

# Designing Today's CleanTech Research Facility: Sustainable, Highly Technical Architectural and Engineering Design Applied to the New York State Alternative Fuel Vehicle Research Laboratory (AFVRL)

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## ABSTRACT

The greatest challenges facing our world today are the need to reduce the pollutants entering our atmosphere AND the need to create fuels that can support our expanding global economies. The opportunity to support cutting-edge research on both challenges in one facility is truly inspiring. That is the basic premise behind the New York State Department of Environmental Conservation's *Alternative Fuel Vehicle Research Laboratory* (AFVRL).

The creation of working environments to support complex science while mitigating the impact of the facility on the natural environment has never been as important as it is today. The challenge of designing a laboratory for the science of fuels optimization and emissions reduction, while reducing overall energy consumption has yielded results surpassing the goals of the State of New York, setting them on a path to a ground-breaking new science facility.

**Keywords:** sustainable, LEED, architecture, engineering, environmental, emissions, laboratory, engine testing, facility



## 1 FACILITY MISSION

It is only fitting that a facility designed to study the crucial issues of fuel utilization and a cleaner environment respect the environment as much as possible. Functional performance is essential, but so is the need to “walk the walk” and develop the site sensitively, minimize non-renewable energy consumption, and create a stimulating place where people meet, collaborate, and solve complex problems.

The facility will house the State's Department of Environmental Conservation's (DEC) Bureau of Mobile Resources and Technology Division (BMRTD). Here scientists will analyze the transportation sector's emissions standards, translating accurate and repeatable data into policy. This once sequestered science becomes the focus of a state-of-the-art center that encourages academic interaction and public engagement.

The BMRTD has also facilitated numerous collaborative efforts involving research and emissions testing with the New York City Department of Environmental Protection (DEP), the United States Environmental Protection Agency (EPA), New York City Metropolitan Transit Authority (MTA), the New York City Taxi and Limousine Commission, New York State Energy Research and Development Authority (NYSERDA), and private and academic researchers.

## 2 BUILDING PERFORMANCE

The research and testing capabilities are required to accommodate a wide range of vehicular configurations and to accurately measure emissions derived from conventional and alternative propulsion fuels. The facility is also required to be technically and operationally accessible to other government agencies, authorities and industry groups in support of collaborative projects with shared objectives. The unique technological capabilities of the facility will be exploited to accommodate links with educational institutions in support of engineering science in graduate and undergraduate programs.

The facility will not only house an 800-horse-power chassis dynamometer, engine dynamometers, vehicular test/preparation area, chemical analysis, particulate matter, and clean weigh laboratory. The following are the core functional testing support functions within the building:

- Heavy-Duty Chassis testing cell
- Light/Medium Duty Chassis testing cell
- Engine testing cell
- Particulate Matter (PM) Lab
- Chemistry Analysis Lab
- Portable Emissions Measurement Systems Lab (PEMS)
- Filter weigh Particle Clean Lab Building Design

Set within a clean technology research and development campus (the first of its kind in the nation), the *AFVRL* project is a culmination of clean technology practice coupled with an appropriately contextual high-tech, Adirondack-style architecture. This has been achieved by utilization of local materials, primarily granite stone, and use of wood veneer products as accent ceilings and exterior treatment melded with clean lines of glass curtain wall systems and photovoltaic cells.



The building is organized by programmatic function. Half of the main floor is dedicated to vehicle testing and preparation, the other half dedicated to more people focused spaces like labs and offices. What happens in between and throughout the remaining building support areas are opportunities for employee interaction and collaboration. Circulation paths cross frequently, punctuated by amenities and natural places for pauses and impromptu conversation and engagement. Transparency is also an architectural feature that is celebrated wherever possible, further creating opportunities for individuals to witness one another's findings, thought process, and collaboration.

