

The Terrorist Threat to Liquefied Natural Gas: Fact or Fiction?



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On 14 February 2007, the Saudi Arabian arm of al-Qaeda put out a call to all religious militants to attack oil and natural gas sources around the world. Through such attacks, according to the call, al-Qaeda hopes to “strangle” the U.S. economy.¹ Such proclamations give fodder to those who highlight the possibilities that liquefied natural gas (LNG) could be used as a lethal weapon of mass destruction. Industry officials on the other hand point out the improved security measures in place as a result of 9/11. While the U.S. continues to pursue LNG as a way to diversify its natural gas resources in order to meet anticipated

released a two-page summary of his report on the proposed Sparrows Point LNG terminal in the Baltimore area. In it, he stated that the terminal would be located sufficiently far from homes and schools and would therefore pose “no threat.” Clarke, according to media reports, went on to justify his findings by saying that terrorists “want to kill people. They want to kill hundreds of people.”² Therefore, since the proposed terminal would be located 1.2 to 1.3 miles from the Dundalk neighborhood of Turners Station, according to Clarke, it would not be a sufficiently attractive target for terrorists. Additionally, he said that the

“Once ignited, as is very likely when the spill is initiated by a chemical explosion, the floating LNG pool will burn vigorously...Like the attack on the World Trade Center in New York City, there exists no relevant industrial experience with fires of this scale from which to project measures for securing public safety.”

Professor James Fay, Massachusetts Institute of Technology

future shortfalls and increase energy security, opponents and proponents of LNG have been locked in a bitter debate with no solid conclusion. Proponents are correct in that both safety and security measures currently in place make LNG terminals and ships extremely hard targets for terrorists. However, it would be imprudent to believe that terrorists are either incapable or unwilling to attack such targets. It would be equally imprudent to assume that these targets are impenetrable. If anything, in today’s environment, insiders will always remain a potential threat.

Dangerous Assumptions

On 1 February 2007, the media reported on a study by former White House counterterrorism chief Richard A. Clarke who worked as a consultant to a firm proposing an LNG terminal in eastern Baltimore County. Clarke is said to have

facility would not be close enough to Washington to be a “symbolic target.”³ However, recent studies run counter to Clarke’s alleged conclusion. One of the best ways to study al-Qaeda, or any other terrorist group, is through an analysis of historical trends. In early 2007, Rand Corporation released a lengthy analytical report on terrorist targeting preferences for the Department of Homeland Security. The paper focused on 14 terrorist attacks in which al-Qaeda was believed to have been somehow involved, either through association, sponsorship or direction. According to the study, 10 out of the 14 attacks analyzed had either a medium or high casualty potential. In other words, these attacks were meant to kill people—a lot of people. However, the other four attacks had a low casualty potential. The study further showed a desire to damage the economy, with 10 of the 14 attacks indicating a medium or high potential to damage the economy and the other four with a low

potential. Based simply on the Rand study, Clarke's statement that the proposed terminal location would pose "no threat," is a dangerous assumption which leaves no room for error because al-Qaeda and its associates, through propagations distributed via the Internet, have already expressed an interest in crippling the U.S. economy. To further compound the argument against Clarke's conclusion, energy experts expect LNG imports into the U.S. to increase dramatically through 2030. This shift could potentially make LNG an even more desirable target as the U.S. becomes increasingly dependent on LNG to satisfy its growing natural gas consumption habits.

The final argument against Clarke's claim, and perhaps the most compelling one, lies within a study released by the Government Accountability Office (GAO) in February 2007 on the public-safety consequences of a terrorist attack on LNG.⁴ In its analysis, the GAO scrutinized six completed studies on the potential hazards of an LNG spill. The GAO then drew a series of conclusions from the studies and polled a panel of 19 experts to see whether or not they agreed with the findings. Not all experts agreed on the heat/hazard zone of an LNG spill. One quarter of the experts polled during the study believed that one to 1.25 miles was not a sufficiently conservative estimate to describe the heat hazard zone of an LNG related fire. If the experts who disagreed with this distance happen to be correct, it would put members of the general population located at the questionable threshold of 1.2 or 1.3 miles away from the site in a risky location.

