Desalination Plants and the Iran War: Infrastructure Vulnerability, Geopolitical Risk, and Geoeconomic Consequences

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Introduction:

Geographic and climatic realities in the Arabian Peninsula render water security inseparable from the region's broader strategic calculus. As the U.S.-Iran-Israel conflict has unfolded, desalination facilities have gained importance beyond their status as civilian infrastructure, becoming a critical node where military escalation, energy markets, and economic stability overlap. This report examines how desalination infrastructure has shaped the ongoing conflict and how it may shape a future conflict. These dynamics matter from a strategic viewpoint as well as a humanitarian one. The most likely manifestation for strikes on water infrastructure is infrequent limited infrastructure strikes and cyberattacks as a responsive and managed escalation. A concerted assault on these sites is only likely if the risks are interpreted as existential, as this would open the attacker to high-intensity reprisal such are the consequences of an attack of this nature.

Beyond the immediate military dimension, this report situates desalination within a wider network of interdependence. Since desalination plants rely heavily on petroleum-derived fuel and co-generated steam, attacks on oil, energy, or water infrastructure inevitably cascade across all three sectors. These effects extend into financial markets, sovereign credit ratings, insurance costs, agriculture, and foreign investment, illustrating how a single strike on a desalination facility can reverberate through a nation's entire economic architecture. These insights have implications beyond the region analyzed, as water stress and climate change increasingly enter the realm of national security.

2. Background: Water Scarcity and Gulf Desalination Dependence

The Arabian Peninsula is among the dryest regions on the planet, with rain frequently falling in short and intense episodes that produce temporary runoff before the water evaporates. Much of the region receives less than 100 millimeters of rainfall annually, while potential evaporation exceeds 3,000 millimeters. Arabia consequently has limited perennial surface water, so only a small share of rainfall becomes water that can be stored or reused through the natural hydrological cycle (1).

FAO AQUASTAT places long-term average annual precipitation at 59 millimeters in Saudi Arabia, 78 millimeters in the United Arab Emirates, 74 millimeters in Qatar, and121 millimeters in Kuwait. In 2023, Saudi Arabia had 2.4 billion cubic meters of total renewable water resources, equivalent to approximately 72.1 cubic meters per person. The UAE had 0.15 billion cubic meters, while Kuwait had 0.02 billion cubic meters (2). These volumes present natural bottlenecks that leave growing cities and urban populations with little freshwater. Over time, desalination became embedded in everyday water provision because the Gulf's natural water cycle supplies only a small fraction of the freshwater required by the population (3). The resulting supply gap encouraged Gulf governments to build municipal water systems using seawater to meet urban development needs. However, these water systems address only one part of the region's total water demand. Agriculture, industry, cooling, and other services may rely on groundwater, desalinated water, or a combination of sources. Desalination is important for municipal supply, while agriculture in several Gulf states continues to rely heavily on groundwater.

Groundwater depletion

Groundwater initially extended the limited supply available from rainfall, however, much of the water beneath the Peninsula is accumulated during wetter geological periods. Deep sedimentary aquifers, concentrated primarily in Saudi Arabia and Oman, contain an estimated 2,175 billion cubic meters of water (4). Nevertheless, water withdrawn from these fossil formations is replenished too slowly to support constant extraction. When groundwater levels fall, wells must be drilled deeper into the aquifer. Though groundwater can continue to support localized supply, its shrinking usable reserves limit its capacity to meet future demand. As a result, desalination has assumed a large role in municipal provision as aquifers have become less reliable.

Agricultural development has further drawn down the groundwater reserve, especially in Saudi Arabia. The General Authority for Statistics recorded 10.849 billion cubic meters of non-renewable groundwater abstraction in 2023, with agriculture consuming 9.356 billion cubic meters of that amount (5). Comparable pressure appears in smaller Gulf states. FAO AQUASTAT reports the UAE's long-term renewable groundwater resources at 0.12 billion cubic meters, while its latest available fresh groundwater withdrawal is 2.156 billion cubic meters. Qatar boasts 0.056 billion cubic meters of renewable groundwater resources and a groundwater withdrawal of approximately 0.25 billion cubic meters (6). Extraction above renewable groundwater flows leaves part of each year's withdrawal unreplaced, progressively reducing the usable water held in the aquifer.

Population growth and urbanization

Population growth has expanded the consumption burden on the Gulf's naturally limited water resources. The UAE's population rose from approximately 3.49 million in 2000 to 10.99 million in 2024, while Saudi Arabia's population reached 35.3 million (7). Most of this demand is concentrated in cities. In 2024, urban residents represented 99.4 percent of Qatar's population, 88 percent of the UAE's, and about 85 percent of Saudi Arabia's (8). This concentration channels water consumption through centralized treatment, storage, and distribution systems. Coastal cities can receive desalinated water directly from nearby plants, while inland population centers require water to be pumped across longer distances. Urban growth has consequently expanded both the volume of desalinated water required and the infrastructure needed to deliver it.

Water use and data centers

Saudi Arabia consumed 15.839 billion cubic meters of water in 2023, with 50 percent of the supply flowing through Saudi's water networks provided by desalination (9). Even though desalination met only an estimated 18.1 percent of national demand, desalination plays a much larger role in urban and household water supply than its share of total national water use implies. Saudi Arabia's large agricultural sector expands the total-demand denominator with groundwater-based irrigation. As does Qatar, whose highly urbanized population routes a greater proportion of national consumption through desalination facilities. Digital infrastructure introduces an emerging source of water demand. Saudi Arabia had 22 active co-location facilities and more than 40 under construction, while the regional market was projected to double

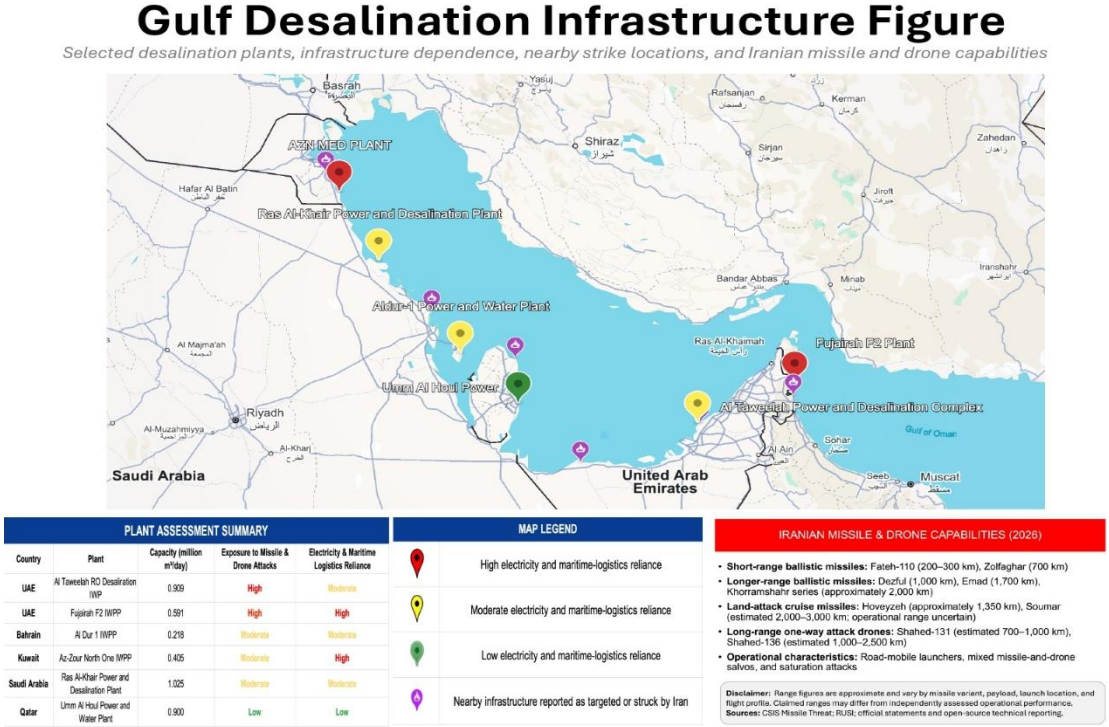
by 2030 (10). This expansion adds cooling and electricity demand in a hot region, but the amount of additional water required depends on the cooling technology and power supply used by each facility.

