

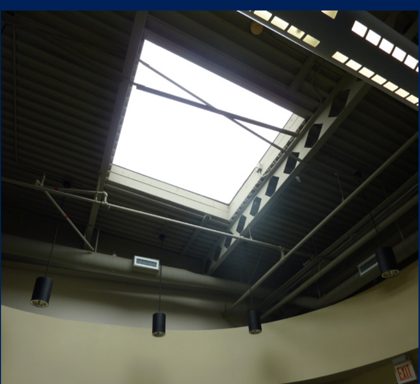

Naval Facilities Engineering Command
NAVFAC SOUTHWEST

Naval Base Ventura County Energy Efficiency Program 2012

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ENERGY EFFICIENCY PROGRAM FOR ADMINISTRATIVE BUILDINGS

AT NAVAL BASE VENTURA COUNTY

By

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2011 - 2012

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APPROVAL PAGE

TITLE:	Energy Efficiency Program for Administrative Buildings at Naval Base Ventura County
AUTHOR:	Kendall Patrick Lousen
DATE SUBMITTED:	June 5, 2012

Adrienne I. Greve Senior Project Adviser	______________________________________ Signature	___________ Date
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ACKNOWLEDGEMENTS

The Energy Efficiency Program (EEP) for administrative buildings at Naval Baase Ventura County was prepared under Naval Facilities Engineering Command Southwest (NAVFAC-SW), Public Works Department, by returned summer-hire in Asset Management (Planning) Branch for Naval Base Ventura County, CA.

The EEP applies national guidance and develops base specific measures to improve energy (electricity) efficiency for administrative buildings. The intent of the EEP is to be used as a model that could be applied to other building classes at Naval Baase Ventura County. The EEP is an effort to achieve these measures and to identify future energy projects.

The EEP simply would not have been possibly without the contributing efforts and support from NAVFAC Southwest, Public Works Department at Naval Base Ventura County, and California Polytechnic State University San Luis Obispo. I, Kendall Lousen, the preparer of the EEP appreciate the efforts of everyone who provided information and guidance in development of this document. Specifically, my senior project adviser Adrienne Greve, my brother and co-worker Chad Lousen, and my immediate supervisor James Danza for allowing me to pursue with this idea; for providing constructive criticism where appropriate; and for their support and being patient in the development of the EEP.

Special thanks also to Sir Michael Obermiller, Tom Carr, Diane Bentley, Kathleen Mallory, Dean Thompson, Jordan Young, Paul Perez, Godofredo Magno, George Vaughner, Jordan Young, Sara Wetherbee, Justin Lepper, Dan Shide, Allen Adams, Greg Middleton, Catherine Girod, Margaret McDonald, Valerie Vartanian, Erik Anderson, Tom Santoianni, Michael Wiltshire, and Bob Fong for approval, support and assistance with gathering information and providing resources for the development of the EEP.

I, Kendall Lousen, the preparer hope the EEP will provide useful information to the Department of Navy in its endeavor to improve energy efficiency for all administrative buildings at Naval Base Ventura County.

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Very Respectfully,

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ACRONYMS

Several acronyms had been used to facilitate ease of writing the EEP. Acronyms are defined in the following tables:

Notation	Definition
ADA	Americans with Disability Act
AE	Asset Evaluation Worksheet
AM	Asset Management Branch
AOP	Activity Overview Plan
ASHRAE	American Society of Heating Refrigeration and Air Conditioning Engineers
AT/FP	Anti-Terrorism/ Force Protection Standoff Standards
BFR	Basic Facility Requirement
CCN	Category Code Number
CEC	California Energy Commission
CEQ	Council of Environmental Quality
CFL	Compact Fluorescent Lamp
CH4	Methane
CNO	Chief Naval Operations
CO2	Carbon Dioxide
DoD	Department of Defense
DoE	Department of Energy
ECM	Energy Conservation Measure
EO	Executive Order
EEP	Energy Efficiency Program
EMCS	Environmental Management Control System
ENV	Environmental Division
EPA	Environmental Protection Agency
FMD	Facilities Management Division
FOB	Forward Operating Bases
FY	Fiscal Year

Notation	Definition
GEB	Generic Electronic Ballast
GHG	Greenhouse Gas
HID	High Intensity Discharge
HPS	High Pressure Sodium
HVAC	Heating Ventilating & Air Conditioning
IAP	Installation Appearance Plan
INFADS	Internet Navy Facility Asset Data Store
IT	Information Technology
MH	Metal Halide
MILCON	Military Construction
MOU	Memorandum of Understanding
MWh	Megawatt hour
MWR	Morale Welfare and Recreation Command
N2O	Nitrous Oxide
NAVAIR	Naval Aircraft Systems Control Command
NAVFAC-SW	Naval Facilities Engineering Command Southwest
NAVX	Navy Exchange
NAWC	Naval Air Weapons Control Command
NBVC	Naval Base Ventura County
PAR	Parabolic Aluminized Reflector
PIR	Passive Infrared
PH	Port Hueneme Installation
PM	Point Mugu Installation
PWD	Public Works Department
QOL	Quality of Life
R	Reflector
RLM	Recessed Lighting Mount
SB	Screw Base
SEA inc.	Sain Engineering Associates, Inc.
SERDP	Strategic Environmental Research and Development Program
SF	Square Feet (Area)
SFPS	Shore Facilities Planning Systems
SNI	San Nicholas Island Installation
SOP	Standard Operating Procedure
SRG 31st	Seabee Readiness Group Command
SRM	Facilities Sustainment Restoration and Modernization
SSPP	Strategic Sustainability Performance Plan
UD	Utilities and Energy Division
UFC	Unified Facilities Criteria Requirements
VAV	Variable Air Volume
WB	Wall Box
YTD	Year to Date

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1.0 INTRODUCTION

Basic Content

This project develops an Energy (Electrical) Efficiency Program (EEP) that will serve to improve energy efficiency in all 33 administrative buildings at Naval Base Ventura County (NBVC). As co-benefits to improving energy efficiency leads to a reduction in Greenhouse Gases (GHGs) and improves indoor environmental quality for occupants. NBVC is located on the southern portion of the Oxnard Plan, roughly 200 miles southwest of San Luis Obispo and 50 miles northwest of Los Angeles, CA. NBVC is a joined base consisting of three installations: Point Mugu, Port Hueneme, and San Nicholas Island.

NBVC is an aviation shore command and a naval construction force mobilization base. A naval construction force mobilization base consists of mobilizing and deploying naval construction force units in response to either a national emergency mobilization or military operations other than war (Naval Construction Force Mobilization Manual, 2000). As a naval construction force mobilization base, NBVC contains more than 12,000 acres of federal land. Of these 12,000 acres, consists of airfield, seaport and base support services to fleet operating forces and shore activities (CNIC, 2011). NBVC is home to more than 100 military commands (all military branches represented) and are ready to support the diverse missions and EO mandates of Department of Defense (DoD). Additionally, NBVC and its tenants directly employ more than 19,000 personnel (military and civilian) workers, serving as the largest employer in Ventura County (CNIC, 2011).

The EEP applies national guidance including executive branch mandate, Department of Defense, Department of Navy, Environmental Protection Agency, Council of Environmental Quality, and Department of Energy. The 2009 Executive Order (EO) 13514 Federal Leadership in Environmental, Energy, and Economic Performance, requires federal agencies to set goals for improving energy efficiency, resource conservation, greenhouse gas (GHG) emission reduction, water efficiency, and green procurement (2009). It should be noted, that the aspects of this list that the EEP fulfills as is not all; instead, the EEP expands on energy reduction and environmental performance for federal agencies.

EO 13514 has not yet been passed down to NBVC; although, the EEP builds on this national mandate and other Department of Defense (DoD) guidance to develop base specific measures for administrative buildings. The EEP develops goals for reducing GHGs contributed to electrical use. Goals to improve indoor environmental quality for occupants are also included in this EEP. In the future, the EEP could be used as a model that can be applied to other building classes, such as Navy support services and personnel on NBVC.

According to the U.S. Environmental Protection Agency, gases that trap heat in the atmosphere are often called greenhouse gases (EPA, 2011). After compiling the data, this EEP presents the three most common and plentiful GHGs resulting from human activities, these include: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O); other GHGs such as fluorinated gases are not included in this scope. These data, which reflect only electrical use in administrative buildings, would be one component of a more complete GHG inventory that would include all energy and emissions sources. The evaluation identifies which administrative buildings that use the most electricity (PM1, PM50, PH44, PH444, PH445, PH1000, PH1169, PH1300, PH1436, and PH1437) from annual Mega-watt hour (MWh) usages on NBVC. It should also be noted that

the GHGs from electricity are not generated on site; instead they are generated and purchased from Southern California Edison Company.

According to the U.S. Council of Environmental Quality (CEQ), climate change is a national security challenge with strategic implications for the Navy. Climate change will lead to increased tensions in nations with weak economies and political institutions (CEQ, 2008). While climate change alone is not likely to lead to future conflict, it may be a contributing factor. In this context, GHGs generated from electricity of these administrative buildings play a small role in the type, scope and location of future navy missions.

1.1 Climate Planning and GHG Reduction

Climate change is affecting, and will continue to affect U.S. military installations and access to natural resources worldwide. Climate change directly affects a wide range of federal services, operations, programs, assets and our national security (CEQ, 2008).

At the installation level, the more frequent and intense heat extremes projected to occur with climate change may strain personnel efficiency, degrade air quality through elevated ozone caused by higher temperatures, and strain electricity supply due to the increased demand on the grid for cooling (DoD Strategic Sustainability Performance Plan, 2008). For NBVC, a naval construction force mobilization base adjacent to the Pacific Ocean may be threatened by sea level rise. The resulting impacts can include coastal erosion, inundation, damaged or destroyed infrastructure, reduced availability of land for operational needs, and reduced water supply due to seawater intrusion (National Intelligence Council Report, 2008).

The EEP is limited in that it only addresses electricity for administrative buildings at NBVC. The energy efficiency programs included in this EEP helps DoD ensure that resources are invested wisely, and are consistent and support the mission for current and future climate conditions.

Many energy efficiency and indoor work environment strategies featured in this EEP build principles from the green building industry. Green building is summarized below.

1.2 Green Building

A green building review is provided to offer some insight on ways to improve energy efficiency for the 33 administrative buildings at NBVC. As co-benefits of integrating these strategies, can lead to a reduction in GHGs, as well as improve indoor environmental quality for worker health and productivity. This green building review also discusses renewable energy (i.e.: solar PV) systems as a way to improve energy efficiency; in addition, this review showcases renewable energy efforts applied at other military installations.

Administrative buildings are built to house administrative occupants at NBVC. Any building that can enhance the purpose for its occupants is inherently more valuable. Energy is also used to support the purposes of the building's occupants. It is a social good to use energy as efficiently as possible, but never at the expense of affecting the health and environment for the occupants working in these administrative buildings. To the extent for understanding how design of buildings and their energy systems impact the performance of the occupants, the EEP optimizes for both concerns.

Starting with energy consumption contributed from various anthropogenic activities audits a concern for internal building performance. As the environmental impact of building's energy consumption becomes more apparent; a shift from conventional building methods taught, are replaced by progressive methods with a green building practice.

Green building is the practice of creating structures and using processes that are environmentally responsible and resource – efficient throughout a build's life – cycle from siting to design, construction, operation, maintenance, renovation and deconstruction; green building is also known as sustainable or high

performance building (EPA – Green Building, 2012). This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

As the pace of technological innovation intensifies, human beings are daily asked to process more information and perform increasingly complex tasks. Therefore, it becomes imperative that building design is a critical tool in the promotion of societal health and well-being. More than half of the adult workforce spends a considerable portion of their time indoors, and of that time interfacing with a computer terminal. As a result, confined to our desks and focused on the artificial glow of the computer screen (Hobstetter, 2007). It becomes important to mitigate the negative effects of this artificial setting through some form of contact with the natural world (Hobstetter, 2007).

One of the co-benefits the EEP aims for is to improve indoor environmental quality for occupants. Thus, one of many green building practices that can mitigate the negative effects of an artificial setting is to redirect more sunlight to the interior of these administrative buildings through the windows and skylights (Figure 1).

Figure 1
Skylights and atriums are displayed at Cal Lutheran University Library.
Source: Lousen, K. January 16, 2012.

According to Hobstetter (2007) in “the late 1960s, a design trend that admitted little or no daylight was believed to minimize distractions, prevent eyestrain, and create a great efficiency in heating and cooling” (para. 6). New research and efforts reverses these assumptions by asserting that windows that admit daylight and provide an amply and pleasant view can dramatically affect mental alertness, productivity, and psychological well-being (Hobstetter, 2007). For example, in a 2003 study of office worker performance at Sacramento Municipal Utility District, conducted by the California Energy Commission (CEC), exposure to daylight was consistently linked with a higher level of concentration and better short-term memory recall (Heschong Mahone Group, 2003).

Electric lights can be turned off when sufficient daylight is available, cutting lighting and cooling costs. Thus, optimizing the use of daylight also has enormous potential to provide energy savings. The CEC estimated that incorporating skylights with automatic daylight sensors into all new educational buildings would save the state of California up to $7 million dollars in energy costs each year, after a decade post – installation (Heschong Mahone Group, 2003).

According to Crume (2007) “Skylights are relatively inexpensive and can help brighten up an otherwise dark space; however, this investment can add unwanted summertime solar heat to a room because they are seldom shaded” (Crume, 2007, P. 35). It can be argued that skylights/ light wells provide optimal lighting when and where properly installed within an administrative office building (Figure 2).

Figure 2
An atrum was constructed at the Cal Lutheran University Library.
Source: Lousen, K. January 16, 2012.

Introduction

While military buildings might be slightly different, there are well documented benefits and outcomes from green buildings. For example, efforts show a return on investment by green buildings, such as reduction in electricity consumption and an enhanced workspace environment. Additional efforts highlight successful experiences in designing and implementing policy programs for renewable energy systems (i.e.: photovoltaic systems) in federal governments (Solar Powering Your Community, 2011). These documented efforts consist of military, Department of Energy (DoE), and Department of Defense (DoD) accomplishments prepared under federal agencies around the nation. Case studies on federal office buildings have documented renewable energy efficiency improvements, as well as GHG reduction and indoor worker health efforts (U.S. Department of Energy, CEC Technical Report, 2003).

Demand for energy is continuing to rise, and federal agencies are increasingly looking to renewable sources such as sun and wind to meet that demand with clean, safe, reliable energy. Fortunately, many of the key technologies that can unlock the power of these renewable resources are on the market today. Rapidly declining prices for solar technologies, in combination with federal policy changes, are bringing increasing amounts of solar energy into the mainstream (Solar Powering Your Community, 2011). The American Recovery and Reinvestment Act of 2009 (the Recovery Act) was signed into law on February 17, 2009 providing unprecedented levels of investment in renewable energy. The U.S. Department of Energy (DoE) is playing a significant role in the effort to reduce costs and increase the use of renewable energy technologies; particularly in federal agencies (Santoianni, 2012).

Department of Defense explores new ways to integrate sustainable practices into support operations at forward operating bases (FOBs), or secured military installation bases. The Strategic Environmental Research and Development Program (SERDP), DoD's environmental science and technology program implemented in partnership with the Department of Energy (DOE) and the Environmental Protection Agency (EPA), is the process of identifying future research needed to enhance the sustainability of FOBs (DoD Strategic Sustainability Performance Plan, 2008).

