

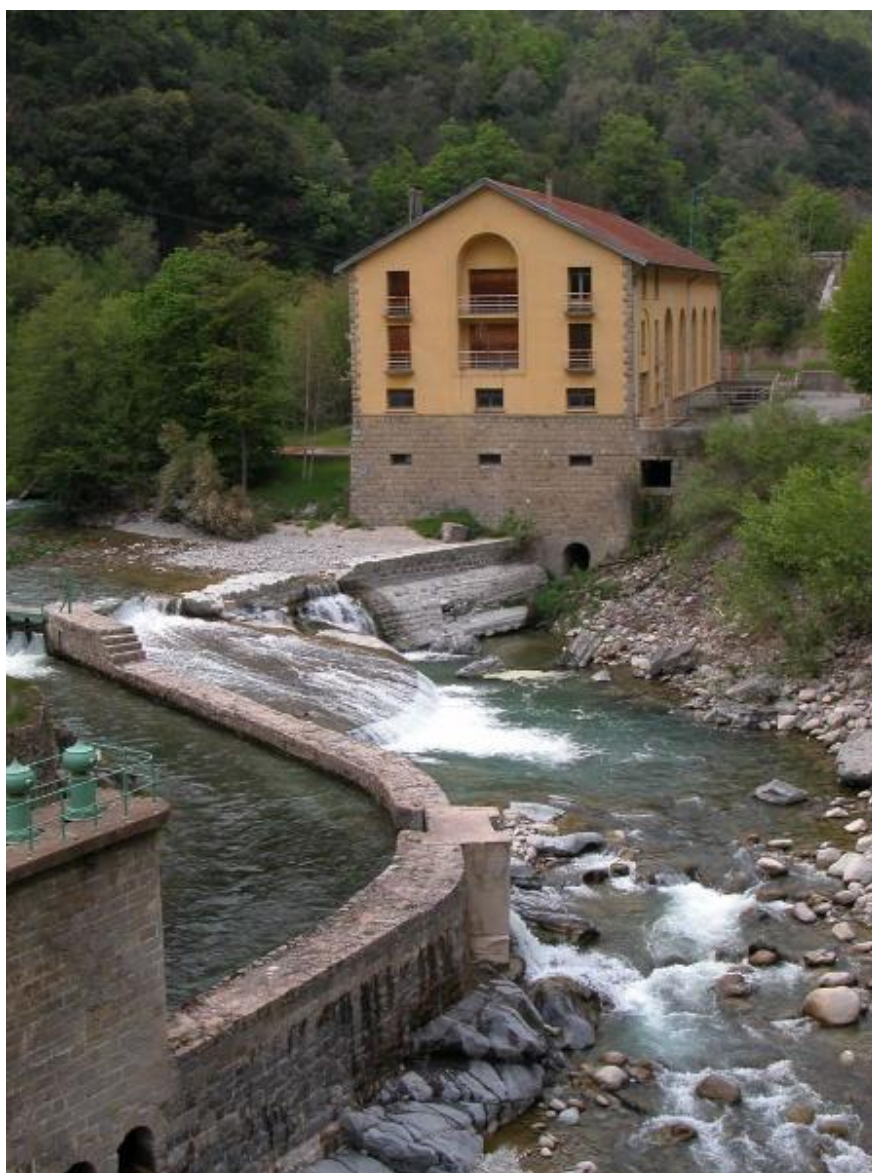
**IEA** - INTERNATIONAL ENERGY AGENCY

**IMPLEMENTING AGREEMENT FOR  
HYDROPOWER TECHNOLOGIES AND PROGRAMMES**

**STRATEGIES FOR MEETING THE CHALLENGES TO HYDROPOWER  
IN THE 21<sup>ST</sup> CENTURY**

*A strategic approach to the direction of hydropower  
and the Implementing Agreement*

**PHASE 3**



JULY, 2004

## **STRATEGIES FOR MEETING THE CHALLENGES TO HYDROPOWER IN THE 21<sup>ST</sup> CENTURY :**

### ***A strategic approach to the direction of hydropower and the Hydropower Implementing Agreement***

The Implementing Agreement for Hydropower Technologies and Programmes (Implementing Agreement) started the 21<sup>st</sup> Century addressing the challenges associated with the development and/or continued operation of hydropower projects. Members of the Implementing Agreement believe that hydropower, when well-planned, constructed and operated, represents a reliable and renewable source of electrical energy that can help meet the growing energy needs of the world, in a sustainable manner.

