AMERICAN UNIVERSITY OF BEIRUT

# THE IMPACT OF PUBLIC ACCEPTANCE ON THE FUTURE OF NUCLEAR ENERGY IN THE MIDDLE EAST: THE CASE STUDY OF JORDAN

by
ALIA HUSSEIN SABRA

A thesis
submitted in partial fulfillment of the requirements
for the degree of Master of Science
to the Department of Mechanical Engineering
of the Faculty of Engineering and Architecture
at the American University of Beirut

Beirut, Lebanon
May, 2017

AMERICAN UNIVERSITY OF BEIRUT

# THE IMPACT OF PUBLIC ACCEPTANCE ON THE FUTURE OF NUCLEAR ENERGY IN THE MIDDLE EAST: THE CASE STUDY OF JORDAN

by
ALIA HUSSEIN SABRA

Approved by:

Dr. Nesreene Ghaddar, Professor — Advisor
Mechanical Engineering, Dean's Office

Dr. Ali Ahmad, Director — Co-Advisor
Energy Policy & Security in the Middle East Program

Dr. Sari Hanafi, Acting Chairperson — Member of Committee
Anthropology and Media Studies

Dr. Hiba Khodr, Associate Professor — Member of Committee
Political Studies & Public Administration

Dr. Nasser Yassin, Assistant Professor — Member of Committee
Health Management & Policy

Date of thesis defense: April 26, 2017

# AMERICAN UNIVERSITY OF BEIRUT

# THESIS RELEASE FORM

Student Name: Sabra Alia Hussein
Last First Middle

☑ Master's Thesis ❒ Master's Project ❒ Doctoral Dissertation

√ I authorize the American University of Beirut to: (a) reproduce hard or electronic copies of my thesis, dissertation, or project; (b) include such copies in the archives and digital repositories of the University; and (c) make freely available such copies to third parties for research or educational purposes.

I authorize the American University of Beirut, to: (a) reproduce hard or electronic copies of it; (b) include such copies in the archives and digital repositories of the University; and (c) make freely available such copies to third parties for research or educational purposes after:

One ---- year from the date of submission of my thesis.
Two ---- years from the date of submission of my thesis.
Three ---- years from the date of submission of my thesis.

08/05/2017

Signature Date

# ACKNOWLEDGMENTS

My recognition and gratitude are addressed to those who helped me reach my target by sharing my survey with their circle of contacts and here I mention Dr. Ali Ahmad, Mutasem Sharman Al Barmawi, Rami Bitar, Dr. Nada Sabra, Fidele Byringiro, Diana Daham, Laura Mashini, Nazih Harb, Reem Jabr and Nouhad Awad.

I would like to particularly thank Dr. M.V. Ramana at the University of British Columbia and Dr. Sari Hanafi at the Sociology, Anthropology & Media Studies department and Dr. Houssam Shaib at the Agricultural and Animal Science Department at the American University of Beirut for their valuable opinion and review of my survey and or sample size methodology.

The five Jordanian stakeholders (Activists Dr. Ayoub Abu-Dayyeh, and Dr. Basel Burgan, Government Officials Mr. Raouf Dabbas - Senior Advisor at the Ministry of Environment and Dr. Ibrahim Badran, and Politician and Businessman Managing Director Mr. Al-Sharif Nasser Bin Nasser) are also acknowledged for their valuable time and the information they shared.

Finally, this work would not have been made possible without the guidance, support and encouragement of Professors Ali Ahmad at the Energy Policy and Security in the Middle East Program, the Issam Fares Institute and Chairperson Nesreen Ghaddar at the Mechanical Engineering Department at the Faculty of Engineering and Architecture. In addition to the great opportunity, they granted me to participate in the11th Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES2016) – Lisbon, Portugal.

At this point, a thought for my family, friends and my classmates in the energy studies program who supported me in this mission.

# ABSTRACT

Alia Hussein Sabra for Master of Science in Energy Studies
Major: Energy Studies

Title: The Impact of Public Acceptance on the Future of Nuclear Energy in the Middle East: The Case Study of Jordan

Increasing demand for water and energy has led Jordan to plan for considering a new energy program, namely; the acquisition of a nuclear power program. This thesis studied potential challenges that might hinder such initiation via surveying the opinion of Jordanians with regards to the future of energy in their country.

The major research question that this study tried to answer and understand is whether the government plans to build a nuclear power plant and the perceptions of Jordan's energy for the Jordanian public are aligned. The selection of Jordan is due to the fact that the debate on whether nuclear is a suitable energy source for Jordan remains lively.

Consequently, the proposed study would have a significant potential for impact to inform the energy debate in the kingdom. Furthermore, since no nuclear initiation contract has been signed yet, it is the ideal time and environment to study the various views and their potential influence on the political and governmental system. A survey, with both Arabic and English translations, was initiated to target through a non-random sampling one hundred Jordanians from the general public. The quantitative content was analyzed using the online software called "Qualtrics" to come up with descriptives, frequencies and cross-tabulations. At the same time, it aided in comparing results to those of previous polls conducted in Jordan and other nuclear-seeking countries of the Middle East and the rest of the world.

Additionally, a non-structured interview was conducted online with universities and nuclear related groups on social media. Another semi-structured set of interview questions was made available to dialogue with some stakeholders in the country. Fourthly, an advanced search method was developed to measure the factors affecting the public's sentiments towards nuclear power in Jordan. Finally, a comprehensive analysis of the quantitative and qualitative results came-up with a better idea of the dynamics around energy decisions in Jordan.

Findings conclude that the average final key factor ranking is Safety, Israel, and Finance factors as highly effective, while Opposition and Multinational Corporations were seen as least effective. There was a quasi-consensus that the public opinion's is not that important which is surprising especially when a minority of people governs the policies. The breakdown between the uncertain somewhat and the certain strong was identified, thus revealing that the strong opposition was higher than the strong in favor.

**Keywords:** Jordan, Nuclear Energy, Public Acceptance, Key Factors, Public Sentiment, Stakeholders

# CONTENTS

# LIST OF ILLUSTRATIONS

Figure Page

# LIST OF TABLES

Table Page

# ACRONYMS

%: percent

$: dollar

AABU: Al al-Bayt University

ASE: Atom Story Export

C: confidence interval

CSS: Center for Strategic Studies

EMRC: Jordan's Energy and Minerals Regulatory Commission

EPC: engineering procurement construction

EJ: Exajoule

GDP: Gross Domestic Product

GJ: Gegajoule

IAEA: International Atomic Energy Agency

IAF: Islamic Action Front

JAEC: Jordan Atomic Energy Commission

JNRC: Jordan Nuclear Regulatory Commission

JOD: Jordanian Dinar

JUST: Jordan University of Science & Technology

KAERI: Korean Atomic Energy Research Institute

Km: Kilometres

KWh: Kilowatt hour

$m^3$: cubic meter

ME: Middle East

MENA: Middle East and North Africa

MP: member of parliaments

MW: mega-watt

MWe: mega-watt electric

NPP:  nuclear power plant

P: picking a choice

PWR: pressurized water reactors

TW: Terawatt

TWh: Terawatt hour

US: United States

VVER: Water-Water Energetic Reactor

SMR: small modular reactors

ss: sample size

yr: year

Z: confidence level

# CHAPTER I

# INTRODUCTION

One of the countries that specifically mentioned nuclear energy as part of its intended nationally determined contributions to climate change mitigation is Jordan (IAEA, 2016).Jordan has indicated it wants to develop nuclear power to meet its growing energy needs and overcome its water shortage through desalination while using a reliable and long-term predictable electricity generation cost (Kahook S., 2014). Debate about the inclusion of nuclear power as an energy source in Jordan is heating up. However, there are challenges that might hinder the initiation of such endeavor. These challenges include funding, ownership and management, liability and insurance, security and environmental issues. To assess the acceptability of nuclear power in Jordan, this study will primarily survey the opinion of the Jordanian public. It will secondarily interview the opinion of some stakeholders concerning the construction of nuclear power plant (NPP) in their country. In addition and most importantly, it will come up with a baseline data about key factors that might be playing a role whether a positive or a negative one in affecting the public sentiment with regards to the nuclear energy program. We believe that the results could potentially have a significant potential for impact the nuclear energy debate.

In 2012, due to natural gas supply constraints from Egypt due to repeated attacks on the gas pipeline running through Sinai, Jordan had to import 5 percent (%) in addition to the 84% heavy fuel oil and diesel. In 2013, Jordan imported 0.3 terra-Watt-hour (TWh) to satisfy its 14.5 TWh electricity consumption. This electricity production came from oil power plants (74.5%), succeeded by natural gas (25.1%), and then hydro

(0.3%) and wind (0.1%) (IAEA, 2013). Currently, it has 2,400 Megawatt electrical (MWe) of generating capacity with a per capita consumption of about 2,000 Kilowatt-hour per year (kWh/yr) and is expected to need 5,000 MWe by 2020 and 8,000 MWe by 2030 when it expects doubled electricity consumption (Tables 1 and 2) (KNEB, 2017).

**Table 1 : Sources of Energy Production and Consumption in 2015 (JAEC, 2016)**

| | **Sources of energy** | | | | | |
|---|---|---|---|---|---|---|
| | **Fossil fuels** | | | **Nuclear** | **Renewables** | |
| | Solid fuels include coal, lignite | Liquid | Gas | Uranium | Hydro | Other renewable |
| Production Amount In Exajoule (Ej) | - | 0.0005 | 0.00897 | - | 0.0006 | 0.007 |
| Consumption Amount In Ej | - | 0.287 | 0.128 | - | 0.008 | 0.006 |

**Table 2 : Energy related ratios in 2015 (JAEC, 2016)**

| | 2015 |
|---|---|
| Energy Consumption Per Capita (Gj/Capita) | 58.8 |
| Electricity Consumption Per Capita (Kwh/Capita) | 2,318 |
| Electricity Production/Energy Production (%) | - |
| Nuclear/Total Electricity (%) | - |
| Ratio Of External Dependency (%) | 97 |

Hence, with these projections, Jordan's significant 98% fossil fuel import for its electricity at a cost of about one-fifth of its Gross Domestic Product (GDP) is leading to growing debt from energy imports and possession of 35,000 tons of uranium ore deposits lead to its interest in nuclear energy (Table 3) (Aboul-Enein et al., 2016 and Schenker, 2015). Therefore, one third of the 2030 projection is expected to be

recompensed from nuclear energy source. Despite its existing regional grid connection of 500 MWe with Egypt and 300 MWe with Syria, Jordan is increasing links with Israel and Occupied Palestine to both increase energy security and provide justification for larger nuclear units (KNEB, 2017).

**Table 3 : Estimated Available Energy Sources (JAEC, 2016)**

| | Estimated Available Energy Sources | | | | | |
|---|---|---|---|---|---|---|
| | Fossil Fuels | | | Nuclear | Renewables | |
| | Solid | Liquid | Gas | Uranium | Hydro | Other Renewable |
| Total Amount In Specific Units* | 40 000 | - | 300.00 | 70 000.00 | - | 0.00 |
| Total Amount In EJ | 251.00 | - | 0.95 | 38.10 | - | 0.05 |

*Solid, Liquid: Million tons; Gas: Billion $m^3$; Uranium: Metric tons; Hydro, Renewable: TW

Despite the proposed idea of a nuclear desalination plant, which did not materialize, Jordan along with Arab countries in the Middle East and North Africa (MENA) region formed in 1988 the Arab Atomic Energy Agency in order to coordinate nuclear-energy research (Ramana and Ahmad, 2016). Discussion on nuclear energy re-emerged after Saudi Arabia halted its oil supply in the early 1990s. However, the government did not initiate efforts before 2007 when it established a Committee for Nuclear Strategy tasked with developing a program to install nuclear energy generation capacity sufficient to provide 30% of electricity by 2030 (WNA, 2015). Furthermore, The Jordan Atomic Energy Commission (JAEC) and the Jordan Nuclear Regulatory Commission (JNRC) were created and the nuclear law modified. During the same year, JAEC started conducting a feasibility study including a comparative cost benefit analysis on nuclear energy (Ramana and Ahmad, 2016). JAEC focuses on safety and security, nuclear science and technology, and safeguards and verification. Its mission is

to transform Jordan into a net electricity exporter by 2030 by ending dependence on fossil fuels. It aims in exploiting national uranium assets, promoting public and private partnerships, providing for water desalination, and enabling competitive industries that are energy-intensive(WNA, d2016).

Around the same time, the Jordan University of Science & Technology (JUST) established a nuclear engineering program (Hibbs, 2007). Consequently, Jordan signed a $70 million dollars ($) loan agreement with South Korean's "Atomic Energy Research Institute (KAERI)with Daewoo Corporation" for a 5 mega-watt (MW) research and training nuclear reactor at JUST, expected to start in 2016 or 2017 (WNN, 2016). In November 2009, JAEC awarded an $11.3 million contract to Worley Parsons for pre-construction consulting for Jordan's first NPP with a foreseeable future of an operating NPP as early as 2015 (MacLachlan, 2009a). In addition, Jordan as a 'nuclear newcomer' is still considering, planning and starting a nuclear power program, and have not yet connected a first nuclear power plant to the grid. Since embarking on nuclear power will need national capabilities and domestic training programs for construction, licensing and operation, Jordan has established a cooperation with France, an experienced country, to bridge the experience gap in the area of education and training (IAEA, 2011). Nevertheless, the country's relatively low financial resources have been reported to be a major obstacle (Ramana and Ahmad, 2016).

In October 2013, Jordan, having refused to renounce its right to enrich, announced that nuclear corporation Rosatom's reactor export subsidiary would be the supplier, while Rusatom Energy International, a Russian contractor, would be its strategic partner and effectively the operator of the plant through a joint venture (WNN, 2015 and Salem, 2016). On September 22 2014, Jordan signed a contract with Rusatom

Energy International to build two 1,000 MW pressurized water reactors (PWR) of Generation III+ (Russian Water-Water Energetic Reactor VVER-1000 design - Atom Story Export ASE-92 nuclear units) at Qasr-Amra in Al-Azraq province situated at about 70 Km South East of Amman as early as 2018 (Table 4) (Aboul-Enein et al., 2016, Schenker, 2015, WNN, a2016, WNA, d2016, and Araj, 2015). However, construction contracts for the two Qasr Amra reactors are yet to be finalized. On the longer term, four nuclear reactors are being considered. By 2026, Jordan's projected nuclear capacity stands at 2,120 MWe (Ahmad and Snyder, 2016).

**Table 4 : Planned nuclear reactors in Jordan**

| Unit | Type | Mwe Gross | Construction Start | Operation Year |
|---|---|---|---|---|
| Qasr Amra 1 | Vver-1000/V-392 | 1060 | 2018? | 2023 |
| Qasr Amra 2 | Vver-1000/V-392 | 1060 | ? | 2024-25 |
| *Total* | | **2,120** | | **2026** |

JAEC said recently that the Kingdom's first nuclear power plant could be operational by 2025, if sufficient financing is secured (JT, aug2016). These steps were taken to meet its "2007 national energy strategy" that envisaged an energy composed of 29% natural gas, 14% oil shale, 10% renewables (wind and solar), 6% nuclear , 1% imported electricity, and the remaining 40% from petroleum products by 2020 (Eran and Grove, 2015 and WNA, d2016).

In March 2015, Jordan signed a $10 billion agreement with Rusatom, with Russia contributing 49.9% of the $10 billion cost, with the Jordanian government being responsible for the controlling (50.1%). The plant would be provided on a build-own-

operate (BOO) basis with Rosatom supplying all the fuel and taking back the used fuel (Salem, 2016).

According to IAEA reviews, Jordan still needs to improve its regulatory and development Infrastructure including upgrading the country's current grid capacity (IAEA, 2014). In April 2016, Russia's nuclear regulator "Federal Environmental, Industrial and Nuclear Supervision Service (Rostechnadzor)" and Jordan's Energy and Minerals Regulatory Commission (EMRC) signed a five-year agreement to cooperate in the development of the legislative basis in the field of nuclear and radiation safety; exchange experience in licensing activities, oversight and control activities; and in safety regulation in the management of used nuclear fuel and radioactive wastes including their transportation and safe storage (WNN, a2016). Moreover, JAEC is currently in discussions with several international companies (Shanghai Electric, China National Nuclear Corporation, Alstom and other Japanese, German, and Czech companies) to be partners in the country's first NPP by providing necessary turbines and electrical systems for the power plant (Ghazal, 2016 and JT, aug2016). JAEC suggested that a final split of share capital in the plant might be Jordan 35%, Russia 35% and China 30% (WNA, d2016).

Finally, small modular reactors (SMR) were also included on the agenda as of November 2013 when JAEC said that it would build several ones of about a capacity of 180 MW (WNA, m2016). JAEC finds SMR suitable with Jordan's grid capacity as it can be used at a load following mode, i.e. the electricity output is varied according to demand; has a lower investment cost; and an enhanced safety which means it can be constructed close to where people live thus reducing the emergency planning zone (Ramana and Ahmad, 2016).

Since in February 2016, the King of Jordan stated that he is "*keen to be a 'model pioneer' in the use of* nuclear energy *for peaceful purposes, with a commitment to the highest levels of security, safety and international best practices, and with full transparency*", the signature of the engineering procurement construction (EPC) contract for the initiation of the 1,000 MW reactors is expected to happen during 2017, and it is a matter of time till they secure finance to be able to start building the first reactor (WNN, f2016, Sputnik International, 2015, and JT, 20aug2016); It is thus the ideal time and environment to study the Jordanian public's opinion, the key factors that might influence its sentimental penchant and its potential capacity to influence the political and governmental system.

# CHAPTER II

# LITERATURE REVIEW

## A. Overview of Public Acceptance to Nuclear Energy in the World

Three in five citizens i.e. 62% globally oppose the use of nuclear energy with only 26%, a quarter, influenced by the most recent nuclear disaster in Fukushima, Japan on March 2011; states latest global poll led by Ipsos Global Advisor in 2011 (IGA, 2011). Another global research agency, GlobeScan surveyed 23,231 people in 23 countries from July to September 2011 revealing only 22% in favor of nuclear energy in contrast to 71% who oppose and 39% wanted to continue using existing reactors without building new ones while 30% preferred to shut everything down (Globescan, 2012). Surveys about examining public opinion on building new nuclear power plants has been conducted internationally for four decades now.

Public attitudes towards nuclear power during the 1950s was still in its early stage of development and yet unmeasured. Movements to oppose the widespread development of nuclear power started since the 1960s (Mazur, 1981). The nuclear power debate reached an unparalleled intensity in the history of technology controversies back in the 1970s and 1980s (The New York Times, 2010). In early 1970s, opposition level averaged 30% following the success achieved in ending an nuclear power project in Germany after large protests were organized (Garb, 1999, Wolfgang, 1990 and Falk, 1982). These protests were soon replicated in other parts of the world as anti-nuclear opposition became a worldwide phenomenon with far-reaching protests being organized not only for the development of nuclear reactors but also the development and testing of nuclear weapons (Kitschelt, 1986 and Brian, 2007).

Huge protests were organized almost everywhere including more than 175,000 people attending several protests in France in the mid-1970s or some 280,000 people participating in protests in West Germany during the same period. Some of these demonstrations included the occupations of declared nuclear sites and the disruption of the transport of material destined to these sites (Giugni, 2004 and Lutz et al., 2009). These protests were further energized following the Three Mile Island accident in April 1979 as several demonstrations were organized in major capital cities around the world including in West Germany and the United States (Walker, 2004 and Kin, 1891). Subsequently in the1980s, polls showed a continuous drop in support for nuclear power with only a third of the public. Despite the declination in support, the public's overall attitude can be described as uncertain when 40% thinks that operating reactors are somewhat safe while around 52% thinks they are dangerous and 5% are not sure (Princeton University, 2017). The reason behind this ambivalence is due to factors related to reactor safety debate among experts, perceptions of the likelihood of reactor accidents, changing personal values, and media coverage of the technology. These factors increase the doubt about the credibility and technical capabilities of both the nuclear industry and its governmental regulators and thus cause great public concern. In April 1986, the Chernobyl NPP disaster occurred in Ukraine putting a near halt to the building of new nuclear reactor units with at least 120 reactors being cancelled in the US, programs being cancelled in Ireland and Poland while ballots to oppose or phase out nuclear power were organized in Austria, Sweden and Italy (Pietro, 2004 and USNRC, 2014). More recently, in March 2011, the Fukushima disaster led China, The Netherlands and Switzerland to freeze all new reactor construction projects while public support dropped in Korea and Belgium. On the other hand, Germany and Switzerland

announced that they were phasing-out their nuclear power plants by 2022 and 2034, respectively and Japan by the 2030s (Maeda and Aaron, 2012, BBC, 2011, SChneider and Froggatt, 2012, and Kanter, 2011).

Opponent actors (groups with a focus on nuclear energy and alternatives to it and large environmental groups that participate in lobbying and public criticism of nuclear energy) believing that nuclear power poses several threats to people and the environment (LaMoreaux, 2010 and Sturgis, 2009), were not anti-nuclear activists only but also scientists who were increasingly concerned about overall safety in the light of its proliferation (Gottlieb, 2009). Other major concerns raised included the high cost of NPP, the problems of processing, transport, storage and safe disposal of nuclear waste as well as health risks and environmental damage from uranium mining and the possible emergence of nuclear terrorism (Greenpeace International and European Renewable Energy Council, 2007 and Giugni, 2004).Furthermore, reactors were considered as complex machines where things can and do go wrong as there have been serious nuclear accidents (Sovacool, 2008). Critics questioned the reliability of new technology in restraining the risks of nuclear fission usage as a power source. They also argued about the energy-intensive stages of the nuclear fuel chain claiming that nuclear power is not a low-carbon electricity source (Diesendorf, 2007 and Kurt, 2008).

Supporting actors, on the other hand, advance the example of operational safety record in the Western world as excellent when compared to the other major kinds of power plants (Cohen, 2009). These actors which are large and lobbying organizations with a focus on nuclear targeting a broad audience, trade and professional associations that support commercial nuclear energy and industry research organizations indirectly influencing public opinion; favor nuclear power and sell it to the public as a sustainable

energy source that produces virtually no conventional air pollution thus reducing carbon emissions. They also claim that nuclear power uranium dependent will increase energy security and independence as oil is an exhaustible resource (Hubbert, 1956 and Newton, 2005). Additionally, risks of waste storage can be further reduced via the latest technology in newer reactors. With these terms, supporting actors managed to attract the public as a British poll showed a 30% decrease in the population against nuclear energy compared with 60% three years ago. Another American poll showed 50% in favor of expanding nuclear energy, up from 44% in 2001 (Beatty, 2009 and Arulchelvan, 2013). Supporting actors attempt to shed the light on the limitations of oil and natural gas reserves and the benefits of fast reactors in safely providing energy for thousands of years.

