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Impact of Renewable Energy Subsidy Policy in Rural Electrification

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Abstract

This paper analyses the Renewable Energy Subsidy Policy of Nepal in light of its development history and impact to increase in access to electricity by easing barriers for rural electrification. Based on the selected parameters the study discusses on the major outcomes due to past subsidy policy interventions towards increasing access to electricity in rural areas. Major developments of off grid electrification in the country have occurred mainly after the formulation of the Renewable Energy Subsidy Policy 2000 and its subsequent revisions. More than 16% of the rural population has access to electricity from off grid renewable energy technology solutions, like solar home lighting system, minigrid, pico, micro and, minihydro and solar wind hybrid systems where the government subsidy policy played an instrumental role. The subsidy policy is not stable, driven by donor funding, not properly targeted to needy communities and mechanisms to deliver the subsidy are cumbersome and time consuming which needs to be addressed by government.

Keywords

Renewable Energy Policy – Rural Electrification – Off-grid – Access to Electricity

1. Introduction

The population in Nepal of 2017 is around 29.4 million, United Nations report estimates the average population density in Nepal is 204 per square kilometer, 19.2 % of the population is urban and 80.8% is rural [1]. According to the population census conducted by the Central Bureau of Statistics (CBS) in 2011, the overall access to electricity is recorded as 76% of total population, which includes all types lighting solutions promoted thus far[2]. Access to electricity is predictably higher in urban (94%) and lower in rural areas (72%). This statistics is very much depends on definition of access of electricity or minimum criteria required to meet it. The average rural household electrification rate of India is about 55.3%, however, the rural household electrification rates vary among states[3].In India, access to electricity is counted only when the national grid reaches an area, whereas Nepal's statistics is accounting all the electrification efforts including small solar home lighting solutions.

Nepal has abundant natural energy resources, it is estimated that it has more than 83GW of hydropower, 200MW wind, 2600MW solar energy potential for electricity generation This means that Nepal has tremendous potential for development of big hydropower projects which can be connected to national electricity grid and used for domestic consumption as well as exporting electricity to neighboring countries for foreign currency income. The energy resources like solar and wind can be developed as off grid solutions to provide electricity to people far from the national grid and whose present consumption is limited [4].

Different studies have pointed out that there a number of barriers for rural electrification in a least developed country like Nepal. Rijal (1986) concluded that for the given irregular topography of Nepal, decentralized energy system using micro hydro units of proper size should be optimal based on economic evaluations [5].The initial demand for electricity in low income household in rural areas will be small. This has the unfortunate effect of making the average cost per unit of electricity consumed high, the fixed cost of transmission and distribution depend in part on peak demand which is only a few hours in the evening in rural areas and this demand pattern results in still higher costs for poor rural communities which is one of the main barriers for electrification of these areas [6].The extension of the national electricity grid into rural areas in developing countries is un-economic, therefore, off grid distributed generation is an alternative approach to rural electrification [7]. According to Ghimire et al. (2010), inaccessible geographical terrain of Nepal is the main barrier to harnessing electricity from potential renewable energy resources[8]. Parajuli (2011) also mentioned that access to electricity in Nepal has a big challenge due to geographical variations, poor transportation infrastructure, fragmented settlements, an elusive electricity development strategy, and a lack of sufficient capital[9]. Gurung et al (2011) concluded that there are also social promotional barriers like making target community aware of the subsidy and proper delivery channel for the implementation of subsidy policies for optimal utilization of renewable energy resources in isolated and poor rural communities of Nepal[10]. A study by Oda and Tsujita (2011) based econometric analyses in Indian state of Bihar demonstrate that location of village is the most important determinant of a village's electricity connection [11]. The current level of electricity access and energy poverty in Nepal requires integrated and innovative plans and policies from the government to address these barriers [12]. Subsidies are creating enabling environment in the promotion of renewable energies technologies and creating renewable energy markets and other resources in the context of high willingness to access and pay for electricity [13].Timilsina and Shah (2016) reinforced that developing countries face four key barriers to rural electrification through renewable energy means: a) information to improve energy supply, b) building awareness of renewable energy, c) an adequate financing mechanism and d) policy support to implement renewable energy projects[14].The issue of electricity affordability is recurrent in the context of rural electrification, as the target groups are usually the rural poor. Rural households are usually very willing to pay for access to electricity services, not having access to electricity; they often have to spend much of their time and revenue to buying or collecting energy sources for their day-to-day needs [15].

