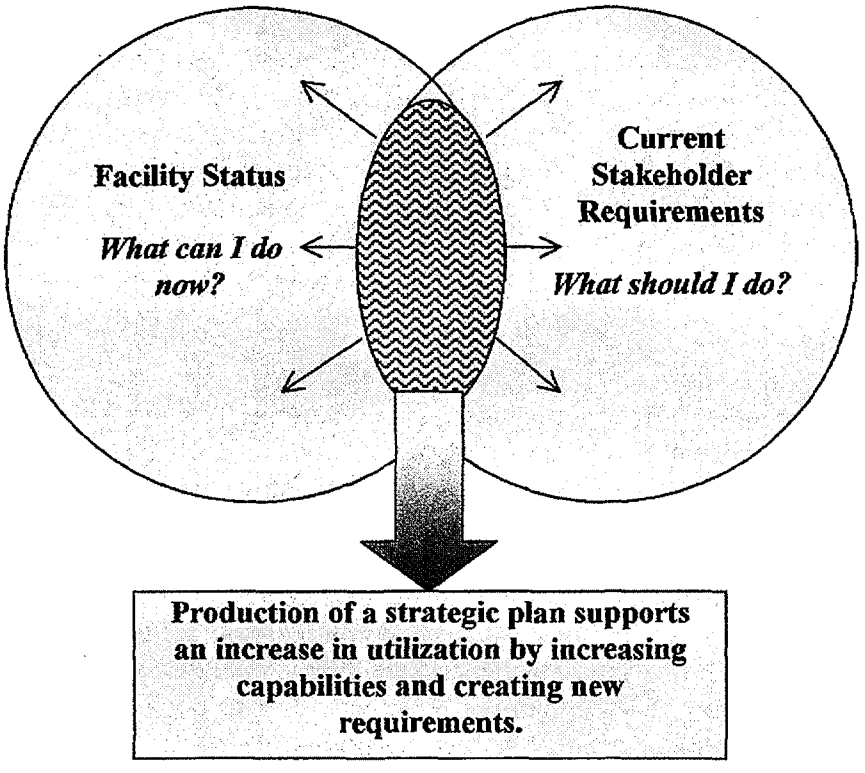

FIG. 1. Increasing utilization.

1.3. Methodology

1.3.1. Overview

The process of creating a strategic plan mainly involves applying common sense and for some sections just requires documenting what is already being done. A brief overview of the process will show that the steps are simple and that they logically link together. An additional advantage of writing the strategic plan is to document the logic and analysis behind the facility's eventual action plan. This avoids the loss of corporate knowledge as an ageing staff retires. Throughout the planning process, while the emphasis might be on utilization and efficient operation, the need for safety and plant improvements as well as for life extending equipment refurbishment should not be lost.

In outline, the strategic planning methodology involves the following steps:

(1) Examine the current and potential capabilities of the facility.
(2) Determine the actual and potential stakeholders in the facility.
(3) Perform an analysis which examines (1) and (2) in the context of the environment and constraints within which the facility operates, in order to:
(4) Generate a vision of future goals and major objectives.
(5) Decide on a few specific objectives and the detailed actions required to achieve them.
(6) Implement, review progress and revise the plan.

1.3.2. Life limiting factors

Before even beginning a strategic planning process it is necessary to start with an examination of any risks which may result in a permanent shutdown of the facility. This type of risk is often referred to as a *life limiting factor*. For example, it is not sensible to plan for new users if the reactor license expires soon and is unlikely to be renewed due to some serious tank or fuel corrosion problems. Life limiting factors will tend to be assessed when the license renewal process is initiated or the safety analysis report is updated, but if the report is somewhat old, it might be wise to reassess these issues before starting strategic planning.

1.3.3. Capabilities

Once life-limiting factors have been handled, the next general step in this planning process is to assess the current capabilities of the facility, i.e. "*What can I do now?*". This might involve a review of previous operating experience, capturing not only what is being done now and has been successful in the past, but also what experiments or irradiations have *not* been successful. The next stage might then be to brainstorm possible new tasks, assess what the competition is doing, and refer to guidance material regarding potential capabilities. This stage might reveal new possibilities such as boron neutron capture therapy, or perhaps research support for neutron capture therapy. In addition it should be noted that there are often some non-technical drivers for accepting or rejecting new directions. For example, the desire for the development of an independent national capability in a particular field.

1.3.4. Stakeholders

The next general step is to address the question *"What Should I Do?"*. This cannot be answered in isolation. The operation organization must involve people of all levels who have an interest in the facility. To do this one must first identify who the stakeholders are *or might*

be, and from *all* potential constituencies, including internal, academic, commercial, governmental and regulatory groups. The stakeholder concept is expanded in more detail in Part 2.

Once the actual and potential stakeholders have been identified, then one must determine what the stakeholders want. Realistically, this should include an honest discussion of the need for this reactor, and could even lead to the identification of the need for a new reactor. Identification of stakeholders' needs may be a process that involves pro-actively educating and involving the stakeholders. Methods for doing so are discussed further in Part 2.

1.3.5. Analysis and vision

All this information is then put into context and analyzed within the framework of the environment and constraints applicable to the facility. A strengths, weaknesses, opportunities and threats (SWOT) analysis, as explained in Part 2, is one method which can be used to aid decision-making. Clearly, this is not an isolated process, as one must assess what resources are available or could be available, and what realistic risks might prevent any proposed changes.

The vision of the facility should be the desired state of achievement to be reached in the future. One must not forget that staff are a key resource. Any change to the performance of a facility will only come from an informed and committed work force, and therefore they need to be full partners in the analysis and visioning process. Reactor staff are not only the most knowledgeable about the facility, but their early involvement will help ensure their ownership and support of the future plan.