Finally and although it has partly recovered since the Fukushima Daiichi accident in 2011, public acceptance of nuclear power decreased significantly in many countries. According to a most recent 2015 study conducted by Pew Research Center in the US, about half of Americans (51%) oppose nuclear power in comparison to 45% in favor and scientists are more inclined to build more NPPs than the general public with a 65% versus 45% favoring, respectively each (NEA and IEA, 2015 and Funk and Rainie, 2015).

**B. Overview of Public Acceptance to Nuclear Energy in the Middle East**

In the mid-2000s, several Middle Eastern countries announced their intention to develop nuclear reactors in order to generate cheaply the energy needed for water desalination among others. This led many to express concerns over these declarations and the underlying intention particularly in view of the prevailing impasse over the

Iranian nuclear power. Concerns raised included the possible development of clandestine military nuclear programs under the cover of these civil nuclear energy ones. Since then, however, little has changed in the region although Algeria, Bahrain, Egypt, Jordan, Kingdom of Saudi Arabia (KSA), Turkey and the United Arab Emirates (UAE) are all at various stages in the planning process under the supervision of the international community and with supplies from Western countries. Among these the UAE is the only country having initiated work on a nuclear reactor with the help of South Korean suppliers (Kamrava, 2012 and Ahmad and Ramana, 2014). It is worth noting that following a market research company TNS that surveyed 750 people in the UAE, 82% of the people were in favor of nuclear power in December 2012 compared with 66% in 2011 before the Barakah nuclear reactor construction started. The 2012 survey also found that 89% of residents became more aware of peaceful nuclear energy and 55% viewed it as a main source of power generation second to oil. The high support of the public contrasted with a decline in concerns related to overall safety of NPP. Still reassurance about nuclear waste disposal is needed (WNA, 2015).

The region lacks an effective or strong civil society capable of leading an organized movement to oppose the development of nuclear power. Thus concerns over nuclear projects are usually expressed from outside the region with most being anchored in political concerns such as the development of clandestine nuclear weapons programs, the socio-political instability plaguing the region including the presence of major terrorist groups and so on. However, the rising instability of the last few years in the region has led to the cancellation or delaying of some projects including those in Egypt and possibly in Jordan due in large part to the great number of refugees. The homegrown skeletal opposition to nuclear energy development in the region is pushed

by political forces in order to gain political dividends such as in Jordan where criticism from environmental activists (Jordanian Friends of the Environment) rose against plans to build NPP, which are supported by the King. It is hard to know how exactly the Jordanian public feels about nuclear energy as protests against nuclear power have never drawn large numbers, but in the aftermath of Fukushima and during the excitement of the Arab spring, the demonstrators went loud and ardent. "Discontent has been muted as Jordanians have soured on protest in general", therefore on December 2013 the International Republican Institute surveyed the Jordanian's opinion to find that 54% support the program, believing it will bring down electricity prices, while a substantial minority 33 % oppose it based on fears of health hazards and pollution. Interestingly, 67%, almost most of the respondents, said they knew almost nothing about the program and hearing a series of statements about nuclear power and potential alternatives reduced the percentage of supporters (Seeley, 2014). In Egypt, on the other hand, a survey was conducted by GlobeScan on November 2011 in Alexandria, Cairo, Giza, and Shubra El-Kheima areas representing 24% of the national population. Results showed a slight 5% increase difference for those opposing in contrast to 31% supporting which was considered high since Egypt lacks active NPP (Khlopkov, 2012 and O'Brien, 2013).

The evaluation of energy policies of Arab countries shows that five countries, namely Bahrain, Iraq, Lebanon, Libya and Yemen don't include nuclear option in their long-term energy strategies. Besides, after initial interest in nuclear power Kuwait, Oman and Qatar have revoked their national plans in the aftermath of the Fukushima accident and in favor of regional nuclear concept among Gulf countries. The detailed evaluation of the development status of nuclear power program in Arab countries

reveals that at present only UAE is at an advanced stage of project implementation (phase 3 of International Atomic Energy Agency (IAEA)'s milestone approach) and it is expected that the first unit will start operation in 2017. The second group comprises three countries, namely Jordan, Egypt and KSA, that already made a conversant decision to introduce nuclear or define a concrete time plan (phase 2 of IAEA's milestone approach). Jordan finalized its bid evaluation and signed project development agreement with Russian Rosatom that foresees a construction start for the first NPP in 2016. Egypt announced that it is prepared to start an international bidding process for its first nuclear energy plant. KSA has announced plans to construct 16 nuclear reactors with a total capacity of 18 GW nuclear capacities by 2032 with estimated investment costs of about $80 billion and hopes to have its first reactor operating by 2022. Algeria is close to make a well-informed commitment to a nuclear power and has reached the end of phase 1. All remaining countries are still in the pre-project stage either in the preparation to make a knowledgeable commitment to establish a nuclear program or simply working on reassessing the appropriateness and viability of nuclear option for their long-term energy plan and evaluating various obligations and commitments associated with the commencement of nuclear power program (Personal Communication: Dr. Habib El Andaloussi).

**C. History of Public Opinion to Nuclear Energy in Jordan**

Jordan's policy-makers have long desired the realization of such nuclear power plan (Schenker, p2015). They and the rest of the Jordanian proponents of such plan insisted on the need to diversify energy sources and to have a long-term energy planning (Tabbara, 2014). Likewise, JAEC stated that nuclear power could be the key to

"energy security" in Jordan. Majd Hawwari, a chief nuclear regulator, argued that "*nuclear power was the only possible option for Jordan*" and attacked opponents of the nuclear plan for suggesting alternatives (Seeley, 2014). Strong support for new nuclear build is one third or more in Jordan. Nevertheless, support for closing all nuclear plants is highest in several countries and Jordan is among them (OECD, 2010). Still, criticism from the community especially environmental activists "Jordanian Friends of the Environment" rose against the supported NPP plans (GlobeScan, 2005). In 2005, a poll conducted for the International Atomic Energy Agency (IAEA) found that 41% of Jordanians opposed NPP construction with 35% supporting and only 33% supported nuclear power as a solution to climate change (Al-Rawad and Al-Khattab, 2015). Another poll found that the Jordanian public rated nuclear power second among personal risks and fourth among societal risks (JT, 2012).

It was hard to know how exactly the Jordanian public felt about nuclear energy as protests against nuclear power have never drawn large numbers, but in the aftermath of Fukushima and during the excitement of the Arab spring, the demonstrations became loud and ardent. They especially intensified following a decision taken in late 2010 to relocate the nuclear reactor initial site, which was 25 Km South of the Red Sea port of Aqaba and 12 Km East of the Gulf of Aqaba coastline, due to seismic padding additional costs (as identified by the Belgian contractor Tractabel), to 40 Km Northeast of Amman in Balaama area near Mafraq (JT, m2012). This new location claimed to have the advantage of being at proximity to the Khirbet Al Samra power plant for using its wastewater to cool the reactor (Green World Conferences, 2008). A peaceful message from the Mafraq residents was addressed to the Prime Ministry, the Royal

Court and the Ministry of Energy clearly stating that the public does not want a nuclear reactor (WISE Amsterdam, 2011).

In May 2012, the opposition to nuclear power reached parliamentary discussions with votes 36 to 27 in favour to halt the nuclear program, including uranium exploration by stating that it *"will drive the country in to a dark tunnel and will bring about an adverse and irreversible environmental impact*" (Haddad, J., 2012 and Salem, 2016). In June 2012, a JAEC official admitted there was increased visibility of opponents in the media, accentuated by concerns of safety, water scarcity, siting and waste management (JT, j2012). In July 2012, discontent reached a breaking point when locals in Ar-Ramtha attacked the site, chosen within their vicinity for the research reactor, by smashing doors and windows, and burning technical documents. Moreover, several scientists and environmentalists launched a campaign against building any nuclear facilities in the country, and urged the South Korean contractor to pull out of the research reactor project (Aboul-Enein et al., 2016 and Namrouqa, 2013). The worldwide well-known environmental organization "Greenpeace" played a prominent role in the public debate by collecting numerous signatures under an anti-nuclear petition submitted to the prime minister, according to media reports (Abuqudairi, 2014). All this led to the decision of relocating the nuclear site for the third time and thus the current chosen site for NPP construction became "Qasr-Amra", a desert area, in Al-Azraq province situated at about 70 Km South East of the Capital Amman.

In September 2012, during an interview with King Abdullah II who replied to a question by Agence France-Presse concerning the opposition and its demonstrations against the nuclear energy program by stating that he understands those who are anti-nuclear because of "*safety concerns or philosophical reasons*". However, there is a need

to look closely at how nuclear can be used safely and effectively to meet the people's urgent needs, especially, that Jordan has 3% of the world's uranium resources. In addition, Jordan is the world's fourth water-scarcest country and thus nuclear energy will grant some degree of self-reliance to afford a cheap desalination. King Abdullah II considered that strong opposition to the peaceful nuclear program is coming from Israel (Petra, 2012). He realized that Israel was putting pressure on countries they approached to disrupt any potential cooperation. As for constructive domestic opposition, He pointed that Jordan will go only for the most secure latest-generation reactor with multiple features that enables them to withstand extreme conditions while describing Japan's Fukushima disaster "involving an old-generation plant". Regarding the location of the plant, he ensured that it would be placed where there is the least earthquake risk and the highest security. As for the claim from Jordanian opponents saying that other countries are shutting their plants, King Abdullah contradicts with the fact that more plants are being set up worldwide, as countries are aware that population density is increasing and with it the need for energy. "*There's no argument, nuclear energy is one of the cheapest energy sources around*" (Petra, 2012). As for the plant construction costs, it would cost about Jordanian Dinar (JOD3.5 billion for what will constitute one third of the total power capacity generated in Jordan today. In comparison, the attacks on the Egyptian gas pipeline during 2010 and 2011 have costed Jordan already JOD2.8 billion and that could have paid for almost one reactor concluded the King (Petra, 2012).

In contrast, 10 days after this interview, the Haaretz magazine posted that Israeli officials have rebutted claims by King Abdullah II that Israel has tried to thwart Jordan's civilian nuclear energy program but instead it has even provided the Kingdom

with material assistance. Therefore, the King's latest accusation, made on the eve of the International Atomic Energy Agency conference in Vienna, surprised and angered Israeli nuclear officials.

During the conference, the Israeli delegation of the Israel Atomic Energy Commission (IAEC) responded officially, by "*We have no problem with a civilian nuclear program in Jordan to meet their energy and water needs and it's a good question why the Jordanians are saying otherwise*", "*Israel believes in the peaceful use of nuclear energy in the Middle East, as long as states fully honour their international non-proliferation obligations*," and continued to add that "*as for the selection of Jordan's nuclear power site, Israel also provided comprehensive geological data to the Kingdom upon its request*"(Haaretz, 2012).

The latest relocation of the nuclear site to 'Qasr Amra' relaunched major protests from indigenous in the area known as the "Bani Sakher" tribe (JT, 2013). Hind Fayez, a tribe descendant and prominent parliamentarian, affirmed that "*I will not allow the construction of the nuclear reactor, not even over my dead body…The Bani Sakher tribal so rejects the construction of the nuclear reactor in Qusayr Amra*" (Namrouqa, 2012). The Islamic Action Front (IAF), Jordan's largest opposition political party, was also initially opposed to JAEC plans. However, after a meeting between IAF and JAEC representatives in February 2013, IAF secretary-general, Hamza Mansour, released a statement outlining 12 conditions JAEC must meet to ensure the effectiveness of the nuclear program. The conditions included environmental protection measures, safe and secure nuclear waste management, a responsible approach to managing the country's water resources, and transparency in the choice of the technology supplier (Taha, 2013).

Nonetheless, the opposing legislative vote of May 2012 did not deter government officials from signing the deal with Russia, which, in November 2013, stimulated fresh fears as experts urged to abandon what they called a dangerous and illogical plan, and activists and environmentalists warned that the project is too risky. "*We are very afraid of this project because it's dangerous to the entire country, people, the environment, and economy. We do not see a need for it when there are cheaper, better and safer alternatives*" said Ali Kassay, a member the Jordanian Coalition for Nuclear Free Jordan (Magid, 2016). "*It's illogical to build a nuclear plant in a country known historically for earthquakes, as well as lack of capabilities, funds, human resources and water*" and "*before making such announcements, detailed feasibility studies and consultations with local communities should have been carried out*," said Environmentalist and Consultant of the Jordanian Ministry of Environment Rauf Dabbas. On the other hand, Araj, an official, claimed that "*ample water will be available inland from the Khirbat Samra wastewater treatment plant*" (Seeley, 2014). Safaa Jayoussi, a Greenpeace climate and energy campaigner mentioned that "*Jordan's nuclear decision is a miscalculation. We saw what happened in Japan's Fukushima NPP. We cannot allow this to happen in Jordan. Nuclear energy will not provide sustainable energy. Jordan should drop its plans before it's too late*." Local environmental organizations said in a joint statement that "*Jordan lacks the funds, means and laws to govern and ensure nuclear safety as reckless government policies continue to provoke Jordanians who reject the nuclear plan*" (Magid, 2016).

Even within the royal family, divisions persist towards JAEC's project as Princess Basma, a strong environmental supporter, has voiced reservations against the nuclear program (Abuqudairi, 2014). On December 2013, the International Republican

Institute surveyed the Jordanian's opinion to find that 54% supported the program, believing it will bring down electricity prices, while a substantial minority 33 % oppose it based on fears of health hazards and pollution (GlobeScan, 2005). Interestingly, 67%, almost most of the respondents, said they knew almost nothing about the program and hearing a series of statements about nuclear power and potential alternatives reduced the percentage of supporters (GlobeScan, 2005).

In April 2014, dozens of tribesmen, farmers, tribal leaders, member of parliaments (MP), former nuclear engineers and environmental activists gathered for two hours at the 1,300 year old palace of Umayyid Caliph Walid II, known as Qusayr Amra, to object the government's plan. Shaish Khraisheh, a former MP and leader of the Khraisheh tribe, declared, "*We absolutely reject the nuclear power project on our land*" (Sputnik International, 2015). The Bani Sakher tribe grew stronger with a group of 5,000 young men who call themselves the "Bani Sakher Awakening". Bani Sakher Awakening launched a series of civil disobedience campaigns to prevent construction crews from ever reaching Azraq area. Both energy experts and environmentalists accused JAEC of omitting plant decommissioning, insurance, maintenance and water costs in their budgetary estimates, which could push the nuclear programme's final price tag to over $50 billion (Abuqudairi, 2014).

Dr. Ayoub Abu Dayaa, a Jordanian energy expert and environmental activist, proclaimed that "*In the West, dozens of countries are turning away from nuclear [power] because the end costs are so prohibitive*". Even locals and farmers got affected as the nuclear power contract signature already harmed their businesses, forcing many to sell off their flocks of sheep and ancestral farmlands. "*No one wants to buy produce from Azraq anymore, the reactors are not even built and we are known as a 'nuclear*

*area*"', said Ahmed Hamad, owner of a farm about 30 Km west of the Qusayr Amra site (Sputnik International, 2015). Moreover, locals remain skeptical to the government's mollification in promising them job opportunities in the highly specialized sector. To make things sloppier, the current chosen site for the planned reactors holds beneath it the Azraq aquifer, a major source of freshwater for the Capital Amman. Environmentalists warned that one accident can toxify-up to one-third of the country's water networks (Sputnik International, 2015). Dabbas added that "*There are no local institutions that have the experience to closely monitor such nuclear activities and plans*" and that the government "*is not serious about enhancing the role of the ministries of health and the environment in this project. Furthermore, there are also security concerns. The plant's site is located near main roads linking Jordan to Iraq and Saudi Arabia*" and that "*Jordan's nuclear plans will take at least 10 years to provide us with energy, but we need energy now*" (Magid, 2016). As the manifestation intensifies, the Jordanian government started meeting with tribal leaders in Azraq in an attempt to negotiate. Activists and local residents have since moved their protests to the heart of Amman and across Jordan (Sputnik International, 2015).

In 2016, an opinion survey conducted by the Center for Strategic Studies (CSS) at the University of Jordan who polled 2,505 Jordanians and 700 opinion leaders between July 24 and August 2 to measure the level of awareness about the use of nuclear energy for peaceful purposes and the Jordanian nuclear program. Around 60% of Jordanians said their knowledge of nuclear energy is insufficient in contrast, 60% of opinion leaders found they had a good knowledge (JT, aug2016, Petra, 2016, and Malkawi, 2017). Opinion leaders believe nuclear energy should be a top strategic priority (67%) and the Jordanian Public believes it should be a strategic priority (77%),

if the neighboring countries possess peaceful nuclear energy. The Jordanian Public had watched, read or heard news mainly on TV; followed by social networking sites, news websites and friends; about the Jordanian nuclear program (43%) much less than opinion leaders (83%) who found their information in newspapers and websites first then on TV and in lectures and workshops. The statement about nuclear power can help curb climate change and the negative impact of burning fuels was believed by 54% of the public versus 73% of the opinion leaders (JT, aug2016, Petra, 2016, and Malkawi, 2017).

# CHAPTER III

# MATERIALS AND METHODS

This work started by conducting a desktop qualitative research through reviewing past research on the issues highlighted in this paper. Due to the nature of this work, the desktop research has extensively looked at online resources. International refereed journals were reviewed. Articles, books and blogs were looked over. Social media including Twitter and more extensively Facebook were navigated to link, interact with both the Jordanian public via inbox, and tweet tools, in addition to clusters like the "*Stop the Nuclear Reactor in Jordan*" and the "*Nuclear Jordan*" groups, which are composed of 98 and 933 members, respectively each. These types of groups include members who discuss the nuclear subject with different views. Additionally, random universities were contacted to comprehend the views of both students and faculty members among which professors and staff. Students and professors who responded to the invitation to discuss the subject came from the public universities of JUST in the Irbid governorate and Al al-Bayt University (AABU) in the Mafraq governorate.

Moreover, a quantitative study was based on an advanced google search engine. This search, amongst the major publishing newsletter sources in the country and the ranking choice of impact factors by some stakeholders , calculated the average of different main factors (1) opposition, 2) safety, 3) security, 4) environment, 5) politics, 6) multinational corporations, 7) finance and 8) Israel), to deduce the 3 top ones that influence the general public sentiment.

In addition to the desktop tool, a field quantitative methodology was effectuated electronically in order to better the retrieval of data. A survey formed of 25

questions was designed using both Arabic and English to ensure clarity and conformity of the questions (Appendix I). Arabic being the mother tongue in Jordan, the use of the language can facilitate the task of reaching all social classes. The poll was then released on the 30th of November 2015 via the online software called "Qualtrics" (Qualtrics, 2017). Jordanian families, professionals, officials and experts were reached out through a circle of contacts.

The survey consists of a personal profile on the respondents, their awareness level about nuclear energy and related energy issues. A quantitative analysis was executed using the report breakout of the Qualtrics software to deduce the descriptive, frequencies and crosstabs with the independent variables of gender, age, background and sector. This quantitative simple non-random sampling technique is compared with the desktop-conducted qualitative interview technique and to verify and literature review explain the reasons behind the collected data. At the same time, it aided in comparing results to those of previous polls conducted in Jordan and other nuclear-seeking countries of the Middle East (ME) and the world.

To determine the size of the sample needed for the poll, the sample size calculator on "Check Market" site was employed with a 95% confidence level (Z) and a 5% margin of error or confidence interval (C) for a population of 6,853,179 Jordanians in 2015 (Check Market, 2017 and Country Meters, 2015). The online calculation was compared to the traditional manual calculation method for validity purposes using the following equation always with the same Z and C values and in addition a percentage picking a choice (P) of 5%. Both gave a similar sample size (ss) result of 385 persons.

$$ss = \frac{Z^2 * p * (1-p)}{C^2}$$

Z = Z value (e.g. 1.96 for 95% confidence level)
P = percentage picking a choice, expressed as decimal (0.5 used for sample size needed)
C = confidence interval, expressed as decimal (e.g. 0.04 = ±4)

Correction for finite population:

$$\text{new ss} = \frac{ss}{1 + \frac{ss - 1}{Pop}}$$

Pop = population

Considering Jordan's large population and to have a round number, the aim of the sample size was set to 400. After this sample size determination, only one quarter will be surveyed due to the financial limitation of the electronic field sampling. A margin of two month November 30, 2015 – January 30, 2016 was given to disseminate the poll via emails, social media and word of mouth. Financial constraints resulted in the survey being electronically fielded and thus collection time of the data extended from January 30, 2016 to February 11, 2017. These constraints also limited the rate of respondents of the Jordanian population to 100. The non-randomly selected sample of Jordanian citizens eligible to vote is a representation of the Jordanian population by age, gender, geographic location, education, background and sector.[1]

Following this quantitative analysis, another qualitative study of the field methodology was based on a semi-structured interview with 5 stakeholders in the country representing groups of activists, political establishment and businesspersons,

[1] This is a non-random method of sampling because lack of finance prevented the study from being based on a random one as was the initial objective of the study

and government officials. Questions included their opinion regarding, namely; 1) their perception regarding the impact of public movement on decision makers in the Kingdom, 2) the manner the government engages with the public with regards to the nuclear energy project, 3) their ranking of the key factors that are most likely to affect public sentiment with regards to its opinion about the nuclear energy project in Jordan, 4) their suspicion about who fuels public opposition against nuclear, 5) their assessment about the role of media, and finally, 6) the ways they suggest that the government can promote the project within opposing tribes.

This interactive dialogue entailed in a qualitative analysis about the current situation from the perspective of existing leaders of the country. Furthermore, it had an added-value in the comparison between the collected quantitative and derived qualitative opinions.

