IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-47950 IBRD-77910)

ON A

LOAN

IN THE AMOUNT EQUAL TO US$106 MILLION

AND AN ADDITIONAL FINANCING

IN THE AMOUNT OF US$60 MILLION

TO

UKRAINE

FOR A

HYDROPOWER REHABILITATION PROJECT

December 21, 2016

Energy and Extractives Global Practice
Europe and Central Asia Region
CURRENCY EQUIVALENTS  
(Exchange Rate Effective December 21, 2016)

Currency Unit = Ukraine Hryvna (UAH)  
US$1 = UAH 26.10  
UAH 1.00 = US$0.038

FISCAL YEAR  
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

APL  Adaptable Program Loan
CAS  Country Assistance Strategy
ASMS Automated Dam Safety Monitoring System
B/C  Benefits-cost
CF   Carbon Financing
CO₂  Carbon Dioxide
CPS  Country Partnership Strategy
EBRD European Bank for Reconstruction and Development
EC   European Commission
EIB  European Investment Bank
EIRR Economic Internal Rate of Return
EMP  Environmental Management Plan
ENPV Economic Net Present Value
EPCU Energy Program Coordination Unit
ERPA Emission Reduction Purchase Agreement
EU   European Union
FIRR Financial Internal Rate of Return
FM   Financial Management
GDP  Gross Domestic Product
GoU  Government of Ukraine
GWh Gigawatt-hour
HPP  Hydropower Plant
HRP  Hydropower Rehabilitation Project
HV   High Voltage
ICB  International Competitive Bidding
IFI  International Financial Institution
ICR Implementation Completion and Results Report
JI   Joint Implementation
KfW  Bank for Reconstruction (Germany)
KP   Kyoto Protocol
MFE  Ministry of Fuel and Energy
MIS  Management Information System
MoECI Ministry of Energy and Coal Industry
MW      Megawatt
NERC    National Energy Regulatory Commission
NEURC   National Energy and Utilities Regulatory Commission
O&M     Operation and Maintenance
NPV     Net Present Value
OP      Operational Policy
PAD     Project Appraisal Document
PIU     Project Implementation Unit
PMC     Project Management Consultant
PPIAF   Public-Private Infrastructure Advisory Facility
PSP     Pumped Storage Plant
PTP     Power Transmission Project
PTP 2   Second Power Transmission Project
SCADA   Supervisory Control and Data Acquisition
UHE     UkrHydroEnergo
WACC    Weighted Average Cost of Capital
WEM     Wholesale Electricity Market
WTO     World Trade Organization

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Practice Manager: Ranjit Lamech
Project Team Leader: Pekka Kalevi Salminen
ICR Team Leader: Dmytro Glazkov
ICR Author: Alexey Morozov
UKRAINE
Hydropower Rehabilitation Project

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DATA SHEET

A. Basic Information

Country: Ukraine  Project Name: Hydropower Rehabilitation Project

Project ID: P083702  L/C/TF Number(s): IBRD-47950, IBRD-77910

ICR Date: 12/21/2016  ICR Type: Core ICR

Lending Instrument: Specific Investment Loan  Borrower: UKRAINE

Original Total Commitment: US$106.00 million  Disbursed Amount: US$137.90 million

Revised Amount: US$166 million

Environmental Category: B

Implementing Agencies:

Cofinanciers and Other External Partners:

B. Key Dates

<table>
<thead>
<tr>
<th>Process</th>
<th>Date</th>
<th>Process</th>
<th>Original Date</th>
<th>Revised / Actual Date(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraisal:</td>
<td>03/31/2005</td>
<td>Restructuring(s):</td>
<td></td>
<td>01/27/2012 10/21/2013 06/16/2014 10/16/2015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Closing:</td>
<td>06/30/2012</td>
<td>06/30/2016</td>
</tr>
</tbody>
</table>

C. Ratings Summary

C.1 Performance Rating by ICR

Outcomes: Moderately Satisfactory
Risk to Development Outcome: Moderate
Bank Performance: Satisfactory
Borrower Performance: Moderately Satisfactory
### C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)

