Environmental Sustainability Index: Arunachal Pradesh

Increasing importance has been given to the integration of environment and economic development in policy-planning process. However, particularly in case of India, data deficiency clearly affects the policy making process. Lack of focused information about various sustainability issues, at state and national level, is not available to various stakeholders like policy makers, private sector, Non Governmental Organizations (NGOs), preventing any further sustainability analysis. Environmental Sustainability Index (ESI), developed by Centre for Development Finance attempts to address these issues of environmental sustainability. ESI, formulated primarily as a diagnostic tool for informing and empowering policy makers, citizens, researchers and activists, seeks to fulfil three main objectives. First, to provide information to ensure evidence-based policy making; second, to facilitate prioritisation of budget allocation between various resource sectors and lastly, to measure and monitor sustainable development at the state level over time.

This research project is an effort to map the current sustainability levels of the Indian states, while simultaneously projecting their ability to protect the environment in the future. Dimensions of sustainability are captured through forty-one indicators, culled from a wide range of themes such as air, water, land, forests, and impacts of pollution on ecosystem and human health and policy responses by various stakeholders. Based on the aggregate score, states are categorised into five groups: 'most' sustainable (top 20 percentile), 'more' sustainable (60-80 percentile), 'moderately' sustainable (40-60 percentile), 'less' sustainable (20-40 percentile) and 'least' sustainable (bottom 20 percentile).

Each state's environmental resources, capabilities and hence challenges differ from others. Hence the tool compares the states across six peer groups; created on the basis of GDP per capita and contribution to India s GDP. Sub index analysis of peer groups reveals a pattern; similar environmental issues are being faced by states with comparable growth trajectories. Consequently, a deeper analysis of successful sectoral policies is initiated to enhance knowledge about policy initiatives and outcomes at state level. In this context, this case let series aims to highlight initiatives (in terms of policy and implementation measures) taken by various state governments to tackle a plaguing environmental issue in their peer group.

This case let focuses on ***Arunachal Pradesh***, categorized under "*Dark Green*" category which signifies that it scores in the 80-100 percentile category. Although it is a smaller state with lower demand for electricity, Arunachal has taken advantage of its natural resource endowments and implemented some smart policies and provided incentives to private developers to meet most of its demand from renewable sources. The following sections provide a snapshot of ESI score and highlight some of the key policies and programs adopted by the State.

ESI Snapshot

ESI Group	Dark Green
Other states in same ESI group	Mizoram, Sikkim, Nagaland, Manipur, Himachal Pradesh
% Contribution to overall India's GDP	0.1
SGDP per capita / annum	28533
% population living below poverty line	3.68

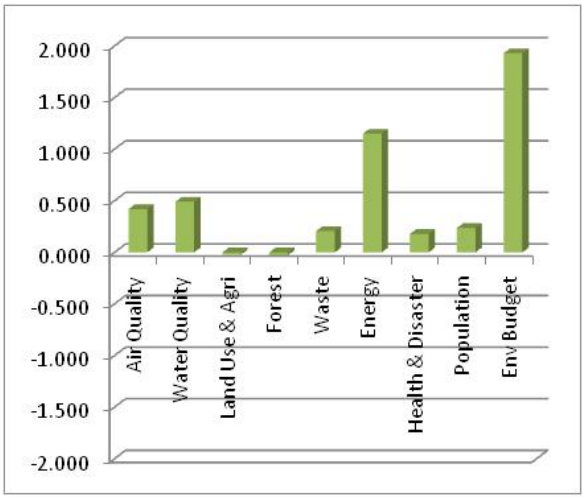

Figure 1: ESI as per 9 sub indices

Columns that lie above the X axis depict a better than average performance (as compared to all 28 states). Columns that lie below the X axis depict a less than average performance (as compared to all 28 states). The height of a column indicates the degree to which a state has performed better or worse than others in that particular sub index. All values are in standardized scores. All sub indices are adjusted to ensure that higher values indicate better performance in that aspect of sustainability.

The spider chart shows the sustainability of states in terms of Driving Force-Pressure-State-Impact-Response. All values are standardized scores. Values farther from the centre indicate better performance. A state's higher positive score in 5 different components add up; and higher green area indicates better performance by the state in all components.

