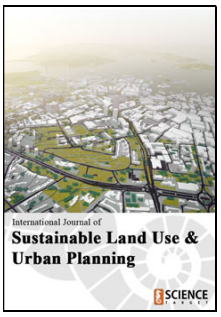
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Resource Efficiency and Innovation in Public Transport: Implementing Inclusive Green Growth in the Himalayas

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Abstract. This paper highlights successful implementation of an innovative project aimed at enhancing resource efficiency and mitigating emissions from transport by introducing pollution free, fuel efficient and safe public transport in a fragile ecosystem of the Himalayas in India (Himachal Pradesh). After analysing the environmental concerns of the state emanating from the transport sector, results of the study are discussed, project components are explored and an implementation framework is presented. Towards the end, project outcomes are highlighted and conclusions are drawn. It is argued that public transport, as an activity offering services of a merit good nature, suffers from serious market and policy failures. It is therefore essential that any attempt to improve public transport should not be confined to purchase of new buses alone, but it should include a wide- ranging reform agenda to correct market and policy distortions to bring about a modal shift from private modes to public transport.
Keywords. *green growth, Himalayas, electrical vehicles, transport policy*

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1. Introduction

Analysing the physical and material basis of development has been an area of intense research in the recent past. Several studies (e.g. Dittrich et.al, 2012; OECD, 2011; UNEP, 2011; Gilzum, 2010) have focussed on this aspect to understand issues underlying unsustainable development. Going by the findings of these studies, it is estimated (e.g. Dittrich et al., 2012) that global material extraction of biomass, fossil fuel, minerals and metal ores has grown by almost 80 percent over the past 30 years from 38 billion tonnes in the 1980s to 68 billion tonnes in 2008. The big five material consuming countries — China, the United States, India, Brazil and the Russian Federation—together consume more than half of the world's resources, and if the 15 leading consumer countries are combined, together they influence about three quarters of resources of the world. However, despite intense use of energy and materials in their consumption patterns, the pollution levels in these consumer countries are very low. Such a paradox is explained by three factors: stringent environmental regulations, the greening of industry and relocation of most polluting activities to the developing world. The problem of developing countries is thus twofold: the increasing resource intensity of consumption in developed countries (even though their production is becoming less resource intensive) getting shifted to emerging economies through international trade and the resource intensity of both consumption and production in developing countries increasing in absolute terms in their industrialization process.

Thus, green growth is a matter of both economic policy and sustainable development policy for tackling two key development imperatives (Daly, 1990; Adam, 2004): the continued inclusive economic growth needed by developing countries to reduce poverty and improve wellbeing and improved environmental management needed to tackle resource scarcity and climate change. There is a growing convergence around the notion that the current economic system is not only unsustainable and inefficient in its resource use but that it is inequitable in its distribution of costs and benefits (Basu, 2006;

Ghertner and Fripp, 2007; Thavasi and Ramakrishna, 2009). Hence, pursuing green growth is an imperative rather than a choice. It is particularly important for many developing countries, as they face severe economic, social and ecological threats from energy, food and water insecurity to climate change and extreme weather risks as well as risks from premature deaths due to pollution, poor water quality and diseases associated with a changing climate. All of these factors undermine their development. Even though most developing countries today contribute only minor shares to global greenhouse gas (GHG) emissions compared to the OECD and major emerging economies, they will increase their emissions if they follow conventional economic growth patterns. Increasingly, developing countries are becoming the sources of global economic growth, emissions and, with these, more intensive use of natural resources.

GFN and CII (2008) estimates show that India has the third biggest ecological footprint, that its resource is already twice of its bio capacity with its bio capacity having declined by half in the last few decades. Being one of the provinces in India located on the western Himalayas, Himachal Pradesh is a predominantly mountainous state with altitudes ranging from 300 meters to over 5000 meters. The state is known for having achieved good social sector outcomes in health, education, gender equality and access to rural infrastructure and is well acknowledged in India and internationally (World Bank 2015). Ninety percent of its 7 million people live in rural areas, 80 percent of whom are dependent on agriculture (largely rain fed) for livelihood, making subsistence farming practiced in the state more vulnerable to droughts and crop failures. Overall, scenic beauty, biodiversity, hydropower potential and horticulture are the key strengths of the state. Tourism, the main non-farm commercial activity, is mostly confined to four major circuits (Shimla-Narkanda, Kullu-Manali, Kangra-Dharamsala and Chamba-Dalhousie). For want of efficient and reliable modes of transport, the state largely remains un-explored by tourists. The tourism business is seasonal, reaching its peak during the summer and winter months. With the increase in per capita incomes, the vehicle ownership per household has increased in the last few years.

