NEPAL ELECTRICITY AUTHORITY

PLANNING, MOINITORING AND INFORMATION TECHNOLOGY

SYSTEM PLANNING DEPARTMENT

LOAD FORECAST REPORT

JULY 2015

SUMMARY

The present study – the Load Forecast Report, 2014/15 (based on Power System Master Plan for Nepal, Load Forecast Report, 1997 by the Norconsult under ADB's TA programme) covers Nepal's internal load growth from the period of fiscal year 2014/15 to fiscal year 2033/34.

Basically the study is based upon the parameters assumed by the Norconsult. The other information presented in the report has been collected from different departments of NEA and other Government Agencies. The methodology and models used in this report are the same as that of Norconsult report, 1997. The power consumption in the fiscal year 2013/14 has been utilized as a base for this study.

Nepal is listed as one of the least developed countries in the world in economic terms and has a per capita income of about USD 426.48 on 2014*[1]. The poverty is widespread with 25.2%*[2] of the population living below the poverty line. The economy is characterized by low productivity, subsistence farming, a narrow export base, low domestic savings and a high dependence on foreign assistance. Development is constrained by difficult terrain and weak infrastructure, and regional imbalances are wide.

Economic growth is influenced predominantly by the performance of agriculture which, given limited irrigation facility, is highly dependent on weather. The share of agriculture sector to GDP is about 31.7% at present. The manufacturing sector accounts for about 6.29% of GDP. The economic growth has not improved substantially over time to overtake population growth. As the current population growth is 1.35% per annum, the gain achieved by development activities has been overshadowed by growing population.

In the FY 2014/15, the GDP was estimated to increase by 6.4 percent with agriculture and non-agriculture sectors registering of 4.5 percent and 6.7 percent growth respectively. But due to the severe earthquake on 25th April 2015 and the subsequent after shocks following the date and thereby causing mass destruction is responsible for the national economy to shrink. The figures presented by the Department of Statistics show that GDP growth rate for the Fiscal Year 2014/15 would remain 3.36%. The forecasts of the GDP for the coming years have not been published from the concerned deparments.

*1 (Source: www.tradingeconomics.com)

*[2] Source: World Bank (www.data.worldbank.org) shows the percentage of people living below the poverty line is 25.2% in 2010.

The country at present is implementing the Thirteenth Three Years Plan (FY 2013/14 to 2015/16) published by National Planning Commission.

For FY 2014/15, the GDP growth figures after earth quake as obtained from the Department of Statistics are as follows:

Sector	**Growth Rates (% per annum)**
Agriculture	1.87
Industry	2.6
Commerce	2.38
Others	5.51
Total GDP	**3.36**
Per capita GDP	**1.98**

The sectoral GDP growth rates for FY 2015/16 published by National Planning Commission in her Thirteenth National Plan are as follows:

Sector	**Growth Rates (% per annum)**
Agriculture	4.8
Industry	5.66
Commerce	7.11
Others	7.94
Total GDP	**6.42**
Per capita GDP	**5.0**

For the remaining years during the planning period the GDPs are taken as in the previous load forecast study.

The results of the Population Census, 2011 conducted by the Central Bureau of Statistics have been used for this load forecast. According to the population census, the total population of Nepal was 26,494,504 with average household size of 4.88 in 2011. The annual average growth rate of population is 1.35

percent. With this growth rate, it has been estimated that the total population would be 27.59 millions in the year 2014.

Based on the estimated economic growth and population projections, the per capita GDP is projected to grow at an average rate of 1.98 percent(on 2014/15, distorted due to the earth quake on 25th April 2015), 4.59 percent (2015/16 to 17/18), 5.08 percent (18/19 to 22/23), 5.57 percent (23/24 to 27/28) and 6.07 percent (28/29 to 33/34) per annum over the base case of the forecasting period.

NEA's new consumer connection in the year 2013/14 is 256,793. From FY 2014/15 to FY 2020/21 new consumers are assumed to grow by 4 % to meet the Electrification Ratio of 80% in FY 2020/21 (Article 5, CDP, Mission, Page 9). The new consumer growth is assumed to reduce by 44,100 annually from F/Y 2021/22 to F/Y 2027/28 so as to meet an Electrification Ratio of 90% in F/Y 2027/28 (Article 4, CDP, Vision, Page 9). From F/Y 2027/28 to F/Y 2033/34 new consumer growth rate is increased in such a way as to keep an Electrification Ratio of 90% in the subsequent years.

The Electricifation Ratio of 90% in those years mean that remaining 10% of the population will use alternative sources such as solar source or the others as the source of electricity.