Probability and Motivation of a Terrorist Attack

Few groups are capable of implementing an attack on LNG. However, an attack on LNG would fit well with al-Qaeda's tactics,

techniques and procedures. al-Qaeda is a radical Sunni Muslim organization with approximately 50,000 members located at various bases of operations in 45 countries. In addition to its own members, al-Qaeda's network includes groups operating in up to 65 countries. al-Qaeda's objective is to serve as a "defensive jihad" fighting against anyone or anything it perceives as attacking Muslims across the world. As a result, the group's aim is to overthrow non-Islamic (or insufficiently Islamic) regimes that seem to oppress their Muslim

Maritime terrorism has been a core part of al-Qaeda and its affiliates' historical strategy

citizens. In 32 incidents traced back to al-Qaeda, there were 3,464 deaths and 8,864 injuries. Although there has never been an attack against either an LNG terminal or tanker, maritime terrorism has been a core part of al-Qaeda and its affiliates' historical strategy. In 2000, suicide bombers rammed the *USS Cole* in Yemen, killing 17 sailors. In 2002, terrorists rammed the *Limburg*, a French oil tanker carrying 400,000 barrels of crude oil.

There have reportedly been indications of terrorists planning to hit LNG tankers. In November 2002, the capture of Abd al-Rahim al-Nashiri, al-Qaeda's operational commander in the Gulf region, brought to light the idea that terrorists were already planning to go after such targets. Nashiri, allegedly a specialist in maritime operations, had already played a key role in the attack on the *USS Cole* and the *Limburg*. According to a Western counterterrorism official during an interrogation, Nashiri indicated that al-Qaeda had information on the vulnerability of supertankers to suicide attacks and the economic impacts they would have. The official informed *The Daily Star* that al-Qaeda had a naval manual describing "the best places on the vessels to hit, how to employ limpet mines, fire rockets or rocket-propelled

grenades from high-speed craft, and turn LNG tankers into floating bombs. They (terrorists) are also shown how to use fast craft packed with explosives and the use of trawlers, or ships like that, that can be turned into bombs and detonated beside bigger ships or in ports, where petroleum or gas storage areas could go up as well. They (manuals) even talk of using underwater scooters for suicide attacks.”⁵

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According to Dan Verton in his book *Black Ice: The Invisible Threat of Cyberterrorism* (2003), “al-Qaeda cells now operate with the assistance of large databases containing details of potential targets in the U.S. They use the Internet to collect intelligence on those targets, especially critical economic nodes, and modern software enables them to study structural weaknesses in facilities as well as predict the cascading failure effect of attacking certain systems.”⁶ al-Qaeda is a “goal-driven organization.” This means that they take action toward an end goal of affecting the “future state of the world.” al-Qaeda’s ultimate goal is to establish “an Islamic caliphate,” which will ultimately extend across the global Islamic community. The biggest obstacle to accomplishing this is the U.S. Therefore, in order to try to achieve this goal, al-Qaeda must first bring down the U.S.⁷ With America’s growing appetite for natural gas, LNG could potentially become one of al-Qaeda’s targets.

The 2007 Rand study, entitled *Exploring Terrorist Targeting Preferences*, not unexpectedly, lists capability and motive as the two variables that can best predict the probability that al-Qaeda, or one of its affiliates, will select a target. It would be impossible for an attack to occur with only one variable. In other words, al-Qaeda must first have a motive. Once a

motive is established, the group must then possess the capability to carry out its selected mission. Without capability, the attack cannot occur, at least not successfully. Capability includes financial backing, technology, flexibility in movement, physical access to target or target area, ability to penetrate security of a target or target area, ability to conduct reconnaissance and planning, external links to sources of information/weapons/technology, and sophistication of media.

The Rand study broke down al-Qaeda’s motivational factors into four plausible groups. These four factors are *coerce*, *damage*, *rally* and *franchise* operations.

Coerce: al-Qaeda’s desire is to “coerce” the U.S. and its Western allies toward a specific goal by causing pain, most likely through casualties. A successful attack on LNG has the potential to be deadly.

Damage: al-Qaeda’s desire is to reduce the ability of the U.S. to intervene in the Islamic world. This would likely be accomplished by somehow damaging the economy. Under the damage hypothesis, al-Qaeda has already repeatedly demonstrated the desire to try to cripple the U.S. economy through both its propagations (i.e.: its call to attack oil and gas sources to “strangle the U.S. economy”) and through a pattern of historical terrorist acts, both successful and unsuccessful, many of which affected the economy to some degree. While the bombing of the World Trade Center was clearly motivated by a desire to take as many lives as possible, it also had a strong impact on the economy.⁸ An attack on LNG would also have an impact on the economy. The extent of that impact would depend upon the extent of the damage, coupled with the human-emotion factor, discussed a little later.

