

# Seminar on: “Monitoring the Implementation of Energy Related SDG Indicators in the Arab Region”

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Economic and Social Commission for Western Asia

**Session III. Renewable Energy (RE): Clean energy for sustainable development**

**RENEWABLE ENERGY IN THE ARAB REGION**

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- Electricity consumption by End User Sector
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# Concepts and definitions

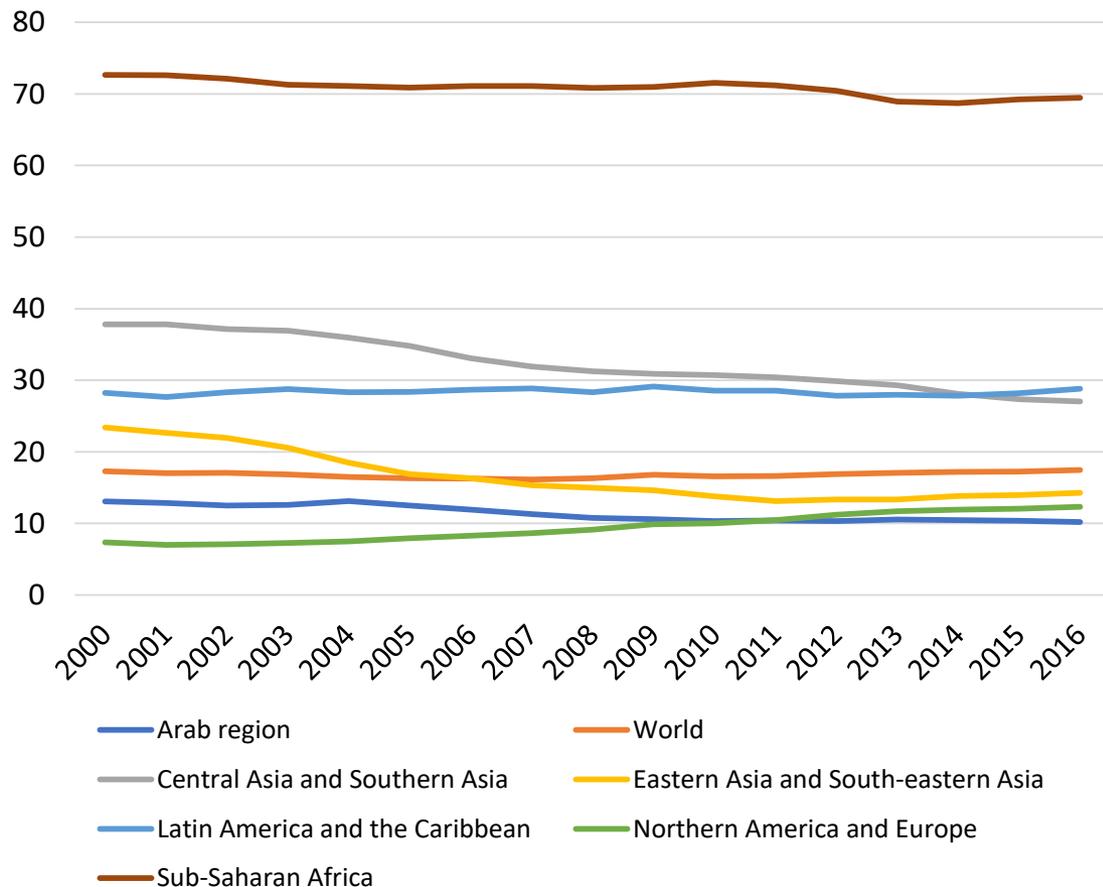
## Definition:

- Renewable energy consumption includes consumption of energy derived from: **hydro, solid biofuels, wind, solar, liquid biofuels, biogas, geothermal, marine and waste.**
- Total final energy consumption is calculated from national balances and statistics as total final consumption minus non-energy use.
  
- **Solar energy** consumption includes solar PV and solar thermal
- **Liquid biofuel** energy consumption includes biogasoline, biodiesels and other liquid biofuels
- **Solid biofuel** consumption includes fuelwood, animal waste, vegetable waste, black liquor, bagasse and charcoal
- **Waste energy** covers energy from renewable municipal waste

# The overall picture

- RE accounts for **around 10%** of the Arab region's energy mix, lowest in any of the world's regions.
- The share of RE has been plateauing since 2010, following a long-term trend of decline – rather than growth.
- Over the tracking period of 2014-2017, RE as a share of TFEFC again declined by 11%, driven primarily by declining consumption shares in Sudan, Syria, Palestine and Tunisia.
- This trajectory is contrary to the world trend, but similarly to Asia largely reflects the move away from (mostly traditional) solid biofuels towards higher quality fuel and electricity.

