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All is not well that lights not well

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The first electric bulb glowed in Kerala in 1906 when its first hydroelectric generator of 200 kilo Watt (kW) ran in a private tea estate (the Kannan Devan Hill produce Company) at Munnar in the High Ranges in the then Travancore area. However, it took more than two decades after that for the Government to come to the scene by commissioning (on February 25, 1929) a 5 mega Watt (MW) thermal station in Thiruvananthapuram, exclusively for the royal and administrative uses. The first public sector power project, designed on a large scale for commercial uses, in Kerala came on line in March 1940 with the first unit of 5 MW of Pallivasal hydro-electric power station. Within the next decade, five more units were added to the project to increase its installed capacity (IC) to 37.5 MW. Sabarigiri hydro-power station of 340 MW of IC, commissioned in 1966-67, was the first (of the two) major power project in Kerala. Idukki, with 780 MW of IC and commissioned in 1976 (I Stage) and in 1985 and 1986 (II Stage) is the largest hydro-power station in Kerala. These two stations together constitute about 54.4 per cent of the total State sector hydropower IC of 38 plants(2058.76MWin 2018-19) in Kerala even today. Along with a few diesel (2), wind (1) and solar (22) small power projects, KSEBL now owns an IC of just 2237.2 MW and draws in power from different external sources such that the total IC of the Kerala power system is now 2999.93 MW (as in 2018-19: Table 1).

Table 1. Installed capacity (MW) of Kerala power system

		2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
KSEBL	Hydro	2008.6	2024.15	2046.15	2049.76	2055.76	2058.76
	Thermal	234.6	159.96	159.96	159.96	159.96	159.96
	Wind	2.03	2.03	2.03	2.03	2.03	2.03
	Solar			1.16	8.83	14.71	16.419
	Total (KSEBL)	2245.23	2186.14	2209.29	2220.57	2232.46	2237.169
Central sector	NTPC	359.58	359.58	359.58	359.58	359.58	359.58
IPP and others	Thermal	198.93	198.93	198.9	198.9	157	157
	Hydro	55.11	58.16	58.16	58.16	66.16	70.66
	Wind	32.85	32.85	41.25	57.25	58.25	58.25
	Solar			13.7	72.78	97.46	117.267
	Total (IPP and Others)	286.89	289.94	312.01	387.09	378.87	403.177
	Grand total	2891.72	2835.68	2880.9	2967.31	2970.92	2999.926

Source: KSEBL Annual administration report, various years

The Kerala la State Electricity Board Limited (KSEBL), the second SEB to be set up on 31.03.1957 under the Electricity (Supply) Act, 1948, with the prime objective of rationalisation of power development at the State level, inherited an IC of 93.5 MW, that rose to 1995 MW by 1999-2000, as against an estimated requirement of about 3160 MW as per the 14th Annual Power Survey (APS). This huge demand-supply gap further widened such that in 2017-18, the system was able to meet only 87% of the energy requirement of 23850 million units (MU; 1 unit = 1kWh). Sadly, Kerala's own energy generation accounted for only 22.4% of this energy requirement. The remaining vast deficit had to be covered with the cushioning energy import to the tune of about 80% in the recent years (Table 2). Still worse, even though own energy and import together exceeded the energy requirement (by about 2%), technical losses in transit burnt away as much as 546 MU, leaving 13% of the energy requirement still unmet! Of course, technical losses are inevitable in a power system, but its minimization is not at all impossible. This in turn can mean that the very costly energy import could well be reduced to some extent.

Table 2. Physical performance of the Kerala power system

	Unit	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Annual energy requirement Unrestricted)	MU	13567.99	14695.17	15442.7	16357.16	17350.02	17808	19521.41	20736.19	21264.51	22040.04	22944.45	23849.54	24432.96
Own generation	MU	7554.08	7695.11	8647.69	6440.44	7189.51	7360	8289.91	5334.27	8163.03	7286.9	6739.25	4325.08	5460.34
(Own generation)/(Energy requirement)	%	55.68	52.36	56	39.37	41.44	41.33	42.47	25.72	38.39	33.06	29.37	18.13	22.35
Power purchase (gross)	MU	6700.5	8149.84	8074.62	9628.87	10204.21	10512	11263.21	14908.82	14070.42	15031.71	16448.36	19734.93	19426.74
(Power import)/(Energy requirement)	%	49.38	55.46	52.29	58.87	58.81	59.03	57.7	71.9	66.17	68.2	71.69	82.75	79.51
Energy available for sale	MU	13331.03	14427.96	15065.2	15293.41	16982.29	17340	18938.8	19877.21	20542.49	21573.16	22727.34	23763.53	24340.79
(Available energy)/(Energy requirement)	%	98.25	98.18	97.55	93.5	97.88	97.37	97.02	95.86	96.6	97.88	99.05	99.64	99.62
Total sale including export	MU	10905.71	12377.89	13396.6	12877.65	14024.99	14678	16181.63	16839.26	18885.46	18788.82	19513.8	20502.21	21276.7
(Energy sale)/(Energy requirement)	%	80.38	84.23	86.75	78.73	80.84	82.43	82.89	81.21	88.81	85.25	85.05	85.96	87.08

Source: KSEBL (2018) and own estimations.

