INITIATIVES POUR L'AVENIR
DES GRANDS FLEUVES
INITIATIVES FOR THE FUTURE
OF GREAT RIVERS

Brazil
Paraguay
Itaipu

Tomorrow's energy landscape and hydroelectricity models

4th
SESSION

APPEALS AND RECOMMENDATIONS

13/17 March 2017

Bringing together actors committed to the development and protection of the world's rivers, Initiatives for the Future of Great Rivers (IFGR) offers an original, international and multidisciplinary forum open to stakeholders and oriented towards action. It acts to conceive the river of tomorrow and contributes to enriching national and international debates on water and climate change. Indeed, rivers are situated at the heart of current climatic and environmental issues (energy, production, food security, public health, mobility, etc.) and could also provide solutions for building a sustainable world.

Founded by CNR, the multipurpose concessionary of the River Rhone and France's leading producer of 100% renewable electricity, IFGR is an association in the general interest chaired by Erik Orsenna, an economist and writer, member of the prestigious Académie Française.

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Introduction

A theme at the heart of IFGR's concerns from outset it appeared appropriate to choose an emblematic site to focus on the issues relating to the future of hydroelectricity. Thus, at the invitation of James Spalding, Paraguayan Managing Director of Itaipu Dam, the high level panel of IFGR (the Rivers Committee) met from 13 to 17 March on the world's second most powerful dam, located on the border between Paraguay and Brazil. Following on from Lyon, Montreal, and Avignon, the aim of this fourth session was to perceive the future of hydroelectricity from an international and multidisciplinary angle, and identify the actions that IFGR could contribute on the international level.

HYDROELECTRICITY

Hydroelectricity designates any process that generates electricity by converting the energy of running water. This conversion can be of different forms: dams (also of different types), run-of-the-river plants, river hydrokinetic turbines, etc. Hydroelectricity is both a clean energy (no CO_2 emissions) and renewable, since the water normally used to generate it is neither consumed nor lost.

However, the reputation of "mega-dams" is often tarnished: the displacement of populations (1.5 million people in the case of the Three Gorges Dam in China), risks of conflicts (between Egypt and Ethiopia, in the case of the Grand Renaissance Dam), impacts on biodiversity, etc. Should they give way to new models of development? What is a "good" dam and according to what criteria?

Itaipu Binacional

In many ways Itaipu Binacional is a model of a virtuous mega-dam. Governed by a binational treaty, the financial redistribution that springs from it can amount to as much as 80% of the budget of certain Paraguayan municipalities.

By way of its hydro-computing centre, Itaipu works with UNESCO in the framework of the International Hydrological Programme (IHP) devoted to research in the area of water, water resource management, education and strengthening capacities.

REMINDER: THE DIFFERENT FORMS OF HYDROELECTRICITY

	Characteristics	Advantages	Disadvantages
Reservoir hydropower plants	They provide a wide range of energy services such as basic load, peak load and the accumulation of energy.	Secure supply through storage of water when electricity consumption is low / production is increased during peak hours.	Higher social and environmental impact.
Run-of-the-river plant	Mainly located in plains, they do not hold back water but generate energy as it flows through the turbines on its way downstream.	Production can be modulated as a function of energy needs. The energy is consumed or injected into a grid. The development schemes can be used for other purposes (flood control, etc.).	No storage capacity, production varies as a function of the water available.
Pumped storage hydroelectricity (PSH) plants	These accumulate water for electricity production. Water is pumped from a reservoir during off-peak hours and then harnessed by turbines during peak periods. By making the water flow backwards, electricity can be produced on demand within a very short response time.	Currently the form of energy accumulation on the grid with the highest capacity.	Production is not 100% renewable (filling the reservoirs requires the consumption of electricity).
Micro-hydroelectricity	Turbines are installed in the run of the river without a dam. Examples are river hydrokinetic turbines and small hydropower plants.	A great potential of development in the world, including the estuaries due to tidal currents. Environmental impacts are reduced.	Limited installed capacity. The site of installation must have certain characteristics (slope).

THE SESSION'S OBJECTIVES AND PROGRAMME: WHAT IS THE ROLE OF HYDROELECTRICITY IN TOMORROW'S ENERGY LANDSCAPE?

Hydroelectricity represents 71% of the world's renewable energy production. It has reached technological maturity and is now much cheaper than other forms of renewable energy ($46 per megawatt versus $126 per megawatt on average for solar energy), although the share of wind and solar energies is increasing more steadily. Regarding the challenges of climate change and the increasing energy requirements needs of developing countries, hydroelectricity still has a great deal of potential to offer. **How can more be gained from its advantages without repeating the errors of the past?**

71%
of the world's renewable energy production is provided by **hydroelectricity**

During this session, IFGR's members wanted to make a dual contribution:

1. **Formulate recommendations that enable territories to harness the energy of their rivers** without jeopardising the capacity of the societies that depend on them to protect their cultures, ensure rivers can be used as vectors of trade, keep agriculture alive and, more generally, maintain peace.
2. **Initiate a concrete project,** so as to participate, practically, in implementing tomorrow's hydroelectricity.

