Managing Environmental Issues During International Electric Power Project Development

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Responsible international project developers most often view environmental matters with quite mixed emotions. Those with whom Dynalytics has worked would certainly never contemplate jeopardizing the health of anyone in the world. But while they want their projects realized, and are willing to implement reasonable requirements, they are often asked to do more than is appropriate, more than is technologically possible, and more than is financially possible.

WHO IS IN CHARGE OF ENVIRONMENTAL MATTERS?

This question can be best answered by considering another basic question. *Why is the project opportunity being considered?* If, as is virtually always the case, the reason is that the developers view it as a business opportunity and seek a return on their investment, commensurate with the risks being taken, the answer is clear. Without a doubt, *the Project Sponsors who are risking equity during the development phase are in charge.*

They, after all, are the only ones who can truly understand and protect their companies' interests as they assess the balances between spending more to meet more stringent standards and continuing development versus devoting additional financial and staff resources in an attempt to negotiate less onerous targets, or possibly withdrawing altogether. There are, after all, a great number of alternate investment possibilities within the power industry, in other industries, and in numerous countries.

Within this framework, environmental issues do not differ from financial issues; they must be viewed in a *business* context. The "pecking order" of those to be satisfied is thus:

1. Project Sponsors
2. The Financial Community
3. Governmental Finance, Trade and Industry Officials
4. Governmental Environmental Officials
5. All others

There is absolutely no implication in this viewpoint that responsible decision makers will allow health to be jeopardized. As they balance broad needs, they always obtain input and guidance from knowledgeable environmental personnel.

WHOSE ENVIRONMENTAL STANDARDS APPLY?

It is critical to establish emission and discharge limits that are, simultaneously, technically and economically attainable, can be adhered to by plant operating personnel with reasonable training and efforts, and that are acceptable to the regulatory community. Unless all three conditions are met the project is unlikely to succeed.

Environmental standards for a specific project, particularly in developing countries, are not *ipso facto* defined in official documents; they are most often established through negotiation. Selecting them for a particular project is, much like addressing Human Rights, an exercise in juggling complex moral issues.

A high standard of living, as measured by per capita gross domestic product, is, as illustrated on Figures 1 and 2, associated with high per capita installed electric generating capacity. The data indicate (through the slopes of the lines) that an installed kilowatt of generation can increase a capacity-constrained country's gross domestic product by *$7,660 per year in South America,* and by *$17,900 per year in Asia.*

