

# SUMMARY

## Introduction

In response to shared concerns about the lack of knowledge about how transport and energy investments contribute to poverty reduction, the Asian Development Bank (ADB), in collaboration with the Department for International Development of the United Kingdom, the Japan Bank for International Cooperation, and the World Bank, undertook a regional technical assistance (RETA) project, *Assessing the Impact of Transport and Energy Infrastructure on Poverty Reduction*. The objectives of the RETA, a study based on a literature and project review and on field research in three Asian countries, were to enhance current understanding of how transport and energy infrastructure contribute to poverty reduction, to fill knowledge gaps, and to identify lessons learned and good practices. The RETA also aimed to help build capacity in developing member country (DMC) research institutions to design and conduct policy-relevant research on poverty and infrastructure.

The RETA was implemented in three stages. Stage 1 assessed the current understanding of how transport and energy infrastructure impacts on poverty reduction, identified knowledge gaps, and developed proposals for supplementing this knowledge by conducting country case studies. In Stage 2, domestic research institutions carried out field research and data analysis to prepare country case studies in the People's Republic of China (PRC), Thailand, and India. Stage 3 analyzed and compared the findings of the three country studies to identify policy and operational implications as well as priorities for future research.

## Literature Review

*In the literature on transport-poverty and energy-poverty linkages, direct, empirical evidence is relatively*

*scarce*. This is because transport and energy, like other infrastructure investments, are intermediate goods: they make possible other activities that increase the productivity and enhance the welfare of poor people, and they contribute to economic growth that may expand the economic opportunities available to the poor and provide additional resources for poverty reduction. However, the linkage is not a necessary one: other political, socioeconomic, and cultural factors are likely to be important in determining the poverty impact.

*Past studies often lacked a reliable methodology*. Most existing studies are of uncertain value because they do not present systematic “before and after” data on poverty or evaluate complementary actions that affect the impact of transport investments, and do not track the effects on poverty long enough. Nevertheless, many people in developing countries believe that transport improvements do alleviate poverty.

*Most of the existing work on transport and poverty reduction has concerned roads, particularly rural roads*. This bias is logical, since roads represent the transport mode most often used by the poor and rural areas are where most poor people live. Not much research has been done on the poverty reduction impact of national or provincial highways, other transport modes, or urban transport. While much past work focused on infrastructure impacts on agricultural production, more recent studies have looked at the impact on nonfarm activities in the rural economy. Studies have generally treated increased access to social and economic services as a benefit, without examining whether this actually enhances the welfare of the rural poor. Recent themes have included the differentiation of gender roles in transport and the impacts of transport infrastructure development on the physical and social environment.

*Few empirical studies have attempted to measure the poverty reduction impacts of energy infrastructure investments*. Quantifying the value of electricity to the poor is difficult, except as it relates to food storage, irrigation, agricultural processing, and small-scale industry. Previ-

ous studies have shown that high initial investment costs, including electricity connection charges, prevent poor people from gaining access to more efficient and affordable energy types.

*Aggregate expenditure on roads and electricity is linked to rural poverty reduction.* A few studies have looked at the composite effects of investments in different sectors on poverty reduction, particularly in rural areas. These studies are helpful in assessing the relative importance of different types of investments and their appropriate sequencing and timing for optimal impact. Of particular interest is a set of studies by the International Food Policy Research Institute (IFPRI), which uses an econometric model to compare the poverty-reducing effect of public investment in different sectors. These include IFPRI's initial studies on the PRC and India, and a further study of Thailand that ADB commissioned as part of this RETA. The studies provide evidence that investments in infrastructure, education, and agriculture work together to improve rural productivity and reduce rural poverty. Because of their additional effects on both farm and nonfarm employment, investments in roads may often have the greatest impact on rural poverty reduction, especially where road density and quality remain relatively low. Investments in irrigation and power may also influence agricultural productivity, but usually have a smaller effect on poverty reduction.

## Project Review

*Previous transport and energy projects of ADB and the World Bank struggled to show a direct link between project activities and poverty reduction.* A review was conducted of the 30 ADB and 36 World Bank projects in transport and energy approved between 1993 and 2001 that had identified poverty reduction as a primary or secondary objective. Most are still being implemented. These included projects that targeted a particular area where most people were poor, and projects integrated within multisector rural development programs. Although the project reports described expected impacts on poverty, they were usually unable to demonstrate a direct link between project activities and poverty reduction, or to provide quantitative indicators to monitor poverty reduction outcomes.

## Research Design

*The literature and project reviews were used to develop a universe of hypotheses—a “propositional in-*

*ventory”—about the poverty impacts of transport and energy investments.* These hypotheses linked transport and energy investments with poverty reduction outcomes in terms of income and expenditure impacts, impacts on farm productivity and nonfarm employment, access to services, access to information, access to common resources, safety, security, and social participation. Some hypotheses had been the subject of empirical research, often with conflicting findings. Others were proposed on theoretical grounds, but had never been empirically tested. The propositional inventory was used as a tool for determining gaps in current knowledge that might be addressed through field research. It also served as a yardstick for comparing progress made by the RETA against the overall challenge of improving knowledge on the poverty reduction impact of transport and energy investments.

Drawing on the propositional inventory, the following key gaps in current knowledge were identified, with a view to including them within the design of the field research wherever possible:

- impacts of sector policy change,
- impacts of changes in service provision,
- impacts of transport modes other than roads,
- impacts of energy sources other than electricity,
- impacts of transport and energy projects on the urban poor,
- constraints on access by the poor to improved transport and energy services,
- gender differences in the impacts of transport and energy investments,
- environmental consequences of transport and energy investments, and
- governance and institutional issues.

*The main focus of the field research was to trace out the causal chain of effects that, in a given context, leads from a transport or energy intervention to a poverty reduction outcome.* The broad conceptual framework for the field research proposed transport or energy interventions as the independent variables, macroeconomic and sociocultural factors as contextual variables, sector policies and situational characteristics as intervening variables, and poverty reduction outcomes as dependent variables. The interaction of multiple factors has been articulated in the studies by IFPRI.

