Solar: Benefits and limitations

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CGIAR
NEXUS Gains:
Realizing Multiple Benefits
Across Water, Energy, Food
and Ecosystems

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ILRI
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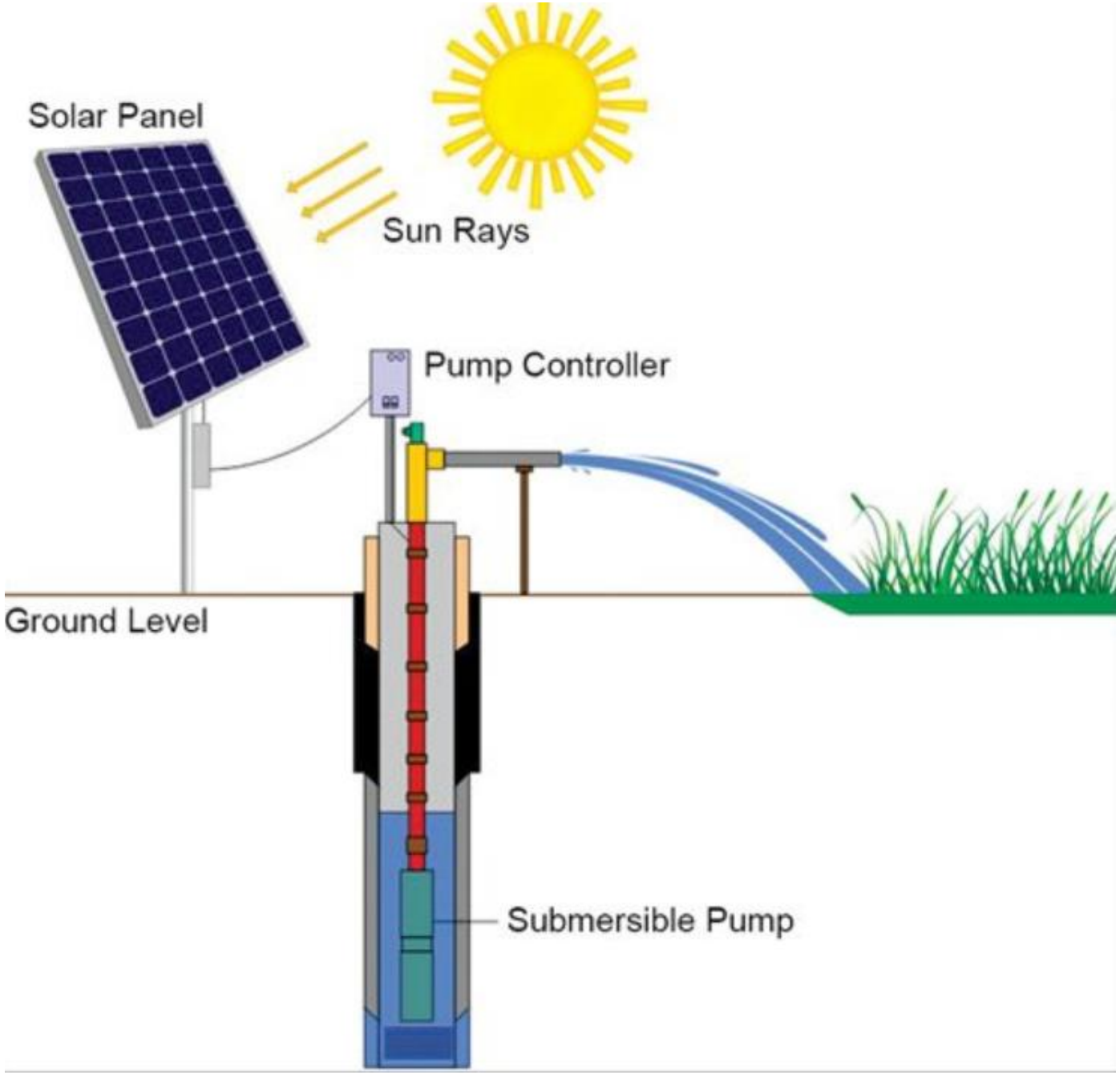
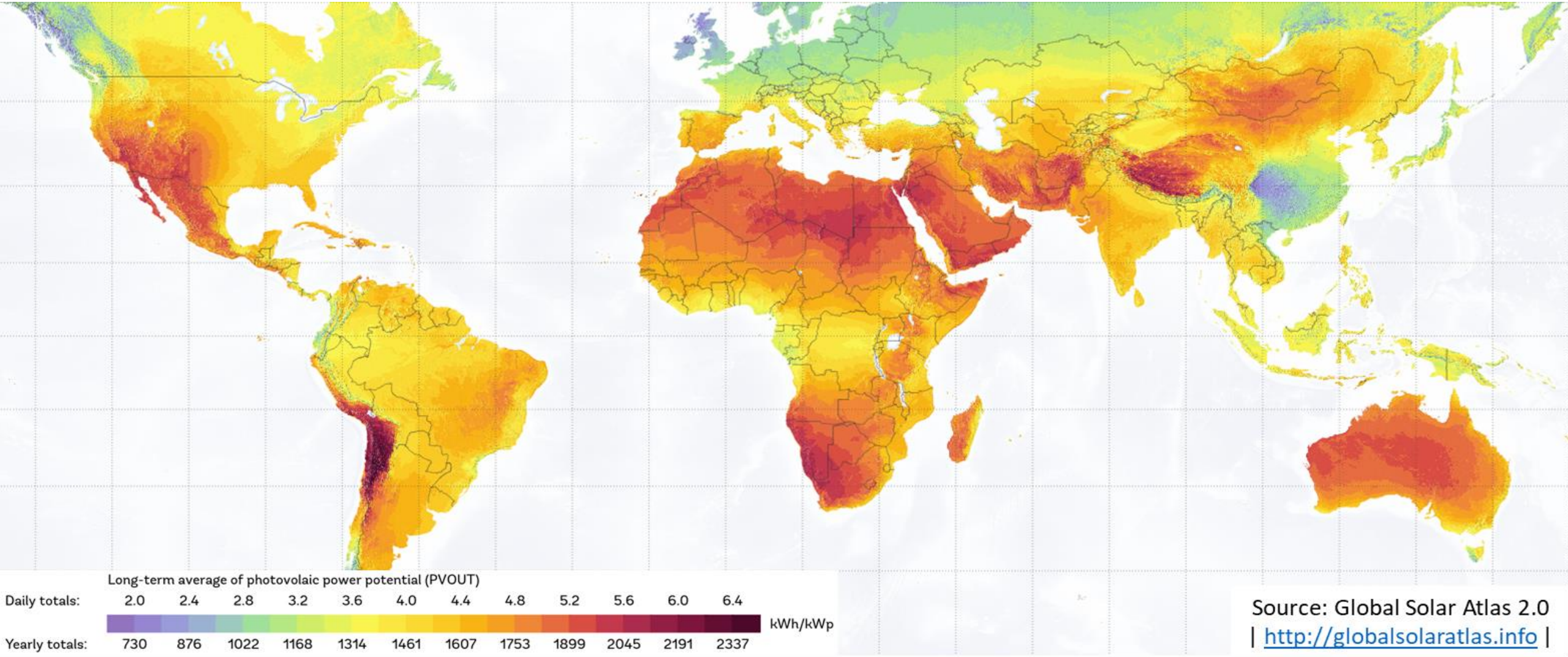


