Institutional Mechansim: Background Paper

"Sustainable settlements in peri-urban areas: with special reference to impacts of transport and energy on natural resources management" (Acronym: periurban)

Programme: Promoting Competitive and Sustainable Growth

Key Action 2: Sustainable Mobility and Intermodality-
Task 2.1.3/4: Accompanying Measure

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1. Introduction

Periurban areas are at the interface of rural and urban areas. The settlements in these areas often are unorganized; widely diverse in social, cultural, political and economic dimensions; do not take note of the carrying capacity of the natural endowment; and lack full-blown institutions and institutional mechanisms. Cheaper natural resources such as land and water are used for industries, housing, construction, intensive agriculture, recreation, education and other services in an unsustainable manner. In the process the sustainable rural system gets engulfed by the urban system and damaged beyond recovery. The modern transport and energy systems, which are unsustainable on their own right, have accelerated the process of such damage. The purpose of the present study is to understand the existing institutional mechanisms with respect to natural resources management in peri-urban areas. The effectiveness of the institutions and gaps in institutions are studied with reference to their ability to manage natural resources in a sustainable manner.

In the next section, the concepts of peri-urban region, natural resources, sustainability, institution, property rights regimes, market forces that are used for the study are presented. In the third section, the methodology of the study is discussed. The framework to study NRM institutions is discussed in the fourth section.

2. Basic concepts

2.1. Periurban Region

An urban area is defined as a place where most of the people are engaged in secondary and tertiary economic activities. In contrast, rural areas are characterized by the dominance of primary activities by its inhabitants. Accordingly, differences in land use pattern, population density, concentration of activities, infrastructure facilities and rate of change in natural, physical, social and economic features characterize urban and rural regions. It can be conceptualized that rural and urban regions are two ends of the continuum and in between remains the peri-urban region. Peri-urban region possesses both the characteristics of urban and rural areas. However, most important characteristic of peri-urban region is the fast rate of change in its natural, economic and social ecosystem.

The peri-urban interface (PUI) is where urban and rural activities meet. Peri-urban areas are those located close to the fringe of cities or urban centers. Population living in the PUI are growing in number and belong to diverse income groups, where their livelihoods depend to some extent on natural resources such as land for food, water and fuel, and space for living (Brook & Davila 2000). Peri-urban areas are a mosaic of agriculture and urban ecosystems, affected by material and energy flows demanded by urban and rural areas. They are socially and economically heterogeneous and subject to rapid change. Small farmers, informal settlers, industrial entrepreneurs and urban middle class commuters may all co-exist in the same territory by with different and often competing interests, practices and perceptions. Few institutions can address both urban

and rural activities. Local government agencies have either an urban or rural focus. Few metropolitan governments include rural jurisdictions. District and regional governments fail to bridge urban and rural concerns.

Natural resources in the PUI are under pressure due to the diverse populations. Some groups depend on them directly for their livelihoods whereas others may use them after some value addition. Land is the main source of livelihood for the population living in peri-urban interface. Due to urban expansion and development, there is a rise in land prices as a result of which the poor are priced out of the areas. In most cases the land, both agricultural and common lands is lost to residential development (low cost housing) and industrial/commercial use. Conflicts tend to arise over access to and control over peri-urban land. The peri-urban poor are adversely affected when natural resources are lost or degraded due to influx of urban population and solid waste disposal from industrial and residential areas. In other words, the market forces render the traditional production system unremunerative (e.g. change in land use from agriculture to construction activities, brick making or stone quarries). Other consequences of the operation of market forces are degradation of resources due to over-exploitation, deforestation, over-grazing and 'mining' the soil of nutrients, effluent disposal from urban areas and extraction of soil/sand for building construction. Similarly in case of water, some sources within the rural areas may be tapped for urban use, thereby creating scarcity for the PU population. Most of the new activities in the periurban areas support the needs of the urban population.

The PUI is therefore in a state of flux, where there are competing interests for livelihood assets. The concern is therefore what kind of natural resource base is desirable in the PUI? The major issues raised are – how the livelihoods of populations living in the peri-urban areas are getting transformed; how do the populations affected cope with the change; how the existing institutional mechanisms have a bearing on such changes and the coping strategies of the populations. Additionally, in view of the flux situation of the use of natural resources in PU areas, whether it is desirable to continue with the same traditional activities linked with natural resources or go for diversified uses or some other option?

Natural Resources

Resources are defined as wealth or means of producing wealth. Natural resources are those resources available in nature and in the context of periurban region can be categorized as land resources, water resources, and mineral and energy resources. Land resources include residential, industrial, agricultural, forest, pasture, recreational, water bodies, etc. Both surface water and ground water come under water resource. Depending on the location there can be different types of mineral and energy resources available in a peri-urban region.

Sustainability

Sustainability is generally defined as 'the ability to provide a healthy, satisfying and just life for all people on earth, now and for generations to come, while

enhancing the health of ecosystems and the ability of other species to survive in their natural environments' (Earth Ethics).

In the context of natural resource use in the PUI, sustainability needs to be understood as livelihood requirements of population dependent on them and do not have the capability/opportunity to meet their needs otherwise. Exploitation of natural resources therefore should not lead to uprooting of the local population. Besides, another important indicator of sustainability is the quality of life in terms of access to clean water, air, and un-polluted environment. In essence therefore, three major issues arise in the context of sustainability. They are: uprooting of PU population and their livelihoods and maintenance of the quality of life.

2.2. Institutional Mechanisms in PUI

The main purpose of looking at institutions in PUI is to examine whether they are in place to manage natural resources within the overall framework of sustainable development. Towards this, there is a need to identify institutional frameworks for natural resource management in PU areas and also examine how weaknesses in the latter have an impact on sustainable natural resource management and livelihood. The objective is to therefore look at those aspects of institutions and their structures that have an impact on natural resource management and livelihood. In PU areas, institutional structures would be shaped by two levels of interface such (1) the interface of purely rural or agrarian institutions with urban institutions and (2) the interface of statutory forms of institutions (customary law, forms of social organization and social relationships). They would invariably have the element of fluidity and are in a state of transition and represent many different influences (urban, rural, formal, informal). A distinction has to be also made between NRM institutional lacunae (weaknesses in the institutional frameworks) and institutional vacuum (Narain, 2003).

Institutions

Institutions refer to "the rules of the game in society" (North 1990; Leach et al. 1999). In the context of natural resources, institutions refer to the rules that define endowment, entitlement, access and control over resources, duties and responsibility. These rules may be derived from government legislation, regulation, customs, norms and various other formal and informal arrangements. The rules are usually nested i.e. one set of rules define how others sets of rules can be changed (Ostrom, 1998). There are operational rules that govern day-today decisions, collective rules that decide how to change operational rules and who can change them, and constitutional choice rules that are used to craft collective choice rules.

An organization is "the structure of working relationships within which decisions are made to allocate and use resources over the period of time for which these resources are planned…Far beyond the time period for which the organization lays down its objectives and plans its resources, there is the vision towards which the institution evolves. The institution therefore, over many years might have a series of organizations but there is the continuing link of this vision through which the institution evolves its identity. The 'institution' is the

embodiment of the culture and value system developed through the series of organizations…The institution emphasizes the processes by which tasks, structures, relationships, and behavior are determined, not the task or the structure itself…The structure will require a series of changes from one phase of growth to another. At the same time within the given structure at any point of time apparently inconsistent substructure are likely to exist. But we live with these inconsistencies knowing that they are temporary and that they are required for a specific phase of growth" (Mathai, 1980).

According to Ganesh and Joshi (1985), "institutions are social arenas where unique strategies are pursued for inducing and maintaining values which satisfy societal needs. Organizations are formal, social mechanisms, which facilitate constant transmission of values, for example a business enterprise or the church. What distinguishes an economic organization from an institutional organization are the intensity and the depth with which individual members of an institutional organization hold the core values which seem to suffuse their total being".

Organizations are complex entities because they are made up of multiple tangible and intangible realities, which simultaneously contradict and compliment each other. Tangible reality of the organization includes strategy, structure, system, staff and skill. Intangible part of the organization includes culture, political system, paradigm, style and superordinate goals (Shukla, 1996).

Formal institutions include government organizations (including local self governments like PRIs) and regulatory authorities, non-government organizations and users' associations (water user's associations, village forest committees, fishermen's associations and cooperatives). Formal institutions are mostly legal entities, registered under law. Whereas informal institutions are enforced endogenously and are embedded in the local customs, behavior patterns, norms and traditions. Both the formal and informal institutions could exist together and influence the use and management of natural resources in the PUI.

Property Rights Regimes

The nature of property rights with respect to natural resources play a vital role in their sustainable use. The property rights may be formal or informal. Informal or customary property rights are legitimized by social norms and codes of behaviour. Property rights regimes are broadly of four categories (Kerr et al. 1997): (a) private property regime, (b) state property regime, c) common property regime and (d) open access regime.

(a) Private Property Regime

This regime allows exclusive rights over property to individuals or organizations. These rights include right to use, exchange, sell, lease and bequeath. This regime is normally expected to be more conducive to sustainable use of a natural resource as the interests of the owners are directly affected by the nature and extent of use of such resources.

(b) State Property Regime

Under this regime, property rights are vested in the State. There are many such natural resources like forests and surface water resources that are governed under State property regime. Some of these resources might be treated as common property or open access resources in terms of their practical use at the local level.

(c) Common Property Regime

Common property implies that a property is owned in common by an identifiable group of people. The members of the group have well defined rights to use the property, not equally all the time. Non-members are excluded from the use of the property. A common property has a set of social conventions, norms, legally enforceable rules and procedures for regulating its use. While creation of a common property regime reduces some of the uncertainty associated with the future use of the property, it also can create a situation of Prisoner's Dilemma regarding the use of property within the defined group.

(d) Open Access Property Regime

An open access property regime implies that there are no defined property rights for a resource. Anyone can access such resources in an unrestricted manner. The benefits of such access accrue to individuals while the associated costs are borne by the community. This feature combined with the lack of certainty about the availability of benefits in the future to any individual leads to over exploitation and consequently degradation of the resource. Ground water and air may be treated under open access regime.

Market Forces

Markets are expected to ensure efficient use of natural resources, but may not benefit those whose livelihoods are dependent on them. In other words, markets may tend to benefit those who can pay a higher price for the resource and in the process would attempt to monopolize the use.

3. Methodology

Both primary and secondary sources of data were used for the study. Key secondary sources of information include internet, reports of government and non-government organizations, books and journal articles. Primary data were generated using a set of both participatory and conventional tools. Email discussion, observations during various peri-urban meetings provided useful insight to the problem. Key informants were identified and interviewed using a checklist covering different issues of the study. Household level data collection was done using structured questionnaire in selected villages. Group discussions were conducted at village level. A number of stakeholders' meetings were held for the case study.

Linkages With Other Work Packages

Institutions and institutional mechanisms affecting the sustainable livelihood, quality of life of peri-urban inhabitants and availability of natural resources in a sustainable manner will be closely linked to studies on conceptual framework (WP2), transportation system (WP5), energy system (WP4) and government policies (WP6). It is obvious from the fact that energy and transportation system directly affect natural resources and livelihood options in the peri-urban area. Similarly government policies and the level at which they are implemented significantly determine how well sustainable aspects are taken care of. Figure 1 indicates the type of interaction of WP 3 with other work packages.

WP1 identifies the conceptual framework for sustainable livelihood, quality of life and NRM needs in periurban areas. All these requirement of periurban inhabitants are fulfilled through various institutions and institutional mechanisms, which are the means to provide services from transportation, energy and other systems. Institutions identify, articulate and implement government policies through various mechanisms. These institutions and institutional mechanisms are at the center stage to fulfill the livelihood and quality of life needs of periurban inhabitants and sustainable management of natural resources.