The ecosystems harbor a wide range of natural resources and are particularly sensitive to change. Regional changes in climate have already affected many physical and biological systems in the mountains. Analysis of temperature trends in the Himalayas and vicinity shows that temperature increases are greater in the uplands than the lowlands. Climate change impacts water resources including increased frequency of precipitation, increase in extreme rainfall intensity, increased variability of rainfall patterns, increased likelihood of water shortages, reduced levels of precipitation as snow, loss of glaciers volumes, earlier snow melt and increased temperature. Other observed parameters include movement of apple orchards to higher altitudes, loss of various tree species, drying of traditional water sources, change in bird types and population, reduction in crop yields and increased vulnerability of winter cropping due to changes in rainfall patterns and planting dates (MOEF, 2009). Projections by the government of India (MOEF, 2009) are even scarier: the annual temperature in the state is projected to increase up to 2.6±0.7ᶜby the 2030s, and the annual rainfall up to 1604±175.2 mm. The projected precipitation is likely to increase by 5% to 13% by 2030s compared to 1970s levels. For a state like Himachal Pradesh that is heavily dependent on agriculture for livelihoods and GDP, the impacts of climate change on water resources are of critical significance.

This paper highlights successful implementation of an innovative project aimed at enhancing resource efficiency and mitigating emissions from transport by introducing pollution free, fuel efficient and safe public transport in a fragile ecosystem of the Himalayas in India (Himachal Pradesh). After analysing the environmental concerns of the state emanating from the transport sector, the results of the study conducted as a component of the project are discussed, project components are explored and an implementation framework is presented. Towards the end, initial results are presented, project outcomes are highlighted and conclusions are drawn. It is argued that public trans-

port, being an activity offering services of a "merit good" (goods whose consumption is socially desirable) nature, suffers from serious market and policy failures. Market failure arises when, due to the public good nature of the product, the market prices fail to recover costs. The policy failure arises when the government policies create perverse incentives for socially undesirable behaviour such as subsidies on fossil fuel, encouraging over-consumption and, hence, increased pollution. It is therefore essential that any attempt to improve public transport should not be confined to purchase of new buses alone, rather it should include a wide ranging reform agenda to correct market and policy distortions to bring about a modal shift from private modes to public transport.

2. The Problem Diagnostics

With the introduction of sustainable development, development and environment have become issues of intense debate. However, the interconnections between the two and its socio-economic dimensions are yet to be understood appropriately. Often, contradictions in the policies and programs addressing the two (poverty and environment) become apparent. Sometimes poverty alleviation programs damage the natural resources (e.g., forest clearance for agricultural expansion and chemical intensive agriculture to increase yield), while several environmental protection programs increase poverty and deprivation (e.g., evacuation of people while declaring nature reserves). Similarly, positive interactions among the environment, poverty alleviation and empowerment are yet to be explored (Kothari, 2013). Therefore, an inclusive green economy approach keeps resource use, environment and poverty in focus and requires breaking away from resource-intensive growth models, promoting a transformation of consumption and production into more resource-efficient and innovation-centric patterns as a pre-requisite to sustainable development. The transport sector, being the biggest consumer of fossil fuel and the main contributor to air pollution, is the main focus area after energy in green growth initiatives.

Transport use causes three types of externalities: congestion, accidents and environmental costs (including air pollution, global warming and noise). The marginal external congestion costs manifest in the form of extra time required due to reduction in speed of the other transport users. A lower speed affects not only the operating costs but also the time costs, which depend on the value of time to the user (since their time costs increase not only because of lower speed but also due to schedule adjustment). The marginal environmental costs, on the other hand, include costs imposed by the emission of air pollutants and noise on society in general and on future generations (in the case of air pollution and global warming). The marginal external accident costs appear in three forms. First, transport users expose themselves to accident risk, and the social costs of this include their own utility loss due to the accident risk (i.e. internal cost), the economic costs associated with the accident risk (net output loss, medical costs, police costs) and the utility loss of relatives and friends. Second, additional transport users also increase the accident risk of the other infrastructure users, thus imposing costs on other users. Finally, as other transport users have to adapt themselves when confronted with a changed traffic situation, it also imposes additional economic costs (e.g. insurance cover and enhanced safety requirements for vehicles).