<table>
<thead>
<tr>
<th></th>
<th>Bank Ratings</th>
<th>Borrower Ratings</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality at Entry:</td>
<td>Moderately Satisfactory</td>
<td>Government:</td>
<td>Moderately Unsatisfactory</td>
</tr>
<tr>
<td>Quality of Supervision:</td>
<td>Satisfactory</td>
<td>Implementing Agency /Agencies:</td>
<td>Moderately Satisfactory</td>
</tr>
<tr>
<td><strong>Overall Bank Performance:</strong></td>
<td>Moderately Satisfactory</td>
<td><strong>Overall Borrower Performance:</strong></td>
<td>Moderately Satisfactory</td>
</tr>
</tbody>
</table>

### C.3 Quality at Entry and Implementation Performance Indicators

<table>
<thead>
<tr>
<th>Implementation Performance</th>
<th>Indicators</th>
<th>QAG Assessments (if any)</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Problem Project at any time (Yes/No):</td>
<td>No</td>
<td>Quality at Entry (QEA):</td>
<td>None</td>
</tr>
<tr>
<td>Problem Project at any time (Yes/No):</td>
<td>No</td>
<td>Quality of Supervision (QSA):</td>
<td>None</td>
</tr>
<tr>
<td>DO rating before Closing/Inactive status:</td>
<td>Moderately Satisfactory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### D. Sector and Theme Codes

<table>
<thead>
<tr>
<th>Sector Code (as % of total Bank financing)</th>
<th>Original</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central government administration</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Hydropower</td>
<td>81</td>
<td>81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme Code (as % of total Bank financing)</th>
<th>Original</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Debt management and fiscal sustainability</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Other public sector governance</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Regional integration</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Water resource management</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

### E. Bank Staff

<table>
<thead>
<tr>
<th>Positions</th>
<th>At ICR</th>
<th>At Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice President:</td>
<td>Cyril Muller</td>
<td>Shigeo Katsu</td>
</tr>
<tr>
<td>Country Director:</td>
<td>Satu Kristiina Kahkonen</td>
<td>Paul G. Bermingham</td>
</tr>
<tr>
<td>Practice Manager/Manager:</td>
<td>Ranjit J. Lamech</td>
<td>Peter D. Thomson</td>
</tr>
<tr>
<td>Project Team Leader:</td>
<td>Dmytro Glazkov</td>
<td>Dejan Ostojic</td>
</tr>
</tbody>
</table>
F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)

The overall program objective is to improve the security, reliability, and quality of energy supply and, therefore, facilitate unimpeded operation of the energy market, both domestically and internationally.

The main objective of the Hydropower Rehabilitation Project is to improve operational stability and reliability of power supply by increasing regulating capacity, efficiency, and safety of hydroelectric plants and, therefore, facilitate unimpeded operation and opening up of the electricity market. Additional objective is to support the Ministry of Fuel and Energy and NERC in preparing and implementing the Energy Sector Reform and Development Program, including the Wholesale Electricity Market (WEM) concept.

Revised Project Development Objectives (as approved by original approving authority)
Not applicable.

(a) PDO Indicator(s)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Baseline Value</th>
<th>Original Target Values (from approval documents)</th>
<th>Formally Revised Target Values</th>
<th>Actual Value Achieved at Completion or Target Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator 1:</td>
<td>A conceptual plan for technical and legal harmonization with EU Energy Market</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (Quantitative or Qualitative)</td>
<td>No conceptual plan for technical and legal harmonization with EU Energy Market</td>
<td>A conceptual plan for technical and legal harmonization with EU Energy Market</td>
<td>Implementation of the Conceptual Plan for Technical and Legal Harmonization with the EU</td>
<td>The Conceptual Plan for Technical and Legal Harmonization with the EU is in the implementation phase. A number of pieces of legislation were prepared, which are in conformity with the EU rules and standards.</td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>06/21/2005</td>
<td>10/14/2015</td>
<td>06/30/2016</td>
</tr>
<tr>
<td>Comments (incl. % achievement)</td>
<td>Target achieved. The Conceptual Plan has been developed and agreed with Energy Community Secretariat and international financial institutions (IFIs) and is currently in the implementation phase.(^1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) To achieve the target ‘Action plan for the Energy Sector Reform and Development’ was developed and approved by the Regulation of the Cabinet of Ministers of Ukraine’s Regulation (dated June 13, 2007, No. 408). This Action plan covered the 2007–2012 period of implementation. After Ukraine joined the Energy Community, ‘Action plan for the implementation of obligations under the Treaty Establishing the Energy Community’, approved by the
<table>
<thead>
<tr>
<th>Indicator 2:</th>
<th>Power market opening as % of consumers free to choose their electricity suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value (Quantitative or Qualitative), MW</td>
<td>0.00</td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
</tr>
</tbody>
</table>

