

**TIME AND COST OVER-RUNS OF THE
POWER PROJECTS IN KERALA**

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This paper is the outcome of a just-concluded larger study on the power sector in India with particular reference to Kerala. An earlier version of this paper was presented in a seminar at the Centre for Development Studies; we are thankful to M. N. V. Nair, K. K Subrahmanian, K. Pushpangadhan, P. Mohanan Pillai, John Kurien, Achin Chakraborty, Indrani Chakraborty, and V. Santhakumar. Vijayamohanan Pillai records his special thanks to Rju for smiling away his excuses of absences from

ABSTRACT

Delays in project implementation and the attendant cost overruns have been a regular feature in the electric power sector in Kerala. Almost all the public projects, including the prestigious major hydroelectric project of Idukki, have been the unfortunate victims of time and cost overruns on account of a number of avoidable factors, labour disputes being singled out as the prime villain. In this paper we take up a detailed analysis of the cost of inefficiency involved in the time and cost overruns in the power projects of the KSEB, and their possible causes. We find that the arguments by the government in favour of private sector participation in power generating capacity addition, under the pretext of a severe resources crunch, is flimsy to the extent that the government is actually over-spending on each of the projects undertaken. We find that the real problem arises not out of a shrinking coffer but out of the inefficiency of management coupled with the political economy of vicious rent seeking.

JEL Classification : L94, Q48

Key Words : Kerala, power sector, time and cost overruns, labour disputes, corruption

*“Quite obviously it came up through the waste,
Rejects through ignorance or apathy
That passage back. The problem must be faced;
And life go on.....”*
- Roy Fuller (“The Image”)

1. Introduction

This paper on time and cost overruns of the power sector projects in Kerala is a part of a larger study on ‘The Plight of the Power Sector in India: Inefficiency, Reforms and Political Economy’, and discusses the costs of inefficiency in the particular context of the Kerala power sector at the project implementation stage. In an earlier paper (Kannan and Pillai 2001 a) we have discussed the cost of inefficiency involved in general in the Indian power sector at the various stages of operation. Here we take up an analysis of the cost of inefficiency involved in time and cost overruns in the power projects in Kerala. This is of very significance in the present context of arguments by the government in favour of private sector participation in power generating capacity addition, under the pretext of a resources crunch. The government is said to be under a tight constraint of severe funds scarcity and hence incapable of undertaking new projects for power development. However, we will find that this argument is flimsy to the extent that the government is actually over-spending on each of the projects undertaken. Each project involves immense cost overrun. Had the government been able to

implement each project efficiently within the normally expected constraints of time and cost, then it could have saved huge resources and hence undertaken a large number of additional projects. It is not that the government has no resources meant for power development, because it is actually over-spending; the problem is in the inefficiency of management, coupled with the political economy of corruption. The present paper, in six sections, has the limited objective of bringing into light this aspect. Following this introduction, section 2 provides a brief discussion of the individual projects, falling under the time and cost overruns and the third section, their comparative analysis. The costs of delays are examined in section 4, and the possible causes in section 5. The last part briefly discusses the political economy of corruption involved in the time and cost overruns of the power projects in Kerala, and concludes the study.

Delays in project implementation and the attendant cost escalation have been a regular feature in the electric power sector in Kerala. Normally the construction of a major hydro-power plant is expected to be completed within 8 – 10 years and that of a mini hydel project in 2 – 3 years. However, the Kerala experience baffles all the common senses in this respect, with longer time and higher cost over-runs in the case of both major and mini hydel projects. A ‘classic’ example is the Kakkad hydro-electric project of 50 mega watt (mw) installed capacity; the project was sanctioned as long back as in 1976 with an original cost estimate of Rs. 1860 lakhs; this project was proudly presented that time as the least cost hydro-electric project in the State! It was scheduled to be commissioned in 1986; but it took 23 years for the Kerala power system to tap the energy potential of this project (major construction works on it started only in 1979), at an estimated cost of Rs. 153.5 crores, about 725 per cent above the original one!

The Kakkad story is not an isolated exception, but forms only a part of an unending serial of over-runs in Kerala power system. The prestigious major project of Idukki also was an unfortunate victim of time and cost over-run, mainly due to labour disputes, the prime villain in every instance. Idukki Stage I project (3 units of 390 MW) could not be commissioned in the Fourth Five Year Plan (1969-74) as scheduled and had a long gestation period due to labour problems, until it was finally commissioned in 1976. When idukki Stage II project (3 units of 390 MW) was put on line in 1986, after a time over-run of about 8 years, it had a cost escalation of 115 per cent over the original estimate.

Similarly, the next project, Idamalayar (of 75 MW, started way back in 1970 and commissioned in 1987), suffered a time over-run of about 9 years and a cost increase of 285 per cent. Two major firm power augmentation schemes, Sabarigiri Augmentation and Idukki Stage III, too had the same fate. Started in 1972 and 1975 respectively, the works on these projects could not be completed till the turn of the 90s. A cost over-run of nearly 780 per cent (the highest ever among the projects in the Kerala system!) and a time over-run of 10 years go to the discredit of Sabarigiri Augmentation scheme, beyond any common sense accounts. And a cost increase of about 270 per cent with a time over-run of about 10 years lie behind the Idukki Stage III project.

2. Project-wise Analysis

Data on time and cost overruns of 16 other hydro-power projects are available for analysis, the data having been collected from the various volumes of *Economic Review* of Kerala State since 1985. These projects are 1) Kakkad, 2) Kallada, 3) Lower Periyar, 4) Pooyankutty, 5) Malampuzha, 6) Madupetty, 7) Malankara, 8) Chimony, 9) Peppara, 10) Azhutha Diversion, 11) Kuttiar Diversion, 12) Poringalkuthu Left Bank Extension, 13) Vadakkeppuzha Diversion, 14) Vazhikkadavu

Diversion, 15) Kuttyadi Tail Race and 16) Kuttiaady Extension. The details of these projects are given in Table 1 (and also in the Appendix).

1. Kakkad

This project, considered the least cost hydro-electric project in Kerala, is to use the tail race waters of Sabarigiri power house (PH), together with the inflow of two tributaries of Kakkad river, viz., Moozhiyar and Veluthodu streams over a gross head of 132.6 m. for power generation of 262 million units (mu) with an installed capacity of 50 mw.

Though the project was sanctioned by the Planning Commission way back in 1976 at an estimated cost of Rs. 1860 lakhs, the construction activities were started only by 1978-79 due to paucity of funds. Even after the work was started, the progress was tardy. For one example, the total length of the inter-connecting tunnel driven as by the close of 1986-87 was only 886 meters (out of 3036 meters). The poor performance was mainly due to labour disputes for over a year from 3-10-1985 to 29-10-1986. Though the work was resumed on 30-10-1986, it was interrupted on 6-2-1987 due to a rock fall inside the tunnel. In the case of the power tunnel, some progress was achieved only in 1986-87; two earlier contracts with poor performance had to be terminated here.

The time and cost overrun story of this project has already been mentioned. Over a period of 23 years, with a time overrun of about 13 years as in 1999, when it was finally commissioned, the cost escalation of this project was 725 per cent above the original estimate. That is, the actual cost was more than 8 times the original cost estimate. It should be noted that a project is sanctioned at the costs that exist at the time when the project is submitted. The cost estimate is likely to increase over time on account of price inflation. Though the original cost estimate is

presumed to include an allowance for possible price inflation, often the actual experience can deviate from the assumptions. Hence it is natural to consider and identify that part of the cost escalation that is due to price inflation which can by no means be attributed to improper project formulation and/or implementation. However, what remains in the cost overrun over and above the effect of price increase is a matter of concern demanding explanations in terms of real factors involved in faulty planning and execution. For each of the projects, we have estimated the price inflation in terms of WPI for all commodities experienced during the project implementation period, in order to differentiate the effects of price inflation and of other factors on capital expenditure.

