Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

15-Feb-2002

English - Or. English

**ENVIRONMENT DIRECTORATE**
**ENVIRONMENT POLICY COMMITTEE**

ENV/EPOC/GEEI/BIO(2001)8/FINAL
Unclassified

## Working Party on Economic and Environmental Policy Integration
## Working Group on Economic Aspects of Biodiversity

# THE NORWEGIAN MASTER PLAN FOR WATER RESOURCES - A NATIONAL CO-ORDINATED PLAN FOR NON-DEVELOPED HYDROPOWER SOURCES
**Application of a multicriteria approach**

**CASE STUDY: NORWAY**

**JT00120896**



English - Or. English

## FOREWORD

This report was contributed as a national case study to an OECD project on the Applied Evaluation of Biodiversity, being carried out by the Working Group on the Economic Aspects of Biodiversity. It does not necessarily reflect the views of individual OECD Member countries or of the OECD Secretariat. It is published under the responsibility of the Secretary General.

**TABLE OF CONTENTS**

# THE NORWEGIAN MASTER PLAN FOR WATER RESOURCES – A NATIONAL CO-ORDINATED PLAN FOR NON-DEVELOPED HYDROPOWER SOURCES
## Application of a multicriteria approach

by

Hilde Kyrkjebø

## Executive Summary

This case study describes the methodology used in a plan invented for ranking non-developed hydropower sources. The plan was initiated due to increasing concern from various interest groups toward further development of the remaining hydropower sources. The idea was to evaluate projects with the aim of prioritising the projects and to develop the most economically sound and least environmentally damaging projects first.

A multicriteria methodology was established for ranking groups of projects accounting for a number of screening stages. Consequences for 13 user interests are described for each project. Among these interests are nature conservation, wildlife, fish and reindeer husbandry. A score from –4 to + 4 was assigned to each interest (–4 indicates a very serious negative impact, and +4 similarly positive impact).

The projects were ranked on the basis of user interest scores and the economy of the project (the total development costs pr capacity unit) using a preference function. After possible correction for regional economy, size of the project and comments from stakeholders, they were placed in three categories. The first category included projects most favourable for development (both economically and from an environmental point of view). It was proposed that only projects in this first category could be considered for a licence, in order to cover the energy demand for the years to come. The second category included projects that might be exploited for power production at a later stage or could be used for other purposes. The third category included watercourses that were not regarded as relevant for development, either because of serious conflicts with other user interests, and/or because of high financial costs involved.

A major research effort was invested in development of the plan. The aim was to evaluate every project equally according to a set of criteria and also to give insight to the different steps in the process. The process involved various ministries, government agencies and other stakeholders (power companies, NGOs and local authorities).

The first Master Plan was presented to the Parliament in 1985 and political consensus was achieved. The plan has since served as a strategic tool for further development of the non-developed hydropower sources. The case study describes the method that was used initially to establish the plan.

**Ecosystem studied:** Watercourses and the surrounding natural environment

**Valuation Method(s) used:** A multicriteria approach, a methodology that combines qualitative and monetary units

**Main lessons learned:** In the Master Plan impacts for different user interests are evaluated collectively for a large number of potential hydropower-projects, and the results compared for the purpose of setting an order of priority. The work shows that it was easier to reach some kind of consensus about which projects to develop through the ranking of projects (instead of individual project proposals). The plan has served as a strategic tool for further development of non-developed hydropower sources, to secure an overall positive net impact where both potential positive economic and negative environmental aspects are included.

**Contact details of the delegate:** Hilde Kyrkjebø, Directorate for Nature Management, N- 7485 Trondheim, Email: hilde.kyrkjebo@dirnat.no, Tel: (47) 73 58 09 45, Fax:(47) 73 58 05 01.

## 1. General description

- *Ecosystem*: Watercourses and the surrounding natural environment.

- *Description of main impacts*: The predicted impacts of potential hydropower projects are described and evaluated for 13 user interests. Among these interests are nature conservation, wildlife and fish, reindeer husbandry, water supply and protection against pollution.

- *Description of main sources of these impacts*: Potential hydropower development.