The challenge facing participants in the Implementing Agreement is to move to the next level, to provide balanced, objective information to decision makers and the public on the merits of hydropower as a valuable renewable and sustainable resource, while continuing to expand the universe of knowledge on this subject. In relation to this there has been a recent encouraging development. Ministers and Government Representatives from 154 countries gathered from June 1<sup>st</sup> to 4<sup>th</sup>, 2004, in Bonn (Germany) for the International Conference for Renewable Energies. Building upon the agreements reached at the Earth Summit in Rio de Janeiro (1992), the Millennium Declaration and the Millennium Development Goals (2000), and the World Summit for Sustainable Development (2002), they committed to boost the global share of renewable energy within the total energy supply.

The Political Declaration signed in Bonn, identifies hydropower as one of the renewable technologies "to be substantially increased with a sense of urgency". It recognized that hydropower, together with solar, wind, biomass/fuel and geothermal energy, "can significantly contribute to sustainable development, to providing access to energy, especially to the poor, to mitigating greenhouse gas emissions, reducing harmful air pollutants, thereby creating new economic opportunities, and enhancing energy security through cooperation and collaboration."

The Hydropower Executive Committee (ExCo), has developed strategies for the future direction of the Implementing Agreement in the 21<sup>st</sup> century that are aligned with these international priorities. They are presented here as the Strategic Plan for Phase 3.

## **HYDROPOWER IN THE 21<sup>ST</sup> CENTURY**

Hydropower was one of the original and predominant sources of electrical energy in the early and mid-20<sup>th</sup> century. With the world's electricity production predominantly from fossil fuels, and energy demand continuing to escalate, the pressures on the world's climate and general environmental well-being are also growing. In most countries, hydropower's role is now less significant in terms of overall energy production, although often important for the provision of ancillary services, including storage. Over the last two decades the development of new hydropower projects, as well as the modernization of existing plants, while still significant, has been under increasing pressure for a variety of financial, environmental, social and regulatory reasons.

However there are opportunities for hydropower to have a more significant position as a sustainable component of the world's portfolio of energy production. To achieve this, six Strategic Issues have been selected by the Implementing Agreement as the focus of Phase 3:

- ➔ Strategic Issue 1 – Vision, Mission, Goals, and Objectives of the Implementing Agreement
- ➔ Strategic Issue 2 – Public Acceptance of Hydropower
- ➔ Strategic Issue 3 – Strategic Initiatives
- ➔ Strategic Issue 4 – Strategic Alliances with other Organizations
- ➔ Strategic Issue 5 – Increased Membership
- ➔ Strategic Issue 6 – Research Priorities

## **STRATEGIC ISSUE 1 – VISION, MISSION, AND GOALS, OF THE EXECUTIVE COMMITTEE**

The foundation of an organization's goals and objectives is the Vision Statement it has chosen to guide it into the future. The Vision Statement identifies the direction that an organization is moving toward, and forms the basis of its goals. The Implementing Agreement represents a partnership of countries, each with an investment in hydropower as an energy resource.