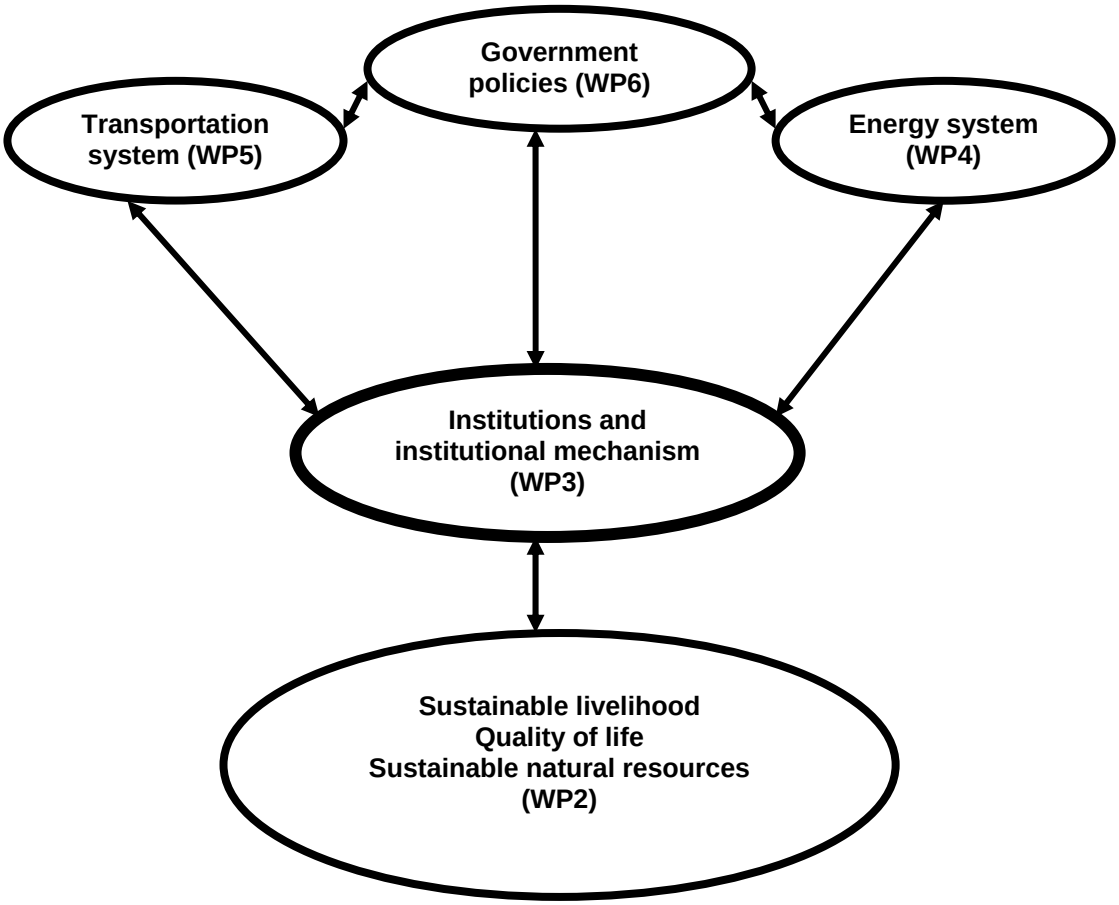


Figure 1: Linkages of WP3 With Other Packages

The framework for studying the objectives is presented in Figure 2. The types of issues that will be covered under the study of institutions include ownership, access, control, quality, equity and multiplicity.

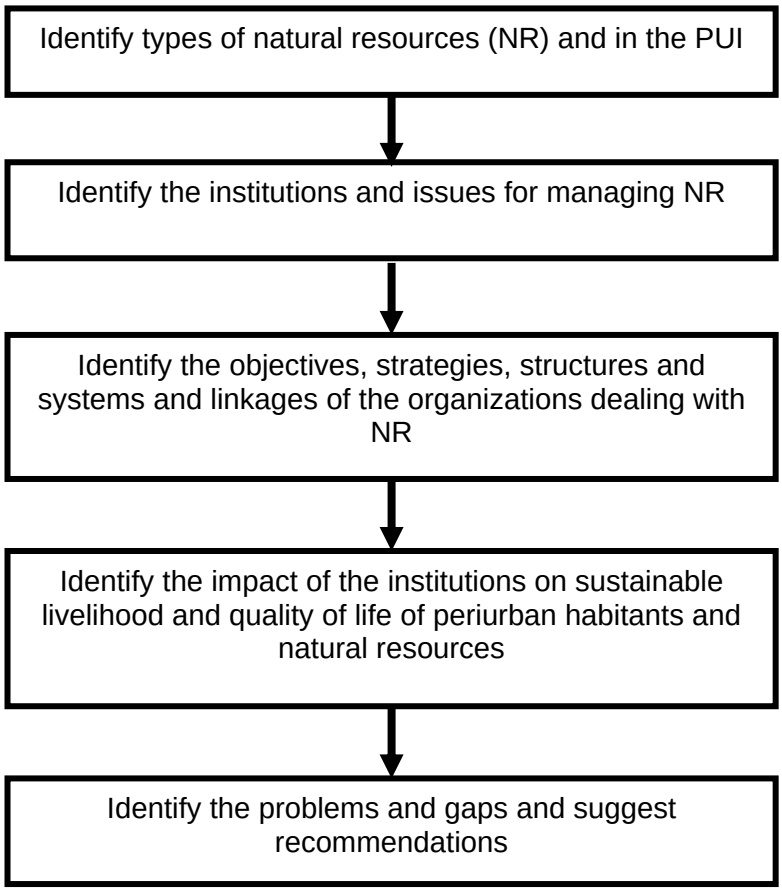


Figure 2: Framework for Studying the Objectives

4. Framework for Studying Institutions

A comprehensive study of the formal institution will involve an understanding of the immediate environment in which the institution functions, internal working of the concerned institution and the linkages that the institution has with other institutions and the environment (Figure 3).

A study of the immediate environment will cover political, economic, social, technological, environmental (physical) and legal factors that affect the institution. Some of the key political factors include influence of peoples' representatives in the day-to-day and long-term functioning of the institution and relevant government policies. Economic factors will include job opportunity, unemployment level, factor market condition (finance, human resource, raw material, energy, etc.), demand condition, etc. Social factors would include population demographics, income distribution, social mobility, lifestyle changes, attitude of work and leisure, consumerism and level of education. Technological environment will cover state of infrastructure such as energy, transportation,

telecommunication, etc. Environmental factors would include environmental protection law, waste disposal, energy consumption, etc. Legal factors will cover health and safety law, employment law, property right regimes, etc.

A study on the internal working of an organization will include mission, objective, strategy, structure, system and stakeholders of the organization. Mission of the organization describes the purpose of its existence and the scope of its activities. It answers the question: why an organization exists? The purpose of its existence needs to be shared by the employees of the organization.

Objectives indicate what the organization aims to do. Strategy is the means of achieving objectives of an organization.

Structure is the formal or quasi-formal network of reporting or control relationships in an organization and the powers and duties associated with each role in this network. The network of reporting relationships (superstructure) is commonly depicted through an organization chart, and the powers and duties (infrastructure) associated with roles are frequently formally stated in manuals in the larger, more bureaucratic organizations (Khandwalla, 1995).

Systems are reutilized and standardized ways of performing significant management functions such as planning and goal setting, choosing investments, coordination, control, buying, marketing, financing, managing personnel, training staff, scheduling operation, quality control, plant maintenance, public relations and projecting the organization's image, etc. The way a function is to be performed may be formally documented or at tacit level (Khandwalla, 1995). Systems refer to both formal and informal rules and procedures. System changes can enhance organizational effectiveness without disruptive effect (Srinivasan, 2002).

For the effective role of institutions in ensuring sustainable natural resource management, all the institutions must have minimum critical mass of resources. Finally, presence of all the necessary linkages must be ensured for effective management of natural resources.

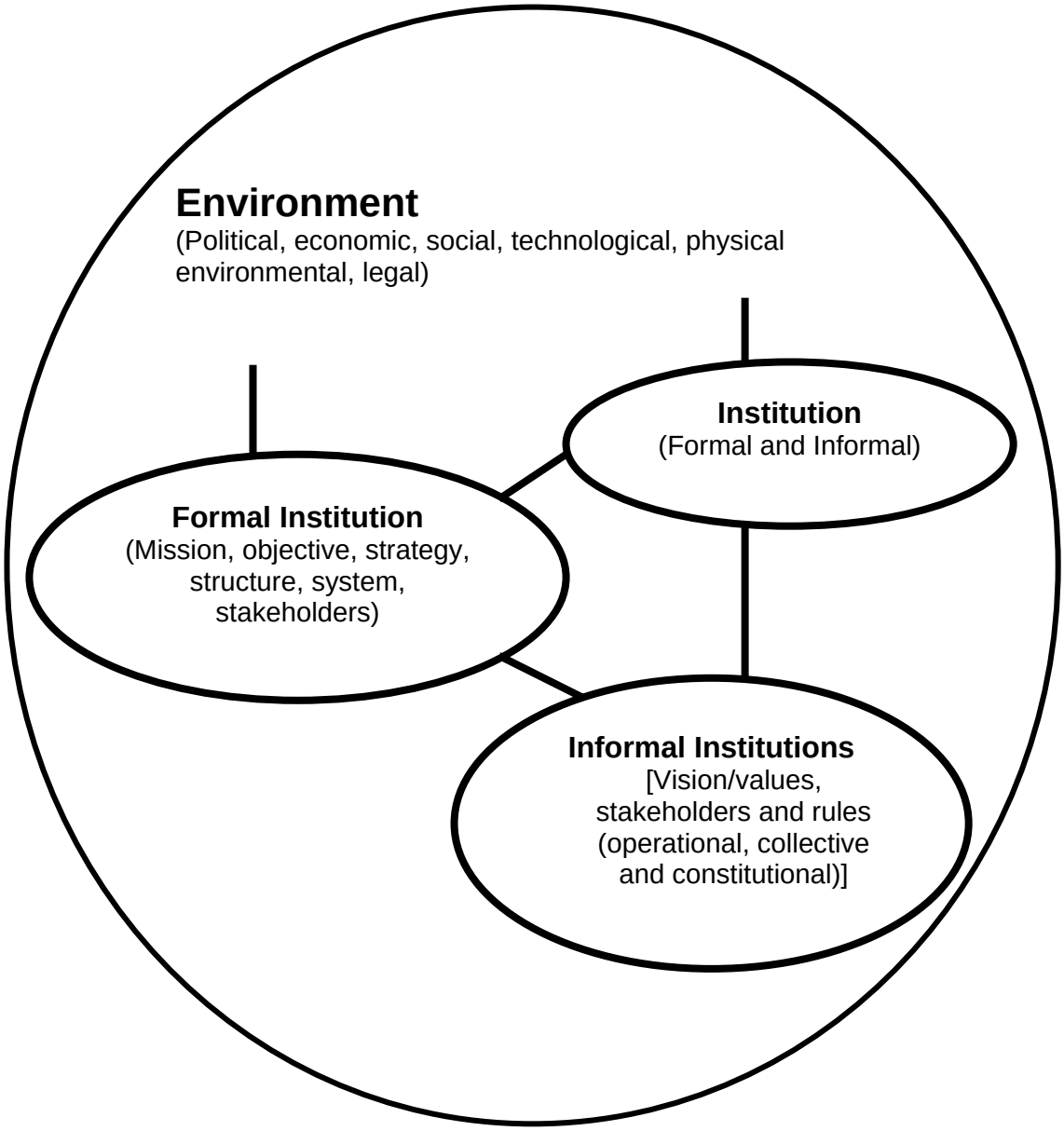


Figure 3: Elements for Studying Institutions

5. Understanding Periurban Issues of Energy and Transportation

It is needless to emphasize the role of infrastructure sector in economic growth. The Far Eastern Economic Review (1993) citing the World Bank, estimates that every 1% growth in national output requires a 1.2% increase in transport investments, with even higher ratios applying to telecommunication and electricity. This imposes tremendous strains on public budgets when economic growth averages 6-7% in the country. Infrastructure affects agricultural production indirectly through prices, diffusion of technology and the use of inputs. It is observed that infrastructure has a profound effect on the income of the poor and positively affects savings, investment and health. From a study in Bangladesh it is found that from the development of road and transport infrastructure “functionally landless and small farmers garner a large share of the

increase from crops, wages, and livestock and fisheries, while the large land owners capture most of the smaller increase in business and industries" (Ahmed and Hossain, 1990). Fast increasing population and declining sex ratio (number of female per 1000 male) in urban areas, increasing disparity between average income of periurban and urban workers and declining quality of life of poorer strata of society in the periurban areas can be significantly attributed to the sorry state of periurban infrastructure.

