



ABU DHABI'S NUCLEAR POWER PLANT FOLLY

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In December 2009, Abu Dhabi awarded South Korean companies a four-reactor BOT contract to generate 5,600 MW of electricity. In two contradictions, the emirate announced in February 2008 the plan to build Masdar City, a zero carbon, zero waste, and 100 percent renewable energy powered town; and in July 2009, it became the secretariat headquarters of the International Renewable Energy Agency (IRENA). This article argues that Abu Dhabi's non-representative, non-participatory governance enables a poorly informed ruling elite enjoying rentier economic circumstances to reach such decisions. It concludes that the Masdar spirit and IRENA's principles require Abu Dhabi to abandon nuclear energy for safe solar and wind power.

THE NUCLEAR POWER PLANT

On December 28, 2009, Abu Dhabi awarded a contract¹ to build, operate, and transfer a 5,600 MW nuclear power plant composed of four reactors of 1,400 megawatt (MW) each to a consortium of South Korean firms.² The firms are led by Korea Electric Power Corporation and include Hyundai Engineering and Construction as well as Doosan Heavy Industries and Construction Company. The project is to be completed in three phases between 2017 and 2020. Its estimated cost is reported between \$20 and \$40 billion.

In contradiction, Abu Dhabi has been simultaneously involved in two projects that are the antithesis of nuclear energy in terms of safety, environmental protection, and the promotion of renewable energy alternatives. The first is construction of the futuristic Masdar project. The second is becoming the secretariat headquarters of the International Renewable Energy Agency (IRENA). In what follows is a description of the two projects.

CONTRADICTION I: THE MASDAR PROJECT

In February 2008, Abu Dhabi announced a futuristic environmentally friendly project called "Masdar,"³ the Arabic word for

"source." Costing \$22 billion, the Masdar project includes the construction of a six square kilometer zero carbon, zero waste, and a 100 percent renewable energy-powered city, called Masdar City, for about 50,000 residents specializing in the research and application of renewable energy and sustainable technologies. The electricity for Masdar City will be generated by solar power. Drinking water will be provided through a solar-powered desalination plant. Landscaping and agriculture will be irrigated with treated wastewater.⁴ A part of the Masdar project involves the making of hydrogen power commercially viable. To that end, Masdar is developing in Abu Dhabi a 500 MW hydrogen-fired power plant.⁵

CONTRADICTION II: HOSTING IRENA'S SECRETARIAT HEADQUARTERS

Abu Dhabi's decision to build the Masdar project may have been driven by its eagerness to become the first city in the Middle East to host the headquarters of an international organization. The Masdar project was announced in February 2008, just a few months prior to the International Renewable Energy Agency's (IRENA) establishment in January 2009. A well-orchestrated campaign by Abu Dhabi offered IRENA a package

worth \$136 million, including a \$22 million headquarters building in Masdar City that would be “energy positive” with a solar photovoltaic (PV) roof, rent free for life, plus \$3 million annually for facility operations, a \$50 million fund for renewable energy projects in developing countries, scholarships, and a host of other features.⁶ In July 2009, Abu Dhabi won the vote to host the agency’s secretariat headquarters, while Bonn, Germany, was named the site of an IRENA Center for Science and Technology, and Vienna, Austria, became the site of an IRENA liaison office for cooperation with other organizations active in the field of renewable energy.

In December 2009, five months after becoming IRENA’s secretariat headquarter city, Abu Dhabi announced its four-reactor nuclear power plant. The emirate’s decision to build not one, two, or three, but a four-reactor power plant was the antithesis of the Masdar project’s ideals and a betrayal of IRENA’s principles, as appears in its mission statement: “To promote the widespread and increased adoption and sustainable use of all forms of renewable energy. IRENA’s Member States pledge to advance renewables in their own national policies and programs, and to promote, both domestically and through international cooperation, the transition to a sustainable and secure energy supply.”⁷

IGNORING WHAT HISTORY HAS TAUGHT

The lessons from the disasters at Three Mile Island⁸ in the United States in 1979 and at Chernobyl in the Ukraine in 1986,⁹ the scores of radiation incidents since the 1940s,¹⁰ and the challenge of safe disposal of spent reactor fuel all seem to have been overlooked in the decision to develop nuclear energy.¹¹

The decision to build a four-reactor plant is particularly disconcerting because it is oblivious to the fact that environmentally friendly and safe technologies for harnessing the sun, wind, and other renewable energy sources to generate electricity on a commercial scale are already available. A

report by the Renewable Energy Policy Network for the 21st Century (REN21) demonstrates that in 2008 global power capacity from new renewable energy sources (excluding large hydro) reached 280,000 MW, a 16 percent rise from 2007.¹² This represents nearly three times the capacity of the United States nuclear sector. Further, the report states that for the first time, more renewable energy than conventional power capacity was added in 2008 in both the European Union (EU) and United States.

