

## COMPLETE ECONOMIC ANALYSIS

### A. Introduction

1. Investment in the urban water supply sector in Cambodia since 1993 has been centered primarily in Phnom Penh. Investment in water supply in the provinces has been slow and the public waterworks (PWWs) across Cambodia have suffered from inadequate levels of investment, both in terms of physical infrastructure and institutional development. Structural and organizational weaknesses in the water sector manifest as a lack of corporate status, insufficient autonomy and accountability, and a high degree of control by government. Rapid urbanization has exacerbated the situation and many urban residents lack access to adequate and safe water supply and sanitation services. This lack of investment in the water sector has resulted in PWWs operating unsustainably and delivering substandard services. Typical problems include old pipework, insufficient coverage, inadequate operation and maintenance, intermittent supply, high levels of nonrevenue water (NRW), and water quality issues. Moreover, tariff structures are poorly designed, inconsistent amongst the PWWs, and the true costs of service provision are rarely recovered. In contrast, strong management, corporatization, staff development, and high efficiency have allowed Phnom Penh Water Supply Authority to flourish over the same period. Today, it is one of the most efficient water utilities in Asia.

2. Cambodia's current estimated population is 14.7 million<sup>1</sup> of which 2.96 million (20%) is urban. However, rapid urbanization far exceeds rural population growth and by 2030 its urban population is expected to increase to 5.6 million. There are 24 provinces and 26 cities and district towns. Cambodia's 2015 Millennium Development Goal (MDG) targets for access to improved water sources (80%) and improved sanitation (74%) in urban areas have already been achieved, with results of 88% and 89%, respectively.<sup>2</sup> However, in 2009, while more than 78% of residents in Phnom Penh had access to piped water supply, the national average was only 42%,<sup>3</sup> ranging from about 12% for Siem Reap to over 64% for Pursat. Levels of NRW range from 6% in Phnom Penh to 26% in Stung Treng; however, with the exception of Phnom Penh, the reliability of these figures is suspect. So much remains to be done to (i) increase the number of piped water connections; (ii) increase access to potable water; and (iii) improve sector performance in key areas, following in the footsteps of PPWSA.

3. The Department of Potable Water Supply (DPWS), under the Ministry of Industry and Handicraft (MIH),<sup>4</sup> is responsible for the countrywide coordination, policy, and regulation of urban water supply. Of the 12 PWWs, two were transformed into autonomous water authorities, PPWSA in December 1996 and Siem Reap Water Supply Authority (SRWSA) in 2007, which have been successful in improving financial and operational performance. MIH directly controls the remaining ten PWWs through its provincial line agencies. DPWS also licenses private operators and regulates all public and private operators' tariffs.

4. The Project will address the challenges identified by the MIH in its priorities and strategies for the Fifth Mandate of the National Assembly (2013–2018), which are (i) insufficient legal and regulatory frameworks; (ii) PWWs (except PPWSA and SRWSA) still dependent on the Government for financial support; (iii) old production and distribution system and inadequate

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<sup>1</sup> 2013 Cambodia Intercensal Population Survey.

<sup>2</sup> WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation (1980-2012), updated in 2014.

<sup>3</sup> Piped water supply currently (2014) estimated at around 50% coverage, but no formal data are available on this.

<sup>4</sup> Previously the Ministry of Industry, Mines and Energy (MIME), up to December 2013.

and inefficient human resources; (iv) limited financial resources for rehabilitation and development of the sector; and (v) low national urban water supply coverage.

5. The Project will provide new and rehabilitated water supply infrastructure and extend system coverage, expanding access to safe water and improving health and hygiene conditions in nine towns with a total population of 551,000. Eight PWWs, plus SRWSA, were selected for the Project by the MIH to (i) address the most urgent needs of the urban water sector, through improvement and/or expansion of services and (ii) prepare for sector reform aimed at improving 24-hour service coverage, water quality, and sustainability of services through increased levels of autonomy. The Project will provide piped water supply to an additional 58,000 residents through (i) a new water supply system for Stung Treng; (ii) a new distribution zone in Siem Reap; and (iii) system expansion in Svay Rieng. In addition, the Project will rehabilitate existing water treatment plants in Kampong Cham, Kampong Thom, Kampot, Pursat, Sihanoukville, Stoung, and Svay Rieng.<sup>5</sup> Through these targeted interventions, the Project will assist MIH to improve PWW performance by replicating similar initiatives that made PPWSA successful.<sup>6</sup> The Project design will incorporate lessons from previous ADB projects<sup>7</sup> and from the PPWSA experience. The Project will assist the PWWs in reducing real NRW levels to below 15%, through improved materials and construction practices to complement their ongoing NRW reduction initiatives and those with other development partners.<sup>8</sup>

6. The Project is aligned with the (i) phase 3 of the government's rectangular strategy on growth, employment, equity, and efficiency<sup>9</sup>; (ii) National Strategic Development Plan (NSDP) 2014-2018;<sup>10</sup> and (iii) action plan of MIH to facilitate private sector partnerships, strengthening the management of publicly-owned waterworks, and integrating urban water supply with urban environmental management. The Project supports ADB's water and sanitation sector assessment, strategy and roadmap (ASR) and the ADB water operational plan 2011–2020<sup>11</sup> to improve the efficiency of water services. The three pillars of the proposed ADB CPS (2014–2018)<sup>12</sup> are supported, namely (i) strengthening rural, urban and regional linkages, through investments in water supply infrastructure and services, (ii) human development, through improved urban water supply management capacity, and (iii) support for public sector management, by supporting decentralization and deconcentration and improved public financial management capacity through the support of the MIH's plan for financial autonomy of the PWWs by the end of 2018.

7. Comprehensive capacity development is currently being implemented at selected PWWs with assistance from Japan International Cooperation Agency (JICA), focusing on water utility

<sup>5</sup> 2012 population data are Kampong Cham (64,000), Kampong Thom (46,000), Kampot (48,000), Pursat (51,000), Siem Reap (141,000), Sihanoukville (71,000), Stoung (51,000), Stung Treng (34,000), and Svay Rieng (45,000).

<sup>6</sup> Includes strong and long-lasting leadership, autonomy to allow the freedom to operate on corporate principles, continuous staff development, performance-based bonus system, customer orientated service, and high quality infrastructure and equipment. Also, there is a strong focus on nonrevenue water reduction, energy efficiency, and expansion of coverage.

<sup>7</sup> Includes poor and inflexible design of water treatment plants, low quality equipment procured, equipment not sustainable or easily repaired or replaced, difficulties working with two ministries for water supply and sanitation.

<sup>8</sup> Development Coordination (accessible from the list of linked documents in Appendix 2).

<sup>9</sup> Royal Government of Cambodia. 2013. *Rectangular Strategy for Growth, Employment, Equity, and Efficiency – Phase III*. Phnom Penh.

<sup>10</sup> Key NSDP actions for water supply are: (i) develop a legal framework for urban water supply; (ii) promote decentralization and deconcentration (D&D); (iii) transfer full autonomy for service delivery to all provincial waterworks; (iv) increase sector financing; (v) improve sector performance and access to safe, affordable, and sustainable water supplies; and (vi) improve water source protection and enforcement of regulations.

<sup>11</sup> ADB. 2011. *Water Operational Plan, 2011–2020*. Manila

<sup>12</sup> ADB. 2014. *Draft Country Partnership Strategy: Cambodia, 2014–2018*. Unpublished.

management and finance. JICA is also assisting MIH at national policy level for the development of the Water Law. Under new leadership in 2014, the MIH completed a comprehensive assessment of its public water utilities, to establish the actual situation at each; from which short and medium-term action plans are being developed. In particular, the MIH will pressure the PWWs to provide the quality and affordable water supply needed for full cost recovery and savings for future investment, reducing gradually the reliance on the external support. ADB is planning a standalone capacity development TA to develop capacity at national level and assist with institutional reform, regulation, and tariff setting in parallel with the implementation of the Project, which will complement the new direction of the MIH.

## **B. Overall Approach to Economic Analysis**

8. Nine (9) provincial towns were selected<sup>13</sup>. The PPTA deliverables included feasibility study reports (FSRs) for the nine subproject towns, four of which were full FSRs while the remaining five were short FSRs.<sup>14</sup> Economic analysis were initially conducted for the four provincial towns with full FSRs but similar analysis were subsequently done for the remaining five towns. An overall economic evaluation for the whole project was likewise undertaken.

9. The economic analysis of the water supply investment was undertaken in accordance with the principles and procedures set out in the ADB guidelines<sup>15</sup>. The period of analysis extends over 30 years from the start of project implementation in 2015 to 2044. Costs and benefits were quantified at August 2014 prices and were converted to their economic cost equivalents using shadow prices. An exchange rate of USD1.00 to KR4,000 was used when converting foreign exchange costs to local currency equivalent. All costs were valued using the domestic price numeraire. Economic costs were derived from the technical team's financial estimates of investment and recurrent costs, adjusted for transfer payments and other market distortions. Taxes and duties were excluded because they represent transfer payments. Traded goods, net of taxes and duties, were adjusted by the shadow exchange rate factor (SERF) of 1.1 while a standard factor of 1.0 was applied for non-traded goods (except for unskilled labor). For unskilled labor, the shadow wage rate factor (SWRF) of 0.75 was used.<sup>16</sup> Both costs and benefits were treated as increments to a "without project" situation.

10. The economic viability of the project was determined by computing the economic internal rate of return (EIRR) and comparing the result with the economic opportunity cost of capital (EOCC) of 12%. An EIRR exceeding the assumed EOCC indicates that the project is economically viable. The viability of the investments was then tested for changes in key variables such as capital costs, O&M costs and benefits through sensitivity analysis. Distribution of project benefits and poverty impact analysis were also undertaken to determine how much of the net economic benefits resulting from the investments will directly benefit the poor.

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<sup>13</sup> The nine selected towns are under the following provincial waterworks (PWWs): Kampong Cham (KCPWW), Kampong Thom (KTPWW), Kampot (KPWW), Pursat (PPWW), Siem Reap (SRWSA), Sihanoukville (SPWW), Stoung, Stung Treng (SRPWW) and Svey Rieng (SRPWW).

<sup>14</sup> The four FSRs are contained in Appendix 5 while the five short FSRs are included in Appendix 6 of the PPTA Study.

