



# Dams FOR Human Sustainable Development

## ICOLD: 80 years old and still young !

**O**n November 24<sup>th</sup> 2008, ICOLD celebrated its 80<sup>th</sup> birthday in the prestigious Palais de la Découverte, in Paris, on the Champs Elysées. 450 persons from 45 countries gathered around ICOLD officials, ministers and other high level persons from all over the world for this historic celebration, which was coupled with another important event at UNESCO: Solving the Water and Energy Nexus.

The celebration was also the occasion for officially launching the “World Declaration on Hydropower and Dams for African Sustainable Development”, initiated by ICOLD and joined by the World Energy Council, the African Union, the

Union of Producers, Transporters and Distributors of Electric Power in Africa, the ICID and the IHA.

In this special issue of the Dams newsletter, we highlight the most important elements of the historic celebration under the general theme: “Dams for human sustainable development”. After the opening ceremony by officials, two round tables addressed the two crucial subjects of water and energy.

The variety of the presentations from different countries shows how ICOLD, after 80 years of sharing experience, is continuing to work for human sustainable development by helping the world to manage water resources.

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# 80 YEARS OF ICOLD: a prestigious celebration



Mr Luis Berga  
President of ICOLD

**ICOLD** President Berga opened the ceremony with a all-encompassing speech on ICOLD and its importance for the world of dams and hydropower. He presented ICOLD and the history of its foundation, then explained that “Our organisation is based upon five pillars: the National Committees, the Executive Committee, the Officers, the Secretary General and the Central Office, and the Technical, Administrative, and Special (Ad Hoc) Committees. The National Committees are our central pillar and our purpose, and one of our main tasks is to support, encourage and promote the activities of these National Committees, in order to ensure that we are forever present in the different regions and countries of the world.” He also paid a tribute to “All those honourable engineers and experts of great prestige [who] have contributed to the progress of ICOLD, and to disseminating the organisation’s activities all over the world. It is from here that we can take the opportunity to remember them with great respect and consideration.”

The Former President of the French Committee, **Mr Patrick Le Delliou**, brought to the audience apologies from **Mr Jean-Louis Borloo**, State Minister for Energy, Sustainable Development and Land Use. “Mr Borloo was not able to welcome this ICOLD event, as still

planned a few days ago”. He then recalled the history of Gustave Mercier, the first President of ICOLD. “In France like everywhere, ICOLD is a tremendous asset. It offers dam specialists a unique opportunity to share knowledge.”

After praising the role of technical committees, Mr Le Delliou explained why the French committee changed its name from “Comité Français des Grands Barrages” (French Committee on Large Dams) to “Comité Français des Barrages-Réservoirs” (French Committee for Dams and Reservoirs). The word “large” has disappeared because we wanted to build references also for the multitude of small



Mr Patrick Le Delliou  
Former President of the  
French Committee



# in Paris



Mr Michel de Vivo  
Secretary General of ICOLD

dams, with their specific problems. The word “reservoirs” has appeared because it conveys the multiple uses of the storage. This name change reflects an evolution similar to that of ICOLD, which has created a technical committee on small dams.

The President of the French « Académie des Technologies », **Mr François Guinot** saw in ICOLD “the promoter of a formidable technology” and “an essential actor in solving crucial problems for humanity’s future”. No sustainable development is possible without access to water and energy. There are substitutes for oil and other fossil energies. But there is no substitute for water, so essential for life.

He called for entering the “symbiotic era”: “Like the Neolithic revolution, it will be a new definition of man’s relationship to nature and it will drive home the realisation that the whole human species shares a common destiny. Humanity must take the responsibility for a harmonious co-evolution with the other living species, to reach a symbiosis. Symbiosis being defined as a long term coexistence of two species with a mutual benefit. Dams can be a strong element of this new symbiotic era. You know where the problems to be solved are in order to ensure they will be. Everybody is waiting for what you are going to produce in the next 80 years !

**Mr Christian Kert**, member of the French National Assembly then spoke : “ICOLD helped me greatly by inviting me to its annual meeting in Sofia at a moment when I was drafting a report for the French National Assembly devoted to dam safety. During that meeting, I was able to witness a community of destiny among all the dam professionals of the world”.

“Dams for human sustainable development... two years ago, I would have questioned the reality of that motto. Today, I say it in front of you, it’s obvious that dams can be a tool for sustainable development. (...) Yes, I believe it’s a little bit of daily life which runs into your pipes”



Mr François Guinot  
President of the French  
“Académie des Technologies”



Mr Christian Kert  
Member of the French  
National Assembly

## Speech by Honorary President Giovanni Lombardi

**“Authorities, ladies and gentlemen, dear ICOLD friends”**

After a long and intense period of development of the dam building industry, it seemed, when I left the Presidency just 20 years ago, that this golden age of hydraulic infrastructure would end definitely. The reasons for that tendency are multiple. First, the number of potential sites in the “old” countries was shrinking fast or had even reached zero. Then, as you know, “Green Fundamentalism” has indirectly contributed to orient productive investments toward other projects like fossil fuel plants, much less environmentally favorable. And finally, the messages of the “World Commission on Dams”, may be well-intentioned, but are in reality negative and misleading, and have succeeded in turning the world financing institutions away from the terrible problems of water, irrigation and energy, internationally. The situation of those problems has worsened and the impact of the allegedly scientific report of the WCD is diminishing, the interest for hydraulic works is back. Because they can contribute, partially, but in an efficient and sustainable way, to solve those problems.

The situation of those problems has worsened and the impact of the allegedly scientific report of the WCD is diminishing, interest in river development works is back. Because they can contribute, partially, but in an efficient and sustainable way, to solve those problems.

Since it accompanied closely the development of dams during the last century, ICOLD will have to promote, accompany and support this renaissance, of course on the technical side of the matter, but also on all the other aspects of it :safety, ecology, economy. I am sure it will know how to do it.

One of the eminently useful functions of ICOLD is to create privileged relations between its members all around the world. Another function, equally important, is the huge and very serious work of its technical committees, which should be congratulated and thanked.

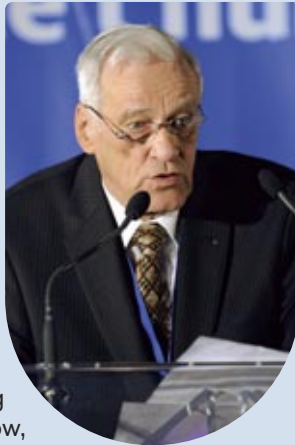
(...)

One problem should preoccupy all of us : the lack of engineers in most of the countries, and not only for the dam industry. There are many reasons for that.

