China

Dadong-Qinhuangdao Railway Construction Project (1)(2)

Report Date: October , 2002
Field Survey: August, 2001

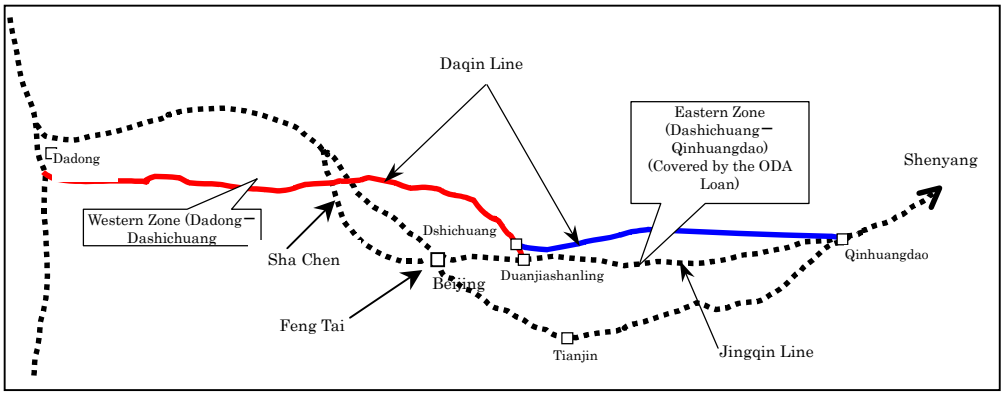
1. Project Profile and Japan's ODA Loan

Site Map: Between Dadong and Qinhuangdao

Site Photo: Coal Loaded Freight Train Passing Dashichuang Station

1.1 Background

In China, the national economy has been developed under the Seventh Five-Year Plan (1986–1990) and the Eighth Five-Year Plan (1991–1995), and thereby there has been an increased demand for energy. In particular, demand for coal has increased in coastal areas where the economy has rapidly developed. During the 1970s and 1980s, since the insufficient transportation capacity was not able to carry hundreds of thousands tons of coal in Shanxi Province, new coal pits were not developed.[1] At appraisal, the construction of a railway for a coal-carrying route and the development of coal pits were being embarked upon. At that time, coal was carried via Beijing to Qinhuangdao Port by the Fengshada Line (Fengtai–Shacheng–Dadong). The transport capacity of the Fengshada Line was 79 million tons per year



while the actual volume in 1987 had already reached 79 million tons (coal occupies 65 million tons). Since a further increase in the transport capacity was impossible, the construction of the Daqin Line was launched.

The Daqin Line, aimed at coal transportation, connects Dadong and Qinhuangdao Port and has a

[1] Coal is produced mainly in the north of Shanxi Province including Dadong. It needs to be transported to the east and south of the country where coal is in high demand. Major production areas of coal are north of Shanxi (Dadong, Yanbei and Jinzhou), west of Inner Mongolia (west of Dadong, Bohai Bay District and Baotou) and Shaanxi Province. In 1990, coal production was estimated approximately at 142.6 million tons.

length of 652 Km. The construction was divided into two phases. The first phase, which aimed for a total of 410 Km of construction (Dadong–Dashichuang zone with a length of 386 Km and Qinhuangdao–Qinhuangdao Port zone with a length of 24 Km) was initiated in December 1985 under Chinese governmental fund, and was supposed to be completed in December 1988. The second phase of construction, which covered Dashichuang–Qinhuangdao with a length of 242 Km, was commenced in 1988 under Japan's ODA Loan and was expected to be completed in 1991.

1.2 Objectives

To newly construct an electrified single-track line in the zone of Dashicuang–Qinhuangdao (242 Km) covered by the second phase construction, in order to respond to the increasing demand for coal transportation to Qinhuangdao.

1.3 Project Scope

The construction of an electrified single-track line between Dadong and Qinhuangdao (242 Km). The main contents of the project were to newly construct a roadbed, rail track, bridges, culvert, tunnels, power equipment, communications, signals, buildings, rails, and transformer station. The ODA loan was to cover the total amount of the foreign currency portion of the project costs.