For energy management efforts, the DoD continues to pursue an investment strategy designed to reduce energy demand in fixed installations, and to reduce energy from traditional sources while increasing the supply of renewable energy sources (i.e.: solar, wind, geothermal, etc.). Financing for these investments comes primarily from the Energy Conservation Investment Program and mechanisms such as Energy Saving Performance Contracts, Utility Energy Services Contracts, and Power Purchase Agreements. Efforts to curb demand for energy – through conservation measures and improved energy efficiency – are by far the most cost-effective ways to improve an installation's energy profile (DoD Strategic Sustainability Performance Plan, 2008).

A large fraction of DoD energy efficiency investments go to retrofit existing buildings. For example, skylights are a green building practice that was integrated/ retrofitted to an administrative building at Dyess Air Force Base, Texas (Figure 3).

Figure 3
Dyes Air Force Base retrofits administrative building with skylights
Source: DoD Strategic Sustainability Performance Plan, 2010.

Skylights not only draw in more indirect sunlight for interior workspaces, but also reduce building energy loads. Typical retrofit projects install high efficiency heating, ventilation and cooling (HVAC) systems, energy

management control systems, improved lighting, and better insulated and/ or reflective roofs (DoD Strategic Sustainability Performance Plan, 2010).

DoD is also committed to renewable energy not only because it is dedicated to showing leadership in sustainability, but also because it improves resilience and thus mission readiness. Military installations are generally well-situated to support solar, wind, geothermal and other forms of renewable energy, as long as the type of energy facility, siting, and its physical and operational characteristics are carefully evaluated and mitigated as needed for any possible mission or readiness impacts (DoD Strategic Sustainability Performance Plan, 2010).

Several military installations around the nation understand the importance for renewable energy and the need to improve energy efficiency. For example, Nellis Air Force Base in Nevada built a 14.2 megawatt (MW) photovoltaic solar array using a public-private partnership power purchase agreement (Figure 4).

Figure 4
Nellis Air Force Base constructs a 14.2 MW PV-System.
Source: DoD Strategic Sustainability Performance Plan, 2010.

More than 72,000 solar panels track the sun to generate 30 million kilowatt-hours of electricity per year – equivalent to a quarter of the total power used at 12,000-person base. Nellis buys electricity at a lower rate thus saving $1 million a year in electricity costs and avoiding 22,000 tons of carbon dioxide emissions (DoD Strategic Sustainability Performance Plan, 2010).

29-Palms, a marine base in the Mojave Desert, CA has built an electrical system – powered in part by renewable energy – that would contribute to provide the base of 27,000 military and civilian personnel with power if the electrical grid goes dark (Medici, 2011). Among these renewable energy sources: three megawatts a year from solar panels (Figure 5), 500 kilowatts a year from a wind farm, and 7.2 megawatts a year from co-generation plan that recycles waste heat into usable energy (Medici, 2011).

Figure 5
29-Palms Marine Base constructs a 3 MW PV-System.
Source: DoD Strategic Sustainability Performance Plan, 2010.

Although, NBVC Port Hueneme and Point Mugu receive their electrical energy from Southern California Edison Company, San Nicholas Island supplies their own electrical energy from the electrical power plant on the base.

Other military bases have taken the environmental stewardship of EO 13514 and expanded their use of renewable energy projects. For example, the Army in Fort Irwin, CA is building a 500 megawatt solar panel system that would eliminate the need for outside power. The Army would use up to 28 megawatts, while the remaining power supply will be sold to pay for the project (Medici, 2011).

At a panel discussion with Tom Hicks (Deputy Assistant Secretary of the Navy) on July 2011, discussed the system would provide about 33 percent of the power needed to run the base. According to Hicks, the service

anticipates to have 100 megawatts of solar power, six megawatts of wind power, and 270 megawatts of geothermal power by the end of next year (Medici, 2011). Overall, Federal agencies across the nation have integrated strategies of EO 13514 to be self-sustaining, and or doing more with less; starting with the commencement in Federal Leadership in Environmental, Energy, and Economic Performance.

The EEP discusses smart investments to improve energy efficiency; as well as reduce GHGs and improve indoor environmental quality for administrative building occupants. The EEP provides strategies that either reduce and/or minimize cost consumption of electrical energy. With energy efficiency, there is a host of other things that happen, improved air quality generally speaking; also improved indoor conditions and improved health conditions for occupants. As a model program for administrative buildings at NBVC, the EEP can be applied to other building classes; additionally, the EEP provides the next steps or implementation measures that Department of Navy can choose to adopt by taking the preliminary steps toward a sustainable future.

1.3 EEP Development Process

The development of the EEP consisted of identifying an attainable project scope; and then prioritizing the required elements that would constitute a well-organized and sequenced procedure for the 33 administrative buildings at NBVC. Elements for this methodology required accessibility to Federal documents and resources, as well as the assessment of the critical information collected.

Of this sequenced procedure for the EEP consisted of: a site conditions analysis, distilled governmental documents and applied this guidance for base specific measures, a workspace conditions and perceptions survey, and energy usage charts from data collection.

The first step examined the current site conditions for the 33 administrative buildings at NBVC. This covered the physical setting for the exterior architecture, building utilization, age of the building, square feet/ area, upgraded/ retrofitted buildings, and annual electrical usage expressed in megawatt hours (MWh).

The second step identified relevant history and applied DoD guidance. The relevant history not only described the background, but identified the chain of command for this naval installation. The chain of command at NBVC enables identification of which tenant command would be in need of an energy efficiency improvement, thus informing business managers of their assets (administrative buildings) that are subject to the EEP. The chain of command provides opportunities for funding incentives and/ or the option for private-public purchase agreements for an energy efficiency program.

After developing programs that improve energy efficiency and reduce GHGs for administrative buildings, the EEP focuses on worker health, productivity, and conditions. The third step of the EEP developed a workspace conditions and perceptions survey for the occupants in these administrative buildings at NBVC. The goal of this survey was to receive input from all 33 facility managers of these administrative buildings; however, eight corresponded and then referred thus survey to other facility occupants (civilian workers).

The eight administrative building managers and tenants from (PM66, PM345, PM632, PH850, PH1000, PH1169, PH1430, and PH1436) were interviewed in this survey.

This workspace conditions and perceptions survey included a set of open – response questions.

- What do you currently like about your workspace?
- What do you with you had for your current workspace?
- Would you say there is enough storage for your workspace?
- Out of the following options [location, accessibility, flexibility, storage, air circulation/heat,

windows] identify which two influence your work productivity for your workspace?

For comfort level, the questions were geared with pre-selected response options; either two-response choices per question or four-response choices per question. Questions for part-two of this qualitative assessment, included:

- Which of the two lighting options [artificial or natural lighting] do you rely on for your workspace?

- How is the exposure or circulation of air/heat in your workspace? With this question, the four-response choices consisted of: Yes (Too Much); Yes (Perfect circulation); Rarely (Varies on condition of the day); Never (Stuffy, find myself perspiring).

- Do you feel that where you sit you have access to ample/exposure direct or indirect sun exposure? With this question, the four-response choices consisted of: Too much direct/ indirect sunlight; Enough/sufficient access to sunlight; Moderate exposure; Not Enough.

- How productive would you say you are at your workspace? With this question, the four response choices consisted of: Highly Proficient; Sufficient; Adequate/Moderate (could be improved); Poor/Needs Improvement.

The fourth step of this development process required data collection. The EEP asked by NAVFAC-SW Department of Public Works for a descriptive utilization of each building and the deficiencies for the 33 administrative buildings. For data collection, administrative building records were critical to collect and examine before energy efficiency measures and/ or facility retrofit options could be developed. Asset Evaluation (AE) Worksheets provided pertinent data for all property records at NBVC. The data collected on the AE Worksheets suggested whether a new/upgraded building control system would help reduce GHGs and/ or improve worker health and productivity.

1.3.1 Site Assessment

This site assessment consists of three sections that are described in the forthcoming chapter; these include policy context, relevant history and physical settings. The relevant history section is needed to understand the procedure and command at NBVC. The policy context section describes DoD guidance relevant to this EEP. Lastly, the physical setting section includes a summarized description of building use, physical condition, and electrical using audit reports for the administrative buildings.

1.3.2 Data Collection

The EEP development relies on data collected through building control systems iNFADS Asset Evaluation (AE) Worksheets. A building control system in this context refers to lighting controls (wall switches and passive-infrared (PIR) wall box sensors) or programmable thermostats (HVAC). Using the AE Worksheets, this EEP assesses deficiencies and provides major/minor facility options that would enhance a more productive work environment. Based on this data, the EEP proposes energy efficiency measures and/or facility retrofit options for the facility managers of these administrative buildings.

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Distilled DoD Guidance
Relevant History
Physical Settings & Conditions Assessment

2.1 Policy Context

There are a series of DoD documents that set overarching policy direction for federal agencies. The EEP applies this guidance to administrative buildings at NBVC.

High Performance and Sustainable Buildings Memorandum of Understanding (MOU)

The "Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding" (MOU) was signed by 21 Deputy Officers from various U.S. Federal agencies on February 24, 2006. Philip W. Grone, Deputy Under Secretary of Defense for Installations and Environment hereafter signed and committed to federal leadership for current and future design, construction, and operation of High Performance and Sustainable Buildings (Grone, 2006). According to Grone, the Federal government owns approximately 445,000 buildings, in addition to leasing an additional 57,000 buildings; in which, a portion of these buildings consists of administrative buildings (Grone, 2006). Using this MOU, NBVC understands the importance for high performance and sustainable buildings.

An element of this MOU is "the implementation of common strategies for planning, acquiring, siting, designing, building, operating, and maintaining High Performance and Sustainable Buildings" (Grone, 2006, P. 1). The MOU provides justification for the EEP to improve energy efficiency through high performance and sustainable buildings. One aspect of maintaining sustainable buildings is to maintain the indoor environmental quality for occupants. The principle goal of this MOU applicable to the EEP seeks to follow a common set of sustainable "Guiding Principles" for the integrated design, energy performance, and indoor environmental quality (Grone, 2006). The EEP applies these guiding principles to optimize energy performance and to improve indoor environmental quality for administrative building occupants at NBVC.

This MOU calls all federal agencies to use a collaborative, integrated planning and design process that includes the following:

- Initiates and maintains an integrated project team in all stages of a projects planning and delivery;
- Establishes performance goals for siting, energy, and indoor environmental quality ;

Additionally, this MOU calls all federal agencies to establish performance goals for other comprehensive design goals, and ensures incorporation of these goals throughout the design and lifecycle of the high performance and sustainable building (MOU-Guiding Principles, 2006).

Aside from these goals, the MOU also calls to establish a "whole-building performance target" that takes into account a set of variables that are as follows:

- Intended use
- Occupancy
- Operations
- Energy demands
- Design

The whole-building performance target variables are accounted to earn the Energy Start 7 targets for new construction and major renovation, where applicable (MOU-Guiding Principles, 2006).

Executive Order (EO) 13514

EO 13514 Federal Leadership in Environmental, Energy, and Economic Performance was signed October 2009. Under this EO, Federal agencies, including the military are required to develop, implement and annually update a plan that prioritizes actions based on positive return on investment when meeting GHG emission reduction targets. EO 13514 (2009) requires the following:

- 15 percent of buildings meet the Guiding Principles for High Performance and Sustainable Buildings by 2012;
- Design all New Administrative Naval buildings which begin in the planning process by 2020 to achieve zero-net energy by 2030;
- Pursue cost – effective and innovative strategies such as reflective roofs and vegetative green roofs.

Unified Facilities Criteria (UFC)

The Unified Facilities Criteria (UFC) system sets standards for DoD projects with regard to planning, design, construction, sustainment, restoration, and modernization (2002). The UFC sets mandatory energy and water conservation criteria and measures (i.e.: photovoltaic). The UFC applies to new construction and to major renovation and minor modifications and renovations to facilities. The classification of a building modification into a minor or major renovation category depends on the overall magnitude and scope of work to be accomplished. Minor repairs, modifications, and renovations will comply with applicable energy and water conservation criteria to the extent of the item or system to be replaced. The factors that determine a major renovation from a minor renovation are described below.

Major Renovations are projects where a building's envelope is altered or if changes include replacement of the buildings' lighting, plumbing, electrical, and heating, ventilating, or air conditioning (HVAC) systems in combination with other significant alterations of the building's spaces. All building components and systems being renovated or replaced must comply with energy and water conservation criteria.

According to the UFC, after Asset Evaluation (AE) provides a site assessment of a facility, under the notes includes recommendations for areas of improvement (i.e.: light bulb replacement would be a minor modification). Additional minor modifications and renovations include: repairs and/ or replacement of windows, doors, lighting fixtures, HVAC equipment, and similar types of modifications to existing buildings are classified as minor repairs or modifications.

According to the UFC, there are there are plenty of energy conservation considerations that must be considered for administrative buildings constructed on a naval base (UFC 3-400-01, U.S. Navy, 2002). Some energy conserving measures are related to the siting and footprint of a facility including requirements to take advantage of solar orientation, prevailing winds, and natural topography. To implement such energy conservation measures, alternative funding sources such as rebates from the utility companies shall be considered and used where available and appropriate. Photovoltaic power generation is most likely to be life cycle cost effective where there is a relatively small power requirement compared to the cost of connecting the load to the existing electrical grid (UFC 3-400-01, U.S. Navy, 2002).

Additionally, the UFC identifies key sections of the Energy Policy Act of 2005 (EPAct) that affect DoD buildings, including Section 109 which requires that buildings be designed to attain 30 percent lower energy consumption than either standard 90.1 of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) or that of the International Energy Code, if lifecycle cost effective (DoD Strategic Sustainability Performance Plan, 2010).

Anti-Terrorism and Force Protection (AT/FP) Standards

NBVC must also adhere to all Anti-Terrorist and Force Protection (AT/FP) standards. AT/FP standards have been integrated into federal agencies since September 11, 2001. Application of the AT/FP standard is required for the following project types: new construction, major investment, conversion of use, glazing replacement, building additions, leased buildings, and for expeditionary and temporary structures.

All AT/FP standards apply to any facility renovation, operation and construction, or new footprint for any facility. AT/FP standards that apply are standoff distances. Standoff distances refer to the space surrounding the building envelope of the facility. There are minimum distances set for particular uses and locations including: a controlled perimeter (an enclosed area that has a defined space requirement, such as parking and roadways) and trash containers. These standoff distances expand of varying uses (i.e.: construction, renovation) and change of uses for facilities (i.e.: primary gathering facility to low-occupancy facility). For example, a primary gathering facility requires a minimum 82-feet etback from the building envelope to the edge of a parking area (AT/FP, 2010). A visual diagram (Figure 6) illustrates the AT/FP standards and standoff distances for 'primary gathering' or administrative buildings.