Climate stress

Climate change adds heat pressure to a water system already operating near physical limits. The World Meteorological Organization reported that 2024 was the region's hottest year on record, with temperature 1.08°C above the 1991–2020 average (11). World Bank CMIP6 projections show increases in average surface air temperature across Saudi Arabia, the UAE, Qatar, and Kuwait, and the projected temperature signal shifts beyond historical natural variability more clearly than precipitation trends (12). Warmer air can hold more water vapor, which raises evaporative losses from soils and exposed water surfaces after rainfall. Air-conditioning systems also operate for longer periods as ambient temperatures rise, shifting peak electricity demand into the hottest months. Desalination plants must continue operating during the same periods, reducing the spare generating capacity available across the water system.

Figure 1. Comparative Dependence of Desalination (13)

Country	Population (millions, 2023-24)	Share of total national water demand	Share of drinking/ municipal water	Annual desalinated water production (million m³/yr)	Dependence
Qatar	3.2	77.3%	99%	560	Extreme
Bahrain	1.6	67.5%	90%	242	Extreme
Kuwait	4.3	42.2%	90%	712	Very high
UAE	9.9	52.1%	42%	2,005	High
Oman	5.1	31.0%	86%	280	Moderate
Saudi Arabia	34.0	18.1%	70%	1,947	Moderate
Iran	**92.0**	**3.0%**	**N/A**	**233**	**Low**



Map source: Google Earth. Plant locations, infrastructure-dependence ratings, and exposure assessments are the authors' analysis based on official plant documentation and open-source reporting.
https://earth.google.com/earth/d/1C1cTO_99VaWtoYGOufpQp4zF5MP51Gwc?usp=sharing

3. The Iran War and Strategic Infrastructure Targeting

Attacks and Threats to Desalination Facilities

Across the world, governments and armed actors increasingly view continued water and natural resources through the lens of national security. Attacks on desalination plants fail to distinguish between military and civilian targets, rendering the humanitarian, legal, and political consequences of an attack difficult to ignore. Desalination plants are vulnerable as a result of the system's geography, requiring direct access to seawater, leaving many of the region's largest facilities fixed, visible, and concentrated along the coast. Operations necessitate electricity, seawater intakes, pumps, treatment chemicals, skilled personnel, digital control systems, storage facilities, and transmission networks. An attack does not need to destroy the entire plant to interrupt water production. Damage to a power connection, intake, pumping station, or transmission line may be enough to stop operations.

A strike on a combined power-and-water station could reduce electricity and freshwater production at the same time. Damage to a seawater intake could halt production even if the main plant remained intact. Maritime conflict, oil spills, or other forms of pollution could also contaminate the source water entering a facility and force plant closure (14). Disruption to shipping could delay the delivery of membranes, treatment chemicals, replacement equipment, and other supplies needed to maintain operations. These connections allow an attacker to place pressure on a much larger civilian and economic system by damaging only one part of the network (15) (16). From the Gulf governments' perspective, protecting only the main plant buildings would leave much of the system exposed. The wider system includes seawater intakes, substations, pipelines, reservoirs, control networks, vendor connections, and repair supply chains. Defense planning must account for all of these components. Governments also need emergency water storage, spare equipment, distributed production, regional interconnections, cyber protection, and trained repair teams.

Targeting desalination facilities did not appear in any publicly announced campaign related to the 2026 U.S.-Iran-Israel War, instead, the pattern developed gradually through physical attacks, disputed allegations, retaliatory statements, and threats of further escalation. It is important to separate confirmed damage from claims about who carried out an attack or whether a desalination facility was the intended target. Critically, water production can be affected indirectly by damage to electricity infrastructure, maritime disruption, pollution, cyber incidents, or a precautionary shutdown. In an active conflict, governments may use attribution claims of attacks on civilian infrastructure to support their own escalation narratives (17).

Developments from July 17 through July 22 show that this risk is no longer hypothetical. Kuwait reported consecutive attacks on facilities connected to desalination, while Iranian state media alleged that an electricity-and-desalination plant in Hormozgan had also been struck. The United Nations called for attacks on essential civilian infrastructure to stop. The United States then publicly linked future Iranian attacks on shipping in the Strait of Hormuz to retaliatory strikes against Iranian bridges or power plants (18) (19) (20). Together, these developments show how shipping, electricity, energy, and water infrastructure are becoming connected parts of the escalation cycle.

Strategic Logic and Humanitarian Dimension

The logic of cost imposition expands into a broader theoretical framework of coercive infrastructure targeting. The coercion theory differentiates denial strategies, which aim to directly defeat adversary military forces from punishment strategies, seeking to increase costs on civilian populations and economic expenses to the point that resistance becomes politically unacceptable (21). Civilian infrastructure targeting

applies punishment strategy to physical systems, such as plants, grids and networks that deliver what civilians need. Water facilities are generally presumed to be civilian objects and parties to a conflict must distinguish civilian objects from military objectives, take feasible precautions, and consider whether expected civilian harm would be excessive in relation to the anticipated military advantage. Drinking-water installations and supplies also receive special protection under international law, subject to limited legal exceptions (22). These protections do not remove water infrastructure from military calculations, instead, they increase the legal, diplomatic, and reputational costs associated with attacking it.

States are tempted to use this strategy when they are unable to defeat an adversary's forces due to insufficient conventional military strength (23). This relates to Iran's position with the United States and Israel. The costly wartime experience of the Iran-Iraq War forged a strategic culture and military doctrine rooted in asymmetric deterrence and irregular warfare strategies, best exemplified by forward defense in the Shia Crescent to impose costs on adversaries without risking fighting on Iranian territory. In the decades since, this doctrine has evolved to states prioritizing missile capabilities, which offer immense target flexibility. While states can deploy missile defenses or secure facilities underground, these costly counterstrategies often remain limited to military compounds, leaving civilian infrastructures more vulnerable.

Given that desalination facilities are fixed coastal installations vital to regional survival, they represent uniquely vulnerable high-impact targets. This dependence creates a possible source of asymmetric leverage for Iran, especially against Gulf states with stronger conventional forces and close security relationships with the United States. Hudson Institute analysis argues that Iran could exploit the region's dependence on desalination to pressure Gulf governments and complicate U.S. efforts to control the conflict (24). Previous attacks were primarily used as a response mechanism to apply political pressure, not legitimate attempts to induce humanitarian crises. Instead, it is an asymmetric warfare tactic and deterrent to communicate the ability to induce high costs on civilian and state infrastructure alike. Limited Iranian strikes on water infrastructure present a strategy of managed escalation and deterrence signaling, communicating red-lines and their ability to impose acerbic costs on their adversaries.

Despite international law protections, the deeper risk is that water infrastructure becomes an accepted bargaining instrument in regional conflict. Once attacks and threats against desalination become part of reciprocal deterrence, similar actions may become easier to justify during future crises. The United Nations Economic and Social Commission for Western Asia estimates that nearly 40 million people in GCC countries depend on desalinated water drawn from the Gulf. A prolonged disruption could quickly develop into a humanitarian emergency (25).

The Cyber Dimension

Desalination facilities and water infrastructure are not only vulnerable to physical strikes, as they depend on industrial control systems to run pumps, valves, chemical dosing, pressure, and water-quality monitoring. Manipulating these systems could interrupt production, damage equipment, and force a shutdown without a single drone or missile (26). A cyber attack could gain initial access through an

enterprise network, an exposed remote-access service, stolen credentials, or a third-party vendor, followed by movement into the operational-technology environment that runs the physical process. Once there, an adversary could stop pumps, change valve positions, alter chemical dosing, falsify sensor values, or mislead operators, any of which could force a shutdown.

