Saudi Arabia: Balancing the G20’s Global Impact
Extreme aridity and trade cause large physical impacts

Extreme aridity means that food and forest products must increasingly be imported as population and per capita affluence grows. The Saudi Kingdom ranks first for scarce water use having three times the G20 average per capita, but is middle ranking in absolute whole economy terms (see radar diagram and table). One half of scarce water is imported for foodstuffs with leading supplying countries being Pakistan, Egypt, India, USA and Syria. The land footprint is three quarters the G20 average, is mostly external to the Kingdom, but half of crop land is domestic due to grain sufficiency policies.

For threats to animal species, Saudi Arabia is twice the G20 average in per capita terms, ranking second behind Australia and ahead of the USA. Total threats are 279 species. Nearly one half of the threats are imported from close trading partners with Yemen, Sudan, Pakistan, Bahrain and the UAE being leading suppliers.

Threats are driven principally by wild harvesting, climate change and pollution.

Greenhouse emissions due to domestic consumption have doubled in the past decade giving per capita levels one half greater than the G20 average but still ranking in the lowest quarter of the G20 in absolute terms. Rapid growth in fossil derived electricity use is the main driver, but oil and gas use have doubled in the same period. Sea water desalination is an important component but supplies only one quarter of total water and about one tenth of the national greenhouse account.

Inequality is difficult to gauge due to lack of data

The Saudi Kingdom’s oil wealth gives a per capita GDP near average and mid ranking for the G20 (see radar diagram and table). The absolute GDP value of around $500 billion sits in the lower quarter of the G20 and this increases by one half when expressed in nominal or purchasing parity terms, but the overall ranking remains similar. Saudi Arabia is a creditor in net international debt terms, bracketed by Germany and Russia.

The Kingdom’s inequality status presented here is obscured by lack of systematic data on income distribution. This information possibly presents an underestimate of income inequality. More robust data on wealth inequality (different from income inequality) shows Saudi has high inequality but lags wealth inequality leaders such as Russia and the USA. Water, oil and electricity are delivered below the production cost and two million poor citizens receive a monthly government stipend to maintain basic living.

Less than one half of one full time worker is required to deliver goods and services to each Saudi citizen, near average for the G20, but one half that of job intensive countries such as Australia and the UK. Nearly half of the workforce is external to the Kingdom in China, India, Indonesia and Pakistan (see pie diagram).
Domestic consumption should foster local employment: A five million strong external workforce supplying food and manufactures could increase rapidly as growing affluence demands consumer goods. In external workforce terms, the Kingdom mimics a high income country but lacks breadth of employment options for its citizens. High youth unemployment, a narrow skills base, internal stability issues, low female participation rates and reliance on guest labour present policy conundrums requiring significant social change. Solving the housing-energy-water nexus for poor and rich countries nearby could create a diverse employment boom.

Energy affluence a strong driver: Large prospective investments into solar, wind and nuclear power sources aim to decarbonise all increases in electricity supply. Low thermal efficiency of buildings, cheap petrol prices and rapid growth of personal affluence mean energy efficiency and carbon mitigation efforts may falter. One quarter of consumption emissions are imported for consumer manufactures, food and heavy machinery and, inevitably, emissions imports will grow given the narrow base of the economy. Nuclear prospects remain unclear geopolitically, while nuclear electricity desalination hybrids may be outpaced by solar plants with shorter build times and no spent fuel waste issues.

Subsidies for irrigated agriculture are reducing: Depletion of fossil groundwater aquifers due to agricultural self sufficiency policies is declining, with reduced subsidies especially for traded commodities such as wheat. A doubling of desalination capacity, wastewater reuse and surface water yield is underway which could potentially reduce groundwater extraction to semi-sustainable levels.

Key animal species under acute pressure: Covering nearly two million square kilometres, Saudi Arabia intersects the ecology of Europe, Africa and Asia. Extreme aridity over fifty two bioregions gives sparse biological productivity, increasingly under pressure from land conversion, over cutting, over grazing and high hunting activity. The current thirty protected areas will be doubled to represent each bioregion effectively, and investments made into species recovery for the Houbara bustard, Arabian oryx, Arabian leopard, sea turtles, and dugongs.

