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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

USE OF ENERGY-EFFICIENT TECHNOLOGIES: U.S. MARINE CORPS' PERCEPTIONS TO ADOPTION

By: Vinh N. Nguyen
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        December 2013

Advisors: Kathryn Aten,
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U.S. MARINE CORPS' PERCEPTIONS TO ADOPTION**

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U.S. MARINE CORPS' PERCEPTIONS TO ADOPTION

ABSTRACT

Identifying effective methods for influencing Marines to accept energy-efficient technologies is vital to achieving a positive and sustainable energy outlook for the United States Marine Corps (USMC). The purpose of this study is to support the adoption of energy-efficient technologies by the USMC to increase Marine combat effectiveness. Toward this end, Marines' concerns, awareness, and enthusiasm regarding energy-efficient technologies were explored, as well as the influencers on these factors. This study and final recommendations are based on an analysis of focus group data from two focus groups held at the Naval Postgraduate School and two at Camp Pendleton. This analysis revealed key influence drivers and suggested potential influence strategies that the Marine Corps Expeditionary Energy Office can implement to help foster its initiatives.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAR   After Action Report

CG   Commanding General
CoC   Chain of Command
COP   Combat Out-Post

DoD   Department of Defense
DOI   Diffusion of Innovations
DoN   Department of the Navy

E2O   Expeditionary Energy Office

GREENS   Ground Renewable Expeditionary Energy Network System

HazMat   Hazardous Materials

IMEF   First Marine Expeditionary Forces
IRB   Internal Review Board

LBV   Load Bearing Vests

MOS   Military Occupational Specialty

NPS   Naval Postgraduate School

PFT   Physical Fitness Tests
PME   Professional Military Education

RDT&E   Research Development Test & Evaluation

SOCOM   Special Operations Command
SPACES   Solar Portable Alterative Communications Energy System

TAM   Technology Acceptance Model
TRA   Theory of Reasoned Action

USMC   United States Marine Corps

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I. INTRODUCTION

Monetary issues and loss of life are key concerns driving an effort by the United States Marine Corps (USMC) to decrease energy use. A study conducted by the United States Army in 2007 examined the link between casualties and energy and found that one out of every 24 fuel convoys in Afghanistan, and one out of every 38 in Iraq, led to a military fatality (Humes, 2011). In 2011, Edward Humes (2011) noted that "the Department of Defense uses more petroleum (and energy) than any other organization on the planet—$13 billion to $18 billion worth a year, depending who does the math. That accounts for more than 80% of the federal government's energy tab" (p. 1). As a result, the U.S. military, including the Marine Corps, is seeking to increase energy efficiency and embrace alternative energy. General James F. Amos, the commandant of the Marine Corps, stated, "Transforming the way we use energy is essential to rebalance our Corps and prepare it for the future" (Marine Corps Expeditionary Energy Office, n.d., para. 1). To prepare for this transformation, the Marine Corps created the Expeditionary Energy Office (E2O) to combat these concerns. The E2O seeks to change the way the Marine Corps employs energy and resources to increase combat effectiveness.

The E2O's mission is to "analyze, develop, and direct the Marine Corps' energy strategy in order to optimize expeditionary capabilities across all War fighting functions" (Marine Corps Expeditionary Energy Office Headquarters, 2011, p. 5). The E2O was directed to "develop a plan to decrease the Marine Corps' dependence on fossil fuel in a deployed environment" (p. 5). The E2O has determined that energy is a critical combat enabler and growing vulnerability. The adoption and employment of energy-efficient technologies within an expeditionary environment will facilitate a lighter and faster force whose self-reliance will foster combat effectiveness (Marine Corps Expeditionary Energy Office Headquarters, 2011).

The development and use of energy-efficient technologies by the E2O is a key part of making the USMC more effective and efficient and can potentially reduce the number of casualties. To date, the USMC has created the E2O and published the *USMC Expeditionary Energy Strategy and Implementation Plan* with the goal of increasing

combat effectiveness through greater energy efficiency and the use of energy-efficient technologies. Technologies developed by the E2O, such as the Ground Renewable Expeditionary Energy Network System (GREENS), and the Solar Portable Alterative Communications Energy System (SPACES), have the potential to decrease dependency on fossil fuels by using sustainable sources of energy, such as harnessing the power of the sun and wind to generate energy. However, these technologies can provide benefits only if widely adopted and used, which will likely require increased awareness and a change in ethos (Marine Corps Expeditionary Energy Office Headquarters, 2011).

E2O strategy statements acknowledge this concern.

Achieving success will require no less than institutional change. … Finally, and most critically, we must change the way we think about energy—our warrior ethos must equate the efficient use of energy and water resources with increased combat effectiveness. (Marine Corps Expeditionary Energy Office Headquarters, 2011, p. 17)

An MBA study currently in progress finds that Marines are largely unaware of E2O technologies (Ciarcia, 2013), which suggests both a challenge and an opportunity. A persistent lack of awareness would likely slow the adoption of energy-efficient technologies. However, because Marines have not yet formed opinions about energy-efficient technology, the E2O has the opportunity to influence Marines' perceptions and adoption decisions positively.

The academic literature suggests opinion makers, communications methods, perceptions of both the problem and the solution, and individual characteristics, influence the adoption of new technologies. Therefore, to help the E2O, it is necessary to know the answers to the following questions.

- Who and what are key opinion makers?
- Through which communication channels is information about technologies communicated?
- What are Marines' perceptions of energy-efficient technologies? (to include perceptions of the problem the technology may solve and of the solution the technology may provide)
    - How do a Marine's individual characteristics influence the adoption decision?

The primary purpose of this study is to analyze the adoption of new energy-efficient technologies by the USMC intended to increase Marine combat effectiveness. Toward that end, focus group data are collected and analyzed. Marines' perceptions and attitudes regarding energy-efficient technologies are first identified. Second, key influence drivers of these perceptions and attitudes are also identified and recommendations made to support the adoption of energy-efficient technologies by Marines.

A. PURPOSE/RESEARCH QUESTIONS

The purpose of this study is to support the adoption of energy-efficient technologies by the USMC to increase Marine combat effectiveness. Toward this end, Marines' concerns, awareness, and enthusiasm regarding energy-efficient technologies were explored, as well as the influencers on these factors. This study and final recommendations are based on an analysis of focus group data from two focus groups held at the Naval Postgraduate School and two at Camp Pendleton. This analysis revealed key influence drivers and suggested potential influence strategies.

The following are the primary and secondary research questions.

- Primary question
  - What are the drivers that lead Marines to accept and adopt energy-efficient technologies?
- Secondary questions
  - Who are the opinion makers who influence Marines opinions regarding new tools/technologies?
  - What communication channels have influenced Marines' perceptions of new tools/technologies in the past?
  - What are Marines' perceptions of energy-efficient tools/technologies?
  - How do Marines perceive the problems posed by dependence on fossil fuels?
  - How do these drivers differentially influence different types of decision makers (end use, squad leader, platoon leader, company commander)?

B.   RESEARCH APPROACH

Why individuals adopt or resist technologies is a central question in technology management and energy conservation research (Arkesteijn & Oerlemans, 2005; Darley & Beniger, 1981; Kleijnen, Lee, & Wetzels, 2009; Rogers, 1995). The media, communication patterns, and peer influence have been shown to influence people in organizations (Watkins, 2003). This study was designed to explore Marines' attitudes and perceptions of energy-efficient technology and to identify key influencers of these attitudes and perceptions. A focus group methodology was selected because it provides the opportunity to watch opinion formulation in action (Barber, 2007). This method is particularly useful when participants are unaware of the topics. Barber (2007) stated that focus groups "emphasize the significance of a comparative focus with the ultimate aim of enhancing analytical sophistication" (p. 145).

A theoretical framework was developed that guided the data collection and analysis. The framework focuses attention on five key drivers of the acceptance of technologies. *Acceptance* is defined as the decision to adopt or support the technology. These drivers are opinion makers, communication method, individual perceptions of the problem, individual perception of the solution, and characteristics of the decision maker. This framework draws largely from Watkins' (2003) model for organizational influence campaigns. Watkins' model to focus on individual, rather than organizational, factors and technology adoption were adapted. The researchers drew from Rogers' (1995) ideas on the role of communication channels in the diffusion of technology, research on the role of individual perception in technology adoption, (Arkesteijn & Oerlemans, 2005; Kleijnen et al., 2009), and research on the role of characteristics of the end user in technology adoption and diffusion (Arkesteijn & Oerlemans, 2005; Rogers, 1995). Based on this research, Watkins' model was adapted to develop the guiding theoretical framework for this study, depicted in Figure 1.

Influence Campaigns
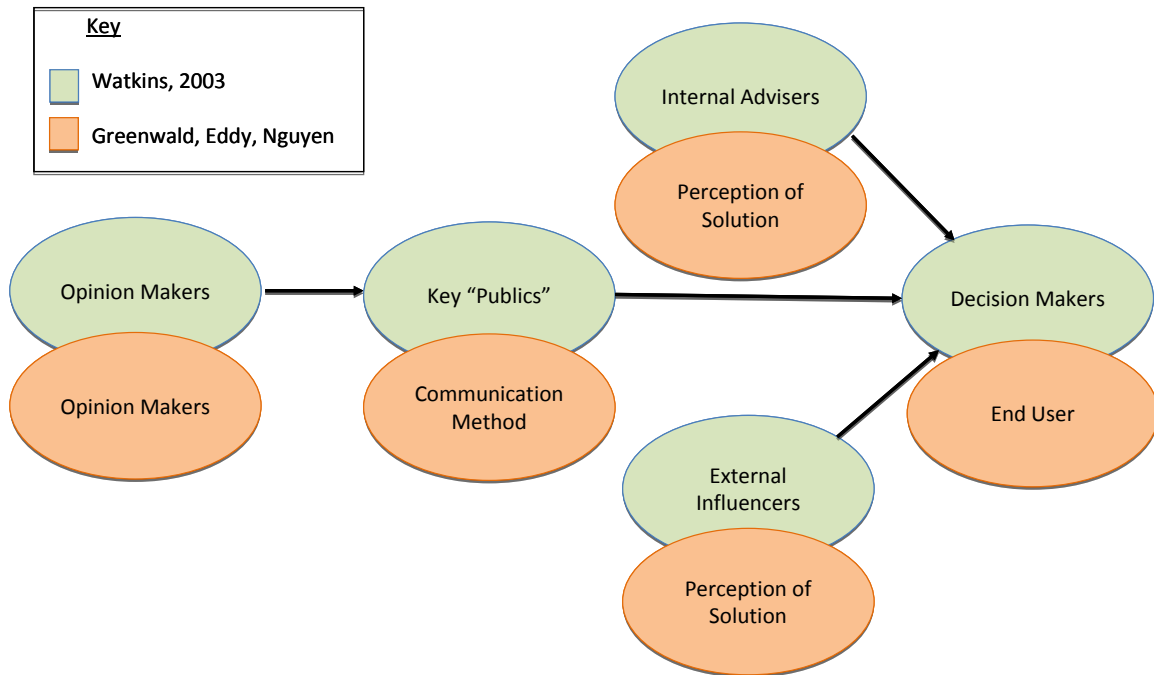
Figure 1.   Influence Campaigns (from Watkins, 2003)

A very broad understanding of Watkins' concept of opinion makers was adopted. Watkins (2003) defined opinion makers as those who "provide data and analysis that shape the opinion [of the decision makers]" (p. 11). The researchers sought to identify key influences, including but not limited to people, on Marines' enthusiasm for or resistance to energy-efficient technologies.

Communication method is defined as the way in which information flows to the end user of a technology. Rogers (1995) argued that communication channels create knowledge, spread information, and are important to adoption decisions because that knowledge and creation affect the end user's decision. Many methods of communication are now available to organizations. The researchers sought to identify which communication methods are most likely to link opinion makers to Marines' perceptions and acceptance of energy-efficient technologies.

The academic literature (Arkesteijn & Oerlemans, 2005; Kleijnen et al., 2009) suggests that perception is a key driver of technology acceptance. Perception of the

problem is defined as individuals' perceptions of the magnitude and severity of the problem a given technology might address (Kaplan & Tripsas, 2008). In the case of the USMC and energy-efficient technologies, interest is focused upon to what degree and why Marines view dependency on fossil fuels as problematic. Similarly, drawing from Kaplan and Tripsas (2008), perception of the solution is defined as Marines' understanding of how and to what extent a particular technology will address a particular problem.

Finally, many studies suggest that individual characteristics are likely to influence the acceptance of technologies (Arkesteijn & Oerlemans, 2005; Rogers, 1995). Functional expertise (Kaplan & Tripsas, 2008; Orlikowski & Gash, 1994) and level in an organization (Kaplan & Tripsas, 2008) have been shown to influence the acceptance of technologies. Military Occupational Specialty (MOS) and rank are focused upon in particular.

C.   ORGANIZATION OF STUDY

Chapter II presents a review of the literature on the academic topics used to compose the theoretical framework that guides this research. Chapter III explains the methods used for this study. Chapter IV details this study's analysis and findings. Chapter V discusses pertinent discoveries and implications, and gives recommendations to address those discoveries. Chapter VI offers final thoughts on the research and recommendations for the best communication methods and opinion makers to use for the successful adoption of energy-efficient technologies.

II.   LITERATURE REVIEW

A.   INTRODUCTION

This chapter identifies and describes the theories and concepts, which developed the framework that guided this study. Studies of influence and communication with research on technology adoption were integrated to develop the framework and guide the exploration of the following questions.

- Who are the opinion makers influencing Marines' opinions regarding new tools/technologies?

- What communication channels have influenced Marines' perceptions of new tools/technologies in the past?

- What are Marines' perceptions of energy-efficient tools/technologies?

- How do Marines perceive the problems posed by dependence on fossil fuels?

- How do these drivers differentially influence different types of decision makers (end user, squad leader, platoon leader, company commander)?

Research on technology adoption and diffusion seeks to explain why individuals accept and use technologies, and how technologies and innovations diffuse across populations. Various researchers draw on planned behavioral theories to answer these questions. This study focuses on three key theories: Diffusion of Innovation (DoI) (Rogers, 1995), Technology Acceptance Model (TAM) (Davis, 1989), and Technology Resistance (Kleijnen, Lee, & Wetzels, 2009).

B.   ROGERS' DIFFUSION OF INNOVATIONS (DOI) MODEL

Rogers' (1995) DoI model identified the significant elements in technological change. This model illustrates how rates of adoption are influenced by key factors within an innovation-decision process occurring over communication channels. His DoI model primarily considers influences, ideas, behaviors, and communication within a social context, but does not provide enough focus on individual adoption. Ellsworth (2000) described innovation attributes as the most critical benefits of Rogers' DoI model writing, "Practitioners are likely to find this perspective of the greatest use if they are engaged in the actual development of the innovation or if they are deciding whether (or how) to

adapt the innovation to meet local requirements…Rogers' framework can be useful in determining how it [the innovation] is to be presented to its intended adopters" (p. 40).

The DoI model identifies and explains factors that influence the decision process of whether to adopt or reject an innovation. Developed by Everett Rogers in 1962, the DoI model illustrates how innovations diffuse through populations or social networks. An innovation is defined as an idea, practice, technology, or perceived as new. Rogers studied diffusion from a communication framework by analyzing how communication processes in social networks influence the rate of innovation adoption. The DoI model presents a five-stage innovation-decision process, including characteristics of individuals, opinion makers, social norms, and ideas and behaviors that influence decisions at each stage, and ultimately impact, the adoption or rejection of an innovation. Rogers' model is depicted in Figure 2 and explained below.

Rogers (1995) defines diffusion as a process by which an innovation is communicated through certain channels over time among the members of a social system or network. According to Rogers (1995): (1) potential adopters can be individuals, groups, or organizations at different levels of any social system; 2) the target of diffusion is innovation; 3) the process through which diffusion occurs is communication; 4) the means is communication channels; 5) the context of innovation is a social system; and 6) diffusion occurs through change over time.
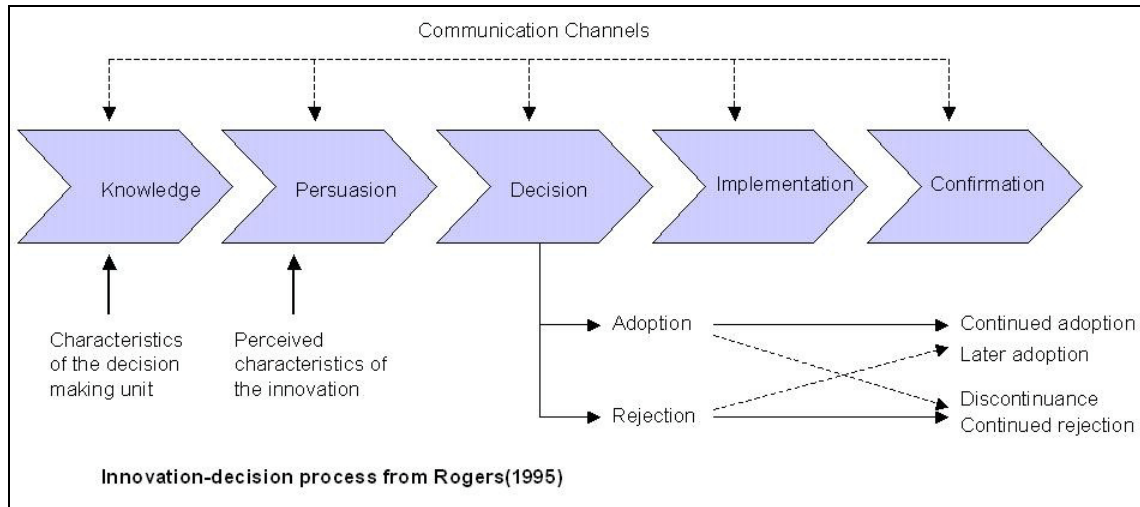
Figure 2.   Innovation-decision process (from Rogers, 1995)

1.   Innovation-decision Process

The innovation decision-making process, comprised of five identifiable stages, moves from a change in knowledge to a change in behavior. The five identifiable stages include knowledge, persuasion, decision, implementation, and confirmation. Knowledge occurs when a potential adopter is exposed to the innovation's existence and gains awareness on how it works. Persuasion arises when a potential adopter forms an attitude, either positive or negative, toward the innovation. Decision arises when a potential adopter engages in activities, which determine whether to adopt or reject the innovation. Implementation occurs when a potential adopter uses an innovation. Confirmation occurs when potential adopters seeks reinforcement of the decision to use the innovation or, because of conflict, reverse their previous decision. Darley and Beniger (1981) argue confirmation of an adoption decision can be done through social networks.

2.   Opinion Makers (Rate of Adoption)

Rogers identified five factors that influence the rate of adoption that include the nature of the social system or network, communication channels, perceived attributes of innovation, the type of innovation-decision, and the extent of a change agent's promotion efforts. The first factor that influences the rate of adoption is the nature of the social network. A social network is defined as a set of interrelated units (such as the non-

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commissioned officers of a platoon, the tenured professors of a college, or all the members of a political party) engaged in joint problem solving to accomplish a common goal. The social framework, patterned arrangements of the units in a system, affects the way diffusion occurs within a social network. A social network encompasses system norms, roles of opinion makers and change agents, types of innovation decisions, and the consequences of innovation. System or network norms are established behavior patterns for the members of a social network. Roles of opinion makers and change agents affect the degree to which an individual is able to influence other individuals' attitudes informally in a desired way. Types of innovation-decisions, as described in greater detail below, include optional innovation-decision, collective innovation-decision, and authority innovation-decision. The consequence of innovation accounts for desirable versus undesirable (whether the effects of the innovation become functional or dysfunctional within the social system), direct versus indirect (if changes to the social system are immediate or the result of a second order effect to a different innovation), and anticipated versus unanticipated (changes were recognized and intended versus unintended).

3.   Communication Methods (Channels)

Communication channels are the second factor that influences the rate of adoption. Communication is "the process by which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 1995, p 17). Messages flow from one individual to another through communication channels. Two types of communication channels are mass media and interpersonal (Rogers, 1995). Mass media channels include mediums, such as the Internet, television, and radio, which expedite the action of a few individuals to reach a wider audience. Mass media facilitates reaching big audiences rapidly to create knowledge, spread information, and lead to changes in weak attitudes. Interpersonal channels involve face-to-face exchanges between two or more people, which enable individuals to seek clarity and to create environments to form or change strongly held attitudes. Subsequently, interpersonal channels are more important at the persuasion stage of the innovation decision process

where mass media channels are more essential at the knowledge stage of the innovation-decision process. Diffusion, therefore, is a specific type of communication, which occurs to exchange a new idea with one or several others (Rogers, 1983).

Another factor that influences the rate of adoption is the extent of the change agent's promotion efforts (Rogers, 1995; Darley & Beniger, 1981). Change agents are people who introduce innovations into a society (workplace) that they expect will have desirable, direct, and anticipated consequences. Change agents achieve results through facilitating groups of people through a systematic process to develop, organize, and to sell new ideas (Ellsworth, 2000). They are the invisible hands that turn vision into action. To be successful, change agents require the knowledge, skills, and tools to implement change in the workplace or society. Rogers' DoI model provides guidelines for change agents concerning what attributes can be incorporated into the innovation to facilitate acceptance by the intended adopter.