The annual consumption figure for new consumers is taken as 368 kWh per annum in the base case on year 2014/15. As there is no good source to know the average energy consumption per annum by the new consumers so the figure is derived by taking an assumed annual consumption figure of 315 units per new connection in year 2003/2004 and that of 360 units in year 2011/12 forecast (published in year 2013/14) and extrapolating. The units consumption per new consumers per annum is as follows. (The average consumption per annum of the new consumers is taken as a step for a particular interval) :

Table: Average Annual Energy Consumption (kWh) for new consumers

14/15- 17/18	18/19 – 22/23	23/24-27/28	28/29-33/34
380	410	450	490

The income elasticity figure of 1.4 has been applied in the forecast.

Price elasticity figure of -0.4 has been applied which is the same as the price elasticity in other developing countries.

The inflation of 7% has been taken for the whole planning period. National Planning Commission's Thireenth National Plan assumes the figure to remain 7% in her three yearly plans till year 15/16. As there are no other predictions made then, hence the same figure is assumed to continue in the remaining years of forecasting.

The Real price increase is taken as 0% meaning there by the tariff is increased such as to balance the inflation in base case scenario.

The Industrial GDP growth rate is assumed to be 2.6 percent for the FY 2014/15 irrespective from the NPC's figure of 5.6 percent for the year. This figure is derived from the figures obtained from the Department of Statistics with the assessment made after the earth quake on 25th April 2015. The GDP growth rate is taken as 5.32% from F/Y 15/16 to F/Y 17/18, 5.4% from F/Y 18/19 to 22/23, 5.47% 23/24 to 27/28, 5.54% thereafter. (Source for F/Y 15/16 NPC's is 13th three years' plan. Afterwards as per previous forecast.)

A list of identified new industrial loads has been prepared by NEA on the basis of information from Department of Mines and Geology. The projects are in most cases said to be licensed. The total industrial load forecast has been calculated by adding the enormous power demand of these industries to the natural industrial load growth. The other smaller industrial load demand has been catered in the natural growth. As indicated above an annual increase in the electricity tariff of 0% in real terms is projected meaning there by the price increase will just balance the inflation of 7% throughout the planning period.

The elasticity of GDP for commercial and other consumers is taken as 1.3 and 1.2 respectively.

Sectoral GDP related to commercial consumers is projected to grow by 2.38% (FY 2014/15, the result of reduction in projection of 6.26% as per NPC's Thirteenth Naional Plan for the year due to earth quake on 25th April 2015. The figure is derived form the figures publised by Department of Statistics). The projections of the GDP growth rate for the commercial consumers is assumed to be 6.25% from F/Y 15/16 to 17/18, 6.37% in F/Y 18/19 to 22/23, 6.5% in F/Y 23/24 to 27/28, 6.62% thereafter. (Source for F/Y 14/15 Department of Statics' figure of GDP assessment after earthquake on 25th April. Afterwards as per previous forecast.)

The price elasticity for commercial consumers is estimated to be -0.4%, the elasticity in GDP to be 1.3. The tariff increase in real price is taken as 0% meaning there by the price would be increased just as to balance the inflation of 7% per annum.

The projections of the GDP growth rate for the other consumers is assumed to be 5.51% in F/Y 14/15, 7.94 from F/Y 15/16 to 17/18, 8.07% in F/Y 18/19 to 22/23, 8.21% in F/Y 23/24 to 27/28, 8.34% thereafter. (Source for F/Y 14/15 Department of Statics' figure of GDP assessment after earthquake on 25th April. Afterwards as per previous forecast.)

The price elasticity for the other consumers demand for practical purposes is assumed to be price inelastic – given the fact that this consumer group is dominated by public institutions. The elasticity in GDP is assumed to be 1.2 and the real tariff increment is assumed to be 0% (tariff increment would just balance the annual inflation of 7%).

The main electricity-consuming entities within the agriculture sector are irrigation schemes. The irrigation load has been calculated based upon the data provided by the Department of Irrigation (DOI). The department has provided its target for installation of deep and shallow tube wells as per the Agriculture Prospective Plan program. It has also provided a detail power consumption pattern of each tube well and its operating hours.

In the forecast the export sales (committed and non-committed) to India across the border are included. The export sale is assumed to increase by 3% annually.

The total system losses are projected to be reduced from 24.5% at F/Y 2013/14 to 15% in F/Y 2020/21 by decreasing the loss by 1.36% every year. In the remaining years the loss is kept constant of 15%.

An optimistic case is considered with the followings:

Domestic

Average Consumption per new Connection (kWh)

14/15- 17/18	18/19 – 22/23	23/24-27/28	28/29-33/34
380	410	450	490

Number of new customers done the same as in the base case.