- Generating sufficient skills and aptitude in Saudi citizens to engage in gainful employment needs to be a front and centre priority for the Saudi Kingdom’s leadership. Through a sovereign wealth fund that stabilises equity and flows in petrodollars, a renewable energy transition could revamp attitudes, living spaces and lifestyle to ensure the Kingdom’s, and the region’s prosperity.
**Rationale for Indicators**

**Greenhouse Emissions (CO2-e):** The emissions footprint for each person’s consumption leading to heat gain in the atmosphere and oceans and thus increasing climate disruption (due to accounting uncertainties, the indicator excludes land use, land use change and biomass burning). **Measure:** Tonnnes of CO2 equivalents per capita excluding land use change, forestry and biomass burning Year 2011, Source- Eora Global Database [http://worldmrio.com/](http://worldmrio.com/)

**Scarce Water Use:** The scarce water use footprint. Over- extraction increases threats to human water security and river biodiversity in 30 of the globe’s 47 most volumetric river basins. This scarce water is eventually consumed as clothes, food and beverages. **Measure:** litres of scarcity-weighted water use per capita. Year 2011, Source-Eora Global Database [http://worldmrio.com/](http://worldmrio.com/)

**Endangered Animal Species (Species threats):** Land clearing and over-fishing are two of 15 or more drivers of accelerated rates of biodiversity endangerment. This species threat footprint traces endangered animal species from the IUCNs ‘Red List’ to complex trade networks of threatening production activities. **Measure:** number of endangered animal species (species threats) per one million of human population. Year 2000, Source- Eora Global Database [http://worldmrio.com/](http://worldmrio.com/)

**Land Footprint (Land):** The land footprint in trade corrected terms or consumption terms required for built infrastructure, crops, forest, fishing and grazing. Same accounting principle as the ‘ecological footprint’ but excludes energy/carbon land as the emissions indicator specifically accounts for that impact. Expressed in ‘globally-average hectares’ adjusted for productivity potential. **Measure:** Land area in globally-average hectares required to underpin consumption footprint. Year 2011 Source- Eora Global Database [http://worldmrio.com/](http://worldmrio.com/)

**Material Footprint (Material usage):** The material use footprint. Increasing material use by developed and developing economies poses long term threats to sustainability at both ends. Limits to resource quality of virgin materials and a faster consumption lifecycle suggest issues for disposal and recycling. **Measure:** total material flow in tonnes per capita. Year 2008, Source- Eora Global Database [http://worldmrio.com/](http://worldmrio.com/)

**Inequality (Gini coefficient):** The footprint or production chain measure of the distribution, or spread of wages within a country, across the population. A smaller rich elite and a large working poor gives a higher Gini coefficient while a more equal country has a lower value (e.g. South Africa 0.59, USA 0.38, Japan 0.29). **Measure:** Time series of Gini footprints computed as part of Eora employment studies. Data not yet available as part of Eora Database. Year 2011

**Employment Footprint (Jobs):** A social indicator measuring the domestic and outside workforce required to maintain domestic consumption and lifestyle. A cascade of lower paid workers delivers goods and services through complex production chains to more affluent consumers. **Measure:** Full time equivalent workers (domestically and out-of-country) per capita of domestic population, Year 2011 Source- Eora Global Database [http://worldmrio.com/](http://worldmrio.com/)


**Gross Domestic Product (GDP):** A conventional and widely accepted economic measure of development and progress in each country. This is not a footprint or production chain measure. **Measure:** GDP per capita in deflated 2005 US dollars from United Nations data depository Year 2012 Source- GDP by Type of Expenditure at constant (2005) prices: [http://data.un.org](http://data.un.org)

**Biodiversity-threatened animals:** International trade drives biodiversity threats in developing nations. **Measure:** [http://dx.doi.org/10.1038/nature11415](http://dx.doi.org/10.1038/nature11415)

**Land Footprint:** Moran et al. (2013). International trade in scarce water. **Measure:** [http://dx.doi.org/10.1016/j.ecolecon.2013.02.013](http://dx.doi.org/10.1016/j.ecolecon.2013.02.013)

**Material Footprint:** Lenzen et al. (2012). International trade drives biodiversity threats in developing nations. **Measure:** [http://dx.doi.org/10.1016/j.ecolecon.2013.02.018](http://dx.doi.org/10.1016/j.ecolecon.2013.02.018)

**Employment footprint:** Alsamawi et al. (2014). The employment footprints of nations: Uncovering master–servant relationships. **Measure:** [http://dx.doi.org/10.1073/pnas.1220362110](http://dx.doi.org/10.1073/pnas.1220362110)

**Inequality and gini coefficient:** Alsamawi et al. (2014). The inequality footprint of nations: A novel approach to the quantitative accounting of income inequality. **Measure:** [http://dx.doi.org/10.1016/j.ecolecon.2013.02.014](http://dx.doi.org/10.1016/j.ecolecon.2013.02.014)

**Greenhouse Emissions:** Kanemoto et al. (2013). International trade undermines national emission reduction targets: New evidence from air pollution, Global Environmental Change, 24, 52-59 [http://dx.doi.org/10.1016/j.ecolecon.2013.02.016](http://dx.doi.org/10.1016/j.ecolecon.2013.02.016)


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