This is not hypothetical for Iranian actors. IRGC-affiliated groups have exploited internet-facing Unitronics controllers left on default passwords or no password at all across water and wastewater systems (27)(28). A joint federal advisory of April 7, 2026, went further: the Federal Bureau of Investigation, Cybersecurity and Infrastructure Security Agency, National Security Agency, Environmental Protection Agency, Department of Energy, and U.S. Cyber Command reported Iran-affiliated actors exploiting internet-facing OT devices, including Rockwell Automation and Allen-Bradley controllers used in water, wastewater, and energy environments. The actors interacted with controller project files and manipulated information shown through HMI and SCADA systems, and some organizations experienced operational disruption and financial loss. The agencies assessed that this activity increased as tensions grew among Iran, Israel, and the United States (29). The advisory does not document an attack on a Gulf desalination plant, but it shows Iran-affiliated actors actively pursuing disruptive access to the same class of systems these plants depend on.

Prevention requires OT-specific security, not standard business tools. NIST Special Publication 800-82 Revision 3 stresses safety, reliability, and continuous availability. Plants should maintain an accurate OT inventory, remove unnecessary internet exposure, require phishing-resistant multifactor authentication for remote access, tightly control vendor connections, and segment enterprise and OT networks with access limited by operational role. Because active scanning can disrupt operations, facilities should rely on passive, protocol-aware monitoring and watch for changes to controller logic (30). Safety systems warrant separate protection, with credentials and network trust kept apart from ordinary process control. Resilience closes the gap: offline and immutable backups of controller configurations, tested manual procedures, spare components, emergency water storage, and OT-specific incident-response exercises (30) (31). These measures cannot eliminate cyber risk, but they make an intrusion harder and reduce the damage if one occurs.

4. Geopolitical Risk Analysis

Regional Power Competition: Who are the Actors?

Iran

Iran instrumentalizes attacks on desalination infrastructure to secure asymmetric advantage over its Gulf rivals. They are likely to keep attacks on desalination as a coercive reserve instrument and an escalation signal, since a systematic and large-scale attack on desalination facilities would constitute a definitive escalatory action, exposing Iran to high-impact retaliatory strikes on civilian infrastructure.

Accordingly, Iran has incorporated desalination plants into its strategic calculations, but has acted with relative restraint. On March 22, 2026, the Iranian military warned that if Iran's energy infrastructure was attacked, Iran would target regional energy systems and desalination facilities associated with the United States and its partners. The IRGC issued a narrower statement the following day that focused on retaliatory strikes against power plants and appeared to withdraw the threat against desalination facilities (32) (33). This strategic retrenchment may reflect Iran's calculation that attacking water facilities would increase the intensity of its adversaries' retaliation and the political costs, while stepping back from this threat leaves room for diplomatic restraint and reduces the risk that a broader regional coalition will be formed against Iran in the future.

Desalination also serves a defensive strategic role for Iran. Southern islands and coastal settlements are dependent on these facilities, while projects transferring water from the Persian Gulf and the Gulf of Oman are intended to sustain industrial production and demonstrate Iran's ability to develop infrastructure under sanctions (34). Iran therefore shares its neighbors' vulnerability in relation to how desalination plants can be exploited, albeit to a smaller magnitude since Tehran is less dependent on desalination.

GCC

The main strategic role of the GCC is to transform the water security risks faced by individual member states into a regional collective security issue. In December 2025, the GCC Supreme Council reaffirmed that the security of the member states is indivisible and that aggression against any one member state is equivalent to aggression against all member states (35). This principle provides the GCC with a political framework for defining an attack on desalination plants as a regional security threat, but it cannot guarantee that the member states will adopt a unified military response.

Desalination infrastructure also gives the GCC a more direct role in crisis coordination. Since desalination plants often double as power-generation facilities, transmission networks, and pumping stations, damage to one component could reduce water supply capacity (36). Under these circumstances, the GCC can coordinate among its members at the technical level and unify the crisis information released externally by the member states. This type of coordination is more likely to produce consensus than collective military retaliation, while it does not require all member states to adopt the same position on whether to escalate the conflict with Iran. The strategic role played by desalination here is that member states incorporate infrastructure resilience into collective defense, while preserving diplomatic space for states seeking to avoid military escalation. However, coordination remains constrained by members' preference for retaining national control over water policy and by the absence of binding enforcement at the regional level. These limits mean that members could recognize an attack on desalination infrastructure as a common threat, while still disagreeing over the scale and form of a collective response.

Saudi Arabia

Riyadh's economic model treats tourism development, industrial expansion, and large-scale urban projects as important vehicles for diversified economic growth. Vision 2030 stable water security to continue attracting private capital and foreign investment. Disruptions to water supply would weaken the ground on

which these investments are made. In this way, Iranian attacks on Saudi Arabia's water infrastructure could raise the implementation costs of Vision 2030 and weaken Riyadh's ability to attract long-term investment by continuously threatening key urban and industrial nodes.

Saudi Arabia has the additional vulnerability of a robust agricultural sector, which accounts for most of the national water budget. Notably, only 18.1 percent of total national consumption is derived from desalination processes, with agriculture drawing heavily from groundwater reserves. However, groundwater reserves are finite by definition, rendering the long-term source dividend likely to change in the future.

Desalination's role is much larger in urban supply: approximately 70 percent of drinking and municipal water (36). This concentration gives desalination strategic importance in densely populated cities where foreign investment is densely concentrated. In addition, attacks on desalination facilities directly impact urban residents. The government may be able to mitigate a short-term disruption through fiscal spending, but repeated water outages would increase maintenance expenditures. Infrastructure losses would become an issue of governing capacity, and the political credibility of Vision 2030 would also be affected because the government needs to demonstrate that economic modernization can proceed alongside the security of essential public services (37).

United Arab Emirates

The UAE's main population centers and economic activities are concentrated in coastal areas. Water produced by desalination plants must be transmitted through distribution networks to other cities. Once a large facility ceases operation, the effects would enter urban water supplies through the transmission system. Critical public services would usually receive priority, while commercial and industrial users could face stricter water allocations. This allocation pressure makes desalination plants strategic nodes capable of affecting the operation of the UAE economy (38).

The Jebel Ali Power and Desalination Complex has a daily production capacity of approximately 2.228 million cubic meters and is one of the world's largest single-site desalination facilities (39). The facility supplies a large volume of urban water. An attacker would only need to keep Jebel Ali's intake, power-generation, or production processes offline for a short period to force Dubai to draw down its water reserves rapidly and reallocate output from other facilities. Once water supplies become constrained, commercial projects would need to increase spending on water supply. If similar disruptions recur, companies would incorporate the additional costs into future investment decisions. Since the UAE attracts international capital through an efficient and low-risk business environment, persistent water-supply risks would weaken the predictability on which this economic model relies (40).

Fujairah provides the UAE with an alternative water source. Its desalination facilities allow the UAE to transfer water from the east coast to inland and northern areas when Arabian Gulf water sources face military disruption (41). This arrangement increases the geographic dispersion of water sources and makes Fujairah a more strategically valuable target. If Iran attacks local desalination facilities or transmission lines connecting them to inland areas, the UAE would lose part of its alternative capacity located outside the Strait of Hormuz. Attacks on Fujairah's port and energy infrastructure in 2026 have already demonstrated

Iran’s capability to strike. The concentration of water plants, ports, power-generation facilities, and water-transmission infrastructure in the same area requires the government to protect the entire infrastructure node. Iran could therefore use limited and repeated threats to increase the cost of maintaining the UAE’s position as an economic hub. However, Abu Dhabi has multiple production facilities, and its cross-emirate water-transmission network alleviates the pressure to some extent.

United States

The U.S. underpins Gulf security partly by backing the protection of critical infrastructure, having pledged in September 2025 to treat an attack on Qatar's infrastructure as a threat to U.S. peace and security (42). These commitments lead Gulf states to expect American help defending the desalination plants sustaining their water supplies, so any Iranian threat to these facilities becomes a test of U.S. resolve. This creates a trust trap: after Iran warned in March 2026 that it would strike partners' desalination and energy systems if the U.S. attacked its own energy infrastructure, a muted U.S. response risks convincing partners that American commitments don't cover essential infrastructure, while a large-scale military response risks provoking further Iranian strikes on water and power facilities across the Gulf.

