CHINA: Second Power Project
(Loan 671-CHA)

December 30, 1976

MEMORANDUM TO THE EXECUTIVE DIRECTORS

SUBJECT: Project Performance Audit Report - China: Second Power Project (Loan 671-CHA)

Attached, for information, is a copy of a report entitled "Project Performance Audit Report - China: Second Power Project" prepared by the Operations Evaluation Department.

Attachment

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Mervyn L. Weiner, Director-General, Operations Evaluation

DATE: December 3, 1976

FROM: Shiv S. Kapur, Director, OED

SUBJECT: Project Performance Audit Report on China: Second Power Project (Loan 671-CHA)

I am attaching for your approval the Performance Audit Report on China: Second Power Project supported by Loan 617-CHA of 1970. The report has been revised in light of comments provided by East Asia and Pacific Regional Office and Central Projects Staff, and the borrower.

Attachment

cc: Messrs. Baum
Bell

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Mervyn L. Weiner

DATE: December 27, 1976

FROM: Bernard R. Bell BRB (ca)

SUBJECT: Project Performance Audit Reports on -
(1) China: Tachien Power Project (Loan 574-CHA)
(2) China: Second Power Project (Loan 671-CHA)

In reponse to your query, I am satisfied that the comments and suggestions of the staff of the Regional Office have been fully taken into account in these two audit reports.

BRBell:bcl

Mw Bohr

1. Project File
2. cc: Mr. Piriou

部 濟 經

MINISTRY OF ECONOMIC AFFAIRS

15, FOO-CHOW STREET
TAIPEI, TAIWAN
REPUBLIC OF CHINA

10/27

October 22, 1976

Mr. Kenneth A. Bohr
Acting Director
Operations Evaluation Dept.
The World Bank
1818 H Street, N.W.
Washington, D. C. 20433
U. S. A.

Dear Mr. Bohr:

Thank you for your letter of September 24, and the enclosed copy of the draft of the project Performance Audit Report on the Second Power Project (Loan 671-CHA). We find the report a very comprehensive analysis of many projects, which have been operating satisfactorily since completion of their construction.

As energy sales, load forecast, etc. pertaining to power system vary under different conditions, Taipower will furnish you with these figures for reference.

Yours sincerely,

Kuang-Lien Chin

Kuang-Lien Chin
Chief Secretary

cc: Taipower

907
10/27

1. Project File
2. cc: Mr. Perkins

P. O. Box 171
Phone 3518011
Cable TAIPOWER
Telex 11520

台灣電力公司
TAIWAN POWER COMPANY
39 East Hoping Road, Section 1, Taipei 106, Republic of China

In Reply Please Quote 10/26
IBRD-2777

October 19, 1976

Mr. Kenneth A. Bohr, Acting Director
Operations Evaluation Department
Int'l Bank for Reconstruction and Development
1818 H Street, N.W.
Washington, D.C. 20433
U. S. A.

Subject: Second Power Project (Loan 671-CHA)
Project Performance Audit Report

Dear Mr. Bohr:

Reference is made to your letter dated September 24, 1976 with the draft of Project Performance Audit Report on the Second Power Project (Loan 671-CHA).

We are sending you herewith for your reference some new up-to-date figures of peak load, energy sales, load forecast, ... etc., as shown on Table C and page A.4 of said report indicated by red ball pen. We have no other comment.

Sincerely yours,

Paul K. Chien

Paul K. Chien
Acting President

Encl.

cc: Ministry of Economic Affairs (w/c)
Ministry of Finance (w/c)

ph/cp

880
10/22

Table C

KEY INDICATORS
Estimate v/s Actual
(All figures in NT$ mill., unless stated otherwise)