Tariff increment is considered as 15% in F/Y 15/16, 20% in F/Y 22/23 and 32/33.

Industrial Customers

Tariff increment is considered as 15% in F/Y 15/16, 20% in F/Y 22/23 and 32/33.

Commercial Customers

Tariff increment is considered as 15% in F/Y 15/16, 20% in F/Y 22/23 and 32/33.

Other customers:

Tariff increment is considered as 15% in F/Y 15/16, 20% in F/Y 22/23 and 32/33.

Results:

The total energy requirement in Nepal is projected to grow by an average of 8.1 percent per annum over the forecast period, from 5,988.98 GWh in F/Y 2013/14 to 28,329.85 GWh in F/Y 2033/34 (including export to India). The peak demand is projected to grow from 1201 MW in F/Y 2013/14 to 5785.3 MW in F/Y 2033/34. The energy demand, supply requirements and peak load forecasts for Nepal for the period 2013/14 to 2033/34 is provided (Appendix 11).

1. METHODOLOGY

1.1 GENERAL

Due to the early stages of electrification in the country, characterised by a low per capita consumption and an important element of supply drive in the development within the sector, an open and disaggregated approach to demand forecasting for Nepal has been adopted. This in in line with the methodology of three of four latest forecasts described above. It implies a forecasting technique which has the flexibility to draw on information peovided by NEA, drawn from government statistics and plans, and obtained from other sources.

Past consumption has been studied on a sectoral (consumer category) basis, linking it to explanatory variables such as production and income. Five consumer categories which are homogeneous with respect to deman determinants have been adopted: domestic, industrial, irrigation, commercial and the others. Recent developments in the price of electricity have been reviewed, as have the number of new consumers and unit electricity consumption.

Past achievements within the electricity sector and economy in general have been studied in order to try to establish realistic estimates with respect to future development of the explanatory variables. Official development plans and projections have been a point of departure.

Future demand relations have been estimated, to which the projected explanatory variables have been applied. In addition, future developments that may represent a shift in demand for electricity, such as large new industry and irrigation projects, have been considered and added, where appropriate. Examples are large new industrial and irrigational loads, and NEA's line extention and new consumer connection programmes.

The forecast covers the Integrated Nepal Power System (INPS), to which small scale exports accross the border to India have been added, in order to obtain total electricity sales.

The forecast is prepared on an unconstrained basis with respect to NEA's ablility to provide the energy, required.

Total system generation and peak demand are derived from total sales by applying the estimates of future loss ratios and load factors.

1.2 DEMAND MODEL

1.2.1 Domestic Sector

The development of electricity consumption is described in terms of an equation with income, the number of new connections, unit consumption and the price of electricity as explanatory variables. Often demographic trends (population growth and urbanisation) are used as explanatory variables. However, for a country like Nepal where only 50.4 percent of the population has direct access to electricity, it is more relevant to use the expected number of new consumers as an explanatory variable than the population growth rate. It is assumed that the new consumers are connected evenly during the year.

The model for the domestic sector is as follows:

$$D_t = D_{t-1}(1 + a_t * b)(\frac{\Delta P_t}{\Delta CPI_t})^c + 0.5 * \Delta N_{t-1} * d_{t-1}(1 + a_t * b)(\frac{\Delta P_t}{\Delta CPI_t})^c + 0.5 * \Delta N_t * d_t$$

Where,

D_t =Electricity Consumption, period t

ΔP_t=Change in price of electricity , period t

ΔCPI_t= Change in consumer price index, period t

ΔN_t=New consumers connected, period t

a_t= Real income growth rate, period t

b= Income elasticity for electricity

c= Price elasticity for electricity for households

d_t= Average consumption for new consumers, period t

1.2.2 Industrial, Commercial and Other Sectors

The development of electricity consumption for industrial, commercial and other consumers may be described as an equation with sectorial GDP and price of electricity as main explanatory variables. In addition, there may be projects of a usually large size that will cause a shift in demand and which therefore should be taken into account separately. However, caution should be exercised to avoid double counting, since historic growth in electricity consumption in the sector will also reflect any large projects.

The model for the commercial and industrial sectors is as follows:

$$D_{t,i} = D_{t-1,i}\left(1 + a_{t,i} * b_i\right)\left(\frac{\Delta P_{t,i}}{\Delta CPI_t}\right)^{ci} + \Delta L_{t,i}$$

where,

$D_{t,i}$=Electricity consumption by sector i, period t

$\Delta P_{t,i}$= Change in price of electricity for sector i , period t

ΔCPI_t= Change in consumer price index, period t

$a_{t,i}$= Real income growth rate for sector i, period t

b_i= Propensity to increase electricity consumption in relation to GDP change, sector i

ci= Price elasticity for electricity for sector i

$\Delta L_{t,i}$= Large new projects in sector i, period t

1.2.3 Irrigation

The electricity consumption for irrigation purposes has varied considerably from year to year due to climatic conditions. It is not

possible to take such variation explicitly into account. The aim of the forecast is therefore to forecast for the long term development around which actual consumption will vary due to climatic and other conditions.

