The Challenge to Sustainable Power Infrastructure Development in a Multinational Environment

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Introduction

The world has made significant progress in the last two decades translating a global vision into practice. For instance, the practice of sustainable development stimulates both benefits and difficulties while communicating needs and promoting understanding. This has further led to open dialog among individuals, governments, companies, and groups in all corners of the world. Depending upon the geographic location, this dialog has been translated into action, creating a momentum that has become infectious. Every year statutory and regulatory requirements become stricter, and various acceptable standards are promulgated by numerous organizations. On the flip side, the cost of compliance continues to drop to levels that governments and private sector firms find economical and acceptable.

Sustainable Development2

In 1987, the Bruntland Commission Report,3 which resulted from the United Nations-sponsored World Commission on Environment and Development, defined sustainable development globally as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*" In the last 20 years, the consideration of sustainable development has required social, economic and environmental objectives to be balanced and integrated through mutually supportive policies and practices or trade offs. Considerations this broad are fraught with risks especially in infrastructure development. Nonetheless, most recent international efforts have been directed toward implementation of this goal. For example, the Organization for Economic Development and Cooperation (OECD) has promulgated suggested guidelines for creating a National Sustainable Development Strategy (NSDS) that is intended to guide under-developed and developing countries. An NSDS is defined by the OECD as:

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2 This section has been adapted from: "Applying Risk Management Techniques to Global Growth In Sustainable Infrastructure Projects," Lia C. Nielsen and Dr. Kris R. Nielsen, *Proceedings of the 4th Civil Engineering Conference in Asia Region*, ACCEC, Taipei, Taiwan, June 26, 2007.

3 Bruntland Commission Report, World Commission on Environment and Development, 1987.

"A coordinated set of participatory and continuously improving processes of analysis, debate, capacity-strengthening, planning and investment, which integrates the economic, social and environmental objectives of society, seeking trade-offs where this is not possible."4

Although universally accepted as an important goal, sustainable development means different things to different entities. Regarding this issue with NSDSs, the OECD said:

"The achievement of sustainability in national development requires a strategic approach, which is both long-term in its perspective and integrated or 'joined-up' in linking various development processes so that they are as sophisticated as the challenges are complex. A strategic approach at the national level implies:

- *linking long-term vision to medium-term targets and short-term action;*
- *'horizontal' linkages across sectors, so that there is a coordinated approach to development;*
- *'vertical' spatial linkages, so that local, national and global policy, development efforts and governance are all mutually supportive; and*
- *genuine partnership between government, business, and community and voluntary organizations, since the problems are too complex to be resolved by any group acting alone.*

Over the last decade, governments, the private sector and civil society in countries across the world have struggled to meet the challenges of sustainable development through a wide array of approaches to develop such visions, linkages and partnerships at national and local levels.'

Now another 5 years later, there is developing a global consensus that is particularly strong between the American countries encompassing all types of stakeholders: individual persons; non-governmental organizations; local, regional or national governments; private companies – just to name a few of the groups. Particularly important are increased interests in achieving needed infrastructure through combinations of governments and private firms. Further, the emerging consensus is that infrastructure projects which lead to social development must come through sustainable project "development and cooperation" that recognizes larger and larger groups of stakeholders, for example, through bi-national or multi-national cooperation and recognition that sustainable infrastructure development also requires cooperation between multilateral development banks and/or private firms.

Now, with increased cooperation the focus must be on the "risks" and "risk management." To benefit form the emerging consensus of sustainable infrastructure development, one of the most important and early needs, as well as tests, will be in the development of energy infrastructure – particularly electric power generation infrastructure. At a recent convocation held at Princeton University, global industry leaders, educators, and professionals were introduced to many of the issues that the engineering and construction industry will face in the future. For example, in regards to sustainable infrastructure development, attendees were told that forty-eight (48) percent of all energy use and greenhouse gas sources are the result of infrastructure construction and operations. Further, as a segment of transportation infrastructure, transit projects have a comparable figure of as low as seventeen (17) percent. This