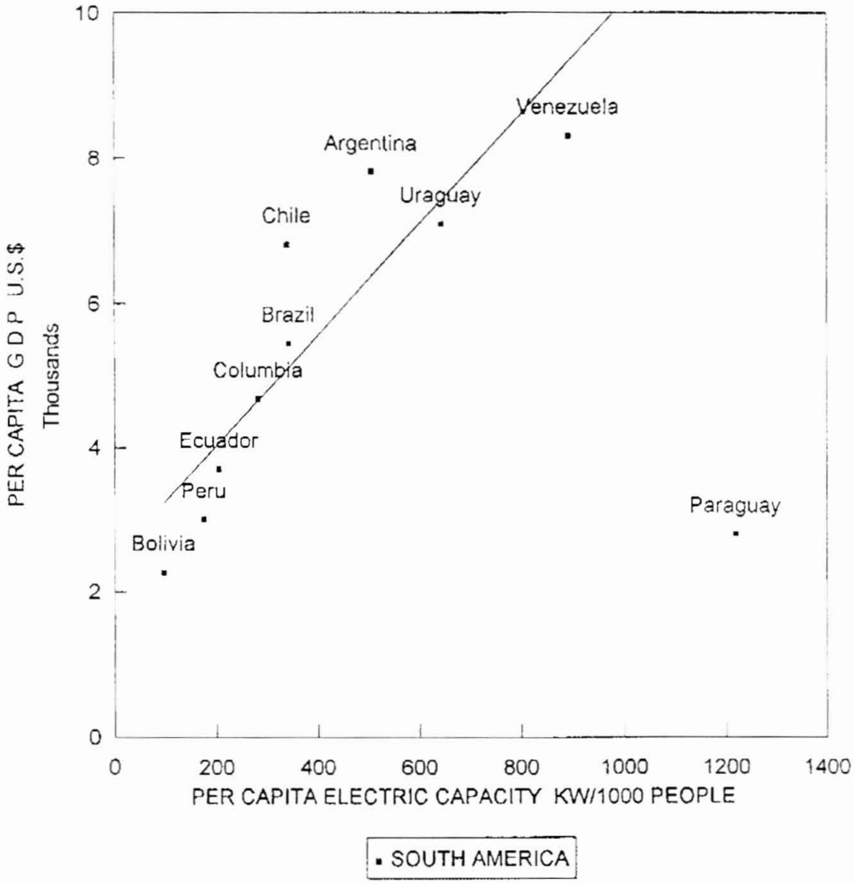

Figure 1. Electric Sector GDP vs. Generating Capacity

Electric generating capacity, however, typically costs only $1,000 per kilowatt to install. Basic questions then arise. Should power plants in countries whose citizens are not able to afford basic foods and medicines be held to the highest possible environmental standards? Are the incremental health benefits worth the higher costs that will be incurred, thus making less money available for other pressing national needs? Is the country better off if project developers decide profits are inadequate, partially because of environmentally related expenses, and simply do not invest to provide needed generating capacity?

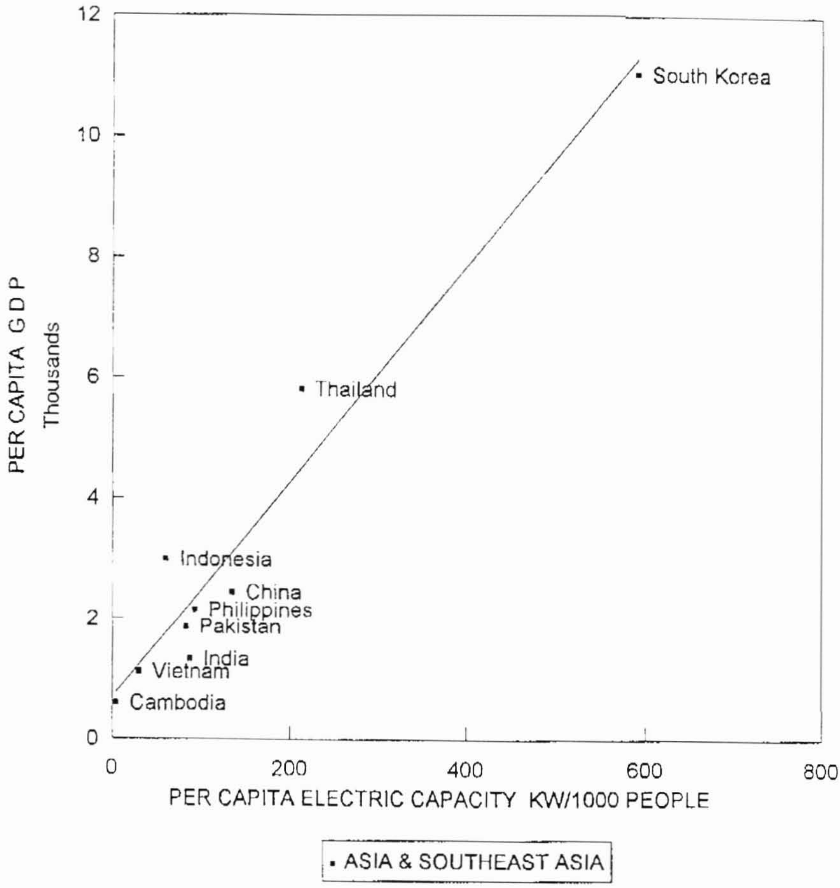

Figure 2. Electric Sector GDP vs. Generating Capacity

These are questions that should be answered by the political leaders. They are, however, often unfortunately answered by default at lower technical staff levels.