Task analysis and assessment of both operating costs and income are also necessary aspects of this stage and are discussed in detail in Part 2.

1.3.6. Objectives and action plans

The desired outcome from the SWOT and other analysis might be a table of capabilities divided up into four categories: can do, could do, can't do and don't want to do (see example in Table I). This will then lead into the definition of some major objectives for the future of the facility. The specific objectives and detailed action plans for achieving those objectives become the core of the future efforts of the facility staff and the strategic plan.

Table I. Example of sorting capabilities for a 100 kW pool-type reactor

Can Do	Could Do	Can't Do	Don't Want to Do
Tracer isotopes	^{41}Ar production	Irradiate ^{99}Mo plates	Dissolve bromine
Train undergraduates	Train regulatory staff		
Silicon doping research		Industrial scale silicon doping	
	Boron neutron capture therapy research support		Irradiate patients for boron neutron capture therapy

Once written, the strategic plan then becomes a management tool for controlling and assessing the work of the facility staff. It is revised and adjusted as needed.

1.4. Model strategic plan outline

Using the methodology discussed above leads to the following model structure for a strategic plan:

(1) Executive summary – An overview of the plan, and statement of management commitment.
(2) Introduction – The purpose of the plan.
(3) Facility description – A brief review of the facility.
(4) Capabilities – Existing and potential applications.
(5) Stakeholders – Who are they and what are their needs?
(6) SWOT – An analysis of strengths, weaknesses, opportunities and threats.
(7) Vision and mission – A concise statement of direction.
(8) Strategic issues – Factors which impact the facility.
(9) Organization and personnel – Organizational structure and responsibilities.
(10) Major objectives – A few selected priority goals.
(11) Specific objectives – The specific achievements which result in reaching a major objective.
(12) Specific action plan – The detailed steps to fulfilling a specific objective.
(13) Marketing – Recruiting new users.
(14) Financing – Balancing the budget.
(15) Review and feedback – Checking the implementation of the plan and updating it.

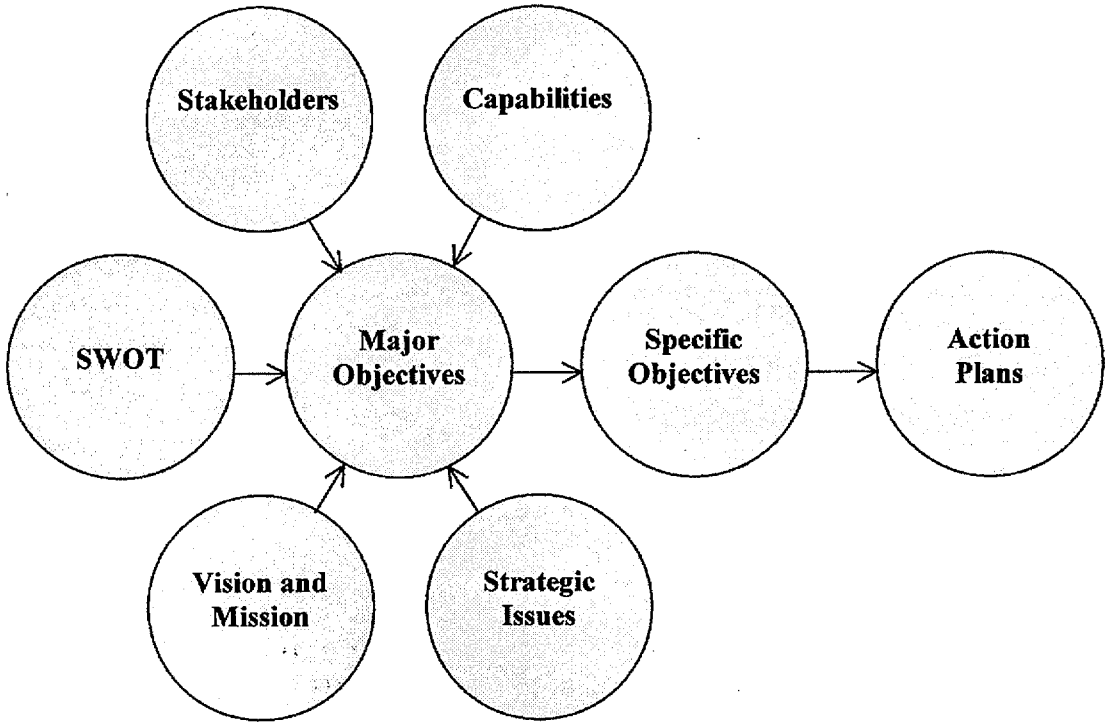

FIG. 2. Outline of the strategic planning methodology.

This may be represented diagrammatically as in Fig. 2. Taking the figure and the model structure together, one can begin to see how the information gathering and analysis exercises of the planning provide the input for the objective setting, which then feed into financial requirements and marketing strategy.

Typically, the specific action plans will be separate documents from the plan itself, however the plan will normally summarize and reference them.

The model strategic plan structure suggested above will be expanded in Part 2 of this document.

Part 2

MODEL STRATEGIC PLAN

The second part of this publication highlights a step-by-step method that is recommended to prepare a strategic plan for a research reactor. A model strategic plan will have chapters covering all of the topics listed in Section 1.4. Each of these chapters will now be explained in more detail to enable the facility manager to prepare a useful strategic plan. However, it should be noted, that the process of preparing a plan should be a team effort and that the process itself is almost as important as the product.