C.   TECHNOLOGY ADOPTION

The technology acceptance model (TAM) recognizes and explains the components that influence information technology acceptance to predict the acceptance and use of information technology and information systems by individuals. Developed by Fred Davis in 1989, the TAM is considered one of the most influential research models on technology acceptance and has received prominent attention by researchers over the past years (Chen, Li, & Li, 2011). The unique feature of the TAM is how it provides the foundation for tracing the impact of the external factors on internal beliefs, attitudes, and intentions. The TAM achieved this end by identifying a handful of basic variables suggested by previous research dealing with cognitive (awareness and understanding) and affective (attitude and perception) factors of computer acceptance using Theory of Reasoned Action (TRA) for modeling the theoretical relationships among these variables (Davis, Bagozzi, & Warshaw, 1989). According to the TAM, technology acceptance is a function of a potential user's perceptions of a technology's usefulness and ease of use as shown in Figure 3.
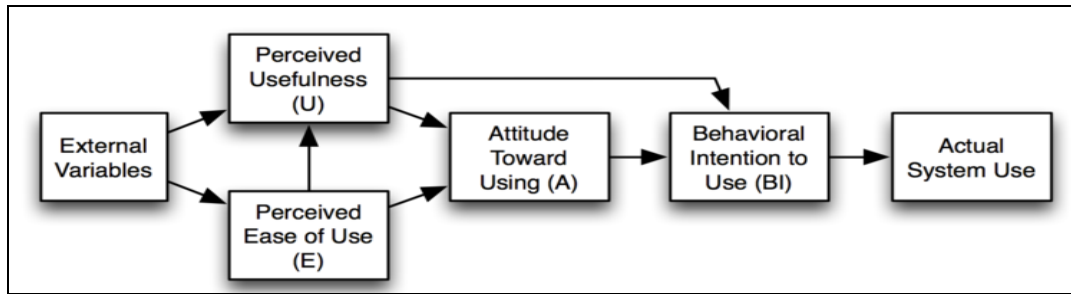
Figure 3.   Technology Acceptance Model (from Davis, 1989)

1.   Perception of the Solution (Perceived Usefulness and Perceived Ease of Use)

Perceived usefulness represents how people will or will not use an innovation to the extent they believe it will help them in doing their jobs better. Davis (1989) defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). Perceived ease of use considers while someone may think the technology is beneficial, it is still believed to be too difficult to use and the advantages of employing it are outweighed by the effort required to use it. Davis (1989) describes perceived ease of use as "the degree to which a person believes that using a particular system would be free from effort" (p. 320).

2.   From Perceptions to Adoption

Research by Davis, Bagozzi, and Warshaw (1989) shows that use is predicted from intentions; perceived usefulness is a chief determinant of intention to use; and perceived ease of use is a noteworthy secondary determinant of intention to use. Interestingly, ease of use appeared to be processed from a self-efficacy perspective; as people learned to use a new technology, the perceived ease of use became less important. The findings of the study supported the fact that although ease of use is important, users will accept a lower level of perceived ease of use to benefit from a higher level of perceived usefulness. Overall, the study found that the use of well-informed measures of determinants (perceived ease of use and usefulness) in calculating innovation use would reduce the risk associated with innovations being delivered for implementation and not used (Davis, Bagozzi, & Warshaw, 1989).

3.   Adoption of Energy-efficient technologies

Studies specific to the adoption of energy-efficient technologies have found that social networks and characteristics of the technologies and individuals influence adoption. This thesis presents three studies.

Darley and Beniger (1981) study the diffusion of energy-conserving innovations in households. Specifically, they examine solar heating. They explored how individuals evaluate innovations and found that social networks are the strongest factor in the adoption of energy conserving innovations. Their study results in three key findings: First, the decision to adopt or reject any innovation is determined by interpersonal networks surrounding the potential adopter; mass media is less critical. Second, small fixes, such as insulation or a water flow restrictor in a household, can be viewed as an innovation. Third, free market operations will not alone achieve the level of conservation available to households (Darley & Beniger, 1981).

Darley and Beniger (1981) state that adoption can simply be a process of communication or spread of information through space. The process flow starts with mass media to what Darley and Beniger (1981) call the "early adopter-elite." The "early adopter-elite" can also be viewed as the opinion makers from an influence campaign. The elite adopts an innovation and communicates it throughout their personal network, which spurs diffusion in areas other than the center of diffusion. These second-order adopters are "imitators." The last step in the process flow is diffusion through close proximity (Darley & Beniger, 1981).

Darley and Beniger (1981) conclude that adoption occurs through personal networks first and then influencers outside personal networks occur at a second stage. Thus, rational calculations are not the only factors that influence technology adoption. Whom one knows and where the information comes from is also a strong factor. Furthermore, Darley and Beniger (1981) suggest putting change agents in place to counter whatever elements become barriers to innovation whether they are perceptions, complexity, or the environment.

Darley and Beniger (1981) draw on Rogers' five dimensions of an innovation that determine the likelihood of its adoption: (1) relative advantage, (2) value compatibility, (3) complexity, (4) trialability, and (5) observability. Darley and Beniger (1981) examine how these dimensions impact California homeowners' decisions to adopt solar hot-water heating. They find that three of Rogers' dimensions had an impact: (1) economic and ecological considerations, (2) trialability, and (3) complexity (but lesser than the first two). Darley and Beniger (1981) argue that modifying and extending these three Rogers' dimensions into the following psychological dimensions may provide a better explanation of the adoption of energy conserving innovations: (1) cost, (2) savings, (3) certainty of savings, (4) value, attitude, and style compatibility, (5) innovation and life-pattern interactions, (6) trialability, (7) dissatisfaction with existing situation or product, (8) effort and skill involved in installing innovation, and (9) role of social networks. This study focuses on characteristics of technologies including, trialability, complexity, and observability.

The level of trialability effects the perception of the solution. It is the ability to test something before adoption. Darley and Beniger (1981) cite a general example of well-known marketing strategies: "free ten day trial, with refund-if-you-are-not-satisfied and they explain that it is important to gain the trust of the end user and also to instill confidence (p. 158). This study uses the trialability dimension and explores how it affects the perception of the solution in terms of Marines' adopting energy-efficient technologies to use less fossil fuel. Trialability is important to this project's model because the studies suggest it has a strong impact on how Marines will adopt a new technology. Watkins only introduces the fact that trialability is important and does delve into great detail about its effect. Complexity refers to how hard a technology or piece of equipment is to use, which is similar to TAM's ease of use. In the case of solar hot water heating, potential users might consider, "Is it just as easy to use as a gas or electric hot water heater?" Another complexity issue could be "How hard is it to fix or maintain?" Darley and Beniger (1981) argue that the observability of the outcome of an innovation will determine the probability of others seeing it, and subsequently, adopting it. For example, if a

homeowner sees a neighbor's solar panels outside, that homeowner may become interested in using them. Thus, seeing them increases the probability of adoption.

4.   Individual Characteristics

Arkesteijn and Oerlemans (2005) conducted a study on the early adoption of green power in Dutch residential users. The research data were collected in June 2001, one month before the green electricity market was liberalized. The residential green market, however, consists of mainly early adopters that stem from one of the two developments: the liberalization that changed the structure of the energy market, and the energy policies of governments and environmental concerns that lead to focusing on sustainability. The study centered on factors that drive the need for green technology, and how those needs lead to early adoption or non-adoption in residential households.

Arkesteijn and Oerlemans' (2005) research focused specifically on the individual. Their theoretical models were strongly based on Fishbein and Ajzen (1975): the theory of reasoned action, and Rogers' (1995) adoption model. They, however, expanded on them by emphasizing the cognitive aspects of early adoption or non-adoption through economic factors and trust. Trust becomes a mechanism for the individual/group that does not fully understand the technology/product (Arkesteijn & Oerlemans, 2005).

The authors found that (1) a high level of perceived responsibility for the environment, as well as a high willingness to pay, increases the likelihood of adoption, and (2) people who had higher levels of the basic prior knowledge, which had to be acquired actively and showed environmental friendly behavior in the past, were more likely to adopt (Arkesteijn & Oerlemans, 2005). The lack of visibility (social and product) did not deter early adopters. Individuals who understand the use and background of sustainable energy, and feel they have a personal responsibility to make a positive environmental stance, have a higher tendency to become early adopters of green technology. The complete opposite is true for non-adopters.

D.   RESISTANCE

Kleijen, Lee and Wetzels' (2009) resistance hierarchy, depicted in Figure 4, highlights different antecedents and their potential connection to one of three components of resistance: postponement, rejection, and opposition. Antecedents incorporate two main groups: (1) degree of change required, and (2) conflicts with prior belief structure, including physical risk, economical risk, functional risk, social risk, traditions and norms, perceived image, and usage patterns. Recent research examines how the combinations of antecedents create resistance (Kleijen, Lee, & Wetzels, 2009).

Antecedents

Resistance Hierarchy

Risk
Physical
Economic
Functional
Social

Traditions & Norms

Usage Patterns

Perceived Image

Postponement

Rejection

Opposition
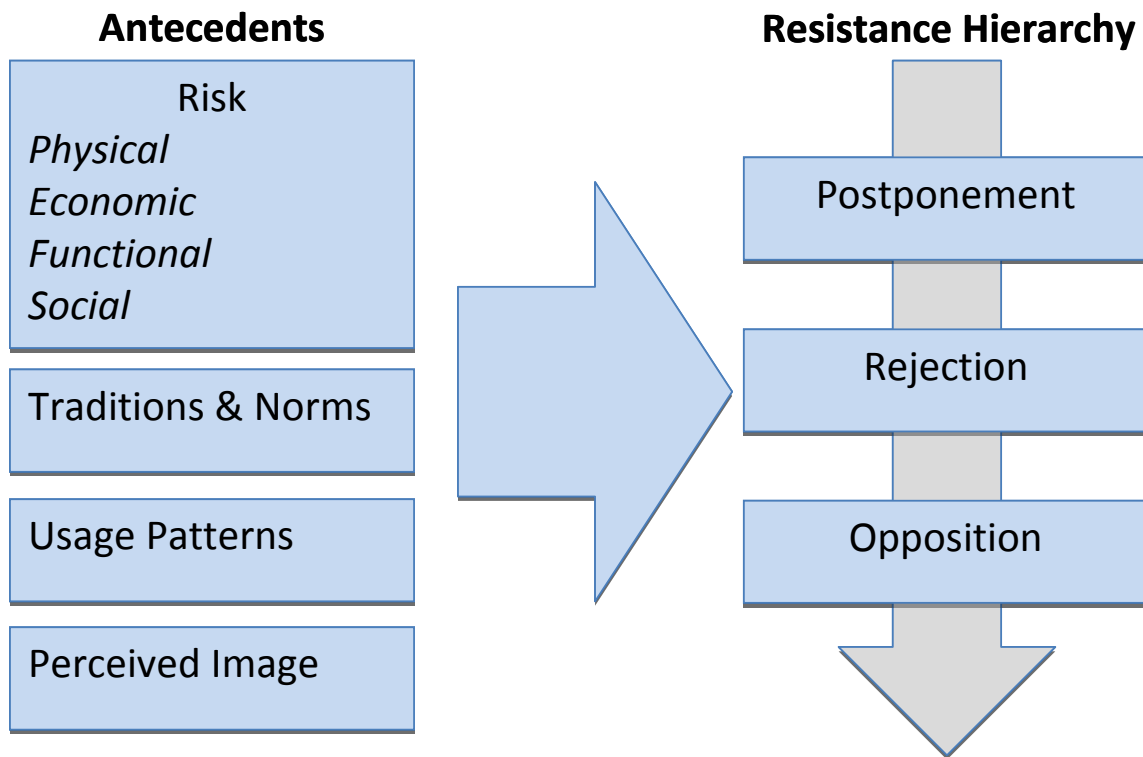
Figure 4.   Resistance Hierarchy (from Kleijnen, Lee, & Wetzels, 2009)

1.   Antecedents

Four drivers identified influence resistance concerning the adoption of an innovation: risk, traditions and norms, perceived image, and usage patterns. Within the risk driver, four different types influence resistance: physical, economic, functional, and social. Physical risk focuses on the fear of physical danger that might occur by adopting

the new technology. Economic risk draws attention to the cost of the new technology and whether the benefits outweigh the risks. Functional risk involves uncertainty concerning the innovation. Does the new technology work as intended and, if not, what are the negative implications? Social risk involves the acceptance or rejection by the adopter's social environment. Will the adopter be ostracized from his social system (Kleijnen, Lee, & Wetzels, 2009)?

The three remaining drivers that influence resistance are traditions and norms, perceived image, and usage patterns. Traditions and norms address the schema of an individual. The more comparable the new technology is within the adopter's patterns and habits, the more likely resistance will not occur (Herbig & Day, 1992). Perceived image focuses on the adopter's associations given the circumstance of the new technology. If the new technology is associated with something with a bad reputation, the potential resistance is more likely (Ram & Sheth, 1989). Usage patterns are formed from habitual behavior of using a product repeatedly. If the new technology is harmonious with the adopter's current patterns, it will most likely result in less resistance (Ram & Sheth, 1989).

2.   Resistance

Kleijnen, Lee, and Wetzels' (2009) study found postponement to be similar to "delaying" connected economic risks and usage patterns as the main drivers. Postponement was defined as an innovation acceptable in theory, but adoption may not occur immediately. Rather, it may not occur until the circumstances are more appropriate for the adopter. Situational barriers that can be temporary in nature often drive end users to resist innovation until they feel its application is useful. Therefore, it could be beneficial to communicate how innovations fit within a person's lifestyle and bundle innovations with products already part of someone's usage patterns. Kleijnen, Lee, and Wetzels (2009) identified rejection as a considerable high reluctance to adopt. Furthermore, their research suggests strong unwillingness to adopt is not from a lack of

knowledge or inexperience, but rather from extensive evaluation. Other research by Hirschheim and Newman (1988) hypothesize that rejection is additionally linked with an averseness to change the status quo.

Kleijnen, Lee, and Wetzels (2009) equate opposition to sabotage. Additional research describes innovation disruption as a strategy to stop an innovation in having adoption success (Davidson & Walley, 1985). This type of resistance occurs when the end user becomes convinced that the new technology is undesirable. Given these findings, it is reasonable to suggest that opposition seems to be driven by factors embedded in a person's personal and societal environment. This concept is consistent with the discoveries that traditions and norms drive only this resistance type. It is extremely difficult to change a societal context; consequently, organizations should consider investigating the flexibility of the innovation, even after introduction (Ram & Seth, 1989).

3.   Strategic Implications of Resistance Hierarchy

Research by Kleijnen, Lee, and Wetzels (2009) presented the collection of antecedents and definitions for the types of resistance. Postponement was agreed to be "an active decision to not adopt an innovation at that moment in time" (Kleijnen, Lee, & Wetzels, 2009, p. 352). Postponement, considered the weakest form of resistance, occurred when an innovation changed existing usage patterns and possessed economic risk. Rejection was referred to as "the active decision to not at all take up an innovation" (Kleijnen, Lee, & Wetzels, 2009, p. 352). Rejection occurred when innovation changing existing usage patterns and economic risk were combined with poor image and social and functional risk. Opposition was agreed upon to refer to "actual active behavior directed in some way towards opposing the introduction of an innovation" (Kleijnen, Lee, & Wetzels, 2009, p. 353). The strongest form of resistance, opposition, occurred when functional, social, and physical risks were combined with a conflict in existing traditions and a poor image.

Strategic implications observed by Kleijnen, Lee, and Wetzels (2009) identify that as the number of risk dimensions increase, people more likely tend to outright reject

innovation, rather than postpone adoption. Although economic, functional, and social risks are important drivers of rejection, perceived image also plays an integral role. Image, in most cases, serves a signaling function to compensate for a lack of knowledge.

Further evaluation and data generated through Kleijnen, Lee, and Wetzels' (2009) focus groups highlighted the significance that antecedents are different in nature for each form of resistance. Individual and combinations of antecedents are linked to a particular resistance type in the resistance hierarchy provided in Figure 5. Overall, the study showed several combinations of antecedents lead to risk, but clearly demonstrated how perceived risk maintains the dominant role to innovation resistance.
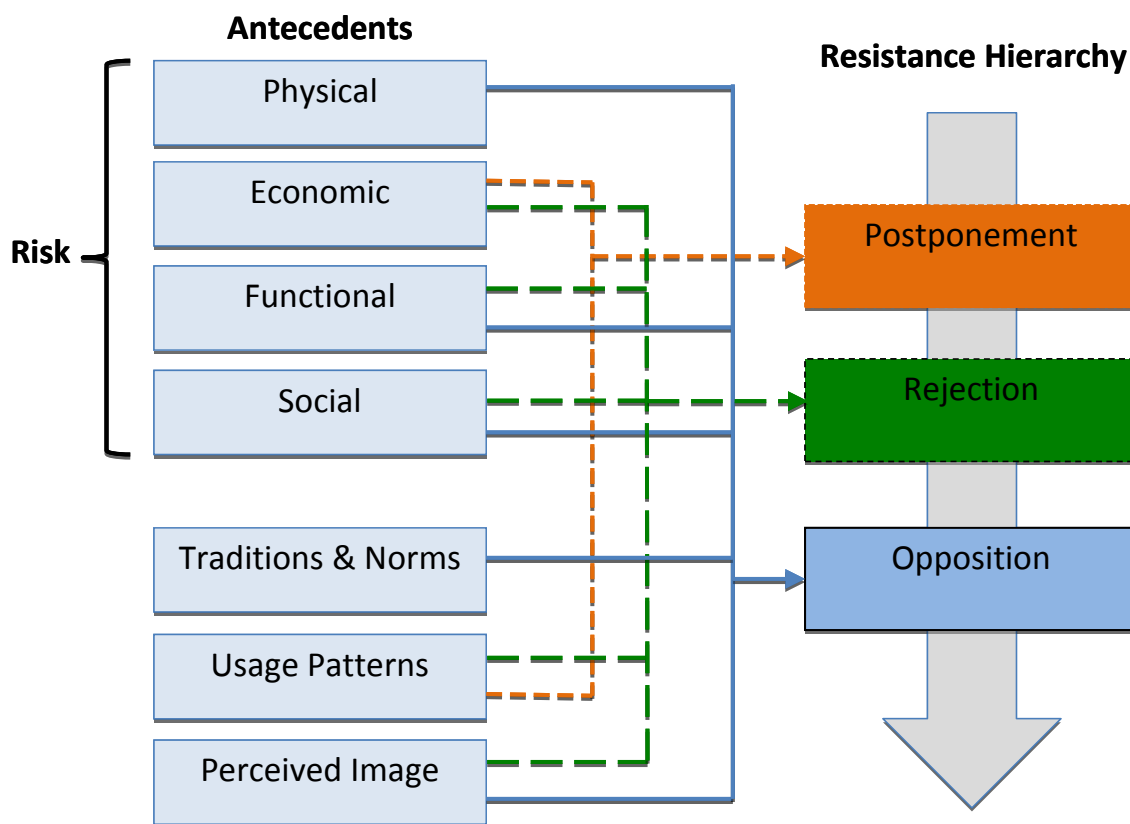
Figure 5.   Resistance Hierarchy Links (from Kleijnen, Lee & Wetzels, 2009)

From the results of focus groups, some interesting conclusions can be applied to drivers. Drivers differ from the various resistance forms, but some common interpretations can be utilized going forward. Risk plays an important role throughout the

various types of resistance. This observation suggests that reduction strategies will play an integral role in reducing resistance toward innovations. A common theme among researchers advocates the use of information to increase knowledge about risks and their solutions (Dowling & Staelin, 1994; Locander & Hermann, 1979). On the other hand, previous resistance research cautions against this method due to the discovery of information overload as an important stimulus to resistance (Herbig & Kramer, 1992). To overcome resistance, information should be tailored to the target audience's concerns or issues. For example, "new media can be particularly helpful in providing demonstrations on how products work in virtual environments, illustrating how products can be incorporated in existing habits and current situations" (Kleijnen, Lee, & Wetzels, 2009, p. 353).

E.   COMMONALITIES IN THEORIES

The aforementioned studies mentioned are grounded in behavioral theories. They suggest that communication channels and perceptions influence behavior. Other studies focus on influential factors, or what this study calls, the opinion makers in the framework. These studies suggest that certain people not only control the flow of information, but also shape opinions of potential users through their actions. Therefore, this study wants to understand better who sets the example for a Marine who will potentially use an energy-efficient technology.

To understand communication and influence better, Watkins' Influence Campaign is considered, which suggests that opinion makers, information, and internal, as well as external, perceptions, shape how and if an end user is positively influenced. This concept becomes the ultimate framework.

F.   WATKINS' INFLUENCE CAMPAIGN

The E2O seeks to find the most effective way to integrate energy-efficient technology into the USMC's culture to increase combat effectiveness by decreasing energy consumption. To achieve this change in warfighters' ethos, an exploration of the drivers that influence energy adoption behavior within the Marine Corps is mandatory. The question is "how can Marines be successfully influenced to use energy-efficient

technology?" Michael Watkins Influence Campaign has been chosen to help frame how to identify drivers of adoption. Watkins (2003) states, "Leaders conduct diplomacy when they seek to influence the behavior of outside parties in order to advance their institution's strategies" (p. 1). The goal is to use Watkins' Influence Campaign to help learn how the Marine leadership can impact the Marines' decisions to adopt energy-efficient technologies. Once what elements influence them are discerned, and to what degree, this study can recommend an adoption strategy. Watkins (2003) states that managers have four key areas for influence: negotiation, coalition building, advertising, and public relations. The influence campaign aims at shaping decision makers' perceptions of their interests and choices in what Watkins calls the "chain of influence." This chain connects decision makers to their superiors and opinion makers and contains the following.

- Decision Makers—The people who will actually make the final decision.
- Advisers—The individuals/groups that provide advice to decision makers affecting their perspective on the decision.
- Influencers—The individuals, institutions, or coalitions external or internal to the decision-makers' organization that influence their decision.
- Key "publics"—The broader public that reaches the decision maker.
- Opinion Makers—The institutions that provide the data and analysis that shape the opinions of the key public.