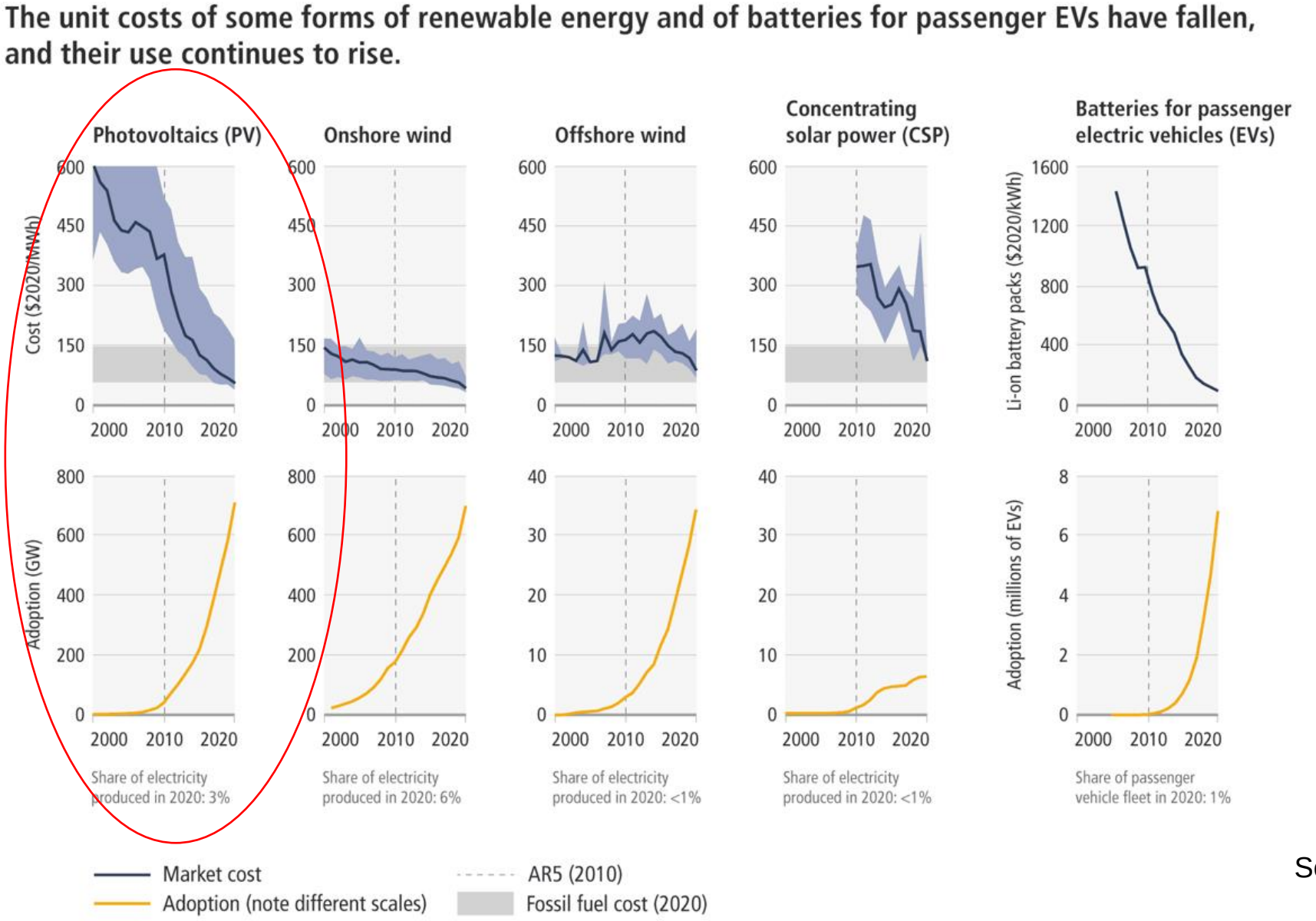
Source: www.taiyosolar.in

1) Solar energy: Large, global potential, but not necessarily where the (surface) water is