The nature and dimensions of India's periurban infrastructure problems are complex and diverse. While financial resource limitation is on the top of agenda, the institutional, administrative, technological and environmental problems are not less in magnitude. The art of efficiently managing the operation and maintenance of energy and transportation infrastructure projects have not been mastered in many periurban areas of the country. Because the effects of energy and transport infrastructure on natural resource degradation, poverty alleviation and periurban are development are so definitive in agriculture-based, low-income developing countries, there is a need to comprehensively study the governance of periurban infrastructure sector system.

With reference to energy and transportation infrastructure in periurban areas, usage, key issues, institutions involved, weaknesses in the existing system and recommendations for effective management for ensuring sustainable use of natural resources are discussed below.

5.1. Energy

Energy use by periurban communities is dominated by industrial, commercial, agricultural pumping, cooking and lighting needs. Industries and commercial establishments consume a significant amount of energy, in both nonrenewable (coal, oil, natural gas and electricity) and renewable (biomass and biogas) form. Agricultural pumping uses either electricity or diesel. Cooking energy is primarily met by LPG, fuel wood, crop residue and dung cake. Lighting in periurban area is often met by electricity, but considering its poor reliability and unaffordability by some households, kerosene lamps are also used. For rural and urban areas, residential and agricultural energy need, source and problems faced are presented in Tables 5.1 and 5.2 respectively. Status of periurban households will lie in between the rural and urban households. For example, number of periurban households primarily dependent on firewood will lie between 23% and 64% of total households in the Periurban interface. Similarly, number of households in the periurban area that use electricity for the lighting purpose varies between 44% and 88%.

Table 5.1: Residential Energy Need, Source and Problems

Energy need	Energy source	Rural (% of total rural household)	Urban (% of total urban household)	Problems faced by periurban consumers
Cooking	Fire wood Crop residue Dung cake Coal, lignite, charcoal Kerosene LPG Electricity Biogas Others	64.1 13.1 12.8 1.1 1.6 5.7 0.1 0.5 0.8	22.7 2.1 2 4.6 19.2 48 0.3 0.4 0.2	Fast disappearance of biomass Un-affordability of commercial energy Health hazard
Lighting	Electricity Kerosene Solar Other oil Any other No light	43.5 55.6 0.3 0.1 0.2 0.3	87.6 11.6 0.2 0.1 0.1 0.4	Brownout: 3-14 hour Voltage fluctuation:+/- 40% Damage to the equipment because of high voltage fluctuation
Ventilation, Entertainment and communication	Electricity Others	43.5 56.5	87.6 12.4	Brownout: 3-14 hour Voltage fluctuation:+/- 40% Damage to the equipment because of high voltage fluctuation
Drinking Water	Electricity Other	24.3 75.7	68.7 31.3	Supply when electricity available

Source: Census of India 2001, Series 1, Tables on Houses, Household Amenities and Assets, Government of India, New Delhi, pp 333, 351, 390, 391.

Table 5.2: Agricultural Energy Source and Problems (1991/92)

Energy source	Number (million)	Total (GW)	Total (%)	Problems in periurban area
Human Male Female Draught animal Tractors Power tillers Diesel engines Electric motors Combines	 149.2 50.8 84 1.3 0.09 4.6 8.3 0.04	 8.95 2.54 31.5 29.1 0.54 17.16 30.96 1.51	 7.32 2.08 25.76 23.8 0.44 14.04 25.32 1.24	• Shift towards water intensive crops • Intensive use of pesticides • Sewage irrigation • First depleting water table and hence usage of heavier duty pumps year after year • Increasing mechanization

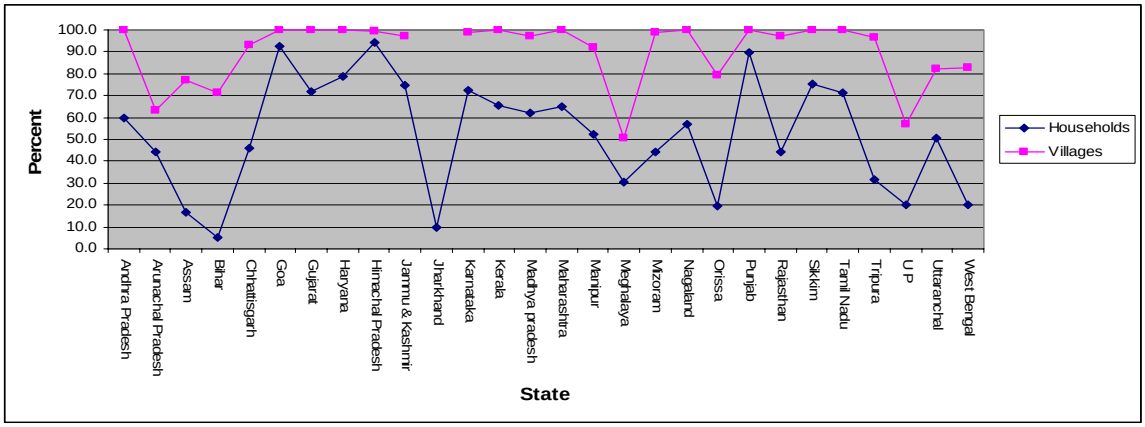
Source: TEDDY 2002/03, TERI, New Delhi, PP 229

In general commercial and industrial energy needs in the periurban area are met by electricity. Normally reliable and good quality grid electricity is provided through separate feeder for industrial energy consumption. However, electricity used for commercial purpose has to suffer from 3 to 14 hour of brown out and voltage fluctuation as high as 40%.

Decennial census figures for rural areas include data for periurban areas. According to Census of India 2001 and Central Electricity Authority (CEA), electricity is available in 43.5% of Rural Households (60,180,685) and 84% of villages[1] (4, 92, 297) in the country. Figure 5.1 indicates the summary of electrified villages and rural households for different states. Considering the present level of achievement that took more than five decades after independence, Government of India's target of electrifying every village by 2007 and every household by 2012 appears to be a highly demanding task.

Most of the states in the country have nearly 100% electrified villages. However, only 50% villages in Meghalaya, 57% villages in UP, 64% in Arunachal Pradesh and nearly 80% villages in Assam, Bihar, Orissa, Uttaranchal and West Bengal are electrified. Considering their proximity to urban centers, periurban villages are likely to have 100% electrification.

As regards to number of electrified rural households the regional imbalance is very stark. Only 5% of households in Bihar are electrified. Situation of Assam, Jharkhand, Orissa, UP and West Bengal is relatively better where nearly 20% of households are electrified. In contrast, more than 70% households in Goa, Gujarat, Haryana, HP, J&K, Karnataka, Punjab, Sikkim, Tamil Nadu and all Union Territories are electrified. In the absence of availability of data, it will be safe to assume that there will be a wide regional variation in electrification of percentage of periurban households.



Source: http://cea.nic.in/data/opt2_village.htm (Villages by end March 2003)
Census of India 2001, Tables on Houses, Household Amenities and Assets, Government of India, New Delhi (Households by 2001)

[1] A village was considered to be electrified if electricity was "used within its revenue area for any purpose whatsoever". This definition was changed in 1997. Accordingly, "a village is deemed to be electrified if electricity is used in the inhabited locality within the revenue boundary of the village for any purpose whatsoever".

Figure 5.1: Extent of Rural Electrification in the Country

The average annual investment in rural electrification during last decade was approximately Rs. 8800 crore. According to the estimate of the Planning Commission the investment required for full coverage of villages at 2000/01 prices is Rs. 1,07,823 Crore. Even if the Government of India provides enough budgetary support for such investment, the issue moves to the other level, i.e. addressing demand side factors (developing socio-economic status of the rural household to avail such facility) and supply side factors (providing reliable electricity).

In the absence of adequate and reliable information, it is safe to state that, a significant segment of the periurban households are not in a position to avail electricity considering their economic status. They lack the capacity for initial capital investment and means to pay regular bill for the energy consumed. Well planned intervention is necessary at both the ends.

The reliability of electricity supply in periurban area is far from satisfactory. It is evident from the fact that the electricity supply is characterized by frequent and long interruptions of services, large voltage fluctuations and service is delivered not when needed but when available. Based on our own data from the periurban areas of Gujarat it is observed that brown out ranges from 3 hour to 14 hours per day accompanied by high voltage fluctuations. Based on discussion with some of the officials of State Electricity Boards (SEBs) it is observed that there is hardly any system of collecting data for measuring service reliability in periurban areas.

In most of the states it is difficult to segregate periurban electricity consumption on the basis of its use in agricultural, commercial, domestic and industrial. In the absence of appropriate metering system, often the consumption is allocated to various categories. In the periurban areas agricultural consumption is significant. Considering the large gap between cost of supply and revenue received from agricultural consumption, prima-facie it is not surprising why quality of electricity service to periurban area (agriculture and domestic) is so poor. However, key issues one needs to address are the linkage between the price of electricity and the quality of service; and reliability of the agricultural consumption data, given distribution companies' poor system of metering and management system.

