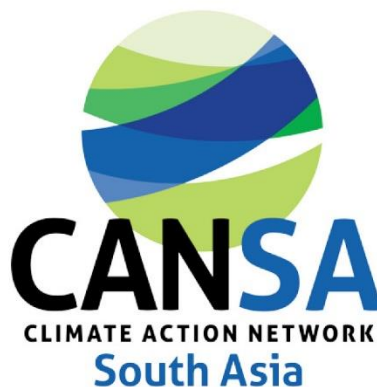


STATE OF CLIMATE ACTION IN NEPAL:

Nepal-CANSA Annual Snapshot 2018



Nepal Climate Action Network South Asia (N-CANSA)
Kathmandu, September 2018



STATE OF CLIMATE ACTION IN NEPAL: Nepal-CANSA Annual Snapshot 2018

Country Report prepared by N-CANSA as the First Civil Society (Citizens') Assessment of Progress and Pitfalls on the Road to Fossil Fuel Free Climate Resilient Future for Nepal

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Foreword and Acknowledgements

Climate Action Network South Asia (CANSAs) held its annual general assembly on July 2017 in Nagarkot, Kathmandu. One of the concerns expressed at the meeting was that, while there were plenty of climate change related activities and projects, there was a relative weakness in climate activism – which is the primary driver capable of pushing a lethargic or reluctant policy milieu in the direction of renewable and sustainable future. This was especially worrying because, despite the many projects and activities by national and international agencies, academia and NGOs, countries were sliding towards a reverse, non-renewable path of more fossil fuel dependence. This was as true of the Global North as the Global South, and more so in South Asia which, not being a fossil fuel rich region, had more to lose economically and strategically if it did not reduce its debilitating dependence on fossil fuel.

A concept note was subsequently circulated to all CANSAs focal points in end July that described the basic motivation and idea behind this exercise of producing an Annual State of Climate Action in South Asia report. It was to be an ambitious but preliminary first step towards a CANSAs version of an IPCC report but through the lens of South Asian national civic movements, whose motivation stems not from a desire for business profit nor for control and management of their respective societies but from a moral commitment to the cause of a sustainable and renewable future. It was meant to assess ***what actions governments, businesses and civic organizations have taken or not taken during the year*** on climate change mitigation and adaptation, and to provide early warning signals if things were moving too slowly or in the wrong direction. Such an exercise was felt to be necessary not only to prod our officialdom onto a more dynamic climate-friendly path but also to give better context to our own research and implementation activities which would otherwise be in danger of missing the forest of higher goals and issues for the day-to-day trees of specific projects.

Nepal chapter of CANSAs (N-CANSAs) decided to set the ball rolling and to move ahead with preparing the Nepal report. It is said that no constitution is ever made perfect since nothing is, even humanity as per Emanuel Kant's famous saying, "*Out of the crooked timber of humanity, nothing straight was ever made*": it is constantly perfected through the democratic process over years and generations with goodwill and effort of people true to the original vision. The same should be said of this report: it is the first attempt of its kind and will be perfected every following year. This report does not claim to be comprehensive: there are important areas that need more in-depth examination such as changing household energy consumption; solar (both photovoltaic and water heating); energy efficiency; energy (with water) footprint studies; nexus between water-energy-food-climate change, etc. Even the topics that we have managed to examine in this report have much room for deepening and expanding in coverage. Our modest hope is that this first-time effort will serve as a template for voicing our collective civic concerns.

What we hope for is that more people concerned with climate change and sustainable renewable development will join this network and contribute to broadening, deepening and constantly perfecting the report in the coming years. We have received enthusiastic support of N-CANSAs members as well as those within our respective networks and we thank all of them. We must, however, mention that this effort has been entirely voluntary: not a cent/paisa was

taken from any donor or grant-giving agency, national or foreign. This is not to say that we will not need to raise funds for this effort in the years to come, especially for printing and dissemination as well as for being able to pay for bare sustenance and travel of younger researchers and interns. However, that is for the future and will depend on how the network for this exercise expands beyond the small team that prepared this first snapshot report, a process which we hope will start from the very day of its release.

We eagerly await your response, suggestions and future participation in this effort of ours to push Nepal (and indeed all South Asia) away from fossil fuel addiction and towards a much more resilient and sustainable renewable future.

N-CANSA Team
Kathmandu
September 2018

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1 Cause for Concern

While it is widely believed that Nepal is rich in renewable resources – especially hydropower in its cascading rivers, number of high solar insolation days and biomass yield – the pace of harnessing these renewable forms of energy has remained lethargic compared to the existing domestic demand. To make matters worse, the country's current consumption of fossil fuel, including of electricity through the national grid, is increasingly veering towards a debilitating dependence on foreign, carbon-footprinted imports. Making things worse, in the last few years, the shift towards nationally available (hydro)electric transport is losing momentum, as is the case with the installation of solar PVC and biogas, while that of petroleum-fueled transport is growing uncontrollably. This regressive (from a climate resilience perspective) story is a sad commentary on Nepal's contemporary governance which, in the past, had pioneered many successful renewable energy technologies, in electric transport, biogas, hydropower (especially small) and solar PVC.

Countries blessed with renewable energy resources have taken strong policy measures to affect the shift away from fossil fuel dependence with remarkable results. Iceland began its post-World War-II development journey with coal and petroleum accounting for 84% of its energy used, but decided instead to switch to domestically available renewable hydropower beginning in the late 1960s. Today its electricity is entirely renewable, being derived 80% from hydropower and 20% from geothermal.¹ Norway produces 99% of its electricity from hydropower although it is the world's 11th top crude oil exporter.² It is the biggest hydropower producer in Europe and 6th in the world. However, its hydropower journey was motivated by the need for industrialization ("nation-building" it was called) and not raw energy export; and the first pieces of legislation in the 1900s was to bring hydropower sites under national control.³ Iceland's per capita electricity consumption is the highest in the world at 31000 kWh/capita with Norway being 2nd with 27700 kWh/capita. Nepal stands 196th in global ranking with 77 kWh/capita, much behind India (158th with 502 kWh/capita) and Bangladesh (177th with 148 kWh/capita).⁴

As of today, and as will be discussed further below, unlike Iceland and Norway, Nepal is moving in the reverse, non-renewable direction. While adaptation to the ill effects of global climate change, brought about mainly by Annex-1 countries of the Industrialized North, is necessary, it is also important that we ourselves practice mitigation in fossil fuel consumption, not only as a safe and sane future pathway but also as a resilience enhancing measure. It makes little sense to increase one's vulnerability by increasing dependence on non-renewable fossil fuel while simultaneously pursuing a policy of adapting to the ill effects that such a path will have bestowed.

Nepal's experience with anthropogenic climate change consequences lie in the rise in average temperature, alteration of precipitation patterns thereby impacting ecosystems and livelihoods dependent upon them, as well as increase in frequency and intensity of natural disasters (MoPE, 2016). Further, a study by Nepal's Department of Hydrology and Meteorology shows

that the Nepal maximum temperature trend is significantly positive with an increase of 0.056°C per year in 1971-2014 and all Nepal minimum temperature trend is also positive at 0.002°C per year, with temperature rise in high mountains more prominent than other regions of the country (DHM, 2017). Such a dramatic rise in temperature in such a short period is unnatural and potentially catastrophic. The same study says that the hydrological cycle is also being impacted with an alteration of rainfall patterns in southern plains, *Chure* and mid-hills while there is an alteration of snowfall in high mountain regions (DHM, 2017). The number of cool days is on a decreasing trend in nearly all districts of Nepal (DHM, 2017).

