| 8th Nigeria Energy Forum 2023 | 18th July 2023 |

Harvesting the Sun for smallholders in Africa and Asia

Opportunities for South-South Learning and Cooperation

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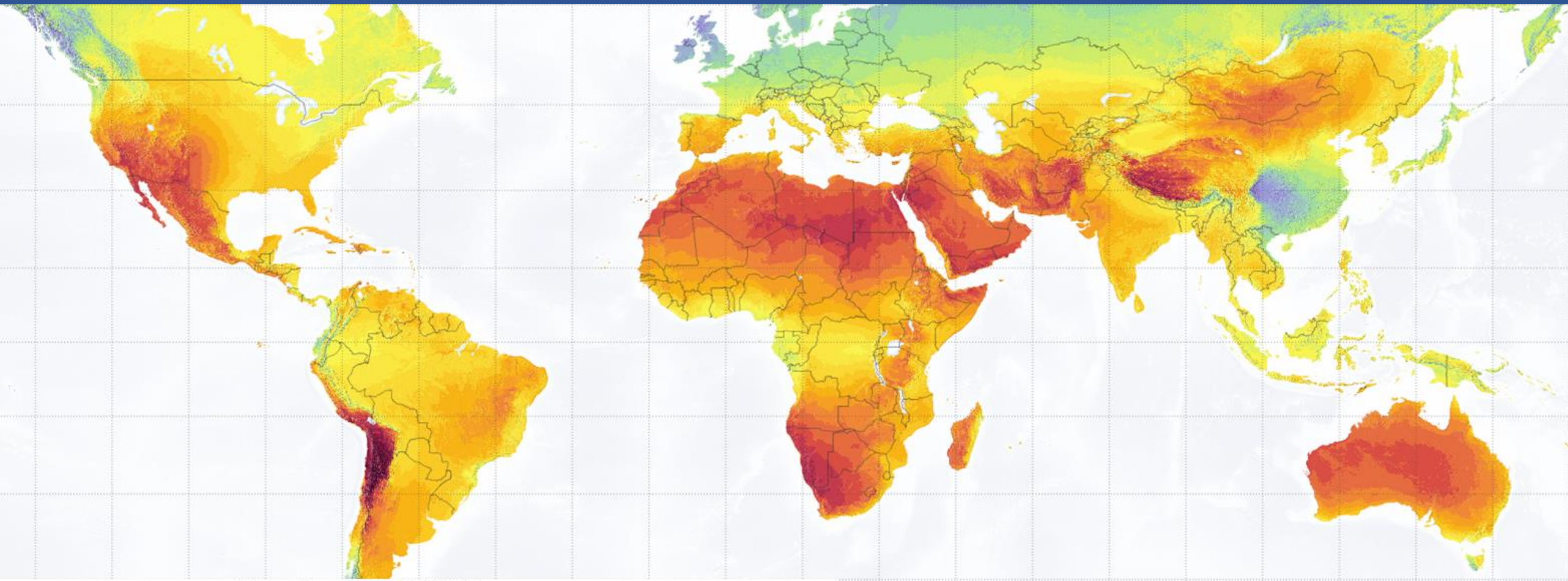
Brighter Sun: Plentiful Solar Resource