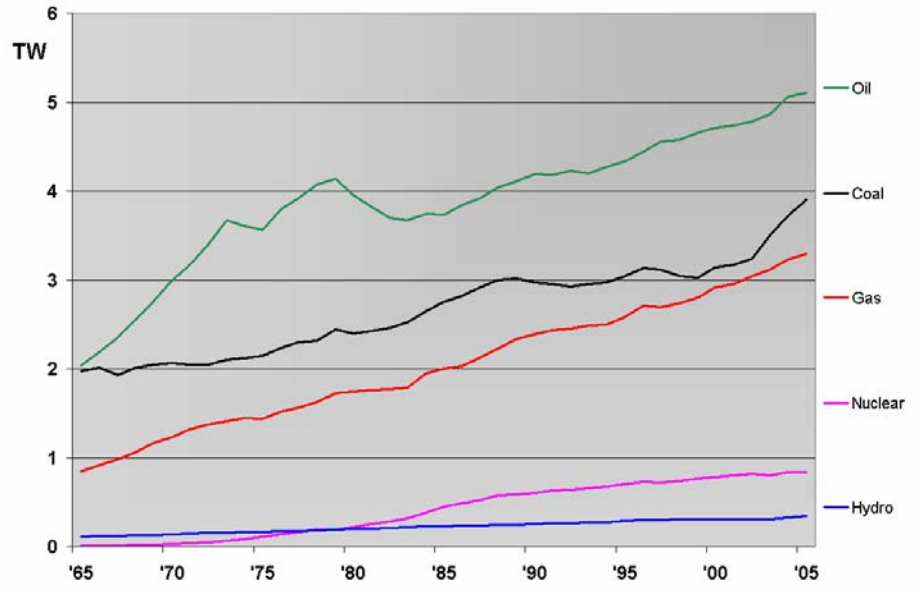
4 Bruntland Commission Report, World Commission on Environment and Development, 1987

figure, however, ignores several needed metrics. For instance, the electric generating plants, transmission lines, distribution lines, etc., typically are not considered when mass transit systems are evaluated. Yet, electric power generation development is one of the fastest growing infrastructure development sectors globally. With this in mind, the discussion below highlights some of the major risks that must be addressed regarding sustainable infrastructure in the electric power sector.

Electric Power Infrastructure

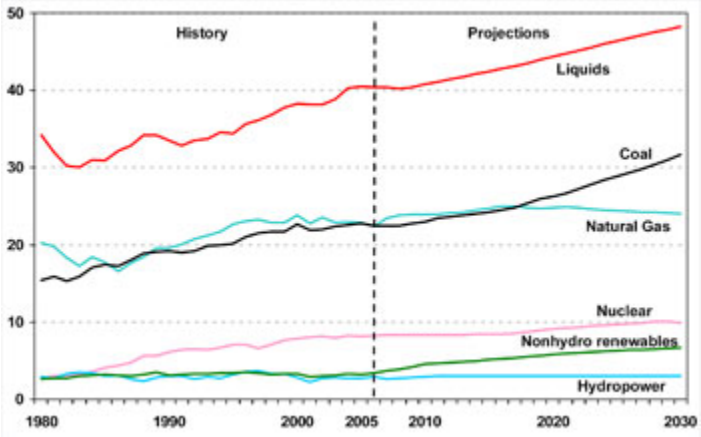
The importance of electric power cannot be over emphasized in regards to social development. Almost everything that does not have an internal combustion engine operates or is controlled by electricity. In addition, nearly everything (including those items that operate via an internal combustion engine) is produced, stored, maintained or transported with the assistance of electric power. Electricity permeates every corner of our daily lives. Having twenty four hour access to reliable electricity by some measures defines social development and is one of the major drivers of world urbanization. Over the last forty years global humanity on average has increased their quality of life. Providing electric power is one of the basic goals to which most countries are committed. Yet, the drive to have reliable electric power and better the lives of humanity is one of the chief causes of global carbon build-up which in return is regarded as the primary cause of climate change. McKinsey & Company in a report5 released in November 2007, reported that one of the main drivers of carbon emission growth was increasing use of carbon based fuels for electric power generation.