The rapid-onset climate intensified hazards such as windstorms, floods, avalanches and landslides and slow-onset hazards such as frequent droughts, accelerated glacier melting and rise of ideal conditions for forest fires are becoming new normal in the country (MoSTE, 2014). Trend of flash floods shows increasing trends of downpour in a 24-hour period (DHM, 2017): it has not only led to increasing loss and damage to infrastructures, rise of agricultural droughts, impact on health and human lives but also to less recharge of groundwater, leading to declining well yields and the drying of springs (CBS, 2017). These are in addition to other drivers of natural resource mismanagement, which exacerbate the harmful impacts.

The temperature projections through Global Circulation Models (GCM) reveal a significantly consistent increase in temperature in Nepal with an increase of 0.5-2.0°C by 2030s and 3.0 to 6.3°C by 2090s (NCVST, 2009). It is also projected that in the monsoon months a wide range of precipitation change is likely to occur with -14 to +40% variability by the 2030s; and it will further swing in between -52+135% by 2090s, which means maximum instability with huge and anomalous departure from the established rainfall pattern in the country (NCVST, 2009). This trend of climate variability indicates that the future holds potentially damaging climate-induced setbacks and warn us to strengthen individual, family, community, national resilience to cope with and adapt to the impacts accordingly. More importantly, it also gives a clear warning of the need to reduce the rate of greenhouse gases (GHGs) emission, in particular CO₂ from burning fossil fuels, and dependence on these harmful sources of energy.

Within this backdrop, the objectives of this first civil society (citizens') assessment are to:

- 1) re-visit the climate commitments that Government of Nepal has made through climate concerned policies in the country and ratification of international climate conventions and agreements internationally;
- 2) analyze the state of action in Nepal on mitigation looking at the fossil fuel spending and consumption trend as well as actions or lack thereof in other energy sectors; and
- 3) recommend climate actions to reduce the country's dependence on fossil fuel.

N-CANSA strongly asserts that human-induced global warming is a serious issue for human-kind that was created in the energy sector but whose impact will be felt by all societies mainly through the water sector – with too much water, too little water, at the wrong time and wrong places. It views current trends in the increase of climate-related disasters as slated to increase in frequency and intensity; and it advocates the need to take strong counter-measures to promote renewable energy and discourage fossil fuel consumption as well as to address those drivers serving as obstacles to achieving a sustainable renewable future.

2 Nepal's Climate Commitments

Notwithstanding its relatively small contribution to global GHG emissions, Nepal as a country still has the moral and legal obligation to work out and declare emission peak year and strive to mitigate emission output to conform to the climate commitments at home and abroad. Furthermore, as presented in Table 1 in appendix, Nepal has committed to taking actions in climate change mitigation through the several national and international legal instruments, right from UNFCCC in 1994 to the Nepal Government's Nationally Determined Contribution in 2016. Nepal is a party to United Nations Framework Convention on Climate Change (UNFCCC), and has ratified Paris climate agreement 2015, as well as a host of other secondary agreements and commitments. Principally, the UNFCCC's goal is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system; and the Paris climate agreement goal is to limit the global temperature rise to 2°C from the pre-industrial era before the end of this century (UNFCCC, 1992). To pragmatically achieve both goals, greenhouse gas emissions as well as the use of fossil fuel causing those emissions must be reduced until their total eradication, by every country on this planet.

With the principle of "common but differentiated responsibilities" as mentioned by Article 3 and 4 in UNFCCC, all Parties including Nepal make general commitments to address climate change through climate change mitigation and adaptation to the eventual impacts of climate change. Within this background, there is no legal confusion that the large emitters are responsible for reducing the GHGs emission rate to meet the global goals of these two important climate legal instruments. At the same time, a tiny emitter like Nepal stands also on the same moral ground to limit its GHG including CO₂ emission rate.

In this respect, Nepal has made policies, strategies and commitments to lower its dependency on fossil fuels – the largest source of CO₂ emission in the country. For example, climate change policy 2011 and environment-friendly vehicle and transport policy 2014 have the aim of reducing the GHG including CO₂ emission, among other things, as one of the common outcomes⁵. Earlier in 2001, the government had formulated a National Transport Policy that clearly specified the need to develop pollution-free public transport with renewable sources of energy such as hydroelectricity and solar. A country climate action plan – Nationally Determined Contribution (NDC) 2016 – also makes the commitment to lead Nepal along mitigative as well as adaptive pathways to address the global issue of climate change and its impacts.

Nepal government has also recently published a *White Paper on the Current Situation in Energy, Water Resources and Irrigation Sector and Future Pathways*.⁶ It commits Nepal to developing climate change adaptive infrastructure, promises to displace fossil fuel in transport and industrial areas with renewable energy, and targets increasing Nepal's per capita energy consumption to 700 kWh in five years and 1500 kWh in ten years by developing 3000 MW within the coming three, 5000 MW within five and 10000 MW within ten years. Similar sounding commitments were also made by previous other governments in the last ten years. The big question civic movements are being forced to ask, as will be discussed below with a review of the situation as actually prevails, is: how committed is Nepal government to following these policies or are they merely dressed-up tokenism? The big question that prompted this

civil society review is: ***Are we moving on the right track to CO₂ emission mitigation, fossil fuel consumption reduction and sustainable pathway to development?***

3 Trends in Fossil Fuel Consumption

Spending on and import of fossil fuels – the major source of CO₂ emission – is the strong base from which one can assess the state of climate action of the country. Table 2 in appendix A shows the trend of imports and spending on fossil fuels by Nepal, via the monopoly parastatal Nepal Oil Corporation, in 1993/94—2017/18. The financial year 1993/94 has been set as baseline year because it was 1994 in which Nepal ratified UNFCCC and became a party country to the convention and has engaged with the global regime framework battling the adverse effects of man-made climate change ever since.

What we see is that in the financial year of 1993/94 the import and consumption of petroleum products were: petrol 31,476 kL, diesel 1,95,474 kL, kerosene 1,62,324 kL and liquified petroleum gas (LPG) 9,308 MT respectively. Compared to the baseline year 1993/94, import and consumption of diesel doubled in the 16 years by 2008/09; petrol doubled in the nine years by 2002/02; and LPG doubled in just three years by 1995/96. This increasing trend between the base year and doubling year for those different fuel commodities are sadly continuing along an ever-increasing path. The import of kerosene doubles in seven years by 1999/20 and then tails off gradually reaching 19,607 kL by 2014/15, a fact explained by its widespread replacement for domestic cooking by LPG.

In contrast to kerosene, the import of petrol, diesel and LPG has been rising considerably. In the very first year after the historic elections to the Constituent Assembly in 2008, Nepal's diesel import doubled, from 303,212 kL in 2007/2008 to 608,065 kL in 2009/2010. This was not due to any dramatic increase in industrial production but to the loosening of import license for luxury diesel SUVs as well as captive generating plants for electricity due to the increasing and chronic power cuts in the national grid. This regressive (from a climate perspective) policy of increasing fossil fuel import was not a one-time aberration but has become a continuing unfortunate trend: the import of petrol and diesel was 2,53,381 kL and 8,08,567 kL respectively in 2013/14 when paradoxically an environment-friendly vehicle and transport policy was endorsed by Nepal's parliament. Ironically, the policy was undermined and rendered impotent when the Government's import of diesel and petrol increased by 13.99% and 13.45% respectively in the following year 2014/15. Likewise, the import ballooned to 63.23% for diesel and 60.73% for petrol in the years following the adoption of the policy. This clearly shows that the policy implementation is poor, indeed signifying either feeble political will and government interest or mere lip-service in the sector of meaningful climate actions.