NAVFAC

ANTI-TERRORISM / FORCE PROTECTION (AT/FP) MINIMUM STANDARDS

STANDARD 1 – STANDOFF DISTANCES

Capital Improvements CORE

Table B-1 Standoff Distances for New and Existing Buildings

Location	Building Category	Standoff Distance Requirements			
		Applicable Level of Protection	Conventional Construction Standoff Distance	Minimum Standoff Distance(1)	Applicable Explosive Weight (2)
Controlled Perimeter or Parking and Roadways without a Controlled Perimeter	Billeting and High Occupancy Family Housing	Low	45 m (3) (148 ft.)	25 m (3) (82 ft.)	I
	Primary Gathering Building	Low	45 m (3) (4) (148 ft.)	25 m (3) (4) (82 ft.)	I
	Inhabited Building	Very Low	25 m (3) (82 ft.)	10 m (3) (33 ft.)	I
Parking and Roadways within a Controlled Perimeter	Billeting and High Occupancy Family Housing	Low	25 m (3) (82 ft.)	10 m (3) (33 ft.)	II
	Primary Gathering Building	Low	25 m (3) (4) (82 ft.)	10 m (3) (4) (33 ft.)	II
	Inhabited Building	Very Low	10 m (3) (33 ft.)	10 m (3) (33 ft.)	II
Trash Containers	Billeting and High Occupancy Family Housing	Low	25 m (82 ft.)	10 m (33 ft.)	II
	Primary Gathering Building	Low	25 m (82 ft.)	10 m (33 ft.)	II
	Inhabited Building	Very Low	10 m (33 ft.)	10 m (33 ft.)	II

(1) Even with analysis, standoff distances less than those in this column are not allowed for new buildings, but are allowed for existing buildings if constructed/retrofitted to provide the required level of protection at the reduced standoff distance.
(2) See UFC 4-010-02, for the specific explosive weights (kg/pounds of TNT) associated with designations – I and II. UFC 4-010-02 is For Official Use Only (FOUO)
(3) For existing buildings, see paragraph B-1.1.2.2 for additional options.
(4) For existing family housing, see paragraph B-1.1.2.2.3 for additional options.

Figure B-1 Standoff Distances – Controlled Perimeter

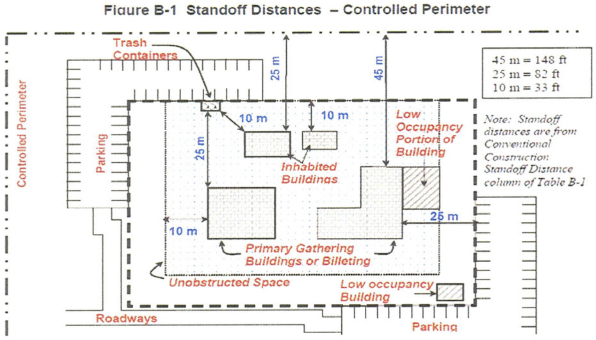

Figure B-2 Standoff Distances – No Controlled Perimeter

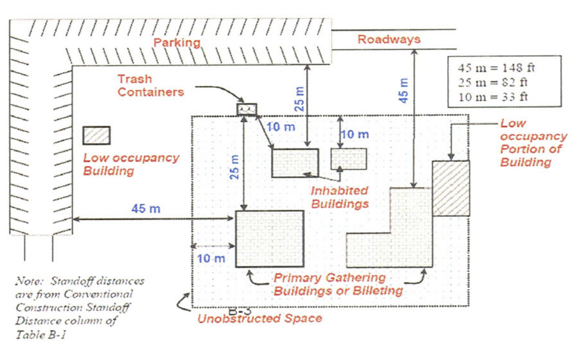

Figure B-3 Parking and Roadway Control for Existing Buildings – Controlled Perimeter

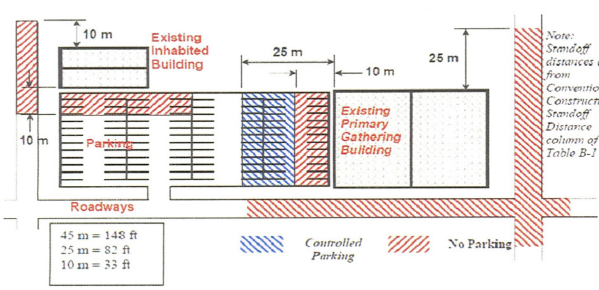

Figure B-4 Parking and Roadway Control for Existing Buildings – No Controlled Perimeter

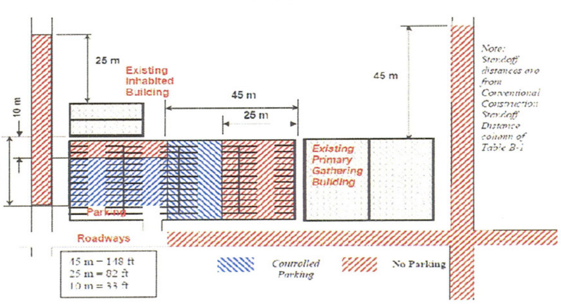

Figure 6
The diagram above provides the Anti-Terrorism and Force Protection (AT/FP) Standoff Standards for New and Existing Buildings. Source: NAVFAC-SW, AT/FP Training Course, 2010.

Naval Air Footprint Reduction Program

The Naval Air (NAVAIR) Footprint Reduction Program consists of preparing facility-planning documents for all buildings and tenants affected by the consolidation (or change in facility use). Whenever there is a proposed consolidation of a facility and depending on whether it is a major or minor renovation all AT/FP standards apply. The facility planning documents consist of Asset Evaluations (AEs) and Basic Facility Requirements (BFRs) to derive space surplus and deficiencies. For any project under the NAVAIR Footprint Reduction Program, Asset Evaluation (AE) provides an up-to-date floor plan, space utilization by department, category code number (CCN), and AT/FP standoff standards compliance (NAVAIR Footprint Reduction Program, 2009). The 33 administrative buildings at NBVC consist of a 61010 CCN.

For AE, the process involves compiling existing utilization data and floor plans for all affected NAVAIR buildings from base planners and internet Navy Facility Asset Data Store (iNFADS). iNFADS can provide a property record for any U.S. Navy building. iNFADS also provides the facility utilization (i.e.: 61010 CCN: Administrative Office), facility tenant (i.e.: facility manger), and internal facility conditions and deficiencies (i.e.: inadequate conditions for building or structure, electrical systems, environmental systems, and so forth are provided in the notes for all AE Worksheets (NAVAIR Footprint Reduction Program, 2009).

The AE process of using iNFADS for navy buildings has been divided into two category components. The first category consists of an approved list of buildings awaiting demolition; whereas, the second category consists of a list of buildings awaiting renovation or consolidation (NAVAIR Footprint Reduction Program, 2009). Furthermore, according to the Cultural Resource Specialist at NBVC, all 33 administrative buildings at NBVC have been approved for consolidation or facility retrofit (Girod, 2011); of this consists of internal retrofit changes that would be made to maximize energy efficiency and improve indoor environmental quality for occupants.

Installation Appearance Plan (IAP)

The Installation Appearance Plan (IAP) is the direction for designing, developing and reviewing all installation construction and renovation projects at NBVC. The IAP has two purposes: provide aesthetic and functional direction for new development and renovation efforts; and protect and preserve the Installation's natural and historic resource. Through preservation of resources must be a high priority, guidelines must be flexible enough to allow for renovation, expansion or demolition of inadequate facilities that may need to be removed to make room for other mission essential facilities (IAP, 2008). The focus of the IAP for NBVC is to identify areas where a majority of military personnel and the public works would be utilized and achieve the greatest impact for the least cost (IAP, 2008).

NBVC Activity Overview Plan (AOP)

The NBVC Activity Overview Plan (AOP) provides regional land and facility requirements from a functional point of view. In addition, the AOP also provides land use recommendations for DoD facilities and military operations. The AOP is an implementation tool that is to be used to achieve the Chief Naval Operations (CNOs) 21st Century Shore Support Vision to manage Navy Region Southwest Installations at NBVC (AOP, 2006). The AOP consists of a comprehensive inventory of supported units (i.e.: navy operations and land uses), tenant commands (i.e.: NAWC, MWR, NAVAIR, 31st SRG), and facility assets at NBVC makes it one of the most unique and versatile based in the Navy (AOP, 2006).

This AOP examines land use choices involving all aspects of operation, support, and quality of life activities. There are more than 1,500 buildings and structures at NBVC, many of which are assigned to various commands. In development of this EEP, Administrative buildings are assigned to NAWC, NAVAIR, or NBVC. This facilities analysis data tabulated and illustrated in this study is based on three functional classifications:

1) Mission
2) Support
3) Quality of Life (QOL)

Mission-related functions at NBVC include port operations, air operations/ ranges, RDT&E, training, ordinance, and Seabee Operations and mobilization. Support functions include supply, facilities/ sustainment, restoration, and modernization (SRM), utilities, base services (such as administration, public affairs, human resources, and personnel support), information technology (IT)/ communications, Federal fire, force protection, environmental, and religious services. QOL functions include bachelor housing, family housing, recreation/ community support, food services, social services, and health services (AOP, 2006). Based on the AOP, the EEP seeks to:

- Identify ways to meet requirements, optimize resources, reduce costs, increase capabilities, and improve efficiency;
- Identify goals to maximize energy conservation from utility systems and provide ecologically sustainable solutions;
- Optimize land use allocation and siting and maximize the physical efficiency of facilities;

The readiness condition of each facility is routinely rated, as is the physical condition of each facility. Per the Shore Facilities Planning Systems (SFPS), the physical condition of a facility is evaluated by an architect or engineer (A/E) to determine a rating of adequate, substandard, or inadequate (AOP, 2006). There is no scientific methodology that determines these ratings from AE, for this project task is contracted out. Only adequate and substandard facilities count toward meeting facility requirements. The iNFADS is the main source of facility assets data for NBVC.

Using iNFADS for collecting the AE Worksheets show these buildings are rated as follows:

- 17 Administrative Buildings have an adequate rating
- 12 Administrative Buildings have a substandard rating
- 4 Administrative buildings have an inadequate rating

It is policy of the Department of the Navy to reduce energy usage and employ appropriate sustainable design strategies that are life-cycle cost effective. This is the basis for a Renewable Energy and Environmental Design strategy for NBVC. Conversion of existing facilities is a high priority to minimize Military Construction (MILCON) requirements (AOP, 2006). Facility consolidations can be the key to achieving this goal. Often, a rapidly growing activity will expand into whatever space is immediately available, resulting in an inefficient fragmentation of its functions among several locations. Relocations and consolidations of such fragments activities into fewer, more efficiently configured facilities can help the NBVC realize substantial savings in terms of utility use as well as maintenance and repair costs. NBVC currently is planning a number of consolidations and reductions in infrastructure (AOP, 2006).

2.2 Naval Base Ventura County History

This chapter starts off with a brief history of Naval Base Ventura County and then describing the history of the three local naval bases that form the installation. The history section explains the chain of command and lists the number of administrative buildings that will be used in the development of this EEP.

Naval Base Ventura County (NBVC) is bordered by Highway 1 on the north and east, the Pacific Ocean to the south and to the west, and Ventura County Game Reserve northwest. NBVC was first built as a temporary depot in the early days of World War II (Figure 7).

Figure 7
This photo illustrates the historic NBVC Port Hueneme site during WWII.
Source: Installation Appearance Plan, 2008.

The Construction Battalion Center at Port Hueneme is a veteran of that war. The base was originally established to train, stage, and supply the newly created Seabees.

The Seabees are the military support aid who facilitate in military operation/ construction and communication to the Commander of the NBVC, Captain James McHugh. For any executive order both from the Public Works Department (PWD) or the military side, is mandated for NBVC Seabees to carry out that order and mission. In 1941 as the United States entered World War II, Point Mugu became a training area for the Seabees. The Port Hueneme Base was officially established and began operating May 18, 1942 as the Advance Base Deport. In 1945 the Depot was renamed the Naval Construction Battalion Center (CNIC-History, 2011).

Naval Base Ventura County Point Mugu established temporary operations in 1944, thus approximately 4,500 acres under control of the Bureau of Aeronautics was set aside for the Navy. The Navy has conducted operations at NBVC Point Mugu since 1945 (Figure 8).

Figure 8
This is an aerial photo of NBVC Point Mugu.
Source: NAVFAC-SW, PWD Shared Drive, 2011.

NBVC Point Mugu is a major center for naval weapons systems testing and evaluations. The Point Mugu installation provides range, technical, and base support for fleet users and other U.S. Department of Defenses (DoD) government agencies. NBVC Point Mugu provides aviation, logistics, and base operating support to the Naval Construction Force and supplied aircraft intermediate maintenance services to all military and transitory aircrafts in the Ventura County region. NBVC Point Mugu currently maintains a fleet of more than 50 aircraft, many of which are specifically identified to support the assigned Test and Evaluation mission for airborne weapons and electronic warfare systems. There are a total of 10 administrative buildings included in the EEP.

NBVC Port Hueneme is located on the southern portion of the Oxnard Plain, northwest of NBVC Point Mugu. The two sites are about nine miles apart. The base itself covers more than 1,600 acres and has more than 29 miles of roads and streets and 10 miles of railroad track. The Port Hueneme Base is a 1,615-acre complex 60 miles north of Los Angeles (Figure 9).

Figure 9
This displays the spatial distribution between Port Hueneme and Point Mugu.
Source: NBVC Activity Overview Plan, 2006.

As described in an early section, NBVC Port Hueneme offers the Navy's deep water port, between San Diego and Washington (CNIC-History, 2011). There are a total of 20 administrative buildings at Port Hueneme included in the EEP.

San Nicholas Island (SNI) transferred to Naval Base Ventura County (NBVC) on October 1, 2004. It is located 64 miles south of NBVC Point Mugu. SNI is one of eight offshore islands called the Channel Islands. SNI is located within the 36,000 square mile NAVAIR Sea Range. The range provides valuable sea and air space to conduct controlled test and operational training. SNI maintains a 10,000 foot concrete and

asphalt runway that can accommodate an aircraft the size of a C-5. Other island facilities include: radar tracking instrumentation, electro-optical devices, telemetry, communications equipment, missile and target launch areas, as well as personnel support. SNI's mission calls to support the primary research, design, development, test, and evaluation of Air Weapons and associated aircraft systems into strike, anti-surface and anti-warfare aircraft within the Sea Test Range for Naval Air Weapons Station (NAWS) China Lake. There are a total of 3 administrative buildings included in the EEP at NBVC San Nicholas Island.

2.3 Physical Setting & Conditions Assessment

For development of this EEP there are a total of 33 administrative buildings at NBVC. 3 on San Nicholas Island (Figure 10).

Figure 10
These three administrative buildings at SNI are small; in additiion, the polygons for these buildings are not identified on the base map for SNI.
Source: NBVC Activity Overview Plan, 2006.

Of the 30 administrative buildings remaining, 10 are on Point Mugu and 20 on Port Hueneme (Figures 11-12).

This section describes how DoD classifies administrative buildings using the "Unified Facilities Criteria for CCN 61010 Administrative Buildings" (UFC 3-400-01, 2002). According to UFC (2002) administrative offices are the headquarters and office-type buildings used to accommodate administrative and professional activities, business and data-processing machines, records, files, and supplies for administrative office operations (UFC, CCN 61010, 2002).

The site assessment includes a building conditions analysis, which covers the general interior and exterior architectural conditions, the year the building was built, the area (SF), upgrades/ retrofits, the FY 2010/2011 Utility (MWh) and Usage costs. The building conditions analysis component also provides summaries of the building usage and if there are any deficiencies noted from the AE Worksheets (For further information on what an AE Worksheet includes, please contact PWD Asset Management Branch, NBVC Point Mugu).

