Decentralized Energy Options For An Ecologically Fragile Himachal Pradesh, India

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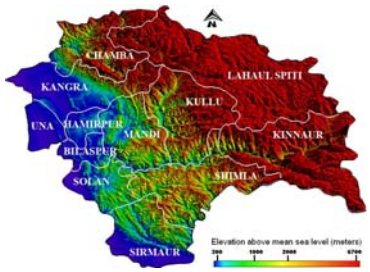
Presented at

Study area and objective

Fig.1:Digital Elevation Model



- Himachal Pradesh is located between 30.38° to 33.21° North latitudes and 75.77° to 79.07° East longitudes, lying in the Western Himalayas, covering a geographical area of 55673 km^2
- One of the highest consumers of bio-energy (fuel-wood, crop-residue, dung-cake) in the country resulting in increased environmental issues like excessive depletion of vegetation, desertification, indoor air pollution etc
- The centralized electrification policies as well as the proposed hydro projects are posing serious threats to the already fragile ecosystem in the state[1].
- In this scenario, we assessed the solar potential of Himachal Pradesh to encourage solar as a decentralized and eco-friendly energy source in the region.

Fig.2:Monthly average rainfall variation

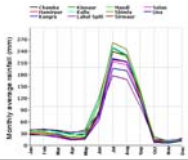
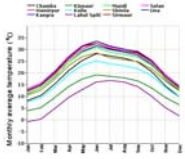


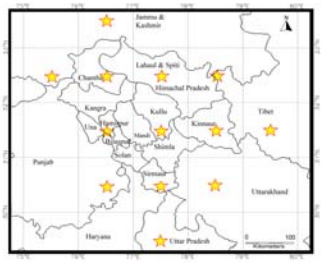
Fig.3:Monthly average temperature variation



Methodology

- Satellite based high spatiotemporal resolution (1°X1°, 22 years) monthly Global insolation datasets from National Aeronautics and Space Administration (NASA) Surface Meteorology and Solar Energy (SSE)[2] were collected (Figure 4) and validated with ground data[3]
- The monthly Global insolation data were represented in Geographical Information Systems (GIS) as solar maps for Himachal Pradesh (Figure 5) and altitude based variations were also observed (Figure 6)

Fig.4: Selected grids for monthly average Global Insolation



Results

- March to October favorable for large-scale/commercial solar applications throughout Himachal Pradesh
- November and February favorable for large-scale/commercial applications in regions below 3500m above sea level
- December and January only favorable for domestic applications like solar cookers and water heaters throughout the state

Fig..6:Variations of global insolation (kWh/m^2/day) at a)low altitude (<1000m) b)mid altitude (1000-3500m) c)high altitude (>3500m)

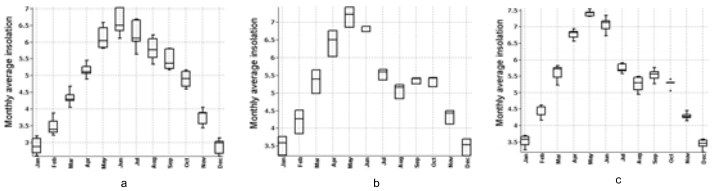
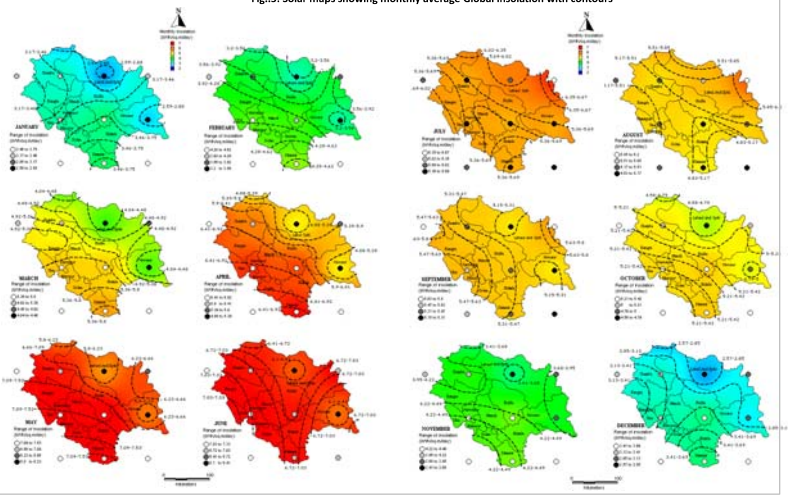


Fig..5: Solar maps showing monthly average Global insolation with contours



Acknowledgement

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References

1)R.K Aggarwal, S.S Chandel, *Energy Policy,* (**2010**) *38*, 2545
2)NASA, Surface Meteorology and Solar Energy Release 6.0 Methodology, (**2010**), <http://eosweb.larc.nasa.gov/sse/documents/SSE6Methodology.pdf>
3)Richard Perez, Robert Seals, Antoine Zelenka, *Solar Energy*, (**1997**) f50, 89