In practice, Washington more likely to act through air and missile defense coordination and crisis-response cooperation, exemplified by the 2025 Eagle Resolve exercise's focus on civilian and infrastructure protection and training joint crisis coordination, which can reduce the odds of successful attacks and speed recovery, but such technical cooperation cannot answer how the U.S. should retaliate once a major plant is knocked out: failing to restore protection erodes partner confidence in U.S. guarantees, while escalating militarily risks drawing more facilities into the crossfire, leaving Washington to continually balance preserving partner trust against controlling escalation.

China

China's Gulf influence in desalination stems mainly from infrastructure construction, exemplified by POWERCHINA's Rabigh Phase III plant in Saudi Arabia, which produces 600,000 cubic meters daily and supplies drinking water to over two million residents and pilgrims in Jeddah and Mecca (43) (44). This places Chinese firms at the core of regional water systems and positions them to lead equipment replacement and restoration after any attack.

Beijing also has a stake in preventing such attacks from undermining its mediation credibility. Its March 2026 five-point initiative with Pakistan explicitly called for ending strikes on Gulf energy, desalination, and power facilities. If Iran keeps threatening Chinese-built water facilities without China being able to leverage its ties with Tehran to curb the risk, Gulf states may lose confidence in Chinese diplomacy (45).

Lacking military tools in the region, China's real leverage lies in diplomatic pressure and engineering restoration. Gulf states will still depend on their own air defenses and U.S. security cooperation for protection, but if Chinese companies reliably supply technical personnel and replacement equipment after attacks, Beijing can convert recovery capacity into influence and reinforce its image as a development partner.

If U.S. military responses fail to protect these facilities, Gulf states might turn more toward Chinese arms procurement and see China as a partial alternative to U.S. security guarantees. Desalination plants thus test China's regional strategy: Beijing must safeguard its commercial reputation and mediating role without being pulled into a security competition that would demand military commitments it seeks to avoid.

5. Geoeconomic Impacts

Energy-Water Nexus

The Gulf's water infrastructure is often hybrid, with Independent Water and Power Projects (IWPPs) also manufacturing electricity from the same fuel. The gas-steam turbine combined cycle (GTCC) is the preferred plant type across the Gulf, maximizing efficiency by operating as a cogeneration power-desalting plant (CPDP) where the low-pressure steam powers steam turbine and feeds thermal desalination units directly (46). This is the regional standard: Shuaiba North in Kuwait, Jebel Ali in the UAE, and Ras Girtas and Mesaieed in Qatar are all CPDPs. Roughly three-quarters of GCC desalination plants are integrated into the national electrical grids, simultaneously generating water and electricity. While co-location is cost effective and highly efficient, it also presents a vulnerability since a single asset now carries two essential outputs, rendering an attack, fuel interruption, or intake contamination as doubly detrimental.

Oil and water interdependence

The Gulf's hydrocarbon wealth directly fuels desalination efforts. Saudi Arabia alone burns roughly 300,000 barrels of oil per day to desalinate seawater, and across the region co-generation and desalination absorb close to 40% of primary energy, with the GCC as a whole estimated to burn around half a million barrels of oil a day in this function (47). This produces a closed loop that presents a critical vulnerability: an energy shock is simultaneously a water-production-cost shock. Since the cost of a cubic meter of desalinated water rises and falls with the very oil and gas prices that a Hormuz disruption sends soaring. This interdependence is historical as well as physical, it was oil revenue, and especially the 1973 price spike, that funded the original construction of the kingdom's desalination fleet, and it is oil that continues to run it. Therefore, in economic terms, attacks on energy infrastructure create downstream effects on desalination plants that render them indivisible concerns. Precedent from 1990-1991 also shows the coupling can also work through the water itself, when Iraqi forces released oil into the Gulf, they introduced carcinogens such as benzene that desalination could not remove, forcing many Kuwaiti plants to cease operations (48).

Electricity disruption effects

Since water and power are co-produced, an electricity disruption is a water disruption, and the timelines involved are alarmingly short. This interdependence means disruption does not need to affect the entire grid

to matter, the loss of a single generation asset, transmission corridor, or substation can cascade into the water supply that sustains essential services and social stability (49). The engineering imposes harsh physical deadlines: power disruptions beyond 30 minutes can trigger permanent membrane damage in reverse-osmosis units, requiring replacement cycles that cost between $500,000 and $2 million per unit, while recovery protocols for a major disruption typically require 2 to 4 days for a desalination plant restart, with rolling blackout scenarios cascading into water rationing within 24 to 48 hours (50). At the system level the figures are starker still, if multiple or large-to-mega-sized facilities were significantly disrupted, impacts would be felt within 48 to 72 hours, and emergency resilience varies sharply across the region, water storage reserves might last 16 to 45 days in the UAE, but Saudi Arabia's reserves are far less developed (51). Freshwater output can be interrupted not only by striking the water treatment units but by hitting the energy plants and grid connections that feed them, or the pumping stations and pipelines that distribute the finished product (15). The 2026 war moved this from theory to demonstration: an Iranian aerial strike on Kuwait damaged a combined power-generation and water-desalination plant, sparking a fire and knocking out several electricity-generation units, and raising immediate concern over both electricity and water supply in a country that depends on desalination for 100% of its potable water (53).

Financial Market Effects

Sovereign risk premiums

Within one the most critical regions of the world, the sovereign CDS spreads remain the markets go-to gauge for risk. All six GCC countries' sovereigns are investment grade except Bahrain and Oman. Saudi Arabia holds a Triple Aa3 credit rating by Moodys while Qatar, and UAE have double A2 rating with Kuwait lagging behind on A1 rating. With Bahrain and Oman's credit rating hovering in the B2 range and Oman's credit rating being at Baa3 (54). Bahrain or Oman tend to have lower credit ratings due to a higher debt burden. On a spread-to-volatility basis, Kuwait screened at 18.9 bps, Qatar 4.6 bps and Bahrain 5.7 bps. Bahrain's 5-year CDS was reported around 231 bps.

The next phase of the Gulf states economic development is diversification towards multiple revenue streams (55). In a June 17, 2026 cross-sector report, Moody's found water management is already a credit risk for roughly one-third of rated sovereigns, against an OECD projection of a 55% surge in global water demand by 2050 for AI and data centers. Water security will become increasingly correlated to a stronger credit rating. Yet military conflict shifts credit ratings much more dramatically, the IMF's April 2025 Global Financial Stability Report (Chapter 2) found sovereign risk premiums can increase notably in response to major geopolitical risk events, particularly in emerging market economies with weaker fiscal and external buffers, and that effects are more pronounced in response to military conflicts. Critically, commodity importers' CDS spreads rise more than 1% cumulatively one week after major events while commodity exporters' spreads typically decline which helps explain GCC resilience as oil exporters (56).

Infrastructure financing costs

The cost of constructing desalination plants in the Gulf is inseparable from the cost of borrowing and it is here that an attack on desalination plants would take its toll. The GCC funds its water infrastructure primarily through long-tenor debt and Independent Water and Power Project (IWPP) structures, non-recourse arrangements repaid over decades from the plant's own cash flows, increasingly raised through *green sukuk*—a bond/loan that abides by Sharia Law. The Saudi Electricity Company's ijarah sukuk was oversubscribed roughly fourfold (57) while the wider megaproject pipeline that this water is meant to serve, while for many of the planned cities for Vision 2030 and the rest of the GCC nations, rests on the same capital markets. That financing model is only cheap when the region's risk premium is low, and conflict repriced it sharply: with yields on GCC dollar sukuk and bonds widening to five-year highs after 28 February 2026, the S&P GCC High Yield Sukuk Index leapt 194 basis points to 7.76% (58). Tellingly for infrastructure specifically, Fitch found that corporate, infrastructure, and project-finance sukuk recorded the steepest liquidity declines of any segment (59), precisely the paper that funds desalination and its host developments. Issuance stalled as planned deals were shelved, a material constraint given that GCC borrowers account for roughly 40% of all emerging-market dollar issuance excluding China (60). The mechanism is straightforward: a strike on a plant raises the perceived risk of every asset financed on the assumption that the plant will keep running, so lenders demand wider spreads, shorten tenors, or withhold capital altogether, and long-horizon projects are the most sensitive because a rate change compounds over their entire life. Notably, the shock proved fast-moving rather than permanent by mid-June 2026, as tensions eased, investment-grade GCC spreads had returned to roughly their pre-conflict levels, with the sukuk to treasury spread narrowing to 67 basis points from about 100 in March (61), though speculative-grade issuers, Bahrain foremost among them, stayed elevated. The durable lesson for financiers is that Gulf desalination has migrated from an engineering line item to a credit variable: since as long as a coastal plant is reachable by a drone. There should be a water-security premium attached to it as currently these plants are vulnerable.