2.1. Executive summary

In this first part of the strategic plan the executive support of the company or owner for the research reactor must be described. A way of doing this is to have a statement by a Director or General Manager that outlines the importance of running the research reactor. It should state that the upper management is committed to the strategic plan as an important tool that will assure long term sustainability for the research reactor. The executive summary is also a good place to discuss the company or owner values, its vision and mission and the link between these and the research reactor.

Clearly, the executive summary must present the key elements, major objectives and conclusions of the strategic plan. It could also include changes in philosophy, financial considerations, new equipment and planned alliances. Furthermore, there should be some short statements regarding the preparation (methodology, time, resources allocated, capabilities, responsible person) and confidentiality of the strategic plan itself.

2.2. Introduction

The introduction should contain a message to all stakeholders and the staff about why a strategic plan is needed for the research reactor (e.g. to increase the utilization or to improve the efficiency of services or products). The message should state the major objectives of the strategic plan, how and when it should be used and outline its structure. Finally there should be a statement about the frequency at which the strategic plan should be reviewed to ensure that it stays current. A review frequency of at least once per year is recommended.

2.3. Facility description

This part of the strategic plan should be a short description of the reactor itself as well as its supporting facilities and structures which will help the reader (especially the non technical managers and executives) to quickly understand the specific issues and objectives outlined in the strategic plan. For example information such as the size of reactor vessel or pool, the reactor power, and the number of beam tubes might be given. For those readers who wish to obtain more technical details (e.g. typical neutron fluxes) on the facility there should be a reference to the facility's design or operating documentation. Also there should be a reference to the IAEA research reactor database (RRDB) available on the internet as an easily available, external source of similar data (http://www.iaea.org/worldatom/rrdb/).

2.4. Capabilities

This part of the strategic plan is very important to complete for all research reactors because it allows the responsible person (e.g. facility manager) to precisely identify the key capabilities of the organization and the extent to which the resources are available in each of them. While the emphasis is on the reactor, the capabilities of the staff and support units should not be overlooked. For example, there might be a significant reactor neutronics computational capability present at the site.

2.4.1. Existing capabilities

The types of projects and services that have been provided in the past should be clearly listed in the strategic plan. This gives a historical background to the research reactor as well as publicizing past work to potential customers. Depending on the organizational structure, the capabilities of affiliated support units should also be identified. Alliances with these groups can strengthen the overall usefulness of the facility. For example, one might be able to offer a complete materials elemental analysis using prompt gamma neutron activation analysis, instrumental neutron activation analysis, and inductively-coupled plasma mass spectrometry.

Examples of some capabilities could include:

— Production of certain isotopes at particular specific activities.
— Neutron activation analysis at a specified precision for a given sample throughput.
— Physics measurements for validation of certain computer codes.
— In-core irradiations at a certain fluence rate of a specified neutron spectrum for materials testing.
— Remote inspection tooling development.
— Radiological emergency response team capability.

2.4.2. Potential capabilities

Once current capabilities have been identified, it becomes necessary to see what else the reactor could do. One suggested approach is to refer to the IAEA report on the applications of research reactors. This report documents all current uses of research reactors and the necessary criteria to enable an application to be performed. It will be of particular benefit to those seeking to increase the utilization or to modify the research reactor for a certain application. In the report, the order in which the applications are presented progresses from those that are possible at any reactor, such as education and training, to those that require a higher power and a more specialized facility with expensive experimental facilities, such as boron neutron capture therapy (BNCT). In addition, this report gives a simplified research reactor capability matrix which at a glance enables the determination of the applications that may be appropriate for a particular power level reactor. For example, it may be seen that a 100 kW reactor is quite capable of performing some good neutron radiography, but would not be suitable for silicon doping.

Once the above exercise is completed the additional potential capabilities should be put on a separate list that will be used when assessing opportunities to increase reactor utilization.

2.5. Stakeholders

Stakeholders can be defined, in this part, as the person(s) and/or institution(s) that have a direct or indirect interest, or involvement, in the operation of the facility. Stakeholders can be either internal or external and may have an authoritative (managerial), utilization, or advisory role.

The contribution of the various stakeholders to the planned activities of the facility can be significant and should thus be determined before the objectives of the strategic plan are identified. It is essential that relevant stakeholders as well as their requirements (needs) are clearly identified.

2.5.1. Identification of existing stakeholders

The following guide could be of assistance in determining the facility's stakeholders. In the following evaluation, a positive answer to a question implies that the particular stakeholder is probably relevant to your facility's strategic planning.

Some examples of stakeholders may be:

2.5.1.1. Government

Normally this body (typically a government Department) handles the political and financial policies that will be applicable to the facility and as such it could be a major role player in the decision or strategy making process.

— Are you currently, or could you in the future, be under the control of a government department?
— Do you receive government funding?
— Does the governing body stipulate your basic purpose for operating (e.g. are you primarily a research, a testing or a commercial facility)?
— Are you involved in a Non-Proliferation Treaty agreement?
— Are there political aspects that you have to take into account, such as participation in a programme to convert from high-enriched fuel to low-enrichment?

2.5.1.2. Upper management

Generally the most direct impact on the facility's future is determined by the immediate (next level of) management decisions. These could be defined in the strategic plan of that managerial level and could involve the following:

— Are the resources available to your facility directly controlled by a higher managerial level?
— Are there specific requirements set by your management regarding operational requirements e.g . fund availability?
— Is decision making regarding operation of your facility based on the input of more senior management?
— Have selective major specific objectives and specific objectives pertaining to the performance of your facility been predefined elsewhere, e.g. pre-identification of institutional responsibilities as an essential part of operation.