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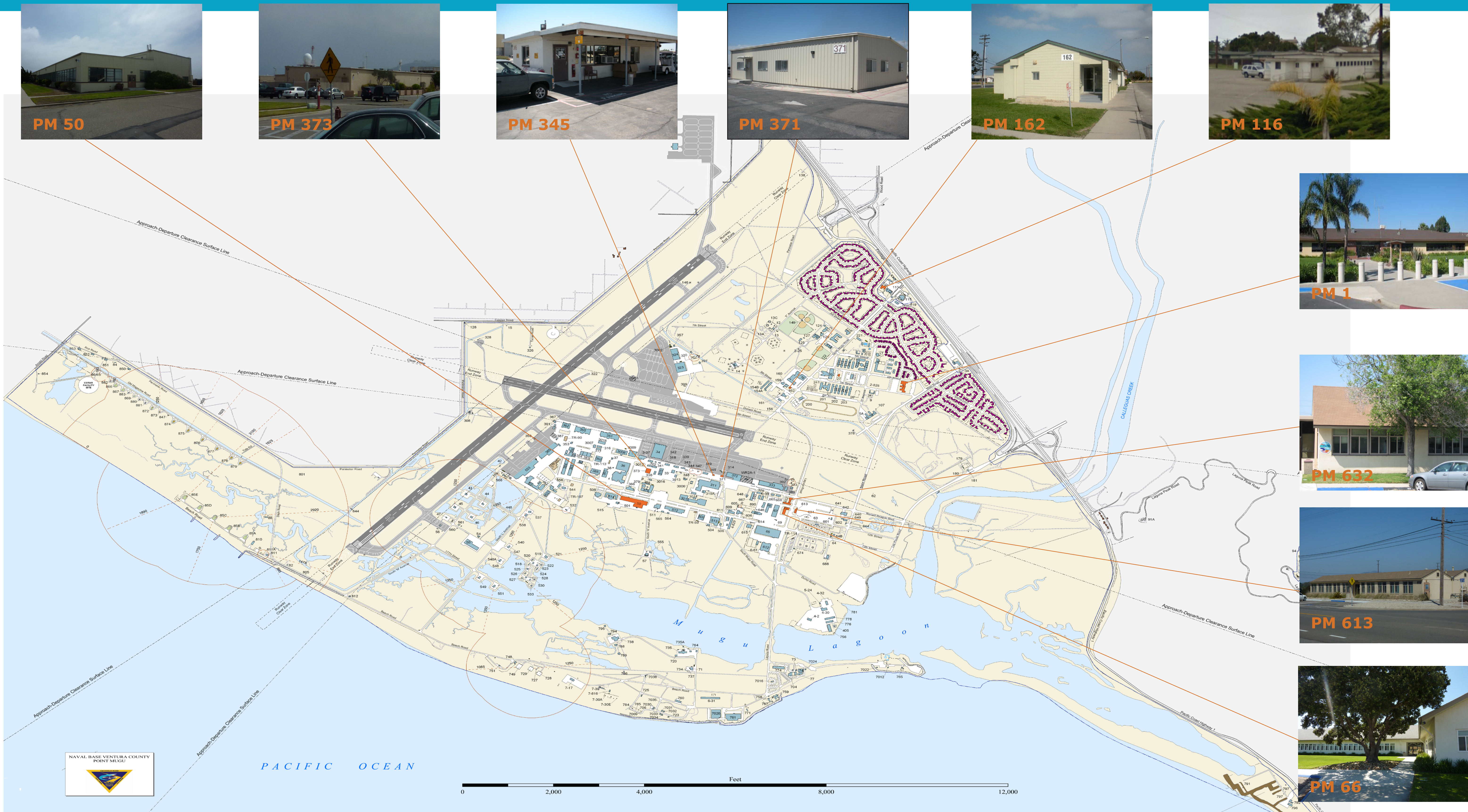

Figure 11

This spatial distribution map of NBVC Point Mugu identifies the location for each administrative building; except PM27 (this building was not approved to photograph because of a radar testing and evaluations activity). Source: Lousen, K. (July 27, 2011).

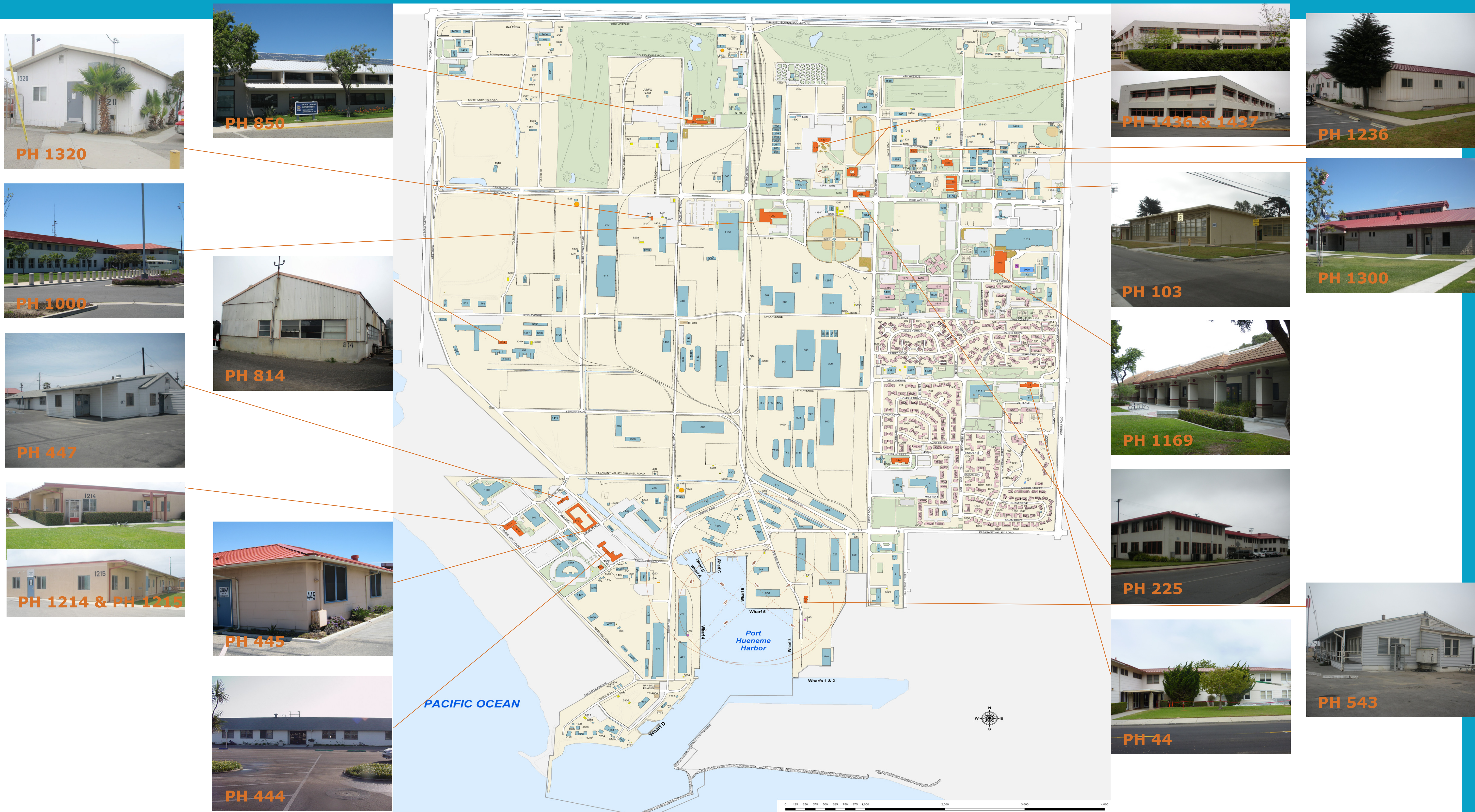

Figure 12

This spatial distribution map of NBVC Port Hueneme identifies the location for each administrative building; the remaining 'orange' polygons on this map are no longer renovated for administrative office uses.
Source: Lousen, K. (July 27, 2011).

Site Assessment

For NBVC all administrative buildings are either single or two-story office buildings with an array of exterior façade selections; such as: olive/ clay colored stucco, grey colored metal or concrete, grey/ sandstone colored cinder block texture, or wood paneling. All 33 buildings are constructed with either a flat, pitched, cross-pitched or sloped roof comprising of layered shingles and/or double-coated painted metal sheath roof.

The site assessment identifies primary administrative uses according to UFC category code number (CCN), AT/FP Standoff Standard compliance, building interior and preponderant users. The preponderant users (Installation Commands and Divisions represented) for these buildings at NBVC include:

- NAVFAC-SW
- AIR TEVRON THREE ZERO
- NAVAIR
- NAWC-WD
- Navy Region Korea
- Naval Surface Warfare Center Division
- NFELC
- NAVBASE
- 31 SRG Seabee Readiness
- 30 NAVCON-REG

The primary use CCN for these buildings is administrative office, although these buildings may also be renovated for additional administrative functions such as:

- Bachelor Quadrant Housing Check-In
- Headquarters and managerial security clearance/ deputy offices
- Naval Criminal Investigation Services (NCIS)/ NMCI Server and Network
- Administrative storage/ files/ computer mainframes and research laboratories
- Department of Public Works Branch Divisions/ Offices/ CED Shops
- Academic Instruction/ University of La Vargne Charter College Office
- Naval Air Warfare Center Division Defense/ Command/ Communications (China Lake Naval Operations)
- Fire Prevention and Training
- Applied Academic Instruction/ Security and Force Protection
- Medical/ Community/ Moral Welfare and Recreation (MWR) Support Services and Personal Properties Office
- Data Processing/ Storage and Laboratory functions

The physical assessment of building interior consists of existing electrical lighting and HVAC systems for the administrative buildings. The Energy Conservation Measures Report (ECMR) for Naval Facilities Engineering Command was prepared by Sain Engineering Associates, Inc in August 2011. The ECMR (2011) was prepared for higher energy using facilities at NBVC (all facility uses represented). The ECMR (2011) covers 5 of the 33 administrative buildings, these include: PM50, PH444, PH445, PH1000, and PH1169. It should be noted, that the ECMR (2011) does not provide individual summaries for the administrative buildings covered in the EEP; instead, collective group summaries for all building classes are provided.

The ECMR (2011) contains descriptions for a set of electrical uses such as: fluorescent lighting upgrades, high intensity discharge (HID) upgrades, incandescent upgrades, lighting controls, and programmable thermostats. Summaries and descriptions of the electrical uses for the 5 administrative buildings (some are specific summaries; whereas, others are generalized) are featured below.

Most of the administrative buildings use 32-watt T8 lamps and generic electronic ballasts (GEB) fluorescent lighting; whereas, other administrative buildings use T12 lamps and magnetic ballasts. Many of the buildings use 700 series (1st generation) T8 lamps and generic instant-start electronic ballasts, and some of the newer buildings use 800 series T8 lamps with higher light output and better color rendering index (CRI). There are some administrative buildings with primarily 3- and 4- lamp fixtures (Figure 13).

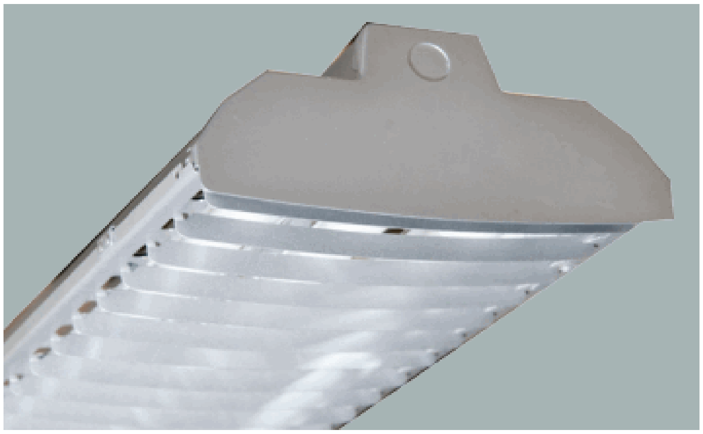

Figure 13
This photo displays a fluorescent 4-lamp fixture, a type of lighting that is common these administrative buildings.
Source: Energy Conservation Measures Report, 2011.

Some of the administrative buildings use high intensity discharge (HID) lighting; mostly equipped with equal spun aluminum reflectors and metal halide (MH) or high-pressure sodium (HPS) lamps (Figure 14). Of the administrative buildings documented from the ECMR PM50, PH445, PH1000, and PH1169 use HID lighting upgrades for high occupancy rooms; auditoriums and warehouses.

Figure 14
This photo displays high bay lighting systems.
Source: Retrieved (2012) from lumenistics.com/lighting solutions.

Many of the administrative buildings at Port Hueneme and Point Mugu have been retrofitted with screw-base (SB) compact fluorescent lamps (CFLs). Most standard incandescent A-lamps range from 60-100 watts. This type of lighting can be found in RLM domes and porcelain sockets (Figure 15).

Figure 15
This photo displays a Satco 75PAR38 Reflector lightig type.
Source: Retrieved (2012) from lightbulbdistrict.com.

Another common lamp fixture type includes R (reflector) lamp, which are mostly 65R30, PAR parabolic aluminized reflector) lamps (Figure 16), which are mostly; and 50-watt MR-18 lamps, mostly in track heads (ECMR, 2011).

Figure 16
This photo conveys compact fluorescent lamps with porcelain sockets.
Source: Retrieved (2012) from lumenistics.com/lighting solutions.

According to Utility Energy Management (UEM) Branch Managers, it was reported in an interview on October 27, 2011 that these lighting types are featured in the following administrative buildings: PM1, PM66, PH850, PH444, PH445, PH1000, PH1169, PH1300 (Santoianni, 2011).

Some administrative buildings have been retrofitted with building control systems, wall switches and/or with passive infrared (PIR) wall-box (WB) sensors. According to the ECMR (2011) some administrative

buildings have lighting system controlled by circuit breakers, which can be a safety hazard. After years of operating breakers on an electrical overload can be used up and eventually the breakers may not trip. There are also a few dimmers, timers, and sockets with pull-string (ECMR, 2011).

Aside from lighting types, a buildings' heating, cooling and ventilation is critical to how occupants respond in their work environment. The AE Worksheets depict that many of the administrative buildings do not have an HVAC system or programmable thermostat. Without these systems, make the work environment undesirable; as a result, occupants may find it difficult for them to remain productive at their workspace – especially during dry-summer heat months.

According to the ECMR (2011) associated building HVAC systems includes: packaged heat pump units, gas furnaces, gas unit heaters, heating and ventilating units, cooling only air handling and bard units.

All of the administrative buildings affected by ECM -9 (HVAC and Thermostats) have intermittent occupancy hours with scheduled occupied and vacant times (ECMR, 2011).

This physical assessment section provides tables and descriptions for each administrative building, facility name, building area (SF), the year the building was built, improvements/ upgrades, and FY 2010-2011 utility usages (MWh) and costs (see Tables 1-4).

For *Table 1*, consists of single or two-story buildings that are constructed with an olive or tan colored stucco facade. This group of buildings is constructed with a pitched or cross-pitched single layered roof, and has double-pane windows on all sides of the building.