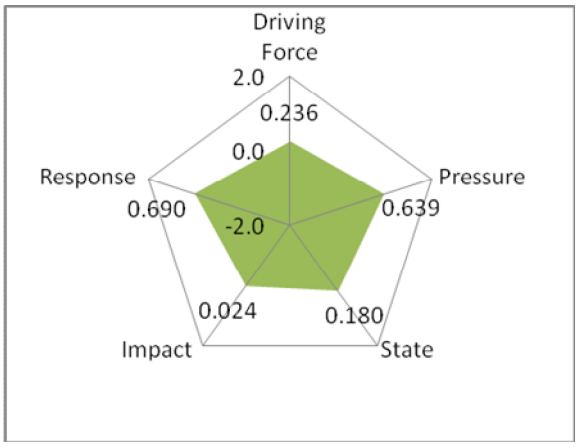

Figure 2: ESI as per DPSIR Framework

Introduction

Arunachal Pradesh has a territory of more than 80 thousand sq. km, which is about 2.55 per cent of India's land area and a third of the area of North-East India. Despite being territorially the largest State in North-East India, its population is only 2.85 per cent of the population of North-East India and 0.11 per cent of India's population. The population density is 13 persons per sq. km, lowest in the entire north east region, as compared to 324 persons / sq. km for all of India. However, the rate of growth of population in Arunachal Pradesh has been much higher than that of the country as a whole, growing on an average, at the rate of 2.98 per cent per annum between 1961 and 2001 (Figure 3) as against a 2.13 per cent growth rate for the country. (2005)

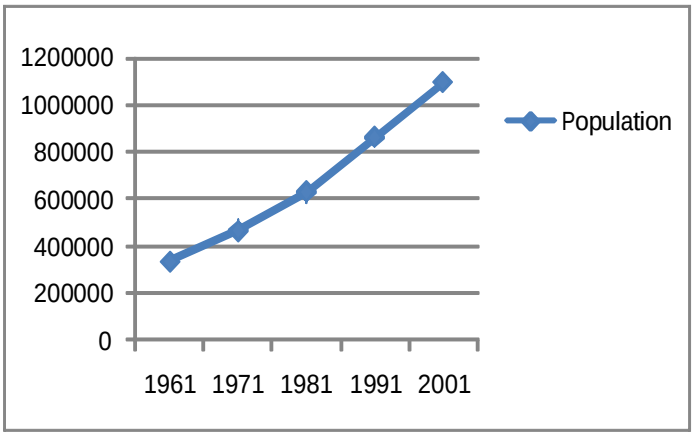

***Figure 3 : Population growth in Arunachal Pradesh* (Human Development Report, 2005)**

The increase in population has been accompanied by growing energy consumption in various sectors. The per capita consumption of electricity in Arunachal Pradesh was recorded as 86.9 kWh in 2001-02 against the all-India average of 335 kWh. (Human Development Report, 2005) As of March 2010, Arunachal Pradesh had a total installed power capacity of 201.9 MW, under the state and central sector; out of which 54 % is derived from hydrological sources, while another 25% from other renewable energy sources. (REEEP, 2009)While 83.3 MW of installed capacity was under state sector, 118.6 MW was under central sector. (IBEF, 2010) In 2000-2001, 46 per cent of the requirement of power was met from diesel generating sets, while the remaining 53.9 per cent of the power requirements was met by hydro electric projects. (2005)

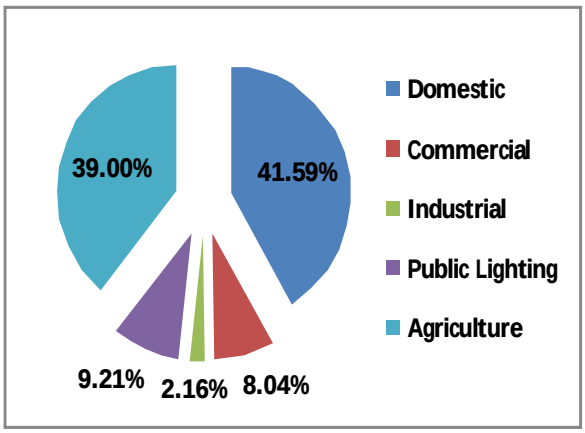

Figure 4: Electric Power consumption in the State (Directorate of Economics & Statistics, 2000)

Hydro-Power Potential

The south-west monsoon makes Arunachal one of the wettest States in the country, with an average annual rainfall of 350 cm (Human Development Report, 2005). With its numerous rivers and streams, Arunachal has considerable potential for the development of hydroelectric power, which is a major source of electricity generation in the state, contributing around 97.6 MW. However, substantial portion of the hydroelectric

power potential has so far remained untapped. Accordingly, Arunachal Pradesh has been focusing on developing its huge hydro power potential. (IBEF, 2010) The Hydro-Electric power potential of Arunachal Pradesh is assessed to be around 50,000 MW. (WAPCOS International Consultants)

