

# AeroVironment

A Case Study in the Development  
of Viable Clean Technologies to  
Mitigate Climate Change



Charging  
43.6V 399

# AeroVironment (AV) Overview

- Established in 1971
- Employees: 600
- Headquarters: Monrovia, California
- UAV Operations: Simi Valley, California
- Notable Accomplishments
  - Six Vehicles in the Smithsonian
    - Gossamer Condor: First Human-powered Flight
    - Gossamer Albatross: Human-powered Flight Across English Channel
    - Solar Challenger: Solar-powered Airplane, Paris to England
    - Quetzalcoatlus Northropi (QN): Flying Pterodactyl
    - Sunracer: Solar-powered car, Darwin to Adelaide
    - Pathfinder, Solar-powered Airplane, Connectivity at 65,000 ft.
  - Impact: Electric Car for GM (EV-1)
  - Helios: Solar Airplane 100K Flight Altitude Record
  - Global Observer, Liquid Hydrogen Fueled UAV



## UAVs



## PosiCharge



## Efficient Energy Systems



# Studying Clean Technologies at Various Stages of Market-Readiness

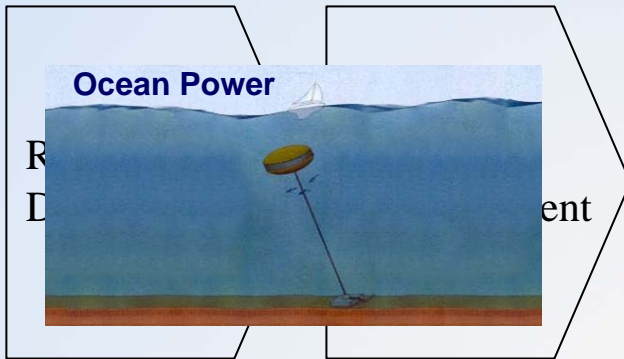


**PosiCharge**



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# AeroVironment Business Model: Research Backbone, Commercial Focus



Innovation  
Leadership

Market  
Opportunity

Product  
Development

New Business  
Startup

Independent  
Business  
Management

Technology  
Prototypes

Market  
Validation

Product  
Validation

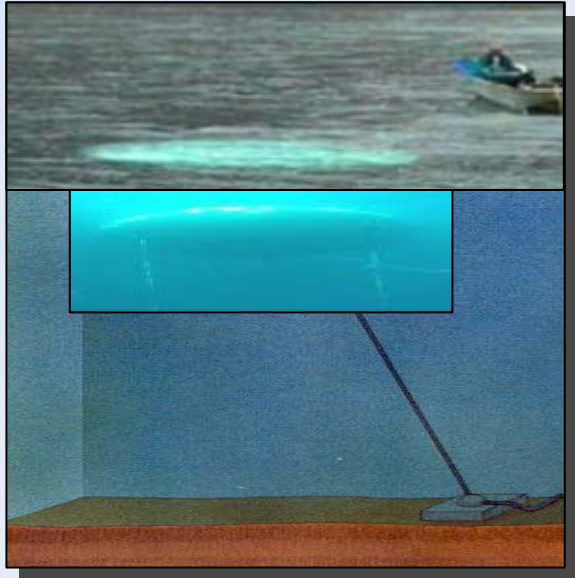
Business  
Operations

Business  
Models

Product  
Operations

Product  
Management

# AV's Ocean Power Technology



- Harnesses power from the ocean
- Anchored to sea floor and floats beneath the surface
- Float holds generator that captures energy through wave movement
- Responds to changing pressure resulting from passing waves
- May provide an unobtrusive, silent and reliable source of power compared to other devices
- Completed scale model testing with encouraging results

