The Coming Era Of Energy Resources Using Forecasting Techniques and Energy Calculator App

(Renewable & Non- Renewable)

B. Samanvitha (Author)
Department of Mathematics
Vellore Institute of Technology
Vellore, INDIA
bayaneni.samanvitha2019@vitstudent.ac.in

Hanita Jain (Author)
Department of Mathematics
Vellore Institute of Technology
Vellore, INDIA
hanita.jain2019@vitstudent.ac.in

DR. CH. RAJAN (GUIDE)
Department of Mathematics
Vellore Institute of Technology
Vellore, INDIA
rajan.chattamvelli@vit.ac.in

Abstract—**So far, electricity has become the most crucial necessity of mankind, whether it is to charge a mobile phone or to launch a rocket into space. This study discusses the consumption of electrical energy over the years among different sectors of India such as; industrial, domestic, agricultural and few others. We particularly focus on resources such as thermal power, hydropower and the inexhaustible energy resources like solar energy, wind energy, tidal and wave energy, nuclear energy, etc. We compared the consumption of electricity generated through renewable resources with that of non-renewable resources and it was observed that there is less electricity generated through renewable sources. By studying the utilization pattern of the past years, the rate of increase in the energy utilization by hydro and thermal power is predicted for the coming years. But, until generation of electricity through renewable resources does not become more viable, we have to monitor and control the usage of electricity so that we reduce the burden on non-renewable resources of energy. In this regard, we will be discussing the prospects of making contracts with the industrialists to generate 30%-40% electricity using renewable resources and for domestic purpose we have developed an app through which power consumption can be regulated and minimized easily.**

Keywords- Forecasting, SPSS, Excel, Android studio, Solar Energy, Thermal Energy.

I. INTRODUCTION (HEADING 1)

Remember those power cuts we used to have during summer season, to save electricity? In fact, we still have some major power cuts in summer seasons. Now, imagine having those power cuts every season, right? But that's what we all are going to face in the coming years if we don't keep a tab on our energy consumption. Because the major source of energy is thermal energy which is a non-renewable energy resource and we will run out of it soon. That is why we need to find an alternative before the situation gets out of our hands because our generation is the last generation to prevent this irreversible damage. But we already have alternatives that are renewable energy resources such as hydro power which is the second major source of energy, solar energy, and wind energy, bio-mass; but all these are not being taken seriously due unawareness. So, how do we bring awareness among people? Previous studies have proposed few remedies like [1] a data analytic model for IoT, in order to integrate the data collected from different sources and to improve energy-aware decision-making. Improving the overall equipment effectiveness of machine tools will improve resource-efficiency and productivity in manufacturing and support the development of smart factories from an energy point of view. [2]To end extreme poverty and expand shared prosperity, universal access to clean, and affordable energy is required. Sustainable energy solutions require: improved description and detection of human needs; appropriate deployment of technology to help meet these needs; the ability to predict behavior and design appropriate incentives to influence preferences and decisions; more targeted interventions; and be capable of dynamically evaluating interventions in real time to make sure programs are actually delivering on their promises. Each of these components benefits from the tools offered by Big Data Analytics. In this paper, we have predicted the future consumption rates, explained and visualized them which will make it easy for people to understand the problem and take an action in the industry sector. And we have developed an android application to keep a check on consumption in domestic households.

II. DATA ANALYSIS

Data represented here is obtained from data.gov.in and the official website of Ministry of Statistics and Programme Implementation (MOSPI). India is the 3rd largest producer of electricity with capacity of 2, 28,722 MW entirely and worldwide it stands in 4th position. Amongst these, 90,062

MW is contributed by states, 72,927 MW is contributed by commercial sector and 65,733 MW is contributed by central government. India's demand for energy is increasing at a very fast pace since the last ten years. This energy requirement has been magnified by the rapid growth of industry along with domestic consumption. Along with it, the energy supply too has increased, but unfortunately it is not exceeded by the energy demand.

Electricity generation: India's gross generation of power from sources was 6,70,654 GWh during 2006-07. It had a growth till 11,67,584 GWh during 2015-16. The power production from sources rose from 11,16,850 GWh around 2014-15 to 11,67,584 GWh around 2015-16 noting a CAGR of about 4.54%. overall generation of electricity in India from sources and non-sources around 2015-16 was 13,35,956 GWh, out of this power generation from sources like coal was 9,43,013 GWh and like hydro was 1,21,377 GWh, from nuclear sources was 37,414 GWh.