- *Key objective of the valuation exercise*: Ranking of hydropower development projects to find the most favourable both economically and environmentally. Impacts of potential hydropower projects are evaluated according to a set of criteria. Classification of area (environmental value of the watercourse), consequences for other commercial and non-commercial interests and development costs related to electricity production potential are appraised. A multicriteria approach was chosen in order to rank the projects, based on impact assessment for the different user interests and the economy of the project.

***The focus of the case study***

For many years development of the watercourses in Norway has created a basis for steadily increasing production and use of energy. Until the late 1970s Norwegian hydropower was evaluated and developed project by project (through a licence process). Through the 1970s the conflicts with other users became more dominant. There was increasing conflict concerning hydropower development and protection of rivers. For each project some would typically argue that the project in question would lead to only a marginal reduction in the rich Norwegian population of rivers, whereas other would regard the river as a representative of an environmental resource exposed to constant pressure. The different stakeholders eventually realised that a more comprehensive approach was needed.

Increased environmental concerns for the remaining watercourses made it important for the Norwegian Parliament to achieve an agreement for development of the projects with the greatest overall positive net impacts on Norwegian society, where both potential positive economic and negative environmentally aspects were included. As a result of this view a Master Plan was designed to rank the remaining hydropower projects from such a perspective, and the proposal to carry out a Master Plan for water resources was endorsed by the Norwegian government in 1981. The Ministry of Environment was responsible for the Master Plan. The work was carried out in co-operation with the Ministry of Petroleum and Energy, the Norwegian Water Resources and Energy Directorate, and in collaboration with other ministries, agencies, government research institutes and local authorities. The plan should not only focus on ranking hydroelectric projects. Another purpose of the plan was to specify which watercourses that should preferably be reserved for other uses, for example rivers for conservation.

## 2. Identification of causes and sources of pressures

- *Identification of sectoral activity and resulting pressure*: Potential change of land use through hydropower development (activity from energy sector).

- *Underlying cause:* Increased energy consumption per capita.

## 3. Impacts on ecosystem in general

The most important effects on nature as a result of hydropower developments are related to changes in the natural course of the watercourse itself, changes in the flow of water and intervention connected with buildings and constructions. This last type of interventions includes dams, quarries, rock tips, roads and power transmission lines. A hydropower development has also various indirect effects on the surrounding natural environment. The nature and magnitude of impacts are highly site specific, vary significantly from one project to another and vary according to the biotopes in which projects are sited.

The main potential sources of impacts on biodiversity are:

- loss or creation of terrestrial and aquatic habitats
- modification of water quality
- regulation of stream flow downstream from dams
- flood control in flood plains
- obstacle to fish migration
- introduction and dispersal of species

Most hydropower development projects have negative effects on fish and wildlife. Wildlife is affected because the places important for reproduction may be lost because areas of land are fenced in, immersed, or split up by dam-construction, magazine, roads or power transmission lines. A dam built in a valley destroys the most productive areas of land, and moose, deer and wild reindeer are often prevented from following their usual trails. The wetlands, with their rich and vulnerable bird population, often including species of high protection value, may be exposed to flooding or draining in connection with the power development. Fish migration may also be prevented.

## 4. Impacts on economy and welfare: Rationale for the valuation method and results.

***The valuation objective***

The overall objective for the Master Plan was to rank the remaining hydropower projects based on economic and environmental variables. The Master Plan was invented to make a priority grouping of projects. Based on this ranking, the idea was that only the projects that were the most economically sound and the least environmentally damaging would be considered for a licence. (When projects is considered for a licence, a final weighing of the different interests is undertaken, based on a more comprehensive impact assessment analysis.) Further the plan should provide the basis for making decision on which watercourses that could be used for other purposes (by specification of which watercourses that should preferably be reserved for other uses.)

The ambition of the plan was to include the remaining potential hydroelectric projects and address them in an overall evaluation process. All together 542 alternative projects were to be appraised. This meant that a large number of projects should be evaluated within a short period of time, and it was necessary with relatively simple procedures. A multicriteria approach was chosen. The aim was to classify every development project equally according to a set of criteria. It was necessary to standardise the description of watercourses and the consequences of development. The analytical work was separated in

different steps. Both formal methods and more individual judgement were used. A secondary, but not less important aim was to make it possible later on to control/give insight to the different steps in the process, to recall which basis each decision were based on.