To improve the prospects of insightful findings about how transport and energy infrastructure affects poverty reduction, the selection of sites for the field work was

based on countries with relative macroeconomic and political stability over the last 10–15 years, where it was to be expected that infrastructure interventions would have had more chance of realizing their potential impacts. The countries selected for field work were the PRC (Shaanxi Province), Thailand, and India (Gujarat State). The range of transport and energy case studies examined is summarized in Table S.1.

**Table S.1. Transport and Energy Case Studies by Country**

Case	PRC	India	Thailand
Secondary/rural Road	■	■	■
Railway	■		
Long-Distance Travel			■
Bus/rail Stations	■		
Private Port		■	
Rural Electrification	■	■	■
Urban Slum Electrification			■
Complementary Credit, Training	■		

Source: Authors' summary.

## People's Republic of China Country Study

The PRC study examined the use of transport and energy services by poor and nonpoor households in selected poor counties in two prefectures of Shaanxi Province, Yulin in the north and Shangluo in the south. The study used household data from the Shaanxi provincial database for poverty monitoring, and from field surveys conducted in four counties. The team used four different definitions of poverty: (i) a measure of income-based poverty based on the official poverty line, equivalent to about 66% of the international “\$1-a-day” standard; (ii) poverty based on incomes of less than \$1 a day; (iii) poverty based on consumption expenditures of less than \$1 a day; and (iv) poverty in value of household assets.

A probit model was used to estimate the impacts of transport and energy infrastructure, in conjunction with other factors, on poverty reduction. The findings suggest that both road and rail investments do contribute to poverty reduction. Whether a village had road access or not in 1998 had no observable effect on household poverty for the extreme poor (those below the national poverty line), although it had the expected effect for the poor defined in other ways. This may mean that the extreme poor could not take advantage of village road access to

escape from poverty. Only if the households have reached some income or asset accumulation threshold can village roads contribute to poverty reduction. Access to electricity in 1998 had the expected impact on poverty only in the case of poverty defined by the value of assets. This suggests that farmers increased their ownership of electrical appliances (especially television sets) after gaining access to electricity, but that they did not use electricity much for income-generating activities.

The field survey database included additional measures of the quality of transport and energy infrastructure. Linking the results to those found using the provincial database, it emerges that when transport and energy infrastructure was of poor quality, it did not contribute much to poverty reduction. Higher densities of roads and stronger electricity systems have a greater impact on poverty than simply providing basic access, since the reliability and quality of transport or energy services are important.

The findings from the statistical analysis, together with the results of participatory village discussions and key informant interviews, were combined to assess the impacts of five different interventions: rural road improvements, road construction, railway construction, rural electrification, and roads and electrification combined with access to technical services and credit. Better performance in poverty reduction in villages with road access was attributed to two main factors: easy access to credit and technical training, and direct effects of road access on transaction costs and time. Smoother and faster motorized road transport also facilitated a shift to high-value perishable products. Households, both poor and nonpoor, substantially increased the share of their income coming from off-farm employment over this period. Village road access did not seem to have made a significant difference in this respect.

Households with access to electricity performed better than those without electricity in terms of income and consumption growth. The value of assets, however, grew faster among the households without electricity. Poor households with electricity, especially the poorest, showed faster rates of income growth than poor households without electricity. In poverty reduction, however, access to electricity did not show any benefits. The main reason for the contrast between impacts on income growth and impacts on poverty reduction is that households with electricity increased their income from both farm and non-

farm activities more than households without electricity. Households without electricity, and in particular the poor among them, increased their income more from off-farm employment. However, little significance can be attributed to these differences, because of the small size of the nonelectrified sample.

Railway construction in two counties had a greater immediate impact on income than on poverty. In 1993, per capita incomes of farmers in Zhen'an and Zhashui were the lowest in the prefecture and the incidence of poverty was very high (80–90%). After railway construction, the counties had the prefecture's highest annual per capita growth rates for gross domestic product and household income, but poverty incidence was still higher than in most other counties in the prefecture. The study found that the poor benefited as much as the nonpoor from employment opportunities generated by railway construction and increased demand for local products and services. Railway construction also had a demonstration effect: local people employed gained confidence, skills, and experience that enabled them to then seek other employment outside their villages.

The PRC country study showed that transport and energy infrastructure contributes to poverty reduction, not only by directly improving the living conditions of the poor, but also by diversifying income and employment sources and helping improve the productivity of poor households. Infrastructure also helps improve health care and education and enhances the contact and communication of the poor with the outside world. However, the team found that the positive impacts of transport and energy investments on the poor were constrained by existing policies and institutional arrangements.

## Thailand Country Study

The Thailand study examined the poverty reduction effects of (i) rural transport improvements, (ii) rural electrification, (iii) urban electrification, and (iv) long-distance transport by road and rail. The three rural sites covered Nakhon Ratchasima and Buri Ram provinces in the Northeast Region and Nakhon Si Thammarat Province in the Southern Region. The two urban sites were in Nakhon Ratchasima City and Bangkok.

Three different definitions of poverty were used. The first was income-based or “objective” poverty. Using national urban and rural poverty lines, respondents were divided into “poor,” “ultra poor,” and “nonpoor” groups. Second, the study examined how people's perceptions about poverty affect their perceptions about infrastructure

improvements. To do so, it introduced the notion of “subjective poverty,” or poverty status as reported by key informants (village and community leaders). Third, the study measured “relative poverty” through self-reports. This was found to correspond closely with subjective poverty, indicating that people accurately perceive their own status and that of other people, and do so in relation to local rather than national norms.

