

Developing a Methodology for Identifying Sustainability Offset Projects Within the Aerospace and Defense Industry

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Massachusetts Institute of Technology
15.915 Laboratory for Sustainable Business (S-Lab)

Bob Little
Hector Perez
Angel Poyato
Bailey Richert
Steven Song



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Executive Summary

While governments from all continents attempt to address sustainability challenges facing their nations through policy and direct action for the benefit of their citizens, there exist additional opportunities for other stakeholders like corporations to collaborate with these governments to contribute services that may be able to make a positive impact in these areas. Among these are corporations in the aerospace and defense (A&D) industry.

This paper explores one potential avenue of collaboration between A&D corporations and governments called offsets. According to the multinational management consulting firm McKinsey & Company, offsets are “industrial compensation arrangements required by foreign governments as a condition of the purchase of goods and services from nondomestic suppliers.”¹ Offset obligations between governments and A&D companies could be met using technologies or other capabilities which address a country’s sustainability needs.

Which sustainability needs to address and which capabilities are best matched to these needs to mutually benefit all parties involved in an offset transaction, however, is often unclear. This paper outlines a 5-step methodology that attempts to address this very problem; a methodology which companies may utilize to identify offset opportunities within the sustainability space that address a real need of the country, are appealing to the government customer, and take into account existing capabilities the company has at their disposal. These five steps are:

1. Assess Country Needs Using Third Party Indices
2. Identify Government Priorities in Sustainability
3. Evaluate Government Multipliers
4. Assess Companies’ Offset Capabilities
5. Match Companies’ Capabilities and Country Needs

In order to provide a robust methodology as well as examples of how this process would be applied within an existing firm, Lockheed Martin was chosen as a case study and will be analyzed herein alongside the general methodology described. Specifically, two real, illustrative examples of sustainability offset projects Lockheed Martin could pursue in India and Saudi Arabia (two nations where Lockheed Martin is currently engaged in business development) were determined by application of this methodology.

In India, Lockheed Martin may wish to leverage a new graphene membrane they have developed called Perforene™ which has potential applications in water filtration and desalination. In Saudi Arabia, Lockheed Martin may wish to leverage their intelligent microgrid solutions as the nation focuses its attention on expanding its energy infrastructure.

¹ Dehoff, Dowdy and Kwon, “Defense Offsets, From ‘contractual burden’ to competitive weapon,” Aerospace and Defense (Americas), McKinsey & Company, July 2014

Finally, challenges which might be encountered by A&D companies using this methodology in actual practice are presented, and recommendations are provided that could address those challenges if A&D companies decide to implement and evolve this methodology in the future.

1 Introduction

1.1 Opportunities for Collaboration

Today more than ever in history, humanity and our way of life is being threatened by the negative effects of global megatrends such as population growth, climate change, and expanding social inequity. In response to these threats and in an effort to provide safeguards for the future securities of their citizens, governments are increasing their efforts to address these trends through policy, regulation and direct action. The United Nations Sustainable Development Goals (UNSDG)² are illustrative of recent collaboration and increasing agreement among countries that positive action must be taken. Clearly, though, governments alone cannot solve the many challenges addressed in the UNSDG. There is emerging space for unprecedented collaboration among governments, businesses, non-government organizations (NGO) and academic institutions to create innovative solutions to emerging challenges of sustainable global development.

This paper explores one of these potential collaboration areas, known as “offsets,” that traditionally aligns technologies, capabilities, and products within the aerospace and defense (A&D) industry to the needs of international customers. When considering how to address sustainability challenges, the question becomes: how might A&D companies utilize offset obligations associated with foreign military sales (FMS) to help countries address and achieve their sustainable development needs and goals (UNSDG-related or otherwise)?

According to a 2012 paper produced by the A&D management consulting firm Avascent and Fleishman Hillard International Communications, “offset regimes are becoming much more sophisticated as offset policies are paired with development objectives” which “create[s] a unique opportunity for forward-thinking companies and executives,” especially those that are “taking a holistic approach to offsets.”³ A recent paper published by McKinsey & Company points out that “offsets are a critical enabler for success in international markets,” “offsets can help Western companies tap into markets that would otherwise be difficult to access,” and “it is common for contractors to propose offset agreements aimed at developing industrial relationships through joint production or development.”⁴ Indeed, offset opportunities within the sustainability space do have the potential to be beneficial not just to the national customer, but also the A&D company themselves. As large, developing countries begin to achieve economic

² United Nations, “Open Working Group Proposal for Sustainable Development Goals.” Last accessed May 11, 2015. <https://sustainabledevelopment.un.org/sdgsproposal>

³ Avascent and Fleishman Hillard, “The Half-Trillion Dollar Challenge: Designing Offset Strategies to Build Reputation and Promote Development” July 2012. www.strategicoffsets.com

⁴ Dehoff, Dowdy and Kwon, “Defense Offsets, From ‘contractual burden’ to competitive weapon,” Aerospace and Defense (Americas), McKinsey & Company, July 2014

growth, global sustainability challenges will become more and more pronounced. Companies with established relationships and a strong understanding of these countries' needs will be well-positioned to influence responsible and sustainable development and also jointly benefit from the significant economic growth that will inevitably occur in the next century.

1.2 Overview of Lockheed Martin and Sustainability

According to Deloitte's 2014 Global Aerospace and Defense Sector Financial Performance Study, over 2 million employees currently work in A&D companies, which include large international corporations like Airbus Group, The Boeing Company, Fuji Aerospace, Mitsubishi Heavy Industries Aerospace, Magellan Aerospace and others.⁵ This paper presents an exploration of offsets in the sustainability space in the industry as a whole, which could be applied by any of the aforementioned companies, but in order to provide a more detailed and robust methodology for actual application, Lockheed Martin is used as a case study.

Lockheed Martin is the world's largest defense contracting company which employs over 112,000 people worldwide.⁶ It is headquartered in Bethesda, Maryland, USA and has regional offices on seven continents. Lockheed Martin views their sustainability initiatives as a "natural extension of [their] business strategy which covers a spectrum of environmental, social, and governance priorities."⁷ As stated in the Lockheed Martin 2014 Sustainability Report, "the future belongs to those who understand the technologies and systems that are the means for profound innovation in a resources-challenged world. Inherent to our business model, we recognize that the long-term value we provide our customers, our stockholders and the world is the enabling of thriving communities, environmental protection and sustainable economic development through technological advancement."⁸

Pursuant to this mission, Lockheed Martin has adopted a comprehensive sustainability management plan to effectively manage, measure and disclose performance related to objectives in six core areas. These six high impact areas for sustainability are:

1. Governance
2. Product Performance
3. Talent Competitiveness

⁵ Deloitte, "Global Aerospace and Defense Sector Financial Performance Study." Last accessed may 11, 2015 <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Manufacturing/gx-mfg-2014aandd-global-financial-performance-study.pdf>

⁶ Lockheed Martin, "Who We Are." Last accessed May 11, 2015. <http://www.lockheedmartin.com/us/who-we-are.html>

⁷ Lockheed Martin, "The Science of Citizenship: 2014 Sustainability Report." Last accessed May 11, 2015. <http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/Sustainability/2014-sustainability-report.pdf>

⁸ Lockheed Martin, "The Science of Citizenship: 2014 Sustainability Report." Last accessed May 11, 2015. <http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/Sustainability/2014-sustainability-report.pdf>

