Critical Technology Assessment: Impact of U.S. Export Controls on Green Technology Items

Office of Technology Evaluation
Bureau of Industry and Security
U.S. Department of Commerce

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I. Executive Summary

The Bureau of Industry and Security (BIS) conducts critical technology assessments to examine the impact of export controls on key existing or emerging technologies that are subject to the Export Administration Regulations (EAR). These technologies are dual-use, meaning they have both civilian and military applications.

This assessment examines the potential effects of export controls on commodities, software, and technology (i.e., items) that either are or can be used to create products that contribute to clean energy, energy efficiency, and other environmental or green initiatives (i.e., green technology). Although this is not an exhaustive assessment of all green technology items and initiatives that may be captured by dual-use export controls, it is an attempt to anticipate ways that BIS can support the creation of green jobs and advances in green technology through facilitation of secure trade in this important area, while mitigating national security concerns.

In this assessment, BIS specifically examined:

- Projects and initiatives receiving grant money from the American Recovery and Reinvestment Act of 2009 and loans from the U.S. Department of Energy's Loan Guarantee Program (established under Title XVII of the Energy Policy Act of 2005) that may be impacted by dual-use export controls; and

- Survey responses from members of BIS's Technical Advisory Committees (TACs) and information from companies that identify items that are currently used or are being developed to support green technology initiatives.

Based on data received from survey respondents and other sources, BIS finds that:

- Most green technology-related items do not require a BIS export license. Licensed green technology-related exports represented 0.05% of total U.S. exports and a mere 0.004% of all energy sector exports in 2008. Of the $1,300.5 billion in total U.S. exports in 2008, BIS identified 5.8% ($75.0 billion) as green technology-related exports, and only 0.9% ($697.4 million) of these required an export license.

- Some of the high-technology parts, materials, and equipment used to produce green technology items in the following areas would likely require an export license: wind power, solar power, alternative fuel vehicles, water purification, and energy efficiency.

- Exporters have expressed concern with the lengthy processing times and difficulty in obtaining export licenses for carbon fiber and machine tools, the material and equipment needed for the production of wind turbines and lighter weight (i.e., energy efficient) commercial composite aircraft structures and engine components. Two companies with production facilities in the United States that are industry leaders for tape laying and tow/fiber placement machines used to manufacture windmill turbine blades are considering moving production of these machines overseas, especially because of the increased demand for wind turbines.

- The export of Metal-Organic Chemical Vapor Deposition (MOCVD) equipment requires an export license for most destinations, and is used to produce the solar cells used in solar panels and LED lighting products. One of the main MOCVD producers in Germany has sold this equipment to a customer that was denied an export license for the same equipment from a U.S. producer.

- There are several green technology items in the areas of water purification (e.g., chemicals, pumps, valves) and energy efficiency (i.e., industrial gas turbine components and thermal imaging cameras) that are subject to an export license requirement for most destinations, but the licensing and export statistics do not show that this license requirement is having an adverse affect on the competitiveness of these industries.

- In most cases and for most destinations, BIS has determined that export licenses are not required for items in the following green technology areas: alternative fuel vehicles, commercial airlines noise reduction, biodegradable/bio-resins for composite materials, and green coating processes. However, research and emerging technologies in these fields could lead to the creation of new high-technology products that would be subject to export license requirements.

Accordingly, BIS will:

- Issue guidance to exporters clarifying which tape laying and tow/fiber placement machines would be controlled under ECCNs 1B001 or 1B101 for MT or NS reasons.

- Monitor the volume of export license applications received for chemicals, chemical equipment, industrial gas turbines and components, and thermal imaging cameras and adjust export licensing policy and regulations where possible to ensure that export controls do not hinder trade in these items, especially when intended for civilian (i.e., non-military) green-related end-uses, consistent with national security interests.

- Develop a green technology working group comprised of existing TAC members to identify emerging technologies that can support green technology initiatives that may be subject to an export license requirement in the future.

- Work with the Department of Commerce's International Trade Administration on harmonization with export promotion efforts for the energy sector.

In addition, BIS will work with other U.S. Government (USG) agencies to develop a license exception, fast-track license review, and/or a one-time product/end-user review procedure for the export of items for civilian (i.e., non-military) green-related end-uses only.

II. Introduction

A. Assessment Overview

The Bureau of Industry and Security (BIS) conducts critical technology assessments to examine the impact of export controls on key existing or emerging technologies that are subject to the Export Administration Regulations (EAR). These technologies are dual-use, meaning they have both civilian and military applications.

This assessment examines the potential impact of U.S. dual-use export controls on commodities, software, and technology (i.e., items) subject to an export license requirement under the EAR that either are or can be used to create products that contribute to clean energy, energy efficiency, and other environmental or green initiatives (i.e., green technology). Although this is not an exhaustive assessment of all green technology items and initiatives that may be subject to the EAR, it is an attempt to anticipate ways that BIS can support facilitation of secure trade in this important area, while mitigating national security concerns.

To identify green technologies, BIS identified North American Industrial Classification System (NAICS) codes for energy, and projects and initiatives receiving grant money from the American Recovery and Reinvestment Act of 2009 and loans from the U.S. Department of Energy's Loan Guarantee Program (established under Title XVII of the Energy Policy Act of 2005) that may be impacted by dual-use export controls. BIS also surveyed members of BIS's Technical Advisory Committees (TACs) and collected information from companies, reports, and websites to identify items that are currently used or are being developed to support green technology initiatives.

B. Assessment Organization

To develop a list of green technology items, BIS first identified the NAICS codes attributed to energy, and evaluated the percentage of exports under these codes in 2008 that required a BIS license. BIS then developed a basic list of technologies and initiatives that support clean energy, energy efficiency, and recycling. TAC members were then asked to identify green technology products in these three areas, and to determine if these products, their components, or the material or equipment used to produce them are subject to the EAR. The list of technologies and initiatives developed by BIS for the TAC members' review, which is similar to the green technology areas for which the Department of Energy received applications for its Loan Guarantee Program, includes:

- Clean Energy: Wind Power, Hydropower, Solar Power, Alternative Fuel Vehicles, and Geothermal Energy;
- Energy Efficiency: Energy Efficient Industrial, Office, and Household Products (i.e., equipment, appliances, building materials, weatherization products), and Carbon Sequestration; and
- Recycling: Waste Management, Rainwater Recycling Systems, Water Purification, and Sewage Treatment.