Nepal's National Climate Change Policy 2011 is an important policy statement charting the path forward towards climate change impact adaptation as well as a decarbonized economy of sustainable development with reduced dependency on imported fossil fuels. The facts on the ground, however, ridicule this policy: the country moves further along an increasingly carbonized path with more than 100% increase in imports of diesel and petrol in 2016/17 compared to the import and consumption in 2010/11. Likewise, except for a temporary decline

in 2015/16 for reason to do with the 2015 Gorkha Earthquake and the subsequent Indian blockade of Nepal, the import of petroleum keeps increasing thereby (both diesel and petroleum import doubling in quantity in the following year) adding to the emission rate of the country, contrary to the commitments of the much-heralded environment-friendly vehicle and transport policy.

Petroleum has dominantly been the primary import of Nepal for many years in Nepal and so is spending to purchase the petroleum. In the fiscal year 1993/94 the import of petroleum was worth NRs 4.9 billion and in the following year 1994/95 the import of petroleum increased by 12.2%. This trend kept rising dramatically and crossed NRs 14 billion in 2000/01, slowing for a year in 2001/02 at NRs 13.90 billion but increasing thereafter. Indeed, outside of earnings from remittances, import of petroleum products amounted to 169% of the total earnings of Nepal from the export of goods, essentially indicating a bankrupt economy.⁷ Despite the Government of Nepal endorsing its Climate Change Policy in 2011 with the goal to “adopt a low-carbon emissions socio-economic development path and supporting and collaborating in the spirits of country's commitments to national and international agreements related to climate change”, the spending on petroleum keeps increasing exponentially and hovers around 150 billion in 2017/18 which is 30 times more than the petroleum expenses that happened in the fiscal year 1993/94. Based on current trends, it is likely that the import, consumption of and spending on fossil fuels will further increase with the recent decision to construct oil storage tanks to increase the capacity of NOC in each of the seven provinces. ***However, no meaningful government decision, or commensurate action, has come to light regarding decarbonization of transport and the reduction of petroleum import and its replacement by domestic hydropower, solar and biogas/mass, despite right-sounding pronouncements.***

4 Status of Biogas and Briquette Industries

Nepal has been among the highest traditional biomass fuel consuming countries in Asia: two-thirds of households rely on biomass as a main cooking fuel, and over two-thirds of these users live in rural areas, which rely on firewood available from nearby forests in the mostly informal economy. The country's fuel mix in 2015 was 78% biomass, 12% petroleum products, 4% coal, 3% electricity and 3% modern renewables⁸, with much of the biomass use concentrated in rural households. Traditional *chulos* using firewood for cooking are highly energy inefficient (at less than 10%) and in the decades since the first oil crises of the 1970s there has been concerted efforts, and some major successes, in achieving energy efficiency in Nepal with fuel efficient stoves, biogas and briquetting.

Dome types and floating drum type biogas plants are the widely installed ones in Nepal. While these were experimented with as early as 1955 and NGO enthusiasts both national and foreign had built plants around the country, its mass installation with the propose of utilizing biogas for cooking and lighting received a major boost with the partnership of Government of Nepal and Netherlands Development Organization (SNV) through the Biogas Support Program (BSP) in July 1992. The major objective was to reduce Nepal's dependency on fossil fuels (kerosene) and firewood by cleaner and greener energy production from animal manure. Some 123,395 biogas plants of different sizes had been constructed in the country till 2004 but the number has

increased to 268,399 by 2012 under the BSP⁹. Increasing use of biogas has resulted in a drastic decline in the use of firewood and kerosene by 239,386 tones and 3,830,000 L respectively (CRT, 2004). Some 112 companies, big and small, are working on biogas at its peak with the number currently standing at 65 authorized biogas companies¹⁰. The use of biogas technology in Nepal has benefited the country by improving the health especially of housewives doing the cooking and children, the environment and the economy through energy conservation (1 biogas plant typically saves around 5 tons of CO₂).

Biogas only met 0.6% of the total energy demand of Nepal as observed in 2008/2009, with the 6m³ type plant costing an average of Rs 31,500 for construction. There are about 200 community and institutional biogas plants in Nepal which were installed by several organizations and actors without governmental subsidies. These plants are relatively large and range from 6 to 75 cubic meters. Normally they are fed from kitchen waste, toilet waste and livestock manure. Through secondary data, it has been assessed that there are approximately 90 institutional biogas plants in the Kathmandu Valley alone.

The biogas program had two distinct phases: the first, a rather lengthy one till 2010 which saw (with the continuing momentum of this earlier successful effort) some 268,399 units installed all over Nepal till 2011/2012 Fiscal year as published on BSP website. It was achieved with a plural mix of state-market-civic involvement in the form of Ministry of Agriculture and the Agriculture Development Bank as well as foreign development agencies with their support and easy credit program for farmers to install plants, the Gobar Gas Company and a host of other smaller ones, and the involvement of scrupulously egalitarian NGOs and academics intent on promoting this form of improved energy access to rural households in Nepal (Rai, 2017). Besides cheap energy (although with high up-front cost to the poor farmers, for which initial government support was required and which made biogas undercut its nearest competitor, the imported fossil LPG by two-thirds over the 50-year life of the plant). This was in addition to the health and sanitation as well as slurry fertilizer benefits which many argue outweigh the energy benefits.

Fix Dome and floating drum with single and double inlet has a long history in Nepal. Co-feeding (using human excreta with animal manure) type is incorporated in most of the design, but due to the associated social stigma, they are not as widely practiced. However, some commercial scale biogas plants are using the co-feeding system adding some portion of kitchen waste (schools, army camps, monasteries, etc.). Use of kitchen waste for gas production is still at a nascent stage; but the polyethylene bag digester has been newly introduced in Nepal due to its portable advantages and cheaper cost. With the support of GIZ, a total of four pilot bag digester type biogas plants was tested by NBPA and AEPC in Armala VDC at the altitude of 1430 m from sea level. This research provided evidence of the feasibility of the bag digester in hilly regions of Nepal where transportation and construction costs are high with the conventional GGC2047 model¹¹.

However, much of all these encouraging efforts are now stalling after 2010 (the current phase) and even to some extent in decline (Rai, 2017). And the primary reason has to do with the Biogas Support Program being integrated into a large, 5-year National Rural and Renewable Energy Program in July 2012, effectively squeezing out many NGOs and smaller companies from participation and loading unto a regulator (the official Alternative Energy Promotion Center,

AEPC) increased role of implementer at the micro-level. When the subsidy rates were doubled in 2013, the market surged with business entities such as dairy and poultry farms constructing biogas plants without adequate technical homework. With the change in paperwork rules and without the framework for quality management at the village level originally provided by NGOs, quality and after-sales services became a serious problem that began to affect loan repayments as well as subsequent upkeep and maintenance. The biogas market went into turmoil, prompting seven renewable energy associations submitting a letter of protest in July 2016 to the government expressing their anger and frustration, stating that small “companies are on the verge of bankruptcy due to the perennial delay in settling bank loans that they have taken out to pre-finance the users’ investment subsidy”.