<sup>15</sup> Include the *Cost-Benefit Analysis for Development – A Practical Guide (2013)*; *Guidelines for the Economic Analysis of Projects (1997)*; *ADB Handbook for the Economic Analysis of Water Supply Projects (1999)*; and *Framework for the Economic and Financial Appraisal of Urban Development Sector Projects (1994)*.

<sup>16</sup> ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Cambodia Greater Mekong Subregion Southern Economic Corridor Towns Development Project, Linked Document on Economic Analysis*. Manila.

11. Socio-economic surveys were conducted in July 2013 for the four subproject towns with full FSRs – Kampong Cham, Siem Reap, Stung Treng and Svay Rieng. For the five other subproject towns where no survey was conducted, the result of survey from Kampong Cham was used in accordance with the benefit transfer method of analysis. The benefit transfer method is used to estimate economic values for services by transferring available information from studies already completed in another location and/or context.<sup>17</sup> The distribution of respondents for each of the four subproject towns is shown in **Table 1**.

**Table 1: Distribution of Survey Respondents for Each Subproject Area**

	Sample Size	Percentage
<b>A. Service Area</b>	<b>45</b>	<b>47.4</b>
<b>A.1 Household with piped water connection</b>	<b>20</b>	<b>21.1</b>
High water consumers	5	5.3
Medium water consumers	5	5.3
Low water consumers	10	10.5
<b>A.2 Household not connected to piped system</b>	<b>25</b>	<b>26.3</b>
Low income household	25	26.3
<b>B. Non Service Area</b>	<b>50</b>	<b>52.6</b>
High income household	10	10.5
Medium income household	10	10.5
Low income household	30	31.6
<b>Grant Total</b>	<b>95</b>	<b>100.0</b>

Source: Socio-Economic Survey Report, 2013.

### C. With- and Without-Project Situations

12. **Kampong Cham.** There are two private operators in Kampong Cham. One private operator provides untreated water to about 105 customers. There is no connection fee but the operator charges KR2500 per cubic meter (m<sup>3</sup>) for domestic customers compared to the Kampong Cham PWW's KR550 per m<sup>3</sup> for the first 10 m<sup>3</sup> and KR 900 per m<sup>3</sup> for consumption above 10 m<sup>3</sup>. However, the minimal investments for improving existing services and the high connection fee<sup>18</sup> of Kampong Cham PWW continue to deprive an increasing number of people in the town of this basic service.

13. The scope of proposed works under this project however, does not include increasing the capacity of the system but only replacement or improvement of existing facilities. Proposed works include the following:

- Drilling of 2 new boreholes to replace existing wells with new submersible pumps (capacities to be refined but no more than capacity of system);
- Additional 3,305m length of 100mm diameter pipe and 1,660m length of 300mm diameter to run in parallel with existing pipe;
- Additional 4,190m length of 110mm diameter pipe and 3,720m length of 63mm pipe for extensions to current system;
- Replacement of current gas chlorination system;
- Provision of gate valves and bulk meters for 5 zones ;
- Construction of second floors for existing office and laboratory buildings;
- Installation of 3 new transformers;

<sup>17</sup> ADB. 2013. *Cost-Benefit Analysis for Development – A Practical Guide*. Manila.

<sup>18</sup> KR440,000 per connection, equivalent to about one month salary of KCPWW personnel.

- Additional 100m deep borehole with submersible pump, wellhead, controls, pump building, power supply, fence, and rising main to existing elevated reservoir; and
- Rehabilitation of existing elevated reservoir and connection into the network.

14. **Kampong Thom.** The existing water supply system was constructed in 1946 and was rehabilitated in 1962 to provide a capacity of 350 cubic meters per day (m<sup>3</sup>/day). The current water treatment plant (WTP) was built under the ADB Provincial Towns Water Supply Project (PTWSP) in 2006, with a capacity of 5,760m<sup>3</sup>/day. The system initially served 6 communes, and eventually increased to 8 communes with served population of 45,947. The Sen river is the main source of raw water.

15. The proposed works for the subproject are designed to improve operation, increase water quality and security of supply. However, this improved scheme is not designed to increase capacity of supply. Expected outputs of the subproject include the following:

- Replacement of the two raw water pumps with submersible pumps;
- Replacement of motor fans and bearings on the clear water pumps;
- Increase water storage capacity to 2,000m<sup>3</sup>;
- Demolish and removal of existing 200m<sup>3</sup> tank;
- Construction of riverbank protection with gabion baskets;
- Provision of four new manual gate valves for filter drains;
- Replacement of the old 3km pipeline network with DN110mm HDPE;
- Replacement of filter block inlet gate valve;
- Replacement of current gas chlorination system;
- Additional sludge drying bed;
- Provision of bladder tank for clear water surge protection;
- Provision of gate valves and meters for zoning purposes;
- Rerouting of alum dosing pipe with ABS pipe; and
- Provision of laboratory equipment.

16. **Kampot.** The water supply system was originally established in 1951 and rebuilt after the Pol Pot regime to service 3,500 people in 4 communes. From 1993 to 1996, the capacity of the treatment plant was increased to 2,800m<sup>3</sup>/day under the SAWA<sup>19</sup> project. In response to increasing water demands due to the increasing population and development of the urban area, the system was upgraded under ADB's PTWSP in 2002. A new treatment plant was built with a capacity of 5,760m<sup>3</sup>/day, and pipelines were rehabilitated. The existing reticulation serves areas up to 5 kms from the WTP. Many old mains have been replaced under a JICA project but there are still some old AC pipes near the center which require replacement.

17. The proposed subproject is designed to improve operation, increase water quality and provide security of supply. However, this improved water supply scheme is not designed to increase supply capacity. Expected outputs of the subproject include the following:

- Replacement of the old chlorination system;
- Replacement of 4 gate valves and 4 air scour valves of backwash for WTP;
- Replacement of 200mm restriction on elevated tank line with 250mm and installation of 2 bulk clear water meters (east & west);
- Additional bladder tank for surge protection on direct pumping line to town; and

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<sup>19</sup> Sanitation and Water Action, a Dutch non-government organization.

- Rerouting of alum dosing pipe with ABS pipe

18. **Pursat.** The original water supply system for Pursat was constructed in 1926 but was destroyed during the late 70's. Rehabilitation works of the system was done from 1993 to 2002. The capacity of the WTP was increased to 250m<sup>3</sup>/day under the Dutch NGO SAWA. The current treatment plant was constructed in 2006 under the ADB PTWSP with a design capacity of 5,760m<sup>3</sup>/day. The sand mining operation and irrigation water outlet located upstream of the intake structure causes turbidity of the raw water.

19. The proposed subproject is designed to improve operation, increase water quality and provide security of supply. However, this improved scheme is not designed to increase supply capacity. The proposed works include the following:

- Installation of a 300 KVA transformer;
- Replacement of 2 raw water pumps with submersible pumps;
- Provision of new gate valve for upper inlet pipe;
- Provision of new manual gate valves for filter inlets and drains;
- Replacement of filter block inlet gate valve;
- Installation of 3km parallel DN160mm HDPE pipe;
- Replacement of the old chlorination system;
- Additional sludge drying bed; and
- Provision of laboratory equipment.

20. **Siem Reap.** Groundwater is currently used as the water source by Siem Reap Water Supply Authority (SRWSA). Boreholes are spread around the town area but there are also many unregulated boreholes abstracting water by households, hotels, and private business establishments. Due to the recent rapid expansion of the town and current low water supply coverage by SRWSA, the unregulated abstraction is widespread and said to be lowering the water table to the extent that the nearby temples at the Angkor UNESCO world heritage are already affected. The main surface water source near to Siem Reap is the Tonle Sap lake, which recedes by several kilometers during dry season, and varies in depth between 1.5 and 12 meters in depth annually. The Tonle Sap is also used by private households near the lake, but not currently by the SRWSA.

21. This subproject is intended to complete the pipe network in Zone 1 and the APSARA zone. SRWSA's current water production capacity is 13,000 m<sup>3</sup>/day, but this will be expanded through two new projects to ultimately meet 2025 water demand projections. A project funded by Agence Française de Développement (AFD) is expected to provide an additional 17,000 m<sup>3</sup>/day by 2017, which will provide the water needs of the new Zone 1 and APSARA zone being developed under this subproject, at an estimated cost of \$9 million. By 2019, another project to be financed by JICA will source water from the Tonle Sap, and will add a further 60,000 m<sup>3</sup>/day production capacity, bringing the total production capacity of SRWSA to 90,000 m<sup>3</sup>/day.

22. The proposed subproject includes the following:

- Installation of 6.5km. main pipeline from WTP to Zone 1, including road reinstatement; and
- Installation of distribution network in Zone 1 and in APSARA zone.

23. **Sihanoukville.** There is significant industrial development in Sihanoukville consisting of the port activities and a brewery operation. The town also has an increasing number of tourism related businesses, but currently does not have the water supply infrastructure to support it sustainably. The water supply system was originally established in 1958 with an initial capacity of 8,000m<sup>3</sup>/day. This original system was made to feed raw water to the two main commercial customers, the port and the Bayon Brewery, and was not intended as a domestic service. Up to 1993, untreated water was served to the population. Some improvements were made in 1994 under a World Bank project, providing a treatment facility supplying approximately 15% of the population with treated water. A second World Bank project in 1998 expanded and rehabilitated the treatment plant and distribution. The current capacity of the WTP is 8,000m<sup>3</sup>/day. There is a private bulk water supply company named ANCO Brothers Co. Ltd which has a facility to supply up to 20,000m<sup>3</sup>/day, but this is currently split between supply to the Water Authority and private businesses.

24. The Sihanoukville subproject aims to improve the provision of safe, affordable, and reliable piped water supply to communities within the four core sangkats with an estimated population of 71,000. The improved water supply scheme will improve the quality of the treated water and improve the operation of the WTP. The proposed works include:

- Rehabilitation of filters with mixed air/water stage;
- Additional clear water storage (500m<sup>3</sup>) with slope protection;
- Installation of raw water flow meter;
- Improvement of control panel for raw water pump security;
- Replacement of intake pump gate valve;
- Re-routing of alum dosing pipe with ABS pipe; and
- Provision of laboratory equipment.