The lack of public consideration for the engineering professions; the length and the difficulty of the necessary studies and the sustained commitment they require; the sirens song of financial engineering, which led many brilliant young adults into the virtual world, away from reality (let’s hope that with the wrecking of this virtual world, this will cease); the illusion that the world was “built” and that therefore, the engineer-builder was no longer necessary; the responsibilities which rest with the engineer are not so easily accepted, in a time when “rights” seem more important than “duties”; finally the proliferation of bureaucratic activities, which is also affecting our profession and which stifles many initiatives.

I wish that ICOLD should follow closely this very important situation and that it should continue to direct the focus of public awareness towards the public, youth especially, on the tremendous problems that need to be solved in the near future and on the absolute necessity of getting a sufficient number of competent engineers. It’s a new mission for ICOLD - only partly new - that it will surely know how to fulfill.

I, of course, wish that ICOLD should continue and develop its public interest mission, which deserves admiration and gratitude.



Mrs Claude Nahon, Sustainable Development Director at EDF, underlined the major role played by hydroelectricity for the development of France and the major role it could have in the future for the development of third world countries. She declared herself “fascinated by the Chinese commitment to double its hydroelectric installed capacity”. Similarly, she described Brazilian and Indian commitments as examples that hydroelectricity is transforming itself “from a renewable energy to a sustainable energy”.

For her, change in the dam world will be based on three pillars:

Governance: We need more transparency, more dialog with all the stakeholders on the territory.

Climate change contribution: We have to demonstrate that dams in tropical zones are not emitters of methane. We are of course all convinced of that, but we have to demonstrate it to other non-specialists with measurements and shared analysis.

The sustainability of water resources: The world of Water thinks about energy, as demonstrated by the themes at the World Water Forum in Istanbul. I think it is crucial that the Energy sector thinks about Water.



Mrs Claude Nahon  
Sustainable Development  
Director at EDF



"Meanwhile, in order to face the challenges of financial crisis, the Chinese government has decided to add 4000 billion yuans of investment. 20% of that amount will be devoted to the water sector."

We are quite confident that for a quite long period of time, hydropower development and dam building projects will not be hampered by the financial crisis, on the contrary.

We are quite confident that ICOLD will have another 80 years of prosperous development and will certainly make even greater contributions to sustainable development of mankind.



**Mr Wang Schucheng**  
Former Chinese Minister for Water and President of the Chinese Committee on Large Dams



**Khun Dan Prakarnchol**  
(Thailand)

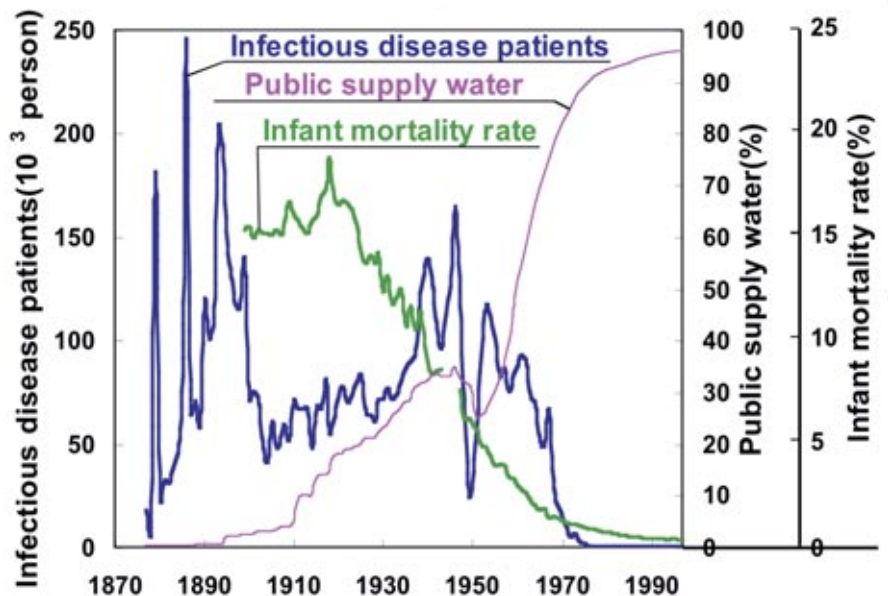
**Mr Wang Schucheng**, Former Chinese Minister for Water and President of the Chinese Committee on Large Dams gave a passionate speech about dams and the world crisis

"Many difficulties have been encountered in the last years: Many important crises like tsunami, world increase of prices, climate change, earthquakes, energy crisis, financial crisis. To encounter these challenges, I think infrastructures like water conservancy projects should not be affected. On the contrary, they should be speeded up in order to confront those difficulties."

To solve the energy problems and to change China overreliance on coal fired plants, Hydro-power development has become a priority in China. Every year, 10 000 MW of hydro power are added topotential, and the total installed capacity has reached 145 GW. In 2030, it will reach 300 GW, that is 60% of the total potential.

To solve the food security problem, the Chinese Government is planning to build grain productive basins with a total producing capacity of 15 billion kg. To ensure the success of these basins, one of the important things is to speed up water conservancy programs.

This graph shows, with Japanese figures, how dams are enhancing public health: Infant mortality rate and number of infectious disease patients are decreasing with public water supply increase.





Mr Pierre-André Wiltzer  
President of the French  
Agency for Development

because of bad examples of the past, where errors were committed in the evaluation of environmental impact. That is why we, and other lending agencies, including the World Bank, have put in place environmental and social impact criteria, before granting loans.”

“We have financed major dam projects like the Manantali on the Senegal river in Mali or the Bujagali dam in Uganda and we will continue to do so. I wanted to stress on the occasion of ICOLD's 80<sup>th</sup> birthday that for us hydropower is one of the crucial renewable energies for the future.”

An illustration of that brilliant future was immediately given by the next step of the ceremony : the presentation of the World Declaration on Dams and Hydropower for Sustainable Development. ●



In the past 80 years, ICOLD has made outstanding contributions and became one of the most influential international organizations. Since 1974, when China became a member of ICOLD, we have been trying hard to participate to all kind of activities. In the future, Chinese Large Dams Committee will further consolidate its relations with ICOLD. We wish to become good friends with all our colleagues from the world.

Mr Pierre-André Wiltzer, the President of the French Development Agency explained why dams were playing a crucial role in development projects.