Below is a brief review of the two nuclear disasters at Three Mile Island in the United States and at Chernobyl in the Ukraine. This will be followed by a discussion on why alternative energy resources to nuclear electricity generation should be pursued. Last, the motives for Abu Dhabi’s contradictory decisions regarding Masdar City and its nuclear energy project are explored.

The Three Mile Island Accident

On March 28, 1979, a partial reactor core meltdown at the Three Mile Island power plant in Pennsylvania severely damaged a brand new reactor--online for only three months.¹³ The experts, who had argued that an accident like this could not happen, initially described it as a “minor malfunction.” Within days, 140,000 people had left the area. Radiation releases from the accident were contained, so that no perceptible effect on cancer incidence was observed, though one team of researchers contested these findings.

Cleanup of the accident took 14 years (from August 1979 to December 1993) and cost around \$975 million. Initially, efforts focused on the cleanup and decontamination of the site. Starting in 1985, radioactive fuel was removed. The defueling process was completed in 1990. The damaged fuel was removed and disposed of in 1993. The contaminated cooling water that leaked into the containment building had seeped into the building’s concrete, leaving the radioactive residue impossible to remove. The accident dented the popularity of nuclear energy--from

1980 to 1984, 51 American nuclear reactors were cancelled.

The Chernobyl Disaster

On April 26, 1986, a reactor at the Chernobyl plant in the Ukraine had a fatal meltdown.¹⁴ A plume was released into the atmosphere containing four hundred times more radioactive fallout than had been by the atomic bombing of Hiroshima. Rain contaminated with radioactive material fell as far away as Ireland. 600,000 people were exposed to high levels of radiation. Over 336,000 people were evacuated and resettled. Farming and other types of agricultural industry would be dangerous for at least 200 years in a large area, and it would be at least 20,000 years before the site of the meltdown were safe.

While Three Mile Island and Chernobyl have been the most serious nuclear accidents thus far, scores of less serious nuclear and radiation accidents have afflicted this industry since the 1940s.¹⁵

THE CASE FOR ABANDONING NUCLEAR POWER GENERATION

The development in recent years of safe and environmentally friendly renewable resources of energy to generate electricity from the sun and wind, among other means, has raised the standards of safety and environmental protection for the nuclear power industry. Given the catastrophic consequences on the lives and well-being of millions of people in the event of a major reactor accident, nuclear power plants must be 100 percent safe, not only 99.99 percent safe.

There cannot be disagreement among proponents and opponents of nuclear energy regarding the catastrophic loss to life and property resulting from a major reactor accident. The disagreement between the two camps, however, surrounds the probability that such an accident might materialize. Evaluating such probability is a subjective matter.

The nuclear power industry claims that reactor design since the Three Mile Island and

Chernobyl accidents has improved and that nuclear energy is now safe and environmentally friendly. The industry's lobbyists are working to convince world leaders that nuclear energy should be part of the solution to the world's future energy needs.

Yet opponents of nuclear energy contend that such claims ignore the carbon footprint created by the processes that turn uranium ore to nuclear fuel. Such claims also ignore the millennia-long damage to the environment resulting from the toxic waste left by the operations of nuclear reactors. Opponents of nuclear power plants believe that all things mechanical are likely to break down at some point due to design defect or human error. They believe that regardless of how infinitesimal the probability might be of a major reactor accident materializing, discounting the monumental losses that would result from such an accident by the infinitesimally tiny probability of the accident occurring would still leave a prohibitively high potential loss to accept.

In the case of a major nuclear accident, the UAE and its neighbors would suffer horribly. They do not possess--indeed, no country possesses--enough hospitals, surgeons, or scientists to cope with a sudden and unexpected flood of tens of thousands, possibly hundreds of thousands, of casualties. Further, in Abu Dhabi's case, there is the added danger of radioactivity contaminating regional seawaters and disabling the desalination plants that provide millions of people with clean drinking and household water. This issue will be discussed next, followed by the challenge of dealing with nuclear waste.