Comments (including % achievement) | The indicator was dropped in 2012. The Government prepared a Draft Electricity Market Law which provided for full opening of the electricity market upon its signing, but the Law is currently under consideration in the Parliament. Originally, the market opening indicator was monitored as a percentage of market opening based on the draft legislation, but in 2012 the draft law was significantly modified and no longer included the percentage of market opening, allowing full market opening upon signing of the law. |  |

<table>
<thead>
<tr>
<th>Indicator 3:</th>
<th>Improve stability and reliability of power supply by increasing installed capacity of hydropower plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value (Quantitative or Qualitative), MW</td>
<td>118.1 - capacity increase after the first phase (1998–2005)</td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
</tr>
</tbody>
</table>

Comments (including % achievement) | Indicator was dropped after introduction of a core indicator (Intermediate indicator #7). |  |

<table>
<thead>
<tr>
<th>Indicator 4:</th>
<th>New market rules and review of primary legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value (Quantitative or Qualitative)</td>
<td>Not established</td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
</tr>
</tbody>
</table>

Comments (including % achievement) | Target partially achieved. The Market Rules and the respective normative base for a new model of the power market were prepared and its entry into force is dependent upon approval of the new Electricity Market Law, which at the date of the Implementation Completion and Results Report (ICR) was approved by the parliament in the first reading (out of three). |  |

<table>
<thead>
<tr>
<th>Indicator 5:</th>
<th>More than 70 units in UHE are refurbished</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of units</td>
<td>21</td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
</tr>
</tbody>
</table>

Comments (including %) | Target achieved. The target was amended in 2015 to reflect cancellation of contracts due to force majeure. |  |

Cabinet of Ministers of Ukraine’s Regulation (dated August 3, 2011, No. 733) was agreed as a targeted conceptual plan.
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Baseline Value</th>
<th>Original Target Values (from approval documents)</th>
<th>Formally Revised Target Values</th>
<th>Actual Value Achieved at Completion or Target Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator 1:</td>
<td>0</td>
<td>225</td>
<td>192.2</td>
<td>192.2</td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>06/21/2005</td>
<td>10/16/2015</td>
<td>06/30/2016</td>
</tr>
<tr>
<td>Comments (including % achievement)</td>
<td>Target achieved.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator 2:</td>
<td>Dam safety monitoring system implemented.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>06/21/2005</td>
<td>10/16/2015</td>
<td>06/30/2016</td>
</tr>
<tr>
<td>Comments (including % achievement)</td>
<td>Target achieved.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicator 3:</td>
<td>Management Information System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value (Quantitative or Qualitative)</td>
<td>2008 - implemented 2009 - in operation</td>
<td>MIS completion, MIS in use in UHE</td>
<td>MIS installed and is in use</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------</td>
<td></td>
</tr>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>10/16/2015</td>
<td>06/30/2016</td>
<td></td>
</tr>
</tbody>
</table>

**Comments (including % achievement)**
Target partially achieved. UHE has undertaken a very ambitious program of installing the management information system (MIS): the System documentation was prepared for all six MIS modules, servers were delivered to the central platform. Network equipment (part of the MIS) was installed at all hydropower plants (HPPs). Two out of six MIS modules were installed and launched. Training has been carried out for UHE staff in office and at the stations.

**Indicator 4:** Policies in the energy sector in accordance with European Union (EU) Directives

<table>
<thead>
<tr>
<th>Value (Quantitative or Qualitative)</th>
<th>Policies in accordance with the Protocol</th>
<th>The Protocol for implementation of EU Directives is effective and is updated</th>
<th>The Protocol for implementation of EU Directives is effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>01/26/2012</td>
<td>10/14/2015</td>
</tr>
</tbody>
</table>

**Comments (including % achievement)**
Target partially achieved. The Protocol for the Implementation of EU Directives is in the implementation phase. The Borrower is making progress according to the Protocol, by gradually implementing the EU requirements.