After going round the table to hear the news from each of the regions of the world represented, Erik Orsenna, the Chairman of IFGR and Bertrand Porquet, its Secretary General, opened the debate by taking stock of the state of hydroelectricity: its place in the world energy mix, its perspectives for growth, its forms, and its integration in grids.

Throughout the session, the debates made use of the case study of Itaipu, discovered via several presentations and visits to the site:

- A presentation of the distributive role of the dam in the territories was given by James Spalding, Paraguayan Managing Director of Itaipu;
- A presentation of the innovation policy of Itaipu, by Francisco P. Domaniczky, Director of Management Coordination;
- The discovery of the technology used for the dam and its operation;
- A visit to the nature reserve of Itabo;
- A visit to the ITAIPU- Guarani Land Musuem.

Binational dam of Yacyreta - Paraguay/Argentina

ITAIPU 1

The lessons of a mega-dam

1.1.

Overall view of Itaipu

A brief history

22 July
1966
Ata do Iguaçu (Iguaçu Agreement): Brazil and Paraguay expressed their joint interest in exploiting their shared resources.

1973
Ratification of the treaty (expiry in 2023): it enshrines the right for each country to consume, theoretically, 50% of the energy produced. Paraguay committed itself to selling its surplus energy exclusively to Brazil at a fixed price until the expiry of the treaty.

1974
The company Itaipu Binational was founded.

Some four thousand kilometres long, the Parana River is characterised by the strength of its discharges, often close to seventeen thousand cubic metres a second at its mouth versus 1,700 m^3/s for the Rhone. One of sixty hydropower installations developed on the river, Itaipu is the most productive dam in the world.

Itaipu, *the stone that sings* in the language of the Guarani, takes its name from the sound that the water makes when passing over the rocks at low flow. The structure is located on the border between Brazil and Paraguay, and it has been managed by a binational company since the project was launched in 1973. The dam and hydropower plant are linked to a reservoir holding 29,000 million cubic metres and to 100,000ha of protected land.

TECHNICAL SHEET OF ITAIPU

Situation	Brazil/Paraguay border
Construction	Between 1975 and 1982 cost of construction in current dollars: about $27 billion (versus $126 billion for the Three Gorges Dam).
Annual production	103,098,366 MWh (2016) (No. 1 producer in world)
Installed capacity	14,000 MW (2nd in world after the Three Gorges Dam)
Number of turbines	20 (18 turbines active simultaneously)
Reservoir	29 billion cubic metres
Ownership and management	Itaipu Binacional – Management company Electrobas – Brazilian national electricity company, main purchaser of Itaipu's electricity. Ande - Paraguayan national electricity company.

1.2.

Redistribution and innovation: key elements of the Itaipu model

Discovering the site of Itaipu requires several steps, in order to broach all the themes linked to the future of hydroelectricity. Indeed, one of the particularities of Itaipu is that it holds the world record for production, while at the same time deploying a socially and environmentally responsible approach acknowledged internationally. What considerations do these two facts lead to? The presentations made by the teams of Itaipu gave rise to lively debates regarding the dam itself and the conceivable perspectives for the other territories.

FOCUS 1 : THE DAM'S REDISTRIBUTIVE CAPACITY

Presentation by James Spalding Hellmers, Paraguayan Managing Director of Itaipu Binacional

Strong financial stability

Itaipu benefits from financial stability linked to the fact that the company does not sell energy but its installed production capacity. In the case of drought, such as in 2014 when production fell from 100 million to 87 million MWh, the budget therefore remained stable. Itaipu sells the right to use the water to two national electricity companies, that of Brazil (Electrobas) and that of Paraguay (Andas), whereas the energy produced by the turbines remains the property of Itaipu.

Allocating the budget

Itaipu has a budget of $3.2 billion a year. More than half this budget is used to reimburse the debt ($2 billion) while $500 million go to the governments via royalties paid for each MWh produced.
The income from the royalties amounts to $320 million a year for both Paraguay and Brazil. Since Itaipu was built, $5 billion have been paid on either side of the border.
In the case of Paraguay, half this income is distributed to the State and the other half to the 17 departments and 250 municipalities. In Brazil, the income generated by Itaipu is not redistributed throughout the country but to 331 local authorities. According to the treaty, the quantity of energy not consumed by one of the two States must be purchased by the other. In 2016, Brazil paid $360 million in addition to Paraguay.

1984
The first electricity production unit was commissioned.

1985
In a context of national economic crisis, Paraguay accepted Brazil's request to sell its electricity at below market prices.

2009
The treaty was renegotiated at the instigation of Paraguay:
- it is henceforth allowed to sell its electricity directly on the Brazilian market.
- the compensation payments to Paraguay for using its energy have tripled (to reach $360 million a year).

A million **fish** were reintroduced

100,000 **ha of land** are protected

The social responsibility fund

In addition to the financial redistribution between the two countries, which reached a record in 2016, Itaipu also implemented targeted actions. By way of example, a million fish were reintroduced into the river in 2016. 100,000 ha of land are protected, which, for a dam, represents the highest ratio of land protected per megawatt of installed capacity (7.5 ha / MW). The benefits can be quantified, since every day the reserves produce oxygen for 22 million people, that is to say three times the population of Paraguay.