The goal is to find the influence environment through audience, media outlets, technology framing, and how they are all integrated into adoption. These new drivers better fit the USMC transition in "ethos." Watkins' model states:

> Effective corporate diplomacy informs the development of company strategy and plays a critical role in its successful realization. Managers must be able to diagnose key external interdependencies, identify the most important influence games their companies need to play, define objectives, and identify the key targets of influence. With this diagnosis in hand, they are well equipped to design integrated influence campaigns and to craft supporting process plans. (Watkins, 2003, p. 16)

Watkins' model in its original form is better for technology diffusion. Conversely, this project focuses on the individual adoption of an energy-efficient technology. Watkins' model does not provide key factors to help identify the role of individual

adoption, which is the reason behind this study's modifications. Using additional literature, gaps in Watkins' model are filled. For example, Arkesteijn and Oerlemans' (2005) study focuses specifically on the individual, which does tailor to this study for the adoption of energy-efficient technologies in Marines, as opposed to Watkins who mainly focuses on an organization. Watkins' model is a good starting point because the researchers are interested in how to identify the drivers that lead a Marine to adopt a technology. This new influence campaign is illustrated in Figure 6. The remainder of this literature review is devoted to several literature articles that focus on elements and sub-elements in the influence campaign that build on concepts and theories to address this study's research questions.
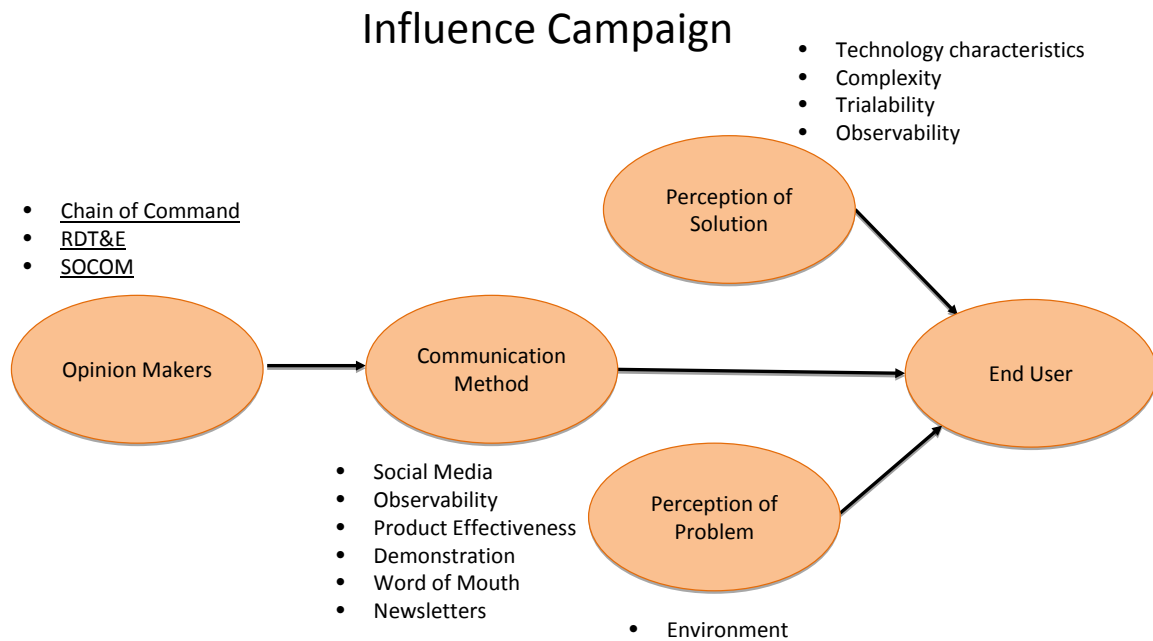
Figure 6.   Research Framework (after Watkins, 2003)

This study adapted Watkins' influence campaign and modified the processes to fit better the influence flow of a Marine adopting an energy-efficient technology. The results were new categories based on articles that discuss the factors of technology adoption.

- Communications method—More effective than Watkins' key publics because of the desire to explore how ideas are communicated to Marines. Everett Rogers analyzed how the communication processes influences the

rate of innovation adoption. He found that communication creates knowledge and spreads information and the researchers want to expand on this concept in context within the Marine Corps. Additionally, with Darley and Beniger's (1981) article, the importance of communication methods are introduced and emphasized.

- Perception of solution—More effective than Watkins' internal advisors because the influence campaign is from the perspective of an individual Marine and not an organization. Marines come from various backgrounds that shape their methods of problem solving. Darley and Beniger's (1981) article, as well as Rogers' (1995) and the TAM, suggest that perceptions shape how and if someone adopts a technology. Additionally, to combat negative perceptions, risk reduction strategies discovered by Kleijnen, Lee, and Wetzels (2009), along with effective communication methods, are vital.

- Perception of problem—More effective than Watkins' external influencers because influencers were incorporated in both perception of the solution and perception of the problem. Again, external influencers fit better from a corporate framework. Darley and Beniger (1981), Rogers (1995), and the TAM suggest that external perceptions are very important factors to explore. In addition, the resistance research and data gather by Kleijnen, Lee, and Wetzels (2009) provide a foundation of knowledge and baseline concerning the perception of the problem within our influence campaign.

Based on the adoption of energy conserving technology literature, this study has identified initial sub-categories for each oval in the influence campaign figure. For opinion makers, the data suggest that the chain of command, Research Development Test & Evaluation (RDT&E), and Special Operations Command (SOCOM) (Special Forces), will be the major people and experiences that shape a Marine's opinion of a certain technology. Based on communication literature, social media, observability, product effectiveness, demonstration, word of mouth, and newsletters, will be the major methods of communication. Based on influence literature, environment will impact a Marine's perception of the problem and technology characteristics, complexity, trialability, and observability, will impact the perception of the solution. Therefore, focus group questions have been formulated to explore these sub-categories and any others that might exist.

G.   STUDY FRAMEWORK

The resistance hierarchy provided the ability to identify antecedents to resistance, and suggested that risk reduction strategies, along with effective communication

methods, were vital to combat negative perceptions. The TAM identified how individual factors that influence information technology acceptance could predict acceptance and use of information technology by individuals through emphasizing valuable determinates concerning the perception of the problem and opinion makers. Darley and Beniger's (1981) theories identified the relevance of communication methods and the perception of the solution. Arkesteijn and Oerlemans' (2005) theories explained the importance of the perception of the solution and the problem. All the various models and theories afforded an explanation into the importance of the elements and sub-elements of Watkins' Influence Campaign. Together, the theories provided a framework that guided this study.

III.   METHODS

A.   RESEARCH APPROACH/INTRODUCTION

The primary data for this study resulted from focus group discussions. Focus groups are appropriate for this study's purposes since they allow insight into Marines' concerns and awareness of energy-efficient technologies. This approach provided the opportunity to observe the collective insight of individuals with regard to the primary and secondary questions. The data were analyzed through qualitative trend and thematic analysis.

The focus group questions were designed to elicit discussions among Marines on the topic of energy efficiency outside and inside their professional environment. Additionally, the focus group was designed to explore how cognitive factors (awareness and understanding) and affective factors (attitude and perception) affect USMC's decisions concerning willingness to adopt or resist energy-efficient technologies. The focus group protocol was reviewed and approved by the Department of the Navy (DoN) Internal Review Board (IRB), USMC IRB, and selected Naval Postgraduate School (NPS) professors.

After consenting to participate, Marines were introduced to the focus group objective:

> Our MBA project will identify Marines' concerns, awareness, and enthusiasm to adopt energy-efficient technologies. Energy-efficient technologies have the potential to significantly reduce fossil fuel dependency for forward-deployed and home-stationed personnel and are hoped to increase combat effectiveness.

Following the consent, the focus group consisted of four leading questions, various probing questions, and multiple activities that can be found in Appendix A.

B.   DATA SOURCES

Four focus groups were conducted. An all-hands email was sent to Marine Corps Officers currently stationed at NPS asking them to voluntarily participate in two focus

groups sponsored by the E2O. In addition, assistance was requested from the E2O to conduct focus groups in Camp Pendleton. The E2O worked with the director of Science and Technology to craft a formal message from the E2O to the First Marine Expeditionary Forces (IMEF) requesting voluntary focus groups. In the beginning of the focus groups, a demographic survey (included in Appendix B) requested individual demographic information including age, rank, highest education attained, number of completed deployments within the previous four years, years of service, and MOS.

Focus Group 1

Participant	Sex	Age	Rank	Education(highest obtained)	# of deployments in the past 4 years	Years of Service	MOS
1	M	27	O-3	Bachelor's	2	5	Military Police
2	M	30	O-3	Master's	0	9	Logistics Officer
3	M	33	O-3	Bachelor's	1	11	Supply
4	M	42	O-4	Bachelor's	1	23	Financial Management
5	M	28	O-3	Bachelor's	1	5	Artillery
6	M	39	O-3	Bachelor's	0	20	Supply
7	M	31	O-3	Master's	1	13	Financial Management
8	M	30	O-3	Bachelor's	2	11	Logistics Officer
9	M	34	O-3	Bachelor's	0	16	Supply

Focus Group 2

Participant	Sex	Age	Rank	Education(highest obtained)	# of deployments in the past 4 years	Years of Service	MOS
1	M	35	O-3	Bachelor's	0	17	Adjutant
2	M	35	O-4	Bachelor's	0	13	Air Command & Control
3	M	29	O-3	Bachelor's	0	7	Communications
4	M	37	O-3	Master's	1	17	Communications
5	M	37	O-4	Bachelor's	1	14	Communications
6	F	32	O-3	Master's	2	11	Logistics Officer
7	F	35	O-4	Master's	1	13	Aviation Supply
8	M	35	O-4	Master's	0	12	Pilot
9	M	27	O-3	Bachelor's	1	5	Logistics Officer
10	M	34	O-3	Bachelor's	1	16	Aviation Supply
11	M	30	O-3	Bachelor's	2	8	Pilot
12	M	34	O-3	Bachelor's	2	15	Pilot

Figure 7.   Focus Group Participant Demographic Breakdown

(continued on next page)

Focus Group 3

Participant	Sex	Age	Rank	Education(highest obtained)	# of deployments in the past 4 years	Years of Service	MOS
1	M	34	E-7	High School	2	17	Assault Amphibian Vehicle Operator (1833)
2	M	33	E-6	High School	3	14	Assault Amphibian Vehicle Operator (1833)
3	M	25	E-4	Some College	1	3	Assault Amphibian Vehicle Operator (1833)
4	M	28	E-5	Some College	1	10	Assault Amphibian Vehicle Operator (1833)
5	M	22	E-3	High School	1	3	Assault Amphibian Vehicle Operator (1833)
6	M	33	E-6	Some College	1	10	Motor Transportation Chief (3537)
7	M	21	E-3	High School	1	3	Rifleman (0311)
8	M	25	E-3	High School	1	4	Assault Amphibian Vehicle Operator (1833)
9	M	31	E-6	High School	2	12	Light Armored Vehicle Mechanic (2147)
10	M	23	E-3	Some College	1	3	Rifleman (0311)
11	M	21	E-4	High School	1	3	Rifleman (0311)
12	M	23	E-4	High School	2	5	Rifleman (0311)

Focus Group 4

Participant	Sex	Age	Rank	Education(highest obtained)	# of deployments in the past 4 years	Years of Service	MOS
1	F	28	E-5	Some College	1	9	Imagery (0241)
2	M	28	E-5	High School	1	9	Field Radio Operator (0621)
3	M	20	E-3	High School	1	2	Logistics/Combat Service Support Specialist (0431)
4	M	27	E-4	High School	1	3	Financial Management Resource Analyst (3451)
5	F	26	E-5	Some College	1	8	Marine Air Ground Task Force (MAGTF) Planner (0511)
6	M	27	E-6	Some College	2	8	CBRN Defense (5711)
7	M	32	E-5	Some College	1	7	Motor Vehicle Operator (3531)
8	M	32	E-6	High School	1	13	Ammunition Tech (2311)
9	F	28	E-6	High School	1	10	Intel Specialist (0231)
10	F	30	E-6	Associate's	1	12	Supply Admin Clerk (3043)
11	M	30	E-6	Some College	1	12	Intel Specialist (0231)
12	F	23	E-5	Some College	1	4	Data Systems Communications (0651)
13	F	24	E-4	Some College	1	4	Signals Intelligence (2621)

Figure 7   Focus Group Participant Demographic Breakdown

(continued from previous page)

Ten minutes were allotted before any formal discussion started to allow the Marines to talk and mingle. The moderator began with an introduction and welcome to include an explanation of the objectives and purpose followed by the leading and probing questions (Appendix A). Four 60- to 90-minute sessions were conducted and digitally recorded (voice only) with the Marines' main ideas written on a whiteboard. The digital recordings were transcribed, which resulted in 161 pages of text.

C.   ANALYSIS APPROACH

Inductive and abductive approaches were utilized, which involved a series of meaning condensation and categorization. Initially, the pictures of the whiteboard were examined with a rough categorization made of how the primary and secondary questions were answered and how the five drivers were completed. Data from the focus group were used to investigate specific occurrences of energy-efficient technology and how they drove the four drivers of this study's framework. This analysis was then used as the basis for discussions and recommendations.

The transcribed recordings were utilized, going line by line to categorize participants' comments into each of the four drivers in the campaign framework. Each focus group was coded separately and their comments grouped into sub-categories. From these sub-categories, common patterns were identified and grouped into key themes under each driver. Additionally, definitions of sub-categories were provided based on a review of the literate and refined through the data analysis (Appendix C). Each focus group was also compared and contrasted to identify interesting findings and trends.

The focus group results between Marine Officers and Enlisted Marines were compared and contracted as well. Trends for different MOSs were identified. The two officer focus groups conducted at the Naval Postgraduate School were grouped together and the two Enlisted focus groups conducted at Camp Pendleton were grouped together to analyze them separately for the "within" analysis. Then, a "between" analysis was conducted. The results of the analysis follow in the next chapter.

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IV.   ANALYSIS AND FINDINGS

A.   INTRODUCTION

The following section reports the analysis and findings. Focus group data were collected and analyzed to specify and explain four high-level drivers in the context of Marines' adoption of energy-efficient technologies: opinion makers, communication methods, perception of the problem, and perception of the solution. The initial high-level drivers from a review of the academic literature were distilled. The focus groups were designed to identify Marines' perceptions regarding concerns about and awareness of energy-efficient technologies. The presentation of the data documents Marines' thoughts and opinions and the analysis identifies likely drivers of the adoption or non-adoption of energy-efficient technologies by Marines.

The analysis was begun by grouping and categorizing comments according to each high-level driver. The grouping resulted in 354 comments across 161 pages, which were then categorized. After categorizing the comments according to the high-level drivers, the comments were divided into sub-categories. Each sub-category was then assessed on intensity and frequency. This analysis was drawn upon to discern inductively key themes within each high-level driver and make recommendations for the U.S. Marines supporting the adoption of energy-efficient technologies. This analysis shows that in the context of the Marine Corps and technology adoption, opinion makers includes those in Marines' formal chain of command, as well as personal experiences and events. The methods of communication through which Marines learn or hear of new technologies are formal guidance, informal correspondence, and personal observation. Opinion makers influence Marines' perceptions of the problem presented by dependence on fossil fuels and their understanding and perceptions of appropriate solutions. The Marines in this study perceive a key issue of fossil fuel dependency to be cost, but competing or unclear definitions of energy-efficient technology contributed to some confusion as to the definition of the problem. Marines' perceptions of the solution (energy-efficient technologies) included concerns about conflicts with traditions and norms, as well as about product effectiveness.

This chapter presents the analysis of Marines' discussion during the focus group sessions. First, each high-level driver is elaborated upon and the sub-categories and key themes explained, including quotes from the focus group sessions to support this analysis. Next, a summary of key themes and findings is provided. Then, NPS officer and Camp Pendleton enlisted focus groups were compared and contrasted by identifying similarities and differences. This chapter concludes with an adjusted influence campaign framework based on the analysis and findings. All the quotations contained in this chapter were acquired from a professional transcription of audio recordings of the focus group sessions. Therefore, if required, spelling and punctuation corrections were made; however, no grammatical modifications were made to any quotations.

B.   HIGH-LEVEL DRIVERS

Drawing on the theoretical framework explained in Chapter II, comments were categorized according to the four high-level drivers: opinion makers, communication methods, perception of the problem, and perception of the solution. For each of these drivers, key themes were identified. To identify themes, we comments were first categorized into sub-categories. The sub-categories emerged from the information as it was read and re-read to look for commonality and patterns in the responses. For example, when a Marine's quote explained that a formal supervisor has to believe and communicate the importance of energy-efficient technologies for it to be successful; the sub-category code "CoC" (representing Chain of Command) was placed next to the quote. A spreadsheet was then created, the rows with each type of sub-category were filled in, and a column added for each main driver. Next, the frequency of "CoC" was counted and each box was filled in for the four main drivers and sub-category. The same process was followed for the creation of each sub-category. The sub-categories were condensed into key themes based on common patterns. Definitions of sub-categories and coding data are located in Appendix C.

The level of intensity of each key theme was subjectively measured by the emotion attached to the comment, head nodding from others in approval, and provoking follow-on discussion associated with each comment. Each key theme was coded with

"1," "2," or "3," which represented little intensity, moderate intensity, and high intensity, respectively. The final category, individual characteristics, was explored by segmenting and comparing the focus groups by MOS specialty and rank across the initial four categories discussed below.

1.   Opinion Makers

Opinion makers were initially defined as anyone or anything that influences the end user's decision to adopt or not adopt an energy-efficient technology. To generate discussion to illuminate opinion makers, participants were asked, "What specialty items did you use while deployed that were not issued to you?" and followed with probing questions, "How did you hear about it?" and, "What was most influential in your decision to use it?" This analysis shows that in the context of the Marine Corps and energy-efficient technologies, opinion makers include individuals in key positions and occurrences the participant faced that shaped their opinion of a product. These themes were labeled people and events/experiences, respectively.

a.   *People*

The category people include comments that indicated influence by individuals within the organization. Sub-categories include chain of command and congress. These people inside the Marine organization influence Marines' behaviors and opinions through their actions (by example) or through formal and informal oral and written guidance. The following paragraphs explain and give examples from the focus group discussion to illustrate the role of chain of command and congress in Marine participants' perceptions of the problem of fossil fuels and energy-efficient technologies as a solution.

(1)   Officers. The participants (Captains and Majors) in focus groups one and two emphasized the role of their Chain of Command in influencing behavior. Chain of command was mentioned eight times (out of 206 total comments) and the level of intensity was moderate (2). The transcription of these comments covered 20 pages out of 94, which suggests that this topic was very important to the Marines. For example, one Marine stated:

Yes, really you have got to start from the top though. If it is not bought at the top, you can tell the captain or commander all day [long, what is] going to be there, but if the battalion commander doesn't care, his priority is this and he goes, Look, we are doing—. What are you going to do? You are going to do what he tells you." Another Marine responded with, Yes, if the Battalion Commander doesn't give a shit, it doesn't matter if the CG [Commanding General] cares about it, that Battalion Commander is the critical point of contact to those Company Commanders and everybody else below.

The following quote is an example of how the participant views the secondary chain of command.

Well it is every level of command. That is where it comes to. Every level is [responsible], start at the top. At the service level, Headquarters Marine Corps saying this is what we need to do so then it goes down right down to the [MARFOR]. Then you have got to translate how they are seeing it in their theater of operations. So you have got the MEF operating in Afghanistan, so now the MEF commander has to translate that down to his level, which includes a lot of air, which is a good point [participant A] said using a lot of it, so there is a lot there." Another followed up with "Yes, you have got to have that translation of going from top to bottom. Again, because he says going from eight to four doesn't mean a commander at the level is going to literally say we are cutting fuel and that is not what it means. That means that—you are operating off—that means that commanders get paid the big bucks to make these decisions. They have got planners and you have got to figure okay, the commandant says—the freaking [MARSOC] commander says hey, reduce fuel usage in half. Well part of it may be that I am going to have to condense operations somewhere so I am not telling freaking Charlie battery over there to cut their use in half.

Another comment reinforcing the importance of the secondary chain of command was:

But it was directed by the president. I was a monitor when it came down and we actually had to go out and establish an organization. So the president directed all military services to do just that, so the SECDEF and everybody else followed suit. We created that element to support the guys that we were provided.

These comments suggest that those in a Marine's immediate chain of command who influence behavior include battalion commanders, company commanders, sergeants major, and platoon sergeants and those in a Marine's secondary

chain of command who influence behavior include any authority figure outside the battalion. Whether it is the immediate or secondary chain of command, the Marines' comments suggest that what those in the chain of command do and say play a distinct role in influencing the perceptions of the end users, the Marines on the ground.

During the first two focus groups conducted with officers at NPS, Marines brought up the topic of wartime funding. The frequency of comments relating to Congress was low (mentioned only twice); however, the level of intensity was extremely high (rated at 3). The Marines' comments indicated extreme dissatisfaction and frustration with Congress and were illustrated by the following statements.

Every time there is a war it doesn't matter about resources.

Change Congress because that is part of what this is. It is not just part of what we are doing.

I think it is comical that we try and use the word efficiency when we start thinking about Congress and the political system because at the end of the day it is the most inefficient system. So we have these great notions of what we want to do and like forget about energy for a minute and let's talk about fiscal responsibility. The military is a horrible example of fiscal responsibility. We are the most irresponsibly organized group because of the way Congress sets it up. If you don't spend it, you don't get it next year. Like there is no; hey, let's plan to set this money aside. It is like you said, feast or famine.

Marine Officers' comments suggest that participants believe that every time the United States is involved in a conflict, Congress fulfills the monetary requirements to complete the mission. This reality causes widespread belief that unlimited funding is available, which in turn, increases energy consumption through unlimited resources. The Marines seem to relate the financial and political actions of Congress as a negative opinion maker to adopting energy-efficient technologies.

(2)   Enlisted. Similarly, enlisted participants mentioned the role of chain of commend in influencing behavior. Chain of command was mentioned 13 times and required 12 pages of transcribed text (out of 148 comments and 69 pages of

transcribed text for the enlisted focus groups analyzed). The intensity of these comments was assessed as high (3) due to the considerable follow-on discussion and emotion in body language and tone.

A Marine made a general comment about a broad category of people, which illustrated the importance of people in the chain of command on Marines' perceptions and behavior. "Even Sergeants and above 'cause they're the ones that, honestly, do all the work, fix everything, they try out everything."

Similarly, a Marine commented on the importance of Marines in general:

I'd just seen older Marines using them, They're like, "Hey, you should probably get one of these 'cause they'll really help you out." All right, if it works for you, it's gonna work for me.

Other comments indicate the importance of particular roles. For example, one Marine commented:

Like Sgt. [xxx] was saying like he trusts Gunny, like it was one of those things like, when I first came into the fleet and my Squad Leader, he'd say, Go buy some cat eyes, you know, you've got to see this reflective stuff, go buy this, go buy that, you need it, you're going to need it," like I looked up to him, I trust him, it's someone you're going to trust, if they tell you to go do something, you're gonna do it because, one, it's going to save your life, two, you know they're right…

Another Marine expanded on that comment by agreeing that the Gunnery Sergeant would have a high impact:

I would do it because I know Gunny, I trust Gunny, I trust his word, you know what I mean? But if, no offense to anyone, other in the room, but, I mean, if someone told me, Hey this really works, try it, I'd have to try it myself first because I don't know them.

Based on the head nodding in approval following these comments, the data suggest that enlisted Marines not only put a lot of trust in those people in their chain of command, and specifically, trust key people and value their opinions. The Marine that made this comment works for the Gunnery Sergeant he is referring to and he did not know the other Marines in the room, which suggests that Marines have a higher

probability of adopting energy-efficient technologies if they heard positive stories about it from another Marine they personally know. Also suggested is that Marines are less likely to adopt energy-efficient technologies if someone they do not know told them about it or showed them the equipment.