Source: Global Solar Atlas 2.0 | http://globalsolaratlas.info |

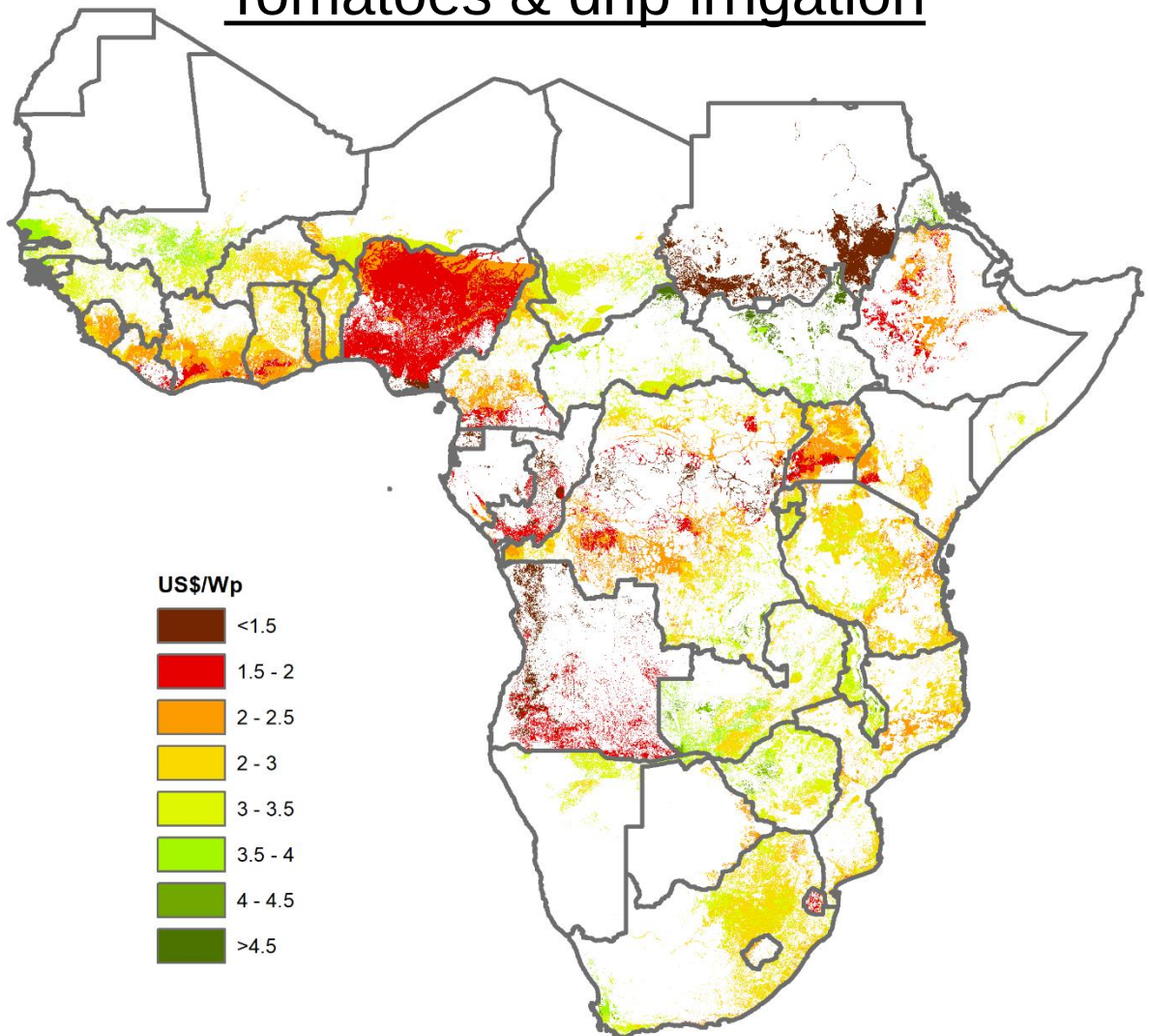
2) The unit cost of renewables has come down



Source: IPCC WG3, AR6 2022.

3) With lower cost solar is increasingly more profitable than diesel

Tomatoes & drip irrigation



- Breakeven installed costs of solar PV irrigation calculates up to which installed cost of the solar array per watt peak (US$/Wp) solar is more affordable than diesel
- Uses LCA & is crop specific
- Necessary as solar and diesel (and electricity) have different inputs and different use characteristics

Source: Xie and Ringler (2021)