In summary, it can be said that the first hurdle for development or connection of electricity in rural area is high initial investment in transmission and distribution line or off grid generation of electricity. Because of which the initial payments for the connection are often high for the rural poor. They may have enough to pay for the regular use of electricity but may not be able to afford the connection fees. The second hurdle is setting the affordable tariff which people can pay in monthly basis from their disposable income or at least from their budget of regular energy expenses like in Kerosene, candle or other local resources. Given the very difficult geographical terrain and acute poverty in the rural areas of Nepal, among all rural electrification barriers, financial barrier for initial investment is considered to be main challenges in increasing access to electricity in rural areas. In order to overcome this barrier government of Nepal (GoN) through Rural Energy Policy 2006 [16] made provision to provide grant to investment as direct subsidy and also decided remove tax and duties on import of the equipment for renewable energy technologies (RET) as indirect subsidy to keep the cost of the technology low to the extent possible. Accordingly GoN introduced Renewable Energy Subsidy Policy 2000[17][18]. In last 16 years, GoN made a lot of efforts to review and refined these subsidy policies to make then effective and efficient but there is no formal study in this areas to analyse outcome or effectiveness of these policies. This study has tried to bring a short analysis of the renewable energy subsidy policies of Nepal to discuss it outcome and issues related with it.

2. Pathway of renewable energy subsidy policy

There is enormous confusion about what is meant by an energy subsidy. The narrowest and perhaps most common definition is: a direct cash payment by a government to an energy producer or consumer to stimulate the production or use of a particular fuel or form of energy. The US Energy and Information Administration has defined an energy subsidy as any government action designed to influence energy market outcomes, whether through financial incentives, regulation, research and development or public enterprises. In a similar way, the International Energy Agency (IEA) defines energy subsidies as any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lower price paid by energy consumers [19][20]. Energy subsidies may be direct cash transfers to producers, consumers, or related bodies, as well as indirect support mechanisms, such as tax exemptions and rebates, price controls, trade restrictions, and limits on market access. They may also include energy conservation subsidies. The development of today's major modern energy industries have all relied on substantial subsidy support from respective government [21].

The IEA has been measuring fossil-fuel subsidies in a systematic way for more than a decade. The analysis performed by the World Energy Outlook is aimed at demonstrating the impact of fossil-fuel subsidy removal for energy markets, climate change and government budgets. The IEA report on Energy Subsidies by Country 2015 shows that Iran, Saudi Arabia, Russia, Venezuela, China and India are the top countries providing subsidies for fossil fuels and electricity [22]. Many governments provide subsidies for energy, either explicitly or implicitly, to producers and consumers. Arriving at a global value of for total energy subsidy is not straight forward because different agencies focus on narrower or wider definitions of what exactly constitutes a subsidy and use different methodologies for their calculations [23].

The 1990s saw an explosion of energy policy changes around the globe [24]. Driven by economic, environmental, security, and social concerns, energy regulation has been in great flux. Many of the changes are having a profound influence on renewable energy, both from policies explicitly designed to promote renewable energy and from other policies that indirectly influence incentives and barriers for renewable energy [25].The need for enacting policies to support renewable energy is often attributed to a variety of conditions that prevent investments from occurring. The majority of the population in rural areas relies on traditional biomass resources for energy; whereas in cities, they are forced to use expensive imported fossil fuels for fulfilling their energy needs. Under the current state of technologies, infrastructures and policy, the Nepalese people will continue to rely on traditional biomass resources and imported fossil fuels for many years to come [20]. For developing countries like Nepal, RETs has a large potential, both in terms of available renewable resources and providing clean and reliable energy, to curtail the import of costly fossil fuels, create employment opportunities, preserve the local environment, and improve the quality of life. The realization of the aforesaid potentials, however, requires a more systematic and comprehensive study supported by research and development. Considering the diversity in both available resources and socioeconomic and geophysical conditions, energy policy should pay due care on the proper hybridization of different energy options to meet both the affordability and acceptability of the local people [26]. Except for providing subsidy to some technologies in the form of capital grant, the government has no fiscal regulations for rural electrification by alternative energy technology solutions.