The development of electricity consumption for irrigation purposes is described in terms of an equation with electricity use by existing irrigation schemes as one element, to which actual consumption will vary due to climatic and other conditions.

The development of electricity consumption for irrigation purposes is described in terms of an equation with electricity use by existing irrigation schemes as one element, to which estimates of the requirements of new projects based on land area under irrigation are added.

The model for irrigation consumption is as follows:

$$D_t = D_{t-1}(1 + a) + \Delta A_t * b$$

where,

ΔD_t=Electricity consumption by existing schemes, period t

a=Change in electricity requirements of existing schemes (%, annual growth rate)

ΔA_t= Large, incremental increases in irrigated land area (hectares, specific projects), period t

b= Average electricity consumption per hectare irrigated land

Appendices

Energy Demand and Peak Load Forecasts (Base Case)

Appendix 1

Fiscal Years	Domestic Energy (GWh)	Industrial Energy (GWh)	Commercial Energy (GWh)	Irrigation Energy (GWh)	Other Loads (GWh)	Internal Consumption	Nepal Energy Demand	**Export Energy (GWh)	Total Sales (GWh)	Sales Growth (%)	Energy Demand (GWh)	System Losses (%)	Generation Requirement (GWh)	System Load Factor(%)	System Peak Load(MW)	Peak Load Growth
2013/14	2,138.90	1,618.65	369.09	50.92	334.88	3.5	4,515.91	3.4	4,515.84		4,519.32	24.5	5,988.98	56.9	1201.0	
2014/15	2,249.01	1,801.89	380.51	70.78	357.02	3.7	4,862.87	3.5	4,862.72	7.7	4,866.37	23.2	6,334.73	56.2	1286.1	7.1
2015/16	2,500.28	2,008.59	411.43	91.63	391.04	3.8	5,406.80	3.6	5,406.58	11.2	5,410.41	21.8	6,920.41	55.5	1422.8	10.6
2016/17	2,772.01	2,192.02	444.86	113.52	428.30	4.0	5,954.73	3.7	5,954.42	10.1	5,958.45	20.5	7,491.08	54.8	1559.7	9.6
2017/18	3,065.69	2,543.88	481.00	136.51	469.11	4.2	6,700.41	3.8	6,700.01	12.5	6,704.24	19.1	8,287.02	54.3	1742.2	11.7
2018/19	3,409.20	2,847.56	520.83	160.64	514.54	4.4	7,457.21	3.9	7,456.71	11.3	7,461.15	17.7	9,070.15	54.4	1903.3	9.2
2019/20	3,787.29	3,159.67	563.96	185.98	564.36	4.7	8,265.93	4.1	8,265.33	10.8	8,269.99	16.4	9,889.91	54.5	2071.5	8.8
2020/21	4,198.76	3,307.32	610.66	212.59	619.02	4.9	8,953.24	4.2	8,952.53	8.3	8,957.43	15.0	10,540.57	54.6	2203.8	6.4
2021/22	4,634.33	3,464.54	661.23	240.53	678.96	5.1	9,684.74	4.3	9,683.91	8.2	9,689.05	15.0	11,398.88	54.7	2378.9	7.9
2022/23	5,082.17	3,631.95	715.99	269.87	744.71	5.4	10,450.09	4.4	10,449.13	7.9	10,454.53	15.0	12,299.44	54.8	2562.1	7.7
2023/24	5,582.84	3,812.51	776.49	300.68	818.08	5.7	11,296.26	4.6	11,295.17	8.1	11,300.84	15.0	13,295.10	54.9	2764.5	7.9
2024/25	6,107.47	4,004.93	842.10	333.02	898.68	5.9	12,192.15	4.7	12,190.91	7.9	12,196.86	15.0	14,349.25	55.0	2978.3	7.7
2025/26	6,652.43	4,209.97	913.26	366.98	987.22	6.2	13,136.11	4.9	13,134.71	7.7	13,140.96	15.0	15,459.95	55.1	3203.0	7.5
2026/27	7,219.30	4,428.48	990.43	402.64	1,084.48	6.6	14,131.89	5.0	14,130.32	7.6	14,136.88	15.0	16,631.63	55.2	3439.5	7.4
2027/28	7,809.79	4,661.33	1,074.12	440.08	1,191.32	6.9	15,183.53	5.1	15,181.79	7.4	15,188.68	15.0	17,869.03	55.3	3688.7	7.2
2028/29	8,502.10	4,912.64	1,166.56	479.40	1,310.55	7.2	16,378.48	5.3	16,376.55	7.9	16,383.78	15.0	19,275.03	55.4	3971.7	7.7
2029/30	9,266.99	5,180.65	1,266.96	520.68	1,441.71	7.6	17,684.57	5.5	17,682.44	8.0	17,690.03	15.0	20,811.80	55.5	4280.7	7.8
2030/31	10,097.43	5,466.49	1,375.99	564.02	1,585.99	8.0	19,097.89	5.6	19,095.54	8.0	19,103.52	15.0	22,474.72	55.6	4614.4	7.8
2031/32	10,999.00	5,771.32	1,494.41	609.53	1,744.72	8.4	20,627.35	5.8	20,624.78	8.0	20,633.15	15.0	24,274.29	55.7	4974.9	7.8
2032/33	11,977.76	6,096.42	1,623.02	657.32	1,919.33	8.8	22,282.64	6.0	22,279.81	8.0	22,288.60	15.0	26,221.88	55.8	5364.5	7.8
2033/34	13,040.26	6,443.14	1,762.69	707.50	2,111.42	9.2	24,074.23	6.1	24,071.15	8.0	24,080.37	15.0	28,329.85	55.9	5785.3	7.8
A (%)	10.1	8.9	7.7	19.4	9.3		9.6	3.0	9.6				8.3		8.7	
B (%)	9.5	7.2	8.1	14.1	9.6		8.7	3.0	8.7				8.1		8.2	