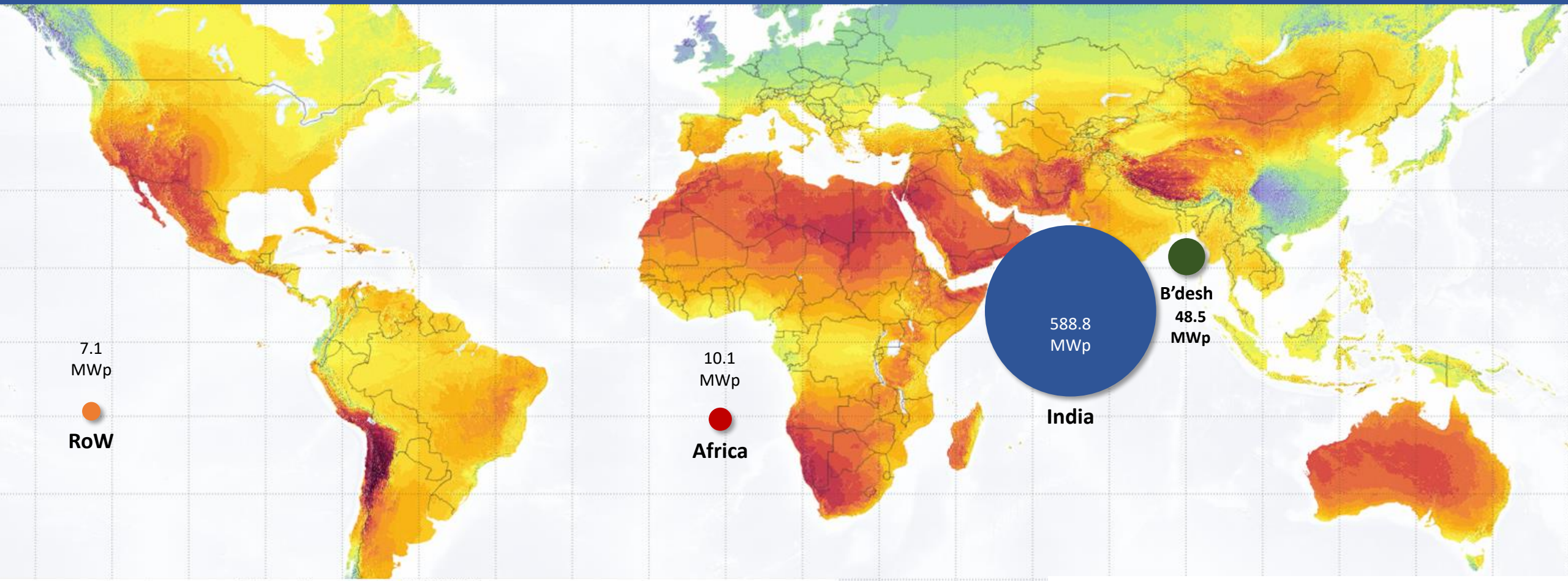
Much of the 'Developing World' can harvest 1,400 – 2,000 peak-hour equivalent of sunshine to (conservatively) generate 3.8 – 5.6 kWh of energy per kWp of installed capacity