2.5.1.3. Academic

Universities and technical education centres are often owners of research reactor facilities. In many cases they could also be important users of the facility with respect to education and training as well as research.

— Is the facility owned by a university or located on a university campus?
— Do you have established, or potential agreements with particular universities or technical education centres regarding utilization of your facilities?
— Do you provide a free service to such academic institutions?
— Are you involved in a nuclear education programme at any academic institutions?
— Do faculty researchers have significant equipment or apparatus set up around the facility?

2.5.1.4. Commercial

Commercial users are those that have products and/or services provided to them by the facility on the basis of a financial agreement. Customers can be classified as internal or external to the institution.

Some examples of customers are:

— Nuclear power plant owners or service contractors.
— Isotope producers or exporters.
— Industrial companies.
— Manufacturers.

— Do you provide services to paying customers?
— Is the financial income associated with these customers significant?
— Does supplying products or services to paying customers significantly affect the reactor's operating or maintenance schedule?

2.5.1.5. Regulatory body

The authoritative licensing body will provide direct requirements for the safe operation of the facility and as such will be involved in the activities of the facility.

— Do you have to satisfy regulatory requirements?
— Are you involved in the training or development of the regulatory body's personnel?
— Is there a requirement from your regulator regarding the establishment of a decommissioning and dismantling plan?

2.5.1.6. Personnel

The staff involved in the operation and direct support activities of the facility are key contributors to the success and well-being of the facility. It is important to recognize that they too are stakeholders with their own needs (career security, motivation, job satisfaction, income) to be met.

— Do you have the means necessary to support the personnel for the facility?
— Are your personnel fully utilized and well trained?

— Are other personnel at your institution (excluding facility staff) directly involved in the utilization of your facility?

2.5.1.7. Public

The public perception of the facility and its uses can be a major issue. This will often depend upon the type of relationship that has been developed with the local population and the media over a period of time.

— Is the local public aware of the facility's existence?
— Is there opposition to the facility?
— Do you have a public relations or public outreach programme?
— Are you involved with the local community?

2.5.1.8. International Atomic Energy Agency

The IAEA often plays either a direct or indirect role in the operation of a nuclear facility. Some facilities have legal Co-operative Agreements with the IAEA and many others request assistance via the Technical Co-operation Department or other regular budget activities. In addition, many facilities are under IAEA safeguards agreements and routinely receive inspectors.

— Do you have regular contact regarding the acquisition or provision of technical information to or from the IAEA?
— Do you receive or provide assistance from the IAEA regarding specialist or technical issues?
— Do you have an IAEA Co-operative Agreement?
— Do you have, or want to have, an IAEA Technical Co-operation project on utilization of the reactor?
— Are you under an IAEA safeguards agreement?

2.5.1.9. Other

A variety of other stakeholders, either local, national or international could be of significance to the facility's strategic planning, e.g. ANSI, OECD (NEA), and EU.

— Are there any other controlling technical assistance bodies or institutions who have a contribution to your facility's operation?
— Do you perform any nuclear data validation or cross section measurements?
— Are any of your personnel involved with standards organizations?

2.5.2. Identification of new stakeholders

Identifying new stakeholders, and in particular new users, requires more creative thinking and effort than the finding existing ones. Initially, reviewing the previous questions but looking for the negative answers this time may provide some assistance.

The second step would be to look at the existing users and to determine if there are more of the same out there. Ask the current customers who else is doing similar work.

Another good source of ideas for potential new users is to look at the types of customers that are using other, similar research reactors around the world. This is not to imply that these customers should be 'stolen', but rather to find similar types of customers in the local vicinity.

It is often important to demonstrate that the facility is meeting the local, national, or regional needs. Therefore, the main local, national and regional industries and agriculture as well as the health and academic institutions should be identified and examined to determine if there are applicable research reactor nuclear techniques that might meet some of their needs.

2.5.3. Needs of stakeholders

It follows that once all of the specific stakeholders have been identified, the next step is to determine each of their requirements or needs. There are various ways that stakeholders requirements could be determined, but basically they all involve pro-active interaction with them. A few examples are:

— Personal visits with existing customers.
— Distribution of promotional pamphlets with easy response questionnaires.
— Visits to academic institutions with a seminar presentation followed by discussions with the faculty and students.
— Attendance at different technical conferences listening for potential applications.
— An open-house of the facility for technical information tours.
— A users forum, workshops, or discussion with brain storming sessions.
— A literature study and subsequent proposal for a project.
— Co-operative projects with several stakeholders, e.g. IAEA for national or government related projects.
— An annual user satisfaction survey.

The needs of stakeholders can generally be categorized into three areas:

— Needs that are known and desired virtually immediately.
— Needs that are known and should be considered for future action.
— Needs that are unknown and require more information and promotion by the facility as feasible or worthwhile to the stakeholder.

Some examples of stakeholder's needs in each category may be:

— *Government:* Ratio of budget from government funds/earned income.
— *Upper Mangement:* Improvement in operational efficiency.
— *Academic:* New experimental facilities.
— *Commerical:* New isotopes delivered at a different time or place.
— *Regulatory body:* Lifetime of the reactor defined.
— *Personnel:* Better working conditions.
— *Public:* No offsite airborne releases.
— *IAEA:* A limitation with respect to funds allocated.

Other user needs might be:

— New materials irradiated at different temperatures.
— New products to be developed or material test facilities to be built.

— New requirements for the enhancement of safety; in WWER reactors for example.
— Production capacity to be expanded.

2.6. SWOT

Once the data gathering phase is over, the analysis phase begins. This could be started with a SWOT analysis followed by an evaluation of the constraints, or strategic issues which must be considered before the major objectives are set and the work, or action plan developed.