Radioactive Accidents Might Disable Desalination Plants

The possibility must not be ruled out that a major radiation leak might force the closure of some--possibly all--of the desalination plants that dot the shores of the eastern coast of the Arabian Peninsula. These plants supply drinking and household water to the entire

populations of Kuwait, Bahrain, Qatar, the UAE, Oman, and the cities and towns of the Eastern Province of Saudi Arabia such as Dammam and al-Khobar, as well as the cities and towns of the Qasim region and the capital, Riyadh. If such an accident were ever to occur, the scale of the resulting human calamity would be unimaginable. Twenty-five million people could be affected. They use some 2.5 billion cubic meters per annum of desalinated water, or seven million cubic meters per day for drinking and household purposes. To put such a daily volume in perspective, it is equivalent to the combined cargos of 14 super-tankers of 500,000 tons each. No emergency preparedness could deliver even a quarter of such a massive volume of clean water on a daily basis for extended periods of time. Indeed, not only would the existing water supplies be radioactive, but the rescue tanker deliveries would become contaminated once they reached the affected areas. Evacuation of millions of people might become necessary, a nightmare of epic proportions in an area bordered by the forbidding Empty Quarter Desert and the sea. As to where these millions might go, that is a whole different challenge to deal with.

The Challenge of Nuclear Waste

Even if all four reactors were to operate without any problem, there would still be the grim task of safely disposing of toxic waste. Reactor waste is radioactive and must be isolated from the biosphere until the radioactivity has diminished to a safe level. Special physical, chemical, and thermal characteristics must be met before a burial site is deemed suitable for the decaying radioactive waste, which may require even a million years until it becomes safe.¹⁶

Meanwhile, during the long sweep of the millennia, an earthquake, a volcano, or some other natural disaster might force the decaying waste to the Earth's surface. Disturbing nuclear waste accidents have already occurred. For example, in the former Soviet Union, waste stored in Lake Karachay was blown

over the area in the spring of 1968 as the lake began to dry up, and the wind carried away a substantial volume of radioactive dust, irradiating half a million people.¹⁷ At Maxey Flat, a low-level radioactive waste facility located in Kentucky, containment trenches collapsed under heavy rainfall and became radioactive.¹⁸ In France, at the Areva plant in Tricastin, liquid containing untreated uranium overflowed out of a faulty tank and about 75 kg of the radioactive material seeped into the ground and, from there, into two nearby rivers.¹⁹

Safe and environmentally friendly solar and wind power are available on a commercial scale and should replace the potentially disastrous 5,600 MW of Abu Dhabi's four reactors. Even if the cost of nuclear electricity is a fraction of the cost of alternative technologies, it is a matter of safety and environmental protection, not economics or finance.

Further, it is doubtful whether nuclear energy is truly cost effective when taking into account the costs beyond the construction and operation of the nuclear power plant. First, there is the cost of decommissioning the reactor at the end of its useful life as well as the costs of disposal of the toxic nuclear waste. Decommissioning costs are enormous. The cleanup costs of decommissioning in the United Kingdom, for example, stood at \$110 billion in 2008. In the United States, even if no new reactors are built, getting rid of the country's nuclear waste will cost \$96.2 billion, according to the Department of Energy.²⁰ Second, there is the capital investment and maintenance of the emergency preparedness assets required to deal with the tens and possibly hundreds of thousands of casualties from a sudden major reactor accident. Last and above all, the loss of life and property damage alone should dissuade decisionmakers from pursuing the nuclear option altogether.

THE CASE FOR SOLAR AND WIND POWER

A number of alternative renewable power resources to generate electricity are available

today on a commercial scale; such as, geothermal, sea waves, solar, and wind, among others. Following is a brief description of two renewable resources: solar power and wind power, both resources in great abundance in the Middle East in general, and the Arabian Peninsula and the UAE in particular.

Solar Power

Solar power is the generation of electricity from sunlight. The solar power industry is growing rapidly with almost 14,000 MW to be added globally through 2014.²¹ Using a technology known as Concentrated Solar Power (CSP), Solar Energy Generating Systems (SEGS) built the world's largest commercially successful solar power generating network in California's Mojave Desert. SEGS is composed of nine plants built between 1984 and 1990 covering more than 900,000 mirrors over 1,500 acres. It generates 310 MW, sufficient to meet the electricity demand of more than 230,000 homes at peak production during the day.²² CSP relies on mirrors or lenses to heat water to drive steam generators.

In 2008, photovoltaic (PV) technology was introduced on a commercial scale. Photovoltaics is the direct conversion of light into electricity. Some materials exhibit a property that causes them to absorb photons of light and release electrons. When these free electrons are captured, this creates an electric.²³ PV cells are constructed of two thin layers of semi-conducting materials (usually silicon) that have been treated chemically. When sunlight hits the PV cells, it creates an electric field across the two layers.