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

Solarization of Agriculture: Global Overview

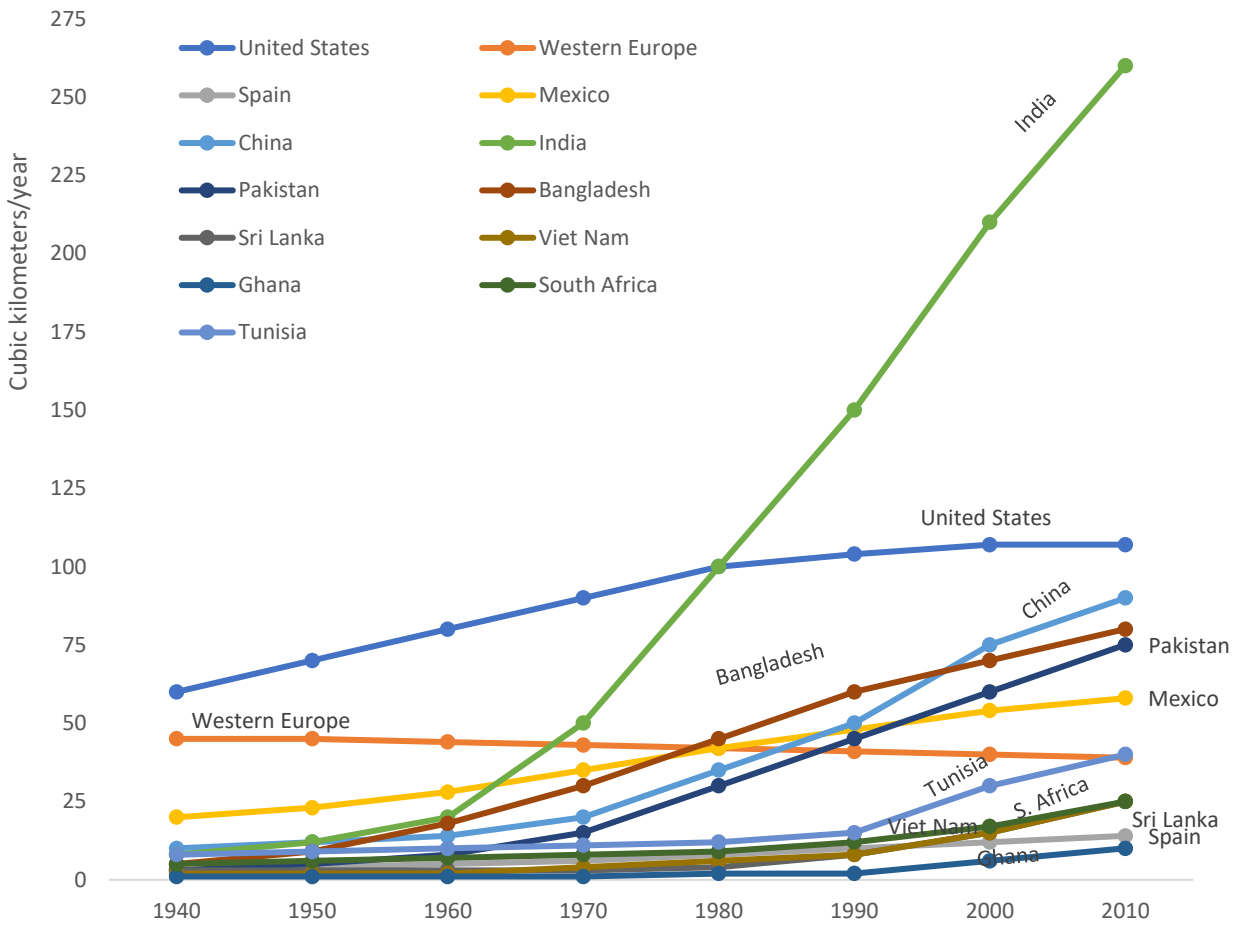
Bulk of the 'early investments' have been made in South Asia | Tremendous untapped potential in Africa