In Himachal Pradesh, road transport is the only mode of transport dominated by personalised vehicles. Its size and spread in the current policy regime poses twin problems: inefficient use of energy and air emissions emanating from the vehicle exhaust. It is estimated that 75% of air pollution caused in the state is attributed to this sector (HPPCB, 2014). Public transport (mostly used by the poor) is a public sector undertaking operating on huge cumulative losses, resulting in poor-quality operations dominated by a highly polluting, obsolete and unsafe fleet. The location of the state in the Himalayas makes it vulnerable to damage due to air and water pollution. The state has pursued development activities aggressively over the past few years, which has exposed it to natural resource degradation, deforestation and

environmental pollution. The major concern in terms of air pollution is unsafe levels of $PM_{2.5}$. HPPCB (2014) notes that increases in the values of $PM_{2.5}$ is a matter of concern. There is no exclusive study on air pollution in the state; however, Greenstone et al. (2015) estimates for India (including Himachal Pradesh) find that 660 million people in India (54.5% population) live in regions that do not meet the 40 μg/m3 National Ambient Air quality standard (NAAQS), and 262 million people live in regions with levels twice this standard. They further observe, "Nearly every Indian (99.5% population) lives in an area with $PM_{2.5}$ pollution above WHO's 10 μg/m3 guideline (Greenstone et al., 2015: 42). All major towns of the state fall within the category of 40-60 μg/m3. HPPCB (2014) attributes this increase in the values of $PM_{2.5}$ to the increased vehicular pollution. The loss of quality of life due to the increase in air pollution is estimated to be an average 3.2 years (Greenstone et al., 2015).

Vehicle population data of the state shows that the share of buses in the overall vehicle population is less than one percent and has been static at that level for the many years. There has been a 100% increase in vehicle population in the past five years. Cars and two-wheelers constitute more than three quarters of the total vehicle population, and its proportion has increased from 61% in 2010 to 77% in 2015. While the growth of private vehicles has been phenomenal, the growth of public transport is negligible. In the absence of a maximum life span of vehicles under the statute, obsolete technology vehicles ply on the roads, leading to the problems of pollution and road safety. The taxation policy of the state imposes a one-time, nominal tax for private vehicles, while public transport is subject to a multiple-tax regime charged at very high rates on a per kilometre basis. Petrol and diesel are the only sources of energy for the vehicles, as CNG and electrically propelled vehicles are yet to be introduced. For these reasons, the transport sector in the state was chosen to be the focus area for the green growth initiative.

3. Methodology

Data collected on air pollution and the contributing factors reveal that the transport sector was the major culprit in air pollution since the state produces power from hydro-electric projects, and there are practically no industries emitting smoke or other air pollutants. Therefore, the green growth initiative selected transport as the main focus sector to identify policy initiatives to be undertaken to curb air pollution. The data available with the Transport Department and the Himachal Road Transport Corporation read with the Annual Reports of the Himachal Pradesh Pollution Control Board revealed that an in-depth analysis would contribute a lot to exposing the policy and planning issues contributing to this. Therefore, a detailed study of the sector was required. In this perspective, the project aimed to:

- Discover the status of public passenger transport in the state and the current policy regime on public as well private modes transport
- Explores the current status of power generation, supply and distribution in the state to discover the possibility of tapping power for the public transport
- Develop a proposal for introducing state-of-the-art public transport to mitigate pollution and start a modal shift from private to public transport

With the goal of assessing the status on the above parameters, both transport and the power sectors were studied in detail, and the data generated was used for developing the project proposals. Studies were done by collecting secondary data from the transport and power departments, although in some cases, primary data from commuters and regulators in the power sector was also collected through personal interviews. Along with interviews, Focused Group Discussions (FGDs) with the stakeholders were held to get their views on the current scenario and their future projections. In this exercise, the institutions of the Local Self Governance, educational institutions and the major government and private entities were

consulted to identify mismatch of demand and supply.

4. Study Findings

4.1 Transport Sector

Public transport in Himachal Pradesh is mostly conducted through the Himachal Road Transport Corporation and is fully owned and managed by the state. Constituted in 1974, the Corporation has a fleet of 2500 buses and operates the same both within and outside the state. Public transport is key to development of the state and the only mode of access for the common public, especially the poor and deprived who have practically no option for accessing many other basic services (like health, education, food and shelter). It thus assumes the status of a "merit good". It is this feature that makes this service a "public good" (a good in which case it is difficult to exclude anybody from the consumption of that good e.g. air, public defence, law and order etc.) since it is not open to the operator to charge fares according to market conditions. This leads to a situation of market failure.