Although several items used in green technology applications are subject to the EAR, many of these items can be exported without a license or under a license exception. The export of only a few high-technology items would require an export license for certain destinations. Those green technology areas affected include:

- Wind Power
- Solar Power
- Alternative Fuel Vehicles
- Water Purification/Treatment/Desalination
- Energy Efficiency

The affected green technology areas are divided below for ease of analysis. In each section below, each item is identified by the Export Control Classification Number (ECCN) on the Commerce Control List (CCL) of the EAR under which it is controlled for export. Reasons for control include national security (NS), missile technology (MT), nuclear nonproliferation (NP), chemical and biological weapons (CB), anti-terrorism (AT), regional stability (RS), and short supply (SS). The number next to the reason for control refers to a column number on the Commerce Country Chart (Supplement No. 1 to Part 738 of the EAR), and is used to identify those destinations for which an export license for the item is required. The Commerce Country Chart has been included in Appendix 1 of this assessment.

III. Green Technology Items Subject to Dual-Use Export Controls

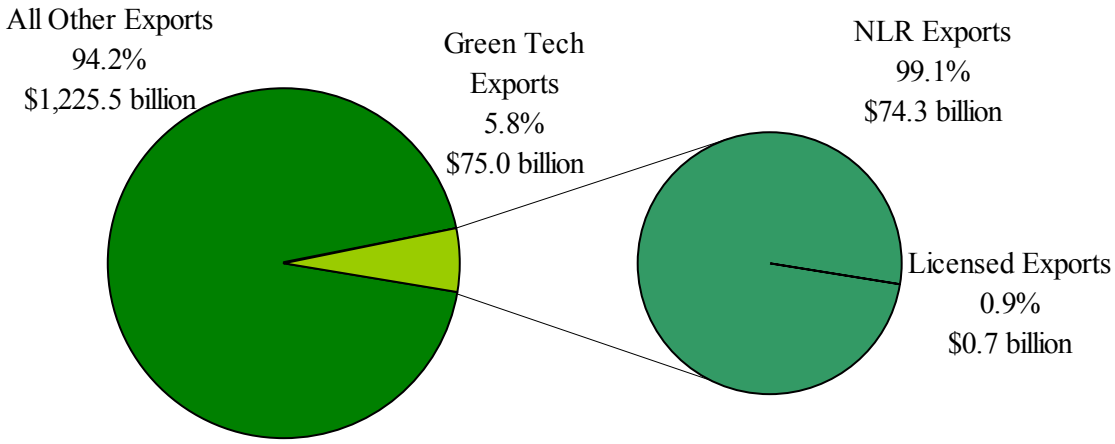
To identify those items that contribute to green technology initiatives that may be impacted by dual-use export controls, BIS reviewed NAICS codes attributed to energy, the projects and initiatives receiving grant money from the American Recovery and Reinvestment Act of 2009 and loans from the U.S. Department of Energy's Loan Guarantee Program, and used TAC member survey responses and information gathered from individual companies, websites, and USG and industry association reports. BIS found that in most cases, it is not the green technology item that is subject to export control, but rather the parts, components, and equipment used to produce the item.

BIS first analyzed the NAICS codes attributed to energy, which include turbine and turbine generator sets, power, distribution, and specialty transformers, and storage and primary batteries. The total value of U.S. exports to all destinations in 2008 of items under these energy sector NAICS codes was $7.7 billion. Only 0.004% ($320 thousand) of total energy sector exports in 2008 required a BIS export license. However, these energy sector NAICS codes represent exports of many items, not just those related to green technology, so even less than the 0.004% of energy sector items that required an export license in 2008 was green technology-related items.

BIS next identified 80 ECCNs (identified by green technology initiative in Sections A-E below) under which green technology products and the items used for their production would require an export license for certain destinations. The total value of exports under these ECCNs represents a much larger group of items than just those supporting green technology, but was used to estimate the potential effect of dual-use export controls on green technology trade. BIS found

that of the $1,300.5 billion in total U.S. exports in 2008, 5.8% ($75.0 billion) were potentially green technology-related exports, and only 0.9% ($697.4 million) of these required an export license, as shown in Figure *1* below.

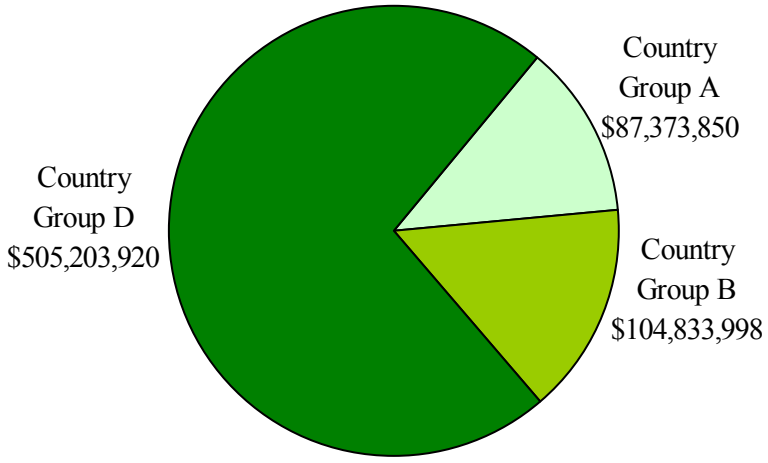
Figure 1: Comparison of Licensed and No License Required (NLR) Green Technology Exports to Total U.S. Exports for 2008



Sources: BIS, U.S. Census Bureau

Licensed green technology-related exports represented a mere 0.05% of total U.S. exports in 2008, but a surprising 22.5% of all licensed 2008 exports ($3.1 billion). A break-out of these licensed exports by destination (i.e., Country Group A, B, or D) is shown in Figure *2* below.[1].

Figure 2: Licensed Potential Green Technology-Related Exports for 2008 by Destination



Sources: BIS, U.S. Census Bureau

[1] Supplement No. 1 to Part 740 of the EAR identifies the countries that belong to Country Groups A, B, or D. See also Appendix 2.

High-technology parts, materials, and equipment used to produce green technology items in the following areas would likely require an export license: wind power, solar power, alternative fuel vehicles, water purification, and energy efficiency.

A. Wind Power

Wind power is a rapidly expanding energy alternative, and wind turbines are being installed around the world at an increasing rate to support household and commercial energy needs. Although an export license is not necessary to export the wind turbines themselves, licenses are required to export the material (carbon fiber) and the equipment (tape laying and tow/fiber placement machines) used to produce the turbine blades. High technology machine tools are used to produce the wind turbine gear case assemblies and hubs, and these items also require a license for export.