The Battalion Commander was another key person. One Marine commented on the importance of the Battalion Commander: "The Battalion Commander might say, Hey, this is the best cover in the world, [then] everybody will wear it."

This next comment shows the intensity and suggests how Marines think certain key people in the chain of command are highly important in shaping opinions:

> If it's not in the Sergeant Major's or the Battalion Commander's interest, they're not going to talk to the Battalion about it, they're not going to give a shit about it, you know what I mean?

These comments unsurprisingly show that the enlisted Marines trust the word of other Marines. Sergeants and above, gunnery sergeants, or battalion commanders are likely to be particularly influential. These two previous comments suggest that enlisted Marines think that if their leadership is not interested in energy-efficient technologies, the adoption and integration into the unit will be less likely to occur.

b.   *Experiences/Events*

The second key theme in the comments organized in the opinion maker category is "experiences/events." This theme includes the sub-categories prior experience, observability, and video games. These sub-categories were grouped into "experiences/events" because they are direct incidents that form a Marine's perception of a product in a negative or positive way. The results achieved after using a certain item drove them to think positively or negatively about a product. The successful use of items on deployments in harsh conditions had greater influence than those used in more benevolent conditions due to the technology or product surviving in an extreme environment. The Marines in the focus groups stressed the need to be able to rely on their

equipment. Some stated their preference of direct experience over any other source of influence. These Marines expressed that direct experience would allow them to feel confident in battle situations by knowing that equipment has previously worked and resulted in successful outcomes. Only officers are discussed in the following section. The enlisted Marines in this study did not discuss events or experiences, which was surprising because that sub-category was popular for the officers. This data suggest that enlisted Marines put their trust solely on people.

The first sub-category in events/experiences is "prior experience," which is defined as a Marine's personal experience with a product. A Marine commented on a positive experience with an energy-efficient technology, but indicated capability issues. The Marine stated,

> I have used the spaces and greens systems. We had a limited amount fielded to my battalion. Some of the companies had it, but they didn't have it company-wide. They had a couple of platoons with it here or a couple of COPs [Combat Out-Post] there. It was pretty good stuff, but the problem is when they took it down to the individual piece of say a radio trying to have some sort of solar rechargeable, solar operated—solar powered radio, but the problem was they weren't compatible with all the different types of radio systems. I mean even the radios that we have out there today, every battery—most people think that you know that these things called a 5590, they think that battery can power everything, but it is just not true. So it becomes for us, for me as a communications officer in a ground combat element, it was an issue of compatibility and availability.

Thus, for this Marine, direct experience suggested that the energy-efficient technology was effective, but not prepared for total integration in the Marine Corps. However, another Marine with a positive perception based on prior experience with energy-efficient technology, responded:

> Yes, two things I saw. Both kind of abstract, but one was we employed a thing called the M2C2. It was a mobile command post, we will just call it that. But the thing that was nice about it is it had all my coms and everything built into it and C2 facilities so they could take one truck and they could drive that one truck, though putting all your eggs in one basket was kind of dangerous. That one truck could do the same as an entire regimental CP of 40 trucks. So one versus 40 when you start to look at the footprint of that log train, to me that is not necessarily having a more efficient truck that can get more miles per gallon, it probably got less, but

because you are reducing all those—the log train that is supporting the COC because you have consolidated, it kind of is energy-efficient and we are going to that technology with the [NODM] I think is what they are calling it now. [NODM] is kind of like the next generation of stuff that the Marine Corps is going to. So that is one way to look at it is, hey maybe we put some of our money towards these packages because I know the MRQ-12 van for aviation guys and [MRQ-13], those are the same kind of things we could focus that energy-efficient technology by reducing the log train and supply train behind it.

Comments suggested that the M2C2 and the GREEN technology system provided Marines with positive experiences, which resulted in positive perceptions of energy-efficient technologies.

The second subcategory is indirect experience, which is defined as hearing or viewing others' experiences about energy-efficient technologies. The data suggest that a Marine may be more likely to adopt a technology if others this person knows have used it and found it to be reliable and useful. The experience of other Marines influences decision makers, which allows them to feel more confident in the equipment even with a lack of their own direct experience. For example, discussing aftermarket products, a Marine explained:

I know our squadron when they were there, they had started using iPads in the cockpit, even though it wasn't authorized, to replace their [maps] because we don't have a moving map, we don't have anything we can just sit on—you have got a telephone book and maps and they actually went out and the squadron took squadron phones [inaudible] iPad and now they are moving towards an android based. But that was initially a west coast squadron used [inaudible] to buy it and then they would pass it on to the replacement squadron. But they bought iPads and—.

This comment generated discussion from three other Marines in the focus group who had the similar experience with iPads. Due to the follow-on discussion, the level of intensity of this comment was rated as high (3). The data suggest that Marines will have a higher tendency to adopt new technology if they see fellow Marines have success using the same equipment.

The third sub-category was the effect video games have on Marines, which is an interesting blend of direct and indirect experience. While the playing of the game is direct, the technology or product is a representation. In both focus groups Marines gave examples of using gear they had previously used (in representation form) in the video game Call of Duty®. The comments suggest that the equipment special operations characters in Call of Duty use influence Marines. For example, Marines from focus groups 1 and 2, listed respectively, commented:

> Like one of my [Marines] was a huge Call of Duty guy. He actually had a point—we put a magazine [pouch] on the front of our flack and you could—you know every time we realized that it would get in the [way]. So we had to change the SOP and it was still [a problem, we] couldn't move when it was inside [a vehicle]. So this kid, I think he got it from Call of Duty, came up with the leg pouch ones where you just strap it on your leg and put your magazine pouches there.

> Most Marines are influenced by video games. When asked Have your Marines been affected by Call of Duty or some other Video Game? their response was a resounding Oh yes. Some Marine units changed the type of equipment they used based on the way it was used in a video game as mentioned above. Additionally, one Marine commented, They want to be unique and want to be [cool] and they want to be part of Call of Duty, basically.

The frequency of video game related comments were low (two times), but the emotion and follow-on discussion indicated a high intensity level (3) and resonance. The Marines participating in this study viewed video games as an influential opinion maker because these games gave them the ability to test a product virtually in a combat environment. Importantly, the fact that the test was virtual did not seem to detract from the influence generated by the experience.

Based on the data, people were the only opinion maker for the enlisted Marines. They did not provide comments on events or experiences, which was surprising because that sub-category was popular for the officers. This data suggest that enlisted Marines put their trust solely on people.

From these comments, two surprising themes were identified. The first theme was the effect Congress had on the Marine officers from the first focus group. The Marines related energy-efficient technologies with financial responsibility. As mentioned above, the comments suggest the actions of Congress effect how seriously Marines view certain initiatives, such as energy-efficient technologies in particular. The second theme was the effect video games have on Marines. In both focus groups, examples of Marines using a certain piece of gear were based on the gear used in Call of Duty. The comments seem to suggest that Marines are influenced by what special operations characters in the Call of Duty games are equipped with. Communication methods are discussed next.

2.   Communication Methods

Communication methods are defined as the medium by which information is transmitted to a Marine. Identifying the effective communication channels is important because communication channels spread information, and ultimately, link "opinion makers" to Marines' "perceptions" and acceptance of energy-efficient technologies. To generate discussion to bring out communication channels, participants were asked probing questions, such as, "How did you hear about it?" "How did you come to the decision to use it?" "Was that communication method effective?" Based on the frequency of responses and the discussion, the following key themes were identified: formal guidance, informal correspondence, and personal observation within the driver, communications methods.

a.   Formal Guidance

Formal guidance includes written guidance in directives and After Action Reports (AARs), and verbal orders passed down the chain of command. The sub-categories that comprise formal guidance are formal communications, AARs, and limiting resources because they are official methods of communications in the Marine Corps that have specific transmission channels.

(1)   Officers. Communicating through the chain of command is a formal method used daily to pass information up and down Marine ranks, and it comes in various methodologies. The more direct communication methods that Marine Corps

officers discussed during the focus groups came in form of written documents and or verbally communicated from a top down approach. For instance, one Marine commented:

> But it was directed by the president. I was a monitor when it came down and we actually had to go out and establish an organization. So the president directed all military services to do just that, so the SECDEF and everybody else followed suit. We created that element to support the guys that we were provided.

Another Marine had the Commandant's agenda in a formal written guidance emailed to them at their command." To that comment, one Marine stated:

> Yes, probably some of you have read the commandant's guidance on this energy-efficient technologies and in that document it kind of alludes to the fact that our reliance on fossil fuels is a critical vulnerability and the use of energy-efficient technologies is a critical capability. What are the measures of effectiveness? How do you define the way—the commandant alludes to it as it will enhance the combat effectiveness of the unit? So he talks about weaving this idea and the acceptance of it into the ethos of the Marine Corps and how that gets done. Well how do you even define the measure of effectiveness of these technologies? Is it number of lives saved because now we only have to do—there is a stat in the thing that says one death per 50 convoys? Is it now we extend that to 100 convoys per one death? Is that a measure of effectiveness that we are looking for? So to get the average lance corporal to buy into these things and okay, how is it going to affect my ability to move, shoot, and communicate and accomplish my mission at the grunt level? I don't think we have defined that exactly.

This communication channel has an impact on the Marines who actually read it. While it may not be a popular method, it still impacts the Marines' perception of key topics and initiatives. Based on this Marine's comment, the data suggest that the message of the use of energy-efficient technology was conveyed by the Commandant as clear and concise; however, the method of distribution was not effective because only one officer from the first focus group read the Commandant's Energy guidance based on a follow-up question generated from another Marine:

> I just want to say something. This points out what [Marine participant] was talking about when he said that he read this letter from the commandant. How many others, just show of hands, actually read that? (No hands were raised)

Additionally, many Marines commented on the importance of formal guidance as a communication method:

General Nally visited two years ago or something. He selectively told a bunch of Marines hey, you are going to be part of the new Energy Efficiency Department in the Marine Corps. There was a big hype about it and everybody was onboard, [they were] excited. They restructured the curriculum to take specific classes, economics related classes, etc. Then lately you know you talk to these Marines that got selected for this Energy-efficient Department on the ITM side of the house, basically most of the [COMOs] and stuff. Now you talk to them and they are saying, "Well it is kind of dying down. There is not much hype about it." So we are thinking well, where did it originally generate? Where did the hype start from? Was it the secretary of the Navy? Is it the Commandant of the Marine Corp's big idea? Who did that and what is the current office in the Marine Corps doing about it right now as well?

Marines conveyed, through the number of comments generated (11), which formal guidance from top leadership is essential to convey Marine Corps initiatives but must be translated down to the lowest level. As one Marine commented:

Well it is every level of command. That is where it comes to. Every level is [responsible], start at the top. At the service level, Headquarters Marine Corps saying this is what we need to do so then it goes down right down to the [MARFOR]. Then you have to translate how they are seeing it in their theater of operations. So you have got the MEF operating in Afghanistan, so now the MEF commander has to translate that down to his level…Which [passed down] to now the division, down to the [next level], the battalion, that makes that company [care]. Those commanders, how that affects them, that translates to them. [That's what responsible] leaders do.

To do this top down communication approach, Marines explained that some commands would hold "stand-downs" and inform every one of a current training initiative or current events. This "stand-down" can occur any time and any location. For example, one Marine stated:

All hands in the gym [huge formation in the gym], get everybody down, sit everybody down. Sometimes they use PowerPoint presentations, but usually that is the way that [information is passed].

Nine out of 11 participants in the first officer focus group agreed that it is a common method of communication in the Marine Corps and is effective at

reaching a large audience in a small amount of time. This medium is good to get the word out but is not effective when it comes to enforcing changes or having a deep impact as indicated in one Marine participant statement:

> I think that is the big piece of all of this as far as changing the mindset of the Marines and that is really what key leaders, the company commanders, captains, lieutenants and at that level—really, if you want to buy into this it has to be from the top down. Really at our level you have to take it, really accept it and push it to the Marines. Not just push it in the formations and say, Hey, here is what is going on. Read this.

The AAR was another form of communication mentioned. It is a formal method of communication Marines trust and use regularly. The AAR is not only a communication channel but also functions as an opinion maker. Opinions are formed based on the information within the communication of an AAR to Marine MOS communities. For example, Marine artillery units will send their AARs to other artillery units to enhance their success further and share lessons learned. Therefore, its significance is quite important. Marines use and trust AARs to help them make better decisions in the field. For example, one Marine stated:

> Yes, you have [After Action Reports]. You get [home after deployment] and after action [reports] gets compiled so [the] the system commander [is made aware]—hey, we look we have a real requirement, we need to fix this.

Their adoption was then increase because they are now better suited to the needs of the Marines. As one Marine commented"

> You get after action [reports] and this gets compiled so then the system commander [says] hey, look we have a real requirement, we need to fix this pack.

Based on these comments, AARs seem to suggest that Marines value this type of communication tool to spread information.

Although some of the sub-categories do not exhibit formal written guidance, verbal orders and/or the actions of leaders set a precedence of the leadership's priorities in form of limiting resources. This somewhat drastic method seems to convey an indirect message to Marines. For example, one Marine quoted:

The only way you can do that is cut the fuel in half and say here is what you have, live within it. This is the only way to do it. If you consume 100 gallons of fuel a day and you want to cut that to 50, the only way to do that is to only supply 50.

This method led to another Marine who provided an example of limiting resources with the following statement:

One thing that I saw happen right before I left Kandahar was that we had a set number of vehicles that were assigned to site command [out] there. Basically they limited the amount of use or the amount of fuel that we were allowed to give for those vehicles. So instead of driving all over base anytime we wanted, we had to be a little bit more efficient or judicious on how we used those vehicles.

Additionally, another Marine continued in the discussion by stating that leadership actions are integral in sending a message that involves limiting resources as a means of communication based on the following comment:

I think from the top down the way you communicate—like I said if you have say I am just going to throw fictitious numbers out there. If you have a company of Marines that uses 100 gallons of fuel a day and you want to cut that metric in half you say, alright, I want it to be cut in half. I only want you to use 50 gallons of fuel a day. If you still provide that company with 100 gallons of fuel a day, they are going to use it.

These statements seem to suggest that by limiting resources, the Marine Corps is sending a clear message of the importance of energy efficiency, which demonstrates a top-down approach, from the President, to the Commandant of the Marine Corps, to the individual Marine. An agreement seemed to exist that this method was effective because Marines find a way to fulfill the mission regardless of the amount of resources provided. From these comments, the data seem to suggest that Marine officers are slightly aware of the Marine Corps energy initiatives but are unclear of the why, and the purpose behind them.

(2)   Enlisted. From the comments during both enlisted focus groups, formal guidance as a means of communication seemed to be significant in listening to the remarks. However, enlisted Marines did not mention AARs as a means of communication, which could explain why they did not have events or experiences as an

opinion maker. Additionally, enlisted Marines did not provide any examples of hearing about energy-efficient initiatives but did state that formal guidance would be the best means of relaying the information. When the question was asked, "So what have you heard from higher about conserving energy? And define higher when, when you answer this question." The response was, "Any higher-ranking than me, I haven't heard nothing about it."

From the reaction from the rest of the enlisted Marines, this statement seemed to be the consensus of the focus group. However, a follow-on comment seemed to suggest that the method of communication should be from formal guidance pushed down. For example, one Marine commented:

> Umm, [It has to] start from the top, like Sergeant said, it's gotta come from the top, the commander gives his intent and spreads it down to the staff and it's up to the staff to spread it out.

The data suggest that one way enlisted Marines receive information is through their chain of command in the form of formal guidance. Comments relating to formal guidance and communications, and through limiting resources, were mentioned four, six, five times, respectively. The intensity of these comments is high (3) due to the follow-on discussion, which included many agreeing comments from other Marines and emotion through raised voices and excited body language.

b. *Informal Correspondence*

Informal correspondence includes word of mouth and news publications as an informal way of communicating from one Marine to another. An example would be one Marine talking to another Marine about a personal experience in an informal way.

(1) Officers. In the officer focus groups, the Marines indicate that informal correspondence is a highly used method of communication as illustrated in the following quotes. For example, one Marine commented, "Absolutely. Pre-deployment everybody is like "Hey, where did you get that?" Next thing you know everybody has got the same GPS."

Another Marine commented on hearing a story about GREENS from a peer, which illustrates the importance of word of mouth as a communication channel:

> I can't speak personally on the use of it, I can only speak of what [I heard] talking to friends of mine in the artillery community that actually used them out in 29 Palms and things I heard back from it was it was a good intention, but in order to get the gear out there it took an entirely separate seven ton. As well as when you get out there for artillery, the intent is get it in place very fast, fire downrange very fast to support the unit you are shooting for and setting these up from my understanding was pretty difficult.

This comment seems to suggest that this particular Marine had no real personal experience with energy conserving technologies but trusted the stories he heard and put a large amount of trust in his peers' views.

The data suggest that views held by the Marines in the focus group were strong and authoritative enough to illustrate that they trusted their source and believed them wholeheartedly even though they had not come in contact with a particular product. One particular example was the use of iPad's onboard helicopters. The iPads were being used for onboard maps vice existing maps due to how effective they were:

> I know our squadron…started using iPads in the cockpit, even though it wasn't authorized, to replace their [maps] because we don't have a moving map…But that was initially a west coast squadron used [item] to buy it and then they would pass it on to the replacement squadron.

Another Marine continued the discussion stating:

> Well that was the thing. I think it was a west coast squadron that started it. Like 169, I think [they] might have started it and then they just passed it on and then everybody went, Oh this is a great idea. A moving map that we can actually use in the cockpit. [That is] exactly how it happened. Guys came into our Squadron Support Division, the Aviation Supply Department and they were like, Hey we saw this squadron out there while we were doing this training and they had these iPads and it was great. Can we get some?

These word of mouth examples are simple, yet an effective communication method used among Marines. Word of mouth was mentioned four times; however, the message that was conveyed through word of mouth influenced a Marine to adopt or not adopt a specific product, which was rated (3) on the intensity scale.

The Marines in both NPS focus groups said that USMC publications were a method of communication that provided some positive press on the use of energy-efficient technologies. In November 2012, the Marine Corps Gazette published an article discussing the use of an energy-efficient technology in Helmand Province, Afghanistan. This particular technology is Ground Renewable Expeditionary Energy Network Systems (GREENS). The article not only elaborated on the purpose of GREENS but also its success in improving the communication reliability in the field through solar arrays. As one Marine commented:

> I actually had a buddy who was one of the first guys to work in the Expeditionary Energy Office and he went to Afghanistan and installed the solar panels out there and it seemed like it was a pretty big hit for the locals out there and it worked pretty well. It got an article written up in the Gazette and everything. It worked out well for him, so I think that is a success story in a sea of angst that is sort of building here.

This comment was followed up by another comment relating publications as a means of communication by providing the following statement:

> Over the years there has been articles in Gazette, Leatherneck, that cover expeditionary energy-efficient systems. I believe that the GREENS [technology] I never saw any deployed, but there [have] been articles over the last couple of years that have been talking about it.

Both these examples seem to suggest that Marines are either reading or hearing about positive outcomes of energy-efficient technology from different modes of publications, but how Marines value the publication, as truth, is another story.

(2) Enlisted. The trend of word of mouth and news publications continued as an informal way of communicating from one Marine to another during the enlisted focus groups. However, news publications seemed not to be a relevant

mode of communications due to the reality that enlisted Marines would tend not to read about energy-efficient initiates as evident in the following comments:

Everybody reads the Marine Times.

That would be a good venue.

But, that being said, who reads the Marine Times, sees energy-efficiency, and then skips past to [the pay article].

The following series of comments seem to suggest that enlisted Marines read the *Marine Corps Times* but will only read an article that provides some sort of value to them. One method brought up time and time again was just through word of mouth. Word of mouth was mentioned 10 times between both of the enlisted focus groups and the intensity was a high (3) based on the following discussion and agreement amongst the Marines. For example, one Marine commented on certain equipment:

If it works maybe I'll tell people, that, Yeah, this is legit, you know, It's awesome, I've had it for a year and it hasn't broke, you know, stuff like that.

Additionally, other comments referenced the use of word of mouth as a means of communication by adding into the discussion about 550 cord (a commonly used rope with a tensile strength of 550 pounds).

I would probably continue using it, I would tell other Marines about it, you know, share it, have them use it, you know, tell them where they can go get it, thinks like that, of course, you know? If I think it's better than 550 cord. 550 cord is amazing, it's an amazing piece of equipment.

New publications, based on the comments, seemed to be a good method of communication "because everyone reads the *Marine Corps Times*" but articles must provide some sort of benefit to the reader to achieve interest that in turn might translate into successful adoption. On the other hand, the data suggest that word of mouth is the most effective communication channel because that is how Marines spread information. Marines seem to tell other Marines about a product that was successful or vice versa. In both these instances, Marines are putting value in what other Marines say and are drawn to material that can provide some sort of benefit to them.

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c. *Personal Observation*

Personal observation is the critical component that Marines indicated as a means of communication. For example, a Marine using a piece of equipment and experiencing its pros and cons as a way of receiving information about it carries a lot of weigh in the product's effectiveness that establishes acceptance. From the responses and reaction from the Marines, sub-categories were identified that comprise personal observation: demonstration, reliability, and proof of concept.

(1)   Officers. Marines stated that testing the new technology was a chief characteristic and driver of adoption. Not only does the existence of test data have to be present, it also has to be reliable as one Marine indicated in the following comment. "Since it is a new technology there could be kinks in it, so reliability may be an issue."

A successful proof of concept of a new technology must perform as intended by the supplier in various environments. For example, one Marine participant stated:

> The key initially I think is going to be that this is got to be like a supplemental. You have got a proof of concept. Say like the MTVR, the sides become solar panels. They simply run that to an outlet where you can like plug into for other things and you can power, so again it becomes a power source. If it breaks, we don't have that power, so it doesn't affect the running of the vehicle. See what I am saying?

From this comment, it could be argued that Marines have a higher likelihood of adopting energy conserving technology if a certain degree of trust exists in the products' tested capabilities. By observing a product's effectiveness through a proof of concept, and determining if it is reliable or not, translates into adoption or non-adoption.