		1969	1970	1971	1972	1973	1974	1975
Peak Load (MW)	Est.	1,848	~~2,200~~ 2,164	2,450 ~~2,463~~	~~2,750~~ 2,784	~~3,150~~ 3,134	~~3,500~~ 3,512	3,900 3,923
	Act.	1,848	2,131	2,399	2,734	3,134	3,452	3,765
Installed Capacity (MW)	Est.	2,245	2,725	3,078	3,633	4,167	4,367	4,974
	Act.	2,245	2,720	2,774	3,519	4,124	4,358	5,300
Energy Sales (GWh)	Est.	10,051	11,696	~~12,941~~ 13,340	~~14,669~~ 15,150	~~16,454~~ 17,032	~~18,437~~ 19,127	~~20,599~~ 21,412
	Act.	10,051	11,964	13,836	16,081	17,938	18,881	21,217
Total Operating Revenues	Est.	5,598	6,661	7,576	8,633	9,729	10,955	12,299
	* Act.	5,598	6,986	8,220	4,463	9,960	~~14,887~~ 14,886	22,059
Total Operating Cost	Est.	3,777	4,377	4,952	5,658	6,143	6,884	7,618
	* Act.	~~3,777~~ 3,818	4,528	5,749	3,176	7,186	11,078	16,864
Oper. Income (less deprec.)	Est.	1,751	2,284	2,624	2,975	3,586	4,071	4,681
	* Act	~~1,751~~ 1,780	2,458	2,471	1,287	2,774	3,808	~~5,196~~ 5,195
Total Internal Cash Generation	Est.	2,625	3,220	3,692	4,195	4,991	5,682	6,432
	* Act.	2,625	3,530	~~3,873~~ 3,874	2,079	4,471	6,407	8,068
Net Internal Cash Generation	Est.	1,011	1,606	1,635	1,719	1,983	2,295	2,676
	* Act.	1,238	1,882	1,896 1,897	947	1,669	2,965	3,337
Construction Expenditure (excl. IDC)	Est.	3,103	5,714	8,140	7,471	6,309	5,808	6,407
	* Act.	3,103	3,816	6,615	4,005	10,144	18,650	20,577
Rate Base: Average Net Fixed Assets in Operation & Working Capital	Est.	17,177	20,420	23,908	26,873	31,014	35,695	39,021
	* Act.	~~17,122~~ 17,174	~~19,712~~ 19,766	~~22,745~~ 22,761	~~23,980~~ 23,972	~~25,743~~ 25,753	~~28,704~~ 28,726	~~37,645~~ 37,654
Rate of Return %	Est.	10.2	11.2	11.0	11.1	11.6	11.4	12.0
	* Act.	10.4	12.3	10.9	5.4	10.8	13.3	~~13.8~~ 14.1
Debt/Equity Ratio	Est.	48/52	49/51	53/47	55/45	54/46	52/48	50/50
	* Act.	48/52	46/54	47/53	51/49	52/48	56/44	52/48
Debt Service Coverage (incl. IDC)	Est.	1.7	2.1	1.9	1.8	1.7	1.7	1.8
	* Act.	~~1.9~~ 1.8	~~2.2~~ 2.1	~~2.0~~ 2.12	~~1.9~~ 2.0	~~1.7~~ 1.8	~~1.9~~ 2.12	~~1.8~~ 2.1
Net Internal Cash Gen. as % of Constr. Expenditure	Est.	.32	.28	.20	.23	.31	40	.42
	* Act.	.39	.49	.28	.23	.16	.16	.16
Tariff (NT$)	Est.	.54	.56	.57	.57	.58	.58	.58
	Act.	.537	.565	.567	.564	.576	1.031	1.070
Oper. Cost/KWh sold (NT$)	Est.	.37	.37	.38	.38	.37	.37	.37
	Act.	.370	.371	.400	.390	.427	.860	.853
Consumer Price Index	Act.	100	104	106	110	119	175	184

Note: Estimates refer to calendar year; actuals shown with an asterisk refer to Fiscal Year.

4. Load Forecast

	Installed capacity MW		Maximum Demand MW		Generation GWh		Sales GWh	
	1	2	1	2	1	2	1	2
1969	2245	2245	1850	1848	n.a.	11119	10002	10051
1970	2720	2720	~~2200~~ 2164	2131	n.a.	13213	11696	11964
1971	2770	2774	~~2450~~ 2463	2399	n.a.	15171	~~12941~~	13836
1972	3350	3519	~~2750~~ 2784	2734	n.a.	17445 ~~19805~~	~~16454~~	~~17938~~
1973	3800	4124	~~3150~~ 3134	3134	n.a.	19805	~~16454~~ 16081	17938 14,669

~~13340~~
~~15150~~
~~17032~~

1. Appraisal
2. Actual

Taipower's power market -- maximum demand -- developed as forecast, however, actual sales were higher by about 9% with a corresponding increase in the average annual load factor, a surprising 72% achieved in 1973.

5. Consultants

Taipower engaged the services of Gibbs & Hill Inc., of New York (GH) for Plant Engineering & Design and to act as Taipower's Procurement Agent. Taipower is satisfied with the performance of GH -- "have done a good job. Due to their cooperation, particularly expediting delivery of piping materials, construction progressed smoothly and full load operation was achieved 4 months ahead of schedule".