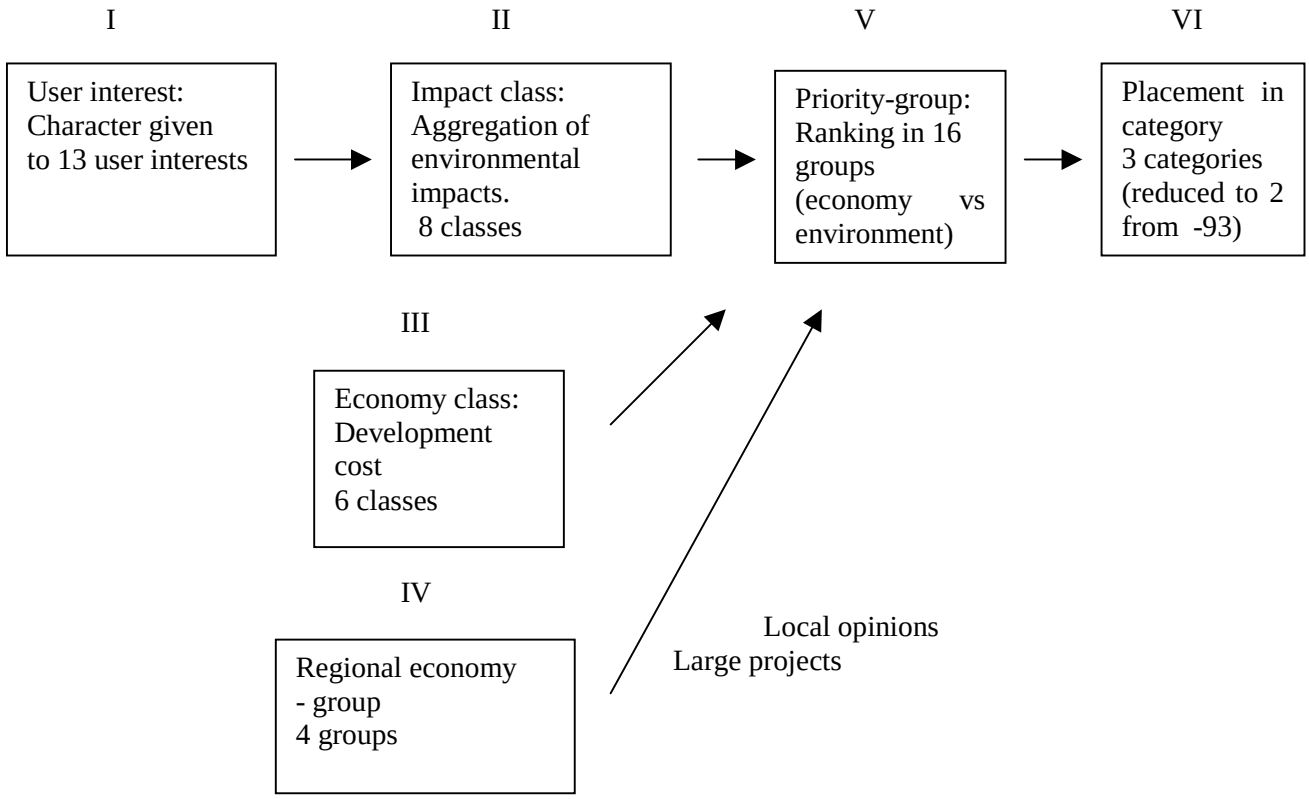
***Sketch of the process***

In the Master Plan, all the interests are evaluated collectively for a large number of projects, and the results are compared for the purpose of setting up an order of priority for the projects. The next chapters will present the different steps of the process in more detail. An overview of the process is given in this chapter.

A total of 16 topics of study (whereby 13 user interests, see chapter A) were defined and evaluated in several phases. Consequences of development were described by each project. For each of the user interest, a score on the scale from –4 to + 4 was assigned to each project. A score of –4 indicates a very serious negative impact, and +4 similarly positive impact. The projects were ranked based on the total evaluation of the user interest (impact classes) and project economy (total costs pr capacity unit). On this basis, the projects were classified into 16 priority groups (put into a matrix). With higher-numbered groups considered less viable for development.