In analyzing the responses to understand how a Marine is passed information, and then in turn, determines if it is an effective communication method, several noteworthy discoveries were found. First, formal guidance from the chain of command is necessary as a mode of communication but must contain sincere motives. In

essence, leaders at each level in the chain of command must communicate to their units why energy-efficient technologies is important and translate the value it provides to adopt them. Marines also said that leaders need to set the example in garrison (units at their permanent military post) to communicate consistency based on the following comment;

> But I mean this guy [would have to walk the walk]. I mean if he said—you know when [I turn off my lights] in the morning. Then his was off. You know? If the colonel's is off then yours better not be on. It is that kind of mindset. If the colonel can do this [I can] but there has got to be no sense of entitlement or exclusion to the rule. When you push solar power but then you see the CGs can with a dedicated generator it kind of sends the wrong message. It also happens in garrison. When you work in a building with three generals or three people with stars on their collars and each of them has their own Chevy Tahoe with a driver, it just sends the wrong message.

In other words, the idea or concept of energy efficiency would be engrained at all levels and stressed as a way of life. It would set the example and communicate that energy-efficient behaviors are a way of life and would increase the likelihood of adopting energy-efficient technologies. This example would have to be continuous, consistent, and supported at all levels. Secondly, word of mouth was a trusted avenue to relay information from one person to another. Marines value another Marines' comments or suggestions, whether through written material, such as AARs, or as simple as verbal communication methods.

(2) Enlisted. Personal observation was also important as a means of communication during the enlisted focus groups by referencing it four times. However, from the responses and reaction from the Marines, it was determined that the proof of concept, demonstration, and reliability comments fit better in the perception of solution high-level driver section. With that said, enlisted Marines conveyed that personal observation was an important communication method. For example, one Marine commented:

> Because you've used it and it works or you've seen people using it and it works or a friend told you that it works or things like that, things of that nature, you know, so…um, you really don't use one until you buy one so you're kind of taking everybody else's word for it.

This comment seems to suggest that observing a product and its usefulness is essential for adoption.

The following list highlights the top three channels of communication by importance (1 being the most important):

1.   Word of Mouth
2.   Formal Guidance
3.   Personal Observation

The data suggest that Marines rely on other Marines for information, which is done informally, through discussions with peers (word of mouth). This communication channel was the strongest based on frequency and intensity. The second channel, formal guidance, is through the chain of command issuing written or verbal orders. The data suggest that it is also highly effective due to the nature of the military culture. The third channel, personal observation, is achieved through personally experiencing the advantages and disadvantages of a certain technology. The experience itself is a communication channel that also leads to Word of Mouth.

3.   Perception of the Problem

In the framework, identified is a Marine's awareness of the need for energy-efficient technologies as an important driver of adoption. The literature suggests that Marine's perception of the need for energy-efficient technologies will affect successful adoption or resistance. Thus, Marines' perceptions of the problem created by fossil fuel dependency are explored. In "perception of the problem," we the following key themes are identified: definition of energy-efficient technology, and perceived image of energy-efficient technologies.

a.   Definition of Energy-efficient Technology

The Marines in this focus groups agreed that using resources is a cost of doing business. They understand that fossil fuel use may be a problem but they are not quite sure how to define or specify it. Therefore, "definition of energy-efficient technology" was identified as a key theme. The issue of definition was mentioned 12 times. The overall intensity was high (3) because of the emotion and follow-on

discussion. The Marines' comments can be divided into two categories. The first category is behavior versus technology. Some Marines think energy efficiency should come in the form of equipment in the deployed environment. Some Marines define energy-efficient technology as something that helps change behavior. These multiple views illustrate that Marines have different opinions about what the problem is. The data suggest that some think it is a behavioral problem while others think it is a technological problem. An example would be using existing equipment but altering behaviors to consume less power. Shutting off lights and turning engines off when not in use is a specific example. One Marine commented:

> Yes, we probably need to just do a survey and find out where are the costs coming from and you know if we are looking at the tactical threshold versus the facility threshold, figure out that first and separate those. Some will mesh on both.

This data suggest that Marines think that it is important to identify the high-cost drivers and alter behavior to avoid high costs. It also suggests that a difference exists between energy efficiency in facilities (barracks or bases) and the energy efficiency that would be used in the field. Similarly, another Marine stated:

> Well that was what I was saying. I think there are two different sides. There may be the more technical side of energy efficiencies and then there is the more cost cutting savings like hey, it is like telling your kids to turn off the lights in the house type of deal. If you are working, then you are going to lunch for two hours, well turn off the lights. You know? Is there two different areas that you can focus on?

Then, another Marine states that he has only seen energy efficiency as a behavioral factor and nothing else:

> Okay, so in a garrison fleet environment, the first time I remember, you know, 'turn your lights off,' the government is requiring us to cut back our energy consumption—electricity basically. So you know now all the rooms have to be set to [a certain temperature]. You have to suffer. When it is hot, you know instead of being 72 it is 74 or 76. So it was a facilities standpoint. [That was] the first time that I can remember hearing it. The automatic light switches in rooms, you know having the duty to make sure you walk around and shut all the lights off when everybody is gone, turning computer monitors off to meet the standards that [were being set] and I don't remember who created it, but the 30% reduction basically in

DoD energy use. So for me, from a facilities ground logistics perspective, that was the first time that energy efficiency was ever discussed. Now it is hardly ever discussed in a deployed environment, but it is really only in a garrison environment.

Another Marine commented as to why he thought the USMC is concentrating on behavior in garrison:

> But in the strategy, the Marine Corps is starting off with facilities so that we can see the plausibility of how it goes in an expeditionary environment.

> I would argue that is a big problem with the Marine Corps because we have gotten so wrapped around the axel on large installations, large [bases] you know? We are looking at the low hanging fruit of these massive structures, but are we planning on fighting another Afghanistan where we go and set up huge bases, which by the way, undermining our entire amphibious doctrine?

This comment suggests that Marines think the Marine Corps are trying to change behavior first, which will lead to the adoption of energy-efficient technologies later. This Marine, however, thought the idea of having big bases while in theater goes against the Marine Corps methodology of being an expeditionary force, which would suggest the whole point is moot.

Furthermore, another Marine raised the issue that additional uses of power on bases while deployed could be avoided. These data suggest that a whole category of behaviors could be eliminated or reduced to include the restaurants and shops on big bases in theater, such as Kandahar and Leatherneck.

> A lot of stuff that is out there now is just creature comfort stuff. Like you go to Leatherneck and they have got Wi-Fi for everybody, you know I remember when I was in Al Asad we had Baskin Robbins, Burger King, I mean Kandahar we had TGIFridays there on the boardwalk. There were all kinds of stuff there that were not [essential]. You don't need it. I mean it is great to have it, it keeps Marines occupied and out of trouble and makes them feel more at home I guess, but you know there is a lot of burdens that we put on ourselves.

Technology is the second part of this category of defining what energy-efficient technology is, which includes using energy-efficient equipment, such as solar panels in the field or a hybrid Humvee. The data suggest that some Marines think the emphasis on energy efficiency should be on technologies used in the field on deployment. One Marine commented:

Well I think again it is two issues because this comes down to money when we talked about the installations and solar power and it is obviously a long term [solution] to save money in budget constraints. So that is one thing that they are going [to] and a lot of that we do go in theater somewhere and you do set up a large logistics operations kind of control hub that obviously, basically, you can do that same thing to reduce your requirements for fuel for generators in Iraq and Afghanistan. But [let's] truly talk expeditionary, you know, we need to think of like that battalion, that company out operating. It is hard because OIF and OEF, a lot of what we have been doing is based off operating and people are thinking of the big FOBs which are bases almost, but I think the key forward is what you are saying. That company going forward out operating, hey you have got vehicles you know, you [have got] an MRAP, a MTVR, a Humvee, the next joint fighting vehicle, with Marines in it, the gear we carry, how can we use this energy-efficient technology? That is where the real problem is because everybody knows it is easy to put solar panels on base and hey, we can save some money hopefully long term after we recoup the initial cost to reduce the need for fossil fuels.

This data suggest that Marines do not know how energy-efficient technologies will be used in the field or IF they can be used in the field at all. The data suggest they doubt their purpose in a deployed environment. Furthermore, another Marine stated that the focus should be on equipment used in the field:

Even though I haven't seen this used in a military application it is out there and it just becomes whether it becomes cost effective. I think solar power has a lot of opportunity, but it needs to be [adapted] to the point of use and I think that can be done because now they basically [have] solar panels woven into a lot of materials. So I mean you can put that [into a lot of things]. It can be incorporated into the [Alice] packs, whatever we call them, the [Molly] packs—whatever the name is now for the packs. Even possibly into your uniform into like your cover or something. These are the kinds of things to be able to get enough to provide [energy] because if you can do that point of use, everybody has it, then everybody has enough for themselves. Even like vehicles, like generators, make it as part of the generator itself so that way obviously you know you are going to need to

run a generator, but integrating into the casing solar panels to provide that extra boost when you don't have to run the generator as much if you are able during good weather. But those kinds of things, incorporating it into literally vehicles and somehow like into the sides of MTVR.

This comment suggests that energy efficiency should be focused on equipment brought into the field. It should be involved with equipment that everybody or every unit is issued so everybody can be energy-efficient.

The second category of definition is focus. Some Marines think the Marine Corps have the wrong focus. The data suggest that some Marines think the focus should be on units that consume the most resources (Aviation); however, the aviation fuel is taken out of Navy's budget and is not a Marine issue. Even though some Marines think Aviation should be targeted for efficiency improvements, they also think it is impossible:

I think anywhere you have aircraft there is a pretty good footprint. Anyway…I think you kind of hit on it too, you are not going to make a jet engine much [more energy-efficient]. I mean yes, there are incremental gains in efficiency, but that is not really what we are talking about. There is a huge amount of GSE or just the personnel to maintain that and maintain the aircraft.

Another Marine commented on how difficult it would be to make the aviation community more energy-efficient:

Impossible, yes. Making the actual aircraft more efficient? You know fuel is a source of energy, so how are we going to get an F18 from consuming 600 gallons to 400 gallons?

Vigorous nods of approval were seen when the Marines were asked if the aviation community uses the most fuel. In other words, the community with the highest fuel cost has the most potential to reduce costs. Due to the nature of aircraft, however, the Marines agreed that this would be impossible. Therefore, the perception of this part of the problem is that it cannot be fixed at this time.

In addition, another Marine alluded that the Marine Corps is straying away from their grass-roots methodology as an amphibious force, which leads them to focus on the wrong type of equipment to adapt into energy-efficient technologies:

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You both bring up really good points and I think there is a big misconception of what energy-efficient technology is versus trying to find ways to suck more energy and stick it on non-energy-efficient technologies like the MRAP is not energy-efficient. [That would] require humongous amounts of cooling power in order to facilitate. We get spoiled and we have FOBs out in Iraq that had satellite television being pumped out to them. You know, like what is going on? The amphibious doctrine, the quick expeditionary force that we were before Iraq and Afghanistan is dwindling and now we are losing sight of that and now we are not looking at what is energy-efficient like [what] in a backpack is energy-efficient? We are looking at like MTVRs and like MRAPs.

Therefore, part of the problem is defining what it is. They do think it is a necessary sacrifice to get the mission or job done. It is the price of freedom. Therefore, they did not think it was a huge problem that needed solving. One Marine stated, "Is there a problem?" Another Marine stated the importance of definition in general:

I think everybody is saying a lot of great things. I think the definition of conserving energy is important to be laid out to begin with because if you plug your computer into a solar panel and you think, Oh, I am conserving energy. [Really,] you are using the same amount of energy, you are just getting it from a different place. So I think not using the computer is as much the answer and I think that sort of mindset is what needs to be pushed down. I think you are asking how does that happen, but I think it partly should be rolled up maybe in part of that training or what have you, exactly what that means. I think right now when everybody thinks conserve energy, they think like I am driving my Prius, which maybe is conserving energy, I don't know, but like you are using solar panels or something like that. You are trying to sell it to a bunch of people like Lance Corporals who go out and buy big F250s and stuff.

The enlisted Marines did not mention defining energy-efficient technologies as a problem. They also did not know about the existence of the E2O, GREENS, or SPACES. This data may suggest that not enough information is available about these topics readily accessible to them to have the opportunity to be confusing. Overall, however, the data suggest that the problem that energy-efficient technologies serve to solve is not clear or the same across Marines.

4.   Perceived Image of Energy-efficiency Initiatives

a.   Officer

The data suggest that the problem has to be important at each level and examples need to be set by leaders and especially the key leaders as described above and incentivize Marines to use energy-efficient technologies. The group felt that the battalion commanders and company commanders are key leaders to instill energy efficiency as a change to the end user's perceived image of energy efficiency initiatives. A Marine commented:

> The other thing is in the commandant's document—so I am not a genius here, I am just kind of regurgitating what I have learned, but he talks about weaving it into the doctrine. As doctrine changes, which it is going to because we are not doing too many amphibious landings these days and we probably won't be, so as doctrine starts to change you have to weave it in there. We train how we fight, that is everybody that is already in knows that, right, so over time I think it is going to be doctrinally acceptable. It is going to take a while. Everything as far as the existing Marines as far as getting them to get the buy in and everything all these gents already said I agree with. The other thing is at the commander level, at the top down you have to have a reporting metric to make people care, which they do. There is actually an expeditionary office in all the MARFORs now and possibly every major MFC I think. It talks about—the guidance document also talks about it is going to become a [DRRS] reporting item (Defense Readiness Reporting System). Most officers know what that is, a lot of staff and COs know what that is because they have a reporting requirement to submit to that. That document is how commanders will be evaluated on their energy efficiency so they are going to care because it is going to affect them directly and that is how you—a way to gain buy in.

The battalion commanders' and company commanders' roles play a distinct part in influencing what the operators, the Marines on the ground, think about a topic. They have the most direct link and will impact Marines the most. Furthermore, the Marines suggested that Marines should be targeted early on to stress the importance of energy conservation in general that would come in the form of instruction in boot camp and in the schools that follow boot camp. A Marine commented:

> Even at the recruit training level and OCS, the whole purpose—and TBS—the whole purpose of those schools is to make a Marine a basic rifleman and to make an officer a provisional [rifle] platoon commander.

So it would be expeditionary energy skills you learn there are going to be at the grunt, infantry, basic level. These are the basic things you need to know. Then once you go to your MOS school, whatever that is, you are going to have certain energy-efficient technologies that are specific to your MOS that you will learn. So it is kind of—it is a pipeline and it is going to be a process and it is going to take a long time.

Another Marine added:

I think there are two populations that need to be looked at. You have those that are already in the Marine Corps who already are operating with a specific mindset because that is the way they have come up and then you have those that are in recruit training, OCS, your brand new assimilating folks who are making the transformation. So they don't know anything, so if you start it there, that is where you really plant the seed for this mindset. Then that will be easier, in my opinion, than the transition that has to be made with those already serving because they are already used to doing what they have always done that has been proven, that they are used to it.

The Marine Corps would have to introduce energy conserving techniques and equipment in their specialty schools. The data show that strong emphasis must be placed on energy efficiency to demonstrate it is not a fad in the Marine Corps, but a way of life.

When the focus group was asked, "what would be an effective way to reach Marines and communicate the importance of energy-efficient technologies?" They agreed that less resources supplied to accomplish the same mission would send a message. The message would be that this initiative of energy conservation is important and it is necessary to ascertain how to perform a job with using less, which would bolster and incentivize the use of energy-efficient technologies because no other alternative is available. Granted, it would not be easy and it would not be across the board for all missions and programs. However, if the Marine Corps picked appropriate areas to allocate fewer resources to, then the soldiers would find a way to get it done. One Marine commented:

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I think from the top down the way you communicate—like I said if you have say I am just going to throw fictitious numbers out there. If you have a company of Marines that uses 100 gallons of fuel a day and you want to cut that metric in half you say, alright, I want it to be cut in half. I only want you to use 50 gallons of fuel a day. If you still provide that company with 100 gallons of fuel a day, they are going to use it.

Three other Marines passionately added the following comments:

The only way you know is to cut their budget.

Again, the problem with—I think what they are doing, that is very high numbers. That is like literally taking all the Marines in country and look at all the fuel that is used for jets, generators, vehicles, everything. So you can put that number so you can't really go to a unit and say per se half because of who controls what. This guy—yes, I think it needs to be translated into actionable items. Like any messages or any strategic guidance, you can't take that and give it to the tactical level as is and expect them to understand what to do. They have got to translate that message down so it gets down to that level and it is actionable. They know that means to me is hey, look—and that is what you have got to—it has to be translated into that look, we are going to reduce electricity. No lights on after such an hour unless you are up doing operations. No—generators will be turned off at this, showers will be reduced to reduce hot water usage. Those kind of things that the Marine can understand and that those NCOs can force them to do and that kind of stuff.

So yes, exactly. So I mean turn off lights, make sure the water is not running whenever it shouldn't be, taking [long] showers, doing the small things that are going to help you become more efficient before you start worrying about the technology.

The Marines explain that if the end user's resources are reduced, but they are expected to maintain the same effectiveness level, the end user will look for alternative methods to extend their supply.

Marines then elaborated on the origins of their perceptions. The data also suggest that Marines have a negative view towards the energy efficiency initiatives because of its association with Congress. The intensity of the Congress comments was high (3) due to the emotion and consensus among the group. The "perceived image of energy-efficient initiatives" is that it cannot be taken seriously because of how closely

tied it is with Congress. Marines have a hard time taking Congress seriously and therefore cannot take the energy-efficient initiative seriously. As one Marine commented:

> I think it is comical that we try and use the word efficiency when we start thinking about Congress and the political system because at the end of the day it is the most inefficient system. So we have these great notions of what we want to do and like forgetting about energy for a minute and let's talking about fiscal responsibility. The military is a horrible example of fiscal responsibility. We are the most irresponsibly organized group because of the way Congress sets it up. If you don't spend it, you don't get it next year. Like there is no; 'hey, let's plan to set this money aside.' It is like you said, feast or famine. When you got it you better spend it because it is not going to be there. I am not even going to go down that road because we all know it. But that is what I am saying like when we think about outside the Marine Corps and we talk about being efficient and responsible, ball it up and throw it out the window because it honestly has no play. It is just a complete joke to even [take it seriously].

> Another Marine added to that:

> And that is one of those pillars that should support the easy adaptation of being energy-efficient. So if we are not fiscally efficient, then why the hell are we going to be energy-efficient? It is just another fad.

> This statement suggests that Marines view the problem of fossil fuels as one of limited real consequence and the need for energy efficiency as a short-term, knee jerk reaction to a tight budget rather than to a long-term serious problem. They cannot take it seriously because of how Congress acts as a whole in other areas of spending. It was surprising how much Marines seem to take the actions of Congress into account. On the other side, a different Marine saw the problem as a perceived image but from another standpoint. This Marine argued that the Marine Corps is taking on energy-efficient initiatives because they want to look good in the eyes of Congress:

> The reason we are doing it though is that we want to be energy-efficient— why? Because it makes us look good to Congress and they say hey, they even have less money—so I think it ties into it because right now the Marine Corps is under scrutiny again because by the way, like I agree with what you said. If we were just going to be a 15 day sustainable force, but man tell me the last time you went and sat at a MEU somewhere for 15 days and then a large army came in and took over? Like unfortunately we have strayed so far from our amphibious doctrine that is just not what we are fighting. Congress and the Marine Corps [together] looked at the

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Marine Corps and said, "Holy mother of God how much money have you guys spent in Afghanistan?" Because set up these frou frou cupcake camps and we have all these things there. Now we have to look at it and be like, man—.

The data suggest that energy-efficient initiatives conflict with long held values and traditions. Those values and traditions are operating as an expeditionary force with a high amount of mobility. The data suggest they do not like traveling with all their existing equipment to a stationary base in theater as it is. The fielding of more equipment to test and use is pushing them farther away from being mobile.

b.   *Enlisted*

The enlisted Marines comments suggested a high concern over the perceived image of energy efficiency initiatives. The following comment set the tone of the conversation displaying dissatisfaction with the Department of Defense's (DoD) push for energy-efficient technologies. The Marine stated:

> We are, as a military, whether it's the Army, Marine Corps, the Navy, Air Force, some of the biggest wasters in the entire world. More so than any other organization, any other place that I can really think of. I mean, even in Third World countries they find a can laying on the side of the road, they take it home so they can use it as a pot. You know, we create those cans, so to speak.

This comment demonstrates that enlisted Marines feel that an ulterior motive exists in integrating energy-efficient technology in the military. Other Marines stated that to change this negative perception, all levels must show genuine care of energy efficiency. Some enlisted Marines strongly felt the benefits of energy-efficient technologies with the following comments:

> It's just makes sense to not have to rely on anybody else. If we're self-sufficient, we're not relying on anyone else to do it for us. We're doing it ourselves and with our organization it's important that we remain self-sufficient and not needing the community.

This comment suggests that some participants felt Marines have lost their expeditionary roots and implies that some energy-efficient initiatives are tied to non-expeditionary strategies, which would suggest that Marines think solutions that bring

them farther away from being expeditionary is a waste of time. Other Marines stated that using energy-efficient technologies could yield monetary benefits. Seven comments focused on their units running out of money or not having sufficient funds for training. The data suggest that the enlisted Marines felt that energy-efficient technology may save money and increase funds available to their unit.

> Everything's just cost-efficient if we do it that way. It, it, it stays away from the fact that we start dipping into this whole sequestration with, you know, messing with career Marines' retirement, you know, Marines going to college, you know, for the Tuition Assistance Program that got pulled and then it goes back again, you know, it's all about money. So everything that we can do I…the way I look at it, everything you do to save money, everything that's cost-efficient can help benefit all of us, all around the military.

Based on the data, the problem appears to be that DoD has a negative public image. A Marine added that the benefits of energy-efficient technologies might improve the DoD's public image. The comment suggests that energy-efficient technologies can demonstrate an image of financial responsibility.

> To expand on that a little bit, if you're not costing as much and there's the potential there to have surplus energy that you can then sell back to, like, the general populace, like citizens? Then, that does something to the military in general's, like, people's perception of it, like, people will look more favorably, I feel like, on the military and on the Department of Defense if there is that kind of like, community interaction, uh, between the energy surplus and then selling it back to the community or selling it to, like, other organizations. Does that make sense?

Another Marine added, "And it's gonna make us look better, just in general as an entire society of Marines."

It was found that enlisted Marines feel that the Marine Corps has a wasteful image. This comment implies that energy efficiency cannot be taken seriously when undertaken by an organization that consistently consumes high amounts of fossil fuels to accomplish its mission. The data suggest that to the extent that Marines perceive that fossil fuel dependency is a problem, it is one of perceptions. Marines suggested that fossil fuel use might indicate a lack of fiscal responsibility and long-term planning.