The WPI for all commodities registered as in 1999 an increase of only 461.2 per cent over 1976 (when the Kakkad project was sanctioned). This implies that the cost escalation is about 1.5 times the general price inflation (as given by the WPI for all commodities). Thus it is clear that price inflation alone is not responsible for cost overrun; about 260 per cent of the increase in the cost estimate can be attributed to factors other than price inflation, which can evidently be treated as a waste of resources.

2. Kallada

This project envisages construction of a dam toe power station of 15 MW installed capacity and generation of 53 MU of power from the existing Kallada irrigation project. Though the contracts for civil works were settled in April 1985, and works began immediately, frequent releases of water through the irrigation outlets of the dam flooded the work areas, preventing the progress of works.

The project was sanctioned in 1981 with an original cost estimate of Rs. 1180 lakhs and was commissioned in 1993-94 at a (revised) cost of Rs. 1802 lakhs, representing 52.71 per cent increase. It was to be

commissioned at the earliest by 1989, but had to undergo a time overrun of 5 years. During the same period, the WPI (all commodities) rose by 148 per cent; and the revised cost estimate of this project appears not to have been inflated to that extent.

3. Lower Periyar

This is a tail race cum run-off-river scheme in the lower reaches of Periyar river downstream of Neriamangalam power house. The scheme envisages the utilisation of the waters of Neriamangalam power station, the spill from the Kallarkutty dam and the available yield from the Perinjankutty catchment and the catchment areas below the dams at Kallarkutty, Idukki and Cheruthoni river, over an average gross head of 302.63 m. for power generation, with an installed capacity of 180 MW and annual generation of 493 MU.

Started in 1983 with an original estimate of Rs. 8843 lakhs, this project was commissioned in 1997 and its revised cost estimate as in 1999-2000 stood at Rs. 353 crores. Over these 14 years (including a time overrun of 6 years), the cost estimate saw an increase of about 300 per cent against an increase in the WPI (all commodities) by 194 per cent. Thus after accounting for the full impact of price inflation on the capital cost of the project, about 111 per cent increase needs to be explained by other factors of wasteful management.

4. Pooyankutty

The scheme envisages construction of a 148 m. high concrete dam across river Pooyankutty and a surface power station with two units of 120 MW each; thus with an installed capacity of 240 MW and annual generation of 645 MU. The scheme was approved by the Planning Commission as far back as in August 1986. However, the central government's sanction of forest clearance is still to be received. The

state government and the KSEB are reported to have fulfilled all the formalities for the issuance of sanction, including the proposals for compensatory afforestation as required under the Forest Conservation Act of 1980. So far only minor preliminary works have been done.

A 14 years incubation for a project proposal is ample evidence of the lethargy and non-commitment on the part of the planners. During this period, the cost estimate was revised upward by 228 per cent, from Rs. 250 crores to Rs. 820 crores, far exceeding (by 45 per cent) the general price inflation (182.7 per cent) during this period.

5. *Malampuzha*

A mini hydel project of 2.5 MW with an annual generation of 5.6 MU, this scheme envisages construction of a power station on the downstream side of the existing irrigation dam (owned by the State PWD) to utilise the irrigation release. Started in 1987 and expected to be on-line by 1989, this mini project is now expected to be commissioned 'in the near future'. After 12 years with a time overrun of about 10 years as in 1999-2000, the capital cost was revised from the original Rs. 295 lakhs to Rs. 679 lakhs – an increase of about 130 per cent. Over the same period the WPI (all commodities) registered an increase of 169 per cent.

6. *Madupetty*

Another mini hydel project of 2 MW with 6.4 MU of annual generation, this scheme aims at construction of a dam toe power house at the existing Madupetty dam for power generation using the water released from the Pallivasal hydro-electric project. Started in 1987 and expected to yield its energy by 1989, this mini project was at long last fully commissioned by January 1998 after a time overrun of about 9 years. The cost estimate was revised from the original Rs. 292 lakhs to

Rs. 775 lakhs by 1995, which, however, came down to Rs. 478 lakhs by 1998, providing a good example for the reliability of estimation procedure of the KSEB; in the case of most of the projects this is so. The cost increase in this case is 64 per cent, against an increase in the general price level by 145 per cent.

7. Malankara

Another small hydro-electric (HE) project with an installed capacity of 10.5 MW and annual generation of 65 MU, this scheme envisages the construction of a dam toe power station at the Malankara dam of the Muvattupuzha valley irrigation project (under construction by the State PWD). The project will utilise the tail water releases from the Moolamattom power house of Idukki hydroelectric project together with the inflow from 153 square km. free catchment less the irrigation requirements.

Started in 1987 and expected to generate power by 1990, this project has by now (1999-2000) registered a time overrun of about 9 years; its capital cost was revised over the period from Rs. 780 lakhs to Rs. 43.36 crores by 1997 and then to Rs. 41.13 crores by 1998 and 1999-2000, thus undergoing a phenomenal increase of 427.3 per cent against a wholesale price rise of 169 per cent. Reminiscent of the mammoth inflationary influence of the 'other factors' on the capital cost of Kakkad project, in this case the other factors of sheer waste and overestimation account for as high an increase as about 258 per cent in the capital cost, that calls for another careful diagnosis.

8. Chimony

Another mini hydel project, this scheme envisages installation of a generating unit of 2.5 MW in a dam toe power station at Chimony irrigation dam (under construction by the State PWD). It is expected

that 6.5 MU of energy can be economically generated during the period from December to May.

Started in 1987 and originally scheduled to be commissioned in 1990, this project fell by 1993 a prey to a dispute between the contractor of the electrical works and the KSEB and all the works were paralysed thanks to a stay order from the High Court obtained by the contractor. By 1993, the capital cost was revised from its original level of Rs. 314 lakhs to Rs. 425 lakhs, representing an increase of 35.35 per cent against a general price rise of 72 per cent over the same period.

9. Peppara

This small project was proposed to benefit Thiruvananthapuram city by making use of the drinking water supply released from Peppara dam (owned by the Kerala Water Authority) through a dam toe power house of an installed capacity of 3 MW and an annual generation of 11.5 MU.

Again a 1987 project supposed to have the normal gestation period of 3 years, it was finally commissioned only in 1996, with a time overrun of 6 years and a cost escalation of 73.7 per cent over the original estimate of Rs. 392 lakhs, against a general price rise of 118.3 per cent during this period. Note that the cost estimate was earlier revised to Rs. 850 lakhs in 1995 and then reduced to Rs. 625 lakhs in 1998 only to raise again to Rs. 671 lakhs in 1999 – another apt example for the haphazard planning mechanism.

10. Poringalkuthu Left Bank Extension

This scheme is to construct a second power station with an installed capacity of 16 MW and an annual generation of 38 MU for better utilisation of the water release from the existing scheme (Poringalkuthu

power house). Its works were started in 1989 and it was expected to be commissioned in 1992-93. After a time overrun of about 6 years, it was commissioned in 1999; the original cost estimate of Rs. 902 lakhs rose by about 374 per cent to reach Rs. 42.7 crores. Comparing this with the rise in the WPI (all commodities) over the same period by 113 per cent, about 261 per cent of the increase in the cost estimate is found to be attributable to 'other factors' of wasteful management and over-estimation.

11. Kuttiyadi Tail Race

This project proposes to utilize the regulated discharge from the existing Kakkayam power station of Kuttiyadi HE project for power generation in a station to be located further downstream. The proposed installed capacity is 2.5 MW and the annual generation 15 MU.