As of October 2009, the largest PV power plant was the Olmedilla Photovoltaic Park in Spain, a 60 MW facility (meeting the electricity needs of more than 40,000 homes).²⁴ Larger PV power plants are currently under construction. These include the 550 MW Topaz Solar Farm in California, expected to begin power delivery in 2011 and be fully operational by 2013²⁵ as well as the 600 MW Ranch Cielo Solar Farm in New

Mexico expected to open in 2010 and estimated at \$840 million.²⁶ To put 600 MW-capacity in perspective, two of the Rancho Cielo safe and environmentally friendly plants could produce 86 percent of the capacity of one 1,400 MW of Abu Dhabi's potentially dangerous four nuclear reactors.

While cost is not the focus here, it is compelling, to note that the capacity of Abu Dhabi's 5,600 MW nuclear power plant could possibly be produced using solar power plants of the Rancho Cielo type for around \$8 billion, as compared to between \$20 and \$40 billion (see above). On the individual dwelling level, solar heated water in Germany marked record growth in 2008, with over 200,000 systems installed.²⁷

Wind Power

Wind power is the conversion of wind energy using wind turbines to make electricity. A 2005 study published in the *Journal of Geophysical Research* found that wind power could satisfy up to seven times the world's electricity needs.²⁸ World wind generation capacity has been growing rapidly in recent years. Existing wind power capacity grew by 29 percent in 2008 to reach 121 GW, or more than double the 59 GW of capacity in place at the end of 2005.²⁹ Wind power accounted for 42 percent of new capacity additions in the United States and for 36 percent of new installations in Europe. As of May 2009, 80 countries around the world were using wind power on a commercial basis.³⁰

The EU climate and energy strategy released on January 23, 2008, commits the community as a whole to source 20 per cent of its total energy demand from renewable sources by 2020.³¹ In the United Kingdom, over 40,000 MW of offshore wind projects are at various stages of development. When completed, by around 2020, a third of the UK's electricity will be generated by wind power.³² Such capacity is equivalent to more than seven times the capacity of Abu Dhabi's four nuclear driven generators, which will go on line about the same time in 2020.

In 2008, China installed approximately 6,300 megawatts, doubling the nation's cumulative wind capacity for the fourth year in a row. The Chinese Renewable Energy Industry Association projects wind capacity to reach 50,000 MW by 2015.³³

ABU DHABI'S DECISION TO SEEK NUCLEAR POWER GENERATION

Abu Dhabi's decision to purchase a huge nuclear power plant at a time when safe alternatives are readily available is inexplicable. How and what kind of decisionmaking processes would produce such potentially disastrous decisions? In response to this question, Abu Dhabi's style of national governance should be considered.

Abu Dhabi's governance is autocratic, non-representative, and non-participatory. Like other Arab kings, emirs, sultans, and presidents Abu Dhabi's ruler Shaykh Khalifa bin Zayid al-Nahyan, also president of the United Arab Emirates is an absolute tribal/clan ruler. Under this power pyramid, the national decisionmaking coalition is very narrow. It consists of a few senior members of the ruler's immediate family. It is easy, therefore, to see why the contract to import four reactors to generate electricity represents a politically driven energy policy with the negative consequences of a poorly informed and self-absorbed ruling elite enjoying rentier economic circumstances of an economy awash with crude oil exports.

In pursuit of tens of billions of dollars in export revenues, foreign suppliers--in this case of nuclear power plant manufacturers and their agents, supported by their governments and politicians--closely associate themselves with the political and business elites in Arab oil exporting countries in general, including Abu Dhabi. Unsafe and potentially disastrous schemes such as nuclear reactors are attractively packaged and propagated with nationalist slogans. In the absence of political parties, a free press, environmental groups, or non-partisan non-governmental organizations, it is impossible to introduce a sound balancing

economic or environmental perspective into energy policy.

There has been no effective dissent in Abu Dhabi against the new nuclear power plant. Nor were there calls to explain the contradiction between the environmentally friendly Masdar project and the emirate's potentially disastrous nuclear power project. Two possible motives for Abu Dhabi's decision are discussed next.