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5. Perception of the Solution

The final driver of this framework addresses the Marine's "perception of the solution." The "perception of the solution" demonstrates an end user's potential plan to solve an existing issue. Based on the data collected, it was found that a Marine's "perception of the solution" is constructed from a "perception of the problem." The "perception of the solution" driver contains three key themes: cost, traditions and norms, and product effectiveness.

a. Cost

(1) Officers. The key theme, cost, does not have a sub-category; however, definitions of cost are varied. Cost type comments were mentioned 15 times between both NPS focus groups. The intensity was ranked as high (3) due to the emotion attached to each comment and the follow-on discussion. The data suggest that some Marines view that the implementation of energy-efficient technologies involves different forms of cost. For example, one Marine focused on the monetary aspect with his comment:

> I would say once the CO started looking at his budget and it got cut when [we had continuing] resolutions it was like, hey how can we save money? Oh, fuel costs us how much? Okay we are going to cut that. It wasn't necessarily looking at conserving energy, it was because fuel costs X amount of money out of his budget. So at the tactical level it is how do we reduce the amount of fuel that we are using to save money so that we can do these other things?

On the other hand, they were more concerned with money and time. For example, one Marine stated:

> Time, you know. How much more time am I going to have to commit to perform the task? How much more budget? What am I going to have to sacrifice in my budget in order to accommodate this and how do you balance out that long term/short term type aspect?

In addition, another Marine added:

> I was going to say with the cost, I mean it is also the money that goes into it, but the time and the effort it takes to maintain it and move it and also the reliability because if that thing goes down, do we have to have two or

three systems instead of just one system in case that system goes down, so we actually have to buy three of them for every one generator we use now? What is it actually going to cost to keep our operations going?

The data suggest that Marine officers are thinking about many variations of cost and that they are also very forward thinking because they discussed the need for multiple backup systems of energy-efficient technologies. The Marine above is suggesting that not only would they bring multiple energy-efficient technologies to serve one purpose but they would also be bringing the non-energy-efficient technology because it is tried and tested and units would want something they know works while testing the new equipment. That issue raises many negative aspects about their perception of the solution. The data suggest that Marines perceived energy-efficient technologies as very complex and costly.

(2)   Enlisted. The key theme, cost, was also a prevalent factor across both enlisted focus groups. It had a frequency of seven times and the intensity was high (3) due to emotion and follow-on discussion. The data suggest that enlisted Marines thought energy-efficient technology initiatives are being brought about because the existing solutions are expensive and that a lack of funds occurs within the USMC. As one Marine commented:

> I agree with you, Gunny, and that's another thing that comes back on the Marines, they tell us all the time, "we're running out of money, we're running out of money, we're running out of money" and so we'll have to go out and buy our own batteries from a store because one, like he said, half the time they won't even work so, I mean, we can talk about saving money all day long but it'll come down to the Marine anyway because we'll spend our own money just to make sure it works.

These comments suggest that enlisted Marines think a funding shortfall exists due to how costly their existing fossil fuel dependent equipment is. When asked the question, "Who has heard about units running out of money?" they responded with:

You hear it all the time.

Oh yeah.

I've heard rumors of first IR being ninety grand in the hole.

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I've heard a rumor that my unit is one hundred ninety grand in the hole.

I got word about a month ago that First Marine Division was $1.5 million in the hole, alright? So it's across the Marine Corps, it's just the budget they give us, the money's out there, it's just the budget that they give you.

Another Marine gave a specific example of what is costly about the current solutions. The conversation steered towards traditional power sources, such as batteries. The data suggest that some Marines think non-rechargeable batteries are too expensive, "It's not only just buying the batteries; it's when we get rid of them too."

Additionally, another Marine elaborated on costs associated with traditional batteries:

It takes a large chunk out of the training budget. I specifically work in HazMat [Hazardous Materials] and each barrel [of used] batteries [is weighed.] And obviously all the batteries in a fifty-five gallon drum are heavy so it usually costs us about $800 per barrel to get rid of, so that's where the re-chargeable batteries come in.

These last two comments suggest that enlisted Marines view traditional batteries as expensive, and for this reason, think energy-efficient solutions have increased importance. It is a little surprising to learn how often funding is talked about from superiors down to the enlisted Marines, which may suggest that leaders want their soldiers to understand they cannot do certain things because of a lack of money. Some comments suggest that the problem is having money for other important programs. If that is the case, then this suggests that spending money on energy-efficient technologies will not free up money for other important programs but actually create more of a problem.

b.   Traditions and Norms

(1)   Officers. The key theme, traditions and norms, as similar to Kleijnen, Lee, and Wetzel's (2009) definition, is interpreted as: "inherited body of customs and beliefs within a relevant social context" (p. 348). Kleijnen, Lee, and Wetzel (2009) also state that traditions and norms "suggest that culture and society create so-called diffusion thresholds, when innovations go beyond this threshold they will be

resisted" (p. 348). This concept is relevant to this study because the Marine Corps have deep roots in their culture and will most likely effect adoption. Traditions and norms contain the sub-categories ethos and perceived image of energy efficiency initiatives. Ethos was mentioned five times and its intensity is a moderate (2) based on moderate frequency but it still evoked follow-on discussion. Perceived image was mentioned three times and its intensity is a moderate (2) due to the emotion and head nods it produced. Traditions and norms are associated with the "ethos," which is a commonly used term to describe the culture within the Marine Corps. The data suggest that Marines think the culture must be changed from within for energy efficiency to occur overall. One Marine commented on how a typical way of life consumes a lot of energy and how the non-essential equipment should be reduced:

> Not allowing everybody to have a [TV]. We joke about it, but it is amazing how much power is actually taken when people start hooking up TVs and coffee pots and all the other little things that get hooked up in a COC type area and you start taking away some computers and things like that. You walk into some places and they have three or four computers per station all of them drawing that four watts every hour or so.

This comment suggests that the Marine culture enables or approves of people using multiple monitors when they could get by with one. It also suggests many areas could be targeted for reduction in consuming energy (TVs, coffee pots, etc.). The next comment illustrates the resistant view some Marines have taken towards energy-efficient solutions, which is embedded in their culture: "I want to repeat what participant 2 said, just cut down on fuel? So if you told me to cut down on my fuel, I would tell you to go [expletive] yourself." This emotional comment suggests that Marines who perceive change as challenging may negatively impact the execution of their mission. This resistance is a natural reaction because they would prefer to use tested technologies that have worked in the past.

Another component of ethos in the Marine Corps is the fact that Marines need to be successful at their mission. The data suggest that Marines understand what works and what does not work for their mission. One Marine commented that they spend the money to provide every Marine a certain piece of gear for insurance purposes:

I have one example and it talks about what another participant was saying is that we had a package come in for individual man pack bridges and the justification statement was solid. They had a no kidding beef for these things, but I mean when you talk about efficiency, it is really not efficient for each individual to have a man pack bridge to cross [a river]. Maybe a company bridge or something like that, but—so when you talk about efficiencies, it is really counter to that. Now everybody has got a man pack bridge, just a bridge that he carries on his backpack—but the justification came through and you know it was no kidding these things were possibly going to save lives. It goes to what someone else was saying is that when it comes down to it, sometimes it is a cost of doing business is that we are just going to be inefficient because we need to. Because we as a nation put a premium on human life and not only human life, sometimes human comforts for [Marines] and things like that.

This comment implies that Marines think it is better to be safe and outfit everyone with a piece of gear that might save their lives. The comment illustrates that not only does the Marine Corps put a premium on safety, but the country does as well, which suggests that some think that the Marine Corps can afford to be energy inefficient to possibly save lives.

The discussion following these comments shifted towards possible solutions to combat the negative perceptions. This next comment illustrates that training and educating a new Marine recruit about energy-efficient technologies and behavior is not enough. It suggests that once new Marines enter the fleet, Marines with more time in (who are resistant) will instruct new Marines that the energy-efficient way is not how the mission is completed, but rather, the traditional way of doing business:

I have a question for that. So you train the recruits, in Officer Candidate School (OCS) or the incoming [enlisted] Marines on how to train them on the system that you want them to use. When they get to the unit, there are people that are already used to a certain method, who will change [the new Marine's] training and revert back to the traditional system.

You see it all the time, you always hear there is the way you learn how to do things and the way it is really done. But if you do that at OCS and [boot camp] and you give these impressionable minds and say okay, this is the way things work, this is the way you want to go with it. But when they get to the fleet, that has to be the way it is done also because if not, then they are just going to say, well okay—they are just going to [do what the older

Marines tell them to], they are impressionable minds and they will say, Okay, I know I learned it this way, but this is the way it is really done.

The data suggest that the training will be wasted because the traditions and norms are so strong that the older Marine will override that new training and energy-efficient methodology. Therefore, it is important not only to train new Marines but the current force as well to change the mindset. As one Marine commented:

> Well that is why it is [so important to be] part of the process because part of it is everyone in the fleet, Marines, you got to do this, develop the metrics, hold folks accountable. At the same time, it takes time to train new folks and that becomes instilled coming through the training pipeline to change the behavior. So you have got to do it at both points, the initial entry and the current folks. It takes time because yes, once you have embedded cultural mindset it is not going to happen right away, Marines will get there and some guys won't want to do it. They will learn to go back to bad habits, if you will. But over time it is culture, it is behavioral.

(2) Enlisted. The data suggest the enlisted Marines also had strong views on the ethos within the Marine Corps. Many comments suggest they think the services waste money:

> We are, as a military, whether it's the Army, Marine Corps, the Navy, Air Force, some of the biggest wasters in the entire world. More so than any other organization, any other place that I can really think of. I mean, even in Third World countries they find a can laying on the side of the road, they take it home so they can use it as a pot. You know, we create those cans, so to speak.

Another Marine added:

> It's ridiculous, the amount of money that we spend on Porta-Johns is, like, $4,000 per month, per Porta-John, yes, it's ridiculous.

Similarly, a Marine gave an example of how the Marine Corps or any service should be run like a business. The Marine's comment suggests that the Marine Corps is not forward looking in terms of revenues and resource allocation:

> It's ridiculous. I mean, we could make more efficient waste management, I don't know exactly how good our facilities are. I've done training on some of them, just because I do HazMat, but, I mean, there are ways and obviously in the beginning it's gonna cost a lot more, it's gonna cost a lot of money up front to do that and with sequestration, that is not gonna be

an easy thing to push. But if we're looking, which I haven't seen since I've been in, that people look that far out, but if you're looking 20 years down the line, okay, in 20 years, are we gonna be making money or are we gonna be wasting money? Where is that [analysis]? In the beginning we're gonna spend a lot of money, say it takes—say today you decide, We're gonna do X Project." Okay, at what point in time does the X Project start giving us what we want? I think that is the point. If I can do it within 10 years, okay, they say we're gonna go in Afghanistan, we're gonna be there for X period of time, now we're getting out. Okay, it will be the same thing. It's like any other business. Okay, so I open a grocery store, I know that I need to put this amount of money down. I need to pay for all of these different costs. At what point do I start making money? If the Marine Corps, or any military in general, starts thinking in terms of, How can I make my own money and support myself?" it would be a lot better off overall.

A Marine then gave an example of a possible solution. This next comment suggests that enlisted Marines think certain things that create waste are the problem:

I think, at that point, it comes down to minimizing waste. 'Cause there's a lot of crap that gets thrown away, that gets left behind, that gets wasted, that doesn't get used, but we pay for it anyway. I feel like, in terms of, energy-efficiency a good place to start would be to look at reducing waste and ways to create things that we are using now that we need in a way that is less disposable, that doesn't have a like…Like an MRE! You open an MRE and every single thing in the MRE has a wrapper. Do we really need that? Is there a way to change how we put those together, to make it not so wasteful so we're not leaving trash when we pull out of a country?

To add to that viewpoint, another Marine commented with:

I know how expensive a generator is, and how much money it costs to put fuel in it, like the GETS trailers that the Communications and the COCs [Commander Operation Centers] use. They go through a 55-gallon drum of JP-8 a day each, and that's if you're not running the air conditioner. If we're in the desert, we're definitely running an air conditioner, so in a giant COC you're using ten, that's ten 55-gallon drums of fuel. Is there another way to get the energy that we need to be able to do that instead of using fuel?

This last comment suggests that enlisted Marines are not aware of GREENS, but however, still think that a more cost efficient way to run mobile command posts should be available based on how much fuel they consume. It is surprising that

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none of the enlisted Marines had heard of GREENS. The moderator of the focus group then asked, "What if I told you there's a generator that runs off solar power. What would it take for you guys to adopt that?" They responded with:

How much power does it give us?

And how much is it going to cost the military?

And how much is it going to cost to fix it?

And how much is it going to cost to train the personnel to fix it when it breaks, and to create that MOS inside of the Marine Corps? Because there is not a Solar Panel Operator Technician MOS, so you would have to create an entire job, train everybody in it, and create the rank structure inside of that, that's gonna be the hard part. Giving us solar panels or having us buy it, that part's easy, it's training people to fix them.

The previous comments suggest that enlisted Marines are concerned with the characteristics and life-cycle costs associated with energy-efficient technologies. The data suggest that they are aware of the training and re-structuring that must accompany a new solution. The comments also suggest they are aware the solution is complex. On the other hand, however, the conversation concerning culture and ethos ended with this next comment:

Say we're on deployment and you don't really have electricity, you can't really plug anything in, you just got to your little PB [Patrol Base] and you grab that SPACES, solar kind of thing, plug it in and you've got music for the next couple days, whatever, like that's the only type of stuff we use it for. We burn our trash, we do everything else, we're not very energy-saving-efficient people.

This last comment suggests that even if units were given energy-efficient technologies that behavior would still have to change in other areas for the Marine Corps to truly be energy-efficient. This last comment suggests doubt exists about changing the USMC's culture to be more energy-efficient even when given the technology.

c. **Product Effectiveness**

The key theme, product effectiveness, incorporates five sub-categories: durability, compatibility, complexity, reliability, and integration. Overall, the frequency of these sub-categories was a seven with a heavy focus on reliability. The intensity is a high (3) due to the follow-on discussion and agreement through agreeable body language. The data suggest when an innovation is introduced to the Marine Corps; a Marine gauges the product effectiveness by the product's longevity in a combat environment, the ease of use, the ability of the product to integrate with existing equipment, and if the product does what it claims to do.

(1) Officers. One Marine participate stated that a GREEN technology system at his company level was successful in Afghanistan. The system was rigged to work properly but the generator would kick in when maximum capacity was reached. This hybrid set up worked well and the transition into the new technology was understandable and easy to rely on because it had a dependable back up in case the new technology failed.

> Yes we saw the same thing in Afghanistan. I saw one successful use of the GREEN system and it was at a company level because that was small enough that the GREENS could power a COC, a company sized COC in the direct sunlight and they had a generator backup. So it was jury-rigged to work properly where they would use solar panels up until it couldn't and then the generator would kick on. But anything below that they didn't have the training to actually employ it and anything greater than that they had too much of a power draw that it didn't really do anything for them except get in the way and break. So you know the threshold of where energy efficiency goes, to what tactical level, what stage of the fight is definitely going to be a factor? I would not want to cross the beach with a GREEN system.

The type and size of unit also determine whether energy-efficient technologies are appropriate and successful. One Marine stated:

> Depends on—like they were saying though, it depends on what level of command you are at and what your unit actually does, whether it is worthwhile or not. But we used more passive [systems] like the solar shades to cool our generators and keep our tents cool, which actually saved us a lot of fuel.

The size and type of unit also tied into compatibility and integration:

> I have used the SPACES and GREENS systems. We had a limited amount fielded to my battalion. Some of the companies had it, but they didn't have it companywide. They had a couple of platoons with it here or a couple of COPs there. It was pretty good stuff, but the problem is when they took it down to the individual piece of say a radio trying to have some sort of solar rechargeable, solar operated—solar powered radio, but the problem was they weren't compatible with all the different types of radio systems. I mean even the radios that we have out there today, every battery—most people think that you know that these things called a 5590, they think that battery can power everything, but it is just not true. So it becomes for us, for me as a communications officer in a ground combat element, it was an issue of compatibility and availability.

This data suggest that not all equipment can be powered by the same energy-efficient technology. Therefore, the perception of the solution is that the equipment creates a compatibility/integration problem because it does not work on all gear. Compatibility and integration also extends to operating in different countries, which the data also suggests is a concern:

> Can I use my energy-efficient technology based on resources available in host nation or do I have to have a certain type of whatever to be able to make it work? If that is limiting us with the specific thing that you need, you know we go to austere places that host nation support is not always going to have some high tech thing.

Moreover, integrating energy efficiency not only into certain sizes of units and types of environments creates an issue but integrating it into types of gear seems to create doubt among Marines. One Marine from the aviation community commented:

> Impossible, yes. Making the actual aircraft more efficient. You know fuel is a source of energy, so how are we going to get an F18 from consuming 600 gallons to 400 gallons?

The data suggest that Marines doubt the characteristics of energy-efficient technologies. They think they are less reliable and less durable: "Possibly less durable, possibly less reliable than standard technologies." Furthermore, the data suggest that Marines think environmental conditions affect the reliability of a solar powered system:

> Yes, but the thing about the GREENS is like we made a lot of solutions for Afghanistan and that is one of them. Hey, look. It is sunshine 365 days out of the year. We are not always going to be there. We are going to be in locations that we might have to find other renewable sources than just solar panels. If we do use dirigibles, why can't we put a wind turbine in it? So that gives you something. You know we use boats, if we are on a coastal region; you have got wave generators that you can use. Riverine you can do riverine generators. We just don't have a lot of [flexibility]. We can go out and get a lot of different technologies to go and do it for specific areas, we just don't know where the next fight is going to be and until we can figure that out, you know, we are going to probably end up choosing a solution that doesn't match the next fight, which is like—.

Similarly, another Marine commented on the reliability, "Since it is a new technology there could be kinks in it, so reliability may be an issue." An addition, a Marine responded with: "Doesn't work as good as the [standard] battery." In addition, another Marine commented on the durability of energy-efficient technologies: "More fragile, so if you use it out there and it gets banged around it is more susceptible to damage." All these comments suggest that Marines perceive energy-efficient technologies as a problem in itself due their unreliable and fragile characteristics.

Another important characteristic is simplicity. The data suggest that a new energy-efficient technology will face resistance if it is too complex, which also suggests that the amount of time to learn how to operate it should be minimal:

> I would say a big stressor on that would be simplicity. Like there are technologies in the civilian sector where we can hold out a little thing and charge your cell phone, plug it in, it is pretty simple. It is a plug and play technology. When you need to have a special MOS just to fix it, I think we have lost sight of the mission when we are talking expeditionary. Because if a basic infantry private can't figure out how to plug that thing in and use the energy, we are kind of doing something wrong.

The Marines also included the amount of training involved with new technology in simplicity. Their comments suggested that the new technology should not require a huge amount of training for the sake of simplicity and to reduce cost: "Who trains those Marines now to fix that gear? Who trains those Marines on how to operate that gear?" In addition, another Marine commented on the importance of simplicity. His comment suggests that if energy-efficient technologies are not kept simple, a host of other problems are faced:

> My point is that we have high demand/low density MOS that are specifically to the energy portion. There is not a lot of electricians out there and that is part of what the issue is going to come down to is, do we have the personnel there who can actually troubleshoot these types of systems? So we are going to have more money and more training, but on top of that everybody is going to have to have some sort of energy efficiency technology. So now do we increase boot camps?

This comment suggests that Marines are in tune to other issues that arise with a complex system to include the timing and cost of training, and possibly, a new MOS solely to work on the special equipment. In addition, the availability of the new personnel to work on degraded equipment in the field is a factor.

Their perceptions of the solution seem to suggest that in some circumstances, Marines will adopt a new technology only if the system is linked to trustworthy pre-existing equipment that is easy to use. Additionally, the learning curve of a new technology must be limited especially in a combat environment. The training required must be minimal and seamless to the end user. In the case of the successful GREEN technology, it was adopted because Marines could easily rig the new technology to a generator providing confidence in the new system. If the perception of the new technology was complex, it might have been pushed to the side.

The perception of energy-efficient technology in many circumstances would suggest that Marines in these focus groups tend to think that the current technology is effective, which demonstrates that Marines attitudes toward new energy-efficient technology are unnecessary and the cost of adopting it is not worth the risk. While some new energy-efficient system itself requires less direct fossil fuel

dependency, in some circumstances, it does require more indirect logistical support. During the discussion, an example was given; the use of solar panels required two additional trucks as compared to the existing technology that required one truck.

On the other end of the spectrum, a success story for high rate of effectiveness is the M2C2 as mentioned above in the opinion makers section. One command post vehicle incorporating the same functionality as 40 trucks resulted in a high rate of effectiveness. The Marines who had experience with the M2C2 were highly impressed. Examples like the M2C2 provide Marines the confidence to adopt new technologies given the tangible value in the new system.

(2)   Enlisted. Comments from the enlisted focus groups relating to product effectiveness were mentioned five times with high intensity (3). A heavy focus was placed on compatibility and reliability. The data suggest that the enlisted Marines have a very strong desire to see that it works and helps complete the mission. The Marines brought up rechargeable batteries and how saving money was beneficial but then another Marine mentioned the lack of effectiveness of the energy-efficient technology:

> The only problem with rechargeable batteries or energy-efficient stuff is if we use those energy-saving resources, whatever you want to call it, those batteries die quicker than a battery that you got out of a package and put in and when it's done, it's done, you throw it away.

Then, another Marine added to that comment and explained how he would rather spend the extra money on something reliable, which suggests that enlisted Marines view the benefits of having batteries or equipment they can trust as outweighing the higher costs of non-energy-efficient solutions:

> Those rechargeable ones, yeah, you recharge them but all of a sudden after the tenth recharge they don't work anymore. So, yeah, I mean, we're spending money on the batteries that do work but, I mean, I'd rather have those in a combat situation than have a battery I think was charged, then all of a sudden I go out and it doesn't work. So, I mean, you can look at it both ways, yeah, we're spending more money, but in the end, I mean, they're better in a sense, I would say, than having them only work for ten times and then they lose charge…

The conversation also steered towards examples of other compatibility issues with different types of equipment. One such example was a vest that holds ammunition magazines and other small pieces of gear. The data suggest that Marines would rather use something that works better than the issued gear:

> Like we get those stupid LBV's [Load Bearing Vests] issued in the government, you know, and the chest rigs are just more efficient, you have all your magazines up front, things like that where it just makes more sense than what, than the stuff we get issued to us.