Table 5.3: Unit Cost of Power Supply and Tariff for Different Consumers (2000/01)

Description	Cost of power supply (Rs./kWh)	Tariff (Rs/kWh)		
		Domestic	Agriculture	Overall average
Andhra Pradesh	4.88	1.74	0.14	1.82
Assam	5.42	1.47	2.33	3.53
Bihar	3.51	1.09	0.12	2
Delhi	4.6	2.74	2.76	3.2
Gujarat	3.36	2.46	0.17	2.25
Haryana	3.6	2.8	0.3	2.15

Himachal Pradesh	2.19	0.93	0.5	2.03
J&K	3.41	1.25	2.5	1.94
Karnataka	4.4	2.49	1.09	2.53
Kerala	2.76	1.04	0.6	2.37
MP	2.72	1.2	0.11	1.67
Maharastra	2.73	1.78	0.25	2.31
Meghalaya	2.68	1.31	0.52	1.74
Orissa	2.80	2.3	1.1	1.58
Punjab	2.47	1.9	Not available	1.76
Rajasthan	3.34	1.38	0.35	1.96
Tamil Nadu	2.76	1.98	0.01	2.34
Uttar Pradesh	2.94	1.3	0.5	1.83
West Bengal	3.43	1.63	0.54	2.41
Average	3.04	1.74	0.28	2.12

Source: TEDDY, 2001/02, pp. 138-139, for all excepting Orissa
Panda, H., (2003), Assessing the Impact of Power Sector Reforms in Orissa, Working Paper 174, IRMA, pp. 12, for Orissa

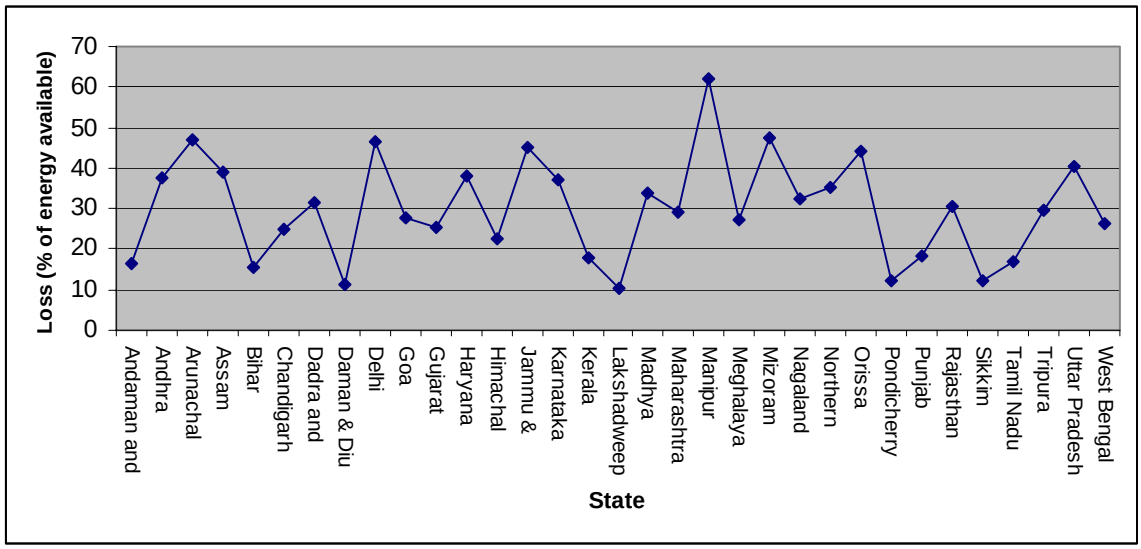
The general perception among the companies involved in electricity distribution is that the subsidized electricity to agriculture and domestic segment is the cause of poor financial health, poor maintenance of distribution infrastructure and lower rate of capacity addition by the companies; and irrational increase in demand for electricity from the consumers. Relatively low energy use density in the periurban area does not make an economic sense for the distribution companies to improve the physical infrastructure. Long distance distribution lines lead to higher distribution loss and low reliability of supply. Periurban consumers perceive that the distribution companies lack accountability, do not treat the consumers equally, often harass and put unfair blame on the consumers and charge a tariff higher than the quality of electricity deserves.

5.1.1. Institutions Engaged in Periurban Electricity Supply and Institutional Reform

State Electricity Boards (SEB) are the primary agencies for supply of electricity and management of electricity infrastructure in the periurban areas.

Management of SEBs is fraught with unhealthy political interferences, poor workforce discipline and archaic systems. SEBs' pricing policy of subsidized (domestic and agriculture) and cross-subsidized (industry and commerce vs. domestic and agriculture) electricity supply made them financially sick, kept the electricity sector away from planned growth and brought bad management practices. To take care of the unreliable and costly electricity supply system, captive electricity generating sets have become a norm in industries, commercial establishments and agricultural sector. Thus, in addition to sub optimal investment in electricity sector, SEBs are gradually losing more and more creamy customers. The management of SEBs, in their race to hide staggering transmission and distribution (T&D) losses (technical and non-technical), artificially increased the unmetered consumption to the priority (agriculture and rural) sector. The financial losses incurred by SEBs were made up from the state

budget. With the dwindling state resources a time came when the states found it extremely difficult to support the SEBs and they became sick one by one. As an example, in 1999/00 total electrical energy lost in transformation, transmission and distribution and unaccounted for came to 30.93% of total energy available for supply (CEA, 1999/00). The loss varied from region to region. It was 40.31%, 35.01%, 28.90%, 28.72% and 25.06% of the total electrical energy available for sale in North-eastern, Northern, Western, Southern and Eastern region respectively (CEA, 1999/00). State-wise transformation, T&D losses and energy unaccounted for is presented in Figure 5.2.



Source: Central Electricity Authority (CEA), "All India Electricity Statistics: General Review 1999-2000, Government of India, New Delhi, pp.130.

Figure 5.2: State-wise Transformation, T&D Losses and Energy Unaccounted for as % of Energy Available in the State (1999/00)

To revitalize the electricity sector (to reduce the reliance on government, to make available power at reasonable cost, to ensure stable and qualitative power supply and to supply power on demand) government in 1991 removed power from the list of activities reserved for the public sector in the Industrial Policy Resolution, 1956. Electricity Supply Act, 1948 was amended to lift many regulatory disincentives to private investment in electricity sector. The amended legal framework of 1991 and 1998 facilitated private investment in generation and transmission respectively. The restructuring process that was initiated in Orissa, Haryana, Andhra Pradesh, Uttar Pradesh, Karnataka, Rajasthan, Gujarat and Delhi faced resistance from a number of the politically sensitive stakeholders. For example, farmers in Haryana, Gujarat and Andhra Pradesh aggressively agitated against any upward revision of electricity tariff for agriculture. Employees of SEBs opposed restructuring for the fear of job cut and likely loss in earning through their collusion with the consumer. Orissa was the first state in the country that has made significant progress in the reform process since 1996 towards its logical end of unbundling and privatizing the key activities such as electricity generation, transmission and distribution. The experience so far has not been encouraging.

Electricity Reform Experience From Orissa

The per capita consumption of electricity came down from 370 kWh to 334 kWh between 1995/96 to 1999/00. During the same period, the transmission and distribution loss came down marginally from 46.94% to 46.63% with losses in the LT segment remaining as high as 68%. There was a decline in collection-as-a-percent-of-billing from 90.5% to 74.6% between 1995/96 and 1999/00. However, between 1991 and 2000 the average tariff increased at a cumulative rate of 15.5% annually (without any significant improvement in customer service). Investment in new meters and distribution network up-gradation is not being done. Although the reform had envisaged breaking down the monopoly, three out of four distribution companies are in the hands of one corporate entity.

It can be concluded by saying that reform was necessary to bring in fresh air to the highly mismanaged electricity sector. However, the question remains, was the privatization route most appropriate?

Given the freedom of tariff increase and clear performance guidelines along with a non-interfering state (to decrease transmission and distribution losses, improve reliability and availability of generating plants, improve employee discipline and productivity and earn an appropriate return on asset base) to wholly government owned entities, probably their performance would not have been different from the privatized distribution companies. Certainly one cannot argue that privatization on its own will bring in higher efficiency and better service to price ratio. Prerequisite for success is an enabling environment for ethical business practice and clearly articulated performance contract.

Innovation in Electricity Distribution in Periurban Areas: Orissa experience

Considering that the health of electricity sector significantly depends on the distribution of electricity, there have been a number of innovative experiments in electricity distribution. One such experiment was initiated in Orissa by the private distribution companies, essentially to increase their revenue collection. The model of such experiment is presented in Figure 5.3.

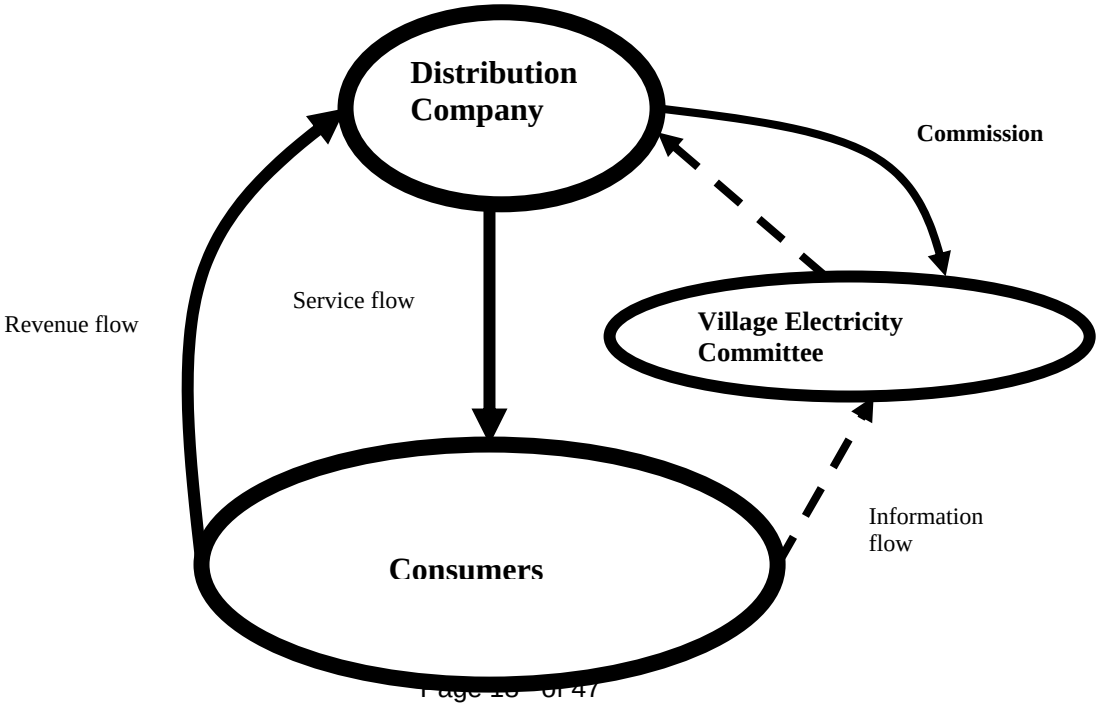


Figure 5.3: Innovation of Electricity Distribution and Revenue Collection in Periurban Area

Committee (VEC) to act as an interface between the consumers and the distribution company. The VEC with appropriate power can provide a platform to the consumers to air their views regarding the services received and facilitate distribution company in collecting revenues. Some of the key activities that the VEC is engaged in include complaint redressal, revenue collection, regularization of consumers, disconnections and reconnections, checking power theft and taking stock of the system part.

The VEC represents all sections in the village and is constituted after careful consideration of the village dynamics. Typically, a VEC will have 5 to 10 members, including president, secretary, line-man of the area and a village contact person.

Some of the key advantages that arose from the creation of VECs include:

- Active involvement of consumers in decision-making.
- Increase in level of awareness on utility, usage etc.
- Smart and timely redressal of consumer complaints
- Input reduction, increase in billing and collection

However, it has been observed that the distribution companies use VEC more for revenue collection than improving service delivery. Developing a sustainable business model for VEC is a challenging task and they are presently faced with numerous difficulties such as resistance from employee's union, political parties, influential stakeholders, poor level of awareness and absence of well-functioning people's institutions in the village. Following issues with reference to VEC need further research.

- Relevance and replicability of VECs
- Ways and means of making VECs socio-economically viable
- Possibility of VECs evolving from pure profit oriented ones to integrated infrastructure service providers
- Ownership of assets

5.1.2. Electricity Act 2003

The Electricity Act 2003 replaced three existing acts such as Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948, and the Electricity Regulatory Commissions Act, 1998 and tried to consolidate the laws governing the power sector in India. The Indian Electricity Act, 1910 envisaged growth of the electricity industry through private licensees. The Electricity (Supply) Act, 1948 mandated the creation of State Electricity Boards for undertaking overall responsibility of electrification of the concerned state. To bring in professionalism and independence in tariff fixation, the Electricity Regulatory Commissions Act, 1998 was enacted. Accordingly, Central Electricity Regulatory Commission was created and based on an enabling provision various states created their State Electricity Regulatory Commissions. Starting with Orissa other states such as

Haryana, Andhra Pradesh, Karnataka, Rajasthan and Uttar Pradesh have passed their Reform Acts and unbundled State Electricity Boards into separate generating, transmitting and distribution companies.