The members of the Executive Committee see their **Vision** as:

***Facilitating worldwide recognition of hydropower as a well established, environmentally and socially desirable renewable energy technology***

In recognition of this Vision the Executive Committee believes its **Mission** is:

***To encourage the sound management and use of hydropower through awareness, knowledge, and support.***

This statement of Mission defines the role the Implementing Agreement would like to play in order to accomplish its Vision. To accomplish its Mission, the Executive Committee has identified the following program-based strategy:

- ➔ Encourage Public Acceptance of Hydropower as a feasible, socially desirable form of renewable energy.
- ➔ Increase the current wealth of knowledge on a wide array of issues currently associated with hydropower.
- ➔ Explore areas of common interest among international organizations in the continued use of hydropower as a socially desirable energy resource.
- ➔ Bring a balanced view of hydropower to the worldwide debate on its feasibility as an environmentally desirable energy technology.
- ➔ Encourage an interdisciplinary approach to the research needed to support the technology.

## **STRATEGIC ISSUE 2 – PUBLIC ACCEPTANCE OF HYDROPOWER**

The Executive Committee believes that the successful future of hydropower is, to a degree, dependent on articulating a clear and objective message about the advantages and disadvantages of hydropower technology. The underlying belief is that well-planned, constructed and operated hydropower represents a viable competitive renewable energy technology. While there are consequences of this technology, resulting in either social or environmental impacts, there are also benefits associated with development and operations that result in a relatively clean energy technology, when compared to currently available alternatives.

A continuing initiative of the Implementing Agreement will be the dissemination of this information. The results from Annex VI, which document hydropower's positive aspects will be communicated to a wide array of audiences through the members of the Executive Committee, the Operating Agents of all Annexes and the Implementing Agreement web site.

## **STRATEGIC ISSUE 3 – STRATEGIC INITIATIVES**

The strength of the Implementing Agreement has been the quality products that have been developed within the Annexes organized under the Executive Committee. Valuable information has been developed and published in the areas of Small Hydropower Resources and Technologies; Public Awareness; Hydropower Competency Network; and Good Practice. While some of the Annexes are completing their work, others are seeing the need to continue their studies, taking their research to new levels.

While it is clear that the work accomplished in Phase 2 has been of tremendous value to the hydropower industry, it is just as clear that much more needs to be done. Issues associated with the socially responsible development and operation of hydropower projects continue to face the industry. To fulfil its Vision for Phase 3 of the Implementing Agreement, the Executive Committee is considering the following initiatives, through the continuation of existing Annexes, and the creation of new Annexes:

### **Continuing Annexes**

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Annex II	Small Hydropower Resources and Technologies
Annex VI	Public Awareness
Annex VII	Hydropower Competence Network
Annex VIII	Hydropower Good Practices

### **Proposed New Annexes**

1. Security of Hydropower Facilities
2. Integration of Wind into Hydro Systems
3. Economic Aspects of Pumped Storage
4. Ancillary Services provided by Hydropower
5. Development of Hydropower in LEDC's to Provide Sustainable Energy Sources

The Executive Committee, may, at any point, choose to pursue either additional or different initiatives, or may modify the initiatives presented here.

The following summarizes each of the continuing and proposed new Phase 3 strategic initiatives:

#### **→ Small Hydropower Resources and Technologies**

Annex II on Small Hydropower will continue into Phase 3 with a work plan that will include:

- |                      |  |
|----------------------|--|
| <b>General</b>       | <ul style="list-style-type: none"> <li>• world wide small hydro information and technology exchange (website)</li> <li>• lessons learned, promotions, barriers</li> </ul>  |
| <b>Technical</b>     | <ul style="list-style-type: none"> <li>• Practical applications of environmental mitigation measures for small hydro plants</li> <li>• Innovative technologies for small hydro development</li> <li>• Successful rehabilitation of small hydro</li> </ul>  |
| <b>International</b> | <ul style="list-style-type: none"> <li>• Co-operating with international and country-aid programmes</li> <li>• Clean Development Mechanisms (CDM) and climate change related to small hydro issues</li> <li>• Input to aid programs of IEA member countries and multi-lateral organizations</li> </ul> |

#### **→ Public Awareness**

In Phase 2, Annex VI on Public Awareness addressed the issue of public acceptance of hydropower through the provision of objective, balanced information. Outcomes included various documents and publications, and an extensive web-based information source.