“I came here to bring you the experience of an aid operator financing great projects and dams: the French Development Agency (AFD). AFD is helping through loans and technical assistance. Energy is, of course, for us one of the main sectors for intervention. We have been working the energy sector since the 50s and we are continuing to do so. Energy demand is increasing in the developing sector and hydro-power will certainly play a key role in the future for facing these needs. Everyone know the problems of fossil fuel issue: scarcity and climate change.”

“Renewable energies have been identified as a key priority by the French Government. But renewable energies must be produced in an environmentally responsible way : it is true for hydropower as it is true for wind or solar energy. We know that dams are sometimes questioned



Mr Abdoulaye Kombari  
Burkina Faso Delegate  
Minister for Agriculture



Kurobe Dam  
(Japan)



# ROUND TABLE Water

# Ressources

**Mr Uzuseck** made a presentation on water and dams in Turkey, the country which welcomed the World Water Forum this year. Turkey is located in a semi-arid region : precipitation has thus an uneven distribution. Water availability is constantly decreasing with population growth: from 4000 m<sup>3</sup> per capita in 1960 to 1600 today, with 1000 expected for



**Mr Ergün Üzücek**  
DS , Head of Dams and Hydro  
Power Plants Division (Turkey)

2030. This 62% of the dams in operation (that is 369 dams) are devoted to small scale irrigation.

**Mr Arthur Walz** explained how water is essential for achieving Millenium Development goals. He gave examples of how climate change is already affecting the water cycle in the USA: there is Loss of Snowpack in the Sierra Nevada Mountains, a decline in the runoff of Sacramento River. "All this highlights the need to adjust reservoir operations as part of the regional water management plan".

Giving a perspective on domestic water requirements (50 liters per capita per day), industry (it takes 246 000 liters of water to produce one ton of steel) and agriculture, he showed how Dams and Reservoirs are "our most realistic option" to facilitate nation building in the emerging and developing countries and for regional development in developed countries.

According to Arthur Walz, we have to move from traditional water resources development to "Integrated Water Resources Management in the river basin". The American specialist ended his presentation with a quote from Founding Father Benjamin Franklin: "When the well runs dry, you know the value of water".



**Mr. Arthur Walz**  
Past Vice-President  
of ICOLD (USA)

**Mr Norihisa Matsumoto,  
Vice-President of ICOLD (Japan)**

**Dams and societies :  
a very long story !**

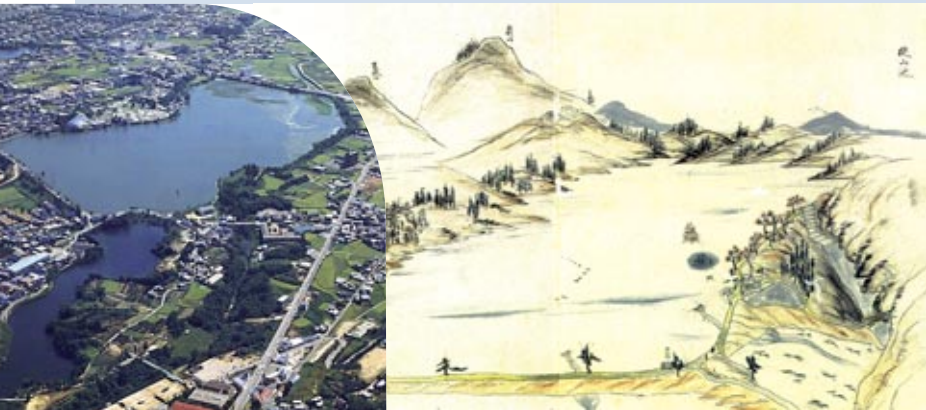
Mr Matsumoto showed the audience how much dams are an intimate part of human history, using Japanese examples. The increase of public supply water is clearly anticorrelated with infant mortality rate and the number of infectious disease patients (as shown on the figure page 5) since the beginning of Japan industrial revolution. More remotely in the past, the availability of water has always been crucial for growing rice, the most important food in Japan. Many irrigation network were created and carefully maintained for centuries, to bring water to the rice paddy fields. The oldest dam in Japan, Sayamaike, built in 616, was such a dam built for irrigation. Along the centuries, it was constantly raised and major rehabilitations were made six times in 1400 years. Now downstream area is densely populated. Its bottom was excavated by as much as three meters and the dam crest was raised by 1.1 meter. Increased storage capacity is used for flood control.



**Mr Adama Nombre**  
Past Vice-President  
of ICOLD (Burkina Faso)

It was a perfect introduction for Past Vice-President **Adama Nombre** who talked on the challenges of water in Africa. Beside the development goals already mentioned, he reminded of the particular situation of Africa regarding water basins : "out of 200 international water basins in the world, 55 are situated in Africa, where 80% of the water resource is shared." This explains why there was so many international basin authorities which developed such as the Nile Basin Initiative, the Niger Basin Authority or the Mano River Union.

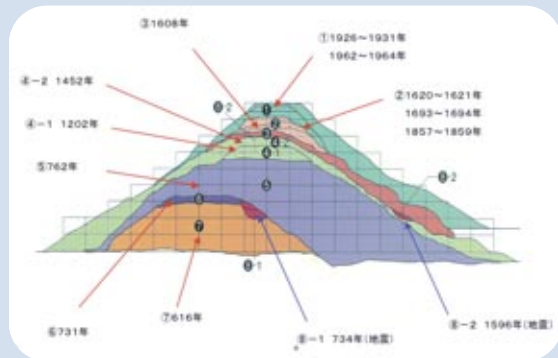
**Mr Bernard Tardieu**, Vice-President of ICOLD, choose first to illustrate how reservoirs helped to develop thirsty southern France, during the 50s. Then he turned to the large water transfer project, showing that the technologies first developed by the dam engineering societies were then applied in many other projects. He went through the examples of the great man made river of Libya, the Beni Haroun Project of Algeria, the Gurara Project of Nigeria. He also detailed two important canal projects: the Seine-North Sea Project in Europe and the new Panama Canal, concluding that "science, technology, engineering methods developed for dams fertilize all hydraulic projects".



On the illustrations, from right to left, a 18<sup>th</sup> century view of the Sayama Ike Dam, and the dam after the 1996 rehabilitation; below a cut view showing the history of the modifications on the dam.

Said Mr Matsumoto: "In 2005, Japanese population amounted to 127 million and the population decreased by about 10 000. This was the first time to happen since we had started taking our census. The future population will decline. Self-sufficiency

of food, clean domestic energy and other issues will become more important. We have lived with water. We have used dams and reservoirs. We have rehabilitated, modified and upgraded dams. I am optimistic that our sons and daughters will use dams and reservoir wisely. I just hope to transfer our experience to them."