Installed generating capacity of electricity: India's entire power capacity rose from 154664 MW in 2007 to 350367 MW in 2016, with a CAGR of 8.52%. The power generation capacity was increased in 2015-16 by 10.74%. By March 2016, the total installation capacity of thermal plants was 73.50% which is around 257528 MW. The remaining inexhaustible energy resources (except hydro) have a total installation capacity of 12.62% which is around 44217 MW. The hydro and nuclear energy resources took up 12.23% and 1.65 % respectively of the entire installation. The complete installation of grid interactive inexhaustible source was around 35776.96 MW in 2015 and had rose up to 42849.38 MW in 2016 which shows a growth of 19.77%.

Electricity consumption: The predicted power consumption rose from 4,55,749 GWh in 2006-07 to 10,01,191 GWh in 2015-16 with a CAGR of 8.19%. The growth in power consumption was 5.55% from 2014-15 to 2015-16. Amongst the entire power consumption in 2015-16, industrial area took the biggest part (42.30%), next in line was domestic(23.86%) and then agriculture (17.30%) with finally commercial area (8.59%). The power consumption in industrial and domestic area rose rapidly when compared with others in 2006-07 to 2015-16 with 9.47% and 7.97 % CAGR.

Production of energy for commercial purpose: 609.18 MTs was the coal production in 2014-15 and 639.23 MTs in 2015-16 indicating a rise of 4.93%. in India, 430.83 MTs in 2006-07 was the generation capacity that rose to 639.23 MTs in 2015-16 that is 4.02%. The electricity CAGR with 4.68% for the period 2006-07 to 2015-16 which has the highest growth rate among all the commercial energy resources since 2006-07 to 2015-16. The entire power generation from commercial sector went down to 13767.83 peta joules in 2015-16 from 14090.95 peta joules in 2014-15 indicating 2.29% decrease. The power generation in peta joules indicates that the coal was the crucial contributor of power for commercial utilities which is around 70.25% of entire power generation in 2015-16.

NON-RENEWABLE ENERGY RESOURCE THERMAL ENERGY: Most of India's electricity is from non-renewable power sources, coal being the major contributor. 48% of the total power production is contributed by 5 states- Gujarat, Maharashtra, Tamil Nadu, Uttar Pradesh and Andhra Pradesh. Coal reserves are majorly in Southern and Eastern regions of our country. The major states with coal mines are Telangana, Jharkhand, Madhya Pradesh, Odisha, West Bengal, Maharashtra and Chhattisgarh. As on march 2016, the coal reserves were 308.80 BTs. The inexhaustible power energy production's overall scope in our country in 2016 was predicted around 1198856 MW. From 2006-07 to 2015-16, 5.74% of CAGR growth has been seen in coal availability. This growth can be attributed to the rise in coal generation boosted by import. CAGR of 6.06% was seen in the raw coal consumption by industrial sector from 2006-07 to 2015-16.

Table 1: State wise Energy Consumption from 2007 to 2017

year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Andaman nicobar	458	515	475	506	499	501	559	368	361	355	370
Andhra pradesh	802	877	928	1014	1065	1157	1135	1196	1040	1230	1319
Arunachal pradesh	299	456	447	503	582	683	719	503	525	600	648
Assam	175	188	199	209	223	250	240	280	314	322	339
Bihar	91	101	107	117	127	134	145	160	203	258	272
Chandigarh	1487	1557	1247	1239	1283	1217	1168	1133	1052	1112	1128
Chhattisgarh	935	874	1418	921	1118	1320	1495	1601	1719	2022	2016
Dadra nagar haveli	13310	14787	11094	11709	13367	13767	14341	14515	13769	15137	15783
Daman diu	8950	9473	6508	7202	7810	7785	7927	8003	6960	7836	7965
Delhi	1417	1433	1374	1448	1530	1587	1613	1446	1561	1557	1574
goa	2098	2169	2260	2005	2061	2025	2045	2198	1803	2738	2466
Gujarat	1331	1486	1457	1559	1508	1663	1796	1973	2105	2248	2279
Haryana	1208	1296	1279	1491	1485	1628	1722	1773	1909	1936	1975
himachal	872	967	1016	1145	1251	1289	1380	1348	1336	1339	1340
Jammu Kashmir	759	795	894	968	988	1015	1043	1066	1169	1234	1282
Jharkhand	659	643	696	750	749	790	847	810	835	884	915
Karnataka	806	844	854	873	925	1081	1129	1179	1211	1242	1367
Kerala	441	444	444	537	551	594	630	645	672	704	763
Lakshadweep	402	427	453	429	532	550	592	665	657	649	633
Madhya pradesh	582	623	584	618	674	672	753	764	813	929	989
Maharashtra	975	1020	969	1054	1096	1204	1239	1183	1257	1318	1307
Manipur	195	222	242	207	242	236	353	266	295	360	326
Meghalaya	547	629	655	613	654	658	690	684	704	835	832
Mizoram	163	354	378	429	462	507	469	445	449	503	523
Nagaland	173	199	226	242	265	257	268	259	311	346	345
Odisha	665	752	775	838	1070	1146	1209	1349	1419	1564	1622
Pondicherry	2693	2357	1988	1865	1850	2125	2136	1692	1655	1672	1784
Punjab	1506	1614	1553	1663	1736	1799	1761	1810	1858	1919	2028
Rajasthan	591	692	747	811	844	927	982	1011	1123	1164	1166
Sikkim	533	732	806	845	880	886	862	700	685	687	806
tamilnadu	1080	1145	1134	1211	1233	1277	1226	1544	1616	1688	1847
telangna									1356	1439	1551
Tripura	179	202	204	224	222	254	296	331	303	329	470
Uttar pradesh	341	346	372	387	412	450	450	472	502	524	585
Uttaranchal	707	856	921	930	1144	1232	1297	1285	1358	1431	1454
West Bengal	397	439	442	515	538	564	594	609	647	660	665