Table a: Wind Power – Wind Turbines

Wind Turbine Component	Items for Production	ECCN	Reason(s) for Control
Turbine blades	Carbon fiber	1A001.b	NS2, AT1
	Carbon fiber prepregs	1C010	NS2, NP1, AT1
	Tape laying and tow/fiber placement machines	1B001	NS2, MT1, AT1
		1B101	MT1, AT1
	Software	1D001	NS1, MT1, AT1
		1D002	NS1, AT1
		1D101	MT1, AT1
	Technology	1E001	NS1, MT1, NP1, AT1
		1E101	MT1, AT1
		1E102	MT1, AT1
		1E201	NP1, AT1
Gear case assemblies and hubs	Machine tools and controllers	2B001	NS2, NP1, AT1
		2B201	NP1, AT1
		2B290	NP2, AT1
		2B991	AT1
	Software	2D001	NS1, NP1, AT1
		2D002	NS1, NP1, AT1
		2D202	NP1, AT1
		2D290	NP2, AT1
		2D991	AT1
	Technology	2E001	NS1, NP1, AT1
		2E002	NS1, NP1, AT1
		2E003	NS1, AT1
		2E101	NP1, AT1
		2E201	NP1, AT1
		2E290	NP2, AT1
		2E991	AT1

Two companies that are industry leaders for tape laying and tow/fiber placement machines used to manufacture windmill turbine blades have production facilities in the United States. Representatives of both companies have expressed concern to BIS regarding the current difficulties they experience obtaining export licenses in a timely manner. For all destinations, exporters waited an average of 32 days for an export license in 2008 for machines controlled under ECCN 1B101, and 51 days for those controlled under ECCN 1B001. This is almost double the average processing time for all export licenses issued in 2008, which was 27 days. For this reason, both companies are considering moving production of these machines overseas, especially now that there is more demand for these machines because of the increased demand for wind turbines.

Those machines controlled by ECCNs 1B001 and 1B101 are controlled for MT reasons. Section 1512 of the Strom Thurmond National Defense Act for Fiscal Year 1999 requires certification from the President of the United States to the U.S. Congress at least 15 days prior to the export of any item controlled for MT reasons to China that the export will not measurably improve Chinese missile or space launch capabilities. Although the President delegated the authority to sign such certifications to the Secretary of Commerce on September 29, 2009, the interagency process for obtaining clearance on this "Presidential certification" remains the same, and historically has added a great deal of time to the timetable for obtaining this type of license. The additional clearance process normally takes an additional six months.

Nevertheless, tape laying and tow/fiber placement machines controlled under ECCNs 1B001 or 1B101 to be used to manufacture wind turbines would not be subject to the MT reason for control because they are not specially designed for the manufacture of "composite" airframe or "missile" structures, thereby eliminating any Presidential certification requirement for such exports to China.[2] Such machines under ECCN 1B001 would also not require a license for NS reasons if used for wind turbine production if they were not "specially designed" or manufactured with the intent (e.g., custom built) for the manufacture of "composite" airframe or "missile" structures, but have subsequently been determined to have other manufacturing applications (e.g., wind turbines). BIS is currently considering revising export controls for those machine tools controlled under ECCNs 2B001 and 2B201 (machine tools used to make the wind turbine gear case assemblies and hubs) based on its finding of foreign availability in the BIS report *Critical Technology Assessment: Five Axis Simultaneous Control Machine* Tools that was published in July 2009.

These changes would establish a license exception for five axis simultaneous control milling machines controlled for NS reasons with x-axis travel greater than two meters and positioning accuracy with "all compensations available" on the x-axis more (worse) than 30 μm. A license exception already exists for the NP reason for control of such machine tools. A fast-track licensing procedure would also be established for those five axis simultaneous control milling machines with a positioning accuracy with "all compensations available" equal to or greater

[2] Tape laying and tow/fiber placement machines are controlled for MT reasons under ECCNs 1B001 and 1B101 if they are specially designed for the manufacture of "composite" airframe or "missile" structures. In the context of the MTCR, "specially designed" means that the manufacturing equipment has no other function or use and is not capable of producing other types of components. Thus, the MT control does not apply to those tape laying and tow/fiber placement machines used to manufacture wind turbine blades.

(worse) than 9 μm along every linear axis equal to or shorter than two meters, and equal to or greater (worse) than 16 μm along every linear axis greater than two meters.

B. Solar Power

Solar power is also an increasingly popular energy alternative with strong USG support. According to a recent report on the U.S. Department of Energy's website, "Vice President Biden and Secretary Chu announced the Department of Energy has finalized a $535 million loan guarantee for Solyndra, Inc., which manufactures innovative cylindrical solar photovoltaic (PV) panels that provide clean, renewable energy. The funding will finance construction of the first phase of the company's new manufacturing facility. Solyndra estimates the new plant will initially create 3,000 construction jobs, and lead to as many as 1,000 jobs once the facility opens."[3]

Exports of solar panels made for household and commercial use do not require a BIS export license for most destinations. However, a license is required for certain high efficiency space qualified solar cells and assemblies. The material and equipment used to make solar cells also usually requires an export license for most destinations.

Solar cells that are silicon-based (Monocrystalline Silicon and Polycrystalline Silicone solar cells) and thin film solar cells (amorphous and organic), which may be subject to a license requirement under ECCNs 3A001.e.1.a and 3A001.e.1.b, are produced using Low Pressure Chemical Vapor Deposition (LPCVD) and Plasma-Enhanced Chemical Vapor Deposition (PECVD) equipment. In almost all cases, the export of this equipment would not require a BIS export license. However, the GaAs III-V-based solar cell (high-level solar cell), which is also controlled by ECCNs 3A001.e.1.a and 3A001.e.1.b, is produced using Metal-Organic Chemical Vapor Deposition (MOCVD) equipment, the same equipment that is used to make light-emitting diodes (LEDs), and is controlled under ECCN 3B001.a.2. Research in the solar energy industry may also be conducted on Molecular Beam Epitaxial (MBE) growth equipment, the export of which is controlled under ECCN 3B001.a.3.[4]

[3] U.S. Department of Energy, *Vice President Biden Announces Finalized $535 Million Loan Guarantee for Solyndra,* 4 Sept 2009, <http://www.energy.gov/news2009/7887.htm>.
[4] Op. cit., Larkin, 6-7.