***Risks and Limitations***

One risk of this non-random sampling methodology is that it does not include a bigger representation of the Jordanian public as it only considers one fourth (100) of the total calculated sample (400). Besides, it restricts the opinions of the different stakeholders within every cluster. Additionally, the google advanced search engine is not a precise nor a very accurate tool. However, the diversity of this four-staged methodology reinforces the quality of the work and brings in the richness needed in the study of such a sensitive and scientific subject all at the same time. The tetra-methodology along with the qualitative and quantitative parts of it will give a general aspect of the direction towards which the future of energy in Jordan is heading and thus its economic growth. In sum, this justification asserts the emphasis on this approach that

will analyze the alignment of different stakeholders and the potential of public influence on political and governmental decisions.

# CHAPTER IV

# RESULTS

Findings from the electronically field methodology revealed that the 100 Jordanian respondents (32% female and 68% male) were predominantly from the 25 to 34 (43%) and 18 to 24 (28%) age groups range and mostly graduates (55%) with a 0% below high school degree level (Appendix II). A remarkable percentage of 64% had a background in Engineering and Architecture mainly males (97%) with all females coming from the public health and environment (67%), science (50%) and engineering (3%) backgrounds, mostly came from the private sector (67%) and originated from the 12 governorates of Jordan, namely; the center Capital Amman including its major cities (Wadi–as-Sir, Tila-al-Ali, Al Jubayhah, Suwaylih, Shafa Badran) (65%), and Al-Balqa governorate (As-Salt and Ayn El Basha) (15%). The remaining 20% came from the North [Irbid (Ar Ramtha, At-Taiba, Kufur Jayez), Ajlun (Kufranjah), Jarash, Mafraq], the South [Al-Aqabah, Maan, Aṭ-Ṭafīlah, Al-Karak], and the Center [Az-Zarqa, Madaba] (Figure 1).

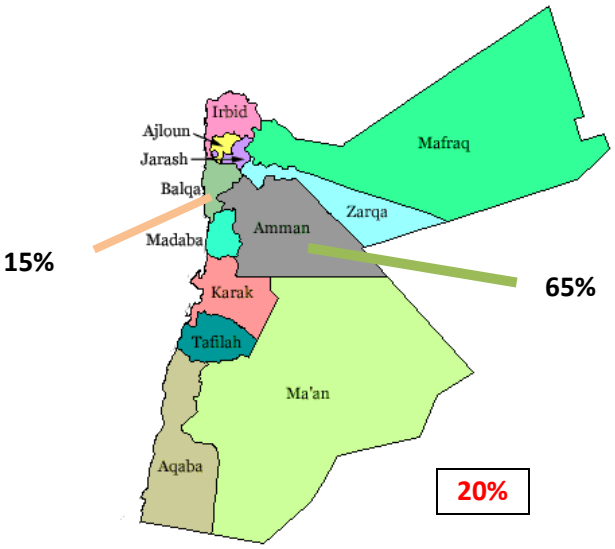



**Figure 1: 12 Governorates of Jordan (McGill, 2017)**

29% rated the current Jordanian energy planning with a "good" grade of 3 on a scale of 1 to 6; with the females 28% and males 29% having similar opinion and mostly coming from an engineering (28%), business (33%) and medical (33%) backgrounds and from the public (33%), private (27%), and international organizations (25%), sectors; stressing that the reasons are mainly the government's little usage of alternative energy sources (57%), has poor to no planning (45%), too much politics is involved (39%) and that there is too much dependence on foreign oil (37%).

Thus 62% believe that those policymakers should prepare now so that new nuclear power plants could be built if needed in the next decade; with the females being more assertive than males by 17%, mainly belonging to the private sector (30%) and to the engineering background (29%); and to ensure a well-balanced energy supply in the future, instead of building right away (59% 'enlarged by the private sector and those coming from an engineering background'). However, they strongly believed that a mixture of solar (88%) and wind alternative energies (66%) should be the most used sources to produce electricity in 10 years from now. It is interesting to note that 27% (female 31% and males 25%, a 6% difference) of respondents mentioned nuclear energy as primary source (Figure 2).

Therefore, 75% (mostly from the engineering background (93%), private sector (90%) and females (85%)) strongly to somewhat agreed to the statement of the need to take advantage of all low-carbon energy sources including nuclear among other and confirmed that a great amount (75%) needs to be taken into account if one of those energy sources had great potential as a climate change solution but starting with cheaper sources of energy (79%).

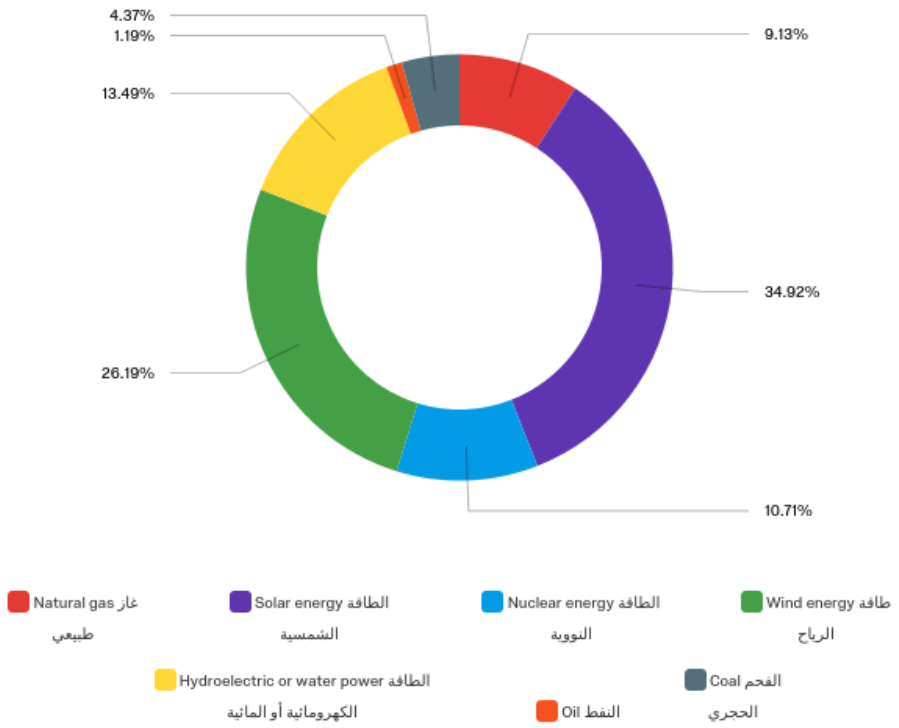



**Figure 2: The energy sources that should be mostly used in 10 years from now**

The 100 participants of the most recent poll in regards to nuclear energy acceptance; strongly opposed by 36% (43% with those who somewhat opposed) in comparison to 17% who strongly favored (53% with those who somewhat favored) the proposition of using NPP as one of the ways to provide electricity in Jordan, noting that only 4% males didn't know what decision to make. It is attention grabbing to note that the females strongly opposed (57%) by 33% more than the males (24%) and were not strongly in favor (0%) (Figure 3).

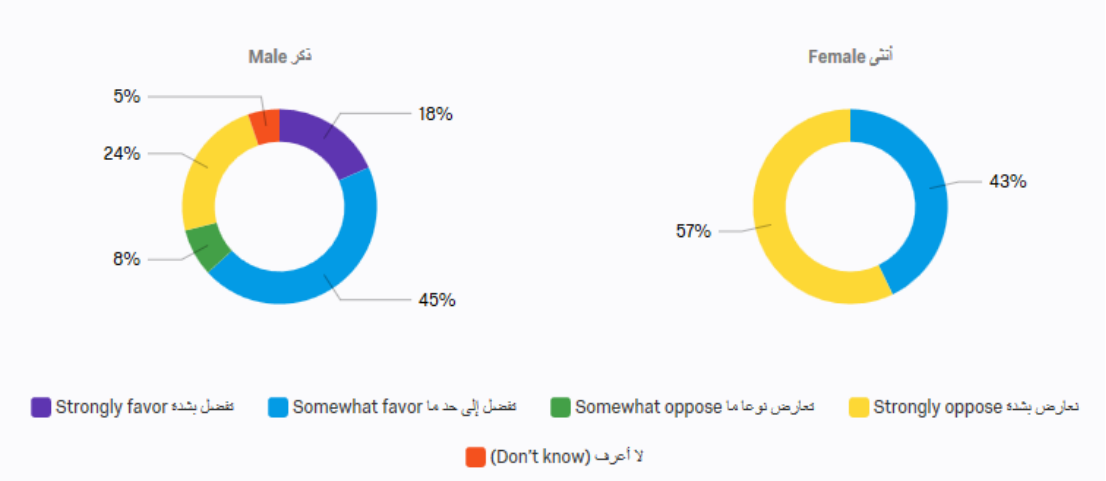



**Figure 3: Gender opinion's difference towards Nuclear Energy Adoption**

Moreover, it is interesting to note that it is the younger generation 18-24 years old who strongly favored the most (57%) and somewhat favored 25-34 (80%) and 18-24 (20%) in comparison to the older one 50-64 who strongly opposed 23%. However, what is encouraging is that the youth significantly somewhat opposed 18-24 (67%) and strongly opposed 25 to 34 (62%) (Figure 4).

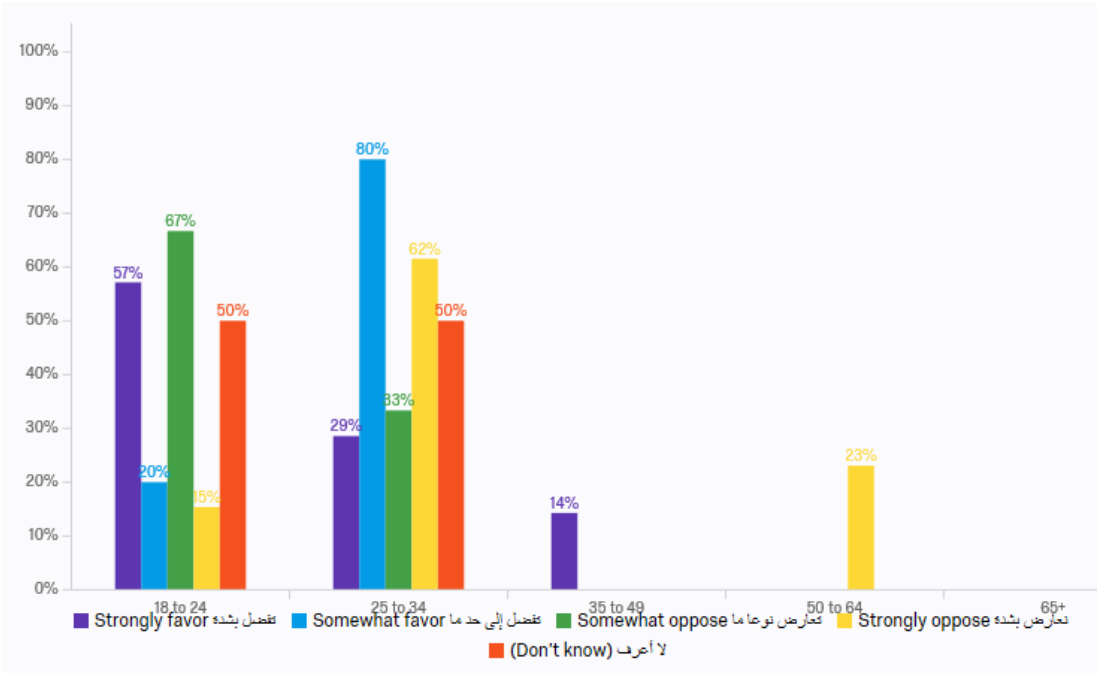



**Figure 4: Age group's opinion difference towards Nuclear Energy Adoption**

In addition, the higher the educational level the higher the somewhat opposition and the strong opposition by Graduates 100% and 69%, respectively each (Figure 5).Those who strongly opposed came from engineering (46%) and Public Health and Environmental Sciences (38%) backgrounds in comparison to those who were strongly in favor coming from again the engineering (71%) field (Figure 6).

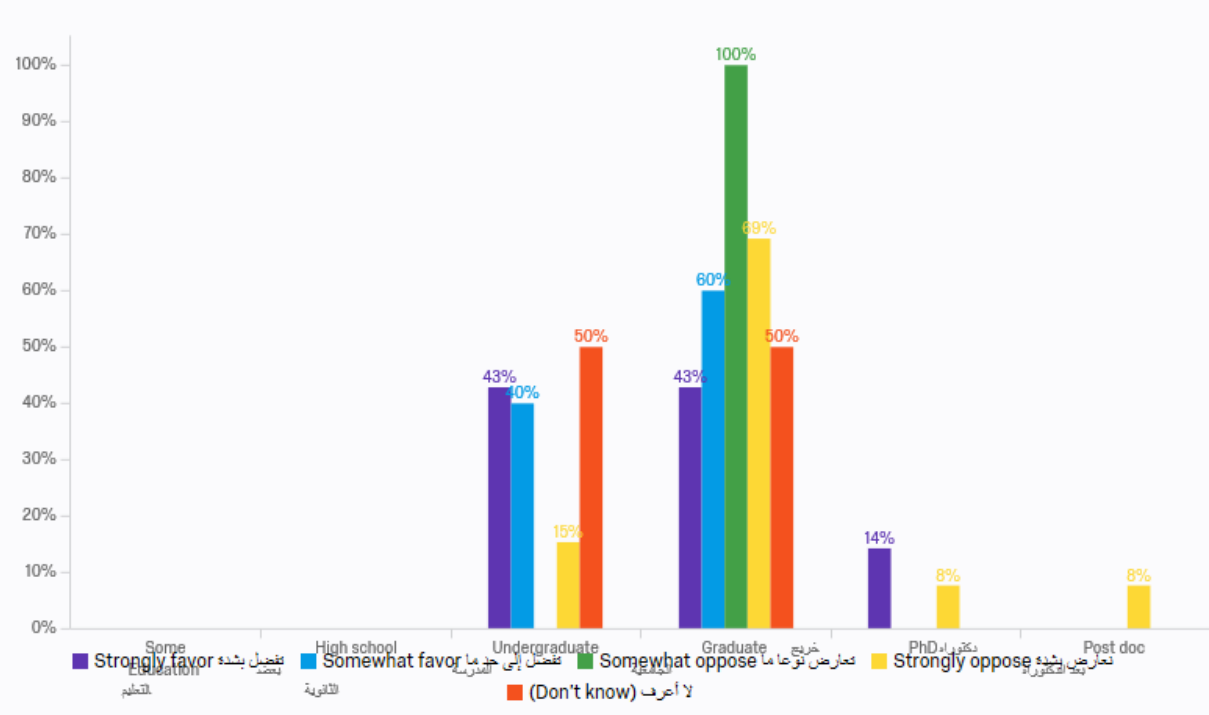



**Figure 5: Level of Education's opinion difference towards Nuclear Energy Adoption**

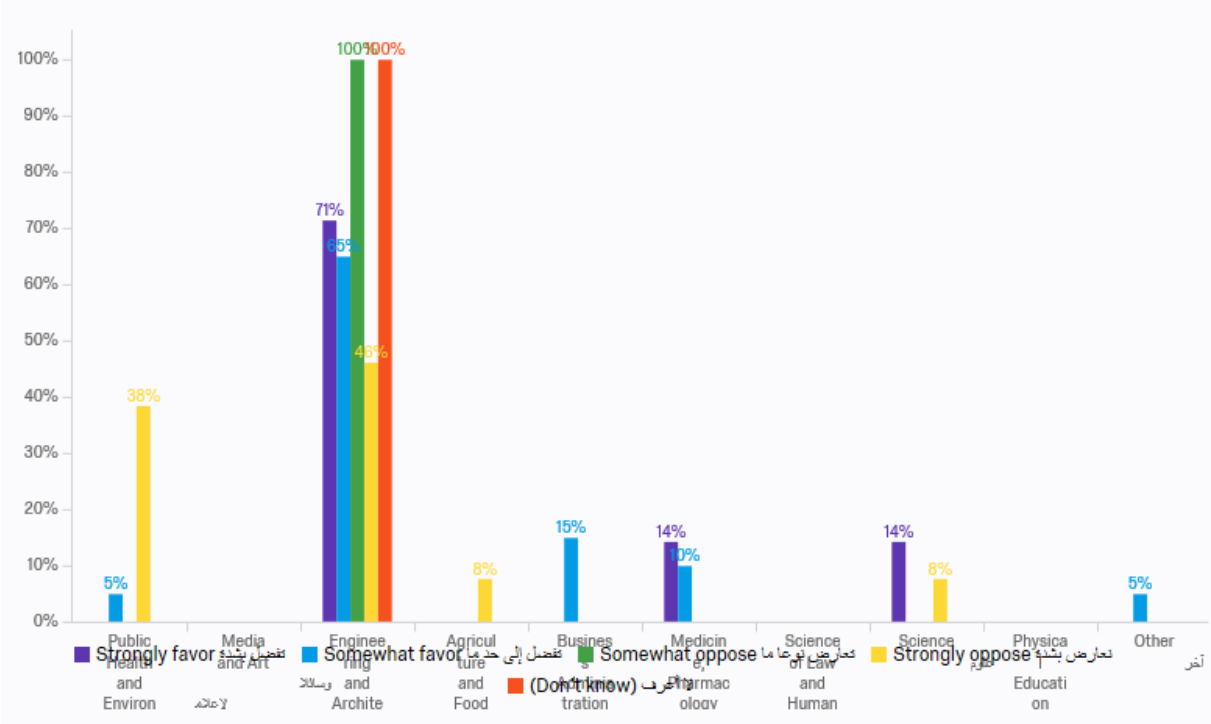



**Figure 6: Background's opinion difference towards Nuclear Energy Adoption**

Looking at the sectors, the strongly oppose came from private sector (38%), international organizations and academia alike (23%) whereas the strongly in favor are from also the private sector (71%) and from academia with a much lesser percentage (29%) (Figure 7). The reasons affecting their choice were mostly the risk of severe accidents (57%), which justifies the strong opposition, with subsequent energy independence (41%) and the cost of electricity (32%), which explains the higher percentage of the strong to somewhat support.

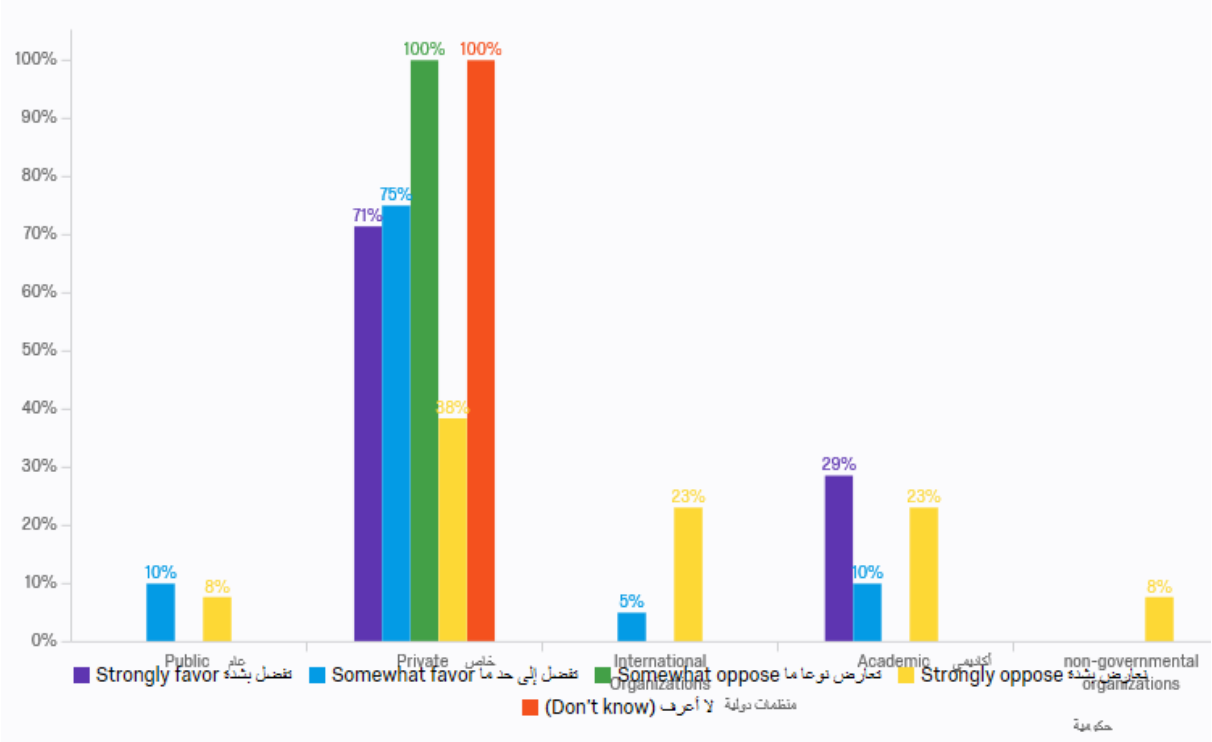



**Figure 7: Sector's opinion difference towards Nuclear Energy Adoption**

Furthermore, the 53% in favor enlarged by those who somewhat favored NPP, found it to be very (33%) to somewhat (24%) important in meeting electricity needs today (a total of 57%) and remains as such in 10 years to come (56%). This is further confirmed by an affirmation that in the next decade NE importance in meeting electricity needs will increase in Jordan (47%).

Interestingly, those who could not decide on its importance remained the same 4% and became even more uncertain with a 2% increase regarding the 10-year projection and doubling (8%) regarding the affirmation of nuclear energy importance. Notwithstanding the high percentage of nuclear energy importance and that of the strong to somewhat in favor, the construction of NPP becomes acceptable if it is located at more  than 100 Km away from their house (40%) for 25-34 years old (53%) or even better nowhere in Jordan (43%) for 65+ (100%) and 50-64 (92%) (Table 5). These

positions concord with those of the NPP strong opposition and the fear of severe accidents risks; but intriguingly, rate the safety of NPP in the world on a scale of 7 very safe to 1 very unsafe, with an average of middle safety 4 (26%) and closer to safe 6 (15%). This high safety rating is justified by the 54% strongly to somewhat agreement with the statement "NPP operating in the world are safe and secure" with 46% strongly to somewhat opposing and a 58% trust in technology and experience making NPP safer. Even at ME level, 53% trusted that "NPP in the ME will be built to withstand the most extreme natural events that may occur". However, when the statement involved their country, "If a nuclear plant is built in Jordan, the authorities will make sure that it will be safe and not have any accidents", most probably fear from governmental corruption reigned and resulted in a 56% disagreement with the statement, thus again justifying the strong opposition.

