Power to the People

Mapping Hydropower Suitability in Nepal

Hydropower in Nepal

Nepal’s steep mountains and the rivers flowing through them give it its advantage for hydroelectricity generation. Therefore, for this analysis, the slope of the land near a river was given the greatest weightage in the suitability calculations. However, hydropower plants are not constructed above 4000m above sea level, rarely above 3000m, because of high construction, maintenance and environmental costs. That lead to an elimination of a significant area, since a large portion of Northern Nepal is at a high altitude in addition to being quite steep. Land between 3500m to 4000m was given lower priority over land at lower altitude for the same reason.

To make the analysis more realistic, buffers were created around each at 1km, 5km, 10km and 20km, with closer buffers being weighted heavier. Tunnels up to ten kilometers long have been constructed in Nepal for hydropower generation.

Nepal has two kinds of hydropower stations based on how they operate: run-of-the-river stations, and those with dams. Hydropower stations with dams generate more electricity, and can store water during the monsoon for the dry season, but are not environmentally friendly and usually involve displacing nearby human settlements. Run-of-the-river stations run on rainwater and water from glaci- ers, and have no dams. They do not store water, so produce little or no electricity during the dry season, but are environmentally friendly and do not require human displacement. In both types of stations, rain plays an important part in replenishing the water, and allowing for greater production of electricity. Therefore, places that received greater rainfall are considered more valuable over drier regions.

The environmental and population aspects of the power plants were also considered. The distance between power plants and human settlements was maximised and areas with low human density were given greater priority. Moreover, regions that were close to, or parts of, protected areas (such as watershed conservation areas, national parks or reserves) were considered to be less suitable than other regions.

Hydropower stations tend to have a significant construction footprint, so a hydropower’s distance from nearby road would have a significant impact on how it can be operated. A hydropower station built far from nearby roads and/or near human settlements or natural environments was assumed to have more significant adverse socioeconomic and environmental impact than that constructed nearby to an existing road network. A power plant’s proximity to an existing road network was included as a factor for consideration, and so was the proximity to electrical transmission lines.

Soil types of different regions were also factored into the modeling. The soil-type of a given location influences the kind of construction and civil work that needs to be done, which directly corresponds to the costs (both environmental and economic) of a project, and thus the suitability of a given project. Areas with more suitable soil were given more points as compared with areas that had less suitable soil for the construction of power plants.

As is clear from the final map above, Nepal has incredible unrealized potential in hydropower. There are clusters of high-density regions very suitable for hydroelectric plants in the Eastern, Central, Mid-Western, and Far Western Regions. While the red regions at the southern part of the country are a surprise, since they would be in mid-hills or the southern plains, they represent areas with very high gradient of altitude, and would be useful for micro-hydro projects, and make up for the lack of relative abundance of clusters of regions of high suitability as in the northern and western parts.

Considering the internal growth in demand and its total potential, it becomes obvious that Nepal is well-poised to become an exporter of hydroelectricity, were the facilities properly developed. It must also be noted that the far eastern and the far western parts are especially suited for electricity exports, with greater hydropower potential, and their proximity to both India and China, who have both a growing appetite for energy. Therefore, if the government made policies with the clustering of energy-clustering in mind, it could make big economic gains through the internal utilisation, and sale of hydropower.

Table 1: Major River Basins of Nepal and their Hydropower Potential

<table>
<thead>
<tr>
<th>Basin</th>
<th>Amount Flow (in billions of m³)</th>
<th>Catchment Area (in km²)</th>
<th>Theoretical Potential (in MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sapta Koshi</td>
<td>33</td>
<td>28 140</td>
<td>22 350</td>
</tr>
<tr>
<td>Sapta Gandaki</td>
<td>50</td>
<td>31 600</td>
<td>20 600</td>
</tr>
<tr>
<td>Karnali</td>
<td>42</td>
<td>41 890</td>
<td>32 010</td>
</tr>
<tr>
<td>Mahakali</td>
<td>7</td>
<td>5 410</td>
<td>4 160</td>
</tr>
<tr>
<td>Southern Rivers</td>
<td>42</td>
<td>40 141</td>
<td>4 110</td>
</tr>
<tr>
<td>Total</td>
<td>174</td>
<td>147 181</td>
<td>83 280</td>
</tr>
</tbody>
</table>

SOURCES:


World Class Reviews Data:


Map: www.island.ug - "International Centre for Integrated Mountain Development (ICIMOD), 2010"