The project was started in 1989, and expected to be commissioned in 1992-93. By 1999-2000, with a time overrun of 7 years, the estimated cost rose by 225 per cent from the original Rs. 397 lakhs. The general price rise during this period was by 132 per cent, indicating an increase of about 93 per cent in the cost estimate due to 'other factors', over and above the influence of price inflation. Note that the revised estimate in 1997 was Rs. 14.48 crores (265 per cent above the original) and in 1998, Rs. 13.38 crores!

12. Azhutha Diversion

This scheme envisages diversion of waters from about 16,8389 sq. km. catchment of the upper reaches of Azhutha river, a major tributary of river Pamba to Idukki reservoir for increasing the power potential of Idukki power project by 57 MU. The scheme will provide diversion of about 57.6 mm³ of water on an average per annum.

The work on this project was started in 1987, anticipating it to be commissioned in 1991. After a time overrun of about 6 years, it was partially commissioned in June 1998. By 1999-2000, the original cost estimate was revised upward from Rs. 290 lakhs to Rs. 14.46 crores, an increase of nearly 400 per cent, against the rise in the WPI (all commodities) by 145 per cent. Thus the factors other than price rise appear to account for about 254 per cent increase in the cost estimate.

13. Kuttiar Diversion

This scheme envisages diversion of waters from a catchment of 10.4 sq. km. of Kuttiyar river (a tributary of Muvattupuzha river) to Idukki reservoir to raise the power potential of Idukki power project by 36.6 MU.

Started in 1988 with an original cost estimate of Rs. 214 lakhs, this project was to be completed at the earliest by 1990-91. At present it is expected to be commissioned in the near future, with a cost escalation by 343.5 per cent to Rs. 949 lakhs over a time overrun of about 8 years as in 1999-2000. This is against a general price rise by 132 per cent during the same period. Thus about 211 per cent increase in the cost estimate of this project remains to be explained in terms of 'other factors'.

14. Vadakkeppuzha Diversion

This scheme envisages diversion from 3.43 sq. km. catchment of Vadakkeppuzha, a tributary of Muvattupuzha river and 0.625 sq. km. catchment of Pothumattom stream, also of Muvattupuzha basin, to Idukki reservoir to augment the firm generation of Idukki project by 12.3 MU.

When the project work was started in 1989, it was proposed to be completed by 1991-92. However, even after a time overrun of 8 years as in 1999-2000, the commissioning date remains 'not fixed', and the original cost estimate of Rs. 131 lakhs rose by 292 per cent to Rs. 514

lakhs against a rise in WPI (all commodities) by 132 per cent over the same period, leaving 160 per cent increase in the cost estimate to be accounted for by 'other factors'. Note that the cost estimate was revised upward to Rs. 786 lakhs in 1997-98 and then downward to Rs. 705 lakhs in the next year only to be drastically cut down again to Rs. 514 lakhs in 1999-2000.

15. Vazhikkadavu Diversion

This scheme envisages diversion of waters from 6 sq. km. of catchment of Vazhikkadavu to the Idukki Reservoir by a diversion tunnel to increase the firm power of Idukki project by 24 MU.

Started in 1989, this project was expected to be completed by 1992-93. However, even after a time overrun of about 7 years as in 1999, it too remains with an uncertain commissioning date. The original cost estimate had to be revised by a phenomenal 760 per cent, dwarfing even the classical Kakkad phenomenon, from Rs. 186 lakhs to Rs. 15.99 crores against a general price inflation by 132 per cent over the same period. Thus an increase to the tune of about 628 per cent in the cost estimate remains as due to the influence of 'other factors' – a shocking example of mismanagement in the preparation of project proposal and cost estimation, that too in the case of only a diversion project, meant to increase water availability only.

16. Kuttiady Extension

The storage capacity of the existing Kuttiady reservoir being highly inadequate, full utilisation of the inflow is not possible now. Hence, under this extension scheme, capacity addition (one unit of 50 MW; 75 MU) to the existing power station is proposed. Though the project was cleared by the Planning Commission in January 1992, major works on it started only in February 1994, and it was originally expected to be commissioned

in 1995-96. After a time over-run of 4 years, it was finally commissioned in 2000, with a cost overrun of 544 per cent over the original estimate of Rs. 30.73 crores (that went to Rs. 198 crores), against a general price inflation of just 73 per cent, leaving an unbelievable waste gap of 471 per cent!

3. A Comparative Analysis

As already explained, the estimation of the capital cost of a project is made based on the price level prevailing at the time when the project proposal is made; and hence there is a time-element of error involved in it representing under-estimation in the face of inflation. Cost estimate is often revised upwards to take account of this, especially when the price level is rising rapidly and/or the time-overrun involves an element of uncertainty as to the completion of the project. Ideally, a revised cost estimate should sufficiently cover the general price rise. And hence what remains in the revised cost escalation of a project over and above the general price inflationary influences is a matter for serious consideration; it may represent an over-estimation due to uncertainty or an element of deliberate attempt at wasteful mismanagement of resources.

Of the 20 projects we have considered above, barring 7 projects, all others have significantly very high remainder in their revised cost estimates in excess of the general inflationary impact (Table 2). The 7 projects are Idukki II, Idamalayar, Kallada, Malampuzha, Madupetty, Chimony, and Peppara. In the case of Chimony project, the work of which had to be suspended due to a dispute with the contractor that brought in Court intervention, the inadequate coverage of the general price inflation in the revised cost estimate might be a case of under-estimation. In the case of a number of projects (for example, Kakkad, almost all the mini projects and some of the diversion projects), the cost estimates have been revised every year in a very haphazard manner,

some time upward and then downward, indicating an inconsistent planning mechanism.

It should be noted that apart from the 'Classical' case of Kakkad project, it is the mini hydel projects and diversion schemes that have become comparatively more prone to time and cost overrun. The mammoth cost escalations in the case of Malankara mini HE project and Vazhikkadavu diversion are a phenomenal swell in some element of error that has crept in the project design and estimation. The other things appear to have influential sway over most of the other projects also.

In general, these 20 projects of the last 3 decades account for time overruns ranging between 62.5 per cent (Kallada) and 500 per cent (Malampuzha) of the expected period of construction, and cost overruns ranging between 52.7 per cent (Kallada) and 777 per cent (Sabarigiri Augmentation), of the original cost estimate (excluding Chimony).

For a more objective comparison, we can analyse the capital cost per kWh of potential energy of these projects (Table 2). Among the power plants considered, the capital cost per unit of electricity was the lowest for Idukki II Stage with 68 Paise per unit and among the augmentation schemes, for Idukki III Stage with only 40 Paise per unit. The highest cost escalation of Sabarigiri augmentation project has spread very thinly over the large units of its energy potential, resulting in a capital cost of only 90 Paise per unit. Idamalayar stands with a capital cost of Rs. 2.81 per kWh of energy. On the other extreme, one's common sense may be baffled at the mammoth capital cost of Rs. 26.4 per unit as per the latest estimate in the case of Kuttiady extension project. Energy from the still unborn Pooyankutty project too is priced out very high at Rs. 12.7 per unit! Malampuzha (Rs. 12.1 per unit) and Kuttiady Tail Race (Rs. 8.6 per unit) are also planned to be high cost energy generators. Note that

the capital cost of energy from Kakkad, the classical example for time and cost over-run, is Rs. 5.9 per unit.