**Table 5: Acceptability to have the authorities construct a nuclear plant**

| | |
|---|---|
| a. Within 20 kilometers of your house نطاق 20 كيلومترا من منزلك في | 6% |
| b. More than 20 kilometers but less than 50 kilometers from your house منزلك أكثر من 20 كيلومترا ولكن أقل من 50 كيلومترا من | 11% |
| c. More than 100 kilometers from your house أكثر من 100 كيلومترا من منزلك | 40% |
| d. Nowhere in Jordan ليس في اي مكان في الأردن | 43% |
| Total | 100% |

Poll participants revealed to be more aware about their considerations of how electricity is produced feeling it is highly important to have a reliable electricity (81%), affordable electricity and energy efficiency alike (77%) and clean air and safety of

workers and public alike (76%). Contributors associated nuclear energy a lot to reliable electricity (52%) again with energy independence being of a same level of association, primarily, and also economic growth and energy efficiency alike (49%), secondarily, whereas affordable electricity dropped to the third place with a 47%; but less to clean air (41%) and not at all to safety of workers and public (34%). Despite their association of NE to economic growth, when they were asked about the priorities to improve Jordan's economic performance, only 9% opted for the usage of energy more efficiently and as little as 1% voted for a faster production of electricity option. Instead, they preferred to improve education and professional training (39%) and invest in research and innovation (24%).

Out of the 100, only 37 % and 34% didn't hear or know about the fact that Jordan is in the process of importing a nuclear reactor from Russia or about the current level of commitment by the government to build NPP, respectively each. In contrast, a majority of 72% knew about the existence of a public opposition to nuclear power in Jordan, 76% were able to recognize either Chernobyl or Fukushima accidents, and 80% read about the economic impact of nuclear power. A little more than the half of the respondents knew that, their government is considering the option of building a SMR (51%) and that a new NPP construction is underway in their country (55%).

When it came to consider sources of accurate and reliable information about nuclear energy, Jordanians believed that NE scientists and engineers (77%), safety, radiation and environmental experts (73%), environmental groups (61%) and the internet (58%) are excellent and good sources; whereas electric utilities (59%), politicians (72%), and social media such as Twitter, YouTube or Facebook (47%) are fair and poor ones.

Finally, upon orienting on the subject of nuclear waste management and specifically the management of the radioactive waste from NPP, the majority strongly to somewhat disagreed with the "radioactive waste from nuclear fuel are safely stored at an NPP site" (58%) which questions the real knowledge and awareness of the participants. Furthermore, statements such as "Jordan should develop a permanent disposal facility" (71%) and "nuclear waste can be transported safely" (52%) were strongly to somewhat agreed to. Nevertheless, a higher percentage of the poll surveyed 76% strongly to somewhat approves with the idea of "nuclear waste should be sent outside Jordan" which indicates that the concept of safety pertains and perseveres after all.

Outcomes from the desktop methodology gathered some facts and opinions from those who responded to the invitation to discuss the nuclear subject. Respondents were professionals and students at universities and members of clusters on Social Media. Below are some of the most interesting ideas that reflect on some of the reasons behind the resistance and or support of nuclear power.

Jordanian Participant (JP) 1, Assistant Professor of Linguistics at AABU, Mafraq, stated that "*I believe that we are in need of alternative sustainable resources of energy. Nuclear power can be one of the many solutions for our energy problem on the long run but it is not the best one. Solar and wind energy can make a much better solution taking into account the position of Jordan. My main concern is the administration of this power as our country has bad reputation in administering big projects, and nuclear energy isn't that trivial thing to mess with or to be handed to unprofessional (and corrupt) people.*"

JP2, Student majoring in Nuclear Engineering at JUST, Irbid, mentioned that "*I*

*am supporting the Jordanian nuclear program. The public is afraid from accidents in nuclear reactors, but the likelihood is very small to happen, and it was on the small order. All plant's components are assured in quality design. The exclusion zone: around the plant is about 5 Km which ensures safety to the public."*

JP3, a member of the "Nuclear Jordan" group on Facebook media, indicated that *"Not to us pro-nuclear people; Fukushima, Chernobyl or Three Mile Island occurred but the lessons were learned and carried over to new builds.*"

JP4, another member of the same "Nuclear Jordan" group, upholds that "*With the Newest technology taking into account the lessons learned from previous accidents, Jordan will have a strong nuclear security and safety systems and measures. The threats of lack of energy resources are much higher than so-called ISIS. The implication of nuclear energy on the environmental, social, economic, political and energy aspects of Jordan is very beneficial."*

JP5, a member of another group "Stop the Nuclear Reactor in Jordan" views the issue as "*Its already for foreign country to have control on it; like another big project they sold. So Jordanians will pay tax and more but to foreign country. Then nuclear power is not helping my country. It is selling another piece of Jordan."*

The investigation in regards to the opinion of the public expanded to include stakeholders representing groups of activists, political establishment and businesspersons and government officials. Out of the 12 stakeholders, representing all the parties of the internal nuclear debate, who were contacted; a semi-structured interview was conducted with the 5 stakeholders who responded to the request. These stakeholders are activists Dr. Ayoub Abu-Dayyeh and Dr. Basel Burgan; government officials Mr. Raouf Dabbas - Senior Advisor at the Ministry of Environment and Dr. Ibrahim Badran; and

Managing Director of the Middle East Scientific Institute for Security (MESIS) Mr. Al-Sharif Nasser Bin Nasser.

Activist Dr. Basel Burgan perceives that nuclear supporters represent the JAEC and the parliament meaning the state. The Bani Hasan Tribe, being the largest among the 6 existing tribes in Jordan known by '*kabilat el malyoun*' aka the '*million tribe*' was able to impact the decision makers in the Kingdom. The effect of their movement was very drastic as they succeeded in exerting a major pressure through sit-ins and demonstrations when the project was initially located in the North in the Mafraq area. Greenpeace Jordan and a group of concerned citizens involving experts and the civic society located next to the proposed site formed a coalition that known as 'Irhamouna' i.e. have mercy on us or give us a break led the opposition on a national scale. This made the government direct the JAEC to choose a new site, which turned to be a desert area, located East of Jordan close to Azraq Village in the Al-Zarqa District. A population of 30,000 people from the Druz sect, which includes the Shishan and Chechen ethnicities, inhabits this area. They are considered minorities and thus extremely weak. The Mayor of the municipality, who is appointed by the Ministry of Interior is Durzi. Since the land of the designated site is a big whole owned by the municipality, the civic society, which formed a coalition since 2014, requested a meeting with the governor. The rejection to their request caused the beginning of new demonstrations. However, their leaders were bribed, fear made them to quiet down, and they ended up considering it as their destiny. This is what makes Activist Dr. Ayoub Abu-Dayyeh describes the impact of public movement as "*very ineffective*" and Government Official, ex-Secretary General of the Ministry of Industry & Trade Dr. Ibrahim Badran states that "*public opposition will have no decisive effect due to the*

*absence of real democracy that will take public opinion into consideration*." Nevertheless, Government Official Mr. Raouf Dabbas agrees with his compatriots by further confirming the words of Activist Dr. Basel Burgan. Dabbas proclaims that the public outcry thus far has been "*muzzled*" and those in the public sector or even any nuclear experts who has dared to speak-out against certain aspects of the program have been either "*fired from their job or have been influenced to change their opinions by providing them with perks or incentives*". For the rest of the public who have stood strong against the JAEC and or the government's lack of professionalism and transparency and in some cases corruption, they have been active on social media and by carrying out limited town hall meetings and seminars. The anti-nuclear establishment is not very organized and with little resources, therefore it is considered "*almos*t *futile"*. Executive Mr. Al-Sharif Nasser Bin Nasser perceives that in terms of public protest, there is a lack of technical knowledge about nuclear technology and thus there is always a challenge to bridge the gap between the public who are in opposition to the nuclear energy program and the decision maker in order to have assigned spaced the discussion. The problem with the current state is that the discussion is very heavily politicized and not looking at scientific and technical base issues. Thus, there is such an important role for the scientific committee to play in filling that gap.

When inquiring about the government's engagement with the public with regards to the nuclear project and the agencies that it might be using to reach that goal. Dr. Abu-Dayyeh views it as superficial and never as partners whereas Dr. Badran prefers to reserve the right to not reply. Mr. Nasser sees that the government is engaging on a small scale with the public. Dr. Burgan mirrors Dabbas words in his response to the impact of public movement: the government engages by quieting few

Bedouins with scholarships and or giving them jobs. In addition, during their meetings with the head of the JAEC commission Dr. Khaled Toukan he would assure them that they can "*eat and drink*" from the land around nuclear reactor. Dr. Burgan stressed that there should be IAEA scoping sessions to engage the public. Furthermore, he tells that Princess Basma the daughter of Ali is the only member of the royal family who did not accept the project from the very start and thus took part in the first protest for the decision of the North Mafraq area that took place at the 4th "*douwar*" aka district and was known as the "*black day*". Environmental and Nuclear experts came up with a document about the impact of the nuclear reactor and handed it in to Princess Basma who in turn gave it to the secretary of the King as he is extremely sheltered and thus even Princess Basma couldn't take an appointment from him at the royal court. On the other hand, Mr. Dabbas had a whole explanation: "*The government is very pro-nuclear but not because it presents a solution to our national energy challenges or needs but rather because it is being advertised and submitted to the general public as the "King's project" or a "strategic" project"*. As such, no one dares to doubt or question its viability and justification. In fact, one is almost perceived as being "*disloyal or even a traitor*" if they oppose the project. Ironically, at a time of severe budgetary deficits, economic austerity imposed upon the public, the ever increasing taxation, and the increasing costs of public services and utilities; the JAEC annual budget has been almost constant at around JOD50 million annually and in-fact the entire program has spent no less than JOD500 million since the program was launched in 2008. All governmental agencies and ministries are therefore obliged to support and promote this project. Information supporting the project is constantly being delivered on all media outlets controlled or influenced by media and no counter arguments are ever accepted to

go out using the same media outlets except on some isolated instances when it was allowed. At the beginning of the program (2008 – 2012), there were several meetings arranged with both sides (the pros and the anti-nuclear experts); but the media seemed to only publish the governments' or the pro-nuclear positions and this showed as if it was convincing the opposition to agree with the nuclear position. This of course was false, not to mention very corrupt and far from the truth. This lack of credibility lead the opposition to take steps to stop or refuse meetings with the pro-nuclear camp unless certain guarantees would be agreed upon regarding the ban of false reporting which lead to cancellation of most if not all the face to face meetings between both camps.

The third question tackled the "who could be fuelling public opposition against nuclear" part to which Dr. Abu-Dayyeh undoubtedly replied the "activists". Dr. Badran added "non-government agencies, specialists and specifying environment activists". Mr. Nasser mentioned "local and international organizations". Mr. Dabbas cited more elaborately "local tribe members; land owners in the area of the suggested plant; local nuclear, atomic and geological scientists and experts; professionals as well as local NGOs have all been involved in the opposition of this project." Interestingly, Dr. Burgan started a personal initiative, which involved individual work by actually visiting villagers in their stores and distributing to them articles about the matter in order to spread awareness. This initiative spread into a collective work by gathering a group of experts that would go to the field and knock on doors in villages to say "watch out from what's coming its dangerous". Safety, security, impact on the environment and finance "cost of reactor" and the "cost of electricity" that will result in an increase in taxes, where all topics pointed out to the villagers.

Dr. Abu-Dayyeh assesses the role of the media by differentiating that the

government's media markets the nuclear program whereas private media highlights the opposition. Mr. Dabbas explains that the media in Jordan is under the influence of the government and security agencies. It has limited area to express opposing opinion in and as such, the nuclear energy topic is one that is continuously being conveyed to the public as a personal mission of His Majesty the King. Here rises the issue of media being bought-off and individual reporters who are on the JAEC payroll buying their influence. Dr. Badran remains neutral by stating that it plays "*a major role through acquainting people with positive and negative effects of nuclear energy*". Mr. Nasser points out that the media is in need of sessions on nuclear energy issues to be trained how to expose and most importantly write about it in a right way to be able to hold the government accountable and have a proper debate discourse. Dr. Burgan goes in details by enumerating the existing newspapers: 1) "El Ray", a governmental magazine, is in strong competition with 2) "El Ghad" who writes for and in the name of the head of JAEC meaning that activists don't have access to these two magazines. 3) El Sabil is known to be for the Islamists i.e. IAF party. 4) Arab today is an independent channel who was actively posting about the opposition's movement during the period 2010-2014, but got bankrupt and thus had to close. 5) El Dustour and 6) Jordan Times are also newspapers loyal to the government. Thus, most of the demonstrations that started since 2010 were covered by Foreign press and not local one. A coalition of legal group, nuclear experts who had a conflict with Khaled Toukan and environmental activists are using social media to express their views and send calls for protests.

The fifth question inquires about the ways the government can promote the nuclear project within opposing tribes and Mr. Nasser prefers to cross the word tribe and exchange it with views and responds by viewing it as an "*issue of democratization*",

"*rights and duties*" and the "*basis of citizenship*". Dr. Abu-Dayyeh persists with the "*bribes and offering employment and scholarships is what they are doing*". Mr. Dabbas confirms that since 2008 the government has been trying to infiltrate the local tribes of the Middle Badia region by setting up bogus government run companies (the Uranium mining Co. and the Nuclear Power Co.) and hiring high level unprofessional unexperienced members of the tribe in these companies and also as Ministers, Senate and the like. This has been going on for quite some time now. Additionally, "*scholarships and special privileges are being presented to the opposing tribe but it is never going to be enough,*" Dabbas claims. Dr. Burgan asserts that it is through "*bribery*" (rewards) and via "*pressur*e" (relocating an employee to a distant place). Dr. Burgan believes that there is no transparency as there is no feasibility report, no words regarding the costs of upgrading the national electricity grid, boilers of reactor and decommissioning. The fact that the reactor weighs 900 tons there is no mention of vehicle to carry it. The experience started with first research reactor in JUST: a soft loan from Korea was taken and only 1 payment was paid back so far. Therefore, the question lays in the payment for the new reactor, which is still unclear, and thus the future loans from banks in Russia and international banks will be a big burden on the national budget and on the Jordanian public, as they will have to pay higher taxes. Similarly, Dr. Badran explains that it is not a matter of promotion that counts but a matter of "*clarification and transparency*" regarding the positive and negative aspects of nuclear energy in Jordan because the issue at the end is pertinent to the future of the Jordanian citizens, their health, environment and financial resources.

The sixth and last question involved a contribution in the ranking of eight key factors that can affect the sentiment of the public to take a side whether being pro or

against the nuclear program in the order of 1 being the highest effect and 8 the least (Table 6).

**Table 6: Stakeholder's Ranking of Key Factors that can affect public sentiment**

| Key Factors | Activist Dr. Ayoub Abou dayyeh | Activist Dr. Basel Burgan | Goverment Official Mr. Raouf Dabbas | Politician Dr. Ibrahim Badran | Politician Mr. Al-Sharif Nasser Bin Nasser |
|---|---|---|---|---|---|
| Opposition | 7 | 5 | 3 | 7 | 7 |
| Safety | 2 | 2 | 3 | 1 | 1 |
| Security | 6 | 7 | 5 | 4 | 4 |
| Environment | 8 | 6 | 8 | 2 | 1 |
| Politics | 4 | 1 | 5 | 6 | 6 |
| Multinational Corporations | 5 | 8 | 5 | 8 | 8 |
| Israel | 1 | 4 | 1 | 5 | 5 |
| Finance | 3 | 3 | 2 | 3 | 3 |

It is noticeable that the majority gave the highest influence (rank 1) to Safety and Israel, and the lowest effect to Multinational Corporations and the Environment (rank 8). However, most of the stakeholders interviewed put Safety at first followed by Finance (rank 2) and Israel (rank 3) as the majority selected the highest effect **1-4 green scale** and the least being Multinational Corporations, Opposition, Security and Environment since the majority chose the **5-8 blue scale**.

Opposition is seen one of the least effective factors (rank 7) by government official and activist for "lack of real democracy" and politician part of the political establishment for "lack of technology knowledge". Another activist also considers it among the 5-8 blue scale but in a higher rank 5 due to the opposition's previous experience that was strong enough to make itself heard. Finally, government official

Dabbas ranks it in the higher green scale as he has hope from the “activism on social media” and the organized “town hall meetings and seminars”.

Both safety (majority ranks 1 and 2) and finance (majority rank 3) factors are seen as highly effective in the 1-4 green scale by all stakeholders because hazard is an non-desirable outcome and electricity cost reduction is desirable at the same time high cost of the reactor that will put the country in debt is refuted.

Israel is also considered among the higher effect of the green scale (with ranks of 1 and 4) and a rank 5 on the blue scale. It is interesting to observe that activists and government officials see that Israel is helping Jordan in its studies to initiate a nuclear site, whereas from the stakeholders from the political establishment sees it as less effective (rank 5). Israel is interested in sharing Jordan’s uranium enrichment and this is why the United States (US) conditioned economic aid to the Kingdom upon its cooperation with Israel (Groisman, 2016).However, since the King as mentioned in his speech finds the majority of the nuclear opposition is coming from Israel, and thus his political establishment is more likely to find Israel of a less effect on public sentiment. This could be seen as a major reason to acquire nuclear by the public that lacks nuclear technological awareness, in order to equal Israel in power.

Security, on the other hand, is perceived rather in the lower range of the blue scale (ranks 5-7) and only two at the limit (rank 4) of the green scale probably the likeliness of a terrorist attack occurrence is not at the priority of the debate as the safety, Israel and finance issues are more of a priority.

Environment is seen in the low effect blue scale (ranks 6 and 8), by activists and government officials mainly, as they are closer to the public and they know what matters them the most. In contradiction, the political establishment seems to again have

a similar opinion considering this factor as highly effective (ranks 1 and 2) due to their educational background and little interaction with the public.

Activists mainly see the politics factor as of high effect on public sentiment as it encloses a lot of misleading information (ranks 1 and 4). Whereas the government official and political establishment perceives it of low effect (ranks 5 and 6).

Finally, the eighth factor, Multinational Corporation is evaluated by all stakeholders as being of least importance (ranks 5 and 8). Since the countries of cooperation are China, Japan, Germany, Russia and Czech Republic for both equipment and share of capital. Perhaps if Israel were among the list the ranking of this factor would have been much higher.

The fourth study of this tetra-methodology builds the baseline of the sixth question asked in the semi-structured interview. In addition to the opinion of the stakeholders, a search using the "google advanced search" engine was utilized to find the number of hits for each of the 8 key factors within and across the 6 newspapers existing in Jordan including the Al Arab Today newspaper which was shut down due to bankruptcy (Table 7 and Figures 8 and 9).These newspapers are namely; "Al Ray الراي", "Al Arab Today العرب اليوم", "Al Dastour الدستور", "Al Sabil السبيل", "Al Ghad الغد", "Jordan Times جوردن تايمز". The engine tool was used with the following criteria: "all these words" with primary $1^0$ words "Jordan الاردن ", "Nuclear النووية ", "Power الطاقة " and the secondary $2^0$ word were be one of the 8 key factors("Opposition المعارضة", "Safety السلامة", "Security الامان", "Environment البيئة", "Politics السياسة", "Multinational Corporations الشركات العالمية", "Israel اسرائيل", "Finance المالية") . The language of the words, whether Arabic or English, would variate depending on the language of the newspaper. Following to that, the search was narrowed to language, region, site of the

newspaper, and with a specification that the words should appear in the text of the page. Finally, the "verbatim" tool option was selected to have Google search specific only for the terms entered i.e. so that Google does not get the context of the search wrong, and thus shows the most relevant results by omitting some entries that would be very similar to the already displayed.

**Table 7: Ranking of Key Factors by Newspapers**

| Factors العوامل | Al Ray الراي | | Al Arab Today العرب اليوم | | Al Dastour الدستور | | Al Sabil السبيل | | Al Ghad الغد | | Jordan Times جوردن تايمز | | Total المجموع | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Opposition المعارضة** | 47 | **8** | 32 | **2** | 30 | **7** | 7 | **8** | 24 | **4** | 31 | **6** | 171 | **8** |
| **Safety السلامة** | 79 | **4** | 21 | **6** | 37 | **6** | 27 | **2** | 23 | **5** | 55 | **2** | 242 | **4** |
| **Security الامان** | 56 | **7** | 4 | **7** | 27 | **8** | 22 | **3** | 20 | **6** | 59 | **1** | 188 | **5** |
| **Environment البيئة** | 107 | **2** | 37 | **1** | 42 | **3** | 32 | **1** | 42 | **1** | 42 | **3** | 302 | **1** |
| **Politics السياسة** | 66 | **6** | 23 | **5** | 40 | **5** | 12 | **6** | 36 | **2** | 10 | **7** | 187 | **6** |
| **Multinational Corporations الشركات العالمية** | 71 | **5** | 25 | **4** | 45 | **2** | 13 | **5** | 27 | **3** | 1 | **8** | 182 | **7** |
| **Israel اسرائيل** | 114 | **1** | 26 | **3** | 41 | **4** | 11 | **7** | 27 | **3** | 33 | **5** | 252 | **2** |
| **Finance المالية** | 94 | **3** | 8 | **8** | 49 | **1** | 19 | **4** | 42 | **1** | 36 | **4** | 248 | **3** |

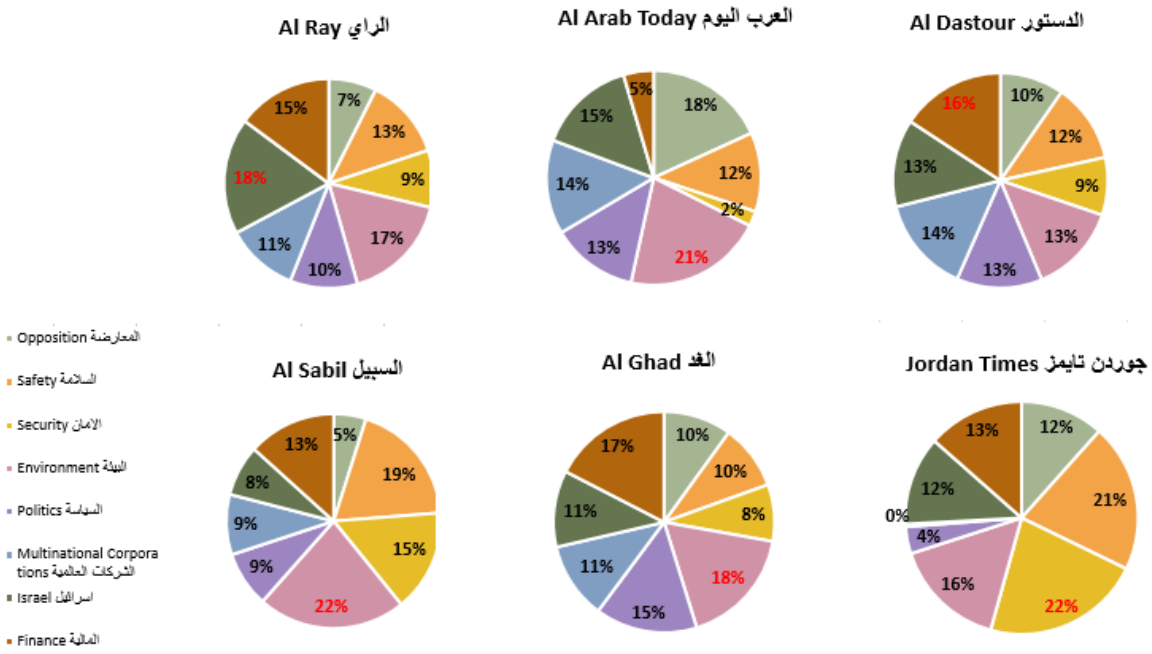



**Figure 8: Ranking of Key Factors within each Newspapers**


**Figure 9: Final Ranking of Key Factors across Newspapers**

Hence, as a final newspaper ranking, the environment factor is in the first place and the opposition factor in the last. This newspaper ranking is very similar to the stakeholders ranking as the safety factor, ranked first by stakeholders, is among the top 4 in the newspaper ranking (4$^{th}$ position). The same goes for the last ranking, a closer similarity puts the multinational corporations in the seventh place by newspapers and eighth place by stakeholders and vice versa for the opposition factor. The second and third places are taken by Israel (2$^{nd}$ and 3$^{rd}$ as per newspapers and stakeholders) and by Finance (3$^{rd}$ and then 2$^{nd}$ as per newspapers and stakeholders), respectively each. This concludes the average final ranking to be Safety, Israel, and Finance factors in the same first rank followed by environment and politics.