Environmental standards do, in fact, differ from one country to another, often by factors of five to ten. Differences may take the form of a limit on maximum ground-level concentration of air pollutants, averaged over a particular time period, being lower in one country than another. As examples, the maximum allowable concentration of SO_2, averaged over a 24-hour period, has been limited to:

COUNTRY	LIMIT (ppm)
Japan	0.04
Malaysia	0.04
Kuwait	0.06
Thailand	0.11
United States	0.14
Saudi Arabia	0.15
Turkey	0.15
Peru	0.30

Similarly, as examples, unit mass emissions of nitrogen oxides (NO_x) have been limited to:

COUNTRY	LIMIT (nanograms per Joule of fuel input)
Germany	70
South Korea	120
Indonesia	161
United Kingdom	230
United States	260
Philippines	350

As another example, related to water discharge, Saudi Arabia limits the temperature rise at the edge of the mixing zone to one Celsius degree. Many other countries will allow between three and five degrees.

Another type of difference arises when one country uses an averaging period that is different from, or in addition to, that used in another country. Thus, for example, Brazil has instituted a maximum allowable one-hour average concentration for NO_x, while many other countries do not utilize this. Until modeling is performed, it is not clear whether or not this shorter period average would lead to requiring more stringent controls than the more commonly used annual average. The World Bank is proposing new guidelines that also include a maximum one-hour average for NO_x.

Still another important difference concerns the number of times standards may be exceeded. The proposed World Bank standards require adherence to low maximum ground-level concentrations ninety-eight percent of the year, thus implying that exceedences will be allowed two percent (seven days) of the year. Other agencies permit higher concentrations, but restrict exceedences to once, or even zero, times per year. Until project-specific modeling is performed, it is not clear which is more stringent.

The practical choices of Standards are:

- the absolute minimum requirements (i.e., maximum impacts) that can be defended on a project-specific basis
- reasonable project-specific standards
- those, if any, of the host country
- those that can be accepted by the financial community
- the internal standards of the developer (or its parent)

Attempting to gain acceptance of absolute minimum standards will rarely be sensible for many technical and political reasons. While decisions must be made on a case-by-case basis, the best approach is to negotiate reasonable project-specific standards.

This, of course, implies that all concerned stakeholders, including project sponsors, the financial community, government officials and the community-at-large are reasonable and will, in fact, negotiate in good faith. Dynalytics' experience indicates that the most difficult problems arise from governments' insecure technical staffs, which will be discussed below.

Dynalytics always assembles three types of information prior to negotiating.

- Exactly what is planned? Clear answers to three simple questions must be available before environmental issues can be efficiently tackled:
  "What do you want to build?"
  "Where do you want to build it?"
  "How do you want to operate it?"

- What general approaches to meeting several different emission standards are acceptable to the developer, *and what are their quantitative impacts on the project's internal rate-of-return*? While this may require several weeks of investigation, and numerous assumptions, it certainly maximizes the likelihood that the opportunity can be realized in a manner acceptable to all stakeholders.

- What are the developer's *best alternatives to reaching an acceptable agreement?* This is the most critical information negotiators should possess, enabling them to make decisions in the broadest business context.

FIGHT? YIELD? WALK AWAY?

International project development is an exciting activity, often leading to emotional entanglements with the immediate opportunity being pursued. The developer, however, is often presented with a set of "non-negotiable demands" by environmental policy-makers, and must force himself to react dispassionately. Cosmetics and presentation may differ, but there are in fact only three possible responses; fight, yield or walk away. While each situation has its own unique factors, the following framework has been useful.

FIGHT IF: your environmental counterpart exhibits flexibility, and there is at least some precedent for the position you are taking, and the issue can be resolved in a reasonable period, and the project is perceived to be important by officials of the host-country, and the project is worth pursuing, and **winning on the particular issue is truly important to the project.**

YIELD IF:
winning on the particular issue is not greatly important to the project, and/or an item of some equivalent importance can be obtained in exchange, and there is no precedent for the position you are taking, and it is clear that your preferred position cannot be accepted in a reasonable period, and the project is worth pursuing

WALK AWAY IF: **winning on the particular issue is truly important to the project,** and it is clear that your position cannot be accepted in a reasonable period.

