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Biogas Distribution in Nepal

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Introduction

Nepal is a country located in the heart of the Himalayas in South Asia. With a total population of 26.5 million more than 80% of Nepalis live in rural areas. Many of the rural households rely heavily on firewood as a means of energy for cooking food. However, this has led to issues of forest conservation and health issues associated with smoke inhalation. In a search for a cleaner and more sustainable energy source, the country initiated a program to develop biogas plants.

Biogas is a renewable energy source that is produced by the bacterial breakdown of organic matter such as livestock and sewage waste. Biogas is comprised of multiple gases, the most dominant of which is methane (CH₄) followed by a smaller concentration of carbon dioxide (CO₂). Biogas turns what would be waste -- such as sewage, manure, or food scraps -- into a clean renewable energy. The gas burns cleanly, is smokeless, and is non-toxic.

In the past 20 years, the number of biogas plants in Nepal has been on the rise as the benefits are recognized and resources for construction are made more available. This is attributed to the Biogas Support Program (BSP). Founded in 1992, this program focuses largely on providing subsidies to make these biogas plants more accessible. However, while some of Nepal's 75 districts are surpassing the expectations for biogas construction, other districts have yet to embrace the technology. Biogas distribution in Nepal has been well documented in text, but not through visual spatial representation. Through GIS, this data was used to create maps that will help to explain the trends and factors affecting biogas distribution.

In this analysis percent Technical Potential Achieved (TPA) and percent Biogas Plants per Household (BPH) were determined for each district in five year intervals. Technical Potential is a projected number configured for the maximum amount of biogas plants that can be achieved with the resources available. Biogas plants per household is the percentage of households in each district that have had biogas plants constructed.

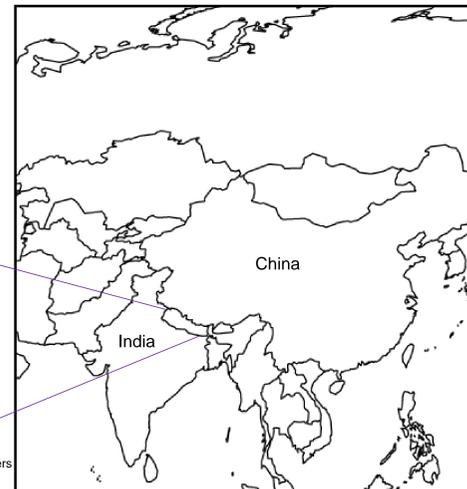
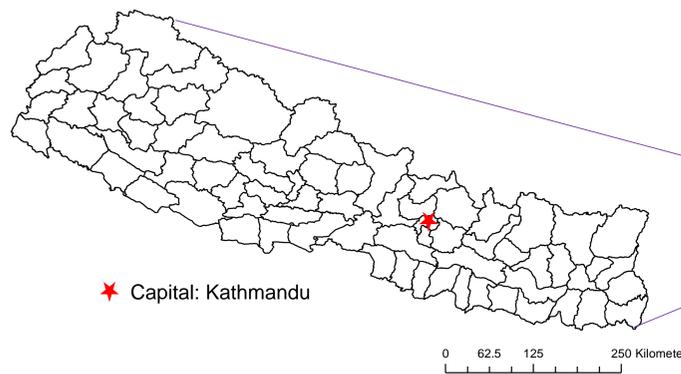


Methods

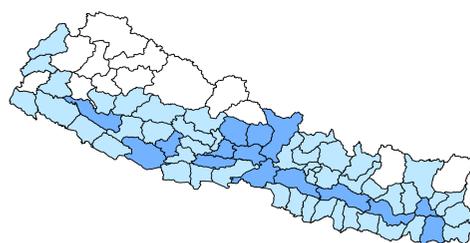
Data for technical potential was retrieved from BSP. The technical potential for each district was determined based on the number of households with livestock. The percent TPA was calculated by dividing the total biogas plant construction to date by the projected technical potential. This was done in five year intervals (1992-97, 1997-2002, 2002-07, 2007-12).