# CHAPTER V

# DISCUSSION

The analyzed results gave a better idea of the Jordanian public status with regards to nuclear power after the 2013 and the latest August 2016 Polls , especially after the most recent Russian deal.  Hence, this study was able to a certain extent; understand the Jordanian public opinion and acceptance, that of its stakeholders and the factors that are mostly affecting the decisions towards nuclear power. This leads to the initiation of a better comparison using our most recent 2017 data with which the possibility to be compared to the 2013 Poll of the International Republican Institute and that of the August 2016 Poll by CSS (Figures 10 and 11). Following to this comparison, it will be evaluated against polls in the ME region and the world (Figures 12 and 13).

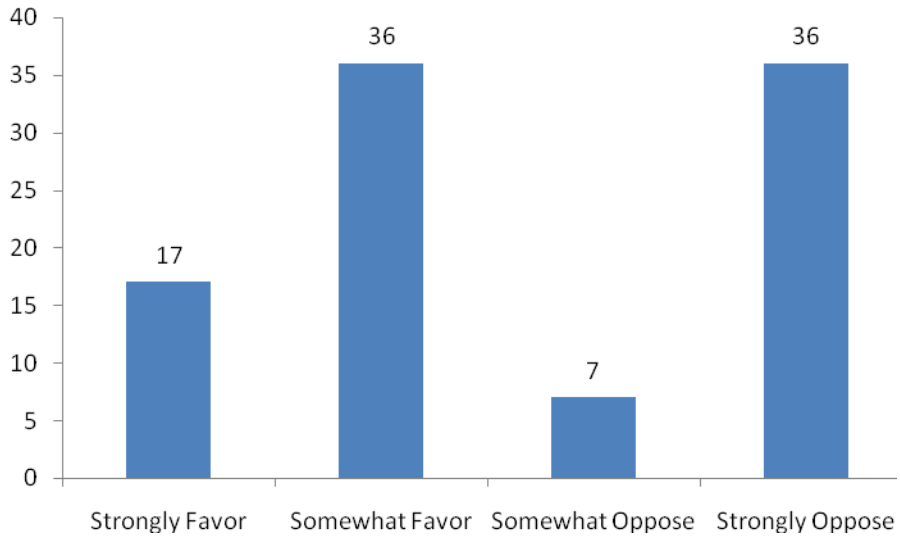



**Figure 10: Jordan Public Acceptance to Nuclear Power in 2017**

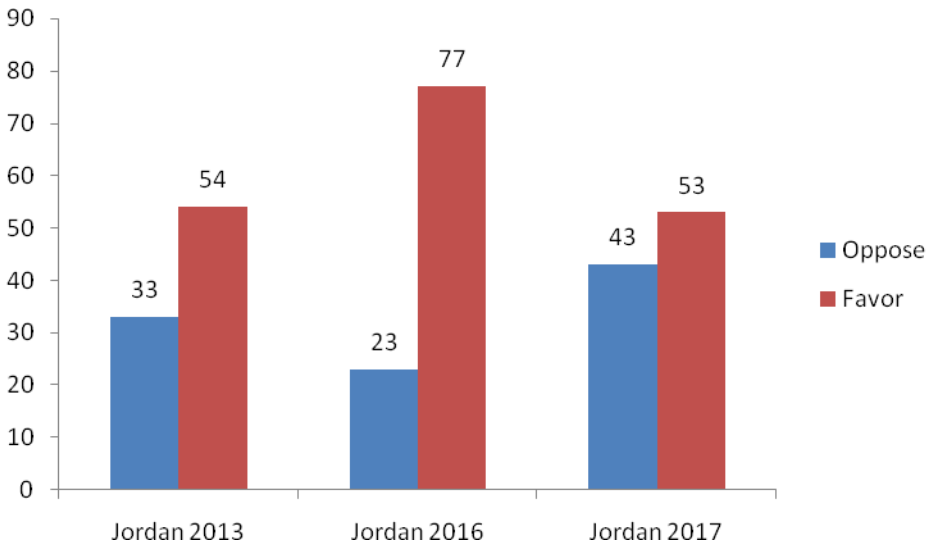



**Figure 11: Our 2017 Poll in Comparison to the 2013 and 2016 Polls**

Referring to the literature review, one of the oldest polls conducted by the IAEA dating back to 2005 showed a higher opposition to NPP construction than support. This indicates in comparison to Figure 10, a least support at all time and a relatively high opposition. The poll of December 2013, consisting of a randomly selected sample of 1,000 Jordanian citizens, found that mostly supported the nuclear power program, believing it will bring down electricity prices, while little opposed it based on fears of health hazards and pollution. The 2016 Poll, considering a large sample of 2,505 Jordanians and 700 opinion leaders, measured the level of awareness about the use of nuclear energy for peaceful purposes and the Jordanian nuclear program. Opinion leaders believe nuclear energy should be a top strategic priority while the Jordanian Public believes it should be a strategic priority one, if the neighboring countries possess peaceful nuclear energy. Our poll of 2017, however, while it withstands the high percentage of being in favor of nuclear power due to the

"uncertainty" of the somewhat in favor percentage (also the same energy independence idea in addition to the cost of electricity); it shows a re-increase in the opposition by 10% and 20% in comparison to the 2013 and 2016 polls, respectively each. This high support was defined in the words of a member of the "Nuclear Jordan" group on Facebook media, who upholds that "*the newest technology, Jordan will have a strong nuclear security and safety systems and measures. The threats of lack of energy resources are much higher than so-called ISIS. The implication of nuclear energy on the environmental, social, economic, political and energy aspects of Jordan is very beneficial."* And even a student majoring in Nuclear Engineering at JUST, Irbid, mentioned that "*I am supporting the Jordanian nuclear program. The public is afraid from accidents in nuclear reactors, but the likelihood is very small to happen."*

However, the uncertainty is reflected in the words of an assistant professor of linguistics at AABU, Mafraq, who stated that "*I believe that we are in need of alternative sustainable resources of energy. Nuclear power can be one of the many solutions for our energy problem on the long run but it is not the best one.*"

These declarations reveal that both professionals and non-professionals of different backgrounds have dissimilar opinions that tend to bend more towards the strongly to somewhat favoritism for nuclear power in Jordan. Nevertheless, having the somewhat in favor higher than the strongly in favor indicates some "uncertainty" and concords with one of the reasons of the Assistant Professor at AABU, an oppositionist, who sees NE as one of the solutions on the long run despite the fact of it not being the best one. Whereas we notice that the strongly opposed are not exceeded by the somewhat oppose.

As for the increase in opposition, it may be due to the reflection of the protest that took place in April 2014, as mentioned earlier in the literature review, and proves that the people living around the nuclear power chosen site and the activists did move their protests to the heart of Amman and across Jordan, especially when majority of the respondents are from Amman. This increase in opposition brings back the weight of the 2005 opposition. A member of the "Stop the Nuclear Reactor in Jordan" group viewed the issue, as "*Nuclear power is not helping my country as taxes will go to a foreign country."* These words justify the rank of the finance key factor being placed first by newspapers and stakeholders. Especially that stakeholder Dr. Burgan stated that "the cost of electricity shall increase by 4 cents more as they the government needs to find a way to pay back the debt to multinational corporations".

In a sum, having the strong opposition exceeding the strong support regarding nuclear power usage; and altogether supported by the concern of the risk of severe accident potentially occurring, thefear from the Jordanian authorities to keep the NPP safe, and the willingness to have the NPP constructed in nowhere inside Jordan; reduces the weight of the high percentage of strongly to somewhat in favor supporters. Furthermore, these results match the baseline search on key factors affecting public sentiment as the safety factor was as well among the ones that ranked first and the environment factor which was ranked fourth. As for the Israeli factor, also ranked first, is most certainly due to the ambiguity existing in the positions of the King who on one side accuses the IAEC as posing a strong opposition to Jordan's peaceful nuclear program and having the IAEC refute and deny his words on the other side. Stakeholder Dr. Burgan views "Israel" as a strong key factor that drives the opposition.

Furthermore, comparing the 2016 poll results to that of our 2017 results is not the same than with the 2013-2017 comparison because the nature of the question asked to the participants of the poll differs. In the 2013 and the new 2017 polls, the purpose is to directly know whether participants oppose or favor nuclear power, whereas in the 2016 poll, the purpose is to know how much of a strategic priority is nuclear power for the government's agenda and that is if the neighboring countries possess peaceful nuclear energy; thus using an indirect way to know the acceptance level of the participants. Moreover, the results of 2016 indicate that the polled public finds the nuclear program more as a strategic priority instead of a top priority, and here, we can associate the "top priority" with the "strongly favor" and the "priority" with the "somewhat favour" which reinforces the idea of the "uncertainty". This could be only right when the 2016 poll found that more than the half said that their knowledge of nuclear energy is insufficient meaning with little knowledge about the subject matter they cannot make a definite decision with regards to the nuclear program.

Interestingly, those who had little to no familiarity with the specifics of the nuclear project in the 2013 poll; decreased by 5% in the new 2017 poll (IRI, 2014). They are a combination of the 37 % who didn't hear or know about the fact that Jordan is in the process of importing a nuclear reactor from Russia and those who were not aware about the current level of commitment by the government to build NPP. Both polls signify that little has been done by the government to spread awareness about the nuclear power program over time and thus the activists alone cannot reach the majority. This is indicated in the words of stakeholder Dr. Burgan who mentioned an individual initiative to educate people and spread awareness. The conducted interviews with

stakeholders in the country prove the 2016 poll results, which showed that a high percentage among opinion leaders were found to have a good knowledge.

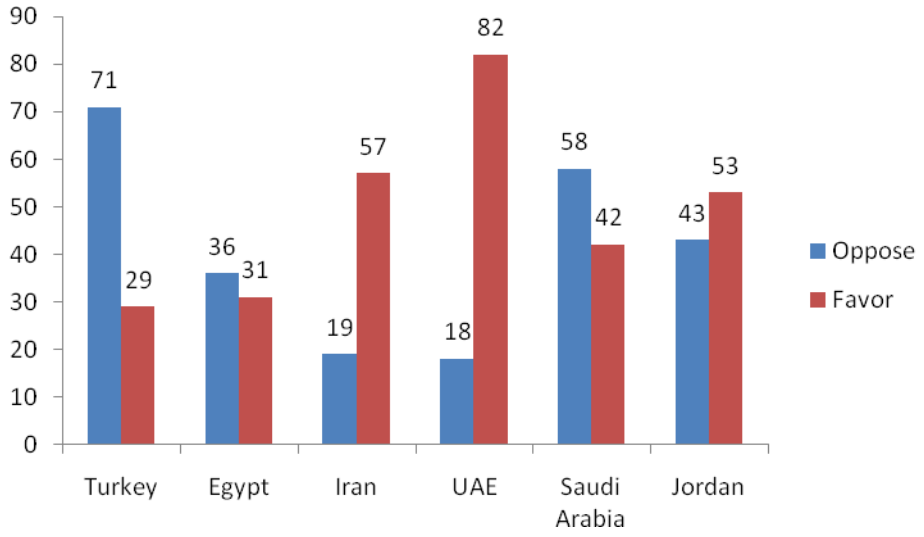



**Figure 12: Jordan Public Acceptance to our nuclear power 2017 Poll in Comparison to the Middle East**

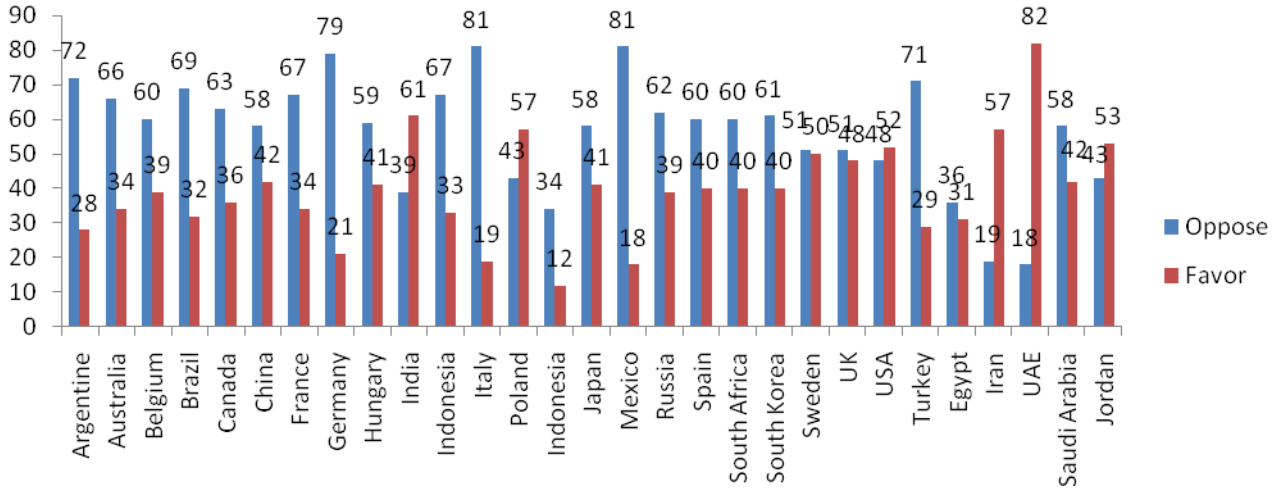



**Figure 13: Jordan Public Acceptance to our nuclear power 2017 Poll in Comparison to the World**

The comparison shown in Figure 5 ranks Jordan as third after Iran in terms of favoring nuclear energy in the Middle East. In terms of opposition, it earns the same third position out of 6 countries, after Saudi Arabia at the regional level. Figure 6 positions Jordan as fifth in favour after Iran and Poland who share the same rank at the level of conducted polls in the world. It earns the 23rd out of 29 countries, as Poland in terms of opposition.

Most probably, the reasons behind these results goes to the fact that most survey participants age between 25 to 34 and 18 to 24 meaning that mostly still go to college and thus can be influenced by the on-going nuclear studies program at some universities. Additionally, the religious and political IAF party, who ended up agreeing to JAEC's plan with some conditions, must have as well influenced its supporters. Another factor putting Jordan's place low on the opposition ranking is the fact that Jordan is a police state and thus probably most were afraid to give their real views and in most cases dissent is not readily allowed so they could not hear both sides of the debate in an unrestricted manner. Finally, not to forget the low level of public awareness, those who knew almost nothing about the nuclear power program in the 2013 poll and did not significantly decrease in our 2017 poll which elucidates the little role of the government represented by JAEC.

Despite the political and religious influence, the majority of survey participants have a high level of education as mostly are graduates and most importantly acknowledge the risks that can erupt from unfortunate governmental corruption and little expertise and thus the fear from potential accidents including nuclear waste contamination and chaos. The good thing that on the political level, a royal member, Princess Basma, who is an avid environmental supporter, is at the same time a voice for the oppressed rebels which most

certainly is another good cause for making Jordan move from rank 26 after Indonesia to escalate 3 ranks since the 2013 poll. On the other hand, the "in favor of nuclear" fourth rank at the international level remained constant since the 2013 poll.

In response to Jordan's declaration about including nuclear energy in its intended nationally determined contributions to climate change mitigation in 2016, surprisingly contributors of our 2017 poll associated nuclear energy more to a low-carbon energy source than those of the 2016 poll and the 2005 poll. However, they made clear that Jordan should start with cheaper sources of energy and their association of it to clean air was not as significant.

Nevertheless, the public has largely been kept out of the information loop regarding most large infrastructure projects in the Kingdom and the nuclear project is certainly no exception as stakeholder Dabbas mentioned. The formal information that is made available is extremely bias and in favor of the official government position and more importantly, it's made available and disseminated via all government driven or back media outlets (newspapers, TV station, radio and government backed social media representative). On the side, the other opinions and counter arguments are forbidden from expressing their views and or allowed on the media outlets. Therefore, the public at large is unaware of the negative impacts the nuclear plant will have on their health, water security, the impact on their tribal land or even the terms of the nuclear agreement and its future implications and liabilities. This analysis is certainly reinforced by the 2016 poll that found that more than half of those surveyed said that their knowledge of nuclear energy is insufficient.

# CHAPTER VI

# CONCLUSION

Jordan called for the development of a nuclear strategy to possess its own energy security and establish a regional balance of power. However, the debates on a civil nuclear program influenced public opinion and sentiment in Jordan, although it was difficult to find reliable surveys to validate this. This is where this study, based on a tetra-methodology, comes in action. It primarily investigates the current Jordanian's public opinion regarding nuclear power; compare it with its antecedent polls. Secondarily, it seeks the opinion of the public via social media and universities. Thirdly, out of those who agreed to participate some stakeholders involved in the debate in one way or another were interviewed, and finally a fourth study focused on constructing the baseline for key factors that might be hindering the opinion of the public while using an advanced search technique.

The quantitative data showed that the majority of the sampled public graded the present energy planning in Jordan as only "good" because the government does not use enough alternative energy sources, plans poorly and gets affected by politics, which renders it much dependent on foreign oil. This grading makes them, especially the females, more inclined to believe that policymakers should prepare now so that nuclear energy would become the primary source if needed in the next decade. However, they strongly believed in alternative energies should lead the way for the coming 10 years. They cared about concentrating on cheaper energy sources that had great potential as a climate change solution. Participants, especially females and the highly educated

generation above 25 years old strongly opposed more than strongly favored the employment of nuclear energy. Risk of severe accidents justified the strong opposition, whereas energy independence and the immediate need of it and its importance for the 10 years to come justified the strong to somewhat support. Interestingly, an increase in indecision about nuclear energy's importance was observed starting with its importance, followed by its 10-year projection and ending by the affirmation of its importance. The strong opposition was seen again in the preference of constructing NPP at a distance more than 100 Km away from their house and even better nowhere in Jordan. Safety of NPP in the world was rated on average of middle safety 4 with an agreement that existing NPP are safe and secure due to trust in technology and experience. However, fear from governmental corruption in Jordan caused a disagreement in the statement, thus again justifying the strong opposition. The 2017 participants find it highly important to have energy reliability, affordability and efficiency coupled with clean air and safety of workers and public alike. On the other hand, nuclear energy was primarily and significantly associated with reliability, independence, efficiency and economic growth. Despite its association to economic growth, nuclear energy was not among the top priorities to improve Jordan's economic performance. The majority was aware that Jordan is in the process of importing a nuclear reactor from Russia and its commitment to build NPP and that a new NPP construction is underway, the consideration of the SMR option, the existence of a public opposition, the recognition of either Chernobyl or Fukushima accidents, and the economic impact of nuclear power. Sources of accurate and reliable information about nuclear energy were attributed to NE scientists and engineers, experts, environmental groups and the internet. Nuclear waste management and radioactive waste were not found to be safely stored at an NPP site and were

supporting the idea of sending nuclear waste outside Jordan.