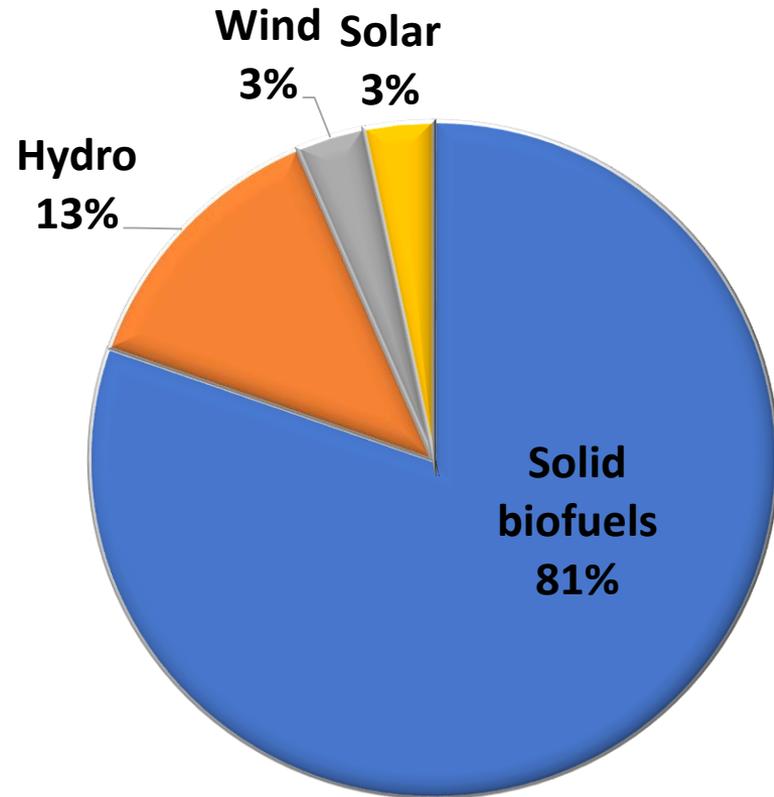
**Renewable energy share in total final energy consumption (%), 2000-2016**



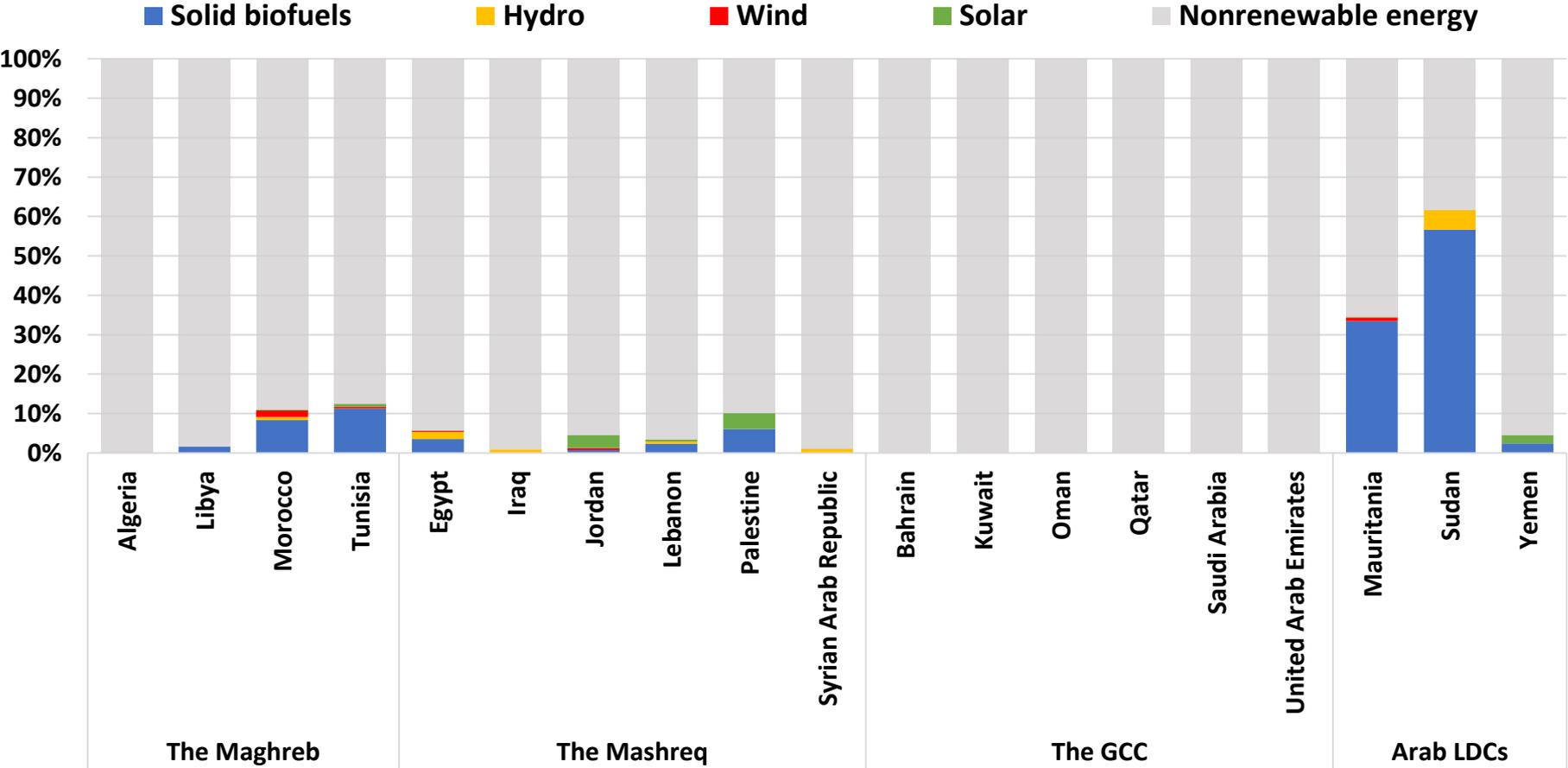
# RE consumption by type of fuel

- Solid biofuels continue to account for the largest share of RE consumed in the Arab region – **around 81%** of total RE consumption.
- We currently lack data to disaggregate how much solid biofuel is modern and traditional respectively.
- The Arab region consumes no other RE according to our current data.