Source: Energy Statistics 2017, MOSPI, CSO.

The graphs plotted below represent this data showing the trend in energy consumption which is mostly increasing with years amongst all the states and UTs.

Figure.1

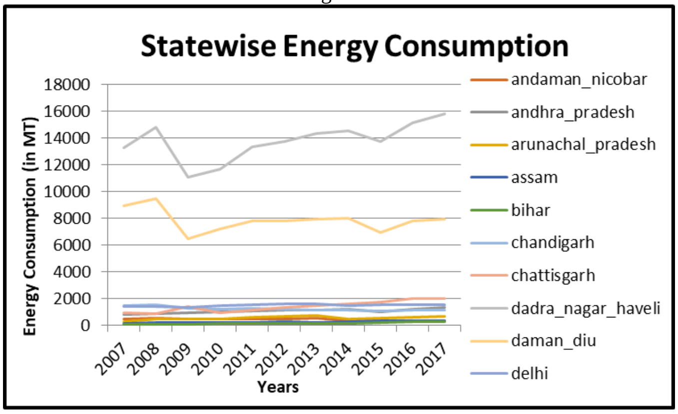


Figure.2

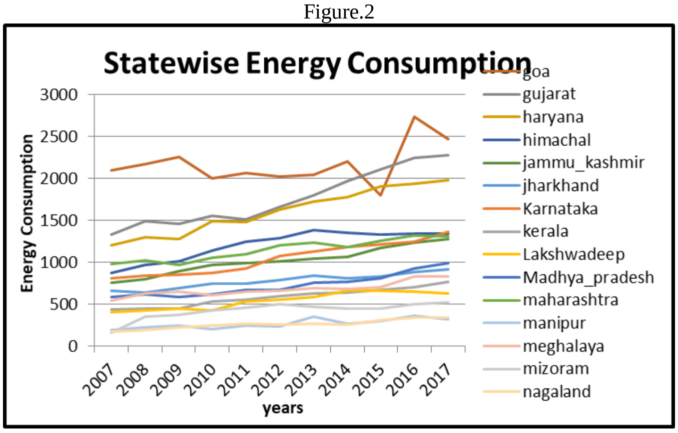
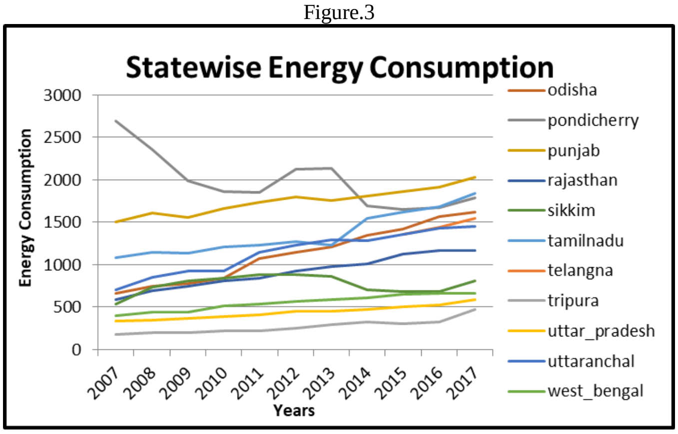


Figure.3



Using SPSS, we forecasted the energy consumption for the next few years, starting from 2018 to 2030, with the help of the data obtained from the MOSPI report.