25. **Stoung.** The Stoung WTP was designed and built in 2003 through a joint agreement among two towns in Italy and Belgium and the Stoung Provincial Waterworks. The inlet is from a stream adjacent to the WTP, with provision for wet and dry season inlets. During the dry season, this stream sometimes completely dries out and water is pumped from a reservoir dam 30kms away to replenish the stream. As evaluated by the PPTA team, there are a number of technical issues in the system which needs to be addressed.

26. The Stoung subproject aims to improve the provision of safe, affordable, reliable piped water supply to the five core communes. The proposed subproject includes the following works:

- Removal of sedimentation tank extension;
- Removal of generator building and construction of a new one near carpark;
- Construction of a WTP in a new location;
- Provision of gate valve for backwash line;
- Demolishing the old WTP and construction of a second WTP on its location; and
- Provision of laboratory equipment.

27. **Stung Treng.** The existing WTP was originally constructed in 1962 with the Sekong River as raw water source located upstream of its confluence with the Mekong River. The WTP is in poor condition and is not operating as designed. There are many large long term leaks in the structural concrete, no filtration and no flow measurement or control. Water is collected in a "clear" water tank and then pumped to an elevated tank to provide constant head for delivery to the reticulation system. In 2009 the reticulation supplied 1,490 households. This had not changed up to 2013. A significant portion of the reticulation is the original French system and

was designed to supply a population of 10,000. The total population of Stung Treng is now more than double this number.

28. The proposed subproject is designed to provide sufficient water to meet the needs of the population. It includes the following works:

- Provision of P&G and intake on Mekong;
- Construction of new WTP of 7,950m<sup>3</sup>/day capacity with elevated storage tank and underground tank;
- Construction of new tanks on old WTP site;
- Provision of electrical & mechanical works;
- Construction of new distribution system on all districts; and
- Provision of laboratory equipment.

29. **Svey Rieng.** The existing water supply system was originally constructed in 1948, using the Vaiko River as the raw water source. The current WTP was built in 2006 under the ADB PTWSP and uses raw water from 3 deep boreholes. The WTP can process 5,760m<sup>3</sup>/day but currently is limited by the fact that only one pump can run at any one time due to power supply limitations.

30. The proposed subproject is designed to improve operation, increase water quality and provide additional water supply. It includes the following works:

- Replacing iron/manganese package plant filters with conventional filters & aeration;
- Replacing current chlorination system;
- Replacing old pipeline network with 5.2kms of HDPE;
- Expansion of pipe network by 23.5 kms;
- Provision of additional frequency inverters in the intake pumps;
- Additional sludge drying bed in WTP site; and
- Provision of laboratory equipment.

#### **D. Economic Benefits**

31. The following economic benefits were considered in evaluating the economic viability of the proposed water supply investments:

- (a) Value of incremental water due to increased supply for (only for Siem Reap, Stung Treng and Svay Rieng);
- (b) Resource cost savings on non-incremental water in terms of (i) avoided costs of treating and storing non-piped water; and (ii) value of time saved for not having to collect water from existing non-piped sources which translates to avoided income loss for those who are gainfully employed or engaged in income-generating activities;
- (c) Value of water saved from improvement in non-technical losses; and
- (d) Health benefits due to reduction in the incidence of waterborne diseases.

32. **Economic value of incremental water due to increased supply.** This was determined based on the increased water consumption from "without project" to "with project" situations. The economic value was computed by multiplying the total additional volume consumed by the



economic value (represented by willingness to pay (WTP) of water users. The formula is represented as follows:

$$\text{Value of incremental water} = [\text{Total annual water consumption with project}] - (\text{Total annual water consumption without project}) * \text{Willingness to pay}$$

33. **Resource cost savings on non-incremental water.** These were computed by multiplying the volume of water consumed by those who are not currently connected by the economic value of non-piped water. The current economic value of non-piped water was based on the estimated costs of treating and storing water as gathered through the household surveys conducted in each of the subproject towns. The *economic value of time saved* by households not currently connected is represented by the avoided income loss from not collecting water from wells and other sources by household members (usually adults) as a result of having direct connections to the piped water system. The computation is represented in the following formula:

$$\text{Avoided costs of storing water} = [(\text{Number of connections with project}) - (\text{Number of connections before project})] * (\text{Consumption for non-piped water}) * 365 \text{ days} * \text{Annual storage cost}$$

$$\text{Avoided costs of treating water} = [(\text{Number of connections with project}) - (\text{Number of connections before project})] * 365 \text{ days} * \text{Treatment cost per connection per day}$$

$$\text{Value of time saved for not collecting water} = [(\text{Number of connections with project}) - (\text{Number of connections before project})] * \text{Time spent in collecting non-piped water per day} * \text{daily wage rate adjusted for SWRF} * \text{economically active population} * 365 \text{ days}$$

34. **Value of non-technical water losses saved.** This was computed by multiplying the amount of water that would have been lost due to non-technical reasons and the supply price of water. It is computed based on the following formula:

$$\text{Value of water saved from non-technical losses} = [(\text{Water production with project}) - (\text{Water production before project})] * \text{Non-technical NRW} * [(\text{Effective average tariff} + \text{Willingness to pay})/2]$$

35. **Value of health benefits.** This was quantified using the Disability Adjusted Life Year (DALY) approach<sup>20</sup>. A DALY is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death. The health benefit attributable to the subproject is reduced health risks from lack of safe and adequate water and sanitation service as measured through savings in DALYs. It was observed that the lack of proper water and sanitation facilities in the towns prompted many households to using untreated and unreliable water from alternative sources—one of the major causes of increased incidence of waterborne diseases.

36. The World Health Organization (WHO) estimated the total DALYs of Cambodia at 38,451 per 100,000 population.<sup>21</sup> WHO also estimated that 10% of the total DALYs of Cambodia was

<sup>20</sup> The approach was developed by Harvard University for the World Bank in 1990 for a study that provided a comprehensive assessment of mortality and disability from diseases, injuries and risk factors. The WHO subsequently adopted the method in 1996. Determination of DALY is continually revised by the WHO.

<sup>21</sup> World Health Organization. 2004. World Health Report. Geneva, Switzerland.

water, sanitation and hygiene related.<sup>22</sup> A conservative estimate of 5% was assumed for this water project. Further following the WHO approach, the annual economic value of a DALY was calculated as equivalent to the country's gross national income (GNI) per capita.<sup>23</sup> The country's estimated GNI per capita in 2013 was \$2,890 (purchasing power parity) with real growth of 2% per annum.<sup>24</sup> Savings in DALY attributable to the subproject are assumed to vary from 1% to 60% of the calculated economic value of DALYs for the subproject towns. The variation was based on the scope and nature of the proposed physical improvements to the water and sanitation facilities. For Siem Reap and Stung Treng, a higher savings in DALY (60%) was assumed since the proposed investments for the two towns comprise 80% of total project cost. The health benefit is computed based on the following formula:

$$\text{Savings in DALYs} = \text{Population with piped water supply}/100,000 * \text{DALY due to unsafe and inadequate water and sanitation} * \text{GNI per capita} * \text{Percentage of savings in DALY attributable to project}$$

37. Data used in computing the annual benefits for each subproject town are summarized in the following table.

**Table 2: Projected Service Area Population, Coverage Area, Number of Connections and Water Usage (Incremental and Non-Incremental)**

	2015	2018	2019	2020	2025	2030	2040
<b>Kampong Cham</b>							
Service area population	63,961	64,057	64,089	64,121	64,281	64,441	64,761
Served Population	30,692	37,916	39,722	41,270	41,270	41,270	41,270
Coverage area	48%	59%	62%	64%	64%	64%	64%
Total connections							
Without project	6,602	8,063	8,433	8,753	8,813	8,813	8,813
With project	-	8,063	8,433	8,753	8,813	8,813	8,813
Projected water usage (000 m3)							
Without project	1,490	1,841	1,928	2,003	2,003	2,003	2,003
With project	-	1,841	1,928	2,003	2,003	2,003	2,003
Incremental	-	-	-	-	-	-	-
Non-incremental	-	-	1,928	2,003	2,003	2,003	2,003
<b>Kampong Thom</b>							
Service area population	46,154	46,361	46,431	46,501	46,851	47,203	47,916
Served Population	21,970	24,970	24,970	24,970	24,970	24,970	24,970
Coverage area	48%	54%	54%	54%	53%	53%	52%
Total connections							
Without project	4,422	5,028	5,030	5,032	5,038	5,038	5,038
With project	-	5,028	5,030	5,032	5,038	5,038	5,038
Projected water usage (000 m3)							
Without project	866	984	984	984	984	984	984
With project	-	984	984	984	984	984	984
Incremental	-	-	-	-	-	-	-

<sup>22</sup> WHO. 2007. Environmental Burden of Disease Series No. 15 (Water, Sanitation and Hygiene). Geneva.

<sup>23</sup> The WHO Commission of Macroeconomics and Health assumes that each DALY can be valued at one year of per capita GNI to arrive at a conservative estimate of the economic value of a DALY.

<sup>24</sup> World Bank. 2012. World Development Indicators. Washington D.C.