Government of Nepal started periodic planning its development efforts in 1950. In its 5th five-year plan (1975-80), the government started to develop the off grid electrification (micro hydro) sector . As a part of the 6th five-year plan (1980-85), the Agriculture Development Bank Limited (ADBL) launched the "Rural Electrification Project and started to provide some government subsidy to these microhydro schemes. In the 7th five-year plan (1985-90), the GoN recognized the importance of alternative energy technologies and promoted micro hydro projects (MHPs) as a tool for developing agriculture and small scale industries. The 8th five-year plan (1992-97) gave special priority to the energy sector with an emphasis on reducing the gap between urban and rural areas. The Alternative Energy Promotion Centre (AEPC) was established during this period as a body of the GoN to co-ordinate and implement rural energy technologies[17]. The 9th (1997-2002) and 10th five-year plan (2002-2007) set clear targets and put emphasis on solar photovoltaic (PV) for rural electrification. In this period the GoN also brought the formal Renewable Energy Subsidy Policy 2000 and promulgated the Rural Energy Policy 2006[16][18][27]. Gradually the GoN felt the need to embrace more renewable energy technologies to bring access to electricity in rural areas and reduce dependency on traditional energy sources and fossil fuels and accordingly revised and refined its subsidy policies. The main objective stated in the renewable energy subsidy policies of Nepal are to; a) improving agro-processing, reducing drudgery b) promoting renewable energy for basic rural electrification (RE) and replacing imported fossil fuel, c) promoting the private sector in the RE sector d) supporting development of the RET market e) increasing the standard of rural electrification services f) supporting productive use of electricity for enhancing livelihoods g) promoting gender equality and social inclusion in the renewable energy sector and h) turning waste to electricity. Initially there were few objectives of the RE policy but the objectives were added as the RE subsidy policy was reviewed and refined. The 2016 renewable energy subsidy policy embraces all these objectives. The RE policy also made provisions for the transportation subsidy to compensate extra transportation cost to ease transportation barrier in access to electricity[17]. In some RE policy it is a separate amount and in others it is combined to a single amount. The geographical category A,B, C1 actually have different subsidy amounts to address the different transportation cost in rural areas. Table 1 summaries provisions of Renewable Energy Subsidy Policy in its different revisions.

Table 1: Renewable Energy Subsidy Policy Revision Matrix

SN	RE Policies	Subsidy amount in NRS thousand (x000) in different subsidy policies										
		Category A, B, C	IWM-E NPR/kW	Mini-micro hydro NPR/kW			Solar NPR/HH			W2E and BMG mini grid NPR/kW		
				PHP	MHP	Mini HP	SSHS	SHS	S+W MG	BMG	BGG	W2E
1	Renewable Energy Subsidy from (ADBL/N)	50-75% of cost of add- on electrification and sooft loan.						xx				
2	Renewable Energy Subsidy Policy, 2057 (2000) - AEPC	A	27	55	70+T21			12				
		B	27	55	70+T8.75			10				
		C	27	55	70			8				
3	Renewable (Rural) Energy Subsidy Policy, 2063 (2006)-AEPC	A	40	65	85+T21	85+T21	1.2	10				
		B	40	65	85+8.75	85+8.75	1.2	8				
		C	40	65	85	85		6				
4	Subsidy Policy for Renewable (Rural) Energy, 2066 (2009)-AEPC	A	60	97.5	125+T30	125+T30	2	10				
		B	60	97.5	125+T30	125+T30	2	8				
		C	60	97.5	125	125	2	6				
5	RE subsidy Policy, 2069 (2013)- AEPC	A	90	165	255	220	5	7	175	200		
		B	80	150	225	190	4.8	6.2	150	200		
		C	70	135	195	170	4.5	6	125	200		
6	Renewable Energy Subsidy Policy, 2073 BS (2016)- AEPC	A	107.5	210	382	382	5	5	495	445	65	400
		B	82.5	190	285	285	4.8	4.8	465	410	185	400
		C	70	175	260	260	4.5	4.5	430	380	150	400

IWM-E-Improved Water Mills electrification, M-MHEP- Mini hydro (100kW-1000kW) andmicrohydro Projects (5-100kW), PHP-Picohydro projects (up to 5kW) projects, W+S-Wind and solar hybrid system, BMG-Biomass and biogas based electrification project, W2E-Waste to energy electrification project. T- Transportation subsidy separate. SSHS solar home system – less than 10Wp, SHS-above 10 to 50Wp, a solar system with PV with astorage battery.

[1]A, B, C- Geographical category for subsidy amount.A- High mountain regions very difficult, B- Mid hill and not accessible areas, C- Accessible areas by road.