Institutional Setup

The state has set up the Department of Hydro Power Development to oversee, coordinate and monitor hydro power development. The Government of Arunachal Pradesh has signed a Memorandum of Understanding (MoU) with central sector power generators and integrated power developers (IPD) for the development of 135 hydroelectric power plants, with an aggregate capacity of 25,722 MW. (IBEF, 2010)

In the Central sector, 405 MW (87.29 per cent) has been developed by the North East Electric Power Corporation (NEEPCO) by commissioning the *Ranganadi* Hydel Project. (WAPCOS International Consultants) In addition to the completion of the said project, many other projects are under consideration and are at various stages, ranging from the investigation stage to the construction and commissioning stage, with capacities ranging from 10 MW in the *Dikrong* Project to 11,000 MW in the *Siang* Upper Project. (Human Development Report, 2005)

Small Hydro-Power Policy 2007

The State Government has promulgated a new hydro policy called Small Hydro Power Policy-2007 to develop around 2000 MW of hydro power from small hydro projects to be built by private developers under Build Own Operate and Transfer (BOOT) basis. Under this policy, hydro power projects of capacity ranging from 1kW to 25 MW would be taken up. (Department of Power, Government of Arunachal Pradesh, 2008)

The policy encourages local participation in various hydro power projects. While the private developers undertaking the projects under this policy have to provide '*free power'* to the state at the rate of 5 percent for projects from 1 kW to 5 MW and at the rate of 8 percent for projects between 5 MW to 25 MW, the local developers are exempted from this *free power* to the state for projects up to 5MW. There would be concession on *free power* for 3 years for projects between 1 kW to 5 MW, 2 years for projects from 5 MW to 10 MW and 1 year for project above 10 MW. There would also be reservation for local developers as per the prescribed norms of the MoU signed earlier on Mega Projects. (AG, 2007) Land for project and other allied infrastructures shall be leased to the developer against payment of land revenue as per relevant tariff of the state government. (IREDA) State Government shall also allow 50% share of carbon credit benefit from carbon trading under Clean Development Mechanism. (Department of Power, Government of Arunachal Pradesh, 2008)

Necessary steps have been taken to ensure effective implementation of the policy. A High Level Selection Committee has been set up to examine the proposals of the prospective developers and submit its observations / recommendations to the State Government. Moreover, upon failure of the developer to commence work at the project site within 18 months from the date of signing of the MoU, the agreement shall stand terminated. The upfront payment, in that case, shall be forfeited. Further, state has assumed complete responsibility of maintenance of law and order as well as rehabilitation and resettlement of the persons so displaced due to the project. (IREDA)

Private Sector Involvement

In Arunachal Pradesh, the development of the power sector has assumed centre stage since the Sixth Five Year Plan when 12.82 per cent of the total Plan outlay was allocated to this sector. (Human Development Report, 2005) The installed capacity available to the state is shared between the centre (117 MW) and the state (45.43 MW); with no private involvement as of 2004. (WAPCOS International Consultants) However, private participation in development of small hydro project with certain attractive incentives is now being encouraged, ever since the adoption of the Small Hydro-Power Policy, 2007.

The policy is also formulated in a manner so as to encourage foreign direct investment (FDI) in the aforementioned sector. According to the Reserve Bank of India (RBI), FDI inflows in the Guwahati region[1] from April 2000 to May 2010 amounted to US$ 64 million. As of March 2010, of the total outstanding investments of US$ 23.7 billion, energy sector accounted for around 95.3 per cent. (IBEF, 2010)

Bio-Mass Energy

India has a biomass energy potential of 19,500 MW, out of which 3,500 MW is from bagasse-based cogeneration and 16,000 MW from surplus biomass. Currently, India has 537 MW commissioned and 536 MW under construction. (GENI, 2006) Biomass gasifier systems for electrical applications aggregating 1.66 MW have, therefore, been commissioned in six states, including Arunachal Pradesh. (ICLEI South Asia, 2007) Further, the National Biogas and Manure Management Programme (NBMMP) is being implemented in the North-Eastern Region (NER) through State Government Departments/State Nodal Agencies; particularly by the Khadi and Village Industries Commission (KVIC) in Arunachal Pradesh. As of December, 2009, 23 Family Type Biogas Plants have been installed in the state. (Press Information Bureau)