Table 1 (Olive/ Tan Colored Stucco Textured Façade)

Complex Name	Facility_Name	Facility_#	Area (SF)	Built	Improvement	Units	Usage FY10/11 YTD	Cost FY10 YTD
Port Hueneme	Administration Bldg	FAC: 444	23,771.00	1943	No	MWH	183	$ 34,861
Port Hueneme	Administration Bldg	FAC: 445	36,511.00	1943	No	MWH	211	$ 40,031
Port Hueneme	Naval FAC EXPED Logistic CTR	FAC: 1000	68,300.00	1993	Yes (2010)	MWH	1,027	$ 195,136
Port Hueneme	30 NAVCONREG/ RSVR Training/Admin	FAC: 225	23,968.00	1944	Yes (1983)	MWH	79	$ 15,683
Port Hueneme	Public Works Department	FAC: 1430	3,120.00	1987	No	MWH	16	$ 3,264
San Nicholas Island	Administrative Office/ Bldg	FAC: 152	2,810.00	1957	No	MWH	48	$ 32,439
San Nicholas Island	Photo Optics Processing/ Storage	FAC: 163	440.00	1958	Yes (2008)	MWH	9	$ 6,625
Point Mugu	NBVC HQ	FAC: 1	24,825.00	1949	Yes (1990 & 2010)	MWH	193	$ 36,723
Point Mugu	BQ Check-In Bldg	FAC: 27	2,966.00	1966	No	MWH	24	$ 4,821
Point Mugu	Training/ Fire Prevention	FAC: 613	5,062.00	1962	No	MWH	29	$ 5,851
Point Mugu	Environmental Bldg	FAC: 632	12,647.00	1959	Yes (2004 & 2010)	MWH	62	$ 11,272

Source: Prepared by Kendall Lousen, Planner Technician (AM Branch) August 2, 2011.

During site visits (2010 and 2011) to PH444, PH445, PH1000, and PM632 there was excessive lighting and heating systems for the amount of underutilized workspaces and hallways for these buildings. Thus, for the amount of electricity used and costs generated for these buildings is "relatively high" for the building area and for the number of underutilized workspace stations (Santoianni and Fong, 2011).

PH444 and PH445 Naval Sea System Communications buildings have not undergone any facility improvements besides double-pane windows. PH444 has a slightly smaller area (23,771 SF), as compared to PH445 (36,511 SF). According to Asset Management Branch Head, PH444 and PH445 are classified facilities; therefore, no further detail per the buildings' description is provided (Danza, 2011).

PH1000 NFELC data processing and logistics command center building has undergone some improvements in 2010; of these improvements, was the installation of a 27 MW photovoltaic system (Figure 17).

Figure 17
The installed 27 MW PV System can be seen on the back side of PH1000.
Source: Lousen, K. January 16, 2012.

PH225 30 Naval Construction Regiment/ RSVR Training and Academic Instruction building and PM1 NBVC Headquarters were constructed before 1950. PH225 (Figure 18) had undergone lighting and facility improvements in 1983; whereas, PM1 had undergone similar improvements in 1990 and in 2010.

Figure 18
This displays a photo perspective of PH225.
Source: Lousen, K. January 16, 2012.

PM1 serves as the headquarters for NBVC Commanding Officer Captain James McHugh, Right-Hand Command Officers Deputy David Sasek, and other NBVC Deputy Officers (Figure 19).

Figure 19
This displays a photo perspective of PM1, NBVC Headquarters.
Source: Lousen, K. January 16, 2012.

PM632 PWD Environmental Branch Division was constructed after 1950 and had lighting and cooling ventilation improvements in 2004. In 2010, PM632 installed solar tubes as a green building practice to offset the dependence on artificial lighting in hallways. PM632 is where the NEPA Project Review Board is ocated. PM632 houses specialized departments, including: Air and Water Quality, Environmental, Conservation, Biological Species and Wetlands Management, HAZMAT clean-up and IR Restoration.

These groups of the buildings from *Table 2* are either single or two-story administrative office buildings that are constructed with a grey colored metal or concrete façade. This group of buildings is constructed with a flat/ sloped metal sheath roof, pitched/ cross-pitched shingle layered roof, or even a granular pebble-rock like roof. These buildings were also constructed with single-pane of double-pane windows on all sides of the building.

Table 2 (Grey Colored Concrete Texture Façade)								
Complex Name	Facility_Name	Facility_#	Area (SF)	Built	Improvement	Units	Usage FY10/11 YTD	Cost FY10 YTD
Port Hueneme	CONSTR/WT/ CED SHOPS	FAC: 814	4,040.00	1959	No	MWH	25	$ 4,956
Port Hueneme	Public Works Department/ Scan	FAC: 850	16,920.00	1959	Yes (2001 & 2010)	MWH	38	$ 7,622
Port Hueneme	Dispatch Center	FAC: 1320	960.00	1977	Yes (2009)	MWH	4	$ 836
San Nicholas Island	Fuel Office Bldg	FAC: 41	200.00	1943	No	MWH	7	$ 4,575
Point Mugu	Coacclogwing/ NMCI/ Training	FAC: 50	80,897.00	1950	Yes (2009)	MWH	2,220	$ 422,016
Point Mugu	Public Works Admin Bldg	FAC: 66	12,435.00	1953	Yes (1990)	MWH	192	$ 36,457
Point Mugu	RSVR Recruiters/ Pass ID/ NCIS	FAC: 116	8,542.00	1959	Yes (2001)	MWH	29	$ 5,455
Point Mugu	NAVAIR WARCEN/WPN DIV China Lake	FAC: 345	640.00	1950	No	MWH	151	$ 30,072
Point Mugu	Admin Bldg VX-30	FAC: 371	2,400.00	2003	No	MWH	3	$ 570

Source: Prepared by Kendall Lousen, Planner Technician (AM Branch) August 2, 2011.

During site visits (2009 and 2011) to PH850, PH1320, PM50, PM66 and PM116 had over heated/cooled hallways, underutilized workspace stations, and bathrooms. These buildings also had a surplus of inoperable lighting controls, wall box sensors, and/ or malfunctioning thermostat/ HVAC systems.

PH850 was retrofitted in 2001 (Figure 20) and had some improvements in 2010 (Figure 21). PH850 was retrofitted to include light shelves and skylights (Figure 22), wall box sensors, timers, and included a solar thermal renewable energy system.

PH850 became the first certified LEED Gold Building for all of NBVC in 2005. According to Utility Energy Management (UEM) Branch Managers, it was reported in an interview of October 27, 2011 that the solar thermal energy system no longer operates and PH850 has inoperable lighting controls, fixtures and digital thermostats (Santoianni and Wiltshire, 2011).

Figure 20
The back and side of PH850 after the facility retrofit.
Source: Lousen, K. January 16, 2012.

Figure 21
This photo displays PH850 and its solar PV System.
Source: Lousen, K. January 16, 2012.

Figure 22
This photo displays the interior workspaces of PH850.
Source: Lousen, K. January 16, 2012.

PH11320 is the dispatch center, which seems to be an energy efficient building given its area and annual usage. PM50 is primarily used as the NMCI Server and Network and Training for all of NBVC; as a result of its user activity, this building is very energy intensive. Types of cooling systems and HVAC Systems should be considered when proposing energy efficiency measures and/or facility retrofits (ECMR, 2011).

PM66 Public Works Department (PWD) was constructed after 1950. PM66 has undergone window and lighting improvements in 1990 (Figure 23). PM66 houses civilian branch departments such as Requirements and Infrastructure, Asset Management (Planning), CED Shops, and PWD Executive Commanding Offices. Both NBVC PWCO Captain Sir Michael Obermiller and NBVC PWO Sir Thomas Carr reside in PM66.

Figure 23
NBVC PM66 installed dual-pane windows in 1990.
Source: Lousen, K. July 22, 2011.

PM116 was constructed in 1959 and had some structural enhancements in 2001. PM116 houses specialized departmental offices such as NCIS, Navy Pass and ID, and the RSVR Recruiters Office. According to UEM Branch Managers and facility occupants, it was reported in an interview on September 19, 2011 that both PM116 and PM66 use a higher amount of electricity than it should – given the poor lighting fixtures and the underutilized corridors/areas (Santoianni and Fong, 2011).

PH814 CED Shop was constructed in 1959 and does not comply with AT/FP standards. PM50 COMACCLOG-WING/ NMCI/ TRAINING was constructed in 1953 and had undergone improvements in 2009.

PM345 was constructed in 1950 and has not undergone any improvements. According to the iNFADS Site Visit in 2009, the building's interior is not configured adequately to UFC 2002 Administrative Workspace Codes, because there is no storage space. PM345 does not comply with AT/FP Standoff Standards and is located too close to the airfield, thus resulting in violation of P-80 airfield safety clearance criteria (AE Worksheet 2009).

These groups of the buildings from *Table 3* are either single or two-story administrative office buildings that are constructed with a wood/ vinyl panel façade. These buildings were constructed with a flat/sloped metal sheath roof, pitched or cross-pitched shingle layered roof. Some of these buildings integrated green building practices, such as light wells and skylights. Some of the buildings in table 3 have ever-changing hours of operation and are often vacant (not renovated) during certain months of the year.

Table 3 (Wood/ Vinyl Panel-like Façade)								
Complex Name	Facility_Name	Facility_#	Area (SF)	Built	Improvement	Units	Usage FY10/11 YTD	Cost FY10 YTD
Port Hueneme	Naval Reserve Forces Korea	FAC: 44	22,602.00	1945	Yes (1980 & 2009)	MWH	156	$ 29,652
Port Hueneme	Administrative Office/ Bldg	FAC: 1214	10,248.00	1967	Yes (1980)	MWH	61	$ 12,100
Port Hueneme	Administrative Office/ Bldg	FAC: 1215	10,240.00	1967	Yes (1980)	MWH	61	$ 12,100
Port Hueneme	NAVSURFWAR-CEN DIV/ RDAT&E	FAC: 447	5,573.00	1943	Yes (1980)	MWH	7	$ 1,353
Port Hueneme	Crane & Rigging Ops Office	FAC: 543	4,069.00	1944	Yes (1980)	MWH	53	$ 10,548
Port Hueneme	Safety & EMBARK Off/ 31ST SRG	FAC: 1236	4,320.00	1971	No	MWH	45	$ 9,036
Point Mugu	University of La Verne	FAC: 162	1,725.00	1956	No	MWH	2	$ 318

Source: Prepared by Kendall Lousen, Planner Technician (AM Branch) August 2, 2011.

PH44 Naval Reserve Forces Korea (Figure 24) was constructed in 1945 and had some improvements and renovations in 1980 and 2009. PH44 is also renovated for medical and community support services (i.e.: Navy Check-In, Pass and ID, Personnel, and HRO).

PH543 Crane and Rigging Optics Office building was constructed in 1944 and had some lighting and storage configuration improvements in 1980. PH1236 is primarily used as a Seabee Readiness and Response academic instruction building. PM162 University of La Vargne offers classes to the users (primarily dependents and Seabees) at NBVC; however, this administrative building is generally vacant during the summer months.

Figure 24
This displays a photo perspective of PH44.
Source: Lousen, K. July 22, 2011.

These groups of the buildings from *Table 4* are either single or two-story administrative office buildings that are constructed with sandstone colored brick-like textured façade/ grey colored cinder block façade. These buildings have either a flat/sloped metal sheath roof, pitched or cross-pitched shingle layered roof. These buildings are constructed with single-pane or double-pane windows that encompass all facing sides of the building; additionally, some even have light wells or skylights.

Table 4 (Sandstone Colored/ Grey Colored Cinder-Block Façade)

Complex Name	Facility_Name	Facility_#	Area (SF)	Built	Improvement	Units	Usage FY10/11 YTD	Cost FY10 YTD
Port Hueneme	Welcome Center	FAC: 1169	40,984.00	1969	Yes (2001)	MWH	324	$ 61,491
Port Hueneme	NCTC HQ Administration	FAC: 1300	11,368.00	2006	No	MWH	156	$ 29,614
Port Hueneme	BATLN OP HQ/31ST SRG 3M/EKMS	FAC: 1436	27,863.00	1990	No	MWH	192	$ 36,457
Port Hueneme	BATLN Operational HQ	FAC: 1437	17,234.00	1990	No	MWH	169	$ 32,162
Port Hueneme	31st SRG HQ/ NCTC/ SARP/ Academic	FAC: 103	18,477.00	1952	No	MWH	7	$ 1,353
Point Mugu	NAVAIR Administrative Office	FAC: 373	11,900.00	1960	Yes (2001)	MWH	115	$ 22,927

Source: Prepared by Kendall Lousen, Planner Technician (AM Branch) August 2, 2011.

PH1169 was originally constructed as the NAVX or Navy Exchange. A navy exchange is similar to what urban planners identify as a "big box" store. A NAVX sells groceries, recreational supplies, clothes; in addition, offers medical services and food commodities for military and dependents. In 2001, PH1169 was renovated as the Welcome Center; in addition, PH1169 retrofitted this building with skylights (Figure 25).

PH1300 NCTC Headquarters constructed light wells and skylights along the central access of the building in 2006. PH373 NAVAIR Administrative Office installed dual-pane windows in 2001. PM373 houses the Human Resources Office, testing wing, and NATEC control unit.

Figure 25
NBVC PH1169 retrofitted in 2001 with skylights.
Source: Lousen, K. July 22, 2011.

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3.0 RESULTS

Building Interior Evaluation
Worker Health & Perceptions Survey

In preparation of this EEP, all 33 administrative buildings at NBVC from fiscal year 2010-2011 were surveyed. Twenty occupants (facility managers and tenants) were interviewed to describe their workspace conditions and perceptions.

After conducting the worker survey in the administrative buildings, a presentation on some energy efficient applications and smart design alternatives was presented to the facility managers and PWD Branch Heads. A total of four concepts that build on distilled guidance were made to jump-start the 2030 zero-net energy goal was presented at NBVC in September of 2011.

3.1 Physical Assessment of Building Interior

Using the Asset Evaluation Worksheets prepared for each administrative building in May 2009, the notes identified deficiencies for certain variables such as inoperable HVAC/ Thermostat, malfunctioning lighting controls and fixtures, windows in need of replacing and deterioration due to age for some of the administrative buildings are described below. This section summarizes the information included in the worksheets.

The AE Worksheets identify the following:

- Property Record Number and Facility Point of Contact Information

- Location (i.e.: Region, Country, State, County, City, Map Grid, Special Area)

- Excess and Disposal (i.e.: Excess Action, Excess Date, Consolidated PR, Disposal Method, Disposal Date, and Disposal Contract Number)

- Acquisition (i.e.: Estate Code, Land CCN, Acq Contract, Acquisition Date, Governmental Cost)

- Maintenance (i.e.: Preponderant User, Prime Use CCN, Prime FAC Code, Maintenance Fund Source and Responsibility, Evaluation Date, Current PRV)

- Measurements (i.e.: Length, Width, Height, Area, Number of Stories, etc.)

- Construction (i.e.: Facility Built Date, Year Improved, Construction Type, Original Project Number, ABMP Code)

- Utilization (i.e.: Facility Use, User Activity, Deficiencies, Condition, Description, Source, Date)

PH44 was downgraded from adequate to substandard due to recent deficiencies found within the facility. The lighting is poor (Figure 26), in that the light switches do not work; resulting in personnel operating the lights at the circuit breaker (AE Worksheet, 2009).