1.4 Borrower / Executing Agency

Ministry of Foreign Trade and Economic Co-operation of the People's Republic of China／Ministry of Railways of the People's Republic of China

1.5 Outline of Loan Agreement

	I	II	Total
Loan Amount	12,131 million yen	6,279 million yen	18,410 million yen
Loan Disbursed Amount	11,073 million yen	4,826 million yen	15,900 million yen
Date of Exchange of Notes	July, 1988	May, 1989	
Date of Loan Agreement	August, 1988	May, 1989	
Terms and Conditions			
Interest Rate	2.5%	2.5%	
Repayment Period (Grace Period)	30 years (10 years)	30 years (10 years)	
Procurement	General untied	General untied	
Final Disbursement Date	August, 1993	May, 1994	

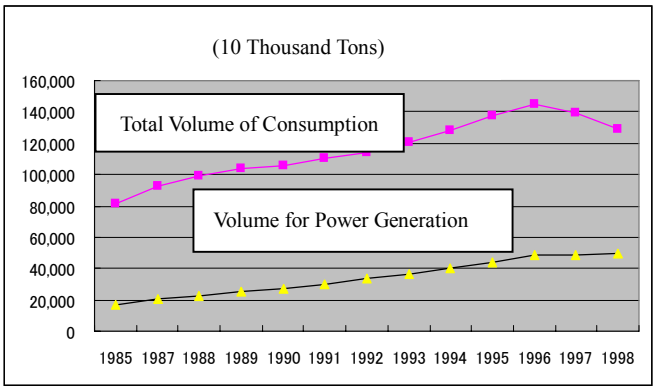
2. Results and Evaluation

2.1 Relevance

The objectives of this project were to ' newly construct an electrified single-track line in the zone of Dashicuang–Qinhuangdao in order to respond to the increasing demand for coal transportation to Qinhuangdao.' This project, nominated as a national project by the Chinese government, was implemented through the plan of 'Jinmei Waiyun (To carry coal of Shanxi out).' During the 1980s and 1990s, the economy grew rapidly and the demand for coal increased accordingly. The destination of coal supply was the south of China. In the coastal area in the south, berths for coal as well as thermal power stations were being constructed. The volume of coal exports was 13.13 million tons in 1987. Although it was not huge quantitatively,[2] the growth rate of export was as high as 36 % compared with that of the previous year. In considering such circumstances, it is assessed that the relevance of this project at appraisal was high.

[2] The total volume of coal transferred via Duanjiashanling and Tianjin in 1986 was 51.42 million tons. Despite a one-year difference in the data for comparison, the share for export was less than 20 %.

Figure 1: Transition of Coal Consumption in China

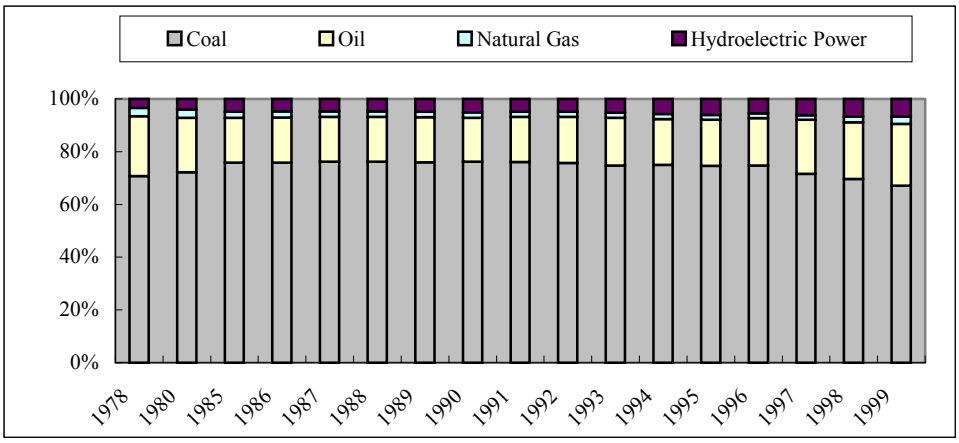


Source: China Yearbook of Statistics.

Later, coal consumption was declining after reaching a peak in 1996. Coal consumption for power generation was also declining (see Figure 8). As a background for this decline, the following factors can be pointed out: (1) the speed of thermal power station construction slowed down due to declining of electric demand growth ; (2) the Chinese government has been encouraging the utilization of alternative energy sources such as oil and gas ;[3] and (3) the economic situation also affected growth of coal demand .

