KINGDOM OF SAUDI ARABIA (KSA)
Climate Fact Sheet

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I- GENERAL CLIMATE OVERVIEW

KSA is characterized by a desert climate, except for the southwestern part of the country, which exhibits a semi-arid climate. Summers in the central region are extremely hot and dry, ranging from 27°C to 43°C in the inland areas and 27°C to 38°C in coastal areas. In winter, the temperature ranges between 8°C to 20°C in the interior parts while higher temperatures (19°C - 29°C) have been recorded in the coastal areas of Red Sea. The average annual rainfall in most parts of the country is below 150 mm throughout the year except the southwestern part where the rainfall occurs between 400 – 600 mm annually (WB CCKP, 2021).

II- CLIMATE CHANGE TRENDS

The ND-GAIN Country Index summarizes a country's vulnerability(1) to climate change and other global challenges in combination with its readiness(2) to improve resilience. KSA's ND-GAIN Index rank is 47. It is the 107th most vulnerable country and the 39th most ready country. The low vulnerability score and high readiness score of Saudi Arabia places it in the lower-bottom quadrant of the ND-GAIN Matrix, which means that adaptation challenges still exist, but KSA is well positioned to adapt (University of Notre Dame, 2023).

From Past to Present:

There is a general warming all over KSA which varies from a minimum of 0.15°C to a maximum of 0.75°C, with an average of 0.40°C. The pattern exhibits a clear systematic distribution with stronger warming tendencies over the interior part of the country and an area of weaker warming along the western and eastern coasts. As for precipitation trends, there are vast areas of rainfall deficits covering all northern parts of the Kingdom (as low as -40%) and the eastern slopes of the Asir mountains (-14% in Abha) (Darfaoui & Al Assiri, 2010).

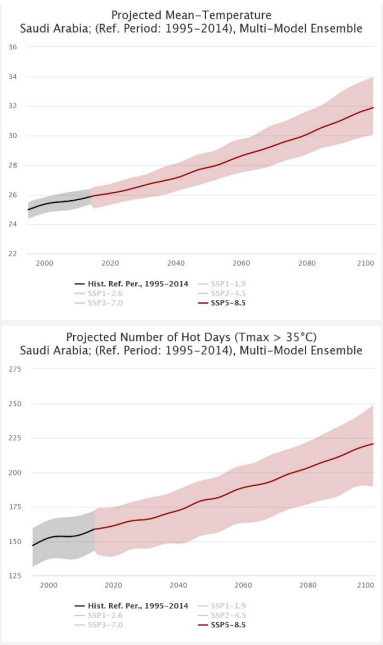


Figure 1: Projected Mean Temperature (top) and Projected Number of Hot Days [Tmax greater than 35 °C] (bottom) (WB CCKP, 2021)

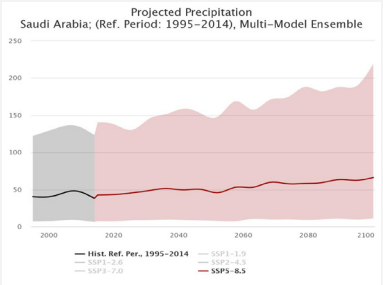


Figure 2: Projected Precipitation (WB CCKP, 2021)

1 Vulnerability measures a country's exposure, sensitivity, and ability to adapt to the negative impact of climate change. ND-GAIN measures the overall vulnerability by considering vulnerability in six life-supporting sectors – food, water, health, ecosystem service, human habitat, and infrastructure.

2 Readiness measures a country's ability to leverage investments and convert them to adaptation actions. ND-GAIN measures overall readiness by considering three components – economic readiness, governance readiness and social readiness.

Projected:

- **Temperature:** While mean temperature for the reference period 1995-2014 was between 24.98 and 25.86 ºC, it is expected to increase and reach 27.85 ºC by mid-century under a high-emission scenario(3), and 31.89 ºC by the end of the century under a high-emission scenario (figure 1, top). In addition, the number of hot days where the maximum temperature (Tmax) is greater than 35 ºC is expected to rise from 158.74 days (2014 reference) to reach 180.59 days by mid-century and 220.67 days by end of century under a high-emission scenario (figure 1, bottom).