A : Average Annual Growth of First Ten Years

B : Average Annual Growth over Forecast Period

Domestic energy also includes the community bulk supply

Note:

1. Energy assumption is exaggerated due to load shedding.
2. It is assumed that the load shedding will be removed by 2017/18. Upper Tamakoshi is expected to be commissioned in F/Y 2017/18.
3. Because of load shedding the load factor obtained is not the real one. So the load factor in 2017/18 is assummed to the load factor similar to the years when there was no load shedding.
4. Years taken under consideration is 1998/99- 2004/2005.
5. GDP growth rate in F/Y 2014/15 is changed and vary from the prediction made by NPC. This is due to the effect of earth quake on 25th April 2015. The figures published by the Department of Statistics were used for the year.

Share of Different Sectors in Total Consumption of Nepal(Base)

FY	Domestic	Industrial	Commercial	Irrigation	Others	Total Nepal	Export	Total Sales
2013/14	2138.9	1618.6	369.1	50.9	334.9	4512.4	3.4	4515.8
2014/15	2249.0	1801.9	380.5	70.8	357.0	4859.2	3.6	4862.8
2015/16	2500.3	2008.6	411.4	91.6	391.0	5403.0	3.8	5406.7
2016/17	2772.0	2192.0	444.9	113.5	428.3	5950.7	3.9	5954.6
2017/18	3065.7	2543.9	481.0	136.5	469.1	6696.2	4.1	6700.3
2018/19	3409.2	2847.6	520.8	160.6	514.5	7452.8	4.3	7457.1
2019/20	3787.3	3159.7	564.0	186.0	564.4	8261.3	4.6	8265.8
2020/21	4198.8	3307.3	610.7	212.6	619.0	8948.4	4.8	8953.1
2021/22	4634.3	3464.5	661.2	240.5	679.0	9679.6	5.0	9684.6
2022/23	5082.2	3631.9	716.0	269.9	744.7	10444.7	5.3	10450.0
2023/24	5582.8	3812.5	776.5	300.7	818.1	11290.6	5.5	11296.1
2024/25	6107.5	4004.9	842.1	333.0	898.7	12186.2	5.8	12192.0
2025/26	6652.4	4210.0	913.3	367.0	987.2	13129.9	6.1	13136.0
2026/27	7219.3	4428.5	990.4	402.6	1084.5	14125.3	6.4	14131.7
2027/28	7809.8	4661.3	1074.1	440.1	1191.3	15176.6	6.7	15183.4
2028/29	8502.1	4912.6	1166.6	479.4	1310.5	16371.2	7.1	16378.3
2029/30	9267.0	5180.7	1267.0	520.7	1441.7	17677.0	7.4	17684.4
2030/31	10097.4	5466.5	1376.0	564.0	1586.0	19089.9	7.8	19097.7
2031/32	10999.0	5771.3	1494.4	609.5	1744.7	20619.0	8.2	20627.2
2032/33	11977.8	6096.4	1623.0	657.3	1919.3	22273.8	8.6	22282.4
2033/34	13040.3	6443.1	1762.7	707.5	2111.4	24065.0	9.0	24074.0