The final priority groupings were made after possible correction for regional economy, size of the projects and the local opinion. The projects were then grouped into three categories and it was proposed that only projects placed in the first category could apply and be considered for a licence immediately, in order to cover the energy demand in the years to come. The second category included projects that might be exploited for power production in the future or used for other purposes. The third category included watercourses that were not regarded as relevant for development, either because of serious conflicts with other user interests, and/or because of high costs involved.

Figure 1 **Master Plan for Water Resources - sketch of the process**




***More about the different steps in the evaluation process***

To make an overall evaluation of the aggregated impacts of the potential hydropower development, and a final ranking of the different projects, it was necessary to separate the analytical work into the following steps:

A. Identification of topics of study (hereby 13 user interests) – basis for evaluation
B. Identification of relevant criteria for the assessment (classification of area and impacts)
C. Classification of impacts (preliminary) – based on report from each watercourse
D. Classification of impacts in the Master Plan – addressed in an overall process - (I)
E. Total impact analysis (weighting of interests) – (II)
F. Economy class - (III)
G. Priority grouping (preliminary) – weighting environment versus economy
H. Final priority grouping – after possible adjustment for regional economy group etc. – (V)
I. Placement in category – (VI)

*A. Identification of topics of study*

In order to investigate the professional basis for the Master Plan – a total of 16 topics of study were defined, hereby 13 user interests.

The topics of study included:

- expected hydropower capacity and financial costs of the project
- the regional economic impact
- data quality (the consideration for mapping and data)
- nature conservation
- outdoor recreation
- fish
- wildlife
- water supply
- protection against pollution
- preservation of cultural monuments
- agricultural and forestry
- reindeer husbandry
- prevention of flooding and erosion
- ice formation and water temperature
- transport
- climate

Expert groups were established to administer the investigation and the studies necessary to chart the different interests. In the course of the work, emphasis was placed on avoiding overlapping, to avoid some interests being counted twice in the impact analysis.

Data quality and regional economy were classified on a scale from 1 and 4. For each of the user interest, a score on the scale from –4 to + 4 was assigned. A score of –4 indicates a very serious negative impact, and +4 similarly positive impact. The quality of area before development (applied to some interests) was given a score between 1 and 4, a score of 4 indicating high value.

*B. Identification of criteria for assessment*

Criteria were identified to standardise the description of the watercourses and the description of the impacts for the different user interests. Relevant criteria to classify an area before development were described, and relevant criteria to describe and classify the impacts of potential development projects for the different user interests were presented. How to use map and how to process data were also described. The expert groups made guidelines for each user interests and a sample report was also produced.

*C. Classification of impacts (preliminary) - based on reports for each watercourse*

For every project considered in the Master Plan, the interests/scientific areas were evaluated and the professional conclusions included in a report on each watercourse. The individual report on the watercourses was presented in the form of an impact analysis with a uniform content. The reports contains an introduction chapter on the natural resource base and society, another chapter on the different uses and interests connected with the watercourse, a chapter on hydro-electric projects, a fourth chapter on the effects of development, and finally conclusion and summary.

In the reports, the predicted consequences of the different projects were described and evaluated for the 16 topics. For some interests (applied on nature conservation, outdoor recreation, wildlife, fish, ancient monuments and reindeer husbandry), the area was described prior to development, that is to say the value of the area was charted.

This was followed by a preliminary impact assessment for each hydroelectric project. Scores for the expected impact on the different interests were given according to the presented criteria. For each project the degree of conflict for the 13 user interest associated was measured on a scale from –4 to + 4. The impact analyses in the reports on the watercourses were preliminary, since they were made on the basis of the watercourses and the hydroelectric projects seen separately.

A main effort in the Master Plan was directed toward preparation of the reports for the watercourses. Major parts of the work were done in the counties. A Master Plan co-ordinator in each county was responsible for preparing the reports on the watercourse in his county, and for distributing the reports to different stakeholders for comments. He was also responsible for co-ordinating the work in the county, collection of data, and contact with the municipalities, various expert authorities and organisations.

The affected municipalities were included in the work at an early stage, through dedicated meetings and other arrangements. Local interest organisations (NGOs) and relevant developer of hydropower-plants were also kept informed. It was considered particularly important to ensure that all affected parties were given the opportunity to read the reports and submit their comments. Generally the subjects addressed by the stakeholders agreed well with the impact analyses presented in the reports on the individual watercourses.