Table b: Solar Power – Solar Panels

Solar Panels	Items	ECCN	Reason(s) for Control
Solar Cells	Thin film and compound solar cells	3A001.e.1.a	NS2, AT1
		3A001.e.1.b	NS2, AT1
	MOCVD equipment	3B001.a.2	NS2, AT1
	MBE equipment	3B001.a.3	NS2, AT1
	Material for production of solar cells	3C001	NS2, AT1
		3C002	NS2, AT1
		3C003	NS2, AT1
		3C004	NS2, AT1
		3C005	NS2, AT1
		3C006	NS2, AT1
	Software	3D001	NS1, AT1
		3D002	NS1, AT1
	Technology	3E001	NS1, AT1

Currently one company in the United States and another in Germany are the leading two global producers of MOCVD equipment. However, at least one company that was unable to purchase MOCVD equipment from the United States because of U.S. export controls was able to purchase the same equipment from its German competitor.[5]

C. Alternative Fuel Vehicles

One avenue for the United States to lessen its dependence on foreign oil and to cut its greenhouse gas emissions is through the production of alternative fuel vehicles. The Department of Energy's Advanced Technology Vehicles Manufacturing Loan Program, which was first appropriated in the fall of 2008, will provide about $25 billion in loans to companies making cars and components in the United States that increase fuel economy at least 25 percent above 2005 fuel economy levels. The first three awards under this program included a $5.9 billion loan to Ford Motor Company to produce more fuel efficient models, a $1.6 billion loan to Nissan North America, Inc. to build advanced electric automobiles and to build an advanced (i.e., lithium ion) battery manufacturing facility, and a $465 million loan to Tesla Motors to manufacture electric drive trains and electric vehicles in California.[6]

Like many green technology products, the export of most gasoline-electric hybrid, electric, and biofuel vehicles will not require an export license from BIS for most destinations, nor will the lithium ion batteries used to power some of these vehicles. However, the fuel cells used to make the lithium ion batteries, if exported as a component not yet integrated into a battery, may be subject to a license requirement in the future. The fuel cells currently integrated into lithium ion batteries for use in commercial vehicles do not meet the technical thresholds necessary to trigger

[5] Op. cit., Larkin, 7-13.
[6] U.S. Department of Energy, *Obama Administration Awards First Three Auto Loans for Advanced Technologies to Ford Motor Company, Nissan Motors and Tesla Motors,* 23 Jun 2009, <http://www.energy.gov/news2009/print2009/7544.htm>.

an export license requirement, but future advances in this technology may lead to fuel cells that would have a license requirement.

Likewise, an export license would not be required in most cases for hydrogen-fueled or biofuel vehicles, but the export of hydrogen or other chemicals used for development or production of petroleum that may be used as a fuel source for these cars may require a license for export if they were produced or derived from the Naval Petroleum Reserves.

Table c: Alternative Fuel Vehicles

Alternative Fuel Sources	Items	ECCN	Reason(s) for Control
Biofuel and hydrogen fuel	Chemicals used for development or production of petroleum derived from the Naval Petroleum Reserves used as fuel for these vehicles	1C980 1C981 1C982	SS SS SS
Lithium ion batteries	Fuel cells developed in the future that meet the technical parameters outlined in the EAR Technology for development of fuel cells that meet the technical parameters outlined in the EAR	3A001.e.1.a 3A001.e.1.b 3E001	NS2, AT1 NS2, AT1 NS1, AT1

According to a U.S. industry representative, there are over 50 producers of lithium ion batteries in the United States. Currently an export license is required for these batteries for only a few destinations, but companies exporting fuel cells that have not been integrated into a battery to a broader range of destinations would potentially be subject to an export license requirement in the future.

D. Water Purification/Treatment/Desalination

Water purification is an area of recycling that will become increasingly important, especially in those countries with large populations and high levels of pollution. Some of the chemicals and equipment needed to build water purification, treatment, and desalination systems do require an export license because of their capability by design to be used in chemical and nuclear weapons systems.

Export license applications for some of this equipment to certain destinations, such as those items controlled under ECCN 2B350, are reviewed under an expedited export license authorization processing policy that was agreed upon by BIS and other USG agency stakeholders. There may be additional policy changes available to BIS that could expedite the licensing of those items intended for use in water purification systems, especially for those destined to certain end-users that do not have foreign military ties, provided these changes are made in accordance with USG regime commitment and statutory requirements.

Table d: Water Purification/Treatment/Desalination -Systems

Water Treatment Items	Items	ECCN	Reason(s) for Control
Chemicals	Diethylamino ethanol, Dimethylamine, Sodium Sulfide	1C995A.2.b	AT1, RS (Iraq)
	Technology	1E998	AT1
Desalination Equipment	Pumps, valves, tanks, mixers, heat exchangers, piping, centrifuges, vacuum pumps	2A226	NP1, CB2, AT1
		2A292	NP2, CB2, AT1
		2B122	MT1, AT1
		2B231	NP1, AT1
		2B350	CB2, AT1
		4A994	AT1
		5A002	NS1, AT1, EI
		5A991	AT1
Desalination Equipment	Software	2D290	NP2, AT1
		4D994	AT1
		5D002	NS1, AT1, EI
		5D991	AT1
	Technology	2E001	MT1, NP1, NP2, CB2, AT1
		2E002	NS1, MT1, NP1, NS2, CB2, AT1
		2E201	NP1, CB2, AT1
		2E290	NP2, CB2, AT1
		2E301	CB2, AT1
		4E992	AT1
		5E002	NS1, AT1, EI
		5E991	AT1

E. Energy Efficiency

Energy efficiency is a green technology area that applies to a number of industries and products. Many energy efficiency initiatives involve improvements to items, software, and technology that are already subject to the EAR. In the aerospace industry, this includes efforts to reduce commercial airline noise, to make biodegradable/bio-resins for composite materials, to make green coating processes, and to reduce fuel consumption by making composite commercial aircraft structures lighter and engines more fuel efficient. Energy efficiency in power generation includes increasing the efficiency of large-scale industrial gas turbine components and advancing technology for reduced emissions. Locating energy loss and inefficiencies in buildings, systems, and equipment requires the use of thermal imaging technology that can identify exactly where

energy and heat loss occur. Finally, energy efficiency in lighting costs is realized through the use of LED products.

A detailed description of how export controls may impact each of these energy efficiency initiatives is provided below, along with Table *e* that aggregates export control information for all of the items identified by ECCN.

1. Commercial Airline Noise Reduction

Sound is a pollutant with an environmental effect that many times is overlooked or forgotten. Research and technology development and sharing in this area, especially as it relates to reducing vibrations or enhancing the performance of existing aircraft components on commercial aircraft, may be captured for export control under ECCNs 9E991 and 9E003.

2. Biodegradable/Bio-Resins for Composite Materials

The production of biodegradable or bio-resin composite materials would be hugely important for recycling and waste management. The discovery of new composite materials may result from the research of aerospace companies searching for ways to make a lighter composite material. The technology for the development of these new composite materials and the software used for their molecular characterization has the potential to be controlled for export under ECCNs 1D001 and 1E001.

3. Green Coating Processes

Manufacturers of commercial aircraft are exploring green coating processes for commercial aircraft, which would include initiatives such as substituting hazardous ingredients with environmentally preferred substitutes. The companies involved in these initiatives contend that processes developed thus far are EAR 99, and would not have an export license requirement in most cases. However, advances in this field could lead to the discovery of technology or applications that would be subject to an export licensing requirement in the future.