Over the years, all input costs across the country (wage rates, interest rates, dollar value and petroleum product prices) have moved from the administered price regime to market determined rates, resulting in an increase in prices to almost double the administered price levels. However, the price of the final product (the passenger travel) is still in the administered price regime since fares are fixed by governments under the provisions of the Motor Vehicles Act. Therefore, fare rates do not match the increase in costs (due to hikes in the price of diesel, wage rates, interest rates and exchange rates), as hikes in these input costs are very frequent, and it is difficult to increase fares commensurate with these hikes. Due to this mismatch, the fare rates are less than the cost of production, making an implicit element of subsidy being passed on to the consumer by the operator, which makes the entire operation uneconomical and eats away the much needed liquidity for future operation. It is no wonder that the public transport in the entire country runs in losses, as a major chunk of its costs remains unrecovered. This ultimately affects the quality of operations, and, over the long run, the quantity of the service provided is severely affected. The study discovered that there were at least 294 new roads opened in the last few years, but no service has been provided by the HRTC so far.

Public transport is subject to a very high tax regime. The public transport vehicles pay taxes on a monthly basis compared to the one-time, nominal tax levied on private vehicles. Even the taxes levied on the interstate routes are very high—almost double the normal Special Road Tax (SRT). In addition, inter-state movement of public transport in India (both buses and trucks) is subject to a severe problem of "tax exporting". This arises when governments tax the non-resident population on arrival to its territory, as corridor states levy high rates of tax on a competitive basis on the entry of outside vehicles.

Even though the Motor Vehicles Act (which is a federal legislation applicable to all states) has a provision for scrapping vehicles on the basis of age, it does not specify any age limit. Because of this, there is a "free rider" problem with owners of antiquated vehicles plying highly polluting, unsafe vehicles with old technology having to pay less private marginal cost at very high social cost. The externalities in the form of pollution, road accidents and congestion enhance the marginal social costs. Data shows that buses up to 20 years of registration age are still in operation, while trucks of more than 30 years registration age are still on roads.

The study results revealed that there is an overlap in the operation of the Corporation through its various depots such that the buses plied by different depots run parallel to each other and therefore, not only affect the business of all depots but also cause avoidable fuel consumption and pollution emission. Such a tendency also leads to buses chasing each other to pick up passengers, exposing the operator to accident risk. If a route planning exercise could be undertaken, it would not only increase profitability and reduce fuel consumption and emission, but it would also enhance passenger

comfort by matching supply with demand and reducing waiting time.

Private cars and two wheelers constitute 77% of the total vehicles and occupy 55% of road space but carry only 11% passengers. Public buses are only 1% of the total population, occupy 20% of road space and carry 85% passengers. Thus, in terms of congestion efficiency, the public passenger transport has a strong edge. In terms of fuel efficiency, pollution emission, reliability and road safety, the Corporation had a very bad record. It was getting only 3 kilometres per litres of fuel, had a highly polluting fleet with no equipment to check pollution, had a very bad record on reliability (on an average 10 % of its fleet was breaking down daily) and a very bad record on road safety.