Insurance rates

Insurance is where the risk to desalination is priced in real time, and it is therefore the cleanest market signal of how the sector's vulnerability is being assessed. The mechanism matters for policy because premiums move on perceived exposure rather than on realized damage: once desalination plants entered the target set in early March 2026, with facilities in Bahrain and on Iran's Qeshm Island reportedly struck the underwriting treatment of the Gulf's coastal infrastructure repriced almost immediately (15). Political Violence and Terrorism cover for Middle East energy and infrastructure assets, the line under which large fixed installations such as desalination and co-located power plants are written, moved from under 1% of insured value to roughly five times that within the first week of escalation, and was being quoted at rates on line as high as 10% for the most exposed assets; a $20 million facility requiring $10 million of cover saw its premium climb from under $100,000 to around $500,000 (62). The structural feature driving this is that a desalination plant is an insurer's nightmare as its high-value, coastal asset that cannot be relocated or rerouted, whose loss would threaten the survival of the population it serves, and which sits within range of the same drones and missiles already in use, so reinsurers have responded not by withdrawing capacity outright but by reducing line sizes and avoiding over-concentration on treaties heavy with Gulf energy, port and state-backed infrastructure exposure (62). For the analyst, the significance is that the cost of insuring

the Gulf's water base has been reset upward for as long as the plants remain reachable, a standing risk premium largely independent of whether any further strike occurs.

The marine war-risk market is worth tracking here not because tanker shipping is the object of concern, but because it functions as the region's most liquid, highest-frequency gauge of Gulf conflict risk, and it is tightly correlated with the infrastructure exposure that desalination represents. Both are underwritten by the same London-centered pool of insurers and reinsurers, both are governed by the same Joint War Committee zone designations, and both reprice off the same actuarial reading of the threat environment; when the Committee redesignated the entire Arabian Gulf a listed conflict zone, marine and fixed-infrastructure premiums moved together (63). Marine cover is simply the faster-moving of the two, because voyages are priced daily while infrastructure policies renew periodically, which makes the Additional War Risk Premium an effective leading indicator: it ran at roughly 0.1% to 0.15% of hull value before the war and spiked toward 2.5% per seven-day period at its March peak, repricing within forty-eight hours of the opening strikes and easing only gradually as tension receded (64). The policy implication is that the marine premium curve can be read as a near real-time proxy for the market's assessment of desalination risk: when war-risk rates on Gulf transits climb, the insured cost of the region's water infrastructure is climbing in parallel, and monitoring the former offers advance warning on the latter well before it surfaces in annual infrastructure renewals or sovereign risk spreads (65). Insurance, in short, has become a first-order variable in Gulf water security: it converts a geopolitical threat into a continuous, quantifiable price, and that price now carries a lasting premium for the demonstrated vulnerability of the plants on which the region depends.

Commodity volatility

The commodity most visibly shaken by the 2026 war was oil, but the more revealing story is how the shock travelled through the Gulf's water system. The Strait of Hormuz carries roughly 20 million barrels of oil a day, about a fifth of global consumption, alongside nearly 20 percent of the world's LNG (66). When coordinated US–Israeli strikes hit Iran on 28 February 2026 and the IRGC declared the Strait closed, Brent rose from around $72 a barrel to $118 by the end of March, a surge of more than 55 percent and, in the World Bank's description, the largest monthly increase on record (67). The gas market moved in parallel: Iranian missiles struck Qatar's Ras Laffan complex, the world's largest LNG facility, knocking out roughly 17 percent of Qatari capacity for years and prompting Qatar Energy to declare force majeure, while Asian spot LNG spiked into the mid-$20s per MMBtu and European gas nearly doubled (49). On its own this is a familiar energy-shock narrative. What makes it matter for desalination is that Gulf water is manufactured with precisely these fuels. The desalination–energy nexus means an energy shock is simultaneously a water-production-cost shock. Desalination is among the most energy-intensive ways to produce water, and in the Gulf, it runs overwhelmingly on oil and gas. Saudi Arabia alone burns roughly 300,000 barrels of oil a day to desalinate seawater, and across the region co-generation and desalination absorb close to 40% of primary energy (69). Because water and power are frequently produced in the same Independent Water and Power Projects, the two outputs are physically coupled: a fuel-price spike or a strike on one is a strike on both. The cost of a cubic meter of desalinated water rises and falls with the very oil and gas prices that the Hormuz disruption sent soaring, which is why an attack on Gulf energy infrastructure and an attack on its desalination plants are, in economic terms, the same event. During the 2026 war this stopped being

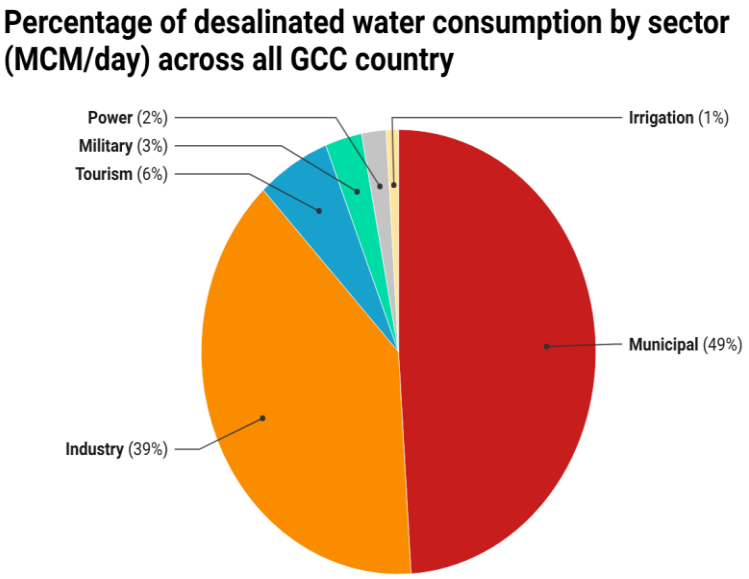
theoretical: the Fujairah water-and-power complex in the UAE and the Doha West station in Kuwait sustained indirect damage, and as previously stated plants in Bahrain and in Iran were reportedly struck directly (15).

Trade and Supply Chain Disruption

Food import vulnerabilities

The Gulf's food security is best understood as the mirror image of its water problem: the same scarcity of arable land and freshwater that forces the region to manufacture its water also forces it to import its food, and the two dependencies compound one another rather than offsetting. Roughly 85% of all food consumed in the GCC is imported, a figure that climbs to about 90-93% for cereals and to nearly 100% for rice, with meat imports at approximately 62% and vegetables at 56%, so the region does not merely supplement domestic production with imports, it substitutes imports for a domestic agriculture that the climate cannot sustain (70) (71). The reason is structural and unfixable at scale as modern agriculture demands enormous quantities of freshwater the GCC does not have, its soils are saline and infertile, and outdoor farming in Gulf summer temperatures is physically destructive to most crops, so the much-touted agritech and vertical-farming push cannot change the underlying arithmetic of a region that must move tens of millions of tons of food through contested waters every week just to feed itself (72). This critical vulnerability is not the dependence itself, wealthy states can always outbid poorer importers, but the fact that virtually all of that food flows through a single maritime chokepoint, the Strait of Hormuz, with more than 70% of GCC foodstuffs transiting it and the GCC importing close to 100 million tons of food annually (73). What the 2026 war exposed is that this is a systemic rather than a commodity-specific exposure: FAO's bilateral trade matrix found cereals at 95% import dependency with 59% routed through Hormuz, oils and fats at 84% dependency with 70% through the corridor, sugar at 97% dependency and 96% chokepoint exposure, and pulses at near-total 97% dependency, meaning a Hormuz shock does not hit one food group with established reserves but engages cereals, oils, animal products, and sugar simultaneously (74). The mechanism proved brutally fast when it was tested: after the 28 February 2026 escalation the IRGC declared the Strait closed on 1 March, tanker traffic collapsed by more than 80-90% within days, and S&P Global recorded just 12 vessels passing through Hormuz on March 28-29 against a February daily average of 135 ships (75) (76). The region's largest ports, Jebel Ali in Dubai and Khalifa Port in Abu Dhabi, which together serve a GCC population of over 50 million and function as the primary entry point for day-to-day supplies of fruit, vegetables, meat, dairy, and medicines, became effectively unreachable, forcing a costly and slower rerouting to eastern-coast alternatives such as Fujairah, the Port of Salalah in Oman, and overland corridors, layering war-risk surcharges and airfreight costs onto the entire food bill (77). The one genuine buffer is strategic reserves, most GCC states hold food stocks reported to last up to 6 months, and officials note that comparable crises rarely last longer than three, but this cushion is finite and degrades under exactly the conditions that would trigger it, because reserves deplete just as alternative routing, higher insurance, and longer transit times drive import costs upward, and perishables cannot be stockpiled at all (78). The deeper analytical point, and the one that ties food back to water, is that the same event threatens both at once: a strike on Gulf energy infrastructure raises the fuel cost of desalination while a blockade of Hormuz simultaneously chokes food and the fertilizer feedstock the wider world needs, so the region's two existential dependencies, imported calories and manufactured water, share a single point of failure in the same 40 km strait.