# Architectural Wind: Building-Integrated Wind Power



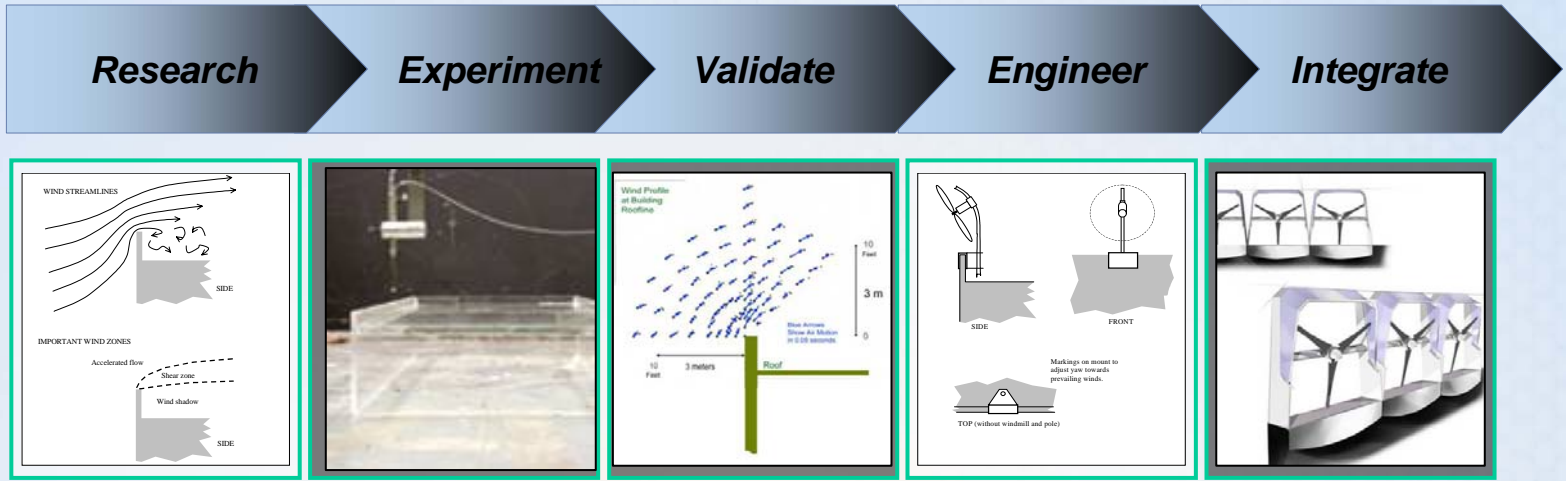
## *Large Scale Wind Challenges*

- Best for rural areas
- Requires wind speeds of 10mph and higher for operation
- Towers needed to optimize wind energy production
- Considered eyesores and loud/noisy
- “Not in my backyard” issues
- Does not work for urban environment
- Special zoning and permitting required
- Significant capital investment required
- High maintenance / inspection
- Difficult to demonstrate and communicate corporate commitment to sustainable energy

## *Market Appetite for Renewable Energy*

- Increased focus from consumers on corporations to demonstrate use of alternative energy sources
- Domestic wind production experienced 29% growth rate for past five years
- International attention and focus
- Changing political environment
- Technology is becoming cost neutral

# Architectural Wind: The Product Development Process



## Competencies Used:

Wind Analysis

Blade Design

Generator

Inverter & Grid Interconnect

Power Electronics

Motor Controls

Braking & Thermal Analysis

Structural Analysis for Mounting

Aesthetics





# Architectural Wind: The Product Development Process



# Architectural Wind: Environmental and Fiscal Benefits



## Architectural Wind Means Pollution Mitigation:

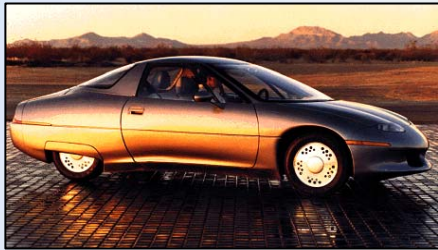
Every kilowatt-hour of electricity produced using conventional fuels releases:

- 1.26 pounds of carbon dioxide
- 1.07 pounds of methane
- 2.03 pounds of nitrous oxide

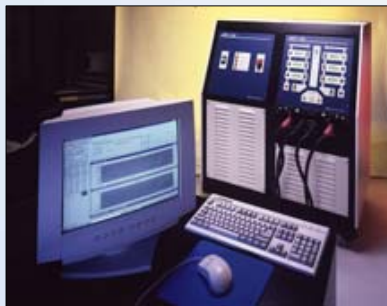
- Solves traditional problems with wind generated power
  - Modular, scalable, smaller, quieter, aesthetically pleasing, eye catching
  - Operates in low wind speeds (5 mph)
  - Easy installation – no or minimal roof penetrations
  - Survivability tested to sustained gusts over 105 mph
- Mounts on building parapet to leverage and optimize the wind acceleration created by “chimney effect”
- Serves as a natural and strategic hedge against increasing fuel costs and utility charges
- Connects Corporate Strategy and Marketing Messages with positive eco-friendly imagery
- Complements and Integrates easily with Other Solutions

# AV Clean Transportation History

**1989**



**Impact**



**ABC-150**

**2004**



**Industrial  
PosiCharge**



**Original On-  
Road Charger**

**1996**



**Future On-  
Road Charger**



**Future On-  
Board Charger**

**2010**

# Fast Charge Benefits

Advanced Fast Charging Technology for Electric Vehicles used in Factories, Distribution Centers and Airport Operations



**PowerServer  
PowerStation**



**Connectors**



**Battery  
Monitor &  
Identifier**



## Benefits:

- Productivity
- Safety
- Space savings
- Battery & vehicle performance
- Employee satisfaction

# Fast Charge Users

A Growing Number of Major Companies Rely on Fast Charging to Support Their Daily Operations Across Multiple Facilities



# High Voltage Electric Vehicle Chargers



- Infrastructure to Enable Practical Electric Vehicles and Rapid Growth of the Market
- For:
  - Electric Vehicles
  - Plug-in Hybrid Electric Vehicles
- 10-minute fast charging
- Safety, Convenience