The expiry date of 2023 and new opportunities for redistribution

The debt incurred by the dam's construction will be reimbursed in 2023. Itaipu will consider transferring 60% of the budget currently allocated to reimbursing the debt to setting up a fund that will allow each country to receive an additional billion dollars a year. This expiry date will also be the occasion for renewing the treaty between Paraguay and Brazil.

FOCUS 2 : CENTRO INTERNATIONAL DE HYDROINFORMATICA- CIH

Presentation by Francisco P. Domaniczky ,
Director of Management Coordination, Itaipu

The International Hydrocomputing Centre was started in 2007 at Itaipu. A category 2 UNESCO centre[1], its role is to contribute to achieving UNESCO's strategic objectives, notably through its International Hydrological Programme (IHP).

[1]Category 2 centres are not legally part of UNESCO but are associated with it by official agreements

"Hydrocomputing" is a multidisciplinary field of study at the interface between environmental, social and technological issues. Thus it contributes to development and innovation, while strengthening capacities in view to ensuring wider use and dissemination of the progress made.

The IHC carries out actions in favour of sustainable water management. Its activities range from monitoring the quality of the water upstream and downstream to relations with the different communities, and setting up nature reserves to protect fauna and flora.

Examples of development programmes

The aim of the programmes *Sistematización de datos en Cuencas* HELP and *Sistema Integrado de Base de Datos* PHI–LAC "FRIEND" is to make the public aware of the world hydrological cycle, and develop and better target water resources.

The programme *Sistema de Presas, Embalses y Vías de navegación de la Cuenca del Plata*, currently being developed, will contain the site in which the database of the dams and reservoirs will be kept, with regulated navigable waterways for each structure.

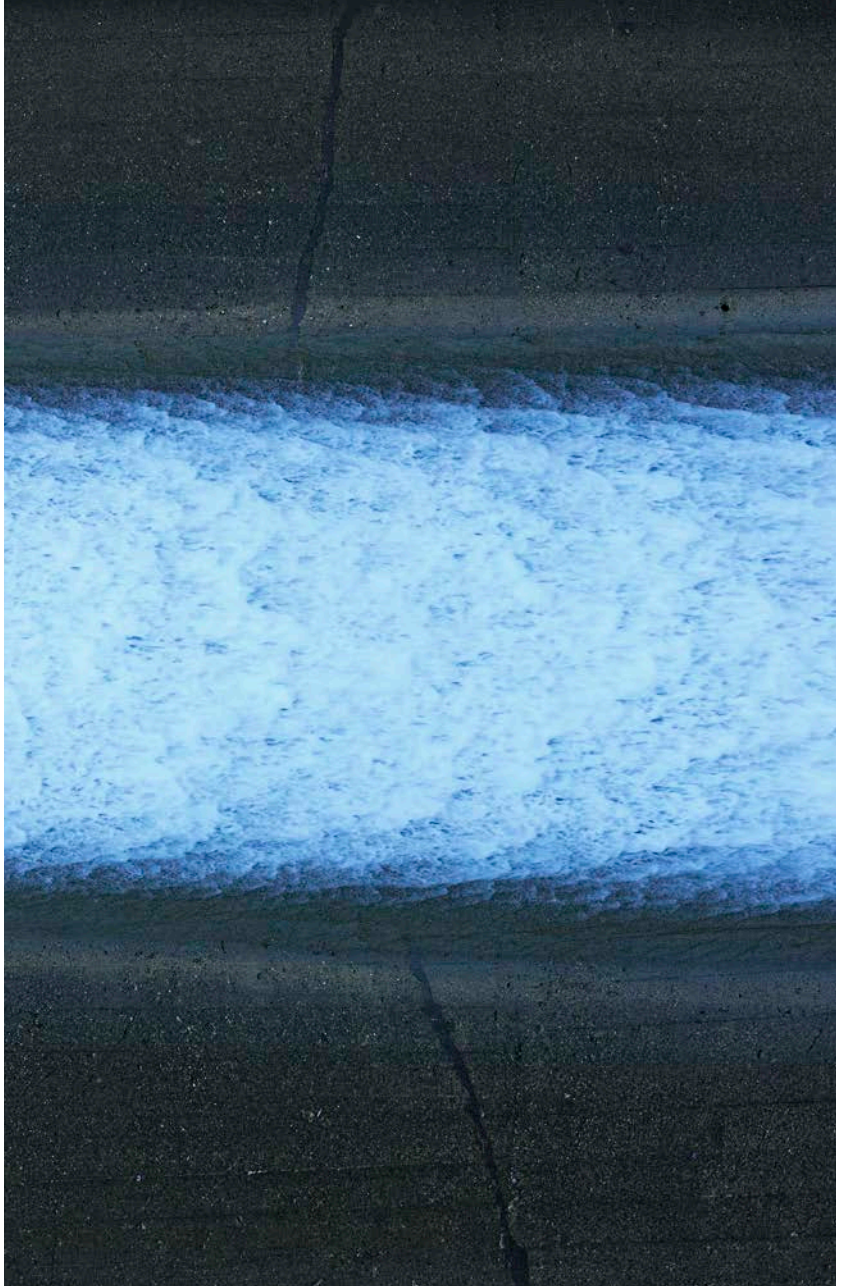
The programme *Modelación Hidrodinámica del Río Paraná*, set up jointly with the Technical Management of Itaipu, is aimed at modelling the behaviour of the Rio Parana between Itaipu and the port of Carlos Antonio Lopez.