6. Design & Procurement

Engineering and Design work by GH started in August 1969 and kept on forecast schedule until July 1971, dropping thereafter -- about 5% maximum in December 1972. Procurement started in May 1970 and was 92% complete by February 1972. The forecast procurement schedule for the first 18 months was too ambitious to achieve. By February 1973 procurement was essentially complete having taken 34 months. The project suffered no delays due to engineering or procurement. All materials, arrived on or even ahead of schedule with the exception of some valves that eventually were airfreighted.

7. Gibbs & Hill Organization

A Project Manager was supported by an Engineering Manager, a Purchasing Manager and a Construction Manager. Excluding drafting personnel, the Engineering Manager had an expatriate supporting staff of 17 engineers/architects. The Purchasing Manager had one expatriate assistant and the Construction Manager was supported by a Resident Engineer and a Testing-Start-Up Engineer.

8. Taipower Organization

Taipower assumed primary responsibility for site supervision and erection of equipment. Its Head office in Taipei was responsible for:

15

P. O. Box 171
Phone 3518011
Cable TAIPOWER
Telex 11520

台灣電力公司
TAIWAN POWER COMPANY
39 East Hoping Road, Section 1, Taipei 106, Republic of China

In Reply
Please Quote
TC-1-2546

July 1, 1976

Personal

Mr. E. A. Minnig
Power Division, East Asia & Pacific Projects
International Bank for Reconstruction
and Development
1818 H Street, N.W.
Washington, D.C. 20433
U. S. A.

Dear Mr. Minnig:

With reference to our conversation during your last visit in June, we are enclosing herewith a revised completion report (marked on your original copy) for Loan 574-CHA Tachien Power Project for your reference.

With my warmest personal regards,

Sincerely yours,

C. H. Wang
Chief Engineer

Encl.

ph

1. RM: Project File
2. cc: Ms Pereira.

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

Where do we stand on this now? Are we ready to finalize it?

TO: Mr. Shiv S. Kapur

DATE: October 18, 1976

FROM: F. H. Howell F.H.H.

SUBJECT: Draft Project Performance Audit Report - CHINA: Second Power Project (Loan 671-CHA)

I have read this report, which you sent to Mr. Bell September 17, 1976. I think the report has been thoughtfully and carefully prepared. The EA&P Region has no comments to offer. 10/19

FHHowell:ls

cc: Mr. Bell
Mr. Baum
Mr. Kirmani
Mr. Beach

852
10/19

September 24, 1976

Dr. David S.L. Chu
President
Taiwan Power Company
39, Ho-ping East Road, Sec.I.,
Taipei, Taiwan
Republic of China

Dear Dr. Chu:

Re: Project Performance Audit Report on China:
Second Power Project (Loan 671-CHA)

Following Mr. Kapur's letter to you of September 15, 1976 enclosing a copy of the draft of the Project Performance Audit Report on Tachien Power Project (Loan 574-CHA), I now attach a copy of the draft of the Project Performance Audit Report on the Second Power Project, supported by Loan 671-CHA of 1970. I would appreciate receiving any comments that you may have on this draft by October 25 so that we can take them into consideration before sending the final version of this report to the Bank's Executive Directors.

I am also sending a copy of this report to the Ministry of Finance and the Ministry of Economic Affairs for their comments.

Yours sincerely,

Kenneth A. Bohr
Acting Director
Operations Evaluation Department

Attachment

TPereira:cmm

September 24, 1976

Mr. Kuang-Lien Chin
Chief Secretary
Ministry of Economic Affairs
15, Fu-chou Road
Taipei, Taiwan
Republic of China

Dear Mr. Chin:

Re: Project Performance Audit Report on China;
Second Power Project (Loan 671-CHA)

Following Mr. Kapur's letter to you of September 15, 1976, enclosing a copy of the draft of the Project Performance Audit Report on Tachien Power Project (Loan 574-CHA), I now attach a copy of the draft of the Project Performance Audit Report on the Second Power Project, supported by Loan 671-CHA of 1970. I would appreciate receiving any comments that you may have on this draft by October 25 so that we can take them into consideration before sending the final version of this report to the Bank's Executive Directors.

I am also sending a copy of this report to the Ministry of Finance and to the President, Taiwan Power Company for their comments.

Yours sincerely,

Kenneth A. Bohr
Acting Director
Operations Evaluation Department

Attachment

TPereira:cmn

September 24, 1976

Mr. M. Li
Chief Secretary
Ministry of Finance
2, Ai Kup West Road
Taipei, Taiwan
Republic of China

Dear Mr. Li:

Re: Project Performance Audit Report on China:
Second Power Project (Loan 671-CHA)

Following Mr. Kapur's letter to you of September 15, 1976 enclosing a copy of the draft of the Project Performance Audit Report on Tachien Power Project (Loan 574-CHA), I now attach a copy of the draft of the Project Performance Audit Report on the Second Power Project, supported by Loan 671-CHA of 1970. I would appreciate receiving any comments that you may have on this draft by October 25 so that we can take them into consideration before sending the final version of this report to the Bank's Executive Directors.