The figure below shows the change in energy consumption in China. The ratio of coal consumption to the total energy consumption gradually decreases after reaching a peak in 1990. By contrast, the ratio of oil energy consumption is increasing. But the ratio of coal is still high: 67 % in 1999. It means that coal is still a crucially important energy source. The Chinese government set up an objective to "make further adjustment of the structure of electricity sources" under the Tenth Five-Year Plan (2001-2005). Under this objective, it established a direction for appropriate development of power stations in which it plans to put a weight on development of large-scale coal power stations with the high-energy efficiency using the clean combustion technology. This project was and is still relevant.

Figure 2: Change in Energy Consumption



Source: China Yearbook of Statistics.

Note: Based on conversion by SCE (Standard Coal Equivalent).

At the time of the appraisal, it was planned to construct an electrified single-track line and later from 1996, to strengthen the transport capacity by expanding it to a double-track line. However, in order to

[3] For instance, coal consumption is prohibited in Beijing, Tianjin and Shijiachuang.

respond to increase in the transport volume resulting from the rapid increase in demand on coals, the Chinese counterparts decided to construct an electrified double track line with its own funds in 1990 when the project was still at the implementing stage, and carried out the construction works ahead of the original schedule. As a reason for this adjustment, the following factors are quoted: the annual transport volume of the western zone of the Daqin Line (Dadong–Dashichuang) in 1995 was adjusted upward from 55 million tons to 75–80 million tons; the fourth phase berth construction[4] in Qinhuangdao Port and the new line construction between Qinhuangdao and Shenyang were expected to increase transport demand; the transport capacity of the Jingqin Line (Beijing–Qinhuangdao) had reached its saturating point, and did not absorb additional increase of the transport demands, thus increasing the necessity to enhance the transport capacity of the eastern zone of the Daqin Line (Dashichuang–Qinhuangdao);. As a result of this adjustment, the transport capacity of the eastern zone of the Daqin Line was enhanced 80 % from 35 million tons per year at appraisal to 65 million tons per year. Total transport volume in 1995 of the Jingqin Line connecting Beijing to Qinhuangdao, the Beijing–Tianjin–Qinhuangdao Line and this line connecting Dashichuang to Qinhuangdao reached 146 million tons.

2.2 Efficiency

2.2.1 Project Scope

As stated in the 'Relevance' of the plan, the project scope was adjusted from a single-track line to a double-track line. Accordingly, the project scope such as the total track length was altered. However, the expansion to the double-track line was done with the local funds and there was no change in the scope of the ODA Loan portion.

2.2.2 Implementation Schedule

At appraisal, the span of construction was scheduled at four years from January 1988 to December 1991. The project was actually completed one year behind schedule in December 1992. The adjustment from single-track to double-track done by the Chinese counterparts with its own funds can be pointed out as a reason for this delay. Despite significant scope adjustment such as to double track construction, there was just a one-year delay, signifying the high implementing capacity of the counterparts. It can be assessed therefore that the project was efficiently implemented.

2.2.3 Project Cost

In constructing a double-track line, parts for which unit construction was favorable (tunnels and bases of long and intermediate bridges) were initially designed for an electrified double-track line with the ODA funds but other construction works were carried out with the local budgets. The local currency portion had a cost overrun of more than 90 % compared with the initial plan. In particular, a notable overrun was seen in roadbed, rail track, bridges and buildings including stations. Reasons for the overrun include adjustment from single-track to double-track ahead of the initial schedule, additional construction of track installation, price increases in equipment and materials, and higher land lease prices.[5] The reason also includes repair charges incurred due to damages of local access roads by heavy construction machines and vehicles during the construction period. Considering the adjustment from single-track to double-track ahead of the original schedule as well as price increases during implementation, despite the more than 90 % cost overrun, it cannot necessarily be said that the project was inefficient.

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[4] The handling capacity of the coal berth in Qinhuangdao Port will be 75 million tons if the second berth constructed by the ODA loan and the first, third berths by Chinese own fund (collectively 60 million tons) are added to that of old berth (15 million tons). It was, therefore, understood that there were no problems in the capacity dealing with 64 million tons (estimate for 1995) of coal shipped from Qinhuangdao. In addition, the fourth berth construction project (Its loan agreement was signed in 1993. Its handling capacity was 30 million tons) was commenced in 1991. Hence, the total coal handling capacity of Qinhuangdao Port reached 103.65 million tons per year after the completion of the fourth phase of construction.

[5] Growth rate of the consumer price index between 1987 and 1994 was about 12 % as an annual average.

The foreign currency portion of the ODA loan decreased to 86 % of that initially planned. Particularly, the foreign currency portion of components related to track installation decreased. It was understood that a more accurate estimate was made at the stage of detail design.