*D. Classification of impacts in the Master Plan*

Based on the reports from the different watercourses, the comments received and additional professional evaluations by the expert groups, a total impact analysis was carried out.

The preliminary impacts described in the reports were corrected in the light of adjustments to the plans, regional and national evaluations (how valuable from a regional or national perspective), and the comments from interested parties (relevant hydropower companies, municipalities, NGOs).

For each of the user interest, a score on the scale from –4 to + 4 was assigned to each project, but now seen in relation to, and compared to, other watercourses and projects.

*E. Total impact analysis for the projects (weighting interests)*

The 13 variables expressing conflicts were then reduced to one variable, representing the overall conflict potential for each project. To compute the overall conflict potential of a project, the following procedure was adopted:

The first step was to sort the projects “technically” in two alternative ways where all the user interests had the same weight:

(a) The number of occurrence of – 4 and –3 scores (“extreme values”) for the 13 interests were counted. The results indicated whether the project was at all acceptable. In this connection the projects were sorted into eight profile groups.

(b) The average value for the scores in each project was calculated and sorted into groups. The results indicated the general conflict potential of the project.

In the next step each project was evaluated individually. The two ranking procedures were used as a reference for the final ranking.

Based on the overall conflict potential variable, the projects were sorted in eight environmental impact classes. Emphasis was given to the comments received from the different interested parties, and the regional and national evaluations (how valuable from a regional or national perspective).

The impact classes were ranked according to a scale from 1 to 8, where class 1 represent the one with the least negative impact on environment, and class 8 the one with the greatest negative impact on environment.

*F. Economy*

All the projects were classified according to the financial cost connected with the development and construction of the power plant. The variable economy was expressed by cost divided by mean annual production, 1/3 weight on summer production and 2/3 weight on winter production. The values were grouped into six classes (6 economy classes). Projects with the lowest cost in relation to power production were placed in economy class 1 and projects with the highest cost in relation to power production placed in economy class 6. The cost was based on the technology at the time.

*G. Priority grouping (preliminary) - weighting environment versus economy*

The next step in the process was to weight the economy of the project against the impact class. With six economy classes and eight impact classes, there were 48 possible combinations. These 48 possibilities were reduced to 16 priority groups, and projects regarded as most relevant for development were placed in priority group 1 and projects regarded the least relevant were placed in priority group 16.

In order to do so the following strategy (preference function) was chosen in priority setting between impacts and economy: Projects with the best economy and the least negative effects on environment were placed in the first priority groups and when sorting the projects into these groups, emphasis was placed on giving relatively more weight to the economy of the projects. For placement in the highest priority groups the impact classes were given relative higher weight. This system of priority groupings means that more weight is given to undisturbed nature, as more of the remaining water resources are developed.

Table 1 assigns a priority group to any project based on a combination of economy and its classification of impacts. The lower the cost of energy produced and the more limited the projects adverse effects, the lower is its priority group. The priority class is found by combining the economy classes (E1 ..E6) and the impact classes ( I1..I8) of the projects. The priority groups (P1..16) are inside the matrix:

Table 1 **Priority setting between impacts and economy in the Master plan (preference function)**

| | | Impact class | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small conflict | | | | | | | Very serious conflict |
| | | **I1** | **I2** | **I3** | **I4** | **I5** | **I6** | **I7** | **I8** |
| Low cost | **E1** | 1 | 1 | 2 | 3 | 5 | 7 | 9 | 12 |
| **Economy Class** | **E2** | 1 | 1 | 2 | 3 | 5 | 7 | 9 | 12 |
| | **E3** | 2 | 2 | 3 | 4 | 6 | 8 | 10 | 13 |
| | **E4** | 3 | 3 | 4 | 5 | 7 | 9 | 11 | 14 |
| | **E5** | 4 | 4 | 5 | 6 | 8 | 10 | 12 | 15 |
| High cost | **E6** | 5 | 5 | 6 | 7 | 9 | 11 | 13 | 16 |

Category 1 Category 2 Category 3

*H. Final priority grouping – after possible adjustment for regional economy etc*

Before the projects were finally placed in the priority groups, possible adjustment concerning grouping was considered for the following variables: a) regional economy b) large projects and c) comments from the stakeholders.

a) Regional economy

An evaluation of the economic situation of the municipality involved, and the assumed effect of hydro-development, has provided a basis for dividing the hydro-development projects into four groups on the basis of regional economic consideration.