The basis for defining transport change was the recorded change in travel time, by the most convenient means, from each village to the district center. Changes in travel time could reflect road improvements, transport service improvements, and/or changing modes of transport, including increased private vehicle ownership. Changes in energy status were measured by the percentage of households in each village connected to electricity in 1990 and 1999. The team carried out an econometric analysis using village-level data from the national rural survey database, combined with household-level data from field interviews; and used household interviews, village-level information and key informant interviews, participatory focus groups, and supplemental secondary data analysis.

The findings of the Thailand country study suggest that many benefits of improving transport and electricity services to poor communities are widely shared, even if households are not equal in their ability to access such services directly. The benefits of communal improvements such as street lighting and village water supply, as well as those such as greater access by teachers, health care providers, security services, and nongovernment organizations (NGOs), are accessible to all. In fact, such benefits probably make a greater difference to the poorer households in the community, since the nonpoor have other options for obtaining these services. Poor households also welcomed improved opportunities to access common resources. Even if the poor do not change their own produce marketing behavior as a result of road improvements, they benefit from increased competition among buyers and traders coming into the community. The benefits are not only lower prices and greater variety of goods, but also more secure supply under conditions to which the poor are particularly vulnerable; furthermore, if poor households rely on wage work for their incomes, road improvements allow them to seek work over a wider area, and electricity offers a greater range of employment opportunities.

Perhaps surprisingly, transport and electricity improvements had not induced a significant change in the employment patterns of most poor households. Farmers remained farmers; urban laborers or petty traders remained in their

occupations. However, transport and electricity improvements had clearly helped many people increase their productivity. Farmers shifted from subsistence crops to higher value crops and livestock; urban workers were able to reach wider markets and work longer hours. About half the rural households studied, and less than half the urban households, felt that their incomes had increased as a result of transport and energy improvements. Income impacts were less widely felt among the poor and least among the very poor, although the differences between income groups were not very great. One area of special concern was the small minority, usually very poor, that had experienced a decline in income.

Positive impacts on education and health are likely to promote income poverty reduction over the longer term, perhaps not measurable within the time span of the present study. It is therefore encouraging to note that the rural poor benefited even more than the nonpoor from improved access to education, and the urban poor benefited even more than the nonpoor from improved access to health care. The findings are particularly significant in girls' education, which is clearly facilitated by safer road travel and better lighting at home and in the community. The same conditions facilitate greater social participation by both men and women, helping build social capital both within and between communities.

The Thailand country study confirmed that transport and energy improvements induce additional expenditure by both poor and nonpoor households, some of which might be seen as a pure consumption expense (tourism, television) but much of which can be seen as a form of investment (work-seeking travel, travel to participate in family or community activities, using lighting and household appliances to extend working hours or facilitate studying). Study respondents strongly rejected the hypothesis that roads or electricity had anything to do with indebtedness.

Long-distance travel was common among both urban and rural households. Poor households were more likely to engage in work-related long-distance travel, whereas nonpoor households were more likely to make long trips for social or personal purposes. Road transport was generally the preferred mode, as it was more convenient and faster. Time savings were important to the poor as well as the nonpoor. Rail transport was used by a relatively small minority of long-distance travelers, mainly because costs were low and when origin and destination were conveniently served by railway stations. For this reason, poor households are more likely than others to travel by train to and from Bangkok.

The team concluded that the most important research result was the finding that poor people place a high value on improved access to transport and electricity. This finding was confirmed both by the econometric analysis and by the subjective evaluation provided by local people.

## India Country Study

The India study was carried out in the state of Gujarat. Three districts were initially selected for the study: Jamnagar, which achieved very significant poverty reduction over the study period; Bharuch, where poverty was relatively low, both at the beginning and the end of the period; and Panchmahal, the only district in the state with persistently high poverty. Kuchchh District, where significant poverty reduction also took place, was added to the sample to include a private port project (Mundra port) in the study.

The study used the national definition of poverty in India, equivalent to a per capita income of about \$88. By this measure, about 60% of all sample households were poor.

The study's two main objectives were to (i) evaluate the impact of transport and energy interventions on poverty reduction at the community, household, and individual levels; and (ii) identify the direct and indirect mechanisms through which this impact on poverty was produced. To achieve these objectives, the study used village-level information and interviews with key informants from service agencies, household interviews with questionnaires, limited participatory focus group discussions, and supplementary secondary data analysis.

At the community level, changes were measured over the 5 years from 1998 to 2002. Since all the villages were electrified before 1997, changes over this period may be largely attributable to recent district road improvements. However, they might also represent delayed effects of village electrification. Since there were no "without-service" villages in the sample, the study could only measure changes that occurred after both electrification and road improvement took place. Consequently, it was not possible to separate transport effects from energy effects at the village level. At the household level, the analysis found significant differences in income between electrified and nonelectrified households, as well as between households that are close to and far from improved roads. The differences were greater for electrification than for road access.

To clarify these findings, the India team used a probit model to predict the probability of a household being poor. The model showed that access to roads and electricity

were significantly (negatively) related to poverty status only in Panchmahal (the district where poverty was still high). In Kuchchh, the relationship between access to electricity and poverty status was significantly negative, but no significant relationship emerged for road access. In other districts, neither service was significantly related to poverty. Distance to improved roads also had no relationship to poverty status. However, per capita expenditures on energy were significantly (positively) related to poverty status in all districts, and per capita expenditures on transport were significantly (positively) related to poverty status in all districts except Jamnagar. These results suggest that it is not mere access to these services that leads to poverty reduction, but rather the use of the services, as measured by expenditures.