Arunachal Pradesh has 81.25% of area under forest cover inhabited by 26 major tribes, 90% of which use biomass as primary source of energy for various household activities such as cooking, water heating etc. The consumption in rural areas of Arunachal Pradesh is about 61 kg per month which is almost three times higher than the national consumption rate; and second highest amongst the North-eastern states. The fuel consumption pattern in rural Arunachal Pradesh reveals that people spend more (79.23%) on firewood followed by LPG (liquefied petroleum gas, 8.81%) and then electricity (4.77%). (Indian Academy of Sciences, 2011)

Improved Chulhas

Accordingly, efforts have been made to resort to indigenous energy-efficient technologies. In this respect, rural people of Arunachal Pradesh, especially of *West Kameng* and *Tawang* districts, have developed a new energy-efficient *chulha*[2] to reduce fire-wood consumption. Estimates suggest that it consumes 50–60% less firewood per family per year compared to the traditional *chulha*. Thus, the improved *chulha*, with higher thermal efficiency of 60% compared to 6–8% in traditional ones, has potential to conserve firewood. The National Programme on Improved Chulha (NPIC) operating in several parts of the country has rated the improved chulha better than the traditional ones. (Indian Academy of Sciences, 2011)

[1] Comprising of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura.
[2] Gas stoves

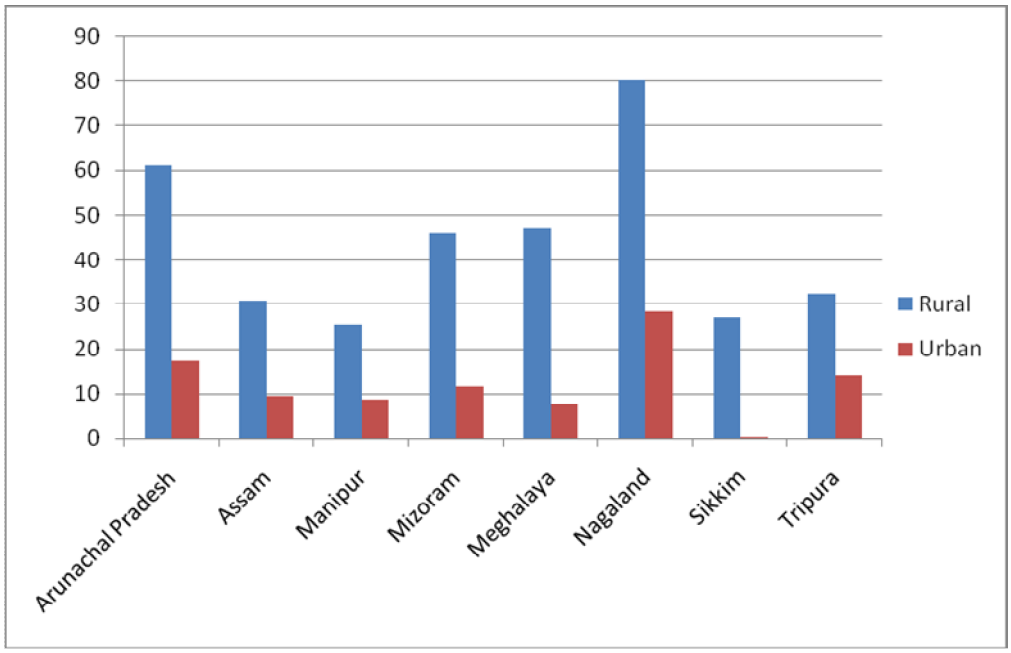

Figure 5: Per Capita Firewood Consumption in North-eastern states
(Indian Academy of Sciences, 2011)

Rural Electrification

Villages in the North-Eastern Region, including Arunachal Pradesh, are most suitable for electrification through standalone renewable energy devices. Low consumption levels of electric power characterize the entire region and a large number of villages are too remote to be electrified through grid extension. Accordingly, the Ministry of Power has provided special attention to this region, which is reflected in significant achievements under the programme in various North Eastern states. Currently, 52 projects are under implementation in the state under the Remote Village Electrification Programme, with 246 remote villages having already been electrified. (Press Information Bureau)

Policies and Programmes

The Government of India had introduced a new scheme '*Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY)-scheme' for Rural Electricity Infrastructure and household electrifications and guidelines were issued by Ministry of power. (Ministry of Power, Government of India, 2005) The progress of the plan shall be monitored by the State Govt. through a high level committee headed by the Secretary (Power) , at the state level and chairperson of Zilla Parishad as a Chairman at the district level on a quarterly basis.

