



October 17, 2016

U.S. Congressman Pedro Pierluisi, Sqr.
Member Task Force
Puerto Rico Oversight Board

Dear Hon. Pedro Pierluisi:

We appreciate the opportunity to submit selected highlights of four key improvement proposals for the consideration of the PROMESA Task Force in support of Puerto Rico's efficiency and cost-effective requirements for economic growth. As the former director of the Hydrocarbon Institute, the Office of Petroleum Fuels Affairs, the precursor of the Office of Energy of Puerto Rico, and for the past 30 years President & CEO of Argos Productivity Solutions, Inc., I have been an active participant in scientific and technological issues associated to the business, government, and academic sectors for helping achieve efficiency and cost-effectiveness. My efforts and initiatives contributing to the solution of many problems associated to economic growth and managerial importance in the energy, maintenance, and environmental fields are well documented. These problems of special interest need to harmonize technology with managerial practices and cultural change. The challenge: achieve sustainable improvement.

In order to help support the challenging efforts of your organization we have prepared four proposals associated to issues of critical importance to the energy and institutional improvement fields via enterprise architecture (EA)¹ visual modeling². This methodology is very familiar to us since some 20 years ago we started applying it to energy-maintenance-environmental compliance issues (as far as I know we were the first to apply the EA methodology to the above fields of interest). As a matter of fact we constructed two restructuring models for the Puerto Rico Electric Power Authority (PREPA): the IDEAREP (Incremental Development of the Enterprise Architecture for Reliability and Performance) and REMAP (Reliability-based Environmental Management and Performance). The idea: cost reductions, reduce unnecessary redundancy, and achieve reliability with sustainable benefit. Our work was instrumental in helping achieve EPA/PREPA Consent Decree compliance, introduce the participation of environmental engineers at each power plant, help reduce sulfur content to lower levels, and formulate preventive work orders to facilitate compliance with particulates, metals, and SO₂ emissions.

¹ **Enterprise architecture** is the set of descriptive representations (i.e. models) that is relevant for describing an Enterprise such that it can be produced to management's requirements (quality) and maintained over the period of its useful life (change). In the context of our work initiatives (proposals) it means: a) a strategic information asset base, which defines de mission; b) the information necessary to perform the mission; c) the technologies necessary to perform the mission; and d) the transitional processes for implementing new technologies in response to changing mission needs. It includes baseline architecture, target architecture, and a sequencing plan.

² **Models** represent reality in a form that can be easily controlled, evaluated, and manipulated. Process modeling is a specialization of enterprise modeling. Models are defined in a variety of ways. One definition of interest: "A model is a structure that a system can use to simulate or anticipate the behavior of something else" (Hoyte, 1992).

Unfortunately, PREPA did not like the framework imposed by an improvement model or to have an institutional improvement model with the type of restrictions associated to process re-engineering, procedures, and business rules. Harmonizing technology with effective management and the need to change the work culture was and still is devil for some key officials more interested in partisan politics and their own style of decision making than work following quality principles of good management.

Please refer to the following summary of four key projects of interest. The EA methodology is fully understood and used by the federal government as the result of the 1996 Clinger-Cohen Act (i.e., the Information Technology Management Reform Act (ITMRA) together with the Federal Acquisition Reform Act became known as the Clinger-Cohen Act) and we can apply it to help implement any priorities of interest to PROMESA. Since the early days in which the Clinger-Cohen Act of 1996 was oriented to improve and/or support the way the federal government acquires, uses, and disposes Information Technology (IT) the field has expanded its horizon to cover a myriad of improvement efforts in all sectors of the world economy. Three of our proposals of interest are associated to PREPA (Hydropower improvements with Pumped Storage, reliability centered asset maintenance, and energy assessments in support of MACT Ruling) and the forth based on visual modeling of the enterprise architecture (originally submitted last April to OCAM and although of great interest to model the ISO 9001 certification process and the consolidation of municipal services OCAM could not proceed to develop it since the Office of Management and Budget (OMB) instructed them not to enter into new contracts for lack of money. Unfortunately, helping re-engineer internal processes and later consolidate municipal and central government services for cost reduction in our opinion are a crucial and necessary step. A brief description of our submitted proposals follows:

1. “Logical & Incremental Development of PREPA’s Hydroelectric Power System: Phase 1 – Pumped Storage via Engineering and Visual Modeling Improvement for Sustainable Economic Growth”.