	2015	2018	2019	2020	2025	2030	2040
Non-incremental	-	-	984	984	984	984	984
<b>Kampot</b>							
Service area population	48,646	49,585	49,902	50,221	51,849	53,529	57,056
Served Population	26,240	30,740	30,740	30,740	30,740	30,740	30,740
Coverage area	54%	62%	62%	61%	59%	57%	54%
Total connections							
Without project	5,248	6,148	6,148	6,148	6,148	6,148	6,148
With project	-	6,148	6,148	6,148	6,148	6,148	6,148
Projected water usage (000 m3)							
Without project	1,454	1,703	1,703	1,703	1,703	1,703	1,703
With project	-	1,703	1,703	1,703	1,703	1,703	1,703
Incremental	-	-	-	-	-	-	-
Non-incremental	-	-	1,703	1,703	1,703	1,703	1,703
<b>Pursat</b>							
Service area population	51,402	51,480	51,506	51,532	51,662	51,792	52,052
Served Population	33,670	38,170	39,670	39,670	39,670	39,670	39,670
Coverage area	66%	74%	77%	77%	77%	77%	76%
Total connections							
Without project	6,825	7,732	8,034	8,036	8,042	8,042	8,042
With project	-	7,732	8,034	8,036	8,042	8,042	8,042
Projected water usage (000 m3)							
Without project	1,229	1,393	1,448	1,448	1,448	1,448	1,448
With project	-	1,393	1,448	1,448	1,448	1,448	1,448
Incremental	-	-	-	-	-	-	-
Non-incremental	-	-	1,448	1,448	1,448	1,448	1,448
<b>Siem Reap (Zone 1 &amp; APSARA)</b>							
Service area population	59,183	69,062	72,708	76,547	99,005	109,310	133,248
Served Population	0	5,040	10,080	15,120	40,320	40,320	40,320
Coverage area	0%	7%	14%	20%	41%	37%	30%
Total connections							
Without project	-	-	-	-	-	-	-
With project	-	1,000	2,000	3,000	8,000	8,000	8,000
Projected water usage (000 m3)							
Without project	-	-	-	-	-	-	-
With project	-	-	442	662	1,766	1,766	1,766
Incremental	-	-	88	132	353	353	353
Non-incremental	-	-	353	530	1,412.81	1,413	1,413
<b>Sihanouville</b>							
Service area population	75,363	82,183	84,591	87,070	100,596	116,222	155,133
Served Population	33,325	37,825	37,825	37,825	37,825	37,825	37,825
Coverage area	44%	46%	45%	43%	38%	33%	24%
Total connections							
Without project	6,665	7,565	7,565	7,565	7,565	7,565	7,565
With project	-	7,565	7,565	7,565	7,565	7,565	7,565
Projected water usage (000 m3)							
Without project	2,530	2,872	2,872	2,872	2,872	2,872	2,872
With project	-	2,872	2,872	2,872	2,872	2,872	2,872
Incremental	-	-	-	-	-	-	-

	2015	2018	2019	2020	2025	2030	2040
Non-incremental	-	-	2,872	2,872	2,872	2,872	2,872
<b>Stoung</b>							
Service area population	51,581	52,014	52,159	52,304	53,037	53,780	55,298
Served Population	10,500	15,000	17,000	17,000	17,000	17,000	17,000
Coverage area	20%	29%	33%	33%	32%	32%	31%
Total connections							
Without project	2,156	3,057	3,457	3,457	3,457	3,457	3,457
With project	-	3,057	3,457	3,457	3,457	3,457	3,457
Projected water usage (000 m3)							
Without project	268	383	434	434	434	434	434
With project	-	383	434	434	434	434	434
Incremental	-	-	-	-	-	-	-
Non-incremental	-	383	434	434	434	434	434
<b>Stung Treng</b>							
Service area population	35,158	36,406	36,832	37,263	39,494	41,858	47,020
Served Population	12,727	14,308	19,578	26,166	35,652	41,712	41,712
Coverage area	36%	39%	53%	70%	90%	100%	89%
Total connections							
Without project	2,638	3,030	3,030	3,030	3,030	3,030	3,030
With project	-	-	4,060	5,340	7,230	8,380	8,380
Projected water usage (000 m3)							
Without project	451	507	507	507	507	507	507
With project	-	-	836	1,117	1,522	1,781	1,781
Incremental	-	-	330	611	1,016	1,275	1,275
Non-incremental	-	-	507	507	507	507	507
<b>Svay Rieng</b>							
Service area population	44,963	44,990	44,999	45,008	45,053	45,098	45,188
Served Population	11,570	17,774	20,359	22,944	25,529	25,529	25,529
Coverage area	26%	40%	45%	51%	57%	57%	56%
Total connections							
Without project	2,376	3,623	3,623	3,623	3,623	3,623	3,623
With project	-	-	4,138	4,653	5,198	5,198	5,198
Projected water usage (000 m3)							
Without project	494	759	759	759	759	759	759
With project	-	-	869	980	1,090	1,090	1,090
Incremental	-	-	110	221	331	331	331
Non-incremental	-	-	759	759	759	759	759
<b>All Project Towns</b>							
Service area population	476,411	496,138	503,217	510,567	551,828	583,233	657,672
Served Population	180,694	221,743	239,944	255,705	292,976	299,036	299,036
Coverage area	38%	45%	48%	50%	53%	51%	45%
Total connections							
Without project	36,932	44,246	45,320	45,644	45,716	45,716	45,716
With project	0	38,593	48,865	51,984	59,491	60,641	60,641
Projected water usage (000 m3)							
Without project	8,782	10,442	10,635	10,711	10,711	10,711	10,711
With project	0	9,176	11,164	12,204	13,824	14,083	14,083
Incremental	0	0	528	964	1,700	1,959	1,959
Non-incremental	0	383	10,989	11,240	12,123	12,123	12,123

Source: PPTA Consultant

38. Other parameters and values used in quantifying the economic benefits of water supply improvement were mainly based on the results of the socio-economic survey. For the five subproject towns where only WTP rehabilitation is planned and with no water supply system expansion, socio-economic survey was not undertaken. For these towns, the results for Kampong Chan were used as warranted by the fact that (i) Pursat, Kampong Thom, and Stoung are similarly situated surrounding the Tonle Sap lake; and (ii) Kampot and Sihanoukville being towns with similar tourism-based local economy. Parameters and values are shown in **Tables 3 and 4**.

**Table 3: Parameters Used for Economic Benefit Computation for Subproject Towns with Socio-economic Survey**

Subproject Town	Kampong Cham	Siem Reap	Stung Treng	Svay Rieng
Willingness to pay (KR/m3)	1,263	1,500	1,829	1,741
Average water consumption (lpcd)	133	120	97	117
Economic cost of storage facility (KR/m3)	342	310	495	626
Economic cost of treating water (KR/conn/day)	104	113	162	147
Economically-active population (%)	45%	46%	44%	46%
Average wage rate adjusted for SWRF (KR/day)	5,232	10,555	4,132	8,049
Time spent in water collection (min/day)	45	45	60	45
Improvement in non-technical NRW	1%	3%	3%	2%
Total savings in DALY (KR billion)	36	188	198	22
Savings in DALY due to project (%)	10%	60%	60%	10%

Source: Socio-economic survey, July 2013

**Table 4: Parameters Used for Economic Benefit Computation for Subproject Towns without Socio-economic Survey**

Subproject Town <sup>a</sup>	Kampong Thom	Kampot	Pursat	Sihanouville	Stoung
Water consumption (lpcd)	108	76	100	104	70
Improvement in non-technical NRW	1%	1%	0.2%	1%	1%
Total savings in DALY (KR billion)	22	3	10	10	15
Savings in DALY due to project (%)	10%	1%	3%	3%	10%

Source: PPTA Consultant.

<sup>a</sup> The SES result for Kampong Cham was assumed for subproject sites without SES.

39. Other economic benefits were identified but not quantified and valued in the computation of EIRR. These include: (i) enhanced capacity and efficiency on project management and water system operations; (ii) income generation from the use of water for livelihood purposes and the multiplier effects of increased income; (iii) climate change resiliency (e.g. readiness to manage impact of possible drought, etc.); and environmental protection. Specific to Siem Reap, impact of the existing ground water over abstraction can result to lowering of water table and damage the temples at the Angkor UNESCO world heritage area.

## E. Economic Costs

40. Economic costs were derived from the estimates of capital and non-capital investments<sup>25</sup>, replacement costs and O&M costs in financial terms, removing price contingencies, duties and taxes and multiplying the net results by the conversion factors. The following conversion factors were applied: shadow exchange rate factor (SERF) of 1.1 for foreign costs and shadow wage rate factor (SWRF) of 0.75 for unskilled labor. The weighted overall factors for capital costs and operation and maintenance (O&M) costs were computed and applied to the net costs to derive the economic cost equivalents of the proposed capital investments and O&M.

41. Based on the distribution of costs as to traded and non-traded components, the overall conversion factor for both capital costs and O&M costs are shown in the following table:

**Table 5: Conversion Factor for Economic Costs**

Cost Components	Capital Costs			O&M Costs		
	Cost	Conversion	Economic	Cost	Conversion	Economic
	Distribution	Factor	Price	Distribution	Factor	Price
Traded	30%	1.10	33%	20%	1.10	22%
Non-traded						
Unskilled labor	30%	0.75	23%	40%	0.75	30%
Others	40%	1.00	40%	40%	1.00	40%
Total	100%		96%	100%		92%
Overall Conversion Factor (CF)			0.96			0.92

Source: PPTA Consultant.

42. The computed economic capital costs are summarized in the following table:

**Table 6: Summary of Economic Capital Costs**

Subproject Town	Economic Cost (KR million)			
	Capital Investment	Replacement Cost	Project Management & Training	Total
Kampong Chan	4,513	1,459	1,321	7,293
Kampong Thom	2,875	2,396	842	6,113
Kampot	371	611	109	1,091
Pursat	1,206	1,268	353	2,827
Siem Reap <sup>a</sup>	51,231	8,335	5,848	65,414
Sihanoukville	1,330	1,080	389	2,799

<sup>25</sup> For Siem Reap, the cost of the AFD-funded development amounting to \$9 million was included in the economic cost since it will provide the water needs of the new Zone 1 and APSARA zone.

Subproject Town	Economic Cost (KR million)			
	Capital Investment	Replacement Cost	Project Management & Training	Total
Stoung	1,378	972	403	2,754
Stung Treng	45,040	6,104	13,186	64,331
Svay Rieng	4,533	2,806	1,327	8,666
TOTAL	112,477	25,031	23,780	161,288

Note: <sup>a</sup> Includes cost for AFD project estimated at KR36 billion.

Source: PPTA Consultant.

43. The opportunity cost of water was excluded in the evaluation since there are no identified water diversion and no competing water users, even in the three subproject towns where new water sources will be developed. For Stung Treng, new water source will be Mekong river; for Svay Rieng, the identified source is ground water located near the WTP; and West Baray lake for Siem Reap. On this basis, the opportunity cost of water is zero since there is no scarcity in water source.

## F. EIRR and Sensitivity Analysis

44. Given the stream of economic benefits and costs over the 30-year period, the EIRRs for the base cases of the nine subprojects range from 14% (for Stung Treng) to 35% (for Kampot). All EIRRs are higher than the assumed EOCC of 12%.

45. Sensitivity tests were computed for scenarios based on (i) 10% increase in capital costs, (ii) 10% increase in O&M costs, (iii) 10% decrease in resource cost savings, (iv) 10% decrease in incremental water, and (v) increase in costs by 10% and decrease in benefits by 10%. **Table 7** summarizes the results of the base case analysis and the sensitivity tests for the nine subprojects. Annual stream of benefits and costs are shown in **Tables 9 to 18**.