The comments also suggest that the enlisted Marines are concerned about the durability and integration. They mention that fixing a new piece of gear is logistically complex, as well as transporting it. They mention that location determines how complex it is to fix something. This data suggest that if equipment cannot be fixed and transported easily, Marines will resist adoption:

> And then they get [expletive deleted] broken, you know, or if somebody sends us parts to fix this… most Marines can figure that out on their own, but then when you go to fix [solar panels] or run [solar panels], put some 550 cord on this to make it work, whatever, it all depends on your situation and stuff. In the States, turning on the RAMP and stuff like that, yeah, solar panels are great, just put them all over all kinds of stuff, I'm a big believer in it but it all depends on where you're going with what you're doing, can you actually use that or carry it around in a pack or hump it around in a pack? If it's going to be in the back of an Amtrac [amphibious tractor] is it going to get broken, damaged, what's the turnaround for us getting parts for it? It all depends where you at."

Enlisted Marines are also aware that for solar panels to work, they need a proper amount of sunlight. This data suggest that they are aware that the geographic location will impact the effectiveness of energy-efficient technologies, such as solar panels:

> And it would have to be a viable concept to be able to say, "Hey, by the way, we've used this in said places where there is a lot of other things going on. Whether we're [operating in different] weather conditions, okay? If I'm in a place like Great Britain, solar power is probably shitty 'cause it rains, what, every other day there?

The Marines shared the view that the solution is complicated and expensive; complicated because changing an ethos and a way of life is not easy. Marines

have been operating with non-energy-efficient technologies for years. They think it will be expensive because they understand that new technologies require research, development, and testing. Many auxiliary costs, on top of the primary cost just to build a new system, occur also that include modifications, training, and maintenance.

6.   Marine Suggestion on Implementation

The Marines argued that the Marine Corps must conduct an in depth cost benefit analysis to illustrate the tangible benefits of integrating new energy-efficient technologies over the legacy equipment. Marines actually need to see that it is a viable option that makes sense for them to use it. Most Marines in this study think that energy-efficient technologies are very expensive and will not sustain the level of operations demanded. It is not surprising that Marine officers are weighing costs and benefits, but it is surprising how in depth they analyze cost. In the Marines' eyes, high costs and low operational effectiveness decrease the possibility of adoption. For example, one Marine commented:

> So I think the installation side and [combat deployments] fall into [different categories], but I start seeing a lot of the solar panels going up around the different bases which I thought was interesting because I always wondered, what does it cost having those solar panels and [what are] their [life] expectancies versus what we pay if we are just paying the electric bill to [a] county or what have you? Because you don't ever see the connection. Yes, it may be more efficient, but are we [really saving money]? Did somebody do that cost/benefit analysis?

In addition, another Marine stated that energy-efficient technologies are not cost effective. "There is a reason we don't have everything run by solar panels right now, because it isn't cost effective." Then, another Marine emphasized that energy-efficient technologies must be evaluated from a mission accomplishment standpoint, as well as a cost-benefit analysis:

> You have got two things [here]. You have obviously got mission effectiveness, we have got to accomplish the mission where it is unlike a for profit company looking just like at a [CBA] to say okay, is it more profitable? Well it doesn't matter if we reduce costs, [and] make money, if we are not accomplishing the mission. So it is like the two prong [approach], if we can still accomplish everything we need to accomplish the mission, yet then I think the other part is doing like a [CBA]. Okay,

well it is going to cost initially this much to put this type of gear in, but we are saving this much on usage, which means okay, we can have less refueling convoys which costs that and then if there are lives saved, you can attribute a life from operating in a hostile environment then you value that life and all that. Then you have got the [CBA]. So then the key is obviously can you make that to where you are saving money and still accomplishing the mission?

Another implementation strategy is proof of concept, which is described as an end user's trust in the equipment. A Marine's trust is a function of how the implementation of energy-efficient technologies is viewed in a realistic environment. Proof of concept combines the sub-categories from product effectiveness (durability, compatibility, complexity, reliability, and integration) into one single notion that the energy-efficient technology will accomplish the mission and increase the feeling of safety. For example, one marine commented:

No, people just want something that—they don't want cool stuff. If it makes them feel like it is going to help them survive, that is the biggest thing."

This new energy-efficient technology will have functionality at the same level or better than the existing product. as a result of an end user predisposition to use the product effectiveness of the existing product as a baseline. Participants commented:

The key initially I think is going to be that this is got to be like a supplemental. You have got a proof of concept. Say like the MTVR, (medium tactical vehicle replacement) the sides become solar panels. They simply run that to an outlet where you can like plug into for other things and you can power, so again it becomes a power source. If it breaks, we don't have that power, so it doesn't affect the running of the vehicle. See what I am saying?

This comment had high intensity level (3) because it generated a unanimous agreement throughout all the participants of the second focus group. It resulted in the following remark:

Yes, our battery technology is really—it is limited. The expectation is commercial level coms, commercial level C2, commercial level vehicle. Why even cars, I can get a car that can go 100 miles, yet I have got a truck that goes a mile on a gallon of gas. A lot of stuff we are using in the military, though it is ruggedized, though it is weighted and protected and

all of that other stuff, there is still an expectation that we can do that in the military. So we come here to a school like this and it is like okay, how do we figure out how to make that happen? But you know—.

Some missions also happen too quickly to set up the solar panels or other similar energy conserving equipment. Therefore, not only is it mission specific, but set-up time is a factor, and the Marines must be trained on the equipment to understand its capabilities, and built trust in the equipment. For example, one Marine stated:

> I think the actual coordination was done at regiment. Once we were going to get the actual gear and everything. Then they came down to the battalion level and trained us on it. It was a classroom setting, it was in the field training right outside. Not going to the field, just right outside in the parking lot in the grass, you know training there. Then so once we got the buy in, we knew how it was used, we could tell the Marines and work with the Marines. But then once we were done with that, they focused on the Marines, the actual operators of it for the majority of the time. It was implanted like that, worked with them and then it was conducted to a live fire field exercise. So very—you know the Marine Corps always says; crawl, walk, run. That is how it was done and that is how I believe this training right here needs to be done because there needs to be buy in at every level.

This comment suggests that opinion makers and the end user must train on the equipment in a non-hostile environment to develop trust that it will work in a combat situation. The term "crawl, walk, run" illustrates that training must be at a slow and graduation process. Once training is completed, it can then be employed in a combat environment. For example, a Marine stated the following about a product used in a combat situation:

> Depends on—like they were saying though, it depends on what level of command you are at and what your unit actually does, whether it is worthwhile or not. But we used more passive like the solar shades to cool our generators and keep our tents cool, which actually saved us a lot of fuel.

The data demonstrates that Marines understand that some drawbacks are associated with energy-efficient technologies; however, if the benefits of the technology exceed the drawbacks in a combat situation, Marines have a high probability of adopting the technology.

Yes, two things I saw. Both kind of abstract, but one was we employed a thing called the M2C2. It was a mobile command post, we will just call it that. But the thing that was nice about it is it had all my coms and everything built into it and C2 facilities so they could take one truck and they could drive that one truck, though putting all your eggs in one basket was kind of dangerous. That one truck could do the same as an entire regimental CP of 40 trucks. So one versus 40 when you start to look at the footprint of that log train, to me that is not necessarily having a more efficient truck that can get more miles per gallon, it probably got less, but because you are reducing all those—the log train that is supporting the COC because you have consolidated, it kind of is energy-efficient and we are going to that technology with the [NODM] I think is what they are calling it now. [NODM] is kind of like the next generation of stuff that the Marine Corps is going to. So that is one way to look at it is, hey maybe we put some of our money towards these packages because I know the MRQ-12 van for aviation guys and [MRQ-13], those are the same kind of things we could focus that energy-efficient technology by reducing the log train and supply train behind it.

On the other hand, if the product does not perform during a mission, it will lose the Marine's trust, which translates into a failed proof of concept, and the Marine will not adopt the system. For example:

If you have it as integrated on it, but not to where it won't function. So if it doesn't work, the unit still functions whether it is the generator, [MTVR], Humvee, new joint fighting vehicle—whatever—it is made that way, it provides and it can run. It is almost like think of a hybrid vehicle. It can run on hybrid and then if you run out of battery power you can just [inaudible] you have got fuel or the thing would be if it breaks it doesn't down the whole system. Now that your solar power is down you can't operate the system then you have a serious point of failure. It has got to be separable in that way. If it breaks, that is fine, let's just go running, I get back to the rear, out of the operation of deployment and then it can be fixed and looked at.

The Marines believed that two main advantages occur. They perceive that energy-efficient tools and technologies are less dependent on fossil fuels and serve as an alternate source of energy. They also believe various disadvantages occur as well to include complexity, which boils down to increased setup time, how to use it, different logistics, and weather dependent. They also perceive it to be expensive and fragile.

The enlisted Marines comments highly focused on the proof of concept. The data suggest that the enlisted Marine would have a high probability of adopting energy-efficient technologies if it is proven that the product works. The proof of concept had a frequency of 24 comments with high intensity and passion. It was found that both groups of enlisted Marines were not aware of the existing energy-efficient technologies available. It was explained to the groups that GREENS and SPACES are currently being used in selected units, and asked, "so now that I told you that there is equipment available for that, what would it take for you guys to start using it?" Their comments were:

Test it, test it.

Let me see if I can break it.

Other comments that followed were:

Let us borrow it for a couple of Field Ops, let's see how it does out there.

Because this way you [find] the most problems, when the [equipment] breaks down and you want to actually test it out, you can get it tested out, you can get it tested out all over, just have them check sitting on the RAMP and then just it out there is not going to do anything. So, it's kind of [messed up], we check her out and fill it out for about month out in 2-9 and see how it holds up.

They showed interest in energy-efficient technologies; however, based on their comments, they displayed a high level of skepticism of the equipment actually performing better and lasting longer than the current equipment. If the product does work, the Marines showed high enthusiasm in adopting it. More specifically, the enlisted Marines were concerned with the product effectiveness in a combat environment. One Marine stated:

Generator solar panel, whatever you want, I mean, that generator, go put it in a desert environment ten weeks, run it constantly, non-stop without it dying for seven months, like, the solar panel, like you're saying, if it breaks because, as Marines, when we're getting in and out of vehicles, we grab stuff, we pull stuff, do this and the other thing, it's going to get caught on stuff. If that thing's durable as can be and it costs $400, by all mean, I'll buy it, but all of a sudden if I go to pull it out of the vehicle, it

gets caught on something, the cord rips out, like am I going to buy it? Is it that durable? Probably not, like it has to be able to withstand Marines and that's just what it comes down to.

An enlisted Marine commented regarding an aftermarket armor plate carrier he used with:

It's not going to happen, everyone's going to pretty much, like they said, they're probably going to go out and buy their own stuff like that, but that's for comfort, that's not for looks, that's so they can move around.

He stated with high enthusiasm, if a product works better than what he was issued, he is willing to purchase it with his own money. Another Marine agreed and added:

Yeah, that's what everybody wants, it's comfortable, put it how you want it, it's easy.

The next section talks more about the specifics of an energy-efficient technology in the form of a performance measure. Thirty percent of the Marines stated that "buy in" must occur or definitive motivation to adopt and use energy-efficient technologies. The participants explain that to change the Marine "ethos," the Marine Corps can stress the critical nature of energy conservation. One Marine stated:

If you tie energy efficiency to an evaluation metric, it is going to make people care. If they don't, then they are going to be gone. It is the same way with physical fitness tests (PFT), rifle ranges, professional military education (PME); they are all marks that are on there for a reason, because it is important to the Marine Corps. A Battalion Commander may not care about energy efficiency, but when there becomes a metric for measuring energy the Regimental Commander can see across his three battalions who are using the most fossil fuels. The result will be somebody getting negative marks, causing wide discussion which will trickle down throughout all the USMC ranks.

The comment above illustrates the need to create a way to measure energy efficiency to reflect the opinion makers and the end user's performance evaluation, which is also supported by the following statement:

Well every level of command has their buy in and has to take that message and push it down. What point if somebody doesn't care, if it is a regimental commander and it gets down to him and just it is not a priority

with him, he doesn't push it down to the battalion commander, doesn't get pushed down to company and you get a whole regiment that it just doesn't become a priority. It is like anything else, the leadership has got to be involved. Then you have got to be genuine and have some level of buy in too. Marines are pretty good about doing what they are told and that is how you usually get people to care, is to buy in. Because if that company commander is now buying in, that battalion commander is not really enforcing it, then he is not going to care from there on down people aren't going to care. You have got to do it all the way down. You have got to get that actionable [item].

These responses advocate an incorporation of a metric that captures and evaluates leaders' effectiveness in conserving energy. Those units and leaders in charge of those units would be commended for their use of energy-efficient technologies vice traditional fossil fuel dependent equipment. The comment above demonstrates lower fuel consumption would illustrate their use of the energy-efficient technology and increase their chances for awards, promotion, and retention. Adding a measurable component to energy efficiency and holding Marines accountable would signify a paradigm shift in the Marine Corps.

Surprisingly, it was found that Marines did not place much emphasis on the attractive appearance of a product, but rather, they focused on the functionality. Marines feel that if it will accomplish the mission and reduce the risk to lives, they will establish trust in the equipment. If this proof of concept exists, then they will have a high probability of adopting the technology.

Overall, the Marines suggest a cost benefit analysis, a proof of concept, and a performance measure to prove the validity and importance of energy-efficient technologies, which suggests that Marines need to see the concrete value that a certain technologies will provide them. Additionally, Marines understand the importance of cost and want to see if the benefits of energy-efficient technologies outweigh their risks.

C.   FOCUS GROUP COMPARISON

1.   Focus Group with Officers

The first two focus groups were conducted at NPS. The demographics (depicted in Chapter III) between the two groups of Marine officers were nearly identical. In the

first focus group, the officers were an average age of 32.6 years old, averaged 0.89 deployments within the last four years, and had an average of 12.55 years of service in the Marine Corps. In the second focus group, their average age was 33.3 years old with 0.92 deployments and 12.33 years of service. While not much variance in the deployments and years of services occurred, the first group consisted of nine males, and the second group had 10 males and two females. Also, another difference between the two Marine officer focus groups was the type of MOS. The first group consisted of 45% combat support officers (logistics and supply), 33% finance officers (comptrollers) and 22% combat arms officers (mp and artillery). The second group consisted of 42% combat support officers (logistics, supply, and adjutant), 33% technical combat support (communications and air command and control), and 25% pilots (fixed and rotary). In both focus groups, the majority of the officers were combat support officers. However, the second focus group differed from the first group because it contained two females, officers with a technical background, and pilots. The second focus group did not have any officers with a financial management background (the first group had three officers).

Despite the differences of gender and MOSs between the two focus groups conducted at NPS, the same narrative was used to conduct the focus group (Appendix A). During the coding and analysis of the transcriptions, few differences were found between their responses. It was concluded that differences in gender and MOS did not change the high-level drivers for captains and majors in the Marine Corps.

2.   Focus Group with Enlisted Marines

The third and fourth focus groups were conducted at Camp Pendleton with a total of 25 enlisted Marines. The third group consisted of Marines with an average age of 26.6 years old, averaged 1.42 deployments within the last four years, and had an average of 7.25 years of service in the Marine Corps. However, the fourth focus group had an average age of 27.3 years old, 1.08 deployments, and 7.77 years of service. Although the two enlisted focus group demographics were very similar, the third focus group had an

average of .52 less years of service than the fourth focus group and the third group had an average of .34 deployments in the last four years, which is likely explained through the differences of MOS between the Marines.

The third focus group's MOS were comprised of the following: 67% vehicle operators and mechanics, and 33% combat arms (rifleman). This group of Marines was comprised of 12 males and zero females. During this focus group, the number of their comments that referenced opinion makers, communications, perception of the problem, and the perception of the solution were 11, 23, 20, and 33 (listed respectively). It was found that the majority of their comments focused on the Perception of the Solution, with 54% (13/33) of the comments focused on proof of concept. It was also determined that the majority of their comments were related to proof of concept, and consisted of the following:

Show me that it works.

If you were to show me that it worked on everything that we do and everything that we use, of course I'll buy it.

We found that the Marines in focus group three were not aware that energy-efficient technologies currently existed in the Marine inventory. We explained that there was equipment such as GREENS and SPACES, and we asked, "So now that I told you that there is equipment available for that, what would it take for you guys to start using it?

Their responses were:

Marine 1:   Test it, test it.

Marine 2:   Let me see if I can break it.

The fourth focus group consisted of 54% combat support, 23% logistical support, and 23% technical combat support. This group had six females and seven males. During this focus group, the number of their comments that referenced opinion makers, communications, perception of the problem, and the perception of the solution were 12, 20, 12, and 17 (listed respectively). It was found that in this focus group, the majority of their comments focused on the communications driver. They commented with the following:

Female Marine 1: Facebook. Ahh, Twitter. LinkedIn. YouTube. Google.

Female Marine 2: [The USMC should] link your names, any changes that happen. Like, Hey, this is brought to you by, you know, E2O…

Surprisingly, the fourth focus group was the only group that mentioned leveraging social media is an effective way to influence Marines to adopt energy-efficient technologies. It was concluded that a difference might exist between enlisted Marines with different occupational specialties and/or gender. Combat arms Marines focused on the testing and product effectiveness of technology and service support Marines were more willing to adopt a technology based off what they heard from their chain of command, which implies that multiple methods of communication must be used to reach all the Marines.

3.   Officer vs. Enlisted

The focus groups between officer and enlisted Marines demonstrated many key similarities, but many key differences as well. It was found that the frequency of the high-level drivers was similar for both officer and enlisted. Both the officer and enlisted Marines' frequency of high-level driver related comments ranked as follows (highest to lowest): perception of the solution, communications, perception of the problem, and opinion maker, which leads to the belief that Marines, regardless of rank, have a high willingness to develop a solution to accomplish a mission, and are less influenced by an opinion maker. However, it was demonstrated that the officers had a higher percentage comments focused on the perception of the solution and the enlisted had a higher percentage to communications.

	Opinion Maker	Communications	Per Problem	Per Solution	Totals
Officer Totals	35	42	36	93	206
Officer Percentages	16.99%	20.39%	17.48%	45.15%	100.00%
Enlisted Totals	23	43	32	50	148
Enlisted Percentages	15.54%	29.05%	21.62%	33.78%	100.00%

Table 1.   Focus Group High Level Driver Comparison

According to the data, both officers and enlisted Marines addressed concerns of budgetary issues affecting the Marine Corps down to their level. However, the officers were more concerned with financial consequences to the U.S Marine Corps at a strategic level, and the enlisted Marines focused at lower level, such as their units' ability to train. Also found was that none of the enlisted Marines were aware of the existence of E2O, GREENS, SPACES, or any other energy-efficient technologies used in the Marine Corps. In contrast, the majority of the officers did, which suggests that the energy-efficient initiatives are not being communicated down to the end user's level.

The data also suggest that the opinion makers for both enlisted and officers were similar. They both view that the most influential people/positions are the battalion commander, company commander, and gunnery sergeant. They used the term "our chain of command" to describe these positions as a group and as individuals.

D.   SUMMARY OF ANALYSIS AND FINDINGS

This chapter analyzed the data collected from both NPS and Camp Pendleton across different ranks and MOS backgrounds. Based on the frequency and intensity of responses, the data and analysis emphasizes several areas to understand what drives a Marine's acceptance or non-acceptance of energy-efficient technologies. Also, the original framework indicated that the perception of the problem and perception of the solution were separate drivers that influenced the end user independently as shown in Figure 8. The numbered themes in each high-level driver summarize the key findings.

ADJUSTED INFLUENCE CAMPAIGN
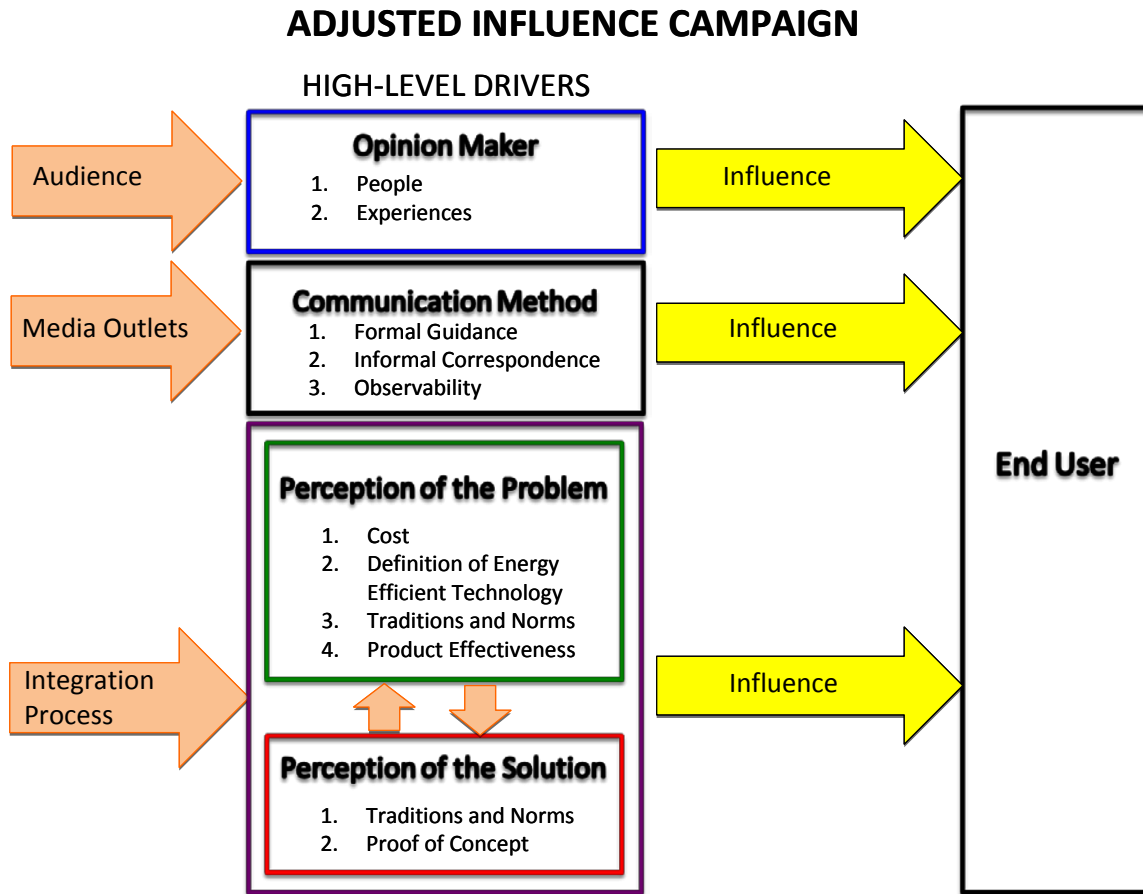
HIGH-LEVEL DRIVERS

Figure 8.   Research Influence Campaign (after Watkins, 2003)

The initial framework was created based on Watkins' Influence Campaign. The original framework depicted that the opinion makers did not have a direct link to the end users. However, opinion makers indirectly influenced the end users by leveraging communications methods, which was demonstrated a linear process of opinion makers through communications method that influenced the end user. As mentioned above, three top communication channels were used, but word of mouth seemed to be the dominant channel among officers and enlisted Marines, which implies that implementation strategies to facilitate Marine-to-Marine communication would increase the likelihood of adoption. The officers were more exposed to the E2O's initiatives, but the enlisted personnel seemed to have never heard of the E2O, which suggests that the existence of the E2O is not being communicated to lower levels of the Marine Corps. A common theme among officers and enlisted Marines is the fact that a lack of definition exists

regarding energy efficiency, which suggests that as understanding the initiatives increases, adoption will increase as well. During the analysis, some variations were discovered that lead to the modification of the framework. The next chapter presents recommendations by taking the findings and new framework into account.