- **Precipitation:** While the average precipitation for the reference period 2014 was 38.16 mm, it is projected to increase by mid-century under a high-emissions scenario to reach 46.77 mm and by end of century under a high-emissions scenario to reach 66.14 mm (figure 2).

III- CLIMATE CHANGE IMPACTS

a- Natural Hazards

One of the main impacts of the change in temperature and rainfall patterns is the occurrence of natural hazards. Figure 3 summarizes the risk level of natural hazards in KSA. It shows that the country has a high risk of coastal floods, extreme heat, wildfires, and water scarcity that will increase due to climate change.

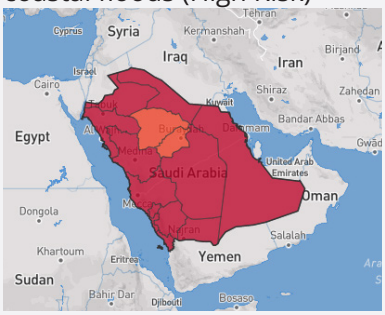
The main climate-related natural hazards that have occurred from 1900 till 2023 in KSA are seen in table 1:

Table 1: Climate-related Natural Hazards (from 1900 till 2023) (EM-DAT, 2023)

Disaster Type	Occurrence (1900-2023)
Flood	24 (of which 12 recorded riverine floods, 4 recorded flash floods)
Storm	2
	Total deaths: 479 **Total damages ('000 US$): 2 905 768**

Heavy rainfall in Saudi Arabia may sometime result in flash floods. For

coastal floods (High Risk)



extreme heat (High Risk)

water scarcity (High Risk)

wildfire (High Risk)

river flood (Medium Risk)

landslide (Medium Risk)

3 SSP5\RCP8.5-The highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century, depicting a world of rapid and unconstrained growth in economic output and energy use.

instance, the November 2022 flash floods of Jeddah which lead to 2 deaths happened after record rain levels reaching 179 mm, the highest value ever recorded in the country (Middle East Eye, 2022). Future climate scenarios indicate an increase in the length of dry periods, and high aridity, rapidly depleting groundwater reserves, and projected temperature increases indicate that water stress is bound to increase. Greater rainfall variability may also result in prolonged droughts. Sand and dust storms are frequent mainly due to the country's desert soils and landscape. High winds carrying sand and dust rise into the air forming clouds that often reduce visibility to zero. These storms disrupt transport and communication and increase respiratory health-related diseases. They also contribute to the spread of desertification by transporting and depositing sand and sediments, which destroy crops, natural habitats, and infrastructure (WB CCKP, 2021).

Figure 4 shows that under a high-emissions scenario, sea level rise is projected to increase and reach 0.27 m by mid-century and 0.75 m by the end of the century, which will increase the chances of coastal floods. In fact, areas ranging between 401 and 1726 hectares and between 1087 and 4674 hectares of sandy beaches are expected to be lost by the year 2100 along the Arabian Gulf and the red sea, respectively. In addition, sea-level rise will accelerate coastal erosion as well as inundation and coral reef bleaching. (Darfaoui & Al Assiri, 2010).

b- Water

Water demands for the agricultural, urban, and industrial sectors in KSA are satisfied from groundwater, surface water, desalinated water, and treated wastewater sources while the non-renewable groundwater supplied the most.

Figure 5 shows that in 2030, 2045-2070 and 2071-2100, the total crop water requirements are projected to be 12,889, 13,209 and 13,964 Mm3 per year respectively. In comparison to 2018, the predictions show an increase of 1,395 Mm3 per year during the 2071-2100 period (11.1%). This implies an increased pressure on water resources, which is caused by the projected rise in temperature in the country. This pressure on water resources is further seen in figure 6, which displays the projected annual Standardized Precipitation Evapotranspiration Index (SPEI)(4) in KSA. The projected maximum annual SPEI drought index under a high-emissions scenario will score a value of -2.19 by 2050 and will reach -2.66 by the end of the century, implying an increasing high pressure on the already scarce water resources. A consequence of water scarcity could be a decline in agricultural productivity especially for crops that need irrigation. Other consequences include inadequate sanitation which can

cyclone (Low Risk)

urban flood (Low Risk)