Appendix 7

Percentage Share of Different Sectors in Total Consumption of Nepal (Base)

FY	Domestic	Industrial	Commercial	Irrigation	Others	Total Nepal	Export	Total Sales
2013/14	47.4	35.8	8.2	1.1	7.4	99.9	0.1	100.0
2014/15	46.2	37.1	7.8	1.5	7.3	99.9	0.1	100.0
2015/16	46.2	37.1	7.6	1.7	7.2	99.9	0.1	100.0
2016/17	46.6	36.8	7.5	1.9	7.2	99.9	0.1	100.0
2017/18	45.8	38.0	7.2	2.0	7.0	99.9	0.1	100.0
2018/19	45.7	38.2	7.0	2.2	6.9	99.9	0.1	100.0
2019/20	45.8	38.2	6.8	2.3	6.8	99.9	0.1	100.0
2020/21	46.9	36.9	6.8	2.4	6.9	99.9	0.1	100.0
2021/22	47.9	35.8	6.8	2.5	7.0	99.9	0.1	100.0
2022/23	48.6	34.8	6.9	2.6	7.1	99.9	0.1	100.0
2023/24	49.4	33.8	6.9	2.7	7.2	100.0	0.0	100.0
2024/25	50.1	32.8	6.9	2.7	7.4	100.0	0.0	100.0
2025/26	50.6	32.0	7.0	2.8	7.5	100.0	0.0	100.0
2026/27	51.1	31.3	7.0	2.8	7.7	100.0	0.0	100.0
2027/28	51.4	30.7	7.1	2.9	7.8	100.0	0.0	100.0
2028/29	51.9	30.0	7.1	2.9	8.0	100.0	0.0	100.0
2029/30	52.4	29.3	7.2	2.9	8.2	100.0	0.0	100.0
2030/31	52.9	28.6	7.2	3.0	8.3	100.0	0.0	100.0
2031/32	53.3	28.0	7.2	3.0	8.5	100.0	0.0	100.0
2032/33	53.8	27.4	7.3	2.9	8.6	100.0	0.0	100.0
2033/34	54.2	26.8	7.3	2.9	8.8	100.0	0.0	100.0