8. In response to the critical situation that Puerto Rico’s economy is experiencing we propose to develop a hydroelectric power improvement project based on pumped storage and best available technology. **The concept:** The cost of electricity per unit during high demand (peak load demand) is much more costly than that of during off-peak demands. Water is pumped back to the reservoir during off-peak loads (e.g., during night times). Thus, pumped storage plants have the advantages of generating electricity at lower cost compared to other peak load plants (gas and diesel power plants). Therefore, the cost required to pump back is cheaper. Another advantage is that pumped storage plant capacity is not limited by the river flow and seasonal variations in the flow. This advantage of pumped storage plants allows to be operated all over the year in all seasons. Pumped storage reservoirs aren't really a means of generating electrical power. They're a way of storing energy so that we can release it quickly when we need it. Pump storage can provide reactive power load to stabilize voltage, black start capabilities, and spinning reserve. Pump Storage is even more valuable *if intermittent sources of electricity such as solar or wind are hooked into a system*. **The objective:** to contribute to the Puerto Rico Electric Power Authority (PREPA) needs to reduce fossil fuels consumption and facilitate the contribution of renewable energy and compliance with renewable energy policies. PREPA, our electric supply monopoly, is in great need of planning and harmonizing the technological, managerial, and work culture components associated to engineering improvement via long-term support of long awaited technological improvement measures with effective Operation & Maintenance (O&M) as a key goal of the proposed project. **The approach:** To advance in the

achievement of long awaited technological improvement and based on our experience and knowledge of PREPA, we propose to commence by planning the various initiatives associated to this project via visual modeling of their hydroelectric architecture. We are confident the proposed approach will provide a logical and incremental improvement of key engineering needs supported with quality processes, procedures, and inter-related key elements (i.e., based on current and future targets) to support Puerto Rico's power and service requirements. It is our belief that by improving the technological, managerial, and work culture components of the PREPA system we could help achieve Energy Improvements for sustainable benefit and energy policy compliance, thereby improving the operation and financial stability of PREPA. **Phase 1:** To assess logical and incremental HYDROELECTRIC power plant improvements and provide a better understanding of the efficiency techniques related to pumped storage. **Phase 2:** To implement the selected measures.

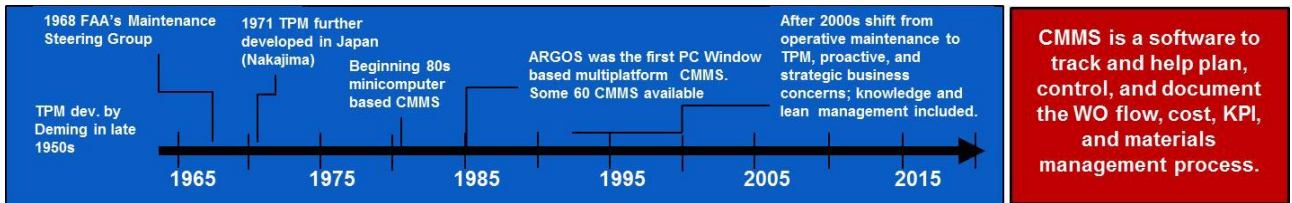
2. “Achieving Logical and Incremental Improvement of the Government and Municipal Enterprise Architecture for Reliability, Cost-Effectiveness, and Performance”

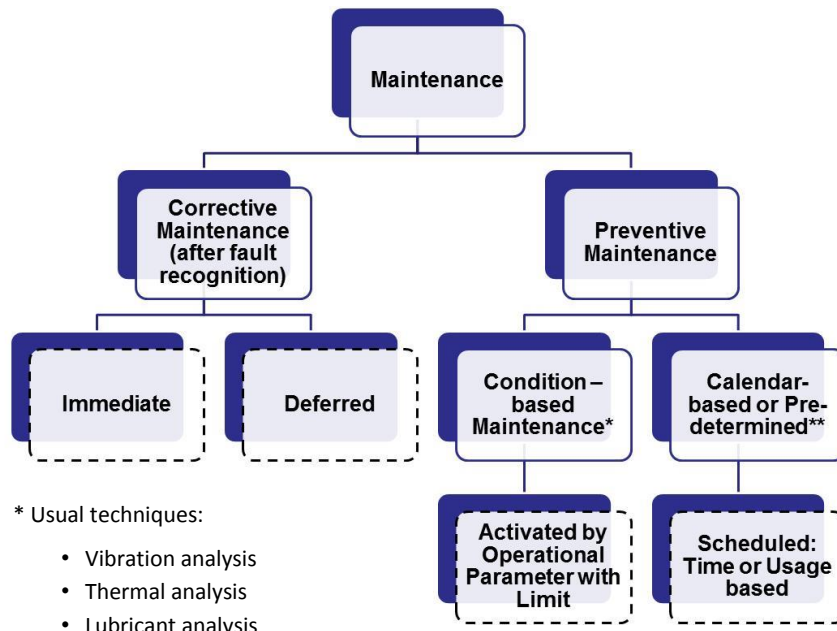
During the past decade global enterprises have moved beyond pure technology architecture focus to include enterprise business architecture, enterprise information architecture, and enterprise solution architecture. Architecture teams that fail to move beyond the technical focus will come under increasing pressure to demonstrate business value. To that effect our proposed modeling effort will help government executives think about the organization as a whole and provide the strategic knowledge-base that is critical for furthering the mission and vision of the government sectors of interest. By developing, applying the model, and watching it closely, we can gain a better understanding of where we are and make better decisions about where we want to go.. This vision yields a set of transformation goals such as simplification, cost reduction, increased agility and better service to the community with improved quality, efficiency and cost-effectiveness. In our case, this transformation will encompass the development of the **Incremental Development of Enterprise Architecture (EA) for Reliability, Cost-Effectiveness, and Performance (IDEAREP)** for institutional improvement, workforce practice optimization, cost reduction, and operational improvement. What we propose to do is to select key elements of the organization, apply Pareto Principle and stay focused on the transformation target using it to steadily guide managerial improvement, cost-reduction and services quality following a systems approach. The answer: to create step-by-step / phase-by-phase an institutional enterprise architecture government model and reengineer key processes and procedures designed to support the required transformation including workforce and information system improvement.