SWOT is an acronym for strengths, weaknesses, opportunities and threats, and is a management tool for assessment of the ability or necessity of an organization to change. It is based upon categorizing functions or tasks as a result of a brainstorming session or the type of evaluation described so far. As a general guide, strengths and weaknesses will be internal issues, with the level of possible control over the situation being less with weaknesses. Opportunities and threats are generally external issues (but not exclusively), and again one would typically be less able to control the threats.

This categorization process is illustrated in Table II below, with a series of questions as well as some examples.

Table II. SWOT analysis with examples

Strengths	**Weaknesses**
— What do you do particularly well ? — Are you the best-in-class in any areas? — Do you have a confirmed fuel supply and take-back policy? ..... — *Example: Supply of 90% of the national requirement for ^{99}Mo.*	— Do you have any actions not fully implemented? — Are there tasks done less well? — Are there operational areas or safety related issues that are poorly understood? ..... — *Example: Supply of only a small quantity of ^{99}Mo even when other reactors are not available.*
Opportunities	**Threats**
— Have you identified any new markets or areas of utilization? — Are there any work areas with room for full implementation? — Are there any tasks done less well with room for improvement? ..... — *Examples: Supply of half of the nation's ^{99}Mo needs.* — *Customer complaints that can be addressed.*	— Are there work areas done badly? — Do you have any concerns about safety critical equipment? — Are your competitors better than you? — Do you have any life limiting factors? — Are there fields you are the worst in class in? ..... — *Examples: No fuel available in a few years time.* — *Most staff are due to retire soon.*

One might consider performing a SWOT analysis at an internal users' meeting as part of a presentation or brainstorming session, and then finalizing it again after a meeting with the stakeholders. Clearly, the more input and honesty associated with the SWOT analysis the more useful it will be.

2.7. Vision and mission

Visioning could take place at several points in the strategic planning process, and there can be some benefit to doing it before the harsh realities of the strategic issues are considered.

The vision of the facility should be the desired state of achievement to be reached in the future. A vision is a dream which should be realistic, but with a bit of stretch. For example the vision of one reactor was "To be *the* neutron source for academia and industry in the UK", and for a western US facility it was "To be the best in the West".

Generally the vision of a facility should be formulated jointly by the persons directly involved in achieving this dream; taking the considerations of the various stakeholders into account.

A mission statement is the method or way that the facility will go about achieving its vision and should be given to clarify briefly *how* the futuristic goal will be reached. The mission statement of the same western US facility was: "To meet all the non-medical radiological and irradiation needs of the State, and to be the place that people in the Pacific Northwest think of first for assistance in these areas."

2.8. Strategic issues

Strategic issues are those issues that will have an impact on, or constrain, the facility's strategic plan. In order to decide what strategic considerations should be taken into account in a plan, the facility should preferably have the guideline or requirements of the next higher level of management available for reference. As discussed, the evaluation of the facility status and capabilities, together with the stakeholder requirements and an appropriate SWOT analysis, should result in the answer to the questions "What can we do?" and "What should we do?". In addition, it should also enable the preparation of the objectives discussed later.

The considerations of the actions resulting from these answers, should result in selection of the strategies to be followed. The following examples are not an exhaustive list, but could act as a guideline to a typical selection of strategies:

2.8.1. Operations

These strategies are required to give an indication of the typical operation of the facility in terms of power levels and operational schedules.

— At what levels of power and for what duration will you operate the facility?
— What factors limit your ability to efficiently utilize the facility?
  - Do you have sufficient funds for continuous operation?
  - Do you have fuel supplies for extended operation?
  - Does your staff availability permit you to meet all the operational requirements?
  - Does your equipment or operations have regulatory safety limitations?

2.8.2. Cost recovery

In certain instances, it will be necessary for the facility to generate income to justify its financial expenditure. The cash flow will depend on the method of recovery of funds from the various users of the facility, either commercial or institutional.

— Do you have a method to recover costs from the facility users?
— Do you have preferential fees for certain customers (e.g. do academic users pay)?
— Is there an opportunity for external sources to assist with your financial liabilities?
— Is it necessary for you to accurately know the various costs of operation of your facility?
  - Do you pay for individual services, e.g. water, electricity supply, building hire, insurance, nuclear liability, etc.?
  - Are personnel salaries part of your operational expenses?
  - Do you pay for your fuel supply?
  - Is there an asset depreciation responsibility for your facility, e.g. building and capital equipment cost recovery over a depreciation period?
  - Do you pay for maintenance?
  - Is the facility responsible for radioactive waste removal and spent fuel storage?
  - Are you responsible for the provision of decommissioning and dismantling funds[1]?

2.8.3. Business and competitor analysis

The evaluation of these abilities should enable a determination as to whether or not the facility should attempt to enter into a competitive market with respect to certain commercial products or services.

— Do you have an established end-user market defined?
— Do you know who are the major competitors in the commercial business?
— Do you have a special product or service which you could pursue in the market?
— Are there areas of potential commercialization that you should develop?
— Do you have a feeling for the commercial viability of new products or services?
— Are there any legal restrictions or trade barriers to be considered before attempting to enter a specific product market?
— Do you have access to a trade organization for assistance (e.g. British Nuclear Industry Forum)?
— Do you have an established web site for marketing information?
— Do you have access to support services for financial or business evaluation?
— Is there something you can do cheaper, quicker or better than the competitors?

2.8.4. Maintenance

The status of the facility is normally directly related to its age and the degree of utilization in the past. Maintenance requirements will be identified according to the condition of plant equipment and associated instrumentation.