There are no detailed policies and guideline for the constructions of biogas plant according to the topography variation of Nepal by the government but construction manuals including construction material quotations are easily available. They recommend that modified biogas plants are only feasible up to the altitude of 3000 m from the sea-level. GoN has given facilities for promoting biogas by applying only 1 % custom duty for the biogas appliances. However, due to ambiguous rules and discretionary acts regarding importing biogas appliances, this encouragement provision is difficult to realize and is increasing the construction cost of biogas plant construction. Till date, most of the acts and rules were designed based only for the GGC 2047 model type. Another factor that has led to a stagnation of sorts in the biogas industry is the massive outmigration of youth, leading to decline in agriculture in general and livestock keeping in particular. Given that a major benefit from biogas plants is the slurry as fertilizer that helps increase vegetable production, a decline in this sector must also be seen a damning indicator that indicts the management of the country's water-energy-food nexus.

The other form of biomass use, i.e. briquetting, is one led entirely by the Nepali private sector and has experimented with all kinds of briquetting technologies, except for the “agglomeration technology” which is mostly popular in Africa. Among all the technologies introduced in Nepal, three –rice husk briquetting technology, beehive briquette technology and briquettes from waste paper and biomass have been practiced on a wider scale. The first biomass briquetting plant Nepal Bio-Extruder Industry Pvt Ltd was established in 1982 in Thapathali, Kathmandu with the annual production capacity of 900 metric tons. Later, similar factories with annual production capacity of 1200 tons of briquettes were established in Butwal (1984) and a third one followed in Dharan (1984) with annual production of 600 tons. Over a dozen such factories are currently registered with the Department of Industries when only 5 were in operation till 1990.

The Indian blockade in 2015 following the Gorkha Earthquake gave tremendous impetus to the briquetting industry with briquette burning *chulos* seeing an upsurge in sales. Villagers were making charcoal briquettes from agri-waste as well as *banmara* weeds from community forests, which found a ready market in urban areas as LPG gas cylinders were either unavailable or available at many times the normal price. However, once the blockade ended, it was “*back to mangalman*” as the saying goes: imported LPG imperialism resumed at breakneck speed while a very domestic briquette industry practically collapsed. ***This regressive situation in Nepal's biomass-based energy production, which could significantly reduce Nepal's dependence on***

fossil fuel especially LPG as well as enhance its energy security, is also a strong negative statement on its climate policy and actions to match those policies.

5 Transportation Sector Scenario

Nepal's transport sector is the second largest energy consuming sector after the domestic sector. It must, however, not be forgotten that the latter mostly consumes biomass and within the ambit of the informal economy. The transport sector, on the other hand, consumes imported petroleum that bleeds away the country's foreign exchange earnings as mentioned above, foreign exchange that could instead be very profitably used in various sectors from health and communication to education and diplomacy. The capital expenditure by Government of Nepal on the transportation sector is on an increasing trend; the expenditure for the year 2016 was 61 billion—2.87 percent of the GDP (NPC, 2018).

The number of vehicles has reached 27,83,428 up to the end of fiscal year 2017/18¹². The overall annual trend of vehicle registration in Nepal has been on rise significantly (see table 3 in appendix). What can be seen is the explosion in the number vehicles just after the new Maoist-led government came to power following the first Constituent Assembly elections in April 2008. Due to the excessive increase in number of vehicles in the country, the Green House Gases (GHG) emission from the transportation sector is increasing which is also corroborated by the Second National Communication (SNC) report 2014 of Government of Nepal, Ministry of Population and Environment (MoPE).

One major problem is the poor state of public transport where public transport vehicles are said to constitute only 2.5% of all the vehicles on the road. Compared to private vehicles, public transport vehicles have a much higher passenger-mile to fuel burned ratio and hence a much lower carbon footprint. Although the state did manage to institute Sajha Yatayat early in Panchayat days, it fell by the wayside after 1990 and closed in 2007. In 2013 it was relaunched as a cooperative and aims to provide secure and comfortable public transport.¹³ However, this is a rarity not emulated by other transport cartels called 'Syndicates' which are run entirely by private associations of small entrepreneurs who have invested in a couple of vehicles and pooled resources with other such entrepreneurs. While they do provide services not otherwise available from the state or cooperatives, it is their anti-competition practices that graduate from lawful cooperation to unlawful collusion which harm the customer-consumer both financially and in terms of burgeoning accidents from poorly maintained and driven vehicles.¹⁴ Recent welcome attempts by the government to end this practice of cartelization has run into stiff resistance from the political clout enjoyed by the Syndicates.

Attempts by other Green-minded entrepreneurs to bring in alternative modes of energy efficient de-carbonized (electric) transport have been met with fierce resistance from these cartels as well as the concerned bureaucracy (Yatayat Byabastha Bibhag) in cahoots with them (Panday, 2017). The socio-political pressure generated by the propaganda that "development = roads" is driving a phenomenon called "*dozer atanka*" (or bulldozer terrorism) where village politicians and local contractors have teamed up to gouge fragile hillsides with multiple alignments of poorly engineered roads that either cause many unnecessary accidents or get

washed away during the monsoon, the debris from which raises river bed levels and causes severe flooding in lower riparian lands. There is an alternative and proven climate- and mountain-friendly technology for Nepal, the goods carrying ropeway (Gyawali et al, 2004) which is "three times cheaper to build than an equivalent motorable road, eight times quicker to install and twice as energy efficient (34 MJ/ton for ropeway versus 53 MJ/ton for roads)". However, despite that fact that this technology was introduced as early as 1924 with the Dhorsing-Matatirtha ropeway, it has been sidelined by petroleum-based technologies such as the diesel trucks, buses and SUVs together with expensive infrastructure that cater to them such as expensive roads and highways.¹⁵

This is not for the lack of policy but rather the lack of commensurate political will. Government of Nepal had formulated the National Transport Policy in 2001 with the objective to develop a transport system that is sustainable, reliable, less expensive, safe, comfortable and self-reliant. The policy clearly draws special attention to improving 'the comfort, reliability, safety, frequency, availability and affordability of the public transport and in reducing harmful emissions arising from the public transport operations'. The policy also explains about the construction of new roads in urban areas and states that public utility services like sewage, drinking water, telephone, electricity, shall be managed separately away from the road pavement to the possible extend. The policy clearly mentions that cycle lane shall be managed separately. It also emphasizes the development of transportation system with renewable sources of energy such as electric and solar, and emphasizes the development of a transportation system that is pollution free.

Right-sounding public policy pronouncements related to the transport sector have been made from the very first periodic plan which was between 1956 to 1961. From then on, continuous mentions of such policies have been made through almost every periodic plan developed so far. While reviewing the policy initiatives taken by the Government of Nepal in the transportation sector, we can see that there are some good policies and under which there are very nice objective, policies, strategies and goals. Some of them, solely developed focusing on the transportation sector, are the Vehicle and Transport Management Act 2049, Vehicle and Transport Management Rules 2054, National Transport Policy 2058, National Sustainable Transport Strategy for Nepal (2014 to 2040), Environment Friendly Vehicle Policy 2014, and Vehicle Emission Testing Manual 2018. There are yet other important policies namely Low Carbon Economic Development Strategy (draft, in the process of revision considering the federal structure), Nationally Determined Contribution of Nepal to the United Nation Framework Convention on Climate Change (UNFCCC), and various other policies which also explains about the emission reduction from the transportation sector.