The qualitative data targeted professionals and students at universities and random public from clusters on social media explained the choices behind the opposition and support to nuclear energy. A participant from the university expressed uncertainty by saying that "*Nuclear power can be one of the alternative sustainable resources for our energy problem on the long run but it is not the best one.",* thus linking it to the somewhat in favor of the nuclear energy program. A student majoring in Nuclear Engineering justifies the strongly in favor by "*the likelihood of accidents is very small to happen, because plant's components are assured in quality design".* A member of the "Stop the Nuclear Reactor in Jordan" group justifies the opposition "*Jordanians will pay more tax but to foreign country."*

The interviewed stakeholders representing groups of activists, political establishment, businesspersons, and government officials who took part in the debate on nuclear energy had different views. **Question 1: How would you perceive the impact of public movement on decision makers in the Kingdom?** Opposition was found to be effective when it was spread on a national scale forcing the government to listen and choose a new site in a desert area. However, it became almost futile when minorities, inhabiting the new site, protested the new decision. Additionally, absence of real democracy and adopting the stick (job dislocation and losing jobs) and carrot (incentives) method weakens the opposition. In addition, a scientific and technical knowledge about nuclear technology gap was identified as necessary to be bridged to better the debate. **Question 2: How does the government engage with the public with regards to the nuclear energy project, and through which agencies?** Information supporting the nuclear project has been constantly delivered in a controlled

manner on all media outlets and no counter arguments were ever accepted to go out on the same media outlets. This indicated that the government's engagement with the public and the agencies that it might be using to reach that goal was superficial on a small scale and never as partners but rather as the "King's project" and this tags opponents as "disloyal". The JAEC annual budget has been almost constant despite severe budgetary deficits, thus rendering governmental agencies and ministries obliged to support and promote the project. The need for IAEA scoping sessions to engage the public was raised. **Question 3: Who do you think fuels public opposition against nuclear?** Activists, non-government agencies, local tribe members and landowners in the area of the suggested plant, local scientists and experts and professionals were all perceived as fuelling public opposition against nuclear. Personal initiatives were conducted to raise awareness on safety, security, environment, and the cost of reactor and electricity that will result in an increase in taxes. **Question 4: How would you assess the role of media? and why?** The media and individual reporters has been bought-off by the JAEC. Therefore, most demonstrations were covered by foreign press; thus forcing the coalition, in conflict with Khaled Toukan (JAEC), to use social media to express its views and send calls for protests. The media was also found to be in need of sessions on nuclear energy issues to be trained how to expose and most importantly write about it in a right way to be able to hold the government accountable and have a proper debate discourse. **Question 5: How do you think the government can promote the project within opposing tribes?** A shift towards democratization is the way the government can promote the nuclear project within opposing tribes or views. However, what is happening in reality is that the government has been setting up false companies and hiring inexperienced tribe members in these companies in addition

to "*scholarships and special privileges".* Lack of transparency exists as there is no feasibility report and no words regarding the costs of upgrading the national electricity grid, boilers of reactor and decommissioning not to mention the future loans. **Question 6:** the ranking of the eight key factors that can affect the sentiment of the public resulted in Safety, Finance and Israel as having the highest effect and Multinational Corporations and the Environment with the lowest effect.

The 8 key factors searched among the 6 local newspaper to investigate the rate of hits each has the most as those would be terms mostly used by those who run the nuclear debate. This time the environment factor was in the first place and the opposition factor was again considered of least effect. This newspaper ranking is very similar to the stakeholders ranking as the safety, Israel and finance factors, are again among the top 4 and the multinational corporations and opposition factors are among the least 2. This concludes the average final ranking to be Safety, Israel, and Finance factors in the same first rank followed by environment and politics. Opposition was seen one of the least effective factors for "lack of real democracy". Safety, Israel and finance are seen as highly effective because hazard is a non-desirable outcome, there is interest in Jordan's uranium enrichment on one side and perception of power gain on the other, and electricity cost reduction is desirable and higher taxes are rejected. Security was perceived of low effect probably due to the minor likeliness of a terrorist attack occurrence is not at the priority of the debate as the safety, Israel and finance issues are more of a priority. Activists and government officials see environment as of low effect, as they know what matters the public the most, whereas, the political establishment sees it as highly effective due to their educational background and little interaction with the public. In addition, activists saw the politics factor as of high effect

on public sentiment as it encloses a lot of misleading information, whereas, again the political establishment perceived it of low effect. Finally, Multinational Corporations are evaluated as being of least importance since the countries of cooperation are not the main threat.

While our 2017 poll and the previous ones showed that there is a continuous public support to Jordan's nuclear program, as the King supports it, the somewhat to strongly in opposition was weaker as suspicion and fear reside towards decisions taken in a corrupted environment. However, what our 2017 poll identified was the breakdown between the uncertain somewhat and the certain strong, thus revealing that the strong opposition was higher than the strong in favor. This revelation gives a primary answer to the major research question of this study by concluding that the government plans and the perceptions of Jordan's energy for the Jordanian public are not aligned. However, this is not a definite conclusion as the sample size is not adequate and the study needs to be carried on to englobe a much bigger portion of the Jordanian public while using a non-random method.

A comprehensive analysis of the quantitative and qualitative results show dynamics around energy decisions in Jordan. There is a quasi-consensus that the public opinion's is not that important which is surprising especially when a minority of people governs the policies. The results generated by this study could potentially highlight the key factors that most and least likely to affect the Jordanian public sentiment vis-a-vis the nuclear debate.

Considering the low level of public knowledge regarding the nuclear energy project, it is clear that Jordan needs an open political debate and a serious public

dialogue that examines long-term alternative energy strategies, their cost effectiveness and the risks involved in selecting a civil nuclear energy program. Officials will need to learn to listen more to public opinion and engage with an open, informed and democratic dialogue that seeks to settle a strategic issue with intergenerational impact. Unless the public is well informed, its opinion towards nuclear power is uneasily changed and the future prospects for the nuclear industry in Jordan and the region is uncertain. Looking at Jordan in the regional dimension, in the context of justifying civil nuclear program, is an argument that has been made on the need to close the gap in nuclear expertise with countries in the region like Israel, Iran and Turkey.

"*I have said 'culture, machine, outcomes' meaning how people react and interact with nuclear power determines the outcome*," said Akira Tokuhiro, nuclear energy expert the University of Idaho (The National, 2015). This statement suggests that this study is a pilot one that paves the road to a much needed national-level research to consider the remaining 300 respondents required to have a good and coherent assessment of the level of public acceptance towards the establishment of a NPP in Jordan. In addition to that, more qualitative information needs to be collected from some stakeholders to ensure inclusion of all categories of the officials. Finally, a better more accurate tool needs to be utilized to find a precise ranking of the factors and then compared to that of the public answers when asked about them in the subsequent survey.

# BIBLIOGRAPHY


Aboul-Enein S., Al-Khunaizi T., Chekina V., Erdurmaz S., Khalil A., Khlopkov A., and Konukhov D. Prospects for nuclear power in the Middle East: Russia's Interests.*Valdai Discussion Club*. (2016) Grantees Report

*Abuqudairi A. Jordan nuclear battle heats up. 14 April 2014. Al JazeeraEnglish. Accessed through: http://www.aljazeera.com/news/middleeast/2014/02/battle-heats-up-over-jordanian-nuclear-power-201422685957126736.html*

Ahmad A. Can SMRs Rescue Jordan's Nuclear Program?. (2014). *Energy Intelligence*. Accessed through: https://cmi.princeton.edu/bibliography/related_files/Ahmad_2014_NucInt_Weekly_SMRJordan.pdf

Ahmad Ali and. Ramana M. V (2014). Does Middle East really need nuclear power?. Accessed through: http://www.almonitor.com/pulse/originals/2014/09/

Ahmad, A. and Snyder, R., 2016. Iran and multinational enrichment in the Middle East. Bulletin of the Atomic Scientists, 72

Al-Rawad, M. and Al Khattab, A., 2015. Risk perception in a developing country: the case of Jordan. *Int.Bus.Res.* 8, 81–96.

Araj K. 3-6 February 2015. Developing the Project Development Agreement. Jordan Atomic Energy Commission. Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure. Accessed through:https://www.iaea.org/NuclearPower/Downloadable/Meetings/2014/2015-02-03-02-06/B3_G1_Jordan_Araj.pdf

Arulchelvan S.. (2013).Study on Public Awareness & Media Coverage of Nuclear Energy Issues in India. Online Journal of Communication and Media Technologies.Vol.3, Issue 1

BBC (2011). Germany: Nuclear power plant to close by 2022. http://www.bbc.com/news/world-europe-13592208

Beatty, R. A. (2009). The Nuclear Renaissance, What Makes Now the Right Time, 33 Arguements. Center for Reactor Information (CFRI). http://www.sustainablenuclear.org/PADs/pad9708beatty.html

Check Market. Sample size calculator. ©2016 Check Market https://www.checkmarket.com/sample-size-calculator/

Cohen Bernard (2009). The Nuclear Energy Option. http://www.phyast.pitt.edu/~blc/book/BOOK.html

Country Meters. Jordan of Population 2015. http://countrymeters.info/en/Jordan

Diesendorf Mark (2007). Is nuclear energy a possible solution to global warming?. http://www.ceem.unsw.edu.au/sites/default/files/uploads/publications/NukesSocialAlternativesMD.pdf

Eran and Grove, 2015.Threats to Stability in Jordan. Strategic Assessment. Volume 18.No. 2.July 2015

Falk Jim (1982). Global Fission: The Battle Over Nuclear Power. Oxford University Press.

Funk Cary and Rainie Lee (2015). Public and Scientists views on Science and Society. Pew Research Center

Garb Paula (1999). Review of Critical Masses, Journal of Political Ecology, Vol 6.

Ghazal M. May, 2016. Jordan in negotiations with potential partners in nuclear project. *The Jordan Times*.http://www.jordantimes.com/news/local/jordan-negotiations-potential-partners-nuclear-project

Giugni, Marco (2004). Social Protest and Policy Change: Ecology, Antinuclear, and Peace Movements. http://books.google.com/

Globescan (2012).Renewed concerns over nuclear risks among the public. http://www.globescan.com/news-and-analysis/blog/entry/

Globescan (2011). *Opposition to Nuclear Energy Grows: Global Poll*.http://www.globescan.com/news-and-analysis/press-releases/press-releases-2011/

GlobeScan, 2005. Global Public Opinion on Nuclear Issues and the IAEA: Final Report from 18 Countries. Prepared for the International Atomic Energy Agency by *GlobeScan Incorporated*, London.

Gottlieb Robert (2005). Forcing the Spring: The Transformation of the American Environmental Movement. Island Press, USA

Green World Conferences, 2008. Jordanian energy market overview. 2nd annual Jordan Energy Conference on 23-24 March 2016. http://www.greenworldconferences.com/jec2015/

Greenpeace International and European Renewable Energy Council (2007). Energy Revolution: A Sustainable World Energy Outlook.p.7. http://www.energyblueprint.info/

Groisman M. July 4, 2016. Jordan determined to sign a nuclear cooperation deal with the US. The Jerusalem Post. Retrieved from: http://www.jpost.com/Middle-East/Jordan-determined-to-sign-a-nuclear-cooperation-deal-with-the-US-459457.

Haddad, J., 2012. Impact of Fukushima on the Siting & Public Communication. Presented at the Evaluation Methodology of the Status of National Nuclear Infrastructure Development and Integrated Nuclear Infrastructure Review (INIR), Vienna, Austria.

Haaretz, 2012. Israel Helped Jordan With Its Nuclear Energy Program, Official Says. Barak Ravid. September 23, 2012. Accessed through: http://www.haaretz.com/israel-news/israel-helped-jordan-with-its-nuclear-energy-program-official-says-1.466249.

Hibbs, M., 2007. Jordan reactor sitting study to be done in 2009, JAEC says. *Nucleon*. Week 48, 10.

Hubbert King M. (1956-06). Nuclear Energy and the Fossil Fuels. Publication # 95. API. p. 36.

International Atomic Energy Agency (IAEA), 2016. Climate Change and Nuclear Power 2016.

Vienna, 2016. www-pub.iaea.org/MTCD/Publications/PDF/CCANP16web-86692468.pdf

IAEA, 2014. IAEA Mission Concludes Peer Review of Jordan's Nuclear Regulatory Framework. https://www.iaea.org/newscenter/pressreleases/iaea-mission-concludes-peer-review-jordans-nuclear-regulatory-framework

IAEA, 2013. Jordan: Electricity and Heat for 2013. Retrieved from: http://www.iea.org/statistics/statisticssearch/report/?country=JORDAN&product=electricityandheat&year=2013

IAEA, 2011. International Status and Prospects of Nuclear Power. 2010 Edition

International Republican Institute.(IRI), 2014. IRI Poll: Jordanians Encouraged by Stability; Concerned about High Prices and Refugee Numbers. http://www.iri.org/resource/iri-poll-jordanians-encouraged-stability-concerned-about-high-prices-and-refugee-numbers

Ipsos Global Advisor (2011). KSA: *Global Citizen Reaction to the Fukushima Nuclear Plant Disaster (theme: environment / climate)*. https://www.ipsos-mori.com/

Jordan Atomic Energy Commission (JAEC), 2016.Jordan. IAEA. RetJrieved from: https://cnpp.iaea.org/countryprofiles/Jordan/Jordan.htm

JT, aug2016. Most Jordanians support nuclear energy programme-poll.31 August 2016. *Jordan Times*. http://jordantimes.com/news/local/most-jordanians-support-nuclear-energy-programme-%E2%80%94-poll

JT, 20aug2016. Jordan seeking funds for first nuclear power plant — official.20 August 2016. *Jordan Times*. http://jordantimes.com/news/local/most-jordanians-support-nuclear-energy-programme-%E2%80%94-poll

JT, 2013.Nuclear programme "to lowerelectricitycostsby70%." *Jordan Times*.

JT, 2012. Deputies vote to suspend nuclear project. *Jordan Times*.

JT, m2012.Search for Jordan's reactor site expands after protests. 19 *March 2012* https://www.wiseinternational.org/labels/mafraq

JT, j2012. Ramtha Residents Trash Nuclear Reactor Building, Destroy Documents. Jordan Times. July 12, 2012. http://jordantimes.com/ramtha-residents-trash-nuclear-reactor-building-destroy-documents.

Kahook S.. Nuclear Power and its fuel cycle: Options for Jordan. *Nuclear Fuel Cycle*. (2014) Jordan Atomic Energy Comission.

Kamrava Mehran, ed (2012). The Nuclear question in the Middle East. New York: Oxford University Press.

Kanter J. (2011).Switzerland decides on Nuclear Phase-Out. The New York Times. http://www.nytimes.com/2011/05/26/business/global/26nuclear.

Kenya Nuclear Electricity Board (KNEB) 2017. Nuclear Power in Jordan. http://www.nuclear.co.ke/index.php/nuclear-content/country-profiles/nuclear-power-in-jordan.

Kitschelt Herbert P. (1986). Political Opportunity and Political Protest: Anti-Nuclear Movements in Four Democracies British Journal of Political Science, Vol. 16, No.1.

Kurt Kleiner (2008). Nuclear energy: assessing the emissions. Nature Reports, Vol. 2, pp. 130-131.

LaMoreaux H. (2010).Nuclear Waste Pools in North Carolina. Sonoma State University.Projectcensored.org.

Loschky J. and Pugliese A. (2012), Iranians Split, 40% to 35%, on Nuclear Military Power. http://www.gallup.com/poll/

MacLachlan, A., 2009a. Worley Parsons to help Jordan run program for first nuclear Powerplant. *Nucleon*. Week 50,8.

MaCorr Research Solutions Online. Sample Size Methodology.© 2003-2016 MaCorr Research. http://www.macorr.com/sample-size-methodology.htm

Magid A. June 20, 2016. Time to reconsider Jordan's Nuclear Program. http://www.mei.edu/content/article/time-reconsider-jordan-s-nuclear-program

Malkawi S., 2017. Status of Nuclear Infrastructure Development in Jordan. Jordan Nuclear Power Company. IAEA Technical Meeting on Topical Issues in the Development of Nuclear Power Infrastructure Vienna, Austria 31 Jan – 3 Feb 2017

McGill, 2017. Jordan.http://cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/j/Jordan.htm

M.V.Ramana and A. Ahmad. Wishful thinking and real problems: Small modular reactors, planning constraints, and nuclear power in Jordan. *Energy Policy*. 93 (2016) 236–245

Namrouqa Hana. Greenpeace Collecting Signatures against Projected Nuclear Plant. JordanTimes.April27,2013.http://jordantimes.com/Greenpeace+collecting+signatures+against+projected+nuclear+plant-5985.

Namrouqa Hana. Islamists Call for a Halt to Nuclear Programme. Jordan Times. April 4, 2012. http://jordantimes.com/article/islamists-call-for-halt-to-nuclear-programme.

Organization for Economic Cooperation and Development (OECD),.Public Attitude to Nuclear Power. (2010) . *Nuclear Development*. https://www.oecd-nea.org/ndd/reports/2010/nea6859-public-attitudes.pdf

Petra, 2016. Study reveals citizens' opinion about Jordan's nuclear program. 31/08/2016. Accessed through: http://www.petra.gov.jo/Public_News/Nws_NewsDetails.aspx?Site_Id=1&lang=2&NewsID=267208&CatID=13&Type=Home&GType=1

Petra, 2012. King: Jordan will have a new Parliament by the new year. 12/9/2012. Accessed through: http://www.petra.gov.jo/Public_News/Nws_NewsDetails.aspx?Site_Id=1&lang=2&NewsID=83821&CatID=13&Type=Home&GType=1

Personal Communication: Dr. Habib El Andaloussi, Chief of Energy Section at UN-ESCWA.

Qualtrics. Qualtrics Online Sample.© 2017 Qualtrics LLC. https://www.qualtrics.com/

Ran kin W. L. et al. (1981). Nuclear Power and the Public: An Update of Collected Survey Research on Nuclear Power. Seattle, Wash.: Battelle Human Affairs Research Centers.

Risa Maeda and Sheldrick Aaron (2012). Japan aims to abandon nuclear power by 2030s. Reuters. http://www.reuters.com/article/2012/09/14/us-japan-nuclear.

Tabbara B. Nuclear power and oil shale. (2014). *The Jordan Times*. http://www.jordantimes.com/opinion/bahjat-tabbara/nuclear-power-and-oil-shale

Taha K.. Nov 2013.Jordanians fret over 'dangerous' nuclear plan. Opposition to dangerous nuclear power, in Jordan. Phys Org.http://phys.org/news/2013-11-jordanians-fret-dangerous-nuclear.html#jCp

The National. April 5, 2015**.** Jordan set to declare international tenders for nuclear plant.http://www.thenational.ae/business/energy/jordan-set-to-declare-international-tenders-for-nuclear-plant.

Salem A., 2016. Arab Civil Nuclear Energy Programmes in a New Strategic Landscape. The Nuclear Forum. http://www.acsis.org/NF/index.php?option=com_k2&view=item&id=63

Samuel Walker, J. (2004). Three Mile Island: A Nuclear Crisis in Historical Perspective. (Berkeley: University of California Press).

Schenker D. The Middle East's Next Nuclear Power?. The Washington Institute. (2015). http://www.washingtoninstitute.org/policy-analysis/view/the-middle-easts-next-nuclear-power.

Schneider Mycle and Froggatt Anthony (2012), "2011–2012 World Nuclear Industry Status Report", Bulletin of the Atomic Scientists, vol. 68, no. 5.

Seeley, N.,2014.The Battle Over Nuclear Jordan. *Middle East Research and Information Project*, 44, pp.18–28. http://www.merip.org/mer/mer271/battle-over-nuclear-jordan.

Sovacool Benjamin K. (2008).The costs of failure: A preliminary assessment of major energy accidents, 1907–2007. Energy Policy. 36 pp. 1802-1820

Sputnik International. October, 2015. Contract on Construction of Jordan NPP by Russia Likely Within 2 Years. http://sputniknews.com/business/20151014/1028534172/jordan-russia-npp.html

Sturgis Sue (2009). Investigation: Revelations about Three Mile Island disaster raise doubts over nuclear plant safety. The Institute for Southern Studies.

The New York Times (2010). A Reasonable Bet on Nuclear Power. http://www.nytimes.com/2010/02/18/opinion/18thur2.html

U.S. Nuclear Regulatory Commission (2014)."Backgrounder on Chernobyl Nuclear Power Plant Accident". http://www.nrc.gov/reading-rm/doc-collections/

WISE Amsterdam, 2011. Anti-nuclear opposition growing in Jordan. Nuclear Monitor Issue:#732. Number: 6162. 09/09/2011. https://www.wiseinternational.org/labels/mafraq

World Nuclear Association (WNA), May 2016. Nuclear Power in Jordan. England and Wales http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/jordan.aspx

WNA, December 2016. Nuclear Power in Jordan. *World Nuclear Association*, London.http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/jordan.aspx

Wolfgang Rüdig ed. (1990). Anti-nuclear Movements: A World Survey of Opposition to Nuclear Energy. Detroit, MI: Longman Current Affairs

World Nuclear Association (2015).Nuclear Power in the United Arab Emirates. Accessed through: http://www.world-nuclear.org/info/Country-Profiles/Countries-T-Z/United-Arab-Emirates/.