RE consumption by type of fuel in the Arab region, 2016



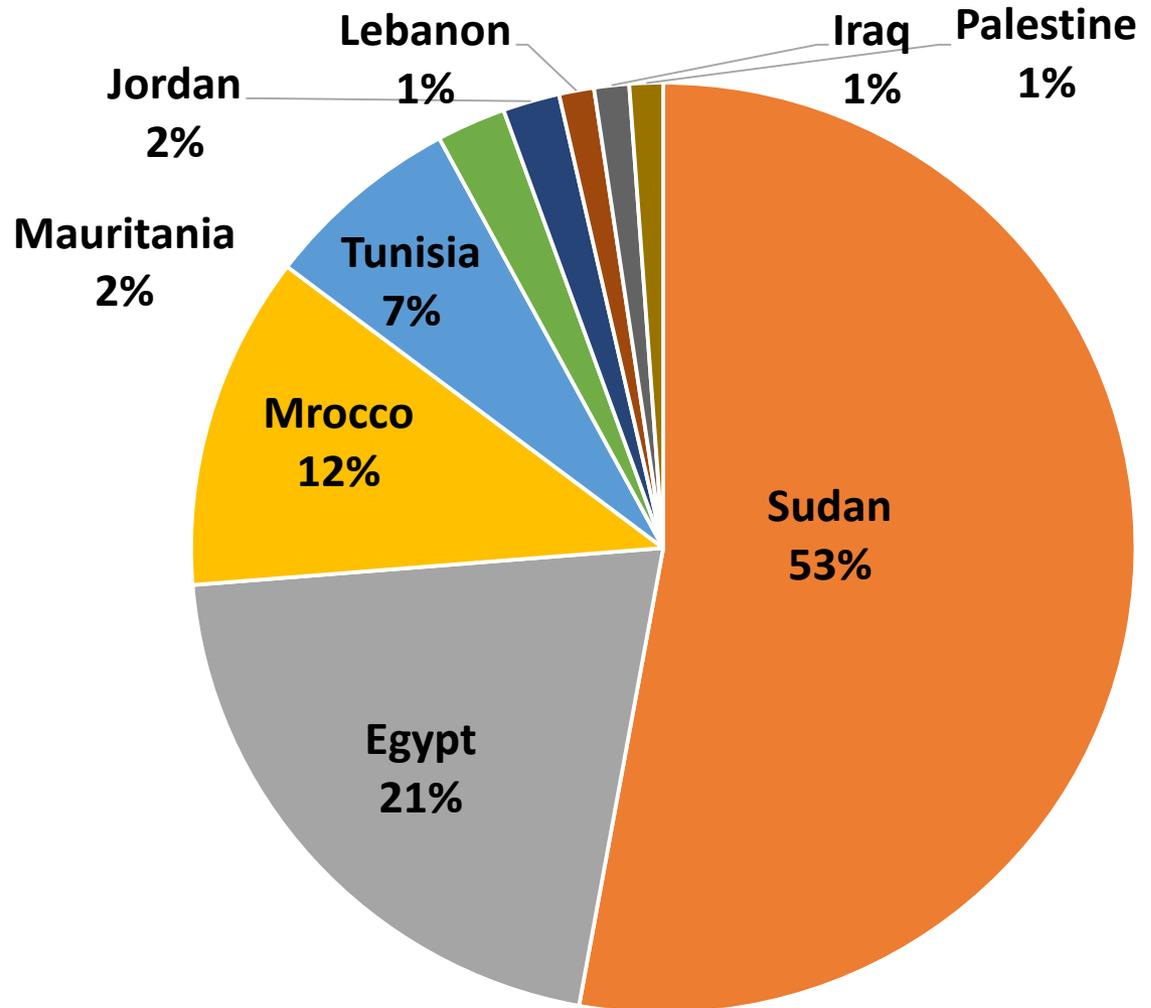
# Renewable Energy consumption by type of fuel



Only in Sudan, Mauritania, Tunisia, Morocco and Palestine does renewable energy contribute a substantial share - above 10% - to the national energy mix.

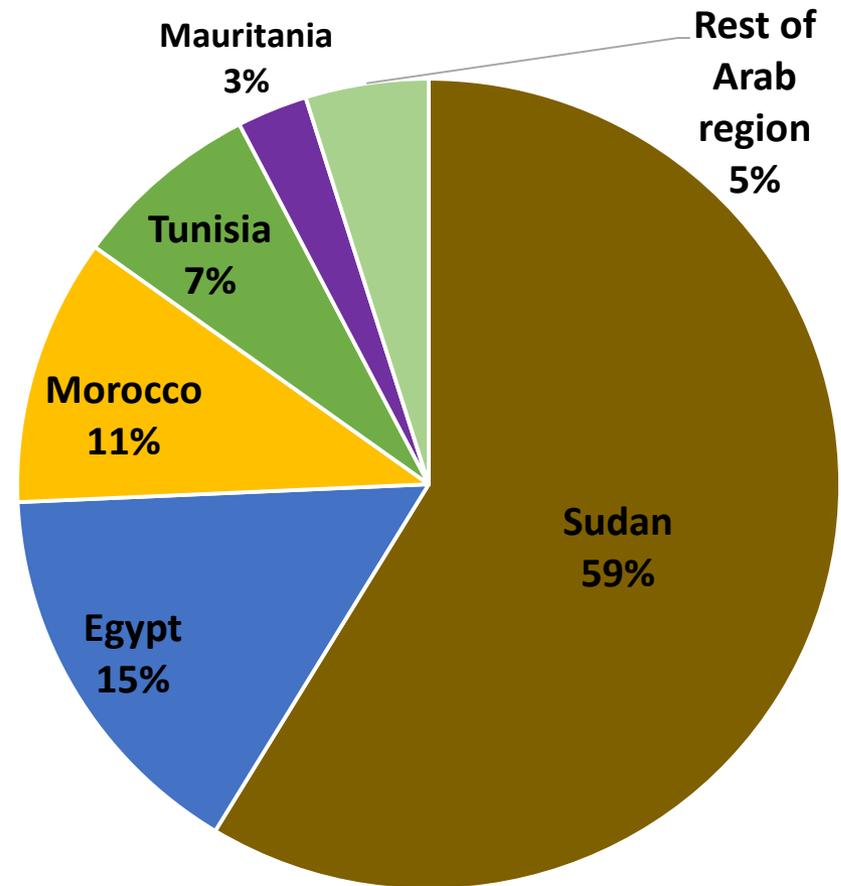
# Renewable energy consumption is concentrated in a few countries