**Table 7: EIRR and Sensitivity Test Results**

	Base Case	Sensitivity Tests				
		Investment	O&M	RSC	Incr. Water	Cost (+10%)
		+10%	+10%	-10%	-10%	Benefit (-10%)
<b>Kampong Chan</b>						
ENPV	2,809	2,380	2,658	2,703	2,809	1,368
EIRR	20.8%	18.9%	20.4%	20.5%	20.8%	16.0%
<b>Kampong Thom</b>						
ENPV	1,416	1,127	1,332	1,361	1,416	530
EIRR	19.6%	17.5%	19.2%	19.3%	19.6%	14.7%
<b>Kampot</b>						
ENPV	552	507	461	484	552	222
EIRR	36.4%	32.4%	32.4%	33.3%	36.4%	20.9%
<b>Pursat</b>						
ENPV	1,277	1,144	1,184	1,182	1,277	698
EIRR	28.1%	25.2%	27.0%	26.9%	28.1%	20.1%
<b>Siem Reap</b>						
ENPV	3,439	-415	2,961	3,150	2,441	-5,570
EIRR	13.0%	11.9%	12.8%	12.9%	12.7%	10.5%

<b>Sihanoukville</b>						
ENPV	759	628	614	691	759	130
EIRR	20.7%	18.6%	19.1%	19.9%	20.7%	13.4%
<b>Stoung</b>						
ENPV	1,459	1,327	1,339	1,393	1,459	809
EIRR	27.3%	24.8%	26.1%	26.6%	27.3%	20.0%
<b>Stung Treng</b>						
ENPV	-5	-3,871	-478	-225	-872	-8,680
EIRR	12.0%	10.9%	11.9%	11.9%	11.7%	9.5%
<b>Svay Rieng</b>						
ENPV	3,378	2,935	3,141	3,197	3,108	1,681
EIRR	20.8%	19.1%	20.2%	20.4%	20.2%	16.2%

Source: Consultant's estimate.

EIRR = economic internal rate of return (in percentage), ENPV = economic net present value (in KR million), O&M = operation and maintenance, RSC = resource cost savings

## G. Project Sustainability

46. Project sustainability is highly dependent on the implementation of the proposed water tariff increases, connection of prospective customers, and efficiency of management and operation and the ongoing sector reform by the MIH. While the main objective is to generate sufficient revenue to cover operation and maintenance costs, a strategy to provide subsidized connections (up to 100%) will be implemented under the Project to assist poorer households to connect to the water supply system. In line with this, the waterworks authorities shall undertake a promotion campaign to encourage households to connect while a connection installment plan may also be established for non-poor households. Proposed periodic increases in water rates are proposed starting in 2015 and in some cases like Siem Reap, Stung Treng and Svay Rieng, a series of increases are proposed for three years immediately after subproject completion in 2020 in order to ensure sustainability. However, the actual need and amount of tariff increases will also need to take account of (i) the MIH's ongoing sector reforms with the waterworks, (ii) ongoing initiatives to reduce energy costs and nonrevenue water levels; and (iii) the development of new tariff structures and regulations. Detailed discussions on financial sustainability are included in the Financial Analysis report.

## H. Distribution of Net Economic Benefits and Poverty Impact

47. The nine water supply subprojects are expected to generate total net economic benefits (NEB)<sup>26</sup> ranging from KR987 million to KR7.7 billion. A significant portion of these will accrue to water consumers, many of whom are current users of water from wells, rainwater, river water and other sources and who are expected to connect to the improved piped water supply system to be made possible through this Project. Local labor, for which a significant amount of person-days will be needed for physical rehabilitation or replacement of the facilities and their eventual operation, will likewise gain from the Project. The government or the local economy will lose due to distortions in the exchange rate.

48. The computed poverty impact ratios (PIRs) for the water supply investments vary from 17% to 23%, which means that up to 23% of the NEB will directly benefit the poor. Poverty incidence in the service areas is around 20%.

<sup>26</sup> NEB is the difference between the present value of economic benefits and financial revenues.



## I. Overall Project Economic Evaluation

49. An overall project economic evaluation was undertaken taking into account all the economic costs and benefits attributable to the project. The resulting EIRRs and ENPVs for the base case and test scenarios are shown in **Table 8**:

**Table 8: Summary Result of Overall Project Economic Evaluation**

	<b>Economic Internal Rate of Return (%)</b>	<b>Economic Net Present Value (KR billion)</b>
Base case	13.9%	15,084
Capital cost plus 10%	12.7%	5,763
O&M plus 10%	13.6%	13,211
RCS less 10%	13.7%	13,936
Incremental Water less 10%	13.6%	12,949
Costs plus 10%, Benefits less 10%	10.9%	-8,813

Source: PPTA Consultant.

**Table 9: Economic Evaluation – Kampong Cham**

(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	313	-	313	(313)	-344	-313	-313	-313	-344	
2016	-	-	-	-	-	-	238	-	238	(238)	-262	-238	-238	-238	-262	
2017	-	-	-	-	-	-	2,494	-	2,494	(2,494)	-2,744	-2,494	-2,494	-2,494	-2,744	
2018	-	142	82	29	930	1,183	2,494	145	2,639	(1,456)	-1,706	-1,471	-1,470	-1,456	-1,838	
2019	-	170	114	38	994	1,316	238	206	444	872	849	852	855	872	696	
2020	-	194	141	44	1,054	1,433	57	255	312	1,121	1,115	1,095	1,101	1,121	946	
2021	-	194	141	47	1,075	1,457	-	279	279	1,179	1,179	1,151	1,159	1,179	1,005	
2022	-	194	141	48	1,096	1,480	-	291	291	1,189	1,189	1,159	1,169	1,189	1,011	
2023	-	194	141	49	1,118	1,503	-	298	298	1,205	1,205	1,175	1,186	1,205	1,025	
2024	-	194	141	50	1,140	1,525	625	301	926	600	537	569	580	600	354	
2025	-	194	141	50	1,163	1,548	-	301	301	1,247	1,247	1,217	1,228	1,247	1,062	
2026	-	194	141	50	1,187	1,571	-	301	301	1,271	1,271	1,241	1,251	1,271	1,083	
2027	-	194	141	50	1,210	1,595	-	301	301	1,294	1,294	1,264	1,275	1,294	1,105	
2028	-	194	141	50	1,234	1,619	-	301	301	1,319	1,319	1,289	1,299	1,319	1,127	
2029	-	194	141	50	1,259	1,644	278	301	579	1,065	1,038	1,035	1,046	1,065	843	
2030	-	194	141	50	1,284	1,669	-	301	301	1,368	1,368	1,338	1,349	1,368	1,171	
2031	-	194	141	50	1,310	1,695	-	301	301	1,394	1,394	1,364	1,375	1,394	1,195	
2032	-	194	141	50	1,336	1,721	-	301	301	1,420	1,420	1,390	1,401	1,420	1,218	
2033	-	194	141	50	1,363	1,748	-	301	301	1,447	1,447	1,417	1,428	1,447	1,242	
2034	-	194	141	50	1,390	1,775	278	301	579	1,197	1,169	1,166	1,177	1,197	961	
2035	-	194	141	50	1,418	1,803	-	301	301	1,502	1,502	1,472	1,483	1,502	1,292	
2036	-	194	141	50	1,446	1,831	-	301	301	1,531	1,531	1,500	1,511	1,531	1,317	
2037	-	194	141	50	1,475	1,860	-	301	301	1,559	1,559	1,529	1,540	1,559	1,343	
2038	-	194	141	50	1,505	1,890	-	301	301	1,589	1,589	1,559	1,570	1,589	1,370	
2039	-	194	141	50	1,535	1,920	278	301	579	1,341	1,313	1,311	1,322	1,341	1,091	
2040	-	194	141	50	1,566	1,951	-	301	301	1,650	1,650	1,620	1,630	1,650	1,425	
2041	-	194	141	50	1,597	1,982	-	301	301	1,681	1,681	1,651	1,662	1,681	1,453	
2042	-	194	141	50	1,629	2,014	-	301	301	1,713	1,713	1,683	1,694	1,713	1,482	
2043	-	194	141	50	1,661	2,046	-	301	301	1,746	1,746	1,715	1,726	1,746	1,511	
2044	-	194	141	50	1,695	2,080	-	301	301	1,779	1,779	1,749	1,759	1,779	1,541	
									NPV	<b>2,809</b>		<b>2,380</b>	<b>2,658</b>	<b>2,703</b>	<b>2,809</b>	<b>1,368</b>
									EIRR	<b>20.8%</b>		<b>18.9%</b>	<b>20.4%</b>	<b>20.5%</b>	<b>20.8%</b>	<b>16.0%</b>

**Table 10: Economic Evaluation – Kampong Thom**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	199	-	199	(199)	-219	-199	-199	-199	-219	
2016	-	-	-	-	-	-	152	-	152	(152)	-167	-152	-152	-152	-167	
2017	-	-	-	-	-	-	1,589	-	1,589	(1,589)	-1,748	-1,589	-1,589	-1,589	-1,748	
2018	-	97	27	61	613	798	1,589	99	1,688	(890)	-1,049	-900	-899	-890	-1,138	
2019	-	97	27	66	625	816	152	112	263	553	537	541	543	553	445	
2020	-	97	27	69	637	831	36	125	161	670	667	658	661	670	571	
2021	-	97	27	72	650	847	-	138	138	709	709	695	699	709	611	
2022	-	97	27	75	663	863	-	151	151	712	712	697	702	712	611	
2023	-	97	27	78	676	879	-	164	164	715	715	699	706	715	611	
2024	-	97	27	79	690	894	417	170	587	307	265	290	297	307	159	
2025	-	97	27	79	704	908	-	170	170	738	738	721	728	738	630	
2026	-	97	27	79	718	922	-	170	170	752	752	735	742	752	642	
2027	-	97	27	79	732	936	-	170	170	766	766	749	756	766	655	
2028	-	97	27	79	747	951	-	170	170	781	781	764	771	781	669	
2029	-	97	27	79	762	966	-	170	170	796	796	779	786	796	682	
2030	-	97	27	79	777	981	-	170	170	811	811	794	801	811	696	
2031	-	97	27	79	793	996	-	170	170	826	826	809	817	826	710	
2032	-	97	27	79	808	1,012	-	170	170	842	842	825	833	842	724	
2033	-	97	27	79	825	1,028	-	170	170	858	858	841	849	858	739	
2034	-	97	27	79	841	1,045	1,979	170	2,150	(1,105)	-1,303	-1,122	-1,114	-1,105	-1,424	
2035	-	97	27	79	858	1,062	-	170	170	892	892	875	882	892	769	
2036	-	97	27	79	875	1,079	-	170	170	909	909	892	899	909	784	
2037	-	97	27	79	893	1,096	-	170	170	926	926	909	917	926	800	
2038	-	97	27	79	910	1,114	-	170	170	944	944	927	935	944	816	
2039	-	97	27	79	929	1,132	-	170	170	962	962	945	953	962	832	
2040	-	97	27	79	947	1,151	-	170	170	981	981	964	971	981	849	
2041	-	97	27	79	966	1,170	-	170	170	1,000	1,000	983	990	1,000	866	
2042	-	97	27	79	986	1,189	-	170	170	1,019	1,019	1,002	1,010	1,019	883	
2043	-	97	27	79	1,005	1,209	-	170	170	1,039	1,039	1,022	1,029	1,039	901	
2044	-	97	27	79	1,025	1,229	-	170	170	1,059	1,059	1,042	1,049	1,059	919	
									NPV	<b>1,416</b>		<b>1,127</b>	<b>1,332</b>	<b>1,361</b>	<b>1,416</b>	<b>530</b>
									EIRR	<b>19.6%</b>		<b>17.5%</b>	<b>19.2%</b>	<b>19.3%</b>	<b>19.6%</b>	<b>14.7%</b>