Energy losses

Energy transmission and distribution (T&D) losses are of two types: technical and commercial losses (for example, energy theft). The technical losses occur as energy dissipation in the conductors and equipmentused for transmission, transformation, sub-transmissionand distribution of energy and are inherent in a system but reducible to an optimum level. Ideally, these losses in a power system are expected to be around 3 to 6%. Reducing the T&D losses to, say, 10% could have resulted in immense savings in costly power purchase. For example, in 2017-18, with an own generation of 5460 MU of energy and a purchase of 19427 MU, the quantum of energy available was 24887 MU; accounting for 10% T&D loss would leave 22398 MU of energy available for sale, whereas the actual energy sale including export was 21277 MU only. This simply means that achieving 10%T&D loss would have saved a quantum of energy to the tune of 1121.67 MU in that single year! This in turn means that energy purchase could have been reduced by this much (to 18305MU) in 2017-18, with a significant financial implication. That is, in 2017-18, KSEBL incurred an expenditure of Rs. 7526.03 crores for the purchase of 19427 MU, the per unit cost being Rs. 3.87. Thus, the potential energy saving of 1121.67 MU in turn implies a potential financial saving of Rs. 434.54 crores in one year, 2017-18! Five-year potential savings from 2013-14 in this respect come to a massive amount of Rs 2541.3 crores (Table 3).

Table 3. Potential savings of T&D loss reduction to 10%

	2013-14	2014-15	2015-16	2016-17	2017-18
Own energy + Purchase (MU)	22233.45	22318.61	23187.61	24060.01	24887.08
Energy available (MU) after 10% T&D loss	20010.105	20086.749	20868.849	21654.01	22398.37
Actual sale, incl. export (MU)	18885.46	18788.82	19513.8	20502.21	21276.7
Potential energy saving (MU)	1124.65	1297.93	1355.05	1151.8	1121.67
Purchase cost per unit (Rs)	4.91	4.51	3.85	3.88	3.87
Potential purchase cost saving (Rs. Crores)	551.73	585.66	522.04	447.32	434.54
Average revenue (Rs.)	5.29	5.26	5.41	5.49	5.74
Potential sales revenue from energy savings (Rs. Crores)	594.5	682.62	733.35	632.79	644.06

Sources: KSEBL (2018) and own estimations.

There is another dimension to this potential savings: instead of reducing the import (as in the above scenario), the KSEBL could have sold out the potential energy saving to meet the entire energy requirement and earned an additional sales revenue, for example, of Rs. 644 crores in 2017-18, and earned a good surplus over the import cost. For the five years from 2013-14, such potential additional sales revenue could add up to Rs. 3287.3 crores (Table 3).

Failures in planning

Facts do corroborate that the system growth in Kerala has never been up to the mark of potential requirement. Till 1966, the Board had been restricting new connections. The low accessibility (the system being open to the few rich only) along with these restrictions had rendered the system a much smaller one involving in turn slow and low growth. In fact, at the start of the Third Five Year Plan (FYP, 1961-66), Kerala system, even though small, experienced a shortage of 6 MW in firm power capacity (FPC), and at the end of the period, as much as 75 MW, resulting in major power cuts, despite energy import from Tamil Nadu (Government of Kerala 1984: 22). Planning per se has been absent for the long run also. What is technically more relevant and essentially significant for a hydropower system is its firm power capacity (FPC), not just its IC. Then comparing the demand to be met by the system with the FPC would be more reasonably and reliably appropriate. Wide gap between IC and FPC is sheer waste of investment, unless timely FPC augmentation is carried out, and sadly this is the Kerala experience. By 1976 (with the commissioning of the Idukki Stage I project), FPC was 425 MW (42 per cent of the IC) only, equivalent to 3723 MU of energy generation potential. On the other hand, the total storage capacity of all the commissioned hydel reservoirs was equivalent to only 3365 MU, the difference being accounted for by the run-of-the-river-flow of water during the monsoons. The average generation potential was just enough, ceteris paribus, for at the most two normal years against a State (internal) average load growing at 10 per cent per annum.Inordinate investment inertia reigned not only in IC expansion programs, but also in FPC augmentation programs, such that the wasteful wide gap between the two persisted (See, for more details, Pillai 2004).