Hydroelectric-powered trolley bus system was constructed during the 5th periodic development plan (1975-80) and implemented with Chinese aid. Feasibility study for an alternative electricity-based transportation system was proposed during the 6th periodic plan period. It was proposed to be expanded up to Tribhuvan University from the one operating on Kathmandu-Bhaktapur road section. Considering the importance and contribution of transportation sector, road construction connecting "Farm to Market" was prioritized in the 8th plan. The 9th plan objective was to develop less expensive transport infrastructure to alleviate poverty and to be favorable to environmental conservation and pollution control. By the 10th periodic plan, it was

proposed that road projects will be selected based on minimum adverse impact on environmental and regional imbalance and adoption of low-cost technology to minimize environmental degradation. Through the 12th plan, various proposals were made for the development of Kathmandu-Pokhara and East-West electric railway together with the development of footpath and bicycle lane where possible.

In addition to prioritizing the transportation sector in periodic planning, the Government had formulated several policies, the most interesting of which was the Environment Friendly Vehicle Policy in 2014. It aimed to increase the share of environment friendly electric vehicles to minimum of 20 percent till 2020 together with various other ambitious goals. Low Carbon Economic Development Strategy (LCEDS) is another important instrument (which is in the process of revision considering the federal structure and supposed to be approved by the cabinet/parliament soon) which emphasizes the promotion of renewable energy in all the sectors with considerable GHG emissions. Government of Nepal with the technical support from the United Nation Center for Regional Development (UNCRD) developed the National Sustainable Transport Strategy (2015 to 2040) with a vision of “developing a transport system that is efficient, accessible, people-centric, affordable, reliable, safe, inclusive, environment friendly, and climate and disaster resilient”. The strategy had set its objective with three different dimensions: social, environmental and economic with the defined target/indicator for the different objectives under the dimensions mentioned therein.

As explained in the Second National Communication report of Nepal to the United Nations Framework Convention on Climate Change (UNFCCC), the Government of Nepal has updated its fuel standard from April 2010 but the vehicle standards are not developed and implemented. The newly developed Nepal Vehicle Mass Emission Standard (2069) recommended by MOSTE limits carbon emission to 0.64 gram per liter of diesel engines. The Euro-3 standard enforced by the government aims to ban import of substandard vehicles which emit carbon dioxide beyond the given limit. But from the aspect of implementation and effective enforcement of this standard, there is a big question mark due to the lack of monitoring from the concerned agencies.

While there is the inevitable excuse of lack of technical manpower and budget to monitor emissions from individual vehicles or a switch to de-carbonized transport, the issue from the civil society's perspective is the lack of any forward movement in implementing these policies. Although several policies, strategy, act, regulation and manuals have been developed so far in the country in transportation sector to address the negative impacts of dependence on fossil fuel as described above, the scenario of transportation sector is quite frustrating. ***Where is there any indication that these policies and plans were ever seriously implemented?***

6 Renewable Electricity's Progress and Regress

Although it is endlessly repeated that Nepal is rich in hydropower, the pace of harnessing it as well as other forms of renewable energy such as solar must be described as lethargic compared to the existing domestic demand. To make matters worse, the country's current consumption of electricity through the national grid is increasingly turning towards incapacitating

dependence on imported coal-fired electricity. While the private sector Independent Power Producers (IPPs) have made tremendous strides in building national capacity in indigenous development of the nation's hydropower potential, which stands almost at par with the capacity of the national parastatal Nepal Electricity Authority (NEA), demand in Nepal far outstrips the capacity of supply coming on line. A look at the operating hydro projects in Nepal shows that there are 73 projects with a total installed capacity of 996 MW, of which 17 belong to the NEA (including Chilime on a quasi-private mode) totaling 518 MW and 478 MW from 56 smaller projects from private national developers.¹⁶

In the past decades, Nepal suffered a planning flaw best described as a "flood-drought syndrome" wherein a single large (compared to system size) project was selected and built resulting in immediate excess power, followed a few years later by scheduled power cuts (load shedding) as the excess capacity was absorbed by fast growing domestic demand. In recent years, however, licenses have been granted for many smaller projects. Unfortunately, they are all in the run-of-river category where a power plant can run in full capacity only during floods (when all other plants also run similarly) but come down to only a third of the installed capacity for half the year during the dry season. Thus, we have a situation where we have excess capacity during the wet season and often during off-peak night time but severe shortage in the dry season and during peak hours. This planning failure could have been corrected if seasonal storage projects as well as bigger pondages for r-o-r plants had been promoted, not just through the planning process but also through daily differentiated and seasonal pricing policy had been adopted, which has not been done even though it was proposed almost a decade-and-a-half ago.

Industries, commercial establishments and even households have resorted to various means to fill the demand that the national utility was failing to meet – through inverters and battery backups, solar panels on rooftops and even captive diesel and petrol generating sets. In the last few years, however, the NEA has claimed that it has gotten rid of load shedding at least in Kathmandu Valley. As Table 4 depicting peak supply and demand in the National Grid for the year 2074 BS shows, this has been achieved through four highly undesirable (from the perspectives of national security, industrial economic development, geographical inclusiveness and environmental malfeasance) costs: dependence on electricity imported from India, that too coal-fired, power cuts to industry and unannounced load shedding in the outlying (and politically less assertive) cities and districts of Nepal.

What the demand and supply figures show is that of the peak demand of between 1200 to 1300 MW (a "suppressed demand" that would jump dramatically if unrestricted supply was available), the highest generation by NEA was 440 MW on 7 Kartik 2074, the highest by IPPs also on that day of 356 MW, the highest amount imported from India was 505 MW on 25th Jyeshtha 2075, i.e. electricity that comes from "dirty coal" with high ash and sulphur content in addition to the CO₂ it needs to be emphasized (Venkatesh et al, 2014). The total shortage in the Nepal system (met by cutting power to industries and importing from India) reached as high as 756 MW on 14 Magh 2074. It is claimed that this increase in electricity imports is only temporary for a few years until projects in the construction pipeline are commissioned when there will be a surplus in the grid and hence the need to export.

This planning argument is flawed on two counts. First, the bigger projects in the offing such as Tama Kosi would hardly cover the shortage seen above. Indeed, during the Indian blockade, demand for electricity jumped to a peak of estimated 1800 MW (already swallowing up all forthcoming Tama Kosi generation) because people reverted to cooking with induction stoves, an extremely energy-efficient device with as high as 84% energy efficiency, due to the non-availability of LPG or kerosene. Estimates place the actual suppressed demand currently in Nepal at least over 2700 MW and as high as six thousand MW if normal economic growth scenario is to be achieved in Nepal, including 1,000 MW to displace LPG from kitchens; 500 MW needed to electrify transportation; and 700 MW to displace diesel irrigation pumps in the Tarai (Shrestha et al, 2018). Second, India is a monopsony market which has adopted a 'cost-plus' principle and never offered a fair market rate for Nepal's electricity and water. Hence, rather than banking on export to India, Nepali power planners would be wiser to focus more on how any surplus could be utilized within Nepal through creative means, including differential tariffs.