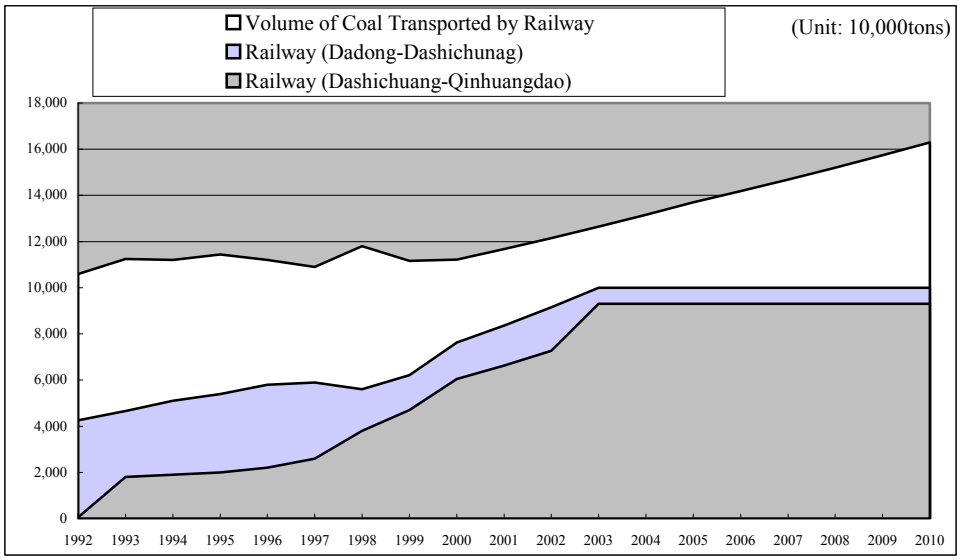
2.3 Effectiveness

The objective of this project was 'to newly construct an electrified single-track line in the zone of Dashicuang–Qinhuangdao in order to respond to the increasing demand for coal transportation to Qinhuangdao'. This section assesses how much this project contributed to the increase in demand for coal transport.

1) The Volume of Coal Transport

Figure 3 shows the trends after 1992 in the transport volume of coal produced in the Northwest District (north of Shanxi Province and west of Inner Mongolia [Shenfu and Dongsheng]) and that of the Daqin Line (western zone of Dadong–Dashichuang and eastern zone of Dashichuang–Qinhuangdao). According to data from the executing agency , more than 50 % of the coal produced in the Northwest District was carried by railway. It is expected that the transport volume by railway will increase according to the increase in the volume of coal production. The volume share of the Daqin Line in railway transportation has been growing since its opening in 1992: occupying 68 % between Dadong and Dashichuang in 2000 and 54 % between Dashichuang and Qinhuangdao. It is expected that their share will increase to 73 % and 68 %, respectively, in 2005. But this prospect is based on a plan that the Daqin Line will take over the volume which has been carried by the other two lines and such other two lines will then specialize in passenger transport .

Figure 3: The Volume of Coal Transport by Daqin Line



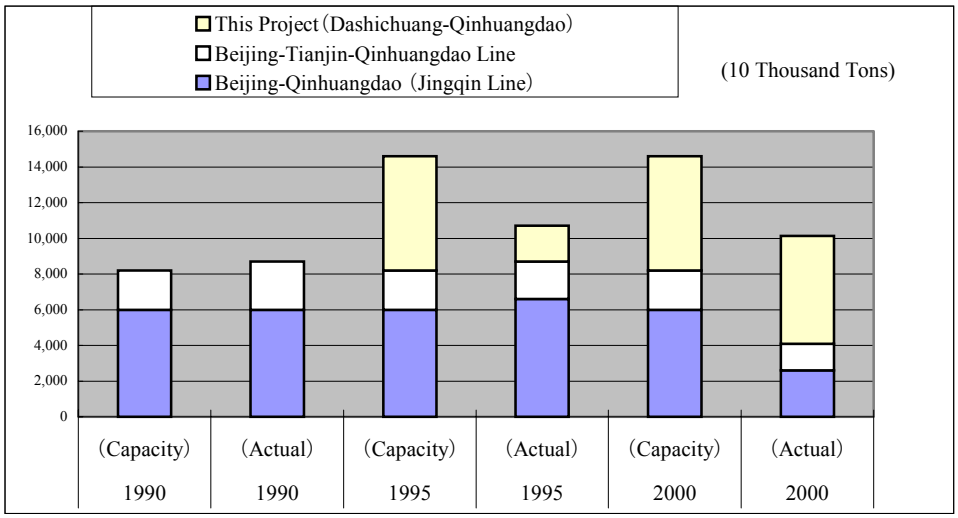
Source: Material from executing agency .