Figure 3: Climate-Related Natural Hazards Risk Level (ThinkHazard, 2020)

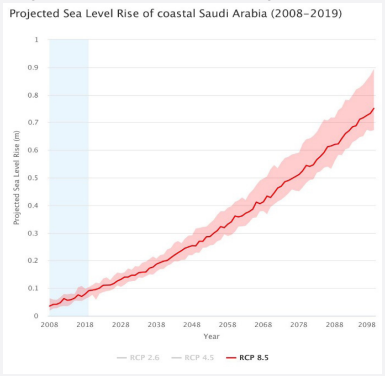


Figure 4: Projected Sea Level Rise of Coastal KSA (WB CCKP, 2021)

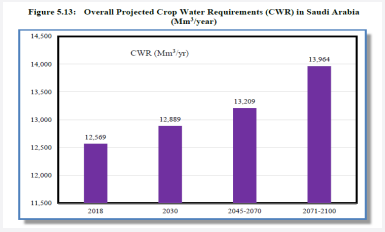


Figure 5: Overall Projected Crop Water Requirements (CWR) (KSA's Fourth National Communication, 2022)

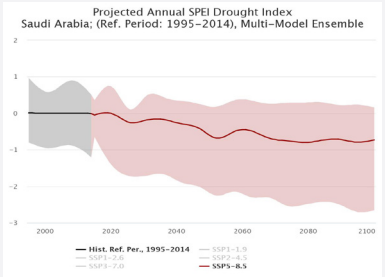


Figure 6: Projected Annual SPEI Drought Index (WB CCKP, 2021)

4 An index which represents the measure of the given water deficit in a specific location, accounting for contributions of temperature-dependent evapotranspiration and providing insight into increasing or decreasing pressure on water resources. Negative values for SPEI represent dry conditions, with values below −2 indicating severe drought conditions, likewise positive values indicate increased wet conditions.

lead to deadly diarrheal diseases and other water-borne illnesses (WWF, 2023).

c- Agriculture

75% of KSA's food consumption needs are reliant on imports from foreign countries (mainly USA, Brazil, and Turkey). The kingdom uses less than 1% of its total land area for agriculture. As of 2018, agriculture, along with forestry and fishing activities account for 2.2% of the Kingdom's total GDP. Changes to temperature and rainfall due to climate change will negatively affect land productivity and the regeneration of pastures, as well as water availability for humans and livestock, and crop yields. This can cause food insecurity among people, and trigger livestock migration which increases the chances of the spread of transboundary diseases among them. (KSA's Fourth National Communication, 2022).

d- Energy

Figure 7 (top) shows that electricity consumption in KSA increased from 1990 (65.22 TWh) to 2019 (354.48 TWh). This increase in consumption also increased the total CO2 emissions from the energy sector by 227.68 % from 1990 to 2019 (figure 8, bottom). It is expected that electricity consumption will keep on increasing especially with the expected increase in the warm spell duration index(5) until the end of the century, under a high emission scenario (figure 8). Renewable Energy: KSA plans on developing over 58 GW of solar and wind power and phasing out all power stations that use petroleum and diesel. To achieve its renewable energy goals, the Ministry of Energy's National Renewable Energy Program (NREP) continues to rollout new initiatives. One of these initiatives includes privatizing all electricity generation by 2025. Another one is a plan to develop 30 solar and wind projects over the next nine years as part of a $50 billion program to boost power generation and cut oil consumption (International Trade Administration, 2022).

e- Health

Climate change is a major threat to public health and extreme weather events associated with climate change, such as heat waves, floods, and drought, can result in casualties and the spread of disease, as explained in figure 9:

In KSA, 24% of deaths from stroke and ischaemic heart disease are

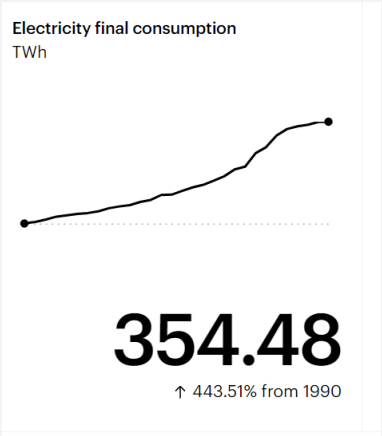


Figure 7: Electricity Final Consumption (top) and Total CO2 Emissions (bottom) (IEA, 2019)