4. Lighter Composite Aircraft Structures and Engine Components

Efforts to produce lighter weight composite aircraft commercial structures using ceramic and ceramic matrix composites means that the research and technology used to develop these items, the software and equipment used to machine them, the materials used to make them, and some of the items themselves likely will require an export license. Materials subject to an export license requirement include carbon fibers, ceramic and ceramic matrix composites, and polymer matrix materials controlled by ECCNs 1A002, 1C010, 1C210, and 1C990.

Production equipment includes a variety of machine tools, including tape laying and tow/fiber placement machines, autoclaves, composite lay-up tooling, cure tooling, and machine holding fixtures controlled under ECCNs 1B001, 1B101, and 1B999. The engines and related components may be controlled for export under ECCN 9A991. The ECCNs for the software and technology used with these items or their development are included in Table *e* below.

5. Efficient Industrial Gas Turbine Components

There are many ways manufacturers are looking to increase the efficiency of large scale industrial gas turbine components. Machine tools controlled for export by some of the ECCNs already mentioned are necessary to make turbine components meeting these specifications, and the components themselves may be subject to an export license requirement under ECCN 9B991.b. The technology behind this design, as well as for advanced combustion technology for reducing emissions of these turbines, would potentially be subject to an export license requirement under ECCNs 9E003.c and 9E003.a.5.

Related to this initiative is the necessity for power generation control systems that are used to interact with power generation equipment based on renewable/clean energy technologies. These systems are comprised of processors with encryption, and would also be subject to a license requirement for export under ECCNs 4A994 and 5A002 to certain destinations.

6. Identifying Energy Inefficiency

Thermal imaging cameras can be used to detect heat or energy loss in equipment, systems, buildings, and homes. These cameras are controlled under ECCN 6A003 and many require a license for export to certain destinations. However, a recent change to the EAR allows the export of certain cameras to certain allied destinations without a license. Like water purification equipment, this is another area for BIS to monitor for future potential policy changes if a large increase in license applications for cameras with this green end-use occurs.

7. LED Products

The same equipment used for the production of solar cells for solar panels is used to produce high efficiency LED lighting products. Although the LED products themselves do not require a license for export in most cases to most destinations, the MOCVD equipment used to produce them is most desirable as it could be used for both solar cell and LED production. MOCVD equipment is controlled under ECCN 3B001.a.2.

Table e: Energy Efficiency

Initiative or Item	Items	ECCN	Reason(s) for Control
Commercial airline noise reduction and energy efficient industrial gas turbine components	Power generation control systems	4A994	AT1
	Encryption	5A002	NS1, AT1, EI
	Equipment	9B991.b	AT1
	Software	4D994	AT1
		5D002	NS1, AT1, EI
		9D991	AT1
	Technology	4E992	AT1
		5E002	NS1, AT1, EI
		9E003	NS1, AT1
		9E991	AT1

Table e: Energy Efficiency (continued)

Initiative or Item	Items	ECCN	Reason(s) for Control
Biodegradable/Bio-resins composite materials	Software for molecular characterization	1D001	NS1, MT1, NP1, AT1
	Technology	1E001	NS1, MT1, NP1, AT1
Green coating processes	Items and technology	EAR99	
Lighter weight composite commercial aircraft structures and efficient engine components	Materials (carbon fibers, ceramic and ceramic matrix composites, and polymer matrix materials)	1A002	NS2, NP1, AT1
		1C010	NS2, NP1, AT1
		1C210	NP1, AT1
		1C990	AT1
	Equipment (tape laying and fiber placement machines, autoclaves, composite lay-up and cure tooling, and holding fixtures Filament winding and tape laying machines)	1B001	NS2, MT1, NP1, AT1
		1B101	MT1, NP1, AT1
		1B201	NP1, AT1
		1B999	AT (North Korea), RS (Iraq)
	Equipment	9A991	AT1
	Software	1D001	NS1, MT1, NP1, AT1
		1D002	NS1, AT1
		1D101	MT1, NP1, AT1
		1D201	NP1, AT1
		1D993	AT1
		1D999	AT (North Korea)
		9D991	AT1
	Technology	1E001	NS1, MT1, NP1, AT1
		1E002	NS1, MT1, NP1, AT1
		1E101	MT1, NP1, AT1
		1E102	MT1, NP1, AT1
		1E201	NP1, AT1
		1E203	NP1, AT1
		1E994	AT1
		1E998	AT1
		9E991	AT1
Identifying energy inefficiency	Thermal Imaging Camera	6A003	NS2, NP1, RS1, AT1
	Software	6D003	NS1, AT1
	Technology	6E001	NS1, NP1, RS1, AT1
		6E002	NS1, NP1, RS1, AT1
		6E201	NP1, AT1
LED products	MOCVD equipment	3B001.a.2	NS2, AT1
	Software	3D001	NS1, AT1
		3D991	AT1
	Technology	3E001	NS1, AT1

IV. Conclusion and Recommendations

BIS finds that:

- Most green technology-related items do not require a BIS export license. Licensed green technology-related exports represented 0.05% of total U.S. exports and a mere 0.004% of all energy sector exports in 2008. Of the $1,300.5 billion in total U.S. exports in 2008, BIS identified 5.8% ($75.0 billion) as green technology-related exports, and only 0.9% ($697.4 million) of these required an export license.

- Some of the high-technology parts, materials, and equipment used to produce green technology items in the following areas would likely require an export license: wind power, solar power, alternative fuel vehicles, water purification, and energy efficiency.

- Exporters have expressed concern with the lengthy processing times and difficulty in obtaining export licenses for carbon fiber and machine tools, the material and equipment needed for the production of wind turbines and lighter weight (i.e., energy efficient) commercial composite aircraft structures and engine components. Two companies with production facilities in the United States that are industry leaders for tape laying and tow/fiber placement machines used to manufacture windmill turbine blades are considering moving production of these machines overseas, especially because of the increased demand for wind turbines.

- The export of Metal-Organic Chemical Vapor Deposition (MOCVD) equipment requires an export license in most cases, and is used to produce the solar cells used in solar panels and LED lighting products. One of the main MOCVD producers in Germany has sold this equipment to a customer that was denied an export license for the same equipment from a U.S. producer.

- There are several green technology items in the areas of water purification (e.g., chemicals, pumps, valves) and energy efficiency (i.e., industrial gas turbine components and thermal imaging cameras) that are subject to an export license requirement, but the licensing and export statistics do not show that this license requirement is having an adverse affect on the competitiveness of these industries.

- In most cases, BIS has determined that export licenses are not required for items in the following green technology areas: alternative fuel vehicles, commercial airlines noise reduction, biodegradable/bio-resins for composite materials, and green coating processes. However, research and emerging technologies in these fields could lead to the creation of new high-technology products that would be subject to export license requirements.