While the specific work plan for Phase 3 is still under consideration, it would include a new body of participants, as well as a new Operating Agent. Activities would include accumulating information for further populating the web-site, and initiating key programs previously identified, but not yet implemented.

### → **Hydropower Competence Network / Integrated Hydropower Education Systems**

Annex VII on Hydropower Competence Network for Education and Training (HCN) will be succeeded in Phase 3 by an Annex named Integrated Hydropower Education Systems.

While the specific work plan for Phase 3 is still under consideration, it includes:

- Incorporating current issues into existing education systems
- Absorbing current knowledge and world-wide experience to enable engineers to effectively solve hydropower problems
- Tasks covering social, environmental, economic and technical issues such as
  - Advanced operation and maintenance measures
  - Innovative construction methods
  - Social and environmental challenges
  - Risk management, analysis and evaluation
  - Water resource development systems
  - Economic and financial measures
- Enlarged application of the competence network developed in Phase 2

### → **Hydropower Good Practices**

Annex VIII on Hydropower Good Practices will continue into Phase 3. The work plan includes the publication and dissemination of the case history report compiled in Phase 2. This is scheduled for the latter half of 2004. Other future activities are under consideration.

### → **Security of Hydropower Facilities**

Since September 11<sup>th</sup>, 2001 there has been a heightened awareness of man-made security hazards to hydropower projects. This, together with the already well-developed response mechanism to natural hazards, has led to a number of comprehensive, but largely national or regional, approaches. Proposals for a new Annex on Security of Hydropower Facilities will be presented at the next EXCO meeting, with an initial activity being a comprehensive review of on-going initiatives. This will include utility-specific, regional, national and international programs and plans for the future. In addition to security hazards, consideration will be given to including the broader issue of safety of hydropower facilities, as well as to operating-level public safety initiatives.

### → **Integration of Wind into Hydropower Systems**

Wind generation is growing rapidly throughout the world as efficiency, reliability and cost performance improves. World wide over 30,000 MW have been installed, with a 10 to 20% growth per year. As wind power is intermittent and cannot be reliably forecast, the integration of these resources into an electricity grid can have significant impacts. Hydropower, through its flexible operation mode and reservoir storage capability, is considered by the wind industry as an ideal partner in certain locations. This is enhanced by hydropower's physical land technical infrastructure already in place. From its perspective, the hydropower industry acknowledges both the benefits, and the potential restrictions, in providing a "firm and shape" service. The Wind Implementing Agreement has formed an Annex on the Integration of Wind and Hydropower System, and has proposed that the Hydropower Implementing Agreement form a similar Annex. The proposed Annex on Integration of Wind into Hydropower Systems would have some common goals, and some discrete to the Hydropower industry. Working together with the Wind Annex, the

Hydropower Annex would have the objective of identifying ways that hydropower could enhance the development of wind energy, while increasing its own value and effectiveness.

→ **Economic Aspects of Pumped Storage**

Hydropower's role as an energy producer is enhanced by its value as a provider of ancillary services. Energy storage requirements are also increasing in importance and value to support both large-scale fossil-based generation and small-scale distributed generation; particularly where large amounts of non-firm renewables are integrated. The role of hydropower in providing energy storage through pumped storage is a significant opportunity in some electricity systems, though barriers exist to its wide-scale deployment.

A proposed new Annex would address the opportunities for pumped storage as well as the barriers, and provide suggestions for ways to improve economics, viability and acceptance.

→ **Ancillary Services Provided by Hydro Power**

The previous two Strategic Initiatives cover specific aspects relating to ancillary services provided by hydropower. However the broader issues of the provision of these services could be the subject of a new, and separate Annex. Alternatively, these initiatives could be bundled as tasks under one, or two, Annexes. The level of interest and final decision will be made at the next ExCo meeting in November 2004.