4. Supplier Sustainability
5. Resource Efficiency
6. Information Security

Lockheed Martin recognizes that “the broad scope of advanced technology systems, products and services [they] provide deliver shared value—and deepen strong relationships built on trust—on all seven continents.”⁹ They are one of the only A&D companies that complies with the Global Reporting Initiative (GRI) which developed the world’s most widely used sustainability reporting framework.¹⁰ As Lockheed Martin chairman, president and CEO Marillyn Hewson said, “these efforts helped us earn distinction as a new addition to the Dow Jones Sustainability World Index and, for the fourth consecutive year, a position on the CDP S&P 500 Climate Disclosure Leadership and Clean Performance Leadership Indices. This recognition helps confirm that our business strategy, which incorporates sustainability into our day-to-day operations, is not only responsible but also relevant to investors.”¹¹

1.3 Project Overview

The objective of this paper is to identify a methodology which will assist companies within the A&D industry identify offset opportunities which address sustainability needs of countries where they do business by matching those needs with pre-existing capabilities, resulting in mutually beneficial scenarios for all stakeholders involved in such a transaction. A team of five Massachusetts Institute of Technology (MIT) Laboratory for Sustainable Business (S-Lab) students with diverse global and industry backgrounds conducted this project with assistance from Lockheed Martin, which served as a case study so that a realistic and robust result (as to one based purely on research and hypotheticals) could be achieved. Additionally, the S-Lab team developed recommendations for addressing challenges which the team believes will present themselves when executing the methodology in practice. These are presented in the final section of this paper.

The case study involving Lockheed Martin involves identifying sustainability offset opportunities within two countries, India and Saudi Arabia. The existing sustainability needs of these countries were reviewed, and in parallel, Lockheed Martin’s offset capabilities were evaluated, taking into account numerous avenues in which offsets can occur such as direct, indirect, and through the use of Lockheed Martin’s product portfolio. Then, a process for matching India and Saudi Arabia’s sustainability needs with Lockheed Martin’s offset capabilities was developed: the core

⁹ Lockheed Martin, “The Science of Citizenship: 2014 Sustainability Report.” Last accessed May 11, 2015.
<http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/Sustainability/2014-sustainability-report.pdf>

¹⁰ Global Reporting Initiative, “What is GRI?” Last accessed May 11, 2015.
<https://www.globalreporting.org/information/about-gri/what-is-GRI/Pages/default.aspx>

¹¹ Lockheed Martin, “The Science of Citizenship: 2014 Sustainability Report.” Last accessed May 11, 2015.
<http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/Sustainability/2014-sustainability-report.pdf>

element of the framework. Lastly, this report provides two illustrative examples of mutually beneficial offset opportunities in India and Saudi Arabia which were identified using the S-Lab team's methodology, thereby demonstrating the results an A&D company could see upon application of the process in their offset planning strategies.

Below, Figure 1 depicts the overview of the sustainability offset identification process developed by the S-Lab team, which will be thoroughly explained under the section "Project Methodology and Process." The center of the figure represents the overlap of the countries' sustainability needs, Lockheed Martin's offset capabilities, and the interests of the other key stakeholders. It is within this intersection that the ideal offset projects can be identified.

Before that can be done, however, all three elements (country needs, offset capabilities, stakeholders) need to be thoroughly evaluated and understood. That is what this methodology seeks to achieve: a replicable process by which these three factors can be fairly and accurately evaluated in order for A&D companies like Lockheed Martin to make informed decisions about the offset projects which are likely to have high impact per investment.

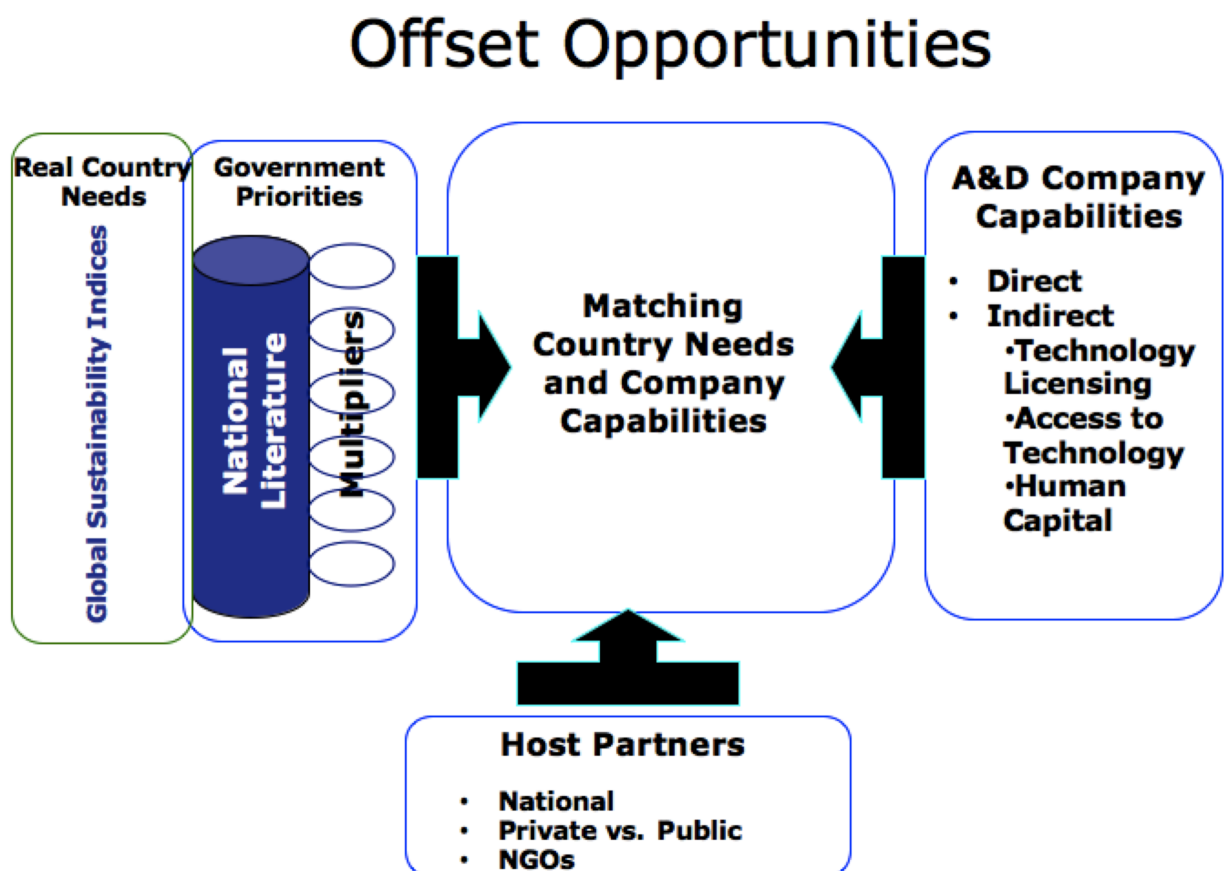


Figure 1

1.4 Countries Chosen for Case Study Evaluation

The S-Lab team decided to choose two countries on which they would focus and identify potential offset opportunities. Which two countries to choose was determined using the five following criteria.

- 1) Military spending as a percentage of the nation's gross domestic product (GDP)
- 2) Country's offset policies
- 3) Macroeconomic outlook
- 4) Political stability
- 5) Demographics

Using these criteria as a starting point for the team's initial research, it was eventually decided that India and Saudi Arabia should be chosen for this project. Detailed information for each country is provided below.