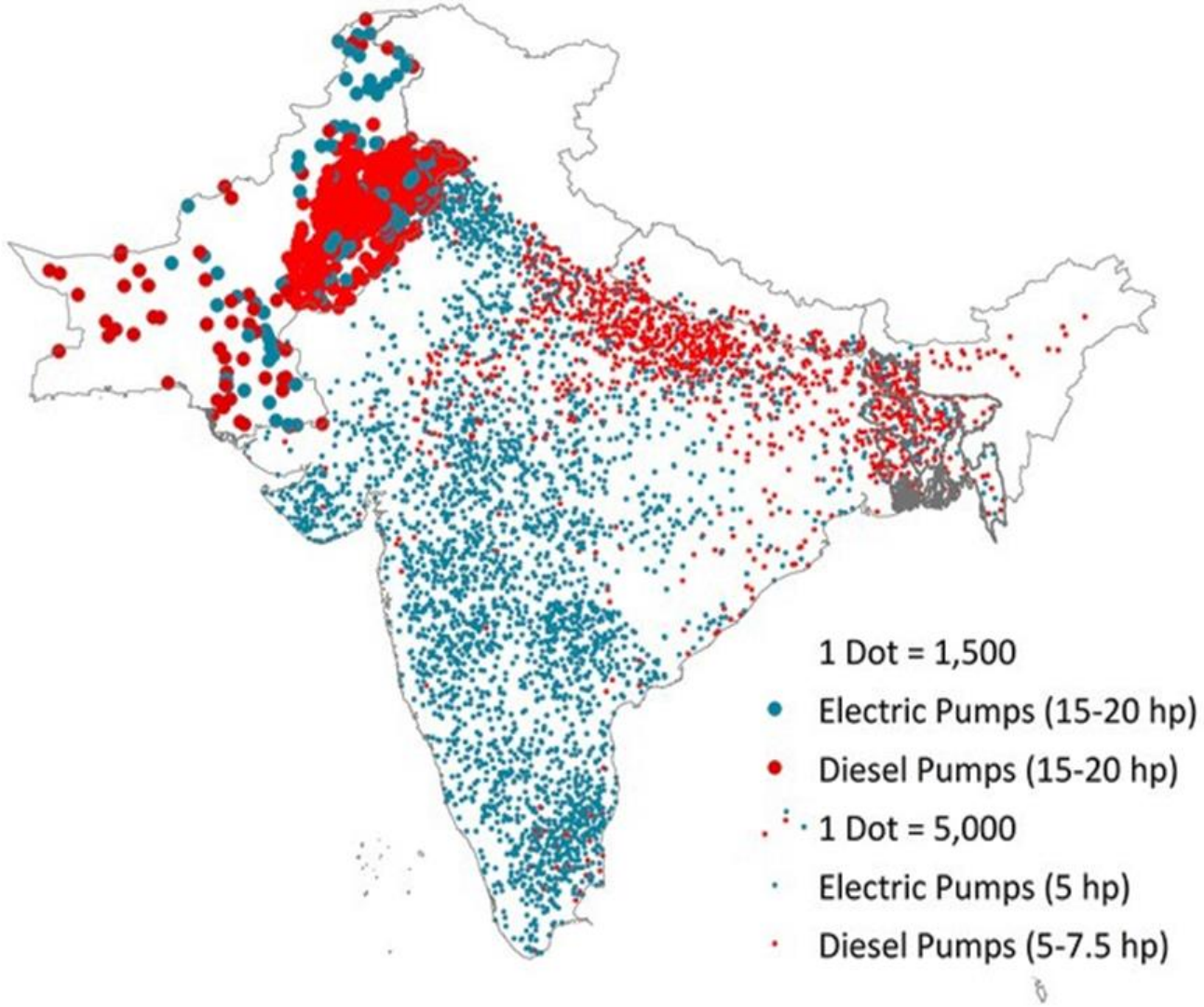


Source: IRENA Off-grid RE Statistics 2022
https://www.irena.org/Publications/2022/Dec/Off-grid-renewable-energy-statistics-2022