To encourage private participation in electricity sector and for distancing the regulatory responsibilities from the Government to the Regulatory Commissions, a comprehensive Electricity Act, 2003 was brought in. Mandatory existence of SEBs, regulation of licensees by state and the SEBs do not find place under the new Act. Some new features like power trading and open access have been incorporated in the new Act.

Electricity Act 2003 has been described as a harbinger to electricity infrastructure development in the country. Although the Government is in the process of bringing out policy documents for universal access and rural electrification, Sections 4 to 6 of the Act, as quoted below, provides the direction.

Section 4: National Policy on Stand Alone Systems for Rural Areas and Non-conventional Energy Systems

The Central Government shall, after consultation with the State Governments, prepare and notify a national policy, permitting stand-alone systems (including those based on renewable sources of energy and other non-conventional sources of energy) for rural areas.

Section 5: National Policy on Electrification and Local Distribution in Rural Areas

The Central Government shall also formulate a national policy, in consultation with the State Governments and the State Commissions, for rural electrification and for bulk purchase of power and management of local distribution in rural areas through Panchayat Institutions, users' associations, cooperative societies, non-governmental organizations or franchisees.

Section 6: Obligations to Supply Electricity to Rural Areas

The Appropriate Government shall endeavor to supply electricity to all areas including villages and hamlets.

Based on the provisions of the new electricity act and the forthcoming policy documents it will be possible to develop local level institutions for integrated energy system (not only electricity) in the periurban areas. These institutions will facilitate to

- Meet electricity needs by local generation and grid support
- Meet cooking energy needs by a combination of biogas, producer gas and LPG
- Reduce domestic and irrigation electricity demand and cooking energy demand through demand side management measures

- Own financial stake and run on commercial line
- Become self reliant on primary energy sources: crop residue, energy plantation, etc.
- Empower local community by Economic (through job) and institutional (through management) means

Some of the possible institutions for undertaking the task will include Producer Companies (Companies, Amendment Act 2002), Cooperatives, Public Companies, User Groups/Self Help Groups, Panchayat, NGO, Franchisees, etc.

5.1.3. Institutions Engaged in Periurban-nonelectrical Energy Supply and Institutional Reform

Non electrical energy in the periurban area is used mostly pumping for irrigation purpose, cooking and lighting. Supply and distribution of diesel and liquefied petroleum gas (LPG) in the periurban area is at the hands of both government and private oil companies and their retailers. Most of the retailers are located in the fringe of urban area and the far off periurban consumers often do not get home delivery (need to make their own arrangement for transportation) and at the end have to pay a higher price compared to the urban consumers.

Kerosene is distributed by the public distribution system and it is rarely adequate for their need. The periurban consumers often resort to grey and black market.

A significant chunk of periurban household depend on firewood for cooking. The market for firewood is not regulated. Wood is cut from the forest, often under the control of forest department of the government, both legally and illegally. Some time wood is also available from the Panchayat land. Some of the competitors for fire wood used for domestic cooking are brick kilns and agro-processing industries. Considering the scarcity of and increasing price of wood with time, there is a need for a comprehensive national policy for biomass utilization.

Almost every state has an Energy Development Agency to look into the planned development and exploitation of renewable energy. However, their effectiveness is far from adequate, considering the need, resources at hand and the organizational reach. Integrated energy planning at district and block level has not made any significant impact.

5.1.4. Need for an Alternative Thinking

Over the years, government's dependence on centralized energy system has led to high capital investment, serious environmental consequences, high transmission and distribution losses, low reliability and fluctuating voltage, drain of foreign exchange (for importing oil) and inaccessibility of electricity to poor households. Such systems have not been economically efficient, need oriented, equitable, self-reliant, empowering, and environmentally sound. Although sustainable development is preached it has not been practiced at least with reference to the periurban energy use.

The strategy that can follow to achieve a sustainable rural energy system cannot be through either purely government or market mechanism. The former will lead to bureaucratization, red-tapism, etc. The latter will not look after equity, environment, R&D and other long term needs. The most appropriate initiative could be “encouraging individual initiative subject to local community control”. This option, as suggested by Reddy, (1999) has three process strategies for periurban energy. They are:

- Individual initiative as far as possible through the market,
- Village/community monitoring and control, and
- Government facilitation and enabling support.

Over the years, decentralized energy system has not appealed to policy makers, R&D organizations and related and supporting industries because of their small-scale operation and rustic orientation. Some initial efforts by amateurs have not been successful and given a bad name about the efficacy of the system. However, with the various renewable technologies at its maturity, given appropriate management input, the decentralized energy system comprising both renewable and non-renewable energies can be made successful.

5.1.5. Possible Model Governance Structure of a Decentralized Periurban Energy System

Decentralized energy system operates at local level. It tries to meet the local energy need, mostly using locally available primary energy sources. The governance of such a system can follow any one of the following general categories of local institutions (Uphoff, 1984).

(a) Local Administration: Consisting of local agencies and staff of government that are accountable to bureaucratic superiors (for example, Block Office);

(b) Local Government: Comprising elected or appointed bodies having authority to deal with development and regulatory tasks and accountable to local residents (for example, Gram Panchayat);

(c) Local Membership Organization: Self-help associations whose members may seek to handle: (i) multiple tasks or (ii) specific tasks or (iii) needs of members who have some particular characteristic or interest in common (for example, artisans’ associations). Membership in such local organizations can vary from being inclusive (as in i above) to exclusive (as in iii);

(d) Co-operatives: Kinds of local organization that pool members’ economic resources for their benefit (for example, producers’ co-operatives);

(e) Local Service Organization: formed primarily to help persons other than members, though members may benefit from them (for example, charitable association);

(f) Private Business: either independent operations or branches of extra-local enterprises engaged in manufacturing and services.

It is evident from the above classification that Local Administration and Local Government are public institutions and they have the force of law and the resources of the state behind them. Local Service Organizations and Private Business do not provide customers the right to determine the activities of the organization. Local Membership Organization and Co-operatives come into being to serve the interest of their members. By serving collective interest, becoming more flexible and adaptive than government agencies, and functioning largely by consensus and persuasion, they possess the advantage of both public and private sector. (Uphoff, 1984).

The type of local institution more appropriate for rural infrastructure depends on the value addition stage in which the infrastructure project is. There are four generic value addition stages for a rural infrastructure project such as design and engineering, construction, operation and maintenance, and service. Since design and engineering, and construction are highly technical in nature and local communities are not likely to possess such skill, these could be best managed by Local Administration and Local Government. This does not exclude the need for active participation of local community in the system design and installation.

> "Moving into rural areas with fully standardised designs, which may not address the perceived needs of the intended beneficiaries and which will thus not enlist their commitment and resources needed for operation and maintenance, is a recipe for failure" (Uphoff, 1984).

The extent of willingness and ability of local institutions to discharge operation and maintenance (O&M) responsibilities depends in large part on their having been involved in design and construction activities. Similarly, local material and local skill should be used by the construction-in-charge (i.e. the Local Administration and Local Government).

In periurban energy projects, the critical variable appears to be how much the community understands and values the benefits provided by the infrastructure in question. This is why local participation in design and construction is essential, first in ensuring that the infrastructure is needed and supported, and second in giving people a sense of ownership and responsibility for the facility. Experience has shown that central organizations are not good at managing at local level. If the need for operation, maintenance and servicing is easily measured, if responsibility can be fixed on one or a few persons and if those inconvenienced by the lack of such services are influential, it is better that local institutions should be charged with such responsibilities. Since operation and maintenance are routine activities, a more professionalised or bureaucratic capacity is needed for it. So specific features in the structure of local membership organization and co-operatives should be provided for the purpose. How well the infrastructure

project task is carried out depends on the level of active involvement of the concerned members.

From the above discussion, we can summarize the following:

- Local Administration and Local Government will be in a better position to handle design and engineering and installation activities of the periurban energy project because of high level of technicalities involved in it.

- Local Membership Organizations and Co-operatives are in a better position to handle routine operation, maintenance and service activities. Because they:

  - Can easily ensure sustainable supply of primary input energy to the periurban energy project and assured market for the output energy,

  - Can effectively and economically monitor and control any free-rider, and

  - Cost of service provision and revenue collection will come down

- Active involvement of Local Membership Organizations and Co-operatives during systems design and installation will help effective operation and maintenance at a later stage.

- Local Service Organization and Private Business may be appropriate in certain situations, if it operates under the control of the community it serves.

The experiences from the community energy initiatives in India are not very encouraging. There is hardly any successful community energy project, in spite of the Government's subsidy to the tune of 90% of the project investment. The major reason of their failure is not technological but managerial. For most of the cases, the way the projects were conceived, designed, installed and managed, success would have been a miracle. For ensuring their success, appropriate administrative and economic arrangements need to be in place. Such a model is presented in Figure 5.4.

The Rural Energy System administrative structure as depicted in Figure 5.4 has three significant components such as Promotion Agents, Strategic Management Committee and the Operating System.

Promotion Agents are of two types, i.e. guiders and mentors. Guiders are divided into two groups: all those institutions involved with rural energy technology (RET) information services and other institutions engaged in advisory and consultancy services. Examples of RET guiders include Ministry of Non-conventional Energy Sources (MNES), Gujarat Energy Development Agency (GEDA), Sardar Patel Renewable Energy Research Institute (SPRERI), Khadi and Village Industries Commission (KVIC), Council for the Advancement of People's Action and Rural

Technology (CAPART), Private Consulting Firms, Engineering Colleges, Agriculture Universities, etc. Technology Mentors are generally of four types: investment promotion board and venture capital institutions; testing, quality assurance and standardization institutions; related and supporting industries; and basic physical infrastructures. Some of the Technology Mentors for RETs include Commercial Banks, National Bank for Agriculture and Rural Development (NABARD), Indian Renewable Energy Development Agency (IREDA), Bureau of Indian Standards (BIS), Small Scale Industries (SSI), Bharat Heavy Electrical Ltd. (BHEL), Manufacturer of plant and equipment. Donor agencies, market outlets for RETs, etc. The promotion agents support in undertaking pre-feasibility and detailed feasibility study of the RES. Specifically their expertise is useful in resource endowment assessment, socio-economic analysis of household, present and future energy consumption level, identifying optimal mix of rural energy technologies and site selection.