The first group is characterised by the following conditions: The state of the municipal is relatively good, with a level of income taxes above average and little unemployment. The project will have little effect on employment and income from taxes. Those municipalities are given low priority from the point of view of regional policy. At the other end of the scale, group 4, the conditions are characterised as follows: The state of the municipality is especially poor, with income from taxes generally below 70 per cent of the average. Unemployment is high, and the power production is expected to have a fairly substantial effect on employment and income from taxes. Those municipalities are given high priority from the point of view of regional policy. In the sub-division bases on the regional economy, the two remaining groups lie between these extremities.

It was possible to move a project to a lower priority group (maximum two), if important for the regional economy.

b) Large projects

The size of the project was not a formal ranking criterion, but some large projects were promoted because of their size.

Because larger projects may easily have a major impact on the other user interests, they will easily be placed far down in the priority grouping. This may have an unfortunate effect, because several smaller projects, taken together, may result in equally serious negative effects as one large project. This was also taken into account by moving some larger projects further up in the order of priority.

c) Comments

Some projects have been given a different place on the priority list as a result of the comments received on the main report. For projects where the affected interests are mainly local, emphasis was placed on the comments from the municipalities and counties. Where national interests are affected, however, these were largely decisive.

It was possible to move a project to a higher priority group (maximum 2), if there was strong local resistance against the project.

*I. Placement in categories*

A project order was proposed through the placement in category. In this phase a further consideration was made when the priority groups were put into the three categories. It was proposed that only projects placed in category I could be considered for a license.

Category I : comprised priority group 1-5 in the Master Plan. It was proposed that only projects in this category should be considered for a license (if an application was made), in order to ensure an adequate supply of energy in the years to come.

Category II : comprised priority group 6-8 in the Master Plan. Projects in this group could be used for hydropower development later on ("projects on hold"- not possible to apply for a licence today) or might be used for other purposes. (And Projects in category II only to be moved to category I through updates endorsed by the Parliament.)

Category III: comprised priority group 9-16 in the Master Plan. The project in this group, in the light of the technical solutions evaluated, are not considered relevant for hydro-power development, due to the large degree of conflict with other user interests and/or high cost of development.

(This has later been reduced to two categories, one category open for licence application, and another where application for a licence is not possible for the time being.)

***Results achieved***

*The final product*

The first Master plan was presented in 1985. The plan was based on 285 reports covering 310 watercourses and represented an annual power potential of 41TWh. Altogether, 542 alternative projects

were considered. These were all treated in separate reports, worked out in close collaboration with professional experts, local planners and power companies, various interest groups and the Ministry of Environment in co-operation with the Ministry of Petroleum and Energy.

The plan gave an overview of the hydropower resources, and an overview of the conflicting interest in the watercourses. Through the plan the most valuable watercourses were identified and a "preliminary " protection against hydropower development was proposed. Through the priority grouping (weighting environment versus economy) the plan presented a proposal of an administrative procedure for further development of the remaining hydropower sources.

*Involvement of stakeholders*

The process was partly based on a "intensive hearing process". The different reports have been sent, in turn, to counties, municipalities, power companies and local interest organisations for comment. On the basis of the reports on the watercourses, the comments received and additional professional evaluations, a main report was prepared which was also distributed to affected parties for comments.

The main impression from the comments received was that the impacts of hydropower developments, as assumed by expert groups responsible for the reports, confirmed very well with the feedback from the various stakeholders.

*About the process / approach*

In the Master Plan a large number of potential projects were addressed in one process and this is the strength of the chosen approach (instead of addressing individual projects and sites, one by one). The development of watercourses for hydropower installation presents a number of apparently incommensurable environmental, economic and social trade-offs. A multicriteria approach, were many interests were seen together, gave a solution to a complicated issue. Conflict between political goals and scientific ideals was solved through a dialectic process.

Strength of the chosen method is that it is simple and easy to understand. From the very start of the process it was regarded necessary to use qualitative measurement for measuring the impacts for the different user interests. In the final ranking it was assumed necessary to judge each project individually, but with the help of a more technical ranking as a base. An effort was made concerning verification of the different steps to include transparency in the process (to allow for possible inspection after finalisation). Through involvement of stakeholders, a consensus on which watercourse to develop first was reached.