**Mr Bernard Tardieu**  
Vice-President  
of ICOLD (France)





# ROUND TABLE Energy

# Challenges



Mr C.V.J. Varma  
Honorary President  
of ICOLD (India)

**Honorary President C.V.J. Varma**, President of the Indian Council of Power Utilities, briefly reminded the audience of the water and energy challenges in India, his country. But he devoted most of his time to proposing a program of action for the future of ICOLD, in 5 points: 1) To prepare a base on the need for storage reservoirs vis-à-vis the misconception that run-of-river projects are a better option. 2) The Public Awareness Committee should be given back the importance it used to enjoy and given full support and guidance. 3) Perhaps a sub-group of the committee should be entrusted with the responsibility on preparing a note as was done earlier when environmental aspects were discussed. 4) The Committee on Seismicity should be renamed as "Reservoirs and Seismicity". 5) Till now, Clean Development Mechanism benefits (in the Kyoto Protocol) are only admissible to Hydro-power Stations up to 50 MW capacity. This should be extended to stations of more than 50 MW.



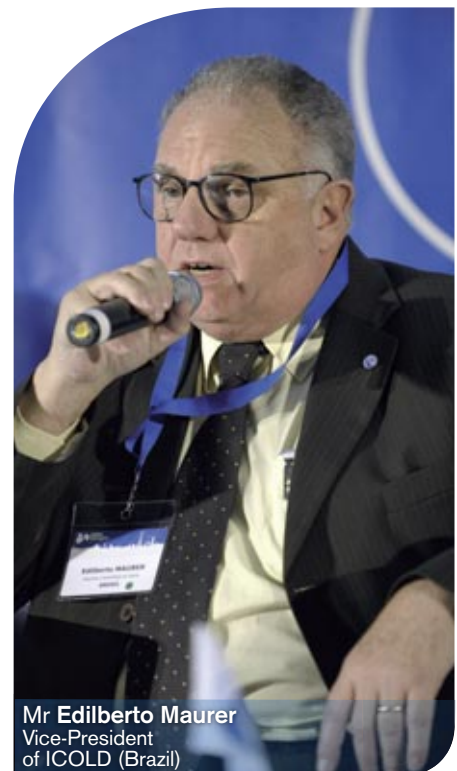


Mr E. Bellendir  
Director of the Engineering Company  
Vedeneev VNIIG (Russia)



Mr E. Bellendir then gave a general presentation on Russia. "Russia offers one of the largest hydro-power resources globally - about 10% of global hydro-power resources. We are in the second place in world after China in terms of commercial hydro resources". There is still a huge hydropower potential to be developed, especially in Siberia, where 20% of the potential is developed, and in the Far East, where only 6% is developed. Those figures compare to China's (20%) and India (22%). He then detailed some of the projects being constructed on the Tipton River, in South Yakoutia. Rushydro is the largest generator of electricity in Russia and the number two hydro generating company in the world in terms of installed capacity : 50 hydro power plants with about 25 GW capacity in 2008.

The public's attention was then brought to the other side of the world, when Mr **Edilberto Maurer**, ICOLD Vice-President gave a general vision of hydropower in Brazil. Generating 75.8% of Brazilian electricity, the hydropower plants play a key role in its development and will continue to do so in the future. Two huge projects are in construction : the Belo Monte plant (11 182 MW) in the state of Para and the Madeira River plant (10 250 MW), near the Peruvian border.



Mr Edilberto Maurer  
Vice-President  
of ICOLD (Brazil)



Mr Jia Jinseng  
Vice-President  
of ICOLD (China)

Mr Jia Jinseng, Vice-President of ICOLD, highlighted the crucial challenges facing his country, where hydro-power is 5% inferior to the world's average, despite the 145 GW capacity available in 2007. But that represented only 14% of the total electricity in China, with thermal power constituting 83%, well above the world average. He explained that four crucial questions are asked now: How to guarantee dam safety? How to be sustainable hydro-power? How to minimize social impacts? How to rehabilitate the existed dams with incidents? For each of these questions, he gave examples of the way Chinese dam engineers were looking forward and bettering their performance.



Mrs Alison Bartle, editor of the International Journal on Hydropower & Dams gave a most interesting presentation, replete with many figures on world hydropower production, which now stands at 3045 TWh/year. Hydro capacity is 848 400 MW and Hydro-supplies more than 50% of national electricity in more than 50 countries. There is about 158 000 MW of hydro under construction, and more than 350 000 MW planned. Mrs Bartle took the audience to a world tour of large dams under construction, noting that the World's fastest growing economies are also the leading countries for hydro and dam development: the so-called BRIC countries (Brasil, Russia, India, China). ●



Mrs Alison Bartle  
Director of Hydropower  
& Dams Magazine



Thissauros  
(Greece)



**Mr J-F. Astofli**  
Senior Vice-President of  
Hydro Generation and Engineering  
Division of EDF (France)

# Nam Theun

## A partnership FOR development

By Mr J-F. Astofli, Senior Vice-President of Hydro Generation and Engineering Division of EDF (France)

development objectives. It is forecast that when commercial operation commences in December 2009, the project will provide an annual revenue to Laos of US\$ 80 million in the form of taxes, royalty charges and dividends. This will be the largest single source of foreign exchange income to the country.

The Nam Theun 2 project occupies a site that provides an excellent opportunity for hydroelectric development. The project exploits the head difference between the Nam Theun and Xe Bang Fai rivers, both of which are tributaries of the Mekong.

From the beginning, Nam Theun 2 aimed at becoming a model for sustainable and responsible hydropower development.

Some 5700 people will be resettled from the reservoir area to new villages along the southern lakeshore. The new communities will be designed along traditional lines keeping social and cultural units intact, after years of carefully designed multidisciplinary studies (600 social and ecological studies). A pilot village programme has provided guidance on infrastructure design and

alternative livelihood opportunities. The project will continue to support these communities during the concessions period, with the objective of achieving a long-term and sustainable uplift in living standards. The Reservoir area is covering one of the mythical Ho Chi Minh trails, heavily bombed by the US Army during the Vietnam War. 15 000 US ordnances had to be removed for an estimated cost of \$10 millions.

The catchment area for the Nam Theun 2 project is principally to the North of the reservoir and extends to the Vietnamese border. Much of the catchment comprises relatively pristine rain forest and is designated as a National Biodiversity Conservation Area. Illegal incursions into this area have been difficult to control in recent years and the project will provide an annual source of funding to enhance protection measures.