It will be enlightening to compare these figures with the *original* capital cost of Enron project (Dabhol power project phase I) in Maharashtra much criticised as ushering in an era of stupendously high-cost energy in India. Its original capital cost of Rs. 4.48 crores per MW of capacity at the normal load factor of 68.5 per cent implies a unit capital cost of Rs. 7.5 per kWh. The Kuttiady extension project undertaken with a Canadian loan and contracted for its completion with a Canadian firm (SNC Lavalin) involves a capital cost, which is about 3.5 times the controversial original cost of the Enron project! It should be remembered that Enron's was a *new* project, while only an *extension* work was done at Kuttiady. It is highly significant to note that the Kuttiady extension work contract was awarded to the Canadian firm by a leftist government in the State that is credited with an assertive anathema against foreign capital, especially the Enron, but has time and again stood in defence of the Canadian firm, sanctioning all their demands of time and cost over-runs. Now compare the other projects also.

4. The Cost of Delays

The delay in commissioning a power project invariably involves different elements of avoidable costs to the society. The most immediate one is the cost escalation itself. A direct cost of over-runs is in terms of the additional energy realisable, were the project commissioned in time, as well as the additional sales revenue thereof. The increased availability of power could reduce the requirement of costly energy import, thus effecting some cost savings in it. In addition to these is the indirect cost of unsatisfied demand corresponding to the additional energy realisable.

In this section we make an attempt to quantify the cost of time over-runs of the projects under study in terms of additional energy and

revenue that could be realised if these projects were commissioned in time. The results are shown in Table 3.

We start with the year 1983-84, by which time, it is assumed, the four earlier projects, Idukki II and III Stages, Idamalayar, and Sabarigiri Augmentation could be brought on line, so that the available firm generation capacity in 1983-84 would be 5554 MU, instead of the actual 3726 MU. Given the firm power capacity utilisation (98 per cent) and loss (26 per cent) structure in the system, this then yields additional generation of 1788 MU and additional sales of 1327 MU, which at an average rate of 35.2 Paise per unit would realise an additional revenue of Rs. 46.7 crores in that year. Additional revenue obtainable in 1984-85 comes out at Rs. 53.8 crores. The total revenue thus realisable during these 17 years from 1983-84 to 1999-2000 is estimated at Rs. 886.3 crores, or Rs. 52 crores per year! This then represents one cost of avoidable time over-runs of these 19 projects (excluding the non-starter Pooyankutty project) in Kerala (Table 3). It is very distressing to think of such a situation that the cash-strapped KSEB has been forced to forego a revenue of about Rs. 52 crores a year on average due to delays in getting the on-going projects commissioned in time.

Such additional generation that could be effected through timely completion of projects could reduce to a good extent the costly dependence on energy imports.

Timely completion of these projects could avoid the substantial burden of capital cost escalation also (Table 4). Such savings factor highlights the fact that when capital cost is escalated more than what is planned, it results in a loss of its alternative uses. Considering the resources constraint of the Government, if these resources were used more efficiently, then the resultant increased availability of these resources to the Government could be used for taking up more projects.

To the extent that such actual cost escalation reflects inefficient resources utilisation, the savings in capital cost, that could have been obtained in the absence of cost overruns, also represents a capital waste involved. For example, suppose that Kakkad hydro-electric project could be commissioned in time in 1986 itself, 8 years after its construction works started. Accounting for the general price inflation during this period, the capital cost of this project by 1986 would be at the most only Rs. 39.66 crores, saving as much as Rs. 113.86 crores, almost enough to construct 3 more similar plants, or to add to the system capacity by another 140 MW at the nominal cost of Kakkad project! Thus the capital waste involved in this case is equivalent to 3 more similar plants (Table 4) or an installed capacity of 140 MW! Timely completion of lower Periyar project could save as much as Rs. 189 crores, enough for a similar project of more than 200 MW capacity! The second highest savings, after Lower Periyar project, could come from Kuttiady extension project to the tune of Rs. 158.3 crores, almost enough for four similar or Kakkad-type projects! As already noted, Kallada project (the only exception), even with 5 years over-run, has not eaten up resources beyond the limits set by general price inflation. Timely completion of all other 18 projects (excluding the non-starter Pooyankutty) could yield a mammoth saving in capital cost of Rs. 644.03 crores, almost enough for 16 Kakkad-type projects with 800 MW capacity! Since so much capital resources have gone wasted, this 800 MW (or Rs. 644 crores) represents the capital waste involved in the faulty planning and implementation of power projects in Kerala. That is, the capital waste factor involved is 16 (i.e., 16 Kakkad-type projects)! And the KSEB still reeling down in the red, the government lets such waste and mismanagement pass.

It is in this light then that we should examine the so called financial 'inability' of the SEBs (and the governments) to finance power development in general. The basic argument put up in defence of inviting

private sector participation in power development has come out of the resources crunch experienced by the governments. However, this defence is turned out to be flimsy in the face of the fact that there is over capitalisation in actual practice in the case of each project the government has undertaken; the government could, through efficient performance, save substantial resources, which could in turn be used for taking up additional projects. Behind this inability works the political economy of corruption.

The gravity of the problem of over-runs can be gauged by considering the combined effect of both the time and cost over-runs, a measure of which, called 'capital x time waste factor' (also see Morris 1990), is obtained as the difference between the actual capital x time (CaTa) and the originally planned capital x time (CoTo) measures as a percentage of the latter (where Ca and Co are the actual (or latest) and originally planned estimates of capital cost and Ta and To are the corresponding period of commissioning). In estimating this resources waste factor, we assume that expenditure over the course of a project takes place uniformly. Thus in the case of the Kakkad project, the originally planned resources were Rs. 18.6 crores x 10 years = Rs. 186 crore years, but the actual resources spent were Rs. 153.52 crores x 23 years = Rs. 3530.96 crore years, such that there was a capital x time waste of Rs. 3344. 96 crore years or 1798.4 per cent of the originally planned resources. Thus it shows that as a result of time and cost overruns, this project has eaten up about 1800 per cent more capital x time than what was originally expected. In other words, if the Kakkad project could be completed on time as per plans, then the KSEB could increase the quantum of similar projects by about 1800 per cent with the same resources it actually spent for a single project.

The capital x time waste factor for the 19 projects (excluding the non-starter Pooyankutty) ranges from 148 per cent for Kallada project to 2766 per cent for Vazhikkadavu diversion! (Table 4). There are as many as 9 projects (6 of which are mini or diversion projects) having more than 1000 per cent waste factor. That on average, each project has eaten up extra resources worth 1100 per cent just shows in general the enormous waste of capital x time resources in power project implementation in Kerala.

Kuttiady power project had been out of service for a long time now in the name of extension works going on there. The extension programme with a time over-run of more than four years and a stupendously exorbitant capital cost of Rs. 26.4 per kWh of energy potential, also involved substantial revenue loss for the parent project due to its closure. The firm generation potential of Kuttiady power station is about 270 MU or 0.74 MU a day, equivalent to a sales revenue of about Rs. 15 lakhs a day. If the extension scheme were commissioned in time (i.e., in 1995-96), it could fetch sales revenue of about Rs. 7.1 lakhs a day. During the last 5 years, the total loss of sales revenue alone comes out to be Rs. 399 crores in this case!

5. Causes of Delays

A host of causatives are at work behind the delays – changes in the technical design and feasibility reports, original cost estimates being based on inadequate or incomplete data and unrealistic assumptions, inefficient management, inadequate geological and technical investigations of the projects at the outset, vague and ambiguous specifications and conditions of contract, sluggish decision making at various stages of construction, lack of availability of materials or of transportation facilities, infighting and ego clashes among different groups of the bureaucracy and technocracy of the KSEB, unwarranted

transfer of planning and supervisory staff between projects during their construction, a lack of vision about the power needs of the State, labour

Causes of Delays

The principal causes of delays in the case of hydro-power plants, *inter alia*, have been listed by the Committee on Shortfall in Generation During the Third Five Year Plan under the Chairmanship of Sri. K. P. S. Nair as follows:

1. Inadequate investigation before finalising technical project report.
2. Major change in the scope of work like
 - (a) change in the location of dam;
 - (b) change in design of dam foundation;
 - (c) change in design of Water Conductor System;
 - (d) change in location of power station and switch yard;
 - (e) change in generator capacity.
3. Delay due to inter-State aspects.
4. Delay in issue of authorisation by Central/State authorities.
5. Delay in foreign exchange tie ups.
6. Change in key personnel in the course of advance planning and execution.
7. Delay in procurement of equipment due to
 - (a) late issue and late finalisation of tenders;
 - (b) procedural delays in processing through DGS&D;
 - (c) processing of foreign exchange release by Government of India (GOI).
8. Delay in procurement of construction equipment.