The reason is shown by the following figure6 produced by the U.S. Department of Energy's Energy Information Administration (EIA). The extreme growth in electric power consumption world wide in the last 40 years is accompanied by the increase from producing electricity via carbon producing fossil fuels.



5 "Reducing US Greenhouse Gas Emissions, How Much at What Cost," McKinsey & Co., New York, NY, USA, November 2007.
6 "World Consumption of Primary Energy by Energy Type and Selected Country Groups, 1980-2004" (XLS). Energy Information Administration, U.S. Department of Energy (July 31, 2006).

In most countries, especially in the Americas, there has been a desire to commit to building sustainable infrastructure, but that desire conflicts with desire to improve the human condition, especially when it comes to providing electric power infrastructure. On a global scale, as the above figure illustrates, renewable power generation, except hydropower, does not even appear on the graph. Similar EIA data in the following figure from EIA on projections of U.S. electric power consumption by generation source (quadrillion BTUs) as of June 2008 also illustrates why carbon emission reduction was one of the key themes in the recent US elections. In 2030 over 80% of U.S. electric power will still be produced by fossil fuels.



The reality is that power generation infrastructure, if is to comply with the growing consensus in the Americas must rely on hydropower and nuclear power generation for base load7 electric power generation over the next 20 years as new renewable technologies are developed, if we are to have sustainable infrastructure development at the same time.

Given the above facts, electric power provided by the Itaipu Bi-national Hydroelectric Plant is a good example of the type of regional cooperation that is necessary for the Americas. Providing sustainable electric power generation infrastructure, however, especially if provided through hydropower and nuclear power generation is a very expensive proposition. Currently, countries in the Americas and multilateral development banks are consumed with solving the global economic slowdown, and they will be consumed for several years in doing so. The latest discussions are that it will be at least through 2010! Demand will slip and electric power consumption may slip, but it will then continue its unrelenting rise because electricity allows humanity to achieve betterment. Ironically, providing for infrastructure development may be one of the solutions used globally to recovery economically, so politically the growing consensus should lean toward sustainability by demanding hydropower and nuclear generation infrastructure. In the long run, however, these two forms of electric power generation infrastructure can no longer be provided by governments and multilateral development banks. Developing concepts of private sector involvement through the use of Public Private Partnerships (PPPs) to execute and operate the such electric power generation infrastructure at the

7 Baseload or baseload demand is the minimum amount of power that a utility or distribution company must make available to its customers, or the amount of power required to meet minimum demands based on reasonable expectations of customer requirements. Baseload plants are the production facilities used to meet some or all of a given region's continuous energy demand, and produce energy at a constant rate, usually at a low cost relative to other production facilities available to the system.

current time and in the future is almost a given. Private investment firms are one of the stakeholders groups who are involved to large degree in the Americas.

When the concept is broadened to a regional area, like Itaipu, involving the private sector becomes more difficult and the risks are greater. Fortunately, electric power generation is particularly well suited for PPPs, but the greater risks and their management must be well defined for hydropower and nuclear power generation to attract private infrastructure investment. Some of these risks to be considered are addressed below.

Risks to be Considered in Integration and Cooperation Models for Bi-lateral and Multinational Sustainable Electric Power Infrastructure Projects

The following discussion is based on experience with hydropower and nuclear power generation infrastructure development in the Americas, as well as, elsewhere internationally. Pegasus-Global has been involved for thirty-five years in the Americas with hydroelectric projects ranging from the Guri Dam and Hydroelectric Complex in Venezuela to Rio Madeira-Monaro Hydroelectric Power Plant in Brazil. Pegasus-Global has also been engaged on over 50 nuclear power generation projects in the Americas, including the latest generation 3+ units that have been ordered in the U.S. The experience has involved public and private owners, E&C contractors, and the financial firms participating in PPPs. This discussion is not meant to be an exhaustive listing of the risks, but rather the special risks that bi-national or multinational electric power infrastructure adds to the equation, coupled with the perspective that comes from use of a PPP model.