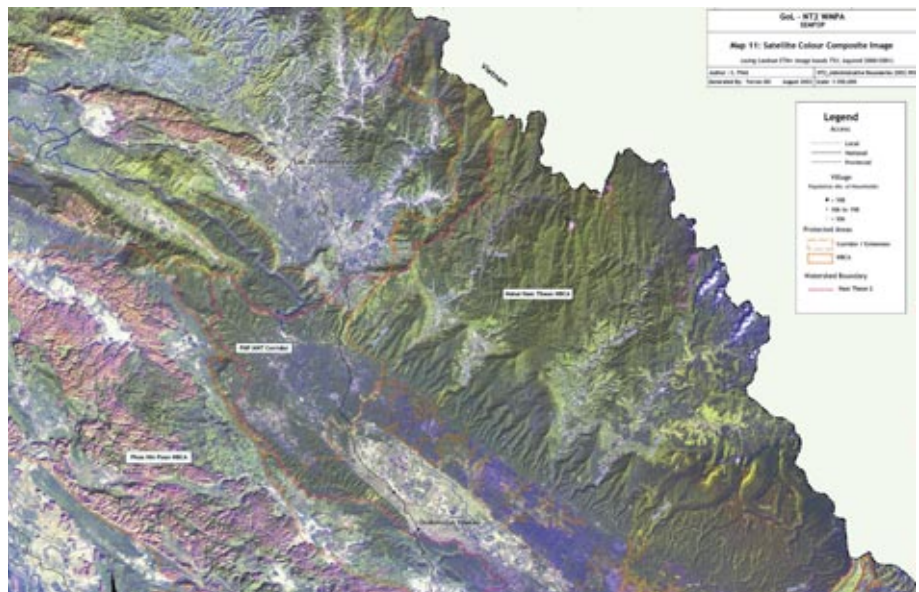
The Nam Theun 2 project has attracted World Bank, Asian Development Bank and European Investment Bank support, and offers a vital means for Lao PDR to generate energy and prosperity in a sustainable manner for the future.

**For** a long time, the Nam Theun project seemed condemned, first by the 1997 Asia crisis, then because of the NGO opposition and the refusal of the World Bank to finance any large dam. With the U-Turn of the new 2003 Water Resources Sector Strategy, the World Bank rejected the WCD guidelines and recognized the role of dams for development. Nam Theun works could finally begin, in 2005 and they will finish at the end of the year.

Laos is a landlocked country with few natural resources and one of the lowest per capita incomes in the world. The pressure on forestry assets is considerable, and the development of hydropower for export offers a vital and sustainable alternative source of national revenue for poverty alleviation.

Lao PDR has exported electricity to Thailand since 1971. In 1993, an agreement was signed for Thailand to take some 1500 MW of hydropower from Laos. This figure was increased to 3000 MW in 1996. Currently, only Theun-Hinboun (214 MW) and Houay Ho (136 MW) have been completed under this agreement.

The Nam Theun 2 project has long been recognized as having the greatest potential to achieve the country's





# World Declaration LAUNCHED in Paris !

**Secretary** General Michel de Vivo shortly reminded the audience of the way ICOLD worked and presented the World Declaration “Dams and Hydropower for African Sustainable Development” in the African context of huge needs and huge potential. He took the example of the Grand Inga Project, which could produce 280 TWh per year at a cost of \$0.01/kWh. He then asked: “What can ICOLD do for Africa ?” and gave the following answers.

Of course, the World Declaration that we present today is the main way ICOLD is contributing to sustainable development of Africa. But this is far from being the only one. We can have a strong promotion of good technical, economical, social and environmental practices. We can offer an easier access to ICOLD to the less developed African countries. We can promote dam financing in Africa among the financial operators and offer close links with Michel de Vivo then listed the 18 African countries already ICOLD members : Algeria, Burkina Faso, Cameroon, Congo (Democratic Republic of), Egypt, Ethiopia, Ghana, Ivory Coast, Lesotho, Libya, Mali, Morocco, Nigeria, Soudan, South Africa, Tunisia, Zambia and Zimbabwe.

The floor was then given to an African representative, Mr Abdoulaye Kombari, Burkina Faso Delegate Minister for Agriculture.

He underlined how dams have been crucial for many civilizations, enabling them to mobilize water. They also allowed developed countries to master water and energy. “ICOLD is the world leader for the dams profession and I would like to thank here publicly ICOLD for the capacity building it created, which allowed dozens of young professionals to train in Turkey and in Morocco.” In Africa, 90% of the hydro potential is still to be exploited, he said. “Our country is considered as a leader in the dam building profession for West Africa. In 2011, we wish to welcome the ICOLD 79<sup>th</sup> annual meeting in Ouagadougou.”

“Dams have a great role to play in Africa’s Development and I want to celebrate the initiative by the stakeholders of the World Declaration “Dams and Hydropower for African Sustainable Development”, he ended. ●



Mr Wolfgang Pircher  
Honorary President of ICOLD  
is handed the World Declaration  
by Mr Michel de Vivo

the very minimum to ensure a reasonable quality of life. The average consumption in Africa is 547 kWh/person/year<sup>(1)</sup> whereas it is 10,833 kWh/person/year in North America. But even this low figure is misleading, since it misrepresents the large disparities in national consumption. For instance Libya accounts for 2250 kWh/person/year; South Africa 4542 kWh/person/year but Zambia 604 kWh/person/year and Burundi 22kWh/person/year.

A reliable electricity supply, taken for granted in many parts of the world, can be a life-saving commodity in the less developed African nations, in that it can provide refrigeration for food and medical supplies, and a power supply for healthcare facilities. Particularly in rural communities, there are also major educational benefits: the provision of electricity will enable children to benefit from computer technology, as well as light to do evening homework.

**Tremendous potential**

At the same time, there is a tremendous potential for producing electricity in Africa. There are projects like Grand Inga (40 000 MW hydropower plants and generating more energy than 280 TWh/year) which have the potential to deliver exceptionally cheap electricity at less than \$ 0,01<sup>(2)</sup>, when the average cost for coal is \$ 0,04, and most of the other energies (gas, nuclear, wind, solar) are still more expensive. The kWh of power from diesel generators, widely used in Africa, costs from \$ 0,15 to \$ 0,30. Inter-continental co-operation will be required to develop power distribution networks across the

which only 4% is being exploited. However, it is to be noted that Africa lacks the infrastructure to manage water variability. Reservoir storage available per capita is very small, 38 m<sup>3</sup> for Ethiopia and 687 m<sup>3</sup> for South Africa, versus 4700 m<sup>3</sup> for Australia and nearly 6000 m<sup>3</sup> for North America. Currently, only some 40% of the rural population is served with potable and safe water supply. Multipurpose hydropower schemes have a crucial role to play in promoting water security providing the double benefit of water storage capacity and power generation.

