

Table 1. Historical milestones and expert ratings of the importance of dimensions of energy security
(dimension ratings are expert averages ranging from 0 to 10)

Date	Historical event	(1) Physical availability	(2) Technology development	(3) Economic affordability	(4) Social accessibility	(5) Governance	(6) Manmade threats	(7) Natural environment
July 28, 1914 to November 11, 1918	First World War							
July 11, 1924	Foundation of the World Energy Council (WEC) (https://en.wikipedia.org/wiki/World_Energy_Council)							
September 1, 1939 to September 2, 1945	Second World War: From an energy perspective, this era was marked by the failed Nazi invasion of Soviet Russia (Operation Barbarossa, badly timed in respect to the Russian winter) epitomizing the importance of timing a campaign and providing logistical support for an army.							
February 4-11, 1945	The Yalta Conference marked the beginning of the Cold War, an era during which oil was provided at preferential prices to country members of the Eastern Block by Soviet Union (Russia) (https://www.historyonthenet.com/the-cold-war-timeline-2)							
1947	Stanolind Oil and Gas (an exploration subsidiary of Amoco) conducted the first experimental fracturing in southwestern Kansas, using gelled gasoline and sand from the Arkansas River (Montgomery & Smith, 2010). Multistage hydraulic fracturing combined with horizontal drilling (60 years later) fueled the shale gas and oil revolution observed presently.							
February 1958	Foundation of the European Nuclear Energy Agency (ENEA), which in 1972 was renamed to Nuclear Energy Agency (NEA) (https://www.oecd-nea.org/general/history)							

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September 1960	Foundation of the Organization of Petroleum Exporting Countries (OPEC)							
October 6 to 26, 1973	Yom Kippur Arab-Israeli war: an unprecedented era of a war in the Middle East, prelude to the 1st Oil Crisis							
October 1973 to March 1974	1st Oil Crisis (Shock): The 1973 (1st) Oil Crisis started when the Organization of Arab Exporting States proclaimed an embargo at nations perceived as supporting Israel during the Yom Kippur war. Cars in the US famously form lines to purchase a limited quantity of gasoline at gas stations.							
November 18, 1974	Establishment of International Energy Agency (IEA) (https://en.wikipedia.org/wiki/International_Energy_Agency)							
April 10, 1975	US Congress instituted US oil export ban by passing the Energy Policy and Conservation Act (EPCA), as a response to the 1st Oil Crisis.							

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January 1978 to February 1979	<p>Iranian Revolution: The 1979 Islamic Revolution in Iran began in early 1978 and ended a year later (https://www.britannica.com/event/Iranian-Revolution), when the royal reign of Shah Mohammad Reza Pahlavi collapsed, Sheikh Khomeini took control as grand ayatollah of the Islamic republic (https://www.federalreservehistory.org/essays/oil_shock_of_1978_79), and Iran, a major oil producer and exporter, turns into a theocratic state. As a result of reduced Iranian oil output, the world production of oil declined by 7% (https://econweb.ucsd.edu/~jhamilton/oil_history.pdf), being partially responsible for precipitating the Second Oil Crisis. An extended timeline of events of the Iranian Revolution is presented by the Brookings Institution (https://www.brookings.edu/blog/order-from-chaos/2019/01/24/the-iranian-revolution-a-timeline-of-events/). A detailed timeline of the Iranian Revolution is available at https://www.reuters.com/article/us-iran-revolution-anniversary-timeline/timeline-of-the-iranian-revolution-idUSKCN1Q017W.</p>							
1978 to 1979	2nd Oil Crisis (Shock), detailed at https://www.federalreservehistory.org/essays/oil_shock_of_1978_79 , a repeat of the global nightmare experienced during the 1st Oil Crisis.							

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January 23rd, 1980	<p>Carter Doctrine set out by President Jimmy Carter: <i>"An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force"</i> (http://www.presidency.ucsb.edu/ws/?pid=33079). The US made clear that it will not allow control of the oil-producing Persian Gulf region by actors inimical to the unhindered operation of the global oil market.</p>							
August 2, 1990 to February 28, 1991	1st Gulf War: Saddam Hussein's unsuccessful bid to conquer Kuwait and dominate the Persian Gulf, a region of immense geopolitical importance due to its abundance of energy resources. Saddam Hussein's invasion of Kuwait stayed in the collective global memory as the picture of burning oil wells.							
December 25, 1991	Mikhail Gorbachev's 12-minute speech on national television announcing that the Soviet Union would cease to exist. In his 12-minute speech, Gorbachev made an indirect reference to the importance of energy for the success and security of a state: "We have a lot of everything – land, oil and gas and other natural resources..." (Yergin, 2011). The end of the Cold War introduced uncertainty into the geopolitics of energy.							
March 20, 2003 to December 18, 2011	2nd Gulf War: The reality of the war and occupation of Iraq gave way to uncertainty, political insecurity and sectarian violence, which were followed by the offensive against the Islamic State after 2015 (https://www.bbc.com/news/world-middle-east-14546763).							