Rally: al-Qaeda’s desire is to rally support in the Muslim world. Under the rally hypothesis, hard targets symbolize

U.S. strength and are the most difficult targets to penetrate. Three of the 14 terrorist attacks analyzed by Rand were hard targets. “By striking and destroying them, al-Qaeda has been able to underscore its credentials as a meaningful force, establishing a benchmark of power that it has then used to build morale among existing members and attract new recruits.”⁹ Indeed, al-Qaeda tends to hit soft targets more frequently than hard targets. However, it has already proven it is willing to hit hard targets. With the numerous security measures implemented in every LNG shipment, LNG terminals and tankers are extremely hard targets. The added publicity surrounding LNG terminals in the U.S. could potentially draw increased appeal to them as targets for terrorist groups hoping to send out a strong message on their strength and potential, which could lure more support.

Franchise: al-Qaeda might not possess the means or capability to carry out a particular terrorist act and, therefore, a like-minded terrorist group might assume the task instead. Under the franchise hypothesis, since 9/11 and the global war on terrorism (GWOT), the U.S. has managed to destroy much of al-Qaeda’s infrastructure in Afghanistan. However, some analysts believe that rather than destroying bin Laden’s movement, the GWOT has actually “given rise to new, less predictable organizations composed of dozens of like-minded extremists.” If al-Qaeda is unable to execute an attack on LNG, perhaps a lesser known extremist group would step in unexpectedly.

The Rand study found that the majority of terrorist acts committed fell under at least two categories of the above hypotheses. For example, the 1993 bombing of the World Trade Center, in which a car bomb was detonated in the underground parking garage, killing six people, and injuring 1,042, falls under the categories of *coercion* and *damage*. This attack was

meant to cause mass casualties while also impacting the economy. 9/11 falls under three categories – *coerce*, *damage* and *rally*. It caused mass casualties, impacted the economy and rallied support in the Muslim world. A well executed attack on the U.S. LNG infrastructure would fall under three categories or even potentially under all four categories.

The most controversial LNG terminal in the U.S. is the Suez Energy North America’s Everett LNG terminal in Everett, Massachusetts. The location of this terminal makes it an ideal candidate for a terrorist attack under the *coerce* hypothesis. Almost weekly, LNG tankers have to pass within several hundred yards of the crowded Boston waterfront, past the end of the Logan International Airport runway and under a busy bridge. Immediately after 9/11, Richard Clarke, who was then the White House counterterrorism chief, prompted the U.S. Coast Guard to close Boston Harbor to all LNG tankers. LNG shipments resumed several weeks later after a federal judge ruled there was no evidence of a credible threat.¹⁰ However, these LNG operations started back up under much heavier security.

The rest of the world does not seem to share the same security and safety concerns as Americans regarding LNG. This could be a potential problem. Acting on these concerns, the U.S. has strict security measures in place. Meanwhile, in other areas of the world security is severely lacking, leaving massive tankers floating as easy targets. An attack could occur anywhere. One key location would be in Southeast Asia. Since 9/11, analysts have often pointed to the vulnerabilities of the Strait of Malacca. The Strait of Malacca is approximately 600 miles long, but only 1.5 miles at its narrowest point. Furthermore, it is the busiest chokepoint in the world. In 2006, more than 65,600 ships sailed through it.¹¹ An attack on an LNG tanker in the

narrowest part of the strait would put a serious delay on the traffic traversing through. This could have a significant impact on the world's economy, which is heavily dependent on commerce traversing the strait. At least a dozen LNG tankers pass through the Strait every day.¹² Catherine Zara Raymond, of the Jamestown Foundation, described a number of potential scenarios that could occur in Southeast Asia involving maritime terrorism.¹³ Citing concern by Singapore's Foreign Minister George Yeo in a speech to the ASEAN Regional Forum in July 2005, Raymond suggested that terrorists could hijack an LNG tanker and blow it up in Singapore harbor. Yeo described the potential impact of such a scenario as severe. According to Raymond, terrorists would most likely try to create an explosion onboard an LNG tanker by ramming a smaller vessel into the LNG tanker. This could rupture the hull and cause the gas to escape. However, experts point out that the fire would likely be contained at the site where of the leak, burning the fuel off as it escapes and therefore might not be as deadly, as would be the case if a vapor cloud were allowed to form and then ignited.

When assessing the probability of a terrorist attack against LNG infrastructure based on the Rand Study, it is important to remember that these are simply a series of hypotheses based on an intense analytical study of previous terrorist attacks not related to LNG. It is not a scientific study but it might provide some indication of the probability of a terrorist attack against LNG. The fact that LNG fits well into each hypothesis would seem to increase its potential as a target.