3. “Applying the Pareto Principle to Achieve Short Term Improvements in Asset Maintenance and Reliability Practices Across all of Puerto Rico Electric Power Authority (PREPA) Power Plants”

For many years PREPA has suffered serious plant failures but more important, has incurred in an expensive maintenance work practice (WO) because of poor maintenance and lack of any significant documentation of their WO planning and scheduling of their critical physical assets. The unfortunate situation is that although they have a very comprehensive CMMS (computerized maintenance management system) the system lack user friendliness, lacks a documented knowledge base (many key official has retired or left the company) and the critical financial support of the Executive Level to help migrate to a work practice capable of balancing technology with managerial know-how and cultural change. To help correct some of the known barriers that limit performance our firm started in 2004 the development of the REMAP model (i.e., Reliability Environmental Management and Performance) an instrument that was very successful in helping comply with the EPA/PREPA Consent Decree by linking

maintenance work practice to environmental compliance in the Cataño Basin. To help resolve the existing situation, we propose to develop the PREVENT Reference Model, following a logic and incremental approach to assess the existing condition of critical power plant assets (i.e., migrating to an asset centric focus) and help increase efficient and cost-effective maintenance performance with work capacity in compliance with ISO 55,000 standards to support PREPA’s asset management and asset management systems for reliable power plant operation. APSI is well known for having developed ARGOS, the only local commercial computerized maintenance management system (CMMS) that ranked for several years among the first 25 applications in the maintenance world. The following maintenance work order improvement modes for power plant risk reduction are associated to our goal of migrating to a Reliability Centered Mode with Sustainable Performance at Effective cost. **Mode 1: Migrate from a reactive or corrective (run-to-fail) maintenance (CM) to a preventive (PM) mode – SAVINGS: 15-25%; Mode 2. Migrate to Reliability Centered Mode (RCM) – SAVINGS: 30-50%; and Mode 3. Migrate to a TPM mode.** PM was originally oriented to eliminate failures and help implement periodic system overhauls to ensure goal compliance. However, a calendar-based mode is not cost-effective and do not necessarily satisfy maintenance goals. A condition-driven PM (direct monitoring) is called Predictive Maintenance (PdM). In brief, the overhaul mode assumes (in reality many profiles exist) that all equipment suffers from “a bathtub curve”. Migrating to a RCM goal is not to prevent all failures but to identify the severity of the impact of a component failure to determine the most cost-effective maintenance approach to satisfy goals and program requirements (i.e., proper balance of parameter activated with limits PM, applying predictive testing and inspection with key indicators of potential failure) and CM to achieve a proper failure management strategy). RCM look at investments in redundancy and backup provides more cost effectiveness than following a simple PM approach; and under a TPM (a proactive approach) the asset operator is trained to perform many of the tasks associated to simple maintenance and fault finding. TPM is a complement to lean manufacturing (i.e., the expenditure of resources for any goal other than the creation of value is considered wasteful) and is designed to make processes more reliable and less wasteful. To succeed we need to harmonize technology with managerial know-how and work culture. It is not a maintenance management program. It will be oriented to achieving a reliable power generation function.





* Usual techniques:

- Vibration analysis
- Thermal analysis
- Lubricant analysis

**Task done on a continuous established interval of time

Lean Management or Lean Production - it is based on the elimination of waste, continuous improvement, and the concept of Just-in-Time for achieving a World Class Manufacturing operation or the capacity to compete anywhere in the world (Wireman, 1990).

Maintenance Strategy – Although there are different possible definitions we can say it is the choice between corrective, preventive, condition based maintenance, inspection, equipment upgrades, and backup equipment. The mix of these elements is specific for each facility of interest.

4. “POWER PLANTS ENERGY ASSESSMENTS FOR ENERGY & ENVIRONMENTAL COMPLIANCE”³

The U.S. Environmental Protection Agency (EPA) has included energy assessments as requirements in the recently-finalized Title 40 Part 63 Subparts DDDDD and JJJJ, or Boiler MACT, rulemakings. In issuing these rules, EPA noted that energy efficiency was chosen over fuel switching as a “beyond the floor” option. The Department of Energy has found that by using best practices, fuel/energy use can oftentimes be decreased by as much as 10-15%. In terms of the Energy Assessment, the boiler and turbine system are the focus of the study. The assessment will focus on the four typical components of a steam production and delivery system:

1. Steam Generation (boiler)
2. Distribution (piping, manifolds, insulation)
3. End-Use (process, turbines, motors, drives)
4. Recovery (condensate return, traps, etc.)

