

The Vancouver Aquarium Expansion Project

VANCOUVER, BC



ASSOCIATION OF CONSULTING
ENGINEERING COMPANIES | CANADA

Canadian Consulting Engineering Awards 2015

SUBMITTED BY:

APPLIED ENGINEERING SOLUTIONS LTD.

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Mary Merraro

Subject: RE: 2015 Canadian Consulting Engineering Awards

From: Parsons, Bronwen [<mailto:bparsons@ccemag.com>]
Sent: Thursday, March 12, 2015 1:53 PM
To: Elaine Chong
Subject: Applied Engineering - Vancouver Aquarium Expansion - 2015 Canadian Consulting Engineering Awards

Dear Elaine Chong :

This is to confirm that we have received your Notice of Intention to Enter the above project in the 2015 Canadian Consulting Engineering Awards.

We have also received your entry fee cheque for \$350.00 + \$45.50 HST @ 13%.

On behalf of the Association of Consulting Engineering Companies-Canada (ACEC /AFIC) and Canadian Consulting Engineer magazine, thank you very much for taking part in the program.

You have now fulfilled the requirements for **Stage 1**. There are two more stages to the entry process:

Stage 2 - deadline Tuesday, April 21, 5:00 p.m. EDT

Documents required:

- Official Entry Form / Project Outline

This is an electronic form to be completed online at

<http://www.canadianconsultingengineer.com/official-entry-form-project-outline/>

Once submitted, you will receive a confirmation receipt by e-mail.

Please note that when completing the Official Entry Form at (2) Project Highlights, you should complete only the questions related to your project's category. For example, entries in Technical Categories A-F complete Questions 1-5; Entries in Category G Project Management complete Questions 6-10, etc.

Stage 3 - deadline Thursday, April 23, 5:00 p.m. EDT

Documents required:

- Entry Consent Form - print. Signed by entering firm and owner/client. Form attached.
- Project Entry Binder - print. Description and photographs of project in loose leaf binder, maximum 10 pages + forms.
- Project Entry - PDF. An electronic file of the Project Entry Binder to be posted at a special ftp site.

The Information & Entry Rules document attached gives you further details.

Please send all material to:

Bronwen Parsons, Editor
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www.canadianconsultingengineer.com

We thank you again for your participation in the awards. Don't hesitate to call me if you have any questions.



PROJECT: THE VANCOUVER AQUARIUM EXPANSION

Name of Member Firm Submitting: Applied Engineering Solutions Ltd.
Address of Firm: 2nd Floor, 1330 Granville Street
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Tel: (604) 569-6500
Fax: (604) 569-6501
Email: sghataurah@appliedengineering.ca

Contact Name: Sunny Ghataurah
Project Title: The Vancouver Aquarium Expansion Project
Location of Project: Vancouver, BC
Category of Entry: Technical – A. Buildings
Project Owner: Vancouver Aquarium
Project Client: Vancouver Aquarium
Prime Consultant: Musson Cattell Mackey Partnership

Summary Description of Project: This project is the largest expansion and renovation in the history of the Vancouver Aquarium. Applied Engineering Solutions' engineering design services included enhancing the electrical systems, powering equipment, lighting and lighting controls, low tension systems and the addition of new generator systems providing peak shaving. These generators removed the necessity to upgrade the incoming High Voltage infrastructure to the facility and surrounding area.

Names of Other Consultants Involved: Turnbull Construction Project Managers (Project Manager)
Names of Contractors Involved: PCL Constructors Westcoast Inc.

INNOVATION

This project is the largest expansion and renovation in the history of the Vancouver Aquarium. Featuring state-of-the-art sustainable design, the multi-year project includes a new entrance pavilion, outdoor plaza, upgraded public walkways, increased green space and expanded exhibits. The intent of the project was to double the indoor exhibit space and increase the pools by approximately a third, as well as adding the necessary support space to facilitate such a large expansion.

Applied Engineering Solutions (AES) was retained to assist with the expansion issues that had come up. The incoming High Voltage infrastructure electrical service needed to be upgraded not only to the facility but throughout the entire surrounding area. This problem was an unexpected and unresolvable service replacement that would require a quick and cost-effective solution to allow the Aquarium to resume their project and proceed with the expansion.

Our team completed an in-depth review and proposed a multi-pronged solution consisting of initial and ongoing load control and automatic usable power. In addition, a parallel, modular, scalable, emergency generator system was installed to automatically and seamlessly take some of the load off of the utility service during peak load periods (peak-shedding). By incorporating paralleling soft-transfer, previously implemented primarily for hospitals, casinos, and other critical power projects; this unconventional application required an understanding not just of the technical issues around creating a high-reliability automated power control system, but an understanding of a

different organizational priority system. Conventional emergency power systems focus on delivering power to systems to permit safe evacuation in an emergency, but the emergency power for the Aquarium is focused on meeting a variety of operations.