I am also sending a copy of this report to the Ministry of Economic Affairs and to the President, Taiwan Power Company for their comments

Yours sincerely,

Kenneth A. Bohr
Acting Director
Operations Evaluation Department

Attachment

TPereira:cmm

WORLD BANK / INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. Shiv S. Kapur, OED

DATE: September 22, 1976

FROM: Donald King, WAP

SUBJECT: Draft OED Performance Report, Second Power Project, Loan 671-CHA

I think the OED report covers the subject well, notes that there were no significant problems in the implementation of the project, and that it was very successful. I would agree with para. 11 "there are no specific lessons to be learned from this successful project." However, it is perhaps worth noting that this borrower falls in the category, described in the IBRD report on Project Supervision prepared by OED this year, of sophisticated borrowers who because of their experience and expertise should be given only minimum Bank supervision (allowing the greater supervision resources to be devoted to weaker borrowers). This was the case for Taipower. Supervision visits were on a more or less annual basis, brief and mainly to check that the project was staying on course.

DKing:ev

INTERNATIONAL DEVELOPMENT ASSOCIATION | INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT | INTERNATIONAL FINANCE CORPORATION

OFFICE MEMORANDUM

TO: Mr. B.R. Bell, Vice President, E.A. & P.
Mr. W.C. Baum, Vice President, Projects

DATE: September 17, 1976

FROM: Shiv S. Kapur, Director, OED

SUBJECT: Draft Project Performance Audit Report - China: Second Power Project (Loan 671-CHA)

I attach for your comments, a draft Project Performance Audit Report on China: Second Power Project assisted by Loan 671-CHA of May 1970. I would appreciate receiving any comments you might have by October 25, 1976.

On September 25, 1976, I expect to send the draft paper to Taiwan Power Company and to the Government of the Republic of China so that we might receive their comments about the same time as yours.

Attachment

cc: Messrs. Kirmani
Votaw
Rovani
Howell
King
Beach
Minnig
Vacchelli

OFFICE MEMORANDUM

TO: Mr. E. B. Arnold

DATE: February 27, 1975

FROM: E. A. Minnig

SUBJECT: CHINA - Loan 671-CHA Talin No.4 Thermal Unit 375 MW
Lower Tachien Hydro Units No.3 & 4, 180 MW
Completion Report

This report was prepared on information provided by Taipower and does not include the transmission element.

A. Talin No.4 Thermal Unit (375 MW)

Summary

Talin No.4 was completed ahead of schedule and within the original cost estimate.

1. Basic Information

Appraisal:		October/November 1969
Reappraisal:		February/March 1970
Board Date:		April 21, 1970
Signing Date:		May 16, 1970
Effectiveness:		September 8, 1970
Project Completion:	(scheduled)	December 1973 (First Synchronization)
	(actual)	October 23, 1973 (Full Commercial)
Closing Date:		December 31, 1975
Loan Amount:		US$ 31.5 million including IDC. Talin No.4 only.

2. Project Scope

Extension of the existing Talin oil-fired steam Power Station (Units 1-3 = 975 MW) at Kaohsiung in southern Taiwan by the addition of a fourth 375 MW unit to meet power demand in the two densely populated and industrially developed areas of Taiwan (Taipei - Keelong area in the north, and Kaohsiung area in the south). Financing under loans 574-CHA and 671-CHA also included a double circuit 345 kV transmission line connecting the two load centers plus a feed-in substation for hydro generated energy in Central Taiwan. The unit includes one indoor tandem compound four flow turbine at 375 MW, 2400 psig, and 1000°F; one indoor hydrogen cooled generator rated for maximum capacity of 422 MVA; and one outdoor-type oil-fired boiler rated at 2,625,000 lbs/hr of steam flow at the superheater outlet.

3. General Project Considerations (Feasibility Report May 1969)

(i) The existing plant site Talin was chosen in preference to Linkou in the North because of cost advantages in fuel supply and transmission;

(ii) Taipower considered international competitive bidding advantageous and accordingly approached the Bank for financial assistance;

(iii) A unit capacity of 350 MW was compared to a 500 MW unit.