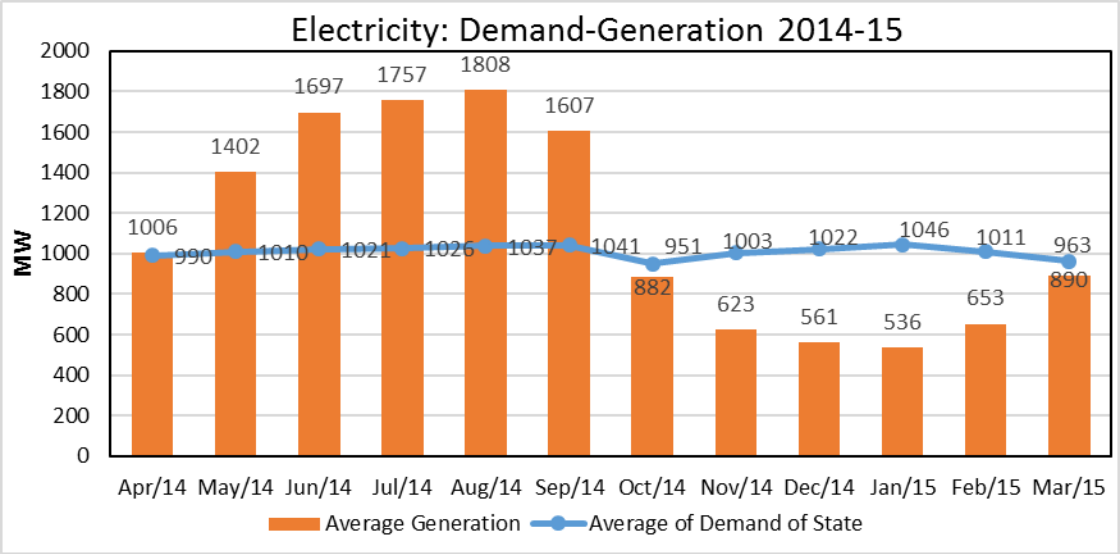


Figure 1: Electricity Demand and Generation-2014-15

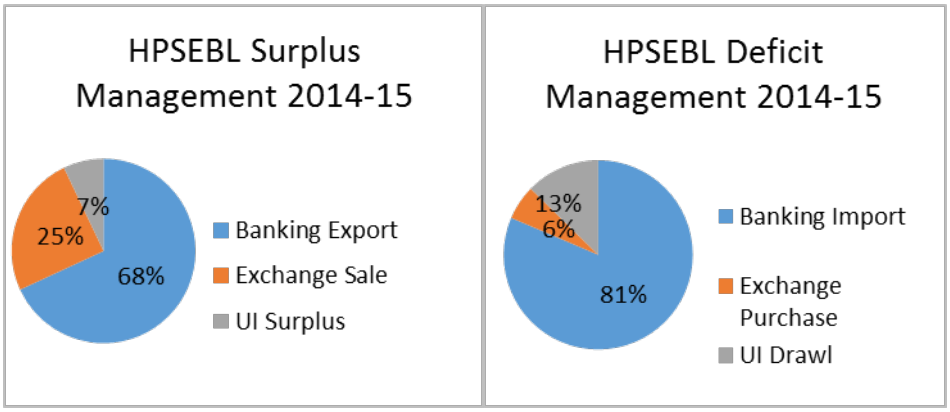


Figure 2: Disposal of Electricity

4.2 Power Sector

Currently, the total installed capacity of the state is 9433 MW, 80% of which is generated through Run of the River (ROR) type hydro-electric projects. The ROR plants have limited or no storage capacity and have to perform work with the available water flows. When the NR grid has surplus electricity and injecting further surplus is not allowed, the water from HEPs is spilled without generating electricity. This causes irrecoverable loss of energy.

The state is able to generate surplus electricity during the summer months and is deficit in generation during the winters. Therefore, demand and supply of electricity in the state is managed in three ways:

- Interstate Banking: This is a method of shifting electricity generated during summer months for use in winter months. This is done by exporting surplus power during summer months and importing it back during winter months under a seasonal banking arrangement.
- Exchange Sale/Purchase: Apart from summer-winter seasonal variation, actual generation and demand is anticipated on a daily basis, and any mismatch is managed by selling surplus and purchasing deficit power from power exchange (IEX).
- Unscheduled Interchange: Generation from ROR plants depends on local weather conditions. Cloud cover can reduce melting of ice, reducing water flow and generation, or rain can increase water flow, increasing generation or a flood-like situation. High silt can cause a drop in generation. Thus, after all anticipation and planning, the generation and demand do not always match. This surplus and deficit is managed by under drawl and over drawl from Northern Region Grid.

Unscheduled Interchange is a grid stabilisation mechanism that incentivises connected entities to generate/consume according to a declared schedule. Northern Region (NR) Grid frequency is maintained at 50 Hz. Electricity supply is scheduled against anticipated demand for a time slot of every 15 minutes throughout 24 hours of a day. When demand for electricity is more than the supply, grid frequency decreases from 50.00 Hz; and when demand is less than supply, grid frequency increases above 50.00 Hz. Thus, using grid frequency as an indicator of a demand-supply situation, any deviation from the declared schedule is penalised to keep the grid frequency within predefined tolerances.

UI charges for electricity exchange with grid at different grid frequencies is plotted in Figure 3. Any unscheduled electricity injected or drawn from the NR grid at grid frequency > 50.03 Hz gives and for frequency >50.05 Hz gives zero realisation.