India

After the United States and China, India is likely to become the next military superpower in the medium term. Already the world's largest importer of military goods, India plans to continue increasing defense spending over the next few years as the country pursues modernization. Its average military spending during the last 5 years has been approximately 2.5% of GDP¹². In addition, rapid economic growth accompanied by a population that will soon surpass that of China and relative political stability makes India a priority country for aerospace and defense companies. Firms in this sector will also be increasingly required by national offset policies to tackle the country's needs such as eradication of extreme poverty, social inequality or infrastructure deficit.

Saudi Arabia

In 2014, Saudi Arabia positioned itself as the fourth highest military expenditure in the world with \$80.8 billion, more than 10% of Saudi GDP.¹³ A benevolent policy offset scheme makes this Middle Eastern country a priority as well for any aerospace and defense company. Saudi Arabia has a solid economy, "one of the best performing G-20 economies in recent years" (IMF). Bolstered by a continuous GDP growth and a decline in public debt, Saudi Arabia's domestic and foreign policies remain stable and predictable; stability is a prominent value in Saudi domestic politics.¹⁴ With a population of nearly 30 million, most of them young individuals (51% being under the age of 25¹⁵), Saudi Arabia is in a position for sustainable economic growth.

¹² The World Bank, "Military Expenditure (% of GDP). Last accessed May 11, 2015.
<http://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS>

¹³ CNN Money, "Saudi Arabia Boosts Military Spending to Record Level." Last accessed May 11, 2015.
<http://money.cnn.com/2015/04/13/news/economy/military-spending-saudi-arabia/>

¹⁴ <http://www.internationalpolicydigest.org/2014/07/13/saudi-arabia-stable/>

¹⁵ Murphy, Caryle. "Saudi Arabia's Youth and the Kingdom's Future". February 7, 2012.
<http://www.newsecuritybeat.org/2012/02/saudi-arabias-youth-and-the-kingdoms-future/>

2 Project Methodology and Process

The following subsections will detail in chronological order the methodology that was used by the S-Lab team to identify offset sustainability projects for Lockheed Martin within Saudi Arabia and India. It was the goal of the S-Lab team to create and document a process which had replicability. That is, the methodology described below, including resources utilized, could be applied to any other country - developed or developing - in which Lockheed Martin (or any other A&D company) wishes to identify potential sustainability offset projects which would create mutually beneficial gains for all stakeholders involved.

Figure 2, below, depicts the five steps of the sustainability offset identification methodology developed by the S-Lab team.



Figure 2

2.1 Assess Real Country Needs Using Third Party Indices

Every country in the world is faced with a set of challenges that threaten the welfare of its environment and its people, which can be called “sustainability challenges.” These could include, but are not limited to, issues like greenhouse gas emissions, water shortages, and air pollution. As a first step in identifying potential offset opportunities that will have great benefit to a country, it is key to understand what the real, existing challenges facing that country are. In theory, by targeting the most dire needs of a nation, A&D companies have the potential to make the biggest positive impact - as well as generate an offset project proposal which would seem appealing to governments of those nations as it addresses a real need. To determine what these most crucial needs are, A&D companies should utilize existing indices curated by third party organizations that can convey this information in a concise as well as unbiased manner.

There are many indices available which provide insight into a nation’s sustainability challenges. These include but are not limited to the following:

- Social Progress Index, by the Social Progress Imperative, socialprogressimperative.org
- Legatum Prosperity Index, by the Legatum Institute, prosperity.com
- Sustainable Society Index, by the Sustainable Society Foundation, ssfindex.com
- Environmental Performance Index, by Yale University, epi.yale.edu

A&D companies will be faced with a frustrating task if they attempt to incorporate each one - or even more than one - into their evaluation from a purely quantitative perspective. Each index has been developed by separate teams of experts who have used separate systems which rank and rate countries’ issues in a unique manner. That is not at all to suggest that the indices provide conflicting information. On the contrary, the final conclusion and resulting needs of a nation will be similar between them. However, choosing one index and using this as the numerical basis for the offset model is a reasonable approach on a granular level.

For this case study, the S-Lab team chose the Social Progress Index (SPI). Developed by a team composed of Harvard and MIT professors, the Social Progress Imperative is an organization which strives to “redefine how the world measures success¹⁶” by evaluating nations’ competencies in key areas that have direct impacts upon both the Earth and its people. Rather than simply evaluating a country’s growth and success based upon financial factors like GDP, the SPI is the ranking system used by the Social Progress Imperative that “enabl[es] leaders to systematically identify and prioritize issues.”¹⁷

SPI is recalculated annually with new data becoming available around late April. Countries are ranked in the SPI in the following way. First, three main categories (Basic Human Needs, Foundations of Wellbeing, and Opportunity) are used to organize 12 subcategories (4 each) as shown below in Table I.

Table I. SPI Categories

<u>Basic Human Needs</u>	<u>Foundations of Wellbeing</u>	<u>Opportunity</u>
Nutrition and Basic Medical Care	Access to Basic Knowledge	Personal Rights
Water and Sanitation	Access to Information and Communications	Personal Freedom Choice
Shelter	Health and Wellness	Tolerance and Inclusion
Personal Safety	Ecosystem Sustainability	Access to Advanced Education

Each country is given a score out of 100 for each of the 12 subcategories and is also ranked with regards to that subcategory out of all the countries (132 countries were included in the SPI ranking in 2014).

When choosing an aspect of sustainability on which an A&D company like Lockheed Martin may wish to focus their offset efforts, it may be enough to examine how each subcategory scored within a particular country alone. However, there is a potential opportunity at this point to consider the impact that an A&D company may be able to make across countries. If an A&D company is able to identify one or two sustainability challenges which are being faced by many nations simultaneously, it would be beneficial for them to spend time trying to identify potential offset capabilities, products, or projects which address these issues. The benefit comes in the future when the company wishes to tackle sustainability issues using an offset approach in a country where they have not done so before. If they have prior knowledge and experience applying one technology to a sustainability problem elsewhere, for example, they may save time and hassle trying to develop or flush out challenges associated with tackling a whole new problem.

¹⁶ Social Progress Imperative, “The Imperative.” Last accessed May 11, 2015.
<http://www.socialprogressimperative.org/about/the-imperative>

¹⁷ Social Progress Imperative, “The Imperative.” Last accessed May 11, 2015.
<http://www.socialprogressimperative.org/about/the-imperative>

2.2 Identify Government Priorities in the Sustainability Sector

In addition to the country's actual needs as determined by third party indices like SPI, governments have separately assessed their own peoples' needs as well. Governments employ different methodologies to evaluate their needs, but most of them lack numeral indicators to facilitate the understanding of their priorities. Furthermore, government priorities change and adapt in benefit of certain political environments. For this particular reason, it is difficult to determine continuity in government policies. Nevertheless, it is important to expose the available sustainability efforts and priorities of the target countries.