Some of the forecasting models that were used to predict the consumption were, Holt's forecasting model: this model is also known as linear exponential smoothing model used to forecast data with trend. This model basically has three different equations working simultaneously to obtain the final predicted value. The first equation modifies the before forecasted value for previous interval's trend. In the second equation, the trend of the data is automatically noted, which is difference in the previous 2 forecasted values. And in equation 3, we calculate the final forecasted value. ARIMA model (p, d, q): it stands for the AutoRegressive Integrated Moving Average. It is a forecasting model which makes use of the dependent association ship between the recorded value and the lagged observation. It makes the time series data stationary by taking the difference between the previous observed values. ARIMA models are based on the concept of moving averages that has residual errors from the lagged observations. Here p, d and q denote the lag order, degree of differencing and order of MA respectively.

Brown's forecasting model: Also known as Brown Exponential Smoothing, which is usually applied to the time series data having some trend component but no seasonal component. Hence, the forecasted data obtained using the past data can be tabulated as:

Table2: predicted energy consumption in million tonnes from 2018 to 2030:

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Andaman nicobar	370	355	340	325	310	295	280	266	251	236	221	206	191
Andhra pradesh	1319	1363	1406	1449	1493	1536	1579	1623	1666	1709	1753	1796	1839
Arunachal pradesh	648	648	648	648	648	648	648	648	648	648	648	648	648
Assam	350	367	383	400	417	434	451	468	485	502	519	536	553
Bihar	300	327	353	380	407	434	460	487	514	540	567	594	620
Chandigarh	1003	963	922	881	840	799	759	718	677	636	595	555	514
Chhattisgarh	2088	2203	2318	2433	2548	2662	2777	2892	3007	3122	3237	3352	3467
Dadra nagar haveli	15393	15651	15909	16167	16425	16683	16941	17199	17457	17715	17973	18230	18488
Daman diu	7856	7856	7856	7856	7856	7856	7856	7856	7856	7856	7856	7856	7856
Delhi	1604	1622	1639	1657	1674	1692	1709	1727	1744	1761	1779	1796	1814
Goa	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170	2170
Gujarat	2374	2469	2563	2658	2753	2848	2943	3037	3132	3227	3322	3417	3511
Haryana	2102	2184	2267	2349	2432	2515	2597	2680	2762	2845	2928	3010	3093
Himachal	1340	1341	1341	1342	1343	1343	1344	1344	1345	1345	1346	1346	1347
Jammu Kashmir	1334	1387	1439	1491	1543	1596	1648	1700	1753	1805	1857	1910	1962
Jharkhand	935	961	987	1013	1039	1065	1092	1118	1144	1170	1196	1222	1249
Karnataka	1423	1479	1535	1591	1647	1704	1760	1816	1872	1928	1984	2040	2096
Kerala	780	813	846	879	912	945	978	1011	1044	1077	1110	1143	1176
Lakshadweep	656	679	702	725	749	772	795	818	841	864	887	910	933
Madhya pradesh	1056	1140	1224	1308	1392	1477	1561	1645	1729	1813	1897	1981	2065
Maharashtra	1370	1408	1445	1483	1520	1557	1595	1632	1670	1707	1745	1782	1819
Manipur	352	366	381	395	410	424	439	453	468	482	497	511	526
Meghalaya	832	855	879	902	925	949	972	996	1019	1042	1066	1089	1113
Mizoram	559	595	631	667	703	739	775	811	847	883	919	955	991
Nagaland	362	379	397	414	431	448	465	483	500	517	534	551	569
Odisha	1735	1836	1937	2038	2140	2241	2342	2443	2544	2645	2746	2848	2949
Pondicherry	1693	1602	1511	1420	1329	1239	1148	1057	966	875	784	693	602
Punjab	2028	2074	2120	2166	2212	2258	2304	2350	2396	2442	2488	2534	2580
Rajasthan	1262	1321	1379	1438	1496	1554	1613	1671	1730	1788	1847	1905	1964
Sikkim	920	1034	1148	1261	1375	1489	1603	1717	1831	1945	2059	2173	2286
tamilnadu	1924	2000	2077	2154	2230	2307	2384	2461	2537	2614	2691	2767	2844
Telangna	1649	1746	1844	1941	2039	2136	2234	2331	2429	2526	2624	2721	2819
Tripura	417	440	464	487	510	533	556	579	603	626	649	672	695
Uttar pradesh	579	602	625	648	671	694	717	740	763	786	809	832	855
Uttaranchal	1529	1603	1678	1753	1828	1902	1977	2052	2126	2201	2276	2350	2425
West Bengal	692	719	745	772	799	826	853	879	906	933	960	987	1013

And the above data can be plotted on a graph as follows:

Figure 4.