Note: Data until 2000 is actual. That after 2001 is estimated on the basis of production prospects in 2005 and 2010.

Figure 4 compares the designed and actual volume of coal which is carried by the zone of this project (Dashichuang–Qinhuangdao, eastern zone of the Daqin Line) and other railway lines (the Beijing–Tianjin–Qinhuangdao Line and the Jingqin Line) in 1990, 1995 and 2000. The actual volume transported by the Jingqin Line decreased from 66 million tons in 1995 to 26 million tons in 2000. Similarly, that of the Beijing–Tianjin–Qinhuangdao Line decreased from 21 million tons in 1995 to 14.9

million tons in 2000. Meanwhile that of the Daqin Line increased from 20 million tons to 60.52 million tons, reaching about 60 % of the share. This reveals that a shift in coal transportation from other lines to the Daqin Line has been already made. Hence, contributions to the demand for coal transport by the zone targeted by this project are becoming significant.

Figure 4: Comparison of Capacity and Actual Performance of Coal Transport Volume to Qinhuangdao



Source: Documents supplied by the executing agency

Figure 5: Prospect and Actual Demand for Coal Transportation to Qinhuangdao

Unit: ten thousand tons

	1990	1995	2000
Prospective (a)	7,950	10,600	13.300
Actual (b)	8,700	10,700	10,147
(b)/(a)(%)	109.4	100.9	76.3

Note: Prospective data is from appraisal documents, actual data is from the executing agency .

Figure 5 compares the prospect for coal transport demand and the actual demand by the above three lines. The actual transport demand in 1995 slightly exceeded the prospected demand. However, the actual demand in 2000 remained mostly at the same level in 1995, occupying only 76 % of prospected demand. The Ministry of Railways estimated that the transport volume of the Daqin Line in 2005 would be 100 million tons between Dadong and Dashichuang, and 93 million tons between Dashichuang and Qinhuangdao. This ODA loan will play a significant role in the transportation of coal to Qinhuangdao. It is also planned to increase the number of train services[6] and traction freight cars as the coal transport capacity between Dashichuang and Qinhuangdao is 65 million tons.

2) Financial Internal Rate of Return

At appraisal, the financial internal rate of return (FIRR) of this project was estimated at 7.0 % by using

[6] The number of services at the field survey was 70 on a daily average and the number of traction cars per one service was 66 (one car can carry 60 tons of coal).

incomes from coal transport and passengers as benefits. However, after recalculation based on a few available documents, it was not possible to calculate the FIRR as rail car replacement and maintenance expenses were high. This project, based on the result of the FIRR, cannot be assessed as having low financial efficiency considering followings : (1) the strategic significance of coal as an energy source is still high; (2) this project is expected to play an important role in the transportation of coal to Qinhuangdao in the future; and (3) there will be the indirect benefit that other lines—having been involved in coal transport—will have room for passenger transport.

Preconditions
Project life: 30 years
Benefits: coal transport income by this project implementation
Costs: initial investments + rail car procurement and replacement expense + maintenance expense

