Emergency Water Conveyance Project into Dalian Cost Benefit Analysis

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ABSTRACT: The project of transporting water to Dalian in urgent situation is a large-scale Inter-basin water transfer project, which in order to solve the serious problem of the shortage of water in Dalian. It is a key construction project in Liaoning province project, which will cost huge investment and need spending long construction period. Dalian is of great shortage of water resource, it's water supply depends on the Large-scale water conservancy project. In order to provide reference to investment and construction of similar project in the future, this paper use the benefit factor analysis and set a model, to analyze the factors, such as economic, social impact, environmental impact. If the construction and use of the funds put into operation, we concluded that the construction of the project was reasonable in economy. The construction of this project will solve water shortage problems periodically and play a significant role in the future of urban development in Dalian.

KEYWORDS: Dahuofang Reservoir; Conveyance project; Cost analysis; Benefit analysis

1 PROJECT OVERVIEW

Water conveyance project is connected into the emergency room use everyone as water reservoir via the City, Liaoning Province 4 9 counties (districts) of a large-scale inter-basin water transfer project, the line length 222.17km where three water conveyance Engineering length 167.67km, supporting projects in Dalian length 35.37km pipeline by the PCCP pipe, steel pipe and tunnel composed; the project of water diversion capacity of 300 million m\textsuperscript{3} protect the city and surroundings Golden state Dalian Changxing island. Wafangdian region industrial and domestic water needs. This project consists of water conveyance (Phase II) project which will start from Anshan water distribution stations, via four cities Liaoyang, Anshan, Yingkou and Dalian City and 9 counties of them (cities, districts),the laying of water pipelines, transferred Bilihe, adjusted after part cities the use of surplus pipeline capacity within three Bi-lying sub shop reservoir regulation sent to Dalian city, to solve the water shortage problem, the other part of the amount of water taken by water pipelines Dongfeng Reservoir solve Changxing Island, tile-roofed house shop area water Resources. In May 2009, the project officially started construction. At the end of 2012, the southern section of the main project using Biliuhe Changxing Island Economic Zone water supply. At the end of 2014, the northern section of the pipeline and pumping station projects completed on-line debugging, formally supply water in July 2014 Emergency water conveyance project. Into even the cost-benefit analysis (SL72-2013) were calculated and analyzed in accordance with the relevant regulations, "construction project economic evaluation methods and parameters" and the third edition of "water conservancy construction project economic evaluation norms."

2 THE COST-BENEFIT ANALYSIS

2.1 Calculation Parameters

Social discount rate I, according to "construction project economic evaluation methods and parameters,"the third edition of the value of 10%, calculated and analyzed indicators. Calculation period and base year, including all of the calculation period and the next period has occurred. The project has undergone a period of years 2007--2015, the future of the 2016 Year-2052. Since July 2014 the project has been running...
through the water, the overall situation is good, providing industrial and domestic water security for multiple counties (districts).

According to statistics, in 2014 the whole area of Dalian gross production of 765.56 billion yuan, an increase of 5.8% over the previous year \(^1\).

2.2 Calculation

2.2.1 The Project Investment

The static investment costs 3.99468 billion yuan, environment protection, protection of hydrology, land investment 6.22x10^8 yuan; total static investment of 4.61639 billion yuan; sources of funding are the following: (1) State aid funds; (2) the Dalian municipal government invested; (3) Dalian City water Co., Ltd. Corporate identity projects to the State development Bank loans.

2.2.2 Annual operating costs

This works for inter-basin water transfer project, the main purpose of water supply, its main operating costs and maintenance costs by the management staff salaries and benefits, engineering, project management fees, water, electricity, engineering, insurance premiums and other cost components.