# Current EV Market Trends

- Major Factors Influencing the Market:

- ↑ – Growing Climate Change Concerns
- ↑ – Oil Price Uncertainty
- ↑ – Increasing Regulations
- ↑ – Developments in Battery Technology

- Market Constraints:

- ↑ – Safety Concerns
- ↑ – Performance Predicaments
- ↑ – Maintenance Concerns
- – High Manufacturing Costs





*AeroVironment Inc.*

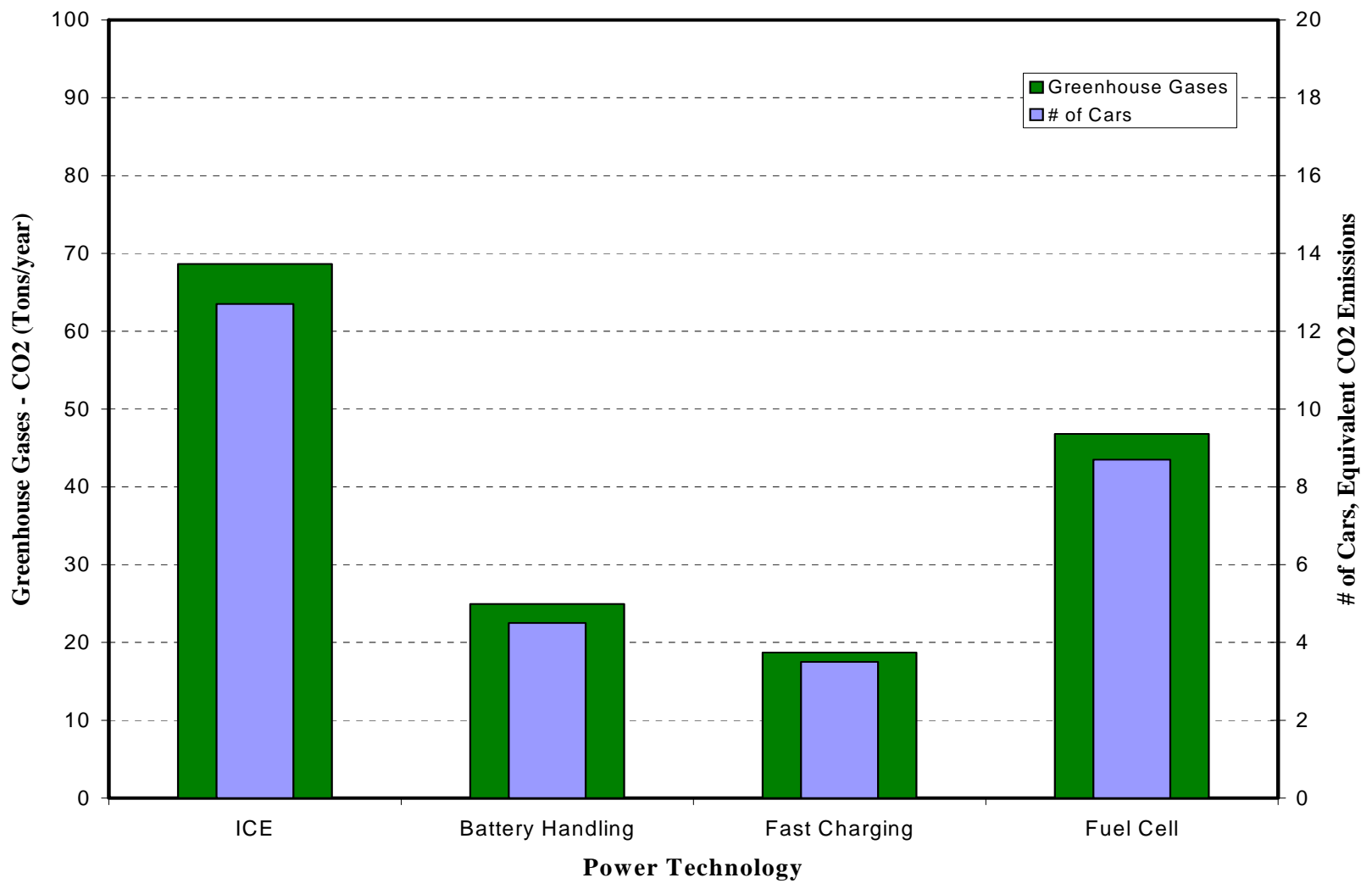
*Charlie Botsford  
Efficient Energy Systems  
1960 Walker Avenue  
Monrovia, CA 91016  
626-357-9983*

*[botsford@avinc.com](mailto:botsford@avinc.com)*





# PosiCharge: Power Systems for Forklifts – Carbon Footprint



# PosiCharge: Fiscal Benefit of Capital Goods and Operating Expense Reductions