To achieve project objectives a well-balanced team with Qualified Energy Assessors will be assembled with the following capacities:

1. Demonstrated capabilities to evaluate energy savings opportunities for steam generation and major energy using systems.
2. Has background, experience, and recognized abilities to perform the assessment activities, data analysis, and report preparation.
3. Familiar with operating and maintenance practices for steam or process heating systems.
4. Additional potential steam system improvement opportunities
5. Additional process heating system opportunities.
6. Industry specific steam end-use systems.

To succeed we need to conduct the following tasks:

1. Visual Inspections of the boiler system

³ The proposed work was originally submitted as an unsolicited pilot project for the consideration of PREPA’s Planning & Environmental Directorate, April 27, 2015.

2. Evaluation of Operating Characteristics
3. Inventory of Major Systems Consuming Energy
4. Review of Available Plans and Procedures, logs and fuel usage
5. Listing of Major Energy Conservation Measures
6. Listing of the Energy Savings Potential
7. Comprehensive Report detailing the ways to improve efficiency, the cost of specific improvements, benefits, and the time frame for recouping those investments.

In the process of assessing the various improvement opportunities the Team will identify various potential energy assessment opportunities, such as:

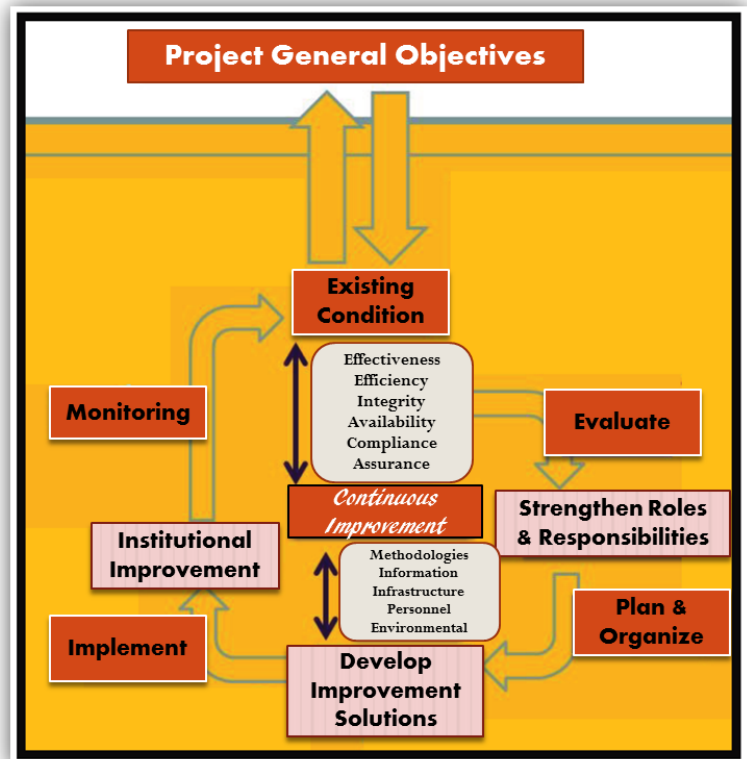
1. Equipment upgrades
 - Boilers/Burners, HVAC, Lighting, etc.
2. Efficiency improvements
 - Related to O&M
 - Work practice
3. Load reduction
4. Waste Heat Recovery
 - Economizers
5. Monitoring instrumentation

Methodological approach:

Management Control can be achieved if proper performance indicators are defined, measured, verified, and analyzed. The Team recognizes three ways any comprehensive energy assessment program saves energy:

1. efficient facility envelopes,
2. efficient equipment, and
3. efficient O&M

The energy assessment is required not only for the boiler system, but also for major energy use systems consuming energy from affected boilers. The diagram at your right provides a general overview of the work approach.



We consider that the above initiatives will help support the critical years ahead of us before combined cycle projects are implemented and more significant contributions of renewable



energy in support of economic growth are made possible. Appreciate this opportunity to contribute from a multi and interdisciplinary perspective to the solution of problems of technological and managerial nature in support of the Puerto Rican economy.

Cordially,

Juan J. Rigau, Ph.D.
President, Argos Productivity Solutions, Inc.⁴

⁴ What sets us apart is our capacity to follow a system approach, expedite the successful implementation of strategic plans, facilitate sustainable institutional improvement, and support efficient and cost-effective energy/maintenance solutions in support of our partners and the entities we serve.

SENIOR CONSULTANTS

JUAN J. RIGAU, PH.D., PRESIDENT & CEO APSI AND PROJECT DIRECTOR

ENERGY-MAINTENANCE-ENVIRONMENTAL AFFAIRS

President, Argos Productivity Solutions, Inc. (APSI)

(July 1980 – Present) - Total responsibility for company operations, business development and customer satisfaction. Overall project management and analysis. Directed the development of over 10,000 buildings technical audits including over 140 hospitals facilities. Developed the first world energy-maintenance-environment visual Enterprise Architecture improvement models (2000-2008).