World Nuclear News (WNN), December 2015. Russia renames overseas subsidiary. http://www.world-nuclear-news.org/C-Russia-renames-overseas-subsidiary-31121503.htm

World Nuclear News (2013).*Survey finds growing support in UAE*.http://www.world-nuclear-news.org/np-survey_finds_growing_support_in_uae-1903137.html

World Nuclear News (WNN), February 2016. Royal recognition for Jordan's nuclear program. http://www.world-nuclear-news.org/NP-Royal-recognition-for-Jordan-nuclear-program-0202167.html

World Nuclear News (WNN), April 2016. Russia, Jordan to cooperate on nuclear regulation.http://www.world-nuclear-news.org/NP-Russia-Jordan-to-cooperate-on-nuclear-regulation-1804165.html

# APPENDIX I

# SURVEY

**Jordan's Energy Future through the Eyes of Jordanian University Students Survey**

استطلاع للرأي حول مستقبل الطاقة في الأردن من خلال عيون الطلاب الجامعيين في الأردن

**Demographics** التركيبة السكانية

**1. Age Group** الفئة العمرية

| | |
|---|---|
| | 18to24 |
| | 25to34 |
| | 35to49 |
| | 50to64 |
| | 65+ |

**2. Gender** الجنس

| |
|---|
| Female أنثى |
| Male ذكر |

3. **What was the highest level of education you completed?** ما هو أعلى مستوى تعليمي توصلت اليه؟

| | |
|---|---|
| | Some Education بعض التعليم |
| | High school المدرسة الثانوية |
| | Undergraduate الجامعية |
| | Graduate خريج |
| | PhD دكتوراه |
| | Post Doc ما بعد الدكتوراة |

**4. From which Jordanian Village or City do you come from?**

من اي قرية أو مدينة أردنية تأتي؟

- (1) Ajloun عجلون
- (2) Al-Aqabah العقبة
- (3) Al-Balqa البلقاء
- (4) Al-Karak الكرك
- (5) Al-Mafraq المفرق
- (6) Amman عمان
- (7) Aṭ-Ṭafīlah الطفيلة
- (8) Az-Zarqa الزرقاء
- (9) Irbid اربد
- (10) Jarash جرش
- (11) Maan معان
- (12) Madaba مادبا
- (13) Ar-Ruṣayfah الرصيفة
- (14) Al-Quwaysimah القواسمية
- (15) Wādī as-Sīr وادي السير
- (16) Tilā' al-'Alī تلاعالعلي
- (17) Khuraybat as-Sūq خريبات السوق
- (18) Aḍ-Ḍulayl الضليل
- (19) Al-Baq'ah البقعة
- (20) Al-Hāshimiyah الهاشمية
- (21) Al-Ḥuṣun الحصن
- (22) Al-Jubayhah الجبيهة
- (23) Al-Mashāriqah المشارع
- (24) 'Anjarah عنجره
- (25) Ar-Ramthā الرمثا
- (26) Ash-Sharīḥ الصريح
- (27) Askān Abū Nushayr اسكان أبو نصير
- (28) As-Salṭ السلط
- (29) Aṭ-Ṭurrah الطرة
- (30) Aydūn ايدون
- (31) 'Ayn al-Bāshā عين الباشا
- (32) Bayt Rās بيت راس
- (33) Kufranjah كفرنجه
- (34) Kurayyimah كريمه
- (35) Marj al-Ḥamām مرج الحمام
- (36) Muḥayyam al-Ashhahīd 'Azmī مخيم الشهيد عزمي-المفتي
- (37) Nā'ūr ناعور
- (38) Saḥāb سحاب
- (39) Shafā Badrān شفا بدران
- (40) Ṣuwayliḥ صويلح
- (41) Umm Qushayr أم قصير والمقابلين
- (42) Qasr-Amra قصر عمرة
- (43) As-Samra السمرا

**5. What is your background?ما هي خلفيتك؟**

❍ Public Health and Environmental Sciences الصحة العامة والبيئية العلوم
❍ Media and Art وسائل لإعلام والفنون
❍ Engineering and Architecture الهندسة والهندسة المعمارية
❍ Agriculture and Food Sciences الزراعة والعلوم الغذائية
❍ Business Administration إدارة أعمال
❍ Medicine, Pharmacology and Nursing الطب والصيدلة والتمريض
❍ Science of Law and Human Rights علم القانون وحقوق الإنسان
❍ Science علوم
❍ no specific background, please specify يرجى تحديد ،أي خلفية معينة

**6. To which sector you belong?. إلى أي قطاع تنتمي**

❍ Public عام
❍ Private خاص
❍ Governmental حكومي
❍ Academic أكاديمي
❍ non-governmental organizations منظمات غير حكومية

**7. Overall, do you <u>favor or oppose</u> the use of nuclear energy as one of the ways to provide electricity?**

بشكل عام، هل تؤيد أم تعارض استخدام الطاقة النووية باعتبارها واحدة من الطرق لتوفير الكهرباء؟

| | |
|---|---|
| Strongly favor<br>تفضل بشدة | |
| Somewhat favor<br>تفضل إلى حد ما | |
| Somewhat oppose<br>تعارض نوعا ما | |
| Strongly oppose<br>نعارض بشدة | |
| Don't know<br>لا أعرف | |

**8. Based on your answer to the previous question, which of the following considerations affected your position? (You can tick more than one)**

بناءً على إجابتك على السؤال السابق، أي من الاعتبارات التالية تؤثر في موقفكم؟
(يمكنك اختيار أكثر من اجابة)

| | |
|---|---|
| Reliable supply of electricity<br>الحصول على الكهرباء بشكل موثوق | |
| Cost of electricity<br>تكلفة الكهرباء | |
| Energy independence<br>الاستقلال في مجال الطاقة | |
| Risk of severe accidents<br>خطر وقوع حوادث خطيرة | |
| Security concerns | |

| | |
|---|---|
| مخاوف أمنية | |
| Availability of human resources<br>توافر الموارد البشرية | |
| Financial Expenditure<br>الإنفاق المالي | |
| Economic growth<br>النمو الاقتصادي | |
| Job creation<br>خلق فرص العمل | |
| Climate change<br>تغير المناخ | |
| Other (please specify)<br>غير ذلك (يرجى التحديد) | |

**9. How important do you think nuclear energy will be in meeting electricity needs in Jordan?**

برأيك ما مدى أهمية الطاقة النووية في تلبية احتياجات الكهرباء في الأردن؟

| | |
|---|---|
| Very important<br>مهم جدا | |
| Somewhat important<br>مهم الى حدَّ ما | |
| Not too important<br>ليس مهما جدا | |
| Not important at all<br>ليس مهما على الإطلاق | |
| Don't know<br>لا أعرف | |

**10. How important do you think nuclear energy will be in meeting electricity needs in Jordan in 10 years to come?**

برأيكما مدى أهمية الطاقة النووية في تلبية احتياجات الكهرباء في الأردن في 10 السنوات القادمة؟

| | |
|---|---|
| Very important<br>مهم جدا | |
| Somewhat important<br>مهم الى حدَّ ما | |
| Not too important<br>ليس مهما جدا | |
| Not important at all<br>ليس مهما على الإطلاق | |
| Don't know<br>لا أعرف | |

**11. In the next decade, do you think that nuclear energy's importance in meeting electricity needs will increase, decrease, or remain about the same in Jordan?**

في العقد القادم ، هل تعتقد أن أهمية الطاقة النووية في الأردن ستزداد،ستنقص أو ستبقى على نفس المستوى ؟

| | |
|---|---|
| Increase<br>زيادة | |
| Decrease<br>انخفاض | |
| Remain about the same<br>لا تتغير | |
| Don’t know<br>لا أعرف | |

**12. Please tell us your personal opinion about the following statements.**

من فضلك قل لنا رأيك الشخصي حول العبارات التالية

| | **Strongly Agree**<br>موافق بشدة | **Somewhat Agree**<br>أوافق إلى حد ما | **Somewhat Disagree**<br>لا أوافق إلى حد ما | **Strongly Disagree**<br>لا أوافق بشدة | Don’t know<br>لا أعرف |
|---|---|---|---|---|---|
| Policy makers should prepare now so that new nuclear power plants could be built if needed in the next decade<br>ينبغي على صانعي السياسات الإعداد في حال تم الحاجة الى بناء محطات الطاقة النووية الجديدة في العقد المقبل | | | | | |
| Policy makers should definitely build nuclear power plants now<br>ينبغي بالتأكيد على صانعي السياسات بناء محطات الطاقة النووية الآن | | | | | |

**13. Would it be acceptable to you to have the authorities construct a nuclear plant:**

هل تقبل ان تقوم السلطات بناء محطة نووية

a. Within 20 kilometers of your house

في نطاق 20 كيلومترا من منزلك

b. More than 20 kilometers but less than 50 km/mi from your house

أكثر من 20 كيلومترا ولكن أقل من 50 كيلومترا من منزلك

c. More than 100 kilometers from your house

أكثر من 100 كيلومترا من منزلك

d. Nowhere in Jordan

ليس في اي مكان في الأردن

**14. These are some topics about nuclear energy. Please tell me if you have heard or read any information on the topic**

هذه بعض المواضيع حول الطاقة النووية. من فضلك قل لي إذا كنت قد سمعت أو قرأت أي معلومات عن الموضوع

| | **Yes** نعم | **No** لا |
|---|---|---|
| Jordan is in the process of importing a nuclear reactor from Russia<br>الأردن يخطط لاستيراد مفاعل نووي من روسيا | | |
| Public opposition to nuclear power in Jordan<br>المعارضة الشعبية للطاقة النووية في الأردن | | |
| The current level of commitment by the government to build nuclear power plant<br>المستوى الحالي لالتزام الحكومة لبناء محطة للطاقة النووية | | |
| Fukushima or Chernobyl<br>فوكوشيما أو تشرنوبيل | | |
| Economic impact of nuclear power<br>الأثر الاقتصادي للطاقة النووية | | |
| The option of building a small modular Reactor (SMR) in Jordan<br>خيار بناء مفاعلات حدات صغيرة في الأردن | | |
| New nuclear power plant construction is underway in your country<br>بناء محطة للطاقة النووية جارٍ في بلدك | | |

**15. These are considerations for the way electricity is produced. For each one, please tell me if it is of high, medium, or low importance to you?**

هذه اعتبارات متعلقة بإنتاج الكهرباء من الطاقة النووية، من فضلك قل لي إذا كانت اهمية هذه الاعتبارات بالنسبة لك عالية، متوسطة أو منخفضة؟

| | **High** عالي | **Medium** متوسط | **Low** منخفض | Don't know لا أعرف |
|---|---|---|---|---|
| Clean air هواء نظيف | | | | |
| Reliable electricity الحصول على الكهرباء بشكل موثوق | | | | |
| Affordable electricity الكهرباء بأسعار معقولة | | | | |
| Energy Efficiency كفاءة الطاقة | | | | |
| Energy independence الاستقلال في مجال الطاقة | | | | |
| Safety of workers and public سلامة العمال والعامة | | | | |
| Job creation خلق فرص العمل | | | | |
| Economic growth النمو الاقتصادي | | | | |
| Climate change solution حل لتغير المناخ | | | | |

**16. Do you associate nuclear energy a lot, a little, or not at all with**
هل تربط الطاقة النووية كثيرا، قليلا، أو لا على الاطلاق مع ...

| | **a lot** كثيرا | **a little** قليلا | **not at all** لا على الاطلاق | Don't know لا أعرف |
|---|---|---|---|---|
| Clean air هواء نظيف | | | | |
| Reliable electricity الحصول على الكهرباء بشكل موثوق | | | | |
| Affordable electricity الكهرباء بأسعار معقولة | | | | |
| Energy Efficiency كفاءة الطاقة | | | | |
| Energy independence الاستقلال في مجال الطاقة | | | | |
| Safety of workers and public سلامة العمال والعامة | | | | |
| Job creation خلق فرص العمل | | | | |
| Economic growth النمو الاقتصادي | | | | |
| Climate change solution حل لتغير المناخ | | | | |

**17. From 1 to 6 where 1 is the top grade and 6 means failure. What grade would you give to Jordan's energy planning?**
من 1 إلى 6، حيث 1 هو أعلى درجة و6 يعني الفشل. ما هي الدرجة التي تعطيها لتخطيط الطاقة في الأردن؟

| | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |

**18. What are the reasons for that grade? (You can choose more than one)**

ما هي أسباب هذه الدرجة ؟ (يمكنك اختيار أكثر من اجابة)

| # | What are the reasons for that grade? (You can choose more than one) ما هيأ... | Percentage |
|---|---|---|
| 1 | Poor planning/not planning ahead عدما لتخطيط للمستقبل / سوء التخطيط | |
| 2 | Need to use more alternative energy sources الحاجة إلى استخدام مصادر الطاقة البديلة أكثر | |
| 3 | Government is not doing a good job الحكومة لا تقوم بعمل جيد | |
| 4 | Too much politics involved مستوى عالي من التسيس | |
| 5 | Too much dependency on foreign oil/energy – need to become energy independent الحاجة إلى أنتاج طاقة بشكل مستقل– الاعتماد العالي على النفط الأجنبي | |
| 6 | Current plan is good الخطة الحالية جيدة | |
| 7 | Not efficient energy sources لا مصادر طاقة ذات كفاءة عالية | |
| 8 | Price/cost of energy is too high تكلفة الطاقة مرتفعة جدا / السعر | |
| 9 | Current plan is not perfect, need to come up with a new one to plan for future (general) الخطة الحالية ليست مثالية ،تحتاج إلى خطة جديدة للمستقبل ( عام ) | |
| 10 | They are considering building a nuclear plant الحكومة تدرس بناء محطة نووية | |
| | Total | |

**19. Thinking about the nuclear power plants that are operating now in the world, how safe do you regard these plants? Please think of a scale from "1" to "7," where "1" means very unsafe and "7" means very safe. The safer you think they are, the higher the number you would give**

فكر في محطات الطاقة النووية التي تعمل حول العالم، وفي مدى سلامتها؛ يرجى التفكير في نطاق من " 1 " إلى " 7 "، حيث " 1 " يعني غير آمنة جدا و " 7 " يعني آمنة جداً.

| # | Thinking about the nuclear power plants that are operating now in the world... | Percentage |
|---|---|---|
| 1 | High (5-7) عالي | |
| 2 | 7 – Very safe آمن جدا | |
| 3 | 6 | |
| 4 | 5 | |
| 5 | Middle (4) متوسط | |
| 6 | 3 | |
| 7 | 2 | |
| 8 | 1 – Very unsafe غير آمن جدا | |
| 9 | Low (1-3) منخفض | |
| | Total | |

**20. Which one of these energy sources do you think should be the most used as to generate electricity 10 years from now? (you can choose more than one)**

برأيك أي واحد من مصادر الطاقة هذه يجب استخدامها الأكثر في توليد الكهرباء بعد 10 سنوات من الآن؟ (يمكنك اختيار أكثر من اجابة)

| # | Which one of these energy sources do you think should be the most used as... | Percentage |
|---|---|---|
| 1 | Natural gas غاز طبيعي | |
| 2 | Solar energy الطاقة الشمسية | |
| 3 | Nuclear energy الطاقة النووية | |
| 4 | Wind energy طاقة الرياح | |
| 5 | Hydroelectric or water power الطاقة الكهرومائية والمائية | |
| 6 | Oil النفط | |
| 7 | Coal الفحم الحجري | |
| | Total | |

**21. Please tell us if you agree or disagree with the following statement**

من فضلك قل لنا إذا كنت توافق أو لا توافق مع العبارة التالية.

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حد ما | Somewhat Disagree لا أوافق إلى حدما | Strongly Disagree لا أوافق بشدة | Total |
|---|---|---|---|---|---|---|
| 1 | We should take advantage of all low-carbon energy sources, including nuclear, hydro, and renewable energy, to produce the electricity we need while limiting greenhouse gas emissions يجب علينا الاستفادة من كل مصادر الطاقة منخفضة الكربون بما في ذلك الطاقة النووية والطاقة المائية والطاقة المتجددة لإنتاج الكهرباء ،بينما نحد من انبعاث الغازات الاحتباس الحراري | | | | | |
| 2 | We should not worry about climate change لا ينبغي لنا أن نقلق بشأن تغير المناخ | | | | | |
| 3 | cheaper sources of energy should be used first مصادر أرخص من الطاقة ينبغي أن تستخدم اولاً | | | | | |

**22. Please tell us if you agree or disagree with the following statements.**

من فضلك قل لنا إذا كنت توافق أو لا توافق مع العبارات التالية.

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حد ما | Somewhat Disagree لا أوافق إلى حدما | Strongly Disagree لا أو افق بشدة | Total |
|---|---|---|---|---|---|---|
| 1 | Nuclear power plants operating in the world are safe and secure محطات الطاقة النووية العاملة حول العالم هي آمنة و مأمونة | | | | | |
| 2 | As we have learned from experience and as technology has improved, nuclear power plants have been made safer كم تعلمنا من التجارب ومتحسن التكنولوجيا ،أصبحت محطات الطاقة النووية أكثر أمانا | | | | | |
| 3 | Nuclear power plants in the Middle East will be built to withstand the most extreme natural events that may occur here سيتم بناء محطات الطاقة النووية في منطقة الشرق الأوسط على الصمود ف يوجه الكوارث الطبيعية القصوى | | | | | |
| 4 | If a nuclear plant is built in Jordan, the authorities will make sure that it will be safe and not have any accidents إذا تم بناء محطة نووية في الأردن فإن السلطات ستتأكد من كونها آمنة ولن يحدث لها أي حادث | | | | | |

**23. On the subject of nuclear waste management and specifically the management of the radioactive waste from nuclear power plants, do you agree or disagree with the following statements?**

حول موضوع إدارة النفايات النووية و تحديدا إدارة النفايات المشعة الناتجة عن محطات الطاقة النووية، هل توافق أو لا توافق مع العبارات التالية ؟

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حد ما | Somewhat Disagree لا أوافق إلى حد ما | Strongly Disagree لا أوافق بشدة | Total |
|---|---|---|---|---|---|---|
| 1 | Radioactive waste from nuclear fuel are safely stored at a nuclear power plant site يتم تخزين النفايات المشعة من الوقود النووي بأمن أن في موقع محطة للطاقة النووية | | | | | |
| 2 | Jordan should develop a Permanent disposal facility يجب على إنشاء منشأة للتخلص الدائم من النفايات لمشعة | | | | | |
| 3 | Nuclear waste can be transported safely يمكن نقل النفايات النووية بأمان | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | Nuclear waste should be sent outside Jordan يجب أن ترسل النفايات لنووية خارج الأردن | | | | | | |

**24. Please tell us if you think each of the following would be an excellent, good, fair, or poor source of accurate and reliable information about nuclear energy**

من فضلك قل لنا إذا كنت تعتقد كل من المصادر التالية ستكون ممتازة، جيدة، عادلة ، أو فقيرة لحصول على معلومات دقيقة وموثوقة عن الطاقة النووية

| # | Question | Excellent ممتازة | Good جيدة | Fair عادلة | Poor فقيرة | Don't Know لا أعرف | Total |
|---|---|---|---|---|---|---|---|
| 1 | Nuclear energy scientists and engineers علماء ومهندسين الطاقة النووية | | | | | | |
| 2 | Safety, radiation, or environmental experts خبراء بيئة ،سلامة وإشعاع | | | | | | |
| 3 | Politicians السياسيين | | | | | | |
| 4 | Electric utilities شركات الكهرباء | | | | | | |
| 5 | The Internet الإنترنت | | | | | | |
| 6 | Environmental groups جماعات حماية البيئة | | | | | | |
| 7 | Social media, such as Twitter, YouTube or Facebook وسائل التواصل الاجتماعي ،مثل تويتر ،يوتيوب أو الفيسبوك | | | | | | |

## 25. What are the priorities to improve Jordan's economic performance?

ما هي الأولويات لتحسين الأداء الاقتصادي في الأردن ؟

| What are the Priorities to improve Jordan's economic performance? ما هي ال... | Percentage |
|---|---|
| a. Improve education and professional training تحسين التعليم والتدريب المهني | |
| b. Invest in research and innovation الاستثمار في مجال البحث والابتكار | |
| c. Facilitate the creation of companies تسهيل إنشاء الشركات | |
| d. Use energy more efficiently استخدام الطاقة بصورة أكثر كفاءة | |
| e. Produce more electricity fast إنتاج المزيد من الكهرباء بسرعة | |
| f. Invest in transport infrastructure (motorways, railways, etc.) الاستثمار في البنية التحتية للنقل (الطرق السريعة والسكك الحديدية الخ ) | |
| g. Increase the legal number of working hours زيادة العدد القانوني لساعات العمل | |
| Total | |

**THANK YOU**

شكرا

# APPENDIX II

# SURVEY RESULTS

**Q1 - Age Group الفئة العمرية**

| Age Group الفئة العمرية | Percentage |
|---|---|
| 18 to 24 | 28% |
| 25 to 34 | 43% |
| 35 to 49 | 15% |
| 50 to 64 | 12% |
| 65+ | 2% |
| Total | 100% |

**Q2 - Gender الجنس**

| Gender الجنس | Percentage |
|---|---|
| Male ذكر | 68% |
| Female أنثى | 32% |
| Total | 100% |

**Q3 - What was the highest level of education you completed? ما هو أعلى مستوى تعليمي توصلت اليه؟**

| What was the highest level of education you completed? ما هو أعلى مستوى تعلم... | Percentage |
|---|---|
| Some Education بعض التعليم | 0% |
| High school المدرسة الثانوية | 3% |
| Undergraduate الجامعية | 29% |
| Graduate خريج | 55% |
| PhD دكتوراه | 9% |
| Post doc ما بعد الدكتوراه | 4% |
| Total | 100% |

**Q4 - From which Jordanian Village or City do you come from? من أي قرية أو مدينة أردنية تأتي؟**

| From which Jordanian Village or City do you come from? من أي قرية أو مدينة... | Percentage |
|---|---|
| Ajloun عجلون | 0% |
| Al-Aqabah العقبة | 2% |
| Al-Balqa البلقاء | 2% |
| Al-Karak الكرك | 2% |
| Al-Mafraq المفرق | 0% |
| Amman عمان | 53% |
| Aṭ -Ṭafīlah الطفيلة | 0% |
| Az-Zarqa الزرقاء | 0% |
| Irbid اربد | 2% |
| Jarash جرش | 4% |
| Maan معان | 2% |
| Madaba مادبا | 2% |
| Ar-Ruṣayfah الرصيفة | 0% |
| Al-Quwaysimah القواسمية | 0% |
| Wādī as-Sīr وادي السير | 4% |
| Tilā' al-'Alī تلال العلي | 7% |
| Khuraybat as-Sūq خريبات السوق | 0% |
| Aḍ -Ḍulayl الضليل | 0% |
| Al-Baq'ah البقعة | 0% |
| Al-Hāshimiyah الهاشمية | 0% |
| Al-Ḥuṣun الحصن | 0% |
| Al-Jubayhah الجبيهة | 4% |
| Al-Mashāriqah المشارع | 0% |
| 'Anjarah عنجره | 0% |
| Ar-Ramthā الرمثا | 0% |
| Ash-Sharīḥ الصريح | 0% |

| | |
|---|---|
| Askān Abū Nushayr اسكان ابونصير | 0% |
| As-Salṭ السلط | 4% |
| Aṭ -Ṭ urrah الطرة | 0% |
| Aydūn ايدون | 0% |
| 'Ayn al-Bāshā عين الباشا | 2% |
| Bayt Rās بيت راس | 0% |
| Kufranjah كفرنجه | 2% |
| Kurayyimah كريمه | 0% |
| Marj al-Ḥamām مرج الحمام | 0% |
| Muḥ ayyam al-Ashhahīd 'Azmī مخيم الشهيد عزمي-المفتي | 0% |
| Nā'ūr ناعور | 0% |
| Saḥ āb سحاب | 0% |
| Shafā Badrān شفا بدران | 2% |
| Ṣ uwayliḥ صويلح | 2% |
| Umm Qushayr أم قصير والمقابلين | 0% |
| Qasr-Amra قصر عمرة | 0% |
| As-Samra السمرا | 0% |
| Total | 100% |

**Q5 - What is your background? ما هي خلفيتك؟**

| What is your background? ما هي خلفيتك؟ | Percentage |
|---|---|
| Public Health and Environmental Sciences الصحة العامة والعلوم البيئية | 13% |
| Media and Art وسائل الإعلام والفنون | 0% |
| Engineering and Architecture الهندسة والهندسة المعمارية | 64% |
| Agriculture and Food Sciences الزراعة والعلوم الغذائية | 2% |
| Business Administration إدارة أعمال | 7% |
| Medicine, Pharmacology and Nursing الطب والصيدلة والتمريض | 7% |
| Science of Law and Human Rights علم القانون وحقوق الإنسان | 0% |

| | |
|---|---|
| Science علوم | 4% |
| Physical Education التعليم الجسدي | 0% |
| Other آخر | 2% |
| Total | 100% |