The "Cultivando Agua Buena" programme

In line with its activities to improve the quality of water, Itaipu has set up the Cultivando Agua Buena (CAB) programme. Initiated by the Brazilian part in 2007, it has developed on the Paraguayan side through the deployment of awareness programmes carried out with local communities, notably in December 2016 at Hernandarias, a town located just next to the dam.

The CAB programme is aimed at implementing the Sustainable Development Objectives (SDO) in different territories by launching interlinked projects. Its guiding principle is based on the systematic involvement of all the sectors concerned by the management of the resource (public and private sectors, education, religious communities, etc.). The CAB programme is currently being deployed in Brazil, Argentina, Uruguay, Guatemala, the Dominican Republic and Costa Rica.

CAB was recognised by the United Nations in 2015 as one of the most advanced solutions in the world for achieving participatory management at the scale of a watershed.



What are the changes facing hydroelectricity?

2

Seven recommendations for using river energy better

The downwards trend for renewable energy prices and continuing technological advances are strong factors in favour of an energy mix with a smaller carbon footprint. Hydroelectricity, which currently represents 71% of the world's renewable energy production, must overhaul its methods and tools in order to remain at the heart of the this transition.

From the discussions on the case of Itaipu emerged a non-exhaustive inventory of key elements to be taken into account. On the basis of this example, IFGR wants to take a global and concrete view of how hydroelectric projects are implemented around the world.

Consequently, the group formulated seven recommendations intended for developers, public authorities and all the other stakeholders involved in the future of river territories.

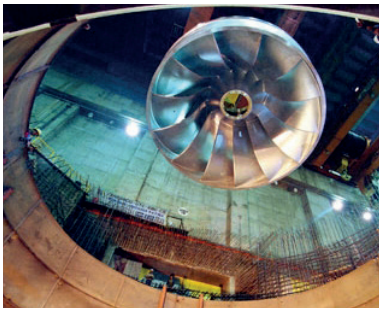
1. FOCUS ON CHANGING THE METHOD RATHER THAN ON THE SIZE OF THE DEVELOPMENT SCHEMES

Large energy infrastructures have been a key source of economic development in developed countries, and they remain so for many developing countries like Paraguay. However, the consequences of these developments have persuaded certain governments to change their approach: for these countries, it is urgent to study clean and renewable energy solutions as alternatives to dams, failing which fossil fuels will remain the principal option.

Designing smaller installations would permit reducing their ecological impact and make it possible to increase their number with management ensured at local and even individual level. But hydroelectricity, which is often exclusively, though wrongly, linked to mega-dams, can be generated in other ways: river kinetic turbines have emerged to complete the range of energy production solutions available to territories, while run-of-the-river plants have long provided a proven river development solution capable of ensuring fluvial continuity. (--> see the different forms of hydroelectricity in the introduction).

To assist this miniaturisation, **local energy consumption loops** have to be developed in addition to centralised grids. Hydroelectric energy can be technically integrated in such local loops: it can be distributed by a national or regional grid, by mini-grids and even remotely. These options nonetheless raise other problems, since a great many smaller and dispersed installations are far more complex to manage than large centralised infrastructures. The resulting problems of governance could eventually hamper integrated resource management. Is it always more acceptable to build several smaller structures on a river than one mega-dam? How can the real impact of the different options on populations and biodiversity be measured?

The examples of Paraguay and Bangladesh (see below) show that a binary viewpoint that simply pits mega-dams against small hydropower development schemes, is incapable of grasping the complexity of the national and local stakes in play.



Paraguay: hydroelectricity as a development option

The flood linked to the creation of the Itaipu reservoir had marked impacts on the populations involved (12,000 persons displaced) and on biodiversity. The dam's economic benefits and environmental programs nonetheless attract considerable assent from the local populations and associations. According to the Itaipu's Managing Director, James Spalding Hellmers, ***the cost-benefit analysis of the dam regarding the environment also has to take into account the consequences that an alternative choice of energy production would have had****. Itaipu represents the equivalent of 22 nuclear power plants. In 2016, production reached a new world record unrivalled anywhere else, with 103,098,366 MWh. This performance is equivalent to avoiding the daily consumption of about 450,000 barrels of crude oil. Likewise,* ***80 million tons of CO_2*** *emissions are avoided every year (which represents about 26 million cars each travelling 15,000 km).*

Bangladesh: restoring the natural rhythm of the river after nearly 40 years of dams

For Bangladesh, dams are no longer an option. In the 1970s the country wagered on these structures to contain the river, created reservoirs and promoted irrigation, by profiting from its network of ***more than 700 rivers****. After 40 years of insurrections and conflicts with local populations, the government radically changed its policy and in the 2000s* ***started a vast programme to dismantle its dams and restore its rivers****.*

To go beyond these opposing strategies, IFGR called for the **adoption of a more holistic approach**, more open to alternatives with account taken of more factors than the sole issue of energy. This approach relies on several prerequisites:

- territorialisation of the issue by taking account of the territory's specific characteristics, and by taking into account more factors than only that of energy;
- the evaluation of all the dams' impacts (environmental, economic, societal and cultural);

- alternative options to projects considered initially must be provided;
- studying the synergy between sizes and energy mixes;
- working on the governance of different systems;
- looking beyond good practices, which by nature are retrospective since they stem from past experiences. Turning resolutely to the future implies considering new processes for the continuous improvement of decisions, capable of completing these good practices by fixing them in the minds of all the actors, elected representatives and members of the community.