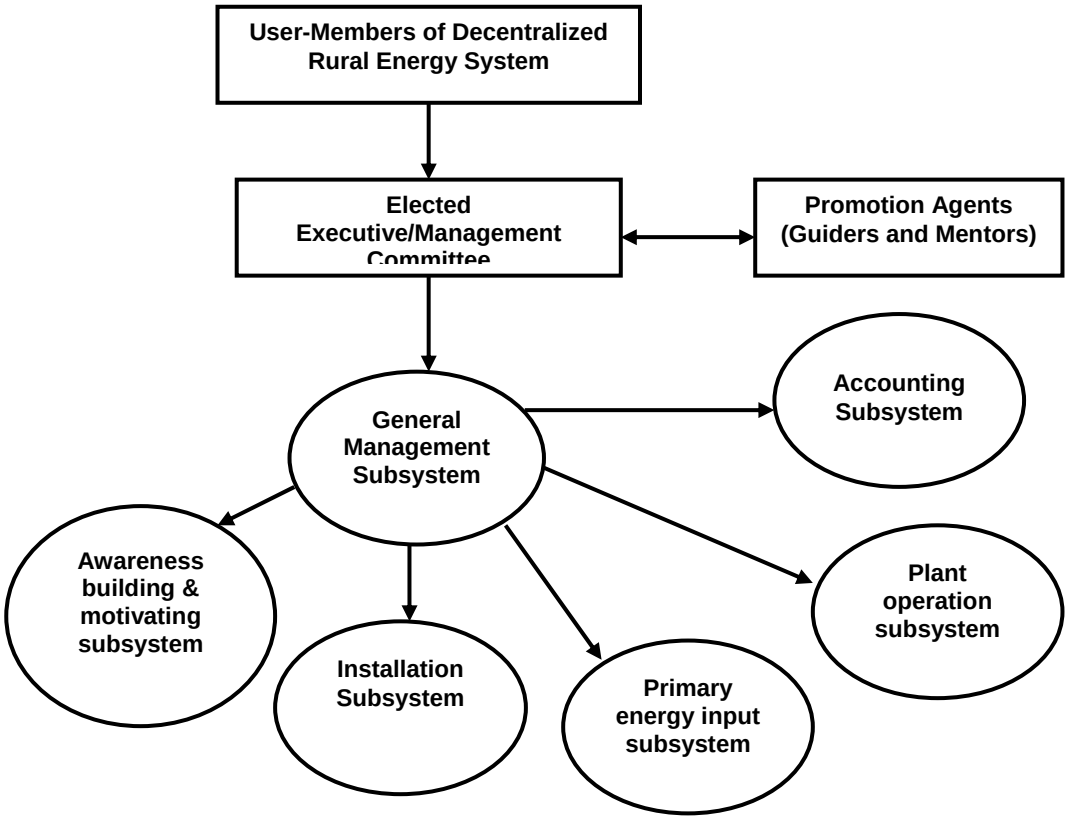


Figure 5.4: Model Administrative Arrangement of a Periurban Energy System

The strategic management committee (SMC) can be of different type depending on the type of organization selected for the RES. If it is a co-operative than the management committee elected by the members of co-operative becomes the strategic management committee. The role of the committee is to take the strategic decision and becomes the interface for Promotion Agents, Members of RES and the Operating System of RES. SMC should have enough authority and responsibility to operate as a smooth interface. It liases with Promotion Agents; understands the service aspiration of members and solicits their support through

timely payment of dues and other inputs and gives guidance and resources to Operating System who in turn provides quality service to members.

If it is a local service organization or private business, than the SMC is its Board of Directors.

The key tasks of Promotion Agents include feasibility study, detailed design and engineering, installation, extending maintenance support, arranging finance and providing management input. The Promotion Agents must have good understanding of rural development and rural technology. Whatever the organization type may be it must have a sound Operating System consisting of a number of sub-systems. These are Awareness building and Motivating sub-system, Installation subsystem, Primary energy input subsystem, Plant operating subsystem, Accounting subsystem and General management subsystem. The Awareness building subsystem is a key component for the success of RES. During a study of the reason for failure of Ramnagar community biogas plant (CBP), it was found that more than 90% of members were unaware of the capital and operating cost, rationality of pricing of dung and gas, and their role for smooth operation of the plant. While dung was taken away from the members, slurry was not given to them. Government subsidy, meeting the target of government agencies and fulfilling the aspiration of local leaders became the prime motive for constructing the CBP at Ramnagar. No effort was made to build awareness of villagers and make the project transparent. Awareness building plays a critical role in killing complacency and inertia to change that hampers development in rural area.

Installation of the RES should be done as far as possible with the active participation of local manpower and future plant operating personnel. This phase is a true learning phase for the operating staff. Through their active involvement at the installation phase they develop a sense of ownership of the project.

Sustainable supply of primary energy (cow dung, biomass, etc.) is key to the success of the RES. One of the main reasons of the failure of RES is not having timely supply of adequate quantity and quality of primary energy. Erratic energy input to the RES directly affects reliability and availability of energy to the consumer. The subsystem should ensure enough cattle population (for cow dung) and forest cover (for biomass), adequate manpower and appropriate logistics and mechanisms for primary energy procurement.

Plant operation subsystem needs to schedule its activities depending on the requirement of the users. It should have trained staff, sound operating procedures and capability to undertake routine maintenance of the entire energy system, till the consumer end. The Plant operating subsystem should facilitate record keeping through appropriate measuring system of inputs and outputs of RES.

The Accounting subsystem keeps all the record of input (biomass, dung, labour-hour) and output (gas, slurry) of the RES. Its record should also include all the

receipts and payments. Transparency of accounting record is vital for the success of RES.

General management subsystem helps in developing detailed strategy and structure of RES, procedures, staff requirement and training needs of various subsystems. It must monitor regularly the service quality of RES. It functions as the executive wing of the Management Committee.

5.1.6. Concluding Remarks

The traditional approach of supply oriented rural electricity infrastructure development is capital intensive and will not facilitate full coverage in near future. Electricity sector reform as is being practiced does not appear to be beneficial for the rural sector. In contrast to the generally perceived notion, consumers are likely to pay a price commensurate with the quality of service.

For electrification in the rural area informal systems are likely to be cheap, have the flexibility to meet the expectations of periurban consumers and more effective.

Thus there is a need for paradigm shift in our thinking of managing periurban electricity infrastructure. Table 5.4 shows the comparison between existing and new approach.

Table 5.4: Comparison of Existing and New Approach to the Management of Periurban Energy System

Existing approach	New approach
☐ Supply driven ☐ Centralized ☐ Government sole provider of service ☐ Full coverage expensive and time consuming ☐ Demand shrinking ☐ Increase dependency	☐ Integrated ☐ Decentralized ☐ Government is central star in the constellation of service providers ☐ Full coverage cheaper and speedier to achieve ☐ Demand creating ☐ Empowering

Electricity Act 2003 provides an opportunity for accelerated development of electricity infrastructure in the periurban area through the involvement of private and public bodies and people's institutions, and innovative concepts like open access and delicensing.

Promotion of Total Energy Management Centers at local level with scope for micro-generation and micro-distribution appears to be most effective in the periurban area. Electricity distribution as the sole activity for the local level institutions will not likely to be effective. It may be appropriate to identify

minimum size of network that can be independently managed (bring down competition to circle/division/subdivision level), reduce entry barrier for decentralized electricity system, avoid negative discrimination for the decentralized electricity system, allow flexible tariff system by linking with service quality and develop innovative regulatory measures near the service provider.

From a preliminary study, it appears that Periurban energy projects are likely to have a higher degree of success if the following conditions are fulfilled.

- Independent organisational entity
- Significant ownership of user-members
- Transparent system of operation
- Complete awareness of the roles and responsibilities of members, and benefits and costs of the project before the project installation,
- Active involvement during project feasibility study, design and engineering and installation and operation
- Continuous up gradation of quality, quantity and diversity of services

5.2 Transportation

Transportation network, be it road, rail, air or water, acts as the lifeline of a country and the de facto barometer of overall economic and industrial growth (Hyderabad, 1996). An effective and efficient transportation network providing accessibility to villages through development of road communication facilities is important for enabling all other facets of rural development. This would also help integrate the communities in the periurban with the mainstream society. However even after over 50 years of independence, about 40 per cent of the villages still lack connection with the nearest road or railway station.

Periurban transportation involves movement both within and outside the periurban interface. Transportation per se has little meaning. It is a means to fulfill certain needs such as employment, education, health, social relation, entertainment, administrative services, legal services, banking and financial services, political activity, marketing of local produces, getting inputs for local production and consumption system, energy, water, waste disposal from industry and household, warehousing, construction materials. The needs for transportation and the direction of flow are presented in Table 1.

The principal means of periurban transport are due to

- Human and animal energy (walk, bicycle, rickshaw, boat, head load, animal backload, animal cart
- Combustion engine (private) (car, tractor, two-wheeler)
- Combustion engine (public) (bus, van, auto, taxi, train, ferry)

5.2.1. Rural Transportation

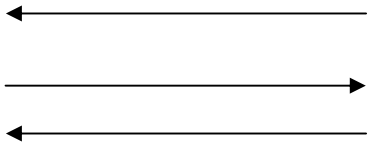
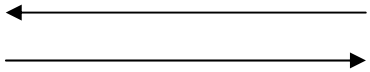
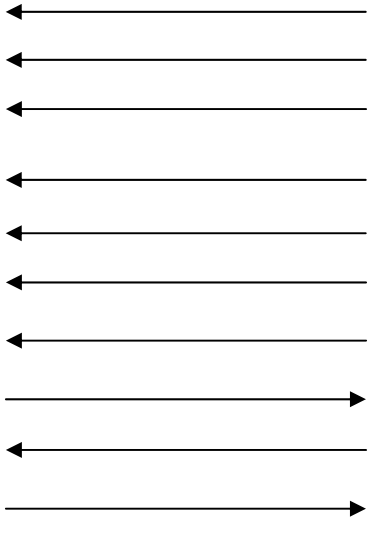
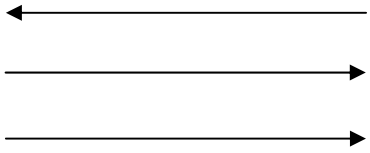
Rural Transportation is the backbone of the development of a village economy and the development of rural transport assumes special importance from the

point of view of economic integration of the rural areas with the administrative**,** marketing and servicing centers (Singh, 2001). This connectivity brings different areas in close contact and enhances interaction between rural, periurban and urban areas.

Connectivity improves accessibility and facilitates smooth flow of goods and services. It helps the rural poor by increasing their accessibility to schools, healthcare centers and to more employment opportunities. They also provide accessibility to productive resources and physical mobility of raw

Table 5.5: Transportation Needs and Direction of Flow

Transportation needs	Direction of flow		
	Urban	Periurban	Rural

Natural resource • Water • Energy o Nonrenewable o Renewable	
Employment • Low skill wage employment • High skill employment	
Services • Education • Health • Entertainment • Administrative • Legal • Banking and financial • Marketing agricultural produce • Non-labour agricultural input • Construction material • Municipal waste • Consumer goods and consumer durables • Warehousing	
Manufacturing • Raw material • Finished goods • Industrial waste	

materials, farm produce and other products, increase the size of markets and create conditions for strengthening economic linkages (Muraleedharan et. al, 2003). Studies have established that connecting the periurban and rural habitations to a neighboring market or to the main road leading to market enhance the income of primary agricultural producers and the people engaged in services and trade. Rural enterprises in China employ more than 100 million people (18% of the labour force) and provide more than a third of national output. This success is due to the provision of a minimum package of transport, telecom and power at village level (Moitra, 2001).

In Bangladesh, villages classified as ‘Most Developed’ in terms of access to transport infrastructure were significantly better than the ‘Less Developed’

villages in terms of agriculture production, income, labour demand and health (Moitra, 2001).

Transportation facilities like road network, railway network, navigable river, navigable canal and other waterways contribute in a major way towards the overall development of an area. Information pertaining to transportation facility in rural areas is presented in Table 5.6 and Table 5.7.

Table 5.6: Percentage of Different Types of Transportation Facilities in Rural India

Inhabited villages with	Percentage
Any communication facility	34.4
Bus stand	33.8
Railway station	1.4
Navigable waterways	0.6
* Excluding Jammu and Kashmir, where Census is not held in 1991 Source: Census of India, 1991, Availability of Infrastructural Facilities in Rural Areas of India: An Analysis of Village Directory Data, New Delhi: Office of the Registrar General, India, 1997.	

Table 5.7: Percentage of Inhabited Villages with Different Types of Approach Roads and Waterways in India

Inhabited villages connected by	Percentage
Pucca road	37.0
Navigable river	0.8
Navigable canal	0.1
Other waterways	0.2
*excluding Jammu and Kashmir, where Census is not held in 1991	

Source: Table 2 from Singh, 2001

5.2.2. Roadways

In India, transportation in rural and periurban area is generally a mix of animal driven carts, bicycle, light pneumatic tyred vehicles and a few heavy vehicles (Moitra, 2001). Two wheelers and cars are observed in some of the areas connected by roads. About 70 per cent people who are living in rural India are adversely affected in their movement due to gross inadequacy and inefficiency of rural transportation and rural roads in India.