In general, both energy and water needs are critical in these nations, so the obvious multiple benefits of hydro schemes (particularly when storage reservoirs are included) are of special significance in Africa.

The effects of extreme climatic conditions (large-scale floods and regular droughts) that Africa suffers from can be vastly mitigated by dam/reservoir schemes. Naturally the supply of clean drinking water and irrigation water to enhance food security, are major additional benefits of hydro schemes.

**Millennium Development Goals**

Therefore, African potential for hydropower has to be developed now, if we want to reach the goals for water and energy set by the African Heads of State and Government during the recent Summits of the African Union and in the context of NEPAD and of UN Millennium Development Goals.

Already, the African Ministers responsible for water and energy, after a meeting in Johannesburg, South Africa, 8-9 March 2006, have committed themselves "to working

Hydropower projects are capital intensive. Tangible actions in the financial mechanisms but also a political will and serious commitment by all the potential stakeholders are required to develop sustainable hydropower projects in Africa. The African Union is striving to create a coordination structure for the development of the big integrating hydropower projects in Africa, with the aim of having a framework for dialog and cooperation between all stakeholders.

**Promoting hydropower development that is environmentally friendly, socially responsible and economically viable**

Regarding the environmental and social impact of hydropower, a number of lessons have been learnt from past experience. Governments, financing agencies and industry have developed policies, frameworks and guidelines for evaluation and mitigation of environmental and social impacts, and for addressing the concerns of vulnerable communities affected by hydropower development. Those guidelines must be adjusted to the relevant individual country context.

We note that the key ingredients for successful resettlement include minimization of resettlement, commitment to the objectives of the resettlement by the developer, rigorous resettlement planning with full participation of affected communities, giving particular attention to vulnerable communities. The decision making process should incorporate the informed participation of the vulnerable

- International Institutions are encouraging the development of hydropower: The United Nations Symposium on Hydropower and Sustainable Development has ended with a strongly worded October 2004 declaration in support of hydropower.

- International lenders are now supporting dams and hydropower

- Production costs of Hydropower generation are "cheap" and independent of fluctuations in fossil fuel prices, while prices of other energies are generally rising.

- Hydropower generation is "clean" and thus forms part of the solution to the problem of climate change; a most important issue during the century to come;

- Hydropower potential in Africa is vast and underexploited;

- Needs of the African population are now almost in a state of emergency.

It is now time for Africa to use its own resources to finally engage its long-awaited development!

It is now time to go for a significant development of dams and hydropower in Africa!

Africa must seize this opportunity and the organizations signing this declaration pledge they will do their best to accompany this great continent in this endeavour. ■



**Approved on November 24<sup>th</sup> 2008 in Paris, by:**

The African Union (AU), The Union of Producers, Transporters and Distributors of Electric Power in Africa (UPDEA), The World Energy Council (WEC), The International Commission On Large Dams (ICOLD), The International Commission on Irrigation and Drainage (ICID), and The International Hydropower Association (IHA).

<sup>(1)</sup> IEA - « Energy Balances for Non-OECD Countries » and « World Energy Statistics 2006 »; IEA, Paris 2006 - <sup>(2)</sup> This cost is just "out the power station" (« borne Centrale ») and does not take into account the cost of the transmission system.

# World declaration Dams and Hydropower for African Sustainable Development



**D**uring the past century, hydropower has made an important contribution to development, as shown in the experience of developed countries, where most hydropower potential has beenharnessed. In some developing countries, hydropower has contributed to poverty reduction and economic growth through regional development and to expansion of industry. In this regard, we note that two-thirds of economically viable hydropower potential is yet to be tapped and 90% of this potential is still available in developing countries.

In Africa, less than 7% of hydropower potential has been developed. We agree that the large remaining potential in developing countries, as well as in countries with economies in transition, can be harnessed to bring benefits to these countries, bearing in mind that the world's poor countries use only one twenty-fifth of the energy consumed by the world's rich countries.

## Huge needs

Among all developing areas of the world, Africa is undoubtedly the continent where needs are the most urgent. In Africa, 65 % of the population do not have access to electricity and consequently live with poor quality of services, in terms of lighting, clean water, health care and education. Electricity is yet an essential tool for achieving the objectives of NEPAD (New Partnership for Africa's Development), UNMillennium Development Goals and sustainable development. The World Energy Council has calculated that a per capita consumption of 500 kWh/year is

continent and the necessary institutional structures for such a power pool.

That great development potential of this clean renewable resource is precisely available in some of the countries with the greatest need for increased installed capacity. In some of the African countries, there is no feasible alternative source of power available on a realistic scale. Grand Inga project's energy production would be equivalent to more than 100 million tons of fossil fuel per year, which would be impossible to buy anyway.

Hydropower has also two major environmental advantages: first it is a renewable energy and by far the most abundant one, 90% of world electricity produced with renewable energy comes from hydropower. Then too, it is a clean energy since the greenhouse gas emissions associated with it are very low compared to the other major sources of electricity (coal, gas, oil). Currently, many Africans rely on firewood as a primary energy source for domestic purposes and this in turn results in significant environmental and health problems.

The 2004 Political Declaration adopted at the Bonn International Conference for Renewable Energies acknowledged that renewable energies, including hydropower, combined with enhanced energy efficiency, can contribute to sustainable development, to providing access to energy, especially for the poor, and to mitigating greenhouse gas emissions.

## Synergy between water and energy schemes

Africa has abundant fresh water potential of

together (ministers of water and energy) to unlock the hydropower potential of Africa as a major renewable energy option to promote sustainable development, regional integration, water and energy security, and poverty eradication in Africa". This commitment was reaffirmed by the African Ministers responsible for electricity during the first conference organized by the African Union Commission in Addis Ababa, Ethiopia, March 20-24, 2006.

Already, the representatives of national and local governments, representatives of utilities and the private sector, United Nations agencies, multilateral financial institutions, other international organizations, non-government organizations, the scientific community and academia, and international industry associations, having met at the United Nations Symposium on Hydropower and Sustainable Development from 27 to 29 October 2004, in Beijing, China, have underlined the "strategic importance of hydropower for sustainable development".

Recently on March 16-17 2007, the World Energy Council convened a high-level International Forum under the theme: "How to make the Grand Inga Hydropower Project happen for Africa", in Gaborone, Botswana. The Forum came up with the establishment of an Inga Action Plan to facilitate the development of the Project.