Head, PR Gov. Renewable Energy Committee, (2006)

Head, PR Gov. Renewable Energy Committee (1999)

Consultant to:

Eight University Presidents (over 10 years) including UPR, Inter American Univ., PUCPR, Sagrado Corazón, SUAGM. Medical Sciences campus, UPR - Consultant for the creation of the Master's program in Environmental Sciences, the SUAGM Bachelor and Master program in Environmental Sciences and the development of the PUCPR Medical School.

Senior Scientist - Center for Energy and Environment Research and Director of Fossil Fuels Research (1977-1980). Recipient of the first grant offered by the Energy Research and Development Administration (ERDA) for studying the biodegradation of heavy and extra-heavy oils of Venezuelan origin.

POWERCHINA/HYDROCHINA– Authorized Representative for energy and economic development programs (2014-Present).

SIEMENS Building Technology Division, consultant on energy audits, maintenance management and sustainable improvement (2010 – present).

Johnson Controls, Inc. consultant in the development of investment grade energy audits (Level 3) and performance contracting in government projects (7 years).

Black & Veatch (4 years) - consultant and contractor for the creation of PREPA's environmental data base.

Government:

Director, Applied Research, FOMENTO (1969-71)

Director, Institute of Petroleum & Environmental Affairs, Economic Development Administration (1971-73) – entity created in support of the refining and petrochemical efforts of Fomento.

Executive Director, Puerto Rico Petroleum Fuel Affairs Office (Office of the Governor, 1973-76) (precursor of the PR Energy Office).

Publications: Thirteen basic science professional publications in referee journals and consulting and applied reports covering hundreds of applied reports in the energy, maintenance and environment fields.



WILLIAM WRIGHT, PH.D., SENIOR CONSULTANT TO APSI

Chief Consultant, [ArchSmart LLC](#)

July 2006 – Present (10 years 1 month) Washington D.C. Metro Area

Consultant to Department of Homeland Security for Enterprise Architecture, Data Architecture, and Systems Engineering.

President, Trans-X, Inc

2006 – Present (10 years)

Design and development of database systems, NIEM XML schemas and message exchanges, and enterprise architecture. Design and development of tools to automate design and development of message exchanges,

CTO, [Trouw Technologies](#)

2005 – 2006 (1 year)

CEO, [Computas NA](#)

2000 – 2004 (4 years) Greater Seattle Area

Commercial Software products company. Founded the company and led it to position of leadership in the international enterprise architecture market with clients in the US, Canada, Europe, Asia, Australia and South America. Sold the company to Trouw Technologies in Dec 2004

Chief Enterprise Architect [Boeing Commercial Airplanes](#)

1992 – 1995 (3 years) Greater Seattle Area

Director of Software and Database Systems [US Air Force](#)

1978 – 1981 (3 years)

Led teams into major development projects of high Pentagon interest that were in trouble, or were suspected of being in trouble, or were in the definition phase and trouble needed to be avoided. Conducted evaluations and analyses, recommended corrective actions, and monitored get-well programs.

Dr. Wright has provided technical support in the field of visual modeling of Enterprise Architecture to Argos Productivity Solutions, Inc. since 2002. He also participated in the formulation of the Institute for Solar Energy Applications (2007-2008)

ANTONIO SANTIAGO VÁZQUEZ, PH.D, SENIOR CONSULTANT

DR. ANTONIO SANTIAGO VÁZQUEZ; PH.D. in Environmental Engineering and Mathematics, Northwestern University, Evanston, Illinois, 1964.

Former Secretary of Public Works, 1969-1972; Chief of Staff of the Governor of Puerto Rico, 1977-1979; professor of School of Engineering, 1956-1969; 1973-1979; a recognized consultant with many honors and accomplishments in the fields of hydroelectric power and water resources.

Dr. Santiago Vázquez consulting firms have performed several important studies in Puerto Rico. Island-wide Water Supply Implementation Plan in 1983, Development Plan for the San Juan Bay Area in 1982, Development Plan for Mini and Micro Hydro-Power Plants in Puerto Rico, Impact of Heavy Trucks in the Roads of Puerto Rico, Mass Transport for Carolina-Rio Piedras-San- Juan using routes and stations in the System of the Metropolitan Bus Authority, and Transportation 2000 in 1976 for Metro Area.

In addition, Dr. Antonio Santiago Vázquez, has been the team leader or has managed over one-hundred studies in Puerto Rico about water resources, water supplies, flood control, environmental impact statements (EIS) and solid waste disposal. He was Partner in charge of Superaqueduct Project (including the EIS) and more than 25 related studies. He was also the Partner in charge in the development of environmental strategies and studies required to build PR 10 road through the Karstic National Forest of Río Abajo, in Utuado, Puerto Rico.

Under his tenure as Secretary of Public Works he established the first computerized system of traffic control in Puerto Rico. Construction of the San Juan-Ponce and San Juan-Arecibo toll-way system in Puerto Rico began under his leadership in 1970, as well as the use of exclusive lanes for public transportation and the design of systems for rapid mass transportation in San Juan (today Tren Urbano). In 1971 he established the development of VADIS, a computerized file of motor vehicles and drivers in the Island that was in use until 1995.