There has been criticism to the approach (mostly from researchers) that the method could have been more analytical and less process-oriented. Some has the view that the plan could have involved more monetary valuation for relevant commercial interest, like agriculture. There has also been discussion about the interests chosen, double counting (correlation), treatment of large projects etc. Some of these elements have later been considered in relation to potential change in the grouping, but no major changes have been made so far.

The implicit valuation attached to the various user interests revealed through the first Master Plan is later estimated by statistical analysis (Carlsen, Strand and Wenstøp 1993). It is calculated that on average the implicit environmental costs comprise about 70% of the financial cost (construction and operational) for the projects in Category I, and about 160% for all projects.

## 5. Design of Policy Responses based on Valuation Results

*Stakeholder involvement*: NGO's initiative initially, co-operation, hearings/proposal circulated for comment. (see chapter 4)

*Institutional development:* Measure: Regulation according to which hydroelectric projects that may be considered for a licence.

### *Administrative procedure*

The Master Plan presented a proposal for an administrative procedure for further development of the remaining hydropower sources (White paper 63, 1984-85). The proposal was generally well received by politicians and the ranking proposal in the first Master Plan was endorsed by the Parliament. The Master Plan has since served as a strategic tool for further development of the non-developed hydropower sources. On the basis of the plan the Parliament has given the instruction to the authorities that only projects placed in Category I (regardless of priority-group) can be considered for a licence. Projects in the other categories have to wait.

The Master Plan has been serving as a pre-sorting of possible hydroelectric projects, where ranking have been based on feasibility studies of the potential projects. Through the license application process a more comprehensive approach is taken and an environmental impact assessment is required before a license is finally considered.

Generally there is a need to update the variables in the Master Plan since technical solutions, the design of the projects and economic calculations may change. For many of the projects dealt with in the first plan, alternative solutions for development have also been suggested later on. Generally this has lead to more environmental friendly projects.

Continued work (regularly updates presented for the Parliament) will clarify whether alternative developments can be found in watercourses where the conflicts of interests are less serious, or that are cheaper to develop, and which watercourses should be protected or made available for other user interests. Adjustments to the plan have been discussed by the Parliament twice, since the first main report was treated by Parliament. New projects have been included in the list of projects (evaluation and categorisation undertaken) and some projects have left since the watercourses have been given the status as protected under the National Plan for Protection.

Since many of the most valuable watercourses identified in the Master Plan is now protected and the remaining resources for hydroelectric development are getting scarcer (many of the projects are now developed), there is nowadays a discussions about the further development of the plan. Starting in 2001, the Master Plan will be revised and simplified. The proposed line of work is to change from evaluation and sorting of proposed projects, into an evaluation and sorting of watercourses, thus giving the environmental classification of rivers more focus. The new direction corresponds well with the intentions of the EU Framework Directive on Water Management.

## 6. Policy relevant conclusions

### *Lesson learned*

In the Master Plan impacts for different user interests are evaluated collectively for a large number of potential hydropower-projects, and the results compared for the purpose of setting up an order

of priority for the projects. The work shows that it was easier to reach some kind of consensus about which projects to develop through the ranking of projects (instead of individual project proposals). A multicriteria approach, were many interests were seen together, gave a solution to a complicated issue. Conflict between political goals and scientific ideals was solved through a dialectic process. It was important to verify the different steps to include transparency in the process.

Of course such an overall approach presupposes information on large parts of the area within the country. Maybe there is no way around such an overall scanning process when there is multiple use and diverging public interest and conflicts.

It was political consensus about the Master Plan when it was presented. The plan consisted of a major research effort and a complicated political process, involving various ministries and government agencies, private organisations and finally the Norwegian Parliament. Participation of different expert and Ministries lead to a shared ownership to the result. The involvement of other stakeholders (NGOs, power companies and local authorities) was also important for the consensus.

The plan has served as a strategic tool for further development of non-developed hydropower sources, to secure an overall positive net impact where both potential positive economic and negative environmentally aspects are included.

***Transferability of the experience***

The plan shows the application of a multicriteria approach. The approach may be relevant for similar areas where absence of monetary values (or difficulties with monetary evaluation) necessitate an alternative weighting system to rank the different alternatives.