We firmly believe that there is a need to develop hydropower that is economically, socially, and environmentally sustainable. But the above-quoted manifestations of goodwill will not be sufficient in themselves.

communities and those negatively affected, who must in all circumstances derive sustainable benefits from the project. The costs of social and environmental mitigation measures and plans should be fully assessed and integrated in the total cost of the project.

We call upon Governments to recognize the need to plan hydropower developments in a river basin context against the background of the full range of alternatives for energy production ; planning should give due weight to environmental and social factors, as well as economic and financial factors. Africa has 61 international shared rivers, whose basins comprise almost 61% of the surface area of the continent. Accordingly international co-operation in the development of the water-resources of Africa is of critical importance.

We call on multilateral and bilateral funding agencies to engage with African countries on hydropower development, promoting national and regional project development facilities and innovative funding mechanisms.

## In conclusion: Urgently Needed Now!

Conditions are now ripe for hydropower development in Africa and this is a period of unique opportunity:

- The political context is very favourable: The African ministers have delivered a strong message of support for hydropower with their 2006 Ministerial Declarations in Johannesburg and Addis Ababa. It is imperative that Africa takes the lead in promoting this initiative.

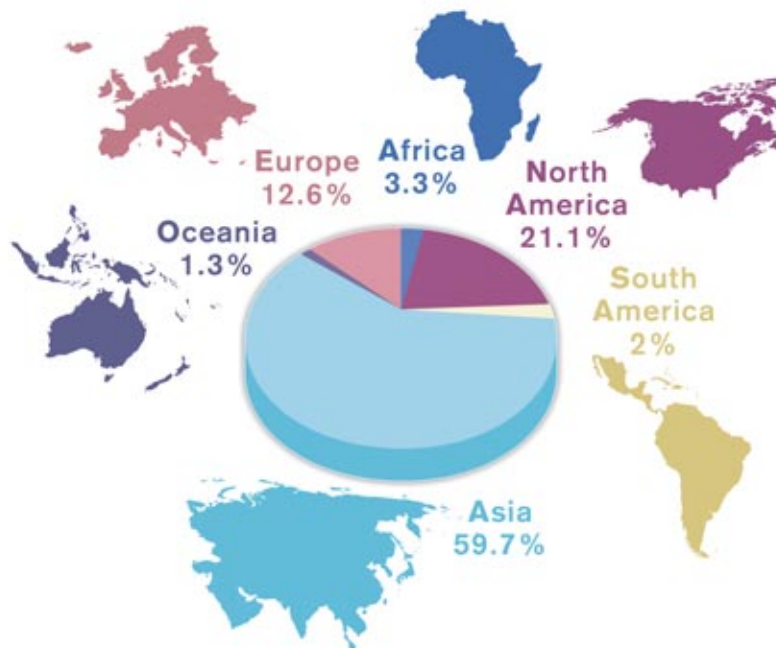
President Berga's conclusive speech:

# Dams AND Reservoirs FOR Sustainable Development

A view of Delta Project  
(Netherlands)



**Water** is life. Water is a precious element, indispensable for the life in the earth and the man's welfare. Currently there are about 50 000 large dams in operation. The rough evaluation of the number of small dams is about 1 million. The total reservoirs capacity is about 8300 km<sup>3</sup>, and the geographical distribution of the large dams, for areas is:







All countries in the world have been constructed dams (large or small), for irrigation, water storage, electricity generation, and flood mitigation, but large dams are concentrated mainly in a few countries which more needs on water regulation and hydropower production. 15 countries in the world have more than 500 large dams that accounts for more than 90% of large dams. China is the leader's country in large dams's number.

**LEADERS' COUNTRIES  
IN NUMBER OF LARGE DAMS**

- 1 **China** 26 278
- 2 **USA** 9265
- 3 **India** 4636
- 4 **Spain** 1267
- 5 **Korea (ROK)** 1205

**The main purposes of the reservoirs are:**

- 38% **Irrigation**
- 18% **Hydropower**
- 14% **Water supply**
- 14% **Flood mitigation**
- 8% **Recreation**

and 8 % others (including navigation, fish breeding, and others).

Currently there are 1200 large dams under construction. Of these, 370 are major dams (height more than 60 m) in 55 countries, mainly in Asia. In the majority of these major dams, 217 (59%),

hydropower is one of the main functions, and in some cases the single purpose.

Large dams and reservoirs regulate about 4000 km<sup>3</sup> per year, which means around 31% of the world's available water resources.

The water that is stored and regulated by dams and reservoirs provides irreplaceable water resources and benefits to water supply, irrigation, hydropower, flood mitigation, river navigation, recreation, tourism, environment, etc. For example, irrigated areas account for 17% of the world's arable land, but produce 40% of the total world crop yield. Also, reservoirs play a significant role in drought and flood mitigation, and one of the purposes of 20% of the world's reservoirs is to reduce the major socioeconomic impact of flooding.

Furthermore, hydro-power, which is a clean renewable and environmental friendly source of energy, yields 20% of the world's generated electricity. Hydro-produces on average 2800 TWh/y which represent 95% of renewable electricity generation, and prevent the emission of more than 2.100 millions tonnes CO<sub>2</sub>. Hydropower is one of the main purposes of dams, and there are more than 8200 large dams (about 25% of the total number of large dams), in which hydro-power is the only purpose or one of the main objectives of the reservoirs.

Then, for almost 5000 years, dams have served to ensure an adequate supply



of water, energy and other benefits to sustain the world's population. They have become an "integral part" of our societies' infrastructure and play a major role in "sustaining and enhancing the quality of life".

On the other hand, all socio-economic analyses show that the stock of dams and reservoirs, electricity, and hydro-power infrastructures that a country possesses is generally closely linked to its socio-economic development, and that these infrastructures are essential for development of the countries. Research work and surveys indicate that the indicators of the infrastructures of dams, number of dams per million inhabitants, and basically the reservoir volume per capita, and the electricity indicators: consumption per capita per year (kwh/per capita/year), and percentage of the population with access to electricity) are closely linked to that country's socio-economic development indicators (Gross National Income per capita and Human Development Index).

The developed countries have a large and varied stock of dams, electricity, and hydropower infrastructures. It is vital for the socio-economic development of emergent and developing countries the construction of new infrastructures, to reach the adequate stock of energy and water infrastructures, in order to have available sufficient supplies of water and energy. However, experience has shown us that infrastructures of water and energy, dams and reservoirs could, in some cases, have a major social and environmental impact, so it is necessary to consider them within the framework of Integrated Water Resource Management: Water, Energy and Sustainable Development. All the feasible alternatives should be considered as part of this holistic approach.