**Table 11: Economic Evaluation - Kampot**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	26	-	26	(26)	-28	-26	-26	-26	-28	
2016	-	-	-	-	-	-	20	-	20	(20)	-22	-20	-20	-20	-22	
2017	-	-	-	-	-	-	205	-	205	(205)	-226	-205	-205	-205	-226	
2018	-	121	55	72	75	323	205	138	343	(20)	-41	-34	-32	-20	-87	
2019	-	121	55	79	77	332	20	165	185	147	145	130	134	147	95	
2020	-	121	55	79	78	333	5	165	170	163	163	146	151	163	113	
2021	-	121	55	79	80	335	-	165	165	169	169	153	157	169	119	
2022	-	121	55	79	82	336	-	165	165	171	171	154	159	171	121	
2023	-	121	55	79	83	338	-	165	165	172	172	156	160	172	122	
2024	-	121	55	79	85	340	306	165	471	(131)	-162	-148	-144	-131	-213	
2025	-	121	55	79	87	341	-	165	165	176	176	159	164	176	125	
2026	-	121	55	79	88	343	-	165	165	178	178	161	165	178	127	
2027	-	121	55	79	90	345	-	165	165	179	179	163	167	179	128	
2028	-	121	55	79	92	347	-	165	165	181	181	165	169	181	130	
2029	-	121	55	79	94	348	-	165	165	183	183	166	171	183	132	
2030	-	121	55	79	96	350	-	165	165	185	185	168	173	185	133	
2031	-	121	55	79	98	352	-	165	165	187	187	170	175	187	135	
2032	-	121	55	79	100	354	-	165	165	189	189	172	177	189	137	
2033	-	121	55	79	102	356	-	165	165	191	191	174	179	191	139	
2034	-	121	55	79	104	358	306	165	471	(113)	-143	-129	-125	-113	-196	
2035	-	121	55	79	106	360	-	165	165	195	195	178	183	195	142	
2036	-	121	55	79	108	362	-	165	165	197	197	180	185	197	144	
2037	-	121	55	79	110	365	-	165	165	199	199	183	187	199	146	
2038	-	121	55	79	112	367	-	165	165	201	201	185	189	201	148	
2039	-	121	55	79	114	369	-	165	165	204	204	187	191	204	150	
2040	-	121	55	79	117	371	-	165	165	206	206	189	194	206	152	
2041	-	121	55	79	119	374	-	165	165	208	208	192	196	208	154	
2042	-	121	55	79	121	376	-	165	165	211	211	194	198	211	156	
2043	-	121	55	79	124	378	-	165	165	213	213	196	201	213	159	
2044	-	121	55	79	126	381	-	165	165	215	215	199	203	215	161	
									NPV	552		507	461	484	552	222
									EIRR	36.4%		32.4%	32.4%	33.3%	36.4%	20.9%

**Table 12: Economic Evaluation - Pursat**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	84	-	84	(84)	-92	-84	-84	-84	-92	
2016	-	-	-	-	-	-	64	-	64	(64)	-70	-64	-64	-64	-70	
2017	-	-	-	-	-	-	667	-	667	(667)	-733	-667	-667	-667	-733	
2018	-	146	48	42	281	517	667	97	763	(246)	-313	-256	-261	-246	-374	
2019	-	170	73	48	298	588	64	145	208	380	374	366	363	380	301	
2020	-	170	73	51	304	598	15	170	185	413	411	396	396	413	334	
2021	-	170	73	52	310	604	-	173	173	431	431	414	414	431	354	
2022	-	170	73	52	316	611	-	175	175	435	435	418	418	435	357	
2023	-	170	73	52	322	617	-	178	178	439	439	422	422	439	360	
2024	-	170	73	53	329	624	573	179	752	(128)	-186	-146	-145	-128	-266	
2025	-	170	73	53	335	631	-	179	179	451	451	433	434	451	370	
2026	-	170	73	53	342	637	-	179	179	458	458	440	441	458	376	
2027	-	170	73	53	349	644	-	179	179	465	465	447	448	465	382	
2028	-	170	73	53	356	651	-	179	179	472	472	454	455	472	389	
2029	-	170	73	53	363	658	-	179	179	479	479	461	462	479	395	
2030	-	170	73	53	370	665	-	179	179	486	486	468	469	486	402	
2031	-	170	73	53	378	673	-	179	179	494	494	476	477	494	408	
2032	-	170	73	53	385	680	-	179	179	501	501	483	484	501	415	
2033	-	170	73	53	393	688	-	179	179	509	509	491	492	509	422	
2034	-	170	73	53	401	696	695	179	874	(178)	-247	-196	-195	-178	-335	
2035	-	170	73	53	409	704	-	179	179	525	525	507	508	525	436	
2036	-	170	73	53	417	712	-	179	179	533	533	515	516	533	444	
2037	-	170	73	53	425	721	-	179	179	541	541	523	524	541	451	
2038	-	170	73	53	434	729	-	179	179	550	550	532	533	550	459	
2039	-	170	73	53	443	738	-	179	179	558	558	540	541	558	467	
2040	-	170	73	53	451	747	-	179	179	567	567	549	550	567	475	
2041	-	170	73	53	460	756	-	179	179	576	576	558	559	576	483	
2042	-	170	73	53	470	765	-	179	179	586	586	568	568	586	491	
2043	-	170	73	53	479	774	-	179	179	595	595	577	578	595	500	
2044	-	170	73	53	489	784	-	179	179	604	604	587	587	604	508	
									NPV	1,277		1,144	1,184	1,182	1,277	698
									EIRR	28.1%		25.2%	27.0%	26.9%	28.1%	20.1%

**Table 13: Economic Evaluation – Siem Reap**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Losses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	1,386	-	1,386	(1,386)	-1,524	-1,386	-1,386	-1,386	-1,524	
2016	-	-	-	-	-	-	1,053	-	1,053	(1,053)	-1,158	-1,053	-1,053	-1,053	-1,158	
2017	-	-	-	-	-	-	16,465	-	16,465	(16,465)	-18,111	-16,465	-16,465	-16,465	-18,111	
2018	-	-	-	-	-	-	19,461	96	19,558	(19,558)	-21,504	-19,568	-19,558	-19,558	-21,514	
2019	662	192	374	54	1,514	2,796	18,463	247	18,709	(15,914)	-17,760	-15,938	-15,933	-15,980	-18,064	
2020	993	288	561	88	2,316	4,245	252	516	768	3,478	3,453	3,426	3,449	3,378	2,976	
2021	1,325	383	748	117	3,150	5,722	-	710	710	5,012	5,012	4,941	4,973	4,879	4,368	
2022	1,656	479	935	146	4,016	7,231	-	827	827	6,405	6,405	6,322	6,357	6,239	5,599	
2023	1,987	575	1,122	186	4,916	8,785	-	931	931	7,854	7,854	7,761	7,797	7,656	6,883	
2024	2,318	671	1,309	217	5,849	10,364	4,167	1,014	5,181	5,183	4,766	5,082	5,116	4,951	3,629	
2025	2,649	767	1,496	248	6,819	11,978	-	1,075	1,075	10,903	10,903	10,795	10,826	10,638	9,598	
2026	2,649	767	1,496	248	6,955	12,115	-	1,126	1,126	10,989	10,989	10,876	10,912	10,724	9,665	
2027	2,649	767	1,496	248	7,094	12,254	-	1,180	1,180	11,074	11,074	10,956	10,998	10,809	9,731	
2028	2,649	767	1,496	251	7,236	12,399	-	1,226	1,226	11,172	11,172	11,050	11,096	10,907	9,810	
2029	2,649	767	1,496	254	7,381	12,546	-	1,276	1,276	11,270	11,270	11,143	11,194	11,005	9,888	
2030	2,649	767	1,496	257	7,529	12,697	-	1,315	1,315	11,382	11,382	11,251	11,305	11,117	9,981	
2031	2,649	767	1,496	260	7,679	12,851	-	1,331	1,331	11,520	11,520	11,387	11,443	11,255	10,102	
2032	2,649	767	1,496	263	7,833	13,008	-	1,331	1,331	11,677	11,677	11,544	11,600	11,412	10,243	
2033	2,649	767	1,496	267	7,989	13,168	-	1,331	1,331	11,837	11,837	11,704	11,760	11,572	10,387	
2034	2,649	767	1,496	270	8,149	13,331	4,167	1,331	5,498	7,833	7,416	7,700	7,756	7,568	5,950	
2035	2,649	767	1,496	274	8,312	13,498	-	1,331	1,331	12,167	12,167	12,034	12,090	11,902	10,684	
2036	2,649	767	1,496	278	8,478	13,668	-	1,331	1,331	12,337	12,337	12,204	12,260	12,072	10,837	
2037	2,649	767	1,496	281	8,648	13,841	-	1,331	1,331	12,510	12,510	12,377	12,433	12,245	10,993	
2038	2,649	767	1,496	285	8,821	14,018	-	1,331	1,331	12,687	12,687	12,554	12,610	12,422	11,152	
2039	2,649	767	1,496	290	8,997	14,198	-	1,331	1,331	12,868	12,868	12,735	12,791	12,603	11,315	
2040	2,649	767	1,496	290	9,177	14,378	-	1,331	1,331	13,048	13,048	12,915	12,971	12,783	11,477	
2041	2,649	767	1,496	293	9,361	14,566	-	1,331	1,331	13,235	13,235	13,102	13,158	12,970	11,645	
2042	2,649	767	1,496	298	9,548	14,758	-	1,331	1,331	13,427	13,427	13,294	13,350	13,162	11,818	
2043	2,649	767	1,496	303	9,739	14,954	-	1,331	1,331	13,623	13,623	13,490	13,546	13,358	11,994	
2044	2,649	767	1,496	308	9,934	15,154	-	1,331	1,331	13,823	13,823	13,690	13,746	13,558	12,174	
									NPV	3,439		-415	2,961	3,150	2,441	-5,570
									EIRR	13.0%		11.9%	12.8%	12.9%	12.7%	10.5%