AES was able to design a solution that would allow the Aquarium to change the emergency power delivery based on their changing priorities, which can change from hour to hour. The changes occur automatically, but permit manual intervention for unforeseen conditions, or to minimize fuel consumption.

- unconventional applications - advanced technology

The application of this type of automated system had not been done by any of the local power equipment suppliers and extensive communication and coordination was required to attain agreement between all parties involved.

The system is controlled by a 15" touch screen Human Machine Interface (HMI). This user-friendly interface provides the ability to view multiple screens, displaying functions and allowing users to change the set points. This particularly advanced technology provides ease of use for the new systems.



COMPLEXITY

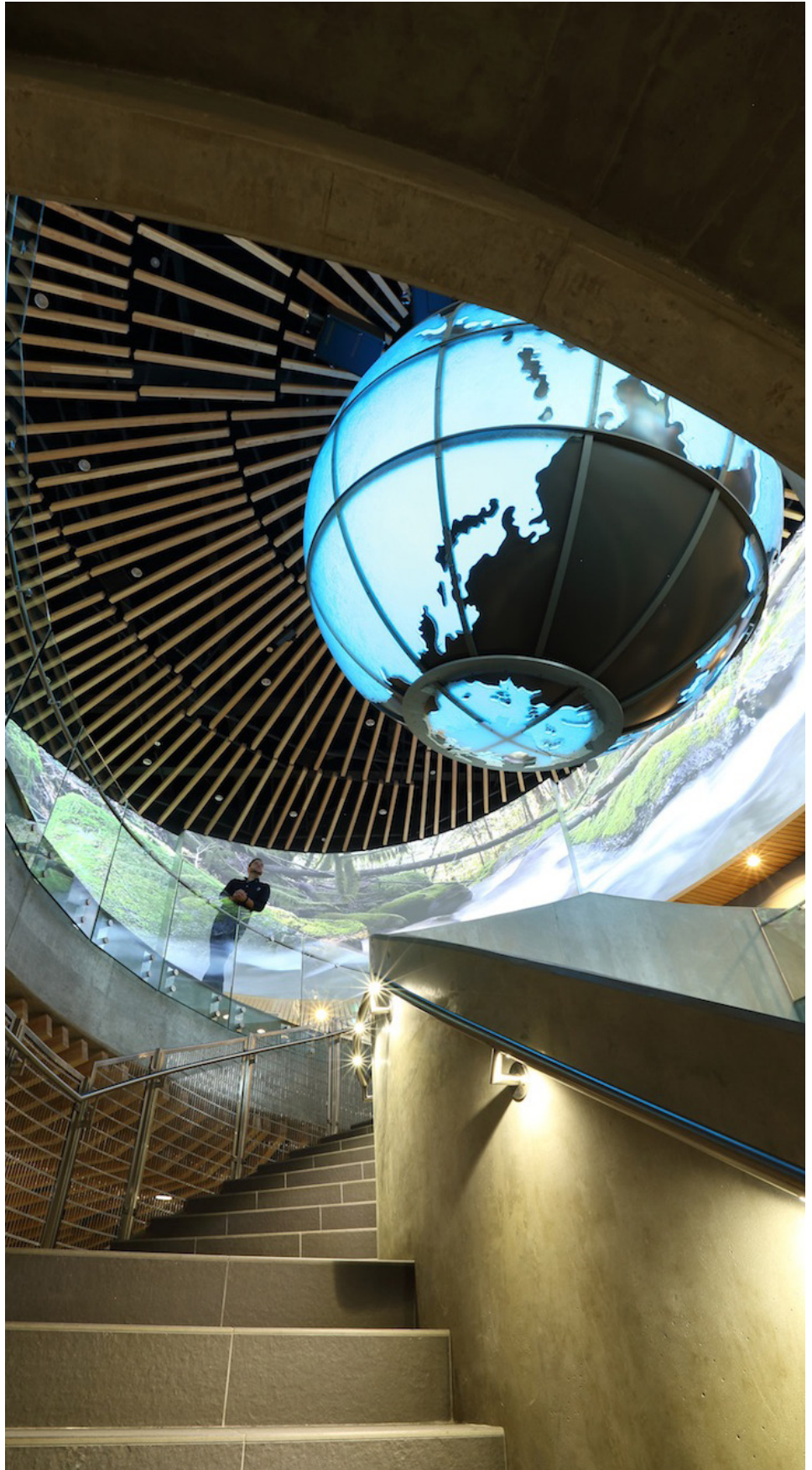
The Aquarium had only recently discovered the need to upgrade the incoming High Voltage infrastructure electrical service, but had only budgeted for the existing emergency power generator to be replaced in order to support the expansion.