Enriching the Business Elite

The business elite in the UAE, similar to those in the rest of GCC states and the wider Arab world supports its ruler in return for a business environment conducive to making money. The Abu Dhabi merchant families import a myriad of goods, represent foreign companies, engage in joint ventures with outside partners, manufacture light goods, etc. In conducting these businesses, the merchants enjoy privileges such as beneficial monetary, fiscal, and foreign exchange policies; protection from foreign competition; and a labor law that tolerates ill treatment of foreign workers, including the absence of a minimum wage legislation, debilitating work conditions for manual laborers, extremely poor living accommodations, no right to change employment or to leave without employer's permission. Actions taken by the foreign workers such as strikes often instigate brutal police reactions, severe penalties, and deportation.

Merchant families are important for the emirate's internal security. Foreign workers, mainly employed by the business sector constitute around 85 percent of the UAE's estimated population of six million. Given that the government bans political parties, social associations, and labor unions, employers become the eyes and ears of an elaborate internal security force--a first line of defense against political dissent and labor unrest.

It is safe to consider that a certain proportion of the \$20 to \$40 billion nuclear power plant contract as well as the \$22 billion Masdar project, among other government schemes, will benefit Abu Dhabi's merchant families. Foreign companies work locally

through local sponsors in return for hefty commissions to the sponsors. Also, while foreign companies are the primary contractors, there will be a good deal of sub-contract work for local companies to perform.

Egoism and Regional Posturing

The second motive behind Abu Dhabi's contradictory decisions is egoism, that is the desire to show that it is also important, rich, modern, on the edge of technology, and in a sense powerful. Gulf Cooperation Council states (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates), with trillions of dollars in revenues and reserves from crude oil exports, are locked into a wealth-flaunting contest. They compete with one another on who has the tallest building, owns the biggest airline, the largest airport, the most gigantic indoor theme park, hotel, golf course, ice skating rink, even who attracts the most foreign conventions and sporting tournaments, and so on. Specifically, in Abu Dhabi, egoism may explain Abu Dhabi's eye-catching projects. Following are three examples.

The first is the world's most expensively constructed hotel. Opened in 2005, the Abu Dhabi government-owned Emirates Palace cost \$3 billion.³⁴ It has an entrance arch just slightly smaller than the Arc de Triomphe in Paris and a lobby-atrium with a dome larger than St. Paul's Cathedral in London, topped by a two-meter finial made of solid gold.³⁵

The second is a Louvre Museum clone in Abu Dhabi, to be completed by 2012. A 30-year agreement for a Louvre in Abu Dhabi was announced on March 7, 2007. Abu Dhabi paid \$525 million to be associated with the Louvre name, and an additional \$747 million in exchange for art loans, special exhibitions, and management advice.³⁶ By around 2020, Abu Dhabi is also expected to spend about \$500 million building its own collection, with the French Museums Agency expected to play an advisory role. These figures do not include the cost of the museum's construction, estimated at around \$110 million.³⁷

The third is the world's largest indoor theme park at a cost of \$40 billion. The highlight of this development is the Yas Island Circuit, which hosts the Formula One Abu Dhabi Grand Prix.³⁸

While there is of course a strategic element here--to increase the emirate's regional political standing--building national morale and confidence is also an important factor. Abu Dhabi's importation of four nuclear reactors may be seen as a way for its leaders to flaunt the vast financial reserves their emirate has accumulated in recent years and assert itself both regionally and internationally. For example, in a clear challenge to Saudi Arabia and in order to share the limelight with Riyadh, Abu Dhabi was forceful in its effort to become the headquarters of the proposed Gulf Monetary Union, or the GCC's Central Bank. Riyadh won the contest on May 6, 2009, and on May 21, 2009, the UAE quit the proposed union in retaliation.³⁹

Regarding Iran, the UAE is in a serious dispute with Teheran over three small islands near the Strait of Hormuz: Abu Musa, Greater Tunb, and Lesser Tunb. The islands were invaded on November 30, 1971, by the Shah's forces and forcibly seized. Bilateral talks between the UAE and Iran in 1992 failed. The UAE have attempted to bring the dispute before the International Court of Justice, but Iran refuses to do so. Frustrated by its inability--despite its riches--to challenge Tehran over the three islands, Abu Dhabi's four 5,600 MW reactors, which dwarfs in size Iran's single 1,000 MW reactor at Bushehr, might go a certain way toward restoring some of the lost national pride felt at home in the UAE for domestic consumption.

CONCLUSION

As a member of IRENA and the location of the IRENA secretariat headquarters, Abu Dhabi is obligated to promote the agency's objectives faithfully and vigorously. Yet Abu Dhabi has paradoxically contracted to import from South Korea a huge state-of-the-art nuclear power plant, which will serve as a showcase for the nuclear power industry to

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