2.4 Impact

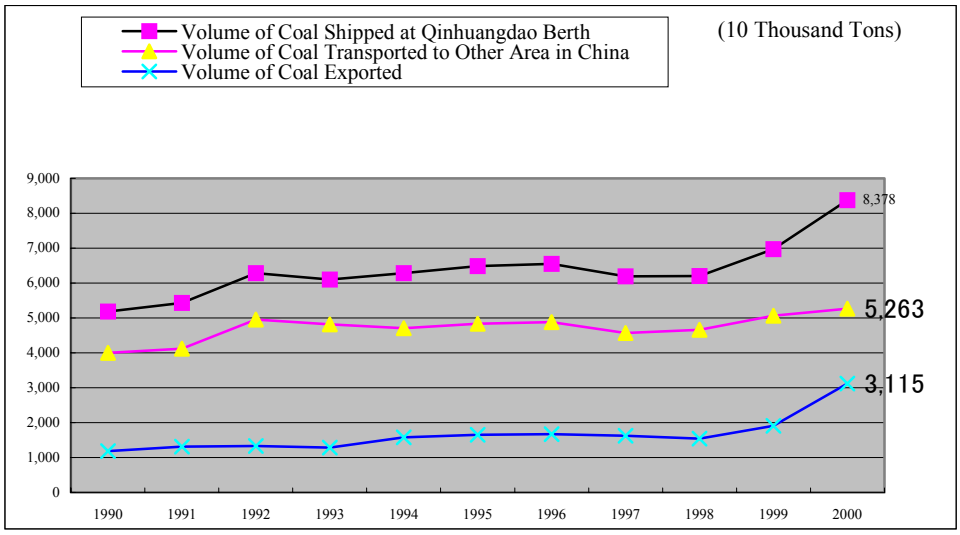
At the time of appraisal, coal occupies more than three quarters of the primary energy consumption in China. Figure 2 illustrates its declining trends, but nonetheless, coal's significance has not changed yet.[7] Coal is concentrated in northern China, mainly in Shanxi Province, and coal-consuming areas such as the northeast, east, midland and south demanded coal supply from north China. According to documents at appraisal, it was estimated that among 106 million tons of coal carried by railway in 1995, 64 million tons would be shipped from Qinhuangdao Port to supply the coal demand in coastal areas and for exporting. The coal demand in Chinese coastal areas was expected to reach 50.8 million tons in 1995. Hence, it was expected that increasing coal supply from north China to coastal areas would boost production activities and promote economic development in coastal areas.

1) Impacts on the Economy in Coastal Districts and Export Growth

Figure 6 explains the trends in the volume of coal shipped in and dispatched from Qinhuangdao Port. The volume for domestic supply has been 50–60 million tons after the year of the project completion in 1992. Exports are gradually increasing from 11.87 million tons in 1991 to more than 30 million tons in 2000. With the increase in exports, the volume of coal shipped in the Qinhuangdao coal berth in 2000 exceeded 80 million tons.

[7] The share of coal to energy consumption in 1999 was 67 %.

Figure 6: Trends in the Volume of Coal Shipped in Qinhuangdao Coal Berth (Actual)



Source: Documents supplied by Port Authority of Qinhuangdao City.

In overview, among the 100 million tons of coal that was transported by three lines to Qinhuangdao in 2000, 80 % was shipped in the coal berth at Qinhuangdao Port, while 50 % of this was transported to other areas in China and 30 % was exported.[8]

According to data in 2000 (Table 7), major domestic destinations of coal shipped in Qinhuangdao Port were 8 provinces and cities: Liaoning Province, Shandong Province, Jiangsu Province, Shanghai City, Zhejiang Province, Fujian Province, Guangdong Province and Hainan Province. Their share exceeded 90 % in the same year.

Table 7: The Actual Volume According to Destinations (2000) Unit: ten thousand tons

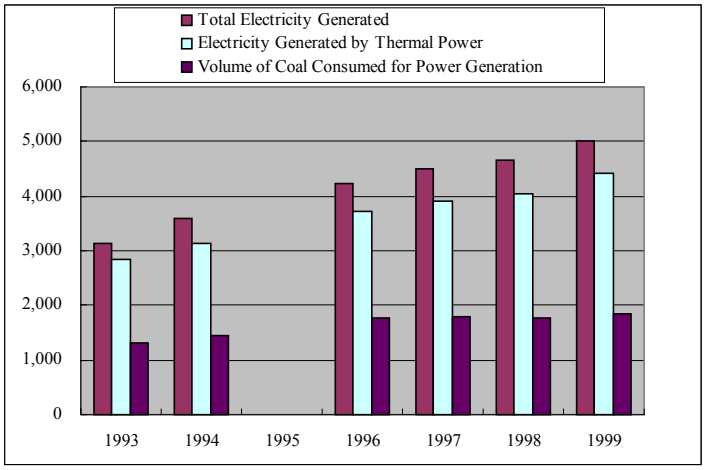
Destinations	Liaoning	Shandong	Jiangsu	Shanghai	Zhejiang	Fujian	Guangdong	Hainan	Miscellaneous	Total
All Berths for Coal	367	257	408	958	1,250	343	1,182	71	427	5,263
Share (%)	7.0	4.9	7.8	18.2	23.8	6.5	22.5	1.3	8.1	100.0

Source: Documents supplied by Port Authority of Qinhuangdao City.

Figure 8 reviews the total volume of electricity generated, the volume generated by thermal power, and the volume of coal consumption for thermal power generation of 8 provinces and cities in 2000. The share of thermal power generation in these provinces and cities to the total volume of electricity was as high as 90 %.