(1) Labor wages and benefits: Management during (2) project operation 247 people, the annual salary of 30,000 yuan / person, calculated on employee wage s and welfare of 16.19 million yuan;

(2) Engineering and maintenance costs: a fixed asset s 1.5% calculated as 75 million yuan;

(3) Project management fee: press twice the wages and benefits of computing, project management fee of 32.38 million yuan;

(4) Water: water diversion project to connect the emergency 1.34 yuan / m³ run in the purchase price of the company’s water, to be turned over to the water 402 million yuan per year;

(5) Electricity: water from Anshan confessed required pump pressure, to 122.8 million yuan in electricity;

(6) Engineering insurance: engineering insurance run by 0.25% of the project part of the investment is calculated premiums of 999 million;

(7) Other costs: other costs are wages and welfare, engineering maintenance, project management fees of 10% counted for 11.78 million yuan.

Total annual operating costs:

\[ \sum((1) +(2) + (3) + (4) + (5) + (6) + (7)) = 6701400 \text{ yuan} \]

2.3 Benefit Analysis

The southern section of the project run well when it started to operate for a test since 2012. It has been supplied water more than 5.6x10^8 m³ to Changxing Island Industrial Park. There are two water pumping stations supply which water to Changxing Island to meet the region's industrial
development and residential water needs. This project provide reliable water source to economy development of Dalian after 2015. It is designed to increase urban industrial water and domestic water supply for 3x10^8 m³ in 2015 and will reach 2.79x10^8 m³ actually. The part of water for industrial is 1.05x10^8 m³, the rest of water for living is 1.74x10^8 m³.

2.3.1 Economic Benefits

2.3.1.1 Economic industrial water supply

Construction Dahuofang Reservoir water diversion project for the Changxing Island Industrial Zone, Jinzhou, Wafangdian Industrial Zone to provide a reliable water supply, and promote the development of aquaculture, processing and other enterprises. Its industrial water apportionment coefficient method used to calculate the economic benefits, unilateral water efficiency is calculated as:

\[ Ba = \frac{1}{D} \times \rho \times \xi \]

Wherein:

- Ba - unilateral water supply benefits yuan / m³
- D- yuan output value that is within the range of water water, m³ / million
- \( \rho \)- value growth rate
- \( \xi \)- apportionment factor.

Calculated by the unilateral project of water supply benefits for 10.27 yuan, from 2015 to meet the design production capacity, the total water supply benefits to 1.07835 billion yuan.

2.3.1.2 Water Economic Life

Dalian foreign population is more, there are a lot of migrant workers in Jinzhou Industrial Park Zone, Development Zone, population growth, increasing demand for water, and everyone is connected into the reservoir housing project about a year in Dalian provide supply 1.74x108 m³, the economic benefits of using the shadow price 5.6 yuan / m³ calculation, water efficiency to meet the design standard of living after years of 974.4 million yuan. As the degree of economic development and improvement, domestic water may be appropriate to increase the cubic unit Price.

2.3.2 Social Benefits

According to the analysis, the total water supply was positively correlated with GDP, and was negatively related to the amount of tertiary industry to GDP. With population growth and economic development, the social demand for water continues to increase, and there is a waste of water, water pollution and other phenomena, so that increasing shortage of water resources, supply and demand have become increasingly prominent, water resources as a constraint to social-economic development of the
Important factors. Everyone into the reservoir housing construction projects to solve Dalian problem of water shortage in Dalian since 2015, has important implications for agriculture, aquaculture and other industries. Now make analysis of water demand and market price:

2.3.2.1 Water Demand Analysis Market
Prediction of Dalian City in 2030 Urban Water 1.3x10^9 m^3. As shown in Table 1:

<table>
<thead>
<tr>
<th>The annual production</th>
<th>Partition</th>
<th>Municipal water</th>
<th>Industrial water</th>
<th>Water conservation</th>
<th>Water pipe network leakage</th>
<th>Water from water</th>
<th>Total water demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>South of Jinzhou</td>
<td>53481</td>
<td>25408</td>
<td>3355</td>
<td>6539</td>
<td>3441</td>
<td>92224</td>
</tr>
<tr>
<td></td>
<td>Wafangdian</td>
<td>4223</td>
<td>1627</td>
<td>562</td>
<td>542</td>
<td>285</td>
<td>7239</td>
</tr>
<tr>
<td></td>
<td>Pulandian</td>
<td>2663</td>
<td>843</td>
<td>420</td>
<td>368</td>
<td>194</td>
<td>4488</td>
</tr>
<tr>
<td></td>
<td>Zhuanghe</td>
<td>2295</td>
<td>690</td>
<td>421</td>
<td>320</td>
<td>169</td>
<td>3895</td>
</tr>
<tr>
<td></td>
<td>Changhai</td>
<td>307</td>
<td>12</td>
<td>13</td>
<td>26</td>
<td>14</td>
<td>372</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>62969</td>
<td>28580</td>
<td>4771</td>
<td>7795</td>
<td>4103</td>
<td>108218</td>
</tr>
<tr>
<td></td>
<td>Changxing Island</td>
<td>1265</td>
<td>14800</td>
<td>280</td>
<td>524</td>
<td>432</td>
<td>17301</td>
</tr>
<tr>
<td></td>
<td>Pine Island</td>
<td>548</td>
<td>3840</td>
<td>413</td>
<td>218</td>
<td>180</td>
<td>5199</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>64782</td>
<td>37220</td>
<td>5464</td>
<td>8537</td>
<td>4715</td>
<td>130718</td>
</tr>
</tbody>
</table>

According to Ministry of Water Resources Integrated Water Resources Division of the United Nations organizations and well-known international experts views, combined with China's specific water shortage index is determined, the per capita water resources between 500 ~ 1000 m^3/years belong to severe water shortages. The per capita water resources in the region South of Jinzhou is 117 m^3, it has been extremely dry. In May 2015, severe drought in many parts of Dalian. In order to ensure normal water Dalian citizens, reservoirs stopped on the surrounding five townships 3.3 acres of paddy field irrigation. Tucheng village more than 80 villagers, running water before eating, but because of the drought, the water level dropped well water, the villagers live in high feed well water does not come up, more than 80 households rely car pulled shoulder to the side of the library a well to draw water life. Not more than two months of drought makes the farmland irrigation, positive growth of large corn withered.

2.3.2.2 Price Analysis
"Dalian Municipal People's Government Office on the adjustment of urban sewage treatment fee charges notice" to adjust the city's urban sewage treatment fee charges based on. Residents and troops, school life 3.10 yuan per cubic meter of water (including sewage treatment); Industrial water 4.40 yuan per cubic meter; Administrative unit of water 4.00 yuan per cubic meter; Commerce, tourism (including all kinds of entertainment and tourist attractions) water for 6.20 yuan per cubic meter; Public baths with water 6.20 yuan per cubic meter; Sauna, swimming pool and other special industries (including washing, pure water, mineral water, etc.) 21.70 yuan per cubic meter of water.

Dahuofang Reservoir water diversion project and water diversion have the ability to make its construction in Dalian and the surrounding area climate and precipitation has been both increased.

2.4 Analysis Model, the Analysis Results Obtained Indicators
Combination of these cost and benefit analysis, is to establish analysis mod.

![Diagram 1. Cost-benefit Analysis Model.](image)

The cost for the project and the economic situation, it is made with a net present value analysis:

\[ NPV = \sum_{t=1}^{n} \left( CI_t - CO_t \right) \left( 1 + r \right)^{-t} - C_0 \]

among them:
- \( NPV \) — The net present value
- \( CI_t \) — Cash inflows in year \( t \)
- \( CO_t \) — T year cash outflow
- \( n \) — Calculation of the project
- \( r \) — Benchmark rate of return
- \( C_0 \) — Initial investment

The project calculated net present value 1,773,335,700 yuan > 0, So the project is feasible.
economically. Due to social and environmental benefits many forms, and are difficult to measure in monetary terms, it is not only for analysis of specific calculations.

3 CONCLUSIONS

The project of transporting water to Dalian in urgent situation alleviated the difficult problem of water resources for Dalian, improved the ecological environment of water area, provided a reliable water supply to life and industrial development, and promoted the new industrial base in Dalian construction and development, social benefits significantly.

The net present value of index> 0, we can see the construction of the project is economically justified. Since the project is a semi-public project, the main pre-consider the effect of water, with the Dalian Economic development and improvement of people's income level, after a certain period may be appropriate to raise the price of water to increase the effect of the economic benefits of the project.

REFERENCES