The impacts of the private port at Mundra in Kuchchh were different from the impacts of road and electricity improvements. Although these impacts were also covered by the household survey, open-ended discussions with focus groups in two sample villages were particularly valuable in understanding port impacts. In general, the villagers felt that they had not benefited from the construction of the port in their area. The indirect benefits of the port had accrued mainly to landowners and homeowners, as well as to those who could invest in commerce and trade. The port had brought about some negative impacts, which were felt mainly by the poorer households depending on wage labor for their income. Since many landowners had sold their agricultural land and salt farms to the port or the factories, fewer job opportunities existed for wage laborers. The growth in commerce and trade had increased the prices of some essential commodities, putting further pressure on the limited resources of the poor. Instead of employing local labor, the port and associated industries were using labor contractors who brought workers from outside the district and even from outside the state. The origins of these workers indicate that they might have been poorer than the local people. Thus, although port employment had little impact on poverty in its immediate vicinity, it may have been having a positive impact on poverty on a state and national scale.

The overall finding was that improvements in roads, ports, and energy infrastructure had significant effects on poverty at the household, village, and community levels. Impacts that accrued to both the poor and nonpoor included growth in existing economic activities and emergence of new employment opportunities. Others were improved access to health care and education facilities, and improved availability of news and information. The

study also found that the poor gain improved access to common property resources, increased personal security, and enhanced participation in social bonding, building social capital, and social participation.

## Findings on Propositional Inventory

The country studies provided new evidence to support or disprove the hypotheses in the propositional inventory. This is summarized in Table S.2.

For rural transport improvements, the country studies supported hypotheses concerning decrease of transport costs for the poor, access by poor people to health care and education services, and access to common property resources, and their improved personal security and participation in the community. As regards the income generation hypotheses, the studies supported the idea that transport generates farm and nonfarm incomes, but found that this did not disproportionately accrue to the poor.

For rural energy improvements, the main hypotheses supported were those concerning improved quality of education and health care for the poor, and increased information flow to the poor. Hypotheses of reduced energy costs for the poor and decreased pressure on woodlands were rejected. Findings on most other energy hypotheses, including impacts on farm and nonfarm incomes of the poor, were mixed or inconclusive.

For both rural transport and energy improvements, the studies supported the part of the hypothesis on wage employment concerning increased employment and wage rates, but again found that these did not accrue disproportionately to the poor.

The aggregate impact hypothesis that transport improvement significantly affects poverty reduction was supported, as was the hypothesis that transport and energy improvements taken together have a greater poverty reduction effect than their individual effects. However, findings were inconclusive on the hypothesis that energy improvement significantly affects poverty reduction.

The findings on urban transport and energy improvements refer only to Thailand. Among the hypotheses supported were those stating that urban transport improvement facilitates health care and education service delivery to the poor, and affects poor people's health and safety risks and community participation (mostly positively).

**Table S.2. Summary of Findings on Propositional Inventory**

No.	Hypothesis	Evidence from Studies			Observations
		PRC	India	Thailand	
<b>Rural Transport Improvements</b>					
1.	decrease costs to the poor for personal travel and goods transport.	■	■	■	Much of the gain from improvement reflected in time savings.
2.	generate farm income that disproportionately accrues to the poor.	x	x	x	Farm income increases accrue to nonpoor as well as poor.
3.	promote the development of nonfarm activities in rural areas that generate income disproportionately accruing to the poor.	x	x	x	In PRC construction employment was substantial, but nonpoor received greater share.
4.	increase the range of opportunities for wage employment and thereby raise the price of labor in rural areas, generating income that disproportionately accrues to the poor.	□	□	□	Increased employment opportunities and higher wages in India and Thailand, employment migration in the PRC; not disproportionately to poor.
5.	increase the availability and accessibility of education and health care services in rural areas, resulting in greater participation in these programs by the poor.	■	■	■	Frequency and quality of services affected, as well as service take-up and school attendance.
6.	increase the access of the poor to natural capital, especially common property resources (land, water, vegetation, wildlife).	..	■	■	
7.	increase the personal security of poor people in rural areas.	..	■	■	Being less isolated helps reduce the vulnerability of the poor.
8.	facilitate the delivery of emergency relief to the poor in case of natural disaster.	..	□	..	Not explicitly studied, but some evidence from Gujarat earthquake.
9.	have a positive effect on participation of the poor in (a) local organizations (bonding social capital), (b) activities outside the rural community (bridging social capital), and (c) local political processes and management structures.	■	■	■	Although findings were generally positive, in some cases exposure to outside world weakened internal social bonds and made people more critical of village life.
<b>Rural Electrification Improvements</b>					
10.	reduce energy costs for the rural poor.	x	x	x	Unit costs reduced but spending rose due to electricity bills and cost of appliances.
11.	increase farm productivity that generates income increases disproportionately accruing to the poor.	□	x	x	In the PRC poor households with electricity had most income growth; in India and Thailand, fewer poor households reported income growth, and often due to nonfarm activities.
12.	promote the development of nonfarm activities that generate income disproportionately accruing to the poor.	□	..	□	Growth of nonfarm activities confirmed, but nonpoor at least as likely as poor to gain.
13.	improve the quality of education and health care services in rural areas, resulting in greater benefits of these programs for the poor.	■	■	■	Lighting helps for doing homework and reduces eyestrain, electricity helps operation of service facilities.
14.	increase the flow of information to the poor.	■	■	■	Reading, radio, and television increased flow.
15.	by decreasing pressure on woodlands, protect the access of the poor to natural capital.	x	x	x	Few used electricity for cooking or heating, so biomass still widely used.
16.	increase the personal security of poor people in rural areas.	..	□	■	Household and street lighting considered important in Thailand.
17.	have a positive effect on participation of the poor (a) in local organizations (bonding social capital), (b) in activities outside the rural community (bridging social capital), and (c) in local political processes and management of community resources.	x	□	■	Effects were generally less than for rural transport improvement.
<b>Aggregate Impacts</b>					
18.	Transport improvements, all other things being equal, have a significant effect on poverty reduction.	■	□	■	Poverty levels in the PRC and Thailand were inversely related to per capita transport spending.