Government of Arunachal Pradesh has also notified the Rural Electricity Plan in accordance with the National Rural Electricity Policy to provide facilities for access to electricity for all Rural Households during the 11th five year Plan, and provide quality and reliable power supply at reasonable rates. (Department of Power, Arunachal Pradesh, 2007)

Renewable sources for Village electrification

The Central Government in 2008 had announced a package of Rs. 550 crore to provide illumination through solar power in remote villages as well as to generate electricity through

small hydro power projects for villages along the state borders. A plan has been drawn to electrify / illuminate 1483 un-electrified villages of all border districts of Arunachal Pradesh. Further 1058 villages are proposed to be electrified / illuminated from small / micro hydel projects and solar photovoltaic systems. (Press Information Bureau)

Arunachal Pradesh Energy Development Agency (APEDA) has commissioned a 10 KW wind-solar hybrid power plant at the famous Hindu pilgrimage *Parsuram Kund* in *Lohit* district. With this installation, *Parsuramkund* boasts of having the state's second wind-solar hybrid system after *Tenga* in West *Kameng* district, which was installed in August 2009 at a cost of Rs. 34 lakhs. (IBN Live, 2011)

Conclusion

The hilly state has taken several initiatives towards providing up environment friendly energy generation. However, in 2001-02, the cost of production per kW was Rs. 3.12, and the cost of distribution per kW was Rs. 3.03. Against this, the average tariff charged from users was only Rs. 2.43. Hence it is observed that the sector is highly subsidised by the State government. At the same time, the transmission and distribution losses in the State increased from 30 per cent, in 1996-97, to a high of 51 per cent, in 2001-02. (Human Development Report, 2005) While emphasis has been laid on encouraging private participation, the state government need to focus more on financing of renewable energy project to make it sustainable.

This case let was prepared by Harshad Pathak with support from Manasi Diwan and Vivek V. as part of CDF's Environmental Sustainability Index 2011 initiative.

Bibliography

AG. (2007, October 26). *Arunachal Pradesh Small Hydro Power Policy-2007*. Retrieved August 2011, from Arunachal Diary: http://arunachaldiary.com/2007/10/arunachal-pradesh-small-hydro-power-policy-2007/

Department of Power, Arunachal Pradesh. (2007). *Notification on Rurual Electrification Plan.* Government of Arunachal Pradesh.

Department of Power, Government of Arunachal Pradesh. (2008, January 24). *The Arunachal Pradesh Gazette.* Retrieved August 2011, from http://westkameng.nic.in/Actsandnotifications/NotificationfromPower.pdf

Directorate of Economics & Statistics. (2000). *Statistical Abstract of Arunachal Pradesh.* Government of Arunachal Pradesh.

GENI. (2006). *Overview of Renewable Energy Potential in India.* Global Energy Network Institute.

IBEF. (2010). *Arunachal Pradesh.* Indian Brand Equity Foundation.

IBN Live. (2011, June 22). *IBN Latest News*. Retrieved August 2011, from IBN Live : http://ibnlive.in.com/generalnewsfeed/news/10kw-windsolar-hybrid-plant-commissioned-at-parsuram-kund/733868.html

ICLEI South Asia. (2007). *Renewable Energy and Energy efficiency status in India.*

Indian Academy of Sciences. (2011). *Energy efficient chulha in rural Arunachal Pradesh.* Retrieved August 2011, from http://www.ias.ac.in/currsci/25jun2010/1554.pdf

IREDA. *Compendium of State Government Policies on Renewable Energy Sector in India.* Indian Renewable Energy Development Agency.

Ministry of Power, Government of India. (2005). *Rajiv Gandhi Grameen Vidyutikaran Yojna - Scheme of Rural Electricity .* Delhi: Government of India.

Press Information Bureau. *NEW AND RENEWABLE ENERGY PROGRAMMES IN NORTH EAST.* Government of India.

Rajiv Gandhi University, Itanagar. (2005). *Human Development Report.* Itanagar: Government of Arunachal Pradesh.

REEEP. (2009). *Policy and Regulatory Review: Special Report on India and Indian States.* Renewable Energy & Energy Efficiency Partnership.

WAPCOS International Consultants. *Studies of Kalai Hydro Electricity Project.* WAPCOS International Consultants.