→ **Development of Hydropower in LEDC's to Provide Sustainable Energy Sources**

In many countries hydropower, together with dams for irrigation, water supply, etc., has had important roles in their economic and social development. Recently, barriers which are both real and perceived, have slowed this growth in many parts of the world. Electricity, together with clean drinking water and water for irrigation, is arguably the most important driver for quality of life and opportunities in these countries, yet the rate of development is far less than needed.

This proposed Annex will work with national and multi-national agencies to gather experiences of good practice, identify opportunities for change and address systemic barriers. From this, the Annex will propose ways that hydropower can help address the needs of LEDC's to provide sustainable energy sources through low cost electricity.

***STRATEGIC ISSUE 4 – STRATEGIC ALLIANCES WITH OTHER ORGANIZATIONS***

Throughout the world there are numerous organizations involved in continuing the advancement of hydropower. Most notable of these groups are the International Hydropower Association (IHA), International Committee on Large Dams (ICOLD), the United States National Hydropower (NHA) and the Canadian Hydropower Association (CHA). In addition, there are other less well known groups.

During Phase 2, the Hydropower Implementing Agreement initiated a formal process to co-ordinate positions on issues of importance to hydropower. Led by the IHA, "Joint Meetings of International Water and Energy Organizations" are now held as a regular pre-conference activity prior to the annual HydroVision/WaterPower conferences in the USA and Canada. At these meetings participants report on their activities, identify their challenges, and discuss issues of possible collaboration.

- In Phase 3, a Strategic Outreach Sub-Committee (Alliances) will be established within the Executive Committee, charged with co-ordinating outcomes from the IHA led Joint Meetings. It will also identify needs for, and establish, strategic alliances, with other hydropower interest groups worldwide. Alliances will focus on areas of common

needs and interests, and will be geared towards seeking solutions to common problems.

### **STRATEGIC ISSUE 5 – INCREASED MEMBERSHIP**

The strength of the Hydropower Implementing Agreement will be enhanced by membership of an increased number of countries (both inside and outside the OECD) that operate significant amounts of hydropower, or are in the construction/planning stages. Specifically the Executive Committee will seek to increase membership in countries with a significant and well-organized hydropower infrastructure. This will be achieved by a Strategic Outreach Sub-Committee (Membership) through activities designed to:

- ➔ Identify potential new member countries, and develop networks with their representatives
- ➔ Communicate with potential new members the activities of the Annex, the benefits of participation, and the ways in which this will enhance those countries' own national hydropower activities
- ➔ Present activities and outcomes of the Hydropower Implementing Agreement at national and international meetings
- ➔ Communicate specific technologies and programmes directly through papers, brochures and web-sites

### **STRATEGIC ISSUE 6 – RESEARCH PRIORITIES**

The challenges to hydropower development - including changing social values on energy choices, concerns about environmental impacts, and general restructuring of the regulatory framework governing energy production – create new requirements and opportunities for information to adequately support hydropower development. Most research underway at present is related to improvements in equipment, methods to assess performance and software. While the majority of investment is provided by the manufacturing and commercial sectors, limited funds are also invested by public and private utilities through research groups such as CEA Technologies and EPRI. However, there is little investment in research in other, non-equipment areas nor any structured, co-ordinated approaches addressing the full span of research needed to support the technology. Issues such as what areas require either new or additional study, the amount of investment needed, and who should take leadership roles in sponsoring studies need to be addressed.

The Executive Committee recognizes that it is in a unique position, with membership representing major hydropower producing nations worldwide, to bring a co-ordinated response to the needs for research to support hydropower operations and development. Based on the expertise of its members, the Executive Committee can play a key substantial role in identifying research needs, scoping research studies, and identifying potential supporters.