Figure 26
This photo displays inoperable lighting fixtures in PH44.
Source: AE Worksheets, 2009.

PH1436 and PH1437 are utilized as an academic instruction building for Seabee Readiness Group. Based on the AE Worksheets for PH1436 and PH1437, the notes depict the lighting is also poor, and there is no air conditioning for occupants (AE Worksheet, 2009). PH1436 and PH1437 lack an operating HVAC system; there is no air conditioning or ventilation in several of the offices and restrooms (Figure 27). It has also been reported that personnel have become ill from methane inhalation in both facilities (AE Worksheet, 2009).

Figure 27
This photo displays an inoperable HVAC system in PH1436.
Source: AE Worksheets, 2009.

PH1214 and PH1215 also lack an operating HVAC system. There is no air conditioning to regulate the indoor temperature, thus making the indoor environment difficult for occupants to work under. Both facilities are in poor structural condition and are deteriorating due to its age. According to Cultural Resources Property Manager, both facilities are approved for consolidation and/or demolition (Girod, 2011).

Based on the AE Worksheet for PH447, the facility's electrical system does not have the capacity to support the entire facility or its occupants. The air vents are clogged and the programmable thermostat only circulates air in one area of the building (AE Worksheet, 2009).

Based on occupant interviews for PH103 in 2009, the facility use Navy/ Marine Corps Intranet and User Activity NAVBASE Ventura County Point Mugu now occupy a portion of the facility. According to PH103 facility manager, the facility's server room's HVAC system does not have the capacity to sufficiently cool the servers, which could result in equipment loss (Casne, 2011). It was also said that the air ventilation in the men's bathroom of the administrative office area was insufficient for occupants (Casne, 2011).

PH543 also lacks an HVAC system. The walls are crumbling and the flooring in the men's bathroom is coming apart to the age of PH543 (AE Worksheet 2009).

PH814 does not comply with AT/FP Standards. PH814 is deteriorating and is in poor structural condition due to the age of the facility (AE Worksheet, 2009). According to PH814 facility manager, the facility's plumbing system is old and constantly backing up; in addition, lacks an HVAC system to circulate air for its occupants (Atkins, 2011).

According to AE Worksheet for PH1236, the electrical system does not meet the electrical power needs of the occupant's mission. PH1236 also lacks an HVAC system for its occupants (Figure 28). PH1236 is deteriorating due to its' poor physical condition. The facility's ceiling frame has been collapsing; thus causing panels to fall (AE Worksheet 2009). Facility manager reported that the facility does not have an air conditioning system; resulting in uncomfortable work conditions for occupants (Reid, 2011).

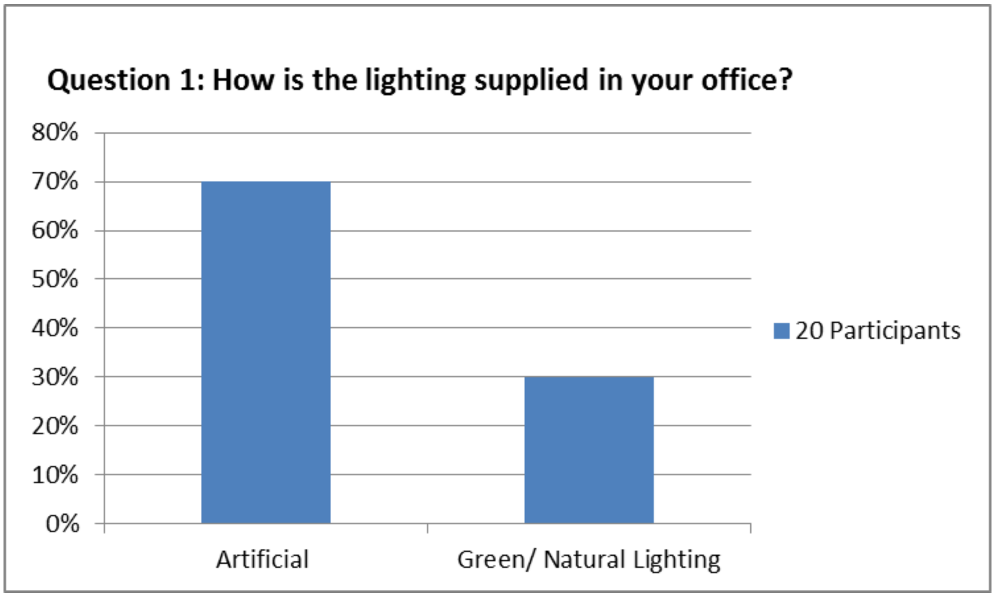
Figure 28
This displays another inoperable HVAC system in PH1236.
Source: AE Worksheets, 2009.

3.2 Worker Conditions & Perceptions Survey

On August 30, 2011, a workspace conditions and perceptions survey was conducted in 8 administrative buildings at NBVC. Of these 8 buildings, a total of 20 occupants (facility managers and tenants) were interviewed in this survey.

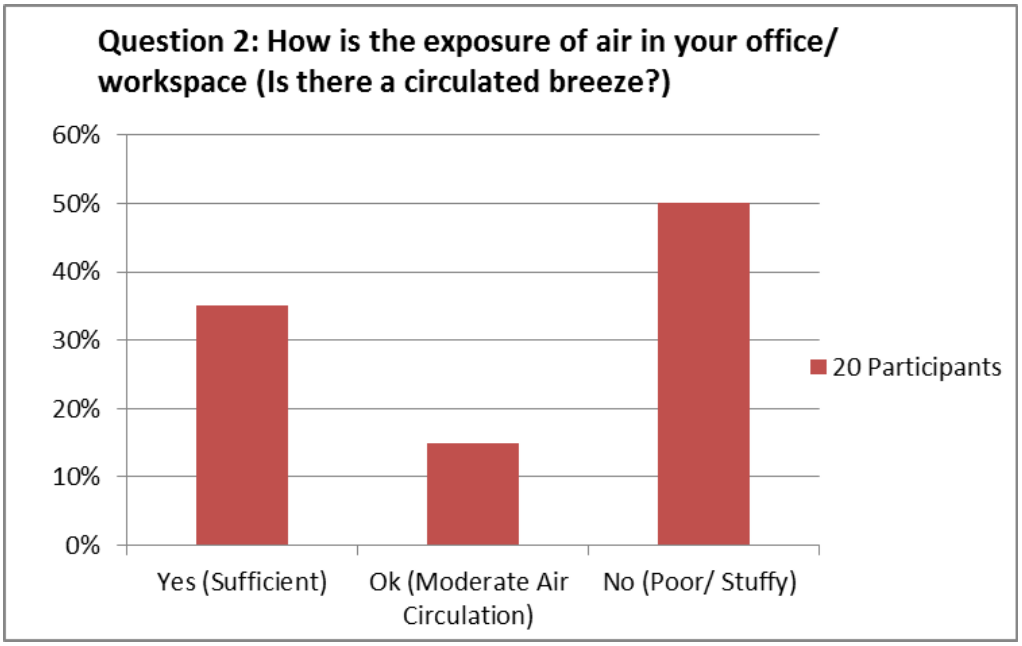
This survey targeted workspace conditions and productivity from administrative occupants at NBVC. The follow tables below illustrate the results for comfort level from the questions asked during the “40 Hours/ Week = The Life in a Cubicle” survey (Tables 5-8).

Table 5: Comfort Level



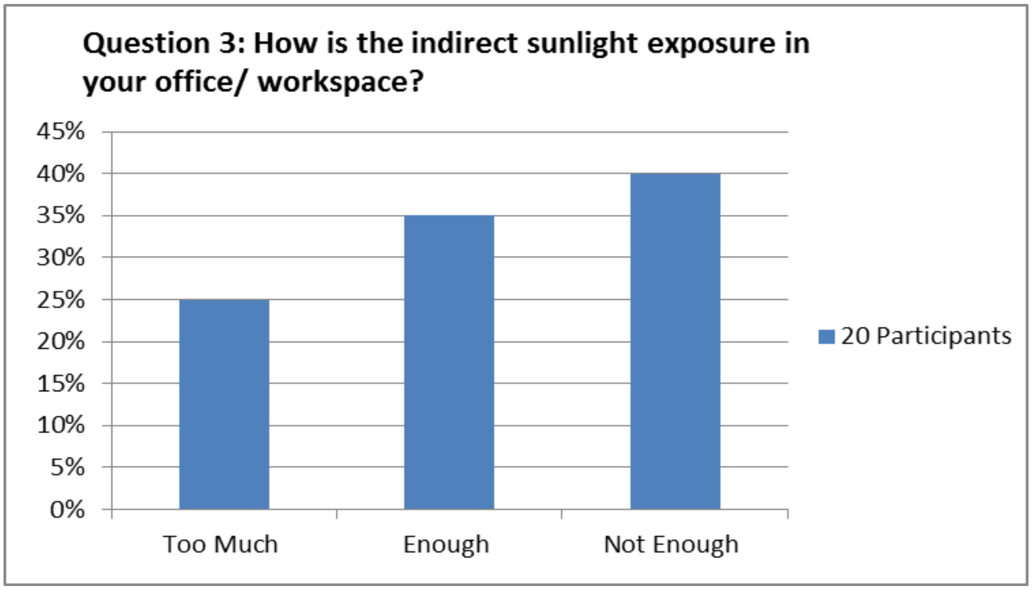
Based on a total of 20 participants from this worker survey, 70% rely on artificial lighting for their ofice/ workspaces. After reviewing the workspace conditions responses of the 20 participants, majority of the occupant’s responses said they “cannot rely on natural lighting due to the thick marine layer that encompasses NBVC”. Others indicated that their workspace need more lighting (did not disclose whether that is artificial or green lighting), because it feels like “being in a black box that does not enable myself to be productive”.

Table 6: Comfort Level



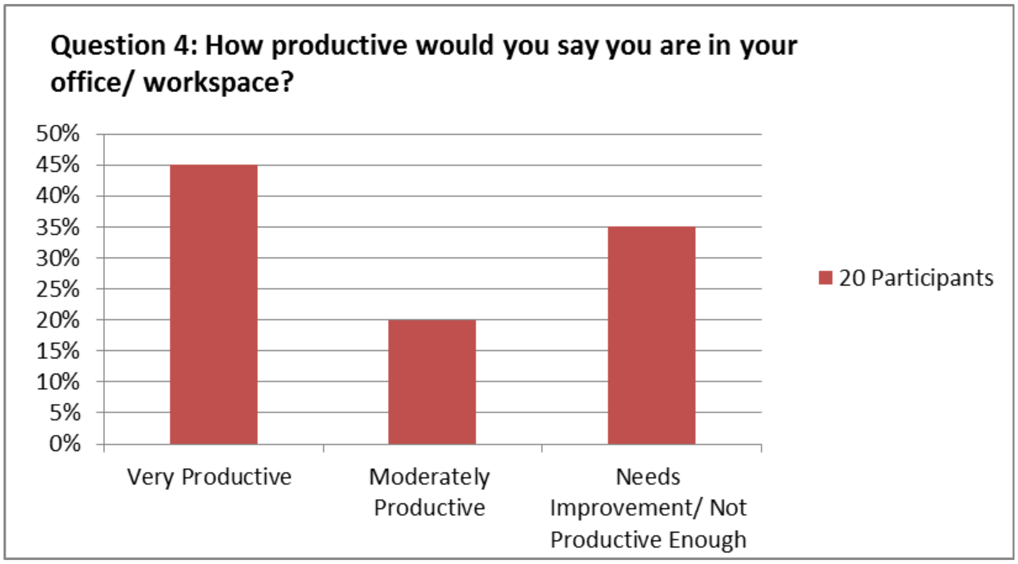
Based on a total of 20 participants from this worker survey, the results depict that 50% agreed that there was “no” exposure of air in their office/ workspace, or that it is often “poor and stuffy”. A total of 35% of the 20 participants indicated that the air exposure in their office/ workspace is “sufficient”. A total of 15% stated the air was “ok” or that there was moderate air circulation depending on the condition of the day. Aside from the comfort level questions from part 2 of the worker survey, collected responses from part 1 of the workspace conditions and comfort level indicated that their workspace/ office needs to have a balance between heating and cooling ventilation.

Table 7: Comfort Level



Based on a total of 20 participants from this worker survey, the results from question 3 convey that 40% indicated that there was “not enough” exposure of indirect sunlight in their office/ workspace. A total of 35% responded that there was “enough” exposure, and 25% stated that there was “too much” indirect sunlight for their office/ workspace.

Table 8: Comfort Level



Based on a total of 20 participants from this worker survey, the results from question 4 convey that 45% expressed that they felt “very productive” in their office/ workspace. 20% of the responses indicated they are “moderately productive” in their office/ workspace; whereas, 35% expressed that they feel their office/ workspace “need improvement/ not productive enough”.

The qualitative survey assessed internal variables relating to functional efficiency and productivity levels that civilians could associate from their workspace conditions and environment. Therefore, using the applied methodology described in the EEP Development Process, the results from the open-ended response questions geared for comfort level stressed to have "better air circulation, high ceilings that allow ventilation for heating and cooling, and needs more indirect solar lighting".

This worker survey data came from 20 occupants out of the 200 or more occupants that work in the administrative buildings. These surveyed participants have different workspace conditions, ranging from an enclosed area that has no windows or skylights to an area with high ceilings and good air circulation.

In addition to the distribution of the worker survey, an occupant, from Department of Public Works, Asset Management Branch was interviewed and asked to describe his workspace environment. The Unified Facilities Criteria Standards provide measurements for individual workspaces per division/rank at NBVC. Although, these set of standards may not justify sustainable workspaces or functional efficiency for governmental civilians in need.

Facility Planner, Paul Perez described his life in a cubicle as "adequate"; in that it could be better and it could be worse. Perez reflected back to his old work environment in China Lake (another Naval Base located in the desert) as an "enclosed space felt like working in a prison cell". After transferring to Point Mugu, he emphasized that he is more productive in his current workspace, because there is a window that allows him to obtain fresh air. If there were to be any improvements in his office, Perez suggested having "more skylights, better air circulation throughout the facility, and a sliding door for each of the manager's cubicle". The life in a cubicle can be stressful and the workspace conditions may not avail optimal success and productivity; regardless adaptation to the workspace area and environment should not constrain one's productivity and worker health.

Overall these results can infer these occupants have adapted to their workspace conditions; although feel they have not reached their optimal work productivity due to their existing work environment conditions.

The next section takes account of the variables examined and the worker survey results, and prepares the needs assessment.

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4.0 Energy Efficiency Program

Needs Assessment
Goals and Strategies

4.1 Needs Assessment

The Energy Efficiency Program (EEP) provides goals and strategies to improve energy (electricity) efficiency in all 33 administrative buildings at NBVC. The EEP presents the three most common and plentiful greenhouse gas (GHG) emissions resulting from human induced activities, these include: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N20). The EEP applies a national mandate and other Department of Defense (DoD) guidance, a physical and existing conditions assessment, and workspace conditions and perceptions survey results.