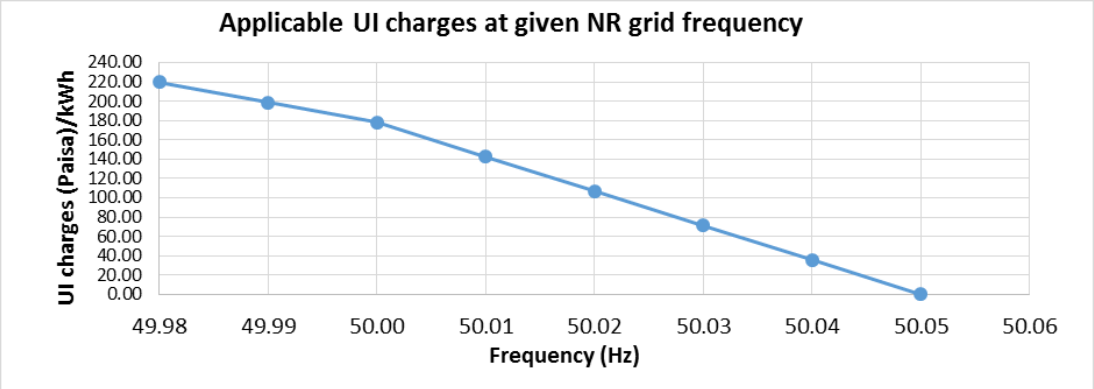


Figure 3: charges for Unscheduled Interchange with NR grid

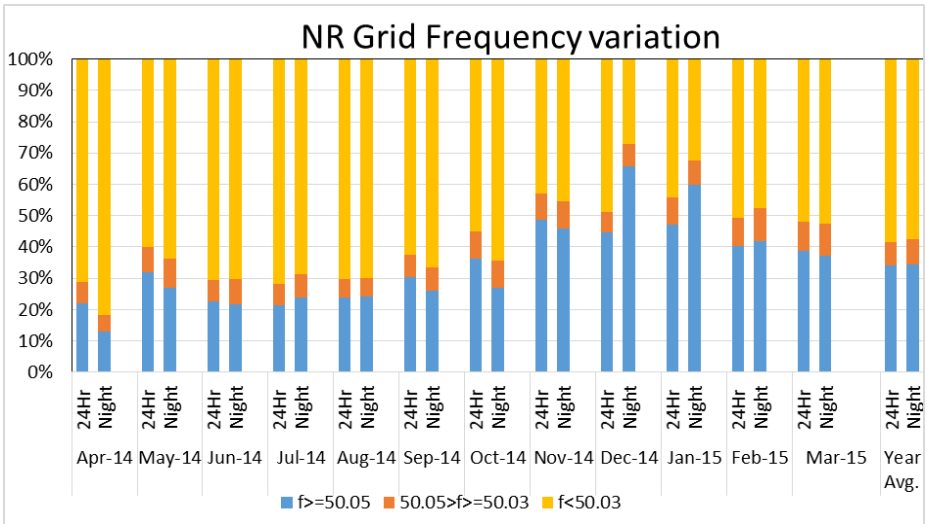


Figure 4: NR Grid Frequency variation

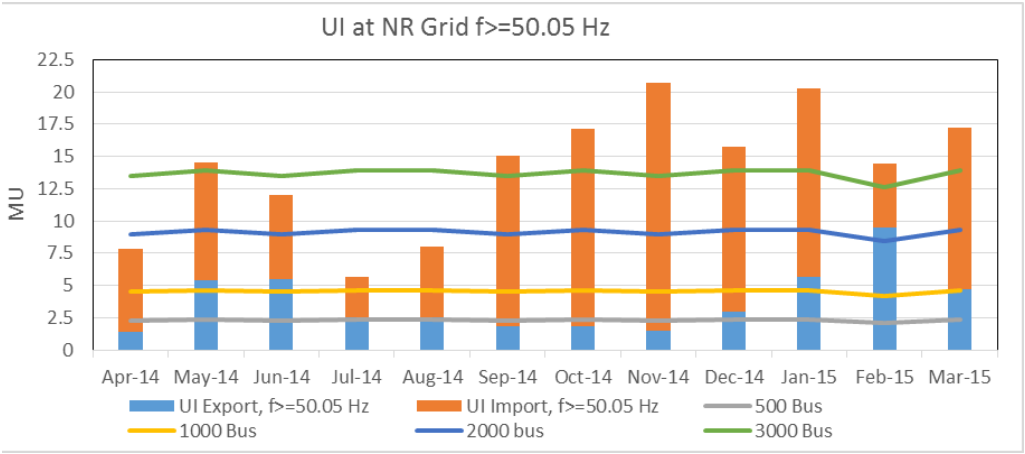


Figure 5: UI at NR Grid f>=50.05Hz

As seen in Figure 4, NR Grid frequency remained above 50.03 Hz for nearly 34% of the year.