	350 MW	500 MW
Capital investment/kW	US$ 122.2	US$ 110.8
Generation Costs US mills/kWh	5.881	5.553
Average systems generating costs 1968		7.27 US mills/kWh.

On this basis -- since the system would have permitted the installation of a 500 MW unit -- a 500 MW unit was the preferred solution. However, the ultimate decision was for the 375 MW unit -- the same as Unit 3 -- in order to profit from erection experience already gained and to save time in design and construction. A further consideration was that at that time only a limited number of manufacturers produced 500 MW units. The reasons for not considering a hydro alternative were:

(i) to meet projected demand a base load unit was required-- the system load factor was already 68%;

(ii) no hydro sites meeting the required characteristics were available for implementation; and

(iii) in any event, the construction time for a hydro plant -- if available -- was longer;

(iv) Incremental Rate of Return

Cost Stream = Cost of Talin No.4; associated 345 kV transmission facilities, plus other transmission and distribution facilities required to transmit and distribute Talin No.4 output; Operating and Maintenance Costs; plus Fuel at US$ 15/t net of taxes.

Benefit Stream = Cost Savings from the initial displacement of less efficient generating plant and subsequent revenues from the supply of new load (US cents 1.43/kWh assumed to be the average revenues 1970-1975).

Rate of Return 17%

4. Load Forecast

	Installed capacity MW		Maximum Demand MW		Generation GWh		Sales GWh	
	1	2	1	2	1	2	1	2
1969	2245	2245	1850	1848	n.a.	11119	10002	10051
1970	2720	2720	2200	2131	n.a.	13213	11696	11964
1971	2770	2774	2450	2399	n.a.	15171	12941	13836
1972	3350	3519	2750	2734	n.a.	19805	16454	17938
1973	3800	4124	3150	3134	n.a.	19805	16454	17938

1. Appraisal
2. Actual

Taipower's power market -- maximum demand -- developed as forecast, however, actual sales were higher by about 9% with a corresponding increase in the average annual load factor, a surprising 72% achieved in 1973.

5. Consultants

Taipower engaged the services of Gibbs & Hill Inc., of New York (GH) for Plant Engineering & Design and to act as Taipower's Procurement Agent. Taipower is satisfied with the performance of GH -- "have done a good job. Due to their cooperation, particularly expediting delivery of piping materials, construction progressed smoothly and full load operation was achieved 4 months ahead of schedule".

6. Design & Procurement

Engineering and Design work by GH started in August 1969 and kept on forecast schedule until July 1971, dropping thereafter -- about 5% maximum in December 1972. Procurement started in May 1970 and was 92% complete by February 1972. The forecast procurement schedule for the first 18 months was too ambitious to achieve. By February 1973 procurement was essentially complete having taken 34 months. The project suffered no delays due to engineering or procurement. All materials, arrived on or even ahead of schedule with the exception of some valves that eventually were airfreighted.

7. Gibbs & Hill Organization

A Project Manager was supported by an Engineering Manager, a Purchasing Manager and a Construction Manager. Excluding drafting personnel, the Engineering Manager had an expatriate supporting staff of 17 engineers/architects. The Purchasing Manager had one expatriate assistant and the Construction Manager was supported by a Resident Engineer and a Testing-Start-Up Engineer.

8. Taipower Organization

Taipower assumed primary responsibility for site supervision and erection of equipment. Its Head office in Taipei was responsible for:

(i) Review of Shop Inspection & Test Reports;
(ii) Job-site Inspection and Quality Control;
(iii) Design of minor items; review of GH engineering; approval of specifications; and justification of equipment costs;
(iv) Coordination;
(v) Accounting;
(vi) Foreign purchases of miscellaneous items;
(vii) Insurance, shipping and transportation;
(viii) Personnel; and
(ix) Financial management Bank loan.

Field supporting staff covered the following activities:

(i) General Services;
(ii) Purchasing, transportation, storage;
(iii) Site accounting;
(iv) Safety;
(v) Installation and Erection;
(vi) Civil Engineering & Architecture; and
(vii) Supervision of local civil contractors.

9. Construction

Actual progress was always ahead of the original schedule. Construction started in July 1970, parallel with Talin No.3 which was completed in December 1970. Construction progress can be summarized as follows:

	Completion %	
	Schedule	Actual
July 1, 1970	0	0
July 1, 1971	8.16	8.39
July 1, 1972	30.97	32.93
July 1, 1973	75.78	85.51
December 30, 1973	96.72	100.00
July 1, 1974	100.00	-

10. Troubles occurring during construction were:

(i) delivery delay in piping valves - airfreighted;
(ii) turbine internal balancing pipe broken during initial operation - no damage to turbine, new pipe successfully fitted;
(iii) poor efficiency of make-up water treatment equipment - change of resin type in ion-exchangers solved problem;
(iv) high pressure heater tube leakage due to stress - being corrected by annealing at jobsite.