[1] NUCLEAR ENERGY AGENCY, "NUCLEAR DECOMMISSIONING: A Proposed Standardised List of Items for Costing Purposes", Interim Technical Document, NEA#01708, OECD Nuclear Energy Agency, Issy-les-Moulineaux, France (1999). (Available at http://www.nea.fr/html/rwm/reports/1999/costlist.pdf).

— Do you have a maintenance manual or procedures that you implement for critical components?
— Do you have scheduled maintenance programmes, e.g. during operation and/or shutdown?
— Are you aware of the status of maintenance of other components?
— What long term replacements do you need to consider?
— What regulatory improvements should you be preparing for?
— Do you implement an in-service inspection programme?

2.8.5. Licensing and regulatory

These issues are defined by the authorities controlling the facility licence and should receive the necessary attention to ensure that the operation of the facility is not interrupted due to either unsafe or irregular applications.

— Is your facility licensed?
— Do the license and support documents reflect the correct status of the facility?
— Do you envisage any changes (upgrades, modifications) to the facility that will impact on the validity of your existing license?
— Are there any specific limitations imposed by the regulatory body that require special attention, or need modification, prior to expanding activities or utilization?
— Are there any frequencies of nuclear occurrences that need attention, e.g. are there a number of less severe events that can be prevented?

2.8.6. Quality management

It is advisable that a nuclear facility be operated according to a suitable quality management system. This ensures that the necessary operations are performed in a controlled and acceptable way, at the same time ensuring that customer quality requirements are satisfied.

— Do you have established operational procedures?
— Do you apply quality control to services and products?
— Is it desirable to apply an international quality assurance programme?
— If you have a quality management system, are you monitoring its success?
— Do you wish to receive accreditation of quality service applications (e.g. ISO 9001)?
— Can you consistently meet the quality requirements of existing or potential customers?

2.8.7. Health, safety and environment

A facility should be implementing procedures and policies to ensure conventional (industrial) safety conditions for personnel and the public. At the same time the health and environmental requirements should be taken into consideration.

— Do you have an acceptable conventional (industrial) safety programme?
— Do you implement these procedures and evaluate their efficiency (e.g. by audits)?
— Do you wish to receive accreditation of environmental applications (ISO 14000)?

2.8.8. Technical co-operation and information exchange

It is often beneficial for a facility to have technical assistance in operation and utilization experiences. This co-operation and information can be provided from various sources, e.g. IAEA, nuclear societies, other facilities or specialist groups, both internal and external to your own institution.

— Are you involved in IAEA inter-regional co-operation agreements?
— Do you have access to the IAEA databases?
— Are your staff included in the IAEA research reactor listserver for your region of the world? If not, check for details on how to subscribe at www.iaea.org/worldatom/rrdb under Listservers.
— Have you attempted to establish working relations with similar reactor facilities?
— Are there areas of interest that you would like to develop but are uncertain about the applications?
— Have you considered joint venture agreements (commercial) with other facilities, e.g. for backup of products or services, personnel exchange and training?

2.8.9. Life limiting factors

As part of the risk assessment that might sensibly take place before making decisions on increasing investment of any kind, one might want to address the following types of questions:

— Does your country provide any requirement to maintain a strategic facility or does it just desire a multipurpose tool?
— Does your country have a maturing nuclear power infrastructure?
— Are then any plans for new reactors?
— Is it likely that you will be required to change the use of your site?
— Have you lost major local users?
— Have your nuclear power plants moved to simulators for their operator training?
— Are you losing customers to competitors?
— Do you have problems with the structural, seismic, or electrical standards of your equipment?
— Are you pressured by a take-back programme for your fuel?
— Do you have problems with structural integrity of any core internals including fuel?
— Are there any reasonably foreseen events coming out of a safety evaluation that might threaten the site?
— What might be the impact of a problem with the reactor tank or any underground pipework?
— Do you have staff available now and in the foreseeable future?
— Do you have any licensing issues or adverse political-financial aspects to consider?
— Do you have uncontrollable costs?
— What is the integrity of your instrumentation and control system, including detectors?

Typically, most of these if they are applicable should already have been identified as threats in the SWOT analysis. Some of these factors might be turned around with effort, and then will help ensure a healthy future for the reactor.

2.9. Organization and personnel

At this point, the strategic plan should carefully evaluate the personnel resources available to perform the various activities. The responsible management should then, by consensus, consider the allocation of the various tasks to personnel according to their abilities and future potential.

2.9.1. Organizational structure

Although in most cases, the structures of an organization are already in place, the allocation of responsibilities should be carefully reconsidered in view of the selected strategies during the previous step in the preparation of the strategic plan. This part should contain a description of the various groups and their specific responsibilities, as well as their reporting lines to management. This is easily represented with an organization chart.

The following categories, although not necessarily complete, are typical for a larger research reactor facility and should be considered during the establishment of an organizational structure with allocated responsibilities. For smaller facilities the personnel involvement might not warrant this level of organization and many of these functions may be fulfilled by a total of two or three people.

— Facility operations (e.g. shifts, product loading and handling)
— Engineering (e.g. design, manufacture, installation and commissioning)
— Reactor utilization (e.g. customer relations and contracts, operation scheduling and marketing)
— Maintenance (e.g. electrical, mechanical, instrumentation)
— Safety (e.g. nuclear licence)
— Nuclear fuel and material accountability
— Safety (e.g. radiological)
— Safety (e.g. industrial or conventional)
— Personnel training (e.g. operators, quality assurance and emergency actions)
— Quality management
— Security
— Environmental
— Property management
— Finances
— Other services (e.g. instrumentation technology, library services, administration and human resources.