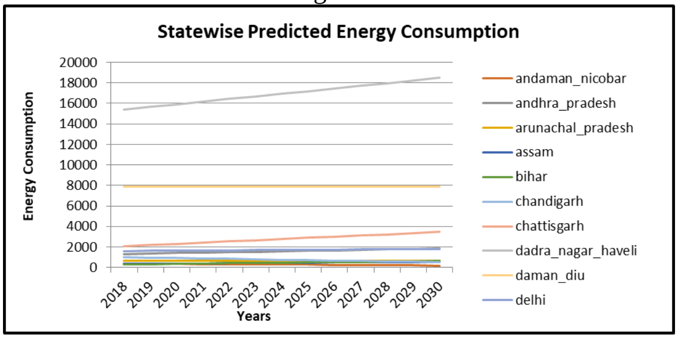


Figure 5.

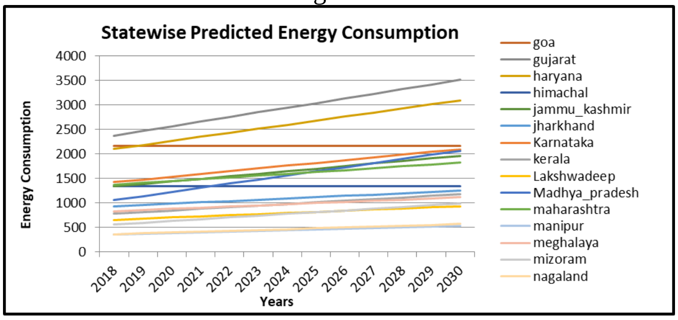
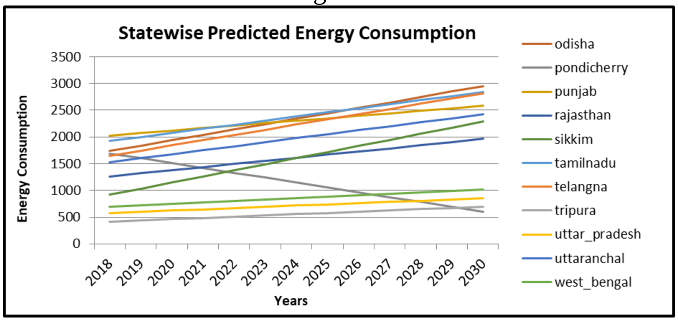


Figure 6.



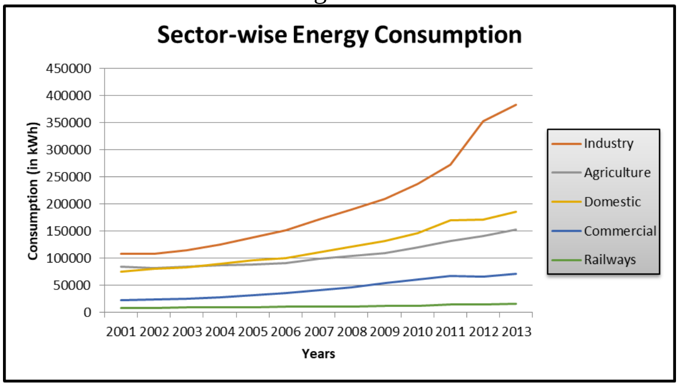
Now let us consider the scenario for various sectors such as industry, domestic, agriculture, etc. We collected the data for consumption of energy by these sectors from the year 2001 to year 2013 from data.gov.in. The data can be tabulated as:

Table3: Sector-wise energy consumption (in kWh) from 2001 To 2013:

Year	Industry	Agriculture	Domestic	Commercial	Railways
2001	107622	84729	75629	22545	8213
2002	107296	81673	79694	24139	8106
2003	114959	84486	83355	25437	8797
2004	124573	87089	89736	28201	9210
2005	137589	88555	95660	31381	9495
2006	151557	90292	100090	35965	9944
2007	171293	99023	111002	40220	10800
2008	189424	104182	120918	46685	11108
2009	209474.1	109609.8	131719.8	54189.19	11424.78
2010	236752	120209	146080	60600	12408
2011	272589	131967	169326	67289	14003
2012	352291	140960	171104	65381	14205
2013	382670	153116	185855	71019	15431

Source: data. gov.in

Figure 7.