9. Shortage of cement and steel, welding rods, explosives, etc.
10. Shortage of spare parts for construction equipment.
11. Late arrival of erection specialists.
12. Delay in delivery of equipment due to failure of supplier to keep up schedule;
13. Difficulties in transporting equipment to site
 - (a) in moving over dimensional packages on railway due to restrictions imposed by bridges, tunnels, etc.;
 - (b) due to difficult terrain and lack of proper access roads.
14. Unprecedented rains and floods.
15. Land acquisition and rehabilitation.'

disputes, court interventions for aggrieved contractors, and so on (Kannan and Pillai 2001 a). Nurturing all these is a lack of political will to finish the work on schedule, borne and bred of course by high level corruption and an indifferent public.

Recurring labour militancy is recognised in general as the single factor that puts the highest cost burden in this respect. And it cannot be otherwise in a politically surcharged atmosphere of highly pampered unionism of diverse hues peculiar to Kerala. Not a single project in Kerala (including the prestigious major project of Idukki) has been left unhaunted by the spectre of tools-downing militancy. The construction work of the Idukki project was much pompously inaugurated by the then chief minister, EMS Namboothiripad, on 10 February 1966; and the very next day started a labour strike, that finally culminated in the death of two

The Cost of Labour Militancy

There are two distressing examples from the recent history of power development in Kerala of the damages caused to the overall power and economic development of the State by the irrational behaviour of organised militant labour. The first is the example of Idukki Stage I, a 390 MW project, which could not be commissioned in the Fourth Five Year Plan (1969-74) and had a long gestation period because of frequent strikes and interruptions of work by labour. This project could be ultimately commissioned only in 1976. The Electricity Board suffered the consequences of delays caused in commissioning this project by way of escalation in costs and revenue foregone as a result of longer gestation period 8 years ago. At the time Idukki – I was commissioned in 1976, there were a large number of consumers in all sectors of the State's economy waiting for power connections. Public memory being proverbially short, people have foregotten the great damage caused to the economy of the State by the long delay in the commissioning of Idukki,

We would, however, like to recapitulate a recent experience of Idamalayar hydro-electric project, which unfortunately is yet to be commissioned (at the time this report is being got ready) because of unreasonable and irrational labour militancy.

The strike by the employees in this project started within three months of the commencement of work on the construction of the dam. The first strike was on 8-12-1976. There were a number of strikes between 8-12-1976 and 5-9-1979 by employees working in dam construction, but these strikes were settled without much loss of time. But

there was a long strike which increased the gestation period of the project by 6 months and 15 days (excluding monsoon off) which commenced on 6-6-1979 (ninth month of construction) and ended only on 25-3-1980. The direct financial loss on this account is estimated to Rs. 125 lakhs and it has also escalated the cost of the project by Rs. 142.5 lakhs.

During the period between 7-5-1977 and 18-1-1983, there were a number of strikes in the power house resulting in a total financial loss of Rs. 15 lakhs.

The two strikes in the tunnel work of this project were something unique perhaps without parallel in the history of power development anywhere in the world. Initially the employees engaged in the tunnel work struck work between 9-6-1980 and 20-11-1980 increasing the gestation period by 5 months. But the most crucial strike which affected the project and postponed its commissioning was started on 10-4-1981 and continued till 10-6-1983 thereby postponing the completion of the project by 2 years and 2 months. The employees involved in the strike were only 110. The financial commitment for settling the strike was about Rs. 125 lakhs.....

The major issue causing this strike was the demand by the contractor's employees engaged in this project for an assurance that they would be absorbed as permanent employees of the Electricity Board. We understand that a number of these workers were working as contractor's labour in earlier hydro-electric projects in Idukki and elsewhere. But we cannot appreciate how this would give any moral or legal rights to these employees to claim permanent employment in the Electricity Board.

It is difficult to quantify the losses to the community due to the 3 strikes (one in the dam construction and two in the tunnel work) extending over a total period of three years and one month. Considering that the total installed capacity of the hydro system in Kerala is only 1011.5 MW an addition of 75 MW three years earlier would have cushioned to some extent the power famine in Kerala especially in the year 1982-83. The losses to the Electricity Board as a result of the strike during dam construction has been estimated to be Rs. 267.5 lakhs. The losses due to the delay in completing the tunnel is estimated to be Rs. 30.98 crores out of which Rs. 29.31 crores is loss of revenue due to delay in commissioning of the project and Rs. 1.67 crores is due to escalation in costs and revision of schedules. The total loss incurred by the project as a result of the delay of three years and one month (1125 days) is Rs. 33.65 crores. The loss per day of delay works out to slightly less than Rs. 3 lakhs. This state of affairs did not stir the conscience of the people of Kerala who remained apathetic. A project being delayed for such a long time and every day's delay costing Rs. 3 lakhs to the taxpayer did not receive adequate publicity in the Press or political platforms. That this could happen in a State with a vigilant press and politically conscious people is a tragedy.

We feel that an in-depth study by one of the all India management institutions into this strike, especially how and why it was allowed to continue for over three years and how and why the public opinion in the most literate State of the Country was silent, would be very useful to draw appropriate lessons for the future.

We strongly recommend issuing an ordinance followed by enactment of appropriate legislation prohibiting strikes under any circumstances in all power projects under construction.Those who take part in such strikes and their leaders should get a minimum punishment of compulsory imprisonment for a specific period prescribed in such a law. In addition, all those who participate in such strikes should be debarred from being eligible for appointments under Government or any other institution owned or controlled by Government.

- Government of Kerala 1984: 57-61.

workers in police firing! It might be a cruel irony that the project (Stage I) could be completed and commissioned only under the coercive 'normality' during the infamous period of national emergency!

Idamalayar project was one of the most unfortunate victims of recurring and long-inertial periods of labour unrest. Some stories, as told in the Report of the High Level Committee (1984) of Government of Kerala, are given in the box above.

Kakkad project had a long tale of unending woes of corruption and trade union militancy. When construction works started, serious defects in design were found out. Initially the whole construction works were awarded to one contractor who had no pre-qualification but was preferred by the then concerned minister. The contractor was too inexperienced and inefficient to yield any progress in works for quite a long time, and the KSEB was forced to terminate the contract in June 1981 and select fresh ones. The construction works on the interconnecting tunnel was started in 1980 at an estimated cost of Rs. 5.59 crores. Soon

the workers went on strike, as the contractor refused to pay the ruling wage rate. In June 1981, another company was entrusted with the work, but still there was no progress; hence the work was divided and given to

The Kakkad Saga of Leakages

The Kakkad hydroelectric project of 50 MW, that took more than 20 years for completion, has been under the jinx on a number of fronts - excessive time and cost overruns and faulty planning and construction. One of the most infamous examples in this connection was the costly effect of an engineering defect in the power tunnel construction that went on from the two opposite sides (with the good intention of expediting the work), but never meeting together. The two tunnels dug from opposite sides just went in parallel!