DoD guidance requires NBVC (federal agencies) to set goals for improving energy efficiency and greenhouse gas emissions reduction. Current physical setting conditions and worker survey results indicate a need for improvement. AE Worksheets shows these administrative buildings to be:

- old condition and have poor structural configuration
- insufficient lighting fixtures
- inoperable HVAC systems
- poor air circulation
- insufficient storage spaces

Workspace conditions and perceptions survey results reveal a need for improved heating, cooling and air ventilation systems; in addition, express a desire for more windows, better lighting options and to have more storage spaces.

Taking these variables into account, the EEP targets the Facilities Management Division at NBVC. Facility Management Division (FMD) controls all federal buildings; in addition, manages property and financial databases to provide the basis for real property management. FMD is responsible for making business decisions on renovating and retrofitting extended life of aged facilities. FMD has the executive control to reduce and consolidate poorly configured buildings to maximize efficiency for space utilization and/or energy distribution (Utility Division). Through a reduction or consolidation of buildings program helps reduce/ eliminate lease payments and outsource for any military construction-funded project.

The EEP provides goals and strategies. For each strategy, a set of considerations are provided as a resource for the FMD. By applying measures to improve energy efficiency, there are a host of co-benefits that could happen. For one, this could lead to a reduction in greenhouse gas emissions (GHGs), thus reducing costs and consumption of electricity. For another this could improve indoor workspace conditions by improving air quality and worker productivity for administrative building occupants.

All administrative buildings are subject to retrofit; thus, these existing strategies and considerations should be implemented to fulfill implementation of these goals. Part of fulfilling the goals of the EEP is to further the implementation of existing regulation. The following section provides goals, strategies and considerations for FMD to choose from in order to effectively carry out the EEP for all administrative buildings at NBVC.

4.2 Goals & Strategies

GOAL [1]
Provide comfortable and productive built environments for all administrative building occupants.

Uncomfortable workspace conditions with inconsistent heating and cooling restricts the occupant's ability to function to full capacity. Physical comfort is critical to work effectiveness. For goal effectiveness, it is essential to provide a built environment that complies with Standard Operating Procedures (SOP) for heating, ventilation and air circulation in all administrative buildings (AOP, 2006). For this goal, a set of strategies and considerations are provided below.

Strategy 1.0: Comply with American Society of Heating, Refrigerating and Air Conditions Engineers (ASHRAE) Standard 55-2004, Thermal Environmental Conditions for Human Occupancy and ASHRAE Standard 62.1-2007: Ventilation for Acceptable Indoor Air Quality Standards is met in all administrative buildings (UFC-61010-2002). To improve energy efficiency and to ensure compliance with SOP, all HVAC and VAV Systems and their emission factors shall be evaluated for all administrative buildings.

Consideration 1.1: It is recommended for Department of Public Works Utilities Division (UD) and Facilities Management Division (FMD) to identify administrative building HVAC systems and evaluate the relative HVAC system components and emission factors. This evaluation can provide information on the type of HVAC system, the usage/ dependency, and the efficiency rating (Anderson, E, 2011).

In order to ensure SOP compliance, HVAC system components that may need to be evaluated includes:

- Building Number
- Building description
- Operator/ Maintenance Code
- Model Number and Serial Number
- Installation Date

An evaluation of the emission factors can help FMD and UD to assess whether the HVAC systems are compliant with ASHRAE standards. For emission factors, these include:

- Range for improvement that can be achieved
- Temperature Class/ Tonnage Class (L-Low, M-Medium, O-Other)
- Circuit 1 and Circuit 2 Charge (lbs)
- System Type Configuration (C-Chiller, P-Packaged unit, S-Split System, R-Rack System)

- System Function (C-Commercial, I-Industrial, T-Tactical, AC-Comfort Cooling)
- Operational Usage and Output
- Energy Efficiency Rating

Strategy 2.0: Comply with all Standard Operating Procedures (SOP) for air circulation, ventilation and thermal regulating devices in all administrative buildings (AOP, 2006). To ensure compliance, an evaluation of the devices and their interior system components may need to be assessed by Shipping Handling Operating Procedures (SHOPS) and Utilities Division (UD) to determine efficiency at full operational capacity.

Consideration 2.1: Identify all existing devices and their system components to assess the condition, operational function and efficiency. Using this assessment, helps to assure whether there is a need to replace existing devices with VAV Upgrades, Temperature and Humidity Monitoring Systems, and CO2 sensors to assess the air quality of spaces to adjust ventilation (ECMR-6, 2011).

Consideration 2.2: Identify all existing thermostats and evaluate these devices, and replace where appropriate (EMCR-9, 2011). Before deciding a replacement, an interior building assessment may need to be conducted to assure a conditions and efficiency analysis is prepared.

For the interior building assessment, some components that shall be evaluated include, but is not limited to the following:

- Building Number
- Interior building description (i.e.: floor area ratio, electrical/ circuit board, control box/ mainframe, basic wiring and wall units, etc.)
- Operator/ Maintenance Code
- Model Number and Serial Number
- Installation Date/ Upgraded
- Range for improvement that can be achieved
- Operational Demand
- Energy Efficiency Rating

GOAL [2]
Create a high quality visual environment for administrative building occupants.

Physical comfort, design configuration, and accessibility to day lighting contribute to worker heath. Based on the results, a need to create a high quality visual environment for administrative building occupants was developed. This goal incorporates more lighting (day lighting and efficient lighting fixtures) in new and existing administrative buildings at NBVC. For this goal, a set of strategies and considerations are provided below.

Strategy 1.0: Incorporate day lighting in new and existing administrative buildings as appropriate and feasible.

Consideration 1.0: Incorporate day lighting fixtures (light-wells/ skylights, light shelves, and solar tubes) in all administrative buildings. Day lighting fixtures can improve energy efficiency, reduce GHGs, lower costs, and improves worker productivity, health, and satisfaction. A short description of each proposed day lighting fixture depicting the benefits and challenges is presented in order assist FMD in installing fixtures as appropriate and feasible.

- *Light-Wells/ Skylights (Figure 29) have some benefits and challenges (Table 13) to consider for choosing a day lighting fixture that is designed to capture light and distribute it to interior workspaces (NREL, 2010).*

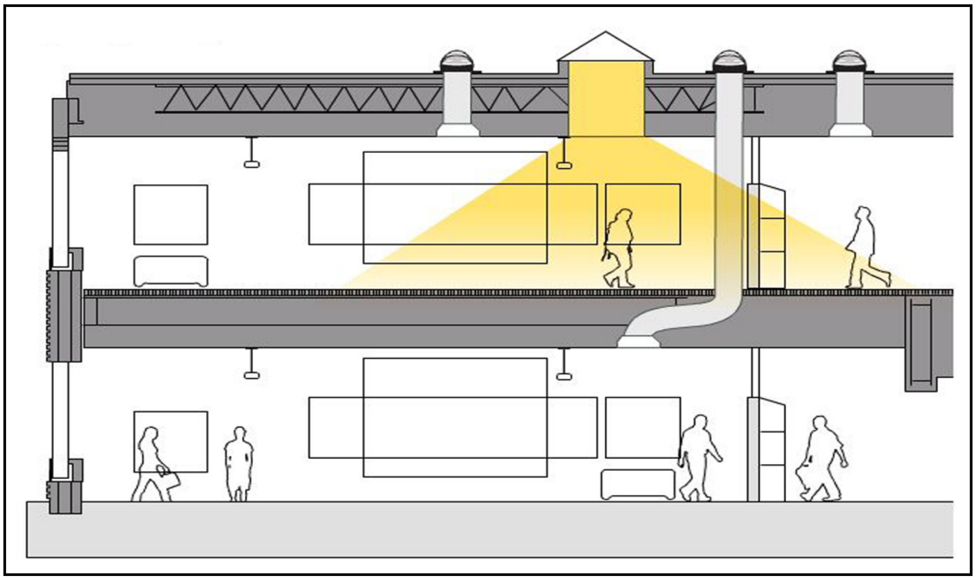

Figure 29
This shows the light distribution through the use of light-wells and skylights (better known as 'top lighting').
Source: NREL (2010) "Strategies for 50% Energy Savings in Large Office Buildings".

Table 13: Light-Wells/ Skylights	
Benefits	**Challenges**
Not dependent on Building orientation	Up to 10% of roof area
Daylight deeper into building	Expensive (Roof Real Estate)
	Difficult to install in existing buildings
	Transient light patterns
	Direct light level impacts (glare/ disruptive)
	Lack of control
	Complex architecture integration
	Maintenance and problems with leaks
	Direct heat gain
	Top floor limited

Designers can incorporate the use of light-wells/ skylights along corridors and hallways where space allocates for occupants, while avoiding excessive heat loss, heat gain, and glare or disruption of worker productivity.

• Light Shelves (Figure 30) also have benefits as challenges (Table 14) to consider for. Light bounces off the reflective surfaces of the shelf and subsequently off the ceiling and creates a more even luminance pattern than would occur without a shelf (Moore, 2006).

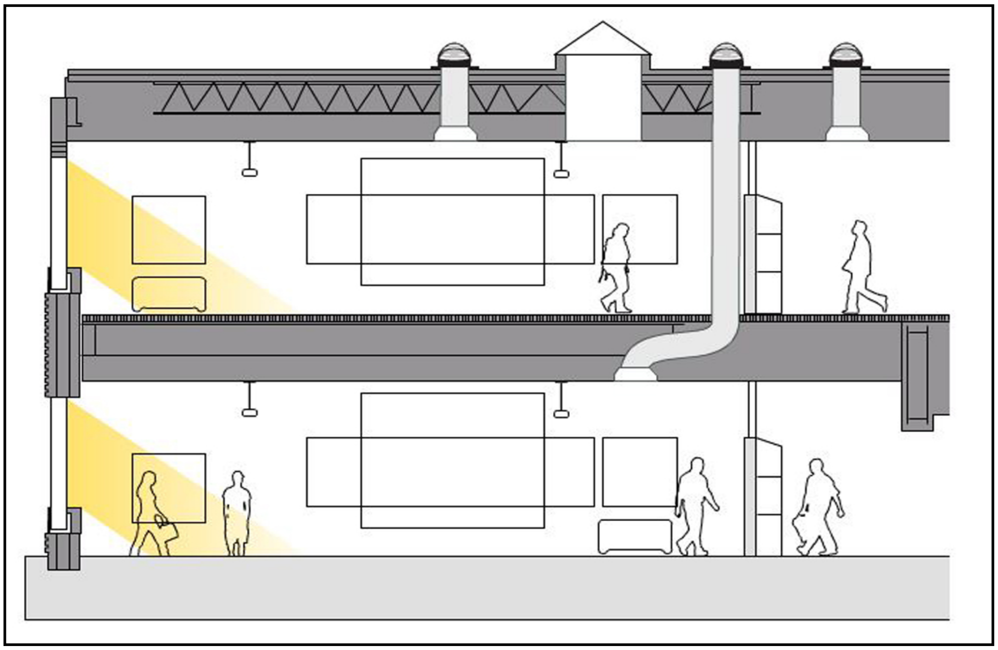

Figure 30
This shows the light distribution through the use of lightshelves and windows (better known as 'side lighting').
Source: NREL (2010) "Strategies for 50% Energy Savings in Large Office Buildings".

Table 14: Light Shelves/ Side Lighting	
Benefits	**Challenges**
Design Feature Panoramic view of surroundings	Orientation dependent Perimter limitation Direct heat gain Direct light level impacts (glare/ disruptive) Transient light patterns Sound control Easily obstructed Shading solutions Ceiling (floor-to-floor height) Finishes Maintenance

Designers can integrate light shelves where architecturally appropriate and feasible, such as along workspace cubicle rows, primary gathering rooms, and/or along hallways.

• Solar Tubes are a sealed system that refract, reflect and concentrate solar light into a small tube using mirrors and lenses (Figure 31). Solar tubes minimize heat gain and heat loss. There are a far greater number of benefits as there are challenges with solar tubes (Table 15).

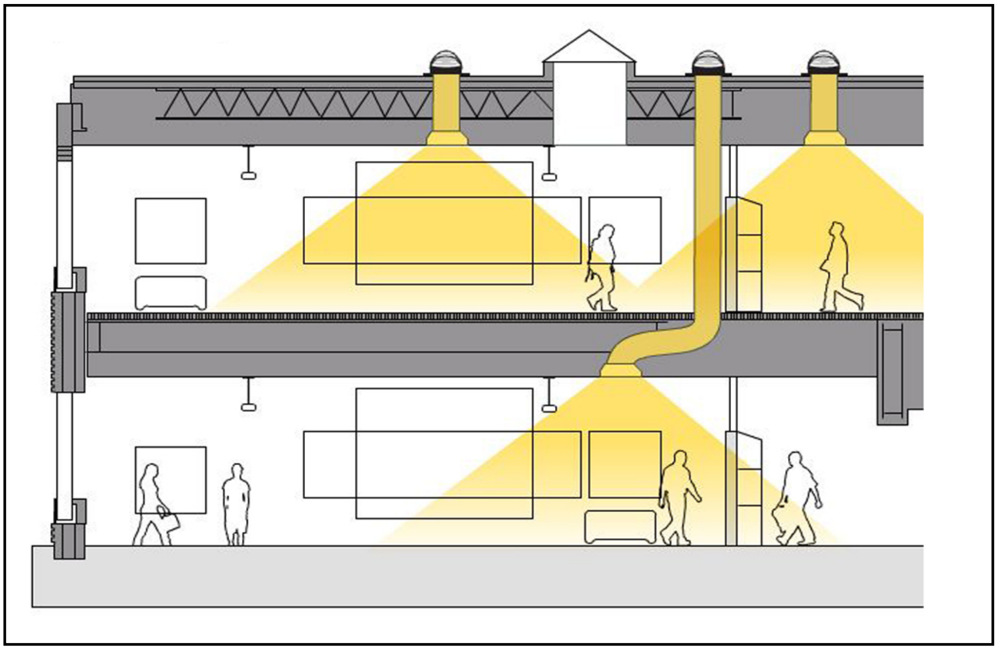

Figure 31
This shows the light distribution through the useof solar tubes.
Source: NREL (2010) “Strategies for 50% Energy Savings in Large Office Buildings”.

Table 15: Solar Tubes	
Benefits	**Challenges**
Highly consistent and controllable Daylight any space in nearly any climate Minimal roof structure impact (<2%) Comfortable thermal performance Flexible modular system for installments Sealed System (leak-proof) Cost-effective distributes light to multiple floors	Finishes and Visual blight Maintenance

Designers can incorporate solar tubes for partially darkened interior workspaces and stations, since this type of day lighting fixture does not obstruct a glare or disrupt worker productivity.

Strategy 2.0: Assure that adequate energy (electricity) is administrative buildings is not wasted. This strategy focuses on considerations on energy-efficient lighting types and controls; from a general lighting fixture to the specific screw-base type of lighting installation.

Consideration 2.1: Use only energy efficient lamp technologies wherever possible such as metal halide, induction lamps, high-pressure sodium, and linear and compact fluorescent sources. This can be achieved by:

• Replacing the high-bay HID fixtures with industrial fluorescent fixtures on a one-for-one basis using T5HO lamps (ECM-2: HID Upgrades, ECMR, 2011).

• Replacing the recessed cans that currently have 65-w R30 lamps with a 10-watt (or less) LED retrofit modules, such as Cree LR-6; replace the PAR-38 incandescent flood lamps with 12-watt (or less) LED PAR-38 floods, such as the Cree LRP-38 (ECM-3: Incandescent Upgrades, ECMR, 2011).