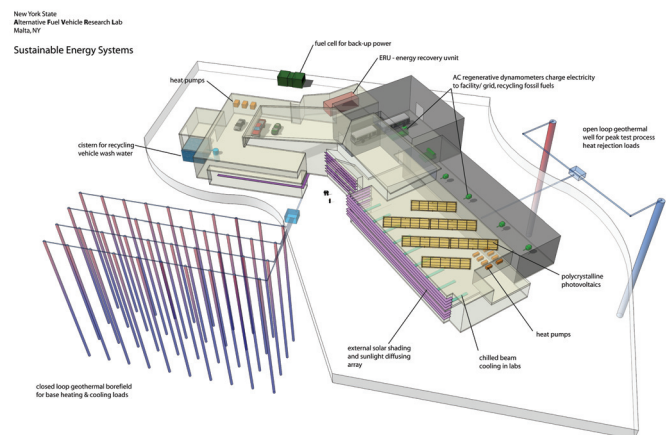
The form of the building roof was greatly inspired by the “Mobius Strip,” a mathematical model used to explain a number of scientific mechanic scenarios as well as genetic replication sequences phenomena. This model is also known to be the design impetus of the recycling symbol which captures the mission of the facility as well as its people. The shape of the Mobius is designed into the building as a metaphor of its purpose, while serving as a mechanism tying very complex programmatic forms of the building together into one cohesive architectural solution.

Finally, form and function meld seamlessly in the new Alternative Fuel Vehicle Research Laboratory where the concepts behind the facility are driven by such disparate design criteria as:

- Accommodating the turning radii of a New York City articulating transit bus internal to the building
- Smart building organization - separation of noise, vibration, harshness and nano-scale measurement cleanroom scientific labs
- Successful integration of environmental building systems

### 3 SUSTAINABLE DESIGN INTEGRATION

Being part of a department that supports state environmental policy legislation, it is imperative that the bureau reflects its mission through the architectural and engineering design of this new laboratory. This facility exemplifies the spirit of the mission by employing renewable and innovative alternative energy sources as the ways and means to condition, power, and integrate the building into its natural setting.



This is accomplished by employing innovative architectural and engineering sustainable building concepts into a performance based structure. More specifically, it is accomplished via the following systems:

- Geothermal (closed-loop) base load heating and cooling
- Geothermal (open well) for process peak load shaving
- Energy recovery wheels to offset high outside air requirements
- Electrical regeneration via AC dynamometers
- Passive and active day lighting strategies
- Photovoltaic system
- Water conservation, both on domestic and process loads

## 4 AUTHORS' BIOGRAPHIES

### 4.1 David Sereno, PE, Principal, Affiliated Engineers, Inc.



Mr. Sereno leads AEI's industrial practice and serves as project manager on many projects. Dave's mechanical engineering expertise includes designing transportation sector test / emissions facilities, alternative fuels test facilities, diesel engine assembly plants and aerospace test facilities. His experience spans a wide range of technical facilities, including alternative fuel test and emissions (gas, diesel, hydrogen, bio-diesel and fuel cells) test laboratories. Dave is currently the project manager for the New York State Alternate Fuel Vehicle Research Laboratory in Malta, New York.

### 4.2 Joseph Ostafi, AIA, LEED AP Project Architect/Designer, Flad & Associates



Mr. Ostafi has over nine years of architectural experience in research facilities for academic, corporate and government clients. His focus has been in the design of science and technology, laboratory planning, clean technology, and site master planning. An innovative designer, he thrives on projects that present unique and complex sets of challenges. Joseph is currently project architect and designer for the New York State Alternate Fuel Vehicle Research Laboratory in Malta, New York and Stony Brook University Advanced Energy Research and Technology Center.

## 5 COMPANY OVERVIEW

Over the past 25 years, Flad & Associates and Affiliated Engineers have achieved a national reputation for the design of some of the most important and complex research facilities in the country. Completed planning and design work totals more than 40 million square feet of laboratory and research space for academic, corporate and government clients including the Department of Energy. A significant focus of our staff has been on projects related to energy research, emissions, and fuels optimization, including projects that ensure reliable, economical, and alternative sources of energy to support sustained economic development without impairing the natural environment.