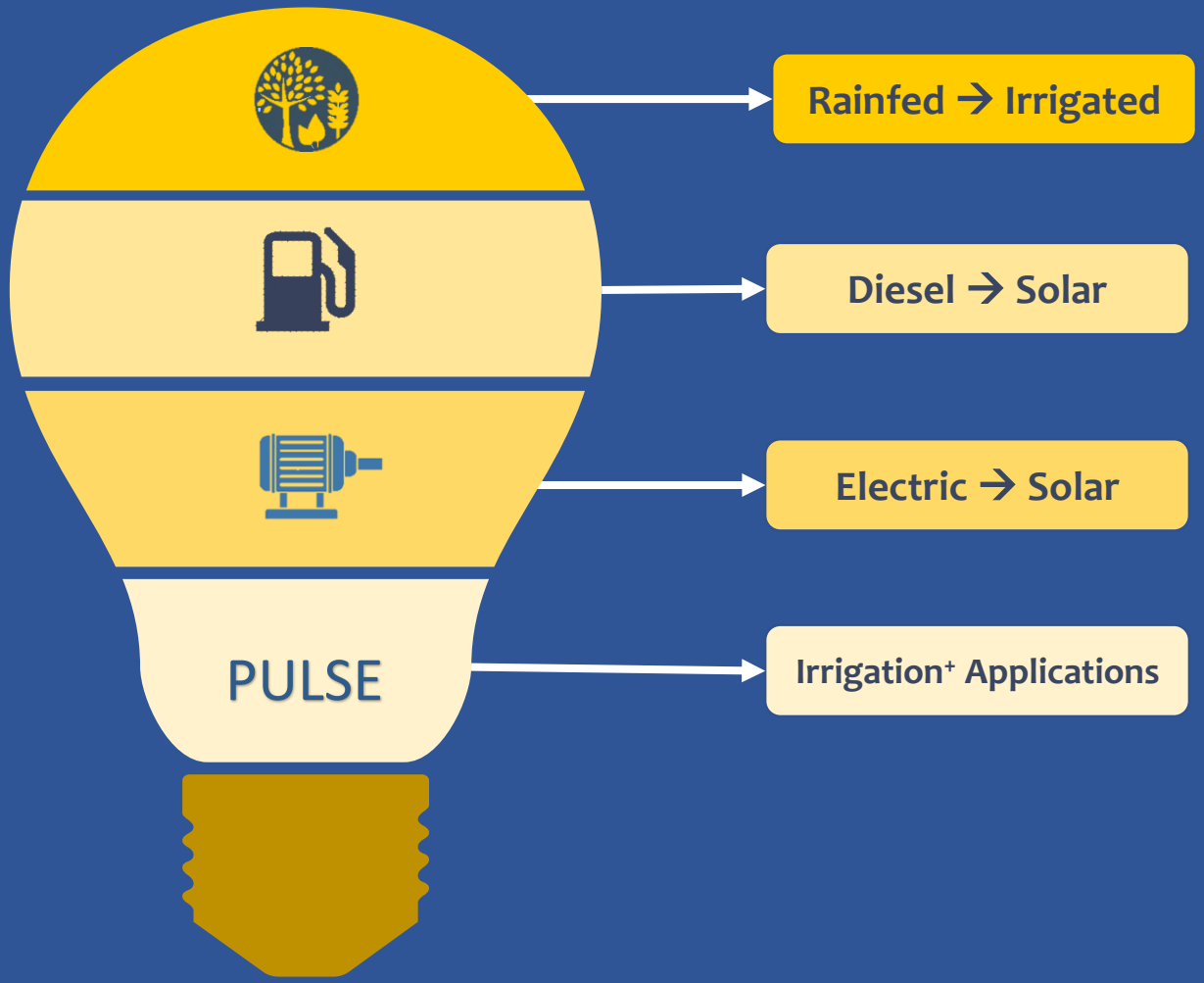
South Asia is 'Ground Zero' for 'Pump Irrigation'

The region has >30 million wells and tubewells with ~1-2m new pumps added each year
IN has more electric pumps; NP, PK and BD rely heavily on diesel pumps





Solar-led Food System Transformation Trajectories



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Solar Irrigation Business Models and Deployment Strategies

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Solar Irrigation Business Models

Individual, Off-grid SIPs dominate… but other models critical to scaling

Individual | Off-grid

- Mainstream
- Equity | Targeting
- High CapEx
- Surplus Capacity
- Perverse Incentives

SPaRC: Solar Power as Remunerative Crop

- Full Utilization
- Right Incentives
- IWMI experiment
- Scaling in India
- Replication: NP, BD

Solar Irrigation Service Providers

- Farmer ISPs
- Diesel replacement
- Fragmented land holdings
- Intensive Irrigation

Solar Enterprises

- Village-scale
- Diesel replacement
- Fragmented land holdings
- Intensive Irrigation

Feeder Tail-end Solar Plants for Agriculture

- Piloted in Mah. (IN)
- Private sector driven
- Fixing incentives

Some Emerging Business Models

Canal-top | Flotovoltaics | AgriPV | Mobile SIPs

+ Land, evaporation, energy generation
- Significantly higher costs

Do the benefits outweigh the additional cost? Will 'floating solar' crowd this out?