**Table S.2. Summary of Findings on Propositional Inventory** (*continued*)

No.	Hypothesis	Evidence from Studies			Observations
		PRC	India	Thailand	
19.	Energy improvements, all other things being equal, have a significant effect on poverty reduction.	x	■	□	In India strong links to income poverty reduction were noted; in Thailand, to nonincome dimensions.
20.	Transport and energy improvements, taken together, have a significant effect on poverty that is greater than the sum of their individual effects.	..	■	..	In India transport improvements tended to reduce inequality, but rural electrification tended to increase it.
<b>Urban Transport Improvements</b>					
21.	reduce transport costs for the poor.	..	..	x	Especially travel to school and health centers, and access to information.
22.	facilitate the delivery of health care and education services to the urban poor.	..	..	■	
23.	reduce (increase) health and safety risks for the poor.	..	..	■	Effects mostly positive, especially improved security; some negative effects, e.g., air pollution, road accidents.
24.	increase (reduce) opportunities for employment for the poor in (a) transport services, (b) commerce and industry, (c) the informal sector.	..	..	□	Substantial occupational change in response to road improvements, but more for nonpoor than poor.
25.	positively (negatively) affect the participation of the poor (a) in community organizations (bonding social capital), (b) in activities outside their neighborhoods (bridging social capital), and (c) in local political processes and management structures.	..	..	■	Due to greater convenience in traveling inside and outside the community.
<b>Urban Energy Improvements</b>					
26.	access to electricity reduces (increases) energy costs for the urban poor.	..	..	□	Household spending generally increased, but some poor households reported decreases.
27.	energy reforms increase the access of the urban poor to modern energy services.	..	..	..	Not explicitly tested, but Thailand study suggests need to give more attention to connecting urban poor.
28.	access to electricity improves the quality of health care and education services, resulting in greater benefits of these services to the urban poor.	..	..	□	
29.	access to electricity reduces (increases) health and safety risks for the urban poor.	..	..	□	Positive effects of street and home lighting, but poor may lack access.
30.	access to electricity increases (reduces) opportunities for employment of the urban poor in (a) energy services, (b) commerce and industry, and (c) the informal sector.	..	..	x	Effects likely for nonpoor, but not significant for the poor.
31.	access to electricity positively (negatively) affects the participation of the urban poor (a) in community organizations (bonding social capital), (b) in activities outside their own neighborhoods (bridging social capital), and (c) in political processes.	..	..	x	Effects reported by the nonpoor, but less by the poor.
<p>■ = Confirmed, □ = Partly Confirmed, x = Not Confirmed, .. = Not Examined.  Source: Study findings.</p>					

## Conclusions

### General

*Transport and energy infrastructure investments have benefited the poor as well as the nonpoor.* Contextual factors in the country influenced this finding. Differences in some of these contextual factors may explain why similar poverty reduction results have not always been obtained in other Asian countries or in other parts of the world.

*The evidence is not sufficient to reject the null hypothesis that the poor and the nonpoor benefit proportionately.* Transport and energy infrastructure is, and is seen to be, a public good, the benefits of which are available to all. Poor people welcome such investments, even if they are not immediately able to take advantage of them. Reduced transport costs are reflected in the prices of their products and of the goods they purchase, as well as in the increased presence of traders and service providers in their communities. Poor people share equally in the qualitative benefits of improved access to health and education services, increased safety and security, and access to information. Transport and energy improvements are less likely, in the short run, to benefit the poorest of the poor, whose efforts are often handicapped by factors associated with chronic poverty; they are more likely to benefit poor households near the poverty line that may be able to escape poverty through their own initiative.

*Poverty is not so much a village as a household characteristic.* Within well-off communities, some households are still poor, and even in disadvantaged communities not all households are poor. Bringing transport and electricity to a community creates opportunities that benefit relatively richer households and enable some of the poorer households to move out of poverty. Even for those households that remain poor, welfare may be improved by some of the secondary impacts of transport and electricity investments at the community level. Particularly with respect to electricity, however, better-off households may be in a better position than the poor to make the complementary investments needed to turn an infrastructure investment into an opportunity to increase household incomes. Consequently, though everyone in a village may in fact be better off as a result of such investments, the perception may still be one of growing social inequality.

*Transport and energy infrastructure creates opportunities to increase the productivity of the poor.* For some households, these opportunities can become powerful driv-

ers of an escape from poverty. Transport improvements were seen as having the most significant impacts on the incomes of the poor, mainly through increasing opportunities for employment in nonfarm enterprises. The impacts of electricity seemed less likely to benefit the poor in the short term.

*Whether transport and energy investments bring economic benefits depends on the assets (natural, physical, human, social, and financial) that people can mobilize to take advantage of these opportunities.* However, transport and energy investments are also important in making nonfarm income-generating opportunities available to landless poor households.

*Whether transport and energy infrastructure brings benefits to the poor also depends on the quality of services provided.* The responsiveness of transport and energy services to the needs of the poor is partly a function of public policy and partly of political culture and institutional governance. In transport, all three countries studied have relatively open transport service sectors offering a wide variety of options tailored to the needs of different users. Competition is keen, resulting in prices that may be close to marginal costs, so that the benefits of road improvements are likely to be passed on to the transport service consumer.

*Time savings are of great importance to the poor, implicitly valued at much more than their opportunity cost of labor.* Other studies have shown that the poor, especially women, are significantly time-deprived. Transport improvements generate time savings for the poor (and others) that are reflected in more time spent on farm or household work or on participation in health care, education, or other community activities. Time savings are particularly important in expanding the radius within which off-farm urban and rural employment opportunities are accessible to the poor. Energy improvements can also contribute to productivity if they are used together with time-saving appliances. Improved lighting can also extend the productive working hours of both men and women.

*Infrastructure and service improvements that decrease risk and increase security, at both personal and community levels, are important for the poor and near-poor.* Access to emergency health care services, though needed only rarely, is greatly valued by the poor, as is the ability to deliver emergency relief in cases of natural disaster and law enforcement in remote communities.