Leakages in the power tunnel has been another recurrent problem. A major leak was detected in the concrete lining of the tunnel gate at Adit-5 of this 13 km-long power tunnel just two months prior to the commissioning of the project in 1999. The KSEB had to spend Rs. 15 lakhs to repair the damaged portion using Epoxy mixture (*The Hindu daily*, 2 September 2001). And very recently, the project had to be shut down (on August 28, 2001) following the detection of a major leak through the same Adit-5. There are reports of widespread allegations of a corrupt nexus between certain KSEB quarters and the contractor lobby, attempting to create more and more work avenues in one or another way (*ibid.*). What is missing in general, however, is an expected social concern over the security of the tunnel and the dangerous consequences. And it must be so in an environment vicious of the political economy of rent seeking and the public indifference to it.

three contractors on condition that the work should be completed within 41 months, and the cost went up to Rs. 11 crores. In due course, three more contractors joined, yet by March 1988, only 30 per cent of the work could be completed! Rightly, it was also a situation where too many cooks were spoiling the broth. Reports show that in all there were 16 contractors entrusted with the work in different phases (*The New Indian Express*, June 20, 2001).

The tortoise continued its pace, but not on any race. Interrupted very often by agitations, the tunnel construction went on and on from two opposite sides, but it never met together; the two tunnels from opposite sides just ran in parallel! An excellent engineering feat!

Finally after 21.5 years, the tortoise reached its destination, eating away more than Rs. 150 crores.

The World Bank aided Lower Periyar project, visualised in the 1970s and cleared by the Planning Commission in 1983, also tells almost the same story of delays. The public sector National Power Construction Corporation (NPCC), that took up the civil works, just wasted more than 4 years without any progress. Finally this contract was terminated in 1993 in an out-of-court settlement and the private sector Hindustan Construction Corporation (HCC) entered the scene. The same company (HCC) had taken up the tunnel works (in February 1984), with the deadline set on 26 October 1989. Later on HCC requested for time extension citing reasons as beyond their control, and the deadline was extended to 30 June 1992. Just one month prior to this date, HCC submitted to the KSEB a memorandum giving details of delays as follows – initial troubles: 5 months; labour problems: 10 months and 29 days; climatical problems: 10 months and 6 days; and obstructions/impediments on the part of the KSEB: 15 months! The company demanded for an additional payment of Rs. 16.33 crores to cover the increased costs due

The Lower Periyar Ecological Jinx

The Lower Periyar power project involves some serious long-run fallout on environment not considered properly. The project causes a 15 km break in the course of the Periyar river, at least during summer, as it is diverted through the tunnel from Pambla to Karimanal, the power station site. The river, already tamed considerably by the Idukki project, thus 'dies' at Pambla and 'resurrects' at Karimanal, where the tail-race water from the power station gives life back to the river!

to this time over-run. They had already been allowed a cost increase of about Rs. 61.8 crores, against the original estimate of Rs. 23 crores. A committee, constituted to look into the fresh demand, recommended, surprisingly, a payment of Rs. 8.5 crores with an immediate disbursement of Rs. 2.5 crores to HCC. The alleged bias towards HCC of the committee, that never cared for the loss to the KSEB amounting to Rs. 117 crores due to the 47 months time over-run, made headlines in the media and the clamour echoed in the legislative assembly for days. The company moved the High Court and the matter went up to the Supreme Court; finally the KSEB had to eat its heart out! It should be added that the World Bank, that had given aid to the project initially, but got reportedly frustrated over the time and cost over-runs, backed out long back.

On Inefficiency, Again!

Anyone familiar with the history of the Lower Periyar project can narrate any number of instances of the KSEB's inefficiency and lack of seriousness in getting the job done on time. For instance, when the steel rope of the surge shaft's gate snapped a few months [before its due date of

commissioning], it took close to two months for the Board to retrieve the equipment from the power shaft's well and to replace the rope. This could have been done in a few days, had the Board acted promptly.

Instead of retrieving the equipment and thus speeding up the commissioning, the Board's attention was focussed on fixing the responsibility for the disaster and find scapegoats....According to a rough estimate, the loss of a day's power generation at Lower Periyar was Rs. 14 lakhs. Any responsible authority would have fixed the generating system first, and fixed the responsibility later.....

One of the main impediments to the project becoming fully functional is said to be the delay in the arrival of the hoists of the five radial gates of the dam at Pampla. The Allahabad-based Thriveni Structural, a public sector undertaking, was given the order for these equipment long back, in 1988. It failed several times to honour the commitment. Insiders allege that the KSEB miserably failed in forcing Thriveni to stick to its schedule or find alternatives [in time].

-The Hindu, 23 October 1997.

Another jinxed project is Malampuzha, one of the first projects planned in the State to generate electricity from water let out from an irrigation dam. The contract for the design, supply and installation works were awarded to a private firm which allegedly had no previous experience in such projects. The civil work was done by the KSEB.

Though the company started the erection work in 1992, it took as many as four years to attempt at a trial run. However, during the trial run, some defects were noticed in the butterfly valve. In 1997, another

trial run was tried, but again during the run, a valve disc got broken. And the story still continues.....

Chimony, locked in a High Court stay obtained by the contractor since 1993, on the other hand, is altogether left out from the KSEB reports now!

It is significant to note in this respect that the KSEB used to present, in its Annual Administration Report, a detailed status report on the progress of each project, which, however, has been missing for quite some time now. Absence of such transparency makes difficult any examination on the causes of delay.

It should not, however, be construed that every power project in Kerala necessarily falls under the jinx of delay. The NTPC thermal project at Kayamkulam could be completed and test fired on 1 November 1998, four months ahead of the schedule. Similarly, the first private sector hydroelectric plant at Maniyar (12 MW) could be completed and commissioned within 15 months in 1994, by the Carborandom Universal Company. In this light, it goes without saying that something is rotten behind the KSEB projects – and it is nothing but the dead political will, dead of corrupt politicians and indifferent public.

6. The Political Economy of Corruption

A detailed discussion of this aspect is provided in Kannan and Pillai (2001 b); below we sketch out the most relevant ones.

In a neo-classical representation of political process, the relationships among the public, government and utility may be aptly analysed in the light of a three-tier hierarchical model of principal-agent problem. The problem consists in the default and breach of trust (i.e., moral hazard and adverse selection, Arrow 1985), likely on account

of the conflicting objectives of self-interest maximisation of the concerned parties and the uncertainty or information asymmetry involved in the relationship. In its simple version, it is assumed that in a regulatory governance structure, the principal's (i.e., the public's) objective is to maximise some measure of social welfare, while the agent (the government as supervisor) and the sub-agent (utility) aim to maximise the returns of their respective rent seeking pursuits. In a complex structure of relationships, the principal may be viewed as a composite set of sectional interests against the background of the general welfare objective; each class in this composite set, such as the contractors, construction workers, bureaucracy, politicians and others, follows its own designs of predatory rent seeking that dominate, in a particular context, the common objective. Such a structuring facilitates to analyse the political economy of corruption involved in the time and cost overruns in the power projects in Kerala.