The PPP model is more complex in that it usually includes operation of the facility for a substantial period rather than being limited to the expectation of engineering and construction only. Globally, private companies are replacing governments in providing the physical infrastructure and the operating infrastructure. The public and private sectors have new roles to play in building large infrastructure projects. PPPs unite the public and private sectors to deliver improved services to the community through innovative solutions, value for money and better services. More advanced PPPs focus completely on services, thus traditional engineering and construction of the infrastructure, and project management and contract administration, are only concerned with the providing of infrastructure. PPPs are focused on the whole-of-life costing, and as a result, the cost of the infrastructure is relatively minor when compared with the cost of services over the PPP's life. As a result, full consideration of the benefits of risk allocation to the private party must include relative assurances that those risks can be managed during the extended operating period. In the past, financing and operations were provided in the more developed countries by companies that were "nationals" of the specific country. Today, however, it is global investors and companies that are involved. As a result, "finance" is the most important factor in the future for infrastructure projects, and the realty is that operations are more important to prospective investors than construction. PPPs today are moving away from the concept of getting projects engineered and constructed, to a concept of providing a service to which the construction of facility infrastructure is merely ancillary.

Risks must be considered in terms of reducing the risk perception of potential global investors, so that the investors do not have to hedge against the perceived risks with a

greater fee over and above the cost of providing the service, the cost of providing the infrastructure and the cost of physical infrastructure upgrades during the period of the PPP. In the case of bi-national or multinational hydroelectric or nuclear power generation infrastructure, the perception at first is that these PPPs will be more risky for investors. Because electric power generation is considered especially important to the well being and security of countries, the risks at the planning stage must be addressed in the treaty that defines the hydropower generation or nuclear power generation infrastructure. The treaties that define the relationship between Brazil and Paraguay that underpins the Itaipu hydropower infrastructure is still a model that reduces the perceived risks from a macro basis!

Risk One – Corruption and Ethics

Corruption, bribery, and ethical behavior are a significant risk factor that is today being evaluated by global investors interested in infrastructure PPPs. Transparency International, for instance, has found that the engineering and construction industry is the second largest source of corruption world wide. The investment community must be assured that corruption and unethical behavior are eliminated through open and transparent processes. Global investors must be assured infrastructure PPP investments will adhere to the growing laws regarding governance, because most investment funds control money of individuals, such as through pension funds. The growing momentum regarding Infrastructure from multilateral organizations like the World Bank and the Inter-American Development Bank, coupled with the momentum from the engineering and construction and business communities through the global organizations including the World Federation of Engineering Organizations, UPADI, etc., and global leaders like Claudio Dall'Acqua and Bill Henry, has energized stakeholders in the last few year against the losses arising from corruption, bribery and unethical behavior. Bi-national or multinational treaties must provide investors with this assurance and provide that the governance rules will transcend national laws. Incorporating and demanding adherence to global rules on fighting corruption and imposing ethics is an absolute necessity in reducing perceived risk, and assuring transparency and accountability in all infrastructures.

Risk Two – Balancing Public and Private Interests

Every stakeholder to infrastructure holds a peculiar and unique position relative to the risk elements for which it assumes responsibility during the execution and operation of the infrastructure. When a bi-national or multinational electric power generation infrastructure is involved, the public of each country involved has to be assured project execution and operation globally recognizes concepts of risk management to which global investors are accustomed. With regard to risk management, a fundamental principle that must guide risk allocation from the perspectives of the governments, investors, owners and contractors is one of predictability. This concept of predictability may appear odd at first, but risks in planning, engineering, procurement, construction, commissioning and operation over long periods that PPPs represent requires a sense of predictability so that the stakeholders know how to react and manage the risks that they face. Predictability underlies the all aspects of project execution, from decisions on project financing to engineering, procurement, construction, and operation. What stakeholders require, however, is a predictable pattern in "who" has the consequences "commercially" when risks arise, as they always do.