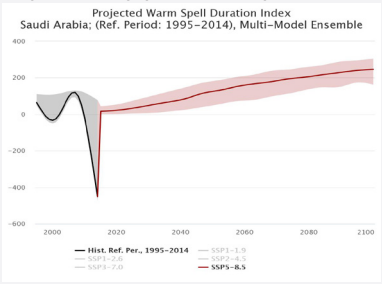


Figure 8: Projected Warm Spell Duration Index (WB CCKP, 2021)

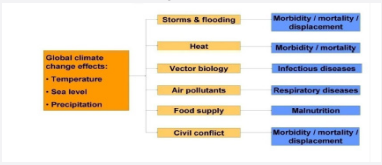


Figure 9: Heat-Related Mortality in Population 65 Years or Over (WHO, 2015)

5 An index that depicts periods characterised by several days of very warm temperatures compared to local or regional averages.

caused by air pollution aggravated by climate change (WHO, 2022). In fact, the kingdom's annual average concentration of PM2.5 is 88 µg/m3, which considerably exceeds the recommended maximum of 10 µg/m3. The main contributors to this poor-quality air are emissions from both vehicles and industry, and from the naturally occurring dust storms which are at their worst during spring and can last from March through to May (IQAir, 2023).

IV- CLIMATE CHANGE RESPONSE: NATIONAL AND INTERNATIONAL

➔ At the national level, KSA does not have a climate action plan outlining specific targets, plans, strategies, policies, and regulations to deliver on its climate change mitigation and adaptation ambitions. However, the kingdom has established different initiatives to address the impacts of climate change. These include (Al-Sarihi, 2019): the 2003 launch of the first National Energy Efficiency Program as a three-year program to improve the management and efficiency of electricity generation and consumption in the kingdom.

- the kingdom's National Committee for the Clean Development Mechanism and Designated National Authority, which were established in 2009. A Council of Ministers' decree established the Saudi Energy Efficiency Centre in 2010.

- In 2012, the Saudi Energy Efficiency Centre launched the Saudi Energy Efficiency Program, which designs and implements energy efficiency initiatives.

- in 2010, the Saudi Green Building Forum was launched to promote the construction of energy- and resource-efficient and environmentally responsible buildings. By the end of 2014, the kingdom had more than 300 green building projects, investing approximately $53 billion.

- the kingdom's first carbon dioxide enhanced oil recovery demonstration project started in 2015. in 2017, a Renewable Energy Project Development Office was established in the Ministry of Energy, Industry, and Mineral Resources to raise the share of renewable energy capacity in the kingdom's energy mix.

➔ In terms of climate governance at the international level, Saudi Arabia ratified the UNFCCC on December 28, 1994. The different documents submitted as part of the UNFCCC are seen in table 2:

Table 2: Timeline of UNFCCC Document Submission (ClimateWatch, 2022)

Date	Document Submitted
2005	First National Communication
2011	Second National Communication
2015	INDC
2016	First NDC
2016	Third National Communication
2021	Updated First NDC*
2022	Fourth National Communication

* The Kingdom aims at reducing, avoiding, and removing GHG emissions by 278 million tons of CO2eq annually by 2030 - a more than two-fold increase versus the previous ambition as outlined in the Kingdom's INDC (130 million tons of CO2eq). Thus, ambition represents progression and the highest possible ambition. Furthermore, by supporting mitigation efforts in other countries (e.g., Middle East Green Initiative), Saudi Arabia's efforts extend beyond its borders.

The Middle East Green Initiative (MGI) is a regional effort led by Saudi Arabia in 2021 to mitigate the impact of climate change on the region and to collaborate to meet global climate targets. MGI goals include the planting of 50 billion trees across the Middle East (10 billion trees will be planted within Saudi Arabia's borders with the remaining 40 billion set to be planted across the region in the coming decades), as well as supporting the region to reduce 670 tons of CO2e emissions. Actions taken under the MGI umbrella will not only positively impact the environment, but will also expand economic diversification, job creation, and private sector investment.

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