Apart from the usual 'sales' procedures of construction contracts and materials purchase orders carried out by means of a collusion between the supervisor (government) and the sub-agent (bureaucracy in the utility), favouring certain contractors, the practice of allowing for time overruns of projects and sanctioning the associated cost escalations involves a 'wide spectrum collusion' among the domineering class interests in the composite principal set, viz., the political party in power (i.e., government), bureaucracy, contractors and trade unions. As already highlighted, recurring unrestricted labour militancy is recognised in general as the single factor that puts the heaviest burden on the pace of the construction works of power projects in Kerala, largely dictated by party-political rivalry rather than genuine labour demands, as for example, in the construction of Idukki hydro-electric project, to begin with. The time overruns out of the striking militancy upon one or another pecuniary pretext essentially go into the contractors' demand for cost escalation,

that is soon endorsed by the Board and sanctioned by the government.¹ Such rent-sharing is a widely recognised official practice in the power-irrigation sectors. The glaring laxity on the part of the government in fulfilling its committed responsibility for enforcing its authority on the contractors and workers to bind them within the contractual terms they agreed to take up to honour is a clear indication of its corrupt collusion. As mentioned above, in Kerala, the time and cost overruns have afflicted only the State power projects; the public sector NTPC thermal and the private sector hydro projects in the State having been completed well within their scheduled times. In this light, then, the cost escalation sanctioned for each late-run project may rightly be taken to represent the cost of corruption involved in construction contract sales in the power sector of the State. Accounting for the general price inflation during the normal construction period, this amounts to Rs. 644 crores or Rs. 35.8 crores per project! Unbelievably, it represents on an average about 60 per cent of the actual project cost! In some cases it is well above 70 per cent; for example, Sabarigiri Augmentation (75 per cent), Kakkad (74 per cent), Malankara (76 per cent), Poringalkuthu left bank extension (71 per cent), Kuttiady extension (80 per cent) and the diversion projects of Azutha (71 per cent), Kuttiar (73 per cent) and Vazhikkadavu (84 per cent). This is all shared among the four parties involved, at the cost of the helpless majority in the ‘principal’ set of tax payers.

Such lucrative rent sharing collusion has unfortunately become firmly institutionalised in the political process of the country. A highly individualistic self-interest domineering ethos have come to stay across

1 Excluding the hydro projects of Kallada and Pooyankutty, and the two diesel power plants. If we stick to the strict assumption that the original project cost estimate allow for possible inflation during construction period, such that the estimate be as on the completion date, then the corruption charges involved would be very much higher.

the social texture only to strengthen this political economy of corruption. It is not that the principal, the public at large, is unaware of all these murky dealings and developments; but they largely remain apathetic, even after enlightened enough in one or another way by the Press, true to the rotten spirit of an individualistic utilitarian society, lying moribund but never dying. This in fact questions at least to some extent the validity of the neo-classical apology of imperfect information as leading to the principal-agent problem. What is at heart of the malady is a lack of a sense of oneness, resulting in the void of an effective platform of checks and balances, that would have avoided problems arising from moral hazards and adverse selection. And this should point towards the significance of a soul-cleansing cultural revolution, reminiscent of that of the era of liberalism.

This may, however, appear a highly idealistic long-term objective. We do recognise the exertion of significant public praxis by a few concerned citizens and their organisations for immediate, palliative results. Strengthening and extending such praxis can go a long way towards imposing the public will for common interests on the political process. For example, there are measures that can effectively be applied to restrain time and cost overruns in the public projects: the construction contracts be so structured as to provide for making the contractors liable for stringent penalties in case of non-performance such as time overrun. The previous LDF state government (1996-2001) was reported to have made some steps in this direction in the case of the Athirappally hydroelectric project by initiating to institute in the contract penalty provisions for delay - something of the first kind in the history of the KSEB, *if* implemented. And it is such *ifs* that govern the direction and tempo of our development.

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Table 1. Profile of Time and Cost Overruns of the Projects

Project	Energy Potential (MU)	Year of Starting	Originally Scheduled Year of Completion	Year of commissioning	Estimated cost (Rs. Lakhs)	
					Original	Actual
Idukki II Stage	1007	1970	1978	1985-86	3168	6800
Idukki III Stage	376	1975	1981	1991	410	1511
Sabarigiri Augmentation	125	1972	1980	1990-91	128	1122
Idamalayar	320	1970	1978	1987	2340	9003
Kakkad	262	1976	1986	1999	1860	15352
Kallada	53	1981	1989	1993-94	1180	1802
Lower Periyar	493	1983	1991	1997-98	8843	35304
Malampuzha	5.6	1987	1989	?	295	679
Madupetty	6.4	1987	1989	1998	292	478
Malankara	65	1987	1990	?	780	4113
Chimony	6.5	1987	1990	?	314	425*
Peppara	11.5	1987	1990	1996	392	681
Pooyankutty	645	1986	-	?	25000	82000
Azutha Diversion	57	1987	1991-92	1998	290	1446
Poringalkuth LB Extn	74	1989	1992-93	1999	902	4273
Kuttiar Diversion	36.6	1988	1990-91	?	214	949
Vadakkepuzha Diversion	12	1989	1991-92	?	131	514
Vazhikkadavu Diversion	24	1989	1992-93	?	186	1599
Kuttiady Tail Race	15	1989	1992-93	?	397	1292
Kuttiady Extension	75	1992	1995-96	2000	3073	19800

Note: * = by 1993.

Source: Government of Kerala, *Economic Review* (various years).

Table 2. Cost Escalation of Power projects in Kerala (as in 1999-2000)

Projects	Time Overrun		Cost Overrun		WPI (All Commodities) Increase (%)
	(Years)	(%)	(Rs. Lakhs)	(%)	
Idukki II Stage	8	100	3632	114.65	258.31
Idukki III Stage	10	166.67	1101	268.54	237.89
Sabarigiri Augmentation	10	125	994	776.56	403.15
Idamalayar	9	112.5	6663	284.74	305.92
Kakkad	13	130	13492	725.38	461.15
Kallada	5	62.5	622	52.71	147.80
Lower Periyar	6	75	26461	299.23	193.68
Malampuzha	10	500	384	130.17	168.53
Madupetty	9	450	186	63.70	144.55
Malankara	9	300	3333	427.31	168.53
Chimony	9	300	111*	35.35*	71.96
Peppara	6	200	289	73.72	118.32
Pooyankutty	15	-	57000	228.00	182.67
Azhutha Diversion	6	120	1156	398.62	144.55
Poringalkuth LB Extn	6	150	3371	373.73	112.67
Kuttiar Diversion	8	400	735	343.46	132.42
Vadakkkepuzha Diversion	8	400	383	292.37	132.42
Vazhikkadavu Diversion	7	233.3	1413	759.68	132.42
Kuttiady Tail Race	7	233.3	895	225.44	132.42
Kuttiady Extension	4	100	16727	544.32	73.03

Note: * = by 1993.

Table 3. Extra Energy and Revenue Realisable from Timely Completion of Projects

Year	Firm Energy (MU)		Generation (MU)		Extra Energy Saleable (MU)	Extra Revenue Realisable (Rs. Crores)
	Actual	Realisable	Actual	Realisable		
1983-84	3725.73	5554.13	3643.4	5431.38	1326.69	46.67
1984-85	3725.73	5554.13	4884.9	7282.02	1797.91	53.83
1985-86	4397.33	5816.13	5357.1	7085.79	1298.12	39.94
1986-87	5053.13	5816.13	4642	5342.70	508.85	24.55
1987-88	5053.13	5816.13	4093.1	4711.07	439.11	24.44
1988-89	5053.13	5816.13	4548	5234.52	521.75	29.58
1989-90	5053.13	5881.13	5075	5906.42	648.62	34.65
1990-91	5554.13	6000.73	5491	5932.32	346.28	18.35
1991-92	5554.13	6562.73	5326	6293.00	756.60	45.40
1992-93	5554.13	6675.73	6189	7438.77	987.34	73.01
1993-94	5607.13	6675.73	5822.3	6932.08	886.60	72.75
1994-95	5607.13	6675.73	6572.3	7824.62	1001.38	86.80
1995-96	5607.53	6751.13	6662	8020.34	1086.20	100.93
1996-97	5619.03	6751.13	5502.9	6611.38	887.38	84.84
1997-98	6118.43	6751.13	5188.7	5725.63	440.70	56.91
1998-99	6249.43	6751.13	7601.6	8212.07	501.95	67.52
1999-2000	6586.43	6751.13	7655.57	7846.84	158.10	26.16
Total					13593.58	886.33