India

In 2014, the new government of India adopted a reformist position to reshape its economic development. Their new set of priorities include the implementation of programs for clean technology and energy efficiency in its endeavor to pursue a low-carbon growth model. Prime Minister Narendra Modi is reported to have shared his vision for "sustainable economic growth without compromising on environmental safety."¹⁸ Within a month of his coming to power, the government initiated a multi-sector debate on reinvigorating the sacred River Ganges, which is one of India's most polluted water bodies. Indian Finance Minister Arun Jaitley has proposed mega solar power projects in Rajasthan, Gujarat, Tamil Nadu and Jammu and Kashmir.¹⁹ India is constantly growing, but the country still faces basic need challenges. Part of their priorities include solving the water scarcity and energy crises.²⁰

Saudi Arabia

The Saudi Arabian General Investment Authority, or SAGIA, is the Saudi government agency in charge of prioritizing the country's investment interests and is therefore is an appropriate organization to turn to for identifying country needs from the government's perspective. SAGIA denotes 6 areas of investment and development interest: Energy, Transport and Logistics, Information and Communication Technologies (ICT), Health, Life Sciences and Human Capital. "Saudi Arabia is funding massive development projects," Finance Minister Ibrahim al-Assaf has said to the Saudi Press Agency.²¹

¹⁸ Huffington Post, "Sustainable Development: An Agenda for India." Last accessed May 11, 2015. http://www.huffingtonpost.com/samarth-pathak/sustainable-development-india_b_5602482.html

¹⁹ The Economic Times, "Budget 2014: Arun Jaitley's power-sector plans draw inspiration from Gujarat model." Last accessed May 11, 2015. http://articles.economictimes.indiatimes.com/2014-07-10/news/51300935_1_solar-parks-solar-energy-corporation-jyotigram-yojana

²⁰ Arlington Institute, "Imminent Water Crisis in India." Last accessed May 11, 2015. <http://www.arlingtoninstitute.org/wbp/global-water-crisis/606>

²¹ Bloomberg Business, "Saudi Arabia's 2015 Budget Will Finance 'Massive' Projects. Last accessed May 12, 2015. <http://www.bloomberg.com/news/articles/2014-12-17/saudi-arabia-s-2015-budget-to-fund-massive-projects-spa-says>

2.3 Evaluate Government Multipliers

In addition to understanding government sustainability priorities as described above from the nation's own literature and investments, a country's national offset policies should also be taken into account. Specifically, a key way in which governments communicate their offset priorities and interests for offset projects (sustainability-related and not) is through the use of multipliers. Multipliers essentially give extra financial credit to A&D companies for offset projects that the government deems particularly beneficial. A multiplier of 1 means that the investment in the offset will be taken at 100% the value of the obligation. With a multiplier of 2, every dollar spent in the offset will be taken at double to fulfill an obligation.

In an ideal world, every country would have established a system of multipliers which would effectively communicate the government's interests and priorities to A&D companies. Unfortunately, not all nations around the world have multipliers built into their national offset policies. Additionally, A&D companies are often at a loss to understand the established criteria (if there even are any) which define these multiplier values. Compounding the difficulty of this situation is that often multipliers are assigned on a case-by-case basis by government agencies or representatives.

India

India is making a dramatic effort towards transparency and clarity in their offset policies. In 2012, major revision to the Defense Offset Guidelines (DOG) created a more open Defense Procurement Procedure, now managed by the new Defense Offset Management Wing (DOMW). India is highly interested in two initiatives: the sustainable development of their national companies, and technological defense acquisitions. In the revised policy, India establishes a multiplier of 1.5 for offsets with Micro, Small, and Medium Indian Enterprises (MSMEs), and a multiplier of 3 for technological acquisitions within the Defense Research and Development Organization (DRDO).²²

Saudi Arabia

The Saudi Economic Offset Program indicates that Saudi Arabia prioritizes the creation of high value jobs, training, technology transfer, investment local firms, developing in-country capabilities, opportunities, diversifying the economy and self-sufficiency. However, the program does not specify values for multipliers, although Foreign Direct Investment (FDI) under SAGIA priorities, often receives high multipliers.²³

2.4 Assess Companies' Offset Capabilities

Identifying the sustainability challenges that the nation is facing as well as those that the government has prioritized is only part of the process of identifying a successful offset project.

²² Defence Review Asia, "India's Defence Offset Guidelines 2012." Last accessed May 12, 2015. <http://www.defencereviewasia.com/articles/180/India-s-Defence-Offset-Guidelines-2012>

²³ Kirchwehm, Heinz, "Success Factors in Offset Deals: A Case Study Based Examination", *International Journal of Business Research and Management*, Vol 5:2, 2014. <http://www.cscjournals.org/manuscript/Journals/IJBRM/volume5/Issue2/IJBRM-163.pdf>

The next portion of the methodology comes from an identification of capabilities an A&D company possesses that they may use to fulfill an offset obligation.

The types of offset capabilities that are typically employed within the A&D industry vary greatly from a direct application of technology to solve a problem to more intangible applications of resources like staff volunteer hours. These offset types and categories are described in the sections below, accompanied by examples to illustrate a specific application of a capability within each category.

Direct Offsets

McKinsey & Company describes direct offsets as “agreements that are directly related to the defense products being sold.”²⁴ For example, in 2007 Lockheed Martin sold six C-130J transport aircraft to India for \$962 million which was followed by a contract for six more aircraft for \$1.1 billion.²⁵ As part of the sales agreement, both deals included direct offsets via foreign military sales (FMS). Specifically, the offset agreement stated that aerostructures for C-130s would be manufactured in India by the Tata Group, which has now been integrated Lockheed Martin’s C-130 supply chain. This direct offset also highlights the ability of Lockheed Martin to support Indian Prime Minister Modi’s ‘Make in India’ initiative through the joint venture between Lockheed Martin and Indian Tata Group.²⁶ India’s defense ministry required an offset of \$275 million.

Because direct offsets as a whole are typically associated with security and defense spending (many core A&D products), it is unlikely that offset obligations would be required by the sale of products that are not specifically defense or security related. Although Lockheed Martin does have noteworthy products that are not specifically security or defense related, Ocean Thermal Energy Conversion (OTEC)²⁷ is one example, this report does not consider direct offsets from non-security or defense related products. However, products like OTEC, with a clear nexus to sustainable needs of countries, have potential to be used in consideration for indirect offsets associated with foreign sales of other A&D products.

Indirect Offsets: Intellectual Property and Technology Licensing

McKinsey & Company describes indirect offsets as “agreements that are not related to the defense products being sold.”²⁸ In this paper, the S-Lab team has divided indirect offsets into

²⁴ Dehoff, Dowdy and Kwon, “Defense Offsets, From ‘contractual burden’ to competitive weapon,” Aerospace and Defense (Americas), McKinsey & Company, July 2014

²⁵ IHS Jane’s 360, “Aero India 2015: Lockheed Martin amidst challenges, but sees bright future for C-130 in India.” Last accessed May 12, 2015. <http://www.janes.com/article/49105/aero-india-2015-lockheed-martin-admits-challenges-but-sees-bright-future-for-c-130-in-india>

²⁶ IHS Jane’s 360, “Aero India 2015: Lockheed Martin amidst challenges, but sees bright future for C-130 in India.” Last accessed May 12, 2015. <http://www.janes.com/article/49105/aero-india-2015-lockheed-martin-admits-challenges-but-sees-bright-future-for-c-130-in-india>

²⁷ <http://www.lockheedmartin.com/us/products/otec.html>

²⁸ Dehoff, Dowdy and Kwon, “Defense Offsets, From ‘contractual burden’ to competitive weapon,” Aerospace and Defense (Americas), McKinsey & Company, July 2014

three subcategories into which they may fall: intellectual property and technology licensing, technology access, and human capital.