*For some of the poorest of the poor, village improvements in transport and energy infrastructure may produce net negative effects on welfare.* These include people whose livelihoods depend on activities that may be displaced by

transport or energy improvements and producers of local goods and services that cannot stand up to market competition. Project designers should, therefore, identify such potentially “economically displaced” poor people and include project components to help them develop alternative means of earning a living.

*Improvement of transport or energy may have less immediate impact on chronic poverty.* The three country studies examined the characteristics of households that had not reported income benefits from transport or energy improvements. The evidence suggested that such households fit the profile of the chronic poor, with relatively high rates of disability and chronic disease, low educational levels, and high dependency ratios. For such households, improved access to health care and education services may be the most important short-term benefit of transport and energy investments, paving the way for improved incomes in the more distant future.

## Private Sector Development

*The differences between the public and the private sector in delivering infrastructure services to poor households are not significant; the poor do not value low-cost, publicly provided services that fail to meet minimum standards of convenience, safety, and reliability and will shift to higher-cost, higher-quality, privately provided services if they have the option.* Greater market competition seems to result in more choices and better prices that help to maximize the benefits reaching the poor. However, meeting the needs of the poor may mean delivering services at less than their true costs. If meeting these needs is a public priority, some form of subsidy may be required.

## Gender Concerns

*The study provided little hard evidence on intrahousehold inequities in access to transport and energy services, but does show that women, particularly poor women, are often put at risk by the lack of or poor quality of transport and energy services.* Reliable transport seems particularly important in encouraging parents to allow girls to continue their education, and in enabling women to participate in social and economic activities, outside the village. Community lighting—street lights and illumination in communal facilities—has a positive impact on women’s (as well as men’s) safety, security, and social participation. Lighting and television/radio in the home lengthen the time available for productive work and

enable women and girls to study and access information that might otherwise be unavailable to them.

## Environmental Impacts

*The poor are relatively unconcerned about the potential negative environmental impacts of transport or energy infrastructure.* Air quality was the main environmental concern expressed by both poor and nonpoor respondents; no one mentioned negative impacts due to poor road design. Traffic accidents are a concern, but views are divided as to whether road improvements reduce such accidents or, by inducing traffic growth and higher speeds, increase them. Most survey respondents did not see degradation of natural resources due to increased access as a negative impact, but rather were happy with the greater opportunities to appropriate a portion of those resources for themselves. The majority view seems to be that, on balance, rural road improvements are environmentally beneficial. In urban areas, both poor and nonpoor residents are more conscious of the negative impacts of transport improvements on air quality, but are relatively insensitive to safety issues.

## Policy and Operational Implications

This study’s recommendations, at several levels, apply not only to national policymakers, but also to projects and programs designed by development partners, and include the following:

*Investment in transport and energy infrastructure should continue until national networks ensure that all people have access to quality services.* If investment stops before the national networks are complete, it will be the poorest who are left unserved. At the same time, the importance of service quality underlines the need for maintaining existing infrastructure networks and capacity expansion as needed to serve the demands of a growing economy.

*The development community should continue to support transport and energy infrastructure and related services.* These have a role to play in poverty reduction programs. While not all the poor will necessarily benefit from such interventions, a significant number will do so. Many nonincome benefits associated with transport and energy investments are equally available to the poor and nonpoor

at the community level and may be especially important for the poor.

*Area targeting should be used to reach remaining pockets of poverty that suffer from a lack of transport and energy infrastructure.* Area-wide, cross-sector investment planning should capture synergies among transport, energy, and other forms of support for poverty reduction. In particular, infrastructure investments should be coordinated with social sector investments focused on enabling the poor to take advantage of the opportunities provided. However, once the basic networks are in place, less scope will exist for area targeting and it will have diminishing returns for poverty reduction.

*The area targeting approach will not suffice to eliminate poverty.* In addition to targeting the remaining geographical “poverty pockets,” this study shows that access to services varies significantly within villages and even, to a certain extent, within households. Some poor households that had characteristics of chronic poverty were not able to benefit economically from transport and energy improvements. Policies are needed that will ensure equitable access within communities; address gender, age-specific, and other barriers to the use of services; and encourage decentralized, demand-responsive management by local authorities. This may require household-level or individual targeting of support, such as subsidized transport and electrical connections.

*Use of labor-based construction methods can increase the poverty reduction impact.* These methods help poor families supplement their incomes on a temporary basis during the construction period. More important, perhaps, they introduce poor people, such as remote rural residents, to the labor market and give them some of the skills needed to seek more productive employment elsewhere.

*Technology choices should be part of the decision-making process through which projects are designed and approved.* In countries where labor is still relatively cheap, labor-intensive methods may be appropriate for road construction. Alternative energy sources such as coal, charcoal, solar cells, or mini-hydro may provide more satisfactory service than grid electricity. When national networks are well developed and well managed, however, they are almost certain to provide more cost-effective support to rural communities than solutions based on local labor and local resources.

*Significant and sustained poverty reduction from an income perspective depends on enhancing the productivity of individuals and households through complementary*

*investments, either public or private.* The investments include not only local transport and energy infrastructure directly serving poor areas, but also the primary and secondary infrastructure networks into which these need to connect, as well as investment in health care, education, extension services, credit, and other productivity-enhancing activities.

*The overall approach of examining the poverty impacts of transport and energy interventions within a wider conceptual framework of contextual and situational influences is transferable from case to case.* However, the types and extent of impacts are case-specific; thus, it is unlikely that simple benchmarks can be developed for measuring the poverty reduction impacts of transport and energy projects.

*The wider policy framework has a vital role to play in ensuring that transport and energy investments are, in practice, pro-poor.* First, it must ensure that the poor can actually benefit from such investments. Then, it must provide safeguards to protect against adverse impacts and to reduce risks that the nonpoor will capture most of the benefits. Lastly, it should ensure that savings from efficiency gains in infrastructure management are redirected to support other programs designed to enhance the productivity and the welfare of the poor.