+ Land, crop productivity
- Significantly higher costs; energy-led

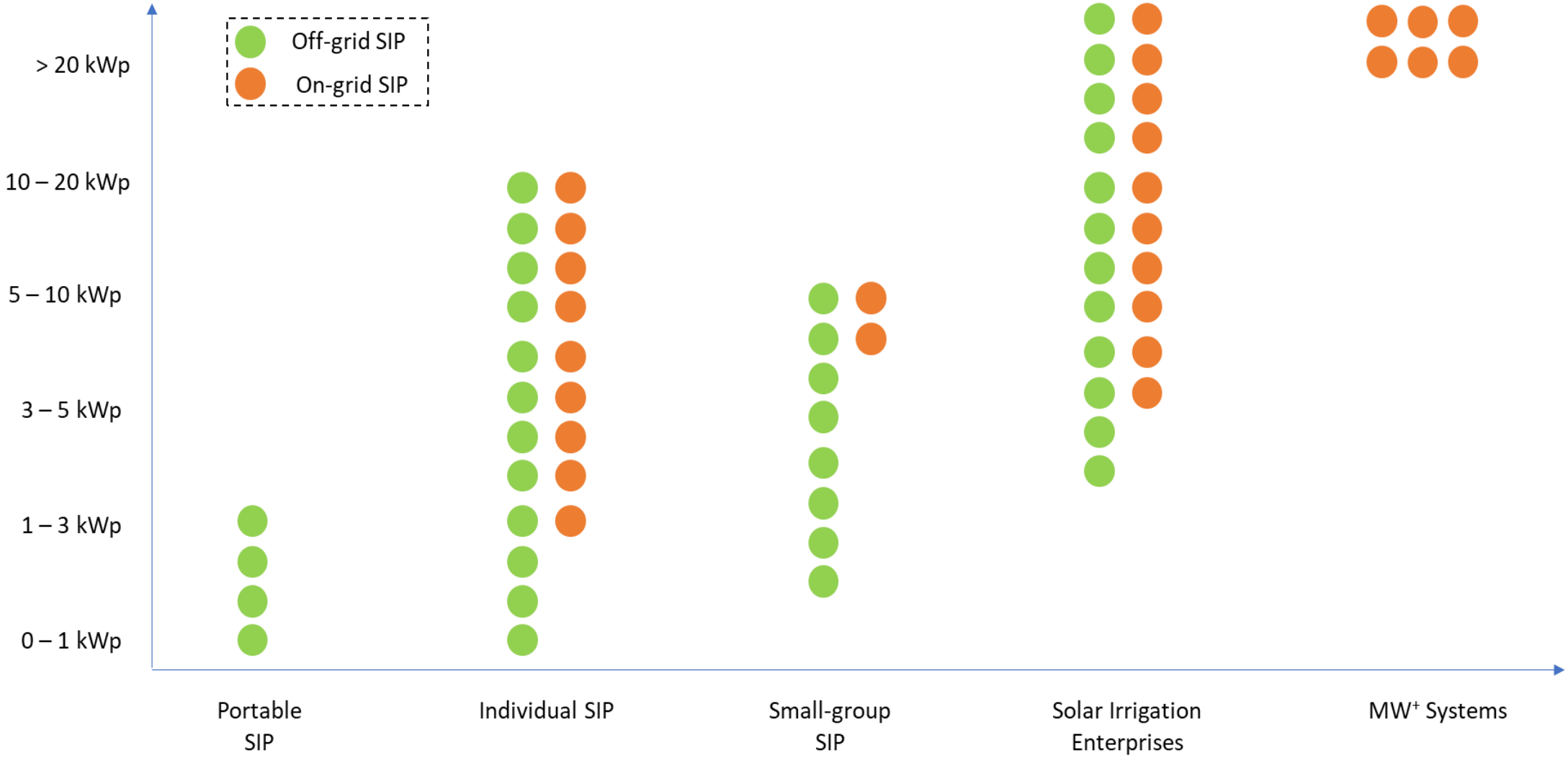
Need farmer-centric business models…

+ Mobility
+ Couples well with drip
- Higher unit costs
- Time to irrigate

Technological and design improvements will spur deployment

Techno-Economic and Techno-Managerial Configurations

Solar Pumps come in all shapes and sizes



Decision Support Tools for Boosting Solar Irrigation

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Solar Irrigation Pump (SIP) Sizing Tool