[8] The major share for export destinations in 2000 was taken by South Korea, Taiwan and Japan.

Figure 8: Trend of the Total Volume of Generated Electricity, the Volume of Electricity Generated by Thermal Power, and the Volume of Coal Consumption for Thermal Power Generation in 8 Provinces and Cities



Source: China Yearbook of Electricity

Note:

1) Total of data from 8 provinces and cities (Liaoning Province, Shandong Province, Jiangsu Province, Shanghai City, Zhejiang Province, Fujian Province, Guangdong Province and Hainan Province)

2) Data from 1995 is not available.

In addition, the total volume of generated electricity rapidly increased: its volume in 1999 had increased 1.61 times from that of 1993 while the volume of electricity generated by thermal power plants also increased 1.56 times. As regards economic development in the areas for the four years from 1996 to 1999, six provinces and cities, excepting Hainan Province and Liaoning Province, achieved more than 10 % economic growth on an annual average. It is understood that this power supply increased in response to the demand for power which accompanied economic growth. Similarly, the volume of coal consumed for thermal power generation also increased 54 million tons, from 130.94 million tons in 1993 to 185.17 million tons in 1999. The zone of the Daqin Line targeted by this project transported 47 million tons of coal in 1999. Though it is difficult to find a direct linkage between demand and supply, it can be estimated that this project contributed to the increase in coal supply to provinces and cities as well as economic development in these provinces.

2) Environmental Aspect

As for environmental aspects, the Ministry of Railways took appropriate measures such as green planting against influences on vegetation and the ecosystem, the use of sound barriers and longer rail for noise reduction in places near schools. In addition, as a countermeasure to wastewater, wastewater disposal facilities, which fulfill the national standard, are installed. Coal transport causes funnel fumes, but this is minimized by sprinkling water.

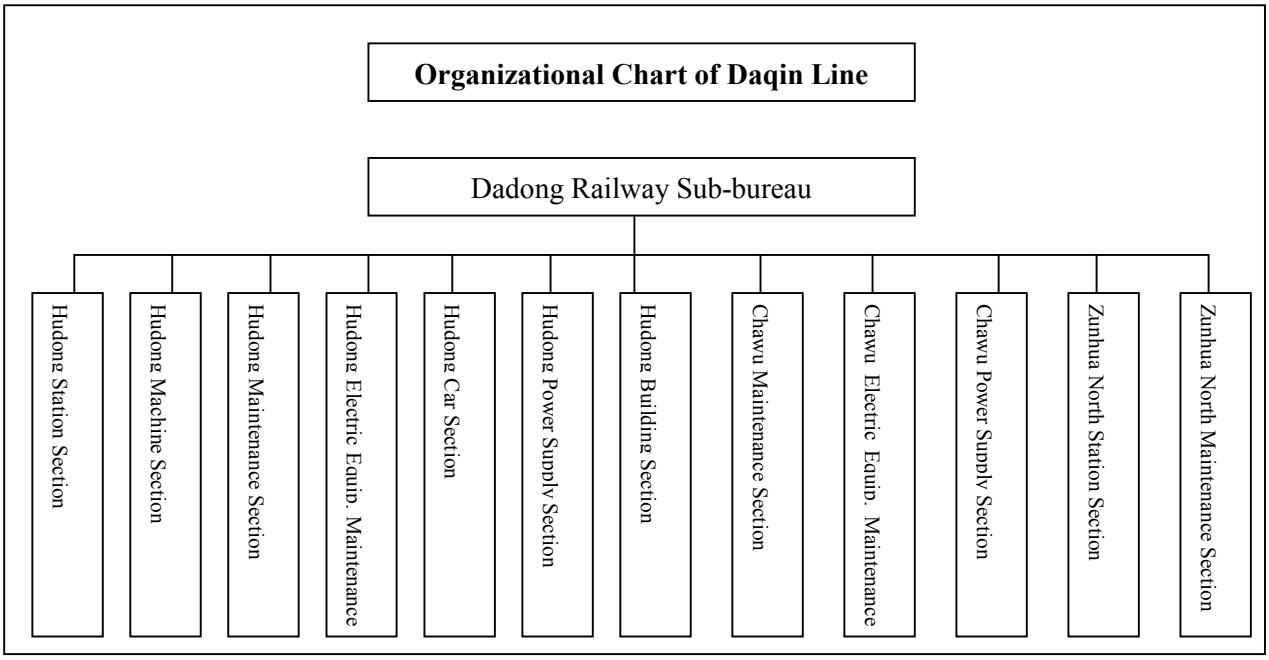
2.5 Sustainability

1) Operation and Maintenance

The operation and maintenance (O&M) of the Daqin Line, including the zone covered by this project, are undertaken by the Dadong Railway Sub-bureau, Beijing Railway Bureau, Ministry of Railways.[9] The total number of staff in the Dadong Railway Sub-bureau is 11,516 (at the time of survey. See the following