- 3 countries – Sudan, Egypt and Morocco – accounted for around 83% of the region's total RE energy consumption.



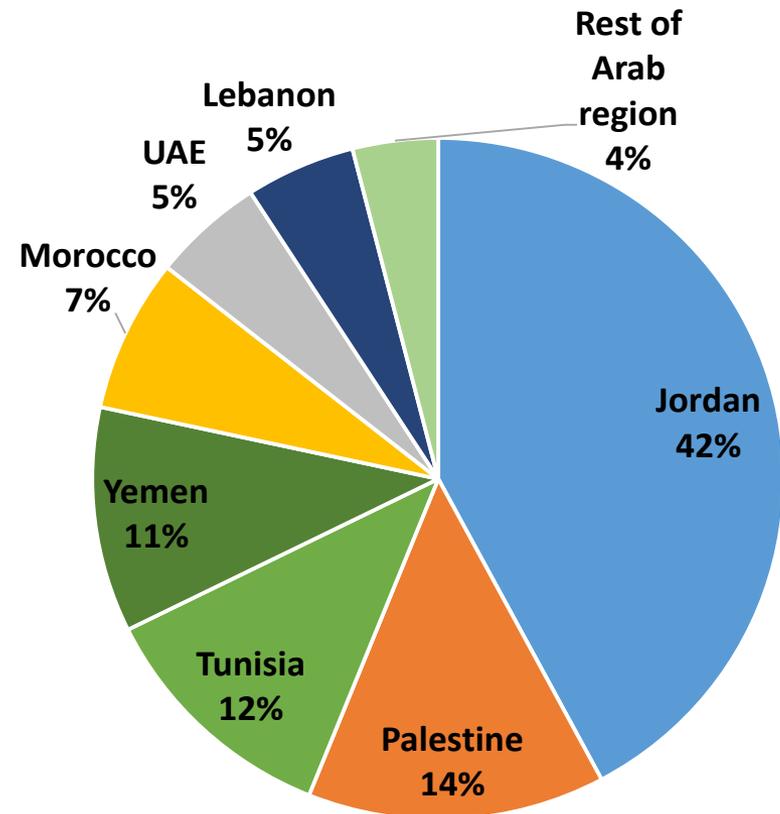
# Solid biofuel consumption by country

- Solid biofuels continue to account for the largest share of RE consumed in the Arab region – around **81% of total RE** consumption.
- 3 countries – Sudan, Egypt and Morocco account for **over 85%** of the region's total consumption of solid biofuel, and Sudan alone **consumes 59%**.
- This high share of solid biofuel in the region's total RE consumption reflects
  - the limited role modern RE technologies have until recently played in the Arab region
  - high access rates to more efficient, non-renewable liquid fuels and electricity in a majority of Arab countries.