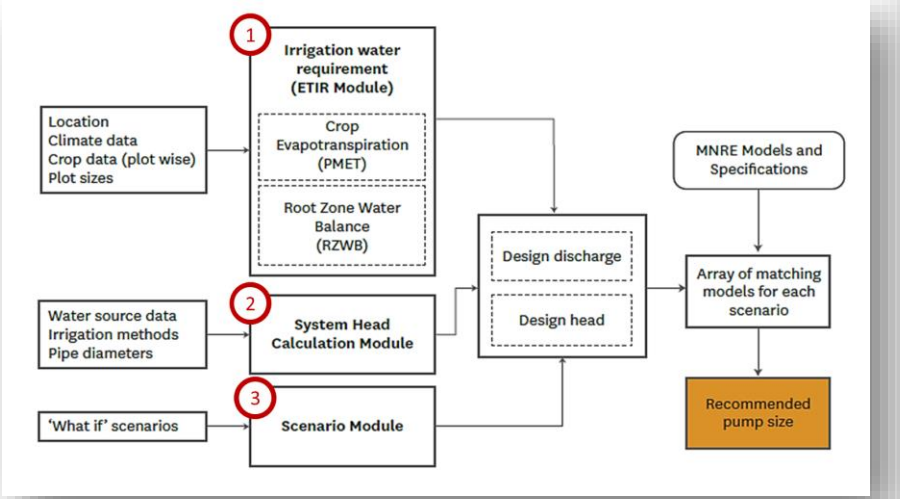
IWMI-ICAR-BISA *Beta* Version for India | SE4RL-NG Scaling to Nepal

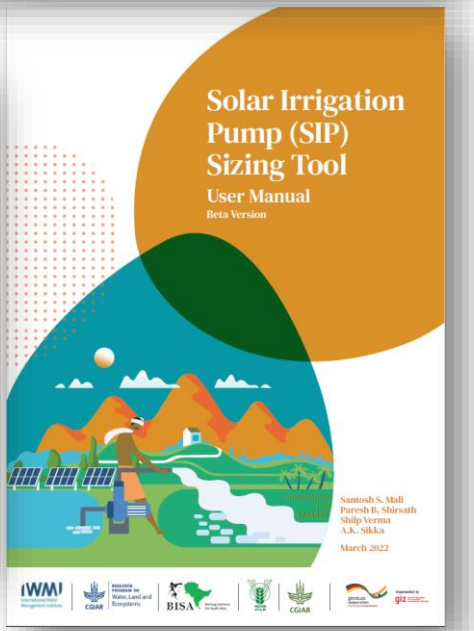
KEY FEATURES

- Built in MS Excel for easy inter-operability
- Fully functional in *offline* mode
- Most user *inputs pre-loaded* using secondary data
- Users free to *over-ride default* options
- Suitable for *data-poor* as well as *data-rich* environments

TOOL MODULES

- Irrigation *Water* Requirement Module
- System *Head* Calculation Module
- *Scenario* Module
- *Result* / Recommendation Module





Key Takeaways for Scaling Solar Irrigation

Lessons from a decade of experiments and experiences

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Top Ten Ingredients for Scale…

1. Promotion mode Subsidy-led | Market-led
2. Cost per watt-peak of installed capacity
3. Financing Subsidy-Loan-Contribution
4. Design Ground-mounted | Floatovoltaics | AgriPV
5. Utilization Sizing | Grid-connected | Off-grid
6. Use Irrigation | Irrigation^{++} | MUS
7. Ownership Individual | Group | Enterprises
8. Equity in access
9. Sustainable resource use
10. Sourcing Domestic | Imported

Solarization of Agriculture is NOT a choice,
only its pace might be…

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Thank You…