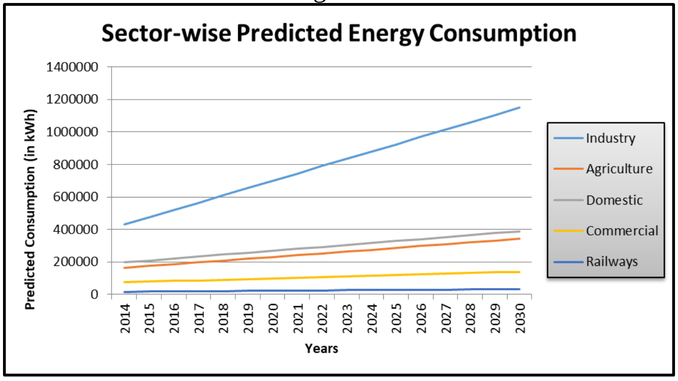


Using the same methods with the help of SPSS, we estimated the energy consumption for the coming years starting from 2014 to year 2030. The estimated consumption quantities can be summarised as follows:

Table4: Predicted energy consumption (in kWh) from 2014 to 2030:

year	Industry	Agriculture	Domestic	Commercial	Railways
2014	429430.2	164166.8	197597.5	75058.5	16398.53
2015	474441.5	175331.7	209569.7	79098	17464.32
2016	519452.8	186496.6	221541.9	83137.5	18530.1
2017	564464.1	197661.6	233514.1	87177	19595.88
2018	609475.4	208826.5	245486.4	91216.5	20661.66
2019	654486.7	219991.4	257458.6	95256	21727.45
2020	699498	231156.3	269430.8	99295.5	22793.23
2021	744509.3	242321.3	281403.1	103335	23859.01
2022	789520.5	253486.2	293375.3	107374.5	24924.79
2023	834531.8	264651.1	305347.5	111414	25990.58
2024	879543.1	275816	317319.7	115453.5	27056.36
2025	924554.4	286980.9	329292	119493	28122.14
2026	969565.7	298145.9	341264.2	123532.5	29187.92
2027	1014577	309310.8	353236.4	127572	30253.71
2028	1059588	320475.7	365208.7	131611.5	31319.49
2029	1104600	331640.6	377180.9	135651	32385.27
2030	1149611	342805.6	389153.1	139690.5	33451.05

Figure 8.



a. RENEWABLE ENERGY RESOURCES

Hydro Energy: our country stands in 7th place in generation of hydro energy worldwide. 44594 MW or 13.5% of the entire electricity production capacity is installed in India in 2017 reportedly.4380 MW of smaller hydroelectric energy units are installed. 122.31 TWh with a 33% of capacity average factor of the total hydroelectricity is produced in India. 148700 MW at load factor of 60% of hydroelectric energy potential is estimated in India. Although water power is said to be a renewable energy source, still we must try to lift off some of the power production load from the water resources as in some parts of India we have already started facing the scarcity of water, for instance; recently there was a huge water crisis in Chennai, Tamilnadu.