Vulnerabilities

A number of known vulnerabilities exist within the LNG industry. These vulnerabilities lie in the human factor. In other words, LNG ships and tankers are structurally sound. The only potential for

problems lie within the people who are somehow involved in the industry.

Inadequate vetting of crews: LNG shipments often originate from politically unstable and unfriendly countries and regions. Some of the locations in which LNG originates include Qatar, Nigeria, Algeria and Egypt. "It's the location of the ports and where the LNG is loaded and who gets on the vessel" that is important, said William Doyle, Deputy General Counsel of the Marine Engineers' Beneficial Association (MEBA).¹⁴ Many ships operate under grossly unregulated "open registry" or "flags of convenience" registries and often originate from ports with poor security systems in place. Due to a lack of any meaningful international regulatory oversight, it would be possible for someone to work under a different identity on board one of these tankers and avoid detection. Under the current system, no uniform, completely trustworthy system is in place for vetting foreign mariners.¹⁵ Background checks are conducted on Americans by the Coast Guard and the Transportation Security Administration (TSA). However, these same background checks are not performed on foreign crews. The Coast Guard does, on the other hand, require crew lists from all vessels entering U.S. ports. Unfortunately, no method is in place to ensure these crews are who they claim to be. Although this is an issue of security for all cargo ships, it is even more critical for ships carrying potentially dangerous cargo, such as LNG.

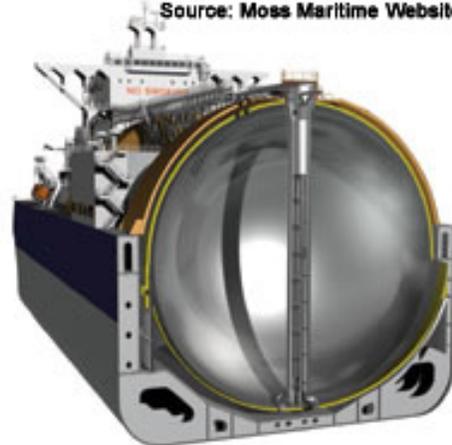
In a testimony to Congress, Ron Davis, President of MEBA, listed a number of differences between U.S. and foreign mariners, saying, "U.S. merchant marines receive their credentials to work from the Coast Guard. Foreign mariners do not. U.S. mariners undergo extensive background checks through the FBI. Foreign mariners do not. U.S. mariners are vetted through the national driver record database. Foreign seafarers are not. U.S. mariners will be subject to

terrorism background checks through the TSA. Foreign Seafarers are not. Finally, U.S. merchant mariners are U.S. citizens or persons lawfully admitted for permanent residency. The mariners who crew these ships are not.”¹⁶ As a result, it is impossible to be certain that a mariner is who he claims to be or that he is not a security risk. Davis said that there were practically no Americans employed on LNG ships today. At the top of MEBA’s list of threats to an LNG tanker is the possibility that a knowledgeable crewmember could deliberately sabotage the vessel. According to Davis, “The most vulnerable (thing) that you have on the ship is the crew. It is the crew that controls the ship... One or two engineers down in the engine room can take control of the ship, can control the steering of the ship, can control the speed of the ship, can have the ship going 20 knots up the Houston ship channel or in the New York Harbor or in places of confined areas. They can ram the ship anywhere they want.” Davis stated that terrorists might one day intentionally ram an LNG ship into a strategic target such as one fully loaded with a highly flammable, explosive material onboard.¹⁷ Or, as William Doyle said, two or three terrorists infiltrating an LNG tanker could cause serious damage by one taking control of the ship and the other(s) detonating an onboard explosion as the tanker enters a busy harbor.¹⁸

Terrorists could attack an LNG tanker as well as they could any cargo ship. In a 2004 edition of *Jane’s Terrorism and Security Monitor*, Jane’s reported that the type of attack widely envisaged, based on analyses of compromised terrorist preparations, would include “an explosion onboard a cargo ship laden with fuel oil and ammonium nitrate fertilizer, in effect turning the vessel into a waterborne fireball.”¹⁹ Should a terrorist somehow manage to get onboard a LNG tanker and cause an explosion, it might be possible to cause a boiling-liquid-expanding-vapor-explosion (BLEVE). A BLEVE might be possible in some instances if the LNG is heated to above

its boiling point while still contained within the tank. This rapid heating could cause a percentage of the LNG within the tank to “flash” into a vapor state almost instantaneously. This would cause pressure in the tank to rapidly build up. While LNG tanks do have massive pressure relief valves in place, if these valves were to fail in their ability to release the gas quickly enough or altogether, the pressure in the tank might create a type of explosion that would send dangerous debris flying. Most experts agree that LNG tankers are built to prevent such an event from occurring. One expert polled during the GAO study, Dr. Robin Pitblado from Det Norske Veritas, however, pointed out that a BLEVE might be possible on a Moss spherical tank because these tanks are constructed such that pressure could build up within them.²⁰ Skepticism exists