2. OFFSET ENVIRONMENTAL DAMAGE AND REDISTRIBUTE THE WEALTH GENERATED

Despite the improvements made to technology and governance that reduce the damage caused by hydropower structures, the territory will inevitably be affected by them. How can one ensure that the **positive externalities** outweigh the **negative externalities**?

Opinion on the notion of **offsetting** was not unanimous in the group. The debate on renewable energies appeared endless: solar energy, just like wind and hydropower, has impacts on the landscape, on land use, on flora and fauna and on the surrounding population. Despite this, can they be placed on the same level as the disasters caused by underground drilling and the greenhouse gas emissions linked to oil extraction and consumption? Using the term offsetting in a uniform way may stir confusion and lead to a feeling of counter-productive guilt among those involved in energy.

On the contrary, there was fairly general consensus regarding **the need to redistribute the added value** generated by hydroelectric structures.

However, this concept raises other questions: **What is the most pertinent area for ensuring solidarity?**

*In **Paraguay**, the income generated by Itaipu is redistributed throughout the territory, an obvious choice seeing that the whole country indebted itself to pay for the dam's construction. However, in Brazil, only 331 communities are concerned. Likewise at a finer scale, the disparity of wealth between the town of Ciudad del Este and the perimeter of the dam located nearby are striking.*

This observation could lead to insisting on developing the town, though the region surrounding the dam is already the richest in Paraguay. This leads to the question, How can local synergies and national solidarity be harmonised?

The second question raised by the issue of redistribution is that of the **value of the structure in the territory**. The hydropower schemes in the Rhone Valley have been a major source of economic development for the direct advantage of the local population. The expression "sharing added value" seems more adapted to that of redistribution in such a context.

Lastly, the very notion of redistribution should be resituated in the **specific context of the societies in which the value of equality predominates**. In Paraguay, which has a mixture of hierarchical and egalitarian value systems, the redistributive scheme of the dam appears to be accepted. In more individualistic countries such as Australia, Canada and, increasingly, France, the construction of large redistributive infrastructures has come under fire to the profit of more decentralised solutions, more in phase with the values of accessibility and individual freedom to which the populations of these countries are attached.

3. BETTER UNDERSTANDING OF THE SITING OF THE STRUCTURES

Great attention is required when choosing the **sites** of dams. This is difficult as it comprises taking different scales into account: should one reason in terms of catchment area, area of residence, or area of employment?

Tools are now available for making more global evaluations of the impacts of infrastructures on ecosystems and populations. By way of example, spatial data on biodiversity and services rendered by ecosystems lead to richer cost-benefit analyses.

New analysis methods can take into account the accumulated impacts of different dams on hydrology, sediment dynamics, ecosystem productivity, fishing, etc. In addition, developers should make their site selection criteria more transparent to improve dialogue with the other stakeholders.

Furthermore, efforts must be made to **integrate the landscape and geography of the sites**, which involves reflection on the design of the installations. The question of siting is linked to the cultural influence of the dam: in addition to the dam's economic and environmental integration, it is crucial to consider its cultural dimension.

The dam should contribute to improving the living environment and act as a symbol of identity. How and on what scale is it possible to enhance its cultural and touristic attraction?
The quest to **make these monuments part of local heritage** could lead to the emergence of pride and legitimise these structures in the eyes of local communities.

*In the case of Itaipu, many of its characteristics can be attributed to the site chosen for its construction, notably its **efficiency and safety**, due to its ideal hydrological and geological emplacement. The dam is located in gorges that concentrate the force of the river in a narrow space, and it is built on basalt. Each of the 18 turbines produces an average of 735 MW for 700 MW of installed capacity, which allows the Paraguayan and Brazilian governments to benefit from a cheaper MWh than that of a MWh purchased at Itaipu.*

*There is also its **acceptability**, which can be explained in particular by the fact that the land was very sparsely populated at the time of the dam's construction, and by its links with the communities located within its immediate vicinity.*

4. GIVING A PRECISE DEFINITION OF THE DAM'S ROLE AND RESPONSIBILITY

Dam managers sometimes hold a specific status in the national institutional landscape. In the case of Itaipu, the income generated from energy production represents nearly 3/4 of the budgets of certain municipalities. What is more, Itaipu has seen its activities evolve beyond its initial specifications. In the same way as CNR has carried out its Missions in the General interest since 2003 (see below) Itaipu has developed environmental, social, educational and public health missions. The management practiced by Itaipu and CNR is often subject to criticism, as they are accused by some of not doing enough, while others say they go beyond their scope of action. Thus it is important to precisely define the dam's responsibility vis-à-vis the public authorities.