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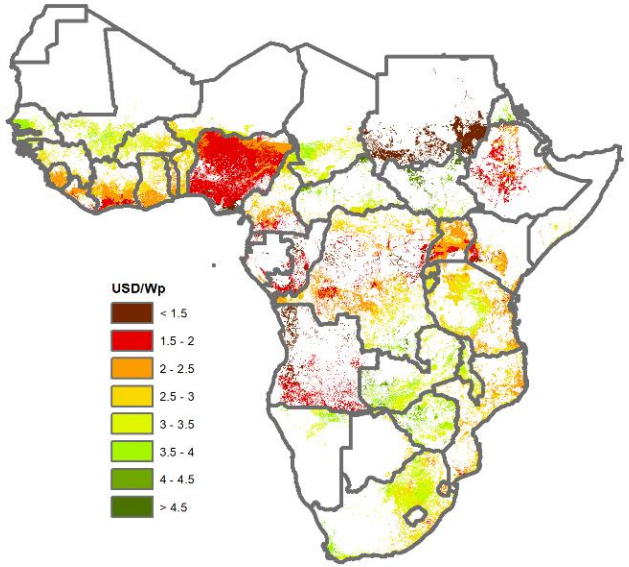
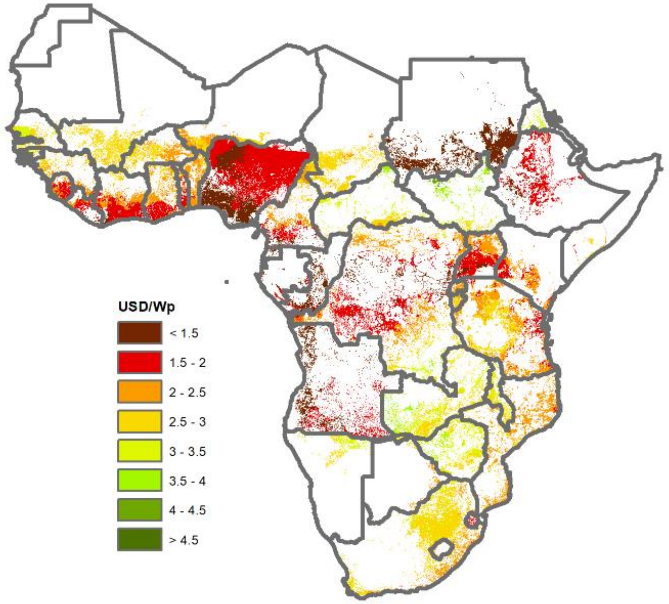
4) Climate change improves the economic outlook of solar irrigation (over diesel irrigation)

- Climate change affects food production, water availability and solar irradiation
- Climate change also affects the relative benefits of solar and diesel irrigation
- Using CMIP6 data, we show that climate change tilts the scale more toward solar pumps (w/o considering mitigation benefits)

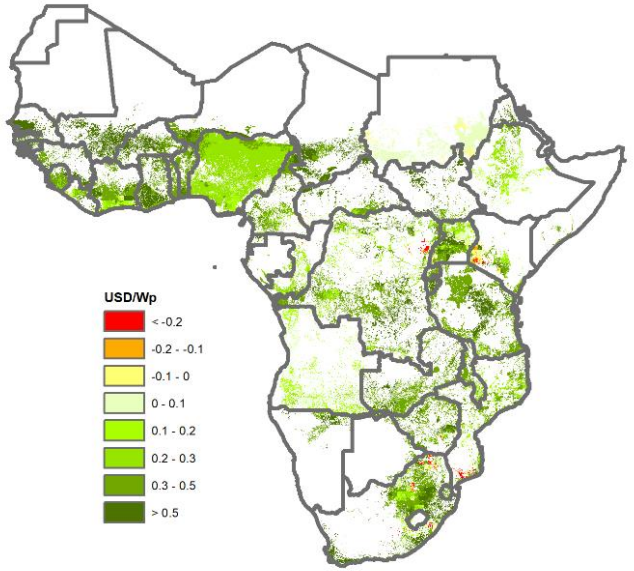
Future (2050-2060)



Historical (2006-2015)