Source: Moss Maritime Website



within the industry regarding Pitblado’s claim. Captain Scott Conway who has served eight years onboard LNG tankers and who is intimately familiar with the construction of the Moss spherical tanker, views Pitblado’s scenario as unrealistic, questioning his conclusions by asking, “Where is the BLEVE going to occur in this tank? Where are you going to direct the flames back at this tank to heat up the liquid? How are you going to build up the pressure so that it overcomes the safety release? When you can explain this all logically as per the ship’s construction, then we’ll talk seriously.”

Inadequate security measures for U.S. facilities: During a hearing in the United States House of Representatives on 21 March 2007, Jim Wells of the GAO raised doubt that the Coast Guard can marshal the resources needed to meet its responsibilities²¹ While it took 40 years to build the fleet of LNG carriers to 200 tankers worldwide, it will take less than four more years for that number to grow to 300. This rapid growth rate coupled with the anticipated growth rate of LNG imports into the U.S. presents a real security challenge. The U.S. faces today potential lack of security measures and resources to protect these new assets.

Shortage of qualified mariners & U.S. officers: The rapid growth of LNG does not affect only the ability to safeguard each ship; it also affects the quality of mariners working onboard these vessels. Due to the nature of LNG, highly skilled and trustworthy individuals are required to ensure its safe transport. Currently, LNG tankers have crews consisting of mostly foreigners. Yea Byeon-Deok, professor and LNG initiative coordinator of the International Association of Maritime Universities said, during a conference in Australia, “Many sub-standard vessels have begun to appear as demand for LNG increases, while there is a chronic shortage of experienced crew.”²² Because of sudden rapid growth in the industry, many experts question whether or not there will be enough qualified mariners to crew these vessels. Nearly 1,500 senior officers and 750 senior engineers will be required to man the 100 new LNG ships. Approximately 80 percent of these ships will be fitted with steam turbines, which require engineers with steam experience, which, according to one report, is a “vanishing resource.”²³ The fact that many senior LNG officers are due to retire soon, and new, highly skilled mariners will be required to replace them exacerbates the situation. It will be tough enough just to replace crew and officers who are retiring, making these shortages

of crew members and officers reach crisis proportions.²⁴

The Society of International Gas Tanker and Terminal Operators LTD (SIGTTO) has recognized the acute shortage. “A short-term answer for an LNG vessel operator is to ‘poach’ its crew from another such operator but, clearly, the long-term answer is training, training, and further training. SIGTTO members, as much as anyone, wish for the quite unique safety record of LNG shipping to be preserved. The influx of new personnel into the industry is of concern, especially if there is a temptation by a minority of operators to ‘cut corners’ and put officers into positions of responsibility on a LNG carrier before they have been properly trained.”²⁵

The U.S. Maritime Administrator has been striving to increase the number of U.S. mariners employed on these tankers. U.S. officers go through a rigid qualifications process to ensure they become highly skilled. Meanwhile, the U.S. has no control over the quality of foreign officers. According to H. Keith Lesnik, Director of the Office of Deepwater Port Licensing, officials are pushing to bring more U.S. officers onboard LNG tankers. So far, four shipping companies have already agreed to do this. Under the Deep Water Port Act, the Administrator has to allow these ships access to the port facilities, whether they have U.S. mariners onboard or not. In an effort to try to influence companies not wishing to comply with the manning request, the Maritime Administrator offers priority processing to companies agreeing to the manning requirement. The priority allows these ships to be moved to the front of the line for the license application process.

No U.S.-Flagged LNG Vessels: Up until 2001, there were U.S.-flagged LNG tankers. Since 2001, however, not a single U.S.-flagged LNG tanker exists.