The hydropower potential of Kerala is estimated at 2301 MW at 60 per cent load factor. That about 92 per cent of this has already been harnessed might be taken as a surprising feat. But wait and consider the case of Tamil Nadu with a hydropower potential of a mere 1918 MW (at 60 per cent load factor) against an actual hydropower IC of nearly 2283.55 MW (https://www.electricalindia.in/hydro-power-scenario-in-tamilnadu/) While Kerala has remained utterly apathetic to the wasteful flowing away of hydro resources, Tamil Nadu has successfully managed to make full use even of the inter-State hydro-resources available to it.

The price paid by Kerala for such failure or absence itself of a perspective planning mechanism has been immense in terms of power shortage for quite a long time. Most distressing is the fact that even during this pinching period of power famine, both the Board and the Government have continued to be negligent, and the public at large indifferent. During the 20 years since 1976-77 (when Idukki Stage I was commissioned), Kerala had added to her IC only a meagre 482 MW. And in the 10 years after commissioning Idukki II Stage and Idamalayar in 1986-87, a paltry 17 MW! Since the commissioning of the Idukki project, Kerala has been too unfortunate to launch another major power project, may be except for the 180 MW Lower Periyar project, commissioned in 1997. Moreover, a large number of (about 16) power projects, with a generation potential of nearly 2000 MU (i.e., about 353 MW, at 60 per cent load factor, roughly equivalent to the State's then power deficit), remained locked in at various points of unwarranted time overrun due mainly to labour militancy and contractual corruption; such situation still continues. Thus, during the six-year period ending 2018-19, the Kerala power system (both public and private sectors) added just 108 MW to its IC.

A Shrinking coffer

Thus, both investment inertia and prolonged lag in investment fruition have come to stay, standing in the way of the timely required capacity expansion. Funds scarcity in financing power development has been explicitly recognised as responsible for this sorry state of affairs. The unwarranted drying up of the conventional source of funds, viz., the State, is generally accused of having led in part to the crisis. Though the plan outlay for power development was on the rise in money terms, from Rs. 118.5 million in First Five Year Plan (FYP) to Rs. 26,710 million in Ninth FYP, its share in total outlay was on the decline, from 39.5 per cent to 26.5 per cent respectively. In the third year of the 13th FYP (2019-20) the plan outlay of Rs. 178145 lakhs earmarked for the energy sector in Kerala was only 4.48% of the gross plan outlay. However, there is another facet in this regard that merits serious account, but has been left unaccounted for - that is, even this allegedly inadequate outlay was not utilised fully for most of the years. This specifically shows that funds scarcity was not the exclusive cause of the problem, though it was a significant one.

A cash-strapped KSEBL

While on the one hand, the Government has been consistently shirking its power development obligations on the excuse of an apparently shrinking coffer, the only alternative (or contributing) source of funds available, viz., the internal resources of the Board itself, on the other hand, has remained weak. For most of the years of its existence, the Board experienced deficit, expenses exceeding its revenue.

The financial morbidity of the Board, like most of other SEBs, has often called for huge sums of subventions from the Government even for financing its normal activities. Informed opinions in pursuit of the culprits behind the financial sickness of the SEBs have unanimously converged onto a single point of inadequate tariff levels, and required continuously monitored upward revisions of the tariff. For example, during the 6 years from 2013-14, tariff income of the KSEBL registered an annual growth of 6.4%, and the total income, about 6% (with non-tariff income falling over the years). Even though total cost was growing only at an annual rate of about 5%, deficit still persisted, but with an overall fall at an annual rate of about 16%.Table 4 shows the disheartening trend in the energy generation cost: steep drastic fall! On the other hand, the energy purchase cost was increasing at an annual rate of 3.4% during this period and accounted for about 57% of the total expenses!The highest growth was in administration and general expenses (19.5%), closely followed by interest charges (19.4%). These two items along with employee cost (growing at 4.3% per annum) accounted for nearly 40% of the total expenses in the recent years.

An earlier study by the present author had thrown light on some obvious scopes for efficiency improvement at various points of operation in the power system that could potentially reduce the supply cost substantially (Kannan and Pillai 2002). Thus, for instance, it had been shown that with some, quite reasonably achievable, improvement in the operational, T & D, and manpower deployment efficiencies, as well as with 1:1 debt-equity capital structure, the KSEB's unit cost of electricity supply in 1997-98 could have been reduced by about 43.3 per cent. This along with the given average revenue realised in that year would have yielded a unit commercial profit of about 16 Paise per unit of energy sold, instead of the reported loss of about 68 Paise per unit! And still there remain resourceful rooms for efficiency improvement at all other levels of functioning. This plainly points to the poignant fact that if the power system had performed efficiently, it could have, along with a scientific tariff structure, generated internal resources sufficient for financing capacity expansion programs, thus also dispensing with the avoidable leaning on the State exchequer.

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