Figure 4 NR Grid frequency variation through the year 2014-15

Upon analysis of the 2014-15 electricity demand and supply situation in HP and the Northern Region (NR) grid frequency variation, it was found that HP injected 82 MU and withdrew 132 MU of unscheduled electricity at frequency > 50.05 Hz for which the realisation is zero (unscheduled withdrawing power is free at grid freq > 50.05, to help grid stability).

It is estimated that 1000 electric buses can be operated annually using total unscheduled electricity exchange by HP with the NR grid at grid frequency >50.05 Hz. This electricity is otherwise injected into the gird. This analysis was conducted to understand the scale of free surplus electricity in the HP/NR grid and to derive a reference value for cost of electricity for electric buses. The UI rate has been used as a base rate for electricity cost, and it has been proposed to HPERC to allow grid frequency linked charging of electric buses at a rate close to the identified base rate.

5. Project Outline

The project envisaged short term (3-year time horizon) and long term (5-year time horizon) actions:

5.1 Short Term Actions

- Drafting and notifying a transport policy that aims to achieve fiscal and regulatory reforms to usher in an era of green growth
- Preparing a Detailed Project Report (DPR) for seeking funding from agencies for procuring at least 1000 buses with the latest technology to replace the existing aged fleet
- Promoting renewable energy by utilizing rooftop solar power generating plants under the existing schemes of the state and federal government
- Scaling up staff to handle the new technology fleet
- Creating inspection and fitness centres with a state-of-the-art pollution check facility to be installed in all the workshops of the Corporation.

5.2 Long Term Actions

- DPR on electrical buses to be prepared and submitted to the government of India to avail benefit under the existing scheme
- Increase gradation of ancillary infrastructure, such as bus terminals, workshops and bus queue shelters
- Implement a road safety agenda to promote safe transport
- Develop tax and regulatory reforms to incentivise public transport over private transport
- Hold workshops for educating and bringing stakeholders on board
- Establish a mechanism for automatic revision of fares on cost escalation.

Table 1

Short Term Measure and Results

Measures	Results
Drafting and notifying a transport policy that aims at achieving fiscal and regulatory reforms to usher in green growth in the transport sector	Transport Policy with wide ranging reforms has been notified and is now under implementation (Box 1)
Preparing a Detailed Project Report (DPR) for seeking funding from agencies for procuring at least 1000 buses of the latest technology to replace the existing aged fleet	A DPR seeking Rs. 85 Crore Soft Loan was submitted to a soft lending agency of the federal government, which sanctioned the loan, and 515 new buses were purchased. Another DPR for sanction of 1123 buses under the JNNURM scheme of the federal government was submitted, and 800 buses have been sanctioned and purchased.
Promoting renewable energy through utilizing rooftop solar power generating plants under the existing schemes of the state and federal government.	Five projects have been sent to the government of India and one has been sanctioned.
Scale up the staff to handle the new technology fleet.	Training workshops for drivers, conductors and mechanics were arranged at the workshop level, and about 1450 people have been trained.
Inspection and fitness centres with state-of-the-art pollution check facility to be installed in all the workshops of the Corporation.	19 inspection and fitness centres have been set up with a pollution check facility.

Table 2

Long Term Measures

Measures	Results
A DPR of electrical buses should be prepared and submitted to the government of India to avail benefit under the existing scheme.	A DPR submitted to the government of India and the project has been sanctioned. Himachal became the first state in the country to get electrical buses. Systematic targeting, total cost of ownership analysis has helped reduce cost by 30%.
Upgrading of ancillary infrastructure like bus terminals, workshops and bus queue shelters.	Work on refurbishment and upgrading was started and completed. Ten new bus stand locations were identified for construction and management under Public Private Partnership basis.
Route planning software to be developed.	Due diligence on technology is underway.
Create a road safety agenda to promote safe transport.	A comprehensive road safety action plan has been prepared and is under implementation.
Tax reforms	A policy decision was taken to introduce one single motor vehicle tax in place of the current multiple taxation rule. In the process, the tax structure of public and private vehicles will be rationalised.
Regulatory reforms	A thorough amendment of the Motor Vehicle Rules is currently underway. As an immediate measure, a maximum life span of buses and trucks has been identified.
Automatic Fare Revision System to be created	Appointment of a Regulator is under consideration.