Importantly, once project-specific environmental standards are agreed to by all stakeholders, unless there is a tax on emissions, there will not be any economic advantage to doing better than necessary. Nor will there be realistic possibilities of not doing as well as agreed with one pollutant in exchange for doing better with another. Reopening the negotiations will most often lead to regulators and community representatives becoming frustrated, loss of credibility and lengthy delays. There are, of course, good-neighbor and good-citizen reasons to do better than necessary, where feasible.

THE ROLE OF TECHNOLOGY

Dynalytics' perspective is that international power projects are but one of many ways for investors to secure adequate returns. Within this context, the pollution control technology selected must be suitable for its intended *business* purpose. Dynalytics thus defines a Selective Catalytic Reduction (SCR) system as follows.

> *"An SCR system is a device purchased, installed and used to obtain an adequate financial return for investors."*

It need not be the most advanced available. It must, of course, be acceptable to regulatory officials who often are insecure and concerned with "image," to the financial community that is concerned about operational experience and performance risks, and to the project sponsors who must operate the facility in a dependable and economic manner. While selecting technology that will function properly is necessary, and its capital and operating costs are important, its effect on the permitting timetable, including technical reviews and the likely outcome of public hearings, must also be considered.

ACCELERATING TIMETABLES AND REDUCING COSTS

The activity with the largest impact on permitting timetables and budgets is producing a clear basis for operating scenarios, plant engineering, and equipment selection. Each time major components change, so do calculations and evaluations.

Once the project is defined, a *"Permit Reconnaissance"* can be undertaken to identify appropriate government agencies, procedural matters, areas of particular concern, the most time consuming activities, public notification requirements and potentially fatal flaws. It is important that this *Permit Reconnaissance* be based on information obtained from competent, responsible and experienced parties.

Sources of information include knowledgeable consulting firms, local (and United States) government staff, information brokers and others with formal training as information professionals. Technical and procedural information is becoming increasingly available electronically through the Internet.

It is exceedingly important to insure that all permit requirements and their significance are clearly understood. An overall licensing, permitting and approvals schedule can then be developed showing the inter-relationship between each permit and the various procedural and engineering tasks involved to gain approval.

Other pre-application activities follow normal business practices, including having initial informal contacts with appropriate agencies, then more formal scoping meetings to identify obstacles which must be overcome such as uncertain operating scenarios, lack of site-specific data, lack of standardized analytical methodologies, and lack of trained technical staff. Additionally, local concerns and public participation practices should be identified as early as possible.

Preparing, discussing informally, and then sending each involved agency a formal summary of points agreed upon, with a request for written confirmation of its points is common business practice. It is crucial for international projects where subtle differences in cultures, laws and language may lead to misunderstandings.

DOCUMENTATION AND APPLICATIONS

Certain documents will be necessary for government regulatory agencies, and the same or additional documents will be required by the financial institutions. Critical documents include the power purchase agreement, fuel supply and transportation agreements, the engineering-procurement-construction contract and the operating and maintenance agreement. Engineers' reports and various approvals and licenses as well as any environmental land use approvals or licenses, or environmental reports will also be required.

Most reviewing agencies have experienced, competent staff.

They, moreover, are willing to commission independent experts to assess controversial situations, or to provide specialized expertise. It will save time and frustration if documents are complete when submitted. This includes:

Project Description

Major equipment selected and operating scenarios, such as part-load profiles, plans for handling gas curtailments, types and compositions of fuels, delivery methods and storage scenario with amounts of fuels to be stored and emergency precautions related to containment and treatment of oil spills, method of cooling/condensing and noise mitigation measures

Site

Description of the site including its location, proximity to wetlands/forest or other conservation areas and flood-plains (if appropriate), land use/zoning requirements, base-line air, water and soil pollutant levels, and noise data

Air

Quantities and emission rates for air pollutants for various realistic operating scenarios, types of control equipment, guaranteed emission rates, predicted ground-level concentrations and comparisons with established criteria

Water

Quantity and source of water, method of treatment, waste-water discharge quantities, compositions, temperatures and disposal methods, and effects on the environment

Solid Waste

Characterization of solid and hazardous wastes, disposal methods, and effects on the environment.