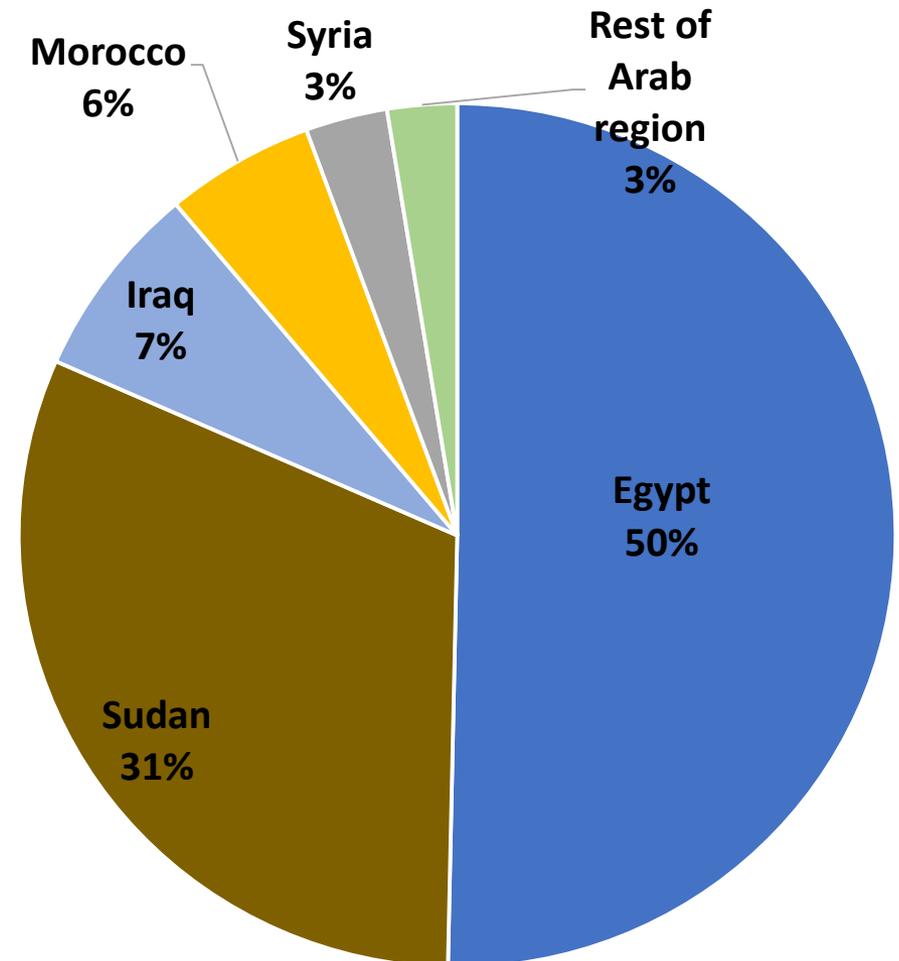
# Solar energy consumption by country

- Solar energy is the second largest RE source in the Arab region and accounts for 7% of the region's total RE consumption.
- It is likely also the fastest growing RE source, TBC once more time series data is submitted.
- Solar resources are generally excellent throughout the region, and costs have fallen significantly, though deployment has so far fallen short of the technology's region-wide potential.
- 4 countries – Jordan, Palestine, Tunisia and Yemen – account for over  $\frac{3}{4}$  of the entire Arab region's consumption of solar power.
- The fast adoption of solar power in countries such as Palestine, Lebanon and Yemen also highlights the potential of stand-alone solar systems, in addition to larger scale utility-size projects, to contribute significantly to energy provision.



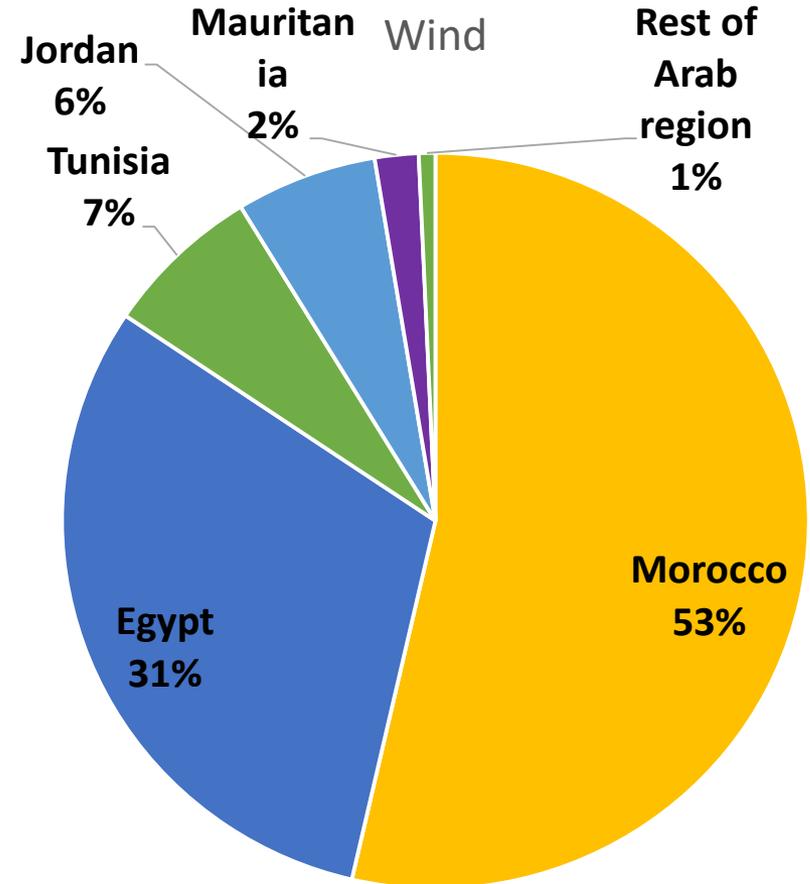
# Hydro consumption by country

- Hydro-power accounted for another **7%** of the region's renewable energy consumption in 2016.
- 4 countries – Egypt, Sudan, Iraq and Morocco – account for close to **90%** of the region's hydro-power consumption, reflecting the very high degree of resources concentration in these countries.
- With available sites largely being in use, further growth potential for hydro-power may be limited.