This management must also be accompanied by oversight of how the incomes of these entities are allocated. According to the law, the income generated by Itaipu must be used for investment costs, science and innovation, and education. However, regulations do not prevent deviations. In the case of Itaipu, the governance of the funds must be carried out at national scale[2].

[2]A study was performed in 2013 by an American economist at the University of Columbia, on the economic benefits of income generated by Itaipu for Paraguay (study by Jeffrey Sachs available online: http://ccsi.columbia.edu/files/2013/11/Leveraging_Paraguays_Hydropower_for_Economic_Development.pdf)

CNR's Missions in the General Interest

CNR became an independent electricity producer in 2001, before its concession specifications were redrafted in 2003. Its historic missions have been enriched by the Missions in the General Interest, a free and voluntary commitment in favour of the Rhone Valley structured in five year action plans. Thus, CNR expresses the singularity of its corporate model, based on the principle of sharing with the territories part of the wealth generated by the river.

5. GUARANTEEING MULTILATERAL DECISION-MAKING

A recurrent theme in IFGR's debates, river governance was broached this time at the micro scale: that of the dam itself. Within the territory managed by Itaipu Binacional, it appears that the land confers a kind of diplomatic immunity. A protection programme has been set up to safeguard spaces that stretch up to 200 km along the river in order to reduce agricultural pollution.

The multilateral management of the river may be seen as the first step towards considering rivers differently; contrary to westerners who have turned them into borders, they are the principal thoroughfares of the indigenous peoples of the regions through which they flow.

The binational model of Itaipu functions in the following way: according to the treaty, the quantity of energy not consumed by one of the two States must be purchased by the other. In 2016, Brazil paid $360 million more to Paraguay. Paraguay's increasing growth is tending to reduce this disparity. According to studies based on the evolution of energy supply and demand, Itaipu should still be capable of supplying all of Paraguay's energy for at least the next 25 to 30 years.

6. IMPROVING ACCESS TO INFORMATION, THE PAST, PRESENT AND FUTURE

When the Itaipu treaty was signed in 1973, there was a prevailing feeling of indifference regarding the environment; information was difficult to obtain and relatively little was known about the subject.

Itaipu is currently developing models that provide local authorities with a huge amount of data to help them and manage the impacts of floods. This has had an effect on relations with knowledge, since people want to participate in collecting data and contributing to enriching knowledge.

IFGR emphasises the importance for public authorities and managers to set up dynamic mechanisms to ensure dialogue with, and information for, populations, and to promote mutual learning between traditional methods and the opportunities provided by technologies. IFGR considers that university education and the education of the general public should by supported in parallel.

7. PRESERVING FLUVIAL CONTINUITY

The heart of the problems raised by dams can be found in their very principle: by breaking fluvial, ecological and fish continuity, they jeopardise the initial functioning of the ecosystem concerned. It is therefore important to measure, at regional scale, the cumulative impacts of the different structures located along a river.

This observation also has an economic dimension: many dams, such as Itaipu, create a barrier across navigable waterways notwithstanding the fact that river transport significantly contributes to reducing the greenhouse gases emitted by road transport. Now technologies exist that allow partially restoring this link. Systems other than locks are available, such as cranes that can move containers from one boat to another at bulk breaking points.

Itaipu: fluvial continuity in question

The reflection now occupying Itaipu regarding the construction of a lock adjacent to the dam took up a large part of the panellists' time during the session. The question concerns the entire continent of South America, where navigable waterways must be developed to satisfy requires for trade and solve the lack of road freight infrastructures. The session press conference, organised on 21 March, allowed James Spalding and Ricardo Alvarez, the legal coordinator of South American navigable waterways and also a member of IFGR, to voice their opinions on this point. Reflection is underway to optimise the Parana's navigability in this region.

> *"Making the journey taken by water visible is also and finally a cultural challenge. An uninterrupted river is a narration, a history."*
>
> Erik Orsenna

EXCHANGES WITH GÉRARD MESTRALLET, CHAIRMAN OF THE MANAGEMENT BOARD OF ENGIE

The Chairman of the Engie's Management Board joined the IFGR programme in the afternoon of Thursday 16 March, to participate in the visit to Itaipu dam and the press conference organised for the event. After observing the hydroelectric scheme and then the Iguazu falls the following day, Gérard Mestrallet declared that he had successively discovered the most imposing human construction" and the "most impressive natural creation".

The following day, after the presentation of the conclusions of the session by Erik Orsenna, Gérard Mestrallet reacted to the proposals formulated by the group.

He concurred with the panellists regarding their observation of the upheaval that has occurred in the energy world over the last fifty years, and pointed out the role played in this transition by a major international company like Engie, active in the sector. For latter this transition represented a threefold revolution: technological, that has seen the production capacity of units fall from GWs to MWs (wind turbines) and to KWs (solar energy); digital, which has boosted energy efficiency; and cultural and societal, through which consumers' relationships with and perceptions of energy are changing profoundly. Deregulated, digitalised, carbon-free and optimised, energy is produced by new tools and controlled at finer levels.

For Gérard Mestrallet, hydroelectricity must assert its place in these changes. He also recalled the need to assist the new powers now available to local authorities to act in energy, since there is a role to be played in the decentralisation underway in countries that already have excess energy capacities. On the other hand, he remained convinced that centralised and decentralised energies must co-exist in the future, especially in developing countries, and called for the overhaul of large dams in more reasonable and appropriate forms.