This first category of indirect offset – intellectual property (IP) and technology licensing - involves A&D companies utilizing IP for existing technology and sharing it to create value and capture offset credit. For example, in 1984 Saudi Arabia purchased the Airborne Warning and Control System (AWACS) from United States (US) contractors and the US government. Four major companies were involved in the project: General Electric, ITT Corp., Westinghouse and Boeing²⁹, the latter being the prime contractor. The project involved establishing an air defense shield for Saudi Arabia with five E-3 Sentry AWACS aircraft and eight KE-3 refueling aircraft.³⁰ The associated costs reached US\$5 billion, the largest defense sale at that time. As a result of this project, Saudi Arabia implemented the first economic offset, The Peace Shield I program. The program called for the re-investment of 35% of the technical value of the Peace Shield contract into advanced joint ventures with Saudi private sector investors. The offset program focused on 3 main goals:

- Develop high-tech industries and services, particularly technological know-how and expertise for the support of the Kingdom's high-technology defense system,
- Technology transfer,
- Private sector investment formation, by requiring 50% Saudi ownership in joint venture project undertakings.³¹

²⁹ Al-Sebaie, Mohammed M., "An analytical study of job satisfaction among Saudi nationals in the Saudi economic offset program companies", 2000. <http://etheses.dur.ac.uk/4507/>

³⁰ <http://www.democraticunderground.com/11338149>

³¹ Al-Sebaie, Mohammed M., "An analytical study of job satisfaction among Saudi nationals in the Saudi economic offset program companies", 2000. http://etheses.dur.ac.uk/4507/1/4507_1971.pdf?UKUDh:CyT



Figure 3: USAF E-3 Sentry AWACS aircraft³²

The Peace Shield program was essentially a multi-type offset project, with direct and indirect offset obligations. With a total of 11 projects, the total investment into the program reached US\$700 million. One of the projects consisted of technology transfer from Boeing's commercial and civil aircraft to Al Salam Aircraft Co, a joint venture Maintenance, Repair and Overhaul (MRO) aircraft company. Boeing Industrial Technology Group (BITG) owns 50% of the company, the rest is owned by Saudi Investors³³. The agreement consisted of knowledge and technical transfer on main airframe modification, composite material design and manufacture, and rotary blade technology. Because of this transfer, Al Salam was the first company to receive FAA certification in the region for civil aircraft maintenance.³⁴ Currently, Al Salam has 145 Aircraft Maintenance Organization certificates from major aviation authorities.³⁵

An important aspect of this category of indirect offset is the enduring value proposition relative to the total investment. There is shared future value for both Boeing and the Saudi investors and neither has to front the total cost of the initial investment. In these arrangements, A&D companies seek to keep the cost of investment down while maximizing value credit for the IP or

³² <http://www.flickr.com/photos/usairforce/8170157527/>

³³ JS Firm, "Alsalam Aircraft Company Ltd." Last accessed May 12, 2015.
<http://www.jsfirm.com/job/Alsalam-Aircraft-Company-Ltd/Riyadh,-Ar-Riyad-Saudi-Arabia-International/982/companyprofile>

³⁴ Al-Sebaie, Mohammed M., "An analytical study of job satisfaction among Saudi nationals in the Saudi economic offset program companies", 2000.
http://etheses.dur.ac.uk/4507/1/4507_1971.pdf?UkUDh:CyT

³⁵ Alsalam Aircraft Co., "Profile." Last accessed May 12, 2015.
http://www.alsalam.aero/alsalam_profile.aspx

technology transferred as well as the long term value created by the project. Among the most important aspects here is that the business must be viable. This requires significant due diligence to ensure the viability of the venture. The challenge to apply this type of offset using sustainability focused IP or technology is to understand the specific technology, the business case, and the viability of potential indigenous partners to successfully deploy the project.

Indirect Offsets: Technology Access

This second category of indirect offset – technology access – involves A&D companies providing access to their technological capabilities to governments or their partners to solve challenges they could not otherwise overcome on their own. What follows is an example of this indirect offset type.

On December 27th, 2000, the government of Chile decided to buy 10 Block 50 F-16 fighters worth \$500 million from Lockheed Martin, in which Lockheed Martin agreed to participate with the Chilean government's CORPO agency in a series of offsets.³⁶ Lockheed Martin revealed that offset work packages linked to the program have so far included investments in the Chilean forestry, fisheries and ship-building sectors.³⁷ More specifically, with regards to technology access, Lockheed Martin committed to two different indirect offsets in the aerospace domain.

The first was the opening of a regional headquarters by Lockheed Martin and the technology based company RASSA in Santiago. The objective was to promote Chile as a leader in the development of technology and generate export revenue from technology services. RASSA, in collaboration with Lockheed Martin, aimed to develop flight information systems, inventory control, seat reservations and ticket sales software for national and regional airlines, using web-based solutions.³⁸

The second offset in the aerospace domain involved the collaboration in the opening of a new General Electric International Technical Center of Excellence. Operated by the Chilean IT company Adexus, Lockheed Martin collaborated in the setup of this hub for the development of highly specialized, world-class technical publications for the global aerospace industry.³⁹

It is easy to imagine myriad scenarios where allowing third party access to existing IT infrastructure, software and technical information can benefit those involved in his type of offset. Access to grid management software, access to supercomputer processing time, access to

³⁶ F-16.net, "Chile." Last accessed May 12, 2015. http://www.f-16.net/f-16_users_article9.html

³⁷ Flight Global, "FIDAE 2006 Show Report: Enaer set to make F-16 parts in Lockheed deal." Last accessed May 12, 2015. <http://www.flightglobal.com/news/articles/fidae-2006-show-report-enaer-set-to-make-f-16-parts-in-lockheed-205819>

³⁸ Mercurio Antofagasta, "Lockheed Martin implementa cuarto proyecto de Offset en Chile." Last accessed May 12, 2015. http://www.mercurioantofagasta.cl/prontus4_noticias/site/artic/20050217/pags/20050217014739.html

³⁹ PR Newswire, "General Electric, Lockheed Martin Mark Inauguration of International Technical Center of Excellence in Chile." Last accessed May 12, 2015. <http://www.prnewswire.com/news-releases/general-electric-lockheed-martin-mark-inauguration-of-international-technical-center-of-excellence-in-chile-55720852.html>

information, surveillance, and reconnaissance capacity are all examples of scenarios where A&D companies could source existing hardware and software solutions to sustainability needs such as precision agriculture, meteorological data, energy efficiency and many more.

Indirect Offsets: Human Capital

The final category of indirect offset involves A&D companies utilizing their staff resources to provide services that address an offset obligation. Lockheed Martin created an example of this offset through one of their more creative initiatives known as the India Innovation Growth Program.



Figure 4: Lockheed Martin India Innovation Growth Program, 2014⁴⁰

In March 2007, Lockheed Martin created a joint partnership with India's Department of Science and Technology, the Federation of Indian Chambers of Commerce and Industry, University of Texas, and Stanford Business School.⁴¹ This program, which functions as a competition amongst innovators that fosters their business capabilities through mentoring and training, has the goal of "accelerat[ing] innovative Indian technologies into the global markets."⁴² Lockheed Martin supports the program through sponsoring business and engineering mentors, and Lockheed Martin's Chief Technology Officer even serves as a judge for the competition.⁴³

In an offset involving human capital, there is room for significant creativity and flexibility in its application. The in-kind contribution of talented employees is often achievable with relatively low opportunity and financial costs, but can provide significant value for the beneficiaries. There are

⁴⁰ India Innovates, "About the Programme." Last accessed May 12, 2015.

<http://www.indiainnovates.in/aboutprogram.aspx>

⁴¹ India Innovates, "About the Programme." Last accessed May 12, 2015.