Within these holistic approach there should be considered all the viable alternatives and the experience gained in the developed countries shows the important role played by dams and reservoirs in water and energy resources.

### **SOCIAL AND ENVIRONMENTAL ASPECTS**

I must emphasised that attention to the social and environmental aspects of dams and reservoirs should be a priority concern that guides all our activities, in the same

way as concern for safety is invariably a top priority.

We, now, aim to find a way to balance the need for the development of water resources, with conserving the environment in a sustainable way, so that the actions taken now will not be detrimental to future generations.

### **ICOLD ENVIRONMENTAL POLICY**

#### **POSITION PAPER**

ICOLD recommends the management of the existing dams and the construction of new dams to remain within the context of Integrated Water Resources Management, taking into account their implementation within a framework of sustainable development, and adhering to the following basic criteria:

- Technical, Economic and Financial Feasibility
- Sustainable Development. Compatibility with the Environment
- Social and Political Acceptance

### **DAMS FOR SUSTAINABLE DEVELOPMENT**

We should all feel proud of our contribution to the sustainable development of water and energy resources, and be satisfied with the countless benefits that dams and reservoirs have provided throughout these 80 years. We must learn from the past and pass this knowledge on to the generations to come.

During the last decades of the XX Century, several water problems had taken place in the world, which has led to a very serious situation of water and energy crisis and poverty. In summary the central point is that there are many who are poor, and in many ways at the same time. About 2 billion people (more than 30% of the World Population) lack the basic levels of the security and services: food, water, sanitation and electricity.

To fight this critic situation the UN implemented in the year 2000 the Millenium Development Goals. Humanity faces the challenge to reach the UN Millennium 8 fundamental goals, whit 12 targets, and 48 indicators, by 2015. If these targets are to be achieved it



ICOLD President Berga discusses with some members of the African delegation



is essential to solve the problems concerning water and energy.

We know that water and energy poverty is due mainly to limited socio-economic development and the lack of water governance, and not to a scarcity of water resources, and then a lack of sufficient renewable water and hydropower resources is not the crucial factor where water and electricity accessibility is concerned.

Looking to the future I think that it is preferable to dream with the future to recapitulate a lot in the past .

Today, the sustainability of water and energy resources is threatened by the Global Changes that are taking place in the world: population growth, urbanization, an increase in the socio-economic development and climate variability, and climate change. In the future it is likely that climate change will accentuate these problems considerably, as well as increasing the impacts and pressures on water and energy resources. Also today, sustainable development and sustainability of life in many regions of the world continues to be threatened by the scarcity and poverty of available supplies of water, food and energy.

Over the past 50 years, water storage has expanded rapidly, primarily in the form of large scale dams for irrigation, energy, urban water supply, and flood mitigation. However, this growth trend has slowed over the past decades due to increasing concerns about the overall social and ecological sustainability of large-scale water storage.

The degree of sustainability of building large-scale dams and the impacts they make on livelihoods of people has been debated during the last decades. Many dams, both large and small, have successfully met the various purposes for which they were designed, without significant negative impacts. In some cases, the economic, social and environmental costs are more evident. Achieving the sustainability of large dams depends on the overall benefits provided by large dams and the solutions considered to mitigate their effects on the livelihoods of people. A balanced approach to ensure that all parameters are taken into account is required.

After the experiences learned from the past and the knowledge and regulations

on socio-environmental mitigation measures, now in order to meet the pressing challenges posed by global environmental change, a new page needs to be turned with regards to storage strategies. Global Change: Population, Urbanization, Socio-Economic Development and, in particular, the likely impacts of climate change elevate the storage of water to a new national, regional and global priority.

In many cases, storage is a viable option, and given the current circumstances (a need for responsible development in the context of changing world, etc.), increasing storage capacities is a major imperative. Storage should be utilized as a tool to drive development, taking into account the socio-economic and environmental impacts. That the level of human development index correlates closely to per capita storage capacity is no statistical coincidence. Furthermore, the potential for large dam infrastructure remains largely untapped in most developing countries.

In the context of global environmental change, global water policy should consider investments in infrastructures and these investment should focus on dams in areas where the infrastructure to provide access is lacking, coupled with investment



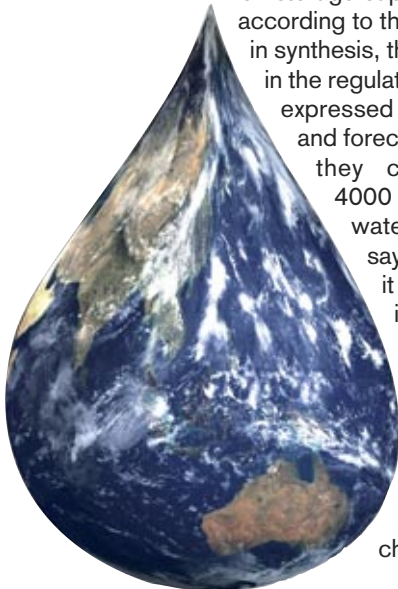
Plavinas HPP  
(Latvia)



ICOLD officials and African delegates celebrate the World Declaration during ICOLD 80<sup>th</sup> birthday ceremony

in capacity to use it. Also investments in climate change adaptation should incorporate water storage as a top priority. This will require new approaches to consider complementary storage strategies across scales from local water harvesting systems to large scale dams.

Then in the future, over the next 25 years, all the socio-economic indicators show that it will be necessary to increase reservoir storage capacity. Future needs vary according to the several scenarios. But in synthesis, the essential role of dams in the regulation of river runoff can be expressed through following facts and forecasts. At the present time they contribute with some 4000 km<sup>3</sup>/year to the available water resources, that is to say, with 31%. In the future it may be necessary to increase this percentage to at least 36%, which would mean increasing reservoir storage capacity by some 2000 km<sup>3</sup>, about 25% of the current reservoir storage capacity. The challenge for the future will



be the utilization of dams and reservoirs for the wise management of the world's water and energy resources as part of each nation's social, economical and environmental development goals. ICOLD is looking forward to working with all countries and other international organizations to meet this challenge.

I hope, that in the future, ICOLD will continue to provide leading engineers and scientists with a forum to exchange and transfer knowledge, experience and technology related to the development and management of the world's water and energy resources.

ICOLD's intent is to ensure that the dams and associated structures required for water and hydropower resources development and management around the world are safe, economical, environmentally responsible, socially acceptable and are operated and maintained for sustained reliability.

**Mr Luis Berga**  
ICOLD President

24<sup>th</sup> November 2008, in Paris