Gérard Mestrallet hailed the integrated and redistributive models present around the table, Itaipu and CNR, and recalled the role that the collective intelligence generated by IFGR could contribute to these reflections.

To sum up

The seven points mentioned above are all tools proposed to decision-makers and are aimed at encouraging them to change their methods in order to build development structures that are accepted and legitimised upstream by all the stakeholders.

A large share of the exchanges of this fifth session focused on the complexity of dialogue on hydropower projects.

It appeared that mutual misunderstanding was partly due to the **difference in the registers of the discourses employed**, as they are not always, in fact less and less so, **based on rational standpoints**. We have shifted away from scientific rationalism that recognises technical progress as a solution to the world's problems, to different types of irrationalism expressed as follows:

- **a refusal to know**, demonstrated by the positions taken by the current American President;
- **greater humility** linked to the difficulty of predicting the future
- **the resurgence of the religious dimension**, concomitant with people's disillusion with science

Regarding the last two points, can they be defined as irrationalities, or an evolution of reason? Rationality is not just a Western expression in our globalised world. From the technological standpoint, the next step should lead to going beyond Cartesian logic towards techniques more in harmony with natural environments. Could a new ethic of development that integrates a larger number of dimensions rekindle the magic of progress?

A project for IFGR

3

On the occasion of this fourth session, Initiatives for the Future of Great Rivers wanted to go beyond recommendations by launching an emblematic project, a symbol of the change of method desired by IFGR. Continuing from the ideas expressed in part 2, the objective will be to meet the challenges now facing the world of energy (increased needs, global warming, decentralisation, smart grids, biodiversity, community participation, etc.).

By nature multidisciplinary, this project will aim to identify the development of a fluvial territory for energy, to meet current and future energy needs without jeopardising other services rendered by the rivers (navigation, leisure, irrigation, biodiversity, as well as being a component in individual and collective identity).

The project sets out from the premise that the river is an opportunity for the territories, to improve access to energy and to develop clean and innovative solutions capable of better responding to social and environmental challenges. Rivers are also spaces for which new mechanisms for community participation in public decision-making can be conceived. Indeed, tensions caused by certain hydropower projects are symptomatic of a breakdown of dialogue between developers, governments and citizens. New methods of legitimising decisions can emerge from such territories, and serve the more general debate now in progress in democracies regarding infrastructure projects with environmental impacts.

THE FORM CONSIDERED

The Call of Expression of Interest (CEI) should lead to the emergence, locally and for a specific river territory, of a meaningful model of energy development, that is to say one thought out in the long term and through which each individual / community can feel involved in building a common future. Based on this concrete example, the CEI should give rise to a methodology reproducible in other territories.

This model will take the form of an evolutive digital map that incorporates a large number of data reflecting all the uses of a river and which can be used as a decision-making tool. The map will generate information based on physical and economic data as well as on less easily quantifiable aspects (biodiversity, cultural heritage, individual and community values) that can be visualised in the form of different layers.
The model will be accompanied with a rigorous methodology for implementing the project, and include the training and transfer of skills to local stakeholders.

THE OBJECTIVES

Launching this CEI addresses industrial, technological, scientific and societal challenges.

In particular, its objectives are to:

- Prevent potential conflicts relating to the imposed construction of mega-dams;
- Get round the deadlock between rational/non-rational standpoints by bringing to light the complexity of relations with rivers;
- Bring specialists out of their bunkers, promote dialogue between sciences, technologies and societies;
- Improve community involvement by making individuals more aware of their energy consumption and more demanding from their elected representatives regarding the management of their natural resources (and the benefits that can be derived from them);
- Improve mutual understanding by making information visible (quantitative data and intangible values);
- Harmonise sectoral policies and thus pool the river's potentialities;
- Give another vision of river development;
- Maintain social well-being in the territory concerned.

STUDY TERRITORIES

Two river territories have been chosen at this stage. They have been chosen for the needs expressed, and for the links that IFGR has forged with them.

- Guyana
  Guyana is rich in relatively accessible hydraulic resources. The needs for energy supplies have been identified, likewise for the need to set up more sustainable river management due to major pollution problems.

- The Senegal river region
  Access to energy is still very unequal in the Senegal River catchment area. What is more, like elsewhere in Africa, these territories will benefit from the bottom-up approach that IGFR wants to initiate.

The two territories are also interesting for studying the synergy between different renewable energies, especially solar energy and hydropower.

4 Perspectives

THE CEI

IFGR will call on the European Union in the framework of its Call of Expression of Interest, in order to give international backing to the project.

Given the different paths provided by the EU, IFGR's positioning could be determined:

- through a response to an EU call for projects (IFGR would in this case be a member of a responding consortium);
- through EU funding of the CEI, which would be driven directly by IFGR.

INTERVENING IN A TERRITORY OF THE EUROPEAN UNION (GUYANA)

The EU's Horizon 2020 programme (H2020) seems the best adapted. The Horizon 2020 programme supports **innovative projects** and aims to rationalise funds in favour of growth. It adheres to three priorities: scientific excellence, industrial leadership and societal challenges.