In 1993, Dr. Santiago Vázquez directed the Governor's Task Force to prepare the "Rehabilitation Plan for the Puerto Rico Aqueduct and Sewer Authority". Under his direction in 1983, the PR Island-wide Water Supply Implementation Plan" was prepared for PRASA. He proposed the creation of the Solid Waste Authority in 1971 and achieved its establishment in 1978 during his tenure as Chief of Staff of the Governor of Puerto Rico.

HONORS

Walter P. Murphy Doctoral Research Fellow, Northwestern University

Doctoral Forgivable Loan, Ford Foundation

Young Executive of the Year in the Government of Puerto Rico, 1970, by the Junior Chamber of Commerce

Selected as one of the ten most outstanding Public Works Executives in the United States, 1971

Citizen of the Year in Environment, 1993, by Environmental Quality Board, 1992

Luis A. Ferré, First Transportation Award as a Puerto Rican Leader in Transportation, 1993.

Previously, Dr. Santiago Vázquez was the first Chairman of the Environmental Quality Board of Puerto Rico which he established, Chairman of the Board of Directors of the Puerto Rico Energy and Power Authority, Chairman of the Board of Directors of the Aqueduct and Sewer Authority, Chairman of the Board of Directors of the Highways Authority, and the first Chairman of the Conservation Trust Fund of Puerto Rico. He was also involved in the conception and establishment of the Puerto Rico Natural Resources Department, which began as an area of the Department of Public Works in 1969. He introduced a computerized inventory system in the Department of Natural Resources in 1971. He also organized the area of Flood Control of the Public Works Department.

Dr. Santiago Vázquez was Chief of Staff (Secretaría de la Gobernación) of the Governor of Puerto Rico from 1977 to 1979. Dr. Santiago Vázquez was a professor of environmental engineering for 17 years at the School of Engineering of the University of Puerto Rico, where he was also the Chairman of the Civil Engineering Department (1966-68). In 1966 he was the founder and first director of the P. R. Water Resources Research Institute and in 1968 founded the P. R. Transportation Institute. He was selected in 1969 Chairman of the Inter- American Conference of Public Works held in San Juan Puerto Rico.

In 1968 Dr. Santiago Vázquez was a member of a team of water supply engineers selected by the Health Department of the United States and the International Development Administration to evaluate the drinking water supply in Perú. Dr. Santiago Vázquez was selected as Chairman of the First International Conference of Water Resources, held in Mayagüez, Puerto Rico and sponsored by the Department of the Interior of the United States. He also was Co-Chairman of the First International Conference of Land and Water, sponsored by the Water for Peace of the State Department of the United States. In 1968 he organized and chaired the First Conference on Water Pollution Control in Puerto Rico.

ORGANIZATIONS

American Society of Civil Engineers
American Water Resources Association
Instituto de Ingenieros y Agrimensores de Puerto Rico
American Public Works Association
Tau Beta Pi Engineering Honor Fraternity
Sigma Chi Scientific Honor Fraternity
American Water Works Association

FRANCISCO LOPEZ, PE, *Licensed Professional Engineer* graduated from the University of Puerto Rico, Mayaguez Campus

Engineer Lopez has vast experience in the production and operation of fossil fuel power plants. He was a former principal shift engineer and operation and maintenance power plant supervisor in PREPA’s Electrical System.

Highlight of experience with PREPA:

- **Operation Administrator** - Organizes, directs and supervises all operation activities related to PREPA’s electrical systems and achieve compliance with applicable requirements.
- **Acting Director of Planning and Environmental Directorate** - Organizes, directs and supervises all planning and environmental protection activities related to the electrical system. Directs and supervises studies and investigations related to renewable energy projects and PREPA’s infrastructure expansion projects.
- **Head of the Environmental Protection and Quality Assurance Division** - **Organizes**, directs and supervises all environmental, quality assurance activities related to the electrical system. Directs and supervises studies and investigations to achieve compliance with environmental laws.
- **Juana Diaz Solar Plant Supervisor** - Supervises the research and development project concerning the operation of a 100 kW photovoltaic pilot power plant. Responsible for system and components operation to maintain proper operating conditions.
- **Training Center Administrator** - Administers projects focuses on creating Training Centers to formally developed employees. Developed the Electric and Distribution Systems Training Centers for PREPA’s employees.
- **Operation & Maintenance Section Supervisor** - Directs and supervises engineering work in the implementation of a power plant quality assurance program.
- **Principal Shift Engineer Supervisor** - Supervised production and operation of 488 MW fuel oil fired drum type Steam Generator Station. Two units were B&W/GE non-reheat rated at 44 MW. Four units were CE/GE reheated rated at 100MW. Responsible for system and component alignment for startup, shutdown and normal configurations. Coordinated production with demand in accordance with the system. Inspected and tested equipment repaired by maintenance crew, accepting it or rejecting it when repaired improperly. Handled plan trip out, boiler or turbo generator failure, requiring cross connection with other unit for continuous operation.