What is worrisome is that this trend in increase in addiction to Indian coal-fired electricity has amplified Nepal's carbon footprint dramatically, swelling dependence of this critical sector of the economy on India despite the fresh memory of the recent Indian blockade. In FY 2074/75 Nepal imported 2582 GWh of electricity paying 19.37 billion rupees. A year ago, in FY 2073/74, the figure was 2175 GWh of electricity for 16 billion rupees, itself a 9.37 percent increase over the previous year FY 2072/73.¹⁷ This is happening even while the official moves to enhance Nepal's energy independence and security is surprisingly lackluster. There are many Nepali private developers who have completed the construction of their hydropower plants, but NEA has not been able to fulfil its end of the deal by completing transmission linkage to the national grid.

As examples¹⁸, consider the 4.352 MW Tungun Thosne Khola and 2 MW Khani Khola hydroelectric projects which were completed on 9 Kartik 2073 and 20 Mangsir 2073 respectively by the private developer Khani Khola Hydropower Company Limited. They have been temporarily connected through an old and inadequate 11 kV transmission line, and the NEA was to have built a new interconnecting 33 kV line, which has not been done. The result is that the company has not been able to evacuate 31 million units of electricity (worth 167 million rupees) which have gone to waste even as the national grid suffers shortages which it meets through import of coal-fired electricity from India.

Strangely, even in the face of this crying national need for internal grid connections, the focus of the NEA (and major donors supporting it) is directed more towards building cross-border transmission lines to India rather than building internal transmission grid capacity, despite India's often threatening "unpleasant consequences" when proposals are made that are favourable to Nepal.¹⁹ This sad story of wasted hydroelectric power repeats itself in other transmission corridors such as the Gandak and the Tamur corridors, even as Nepal's import of coal-fired electricity from India balloons dramatically.

A similar story of official neglect is also happening in the solar photovoltaic sector. Globally, solar PVC electricity costs (for utility scale plants as well as individual household installations) have declined dramatically in the last decade, it being over \$350/MWh in 2009 to only

\$50/MWh in 2017, when in comparison, electricity from gas is \$60, from coal \$102 and from nuclear \$148 per MWh.²⁰ This is making solar almost as cost-effective as hydro, even though hydro provides more round-the-clock supply stability. IRENA (2018) estimates that by 2020, most modular renewable power generation technologies will be further declining in costs and will be undercutting fossil fuel generated power, with hydro around \$0.05/kWh and solar at \$0.06/kWh (in global weighted average levelized cost of electricity).

The result has been a rapid promotion of solar power in countries such as Germany that, like Nepal, do not have their own sources of fossil fuel. Germany hopes to meet most of its energy demand with renewables by 2050. In 2017 PV power accounted for 7.2% of Germany's net electricity consumption (Fraunhofer, 2018) and in the month of April of 2018, it reached as high as 12.1%.²¹ If solar power, both large scale and in individual households, is a proven success in Germany (world leader), why not in Nepal where healthy sunshine hours is much more than in Germany. Annual average Global Horizontal Irradiance for Nepal is 4.7 kWh/m²/day whereas it is only 3.15 kWh/m²/day in Germany which is in a more northern and cloudy latitude. Nepal is still facing a power deficit of more than 400 MW, much of which could be addressed by solar PV, especially with individual investments in urban areas that could easily cover that deficit figure without any extra government outlay.²² While the criticism that solar only provides power during the day and not during the night is valid, what must be remembered is that installation of two to three hundred MW of solar PV, especially by households that can afford it and are connected to the grid through net reversible metering, can get rid of day-time (i.e. office hour) load shedding completely. Furthermore, solar PV installation time is quick, almost a week or so only, which is a fraction of the long gestation period for of four or five years for hydro.

However, solar PV industry in Nepal, and especially individual household customers, face unfortunate resistance in connecting to the grid. On 17th Asar 2074, NEA published a notice on net metering stating that NEA would in principle enable grid connection for energy generated by solar photovoltaic systems via bidirectional energy meter as per the guidelines of the Electricity Distribution Act 2069. On 25th Magh 2074, Nepal Government Ministry of Energy published a Grid Connection Renewable Energy Development Guidelines 2075 which states that the renewable energy generated by individual houses, institutions or commercial entities can sell the surplus to the national grid. It also states that renewable energy such a solar PV, biogas and wind were on the government's priority list. Despite all these promises from the NEA and the Ministry of Energy, the export of excess power to national grid and installation of bidirectional meter has not been moving forward, with reasons having to do with bureaucratic inertia and professional hostility (some senior bureaucrats even labeling renewables such as solar as only "ornamental"). ***This is one more instance of a stated renewable electricity policy rhetoric not matching actual practice in implementation.***

7 Recommendations for Climate Action

There have been significant efforts, especially by the private and community sectors, to wean Nepal away from fossil fuel addiction: private Nepalis have invested billions in small hydropower development; the briquette industry is wholly private; biogas represented a very

successful public-private partnership in the past years; households have invested massively in solar PV panels; and the National Association of Community Electricity Users Nepal (NACEUN²³) has even started a campaign to use its community electricity to displace LPG gas cylinders in rural areas where they have active community cooperatives and associations. However, the bottom-line conclusion of this citizens' review of climate action in Nepal is that, despite right-sounding policies and policy pronouncements and despite commendable private and community efforts to the contrary, ***Nepal's move towards a sustainably renewable future is sluggish and indeed often regressively heading towards more fossil fuel addiction.***

This N-CANSA assessment calls for following measures to be undertaken by government, government bodies at various levels as well as the private sector and other social groupings. The international climate convention and appurtenant agreements have provisions for support with financial resources and transfer of technology by developed countries to least developed and developing countries for climate action by considering economic, social development and poverty eradication policies and actual practices of those countries. It will be through the honest implementation of inspiring, timely and 'no-regrets' activities to mitigate climate- and economy-damaging actions of ours that will give us the moral high ground to make meaningful claims of support from international bodies to help us onto a path of sustainable and resilient renewable future.

- Government of Nepal should demonstrate seriousness about enforcing its stated climate-friendly policies and honouring international commitments on legal climate instruments it has been signatory to. One cannot fool the international community with sweet rhetoric all the time, and sooner or later when the assessment is made Nepal government's credibility, and hence that of the country, will be badly damaged.
- One clear way seriousness can be demonstrated is for the government to declare an emission peak year and to review its stated climate change policies against verifiable quantitative targets of fossil fuel consumption reduction and corresponding reduction in GHG emissions. As an immediate co-benefit, a reduction in fossil fuel consumption will keep the ambient environment clean in the cities like Kathmandu that will ensure a compliance with air quality as committed in Environment Friendly Vehicle and Transport Policy 2014.
- To initiate the process of reducing fossil fuel imports, there are several measures the government should take immediately. The first among these is to tax petroleum products as well as fossil-fuel consuming vehicles and to sequester the tax windfall into a National Self-Reliant Renewable Energy Development Fund (and not fritter the amount in regular expenditure of the government for high officials' facilities). This fund should be used to develop hydropower, solar, biomass, wind and other indigenous renewable sources as well as to promote decarbonized electric transport, including public transport vehicles. A good start has been made with the Rs 5/liter tax on petroleum products for Budhi Gandaki hydroelectric project which has already collected Rs 22 billion; but this good beginning is far from enough to wean the country away from fossil fuel addiction.²⁴
- In the immediate interim, Government of Nepal should enact a separate law for the regulation of supply and distribution of petroleum products. A good beginning would be