The "societal challenges" section deals with the main societal problems giving rise for concern in Europe and elsewhere in the world.

It consists in implementing an approach based on the challenges to be overcome by using the resources and knowledge that cut across a range of technologies and scientific disciplines.

It encompasses the entire ***chain of innovation up to the final steps, before launching on the market, though it does not include this step****. Thus it will comprise activities relating to innovation, such as pilot projects, demonstration, test benches, support for public purchasing procedures and assistance for marketing innovations.*

The major challenges of this priority are:

- ***health, demographic evolution and well-being****;*
- ***European challenges relating to the bio-economy****: food security, sustainable agriculture and forestry, marine and maritime research and research on inland waterways;*
- ***safe, clean and efficient energies****;*
- ***smart, green and integrated*** *modes of transports;*
- ***the combat against climate change****, efficient use of resources and raw materials;*
- ***Europe in a changing world****: innovative and reflexive societies open to all;*
- ***safe societies*** *to protect the freedom and security of Europe and its citizens.*

INTERVENING IN A TERRITORY OUTSIDE THE EUROPEAN UNION (SENEGAL RIVER)

At this stage, it appears easier to join other existing projects/ programmes, if possible in partnership with entities that already have experience with the EU's DG of International Cooperation and Development (DEVCO).

The project should be limited to two geographic areas in which IFGR has legitimacy or strong interest, which is the case of the Senegal River. Once the geographic region has been defined, it will then be necessary to identify the European projects that will be set up, or which are in place, on the basis of information obtained from embassies in the countries concerned, from the EU delegation concerned, agencies such as AFD or from the site of France's permanent representation to the EU, where all the external aid actions are listed.

Furthermore, the current headline initiative in Africa is AREI (Africa Renewable Energy Initiative http://www.arei.org/). IFGR will examine how its project could be integrated within this framework in partnership with the European Commission.

THE NEXT SESSION

The next session will be held from 10 to 13 October 2017, in the Rhone Valley, as in every second semester of each year. First in Lyon and then in Annecy, the panellists will focus on the theme of pollution and health issues linked to rivers. These three days will also provide the occasion to take stock of the projects launched in 2016 and in the first semester of 2017.

This session will be the first organised by IFGR under its new status of association in the general interest. Two members left IFGR in 2017 for professional reasons (Marc Papinutti and Viraphonh Viravong) while three new members will join the IFGR panel in October.

Composition of the rivers Committee

Ricardo Javier Álvarez
Vice-President of the Argentinian subsidiary of the Ibero-American Institute of Maritime Law (IIDM) and legal coordinator of South American Waterways.

Madine Ba
General Secretary of the Organisation for the Development of the Senegal River since April 2013.

Pascal Bourdeaux
Historian, Associate Professor at the Ecole Pratique des Hautes Etudes (Religions of Southeast Asia).

Corinne Castel
Archaeologist, Director of Research at CNRS, Director of the French-Syrian Archaeological Mission of Al- Rawda, working at the laboratory "Archéorient. Environnements et sociétés de l'Orient ancient" of the Maison de l'Orient et de la Méditerranée (MOM).

Julien Clément
Doctor of anthropology; deputy director of the Research and Teaching Department of the Quai Branly Jacques Chirac Museum.

Daniel Dagenais
Vice-President of Operations of the Montreal Port Administration.

Katherine Daniell
Doctor of water sciences and researcher at the Australian National University, member of the National Committee on Water Engineering (Engineers Australia), specialised in water governance and participatory processes.

Bernd Gundermann
Architect, founder and director of Urbia-Group – Think Beyond.

Mohammad Mozammel Haque
President of the Bangladesh Inland Water Transport Authority (BIWTA).

Mirdad Kazanji
Director of the Pasteur Institute of Guyana.

Kabiné Komara
Former Prime Minister of Guinea, Kabiné Komara is the High Commissioner of the Organisation for the Development of the Senegal River (OMVS).

Sergio Makrakis
Associate Professor and researcher at the University of the State of Western Paraná - Unioeste (Brazil); specialised in evaluating the impacts of migration passes on fish populations.

Ghislain de Marsily
Emeritus Professor at the Sorbonne University (Paris VI-Pierre-et-Marie-Curie) and at the Ecole des Mines de Paris, member of the Academy of Sciences.

Gilles Mulhauser
Managing Director of water for the State of Geneva, Switzerland.

Tamsir Ndiaye
Managing Director of the Manantali Energy Management Company (SOGEM-OMVS).

Erik Orsenna
Economist, author, member of the French Academy and specialised in sustainable development, the environment, agriculture and emerging economies.

Papa Abdoulaye Seck
Minister of Agriculture and Rural Facilities of Senegal.

Alfredo Sese
Technical Secretary of Transport and Infrastructure at the Rosario Commodity Market (BCR).

James Spalding Hellmers
Paraguayan Managing Director of Itaipu Binacional.

Yangbo Sun
Director of International Cooperation of the Yellow River Conservation Commission, Ministry of Water Resources, China.

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INITIATIVES POUR L'AVENIR DES GRANDS FLEUVES
INITIATIVES FOR THE FUTURE OF GREAT RIVERS

An event hosted by and organised jointly with ITAIPU BINACIONAL

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