• Install wall-box dual technology sensors (PIR + ultrasonic) to minimize false operations that waste energy; can achieve a conservative estimate of 35% savings for wall-box sensors (ECMR-4: Install Lighting Controls, ECMR, 2011).

• Install vacancy sensors to minimize the time individual spaces are on in administrative building interiors (Vacancy sensors operate like occupancy sensors to turn lights off, but require manual operation to turn lights on) as suggested from Title 24 Part 11 Green Building Standards (California Energy Commission, 2012).

Strategy 3.0: Integrate energy effective design solutions where interior administrative building conditions are deficient and/ or are in poor condition.

Consideration 3.1: For existing administrative buildings, this can be achieved by choosing some energy efficient office design provisions as suggested from New Buildings Institute (2006) these include:

- Use light reflective surfaces to maximize brightness perception while minimizing glare and energy use.
- Use occupancy sensors or scheduled sweep controls to ensure that lighting is not energized when needed.
- Provide manual bi-level switching capability at a minimum in all areas (this is a requisite criterion to qualify for the EPAct tax deductions).
- Use automatic daylight harvesting controls that either switch some lighting off or continuously dim when daylight becomes available.
- Consider using low ballast factor ballasts for fine light level adjustment.

GOAL [2]
Ensure all administrative workspaces meet the required Unified Facilities Criteria (UFC) Standards for administrative office uses as assigned for UFC 6.1010-2002 building class.

The UFC system applies standards for each building use at NBVC (6.1010-2002). Based on the worker survey results, there is a desire for more storage, flexibility, and accessibility of use for their workspaces. This goal is to direct attention for FMD to assure all administrative workspaces comply with UFC Standards. For this goal, a set of strategies and considerations are provided below.

Strategy 1.0: Conduct a Basic Facility Requirement (BFR) for delineating proper configuration and utilization of workspace. This strategy seeks to ensure all administrative workspaces and stations are properly designated under the required UFC 6.1010-2002, Administrative Office Space Standards.

Consideration 1.1: For new administrative buildings:

- Design all interior workspaces that comply with all UFC 6.1010-2002, Administrative Office Space Standards
- Design all interior workspaces to comply with Americans with Disability Act (ADA) Standards for access ways/ entryways
- Configure all workspaces and stations according to GS-ranking, title, and/or branch of service

Consideration 1.2: For existing administrative buildings:

- Conduct an Asset Evaluation for all interior workspaces and conditions to delineate space utilization, storage units/ areas, and human occupancy ratio
- Conduct an engineering survey for proper delineation of the administrative buildings floor space envelop
- Re-configure administrative workspace conditions as required for UFC 6.1010-2002 standards
- Re-configure all administrative office workspaces to comply with AT/FP Standoff Standards
- For limited storage areas (consolidate archives to minimize file units and to conserve space for future use)

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5.0 IMPLEMENTATION

Overview & Next Steps for NBVC

5.1 Overview

The EEP applies national guidance to NBVC and prepares base-specific measures that improve energy efficiency, reduce GHGs, and improve worker health for administrative building occupants. Part of fulfilling the goals and strategies in the EEP are to further implementation of existing Facilities Management Division (FMD) Standard Operating Procedure (SOP) and to adopt some of the proposed considerations where appropriate and feasible. This can be achieved by reinforcing conventional methods, as well as choosing pragmatic solutions; the following section provides a discussion on this combined approach.

5.2 Discussion

FMD can engage with their tenants (facility managers and occupants) using a variety of outreach activities that inform the Deputy Public Works Officer (DPWO) of the poor worker health and structural conditions of the buildings affected by the EEP. These activities could augment NAVFAC-SW Chief Naval Operations (CNO) knowledge about existing policy, current conditions and surveyed results. Furthermore, this could help Department of Navy decide whether to implement parts of the EEP that could apply for other building classes of relevance and as appropriate. The next section discusses some outreach activities that could educate and empower potential tenants and branches of government for adopting parts (if not all; where appropriate, feasible and relevant) of the EEP.

With this Energy Efficiency Program (EEP) available to the Department of Navy, FMD and PWD (Division Managers, Branch Heads, and occupants) need understand how the EEP for administrative buildings work and what their benefits are. Lack of communication, information, dissemination, and consumer awareness can prevent potential tenants (i.e.: military and branches of government) from taking advantage of the EEP and its proposed measures for NBVC. Therefore, tenants must understand perceptions about improving energy efficiency, reducing greenhouse gases, and improving worker health to overcome any negative ideas or views. Tenants also need to determine the price or value equation that will have the most appeal (due to limited access to resources and timing at NBVC, the EEP does not provide any cost estimates, price, or “pay-back-cycle”); however, this should not limit the EEP goals and strategies from being implemented into the Chief Naval Operations SOP.

Community activities such as tours, energy efficiency fairs, and other events can reach different audiences and increase potential customers’ knowledge and confidence in solar energy as an option for their own properties (Solar Powering Your Community, 2011). Mediate campaigns, workshops (i.e.: workspace conditions and perceptions survey), educational displays (i.e.: LEED tutorials, Green Building Review), events (i.e.: Ventura County Regional Energy Alliance), and highly visibly demonstration projects (i.e.: PH850 certified LEED Gold in 2005) are a few examples of outreach activities that could be implemented at NBVC to help educate the tenants about energy improvement programs.

Demonstration projects are important because they increase local awareness of green building and energy efficient applications. Seeing green building practices and energy efficient technologies operating firsthand enables citizens to better understand the technology or practice.

Demonstration projects can include small or large installations of any type of energy efficient technology or practice. To better understand some of the lighting improvements in the EEP, some facilities (i.e.: PH850 and PH1000) have installed efficient lighting types.

To see and experience the different workspace conditions for administrative building occupants, tenants can visit one building that has been replaced with energy efficient lighting and then visit one that has not to compare. Tenants can then differentiate the quality of the visual environment and worker productivity between the two building visits.

The next section provides the next steps for FMD and other tenants to choose from, in order to fulfill the basis for the goals and strategies provided.

5.3 Next Steps

The next steps for NBVC to choose from in pursuit of achieving the goals and strategies in the EEP, presents three concepts. The first concept calls FMD to conduct an Asset Evaluation (AE) during the site visit and to meet with the building managers of each building and assess whether the building is in need of a program control device that could reduce electricity.

This program control device can vary from remote controls, movement sensors for lighting in underutilized office areas, bathrooms or conference rooms. If the building is in need of a program, the EEP suggests integrating smart-design strategies and green building practices that could reduce dependence on electricity. Additionally, smart-design strategies could also enhance lighting; improve interior heating, cooling and ventilation systems in the administrative buildings.

The second concept calls PWD to initiate a Building Emissions Evaluation Requirement for the Project Review Board (PRB). Since 2009, almost all administrative buildings and other building classes have been installed with individual energy meters; however, there is no requirement for building systems on the PRB Checklist that assesses GHGs or these energy loads. In order to achieve a GHG reduction in administrative buildings and other building classes, a building emissions evaluation component should be required.

The third concept calls for consolidation or retrofit of administrative buildings, where AE Worksheets indicate the building is in poor structural configuration and physical condition. This concept calls attention to FMD to retrofit facilities to reduce electricity for artificial lighting, heating, and cooling. A proposed retrofit or consolidation of poorly configured buildings would be applicable if approved and if there is military construction funding for this type of program. This concept also calls attention to Energy Utilities Management (EUM), Environmental Branch Division, and building managers. All tenants should decide collaboratively on whether to improve the administrative buildings workspace conditions.

After reaching an agreement, the first approach would be to determine whether a minor/ major facility retrofit would be need based on the last Asset Evaluation (AE).

Second would be to review the annual electricity from the building through benchmarking, to assess if the usage is increasing or decreasing. With this second approach, there are other variables that need to be addressed, such as: the number of occupants in the building, the hours of operation, the types of electrical equipment, and if there are any periods of vacancy (no user activity).

Third would be to distribute a workspace conditions survey (once a month) to building occupants. This survey can be streamlined during a scheduled energy audit, via NAVFAC-SW Portal, or other webinar outreach sources.

5.4 Conclusion

The underline focus for the EEP is to reduce electricity in administrative buildings; to shift away from the dependence on artificial lighting and ventilation and move toward the integration of green practices for these buildings at NBVC. From this underline focus, EEP builds on a national mandate, physical settings and building conditions, and worker health and productivity survey results. EEP develops base specific measures that serve to provide comfortable and productive built environments, to create a high quality visual environment, and to ensure all workspaces meet existing UFC 61010 Standards for administrative building occupants. Furthermore, the EEP prepares a model program that can be applied to other building classes and uses at NBVC; thus, providing a pragmatic solution for NBVC to choose in pursuit of achieving a sustainable future.

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FY 2010-2011 Energy (electricity) Usages & GHG Emissions Factors

Constants	
MWh/yr (MBTU)	3.41
CO2 (lbs/MWh)	641.26
CH4 (lbs/MWh)	0.029
N20 (lb/MWh)	0.011
CH4 (lbs CO2e/lbs CH4)	21
N2O (lbs CO2e/lbs N2O)	310
lbs/metric ton (lbs/MT)	2204.62

TABLE 1 (Olive/ Tan Colored Stucco Texture Facade)

CCN Facilities	Area (sq.ft)	MWh/yr	CO2 (lbs/yr)	CH4 (lbs/yr)	N2O (lbs/yr)	CO2 (lbs CO2e/yr)	CH4 (lbs CO2e/yr)	N2O (lbs CO2e/yr)	partial GHG (lbs CO2e/yr)	partial GHG (MTCO2e/yr)	CCN Rating
PH 444	23,771	183	117350.6	5.31	2.01	117350.58	111.45	624.03	118,086.06	53.56	Substandard
PH 445	36,511	211	135305.9	6.12	2.32	135305.86	128.50	719.51	136,153.87	61.76	Substandard
PH 1000	68,300	1,027	658574	29.78	11.30	658574.02	625.44	3,502.07	662,701.53	300.60	Adequate
PH 225	23,968	79	50659.54	2.29	0.87	50659.54	48.11	269.39	50,977.04	23.12	Adequate
PH 1430	3,120	16	10260.16	0.46	0.18	10260.16	9.74	54.56	10,324.46	4.68	Adequate
SNI 152	2,810	48	30780.48	1.39	0.53	30780.48	29.23	163.68	30,973.39	14.05	Substandard
SNI 163	440	9	5771.34	0.26	0.10	5771.34	5.48	30.69	5,807.51	2.63	Adequate
PM 1	24,825	193	123763.2	5.60	2.12	123763.18	117.54	658.13	124,538.85	56.49	Adequate
PM 27	2,966	24	15390.24	0.70	0.26	15390.24	14.62	81.84	15,486.70	7.02	Substandard
PM 613	5,062	29	18596.54	0.84	0.32	18596.54	17.66	98.89	18,713.09	8.49	Adequate
PM 632	12,647	62	39758.12	1.80	0.68	39758.12	37.76	211.42	40,007.30	18.15	Adequate

TABLE 2 (Grey Colored Concrete Texture Facade)

CCN Facilities	Area (sq.ft)	MWh/yr	CO2 (lbs/yr)	CH4 (lbs/yr)	N2O (lbs/yr)	CO2 (lbs CO2e/yr)	CH4 (lbs CO2e/yr)	N2O (lbs CO2e/yr)	partial GHG (lbs CO2e/yr)	partial GHG (MTCO2e/yr)	CCN Rating
PH 814	4,040	25	16031.5	0.73	0.28	16031.5	15.23	85.25	16,131.98	7.32	Substandard
PH 830	16,920	38	24367.88	1.10	0.42	24367.88	23.14	129.58	24,520.60	11.12	Adequate
PH 1320	960	4	2565.04	0.12	0.04	2565.04	2.44	13.64	2,581.12	1.17	Inadequate
SNI 41	200	7	4488.82	0.20	0.08	4488.82	4.26	23.87	4,516.95	2.05	Substandard
PM 50	80,897	2,220	1423597	64.38	24.42	1423597.2	1,351.98	7,570.20	1,432,519.38	649.78	Substandard
PM 66	12,435	192	123121.9	5.57	2.11	123121.92	116.93	654.72	123,893.57	56.20	Adequate
PM 116	8,542	29	18596.54	0.84	0.32	18596.54	17.66	98.89	18,713.09	8.49	Adequate
PM 345	640	151	96830.26	4.38	1.66	96830.26	91.96	514.91	97,437.13	44.20	Substandard
PM 371	2,400	3	1923.78	0.09	0.03	1923.78	1.83	10.23	1,935.84	0.88	Adequate

TABLE 3 (Wood/ Vinyl Panel-like Facade)

CCN Facilities	Area (sq.ft)	MWh/yr	CO2 (lbs/yr)	CH4 (lbs/yr)	N2O (lbs/yr)	CO2 (lbs CO2e/yr)	CH4 (lbs CO2e/yr)	N2O (lbs CO2e/yr)	partial GHG (lbs CO2e/yr)	partial GHG (MTCO2e/yr)	CCN Rating
PH 44	22,602	156	100036.6	4.52	1.72	100036.56	95.00	531.96	100,663.52	45.66	Substandard
PH 1214	10,248	61	39116.86	1.77	0.67	39116.86	37.15	208.01	39,362.02	17.85	Inadequate
PH 1215	10,240	61	39116.86	1.77	0.67	39116.86	37.15	208.01	39,362.02	17.85	Inadequate
PH 447	5,573	7	4488.82	0.20	0.08	4488.82	4.26	23.87	4,516.95	2.05	Substandard
PH 543	4,069	53	33986.78	1.54	0.58	33986.78	32.28	180.73	34,199.79	15.51	Substandard
PH 1236	4,320	45	28856.7	1.31	0.50	28856.7	27.41	153.45	29,037.56	13.17	Substandard
PM 162	1,725	2	1282.52	0.06	0.02	1282.52	1.22	6.82	1,290.56	0.59	Adequate

TABLE 4 (Sandstone Colored/ Grey Colored Cinder-Block Facade)

CCN Facilities	Area (sq.ft)	MWh/yr	CO2 (lbs/yr)	CH4 (lbs/yr)	N2O (lbs/yr)	CO2 (lbs CO2e/yr)	CH4 (lbs CO2e/yr)	N2O (lbs CO2e/yr)	partial GHG (lbs CO2e/yr)	partial GHG (MTCO2e/yr)	CCN Rating
PH 1169	40,984	324	207768.2	9.40	3.56	207768.24	197.32	1,104.84	209,070.40	94.83	Adequate
PH 1300	11,368	156	100036.6	4.52	1.72	100036.56	95.00	531.96	100,663.52	45.66	Adequate
PH 1436	27,863	192	123121.9	5.57	2.11	123121.92	116.93	654.72	123,893.57	56.20	Adequate
PH 1437	17,234	169	108372.9	4.90	1.86	108372.94	102.92	576.29	109,052.15	49.47	Adequate
PH 103	18,477	7	4488.82	0.20	0.08	4488.82	4.26	23.87	4,516.95	2.05	Inadequate
PH 373	11,900	115	73744.9	3.34	1.27	73744.9	70.04	392.15	74,207.09	33.66	Adequate

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