Accordingly, BIS will:

- Issue guidance to exporters clarifying which tape laying and tow/fiber placement machines would be controlled under ECCNs 1B001 or 1B101 for MT or NS reasons.

- Monitor the volume of export license applications received for chemicals, chemical equipment, industrial gas turbines and components, and thermal imaging cameras and adjust export licensing policy and regulations where possible to ensure that export controls do not hinder trade in these items, especially when intended for civilian (i.e., non-military) green-related end-uses, consistent with national security interests.

- Develop a green technology working group comprised of existing TAC members to identify emerging technologies that can support green technology initiatives that may be subject to an export license requirement in the future.

- Work with the Department of Commerce's International Trade Administration on harmonization with export promotion efforts for the energy sector.

In addition, BIS will work with other U.S. Government (USG) agencies to develop a license exception, fast-track license review, and/or a one-time product/end-user review procedure for the export of items for civilian (i.e., non-military) green-related end-uses only.

Appendix 1: Commerce Country Chart from Supplement No. 1 to Part 738 of the EAR

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Afghanistan	X	X	X	X		X	X	X	X	X		X		X		
Albania[2,3]	X	X		X		X	X	X	X							
Algeria	X	X		X		X	X	X	X	X		X		X		
Andorra	X	X		X		X	X	X	X	X		X		X		
Angola	X	X		X		X	X	X	X	X		X		X		
Antigua & Barbuda	X	X		X		X	X	X	X	X	X	X		X		
Argentina	X					X	X	X	X	X	X	X		X		
Armenia	X	X	X	X		X	X	X	X	X		X	X			
Aruba	X	X		X		X	X	X	X	X		X		X		
Australia[3]	X					X		X	X							
Austria[3,4]	X					X		X	X			X		X		
Azerbaijan	X	X	X	X		X	X	X	X	X		X	X			
Bahamas, The	X	X		X		X	X	X	X	X	X	X		X		
Bahrain	X	X	X	X		X	X	X	X	X		X		X		
Bangladesh	X	X		X		X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Barbados	X	X		X		X	X	X	X	X	X	X		X		
Belarus	X	X	X			X	X	X	X	X		X	X			
Belgium[3]	X					X		X	X							
Belize	X	X		X		X	X	X	X	X	X	X		X		
Benin	X	X		X		X	X	X	X	X		X		X		
Bhutan	X	X		X		X	X	X	X	X		X		X		
Bolivia	X	X		X		X	X	X	X	X	X	X		X		
Bosnia & Herzegovina	X	X		X		X	X	X	X	X		X		X		
Botswana	X	X		X		X	X	X	X	X		X		X		
Brazil	X	X				X	X	X	X	X	X	X		X		
Brunei	X	X		X		X	X	X	X	X		X		X		
Bulgaria[3]	X					X		X	X							
Burkina Faso	X	X		X		X	X	X	X	X		X		X		
Burma	X	X	X	X		X	X	X	X	X		X		X		
Burundi	X	X		X		X	X	X	X	X		X		X		
Cambodia	X	X		X		X	X	X	X	X		X	X			

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Cameroon	X	X		X		X	X	X	X	X		X		X		
Canada	X										X					
Cape Verde	X	X		X		X	X	X	X	X		X		X		
Central African Republic	X	X		X		X	X	X	X	X		X		X		
Chad	X	X		X		X	X	X	X	X		X		X		
Chile	X	X		X		X	X	X	X	X	X	X		X		
China	X	X	X	X		X	X	X	X	X		X		X		
Colombia	X	X		X		X	X	X	X	X	X	X		X		
Comoros	X	X		X		X	X	X	X	X		X		X		
Congo (Democratic Republic of the)	X	X		X		X	X	X	X	X		X		X		
Congo (Republic of the)	X	X		X		X	X	X	X	X		X		X		
Costa Rica	X	X		X		X	X	X	X	X	X	X		X		
Cote d'Ivoire	X	X		X		X	X	X	X	X		X		X		
Croatia[3]	X			X		X		X	X							
Cuba	See part 746 of the EAR to determine whether a license is required in order to export or reexport to this destination.															
Cyprus[2,3,4]	X					X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Czech Republic[3]	X					X		X	X							
Denmark[3]	X					X		X	X							
Djibouti	X	X		X		X	X	X	X	X		X		X		
Dominica	X	X		X		X	X	X	X	X	X	X		X		
Dominican Republic	X	X		X		X	X	X	X	X	X	X		X		
East Timor	X	X		X		X	X	X	X	X		X		X		
Ecuador	X	X		X		X	X	X	X	X	X	X		X		
Egypt	X	X	X	X		X	X	X	X	X		X		X		
El Salvador	X	X		X		X	X	X	X	X	X	X		X		
Equatorial Guinea	X	X		X		X	X	X	X	X		X		X		
Eritrea	X	X		X		X	X	X	X	X		X		X		
Estonia[3]	X			X		X		X	X							
Ethiopia	X	X		X		X	X	X	X	X		X		X		
Fiji	X	X		X		X	X	X	X	X		X		X		
Finland[3,4]	X					X		X	X			X		X		
France[3]	X					X		X	X							

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Gabon	X	X		X		X	X	X	X	X		X		X		
Gambia, The	X	X		X		X	X	X	X	X		X		X		
Georgia	X	X	X	X		X	X	X	X	X		X	X			
Germany[3]	X					X		X	X							
Ghana	X	X		X		X	X	X	X	X		X		X		
Greece[3]	X					X		X	X							
Grenada	X	X		X		X	X	X	X	X	X	X		X		
Guatemala	X	X		X		X	X	X	X	X	X	X		X		
Guinea	X	X		X		X	X	X	X	X		X		X		
Guinea-Bissau	X	X		X		X	X	X	X	X		X		X		
Guyana	X	X		X		X	X	X	X	X	X	X		X		
Haiti	X	X		X		X	X	X	X	X	X	X		X		
Honduras	X	X		X		X	X	X	X	X	X	X		X		
Hong Kong	X	X		X		X		X	X	X		X		X		
Hungary[3]	X					X		X	X							
Iceland[3]	X			X		X		X	X							