Table 4. Capital Cost Savings

Projects	Capital Cost (Rs) per kWh of Energy Potential		Savings in Capital Cost (Rs. Lakhs)	Capital Waste Factor**	Capital x Time Waste Factor (%)
	Original	Actual			
Idukki II Stage	0.31	0.68	910.20	0.15	329.29
Idukki III Stage	0.11	0.40	844.33	1.27	882.76
Sabarigiri Augmentation	0.10	0.90	838.42	2.96	1872.27
Idamalayar	0.73	2.81	4652.58	1.07	717.58
Kakkad	0.71	5.86	11386.17	2.87	1798.37
Kallada	2.23	3.40	-153.26	-	148.16
Lower Periyar	1.79	7.16	18940.91	1.16	598.65
Malampuzha	5.27	12.13	339.78	1.00	1281.02
Madupetty	4.56	7.47	142.23	0.42	800.34
Malankara	1.20	6.33	3124.06	3.16	2009.23
Chimony	4.83	6.54*	26.89*	0.07	441.40*
Peppara	3.41	5.92	184.00	0.37	421.17
Pooyankutty	3.88	12.71	NAP	NAP	NAP
Azhutha Diversion	0.51	2.54	1027.80	2.46	996.97
Poringalkuth LB Extn	1.22	5.77	3028.05	2.43	1084.31
Kuttiar Diversion	0.58	2.59	696.27	2.75	2117.29
Vadakkapuzha Diversion	1.09	4.28	349.72	2.13	1861.83
Vazhikkadavu Diversion	0.78	6.66	1342.28	5.23	2765.59
Kuttiady Tail Race	2.65	8.61	744.06	1.36	984.80
Kuttiady Extension	4.10	26.40	15825.39	3.98	1188.64

Note: * = by 1993; NAP = Not Applicable; ** = Equivalent to number of Kakkad-type projects

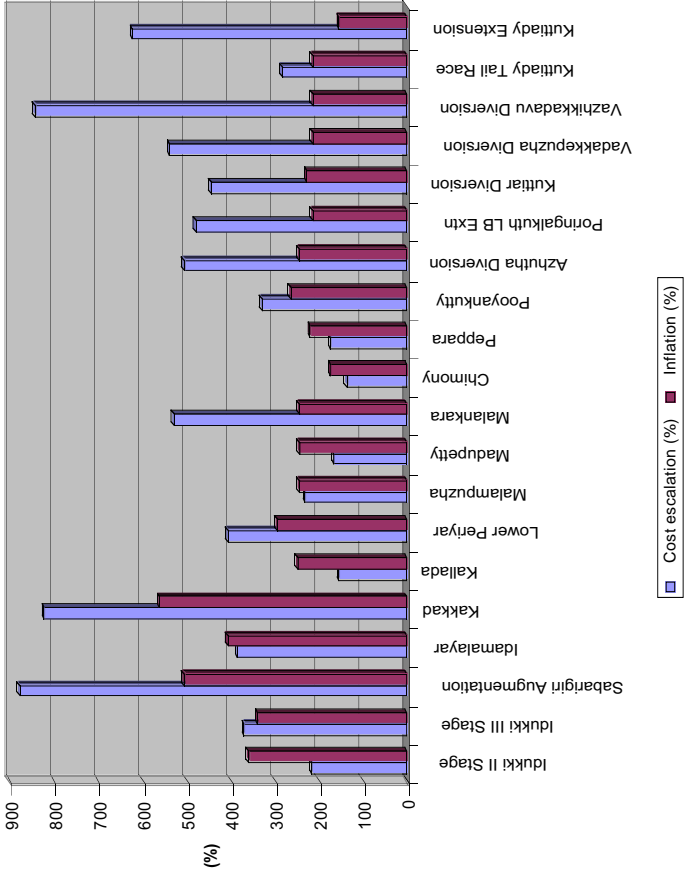
Appendix

TIME AND COST OVERRUN OF POWER PROJECTS IN KERALA						
		KAKKAD	KALLADA	LOWER PERIYAR		
Year of Starting		1976	1981	1983		
Original Cost Estimate, Rs. Lakhs		1860	1180	8843		
Energy Potential, mu		262	53	493		
Original Expected Year of Commissioning		8 Years	8 Years	8 Years		
Year	KAKKAD Revised Cost Estimate	Revised Year of Commissioning	KALLADA Revised Cost Estimate	Revised Year of Commissioning	LOWER PERIYAR Revised Cost Estimate	Revised Year of Commissioning
1985	4117	1986-88	1180	1989	10050	1990
1986	5500	1990	1389	1987-88	14209	1990
1987	5500	Jul-90	1389	Aug-89	14209	1990
1988	6941	Sep-91	1389	Dec-90	10900	Sep-91
1989	7012	Sep-92	1389	Dec-90	14000	Sep-92
1990	7012	1993-94	1389	1992-93	14000	
1991	7012	1993-94	1389	1993-94	14000	1994-95
1992	8800	1995-96	1437	1993-94	18000	1994-95
1993	9869	1995-96	1606	1993-94	26000	1995-96
1994	10935	1995-96	1802	Commissioned in 1993-94	27300	1995-96
1995	15080	1996-97			27300	1996-97
1996	15080	1997-98			27300	1997-98
1997	14599	Jun-98			29899	Commissioned
1998	14599	March 1999			29899	In October 1997
1999	15275	Commissioned on 14.10.1999			35768	

		CHIMONY	PEPPARA	POOYANKUTTY - I
Year of Starting		1987	1987	1986
Original Cost Estimate, Rs. Lakhs		314	392	25000
Energy Potential, MU		6.5	11.5	645
Original Expected Year of Commissioning		1990	1990	8 Years
Year	CHIMONY Revised Cost Estimate	PEPPARA Revised Cost Estimate	Revised Year of Commissioning	POOYANKUTTY - I Revised Cost R Estimate
1988	345	332	Nov-90	780
1988	360	567	1991-92	25000
1989	360	567	1991-92	25000
1990	360	567	1992-93	25000
1991	360	567	1992-93	25000
1992	425	580	1993-94	25000
1993	425	580	1994-95	25000
1994		580	1994-95	59000
1995		850	1995-96	59000
1996		850	Commissioned	59000
1997		850	in June 1996	59000
1998		625		82000
1999		671		82000
2000		681		82000
				1991-92
				1992-93
				During IX Plan
				2003-04
				8 Years
				8 Years
				8 Years

	VADAKKEPPUZHA DIVERSION	VAZHAIKADAVU DIVERSION	KUTTIADY TAIL RACE	KUTTIADY EXTENSION
Year of Starting Original Cost Estimate, Rs. Lakhs Energy Potential, MU Original Expected Year of Commissioning	1989 131 12 1991-92	1989 186 24 1992-93	1989 397 15 1992-93	1994 3073 75 1995-96
Year	VADAKKEPPUZHA DIVERSION Revised Cost Estimate	VAZHAIKADAVU DIVERSION Revised Cost Estimate	KUTTIADY TAIL RACE Revised Cost Estimate	
1989	131	185	397	
1990	131	185		
1991	131	185		
1992	160	200		
1993	160	359		
1994	160	419	660	1995-96
1995	385	1595	1000	1995-96
1996	385	1595	1000	1997-98
1997	385	1595	1448	31.7.1999
1998	786	2000	1338	1999
1999	705	1564	1123	2000-01
2000	514	1599	1292	2001-02

Cost Escalation of Power Projects Vs. General Price Inflation



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