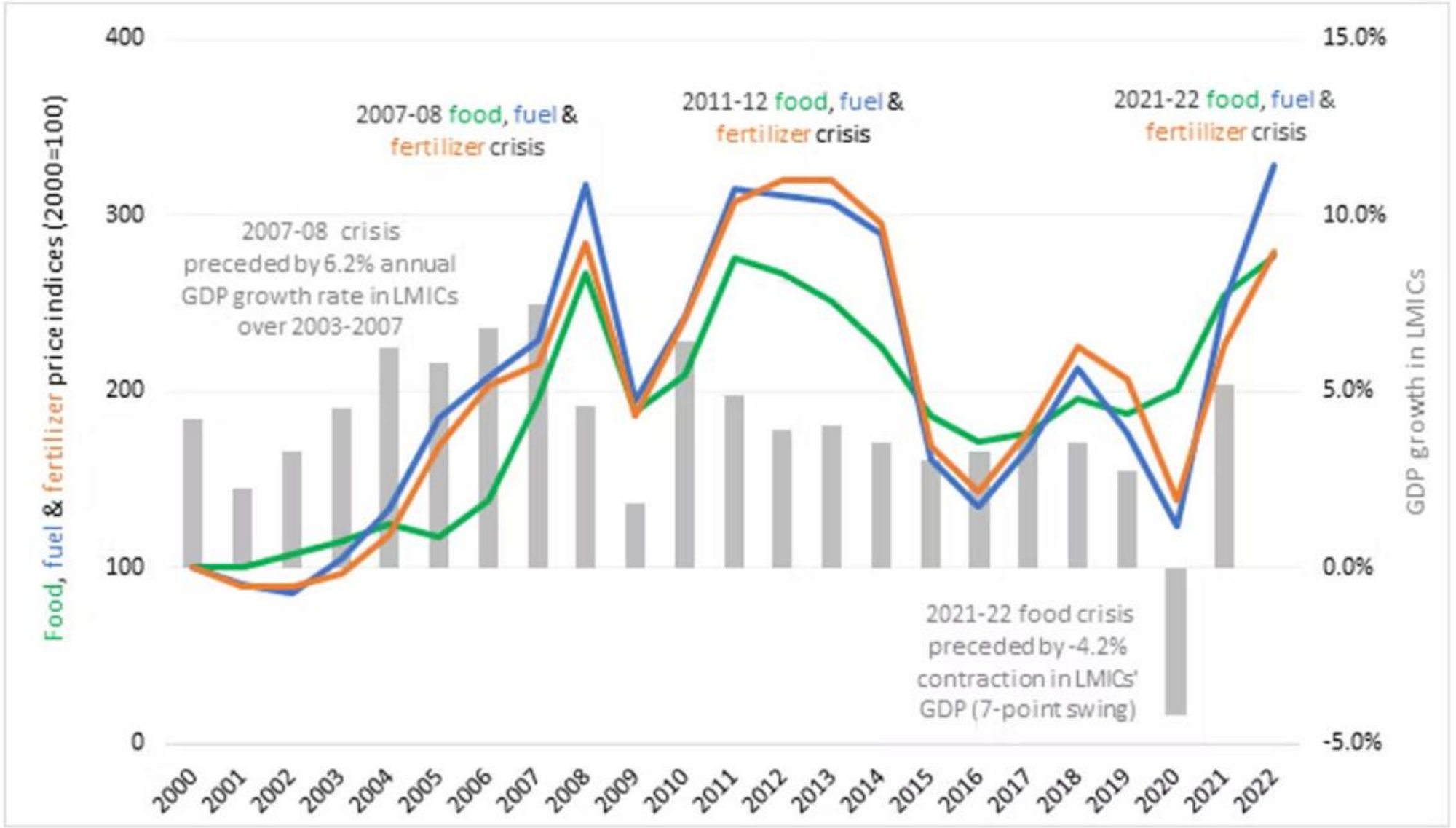


Difference



Xie et al. (in prep)

5) Break the cycle of food/fuel price spikes?



Source: FAO/IMF/World Bank

Other benefits and not so benefits…

- ✓ Improved ‘water control’
- ✓ Higher land and labour productivity
- ✓ Higher gross and net returns
- ✓ Improved food and nutritional security
- ✓ Improved climate resilience
- ✓ Lower carbon footprint
- ✓ If extra energy is fed back to the grid, some incentive to reduce depletion

- ↓ In many cases, increased water depletion
- ↓ Often expansion of irrigated area
- ↓ Solar irrigation is taking off, BUT still only only 0.3m in India, compared to 5-10m diesel pumps (supply chain / subsidy challenges, etc.)