2.9.2. Personnel development

Following the allocation of personnel responsibilities, the strategic plan should identify the potential of personnel for further development. In particular training of multi-functional abilities to ensure back-up during absence, replacement of expertise due to staff turnover and continuity of operation should receive attention. An increasing concern of many facilities today is the loss of expertise due to natural causes, e.g. retirement of older persons with large amounts of experience. This should be considered in the strategic plan since training in preparation for replacement will probably involve extra personnel and costs.

The methods of evaluation of all levels of personnel performance and ability should preferably be established and communicated to staff. Creative suggestions and participation by staff in problem solving should be considered as a strong motivational incentive.

The following areas of personnel development could be considered:

— Technical training (e.g. nuclear applications, engineering, and neutronics)
— Management training
— Applications of quality assurance
— Radiological safety
— Conventional or industrial safety.

2.10. Major objectives

As illustrated in Fig. 2, after completing the analysis of its situation each research reactor should then identify a **limited number** (e.g. 4 to 5) of the most important or major objectives that will move the facility in the direction of its vision. Some of these objectives may include basic objectives, which are required to carry forward what the research reactor was doing well and safely in the past (e.g. reactor availability, renewal of license), as well as new objectives designed to solve issues or develop new areas of expertise or business opportunities for the research reactor.

The SWOT analysis is useful in helping set the major objectives. For example, one might chose to address one or more of the threats and then to focus on defining ways of turning weaknesses into opportunities. Clearly one should not forget to maintain the strengths or these might drift into weaknesses over a period of time. Some other questions that would allow the facility staff to identify the major objectives would include:

— What level of utilization would be ideal for this facility?
— What are the major technical challenges that are now facing the research reactor (e.g. aging vessel or water leakage)?
— Are there any major issues with the state regulator agency (e.g. major upgrades to permit operating the research reactor beyond a certain date)?
— Are there any important environmental issues (e.g. high ^{41}Ar releases from the research reactor, low level radioactive wastes)?
— Is there potential for loss of expertise (e.g. reactor physicists being recruited by outside organizations)?
— Do you have major budget issues (e.g. stakeholder asking to finance a significant portion of the budget)?
— Do you have major radioactive waste liabilities?
— Do you have reactor safety issues?
— Are there any new needs arising from the research reactor users?

Based on all of the data gathering and analysis, an example of an objective that a research reactor facility might choose is: "To increase the level of utilization of the reactor" (see Annex).

2.11. Specific objectives

Once the major objectives have been identified they need to be sub-divided into specific objectives that will assure that the major objectives are reached in a satisfactory manner. These specific objectives should answer the following questions based on the "**SMART**" approach:

— Are they **S**pecific?
— Can progress be **M**easured for this objective?
— Is the objective **A**chievable?
— Is the objective **R**elevant?
— Can it be done in a **T**imely manner?

It is suggested that for each of these specific objectives a responsible person should be designated, a deadline should be set by management, and performance indicators should be identified to follow progress (e.g. milestones, budget, quality, customer satisfaction).

Examples of specific objectives that may arise from some analysis and the major objective "To increase the level of utilization of the reactor" (see Annex) are:

(1) To upgrade the collimation system in beam port #1 to enable more effective use of the small angle neutron scattering facility by September 2001.
(2) To increase the utilization hours of the neutron diffraction facility by academic institutions 30% within 18 months.
(3) To double the capacity for in-core irradiations of reactor materials for ageing studies within one year.

For each of these specific objectives the following need to be assigned:

— **Who?** The name of the person or group responsible for achieving this objective.
— **What?** A listing of resources needed, such as staff, equipment, supplies, money.
— **When?** A schedule that includes a start and end date and perhaps some intermediate milestones for a long project.
— **Priority?** An indication of the importance of each specific objective relative to each other.

2.12. Specific action plan

Once this phase of the strategic planning is reached it is now time to prepare specific action plans that will detail as much as possible the tasks and time schedule necessary to achieve each specific objective. The strategic plan should only contain a summary of the detailed action plans in order to make the strategic plan as simple as possible. The action plans themselves will usually be in a separate document. To prepare good specific plans, the responsible person for the strategic plan should:

— Communicate with all staff that will be involved in actually doing the work. They should make a detailed list of what needs to be done.
— Identify the most appropriate sequence for these activities.
— Identify the resources required for each activity (e.g. people, budget, space and equipment).
— Show the activities on a time schedule.

Each person responsible for a specific objective should ensure that important milestones are well identified on the time schedule and that formal reviews are included in the plan.

Continuing the earlier example, some specific action plan steps that might arise from the example specific objective (1) in Section 2.11 "To increase the utilization hours of the neutron diffraction facility by academic institutions 30% within 18 months" (see Annex) are:

(1) Prepare a marketing plan, including handout materials and a web site.
(2) Organize a forum or workshop for potential new users.
(3) Prepare and offer to give seminars on neutron diffraction applications to appropriate academic departments in the university.
(4) Plan some graduate level student experiments using the neutron diffraction system and offer them to the faculty of the university.

Each of these specific action steps also requires assignment of the same items as before, namely:

— **Who?** The name of the responsible person or group.
— **What?** A listing of resources needed.
— **When?** A schedule that includes a start and end date and perhaps some intermediate milestones.
— **Priority?** An indication of the importance of each action step relative to each other.

2.13. Marketing

In this document, the actions of marketing will be regarded as those, which relate both to the recruitment of customers for the sale of commercial products and services, as well as to the promotional aspects which relate to the recruitment of academic and other users for experimental applications. Since the benefits of a successful marketing strategy are many, beware of the danger of doing anything to acquire a sale. Rather, identify one or two areas in which the facility really excels and concentrate on those. Expansion to accommodate additional products or services can always be handled once the current abilities are well established.