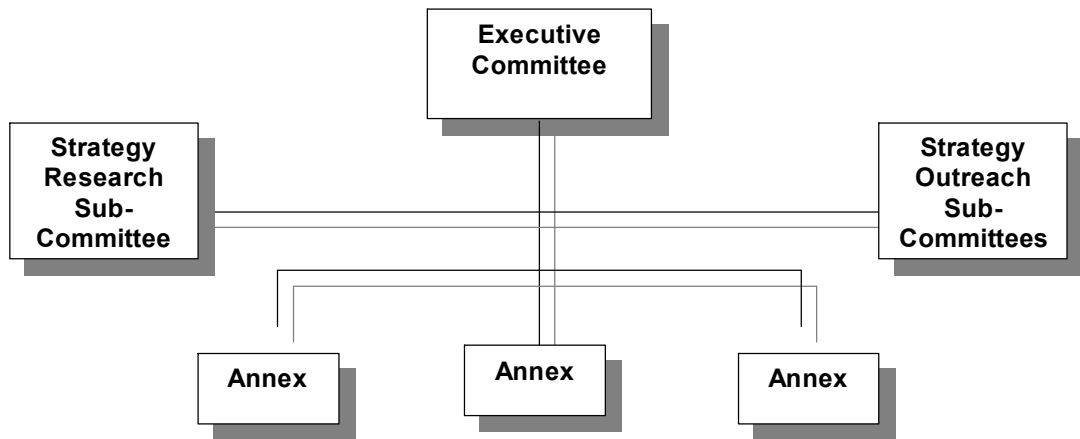
- ➔ In Phase 3 of the Implementing Agreement, a Strategic Research Sub-Committee will be organized that will address the needs of research in the hydropower community. There are many areas of research in hydropower needing consideration and these will be identified through workshops and coordination with research groups such as CEA Technologies, EPRI and others. The deliverables from this committee will be a report outlining R&D needs as well as the benefits achievable.

## **ORGANIZING TO MEET THE CHALLENGE**

To meet the mandates contained in this strategic plan, the Implementing Agreement will organize around a system of sub-Committees and Annexes. Figure 1 shows the proposed organization for

the Implementing Agreement in Phase 3. Table 1 shows the strategic position of Annexes in Phase 3.

### Organization Chart



**Figure 1. Proposed organization of the *Implementing Agreement on Hydropower Technologies and Programmes*, Phase 3.**

During Phase 2, five Annexes were continued, or created, to study, and report on various issues important to hydropower. In Phase 3, studies are expected to continue in existing Annexes II, VI, VII and VIII, and commence in up to five new Annexes.

**Table 1. Potential Structure of Annexes under Phase 3 of the Implementing Agreement on Hydropower Technologies and Programmes**

<u>Annex #</u>	<u>Principal Responsibility</u>	<u>Status</u>
II	Small Scale Hydropower Resources and Technologies	Continued from Phase 2
VI	Public Awareness of Hydropower	Continued from Phase 2
VII	Integrated Hydropower Education Systems	Continued from Phase 2, but renamed
VIII	Hydropower Good Practices	Continued from Phase 2
IX	Security of Hydropower Facilities	New to Phase 3

X	Integration of Wind into Hydro Systems	New to Phase 3
XI	Economic Aspects of Pumped Storage	New to Phase 3
XII	Ancillary Services Provided by Hydropower	New to Phase 3
XIII	Development of Hydropower in LECD's to Provide Sustainable Energy Sources	New to Phase 3