Usually contracts are the primary means of providing such predictability Contracts must allocate the risks between the stakeholders, and this need requires identification, allocation options, and management plans under various contracting strategies. But when contracts involve bi-national or multinational infrastructure, the primary predictability must come from treaties. Predictability is gained from the resulting common understanding in the treaty that risks and their evaluation and management of the duration of the PPP will transcend variations in a country's government in the short term.

Where the infrastructure crosses international or state borders, the global investors and global companies are exploring various ideas, such as, privatized Governing Boards that are made up of individuals either from the concessionaire and the countries involved. The Governing Board can then assure transparent reporting of payments to/from the Concessionaire and reporting of expenditure by the concessionaire or the governments. This arrangement, for example, has assured the success of Itaipu. However, there is an evolving concept that protects public interests and the private investor interests, and thus predictability for both stakeholders, regarding electric power generation infrastructure. It grew from the fact that most power generation infrastructure was provided by private, investor-owned utility companies in the United States. Starting more than a century ago, state governments' granted an exclusive license or right in a geographic area to a single private company to provide electric power generation, transmission and distribution. In other words, they were granted an exclusive monopoly to provide electricity and were guaranteed all of the costs in doing so from the capital costs of infrastructure to operations costs plus a defined return on investment and a profit on incurred operating costs. The government then regulated the utility or different utilities in a state that served different regions through a public utility commission (PUC). If a utility incurred costs in meeting the terms of the franchise they were guaranteed the level of return set in the contract or established by the PUC. After years of argument over the cost, a concept known as "prudency" evolved which provided the predictability that both stakeholders desired. "Prudency" comes from a 1923 decision of the U.S. Supreme Court that reviewed invested costs. The court determined the costs of:

> *"Every investment may be assumed to have been made in the exercise of reasonable judgment, unless the contrary is shown."8*

Over the next few years the role of a PUC evolved so that they performed a prudence review of costs invested or incurred in operations, and eliminated from the all the costs that are imprudently incurred.9 In the last decade, PUC's approve in advance an annual integrated resource plan (IRP) which recognizes generation diversity, goals such as carbon reduction and demand reduction (efficiency improvement), and new base load infrastructure. In the case of electric power generation infrastructure, they approve an amount and a date by which the baseload facility must be placed in service. The utility must report on progress periodically and the PUC can audit performance against plan. For example, if the costs exceed those that were approved by more than a certain amount annually, either the utility cannot recover the costs or the utility can attempt to prove their prudence. If the utility manages the generation infrastructure within the approved amount, the costs are assumed to be prudent.

8 Brandeis in Missouri ex rel. Southwest Bell Tel Co. v. Public Service Commission, 262 U.S. 276, 289 (1923)
9 West Ohio Gas Co. v. PUC of Ohio, 294 U.S. 63,55 S. Ct. 316 (1935)

In a treaty that governs bi-national or multination electric power generation infrastructure the prudency concept can be included. I understand that the joint Brazilian-Paraguayan commission has generally worked well. Finding solutions such as I have suggested is aimed at providing potential PPP investors an assurance regarding risk that improves and lowers the level of return that investors can be expect while at that same time protecting public interests and those of individuals.

One additional risk that has been handled by a treaty is an example from North America. Hydropower generation infrastructure has been built in remote areas of Ontario, Canada, to meet a portion of electric power needs in the Northeast U.S. The Americas have the potential to meet needs and goal in a similar manner. An advantage that is offered by bi-national or multinational electric power generation infrastructure is meeting goals and needs over the long term through cooperation in this manner.