[9] The railway operation between the Qinhuangdao berth and the Qinhuangdao Port berth was originally managed by the Tianjin Railway Sub-bureau, Beijing Railway Bureau, but it was later controlled by the Dadong Railway Sub-bureau, Beijing Railway Bureau in 1998, due to managerial convenience.

organization chart). The maintenance of rail track is carried out by the Construction Section, by dividing the whole length of 650 Km of the Daqin Line into three zones of 200 Km. There are the Hudong Maintenance Section, the Chawu Maintenance Section, and the Zunhua North Maintenance Section, which have 700–800 staffs, respectively. Rail is checked according to a plan on the basis of tenure of use, and is replaced if necessary. Staff in the Maintenance Section check rail and railroad ties every day. In addition, the Beijing Railway Sub-bureau has special vehicles for inspection. It conducts periodic inspection on rail condition twice a year in spring and fall. The maintenance of communication and signal facilities is made by the Eastern Electric Equipment Maintenance Section and the Chawu Electric Equipment Maintenance Section, which have 322 and 509 staffs, respectively. The maintenance related to electric equipment is undertaken by Power Supply Sections at Hudong and Chawu, which have 314 and 1,106 staffs, respectively.



Sections	Content of Responsibilities
Station Section	Railway station maintenance
Machine Section	Locomotive procurement, repair and maintenance
Maintenance Section	Rail track, roadbed, bridge and tunnel maintenance
Electric Equipment Maintenance Section	Communication and signal facility maintenance
Car Section	Car procurement and maintenance
Power Supply Section	Power supply for electrified trains and stations
Building Section	Building maintenance

2) Technical Capacity

According to the Ministry of Railways, the technical capabilities of staff who maintain the Daqin Line are relatively high. Engineers, graduating from railway schools, have experience of more than ten years on average. In addition, technical training is also carried out for general staff. It can be assessed that the standard of technical capabilities and operation & maintenance system are fine.

Comparison of Original and Actual Scope

Item	Plan	Actual
①Project Scope	Electrified single-track line	Electrified double-track line
1) Roadbed	23,947,800 m^3	29,584,000 m^3
2) Rail Track	301.039 km	544.17 km
3) Bridges	127 bridges, 24,614 m	117 bridges, 24,171 m
4) Culvert	18,919.14 m	839 sites, 23,313 m
5) Tunnels	9 tunnels, 12,222 m	9 tunnels, 12,256 m
6) Electrification	266 km (242+24 km)	254.2 km
Transformer	75,000KVA×1	75,000KVA×6
7) Power Equipments		
① Distributing Station	3 sites	3 sites
② Power Cable		
A. High Voltage Cable	37 km	84.5 km
B. Low Voltage Cable	210.5 km	179.6 km
C. Control Cable	8.5 km	27.2 km
8) Communications	250 km	242 km
①Main Cable	450 km	421 km
② Digital Switching Equipment	1,200 sets	1,032 sets
③ Crossbar Switching Equipment	2,000 sets	2,000 sets
④Optical CableTransmission	5sites	3 sites
9) Signal		
①Signal Cable	185.7 km	615 km
②CTC	20 sites	14 sites
10)Buildings (Including Stations)	110,000 m^2	159,500 m^2
11) Repair Yard		
①For E/L,D/I	1 site	1 sire
②For F/c	1 site	1 site
12) Consulting Services	None	None
②Implementation Schedule	January, 1988～December, 1991	January, 1988～December, 1992
③Project Cost		
Foreign Currency	18,410 million yen	15,900 million yen
Local Currency	41,283 million yen	78,189 million yen
	(＝1,200 million yuan)	(＝2,303 million yuan)
Total	59,693 million yen	94,089 million yen
ODA Loan Portion	18,410 million yen	15,900 million yen
Exchange Rate	1yuan＝34.4yen (as of 1988)	1yuan＝33.95yen (as of 1988)