Source: Alternative Energy Promotion Center (AEPC), Government of Nepal

Note: *table 1is prepared taking higher side of the amount in same or similar size technology to make it is ease to compare. In some revisions in subsidy policy technology size is split into more detail which is difficult to capture here. Similarly subsidy for detail feasibility study and rehabilitation of projects is not shown here.*

3. Outcome of the subsidy policy

3.1 Access to electricity in each subsidy policy period

The promotion of renewable energy technologies in Nepal were consolidated after the establishment of AEPC 1996. The center was given mandate by the Government of Nepal and was fortunate to have generous support from external development partners. In 1999, the Denmark government designed a twenty-year framework for an Energy Sector Assistance Program (ESAP) to promote renewable energy technologies which was later joined by the government of Norway in 2003. During the period, Rural Energy Development Program (REDP) launched by UNDP in 1997 was already under implementation. Both of these programs supported Nepal's renewable energy agenda until 2017 in different phases and name of the programs. In this period, Nepal has achieved quite encouraging results in the promotion of renewable energy technologies for rural electrification. The Renewable Energy Subsidy Policy (RESP) 2000 and the Rural Energy Policy 2006 were approved by the government and implemented through AEPC. The RESP was reviewed and revised four times in the period to make it more effective and to include more technologies and to cover more areas. In the last two decades, more than 16% of the total population gained access to electricity from RETs. The credit goes to the generous support of external development partners who provided funds and the policy and institutional arrangement that the GoN made. The Rural Energy Policy 2006 and Renewable Energy Subsidy Policy (2000-2016) are the main policy instruments behind it. Fig.1 shows the numbers of houses those got access to electricity during each RESP period.

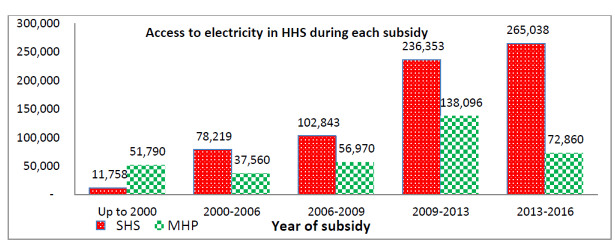

Figure 1: Access to electricity in rural household in each subsidy policy period

Sources: Renewable Energy Subsidy Policy (2000, 2006, 2009, 2013, 2016), AEPC-2016

The data shows the access to electrification from SHS and microhydro increased in each phase of subsidy. In the period, 2000-2006 and 2006-2009 the access was progressive, but during RESP period 2009-2013 and 2013- 2016 the increase in household access to electricity is relatively high. The increase in later years mainly contributed by, on one hand, the increase in subsidy amount in mini/micro hydro and on the other hand due to sharp fall in price of solar PV system (SHS) and higher awareness of RE solutions to rural people who were ready to pay for lighting solutions.

3.2 Cumulative access of electricity in entire period

Fig. 2 shows the cumulative increase in access to electricity in the rural areas in the entire subsidy period of 2000 to 2016. The graph shows year of Renewable Energy Subsidy Policy and cumulative increase in access to electricity separately by SHS and MHP. In the period between 2000 to 2006, the total numbers of HHs with access from MHP were more than SHS. But after 2006 the numbers of HHs with access to electricity by SHS were more than MHP. The HHs with access to electricity increased sharply in the RESP 2009 to RESP 2016. It can be seen that the slope of the access curves has a higher gradient in the recent years then in the past. The subsidy of mini and micro hydro has increased in every RESP revisions, the MHP curve shows upward rise after every revision of subsidy so the beneficiaries of these technologies mostly waited till new subsidy was effective to maximize their subsidy amount. Whereas in case of SHS even though the amount of subsidy per HH has decreased in each RESP revision but the access curve for this technology has a positive gradient. In general, the total access to electricity curves are increasing, but in some years the curves are flat indicating to the shortage of subsidy funds. During such periods, AEPC stopped accepting subsidy applications for the RETs. This occurred when one donor program was finishing and another has not started fully. In the case of micro hydro the approval of subsidy amount and commissioning of MHPs capacity do not have a good matching when both parameters are compared for the same year. Assuming that the impact of the subsidy disbursed is reflected in the installed capacity after a time gap (i.e. subsidy disbursement and construction of MHPs will require time), the real impact of the subsidy amount was translated in project commission matched only after two years. It is also found that the micro hydro development of Nepal is highly dependent on subsidies[27].