**Table 14: Economic Evaluation - Sihanoukville**

(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	92	-	92	(92)	-101	-92	-92	-92	-101	
2016	-	-	-	-	-	-	70	-	70	(70)	-77	-70	-70	-70	-77	
2017	-	-	-	-	-	-	735	-	735	(735)	-809	-735	-735	-735	-809	
2018	-	121	55	113	278	568	735	220	955	(387)	-461	-410	-400	-387	-540	
2019	-	121	55	125	284	585	70	263	333	252	245	226	240	252	160	
2020	-	121	55	125	290	591	17	263	280	311	309	285	299	311	224	
2021	-	121	55	125	295	596	-	263	263	334	334	307	321	334	248	
2022	-	121	55	125	301	602	-	263	263	340	340	313	327	340	253	
2023	-	121	55	125	307	608	-	263	263	346	346	319	333	346	258	
2024	-	121	55	129	314	618	97	263	360	258	249	232	246	258	161	
2025	-	121	55	129	320	625	-	263	263	362	362	336	350	362	273	
2026	-	121	55	129	326	631	-	263	263	368	368	342	356	368	279	
2027	-	121	55	129	333	638	-	263	263	375	375	349	363	375	285	
2028	-	121	55	129	339	644	-	263	263	382	382	355	369	382	291	
2029	-	121	55	129	346	651	-	263	263	388	388	362	376	388	297	
2030	-	121	55	129	353	658	-	263	263	395	395	369	383	395	303	
2031	-	121	55	129	360	665	-	263	263	402	402	376	390	402	310	
2032	-	121	55	129	367	672	-	263	263	410	410	383	397	410	316	
2033	-	121	55	129	375	680	-	263	263	417	417	391	405	417	323	
2034	-	121	55	129	382	687	983	263	1,246	(558)	-657	-585	-571	-558	-752	
2035	-	121	55	129	390	695	-	263	263	432	432	406	420	432	336	
2036	-	121	55	129	398	703	-	263	263	440	440	414	428	440	343	
2037	-	121	55	129	406	711	-	263	263	448	448	422	436	448	350	
2038	-	121	55	129	414	719	-	263	263	456	456	430	444	456	358	
2039	-	121	55	129	422	727	-	263	263	464	464	438	452	464	365	
2040	-	121	55	129	430	735	-	263	263	473	473	446	460	473	373	
2041	-	121	55	129	439	744	-	263	263	481	481	455	469	481	381	
2042	-	121	55	129	448	753	-	263	263	490	490	464	478	490	388	
2043	-	121	55	129	457	762	-	263	263	499	499	473	487	499	397	
2044	-	121	55	129	466	771	-	263	263	508	508	482	496	508	405	
									NPV	<b>759</b>		<b>628</b>	<b>614</b>	<b>691</b>	<b>759</b>	<b>130</b>
									EIRR	<b>20.7%</b>		<b>18.6%</b>	<b>19.1%</b>	<b>19.9%</b>	<b>20.7%</b>	<b>13.4%</b>

**Table 15: Economic Evaluation - Stoung**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	96	-	96	(96)	-105	-96	-96	-96	-105	
2016	-	-	-	-	-	-	73	-	73	(73)	-80	-73	-73	-73	-80	
2017	-	-	-	-	-	-	762	-	762	(762)	-838	-762	-762	-762	-838	
2018	-	89	56	15	368	529	762	118	879	(351)	-427	-362	-360	-351	-491	
2019	-	121	89	22	425	657	73	195	267	390	382	370	378	390	297	
2020	-	121	89	25	434	669	17	227	244	424	423	402	412	424	333	
2021	-	121	89	25	443	677	-	227	227	450	450	428	438	450	360	
2022	-	121	89	25	452	686	-	227	227	459	459	436	447	459	368	
2023	-	121	89	25	461	695	-	227	227	468	468	446	456	468	376	
2024	-	121	89	25	470	704	17	227	244	460	458	437	448	460	365	
2025	-	121	89	25	479	714	-	227	227	487	487	464	475	487	393	
2026	-	121	89	25	489	723	-	227	227	496	496	474	484	496	401	
2027	-	121	89	25	499	733	-	227	227	506	506	483	494	506	410	
2028	-	121	89	25	508	743	-	227	227	516	516	493	504	516	419	
2029	-	121	89	25	519	753	-	227	227	526	526	504	514	526	428	
2030	-	121	89	25	529	764	-	227	227	537	537	514	525	537	438	
2031	-	121	89	25	540	774	-	227	227	547	547	525	535	547	447	
2032	-	121	89	25	550	785	-	227	227	558	558	535	546	558	457	
2033	-	121	89	25	561	796	-	227	227	569	569	546	557	569	467	
2034	-	121	89	25	573	807	955	227	1,182	(375)	-470	-397	-387	-375	-574	
2035	-	121	89	25	584	819	-	227	227	592	592	569	580	592	487	
2036	-	121	89	25	596	830	-	227	227	603	603	581	591	603	498	
2037	-	121	89	25	608	842	-	227	227	615	615	593	603	615	508	
2038	-	121	89	25	620	854	-	227	227	628	628	605	615	628	519	
2039	-	121	89	26	632	868	-	227	227	641	641	618	629	641	531	
2040	-	121	89	26	645	880	-	227	227	654	654	631	641	654	543	
2041	-	121	89	26	658	893	-	227	227	666	666	644	654	666	554	
2042	-	121	89	26	671	907	-	227	227	680	680	657	667	680	566	
2043	-	121	89	26	684	920	-	227	227	693	693	670	681	693	578	
2044	-	121	89	26	698	934	-	227	227	707	707	684	695	707	591	
									NPV	<b>1,459</b>		<b>1,327</b>	<b>1,339</b>	<b>1,393</b>	<b>1,459</b>	<b>809</b>
									EIRR	<b>27.3%</b>		<b>24.8%</b>	<b>26.1%</b>	<b>26.6%</b>	<b>27.3%</b>	<b>20.0%</b>



**Table 16: Economic Evaluation – Stung Treng**

(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Losses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	3,125	-	3,125	(3,125)	-3,437	-3,125	-3,125	-3,125	-3,437	
2016	-	-	-	-	-	-	2,374	-	2,374	(2,374)	-2,611	-2,374	-2,374	-2,374	-2,611	
2017	-	-	-	-	-	-	13,424	-	13,424	(13,424)	-14,766	-13,424	-13,424	-13,424	-14,766	
2018	-	-	-	-	-	-	20,474	-	20,474	(20,474)	-22,521	-20,474	-20,474	-20,474	-22,521	
2019	611	158	112	58	2,940	3,879	18,263	247	18,510	(14,631)	-16,457	-14,656	-14,647	-14,692	-16,870	
2020	1,133	290	230	98	4,008	5,759	568	516	1,084	4,675	4,618	4,623	4,646	4,562	3,991	
2021	1,347	342	276	131	4,500	6,597	-	710	710	5,886	5,886	5,815	5,852	5,752	5,156	
2022	1,499	379	309	148	4,884	7,220	-	827	827	6,393	6,393	6,310	6,355	6,243	5,589	
2023	1,652	416	342	163	5,281	7,854	-	931	931	6,923	6,923	6,830	6,882	6,758	6,045	
2024	1,775	448	370	175	5,649	8,417	556	1,014	1,570	6,847	6,792	6,746	6,803	6,670	5,849	
2025	1,899	479	398	182	6,029	8,988	-	1,075	1,075	7,913	7,913	7,805	7,865	7,723	6,906	
2026	2,001	506	422	189	6,377	9,496	-	1,126	1,126	8,370	8,370	8,257	8,319	8,169	7,307	
2027	2,104	532	445	196	6,737	10,014	-	1,180	1,180	8,834	8,834	8,716	8,781	8,624	7,715	
2028	2,207	558	469	202	7,108	10,544	-	1,226	1,226	9,318	9,318	9,195	9,262	9,097	8,141	
2029	2,290	580	487	208	7,443	11,007	-	1,276	1,276	9,731	9,731	9,603	9,673	9,502	8,503	
2030	2,372	601	506	213	7,788	11,480	-	1,315	1,315	10,165	10,165	10,034	10,105	9,928	8,886	
2031	2,372	601	506	216	7,944	11,638	-	1,331	1,331	10,308	10,308	10,175	10,248	10,071	9,011	
2032	2,372	601	506	216	8,103	11,797	-	1,331	1,331	10,467	10,467	10,334	10,407	10,229	9,154	
2033	2,372	601	506	216	8,265	11,959	-	1,331	1,331	10,629	10,629	10,496	10,569	10,391	9,300	
2034	2,372	601	506	216	8,430	12,125	5,549	1,331	6,880	5,245	4,690	5,112	5,185	5,008	3,345	
2035	2,372	601	506	216	8,599	12,293	-	1,331	1,331	10,963	10,963	10,829	10,903	10,725	9,600	
2036	2,372	601	506	216	8,771	12,465	-	1,331	1,331	11,135	11,135	11,001	11,074	10,897	9,755	
2037	2,372	601	506	216	8,946	12,641	-	1,331	1,331	11,310	11,310	11,177	11,250	11,073	9,913	
2038	2,372	601	506	216	9,125	12,820	-	1,331	1,331	11,489	11,489	11,356	11,429	11,252	10,074	
2039	2,372	601	506	216	9,308	13,002	-	1,331	1,331	11,671	11,671	11,538	11,611	11,434	10,238	
2040	2,372	601	506	216	9,494	13,188	-	1,331	1,331	11,858	11,858	11,724	11,798	11,620	10,406	
2041	2,372	601	506	216	9,684	13,378	-	1,331	1,331	12,047	12,047	11,914	11,987	11,810	10,577	
2042	2,372	601	506	216	9,878	13,572	-	1,331	1,331	12,241	12,241	12,108	12,181	12,004	10,751	
2043	2,372	601	506	216	10,075	13,769	-	1,331	1,331	12,439	12,439	12,306	12,379	12,201	10,929	
2044	2,372	601	506	216	10,277	13,971	-	1,331	1,331	12,640	12,640	12,507	12,580	12,403	11,110	
									NPV	-5		-3,871	-478	-225	-872	-8,680
									EIRR	12.0%		10.9%	11.9%	11.9%	11.7%	9.5%