to keep records of passenger-miles per vehicle category and institute an increasing taxation slab that would *per force* encourage the development and use of mass public transport. A policy of *minimizing* the import of vehicles should be linked to the passenger-mile per vehicle indicator and the *increase* in use of public transport indicated by it. It should also make it mandatory for developing, promoting and blending indigenous biofuels such as biodiesel and ethanol with incentives and tax concessions for biofuel producers, retailers and users. These critical measures should also be part of the larger package of institutional reform in the transportation sector: as currently constituted, the Department of Transport Management and associated wings and offices under the Ministry of Physical Infrastructure and Transport are only engaged in routine administration tasks of vehicle registration and associated tax collection. This institutional structure is highly inappropriate, indeed counterproductive, in weaning Nepal away from fossil-fuel addiction. More effort – and responsibilities – should be put in place to monitor climate friendly indicators described above and to institute punitive measures where stark failure is noticed.

- Local units of governance under the new decentralized federal system, the *gaonpalikas* and *nagarpalikas*, should be required to institute a policy of waste separation in households, schools, factories, restaurants etc. and the organic wastes should be fed into large digesters for cogeneration of electricity as well as organic fertilizer production. Appropriate tax and other financial incentives must accompany these policy measures. In rural areas, in collaboration with community forestry, the briquette industry (especially those clearing invasive species weeds such as *banmara*) must be revived and encouraged, and the products be made of mandatory use in tea stalls and other public eating places as well as in space heating. Reviving biogas should be made part and parcel of the program to revive Nepal's livestock and dairy industry, and indeed of agriculture and agri-industry as well with the use of agri-wastes in energy and organic fertilizer co-production.
- The renewable electricity sector, the backbone of the country's future economic prosperity, must be forced to move away from the fossil-fuel addiction it has been consumed with over the last few years. The first step in this reform is to enact a new electricity act (and the process of tabling that act has remained stalled since the first constituent assembly in 2008) which will unbundle the electricity sector and provide better space for rural communities as well as local units of governance such as *gaonpalikas* and *nagarpalikas* to creatively develop new electricity sources within their jurisdiction and manage their own distribution system. It will also provide Nepal's growing independent power producers a more fair and efficient level playing field to meet Nepal's growing demands.
- The second major step that needs to be taken in this sector is to reform the electricity tariff structure by introducing differentiated seasonal and daily peak rates in addition to allowing reversible net metering in households and commercial establishments. Such a reform will open a new market and encourage developers to invest in appropriate storage facilities in hydro sites as well as in solar and biogas energy sources, thus weaning Nepal away from the shackles of imported dirty coal-fired electricity.

To conclude, despite right-sounding, climate-friendly legal instruments in place, the overall trend of fossil fuel consumption and bankruptcy-level spending for the same has been rising dramatically in the last few years. This unfortunate trend does not indicate Nepal heading towards a sustainable, resilient and renewable climate-proofed future. The sovereign people of Nepal are desperate to see that the government walk the climate talk.

Appendix: Tables and Figures

Table 1: Nepal's National and International Climate Commitments

| Climate legal instruments and their ratification or endorsement year by GoN | Emission mitigation commitments as provisioned by the legal instruments |
|--|---|
| United Nations Framework Convention on Climate Change 1994 | ... to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. |
| Paris Climate Agreement 2015 | ...to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C; ... on the need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries; ... to undertake rapid reductions thereafter in accordance with the best available science. |
| GoN's National Climate Change Policy 2011 | ...to improve livelihoods by mitigating and adapting to the adverse impacts of climate change, adopting a low-carbon emissions socio-economic development path and supporting and collaborating in the spirits of country's commitments to national and international agreements related to climate change. |
| GoN's Environment Friendly Vehicle and Transport Policy 2014 | ...to reduce emission from transport sector; ... to promote progressive and affordable standards for fuel quality, and regulating vehicle emissions to ensure compliance with air quality. |
| GoN's Nationally Determined Contribution 2016 | ...pursues and supports efforts to limit temperature rise to well below 2°C leading to 1.5°C above pre- industrial levels to reduce the risks and adverse impacts of climate change. |

Table 2: Nepal's Import/Consumption of Petroleum and Spending

| Fiscal year | Petrol (KL) | Diesel (KL) | Kerosene (KL) | LPG (MT) | Total annual spending on petroleum (in billion NRs) |
|-------------|----------------|----------------|------------------|-------------|---|
| 2017/18 | 485,036 | 16,14,664 | 22,548 | 3,78,181 | ~ 150.00 |
| 2016/17 | 4,07,270 | 13,19,873 | 19,607 | - | 122.58 |
| 2015/16 | 2,40,386 | 7,85,685 | 14,194 | - | 71.78 |
| 2014/15 | 2,87,473 | 9,21,714 | 19,653 | 2,58,299 | 115.68 |
| 2013/14 | 2,53,381 | 8,08,567 | 18,409 | 2,32,660 | 126.64 |
| 2012/13 | 2,23,087 | 7,21,203 | 24,065 | 2,07,038 | 102.34 |
| 2011/12 | 2,02,467 | 6,53,560 | 41,609 | 1,81,411 | 88.02 |
| 2010/11 | 1,88,082 | 6,52,764 | 43,399 | 1,59,286 | 75.85 |
| 2009/10 | 1,62,902 | 6,08,065 | 52,714 | 1,41,171 | 56.99 |
| 2008/09 | 1,28,372 | 4,89,219 | 77,799 | 1,15,813 | 39.80 |
| 2007/08 | 1,01,624 | 3,03,212 | 1,52,168 | 96,837 | 38.92 |
| 2006/07 | 98,435 | 2,99,419 | 1,92,576 | 93,562 | 32.46 |
| 2005/06 | 81,817 | 2,92,381 | 2,25,007 | 81,005 | 33.65 |
| 2004/05 | 76,097 | 3,08,076 | 2,31,463 | 77,594 | 26.65 |
| 2003/04 | 67,965 | 3,02,644 | 3,13,127 | 66,142 | 20.16 |
| 2002/03 | 68,482 | 3,01,672 | 3,51,696 | 56,079 | 18.81 |
| 2001/02 | 63,578 | 2,87,657 | 3,90,113 | 48,757 | 13.90 |
| 2000/01 | 60,653 | 3,33,791 | 3,25,198 | 40,102 | 14.51 |
| 1999/2000 | 55,570 | 3,27,427 | 3,50,196 | 30,627 | 15.73 |
| 1998/99 | 51,584 | 3,19,158 | 2,98,351 | 25,019 | 12.44 |
| 1997/98 | 47,507 | 3,02,063 | 2,87,595 | 22,961 | 10.01 |
| 1996/97 | 46,621 | 2,59,358 | 2,44,546 | 21,824 | 6.95 |
| 1995/96 | 41,736 | 2,54,323 | 2,13,830 | 18,600 | 6.10 |
| 1994/1995 | 35,019 | 2,28,016 | 1,76,963 | 13,049 | 5.66 |
| 1993/1994 | 31,476 | 1,95,474 | 1,62,324 | 9,308 | 4.9 |