Construction of rural roads for connectivity was one of the components of Minimum Needs Programme since the Fifth Five Year Plan. Only a few states like Kerala, Punjab and Goa have achieved 100 percent rural connectivity whereas many other states are far behind the target (Bhagyalakshmi, 1998). The rural road scenario is presented in Table 5.8.

Table 5.8: Rural Roads Scenario in India

Particulars	Total length '000 km	District roads, village roads etc. ('000 kms)	% of village roads to total road length	% of villages connected with all-weather roads
1950-51	399.9	337.57	84.4	NA
1960-61	524.5	438.99	83.7	NA
1970-71	917.9	799.53	87.1	NA
1980-81	1491.3	1365.27	91.5	29
1984-85	1843.42	1698.59	92.14	35
1989-90	2103.2	2069.5	98.4	45.5
1990-91	2197.9	NA	NA	45.8
1991-92	2296.8	NA	NA	46.2

Source: Table 2 from Hyderabad, 1996.

Note: Based on Eighth Five Year Plan, Volume-II, Sectoral Programmes of Development, Op. cit ., pp. 221-231.

Most of the villages also do not have roads, which can connect them with railway stations and main urban business centers. Also the unsurfaced rural roads are not suitable for efficient and cost-effective transport. The wear and tear of these roads is also very and they also get destroyed during floods (Agarwal et. al, 1991).

Gap in Rural Roadways Transportation Demand and Accessibility

The demand for rural goods transportation is voluminous in 5,89,317 villages spread widely over a vast area of 33 lakh sq. km. Apart from the passenger transport requirements, the transport infrastructure has to handle around 10 lakh tons of inward traffic and 4,000 lakh tons of outward traffic in a year. However much of the rural road length of over 18.2 lakh km is not able to meet the traffic demand (Muraleedharan, 2003).

The village wise connectivity with population less than 1000, population between 1000 - 1500 and population more than 1500 is presented in Table 5.9, 5.10 and 5.11 respectively. The expenditure on transport Sector under Five Year plans is presented in Table 5.12.

Table 5.9: Village Connectivity With Population Less Than 1000

S. No	States/UTs	No. of villages	Villages connected upto 1991-92	Balance to be connected
1	Andhra Pradesh	13888	4504	9384
2	Arunachal Pradesh	3176	612	2564
3	Assam	18777	11362	7415
4	Bihar	53234	14457	38777
5	Goa	172	172	0
6	Gujarat	9814	7362	2452
7	Haryana	3275	3209	66
8	Himachal Pradesh	NA		
9	Jammu & Kashmir	NA		
10	Karnataka	18632	6399	12233
11	Kerala	--------All connected ----------		
12	Madhya Pradesh	63546	13982	49564
13	Maharashtra	25057	6381	18676
14	Manipur	1760	695	1065
15	Meghalaya	4793	80	4613
16	Mizoram	395	287	108
17	Nagaland	NA		
18	Orissa	41132	11428	29704
19	Punjab	8842	8729	133
20	Rajasthan	27598	6655	20943
21	Sikkim	371	234	137
22	Tamil Nadu	19867	11996	7871
23	Tripura	4183	3120	1063
24	Uttar Pradesh	90271	31762	58509
25	West Bengal	27646	11004	16642
26	A& IN Island	460	223	237
27	Chandigarh	0	0	0
28	D & IN Islands	34	30	4
29	Daman & Diu	11	11	0
30	Delhi	54	54	0
31	Lakshadweep	0	0	0
32	Pondicherry	207	207	0
All India		**437195**	**154955**	**282240**

Source: Table 1 from Bhagyalakshmi, 1998.
Note: Based on Compendium of Transport Statistics, Planning Commission, January, 1993

Table 5.10: Village Connectivity With Population of 1000-1500

S. No	States/UTs	No. of villages	Villages connected upto 1991-92	Balance to be connected
1	Andhra Pradesh	3767	2192	1575
2	Arunachal Pradesh	49	36	13
3	Assam	1907	1907	0
4	Bihar	6104	3104	3000
5	Goa	100	100	0
6	Gujarat	3249	3073	176
7	Haryana	1160	1159	1
8	Himachal Pradesh	263	218	45
9	Jammu & Kashmir	611	499	112
10	Karnataka	3461	2384	1077
11	Kerala	10	10	0
12	Madhya Pradesh	4427	2852	1575
13	Maharashtra	5143	4623	520
14	Manipur	110	95	15
15	Meghalaya	64	64	0
16	Mizoram	286	286	0
17	Nagaland	132	116	16
18	Orissa	3524	2817	707
19	Punjab	1657	1657	0
20	Rajasthan	2407	1690	717
21	Sikkim	48	40	8
22	Tamil Nadu	2514	2216	298
23	Tripura	235	170	65
24	Uttar Pradesh	11396	7059	4337
25	West Bengal	5500	3494	2006
26	A& IN Island	16	16	0
27	Chandigarh	3	3	0
28	D & IN Islands	13	13	0
29	Daman & Diu	5	5	0
30	Delhi	37	37	0
31	Lakshadweep	0	0	0
32	Pondicherry	31	31	0
All India		**58229**	**41966**	**16263**

Source: Table 2 from Bhagyalakshmi, 1998.
Note: Based on Compendium of Transport Statistics, Planning Commission, January, 1993

Table 5.11: Village Connectivity With Population of 1500 and Above

S. No	States/UTs	No. of villages	Villages connected upto 1991-92	Balance to be connected
1	Andhra Pradesh	9700	9231	469
2	Arunachal Pradesh	32	31	1
3	Assam	1812	1812	0
4	Bihar	8228	5333	2895
5	Goa	126	101	25
6	Gujarat	5051	5010	41
7	Haryana	2310	2309	1
8	Himachal Pradesh	196	178	18
9	Jammu & Kashmir	567	520	47
10	Karnataka	4935	4111	824
11	Kerala	1252	1252	0
12	Madhya Pradesh	2910	2670	240
13	Maharashtra	6185	6100	85
14	Manipur	167	165	2
15	Meghalaya	45	45	0
16	Mizoram	56	56	0
17	Nagaland	108	108	0
18	Orissa	2649	2629	20
19	Punjab	1689	1689	0
20	Rajasthan	3300	3091	209
21	Sikkim	21	21	0
22	Tamil Nadu	3918	3877	41
23	Tripura	300	300	0
24	Uttar Pradesh	10899	10447	452
25	West Bengal	4928	3008	1920
26	A& IN Island	15	15	0
27	Chandigarh	13	13	0
28	D & IN Islands	25	25	0
29	Daman & Diu	10	10	0
30	Delhi	123	123	0
31	Lakshadweep	0	0	0
32	Pondicherry	53	53	0
All India		**71623**	**64333**	**7290**

Source: Table 3 from Bhagyalakshmi, 1998.
Note: Based on Compendium of Transport Statistics, Planning Commission, January, 1993

Table 5.12: Expenditure on Transport Sector Under Five Year Plans

(Rs. In Crores)

Particulars	Railways	Roads	Road Transport	Others	Total outlay	% of outlay on transport to total plan expenditure
I Plan (1951-56)	217	135	12	70	434	22.14
II Plan (1956-61)	723	224	18	135	1100	23.54
III Plan (1961-66)	1326	440	27	190	1983	23.12
Annual Plan (1966-69)	589	309	55	79	1032	15.58
IV Plan (1969-74)	934	862	128	598	2522	15.98
V Plan (1974-79)	2063	1701	503	1276	5543	14.06
VI Plan (1980-85)	6586.66	3806.66	1275.61	2293.24	13962.17	12.7
VII Plan (1985-90)	16549	6334.79	2151.35	4421.89	29457.03	
Annual Plan (1990-92)	10217	3778.96	1163.98	2873.44	18034.08	
VIII Plan (1992-97)	27202	13210.04	3849.53	11880.3	56141.87	12.93

Government Efforts for Road Transportation

In 1939, the Motor Vehicles Act was passed for regulating motor transport. With increasing importance of road transport, the Government, after Independence, passed the Road Transport Corporations Act, 1948 which was subsequently replaced by the Act of 1990. Under this Act, the State Road Transport Corporations (SRTCs) were set up to cater to the passenger transport. One of the important objectives of this Act was to ensure the provision of efficient, adequate, economic and properly co-ordinated road transport services in the country (Gowda, 1998).

Nationalization of passenger road transport was undertaken as a consequence of the Road Transport Corporations Act, 1950, to provide more and better transport services to the passengers. In several States, Statutory Corporations was set up under the Road Transport Corporation Act, 1950. Subsequently,

most of the states and union territories have nationalized passenger transport in varying degrees (Gowda, 1998).

Government Efforts for Rural Road Development

The Government of India has been implementing many rural development programmes since 1974, with the development of rural roads included as one of the objectives. Prominent among them are *Minimum Needs Programme*, *National Rural Employment Programme, Rural Landless Employment Guarantee programme, Jawahar Rozgar Yojana* and *Pradhan Mandri Gram Sadak Yojana (PMGSY)*.

Pradhan Mandri Gram Sadak Yojana

In order to connect all villages having population of more than 500 through provision of all-weather roads by the year 2007, a national mission for achieving rural connectivity was initiated by Pradhan Mandri Gram Sadak Yojana (PMGSY) in 2001. It is expected that, through the implementation of this programme, about 600,000 km of new all-weather roads will be constructed benefiting 160,000 habitations out of the 350,000 unconnected habitations. This will constitute an addition of 33 per cent to the existing 1,820,000 km. of rural roads and 20 percent to the existing network of 3,300,000 km of total roads in the country. It was estimated that Rs. 60,000 crore of total investment will be needed for this task (Muraleedharan, 2003).

5.2.3. Railways

Only 1.4 per cent of the villages of the country are covered by railway stations. One of the reason is high expenditure for railway communication when compared to roadways communication. There are variations in railway communication across the states. Two to eight percent of the villages in Goa, Gujarat, Haryana, Kerala, Punjab, Tamil Nadu and West Bengal enjoy the facility of railway station. Other states are far behind the national average (Singh, 2001).

The mass transportation in the cities is primarily by roads except that rail-based transport services exist in the metropolitan cities of Mumbai, Chennai and Kolkata. The Indian Railways[2] is operating Electric Multiple Unit (EMU) suburban trains in Mumbai, Kolkata and Chennai to carry commuter traffic from periurban to the cities. In Delhi, only skeleton suburban rail services exist and buses are almost the only means of public transport. In 1999, nationwide 11 million passengers used to travel daily along 63,000 route km. Out of which 5.9 million in Mumbai's suburban network, 1.3 million in Kolkata' local service network and 5.7 lakhs in Chennai's suburban network commute daily (Bana, 1999).

[2] http://pib.nic.in/feature/feyr2003/fapr2003/f170420031.html

5.2.4. Navigable River, Navigable Canal and Other Waterways

Navigable waterways (inland waterways) that include river, canal and backwaters are the cheapest mode of communication and transshipment of goods. However they are a poorly developed system of transportation in India. At the national level less than one per cent of the villages are covered by navigable system of transportation (Singh, 2001). Kolkata and Kochi has a fairly well organized ferry system, which contributes to mass transportation.

5.2.5. Observations Made in Periurban Areas

The following are the observations made on limited field visits in few periurban locations:

- Good access in the form of metalled road exists for periurban interfaces. However, road condition within periurban interface is of extremely varying qualities.

- Periurban residents normally walk or use bicycle/ rickshaw/ auto rickshaw to the nearest public transportation facility. The distance traveled for accessing the public transportation facility varies significantly from location to location.