Energy Demand and Peak Load Forecasts (Optimistic Case) *Appendix 2*

Fiscal Years	Domestic Energy (GWh)	Industrial Energy (GWh)	Commercial Energy (GWh)	Irrigation Energy (GWh)	Other Loads (GWh)	Internal Consumption	Nepal Energy Demand	**Export Energy (GWh)	Total Sales (GWh)	Sales Growth (%)	Energy Demand (GWh)	System Losses (%)	Generation Requirement (GWh)	System Load Factor(%)	System Peak Load(MW)	Peak Load Growth
2013/14	2,138.90	1,676.46	369.09	50.92	334.88	3.5	4,573.73	3.4	4,573.65		4,577.13	24.5	6,065.60	57.7	1201.0	
2014/15	2,313.76	1,882.57	391.72	70.78	357.02	3.7	5,019.50	3.5	5,019.36	9.7	5,023.01	23.2	6,538.63	57.0	1310.6	9.1
2015/16	2,492.90	2,020.13	410.70	73.45	391.04	3.8	5,392.06	3.6	5,391.84	7.4	5,395.67	21.8	6,901.56	56.3	1400.5	6.9
2016/17	2,843.95	2,231.06	457.15	76.26	428.30	4.0	6,040.75	3.7	6,040.44	12.0	6,044.47	20.5	7,599.23	55.6	1561.5	11.5
2017/18	3,233.12	2,630.56	508.86	79.21	469.11	4.2	6,925.08	3.8	6,924.68	14.6	6,928.91	19.1	8,564.73	54.3	1800.6	15.3
2018/19	3,692.35	2,988.98	567.22	82.30	514.54	4.4	7,849.83	3.9	7,849.34	13.4	7,853.78	17.7	9,547.45	54.4	2003.5	11.3
2019/20	4,209.10	3,363.72	632.29	85.55	564.36	4.7	8,859.68	4.1	8,859.08	12.9	8,863.75	16.4	10,599.97	54.5	2220.3	10.8
2020/21	4,785.47	3,582.78	704.81	88.96	619.02	4.9	9,785.94	4.2	9,785.23	10.5	9,790.12	15.0	11,520.43	54.6	2408.6	8.5
2021/22	5,415.99	3,821.16	785.66	92.55	678.96	5.1	10,799.45	4.3	10,798.62	10.4	10,803.76	15.0	12,710.31	54.7	2652.6	10.1
2022/23	5,639.51	3,898.97	810.13	96.31	744.71	5.4	11,195.03	4.4	11,194.07	3.7	11,199.47	15.0	13,175.84	54.8	2744.7	3.5
2023/24	6,364.41	4,167.85	904.46	100.26	818.08	5.7	12,360.72	4.6	12,359.63	10.4	12,365.29	15.0	14,547.40	54.9	3024.9	10.2
2024/25	7,153.63	4,460.68	1,009.78	104.41	898.68	5.9	13,633.12	4.7	13,631.88	10.3	13,637.83	15.0	16,044.51	55.0	3330.1	10.1
2025/26	8,008.58	4,779.60	1,127.36	108.76	987.22	6.2	15,017.76	4.9	15,016.36	10.2	15,022.61	15.0	17,673.66	55.1	3661.6	10.0
2026/27	8,936.46	5,126.93	1,258.63	113.33	1,084.48	6.6	16,526.40	5.0	16,524.83	10.0	16,531.39	15.0	19,448.70	55.2	4022.0	9.8
2027/28	9,945.29	5,505.21	1,405.19	118.13	1,191.32	6.9	18,172.04	5.1	18,170.30	10.0	18,177.18	15.0	21,384.92	55.3	4414.5	9.8
2028/29	11,137.08	5,921.17	1,571.07	123.17	1,310.55	7.2	20,070.27	5.3	20,068.34	10.4	20,075.57	15.0	23,618.32	55.4	4866.7	10.2
2029/30	12,482.36	6,374.53	1,756.53	128.47	1,441.71	7.6	22,191.20	5.5	22,189.06	10.6	22,196.66	15.0	26,113.71	55.5	5371.2	10.4
2030/31	13,985.50	6,868.68	1,963.89	134.03	1,585.99	8.0	24,546.07	5.6	24,543.72	10.6	24,551.69	15.0	28,884.34	55.6	5930.4	10.4
2031/32	15,664.96	7,407.29	2,195.72	139.86	1,744.72	8.4	27,160.92	5.8	27,158.34	10.7	27,166.72	15.0	31,960.84	55.7	6550.3	10.5
2032/33	16,228.12	7,590.58	2,270.91	145.99	1,919.33	8.8	28,163.72	6.0	28,160.89	3.7	28,169.68	15.0	33,140.80	55.8	6779.9	3.5
2033/34	18,170.98	8,194.11	2,538.99	152.42	2,111.42	9.2	31,177.14	6.1	31,174.06	10.7	31,183.29	15.0	36,686.22	55.9	7491.8	10.5
A (%)	11.5	9.5	9.4	7.0	9.3		10.5	3.0	10.5				9.1		9.7	
B (%)	11.3	8.3	10.1	5.6	9.6		10.1	3.0	10.1				9.4		9.6	

A : Average Annual Growth of First Ten Years

B : Average Annual Growth over Forecast Period

Domestic energy also includes the community bulk supply

Note:

1. Energy assumption is exaggerated due to load shedding.
2. It is assumed that the load shedding will be removed by 2017/18. Upper Tamakoshi is expected to be commissioned in F/Y 2017/18.
3. Because of load shedding the load factor obtained is not the real one. So the load factor in 2017/18 is assummed to the load factor similar to the years when there was no load shedding.
4. Years taken under consideration is 1998/99- 2004/2005.
5. GDP growth rate in F/Y 2014/15 is changed and vary from the prediction made by NPC. This is due to the effect of earth quake on 25th April 2015. The figures published by the Department of Statistics were used for the year. For year 2015/16 GDP predictions made by NPC in her Thirteenth National Plan was used.

Share of Different Sectors in Total Consumption of Nepal (Optimistic)