Source: NOC, 2018, and GoN, 2017

Table 3: Fiscal Year-wise Vehicle Registration in Nepal

| Fiscal year | Number of vehicles registered |
|-------------|-------------------------------|
| 1989/90 | 76378 |
| 1990/91 | 13149 |
| 1991/92 | 17467 |
| 1992/93 | 14255 |
| 1993/94 | 18609 |
| 1994/95 | 19414 |
| 1995/96 | 20408 |
| 1996/97 | 23765 |
| 1997/98 | 20425 |
| 1998/99 | 24139 |
| 1999/2000 | 28280 |
| 2000/01 | 40995 |
| 2001/02 | 47160 |
| 2002/03 | 37610 |
| 2003/04 | 39699 |
| 2004/05 | 40711 |
| 2005/06 | 54975 |
| 2006/07 | 88735 |
| 2007/08 | 84740 |
| 2008/09 | 102570 |
| 2009/10 | 201787 |
| 2010/11 | 163640 |
| 2011/12 | 170084 |
| 2012/13 | 208483 |
| 2013/14 | 198343 |
| 2014/15 | 239583 |
| 2015/16 | 343765 |
| 2016/17 | 444259 |
| 2017/18 | 437614 |

Source: DoTM, 2018

Table 4: Typical Peak Supply and Demand of Electricity in the National Grid 2074 to 2075 [MW]

| Date Typical for the Month | Peak Demand | Peak Supply | | | Import from India | Load Shedding in Industry | Total Nepal Grid Shortage |
|----------------------------|-------------|-------------|--------------------|--------------------|-------------------|---------------------------|---------------------------|
| | | NEA | Nepal Private IPPs | Total Nepal Supply | | | |
| 19 Baisakh 2074 | 1272 | 384 | 150 | 534 | 348 | 390 | 738 |
| 17 Jestha 2074 | 1282 | 378 | 214 | 592 | 370 | 320 | 690 |
| 27 Asar 2074 | 1241 | 339 | 296 | 635 | 246 | 360 | 606 |
| 14 Sravan 2074 | 1296 | 346 | 314 | 660 | 271 | 365 | 636 |
| 18 Bhadra 2074 | 1307 | 341 | 336 | 677 | 330 | 300 | 630 |
| 19 Ashwin 2074 | 1312 | 306 | 356 | 662 | 340 | 310 | 650 |
| 10 Kartik 2074 | 1280 | 348 | 339 | 687 | 293 | 300 | 593 |
| 23 Mangsir 2074 | 1247 | 338 | 253 | 591 | 356 | 300 | 656 |
| 21 Poush 2074 | 1273 | 360 | 206 | 566 | 442 | 265 | 707 |
| 14 Magh 2074 | 1281 | 348 | 177 | 525 | 481 | 275 | 756 |
| 6 Falgun 2074 | 1204 | 313 | 167 | 480 | 464 | 260 | 724 |
| 10 Baisakh 2075 | 1181 | 303 | 160 | 463 | 478 | 240 | 718 |
| 25 Jestha 2075 | 1217 | 415 | 287 | 702 | 505 | 10 | 515 |
| 4 Asar 2075 | 1188 | 401 | 344 | 745 | 424 | 19 | 443 |

Source: www.urjakhbar.com

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Notes

- ¹ See Davidsett, B. (2007) Sustainable Energy Development: Iceland as a Case Study. University of Iceland: https://aceee.org/files/proceedings/2007/data/papers/24_3_097.pdf
- ² Taken from: <http://www.worldstopexports.com/worlds-top-oil-exports-country/>
- ³ See Overview of Norway's Electricity History Information. NVE and Norad, November 2016. http://publikasjoner.nve.no/rapport/2017/rapport2017_15.pdf
- ⁴ Taken from the website: <http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption/Per-capita>
- ⁵ See Nepal Government's climate change policy 2011 and environment-friendly vehicle and transport policy 2014.
- ⁶ Issued by the Ministry of Energy, Water Resources and Irrigation in the name of the Minister Barsha Man Pun, 25th Baishakh 2075 (8th May 2018). Downloadable from: https://www.moen.gov.np/pdf_files/White-Paper-2075-with-Annex02.pdf

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- ⁷ Figures from the presentation by Prof. Dr. Amrit Nakarmi (Institute of Engineering Center for Energy Studies, Pulchowk) to the 56th Engineers' Day at Pokhara on 19th July 2018.
- ⁸ Prof. Nakarmi, *ibid*.
- ⁹ Taken from <http://www.bspnepal.org.np/?option=cms&cid=20>
- ¹⁰ Taken from the web site of Nepal Biogas Promotion Association (NBPA): <http://recnepal.org/nepal-biogas-promotion-association-nbpa>
- ¹¹ See Bag Digester –Test of a light Biogas Plant for Nepal available at http://www.build-a-biogas-plant.com/PDF/Implementation_Report_Bagdigester_Nepal2012.pdf
- ¹² Taken from <https://www.dotm.gov.np/uploads/files/vehicles%20data%20till%202074-75.pdf>
- ¹³ Details from Ross Adkin report: <http://www.caravanmagazine.in/letters/nepal-rolling>
- ¹⁴ An interesting study on this has been done by Sambriddhi Foundation: <http://samriddhi.org/publications/competition-watch-in-key-growth-sectors-of-nepalese-economy/>
- ¹⁵ This study, as well as the chapter in it by Upadhyay on Bhattedanda Milkway, can be downloaded from: <http://www.nwcf.org.np/cms/resources/pdf/Ropeway.pdf> Upadhyay also has a chapter in Gyawali et al (2017, *ibid*) titled *Bhattedanda Milkway: why a climate- and mountain-friendly technology continues to be ignored*.
- ¹⁶ Operating hydro projects in Nepal DoED website: http://www.doed.gov.np/operating_projects_hydro.php
- ¹⁷ See reporting in Urja Khabar: <http://www.urjakhbar.com/archives/12951>
- ¹⁸ Data and figures drawn from Urja Khabar: <http://www.urjakhbar.com/archives/12778>
- ¹⁹ The "unpleasant consequences" threat is described in Pun (2014) quoting former water resources secretary and chief of CIAA Surya Nath Upadhaya.
- ²⁰ Data from Business Insider: <https://www.businessinsider.com/solar-power-cost-decrease-2018-5>
- ²¹ Data from PV Magazine: <https://www.pv-magazine.com/2018/05/03/germany-covered-12-1-of-its-power-demand-with-solar-in-april/>
- ²² DoED issued licences for 32 industry-scale solar as of November 2017 is 147 MW. See: http://www.doed.gov.np/survey_license_solar.php It is estimated by PV industry key informants that individual domestic installations in urban as well as rural households could easily exceed that figure.
- ²³ See: <http://naceun.org.np/>
- ²⁴ It has been calculated that putting a tax of Rs 50 per liter of petrol, Rs 30/l of diesel and Rs 600 per LPG gas cylinder would generate Rs 52 billion per annum, more than sufficient to build both West Seti and Budhi Gandaki HEP by Nepali resources alone, much as Ethiopia (a country as poor as Nepal) has managed to build the 6000 MW Grand Rennaissance Dam by itself. See Bidyut Khabar published by National Association of Community Electricity Users Nepal (NACEUN) in its Vol 10 Issue 14 of 29 December 2015.