None of these difficulties affected costs and the delay caused amounted to only a few days.

11. Taipower's assessment of quality and performance of manufacturers and contractors. Because of earlier than anticipated commissioning Taipower considers performance and quality as satisfactory.

12. Taipower's assessment of the Bank's performance is also satisfactory, particularly in respect to the Bank's involvement and responsiveness with procurement, which according to Taipower went smoothly and contributed to the early completion of the Project.

13. Principal Suppliers financed by Loan 671-CHA

Item	Contractor	Amount US$ equivalent (10^3)
Engineering Services	Gibbs & Hill	1529
Turbo Generator etc.	Mitsubishi	6932
Boiler	Mitsubishi	7998
Condenser Tubes	Mitsubishi	552
Power Piping	Tubeco (USA)	2690
Transformer & Switchyard Equipment	Mitsubishi	443

14. Principal Items financed with Supplier's Credits

Boiler Feedwater Pumps	Byron Jackson	675
Condensate Coolers	Mitsubishi	87
Main Power Transformer	Toshiba	835

15. Items financed by Taipower directly

Computer control equipment, other	2055

16. Acceptance and Performance Tests

Performance tests were carried out in November 1973. The results are summarized as follows:

	Test Result	Guarantee	Difference
Boiler Efficiency (%)	89.42	88.47	+ 0.95%
Turbo Heat Rate (BTU/kWh)	7350	7435	+ 1.1 %

17. Financing Arrangements and Costs

The feasibility report prepared by Taipower estimated total costs (excluding IDC) at US$ 48.3 million equivalent and financing was originally envisaged as follows:

IBRD	US$ 24.6 million	51%
Taipower	17.3	36%
Suppliers Credit	1.5	3%
Customs Duties	4.9	10%
Total	48.3	100%

The Bank appraisal mission, after review of the Project, estimated total costs at US$ 45.3 (again without IDC) and proposed financing of the foreign exchange component and the following financing plan:

IBRD	US$	28.2 million	62%
Taipower		17.1 "	48%
Total	US$	45.3 "	100%

18. During the course of construction Taipower, because of its capital intensive program, could not contribute the US$ 17.1 million and was forced to borrow funds on the local market, in addition to which three suppliers credits had to be negotiated (see paragraph 14) totalling about US$ 1.6 million equivalent.

19. A comparison between estimated and tentative actual costs is given in the attachment to this report. Summarized the position is as follows:

	In thousands of US$ equivalent		
	Local	Foreign	Total
Appraisal Estimate	17100	28200	45300
Tentative Actual	18347	27222	45569
Increase (Decrease)	1247	(978)	269

Cost increases occurred mainly in (i) Civil Works; (ii) Construction equipment; (iii) Pressure Piping; and (iv) Miscellaneous mechanical equipment which can be offset by allocation of the contingency item provided for in the original estimate. The resultant increased costs are therefore indirectly attributable to customs duties only.

20. Project Justification in Retrospect

Taipower has not yet calculated generating costs of the new unit. An estimate made in 1973 after commissioning gave the following indications:

(i) In 1973 the average generating costs for Taipower's system amounted to US mills 6.95/kWh;

(ii) Generating costs at Talin (2 x 300 MW plus 2 x 375 MW - including Unit No.4) totalled US mills 5.69/kWh. Since Talin No.4 is the newest unit and the more efficient, its generating costs are if not less, at least equal to US mills 5.69/kWh comparing favorably to the estimate made in paragraph 3 (iii). As a result system savings (1974) can be estimated at about US$ 3.0 million or about 1.4-1.5% of total operating expenses in that year.

B. Lower Tachien Hydro Project (Phase II, 2 x 90 MW)

Summary

Lower Tachien Units No.3 & 4 were commissioned ahead of schedule and below estimated costs.

21. Basic Information

Appraisal - Effectiveness as for Talin No.4			
Project Completion	(scheduled)		June 30, 1973
	(actual)	Unit 3	May 29, 1973
		Unit 4	June 30, 1973
Closing Date:	December 31, 1975		
Loan Amount:	US$ 5.6 million equivalent including IDC (Lower Tachien No.3 & 4 only, Penstock steel procured by Taipower excluded).		