At the time, BC Hydro was unsure how they could provide a larger service and was only just starting a major distribution upgrade for the area (undergrounding conductors and provisioning for doubling the voltage of the high voltage distribution system) so they couldn't provide much information on how the upgrade could occur, although the upgrade was initially estimated to cost millions of dollars that the project had not accounted for.

AES began by reviewing the seasonal load profile of the building, the Aquarium's seasonal power quality and balance, and calculating the anticipated future loads by future phase. We then proposed a solution including ongoing load control, automatic usable power optimization, and installation of a parallel, modular, scalable, emergency generator system.

This solution would defer the need for a service upgrade to a point when BC Hydro would have completed significant upgrading of their off-site distribution to allow the Aquarium to upgrade their service at a lower cost, and thus allowed the Aquarium to continue without the substantial increase in cost associated with the infrastructure upgrade.

Application of this type of automated system required the entire team to facilitate this level of automation, including the owner, their project manager, the rest of the design team, the contractors, their suppliers, BC Hydro, and local regulators tasked with ensuring the system is safe to operate.





- The **Vancouver Aquarium** has a rich history of conservation and education, therefore **careful consideration** and **planning** was crucial.

SOCIAL AND ECONOMIC BENEFITS

Applied Engineering Solutions recognized the importance of this project, as the Vancouver Aquarium is an organization with a rich history of conservation and education. It is a recognized leader in connecting people to the natural world, and visited by more than 35 million people since opening in 1956.

With this in mind, a Measurement and Verification system (M&V) was installed as a part of the new expansion, adding to the M&V system in the existing facility, to allow the owner to quantify the new energy savings and help identify new areas of opportunity for improvement. Careful consideration of emission control options were reviewed to ensure a balance between the Aquarium's environmental and operational goals.

Similarly the system needed to be able to operate without the Aquarium's guests, or extensive marine life, being negatively impacted from airborne emissions, liquid leakage, noise, vibration, heat, poor power quality, or even visual aesthetic (the generators are located outside, concealed from public view to optimize cooling and usable interior space).

The architects incorporated the concealment into the exterior façade of the building expansion to create a blending of the expansion with the existing building in a continuous form. Additionally, the façade enhanced the acoustic, radiated, and transmitted heat and airborne emission properties.

ENVIRONMENTAL BENEFITS

To minimize energy consumption throughout the facility, occupancy sensors, dimmers and low voltage controls were used extensively throughout the expansion to turn lights off, dim lights and sweep lights off where possible. Areas of application include, but are not limited to, the enclosed offices, open offices, washrooms, service spaces, corridors and public spaces. Daylight sensors have also been implemented to dim or turn off lighting when there is sufficient daylight.

LED lighting sources have been used in place of traditional lighting sources to further reduce the carbon footprint of the facility. The facility is provided with dimmable LED lighting that can either be manually operated at a reduced level, or automatically reduced through the use of the installed daylight sensors. A large quantity of outdated lighting has also been replaced with LED and other premium-efficiency sources, providing greater energy efficiency and longer lasting lighting solutions.

Special sound-attenuated generators, customized for even greater sound, vibration, seismic post-disaster and airborne pollution emissions were utilized. Additional selection factors included fuel consumption, run-time, warranty, space consumption, and cooling performance.



MEETING OUR CLIENT'S NEEDS

The intent of the Vancouver Aquarium expansion project was to double the indoor exhibit space and increase the pools by approximately a third, as well as adding the necessary support space to facilitate such a large expansion.

They needed a quick and cost-effective solution for upgrading the incoming High Voltage infrastructure electrical service, to allow the Aquarium to resume their project and proceed with the expansion. AES was able to combine their customer-focused design skills with their electrical systems knowledge to successfully implement an effective solution.

The exhibit and related support spaces have been expanded and the first two generators have been installed and automated. Automatic power quality and load balance correction equipment has been installed both in the existing building and in the expansion. The Aquarium has gone through their first full summer (their peak season for electrical load and visitors) without running out of power, and is now embarking on a major pool renovation. The scalable generation system can have one, or even two, generators added in the future, should they wish to increase the available power during utility outages. That being said, the system is already more than four times the size of the system it replaces.