**Q6 - To which sector you belong? إلى أي قطاع تنتمي؟**

| To which sector you belong? إلى أي قطاع تنتمي؟ | Percentage |
|---|---|
| Private خاص | 67% |
| Academic أكاديمي | 16% |
| International Organizations منظمات دولية | 9% |
| Public عام | 7% |
| non-governmental organizations منظمات غير حكومية | 2% |
| Total | 100% |

**Q7 - Overall, do you favor or oppose the use of nuclear energy as one of the ways to provide electricity? بشكل العام، هل تؤيد أم تعارض استخدام الطاقة النووية باعتبارها واحدة من الطرق لتوفير الكهرباء؟**

| # | Overall, do you favor or oppose the use of nuclear energy as one of the way... | Percentage |
|---|---|---|
| 1 | Strongly favor تفضل بشدة | 17% |
| 2 | Somewhat favor تفضل إلى حد ما | 36% |
| 3 | Somewhat oppose تعارض نوعا ما | 7% |
| 4 | Strongly oppose نعارض بشدة | 36% |
| 5 | (Don’t know) لا أعرف | 4% |
| | Total | 100% |

**Q8 - Based on your answer to the previous question, which of the following considerations affected your position? (You can tick more than one) بناء على إجابتك (يمكنك اختيار أكثر من اجابة) على السؤال السابق أي من الاعتبارات التالية تؤثر في موقفكم؟**

| # | Based on your answer to the previous question, which of the following consi... | Percentage |
|---|---|---|
| 1 | Reliable supply of electricity الحصول على الكهرباء بشكل موثوق | 31% |
| 2 | Cost of electricity تكلفة الكهرباء | 32% |
| 3 | Energy independence الاستقلال في مجال الطاقة | 41% |
| 4 | Risk of severe accidents خطر وقوع حوادث خطيرة | 57% |
| 5 | Security concerns مخاوف أمنية | 30% |
| 6 | Availability of human resources توافر الموارد البشرية | 18% |
| 7 | Financial Expenditure الإنفاق المالي | 24% |
| 8 | Economic growth النمو الاقتصادي | 22% |
| 9 | Job creation خلق فرص العمل | 20% |
| 10 | Climate change تغير المناخ | 29% |
| 11 | Other (please specify) غير ذلك (يرجى التحديد) | 5% |
| | Total | 100% |

**Q9- How important do you think nuclear energy will be in meeting electricity needs in Jordan? برأيك ما مدى أهمية الطاقة النووية في تلبية احتياجات الكهرباء في الأردن؟**

| # | How important do you think nuclear energy will be in meeting electricity ne... | Percentage |
|---|---|---|
| 1 | Very important مهم جدا | 33% |
| 2 | Somewhat important مهم إلى حدّ َما | 24% |
| 3 | Not too important ليس مهما جدا | 19% |
| 4 | Not important at all ليس مهما على الإطلاق | 20% |
| 5 | (Don’t know) لا أعرف | 4% |
| | Total | 100% |

**Q10 - How important do you think nuclear energy will be in meeting electricity needs in Jordan in 10 years to come? برأيك ما مدى أهمية الطاقة النووية في تلبية احتياجات الكهرباء في الأردن في 10السنوات القادمة؟**

| # | How important do you think nuclear energy will be in meeting electricity ne... | Percentage |
|---|---|---|
| 1 | Very important مهم جدا | 31% |
| 2 | Somewhat important مهم إلى حدٍّ ما | 25% |
| 3 | Not too important ليس مهما جدا | 17% |
| 4 | Not important at all ليس مهما على الإطلاق | 21% |
| 5 | (Don’t know) لا أعرف | 6% |
| | Total | 100% |

**Q11 - In the next decade, do you think that nuclear energy’s importance in meeting electricity needs will increase, decrease, or remain about the same in Jordan? في العقد القادم هل تعتقد ان أهمية الطاقة النووية في الأردن ستزداد ،ستنقص أو ستبقى على نفس المستوى؟**

| # | In the next decade, do you think that nuclear energy’s importance in meetin... | Percentage |
|---|---|---|
| 1 | Increase زيادة | 47% |
| 2 | Decrease انخفاض | 26% |
| 3 | Remain about the same لا تتغير | 19% |
| 4 | (Don’t know) لا أعرف | 8% |
| | Total | 100% |

**Q12 - Please tell us your personal opinion about the following statements من فضلك قل لنا رأيك الشخصي حول العبارات التالية**

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حد ما | Somewhat Disagree لا أوافق إلى حد ما | Strongly Disagree لا أوافق بشدة | Total |
|---|---|---|---|---|---|---|
| 1 | Policy makers should prepare now so that new nuclear power plants could be built if needed in the next decade ينبغي على صانعي السياسات الإعداد في حال ما لحاجة إلى بناء محطات الطاقة النووية الجديدة في العقد المقبل | 40% | 32% | 14% | 14% | 91 |
| 2 | Policy makers should definitely build nuclear power plants now ينبغي | 19% | 40% | 16% | 25% | 83 |

| | | | | | |
|---|---|---|---|---|---|
| بالتأكيد على صانعي السياسات بناء محطات الطاقة النووية الآن | | | | | |

**Q13 - Would it be acceptable to you to have the authorities construct a nuclear plant: هل تقبل أن تقوم السلطات ببناء محطة نووية**

| # | Would it be acceptable to you to have the authorities construct a nuclear p... | Percentage |
|---|---|---|
| 1 | a. Within 20 kilometers of your house في نطاق 20كيلو مترا من منزلك | 6% |
| 2 | b. More than 20 kilometers but less than 50 kilometers from your house أكثر من 20 كيلو مترا ولكن أقل من 50 كيلو مترا من منزلك | 11% |
| 3 | c. More than 100 kilometers from your house أكثر من 100 كيلو مترا من منزلك | 40% |
| 4 | d. Nowhere in Jordan ليس في أي مكان في الأردن | 43% |
| | Total | 100% |

**Q14 - These are some topics about nuclear energy. Please tell me if you have heard or read any information on the topic من فضلك قل لي إذا هذه بعض المواضيع حول الطاقة النووية. كنت قد سمعت أو قرأت أي معلومات عن الموضوع**

| # | Question | Yes نعم | No لا | Total |
|---|---|---|---|---|
| 1 | Jordan is in the process of importing a nuclear reactor from Russia الأردن يخطط لاستيراد مفاعل نووي من روسيا | 63% | 37% | 100 |
| 2 | Public opposition to nuclear power in Jordan المعارضة الشعبية للطاقة النووية في الأردن | 72% | 28% | 100 |
| 3 | The current level of commitment by the government to build nuclear power plant المستوى الحالي لالتزام الحكومة لبناء محطة للطاقة النووية | 66% | 34% | 100 |
| 4 | Fukushima or Chernobyl فوكوشيما أ وتشرنوبيل | 76% | 24% | 100 |
| 5 | Economic impact of nuclear power الأثر الاقتصادي للطاقة النووية | 80% | 20% | 100 |
| 6 | The option of building a small modular reactor (SMR) in Jordan خيار بناء مفاعل اتحادات صغيرة في الأردن | 51% | 49% | 100 |
| 7 | New nuclear power plant construction is underway in your country بناء محطة للطاقة النووية جارٍ في بلدك | 55% | 45% | 100 |

**Q15 - These are considerations for the way electricity is produced. For each one, please tell me if it is of high, medium, or low importance to you? هذه اعتبارات متعلقة بإنتاج الكهرباء من الطاقة النووية من فضلك قل لي إذا كانت أهمية هذه الاعتبارات بالنسبة لك عالية، متوسطة ومنخفضة؟**

| # | Question | High عالي | Medium متوسط | Low منخفض | Total |
|---|---|---|---|---|---|
| 1 | Clean air هواء نظيف | **76%** | 15% | 9% | 100 |
| 2 | Reliable electricity الحصول على الكهرباء بشكل موثوق | **81%** | 14% | 5% | 100 |
| 3 | Affordable electricity الكهرباء بأسعار معقولة | **77%** | 16% | 7% | 100 |
| 10 | Energy Efficiency كفاءة الطاقة | **77%** | 20% | 3% | 70 |
| 5 | Energy independence الاستقلال في مجال الطاقة | 70% | 25% | 5% | 100 |
| 6 | Safety of workers and public سلامة العمال والعامة | **76%** | 12% | 12% | 100 |
| 7 | Job creation خلق فرص العمل | 63% | 28% | 9% | 100 |
| 8 | Economic growth النمو الاقتصادي | **68%** | 24% | 8% | 100 |
| 9 | Climate change solution حل لتغير المناخ | 61% | 21% | 18% | 100 |

**Q16 - Do you associate nuclear energy a lot, a little, or not at all with… هل تربط الطاقة النووية كثيرا ،قليلا ،أو لا على الإطلاق مع ...**

| # | Question | A lot كثيرا | A little قليلا | Not at all لا على الاطلاق | Total |
|---|---|---|---|---|---|
| 1 | Reliable electricity الحصول على الكهرباء بشكل موثوق | 52% | 28% | 20% | 100 |
| 2 | Energy independence الاستقلال في مجال الطاقة | 52% | 24% | 24% | 100 |
| 3 | Energy Efficiency كفاءة الطاقة | 49% | 29% | 22% | 100 |
| 4 | Clean air هواء نظيف | 41% | 29% | 30% | 100 |
| 5 | Affordable electricity الكهرباء بأسعار معقولة | 47% | 36% | 17% | 100 |
| 6 | Economic growth النمو الاقتصادي | 49% | 33% | 18% | 100 |
| 7 | Safety of workers and public سلامة العمال والعامة | 34% | 25% | **41%** | 100 |
| 8 | Job creation خلق فرص العمل | 45% | 39% | 16% | 100 |
| 9 | Climate change solution حل لتغير المناخ | 31% | 31% | **38%** | 100 |

**Q17 - From 1 to 6 where 1 is the top grade and 6 means failure. What grade would you give to Jordan's energy planning? ما .يعني الفشل 6 هو أعلى درجة و 1 ، حيث6 إلى 1 من هي الدرجة التي تعطيها لتخطيط الطاقة في الأردن؟**

| # | From 1 to 6 where 1 is the top grade and 6 means failure. What grade would... | Percentage |
|---|---|---|
| 1 | 1 | 7% |
| 2 | 2 | 13% |
| 3 | 3 | 29% |
| 4 | 4 | 15% |
| 5 | 5 | 21% |
| 6 | 6 | 15% |
| | Total | 100% |

**Q18 - What are the reasons for that grade? (You can choose more than one) ما هي (يمكنك اختيار أكثر من اجابة) أسباب هذه الدرجة؟**

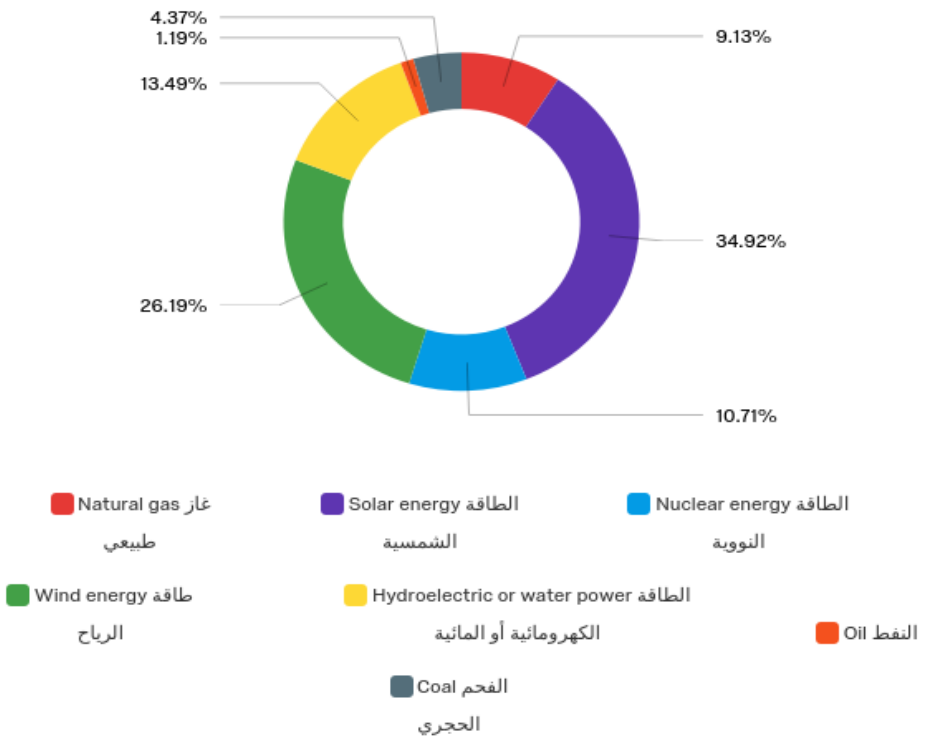
| # | What are the reasons for that grade? (You can choose more than one) ماهي... | Percentage |
|---|---|---|
| 1 | Poor planning/not planning ahead عدم التخطيط للمستقبل / سوء التخطيط | 45% |
| 2 | Need to use more alternative energy sources الحاجة إلى استخدام مصادر الطاقة البديلة أكثر | 57% |
| 3 | Government is not doing a good job الحكومة لا تقوم بعمل جيد | 36% |
| 4 | Too much politics involved مستوى عالي من التسييس | 39% |
| 5 | Too much dependency on foreign oil/energy – need to become energy independent الحاجة إلى أنتاج طاقة بشكل مستقل– الاعتماد العالي على النفط الأجنبي | 37% |
| 6 | Current plan is good الخطة الحالية جيدة | 4% |
| 7 | Not efficient energy sources لا مصادر طاقة ذات كفاءة عالية | 12% |
| 8 | Price/cost of energy is too high تكلفة الطاقة مرتفعة جدا / السعر | 34% |
| 9 | Current plan is not perfect, need to come up with a new one to plan for future (general) الخطة الحالية ليست مثالية ،تحتاج إلى خطة جديد ة للمستقبل ( عام | 24% |
| 10 | They are considering building a nuclear plant الحكومة تدرس بناء محطة نووية | 16% |
| | Total | 100% |

**Q19 - Thinking about the nuclear power plants that are operating now in the world, how safe do you regard these plants? Please think of a scale from "1" to "7," where "1" means very unsafe and "7" means very safe. The safer you think they are, the higher the number you would give فكر في محطات الطاقة النووية لتي تعمل حول العالم ،وفي مدى سلامتها ؛يرجى التفكير في نطاق من " 1 " إلى " 7 "، حيث" 1 " يعني غير آمنة جدا و " 7 " يعني آمنة جداً "**

| # | Thinking about the nuclear power plants that are operating now in the world... | Percentage |
|---|---|---|
| 1 | High (5-7) عالي | 12% |
| 2 | 7 – Very safe آمن جدا | 3% |
| 3 | 6 | 15% |
| 4 | 5 | 12% |
| 5 | Middle (4) متوسط | 26% |
| 6 | 3 | 7% |
| 7 | 2 | 6% |
| 8 | 1 – Very unsafe غير آمن جدا | 14% |
| 9 | Low (1-3) منخفض | 5% |
| | Total | 100% |

**Q20 - Which one of these energy sources do you think should be the most used as to generate electricity 10 years from now? (you can choose more than one) برأيك أي يمكنك اختيار ) سنوات من الآن؟ 10 واحدمن مصادر الطاقة هذه يجب استخدامها الأكثر في توليد الكهرباء بعد أكثر من اجابة)**

| # | Which one of these energy sources do you think should be the most used as... | Percentage |
|---|---|---|
| 1 | Natural gas غاز طبيعي | 23% |
| 2 | Solar energy الطاقة الشمسية | 88% |
| 3 | Nuclear energy الطاقة النووية | 27% |
| 4 | Wind energy طاقة الرياح | 66% |
| 5 | Hydroelectric or water power الطاقة الكهرومائية أو المائية | 34% |
| 6 | Oil النفط | 3% |
| 7 | Coal الفحم الحجري | 11% |
| | Total | 100% |




**Q21 - Please tell us if you agree or disagree with the following statement من فضلك قل لنا إذا كنت توافق أو لا توافق مع العبارة التالية .**

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حدما | Somewhat Disagree لا أوافق إلى حدما | Strongly Disagree لا أوافق بشدة | Total |
|---|---|---|---|---|---|---|
| 1 | We should take advantage of all low-carbon energy sources, including nuclear, hydro, and renewable energy, to produce the electricity we need while limiting greenhouse gas emissions يجبعلينا الاستفادة منكلمصادر الطاقةمنخفضة الكربون،بمافيذلكالطاقةالنووية والطاقةالمائية،والطاقةالمتجددةلإنتاجالكهرباء،بينمانحدمنانبعاثاتغازاتالاحتباسالحراري | 62% | 20% | 12% | 6% | 100 |
| 2 | We should not worry about climate change لا ينبغي لنا أن نقلق بشأن تغير المناخ | 10% | 15% | 18% | 57% | 100 |
| 3 | cheaper sources of energy should be used first مصادر أرخص من الطاقة ينبغي أن تستخدم اولاً | 46% | 33% | 16% | 5% | 100 |

**Q22 - Please tell us if you agree or disagree with the following statements من فضلك قل لنا إذا كنت توافق أو لا توافق مع العبارات التالية**

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حدما | Somewhat Disagree لا أوافق إلى حد ما | Strongly Disagree لاأوافقبشدة | Total |
|---|---|---|---|---|---|---|
| 1 | Nuclear power plants operating in the world are safe and secure محطات الطاقة النووية العاملة حول العالم هي آمنة ومأمونة | 11% | 43% | 26% | 20% | 100 |
| 2 | As we have learned from experience and as technology has improved, nuclear power plants have been made safer كما تعلمنا من التجارب ومع تحسن التكنولوجيا، أصبحت محطات الطاقة النووية أكثر أمانا | 22% | 36% | 26% | 16% | 100 |
| 3 | Nuclear power plants in the Middle East will be built to withstand the most extreme natural events that may occur here سيتم بناء محطات الطاقة النووية في منطقة الشرق الأوسط على الصمود في وجه الكوارث الطبيعية القصوى | 24% | 29% | 27% | 20% | 100 |
| 4 | If a nuclear plant is built in Jordan, the authorities will make sure that it will be safe and not have any accidents إذا تم بناء محطة نووية في الأردن فإن السلطات ستتأكد من كونها آمنة ولن يحدث لها أي حادث | 19% | 25% | 30% | 26% | 100 |

**Q23 - On the subject of nuclear waste management and specifically the management of the radioactive waste from nuclear power plants, do you agree or disagree with the following statements? حول موضوع إدارة النفايات النووية وتحديدا إدارة النفايات المشعة الناتجة عن محطات الطاقة النووية هل توافق أو لا توافق مع العبارات التالية؟**

| # | Question | Strongly Agree موافق بشدة | Somewhat Agree أوافق إلى حدما | Somewhat Disagree لا أوافق إلى حد ما | Strongly Disagree لا أوافق بشدة | Total |
|---|---|---|---|---|---|---|
| 1 | Radioactive waste from nuclear fuel are safely stored at a nuclear power plant site يتم تخزين النفايات المشعة من الوقود النووي بأمان في موقع محطة للطاقة النووية | 24% | 34% | 18% | 24% | 100 |
| 2 | Jordan should develop a Permanent disposal facility يجب على إنشاء منشأة للتخلص الدائم من النفايات المشعة | 58% | 13% | 10% | 19% | 100 |
| 3 | Nuclear waste can be transported safely يمكن نقل النفايات النووية بأمان | 19% | 33% | 19% | 29% | 100 |
| 4 | Nuclear waste should be sent outside Jordan يجب أن ترسل النفايات النووية خارج الأردن | 51% | 25% | 10% | 14% | 100 |

**Q24 - Please tell us if you think each of the following would be an excellent, good, fair, or poor source of accurate and reliable information about nuclear energy من فضلك قل لنا إذا كنت تعتقد كل من المصادر التالية ستكون ممتازة ،جيدة،عادلة،أو فقيرة لحصول على معلومات دقيقة وموثوقة عن الطاقة النووية**

| # | Question | Excellent ممتازة | Good جيدة | Fair عادلة | Poor فقيرة | Don't Know لا أعرف | Total |
|---|---|---|---|---|---|---|---|
| 1 | Nuclear energy scientists and engineers علماء ومهندسين الطاقة النووية | 41% | 36% | 8% | 13% | 2% | 100 |
| 2 | Safety, radiation, or environmental experts خبراء بيئة ،سلامة أو إشعاع | 36% | 37% | 17% | 9% | 1% | 100 |
| 3 | Politicians السياسيين | 8% | 13% | 11% | 61% | 7% | 100 |
| 4 | Electric utilities شركات الكهرباء | 12% | 24% | 31% | 28% | 5% | 100 |
| 5 | The Internet الإنترنت | 19% | 39% | 23% | 16% | 3% | 100 |
| 6 | Environmental groups جماعات حماية البيئة | 25% | 36% | 20% | 15% | 4% | 100 |
| 7 | Social media, such as Twitter, YouTube or Facebook وسائل التواصل الاجتماعي ،مثل تويتر، يوتيوب أو الفيسبوك | 18% | 28% | 21% | 26% | 7% | 100 |

**Q25 - What are the Priorities to improve Jordan's economic performance? ما هي الأولويات لتحسين الأداء الاقتصادي في الأردن؟**

| What are the Priorities to improve Jordan's economic performance? ما هي ال... | Percentage |
|---|---|
| a. Improve education and professional training تحسين التعليم والتدريب المهني | 39% |
| b. Invest in research and innovation الاستثمار في مجال لبحث والابتكار | 24% |
| c. Facilitate the creation of companies تسهيل إنشاء الشركات | 10% |
| d. Use energy more efficiently استخدام الطاقة بصورة أكثر كفاءة | 9% |
| e. Produce more electricity fast إنتاج المزيد من الكهرباء بسرعة | 1% |
| f. Invest in transport infrastructure (motorways, railways, etc.) الاستثمار في البنية التحتية للنقل ( الطرق السريعة والسكك الحديدية الخ ) | 15% |
| g. Increase the legal number of working hours زيادة العدد القانوني لساعات العمل | 0% |
| Total | 100% |