*Transport and energy investments impact upon the income and nonincome dimensions of poverty.* The case studies strongly confirmed that transport and energy investments are agents of economic growth that contribute to poverty reduction by raising incomes. They also confirmed the important role of transport and energy in alleviating nonincome dimensions of poverty, including health care, education, empowerment, opportunity, security, and freedom, thus helping raise poor people’s incomes over the longer term. Thus, investment in transport and energy infrastructure and services not only promotes growth, but also supports education, health care, and other aspects of social development. Such interventions are therefore also important for achieving the Millennium Development Goals.

*The selection and design of transport and energy projects can be more pro-poor.* The transport case studies found that reducing the distance to the highway and improving road quality contributed to income poverty reduction for roughly half of poor households: road connectivity was a necessary condition for poverty reduction. Identification of poor areas that suffer from low road density and poor road quality, and examination of the supporting framework of policies and programs, are therefore important starting points in formulating pro-poor road projects.

The main contribution of new railways development to poverty reduction was found to be through supporting general economic growth. Small areas of high growth also developed around towns served by railway stations. The PRC study found that household poverty reduction was correlated with railway improvement within a 5-kilometer (km) radius of railway stations, but not beyond this zone. Future railway interventions could try to extend these influence areas by including feeder roads to link surrounding communities to new railway stations.

The electricity case studies identified connection fees, tariffs, and quality of service as critical issues affecting the willingness and ability of poor people to take advantage of existing infrastructure. Analysis of how to maximize connections and tariff affordability for the poor should be a critical issue in formulating energy projects.

The case studies found that in poor and disadvantaged rural areas, poverty reduction impacts were greater if both transport and energy were improved, or if transport and/or energy investments were accompanied by other pro-poor interventions, such as provision of small-scale credit and technical training. In formulating future rural transport and energy interventions, the adequacy of complementary programs should be assessed and, where inadequate, provided within the scope of the project, or developed on a multisector basis.

*Safeguards should be built in for those who may suffer negative effects.* A small minority of poor households may suffer negative impacts if their livelihoods are displaced as a result of transport and energy interventions. Project planners should consider this possibility, identify the groups concerned, consult with them, and include specific, targeted remedial measures in the project—most likely assistance in finding more productive occupations—to ensure that, on balance, they are not made worse off.

The study has shown that poor households care relatively little about the environmental impacts of transport and energy infrastructure. Even road safety seems not to be a high-priority concern.

*The trend toward requiring increasingly elaborate project monitoring frameworks may need to be refined.* Generally, ex ante analysis of the poverty reduction impact of projects is highly speculative. Moreover, transport and energy interventions contribute to poverty reduction over an extended period, perhaps as much as 20 years. Attempts to measure impacts over a shorter period are likely to confuse short-term effects with long-term impacts and produce misleading findings. It might be better to do ex ante poverty analysis of the sector rather than the project level,

focusing on identifying and understanding the broad impact channels and critical situational factors. It would also be useful to initiate long-term monitoring studies to track the effects and impacts of a small sample of transport and energy projects over a period of 10–20 years.

## Priorities for Future Research

*Infrastructure and pro-poor growth.* Until now, the debate on infrastructure investment and pro-poor growth has focused on the impacts that can lead to reduction in income poverty. Research is also needed to examine the impacts that can reduce the nonincome dimensions of poverty.

*Link between system-wide transport improvements and poverty reduction.* This study has not directly addressed the poverty reduction impact of system-wide improvements designed to alleviate congestion, increase average speeds, and provide more efficient transport services on a larger scale. Research is needed on the mechanisms by which transport cost savings that accrue in the first instance to vehicle owners or operators are passed on to intermediate users (shippers, merchants, service providers) and end users (travelers, producers, consumers), the degree to which regulation affects this pass-through, and the effects of subsidies.

*Large projects.* The literature review and case studies identified considerable methodological difficulties in examining the poverty reduction impacts of large transport and energy projects, such as expressways or electricity grids. Since large projects account for a substantial portion of investment spending in these sectors, research is needed into methods and models to improve understanding of their poverty reduction impacts.

*Maximize the poverty impact of large infrastructure.* Large infrastructure investments such as limited-access highways, railways, ports, and airports are expected to stimulate economic growth in the areas they serve. The extent to which the poor will participate in the benefits of such projects depends on their ability to access the infrastructure and related services (for example, secondary roads linking communities to major highways), and on their ability to take advantage of resulting employment opportunities (skills, credit, etc.). Research using case studies might identify the factors—such as a combination of transport and energy infrastructure with investment in education and telecommunications—favoring the partici-

pation of the poor in infrastructure-induced economic growth, as well as the barriers to their participation.

*Negative side effects of transport on the poor.* This study has indicated a relatively low level of concern among the poor about the potential risks of road transport. Yet it is commonly alleged that the poor are most likely to be victims of road accidents and vehicular pollution. Research on the real incidence of these negative side effects may help clarify views on this subject, raise awareness, and prepare for policy change if needed.

*Barriers to poor people's participation in energy projects.* This study strongly suggests that participation by the poor in the benefits of energy projects could and should be increased. Research could examine regulatory barriers and issues of high up-front costs, and explore the potential for well-designed, targeted subsidies or credit programs to cover up-front costs.

*Implications of energy sector "unbundling" for the poor.* This study did not address the question of policy changes that involve "unbundling" energy sector services and encouraging greater participation by the private sector. Research in other parts of the world, particularly Latin America, has suggested that such policy change may be beneficial to the poor, even if short-term costs are increased. However, it is also feared that the private sector may raise prices beyond the reach of the poor, and insist on the need for continuing subsidies. This is a fertile area for future research in the context of ongoing sector policy change in the DMCs.