22. Project Scope

The Chingshan (Lower Tachien) Hydro Power Plant on the Tachia River is the second up-stream development of five possible developments and downstream of the Tachien Dam Project financed under Loan 574-CHA. Lower Tachien, thus benefits from the regulation provided by the Tachien storage. Chingshan was developed in two stages with all major civil works completed in the initial stage (2 x 90 MW) financed by US AID and commissioned in December 1970. The Project (Stage 2) was thus limited to the installation of the two remaining units No.3 & 4 bringing installed capacity to 360 MW. Completion of this Project made the Chingshan Power Station the largest hydro facility in Taipower's system.

23. General Project Considerations

With the construction of the Tachien Dam Project underway, expansion of Chingshan was a logical step since operation of Units 3 & 4 would be coordinated with that of the other plants on the river benefitting from the storage provided by the Tachien Project. The location of Lower Tachien -- between the northern and southern load centers -- was also beneficial for operation as a peaking plant.

24. Project Execution

Installation of the Units was carried out by Taipower personnel with assistance provided by manufacturers. Construction started in March 1972 and all work was completed by end June 1973. The organization set-up for project implementation was:

(i)	Erection Team:	Responsible for transportation and erection;
(ii)	E & M Division:	Responsible for penstock installation and engineering services;
(iii)	Shop Division:	Manufacture of steel metal works and maintenance and repair of construction equipment;
(iv)	E & M Inspection Team:	Inspection of installation work;
(v)	Civil Inspection Team:	Inspection of civil works; and
(vi)	TPC Construction Team:	Erection of Transformers and Switchyard.

25. Construction Difficulties

Although commissioned ahead of schedule, the following difficulties were encountered:

(i) Generator No.4 Spider boss could not be tightly connected because spring key did not fit. Spring key trimmed and fitted at local iron works;

(ii) Cotter keys of No.4 Rotor were thicker than design tolerance. Local iron works could not correct deficiency and manufacturer was requested for replacements which were airfreighted. This defect caused delays which were made up by concentrating on other work;

(iii) Pipe fittings supplied by manufacturers were either not processed or erroneously processed. Time was wasted in re-modelling and re-processing;

(iv) Station service switchboard arrived late due to time-consuming ocean-freight requiring power for the auxilliary equipment during test running to be supplied from the Unit 2 switchboard;

(v) Main valve water seal. Downstream seal operated by hydraulic pressure. Upstream seal by turn-buckles. With the penstock full, the upstream seal was difficult to operate. TPC recommends hydraulic operated seals for convenience and efficiency;

(vi) Transformer Unit No.3 because of shipping difficulties arrived late. Because transformer was over-weight for highway transportation, traffic permit issued by Taiwan Highway Administration was delayed.

26. Taipower's Views on Contractors and Manufacturers

(i) Turbine-generator manufacturers (Mitsubishi) shipped equipment as scheduled. Transformers (Tyree-Australia), and station service switchboards (Abbots-USA) arrived late (mainly because of distance and ocean freight);

(ii) Some spare parts and accessories procured in Japan were found short-shipped; and

(iii) Some spare parts and accessories supplied by manufacturers were found defective. However, suppliers took prompt action for adjustments or replacements.

(iv) Technicians dispatched to site by manufacturers for erection assistance were competent and cooperative. TPC, however, recommends that supplier's agents could improve on liaison between their Head Office and TPC, particularly with regard arrangements for manufacturer's technicians to arrive on site.

(v) The local contractor for civil works was competent and carried out works in accordance with the specifications.

27. Main Suppliers

Item	Manufacturer/Supplier	Amount US$ equivalent (10^3)
Turbo-Generator	Mitsubishi	4133 (US$ 23/kW)
Transformer (115 MVA)	Tyree	550 (US$ 5/kVA)
Power Cable (161 kV O.F.)	Furukawa (Japan)	190
Station Transformer (2000 kVA)	Mitsubishi	146 (US$ 73/kVA)
Power C.B. (161 kV)	Mitsubishi	68
Civil Works	Tulin (Taiwan)	70

28. Costs

Estimated to cost US$ 9.8 million equivalent (excluding IDC) of which US$ 4.5 million in local currency and US$ 5.3 million in foreign currency, the Project was completed at a cost of US$ 9.115 million (Local US$ 3.3 million; Foreign US$ 5.815 million). Details are given in the attachment to this report.

29. Whilst it appears that Civil Works and Miscellaneous items were over-estimated and the cost of E & M equipment under-estimated, it could be that TPC in their final cost figures included penstocks and associated valves under E & M whilst usually these items are considered part of the civil works. Nevertheless, the Project was completed at US$ 685,000 below the estimate.