**Indicator 5:** Restructuring of the energy market based on the Wholesale Electricity Market concept

<table>
<thead>
<tr>
<th>Value (Quantitative or Qualitative)</th>
<th>Single-buyer electricity market</th>
<th>Electricity market functioning based on the new model.</th>
<th>Restructuring of the energy market is proceeding based on the Law On Operational Principles of Ukraine’s Power Market</th>
<th>Partially achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>06/21/2005</td>
<td>10/14/2015</td>
<td>06/30/2016</td>
</tr>
</tbody>
</table>

**Comments (including % achievement)**
Target partially achieved. In 2013, the Law No. 663 ‘On Operating Principles of the Electricity Market of Ukraine’ was adopted, which complied with the requirements of 2nd EU Energy Package fully, and with the requirements of the 3rd EU Energy Package partially. However, given the commitment taken by the Ukrainian Government to implement the 3rd EU Energy Package by 2015, in September 2014 the Energy Community Secretariat suggested a new law that was finalized by the Ministry of Energy and Coal Industry (MoECI) Working Group. On September 22, 2016, the Law ‘On the Electricity Market’ was adopted in the first reading by the Ukrainian Parliament. Meanwhile, Law 663-VII is currently under implementation and new WEM mechanisms are gradually introduced to the Ukrainian energy market (balancing, day ahead market, intra-day market and Auxiliary Services Market).

**Indicator 6:** Cumulative emission reduction

<table>
<thead>
<tr>
<th>Tons</th>
<th>375,000</th>
<th>1,000,000</th>
<th>1,300,000</th>
<th>818,397</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date achieved</td>
<td>06/21/2005</td>
<td>09/16/2006</td>
<td>01/26/2012</td>
<td>06/10/2013</td>
</tr>
</tbody>
</table>
Target partially achieved as ERPA closed on 2013 but with 3 more years of implementation emission reductions were over 1.3 mln.

G. Ratings of Project Performance in ISRs

<table>
<thead>
<tr>
<th>No.</th>
<th>Date Archived</th>
<th>DO</th>
<th>IP</th>
<th>Actual Disbursements (US$, millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06/27/2006</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>0.53</td>
</tr>
<tr>
<td>2</td>
<td>06/29/2007</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>0.91</td>
</tr>
<tr>
<td>3</td>
<td>06/26/2008</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>7.23</td>
</tr>
<tr>
<td>4</td>
<td>06/26/2009</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
<td>22.74</td>
</tr>
<tr>
<td>5</td>
<td>02/27/2010</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>32.44</td>
</tr>
<tr>
<td>6</td>
<td>05/21/2010</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>34.44</td>
</tr>
<tr>
<td>7</td>
<td>11/24/2010</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>43.52</td>
</tr>
<tr>
<td>8</td>
<td>05/18/2011</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>45.54</td>
</tr>
<tr>
<td>9</td>
<td>01/11/2012</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>57.24</td>
</tr>
<tr>
<td>10</td>
<td>06/26/2012</td>
<td>Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>66.44</td>
</tr>
<tr>
<td>11</td>
<td>12/19/2012</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>73.85</td>
</tr>
<tr>
<td>12</td>
<td>06/09/2013</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>88.17</td>
</tr>
<tr>
<td>13</td>
<td>12/26/2013</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>98.80</td>
</tr>
<tr>
<td>14</td>
<td>07/07/2014</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>106.16</td>
</tr>
<tr>
<td>15</td>
<td>12/31/2014</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>116.81</td>
</tr>
<tr>
<td>16</td>
<td>06/24/2015</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>120.50</td>
</tr>
<tr>
<td>17</td>
<td>12/10/2015</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>125.94</td>
</tr>
<tr>
<td>18</td>
<td>06/24/2016</td>
<td>Moderately Satisfactory</td>
<td>Moderately Satisfactory</td>
<td>128.18</td>
</tr>
</tbody>
</table>

H. Restructuring (if any)

<table>
<thead>
<tr>
<th>Restructuring Date(s)</th>
<th>Board Approved PDO Change</th>
<th>ISR Ratings at Restructuring</th>
<th>Amount Disbursed at Restructuring in US$, millions</th>
<th>Reason for Restructuring and Key Changes Made</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/27/2012</td>
<td>N</td>
<td>S MS</td>
<td>59.28</td>
<td>Extension of the Closing Date from June 30, 2012 to June 30, 2014</td>
</tr>
<tr>
<td>10/21/2013</td>
<td>N</td>
<td>MS MS</td>
<td>95.05</td>
<td>The restructuring includes reallocation of the remaining funds from Category ‘Unallocated’ to the Category 5 ‘Goods and Consultants’ Services’, including audits under Parts A, B, and C of the project to allow full usage of the loan proceeds for the rehabilitation investments.</td>
</tr>
</tbody>
</table>
The Closing Date for the original loan and the additional loan is extended by two years until June 30, 2016.