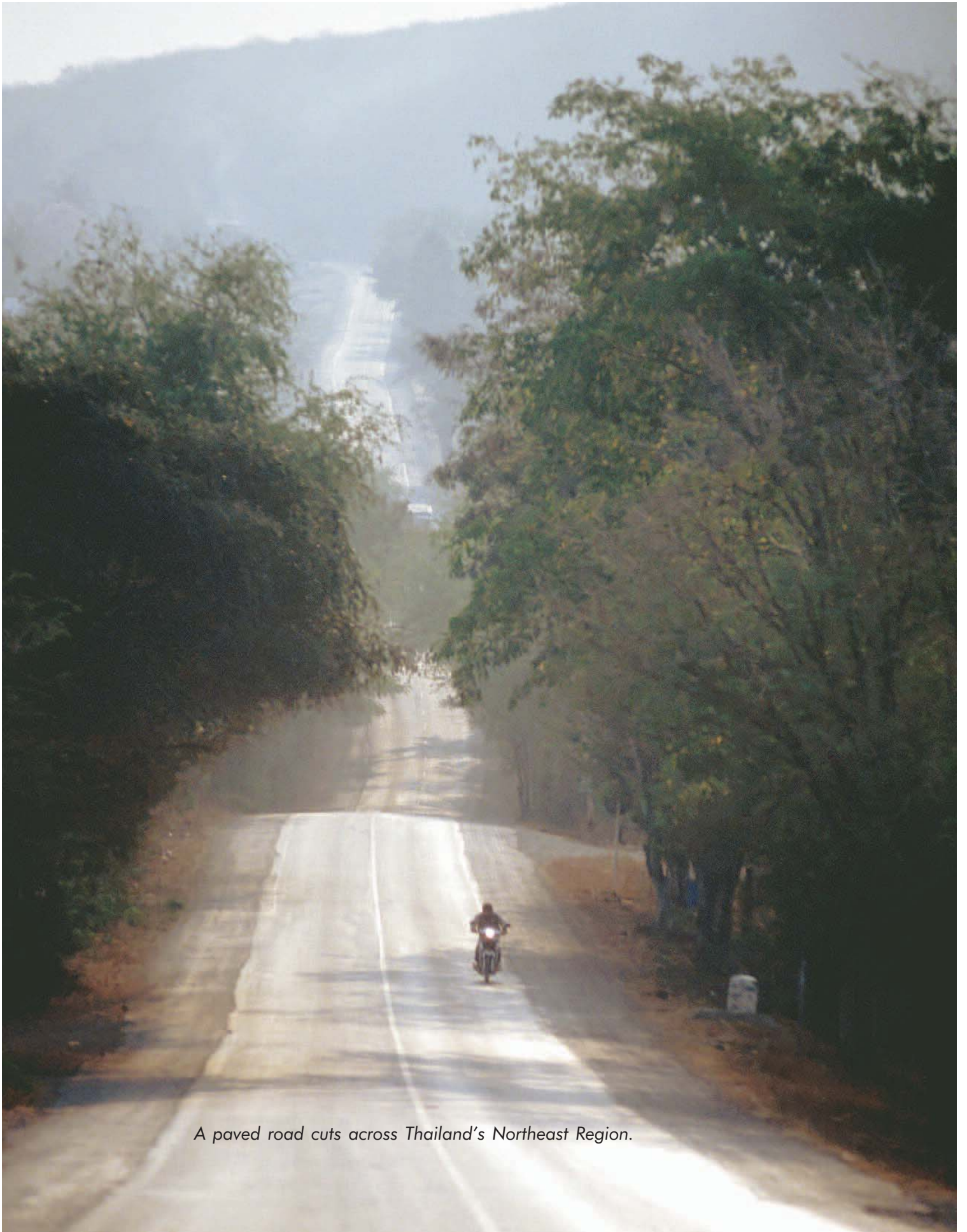
*Service provision.* The field research for this study focused on infrastructure projects, treating service provision as an intervening variable. Although some changes in service provision are clearly related to infrastructure changes (for example, the proliferation of motorized vehicles on recently paved roads), others may be independent of such change. An interesting aspect of this question is the extent to which the poor invest in or otherwise obtain access to assets, such as vehicles, equipment, and appliances, to become direct users of the infrastructure provided, or share in the benefits by using others' equipment, e.g., transporting crops in a neighbor's truck, watching television in a neighbor's home. Further research could focus more closely on such changes in the poor's asset

base and the extent to which the poor can "own" new services in this way. Improved quantity and quality of services at the community level can directly affect the poor, even if they are not direct users of these services: reduced transport costs can lower prices in local markets and increase the reliability of supply; street lighting and electricity in community facilities bring benefits the poor can appreciate.

*Infrastructure and urban poverty.* This study touched only lightly on infrastructure impacts on the urban poor. The nature of poverty is different in urban areas: many goods that are "free" in rural areas, such as water, fuels, and building materials, have to be paid for in cities; wage employment is critical to quality of urban life; and many urban poor depend on the informal economy to make a living. Future research could examine more closely the ways in which the effects, both benefits and costs, of transportation and energy investments in urban areas reach the urban poor. The study also showed that transport and energy projects play a part in improving communication and information flow between rural and urban areas. The full extent of these rural-urban linkages and their effects on the poor, both rural and urban, remain to be further explored.

*Institutional issues.* By focusing on the end user, this study paid little attention to the institutional and governance issues that influence the effects of transport and energy investments on the poor. In addition to the general concerns of maximizing efficiency and quality in service delivery, research is needed on how to make regulatory institutions and service providers (public or private) more responsive to the needs of the poor, including decentralization of regulatory and management responsibility to local authorities, necessary safeguards for equitable participation by the poor, and the possible role of NGOs.

*Gender issues.* This study found that transport and energy improvements create new opportunities for women as well as for men. However, the extent to which women can take advantage of these opportunities is influenced by economic, social, and cultural factors. Research is needed to investigate these gender aspects of transport and energy infrastructure impacts, distinguishing between men and women, and poor and nonpoor.



*A paved road cuts across Thailand's Northeast Region.*