Noise

Ambient noise levels resulting from operation, during daytime/nighttime hours at the site boundary and at any sensitive receptors

Possible Alternatives

A brief discussion of alternative fuels, sites and technologies to establish the reason for the proposed selection

Cost / Benefit Analysis

A brief discussion of alternate pollution control technologies, with reasons presented for the options being proposed.

Consistency in Environmental Analysis

Although many complex documents are required in the development of a project, it is important that the project descriptions and quantitative information presented be consistent. This is a difficult feat as each document may be prepared during a different phase, and the operating scenarios or equipment selection and size may change from one time period to another. Following are some specific examples of items which need attention to consistency.

a. Between the Power Purchase Agreement, the Fuel Supply/ Transportation Agreement and the EPC Contract
   - Fuel analysis
   - Handling of gas curtailments
   - Consistency with design capacity and load factors

b. Between the Power Purchase Agreement and the Thermal Sales Agreement
   - Consistency of fuel usage with design capacity/load factor
   - Consistency of water usage, discharge rates and characterization, with design capacity and load factor

c. Within the EPC Contract
   - Stack height & diameter, building dimensions
   - Emission levels and equipment specifications
   - Water usage and discharge details
   - Noise levels

Interacting with An Insecure Regulatory Staff

Dynalytics has encountered, in numerous developing countries, technical staff of regulatory agencies who have had excellent technical educations, and even been exposed, through literature or site-visits, to operating plants. They often thoroughly understand the theoretical and practical advantages and disadvantages of various types of modern control technology. In most cases, however, they have virtually no understanding of economics or financial realities.

They, moreover, have relatively excellent jobs, and believe, quite realistically, that a decision to approve using any particular technology will have little personal upside, and, even worse, is potentially a career-threatening action.

An insecure staff member takes two defensive positions.

+ **Makes unending requests**
  "We need additional information; We need additional information; We need additional information; We need additional information..."

+ **Focuses on procedural matters**
  "We have a new form; The form was not filled out properly; The form was not filled out completely; The form was not properly certified; The form was not properly delivered; The form does not have all the required attachments; The form..."

Dynalytics' experience throughout the world indicates that staff insecurity is the most common problem, and by far the largest cause of delays in securing permits.

This situation has two important implications. It is absolutely necessary to devote a great deal of time to educating regulatory staff, providing them with vast amounts of information, demonstrating that the decision to approve selection of a particular technology will not be controversial, and is thoroughly defensible. *(The technology is widely used by large companies; the supplier is well established; it comes with guarantees; etc.)*

Secondly, it is very important to have senior-level regulatory staff attend presentations, and become involved in the approval process as early and as intimately as possible.

POST-CONSTRUCTION REQUIREMENTS

Operating Permits in most countries have requirements that, while they must be understood and adhered to, will not severely impact operations in unanticipated ways. These include conditions such as restrictions on the number of hours a plant may operate using a certain type of fuel, or the quantity of a particular fuel used per year, or times when truck deliveries are not allowed. They almost always will include monitoring requirements for air and water.

Two other post-construction requirements are potentially more significant. Permits must be obtained prior to making any significant *changes* in equipment or fuels. While this is common, and even necessary from the regulators perspective, it can lead to lengthy delays at a time when the project sponsors, having made their investments, are most vulnerable.

Additionally, multilateral agencies such as the World Bank and the European Union are asking for permit language that *forces* implementation of more effective control technology as it evolves. This may or may not lead to disagreements about whether or not the proposed technology is appropriate, and whether or not full costs should be passed through under normal Power Purchase Agreement terms.

ABOUT THE AUTHOR

Dr. Herbert W. Cooper, Eng. Sc.D., is president of Dynalytics Corp., a technical consulting firm in Jericho, New York. The firm provides expertise in process design, economic optimization and permitting activities for various industries.

He received his BChE and MChE degrees from the City College of New York and a doctorate in engineering science from Columbia University.

In addition to his industrial activities, Dr. Cooper has taught graduate engineering courses at Columbia University and at Polytechnic University, and has been chairman of the Long Island Section of the American Institute of Chemical Engineers. He has written numerous technical papers, and has been granted several patents.