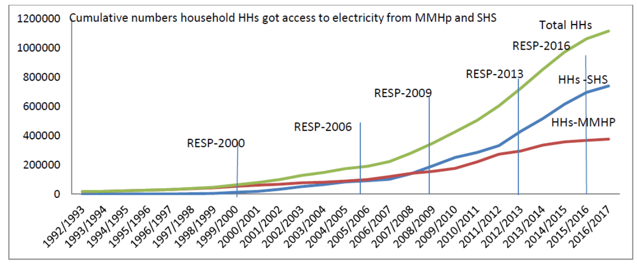

Figure 2: Cumulative increase in access of electricity in rural household in all subsidy policy period

Sources: Renewable Energy Subsidy Policy (2000, 2006, 2009, 2013, 2016), AEPC-2106.

4. Issues on RE subsidy Policy

The analysis in the section 3 shows that the renewable energy subsidy policy that government of Nepal implemented through Alternative Energy Promotion Center (AEPC) has been effective in increasing access to electricity in rural areas easing some of the rural electrifications barriers namely; financial and geographical. However in the span of 20 years of its implementation, a number of issues were raised by different stakeholders who are directly affected by the policy. The beneficiaries or users of the RE technologies and the private sector RET supplier companies are the main beneficiaries of the RE subsidy policy who have raised following issues in different discussion forums, documents and the reports.

4.1 Stability of subsidy policy

Before 2000, the RE subsidy was channeled to support a limited number of technologies like IWM, MHP and some solar home systems through the ADBL. After the establishment of AEPC, it took lead in managing RE subsidy policies. From 2000 -2016, the policy was revised four times. Table 1 above shows that there were substantial changes in the amount of subsidy to different technologies in each revision. The changes in the amount to the same technologies, created ground for beneficiaries to wait for the new policy or just follow earlier policy benefits to them the most. The data suggests that beneficiaries of mini and micro hydro waited for a higher subsidy whereas the SHS beneficiaries rushed to gain benefits of the higher subsidy in the existing policy, as the subsidy for SHS mostly decreases in every revision. This created room for some misappropriation and erratic flow of subsidy applications forms in AEPC. In a number of occasions, there were situations when the new policy was not approved and the old one was already in-active creating confusion and instability in the RE sector.

4.2 Lack of fund available for subsidy

Promotion of renewable energy technologies in Nepal started mainly by donor supported programs. The Government of Nepal started to contribute to the subsidy funds only after some years of its implementation. Different donor programs had different modality of implementation, subsidy disbursement and even different subsidy amounts for a technology in the same rural areas. It is said that even though the government was revising subsidy policy to make it market based but the beneficiaries of the policy always raises the concerns on the lower percentage of subsidy compared to total project cost.

Due to limitation of funds in the program, the subsidy rate and fund for the subsidy was not enough to cover all the technologies and demand eligible for subsidy in rural areas. In many occasions, AEPC had to announce time bound quotas for the different technologies. Specially, due to the high demand of SHS, the beneficiaries waited until the subsidy program was re-opened and many a times the SHS supply companies had to wait months to get the subsidy reimbursed. Pokharel (2003) in his paper on alternative energy technologies in Nepal and the promotional barriers for their implementation concluded that, except for providing subsidies, mainly donor driven, which is also inconsistent, there is no proper policy or legal framework to regulate the alternative and renewable energy sector [28].

4.3 Long process to claim subsidy

The RE subsidy policy always coupled with RE subsidy delivery mechanism, which was prepared to elaborate the process of application and payment of subsidy. In order to comply with requirement of the government and the donors, these mechanisms were lengthy and demanded a number of documents to claim the subsidy. Stakeholders criticized it as a very bureaucratic and resource consuming process. For small RET like SSHS and SHS, the cost of subsidy claiming came out to be substantial portion of total subsidy amount, as shown in Fig. 1.

The RE subsidy policy of Nepal work on the principle of result based financing (RBF), the subsidy amount is reimbursed by AEPC only after achieving output, which demands upfront investment from RETs supplier for quite a long period, resulting in higher cost of capital to them. In a number of interactions, RETs suppliers argued the in general, the cost of claiming, with management and follow up costs, comes to around 15-20% of the total subsidy amount.