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
India	X	X	X	X		X	X	X	X	X		X		X		
Indonesia	X	X		X		X	X	X	X	X		X		X		
Iran	See part 746 of the EAR to determine whether a license is required in order to export or reexport to this destination.															
Iraq[1]	X	X	X	X	X	X	X	X	X	X		X	X			
Ireland[3,4]	X					X		X	X			X		X		
Israel	X	X	X	X	X	X	X	X	X	X		X		X		
Italy[3]	X					X		X	X							
Jamaica	X	X		X		X	X	X	X	X	X	X		X		
Japan[3]	X					X		X	X							
Jordan	X	X	X	X		X	X	X	X	X		X		X		
Kazakhstan	X	X	X			X	X	X	X	X		X	X			
Kenya	X	X		X		X	X	X	X	X		X		X		
Kiribati	X	X		X		X	X	X	X	X		X		X		
Korea, North	See Sections 742.19 and 746.4 of the EAR to determine whether a license is required in order to export or reexport to this destination.															
Korea, South[3,4]	X					X		X	X	X		X		X		
Kosovo	X	X		X		X	X	X	X	X		X	X	X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Kuwait	X	X	X	X		X	X	X	X	X		X		X		
Kyrgyzstan	X	X	X	X		X	X	X	X	X		X	X			
Laos	X	X		X		X	X	X	X	X		X	X			
Latvia[3]	X					X		X	X							
Lebanon	X	X	X	X		X	X	X	X	X		X		X		
Lesotho	X	X		X		X	X	X	X	X		X		X		
Liberia	X	X		X		X	X	X	X	X		X		X		
Libya	X	X	X	X	X	X	X	X	X	X		X		X		
Liechtenstein	X	X		X		X	X	X	X	X		X		X		
Lithuania[3]	X			X		X		X	X							
Luxembourg[3]	X					X		X	X							
Macau	X	X	X	X		X	X	X	X	X		X		X		
Macedonia (The Former Yugoslav Republic of)	X	X		X		X	X	X	X	X		X		X		
Madagascar	X	X		X		X	X	X	X	X		X		X		
Malawi	X	X		X		X	X	X	X	X		X		X		
Malaysia	X	X		X		X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Maldives	X	X		X		X	X	X	X	X		X		X		
Mali	X	X		X		X	X	X	X	X		X		X		
Malta[2,3,4]	X			X		X	X	X	X	X		X		X		
Marshall Islands	X	X		X		X	X	X	X	X		X		X		
Mauritania	X	X		X		X	X	X	X	X		X		X		
Mauritius	X	X		X		X	X	X	X	X		X		X		
Mexico	X	X		X		X	X	X	X	X	X	X		X		
Micronesia (Federated States of)	X	X		X		X	X	X	X	X		X		X		
Moldova	X	X	X	X		X	X	X	X	X		X	X			
Monaco	X	X		X		X	X	X	X	X		X		X		
Mongolia	X	X	X	X		X	X	X	X	X		X	X			
Montenegro	X	X		X		X	X	X	X	X		X	X	X		
Morocco	X	X		X		X	X	X	X	X		X		X		
Mozambique	X	X		X		X	X	X	X	X		X		X		
Namibia	X	X		X		X	X	X	X	X		X		X		
Nauru	X	X		X		X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Nepal	X	X		X		X	X	X	X	X		X		X		
Netherlands[3]	X					X		X	X							
Netherlands Antilles	X	X		X		X	X	X	X	X		X		X		
New Zealand[3]	X					X		X	X							
Nicaragua	X	X		X		X	X	X	X	X	X	X		X		
Niger	X	X		X		X	X	X	X	X		X		X		
Nigeria	X	X		X		X	X	X	X	X		X		X		
Norway[3]	X					X		X	X							
Oman	X	X	X	X		X	X	X	X	X		X		X		
Pakistan	X	X	X	X	X	X	X	X	X	X		X		X		
Palau	X	X		X		X	X	X	X	X		X		X		
Panama	X	X		X		X	X	X	X	X	X	X		X		
Papua New Guinea	X	X		X		X	X	X	X	X		X		X		
Paraguay	X	X		X		X	X	X	X	X	X	X		X		
Peru	X	X		X		X	X	X	X	X	X	X		X		
Philippines	X	X		X		X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Poland[3]	X					X		X	X							
Portugal[3]	X					X		X	X							
Qatar	X	X	X	X		X	X	X	X	X		X		X		
Romania[3]	X					X		X	X							
Russia	X	X	X			X	X	X	X	X		X	X			
Rwanda[1]	X	X		X		X	X	X	X	X		X	X	X		
St. Kitts & Nevis	X	X		X		X	X	X	X	X	X	X		X		
St. Lucia	X	X		X		X	X	X	X	X	X	X		X		
Saint Vincent and the Grenadines	X	X		X		X	X	X	X	X	X	X		X		
Samoa	X	X		X		X	X	X	X	X		X		X		
San Marino	X	X		X		X	X	X	X	X		X		X		
Sao Tome & Principe	X	X		X		X	X	X	X	X		X		X		
Saudi Arabia	X	X	X	X		X	X	X	X	X		X		X		
Senegal	X	X		X		X	X	X	X	X		X		X		
Serbia	X	X		X		X	X	X	X	X		X	X	X		
Seychelles	X	X		X		X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Sierra Leone	X	X		X		X	X	X	X	X		X		X		
Singapore	X	X		X		X	X	X	X	X		X		X		
Slovakia[3]	X					X		X	X							
Slovenia[3]	X					X		X	X							
Solomon Islands	X	X		X		X	X	X	X	X		X		X		
Somalia	X	X		X		X	X	X	X	X		X		X		
South Africa[2,3,4]	X	X				X	X	X	X	X		X		X		
Spain[3]	X					X		X	X							
Sri Lanka	X	X		X		X	X	X	X	X		X		X		
Sudan	X	X		X		X	X	X	X	X		X		X	X	X
Suriname	X	X		X		X	X	X	X	X	X	X		X		
Swaziland	X	X		X		X	X	X	X	X		X		X		
Sweden[3,4]	X					X		X	X			X		X		
Switzerland[3,4]	X					X		X	X			X		X		
Syria	X	X	X	X		X	X	X	X	X		X		X	X	
Taiwan	X	X	X	X		X	X	X	X	X		X		X		

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Tajikistan	X	X	X	X		X	X	X	X	X		X	X			
Tanzania	X	X		X		X	X	X	X	X		X		X		
Thailand	X	X		X		X	X	X	X	X		X		X		
Togo	X	X		X		X	X	X	X	X		X		X		
Tonga	X	X		X		X	X	X	X	X		X		X		
Trinidad & Tobago	X	X		X		X	X	X	X	X	X	X		X		
Tunisia	X	X		X		X	X	X	X	X		X		X		
Turkey[3]	X					X		X	X							
Turkmenistan	X	X	X	X		X	X	X	X	X		X	X			
Tuvalu	X	X		X		X	X	X	X	X		X		X		
Uganda	X	X		X		X	X	X	X	X		X		X		
Ukraine	X					X	X	X	X	X		X	X			
United Arab Emirates	X	X	X	X		X	X	X	X	X		X		X		
United Kingdom[3]	X					X		X	X							
Uruguay	X	X		X		X	X	X	X	X	X	X		X		
Uzbekistan	X	X	X	X		X	X	X	X	X		X	X			

