



Energy Poverty in Sindh, Pakistan

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Problem Statement

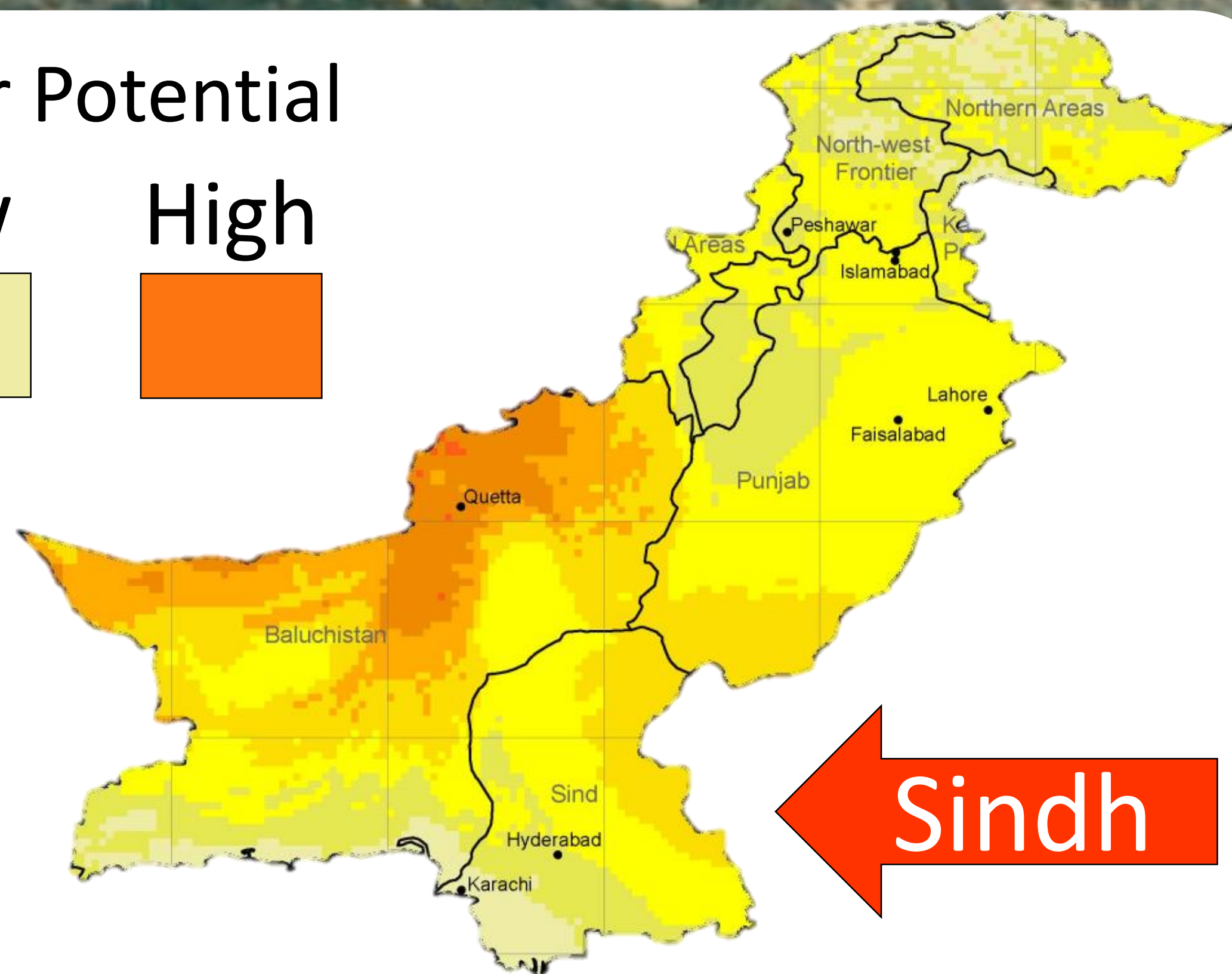
Over the past decade, Pakistan has experienced extended power outages due to an electricity supply shortfall of thousands of megawatts. Rural areas, especially in the Province of Sindh, experience the worst outages, often receiving only two hours of electricity per day. This lack of electricity has inhibited educational advancement, stalled economic growth, and threatened the credibility of the government.^{1, 2}

Background

Until recently, Pakistan was a fast developing country. However, mismanagement within the power sector allowed electricity demand to overtake supply, resulting in power outages. Efforts were made to address the electricity shortfall, but these efforts failed. Complicating the situation, Pakistan has too much debt to afford a fix to the problem. As a result, people in rural Pakistan have essentially no electricity.^{1, 2}

Solar Potential

Low High



Goals

- Determine an effective electric power source for small-scale applications in rural Sindh.
- Recommend a suitable, small-scale, generation apparatus that can power lights and other small electrical devices.