<http://www.indiainnovates.in/aboutprogram.aspx>

⁴² India Innovates, "About the Programme." Last accessed May 12, 2015.

<http://www.indiainnovates.in/aboutprogram.aspx>

⁴³ Lockheed Martin, "2013 Sustainability Report." Last accessed May 12, 2015.

<http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/Sustainability/2013-sustainability-report.pdf>

also potential intangible benefits to this category such as employee morale, sense of self-worth and job satisfaction that comes from being a part of a project with far reaching sustainability impacts. Because of the wide ranging ways to design such an offset, there are many opportunities to apply human capital to country needs with a sustainability nexus. One potential example might be electrical grid management. Projects could be designed that involve contribution of subject matter experts to indigenous utility companies in order to improve efficiency of grid operations.

Lockheed Martin Capabilities

Lockheed Martin is “principally engaged in the research, design, development, manufacture, integration, and sustainment of advanced technology systems and products.”⁴⁴ Lockheed Martin provides a wide range of products and services that have defense, civil, and commercial applications and organizes its five business segments based on the nature of the products and services offered: Aeronautics, Information Systems & Global Solutions (IS&GS), Missiles and Fire Control (MFC), Mission Systems and Training (MST), and Space Systems.⁴⁵

The S-Lab team attempted to identify the Lockheed Martin products and technologies available for potential sustainability applications. From the 2013 Lockheed Martin Annual Report, The Science of Citizenship: 2014 Sustainability Report, and interviews with Lockheed Martin employees, the team identified the following capabilities and products that might be applied to solving sustainability challenges:

- Distributed Energy
- Sustainment
- Ocean Thermal Energy Conversion (OTEC)
- Waste-to-Energy
- Filtration
- Oil & Gas Sensors
- Cyber Security / Training & Testing
- Advanced Nano-Technology
- Robotics / Smart Machines
- Transformation / Transportation Logistics
- Advanced Materials & Manufacturing

It is important to note that the above list is a very high level summary of potential capabilities developed in absence of a detailed product inventory. Ultimately, each of above capabilities requires a detailed assessment by the appropriate stakeholders (business development, sustainability, offset, risk management, finance, sales and marketing, etc.). This assessment should include specific products and technologies, an understanding of how they address a sustainability need, an assessment of the market and business opportunity, detailed knowledge

⁴⁴ Aeroweb, “Lockheed Martin (LMT).” Last accessed May 12, 2015. <http://www.bga-aeroweb.com/Lockheed-Martin.html>

⁴⁵ Aeroweb, “Lockheed Martin (LMT).” Last accessed May 12, 2015. <http://www.bga-aeroweb.com/Lockheed-Martin.html>

of investment costs, and an understanding of the type of indigenous partners that would be necessary successfully employ the technology or product. In short, before the product is ready for an offset application, it must have a well-developed business case.

2.5 Match Companies' Capabilities and Country Needs

An ideal sustainability offset project is one which meets the needs of both the people or environment of the nation in which Lockheed Martin is expanding, aligns with the government priorities in that nation and allows Lockheed Martin an opportunity to adopt technologies within its portfolio without significant further development. Naturally, finding the intersection of these factors can be incredibly challenging, but that is exactly the objective for which the S-Lab team was tasked.

After the steps outlined in the methodology have been completed as described above (defining real country needs, assessing government priorities through legislation and multipliers, and identifying and assessing offset capabilities), the information researched needs to be analyzed in such a way that identifies these potential “win-win,” scenarios for all stakeholders involved.

To facilitate this process, the S-Lab team returned to the SPI table of real needs originally presented in Appendix A. By adding to this rubric a list of the technologies evaluated from the previous section and identifying overlap in areas where the country's needs are the greatest *and* where an A&D company demonstrates capabilities and products, a starting point for generating novel approaches to addressing sustainability challenges through offsets can be developed.

The S-Lab team has generated this rubric for Lockheed Martin, which can be found in Appendix C. Appendix C is a rollup of all the countries of interest with respective SPI scores across the high level categories. This view is helpful in two important ways. First, it provides a visual depiction of significant sustainability challenges shared by all of these countries (three lowest ranked needs highlighted). Second, it identifies potential capabilities that Lockheed Martin might contribute as solutions to address these challenges. By viewing common sustainability needs across multiple countries, Lockheed Martin can both identify where potential exists to impact sustainability and where potential market growth and diversification opportunities exist to create significant business value. By understanding where Lockheed Martin has existing capabilities that align with common country needs, Lockheed Martin can make better informed decisions about which capabilities might warrant further development.

Time and expertise limited the team's ability to develop a robust understanding of specific products and capabilities that exist within Lockheed Martin that have direct sustainability applications. Appendix C is not an all-inclusive list and requires additional rigor, but is intended to act as a starting point for developing a more robust matrix to map specific capabilities and products to sustainability needs identified in the SPI. Appendix D is a more detailed breakdown of the SPI scores for India and Saudi Arabia specifically, which played a role in how the S-Lab team mapped specific capabilities to country needs. As the S-Lab team will discuss in the recommendations below, time should be dedicated to developing a data repository of

capabilities, products, and successful offset projects that have a clear sustainability nexus. As described in Lockheed Martin's 2014 Sustainability Report, Product Performance, Performance Indicator 4, "Start to track sustainability-based intellectual property (IP) monetization," could be a step in this direction. As Lockheed Martin evaluates a product classification framework, the SPI and rubric provided in Appendices C and D might inform this framework.

This process is not one that lends itself well to optimization; that is, finding the ultimate best offset project that would provide the greatest benefit to all stakeholders at the lowest cost. The subjective variables involved in such a process are too numerous to define, but may include:

- Lockheed Martin's willingness (or ability) to share, sell or transfer technology
- A government's willingness, interest, or ability to adopt a technology
- Political dynamics
- Government alignment of priorities with sustainability (or real country needs)
- Governance structure to properly oversee the offset delivery

Because of the many nuances of these subjective variables, the final outcome of any particular offset will depend greatly on the result of a comprehensive engagement process with the host country. Ideally, Lockheed Martin will be able to evolve this methodology to include a matrix that will map the identified offset opportunities with the country priorities determined by offset incentives. Due to the complexity and specific criteria required to determine offset multipliers, this step was determined to be outside of the scope of this project. However, a cross-functional team within Lockheed Martin with specific product information and a detailed understanding of the ability to offer specific benefits like technology transfer, product licensing, training and education would be well-positioned to develop a final rubric which could prove very informative in final offset discussions. This final step would allow all parties to better understand the impact of particular offset options on the sustainability needs of the country relative to the development and deployment costs of Lockheed Martin.

3 Illustrative Examples

The S-Lab team applied the 5-step methodology described above to Lockheed Martin's current activities in India and Saudi Arabia, which allowed the team to identify two examples of sustainability offset projects (one in each country) which Lockheed Martin may choose to pursue in the future. These are detailed below.

3.1 Leveraging New In-House Technologies in India

For the past two decades, Lockheed Martin has maintained a strong presence in India, partnering with Delhi Technological University and sponsoring different social responsibility

activities.⁴⁶ Lockheed Martin's solid foundations in India present an opportunity to expand business development and utilize its capabilities in its current and future offset obligations.