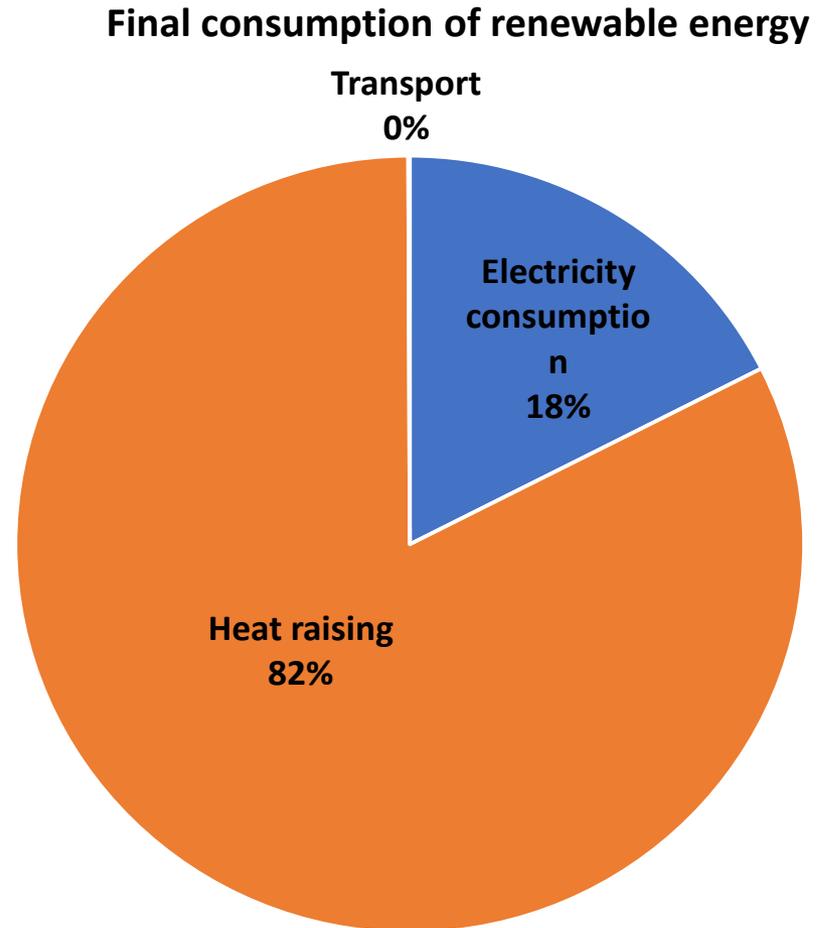
# Wind consumption by country

- Wind energy accounted for **around 3%** of total regional RE consumption.
- Like hydro-resources, large-scale wind resources are unequally distributed throughout the region, although site potential remains under-developed in many countries.
- A number of low-cost wind projects in countries such as Morocco, Egypt, Tunisia and Jordan has in recent years increased the relative attention wind power.
- In 2016, the single largest wind energy consumer was Morocco, which alone accounted for over half of the region's wind energy consumption, followed by Egypt, Tunisia and Jordan. Combined, these **4 countries** account **of over 95%** of the region's consumption of wind energy.



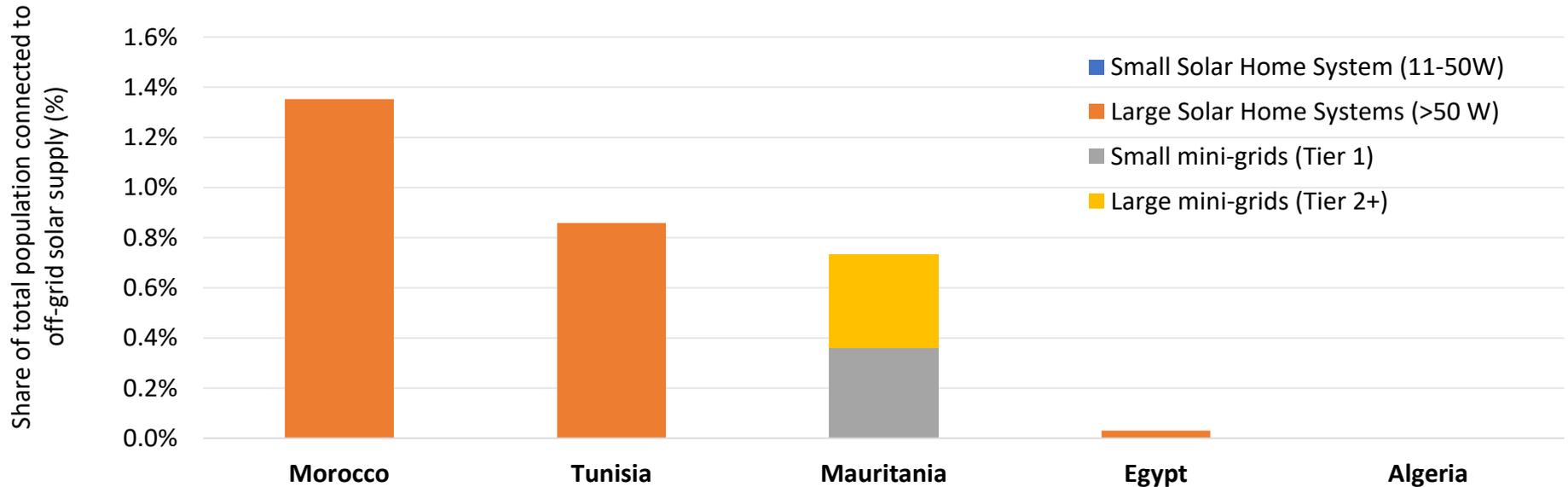
# RE consumption by end-use sector

- The predominant use of RE in the Arab region is in heat raising, reflecting the large share of solid biofuel in the region's RE consumption.
- Sudan, Egypt and Morocco are the largest users of RE both in heat raising and electricity generation.