Beaton and Moernhout (2011) also mentioned that subsidies for the deployment of RETs appear to be relatively ineffective at overcoming a number of barriers commonly referred to as “non-economic”, including regulatory obstacles, infrastructure and access to information. They argued that failure to attend to these factors may result in an ineffective or unnecessarily costly subsidy mechanism [29].

4.4 Need of smart and targeted subsidy policy

It can be seen from Table 1 that the RE subsidy policy was trying to embrace all the technologies for rural electrification as it got revised. The amount of subsidy provided to different technologies to increase access to electricity is very different, it does not seems like following any logic or proper cost baseline, economic status of recipient of subsidy. The revision of policy is not backed by proper analysis on the effectiveness or short comings of the last RE policy. On the other hand, as Nepal does not have rural electrification master plan so the RE subsidy policy cannot base on the particular technology preference plan for a rural area. This resulted in rationing of available funds to different technologies either based on the demand of technology supplier or donor who provided funds. This resulted promoting in less optimal technology solutions in terms of long terms sustainability and better economic return of subsidy investment.

Keyuraphana et al. (2012) also found that the government needs to set up the renewable master plan by brainstorming of all stakeholders' e.g.. government, state enterprise, power producer and educational organizations to design a subsidy scheme for different RET. Last but not least, public awareness and participation should be created to support the government subsidy scheme [30].

4.5 Equity Vs Equality in subsidy

The RE subsidy policy mainly based on the equal access principle, meaning the amount of subsidy for a broader geographical area was kept the same. Even though it made broad provisions of three category for subsidy A, B, C, but in particular category (A or B or C) also there exist a very diverse economic status, paying capacity of people and also very different geographies. The subsidy policy revision were mainly based on the rough estimates of the cost of technologies than the purchasing capacity of the rural poor, therefore, the policy could not reach poor households. The rural households who adopted SHS or communities who could develop MHPs were relative better off in economic status. It can be said that, the provision of the subsidy was not giving everyone equitable access to have RE solutions of their paying capacity. In the later revisions, though the policy added an extra subsidy for gender equity and social inclusion (GESI), but it was nominal to make a big difference. Justification for use of energy subsidies vary from social welfare protection, job creation, the encouragement of new sources of energy supply and economic development to energy security. There is a widespread belief that, to benefit the poor, electricity needs to be sold at a very low price, facts often prove the contrary. In reality richer communities will benefit more than the poorer ones since they can afford to buy electric appliances. In addition, subsidies should be designed in such a way that only poorest segments of society benefit from them and not better ones of communities[23].

5. Conclusions

The Renewable Energy Subsidy Policy of Nepal has been effective in meeting its objectives. The renewable technology based rural electrification has helped improve agro-processing, reduced drudgery, promoted renewable energy for basic rural electrification (RE) and replaced imported fossil fuel, promoted the private sector in the RE sector and development of RETs market, enhanced livelihoods by promoting productive use of electricity, promoted gender equality and social inclusion in the renewable energy sector.

The establishment of AEPC in 1996 revised and refined the RE subsidy policy four times up to 2016. In all, the revisions have increased MHP and decreased SHS subsidy amount . The numbers of rural households gaining access to electricity has increased. But the numbers of HHs buying SHS have been higher than those of MHPs. In the subsidy period 2009-2013 only, four hundred thousand rural households gained access to electricity from SHS and MHP which is highest number.

The analysis showed that the RE subsidy policy of Nepal was instrumental in increasing access to electricity to rural areas. Around one million households amounting one sixth of the total current population gained access to electricity in the period of 15 years. It should be considered as a great achievement for Nepal, because during this period, most other sectors were virtually stagnant as the country was struggling to overcome an armed conflict, drafting and implementing a new federal constitution for Nepal. The development and promotion of off-grid renewable energy technologies is very crucial for faster increase in electricity access to rural areas.

But, it is the need of the time to define a minimum quantity of electricity needed to make available by service provider to a rural household to qualify one with access to electricity, it should at least be enough to cover basic lighting, entertainment and using light electrical appliances based on United Nation's, sustainable energy for all by 2030 (SE4ALL) initiative, which gives clear definition for access to electricity in a multi-tier framework (MTF).

The subsidy policy has been successful in overcoming financial and geographical barriers of rural electrification to some extent. Though the RE policy is performing well, there is a need to address important issues to make it more stable, smart, targeted and to promote equitable access for electricity to all needy people of rural areas.

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