Source	Coal	Wind	Solar	Hydro
Complexity	●	●	●	●
Cost	●	●	●	●
Supply	●	●	●	●
Initiative	●	●	●	●

Key

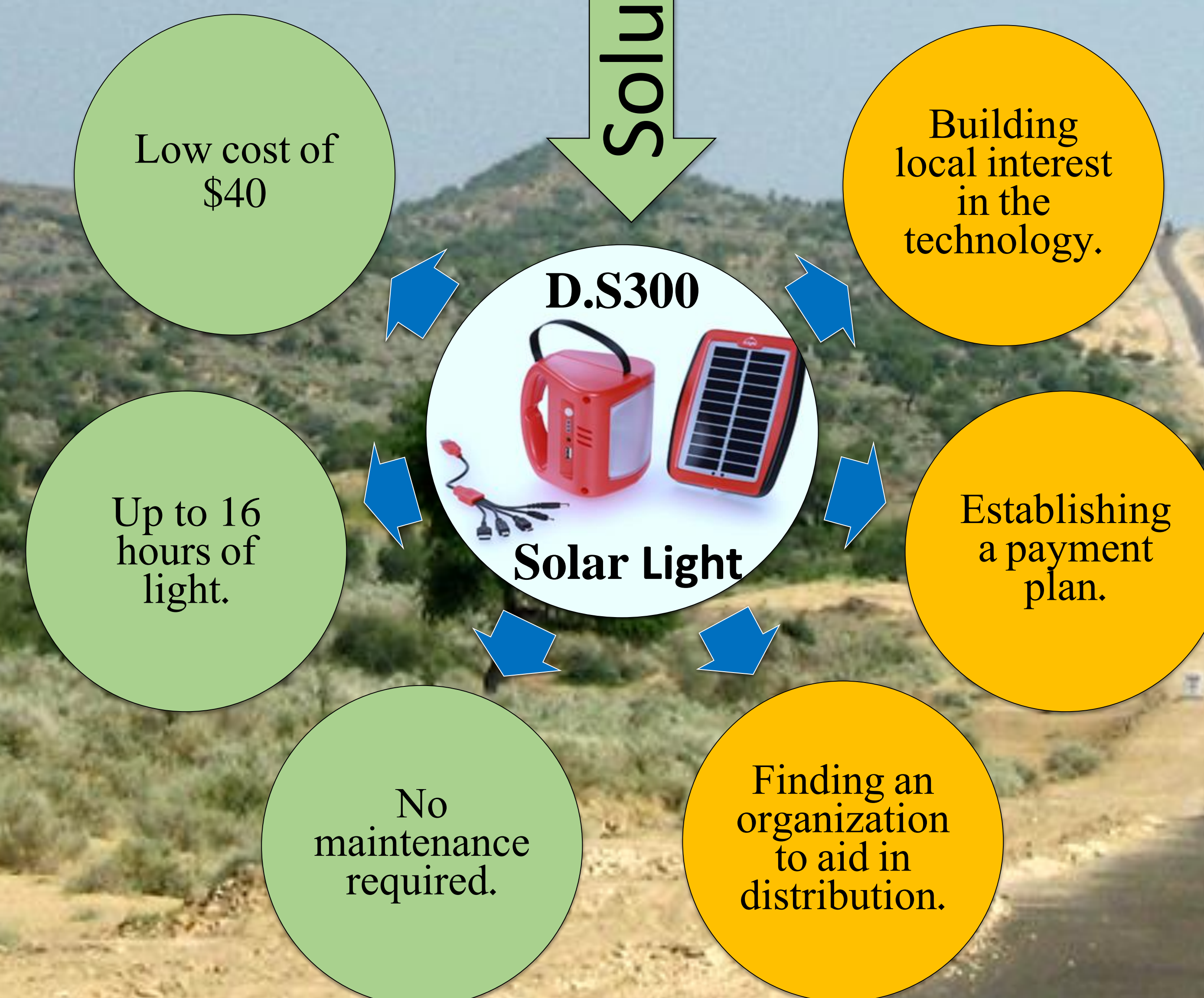
- Desirable
- Average
- Undesirable

Methods

- Established four categories based on Sindh's situation.
- Researched within the four categories for coal, hydro, wind, and solar.
- Our sources included interviews, scholarly case studies, local newspaper articles, and governmental reports.
- Formulated a 3 point rating system and assigned individual rankings based on our research to select the energy source.
- Searched for a small scale apparatus based on the selected energy source.

Advantages

Challenges



Benefits



References

1. Kugelmann, M. (March, 2013). The National Bureau of Asian Research. *Pakistan's Energy Crisis: From Conundrum to Catastrophe?* Retrieved from <http://www.nbr.org/research/activity.aspx?id=325>
2. Kessides, I. N. (2013). Chaos in power: Pakistan's electricity crisis. *Energy Policy*, 55, 271-285. Retrieved from doi:10.1016/j.enpol.2012.12.005
- Design, d.light. (2015). D.light. *D.light S300*. Retrieved from <http://www.dlight.com/solar-lightingproducts/multifunction/dlight-s300/>
- Practitioners like Aurore distribute solar products to rural users [Photograph]. (2012). Retrieved April 27, 2015 from <http://www.ashden.org/blog/ashden-indian-collective-ushers-international-year-sustainable-energy-all-asia>
- Grobl, Karl (Photographer). (2014). (Photograph of children using a solar-powered flashlight). Retrieved April 27, 2015 from <http://news.discovery.com/tech/gear-and-gadgets/ikea-gets-into-flexible-led-lighting-140828.htm>
- D.Light S300 Solar-Powered Lamp [Photograph]. Retrieved April 25, 2015 from <http://www.phatrice.com/d-light-s300-solar-powered-lamp>
- Solar energy in Pakistan [Graphic Map]. (2007). Retrieved April 28, 2015 from <http://www.geni.org/globalenergy/library/renewable-energy-resources/world/asia/solar-asia/solar-pakistan.shtml>
- Road in Tharparkar District of Sindh, Pakistan [Photograph]. (2006). Retrieved April 28, 2015 from http://en.wikipedia.org/wiki/Thar_Desert

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Conclusion

While distributing the D.S300 would not eradicate rural energy poverty in Sindh, it would still improve the quality of rural life. Furthermore, the D.S300 can serve as a step towards future solar projects by familiarizing the locals with the characteristics and potential benefits of solar energy.