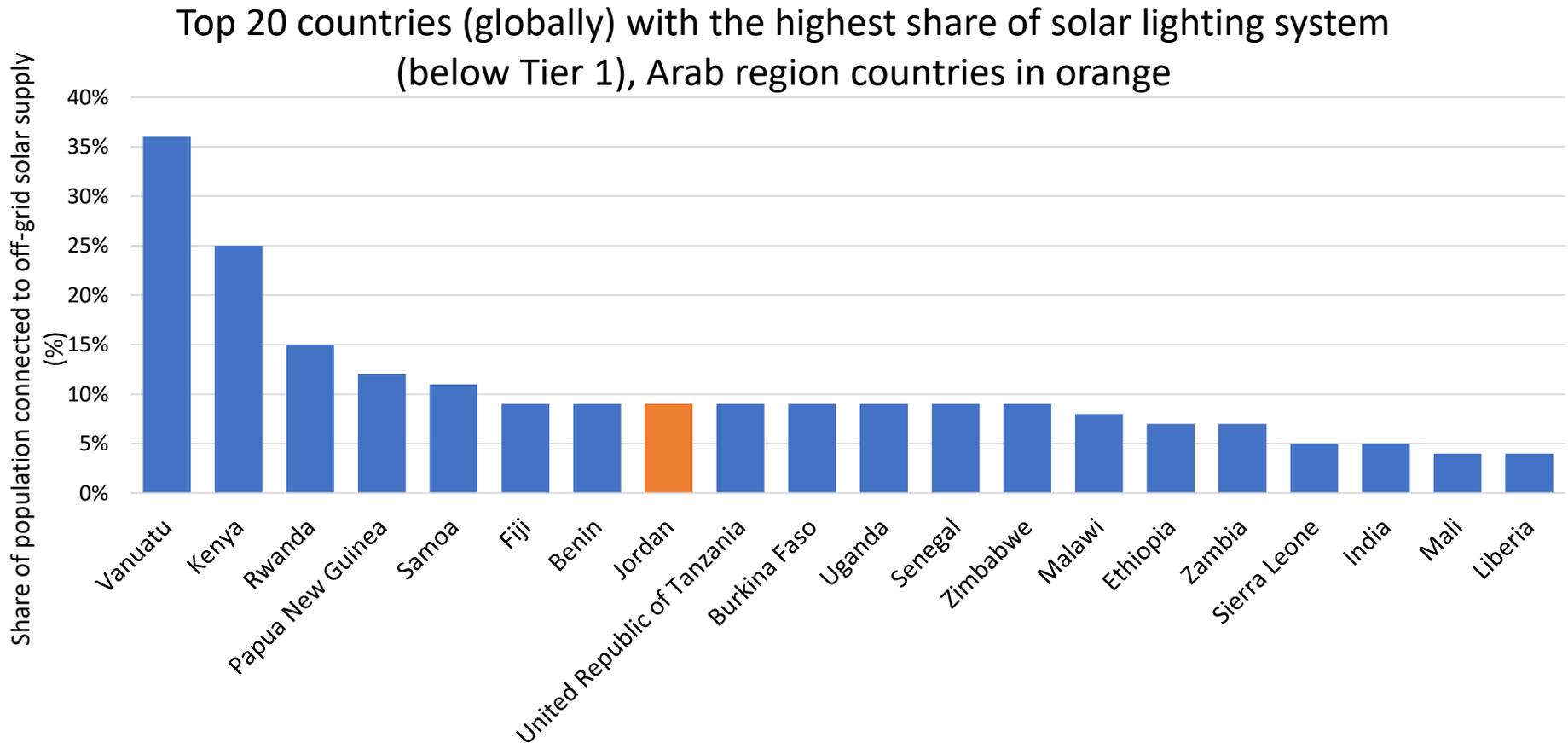
# Off-grid access

## Arab countries with highest off-grid access rate (Tier 1 and above)



- IRENA data lists only 5 Arab countries as having off-grid rates of Tier 1 level and above (small and large solar home systems and mini-grids).
- Some use is shown for Morocco, Tunisia, Mauritania and Egypt, and none for Algeria.

## Off-grid access continued...



IRENA data lists Jordan as one of the world's 20 countries with the highest share of solar lighting systems. No other Arab country is listed.

# Data observations

	Final consumption of renewable energy (PJ)		
	Electricity consumption	Heat raising	Transport
	2016	2016	2016
Algeria	0.87	0.25	0.02
Bahrain	0.00	0.00	0.00
Egypt	46.99	76.61	0.17
Iraq	5.87	1.21	0.00
Jordan	2.84	8.68	0.00
Kuwait	0.00	0.00	0.00
Lebanon	1.25	5.85	0.00
Libya	0.01	6.42	0.00
Mauritania	0.44	13.61	0.00
Morocco	16.22	52.23	0.19
Oman	0.00	0.00	0.00
Qatar	0.00	0.00	0.00
Saudi Arabia	0.00	0.31	0.00
State of Palestine	0.00	6.81	0.00
Sudan	25.14	287.56	0.00
Syrian Arab Republic	2.43	0.22	0.00
Tunisia	1.64	38.55	0.01
United Arab Emirates	1.13	1.94	0.00
Yemen	2.11	2.49	0.00
<b>Arab region</b>	<b>106.94</b>	<b>502.74</b>	<b>0.38</b>

What are these small values of RE use in transport? (zero values for liquid biofuel in all countries)

# Data observations

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More data would help us understand what kind of fuels are used for what.

# Data observations

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What kind of RE is used for heat raising in the UAE? The UAE is the only GCC country to feature RE for heat raising.