The reason for this is purely economic. It is more costly to register a ship in the U.S. than in a foreign country because a U.S.-flagged vessel is required to employ Americans, which is more expensive, and also pay higher taxes and fees. Additionally, running a U.S.-flagged vessel entails much more stringent requirements because it falls under the U.S. Code of Regulations. These U.S. regulations require more rigid crew training and more stringent licensing standards on crew documents. All these factors drive up the costs of running the ships. The real benefit for a ship to carry a U.S. flag would be so that it can carry cargo from state to state within the U.S. and it can carry U.S. military cargo from U.S. bases to overseas bases. Neither of these advantages serves as a motivator to LNG trading companies because neither is necessary in an LNG operation. The flag flown has no bearing on the ship's operator. Registering a ship is a fairly easy process. The International Transport Worker's Federation lists 28 countries as flag-of-convenience (FOC) countries. Registering a ship in an FOC country generally requires much less paperwork than do countries that have national registers. In some cases, such as Panama, registration can be done in just a few hours by fax.²⁶ The implications are that since requirements are much less stringent, security precautions and fleet training are most likely lacking.

Hijacking: A 2004 study conducted by the European Conference of Ministers of Transport jointly with the Organization for Economic Cooperation and Development (OECD), describes two scenarios involving terrorists striking at sea. In the first scenario, called the Trojan Horse scenario, terrorists develop legitimate trading identities that would allow them to ship and misuse "dangerous consignments." In the second scenario, the hijacking scenario, terrorists seize control of an entire vessel and its cargo to use it in a mass assault. According to

Janes Terrorism and Security Monitor, the intelligence community feared that preparations for a major seaborne assault might already be in an advanced stage.²⁷ In March 2003, during the night, about a dozen heavily armed men boarded the chemical tanker *Dewi Madrim* off the coast of Sumatra. The hijackers proceeded to take over the ship. Experts believed that this might have been a training exercise because the pirates navigated the ship for an hour through the Strait of Malacca then kidnapped the captain and first mate without demanding a ransom. Some experts believed that the hijackers could have been terrorists practicing operation of a large vessel in the crowded shipping lanes.²⁸ According to an ABC News investigative report, fears in shipping and security circles were increasing with the notion that these armed terrorists, or ven pirates, could take control of a vessel carrying LNG and transform it into a floating bomb. Admiral Kevin Eldridge, who was the commander of the U.S. Coast Guard's 11th District in California, stated that an attack by ship on U.S. shores was "likely enough for us to put a lot of effort into the planning of it." Eldridge continued, "There aren't enough ships (and) there aren't enough planes for us to set up a picket line, so that we know what's coming." He continued, "We're pushing our borders out. Frankly, if we have a vessel in our port that has a problem, it's too late."²⁹ According to Captain Conway, physically it would be extremely difficult for pirates to successfully scale the 50-foot hull of an LNG vessel. However, according to Anne Korin, co-director of the Institute for the Analysis of Global Security (IAGS), acts of pirates hijacking a ship have been facilitated by planting an insider within the ship.

LNG: A Growing Economic Target?

During the 21 March 2007 hearing, Congressman Bennie G. Thompson, of the second district of Mississippi, observed that although it is important to consider the dangers of LNG, it is equally important to try to assess the economic impacts that an LNG incident might incur. "...Terrorists would just as well like to keep a port out of business for a week or two and that would be an absolutely significant incident... So, I think part of our challenge is how we look at all the consequences associated with the handling of LNG. Clearly, we want to know the hazards initially, but we also want to look at economic conditions that relate to it."³⁰

The variables that would affect the economic impact are too numerous to make such a predetermined calculation possible. Additionally, as time passes and the role of LNG grows worldwide, the potential impact of a terrorist attack on these tankers or terminals increases. According to the Energy Information Administration (EIA), LNG imports comprised only three percent of overall natural gas consumption in the U.S. in 2005. Energy analysts expect LNG imports into the U.S. to increase by 8.7 percent annually through 2030. Conversely, natural gas piped in from Canada, which is the number one source of imported natural gas to the U.S., is expected to decrease by 4.6 percent. At this rate, by 2030, approximately 17 percent of all natural gas required to meet U.S. consumption needs, will be supplied via LNG imports.