Revisions to the Results Framework to modify some of the end targets. In addition, the financial covenant that requires a minimum current ratio of 1.2 is revised and replaced with a self-financing ratio covenant of at least 15% of the average annual value of capital costs incurred by UHE.

I. Disbursement Profile
1. Project Context, Development Objectives and Design

1.1 Context at Appraisal

1. After a decade of economic decline, which halved the country’s economic output and raised the poverty rate to almost a third of the population, between 2000 and 2005 the Ukrainian gross domestic product had rebounded by over 40 percent, and at the time of appraisal the poverty rates began to decrease. The economic growth in Ukraine was a mixture of revival of old activities and emergence of new activities, both supported by access to inexpensive energy supplied from aging, inefficient, and often environmentally polluting sources through extensive electricity, gas, and oil networks inherited from the former Soviet Union. Furthermore, the low-priced domestic coal (and electricity) was one of key resources helping the revival of the steel industry which accounted for 37 percent of the total exports of Ukraine in 2003. Ukraine was faced with the task of ensuring the sustainability of the economic growth and the consolidation of market reforms which were critical for the country to fulfill its stated aspirations with regard to increasing integration with the European Union (EU) and the World Trade Organization.

2. Developments in the energy sector mirrored these changes in the economy. After a sharp decline in the 1990s, the production of electricity in the last three years before the appraisal stabilized at about two-thirds of the 1990 production levels. While significant spare capacities, freed by declining demand, enabled unconstrained energy supplies in 1990s, albeit of low quality and poor reliability, the economic revival exposed a significant loss of available capacity and deterioration of energy infrastructure. The system faced serious challenges in maintaining security, reliability, and quality of energy supply because of (a) lack of investments and deferred maintenance in aging infrastructure; (b) poor financial condition of energy enterprises; and (c) delays in sector reforms. These were far more than sector problems—they threatened the sustainability of economic growth, reduced the competitiveness of the country’s products and services, degraded the environment, and increased the cost of social services. It was also clear that attracting investments, creating jobs, and increasing productivity—key drivers of sustainable economic growth—could not be effectively stimulated without improvements in the security, reliability, and quality of energy supply.

3. At the time of appraisal, Ukraine had made considerable progress in the energy sector reform, which started with restructuring and corporatization in the oil, gas, and power sectors in 1994. As a result of its reform effort, Ukraine unbundled its power industry, introduced elements of competition on the wholesale electricity market (WEM) and the coal market, and liberalized the oil market. In dealing with the aftermath of the 1999 financial crisis, the Government was reasonably successful in reducing non-payments and in moving tariffs toward cost recovery levels. It established the National Energy and Utilities Regulatory Commission (NEURC) which was steadily building its capacity and opened the energy sector to private investors.

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2 As a result of restructuring, the power sector was organized in five thermal power generating companies, one hydropower company – Ukrhydroenergo (UHE), one nuclear power company, one power transmission company, and 27 regional power distribution companies. As of January 2005, one thermal power company and 13 power distribution companies were owned by private investors (Ukrainian and foreign), while other power companies are (majority) state owned.
Rationale for World Bank Involvement

4. Since the early 1990s, the World Bank has supported Ukraine in its efforts to reform and restructure its energy sector, through policy dialogue, technical assistance and financing of adjustment, and investment projects. It prepared several energy sector policy notes, reviewed the results of the first decade of transition, and helped the Government map a way forward for a more strategic sector wide approach. Consolidation of energy sector reforms was a cornerstone of the World Bank’s Country Assistance Strategy in Ukraine at the time and was addressed through the Energy Sector Reform and Development Program (the Energy Program), established with the help of the Government of Japan. The Energy Program helped Ukraine in the implementation of priority reforms and investments identified in technical assistance projects. Furthermore, the Energy Program helped in establishing a framework for sectorwide cooperation and partnership among the World Bank, the European Bank for Reconstruction and Development (EBRD), and bilateral donors. In addition to the Government of Japan, cooperation in the Ukrainian energy sector was supported by the European Commission (Agency for Technical Assistance to the Commonwealth of Independent States Countries) and Sweden (Swedish Agency for International Development). The enhanced cooperation in the energy sector was an important element of the EU-Ukraine Action Plan adopted in February 2005. This action plan outlined a number of steps required to harmonize the structure, regulatory framework, and operation of the Ukraine energy market with the EU Internal Energy Market.