Risk Three – Risks Peculiar to Multinational Hydroelectric Generation Infrastructure

From an engineering perspective, hydropower generation infrastructure is one of the most complex projects to undertake and a very difficult from the perspective of bi-national or multinational infrastructure. Most perceived risks are within four broad categories listed below. The categories are very interrelated. From the perspective of three groups of primary stakeholders (governments, investors, and the general population) the perceived and actual risks from each category are greater in ascending order:

- Technical
- Economic
- Environmental
- Political

Each category of risk generally must be covered in treaties that underpin the generation infrastructure before many of the technical risks are solved, but treaties can solve many contentious issues. For instance, water may come from a basin that includes territories in several countries, but the infrastructure is located entirely in a single country. Sharing the water and electrical output between countries can reduce the perceived risk, include economic advantage to the citizens of the countries involved, and thus reduce the risk from the perspective of prospective investors. Investors factor into their willingness to consider a long term PPP investment from the reduction of issues between counties and the long term benefits to populations. The potential risk reduction in fact affects under-developed regions and developed regions alike.

The most risky issues are political. The root cause of many perceived risks is differences in political ideology. Ideology, however, has a significant chance of changing over the time that a PPP will exist. Recognizing that a PPP within a treaty to build and operate bi-national and multinational electric power generation infrastructure independent of individual country's politics is critical in reducing perceived risk to investors. The treaty should ideally provide high level guidance in the case of hydropower generation infrastructure on political issues like trans-basin diversions of water, future upstream and downstream water uses, etc. This coverage provides the basis of predictability as suggested above.

Risk Four – Risks Peculiar to Nuclear Power Generation Infrastructure

Safety and security are particular concerns globally for nuclear power generation infrastructure. Levels of safety and security for a particular nuclear power plant are typically submitted to government agencies, for example, Brazil's National Nuclear Energy Commission. The current treatment for this perceived risk trend globally, is to have an independent regulatory agency that is independent from the agency that promotes, develops, and/or operates nuclear generation infrastructure. Brazil, for instance, is considering creating an independent nuclear safety regulator which would bring their expanding nuclear program in line with international standards for safety and security inspections.10

The next major risk for nuclear electric power infrastructure globally is engineering and construction costs which lead to many perceptions, especially so for owners and operators who may be public and private entities. The risk causes cost consequences or the perception problems from the public and from rate payers who expect the owners and operators to assure value for money in the execution and operation of the infrastructure, but at the same time assure safety and security. Therefore, the twin areas of economics and safety are assured of reduction in risks by the provision of separation of the regulation as suggested. The "prudency" concept also is important because the cost of nuclear safety is considered when estimating the plant, but new safety enhancing requirements are generally an exception that allows cost and schedule increases. Of course, the owner and operator would have to prove that they made reasonable efforts to identify safety related risks and has in placed rigorous processes to control, reduce, or eliminate impacts to the infrastructure, which assures in particular the public and investors. Once again the goal is predictability.

The other solution is provided by the nuclear power generation suppliers themselves. There are now five competing "standard" designs. This standardization assures that nuclear power generation infrastructure will not be designed as essentially "one of a kind" units, as was done with prior generations of nuclear power plants. The only issues should be site or location related differences. Parenthetically, standardization provides investors with additional assurance that there will not be shortages of qualified operators, maintenance personnel, spare parts, over the duration of a PPP.

Once again, the risks are similar in regards to bi-national or multinational nuclear power generation infrastructure. The most risky issues are still political and the root cause of many perceived risks is differences in political ideology. Just as with hydropower generation infrastructure, providing recognition and guidance with respect to economic and safety regulation within a treaty that is independent of individual country's politics is critical in reducing perceived risk to investors.

A Concluding Thought

The Americas have a great opportunity to achieve sustainable power generation infrastructure through bi-national or multination cooperation. The Americas can achieve

10 "Brazil contemplates independent nuclear agency," The Associated Press, September 2, 2008

the lofty goals to improve the human condition and at the same time entice necessary investor participation through a process for allocating and managing risk, which is essential in reducing execution and operating issues for electric power generation infrastructure.