V. RECOMMENDATIONS AND CONCLUSION

A. INTRODUCTION

This study was designed to identify the drivers that lead Marines to adopt energy-efficient technology. In this research, four focus groups were conducted. The first two focus groups were conducted at NPS that consisted of company and field grade officers (Captains And Majors). The third and fourth focus groups were conducted at Camp Pendleton and comprised enlisted personnel from E–3 to E–7. Drawing on the initial framework developed from the academic literature, high-level drivers were focused upon: opinion makers; communication methods, perception of the problem, and perception of the solution. First, based on the findings, this chapter provides recommendations on how the Marine Corps can leverage high-level drivers (as identified) to increase the probability of Marines adopting energy-efficient technologies. The chapter then provides limitations of the research and recommendations for further research, and concludes with overall benefits of the study.

B. RECOMMENDATIONS

Based on the findings from the focus groups, numerous concepts materialized that should help answer the primary and secondary questions. The following section offers three suggestions to help the E2O understand the drivers associated with successful adoption, and identify areas upon which the E2O may want to focus. None of the following recommendations is mutually exclusive, but applying them independently, in totality, or in some combination, may lead to further acceptance of energy-efficient technologies.

1. Opinion Maker

Based on the analysis and findings, the E2O should focus its energy-efficient initiatives toward the battalion commanders, company commanders, and platoon sergeants in deployed units, units returning from deployment, and units scheduled to deploy. The focus groups identified the battalion commanders, company commanders,

and platoon sergeants as the most influential leadership positions/individuals to the end user. The researchers recommend a special focus on deployed, returning from deployment, and scheduled to deploy units into a combat zone because they have the most to benefit by leveraging energy-efficient technologies. Additionally, energy-efficient technology should be marketed as a USMC initiative. Linking these initiatives to organizations outside the Marine Corps can lead to resistance because Marines may perceive an existence of insincere/ulterior motives behind the push for energy-efficient technologies. The data showed that Marines do not trust outside influencers.

2.   Communication Channels

The data suggest that the most effective communication method to increase the adoption of energy-efficient technologies is through word of mouth. A key approach to develop a positive message through word of mouth is by leveraging communication through peers by recommending the following: creating a Marines-only technology exposition, a more aggressive testing/fielding program, and a basic marketing campaign at the battalion level.

This analysis showed that Marines prefer to see equipment in use and talk to people who used the equipment, which suggests an exposition containing only Marines (no vendors or outside organizations/individuals) displaying current energy-efficient technologies may increase the likelihood of adoption. Such an exposition could enable Marines to observe demonstrations, share experiences using these products, and increase awareness about current tactical and strategic solutions involving energy-efficient technologies. The academic literature (Rogers, 1995) emphasizes that having a hands-on experience with the technology while talking to people who have experience using it increases the rate of adoption. The data suggest that Marines currently do not have the opportunity to experience energy-efficient technologies and discuss the equipment's advantages and disadvantages with an actual user. As a result, an exposition could provide word of mouth communication opportunities to Marines and adoption may increase if these opportunities were present.

An aggressive program that fields energy-efficient technologies to units for testing would be an extension of the Marine-only exposition. This analysis suggests that only a limited number of units obtain the opportunity to test equipment. None of the participants in these focus groups had hands-on experience with GREENS or SPACES, and only 4% of the Marines in the focus groups knew of a unit that was part of a test group, which implies that trialability is limited. Trialability is likely to increase the adoption of technologies (Rogers, 1995; Darley & Beniger, 1981). In other words, an aggressive fielding and testing program could improve the acceptance of energy-efficient technologies by making them more trialable.

The data from the enlisted focus groups suggested that lower level Marines did not know the E2O existed and were not aware of specific efforts or technologies. Based on Rogers (1995), information must be shared to reach a mutual understanding. Thus, information gap needs to be fixed. It is recommended that "all hands" meetings during a battalion's formations be conducted. The battalion commander should lead such events to create awareness of the E2O, its purpose, and most importantly, initiatives. The goal of increasing energy efficiency and specific tools and technologies to do so could also be re-enforced with flyers posted around base.

The importance of word of mouth is suggested by this analysis. For example, the 4% of respondents who learned of GREENS technology through word of mouth from their peers had positive comments on the GREENS generator. However, only 4% had heard of GREENS through word of mouth, which suggests that the Marine Corps should develop a more robust strategy in communicating energy efficiency's existence and importance. As one Marine stated, "If it works, maybe I'll tell people…"

Another Marine followed up with, "I would probably continue using it, I would tell other Marines about it, share it, have them use it. Tell them where they can get it."

As indicated in the previous chapter in which Marines suggested implementation strategies, they stated that hands-on experiences with actual operators would create the trialability opportunities that would also lead to word of mouth. The aforementioned recommendations will create communication methods to spread information about

energy-efficient technologies and the products available for use to expand the existing Marine network that relays trustworthy information. In turn, more word of mouth communication will occur. A Marine-only exposition can spread word of mouth communication and increase the likelihood of adoption.

3.   Managing Perceptions

Perceptions of the problem and solution are reciprocal processes. Their perception of a problem affects a person's perception of appropriate solutions (Bijker, 1997; Kaplan & Tripsas, 2008), which further suggests a focus on two efforts: 1) identification of a definition of a consistent problem, which is consistent with the solution of energy efficiency, and 2) specific measures to influence Marines' perceptions of the problem.

To influence perceptions of the solution (technologies), a first step for the E2O should be to identify a frame for the problem of fossil fuel dependence consistent with the solution of energy efficiency. This analysis shows that Marines are confused as to what the Marine Corps is trying to accomplish through integration of energy-efficient technologies into their way of life and hold varying perceptions of the source and legitimacy of the problem posed by fossil fuel dependence.

For example, this analysis shows that Marines are concerned with fiscal efficiency and that a negative perception of energy-efficient initiatives directly tied to funding issues exists:

> I think it is comical that we try and use the word efficiency when we start thinking about Congress and the political system because at the end of the day it is the most inefficient system. So we have these great notions of what we want to do and like forget about energy for a minute and let's talk about fiscal responsibility. The military is a horrible example of fiscal responsibility. We are the most irresponsibly organized group because of the way Congress sets it up. If you don't spend it, you don't get it next year. Like there is no; hey, let's plan to set this money aside. It is like you said, feast or famine.

This comment suggests that Marines think the driver of the effort to increase energy efficiency and the problem of fossil fuel dependence is the need to reduce cost. This perception is at odds with the message portrayed in E2O statements. This perception

seems likely to hinder adoption. The analysis shows why this mismatch is a problem. When Marines define the problem of dependence on fossil fuels as one of cost, the fact that energy-efficient technologies may be expensive decreases the legitimacy of the E2O objective as shown in this comment:

> It takes a large chunk out of the training budget. I specifically work in HazMat [Hazardous Materials] and each barrel [of used] batteries [is weighed.] And obviously all the batteries in a fifty-five gallon drum are heavy so it usually costs us about $800 per barrel to get rid of, so that's where the re-chargeable batteries come in.

This analysis suggests that perceptions of the problem are influenced largely by the definition of energy efficiency and perceived image. Thus, the E2O should work to ensure that leaders demonstrate to lower-ranking Marines that energy efficiency is a top priority. Leaders at all levels must be consistent in their energy conservation behavior. Chain of command related comments were mentioned for 32 pages of transcription out of 161 pages, which is 20 percent. Marines in the focus groups shared the view that leaders with inconsistent energy conserving behavior would hinder the adoption of energy-efficient technologies, which is evident in the quote from the last chapter referencing the allowed use of multiple computer screens and unnecessary equipment that consume high amounts of electricity.

Leadership and behavior should be consistent to demonstrate that energy-efficient technologies are a top priority in the Marine Corps. For example, a Marine coming out of boot camp may be taught that energy-efficient technologies are important to the Marine Corps; however, once a Marine gets to the unit, the platoon sergeant may instruct the Marine to revert to past habits. Thus, the E2O's message must be translated and consistent at all levels in the Marine Corps.

Another suggestion of implementing energy efficiency is through limiting resources by providing units less fossil fuels. The Marines in the focus groups indicated that they would attempt to use 100% of what they are given because the government budget system is structured as a "get what you use" program. Many Marines in the focus group suggested that being given fewer resources would force them to use what is available, and figure out a way to complete the mission. The researchers recommend that

the Marine Corps incrementally limit resources given to units, which will force the use of energy-efficient technologies. This suggestion by the Marines does come as a surprise because it seems that it would only frustrate a soldier trying to complete the mission. It also seems somewhat blunt. The Marines' suggestions, however, indicate that a strategy must be forceful, such as limiting resources for it to be effective. If the Marine Corps limits the use of fossil fuel technologies, this order must be enforced at all times and through all levels. The data leads to the belief that if the Marines' behavioral patterns were changed, they would have a higher probability of adopting energy-efficient technologies.

C.   LIMITATIONS AND FUTURE RESEARCH

This research conducted focus groups from various specialties but located within the same geographical location (California) where the responses may have been influenced by an analogous environment in which the focus groups were conducted. Also, a small sample size (46 total) of both Marine Corps officer and enlisted participants was the basis and foundation of this research. The limited amount of participants may not be sufficient to understand clearly what drives a Marine to accept and adopt energy-efficient technologies. One hundred percent of the Marine Corps officers were in an educational environment, which might not be relevant in a combat centric topic. The enlisted focus groups were unable to be broken up by rank; therefore, participants consisted of mixed ranks from lance corporal (E–3) to staff sergeant (E–7). Focus groups consisting of senior enlisted personnel may have provided further insight. The study participants only included active duty personnel, and the results may be different for reserve Marines.

D.   RECOMMENDATIONS FOR FURTHER RESEARCH

Additional focus groups exploring what drives Marines to accept and adopt energy-efficient technologies may be useful. Segregating ranks (a group of just E4–E5, then a group of E6s, and a group of E7–E9) rather than lumping all enlisted personnel together may provide more useful feedback because Marines tend to answer more candidly in an atmosphere of like ranks. Branching out to Marines from a variety of

geographical locations and units may provide additional insight the Marine Corps can use rather than limiting it to one coast. Future research could help identify what drives a Marine to adopt energy-efficient technologies and focus groups comprised of specific (MOS) could possibly provide greater understanding throughout the Marine Corps. Further studies could also incorporate the participation of reserve personnel, who may possess different opinions than active duty personnel.

E.   BENEFITS OF THIS STUDY

This study examined and sought answers to understand what drives a Marine to adopt energy-efficient technologies. Identifying the opinion makers and communication channels that have influenced Marines' perceptions in the past provide potential explanations to help the Marine Corps change its ethos to foster energy-efficient initiatives. The research findings may offer the Marine Corps a clearer understanding of what the high-level drivers are and provide a means of going forward to facilitate the "buy-in" of energy-efficient technologies for Marines.

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APPENDIX A. FOCUS GROUP ROADMAP

Activity #1: Brainstorm, facilitators will list responses on white board to further discussion. This activity is to generate conversation and gain data to understand perceptions of energy-efficient technologies and the problems posed by dependence on traditional fuels (D & E).

    1.   *Leading Question #1*: What comes to mind when you hear the phrase "energy-efficient technology?"

        a.   **Probing Questions:**

            i.   In general, what do energy-efficient technologies replace?

            ii.   In general, what are some of the benefits of using these technologies?

            iii.   In general, what are some of the drawbacks?

            iv.   What about specific to the Marines?

            v.   What could be benefits of energy-efficient technologies?

            vi.   What are some potential drawbacks?

    2.   *Transition:* Thank you. Now we would like to change tracks slightly…

Activity #2: Brainstorm, researchers will list responses on white board to further discussion. This activity is to generate discussion and gain data to identify influencers of adoption of new tools and technologies (in general, B & C).

    1.   *Leading Question #2:* What specialty items did you use while deployed that were not issued to you?

        a.   **Probing Questions:**

            i.   How did you hear about it?

            ii.   What was most influential in your decision to use it?

            iii.   What are the pros or cons?

            iv.   How did you come to the decision to use it?

    2.   **Leading Question #3:** What specialty items did you hear about and decide not to use?

        a.   **Probing Questions:**

            i.   How did you hear about it?

            ii.   What were the pros or cons?

            iii.   Why did you decide not to use it?

            iv.   How did you come to the decision not to use it?

Activity #3: Pictures or prototypes of technologies may be shown to draw the conversation back to tools specific to the Marines and gain data to identify influencers of adoption of new tools and technologies (specific to energy efficiency B & C).

1. ***Leading Question #4:*** What are tools/techniques Marines have used to conserve energy?
   a. ***Probing Questions:***
      i. How did you hear about it?
      ii. What are the pros or cons?
      iii. What would cause you to most want to use it?
      iv. What would cause you to be concerned about using it?

2. ***Leading Question #5:*** What are your recommendations?
   a. ***Probing Questions:***
      i. What would help you to increase expeditionary energy efficiency?
      ii. What would increase support for expeditionary energy efficiency?

APPENDIX B. DEMOGRAPHIC SURVEY

Please answer the following questions. Thank you.

Are you male or female?

What is your age?

What is your rank?

What is your highest level of education (please circle highest attained)?
- High School
- Some college
- Associates degree
- Bachelor's degree
- Trade certification
- Master's degree
- Doctorate degree

How many deployments have you completed within the past 4 years?

How many years of service do you have?

What is your MOS/Specialty?

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APPENDIX C. DEFINITIONS

*These definitions come from the researchers' review of the literature and refined through data analysis.

After Action Report (AAR)—formal documentation used by the Marine that critiques a mission.

Accountability (ACC)—inventory management of equipment for which a Marine has signed.

Advertisement and Reviews (ADV/REV)—non-formal information available to the Marine to include billboards, commercial, or prints sponsored by the manufacturer of the product that also contains reviews written by users of the product.

Chain of Command (CoC)—personnel who have direct authority to the end users' decision.

Congress (CONG)—political officials other than the President of the United States.

Complexity (COM)—the level of knowledge and training required to operate the equipment properly.

Cost (Cost)—the end user sacrifices or monetary concerns by adopting a new technology.

Definition (DEF)—the end user perceives as the term "energy-efficient technology."

Decision Maker (DM)—the end user.

Durability (DUR)—the product's ability to perform as expected for a long period of time in a combat environment.

Ethos (ETHOS)—common term to describe the traditions, norms, and culture within the USMC.

Performance Evaluation (EVAL)—an official who assess a Marine's performance, and includes a rating system.

Marine Expo (EXPO)—an annual exposition co-sponsored by the Marine Corps yearly in three different locations (Camp Pendleton, Camp Lejeune, and Quantico) that demonstrates the latest technology, equipment, and systems available to the Marine Corps.

Formal Communications (FC)—official methods of communications in the Marine Corps that have specific transmission channels.

Formal Guidance (FG)—written directives and AARs, and verbal orders passed down the chain of command.

Flexibility (FLEX)—a product's ability to adapt to other systems, as known as compatibility.

Limiting Resources (LIM)—formal guidance to a subordinate unit to reduce assets and/or supplies.

Newsletters (NEWS)—unclassified publications that a Marine can access.

Observability (OBS)—a product that a Marine observed from another Marine or vendor and the ability to see the product's effectiveness.

Prior Experience (PE)—an end user's personal experience.

Peers (PEERS)—an end user's friends, family, or another Marine within the same relative rank level.

Perceived Image (PI)—a Marine's opinion formed of a product or person.

Proof of Concept (POC)—Product Effectiveness (Durability, Compatibility, Complexity, Reliability, and Integration) into one single notion that it will accomplish the mission and increase the feeling of safety.

Preservation of Life (POL)—the product's ability to save Marine's life.

Reliability (REL)—a system ability to perform and maintain its tasks in routine and hostile operations.

Resistance (RES)—any action that exhibits opposition to adopting energy-efficient technology.

Risk (RISK)—a level of sacrifice a Marine is willing to endure.

RDT&E (RDT&E)—Research, development, testing, and evaluation involved in the prior to the production of product.

Special Operations Forces (SOF)—personnel involved in elite direct action units

Training (TRAIN)—formal process of educating a Marine.

Triability (TRIAB)—the opportunity to use a certain product.

Video Games (VG)—interactive games played by Marines that include the Sony Play Station and the Microsoft Xbox 360.

Word of Mouth (WOM)—informal method of verbal communication from one Marine to another.

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LIST OF REFERENCES

Arkesteijn, K, & Oerlemans, L. (2005). The early adoption of green power by Dutch households and empirical explanation of factors influencing the early adoption of green electricity for domestic purposes. *Energy Policy*, *33*, 183–196.

Bansel, H. S., & Voyer, P.A. (2000). Word-of-mouth processes within a services purchase decision context. *Journal of Service Research*, *3*(2), 166–177.

Barber, R. (2007). *Doing focus groups*. Thousand Oaks, CA: SAGE.

Bijker, W. E. (1997). *Of bicycles, bakelites and bulbs: Toward a theory of sociotechnical change*. Cambridge, MA: The MIT Press.

Chen, S. C., Li, S. H., & Li, C. Y. (2011, December). Recent related research in technology acceptance model: A literature review. *Australian Journal of Business and Management Research*, *1*(9), 124–127.

Ciarcia, J. (2013). *Key drivers of Marines' willingness to adapt energy-efficient technologies*. (Unpublished master's thesis). Naval Postgraduate School, Monterey, CA.

Darley, J., & Beniger, J. (1981). Diffusion of energy-conserving innovations. *Journal of Social Issues*, *37*(2), 150–171.

Davis, F. (1989, September). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–339.

Davis, F., Bagozzi, R., & Warshaw, P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, *35*(8), 985–986.

Davidson, R. S., & Walley, P. B. (1985). Computer fear and addiction: Analysis, prevention and possible modification. *Journal of Organizational Behavior Management*, *6*, 37–51.

Derksen, L. (1990). Environmental concern: a motherhood issue for the 90s? *Canadian Sociology and Anthropology Association Meeting*, Victoria, British Columbia, Canada.

Dholakia, U. M. (2001). A motivational process model of product involvement and consumer risk perception. *European Journal of Marketing*, *35*(11/13), 1340–1360.

Dowling, G. R., & Staelin, R. (1994). A model of perceived risk and intended risk-handling activity. *Journal of Consumer Research*, *21*(1), 119–135.

Ellsworth, J. B. (2000). *Surviving changes: A survey of educational change models*. Syracuse, NY: ERIC Clearinghouse.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Herbig, P. A., & Kramer, H. (1992). The effect of information overload on the innovation choice process: Innovation overload. *Journal of Consumer Marketing*, *11*(2), 45–54.

Hirschheim, R., & Newman, M. (1988). Information systems and user resistance: Theory and practice. *The Computer Journal*, *31*(5), 398–408.

Humes, E. (2011). Blood and oil. *Sierra Club*. Retrieved from http://www.sierraclub.org/sierra/201107/blood-and-oil.aspx

Kaplan, S., & Tripsas, M. (2008). Thinking about technology: Applying a cognitive lens to technical change. *Research Policy*, *37*(5), 790–805.

Kleijnen, M., Lee, N., & Wetzels, M. (2009). An exploration of consumer resistance to innovation and its antecedents. *Journal of Economic Psychology 30*(3), 344-357. Retrieved from Elsevier website: www.elsevier.com/locate/joep

Locander, W. B., & Hermann, P. W. (1979). The effect of self-confidence and anxiety on information seeking in consumer risk reduction. *Journal of Marketing Research*, 268–274.

Marine Corps Expeditionary Energy Office Headquarters. (2011). United States Marine Corps expeditionary energy strategy and implementation plan, "bases-to-battlefield." Washington, DC: U.S. Marine Corps.

Minton, A. P., & Rose, R. L. (1997). The effects of environmental concern on environmentally friendly consumer behavior: An exploratory study. *Journal of Business Research*, *40*, 37–48.

Murray, K. B. (1991, January). A test of services marketing theory: Consumer information acquisition activities. *Journal of Marketing*, *55*, 10–25.

Orlikowski, W., & Gash, D. (1994). Technological frames: Making sense of information technology in organizations. *ACM Transactions on Information Systems*, *12*(2), 174–207.

Ram, S., & Sheth, J. N. (1989). Consumer resistance to innovations: The marketing problem and its solutions. *Journal of Consumer Marketing*, *6*(2), 5–14.

Rogers, E. (1983). *Diffusion of innovations* (3rd ed.). New York, NY: Free Press.

Rogers, E. M. (1995). *Diffusion of innovations*. New York, NY: Free Press.

Roselius, T. (1971, January). Consumer rankings of risk reduction methods. *Journal of Marketing*, *35*, 56–61.

Shimp, T. A., & Bearden, W. O. (1982). Warranty and other extrinsic cue effects on consumers' risk perceptions. *Journal of Consumer Research*, *9*(1), 38–46.

United States Marine Corps Expeditionary Energy Office. (n.d.) Mission & Vision. Retrieved from http://www.hqmc.marines.mil/e2o/MissionVision.aspx

Watkins, M. (2003). *Winning the influence game: Corporate diplomacy and business strategy* (HBS Case No. 903-096). Boston, MA: Harvard Business School.

Yeung, R. M. W., & Morris, J. (2001). Food safety risk: Consumer perception and purchase behaviour. *British Food Journal*, *103*(3), 170–186.

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