# Data observations

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	Share in total final energy consumption (%)									
	Solid biofuels	Liquid biofuels	Biogases	Hydro	Wind	Solar	Geothermal	Tide	Municipal waste (renew)	
	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016
Algeria	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bahrain	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Egypt	3.5%	0.0%	0.0%	1.9%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Iraq	0.2%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Jordan	0.7%	0.0%	0.0%	0.1%	0.5%	3.3%	0.0%	0.0%	0.0%	0.0%
Kuwait	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lebanon	2.3%	0.0%	0.0%	0.6%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%
Libya	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mauritania	33.5%	0.0%	0.0%	0.0%	0.9%	0.2%	0.0%	0.0%	0.0%	0.0%
Morocco	8.4%	0.0%	0.0%	0.7%	1.7%	0.2%	0.0%	0.0%	0.0%	0.0%
Oman	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Qatar	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Saudi Arabia	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
State of Palestine	6.0%	0.0%	0.0%	0.0%	0.0%	4.1%	0.0%	0.0%	0.0%	0.0%
Sudan	56.7%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Syrian Arab Republic	0.1%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tunisia	11.3%	0.0%	0.0%	0.0%	0.4%	0.7%	0.0%	0.0%	0.0%	0.0%
United Arab Emirates	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Yemen	2.5%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%
<b>Arab region</b>										

Are these values correct?

# Data observations

Renewable energy share in total energy consumption	2000	0.36
Renewable energy share in total energy consumption	2001	0.35
Renewable energy share in total energy consumption	2002	0.32
Renewable energy share in total energy consumption	2003	0.36
Renewable energy share in total energy consumption	2004	0.36
Renewable energy share in total energy consumption	2005	2.3
Renewable energy share in total energy consumption	2006	2.55
Renewable energy share in total energy consumption	2007	2.02
Renewable energy share in total energy consumption	2008	1.18
Renewable energy share in total energy consumption	2009	1.23
Renewable energy share in total energy consumption	2010	1.7
Renewable energy share in total energy consumption	2011	1.08
Renewable energy share in total energy consumption	2012	1.26
Renewable energy share in total energy consumption	2013	1.36
Renewable energy share in total energy consumption	2014	0.92
Renewable energy share in total energy consumption	2015	0.82
Renewable energy share in total energy consumption	2016	0.93

**Iraq's** RE share fluctuates considerably throughout the years. 80% of this is hydro.

Is this conflict-induced or do climatic factors (affecting hydro) account for this fluctuation as well?

# Data observations

Renewable energy share in total energy consumption	2000	15.26
Renewable energy share in total energy consumption	2001	15.12
Renewable energy share in total energy consumption	2002	14.94
Renewable energy share in total energy consumption	2003	15.71
Renewable energy share in total energy consumption	2004	23
Renewable energy share in total energy consumption	2005	20.15
Renewable energy share in total energy consumption	2006	18.14
Renewable energy share in total energy consumption	2007	16.46
Renewable energy share in total energy consumption	2008	14.62
Renewable energy share in total energy consumption	2009	14.26
Renewable energy share in total energy consumption	2010	13.92
Renewable energy share in total energy consumption	2011	11.88
Renewable energy share in total energy consumption	2012	10.93
Renewable energy share in total energy consumption	2013	11.59
Renewable energy share in total energy consumption	2014	11.14
Renewable energy share in total energy consumption	2015	11.22
Renewable energy share in total energy consumption	2016	11.02

For comparison, Morocco's share of RE in TREC also fluctuates considerably. Morocco, too, uses significant amounts of hydro, BUT also has other factors at play:

- Reduced solid biofuel consumption
- Other variable RE sources (solar, wind) that have increased their share over time vis-à-vis solid biofuel.

# Current data gaps

- No data for 2017
- No actual consumption, only share of TFEC
- No data prior to 2000
- No time series data for consumption by sub-sector
- RE consumption by end-use sector and technology
- Investment data
- Very limited, likely incomplete off-grid use data by numbers and types of technology used
- National cost/price data for RE technologies, including in the off-grid sector
- We also lack quantitative studies about household energy use, household survey data, and qualitative studies that document and demonstrate experience with modern renewable energy, including in the off-grid sector. This includes profiles of average household income levels for those using stand-alone home systems.

# Policy implications

- **Renewables still play no large role in the Arab region.** Most of current consumption is based on solid biofuel, whose consumption trend is declining rather than increasing. Modern alternatives – solar and wind energy in particular – remain niche technologies.
- **Recent years have seen a pick-up in modern RE technologies, particularly solar power.** Solar resources are plentiful in the region, and solar technology has proven to be both flexible and cost-competitive. Still, deployment has been accelerated, but lags considerably behind the technology's vast potential in the region.
- **Decentralised generation offers significant market potential, including in conflict-affected countries.** While in the past, solar and wind power used to be primarily driven by the deployment of individual utility-size projects, highly encouraging developments in the use of solar stand-alone systems in countries such as Jordan, Lebanon, Palestine and Yemen in 2014-2017 suggest far greater policy focus should be turned to distributed generation in its own right.
- **More market uptake requires more proactive legislation.** Harvesting the significant benefits of modern renewable energy requires far more dedicated policy design – and investment – than is currently the case. Effective legislation and a business-friendly environment have been an important driving force behind recent success in deploying low-cost, large-scale solar and wind project in the Arab region. Further growth, including in the off-grid sector, will depend on the affordability of the technology, and hence access to finance, as well as effective quality control for solar home-based products.

# Questions for discussion

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- What explains the large market success of solar in Jordan?
- What market mechanisms were put in place to encourage (i) large scale projects (ii) private user deployment of rooftop solutions? Particular countries of interest: Egypt, Jordan, Morocco ?
- What are the main heat activities in which RE is being used?
- What affects RE uptake in heating/cooling)?
- Our data suggests no use of liquid biofuels. Is this correct? Are any policies planned to promote this?

**Thank you**

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