5. At the time of appraisal, Ukraine was the 11th largest emitter of greenhouse gases (GHGs) in the world and had one of the largest ‘surpluses’ of emission reductions (estimated at about 1.8 billion tons of CO2 equivalent) compared to the 1990 baseline emissions under the Kyoto Protocol (KP). GHG emissions in the energy sector of Ukraine accounted for about 75 percent of all GHG emissions in the country. At the same time, the energy sector was offering ample opportunities for cost-effective reduction of GHG emissions which could be used to attract significant financial support through the KP mechanisms and meet growing investment needs in the sector. However, institutional capacity, necessary to implement KP mechanisms, was low in Ukraine and the country was poorly prepared to capitalize on this opportunity. This is why Ukraine decided to use the World Bank’s unique carbon financing (CF) experience and its pivotal position in the carbon market to build its institutional capacity in this area and mobilize CF support for Joint Implementation (JI) projects in the energy sector.

1.2 Original Project Development Objectives (PDO)

6. The version of the PDO, included in the Project Appraisal Document (PAD) was slightly different from the version in the Loan Agreement. Both versions are included below.

7. According to the PAD, the main objective of the project was to improve operational stability and reliability of power supply by increasing regulating capacity, efficiency, and safety of hydroelectric plants and, therefore, facilitate unimpeded operation and opening up of the electricity market. The additional objective was to support the Ministry of Fuel and Energy and NEURC in preparing and implementing the Energy Sector Reform and Development Program, including the Wholesale Electricity Market (WEM) concept.
8. **According to the Loan Agreement**, the objectives of the project were (a) to improve operational stability and reliability of power supply through increased regulating capacity, efficiency, and safety of hydroelectric plants; (b) to enhance the institutional development of UHE; and (c) to support the Ministry of Fuel and Energy and NERC in developing and implementing an Energy Sector Reform and Development Program, including the Wholesale Electricity Market (WEM) concept.

9. Because the objectives in the Loan Agreement prevail over those included in the PAD, for the purposes of the Implementation Completion and Results Report (ICR), achievement the project’s objectives will be measured based on the Loan Agreement.

### 1.3. Key Outcome Indicators of the Project at Approval

10. Key project performance indicators at approval were the following:

- Increased production of hydroelectric energy by 360 GWh
- Increased (winter firm) hydropower capacity by 250 MW
- Reduced O&M costs in rehabilitated hydropower plants by 20 percent
- Reduced emissions from thermal power plants, including emission reduction of 1,300,000 tons of CO₂ equivalent, due to the increased production of hydroelectric energy.

### 1.4 Revised PDO (as approved by original approving authority)

11. No revision of the PDO was made during the Project’s lifetime.

### 1.5 Revised Key Indicators, and Reasons/justification

12. Two PDO indicators were dropped during the project’s lifetime. The PDO indicator measuring the level of power market opening by percentage of consumers free to choose their electricity supplier was dropped because the new version of the Electricity Market Law required the full market opening upon the law’s approval. Another PDO indicator—improve stability and reliability of power supply by increasing installed capacity of hydropower plants—was dropped because another, more precise indicator better reflected the increase of installed capacity. Adjustments to the electricity market reform related as well as to the indicator measuring the level of opening up the electricity market, reflected the changes in the level of the Government’s commitment to the energy reform, as well as the changes in the pace of the reform. A set of amendments was introduced throughout the implementation period to reflect the delays in the rehabilitation process. The indicator measuring the increase in installed generating capacity was changed to reflect the result of technical adjustments introduced during the implementation, which allowed raising the volume of capacity above the initially planned levels.

### 1.6. Main Beneficiaries

13. Several groups of beneficiaries were identified at the appraisal: (a) the public, by receiving more reliable electricity supplies at little additional cost and by enjoying cleaner water in the Dnipro and the Dniester Rivers due to rehabilitation of hydro units, which at the time of the project appraisal were discharging oil and from the cleaner air due to decreased dependence on air-
polluting thermal plants; (b) UHE, by operating more dependable and efficient equipment; and (c) UHE technical staff by upgrading their skills in operation and maintaining the updated technologies. At the central level, the MoECI, the Ministry of Finance, and National Energy Regulatory Commission (NERC, later NEURC) benefited from the energy reform component of the project.