Using the methodology to evaluate offset opportunities, the team identified that water and sanitation SPI score is 54.57 (based on a 0-100 scale) and ranks 98 out of 132 countries. In addition, studies reveal that drinking water supply and sanitation in India continue to be inadequate, even with the joint efforts perpetrated by the government and several NGOs.⁴⁷ The National Ganga River Basin Authority (NGRBA) was recently created to address the pollution of the Ganges River, the largest and most sacred river for India. In 2011, the World Bank approved \$1 billion in funding, so that can make investments "for reducing pollution in a sustainable manner".⁴⁸

The revised Defense Offset Guidelines (DOG) indicate as a key objective "augmenting capacity for research, design and development related to defense products and services" and "encouraging development of synergistic sectors like civil aerospace, and internal security."⁴⁹ In addition, the government's position on offset priorities is clearly defined with regards to multipliers: 1.5 for Micro, Small, and Medium Indian Enterprises (MSMEs) and 3 for technological acquisitions for the Defense Research and Development Organization (DRDO).

Within Lockheed Martin's product portfolio is graphene membrane called PerforeneTM, a state-of-the-art filter with huge potential applications in different industries. The membrane has micro apertures the size of a nanometer or less which are capable of retaining harmful components, allowing water to flow through the nano-holes. PerforeneTM offers an ideal combination of high technological innovation for multiple applications, not only for defense purposes, but for social progress and human development. It also has the potential to drastically reduce energy use for filtration and desalination processes. This is a breakthrough that can revolutionize water security for countries in need of this invaluable resource.⁵⁰

Pairing these needs and capabilities, Lockheed Martin can evaluate the potential market opportunity for business and sustainability. PerforeneTM could be used to fulfill offset obligations and leverage new markets for water filtration and desalination in South Asia and the Middle East. Similar to the Peace Shield I Program, Lockheed Martin can either partner or transfer technology to MSMEs. A crucial aspect in developing effectively this technology would be the implementation of business plan to assure successful collaboration between Lockheed Martin

⁴⁶ Lockheed Martin, "India." Last accessed May 14, 2015. <http://www.lockheedmartin.com/us/who-we-are/global/india.html>

⁴⁷ Planning Commission of India. "Health and Family Welfare and AYUSH : 11th Five Year Plan"

⁴⁸ Treehugger, "World Bank Approves \$1 Billion for Ganges River Cleanup." Last accessed May 14, 2015. <http://www.treehugger.com/clean-water/world-bank-approves-1-billion-for-ganges-river-cleanup.html>

⁴⁹ Defence Review Asia, "India's Defence Offset Guidelines 2012." Last accessed May 12, 2015. <http://www.defencereviewasia.com/articles/180/India-s-Defence-Offset-Guidelines-2012>

⁵⁰ Seeking Alpha, "Lockheed Martin's Newest Innovation Isn't What You Expect" Last accessed May 14, 2015. <http://seekingalpha.com/article/2350985-lockheed-martins-newest-innovation-isnt-what-you-expect>

and its partners. A Joint Venture in which Lockheed Martin holds majority of shares could be good framework.

Perforene™ is essentially a fabric, India enjoys the advantage of strong textile capabilities, one of the mainstays of the national economy.⁵¹ India is the second largest producer of textiles and garments in the world.⁵² Lockheed Martin can find attractive to manufacture Perforene™ in a country that offers abundance in raw materials and skilled labor, several companies offer a set of technological capabilities to manufacture high performance membranes. Mahavir Corporation, established in 1992 in Ahmedabad, offers a wide range of products and capabilities, particularly manufacture and fabrication of PTFE Coated Fiber-Glass Fabric and Filter Fabric.⁵³ The manufacturer of these products require strict process control with specialized equipment and high skilled labor, capabilities that the fabrication of Perforene™ most likely needs.⁵⁴ Adnano is an Indian-based company, specialized in the supply of graphene for different industries including, electronics and aerospace. These companies provide a powerhouse to Lockheed Martin's venture. Partnering with established companies also offers a variety of ways to structure an investment. A joint venture with an existing company relieves Lockheed Martin of funding the entire capital investment necessary to get the project off the ground.

India is in need of solutions and Lockheed Martin can provide sustainable solutions by partnering with local developing companies, fabricating the membrane in India, and expanding this line of business to the entire South Asia region. It is important to remark that, according to SPI, surrounding countries have similar needs in water filtration and sanitation. With a thoroughly developed and well executed business model, this arrangement could potentially provide enduring value to all parties of the venture.

3.2 Expanding Saudi Arabia's Energy Potential

As identified by the Saudi Arabian General Investment Authority, energy constitutes one of the six priority areas of interest in government investment. With a heavy dependence on petroleum and its major oil projects nearing completion, Saudi Arabia is trying to expand its natural gas, renewable energy and electric power industries.

With regards to electricity, Saudi Arabia generated 292.2 billion kWh in 2013, seven percent more than the previous year and more than double the electricity generated in 2000.⁵⁵ This

⁵¹ India Brand Equity Foundation, "Textile Industry in India." Last accessed May 12, 2015.
<http://www.ibef.org/industry/textiles.aspx>

⁵² Shine, "Textiles Industry in India." Last accessed May 12, 2015.
<http://info.shine.com/industry/textiles/17.html>

⁵³ Mahavir Corporation, "Welcome to Mahavir Corporation." Last accessed May 14, 2015.
<http://www.mahavircorp.com/about.html>

⁵⁴ Conceptual design of membrane structures, Agnesi Vittorio, 1998.

⁵⁵ BP, "BP Statistical Review of World Energy 2014," 2014.
<http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf>

sharp rise in demand for power is driven by population growth, an expanding industrial sector, high demand for air conditioning during summer, and highly subsidized electricity rates. According to the Middle East Economic Survey, Saudi Arabia holds the largest expansion plan in Middle East for power generation, estimating to increase capacity to 120 GW by 2032. By this year, Saudi Arabia plans to add 41 GW of solar power, 18 GW of nuclear power and 4 GW from other renewable sources to expand electricity supply.⁵⁶

Unsurprisingly, Saudi Arabia has already emerged as the world's third largest market for grid.⁵⁷ With such heavy investments in new infrastructure projects in power, transport and industry development, Saudi Arabia represents a very attractive opportunity for Lockheed Martin's intelligent microgrid solutions as part of an offset. An intrinsic challenge posed by the integration of different energy sources is the assurance that these sources operate well together. Intelligent microgrid solutions, especially suited for the presence of renewable energies, can help to ensure uninterrupted power. Other benefits in terms of sustainability are overall reduced carbon emissions, generator fuel usage reduction and reduced electricity costs.