FY	Domestic	Industrial	Commercial	Irrigation	Others	Total Nepal	Export	Total Sales
2013/14	2138.9	1676.5	369.1	50.9	334.9	4570.3	3.4	4573.7
2014/15	2313.8	1882.6	391.7	70.8	357.0	5015.9	3.6	5019.4
2015/16	2492.9	2020.1	410.7	73.5	391.0	5388.2	3.8	5392.0
2016/17	2844.0	2231.1	457.2	76.3	428.3	6036.7	3.9	6040.7
2017/18	3233.1	2630.6	508.9	79.2	469.1	6920.9	4.1	6925.0
2018/19	3692.4	2989.0	567.2	82.3	514.5	7845.4	4.3	7849.7
2019/20	4209.1	3363.7	632.3	85.6	564.4	8855.0	4.6	8859.6
2020/21	4785.5	3582.8	704.8	89.0	619.0	9781.0	4.8	9785.8
2021/22	5416.0	3821.2	785.7	92.5	679.0	10794.3	5.0	10799.3
2022/23	5639.5	3899.0	810.1	96.3	744.7	11189.6	5.3	11194.9
2023/24	6364.4	4167.8	904.5	100.3	818.1	12355.1	5.5	12360.6
2024/25	7153.6	4460.7	1009.8	104.4	898.7	13627.2	5.8	13633.0
2025/26	8008.6	4779.6	1127.4	108.8	987.2	15011.5	6.1	15017.6
2026/27	8936.5	5126.9	1258.6	113.3	1084.5	16519.8	6.4	16526.3
2027/28	9945.3	5505.2	1405.2	118.1	1191.3	18165.2	6.7	18171.9
2028/29	11137.1	5921.2	1571.1	123.2	1310.5	20063.0	7.1	20070.1
2029/30	12482.4	6374.5	1756.5	128.5	1441.7	22183.6	7.4	22191.0
2030/31	13985.5	6868.7	1963.9	134.0	1586.0	24538.1	7.8	24545.9
2031/32	15665.0	7407.3	2195.7	139.9	1744.7	27152.6	8.2	27160.7
2032/33	16228.1	7590.6	2270.9	146.0	1919.3	28154.9	8.6	28163.5
2033/34	18171.0	8194.1	2539.0	152.4	2111.4	31167.9	9.0	31176.9

Percentage Share of Different Sectors in Total Consumption of Nepal (Optimistic)

FY	Domestic	Industrial	Commercial	Irrigation	Others	Total Nepal	Export	Total Sales
2013/14	46.8	36.7	8.1	1.1	7.3	99.9	0.1	100.0
2014/15	46.1	37.5	7.8	1.4	7.1	99.9	0.1	100.0
2015/16	46.2	37.5	7.6	1.4	7.3	99.9	0.1	100.0
2016/17	47.1	36.9	7.6	1.3	7.1	99.9	0.1	100.0
2017/18	46.7	38.0	7.3	1.1	6.8	99.9	0.1	100.0
2018/19	47.0	38.1	7.2	1.0	6.6	99.9	0.1	100.0
2019/20	47.5	38.0	7.1	1.0	6.4	99.9	0.1	100.0
2020/21	48.9	36.6	7.2	0.9	6.3	100.0	0.0	100.0
2021/22	50.2	35.4	7.3	0.9	6.3	100.0	0.0	100.0
2022/23	50.4	34.8	7.2	0.9	6.7	100.0	0.0	100.0
2023/24	51.5	33.7	7.3	0.8	6.6	100.0	0.0	100.0
2024/25	52.5	32.7	7.4	0.8	6.6	100.0	0.0	100.0
2025/26	53.3	31.8	7.5	0.7	6.6	100.0	0.0	100.0
2026/27	54.1	31.0	7.6	0.7	6.6	100.0	0.0	100.0
2027/28	54.7	30.3	7.7	0.7	6.6	100.0	0.0	100.0
2028/29	55.5	29.5	7.8	0.6	6.5	100.0	0.0	100.0
2029/30	56.2	28.7	7.9	0.6	6.5	100.0	0.0	100.0
2030/31	57.0	28.0	8.0	0.5	6.5	100.0	0.0	100.0
2031/32	57.7	27.3	8.1	0.5	6.4	100.0	0.0	100.0
2032/33	57.6	27.0	8.1	0.5	6.8	100.0	0.0	100.0
2033/34	58.3	26.3	8.1	0.5	6.8	100.0	0.0	100.0

Load Forecast Comparative

FY	Peak Load (MW) Previous Forecast	Peak (MW) Base Case	Peak (MW) Optimistic Case
2013/14	1303.9	1201.0	1201.0
2014/15	1426.4	1286.1	1310.6
2015/16	1542.6	1422.8	1400.5
2016/17	1653.7	1559.7	1561.5
2017/18	1837.1	1742.2	1800.6
2018/19	2018.8	1903.3	2003.5
2019/20	2208.7	2071.5	2220.3
2020/21	2361.0	2203.8	2408.6
2021/22	2523.0	2378.9	2652.6
2022/23	2695.4	2562.1	2744.7
2023/24	2888.1	2764.5	3024.9
2024/25	3109.0	2978.3	3330.1
2025/26	3345.5	3203.0	3661.6
2026/27	3597.6	3439.5	4022.0
2027/28	3866.4	3688.7	4414.5
2028/29	4168.8	3971.7	4866.7
2029/30	4493.2	4280.7	5371.2
2030/31	4841.4	4614.4	5930.4
2031/32	5216.4	4974.9	6550.3
2032/33	5621.8	5364.5	6779.9
2033/34		5785.3	7491.8