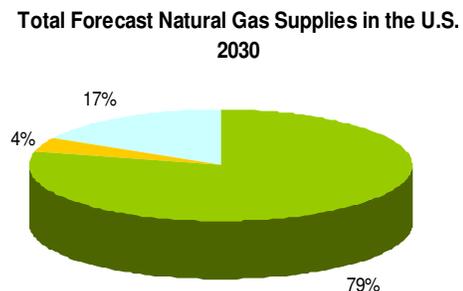
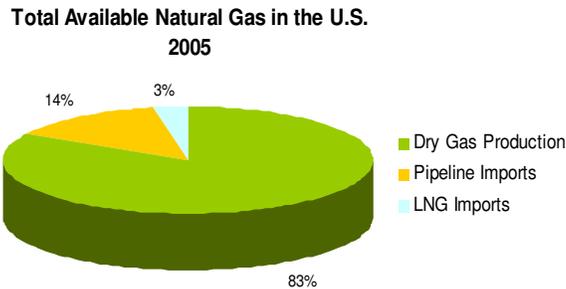
The 17 percent figure is merely an estimated EIA projection based on analysis of numerous trends and variables. The EIA came up with both a low and high LNG estimate forecast through 2030. Variables that contribute to the calculation of a "low LNG" estimate include obstacles, such the denial of construction on a proposed LNG terminal.

A proposed LNG terminal in Mobile Bay, Alabama, for example, did not come to fruition due to its lack of citizen and local government support. Another variable is the discovery of new natural gas fields, which would increase the availability of natural gas imports via pipeline and potentially decrease the need for building new LNG terminals. Examples of variables that would contribute to a high LNG estimate include a shift in Canada's natural gas export to a different end-user, possible environmental factors putting a halt to certain domestic natural gas production, and the successful permitting and construction of LNG terminals in the U.S. As of March 2006, there were five LNG terminals operating in North America. These five terminals had a peak send-out capacity of 5.24 billion cubic feet per day. There were, however, 17 proposed LNG import terminals in North America that government regulators had already approved. If these terminals proceed through construction as planned, they will have the capacity to send out an estimated 24.2 billion cubic feet per day. In addition to these 17 approved terminals, various energy companies are proposing some 25 other LNG projects in Canada, the U.S. and Mexico. These 25 projects will have a send-out capacity of 27.75 billion cubic feet per day.³¹ To offer a point of comparison, in 2006 the U.S. consumed an average of approximately 60 billion cubic feet of natural gas per day.

The EIA estimated that by 2030, LNG could make up as little as seven percent or as much as 33 percent of the total natural gas consumed in the U.S.³² Should the use of LNG in the U.S. follow the trend that would lead to the "high LNG" scenario, or 33 percent, then it would be reasonable to say that the probability of a terrorist attack against LNG, for economic purposes, would increase due to its greater potential economic impact. In order to stress the importance of this, the author will take the high LNG scenario.

Some of the variables required to calculate the economic impact of an LNG disaster include time of year, weather

customers in Spain and Italy, filling supply gaps will not be a problem, as we can make up for the shortfall using the



conditions, location of storage unit(s) affected, natural gas prices, location of incident and perhaps most challenging, the human emotional factor. Emotion, whether positive or negative, can sway the stock market and affect global pricing of energy and the economy. It is impossible to measure anticipated human emotion. A small scale LNG leak could cause natural gas prices to spike temporarily before returning to normal. A large-scale leak or attack that leads to human-casualties could cause prices to spike severely and not return back to their original rates. Despite the unknown outcomes of human emotion, it is critical and cannot be omitted from any potential calculation.

(Maghreb and Transmed) pipelines to Spain and Italy. Gaz de France, however, will be difficult.”³⁴ LNG from Skikda accounted for approximately eight percent of France’s total imports. According to a spokeswoman for Gaz de France, the company was looking at all measures it could take to offset the lost volume.³⁵ Finally, Gaz de France was able to turn to overland transport networks already in place from northern Europe to make up for the potential shortfall. Gaz de France maintains a diverse portfolio of suppliers from Norway, Algeria, Russia, the Netherlands, the United Kingdom, Nigeria and Egypt.³⁶ Shortly after the Skikda blast, stock prices shot up due to a fear factor in the market. These fears were compounded by the uncertainty over how much LNG production had been affected by the blast. Some people reportedly felt that the news had affected the winter 2004 prices at the Northern Border Stock Price (NBP). These prices did settle back fairly quickly, though.