A microgrid typically runs while connected to the grid but its main feature is that in times of power outages or storms it can also operate independently using local energy generation. In this sense, a microgrid can be powered by generators, batteries, or renewable sources like solar panels or waste to energy.⁵⁸ This opens a variety of choices for Lockheed Martin to partner with local Saudi companies in pursuing an offset opportunity in this domain. One mechanism could be to partner with Saudi Electricity Company (SECO), 80% state-owned, 20% trading on the Saudi stock market, and the largest utility company by market value in the Gulf Region.⁵⁹ With a monopoly on the generation of electricity across the country, SECO is also in charge of transmitting and distributing electricity through the national grid. Through a technology licensing approach, Lockheed Martin could potentially provide SECO its microgrid solutions to tackle energy efficiency challenges to effectively balance the rising electricity demand growth. In this case, the technology licensing would be framed under regulation provided by the Saudi Ministry of Water and Electricity through its Electricity & Cogeneration Regulatory Authority (ECRA); the organization which oversees the electricity industry in Saudi Arabia.⁶⁰

Additionally, given the ongoing plans of the Saudi government to expand its current installed base in solar power generation, Lockheed Martin could also explore potential partnerships with local Saudi companies in the form of joint ventures to provide a combined value proposition to the government to effectively integrate renewable sources of energy such as solar into the national grid through a microgrid solution. Saudi agencies that could help in determining adequate local business partners for this endeavor could be Saudi Arabia Solar Industry

⁵⁶ <http://www.eia.gov/>

⁵⁷ <http://smartcitiescouncil.com/>

⁵⁸ Energy.gov, "How Microgrids Work." Last accessed May 14, 2015. <http://energy.gov/articles/how-microgrids-work>

⁵⁹ Arabian Business, "Saudi Electricity Company." Last accessed May 14, 2015. <http://www.arabianbusiness.com/companies/saudi-electricity-company-66578.html>

⁶⁰ Saudi Arabia Ministry of Water and Electricity. <http://www.mowe.gov.sa/>

Association (SASIA), a non-governmental association which seeks to promote solar power in Saudi Arabia and Middle East⁶¹, or DarSolar, a 100% Saudi-owned company which assists companies that are interested in becoming established in Saudi Arabia in the solar industry.⁶²

Between 2013 and 2025, countries in the Gulf region will have spent nearly \$1 trillion on defense and approximately one third of this will be dedicated to capital expenditures. If a 35% offset requirement is enforced, another \$105 billion could be either reinvested or sourced domestically, generating 84,000 jobs in Saudi Arabia alone.⁶³ The example in microgrids illustrates how Lockheed Martin could leverage its own technology to tap into this spectacular opportunity in Saudi Arabia. With the right incentives in place, Lockheed Martin can tackle both Saudi Arabia's national defense strategy and its other sustainable development programs. As we have seen, there is no unique method to establish offset ventures. However, in order to succeed, Lockheed Martin would need to engage in high level decision making discussions with the Saudi government while coordinating several local stakeholders' interests and efforts throughout the offset project.

4 Recommendations

As aerospace and defense companies seek to fulfill increasing offset obligations with countries in which they are currently engaged in business development, there is also increasing opportunity to examine opportunities within the sustainability space where these companies can leverage their own capabilities to address environmental and social challenges. Using the 5-step methodology presented in this paper, the MIT S-Lab team believes that it is possible to identify sustainability offset projects through careful consideration of a country's real sustainability needs, government priorities laid out in national literature and offset policies (such as multipliers) and the A&D companies' own capabilities to meet these needs.

⁶¹ Saudi Arabia Solar Industry Association. <http://saudi-sia.com/>

⁶² <http://www.darsolar.com/>

⁶³ http://www.atkearney.com/paper/-/asset_publisher/dVxv4Hz2h8bS/content/gcc-defense-offset-programs-the-trillion-dollar-opportunity/10192

However, as mentioned above, this process is a complex one which does not lend itself well to optimization. Rather, there are a multitude of ways in which large, international A&D companies might choose to address a myriad of sustainability challenges. The ultimate projects which are identified through this process may be some of the best, but the ultimate decision to pursue such a project is based upon collaboration from many stakeholders and is subject to many factors often outside of the companies' control.

Therefore, it is likely that when applying the MIT S-Lab team's methodology in practice, certain challenges will arise. For example, offset team members at the A&D company may not be fully aware of the capabilities of a technology to meet an identified sustainability need. Ideally, the research and development team who worked on that technology would be able to communicate this information, but it is simply not always the case.

In order to address these and other challenges that arise, the MIT S-Lab team has identified and outlined below several recommendations that A&D companies could act upon which would greatly increase their ability to identify more mutually beneficial sustainability offset projects. These recommendations are presented for the company featured in this paper, Lockheed Martin.

First, Lockheed Martin should develop a product database which can be utilized when developing offset projects. At minimum, this could include an archive of the technologies used in past offsets which could help team members analyze previous successes and help identify types of potential future offsets which would be easily replicable by the application of the same technology. In addition to this past information, a team member should also be able to query current offset obligations Lockheed Martin must fulfill in order to gain additional insights on the working relationships with in-country partners. Ideally, this offset product database would also integrate and identify sustainability characteristics of Lockheed Martin products, whether they have been used in past or current offset projects or not. This may require a full sustainability inventory, or sustainability rating of all products. In other words, Lockheed Martin needs to create a fully built-out menu of products that offer solutions to global sustainability needs (as determined by the SPI, or other widely accepted measures of ESG development needs). Appendices C and D can serve as a starting point for this menu of sustainability focused solutions. Indeed, such a database at first might be quite an undertaking, but over time it would be easier to maintain as many different stakeholders within Lockheed Martin contribute their knowledge about the products, the products' sustainability characteristics, and the products' offset capabilities. Truly, this database would also increase transparency within the organization as it serves as a sustainability offset focal point. Hopefully, it would increase collaboration and innovation between the different business silos of Lockheed Martin to enable more creative offset opportunities.

Second, as mentioned in the first recommendation, large organizations like Lockheed Martin are often stove-piped into specific functions and business segments. This can cause a lack of transparency on how unique capabilities can be matched to a potential offset that might call for technology from another business unit. Sustainability is a challenging problem that requires collaboration from the entire organization; not one office in Lockheed Martin can solve these

complex problems. The S-Lab team recommends a company sponsored initiative, such as a sustainability technology showcase or collaborative summit, to increase collaboration and transparency among the business segments. This will also naturally identify champions within each business segment that have an interest in sustainable solutions. Such an event could also be framed as a competition focused on a specific need, such as renewable energy. The S-Lab team recommends this event be cross-organizational in nature, with participation from the sustainability office, business development, offset office, and representatives from the five major business segments.

Third, the majority of Lockheed's Martin's business development is understandably focused on existing and developing A&D markets. Sustainability presents new opportunities. Lockheed Martin should use sustainability as a lens for identifying new business opportunities and markets. Offsets present an outstanding opportunity to expand into these markets while simultaneously growing their core markets for A&D products. However, full integration of sustainability into all phases of product development will create a broader understanding of how existing technologies might be further developed to address global sustainability needs. Lockheed Martin should consider implementing a sustainability scoring mechanism, similar to the Nike Environmental Design Tool.⁶⁴ This tool could build awareness and incentive for Lockheed Martin's research and design teams to consider and understand sustainability throughout the product design phase. This would ultimately lead to a much more robust inventory and understanding of sustainability throughout the organization and could help make sustainability a signature of Lockheed Martin.

Finally, the S-lab team acknowledges that no offset project is likely to succeed without a robust understanding of the business case for the project: from a detailed understanding of the product, market, capital requirements and financing options to the identification of local partners with the knowhow, infrastructure and governance needed to facilitate success. The illustrative examples identified in this paper for India and Saudi Arabia are intended to assist in understanding the methodology developed by the S-lab team, but these do lack many important details necessary for full deployment. In order to evolve the methodology described in this paper and begin to understand how to build and populate a database of sustainable offset capabilities, the S-Lab team recommends Lockheed Martin conduct a cradle to grave prototype of this 5-step process. In order to test the model, Lockheed Martin should consider an existing product that already has a well-developed business case and market analysis. By matching the product to the needs of a country using SPI, an existing offset negotiation could be used to evaluate the methodology described above. Based on the results, Lockheed Martin can begin an iterative process to improve and further develop the process.

⁶⁴ Nike Biz, "Nike Environmental Design Tool." Last accessed May 14, 2015. <http://www.nikebiz.com/Default.aspx>