- ◆ Professional Engineer
State of New Jersey
Lic. No. 16394
- ◆ Professional Energy Auditor
Commonwealth of PR
Lic. No. 324
- ◆ Professional Engineer
Commonwealth of PR
Lic. No. 6394
- ◆ Corrosion Certification
Cathodic Protection
N.A.C.E., Texas
- ◆ Professional Environmental Auditor
State of New Jersey
Lic. No. 1000495132
- ◆ Safety Valve Certification
N.B.P.V.I.
Columbus, Ohio

PEDRO ANTONIO GELABERT MARQUÉS - *Tulane University of Louisiana*; New Orleans, Louisiana; Bachelor in Science (Geology) in 1956; Graduate School: *University of Michigan*, Ann Arbor, Michigan; Graduate School towards a Master of Science (Geology) 1960

Professional Experience:

Aug 1956 - Sept. 1959: **U.S. Geological Survey**; Physical Science Assistant (Geology);

Aug. 1960 - Aug. 1967: **Chief Geologist, Engineering Geology Section**; Department of Public Works, Commonwealth of Puerto Rico;

Sept. 1967 - Feb. 1968: **Technical Assistant to the Assistant Secretary of Flood Control & Beach and River Conservation**; P.R. Department of Public Works;

Mar. 1968 - Mar. 1969: **Assistant Director, Ocean Eagle Oil Spill Emergency Office**, P.R. Department of Public Works;

Mar. 1969 - Dec. 1970: **Executive Secretary, Committee on Natural Resources of the Governor Advisory Council**; Office of the Governor of Puerto Rico

Dec. 1970 - Dec. 1972: **Executive Secretary, P.R. Mining Commission**, Office of the Governor of Puerto Rico;

Jan. 1973 - Dec. 1976: **Executive President, Environmental Services of Puerto Rico, Inc**, San Juan, Puerto Rico.

Jan. 1977 - Mar. 1978: **Executive Director, Environmental Quality Board**, Office of the Governor of Puerto Rico;

Mar. 1978 – Jun. 1984; **Chairman, Environmental Quality Board**, Office of the Governor of Puerto Rico;

Jan. 1985 - Sept. 1990: **Director, Caribbean Field Office**, Region 2; U.S. Environmental Protection Agency;

Oct. 1991 - Dec. 1992 and 1997-2005: **Coordinator for the Wider Caribbean Region**; Office of International Activities; U.S. Environmental Protection Agency, Washington, D.C.;

Jan. 1994 - Dec. 1996: **Secretary, P.R. Department of Natural and Environmental Resources**;

Jan. 2004 to Present: **Consulting Geologist**, Puerto Rico Professional License No. PG-1

2006 to Present: **Chairman, Board of Directors**, Corporation for the Conservation of the San Juan Bay (Environmental Nonprofit Corporation)

2012 to Present: **Emeritus Member**, Advisory Council, Puerto Rico Conservation Trust Fund (Fideicomiso de Conservación de Puerto Rico de Puerto Rico).

Special Assignments:

Member of the U.S. delegation to the negotiations of the **Action Plan of the Wider Caribbean Region**, United Nations Environmental Program (UNEP); **Member, U.S. Committee to Man and the Biosphere Program (MAB)**; **Member, U.S. Delegation to the Summit of the Americas (SOA)**; and other international meetings. Signatory of **Conference of Plenipotentiaries on the Protection and Development of the Marine Environment of the Wider Caribbean Region** (Cartagena Convention), Cartagena Columbia, March 21-24, 1983. As member of the U.S. delegation, participated in multiple international and regional meetings.

Awards:

1. **Hammer Award for the Intergovernmental Real Estate Disposition Team**, National Performance Review, Office of the U.S. Vice-President, 1997.
2. **Environmental Citizen for the Millennium**, Puerto Rico Environmental Quality Board, San Juan, Puerto Rico June 5, 1999.
3. **Gold Medal for Exceptional Service for Outstanding Contributions to the Conclusion of an Unprecedented International Agreement for the Protection of the Marine Environment in the Wider Caribbean Region**, U.S. Environmental Protection Agency, Washington, D.C., 2000.
4. **Environmental Award for Outstanding Service to the Dominican Republic**, Institute of Engineers, Architects and Surveyor of the Dominican Republic, Santo Domingo, Dominican Republic, January 12, 2002.
5. **Dixie Lee Ray Award of the American Society of Mechanical Engineers (ASME)** for 40 years of environmental stewardship in the Caribbean and Latin America; Anaheim, California, November 2004.
6. **Professional Geologist License No 1**; Puerto Rico Department of State, San Juan, Puerto Rico

Membership:

1. **Member of the Directorate on Caribbean Islands**, U.S. National Committee of Man and the Biosphere (MAB-7); U.S. National Commission for UNESCO, Washington, D.C., 1978 to 1984.
2. **Member of the Advisory Council to the Center of Energy and Environmental Research of the University of Puerto Rico**, San Juan, Puerto Rico, Jan. 1976 to Dec. 1984.
3. **Number Member, Puerto Rico Academy of Arts and Sciences**, San Juan, Puerto Rico, 1972 to present.
4. **Fellow Member, Geological Society of America**, Denver, Colorado, April 8, 1957 to present.
5. **Member and Past President, Geological Society of Puerto Rico**, 1965 to present.
6. **Member, Puerto Rico Examining Board of Professional Geologists**, 1996 to 2000.
7. **Member of the EPSCR State Committee on Research in Puerto Rico**, Central Administration, University of Puerto Rico, Rio Piedras, Puerto Rico (1993 to 2004).
8. **Member, Consultative Council on Environmental Protection**, Puerto Rico Environmental Quality Board, San Juan Puerto Rico, Chairman 1993-1996 and Member 1996 to 2000.
9. **Member, Subcommittee on Research and Development for 1972 Puerto Rico and the Sea**, Office of the Governor of Puerto Rico, 1970 to 1972.
10. **Chairman, Subcommittee on Coastal Zone Management for 1999 Puerto Rico and the Sea**; P.R. Department of Natural & Environmental Resources, San Juan, Puerto Rico, 1972 to 1999.

Publications: Over 20 professional publications available upon request.

About Argos Productivity Solutions, Inc. (APSI) - APSI is an energy-maintenance leader in serving transformational goals for energy-maintenance-environmental improvement, more than 15 recognized consultants serving the government and industrial sectors, EQB, PREPA and firms such as SIEMENS and POWERCHINA. Our mission is to help set transformational goals such as simplification, cost reduction, environmental compliance, clean and healthier environment, better service to customers, and improved quality with efficiency and cost-effectiveness. For over 30 years we have helped our customers transform their operations by developing and supporting technical energy audits, visual enterprise architecture models and applying energy-maintenance effective monitoring with better process management. Our proprietary software applications PCEnergy and Argos, are premier tools for energy audit and analysis and maintenance management, respectively. They have helped us audit over 10,000 buildings including over 145 hospitals facilities. For more information, please call 787.309.9482 or visit our Facebook page.

APSI Profile

- Authorized consultants for SIEMENS, HYDROCHINA, AND POWERCHINA
- > 15 professional consultants
- 5 consultants with MSc and/or Ph.D. degrees
- Highly qualified energy-maintenance professionals.



Key Portfolio

- ThermoEnvironmental analytical instruments
- Visual modeling of enterprise architecture
- Energy-Environment consulting
- Computerized maintenance management software (Argos)
- Cogeneration
- Solar-thermal
- Training and support

Top Sales Service/Products

- ThermoEnvironmental (USA exclusive distributor since 1980 of monitoring instruments):
- Partisol 2000 and 2000i
 - Hydrocarbon, NOx, SO₂, and related critical pollutants
 - Air & water pollutants instrumentation
- Technical Energy Audits & CMMS implementation

To Achieve Coherence, Rules Should be Defined, Including:

- Standards
- Reference Models
- Service Profiles
- Principles

APSI facilitates legal and regulatory compliance

APSI helps achieve compliance with Energy Star Certification

APSI is an innovator in Visual Modeling of Enterprise Architecture for Sustainable Improvement

APSI helps bridge the gap between Strategy and Implementation

Market Opportunities

- Energy Improvement Measures
- Regulatory government (EPA, EQB, Comptroller, etc.)
- Healthcare
- Hotels
- Power Industry
- Industry
- Academic Institutions
- Performance contracting



Contact Information

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CONSULTING ASSOCIATES: HYDROCHINA / SIEMENS ENERGY / BLACK & VEATCH



- **HYDROCHINA**, supervised under the State-owned Assets Supervision and Administration Commission of State Council, is the only giant enterprise that furnishes comprehensive and full range of technical services in the field of hydropower, water resources development and wind power development in China.
- More than 80% of the planning and design work of hydropower projects, nearly 50% of the planning and design work of wind power projects and 70% of safety appraisal of hydropower projects in China are undertaken by HYDROCHINA. The total installed capacity of overseas hydropower projects planned and designed by HYDROCHINA has reached 16GW.
- HYDROCHINA has 10 subsidiary companies, a staff of 10,200 persons; more than 5,700 of them are engineers.

SIEMENS ENERGY

- **SIEMENS** cover the entire range of building technologies and improvement processes. With over a century of experience and continuous development in steam turbine technology, Siemens has stayed at the forefront of development and is a prime partner for our business. With a fleet of more than 20,000 steam turbines worldwide, Siemens is a reliable and experienced partner for PREPA.
- **SIEMENS** is fully familiar with the Puerto Rico Electric Power Authority with many decades of providing products and technical assessments.

BLACK & VEATCH

- **Black & Veatch** is a global engineering, consulting, construction, and operations company specializing in infrastructure development in energy, water, telecommunications, management consulting, federal, and environmental markets. **Black & Veatch** is the 11th largest majority Employee-Owned company in the United States. With revenues of \$3.6 billion, the company is also ranked by Forbes as one of the largest privately owned companies in the United States.
- Their employee-owned company has more than 100 offices worldwide. They have been ranked by *Engineering News-Record* as the industry's No. 1 design firm in both Power and Telecommunications and are consistently in the Top 10 in Water. We're also leaders in more than 20 categories among design firms, contractors and environmental companies worldwide. Black & Veatch is a firm with detailed knowledge of PREPA and participated with APSI in developing PREPA's environmental data base.