**Table 17: Economic Evaluation – Svay Rieng**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RSC	Incr. Water	Cost (+10%)	
											+10%	+10%	-10%	-10%	Ben (-10%)	
2015	-	-	-	-	-	-	314	-	314	(314)	-346	-314	-314	-314	-346	
2016	-	-	-	-	-	-	239	-	239	(239)	-263	-239	-239	-239	-263	
2017	-	-	-	-	-	-	2,505	-	2,505	(2,505)	-2,756	-2,505	-2,505	-2,505	-2,756	
2018	-	-	-	-	-	-	2,505	167	2,673	(2,673)	-2,923	-2,689	-2,673	-2,673	-2,940	
2019	198	258	214	51	510	1,231	239	266	505	726	702	699	700	706	552	
2020	397	319	285	64	586	1,651	57	359	416	1,235	1,229	1,199	1,203	1,195	1,028	
2021	595	381	356	76	665	2,073	-	452	452	1,622	1,622	1,576	1,583	1,562	1,369	
2022	601	381	356	83	678	2,100	-	484	484	1,616	1,616	1,568	1,578	1,556	1,358	
2023	608	381	356	85	692	2,122	-	492	492	1,630	1,630	1,581	1,592	1,569	1,369	
2024	608	381	356	87	705	2,137	587	496	1,083	1,054	996	1,005	1,016	993	732	
2025	608	381	356	87	720	2,151	-	496	496	1,655	1,655	1,606	1,617	1,594	1,391	
2026	608	381	356	87	734	2,165	-	496	496	1,670	1,670	1,620	1,632	1,609	1,403	
2027	608	381	356	87	749	2,180	-	496	496	1,684	1,684	1,635	1,646	1,624	1,417	
2028	608	381	356	87	764	2,195	-	496	496	1,699	1,699	1,650	1,661	1,638	1,430	
2029	608	381	356	87	779	2,210	-	496	496	1,715	1,715	1,665	1,676	1,654	1,444	
2030	608	381	356	87	794	2,226	-	496	496	1,730	1,730	1,681	1,692	1,669	1,458	
2031	608	381	356	87	810	2,242	-	496	496	1,746	1,746	1,696	1,708	1,685	1,472	
2032	608	381	356	87	827	2,258	-	496	496	1,762	1,762	1,713	1,724	1,701	1,487	
2033	608	381	356	87	843	2,275	-	496	496	1,779	1,779	1,729	1,741	1,718	1,502	
2034	608	381	356	87	860	2,291	2,219	496	2,715	(423)	-645	-473	-462	-484	-924	
2035	608	381	356	87	877	2,309	-	496	496	1,813	1,813	1,763	1,775	1,752	1,532	
2036	608	381	356	87	895	2,326	-	496	496	1,830	1,830	1,781	1,792	1,770	1,548	
2037	608	381	356	87	913	2,344	-	496	496	1,848	1,848	1,799	1,810	1,787	1,564	
2038	608	381	356	87	931	2,362	-	496	496	1,866	1,866	1,817	1,828	1,806	1,581	
2039	608	381	356	87	949	2,381	-	496	496	1,885	1,885	1,836	1,847	1,824	1,597	
2040	608	381	356	87	968	2,400	-	496	496	1,904	1,904	1,855	1,866	1,843	1,615	
2041	608	381	356	87	988	2,419	-	496	496	1,923	1,923	1,874	1,885	1,863	1,632	
2042	608	381	356	87	1,008	2,439	-	496	496	1,943	1,943	1,894	1,905	1,882	1,650	
2043	608	381	356	87	1,028	2,459	-	496	496	1,963	1,963	1,914	1,925	1,903	1,668	
2044	608	381	356	87	1,048	2,480	-	496	496	1,984	1,984	1,934	1,946	1,923	1,686	
									NPV	3,378		2,935	3,141	3,197	3,108	1,681
									EIRR	20.8%		19.1%	20.2%	20.4%	20.2%	16.2%

**Table 18: Economic Evaluation – Total Project**  
(KR million)

Year	Value of Incremental Water	Non-Incremental		Non-Technical Loses	Health Benefits	Total Economic Benefits	Capital Cost	O&M Cost	Total Economic Cost	Net Economic Benefit.	Sensitivity Tests					
		Res. Cost Savings	Time Savings								Investment	O&M	RCS	Incr. Water	Cost (+10%)	
																+10%
2015	-	-	-	-	-	-	5,635	-	5,635	(5,635)	-6,198	-5,635	-5,635	-5,635	-6,198	
2016	-	-	-	-	-	-	4,280	-	4,280	(4,280)	-4,708	-4,280	-4,280	-4,280	-4,708	
2017	-	-	-	-	-	-	38,846	-	38,846	(38,846)	-42,731	-38,846	-38,846	-38,846	-42,731	
2018	-	716	323	333	2,546	3,918	48,892	1,081	49,973	(46,055)	-50,944	-46,163	-46,126	-46,055	-51,444	
2019	1,471	1,409	1,111	541	7,667	12,200	37,580	1,844	39,425	(27,225)	-30,983	-27,409	-27,366	-27,372	-32,387	
2020	2,524	1,722	1,514	642	9,707	16,109	1,024	2,596	3,619	12,489	12,387	12,230	12,317	12,237	10,517	
2021	3,267	1,932	1,819	723	11,167	18,909	-	3,116	3,116	15,792	15,792	15,480	15,599	15,465	13,590	
2022	3,757	2,065	2,039	780	12,488	21,129	-	3,409	3,409	17,720	17,720	17,379	17,513	17,344	15,266	
2023	4,246	2,198	2,259	843	13,857	23,402	-	3,648	3,648	19,754	19,754	19,389	19,534	19,329	17,049	
2024	4,701	2,325	2,474	893	15,231	25,624	7,345	3,829	11,174	14,450	13,715	14,067	14,217	13,980	10,770	
2025	5,155	2,453	2,689	931	16,656	27,884	-	3,952	3,952	23,932	23,932	23,536	23,686	23,416	20,748	
2026	5,258	2,479	2,712	938	17,216	28,604	-	4,053	4,053	24,551	24,551	24,145	24,303	24,025	21,285	
2027	5,361	2,505	2,736	945	17,792	29,339	-	4,161	4,161	25,178	25,178	24,762	24,928	24,642	21,828	
2028	5,464	2,532	2,759	954	18,385	30,094	-	4,254	4,254	25,839	25,839	25,414	25,586	25,293	22,405	
2029	5,546	2,553	2,778	963	18,945	30,785	278	4,354	4,631	26,153	26,126	25,718	25,898	25,599	22,612	
2030	5,629	2,574	2,797	971	19,521	31,491	-	4,431	4,431	27,060	27,060	26,617	26,802	26,497	23,468	
2031	5,629	2,574	2,797	976	19,911	31,887	-	4,463	4,463	27,424	27,424	26,978	27,167	26,861	23,789	
2032	5,629	2,574	2,797	980	20,310	32,289	-	4,463	4,463	27,826	27,826	27,379	27,568	27,263	24,151	
2033	5,629	2,574	2,797	983	20,716	32,698	-	4,463	4,463	28,235	28,235	27,789	27,978	27,672	24,519	
2034	5,629	2,574	2,797	986	21,130	33,116	17,130	4,463	21,593	11,523	9,810	11,076	11,265	10,960	6,052	
2035	5,629	2,574	2,797	990	21,553	33,542	-	4,463	4,463	29,079	29,079	28,633	28,822	28,516	25,279	
2036	5,629	2,574	2,797	994	21,984	33,977	-	4,463	4,463	29,514	29,514	29,068	29,257	28,951	25,670	
2037	5,629	2,574	2,797	998	22,424	34,420	-	4,463	4,463	29,958	29,958	29,511	29,700	29,395	26,069	
2038	5,629	2,574	2,797	1,002	22,872	34,873	-	4,463	4,463	30,410	30,410	29,964	30,153	29,847	26,477	
2039	5,629	2,574	2,797	1,007	23,329	35,335	278	4,463	4,741	30,595	30,567	30,149	30,337	30,032	26,587	
2040	5,629	2,574	2,797	1,007	23,796	35,802	-	4,463	4,463	31,339	31,339	30,893	31,082	30,776	27,313	
2041	5,629	2,574	2,797	1,011	24,272	36,282	-	4,463	4,463	31,819	31,819	31,373	31,562	31,256	27,745	
2042	5,629	2,574	2,797	1,015	24,757	36,772	-	4,463	4,463	32,309	32,309	31,863	32,052	31,746	28,186	
2043	5,629	2,574	2,797	1,020	25,253	37,272	-	4,463	4,463	32,809	32,809	32,363	32,552	32,246	28,636	
2044	5,629	2,574	2,797	1,025	25,758	37,782	-	4,463	4,463	33,319	33,319	32,873	33,062	32,757	29,095	
										<b>NPV</b>	<b>15,084</b>	<b>5,763</b>	<b>13,211</b>	<b>13,936</b>	<b>12,949</b>	<b>(8,813)</b>
										<b>EIRR</b>	<b>13.9%</b>	<b>12.7%</b>	<b>13.6%</b>	<b>13.7%</b>	<b>13.6%</b>	<b>10.9%</b>