There are certain logical considerations to be taken into account before a marketing process and strategy can be initiated:

— Have you evaluated the market demand for your product or service?
— Is your product or service ability well defined and ready for customer application (i.e. does it meet the required quality standards)? It is generally inadvisable to attempt to market a product or service of undefined quality.
— Have you identified potential customers or users?
— Have you identified the actual cost and selling price of the product or service?
— Do you have a professional person to do, or assist with, your marketing, promotion and sales campaign?
— Have you developed a selling strategy or approach?
— Have you prepared an information brochure or web page which will assist in the marketing of your product or service?

— Do you have the full technical ability to achieve the quantity and quality of production required for the successful implementation of the product or service should you acquire a customer(s)?
— Do you need technical assistance in finalizing the quality status of your service or product?
— Have you considered a technical partner?
— Do you have a mechanism for obtaining customer feedback?
— Have you carefully considered and evaluated what would entice a customer to buy from you?

The list below gives some reasons why customers might prefer one supplier over another.

— Quality of product or services
— Consistency of quality
— Guaranteed delivery networks
— Back-up service
— Environmentally acceptable practices
— Complete service (from sample preparation to final results)
— Proven technical know-how
— Compliance with local and international safety and quality standards
— Personal contact
— Punctuality, or timeliness of delivery
— Good customer relations
— A variety or group of products or services
— Flexibility
— Ability to deal with diversity.

2.14. Financing

In this part of the strategic planning process the responsible person should summarize on a table the budget required to implement the plan. This should include income and expenditures for each fiscal year, according to the duration of the strategic plan. Budget information should be presented in such a manner that financial people can clearly understand where the money is being used. An example of some items that need to be included are:

— Labour
— Fuel
— Maintenance
— Modifications
— Projects
— Upgrades
— Waste management
— Overhead.

Clearly this is just a summary of some key points. Much more is needed for a complete financial plan for most research reactors.

2.15. Review and feedback

As mentioned previously, the strategic plan is a useful management document as well as a planning tool. Therefore, it should be regarded as dynamic. It should be subjected to review and appropriate revision periodically. At the same time, implementation of the various strategic issues should be monitored for suitable progress against the applicable milestones set in the specific objectives and action steps.

2.15.1. Review of the strategic plan

During preparation of the strategic plan, facility management should ensure that the contribution to the various sections of the document receives input from the responsible persons identified in the strategic plan. Where possible the final strategic plan should be formally accepted by all involved management (e.g. front page signature). This will ensure both accuracy of relevant information as well as ownership in the document.

In those cases where the facility manager feels that such advise or input is desirable, the strategic plan could also be submitted for review to one or two facility managers at other reactors. The IAEA is willing to assist in finding peer reviewers if requested. It is also willing to perform an informal review for facilities in Member States.

2.15.2. Revision of the strategic plan

During the period of application of the strategic plan, it is inevitable that the need to change certain strategies will arise. Review of the strategic plan to evaluate its applicability should be done by the responsible management and the necessary revisions implemented in the document. Generally this should be done at least once a year.

2.15.3. Progress reporting

The implementation of the final strategic plan needs to be reviewed on an on-going basis to ensure that its application is satisfactory. This part should include the control methods that will be applied by management during the on-going application period.

Control should include specified methods of reporting required by the responsible persons (e.g. written and/or oral) as well as the frequencies (e.g. monthly, quarterly and/or annually).

Possible topics for reporting should correspond to the objectives and action steps identified in the strategic plan. Examples include:

— Operational achievements.
— Status of completion or achievement of specific objectives or action steps.
— Finances.
— Levels of commercial or academic utilization.
— Safety (e.g. radiological, nuclear or conventional).
— Project progress.

2.16. Conclusion

The IAEA believes that the survivability of many research reactors around the world depends upon the development and implementation of an effective strategic plan. It is hoped that this document will provide sufficient guidance to facilitate this process.

ANNEX

STRATEGIC PLAN FOR RESEARCH FACILITY	*ANY RESEARCH REACTOR*
Date prepared:	*Sept 14, 2000*

Title of Major Objective :	*INCREASE RESEARCH REACTOR UTILIZATION*				
Person Responsible for Objective:	*FACILITY MANAGER*				
No/Priority	Specific Objective	Responsible	Resources	Schedule	Notes
1	*To upgrade the collimation system in BP#1 to enable more effective use of the SANS facility by Sept. 2001.*	*Charles*	*2 Person-year*	*Start: March 2001* *Completion : September 2001*	*Business case required for new equipment.*
2	*To increase the utilization hours of the neutron diffraction facility by academic institutions 30% within 18 months.*	*Jan*	*3 Person-year*	*Start: April 2001* *Completion: June 2002*	*Academic institution involvement required*
3	*To double the capacity for in-core irradiations for ageing studies within one year.*	*Simon*	*0.5 Person-year*	*Start: October 2000* *Completion: June 2001*	*Marketing group to identify all industries with ageing issues*

CONTRIBUTORS TO DRAFTING AND REVIEW

Dodd, B.	International Atomic Energy Agency
Franklin, S.	Imperial College Reactor, United Kingdom
Klein, J.	Comisión Chilena de Energía, Chile
Letourneau, J.-P.	Atomic Energy of Canada Ltd, Canada
Mikus, J.	Nuclear Research Institute, Czech Republic
Piani, C. S. B.	SAFARI-1 Research Reactor, South Africa

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