- On an average a road and rail commuters from periurban areas in Mumbai spends 2 hours for just getting to and from their workplace, struggling through traffic or packed suburban trains.

- Trend is to construct expressways with usage charge. They are bypassing the weaker sections of the periurban communities and damaging their livelihood by degrading land and water resources and dumping urban wastes.

- The land use pattern in periurban area is fast changing because of access to good quality transportation and energy infrastructure. Agricultural land is used for industry, commercial activity, brick making, waste disposal, recreation, farmhouses and growing fruits and vegetables primarily for urban consumption.

- The local population is often thrown out of their traditional occupation, found unfit for the jobs available, quickly spend money received as compensation in lieu of their land, mutely observe the decline in socio-cultural environment because of the ingress of urban masses and in some cases degradation of ground water and remaining land because of industrial and urban effluents. Few get urbanized and majority is pushed out of their ancestral habitat.

- Number of private vehicles such as fuel-powered two-wheelers is increasing at a fast pace. Social pressure for private ownership of two wheelers and four wheelers are working against sustainable human/

animal driven transport system. Financial credit on easy terms and conditions are facilitating the growth of automobile sector.

- Lack of all-weather road, poorly maintained fleet and unreliable service as far as timeliness is concerned, are characteristics of transportation system in many periurban areas. Poor state of public transport system is further strengthening the cause of unsustainablity.

- Communities often prefer private transport because of better service. For short distance travel, private operators charge higher price than the public service providers. This is because private transporters have to pay regular informal charges to police and transportation authority to keep operating. Penalties for overloading, poor maintenance of vehicles and not abiding the prescribed rules and regulations are common against private operators.

5.2.6. Problems of Traveling Public in Periurban Areas

The following are the problems faced by the traveling public in the periurban areas:

- Discomfort, strain, and the futility of time spent in commuting in crowded transit vehicles, often changing several buses along the way.

- Vehicles are permitted to carry a specified number of passengers. However more number of passengers is carried than allowed in the permit. One of the reasons for this overloading is the inadequate number of vehicles (Gowda, 1998).

- There are no dedicated pedestrian and bicycle lane. The road is used by all types of vehicles and its impact is seen in the form of reduced speed and accidents.

  There is a perennial increase in the number of accidents is causing much anxiety and perturbation. Figures presented in Table 5.13 shed more light on this aspect.

Table 5.13: Number of Motor Vehicle Accidents, Casualties and Injuries

Year	Number of MV Accidents	Number of Persons Killed	Number of persons Injured
1988	2,46,736	46,561	2,14,791
1988	2,70,015	50,711	2,29,671
1990	2,82,602	54,058	2,44,148
1991	2,94,022	56,525	2,55,384
Total	**10,93,375**	**2,07,855**	**9,43,994**

Source: Table 1 from Gowda, 1998.

Note: Based on Motor Transport Statistics of India, 1989-91, Ministry of Surface Transport, New Delhi.

There is a continuous increase in the number of motor vehicle accidents, persons killed and injured. At least 2,07,855 people have lost their lives and another 9,43,994 people injured in the motor vehicle accidents during 1988-91. Reckless driving, driving at a very high speed, driving by the drunken, in-experienced and indifferent drivers, congested and poor quality roads, heavy traffic, etc. are responsible for the motor vehicle accidents (Gowda, 1998).

- Majority of the private vehicle operators harass and exploit the passengers in various forms. In the monopoly areas, the decision of private vehicle operators prevails. Even in fixation of fare, they do not follow any standard procedure (Gowda, 1998). The vehicles ply as per their convenience without sticking to any scheduled time. The employees of these operators do not treat the passengers properly. In some of the cases it was found that private operators are supported and encouraged by some of the staff of the corporations. The private operators engage in price wars by fixing the fare little lower than the fare fixed by corporations.

- Much of the spending of State Road Transport Corporations (SRTCs) in providing amenities is taking place only in urban areas and many of these facilities are unknown in many parts of periurban and rural areas (Gowda, 1998).

5.2.7. Experiences of Periurban Transportation Arrangements

Road Network and Economic Prosperity, Uttar Pradesh

A study of villages of Meerut district of Uttar Pradesh, revealed that the spread of vegetable and potato cultivation in the villages was facilitated chiefly by the network of roads and transport that allowed the produce to be marketed in time (Sud, 2002).

Construction of roads linking villages to the highways had a positive impact on the spread of dairying in the village, Izarpur. Milk traders started selling milk in Meerut city, some 23 kms away, transporting it by bicycles, and horse carts. Milk from the co-operative society was collected twice daily in small trucks, which could not have reached the village in the absence of roads.

The study also revealed that the mobility of the village population improved with the development of road and transport infrastructure. Many landless households started supplementing their income through labour in construction works by commuting to the work sites in private trucks and tempo-taxis. Labour contractors, too, started coming the villages with trucks to transport workers to the construction sites. Some members of the households of these villages also found employment as bus conductors, truck drivers and their assistants. Self-employment through investment in cycle-rickshaws, horse carts and tempo-taxis for hire became possible because of roads. Moreover, to maintain the growing

transport sector, a network of service establishments came up, adding to the employment avenues for the people.

Mini Bus Services for Improving Rural Connectivity, Karnataka

Karnataka is moderately developed state but there exists wide disparity between rural and urban areas in terms of per capita income, infrastructure development including transportation and power (Rajendran, 2003). To address the transportation need, Karnataka Government has introduced a Mini Bus Services (MBS) locally termed '*grameena saaruge*' from August 15, 2003. Initially MBS has been introduced in 21 major districts and will gradually be extended to the remaining districts. The government plans to extend MBS to all 175 talukas, connecting '*hoblies*' (headquarters for a group of revenue villages) and more than 27,000 major villages in the state. The proposed *grameena sasrige* is expected to make a large contribution by integrating the rural economy with the urban. The Government has also announced a number of prizes for the commuters in the initial stage.

The MBS can be operated even on the metal and mud roads as the load is light and the villagers are expected to cooperate and help at difficult times like mud slides and if the bus gets stuck on the roadside.

Businessmen from nearby towns and urban centers travel to undertake petty business and the local population is exposed to newer consumer products. When perishable agricultural products like fruits and vegetables require easier and faster transport the MBS is found to be appropriate mode besides passenger service.

The unskilled labourers, who engage in construction and other activities in the urban areas, commute regularly. More importantly farmers from remote villages quickly transport their products like fruits and vegetables in MBS to market centers located in the urban areas. Similarly, farmers use MBS to bring agricultural inputs like diesel, fertilizers and pesticides from the urban market outlets.

School children's use MBS to go to their schools and informal arrangements have been made to charge fares at subsidized rate to regular children and public. Importantly, teachers who are employed in villages but live in urban centers also utilize the MBS. Therefore, rural schools run regularly.

MBS has also arranged special and exclusive services for women in labour and emergencies like snakebites. Realizing the significance of MBS, 50 women self help groups (SHGs) in Musiri Panchayat Union in Tiruchirapalli district jointly own a bus worth of Rs. 4.5 lakh and successfully run from Mannachanallur town to Moovanur village via Kattukuppam.

In addition, MBS has had an impact in other ways also. The drivers and conductors of MBS help bring newspapers and news-magazines, which help the local population to abreast the knowledge with the outer world.

Road Connectivity in Punjab

Green revolution occurred earlier in the areas having a network of roads linking the input supply depots and output marketing yards like *mandis* with the villages (Sud, 2002). In Punjab the road network increased from around 13,900 kms in 1970 to 40,000 km by 1995 achieving 100 percent rural road connectivity. During the same period, the length of motorable roads in the rural belt also increased from about 16,000 km to over 30,000 km. The number of trucks operating in Punjab rose from a mere 2,000 in 1970 to around 20,000 by 1980 and further up to over 58,000 by the mid-1990s.

Connectivity in Mizoram

The physiological condition of Mizoram is characterized by mountains terrain, steep slopes with a few small plains. The only means of transportation available is road transport (Agarwal, 1997). Any disruption in the transport system on NH 54 cause price rise of essential goods and development activities comes to a grinding halt in absence of any alternate efficient mode of transport system with the rest of the country. There is a need to enhance infrastructural facilities to the surrounding areas to improve the quality of life.

Transportation and Mobility Need Study, Indianapolis[3]

A study was conducted in Indianapolis to examine the transportation and mobility needs among and between the communities surrounding Indianapolis in order to identify periurban travel needs and develop recommendations for improvements. The following alternatives were being considered to meet future travel needs:

No-Build Alternative: This option does not include any roadway improvements beyond those already programmed for construction.

Minimum Change Alternative: This would include additional improvements to existing facilities to improve safety and traffic operations. Changes could include improving intersections, adding lanes, improving roadside safety features and removing parking.

Medium Change Alternative: Similar to the Minimum Change alternative, but with the addition of alternative routes around urban areas or other locations where right-of-way, land use, access points, or environmental conditions might make improving existing roadways difficult or undesirable.

Maximum Change Alternative: Includes the development of limited access roadways (including freeways) on new alignment or in combination with portions of existing roadways.

Israel Railway Authority's[4]

[3] www.in.gov/dot/div/planning/Mobility_Study.pdf+suburban%2Btransportation&hl=en&ie=UTF-8
[4] http://www.asiatradehub.com/israel/railways.asp

One of the goals of the Israel Railway Authority is to integrate the rail system with other transport systems and therefore offer a complementary network, as well as an alternative system, which will help reduce the pressure on Israel's road system. This would essentially help to cope with the challenges of mass passenger.

5.2.8. Policy Intervention for Improving Periurban Connectivity

- **Integrated Area Development Plan:** The development of road network has to be taken up within the framework of an integrated area development plan. The economic base, development activities both of the existing and that of the foreseeable future, size of population of growth centers, peri urban and rural areas and their interaction with the urban centers should be considered while planning the transportation system (Mishra et. al, 2001).

- **Public transportation system and tariff policy:** Well coordinated public transportation system should cater to the growing demands from low-income peripheral areas of the cities. Scheme called *Grameen Vahana Saarige* (Rural motor transport), operating in states like Andhra Pradesh, Karnataka and Tamil Nadu may be introduced in other states in order to provide better transportation facilities (Mishra et. al, 2001). There is also need for co- ordination and co-operation between operators.

- **Decentralization and people's participation:** There is a need for democratic decentralization and a greater involvement of people right from the conceptual state till the completion of the project. Involvement of the people in the upkeep of community assets is also important (Mishra et. al, 2001). Also encouraging more and effective public participation for transportation system planning

- Developing institutional mechanism for decentralized management of roads and transportation system (Partial/full community funding of road, operation and maintenance of road, operation and maintenance of public transportation system, fixing passenger fare and road use fee)

- **Regularizing the Informal Service Provider**

- **Slow traffic lanes[5]:** Pedestrian and bicyclists have to compete for road space with cars, buses and trucks. Constructing bicycle and pedestrian lane will avoid accidents. Incentives should be provided for human energy in the form of tax advantage to bicycle industry.

- **Cost-effective technology:** Due to financial constraints, it becomes important to develop suitable cost-effective technologies using local materials, machinery and other resources. Though the Central Road Research Institute (CRRI) has developed some such technologies, which

[5] Half of the travel surface in cities in China is reserved for bicyclist and pedestrians.

are already in use, yet a need is felt that agencies like PWDs, CAPART and NGOs should be involved in taking up collaborative research work and development of appropriate rural road technologies taking into account various aspects viz., geoclimatic condition, weather condition, recurring flood, vulnerability to earthquake etc. (Mishra et. al, 2001).

- **Link roads:** There is a need for providing the periurban and rural areas with approach link roads to centers of business. Link roads may also be provided to the nearest railway stations minimizing the pressure on road network (Mishra et. al, 2001).

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