So far, in non-terrorist related incidents, with pipelines making up a majority of natural gas transport, impacts have been easily reversed. In the case of the 2004 Skikda disaster in which an LNG related explosion killed 27 people in Algeria, state-owned Sonatrach was able to regain its footing, although there were a number of hurdles to overcome. Two days after the explosion occurred, the media reported that Algeria had lost nearly 25 percent of its export capacity. However, European customers said they were not expecting the outage to cause them problems.³³ Several days later, on 27 January, a Sonatrach official told World Gas Intelligence, “For our

In areas such as the East Coast, where the Everett terminal is located outside of Boston Harbor, LNG is critical to the energy makeup of the region. The Everett terminal is the only terminal in the U.S. that operates at 100 percent capacity 365 days a year. It represents approximately 25 to 30 percent of the base load natural gas brought into the

New England market everyday. This is due to demand outweighing available piped-in sources of natural gas. The other four remaining terminals operate at anywhere from 45 to 65 percent.³⁷ Therefore, an attack either on a tanker within the Boston Harbor or the Everett terminal itself would likely have a much greater economic impact.

As piped-in natural gas supplies become less abundant and U.S. consumption rates increase, were an LNG disaster to occur in the U.S., it would have an immediate impact. Natural gas serves over 64 million customers and provides around 24 percent of all energy consumed. Not only is this energy essential for home heating, it is also increasingly used toward power generation and serves as a major feedstock for the chemical industry. Every one of these sectors could be subject to price hikes, shortened productivity and even increased dependence on foreign trade, etc.

LNG holds appeal of increasing a nation's energy security because of its fungible nature, however it could also be damaging to energy security because of the vulnerability of the extensive infrastructure required to process it. Should terrorists somehow manage to damage or destroy this infrastructure, or the ports that lead to the processing plants, it would be detrimental to those regions which have become highly dependent on LNG.

Conclusions

The natural gas industry has an excellent safety record. However, the 9/11 attacks have changed the threat profile. If the U.S. is to continue increasing its appetite for natural gas, it will inevitably increase its imports of LNG because Canada cannot provide enough natural gas to meet U.S. future requirements. The key question, however, is whether or not the

benefits outweigh the risks and even how big the risks truly are. The most inherent problem with LNG is that despite scientists, scholars, officials and academicians conducting various high-profile studies on the safety implications of LNG, too many unknown variables and unanswered questions still exist. Experts don't agree fully on safety boundaries. Empirical data demonstrating what would happen if there were to be an attack are virtually non-existent. Because of this uncertainty, members of the public remain adamantly opposed to bringing LNG with its foreign ships and crews into their "backyards," perhaps rightly so. More studies are needed to bring about sound conclusions and ensure the greatest possible degree of public safety, as well as to ensure the security of an important commodity.

Building a terminal offshore will certainly mitigate a possible attack, as will enhanced security measures. However, despite the myriad security measures in place, it would be difficult to thwart people willing to die to carry out an attack. Attacks such as 9/11 and the bombing of the *USS Cole* serve as reminders that "events" many industry officials consider improbable are still possible. In fact, some people would say that in hindsight, turning passenger airliners, fully loaded with fuel, into missiles and flying them into the World Trade Center and the Pentagon is indeed probable. While discussing a topic unrelated to LNG, Andrew Kohut, director of the Pew Research Center for the People and the Press, said, "I attended a lot of meetings, and one in February of 2001 with security experts on scenarios for asymmetric warfare, and there were only a minority of people there who thought that the United States could be endangered, seriously threatened by a non-nation state, actor or group."³⁸ Seven months later, the improbable became reality.

People within the LNG industry argue vehemently about the safety of LNG.

William Cooper, Executive Director for the Center of LNG said, “The added security features for the tankers coming into port are such that a successful attack on an LNG tanker is slim to none.” Captain Scott Conway argues that LNG tankers are the safest tankers in the shipping industry. “There’s no way I’d bring my wife or child on an oil tanker, for example. However, we didn’t hesitate to bring our families on the LNG ships. That is how safe the ships were. They’re very well made.” After witnessing various experiments done on LNG and working closely with the liquid, Conway also views it as “an extremely safe, non-toxic, non-explosive cargo.”³⁹ Despite these views, the debate continues, and as long as the uncertainties surrounding the safety of LNG remain unanswered,

officials must continue to strive for maximum safety measures. The U.S. and other consumers of LNG should learn to manage and understand these risks in order to reach a solution that will best mitigate any possible incident. Anne Korin summed it up by saying, “We don’t know what would happen because there hasn’t been such an attack yet.” The goal should be to place a large enough buffer between tankers (and terminals) “from any dense urban areas so as to minimize appeal of the target, which lies in its potential to provide a mass casualty incident.” Finally, when it comes to LNG as an economic target, the best measure to mitigate this possibility is simply to ensure that appropriate measures are taken to keep dependency on LNG at a reasonable level.

NOTES

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