Credit: Amar Imache

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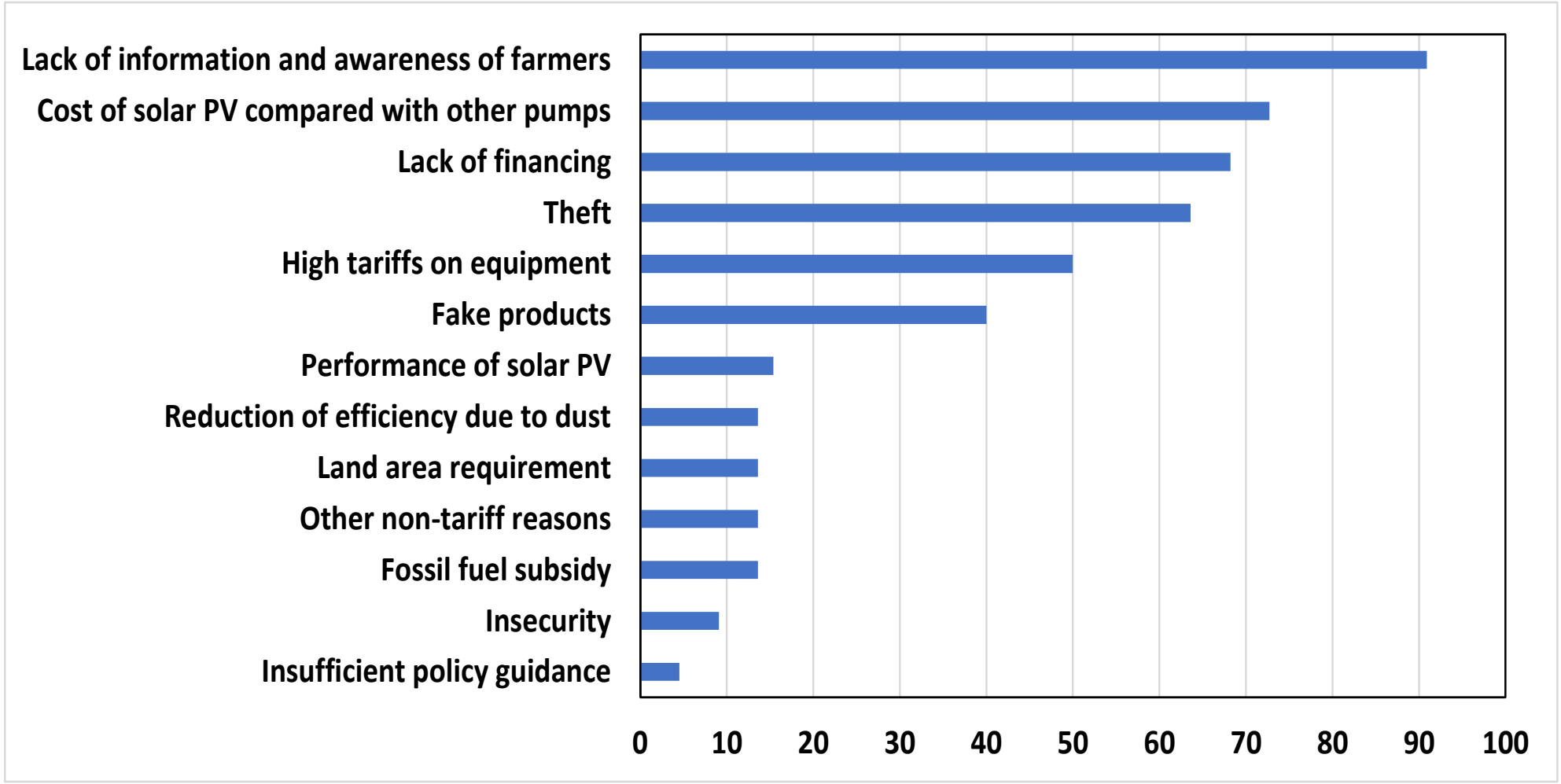
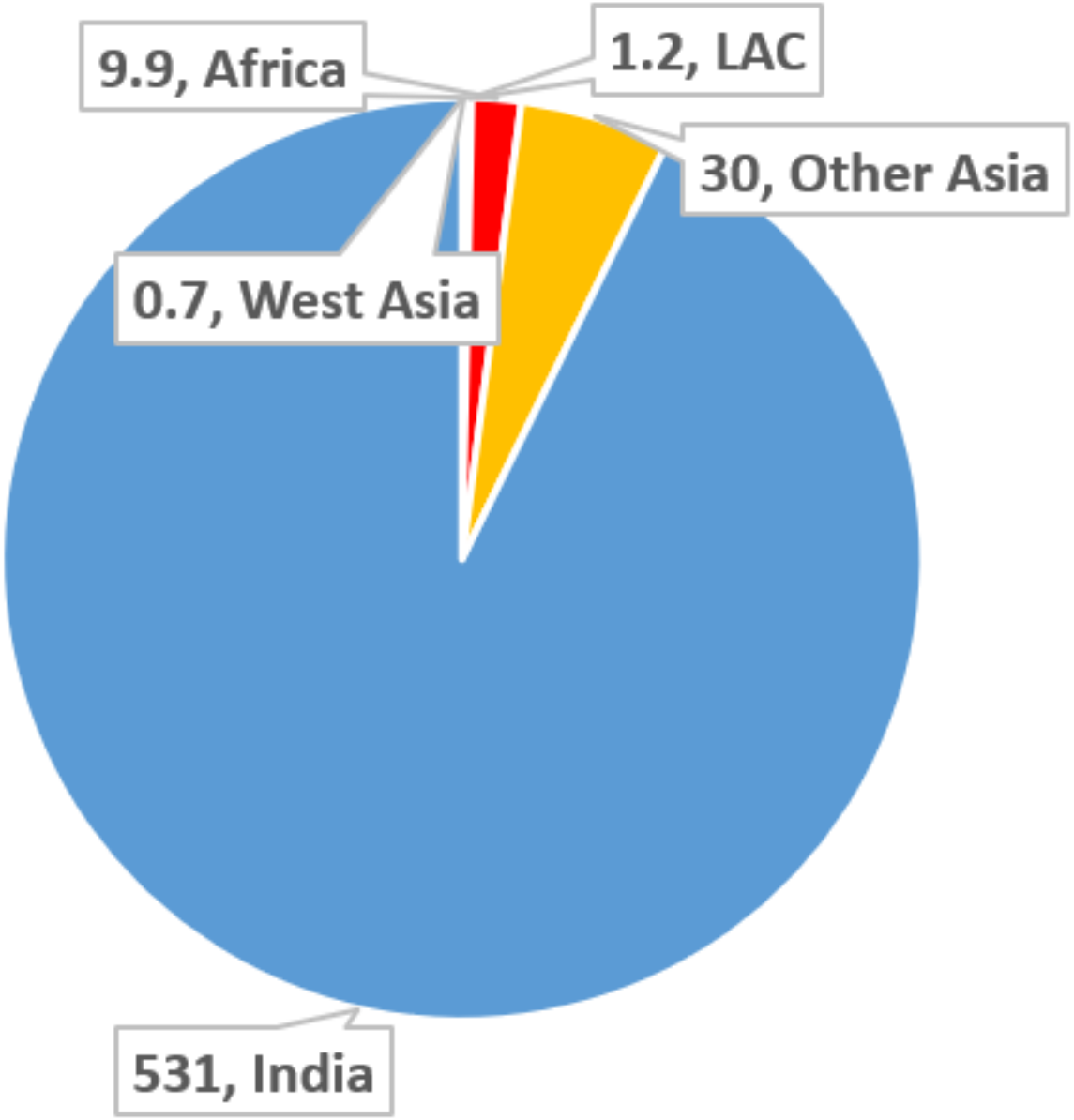
What do solar irrigation dealers tell us about barriers to expansion? (Example to central/northern Nigeria)



Xie et al. (2022)

Distribution of solar pumps by region and MW



INRENA (2021)

Conclusions

- Solar here to stay → growth also supported by climate change (adaptation and mitigation benefits)
- Substantial barriers to growth in Africa (and Asia)
- Not discussed, but: challenges of women accessing the technology
- Need for institutions to reduce depletion
- Need for more assessment of economic viability of different energy sources for irrigation and other productive / domestic uses
- Need for more targeted solarized advice

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