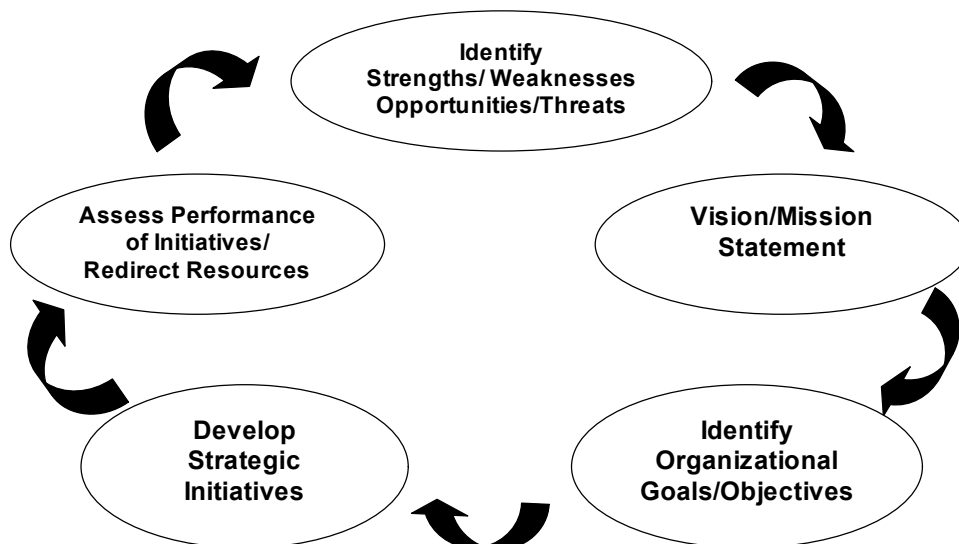
The principal changes from Phase 2 are as follows:

- the addition of five new Annexes to address certain critical issues
- the addition of three sub-Committees: Strategic Research, Strategic Outreach (Membership) and Strategic Outreach (Alliances).

### STRATEGIC PLANNING PROCESS

Strategic Planning is a process to reach an organization's vision by developing a coherent and achievable strategy. To address its future the Executive Committee used a Strategic Planning process as illustrated in Figure 2.

**Figure 2. Strategic Planning Process.**



The Strategic Planning process was begun in 1998 with a discussion of the potential Strengths and Weaknesses/Opportunities and Threats that face the Hydropower Industry today. The discussion was based on a series of papers emanating from a document entitled *The Future of*

*Hydropower*; a discussion of potential strategic initiatives necessary to further the beneficial aspects of hydropower worldwide.

Based on this paper, and the discussion it generated, the Executive Committee was able to develop the Vision and Mission Statements that form the foundation of all of its activities. The Statements clearly express the belief that members of the Implementing Agreement represent some of the best expertise in the hydropower industry and that cumulatively the resources that they bring to the Executive Committee can be a formidable force in shaping the future of the industry.

From the Vision and Mission Statements, programme goals were established that then led to strategic initiatives. The initiatives form the core of what Phase 3 will accomplish to support hydropower as a viable energy resource.

During the first year of Phase 3, the Executive Committee will undertake a formal review of the Strategic Planning Process to ensure that the goals continue to be focused on the Vision and Mission Statement. Recognizing that Strategic Planning is a dynamic process, the Executive Committee will thereafter periodically review progress against what is proposed. Some adjustments to the plan may be needed to improve overall efficiency and guarantee greatest return on investment with respect to initiatives pursued.

#### **COLLABORATION WITH THE RENEWABLE ENERGY WORKING PARTY (REWP)**

The Hydropower Implementing Agreement operates within an institutional structure that comprises its Executive Committee and its Annexes, the Committee on Energy Research and Technology (CERT), the IEA Governing Board, and the Renewable Energy Working Party (REWP). REWP supports and guides the Hydropower IA as it contributes positively to the quality of the IEA Energy Technology Collaboration Program, as well as to the national programmes of the Contracting Parties.

During Phase 3, the Hydropower IA Executive committee will continue to collaborate with the REWP to:

- ➔ Add value to national R&D programmes through international collaboration
- ➔ Promote REWP R&D strategy for developing renewable energy technologies and solutions
- ➔ Contribute to the strategic agenda of the REWP

The Hydropower Implementing Agreement looks forward to a productive working arrangement with REWP to achieve our objectives in Phase 3.