30. Taipower's Views of Bank Involvement

With regard procurement, disbursements and supervision Taipower is satisfied. TPC, however, recommends that the Bank take effective measure to ensure supplier's compliance with regard contractual shipment dates. This, however, should not be a function of the Bank.

C. Recommendations and Conclusions

31. Since these Projects have been successfully completed and are in service, further supervision activity can be suspended. Because Loan 749-CHA, Talin No.5 is still active, financial reporting on Taipower's activities will continue.

32. Installation and Erection of both Projects were carried out by Taipower personnel, who have fully demonstrated their capability.

33. Procurement and disbursements proceeded satisfactory, causing no delay in project implementation.

34. The load forecast prepared at the time of appraisal proved to be accurate in terms of demand but under-estimated in terms of energy due to a more rapid improvement on system load factor. Thus the decision to implement the Talin No.4 Project proved to be fully justified and its earlier than anticipated commissioning a welcomed capacity addition. The delay in implementing the Tachien Dam Project -- Loan 574-CHA -- resulted in initial under-utilization of Lower Tachien No.3 & 4. This could, however, not be foreseen at the time. Given the low incremental investment in these two units (US$ 51/kW excluding IDC)

the financial consequences of the early investment, 6 months [1], are neglible.

35. The principal objectives of the loan -- provision of base load energy (Talin No.4) and peaking power (Lower Tachien No.3 & 4) were fully met, improving system operations and reducing operating costs. Only the delay in the transmission element included in loans 574-CHA and 671-CHA -- which will be the subject of a separate completion report -- have detracted from the realisation of all objectives. It can be stated here that the delay in commissioning the transmission element can be attributed to political factors only, beyond the control of Taipower.

1/ Initial impoundment at Tachien, and thus regulation of the Tachia flow started December 1973.

EAMinnig:gd

cc: Mr. Armstrong (PAS)
Mr. Beach
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CHINA
TAIWAN POWER COMPANY (TAIPOWER)
LOAN 671-CHA TALIN NO.4 AND LOWER TACHIEN NO.3 & NO.4
COST COMPARISON IN THOUSANDS OF US$ EQUIVALENT

	Appraisal Estimate			Tentative Final Costs			Difference
	Local	Foreign	Total	Local	Foreign	Total	Increase/(Decrease)
TALIN NO.4							
Civil Works	6400	-	6400	7796	-	7796	1396
Construction Equipment	4300	300	4600	5174	861	6035	1435
Turbo-Generator & Auxilliary	-	7500	7500	-	7364	7364	(136)
Boiler & Auxilliary	-	8400	8400	-	8528	8528	128
Transformers & Switchgear	-	1100	1100	-	1185	1185	85
Miscellaneous Electrical Equipment	-	2000	2000	-	1032	1032	(968)
Pressure Piping	-	2000	2000	-	2821	2821	821
Miscellaneous Mechanical Equipment	-	2000	2000	-	2805	2805	805
Spare Parts	-	1200	1200	-	1010	1010	(190)
Engineering Services	-	2000	2000	-	1616	1616	(384)
Contingencies	1300	1700	3000	-	-	-	(3000)
Sub-total	12000	28200	40200	12970	27222	40192	(8)
Customs Duties	5100	-	5100	5377	-	5377	277
TOTAL TALIN NO.4	17100	28200	45300	18347	27222	45569	269
LOWER TACHIEN NO.3 & 4							
Civil Works	2600	400 2/	3000	514	-	514	(2486)
Miscellaneous	500	-	500	145	-	145	(355)
Turbines & Generators	-	3400	3400	959	4700	5659	2259
Other Equipment	-	1000	1000	228	1115	1343	343
Contingencies	600	500	1100	-	-	-	(1100)
Sub-total	3700	5300	9000	1846	5815	7661	(1339)
Customs Duties	800	-	800	1454	-	1454	654
TOTAL LOWER TACHIEN NO.3 & 4.	4500	5300	9800	3300	5815	9115	(685)
INTEREST DURING CONSTRUCTION 1/ (excludes Transmission Element)	-	4000	4000	612	3393	4005	5
GRAND TOTAL	21600	37500	59100	22259	36430	58689	(411)

Note: 1/ Taipower information on IDC covers Loan 671-CHA Talin No.4 and Lower Tachien No.3 & 4 plus transmission and substation elements financed by Loans 574-CHA and 671-CHA. The allocation of IDC to the two above projects is therefore only approximate.

2/ Penstock steel financed by Taipower -- not included in Loan 671-CHA.