Economic Spillovers



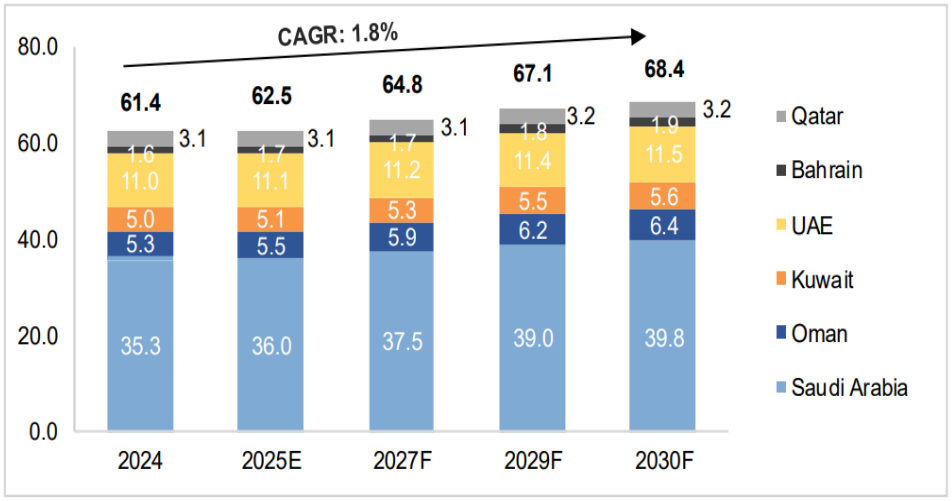
As shown in the figure, about 6 percent of the GCC's desalinated water goes into the tourism sectors. Beyond municipal and industrial water supply, desalination disruption threatens the tourism industry of all the GCC countries. Tourism is a water-intensive industry that struggles in the arid conditions of the Arabian peninsula climate to develop fully. Tourism accounts for 12% of UAE's GDP with the sector being highly water-intensive. As many of these amenities demand excessive amounts of high quality freshwater that mainly desalination plants could provide on an industrial scale, with hotels in Dubai consuming between 650 and 1,250 liters of water per guest (80). The large amount of water required per guest mainly goes into maintaining lawns, golf courses, swimming pools, and water parks; such consumption is also supported by the extensive water infrastructure of the Gulf states and the artificial islands in the UAE, Bahrain, and Qatar (81). A desalination disruption would not only affect the tourism industry but would render the metropolitan centers in the Gulf states uninhabitable for their current populations. In 2008, a U.S. diplomatic cable leak warned that Riyadh "would have to evacuate within a week" if the Jubail desalination plant or its pipelines were seriously damaged could place desalination plants out of commission for a few months creating a severe crisis in the Gulf States (82).

Real estate

The real estate market within the GCC countries is rapidly growing as these nations work towards reducing their reliance on hydrocarbons and diversifying their revenue streams into other industries. Regional GDP growth improved from 0.3% in 2023 to 1.7% in 2024, with about 3.7% coming from non-hydrocarbon industries. Projected growth is expected to increase to 3.2% in 2025 and 4.5% in 2026, as real estate in the Gulf states plays an important role in transitioning towards a non-dominant hydrocarbon economy. The GCC real estate sector is built on strong fundamentals such as stable population growth, rapid urbanization, and expatriate inflows. In 2025, the total population of all GCC nations is expected to surpass 60 million with estimates for 2030 playing it at 68 million (83).

Manufacturing

Exhibit 7.2: GCC Population Forecast (2024 - 2030F)



Sources: IMF

Such growth cannot keep pace with growing utility demands, especially in the event of a conflict. The manufacturing and petrochemicals industry in the GCC countries faces similar challenges as the vast majority of desalinated water, about 39% of it goes towards manufacturing and oil refining, with certain GCC nations using the overwhelming majority of their desalinated water for industry. About half of the desalinated water supply for Bahrain and Qatar goes into petrochemicals and data centers, cities such as Doha, Dubai, Manama, and Kuwait City would not have been possible without desalination plants (15).

FDI

Foreign direct investment is the channel through which desalination vulnerability is most likely to affect economic costs. FDI has become a central pillar of Gulf economic strategy: cumulative inflows into the GCC reached roughly USD 523 billion (excluding intra-GCC flows), the region now accounts for about 4.2% of global FDI inflows (up from 1.3% in 2019), and Saudi Arabia alone drew USD 31.7 billion in 2024 while targeting USD 100 billion annually under Vision 2030 (84). Because FDI is forward-looking, it is acutely sensitive to perceived country risk rather than to realize damage alone, evidence from Iran shows that a confrontation shock can produce a large and persistent collapse in FDI net inflows (on the order of 1.5% of GDP) as investors durably revise their expectations about future stability. In the GCC, geopolitical tension and conflict have already emerged as a leading investor concern, cited by 39% of business leaders in the 2025 EY Attractiveness Survey, up from 31% a year earlier, following the June 2025 escalation (85) (86). Attacks on desalination plants would sharpen this dynamic in a distinctive way: whereas an oil-facility strike threatens revenue, a strike on the water systems that make Gulf cities habitable threatens the underlying premise of the mega-projects, such as NEOM, urban districts, tourism and logistics hubs in the gulf area, that the FDI is meant to finance. The plausible result is not merely a short-term dip but a repricing of long-horizon commitments: delayed or cancelled projects, higher required returns, and a partial flight of the mobile, non-oil capital that diversification agendas depend upon, with Saudi Arabia and the UAE being recipients of roughly 84% of GCC inflows (87).

6. Scenario Analysis

- **Scenario 1: Limited Conflict**

In a limited conflict scenario, the damage is real but contained. This means that fighting has not escalated into a war, but the disruptions are felt across water supplies, energy markets, and global shipping. If the current pattern stays, these disruptions are likely to continue in the same pattern rather than be resolved or escalated.

Given previous instances of Iran-linked hackers targeting water infrastructure in both the US and Israel (88), cyberattacks are likely to remain recurring alongside physical strikes. Since cyberattacks are harder to prove who is behind them compared to missile strikes, attacks on smaller or weaker security systems that haven't invested in cybersecurity upgrades will continue. Over time, this is likely to push Gulf States as well as other targeted countries to isolate important control systems from the internet, even if that means slower, more expensive operations.

With both the Fujairah F1 power and water complex in the UAE and the Doha West station in Kuwait being damaged by missile debris (89). As well as Iran's Qeshm Island desalination plant being damaged from a hit by an air strike (90), it is likely similar incidents are to reoccur. These facilities remain exposed to strikes intended for other targets due to their locations, resulting in unexpected outages and more frequent repairs.