Box: 1. Transport Policy 2014: Guiding Principles

(i) *Overall priority will be given to the public transport over the personalized modes of transport. Within the public transport, passenger transport to the remote and difficult areas to get a high priority notwithstanding the economic considerations. For doing so, suitable changes in the Act and Rules and tax laws to be made;*

(ii) *Since creation and maintenance of the transport infrastructure requires huge investment and at times specialized management skills also, Public Private Partnership (PPP) to be solicited in all fields to the extent possible and advisable;*

(iii) *A mix of command and control instruments (Act and Rules), economic instruments (taxes and fees), market instruments (creating and using markets), and moral education instruments (IEC) to be used to mend the behavior of individuals and firms to achieve the desired results. Action plans made here under to include leveraging of innovations in automobile technology, IT tools and management practices to ensure reduction in cost and the transport externalities;*

(iv) All the existing Acts, Rules and procedures are to be reviewed to make them more relevant to the present day context;

(v) Due importance is given to stakeholder's consultation with a particular focus on women participation in all the planning and implementation process;

(vi) Implementation of the policy to be supervised through a monitoring and evaluation process to achieve results in a fixed timeframe.

6. Implementation and Outcomes

6.1 Implementation

The implementation design of the project entailed both short term and long term measures to ensure that some results are available, even during the course of implementation, to facilitate larger public participation and interest. The overall timeframe is kept at five years, which is in consonance with the planning timeframe and the duration of an elected government. The results achieved during these time periods is as seen in:

6.2 Outcomes

At the end of one and a half years, the performance parameters improved as seen is:

Table 3

Outcomes

Parameter	2013	2015
KMPL (kilometres per litre)	3	4.5
Accidents (per annum)	32	19
Breakdowns (per day)	206	20
Turn over (Rupees In Crores)	496	726

For the initiatives taken by the Corporation, the Corporation was awarded national award on best initiative in the infrastructure improvement in June, 2015.

7. Conclusions

The indiscriminate use of resources emanates from the problem of under-priced or free availability of natural resources from the common pool, such as air and water. This problem of market failure in such resources offers no incentive to the users to use resources efficiently by leveraging technology and innovation. This results in over-exploitation of the finite resources and avoidable pollution. Therefore, green growth initiatives have to include resource efficiency and innovation in infrastructure provision to avoid facing problems of "lock in" (of resources) and "regret" (due to creation of unsustainable infrastructure that has long life) in the future. This is particularly important for fragile ecosystems like the one in Himalayas. The rarefied atmosphere of high hills poses far more health challenges due to air pollution than in plains. Besides, ecosystems there have a limited capacity to rejuvenate and repair the damage naturally.

Transport sector reforms and green growth initiatives not only benefit the environment but also have co-benefit features in the form of increased incomes and leisure time, cost savings, and enhanced competitiveness. To that extent, it has a direct bearing on the quality of life as well. Investment in public transportation besides expanding service and mobility, if well planned, could potentially boost the economy as a whole in many ways. First, there is the potential to generate savings in the form of travel and vehicle ownership costs for public transportation passengers and those switching from personal vehicles, ultimately leading to shifts in consumer spending and the economy as a whole through the operation of multiplier effects. Reduced traffic congestion, resulting from decreased personal vehicle use, often leads to travel cost savings for businesses and households through operating cost savings associated with worker's wage (i.e. less time spent by a worker on travel during a business trip) and reliability effects of reduced congestion (a caveat here: the reliability effects of reduced congestion could potentially have a rebound effect by prompting private vehicle use due to reduced congestion. Hence, a constant vigil coupled with further initiatives will have to be ensured). Second, business productivity improvements due to access to broader labour markets with more diverse skills is enabled by reduced traffic congestion and expanded transit service areas. Finally, additional regional business growth enabled by indirect impacts of business growth on supplies and induced impacts on spending of worker wages. At a macro level, transport induced cost savings and other productivity impacts could even affect competitiveness in international markets.

However, the initiatives should not be confined to purchase of buses alone (as is often the case). Instead it should be more broad to cover the regulatory and tax reforms and to enable a modal shift from private to public transport.

The Himachal Pradesh green growth initiative in the transport sector highlights how a thorough analysis of the existing policy, laws and tax structures revealed that the root cause of the problem is far removed from the common perception and lies in a faulty tax and regulatory regime that offers perverse incentives to the polluters. The study findings make a case for adopting a formal Regulatory Impact Analysis exercise to discover the impacts of the Motor Vehicles Act and the Taxation Act on the transport externalities (pollution, congestion and accidents) to make a case for repealing the redundant provisions. The initiative could achieve results only because it systematically planned the action agenda by thoroughly studying the transport and energy sectors and then identifying action plans based on existing deficiencies.

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