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August 23, 2005	Hurricane Katrina caused catastrophic damage in Florida and Louisiana. The importance of black swan type of natural disasters in the context of energy grids was made clear.							
2005 to 2009	Gas crises between Russia and Ukraine, with a detailed time line available at https://www.reuters.com/article/us-russia-ukraine-gas-timeline-sb-idUSTRE50A1A720090111 . During the Ukrainian crises, there was significant concern in the European Union, which obtains much of its natural gas from Russia.							
December 18, 2010	The Arab Spring upheaval changed the strategic balance in the Middle East and North Africa (MENA), with indirect implications for energy and geopolitics.							
March 11, 2011	Fukushima Daiichi Nuclear Accident: The importance of securing energy installations from "unthinkable" natural threats (even unusual ones like tsunamis as opposed to earthquakes, and further to traditional threats like terrorist attacks) became dramatically obvious in a country (Japan) devoid of indigenous energy resources.							
April 17 to 19, 2011	Major cyber attack on Sony compromised personal details from 77 million accounts and prevented users of PlayStation 3 and PlayStation Portable consoles from accessing the service (https://en.wikipedia.org/wiki/2011_PlayStation_Network_outage). Although this specific incident was not about energy, it brought to light the vulnerability to cyber attacks as a potential threat energy security.							

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August 15, 2012	<p>Cyber attack on 35,000 computers of Aramco, the Saudi Arabian oil company (https://www.nytimes.com/2012/10/24/business/global/cyberattack-on-saudi-oil-firm-disquiets-us.html), the biggest computer hack in history. Following the 2011 Sony incident, this cyber attack impacted a state oil company, Aramco, that supplied 10% of the global demand for oil (https://money.cnn.com/2015/08/05/technology/aramco-hack/index.html), alerting the world to the terrifying possibility of a cyber Pearl Harbor.</p>							
January 16-19, 2013	<p>In Amenas gas plant hostage crisis in the Sahara desert in Algeria: As terrorists linked to Al-Qaeda attacked the Tigantourine gas facility near In Amenas, Algeria, executing at least 39 expat hostages (10 of them Japanese), (https://www.theguardian.com/world/2013/jan/25/in-amenas-timeline-siege-algeria). The world came into the alarming realization that terrorism constitutes a serious global threat to energy infrastructure and the power grid.</p>							
February 25, 2015	<p>The EU Energy Union was adopted with the main task of creating a fully integrated internal energy market to enhancing energy security, improve energy efficiency, decarbonize the economy and support research and innovation (https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union). Further to the states objectives, the energy union of EU member states will allow EU to negotiate better deals for Russian gas and be a more powerful geopolitical player.</p>							

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July 14, 2015	<p>The Joint Comprehensive Plan of Action (JCPOA), a nuclear deal between Iran, the five permanent members of the United Nations (US, UK, China, Russia, and France), Germany and the European Union, was announced. Per JCPOA, Iran agreed to limit its enrichment of uranium in exchange for the lifting of crippling sanctions. A full timeline is available at https://www.armscontrol.org/factsheet/Timeline-of-Nuclear-Diplomacy-With-Iran.</p>							
September 10, 2015	<p>US House Energy & Power Subcommittee approved bill to lift the 1975 oil export ban (instituted by EPCA), encouraging new investments and the creation of new jobs in all areas of the economy.</p>							
May 8, 2018	<p>President Trump announced that he is withdrawing the United States from the Joint Comprehensive Plan of Action (JCPOA, Iran's nuclear deal) and signs a presidential memorandum to institute the <i>"highest level"</i> of economic sanctions on Iran (https://www.armscontrol.org/factsheet/Timeline-of-Nuclear-Diplomacy-With-Iran).</p>							
May 2019	<p>Yemen's Shiite Houthi rebels attacked two Saudi pumping stations with armed drones. As in the case of the Algerian gas plant hostage crisis in the Sahara desert, this incident underscored the potential impact of terrorism as a new threat to energy security.</p>							