Commerce Country Chart

Reason for Control

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention	Crime Control			Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Vanuatu	X	X		X		X	X	X	X	X		X		X		
Vatican City	X	X		X		X	X	X	X	X		X		X		
Venezuela	X	X		X		X	X	X	X	X	X	X		X		
Vietnam	X	X	X	X		X	X	X	X	X		X	X			
Western Sahara	X	X		X		X	X	X	X	X		X		X		
Yemen	X	X	X	X		X	X	X	X	X		X		X		
Zambia	X	X		X		X	X	X	X	X		X		X		
Zimbabwe	X	X		X		X	X	X	X	X		X		X		

[1] This country is subject to sanctions implemented by the United Nations Security Council. See §746.3 for license requirements for exports and reexports to Iraq or transfer within Iraq, as well as regional stability licensing requirements not included in the Country Chart. See §746.8 for license requirements for exports and reexports to Rwanda.

[2] See § 742.4(a) for special provisions that apply to exports and reexports to these countries of certain thermal imaging cameras.

[3] See § 742.6(a)(3) for special provisions that apply to “military commodities” that are subject to ECCN 0A919.

[4] See § 742.6(a)(2) and (4)(ii) regarding special provisions for exports and reexports of certain thermal imaging cameras to these countries.

Appendix 2: Country Groups from Supplement No. 1 to Part 740 of the EAR

Country Group A	
ARGENTINA	JAPAN
AUSTRALIA	KAZAKHSTAN
AUSTRIA	LATVIA
BELARUS	LITHUANIA
BELGIUM	LUXEMBOURG
BRAZIL	MALTA
BULGARIA	NETHERLANDS
CANADA	NEW ZEALAND
CROATIA	NORWAY
CYPRUS	POLAND
CZECH REPUBLIC	PORTUGAL
DENMARK	ROMANIA
ESTONIA	RUSSIA
FINLAND	SLOVAKIA
FRANCE	SLOVENIA
GERMANY	SOUTH AFRICA
GREECE	SOUTH KOREA
HONG KONG	SPAIN
HUNGARY	SWEDEN
ICELAND	SWITZERLAND
IRELAND	TURKEY
ITALY	UKRAINE

Country Group D	
AFGHANISTAN	LIBYA
ALBANIA	MACAO
ARMENIA	MOLDOVA
AZERBAIJAN	MONGOLIA
BAHRAIN	NORTH KOREA
BELARUS	OMAN
BURMA	PAKISTAN
CAMBODIA	QATAR
CHINA	RUSSIA
CUBA	SAUDI ARABIA
EGYPT	SYRIA
GEORGIA	TAIWAN
INDIA	TAJIKSTAN
IRAN	TURKMENISTAN
IRAQ	UKRAINE
ISRAEL	UNITED ARAB EMIRATES
JORDAN	UZBEKISTAN
KAZAKHSTAN	VIETNAM
KUWAIT	YEMEN
KYRGYZSTAN	
LAOS	
LEBANON	

Country Group B			
AFGHANISTAN	CNTRL AFRICAN REPUBLIC	FRANCE	KUWAIT
ALGERIA	CHAD	GABON	LATVIA
ANDORRA	CHILE	GAMBIA	LEBANON
ANGOLA	COLOMBIA	GERMANY	LESOTHO
ANTIGUA/BARBUDA	COMOROS	GHANA	LIBERIA
ARGENTINA	REPUBLIC OF CONGO	GREECE	LIBYA
ARUBA	DEM. REP of CONGO	GRENADA	LIECHTENSTEIN
AUSTRALIA	COSTA RICA	GUATEMALA	LITHUANIA
AUSTRIA	CROATIA	GUINEA	LUXEMBOURG
BAHAMAS	REPUBLIC OF CONGO	GUINEA-BISSAU	MACEDONIA
BAHRAIN	DEM. REP OF CONGO	GUYANA	MADAGASCAR
BANGLADESH	COSTA RICA	HAITI	MALAWI
BARBADOS	CROATIA	HONDURAS	MALAYSIA
BELGIUM	CYPRUS	HONG KONG	MALDIVES
BELIZE	CZECH REPUBLIC	HUNGARY	MALI
BENIN	DENMARK	ICELAND	MALTA
BHUTAN	DJIBOUTI	INDIA	MARSHALL ISLANDS
BOLIVIA	DOMINICA	INDONESIA	MAURITANIA
BOSNIA-HERCEGOVINA	DOMINICAN REPUBLIC	IRELAND	MAURITIUS
BOTSWANA	EAST TIMOR	ISRAEL	MEXICO
BRAZIL	ECUADOR	ITALY	MICRONESIA
BRUNEI DARUSSALAM	EGYPT	IVORY COAST	MONACO
BULGARIA	EL SALVADOR	JAMAICA	MONTENEGRO
BURKINA FASO	EQUATORIAL GUINEA	JAPAN	MOROCCO
BURUNDI	ERITREA	JORDAN	MOZAMBIQUE
CAMEROON	ESTONIA	KENYA	NAMIBIA
CANADA	ETHIOPIA	KIRIBATI	NAURU
CAPE VERDE	FIJI	KOSOVO	NEPAL
	FINLAND		

Country Group B (con't)			
NETHERLANDS	SLOVENIA	WESTERN SAHARA	
NETHERLANDS ANTILLES	SOLOMON ISLANDS	YEMEN	
NEW ZEALAND	SOMALIA	ZAMBIA	
NICARAGUA	SOUTH AFRICA	ZIMBABWE	
NIGER	SOUTH KOREA		
NIGERIA	SOUTH KOREA		
NORWAY	SPAIN		
OMAN	SRI LANKA		
PAKISTAN	ST KITTS & NEVIS		
PALAU	ST LUCIA		
PANAMA	ST VINCENT &		
PAPUA	GRENADINES		
NEW	SURINAME		
GUINEA	SWAZILAND		
PARAGUAY	SWEDEN		
PERU	SWITZERLAND		
PHILIPPINES	TAIWAN		
POLAND	TANZANIA		
PORTUGAL	THAILAND		
QATAR	TOGO		
ROMANIA	TONGA		
RWANDA	TRINIDAD & TOBAGO		
SAMOA	TUNISIA		
SAN MARINO	TURKEY		
SAO TOME & PRINCIPE	TUVALU		
SAUDI ARABIA	UGANDA		
SENEGAL	UNITED ARAB EMIRATES		
SERBIA	UNITED KINGDOM		
SEYCHELLES	URUGUAY		
SIERRA LEONE	VANUATU		
SINGAPORE	VATICAN CITY		
SLOVAKIA	VENEZUELA		