Data for household population was retrieved from the National Population and Housing Census of 2001 and 2012. The percent BPH was calculated by dividing biogas plants in each district by the household population data. This was done in five year intervals. The 2001 census data was applied to maps for 1997 and 2002. The 2011 census data was applied to the maps for 2007 and 2012. Maps were created using this data as layers in the ArcGIS program.

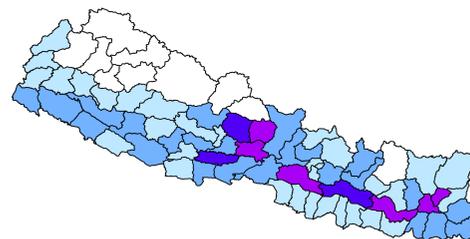
Location of Nepal in South Asia



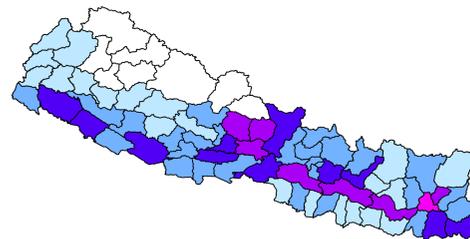
Percent Technical Potential Reached (TPA)



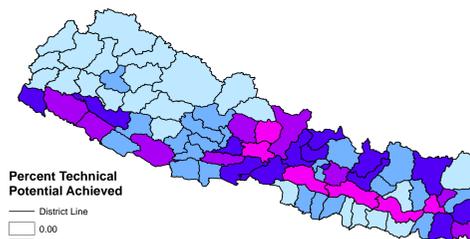
1997



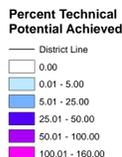
2002



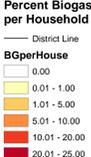
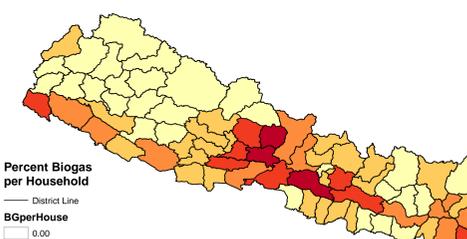
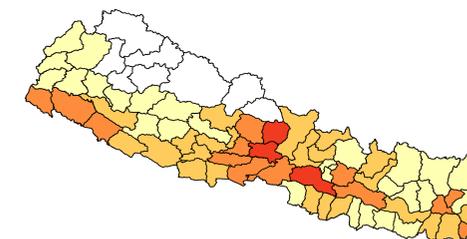
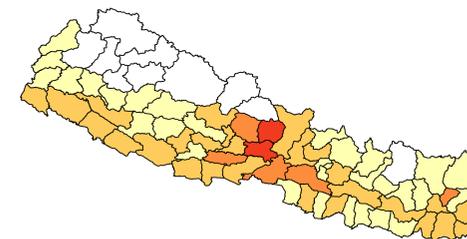
2007



2012



Percent Biogas Plants per Household (BPH)



Analysis and Conclusions

By viewing the results of the TPA and BPH maps, we see that in 1997, thirteen districts had yet to build a single biogas plant. In 1997 and 2007 the numbers continue to increase, and by 2012 every district had begun to develop their technical potential. However, nearly one third of the districts have not constructed more than five percent of their capabilities by 2012. In contrast, by 2012, six districts have actually surpassed the calculated possible amount of biogas plants. The BPH map results show that by the year 2012, 37.3% of districts in Nepal reported less than one percent of their households with biogas.

By comparing the trends of the two maps, it is revealed that some districts have a strong relationship between the percentages of TPA and BPH while others do not seem to have a correlation. Economics may not be a significant factor because of the efforts by BSP to distribute subsidies to lower income households. In the lower elevation regions resources are more accessible yet the biogas technology is not being embraced. For a more comprehensive understanding of these trends, further research is needed on other factors such as urbanization, ethnic groups, development efforts, available skilled labor.

Nepal with its many challenges including elevation, lack of infrastructure, and civil unrest can provide a case study for the feasibility and success of biogas development. While certain districts are surpassing the expectations for biogas construction, other districts have yet to embrace the technology. By continuing to examine the trends of distribution, Nepal and other regions can further promote a sustainable and affordable energy source for rural communities.



Resources

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