This conflict, which affects water and power systems, is likely to continue to disrupt oil prices, shipping routes, water security and political stability. The Strait of Hormuz holds a huge amount of the world's oil and when any threat is presented to the passage it causes prices to spike. An example of this was the incident with the Shell Pearl GTL plant in Qatar, which is the world's largest facility producing motor oil, was hit by an Iranian missile, causing oil prices to triple (91). When similar strikes happen to major facilities like this, they are likely to keep causing repeated price spikes rather than it happening one time.

As threats to the Strait of Hormuz continue, ships are likely to continue to take alternative routes rather than traveling through the passage. This detour around the Strait to the southern Tip of Africa adds about 10 to 12 days at sea and about $1 million dollars in fuel costs, shipping expenses are likely to stay elevated as long as the rerouting continues (92). Due to these added costs, it is likely shipping companies will charge customers more rather than covering the extra costs themselves, resulting in imported goods becoming more expensive.

As prices rise, goods take longer to arrive, and industries that rely on the Gulf countries' materials are likely to face shortages. Countries that import food and energy will likely struggle the most. In a scenario where the conflict is limited, the damage to physical infrastructure means the disruptions would not resolve quickly; repairs will take time.

- **Scenario 2: Sustained Infrastructure Warfare**

If strikes on desalination and power facilities persist, the operational needs will evolve from immediate repairs to long term capacity issues. As of April 15, 2026, Rystad Energy's analysis put total war related damage across the Gulf as high as $58 billion, with $3 to $8 billion of that hitting nonhydrocarbon infrastructure like desalination and power stations. International Energy Agency (IEA) executive director Fatih Birol suggested that damaged facilities would take years to fix, stretching even the current repair timeline longer than may be expected. Sustained infrastructure warfare would therefore overwhelm repair services, leading to a more complex and detrimental effect on the region's economic stability and water security (93).

Infrastructure warfare would deepen the stakes at the Strait of Hormuz, forcing major carriers to reroute via the Horn of Africa indefinitely instead of resuming transit through the volatile strait. This however overstates the safety of Saudi Arabian and UAE bypass capabilities. THe East-West Pipeline and the Fujairah line are static, high value targets, and a campaign built around sustained infrastructure warfare would strike them. The Houthis have shown how quickly this risk can appear, declaring a full naval blockade of Saudi Arabia in July 2026 that closed Bab al-Mandeb to outgoing Saudi shipping, the route Saudi Arabia used to move oil out once Hormuz effectively closed. This risk exposes a rift already forming within the GCC. The UAE formally exited OPEC in May 2026 to avoid Saudi imposed production caps, a move that revealed discontent between the UAE and Saudi Arabia over the region's energy strategy. With sustained infrastructure warfare, this discontent solidifies into a structural divide. In this scenario, the UAE would find itself incentivized to de-escalate with Tehran due to the state's economic strategy focusing on maximizing exports while demand is high, whereas Saudi Arabia would likely be more willing to risk standoff due to its reliance on oil revenue and a stable price.

From an economic perspective, analysts forecast that Qatar and Kuwait could see their economies shrink by as much as 14% should the conflict continue, with the UAE and Saudi Arabia taking smaller hits of 5% and 3% respectively (94). Energy supply chains however maintain a degree of resilience that water infrastructure lacks. Oil and gas can be stored, and even under Hormuz closure, states have found alternative paths to market. Desalination however lacks a comparable workaround. Once a plant is destroyed and reserves dry up, emergency water tankers will help cover gaps but will not effectively substitute the output of destroyed desalination plants. The same campaign capable of shutting down desalination is also capable of eliminating the alternate export routes, at which point the resilience energy currently holds over water fails as well. CSIS's water security analysis flagged Bahrain and Kuwait as the most vulnerable given their dependence on desalination and their limited backup reserve, but a sustained war that succeeds in closing both Hormuz and Bab al-Mandeb would put Saudi Arabia and the UAE in a compatible position on energy.

- **Scenario 3: Regional Water Infrastructure Collapse and Escalation**

Analysts suggest that if a complete closure of the Strait of Hormuz were to occur, a long-term global recession would be the consequence. Following this, it would take several years to reroute energy dependence away from the Gulf states. This would subsequently hurt both Iran and Gulf states, as oil exports are vital to their economies. There are current plans for the UAE to develop a Hormuz bypass by

2027, and routes like these will be developed even further following a complete Hormuz closure. Due to the effects of temporary Hormuz closures throughout the conflict, the war has incentivized major economies to get away from Gulf oil dependence. For Iran, this would lead to an economic cost that will outweigh the goals associated with prolonged conflict. Despite the alternative options for global economies to create alternative routes for shipments, this would be extremely difficult to do as many Asian countries would see huge hits to their import numbers. Countries with the largest reserves will survive much longer, but only a few months of reserves are likely to last a long-term Hormuz closure until effective alternative pathways are arranged (95) (96) (97) (98).

Scenario Matrix

Variable	**Scenario 1**	**Scenario 2**	**Scenario 3**
Oil Prices	Elevated	Extreme	Global Recession
Water Security	Fragile	Critical	Existential
Shipping Costs	Increased	Severe	Systemic
Political Stability	Status Quo	Strained	Profound Destabilization

7. Policy and Investment Implications

For Governments and the European Union

The limited nature of the current conflict means that GCC governments are responding to infrastructure disruption rather than a full-scale collapse, though nations need to consider the possibility of extreme political destabilization if Gulf security collapses. Gulf governments would need to prioritize hardening desalination plants and the power infrastructure that is often interlinked with them against both physical strikes and cyberattacks. Gulf governments would also need to invest in backup infrastructure, redundant plant capacity, and emergency water reserves. For the EU, due to its geographic position and climate, priorities should focus on energy market stabilization and maintaining diplomatic relations with all the GCC nations. They would also need to be willing to collaborate even in extremely dire situations in which some nations north of the Strait are cut off from many resources, such as in the third scenario (99) (100). With oil prices spiking due to insecurity in the Strait of Hormuz, many European governments would face pressure to release strategic reserves, coordinate with alternative suppliers such as importing LNG and crude oil from the U.S. (101), and support other member states most exposed to energy and food import costs. Diplomatically, the EU's interest is containment: keeping the conflict limited through de-escalation efforts is far cheaper than managing the consequences of Scenarios 2 or 3 (102).

For Investors

In each scenario, investors in the energy market would face extreme volatility while those in other GCC industries would face price scares due to the threat of war, effects which worsen as the scenarios progress. As such, energy markets would reward positions in producers outside the Gulf and in companies with diversified supply chains. Depending on the scenario, oil prices may stabilize or continue to rise (103). Since the physical damage and repairs take time, investors should not expect a quick recovery. Currently, the cost of repairs from the war's damage is estimated at $58 billion USD, of which $50 billion is attributed directly to the oil industry, with the remainder allocated for aluminum smelters, power plants, steel plants, and especially desalination plants. A resolution to the conflict would likely spark a post-conflict economic boom, driven by heavy spending on defense and rebuilding by the Gulf states. Regardless of scenario, these nations would need investment in defense, shipping, and critical infrastructure, and private investors may benefit from following these domains (104).

For Defense and Security Planners

The central lesson for defense planners is that civilian water and power infrastructure has become a semi-viable target. Consequently, defense contractors must also consider desalination plants as strategic pressure points. Planners would need to integrate cyberdefense of industrial control systems with physical air and missile defense around desalination and power complexes, treating them with the same priority as oil facilities. This is especially critical because many Gulf desalination plants are co-generation facilities physically integrated with power stations, meaning a strike on electrical infrastructure can also disable water production. Another aspect that defense planners must account for is naval planning, maintaining freedom of navigation through the Strait of Hormuz and escorting commercial traffic, since insecurity in the Strait, even without full closure, is what drives oil prices and shipping disruptions (105). For Western militaries, the goal would be deterrence calibrated to prevent escalation: a visible enough presence to discourage further strikes on civilian infrastructure without actions that push the conflict toward the sustained warfare of Scenario 2 or the complete closure of Scenario 3, which would take at least a few months to repair and bring back online. Additionally, potentially adversarial nations may have an interest in similar investment and aid to the region in competition with Western security planners. China, for instance, is a primary energy export destination in the region and may have the opportunity to increase its security influence by investing in reconstruction of Gulf defenses (106).