Solar Energy: The other and the most reliable solution is the solar energy which is the third largest industry in the world, which is growing at the rate of 25% But it isn't enough growth rate when our current circumstances are taken in to consideration. The fact that we have 300 clear and sunny days, which can help us generate power of 5000 trillion KW per year should drive us more towards this renewable energy resource. Solar energy in single year can possibly exceed the energy output of all fossil fuels in India. 0.20 KW/m^2 of used area which is around 1400-1800 peak capacity operation hours in a year is generated by an average solar power utility. 227.5 MW is the putting capability of economic solar coal power plant (non-storage type) in India with 50 MWs in province and in Rajasthan it is 177.9 MW. Cheaper and clean solar thermal plants with storage capacity are growing to provide electricity. The solar PV and solar thermal storage power plant together can handle the load fluctuations without the use of expensive battery storage. The current solar thermal non-storage power plants in our country that are producing expensive intermittent power each day could be modified into solar thermal storage power plants to produce 3 to 4 times more base load energy at lower costs and not to look for the government subsidies. Solar energy produced principally throughout the morning time during the non-rainy season, compensates wind that produces energy throughout the rainy months in our country. Solar panels can be settled between the towers of wind energy plants. This additionally enhances electricity produced mainly throughout the rainy months. Solar energy plants can be put in close to current hydro energy and pump-storage electricity, making use of the present energy transmission infrastructure and capturing the excess power generated by the photovoltaic plants. Around the morning time the extra auxiliary energy consumption of a solar thermal storage power station can be sort of 100% of the rated capability for method of removing solar power in the form of coal energy. And to reduce the cost of energy, production can be from the low cost photovoltaic plant (33% production) in the mornings while the rest of the day can be from solar thermal energy plant (67% production) to meet 24 hours base load power. 200-3000 Watts motor powered with 1800 WpPV array that can give about 1,40,300 litres of water per day from a complete hydraulic motor of 10m pumps are fitted. Solar electrical phenomenon water pumping systems can be utilized for irrigation and drinking. In 2006, 7068 solar PV water pumping systems were fitted and in 2012 the number rose to around 7771. During summers, solar pumps usage can be increased by managing pumped water flowing over solar panels to keep them neat and cool in order to maintain additional amount of water for the fields. Cheaper solar powered bicycles are obtainable to ply between agricultural activities in village fields, etc. In 2017, 1000MW of solar power was generated and is expected to generate 80KMW by 2020 and 1LMW by 2022. This helped in generation of electricity through solar power where there is lack of electric grids. This led to increase in the installation reach of 25.21GW as of 31 December, 2018. 20 Gigawatts capability was the initial target for 2022 by our government that was reached 4 years ahead. 100 Gigawatts of solar capability was the target increased in 2015 for 2022 resulting in an investment of 100 billion US dollars. The installation of solar power capability went from 2650 MW in 2014 to 20 gigawatts in 2018 which is about 8 times. There has been a drop in the average price of solar power to 18 gigawatts below the typical worth due to installation of 3 gigawatts of solar power in 2015-16, 5 gigawatts of solar power in 2016-17 and over 10 gigawatts of solar power in 2017. 70% of the solar power which is around 3.4 gigawatts is on the rooftops for industrial and commercial purpose. Solar lanterns, solar lighting systems, solar street lighting, solar cookers have been sold out over a great range which lessen the need of kerosene. Indian Railways promised to fit 4 gigawatts solar power on the tracks in January 2019.

Table 5. Solar Energy Production in India month-wise from April 2017-March 2018

Month	Regional solar energy production (gwh)					Total (gwh)
	North	West	South	East	North East	
Mar-18	685.27	703.39	1,872.31	49.26	1.29	3,311.53

Feb-18	548.61	546.8	1,530.38	35.23	0.98	2,677.10
Jan-18	-	-	-	-	-	2,547.77
Dec-17	483.35	465.63	1242.36	31.49	3.35	2,242.64
Oct-17	608.61	456.16	1,069.60	33.31	1.11	2,186.00
Nov-17	518.77	489.3	1,083.92	19.27	1.32	2,094.59
Sep-17	547.08	438.7	974.52	32.84	0.94	2,002.51
May-17	528.92	426.05	935.51	39.72	1.17	1,931.30
Jun-17	489.02	399.95	871.08	36.36	0.92	1,803.35
Apr-17	458.76	419.26	833.47	40.16	0.99	1,752.74

When the internet stored power facility grids frequency is below the required range (50 hertz), the solar energy plants with battery storage facility can be employed to draw more energy from it once the frequency is higher than the required range. Our country faces major construction power tariffs, so we need power plants that are economically feasible, and this can be achieved by installing photovoltaic power plants that are not as expensive as standby generator sets.

III. ANDROID APPLICATION FOR DOMESTIC SECTOR

In here, we have developed an android application using android studio for the domestic households to keep a check on the energy consumption i.e. the electricity usage. The main purpose of this application is to make the public aware of their power consumption by reminding them every week about their usage which helps in lowering their monthly bill and also the consumption of the power. Coming, to the application we have used Android studio is officially an integrated development enivronment for android operating system. This environment uses XML for its front end and Java for its back end. The basic layout of our app is shown below in the images:

Figure 9, 10:

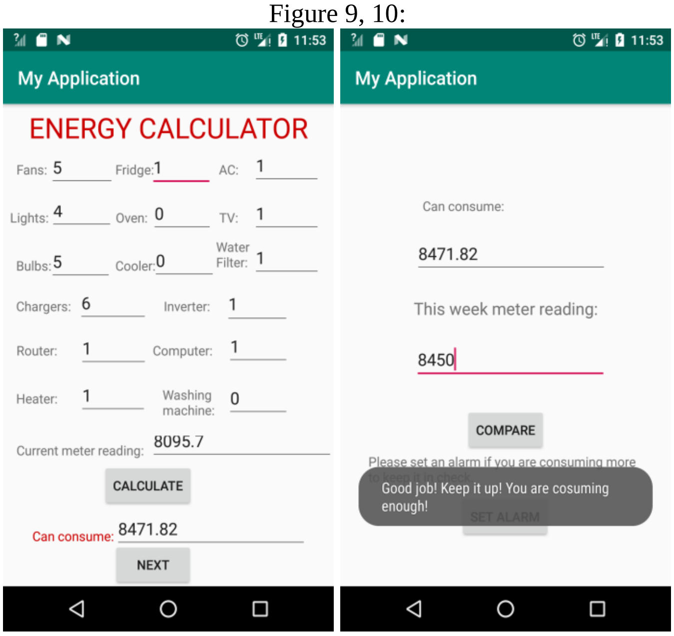
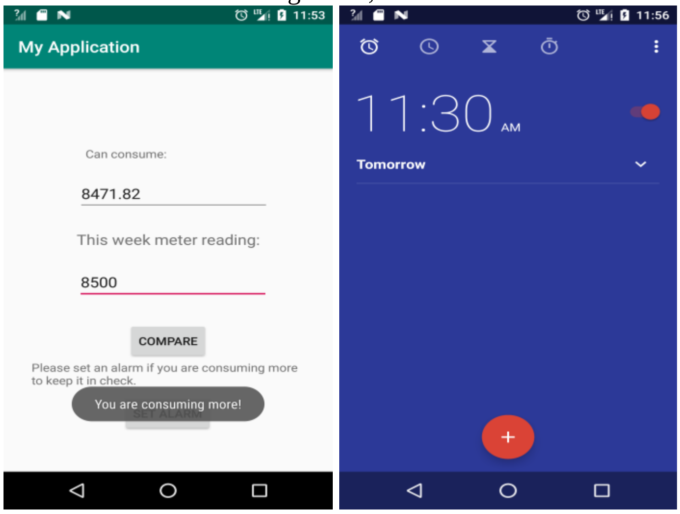


Figure 11, 12:



As we can see, in the app we ask for the client's appliances information and the current reading of his meter. This helps us in calculating the average amount of power he/she can consume in the coming week. We have taken average number of hours a family uses the appliances and multiplied it with week number along with its consumption capacity.

Table 6:

APPLIANCES	AVERAGE NUMBER OF HOURS PER DAY	AVERAGE AMOUNT OF CONSUMPTION PER WEEK
TUBELIGHT	8 HOURS	1.2KW
BULB	8 HOURS	0.7KW
FAN	20 HOURS	10.5KW
TV	6 HOURS	1.2KW
WATER HEATER	2 HOURS	56KW
AC	10 HOURS	70KW
WASHING MACHINE	1 HOUR	3.5KW
OVEN	1 HOUR	15.05KW
FRIDGE	24 HOURS	16.8KW
INVERTER	24 HOURS	151KW
COOLER	14 HOURS	6.8KW
CELL PHONE CHARGER	2 HOURS	0.07KW
ROUTER	24 HOURS	1KW
COMPUTER	3 HOURS	2.1KW
WATER FILTER	24 HOURS	16.8KW

After a week the client can again give his meter reading and the app compares it and gives a conclusion. If the client is consuming enough or less than the expected, it says good job. If the client is consuming more than the average, then the client is asked to set an alarm for the week to remind him every day to keep his usage under control. This way his bill can be managed and the consumption can be reduced.

LIMITATIONS

The app has its own limitations. We have not considered many other appliances like mixer, grinder etc. We have also not considered parameters like consumption of power by small fan, big fan or consumption of fan when the regulator is at its maximum, minimum, medium. We have considered average consumption of all the devices we have mentioned in the app.

CONCLUSION

India's economy is one most rapidly growing economies, but it is not projected to reach the level of energy consumption seen in other major economies- International energy outlook, 2018. The above statement can be justified from the above discussions where we showed the future consumption rates in India and how we will run out of our current sources if we continue to use the same amount of thermal and hydro energy resources at this rate. We have also shared our alternatives which is solar energy that will be a perfect replacement for the current major sources of energy. We further discussed an application on energy saving for the domestic sector which will help the public to keep a check on their energy consumption and reduce monthly current bill. We still have limitations and will work to minimize the limitation to maximum level to make it more efficient.

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