8. Strategic Recommendations

Crucial but Limited Resource: Many Gulf regions face structural and material bottlenecks on their hydroinfrastructure. Reliance on desalination has transformed water infrastructure into a strategic asset within the Gulf region's security dynamics. Although desalination provides a reliable solution to severe water scarcity in under typical conditions, dependence on a limited number of facilities creates new vulnerabilities that can, and have been, exploited during this conflict. Physical attacks against plants, combined with cyber threats targeting operational control systems, possess the potential to disrupt civilian water supplies, economic activity, and regional stability.

Highly Vulnerable: Water facilities are vulnerable from both the inside and outside, facing threats from cyberattacks targeting control systems as well as physical strikes from bombing and missiles. Research into

desalination vulnerabilities, conflict-driven infrastructure risks, and regional water security demonstrates the need for a more resilient approach. Three policy priorities emerge: diversifying water and energy systems through decentralized infrastructure, strengthening physical and cyber protections for critical facilities, and fostering regional and international cooperation to improve humanitarian response capabilities in the event of severe disruptions. Together, these measures can reduce the long term strategic impact of attacks and ensure that water infrastructure remains resilient during periods of geopolitical instability.

Recommendations:

- **Recommendation 1:**

Gulf nations could ensure a more resilient long term water supply by diversifying the water and energy supply. Heavily desalination-dependent areas should develop smaller regional desalination plants, procure modular desalination units that can be rapidly deployed following facility damage and create emergency interconnections across major distribution networks.

- **Recommendation 2:**

Cooperation mechanisms between regional and international organizations and governments is key to ensure the flow of humanitarian aid to vulnerable areas in the event of attacks on desalination plants. Working with regional actors on humanitarian aid not only securitizes these areas against future environmental shocks, but also creates and reinforces strategic partnerships in the Gulf based on shared objectives.

- **Recommendation 3:**

The findings of this paper demonstrate that the Gulf region's heavy reliance on a limited number of large desalination plants creates serious security and humanitarian risks. Physical attacks and cyberattacks could disrupt civilian water supplies, economic activity, and regional stability, while providing limited long-term strategic benefits to attackers. Improving water security therefore requires diversifying water and energy systems, strengthening physical and cybersecurity protections, and fostering greater regional and international cooperation.

9. Conclusion

The U.S.-Iran-Israel conflict demonstrates how desalination infrastructure shapes Gulf escalation. Extreme aridity makes coastal plants indispensable to cities. Damage to treatment units can interrupt production. A strike on external power sources can halt intake pumps, while pipeline damage can block delivery even after production resumes. Attribution presents a separate escalation risk, as reporting may establish damage or disruption without determining that desalination was the intended target. That uncertainty can increase pressure for retaliation even when damage remains limited. Cyber risk interference with industrial control systems can halt operations without physical damage. Manipulated operational data make it harder for operators to distinguish hostile activity from equipment failure, delaying recovery.

For Iran, Gulf facilities offer asymmetric leverage, as these fixed sites are costly to defend and cheap to strike. Even limited disruptions could impose significant civilian costs, perhaps encouraging tighter GCC security coordination against Iran, strengthening demands for U.S. protection, or both. Either reaction would raise the strategic costs for Iran. Because Iran's own infrastructure remains exposed to retaliation, desalination holds its greatest coercive value while actual use remains limited. U.S. commitments would face a credibility test if attacks endangered civilian water systems while retaliation risked widening the conflict. Finally, while Chinese contractors could assist with technical recovery, military protection would remain primarily a U.S. responsibility.

While desalination plants provide the majority of potable water to many GCC nations, the necessary processes are heavily reliant on oil and other energy sources, making these domains interconnected. The financial sector is also affected when desalination infrastructure is targeted; for instance, water-insecure countries often rely on sustainable water production to maintain their credit ratings. Because these facilities are expensive to build and insure, the economy naturally takes a hit when they are destroyed and must be rebuilt during a conflict. These effects cascade across sectors such as agriculture, foreign investment, national security, and supply chains. The scenarios outlined demonstrate increasingly dire implications across all these areas as attacks worsen.

Finally, the analysts recommend three changes to mitigate the negative effects of strategic infrastructure targeting. First is diversifying energy and water supplies throughout the GCC by constructing smaller desalination plants that consume less energy and serve specific regions. Second is reinforcing strategic partnerships among GCC nations to minimize overreliance on EU aid. Finally, strengthening both physical and cybersecurity at each plant to defend against multi-domain attacks.

11. Appendices

Coastal concentration of facilities

Plant name	**Location**	**Coordinates**
Ras Al-Khair power plant	Ras Al Khair, Eastern, Saudi Arabia	27.5367, 49.1389
Al Taweelah Power and Desalination Complex	Al Taweelah, Abu Dhabi, UAE	24.765810, 54.686594
Umm Al Houl Power Qatar	Umm Al Houl, Al Wakrah, Qatar	25.115086, 51.613097
Az Zour North power plant(AZN MED Plant)	Zour, Al Ahmadi, Kuwait	28.7129187, 48.3816255
Fujairah F2 Integrated Water and power plant	Qidfa, Fujairah, UAE	25.301931, 56.370353
Al Dur-1 Power and Water Plant	Al Dur, Southern, Bahrain	25.969278, 50.608007

Exposure to missile and drone attacks

Plant	Rating	Evidence
Al Taweelah Power and Desalination Complex (107) (108)	High	Confirmed Iranian strike within the same Al Taweelah industrial and energy cluster.
Fujairah F2 (109)	High	Confirmed Iranian drone attack within the same Fujairah coastal energy-port corridor, approximately 15 km from the plant.
Al Dur I (110)	Moderate	Confirmed Iranian attack on nearby industrial infrastructure and a confirmed desalination-sector strike elsewhere in Bahrain; direct impact on Al Dur remains unverified.
Az-Zour North (111) (112) (113)	Moderate	Confirmed attacks on Kuwait's southern coastal energy corridor and on two unnamed power-and-desalination plants; no verified direct link to Az-Zour North.
Ras Al-Khair (114) (115)	Moderate	Confirmed Iranian attacks on the wider Jubail–Ras Tanura eastern industrial corridor, but no verified strike at or immediately adjacent to Ras Al-Khair.
Umm Al Houl (116) (117)	Low	Demonstrated Iranian capability to strike major Qatari coastal infrastructure, but the confirmed attack occurred at Ras Laffan in northern Qatar, well separated from Umm Al Houl.

Reliance on Electricity and Maritime Logistics

Plant	Electricity Reliance	Maritime Reliance
Al Taweelah Power and Desalination Complex	Natural gas fueled plant. Part of Transco grid station network (118).	Fuel supplied via Dolphin Gas Project pipeline, seawater drawn from the intake channel. Offshore access dependent (119) (120).
Fujuairah F2	2,000 MW capacity, natural gas primary fuel sourced from Dolphin Energy's cross border pipeline between Qatar and UAE (121).	Diesel is used as backup fuel which must be delivered via ship. Gas fired primarily (122).
Al Dur I	Supplies ~⅓ of Bahrain's installed power capacity and connects to Bahrain's 400kV transmission network. Part of GCC Interconnection Grid linking all 6 Gulf states (123).	Natural gas as primary fuel, distillate as backup. Plant potential to switch to diesel should gas supply be disturbed. Placement on the Arabian coastline allows for seawater intake and fuel access (124).
Az-Zour North	Relies on connection to a 400kV substation at Az-Zour which supplies ~10% of Kuwait's total	Fuel supplied via Kuwait Oil Company pipeline in the form of natural gas, with gas oil as a backup through separate

	power generation capacity.	piping. In order to expand operations, the plant is reliant on imported natural gas, creating maritime import dependence (125) (126).
Ras Al-Khair	2,400MW plant connected to Saudi Electricity Company's grid. Transmission lines run over 1,290 km (127) (128).	Natural gas fuel supply with oil as backup should natural gas be unavailable (129).
Umm Al Houl	Desalination and energy hybrid plant, making the site highly self sufficient.	Uses natural gas supplied domestically, lower import reliance compared to UAE/Kuwait plants, still coastal dependent due to seawater needs (130) (131).

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