1.7 Original Components (as approved)

14. The original project was approved by the Board on June 21, 2005, and became effective on February 3, 2006. The project consisted of five components.

Component A: Rehabilitation of hydroelectric plants.

15. This component included refurbishment of 46 hydroelectric units and associated plant equipment at nine hydroelectric plants. It also included refurbishment of high voltage equipment in nine switchyards connected to these hydroelectric plants.

Component B: Dam Safety.

16. This component included rehabilitation and upgrade of the existing, as well as installation of new dam safety monitoring systems and rehabilitation of drainage facilities and spillway gates on six dams on the Dnipro river and one dam on the Dniester river.

Component C: UHE Institutional Development.

17. This component included establishment of a corporate-wide Management Information System (MIS) in UHE. It also included provision of technical assistance to UHE in improving financial management, enhancing dam safety, optimal scheduling of the multi-purpose cascade of hydropower plants, capacity building in procurement and project management and training for the UHE staff in dam safety.

Component D: Implementation of the Energy Sector Reform and Development Program.

18. This component included provision to the MFE of advisory services and consultant assistance in developing and implementing: (i) an action plan for legal and technical harmonization of the Ukraine’s energy market with the European Union Internal Energy Market; and (ii) a program of priority investments and technical assistance in the energy sector.

Component E: Implementation of the WEM Concept.

19. This component included provision of technical assistance to NERC in implementing the WEM concept, as required for (i) clarifying market design and main principles of market operation; (ii) drafting of main codes and rules; and (iii) specifying the supporting tools such as software, telecommunication systems and metering.

1.8 Other Significant Changes
20. **Additional financing.** In February 2010 Additional Financing in the amount of US$ 60 million was approved. The additional funding was needed to finance local part of the project costs (originally supposed to be co-financed by UHE) due to a deficit of UHE’s own funds, which existed until 2011, which put rehabilitation process on hold. UHE therefore, requested additional Bank financing of about US$ 60 million equivalent for the replacement of turbine equipment to alleviate a major bottleneck on the critical path for hydropower rehabilitation.

21. There were also other considerations in favor of additional financing. The procurement of the hydropower equipment was originally planned to be carried out on a sole source basis from a domestic supplier; however, this resulted in delays because the local manufacturer of turbines started giving preference to contracts with foreign buyers and therefore postponed several deliveries of equipment to UHE, initially scheduled for installation in 2007–2008. Referring to the World Bank’s additional financing enabled UHE to use the International Competitive Bidding (ICB) procedures and promote competition between potential suppliers of the equipment.

22. Finally, additional financing was expected to lift the burden off the hydropower tariff because price increases in WEM made it difficult for the NERC to adjust tariffs accordingly to cover cofinancing obligations of UHE under the project (the total project cost at the time was equal to US$361.8 million).

23. **Project restructurings.** The Project was restructured four times. On January 27, 2012, the Closing Date was extended for the first time, from June 30, 2012 to June 30, 2014. In addition to that, the following changes were introduced: (a) reallocation of funds among categories, including (i) reallocation of funds to Component E to reflect the executed payments to one of the consultants and (ii) directing of unallocated funds for financing of UHE cost overruns; (b) revision of Component D of the project, including targets and monitoring indicators; and (c) change of the official name of UHE from Open Joint Stock Company to Public Joint Stock Company.

24. On October 21, 2013, the Project was restructured to reallocate the funds between disbursement categories to allow full usage of the loan proceeds for the rehabilitation investments.

25. As a result of the next restructuring on June 16, 2014, the Closing Date was extended until June 30, 2016. The extension was necessary because of delays with the implementation of several contracts: late delivery of the HPP turbines and problems which arose at the Kremenchug HPP, where defects in the shafts were discovered during the installation of the new turbines. This required the replacement of shafts for all three turbines. Problems with the implementation of other contracts also affected the decision to extend the Closing Date.

26. In 2015 the Project was restructured to reflect the changes that occurred due to a major devaluation of Ukrainian currency and the subsequent delays in contract implementation. The outcome indicators were revised to reflect the closing date extension and changes in economic and institutional environment. In addition, one of the financial covenants was changed (from requiring maintenance of a current ratio of not less than 1.2 to maintaining a self-financing ratio of not less than 15 percent) to be more relevant in the financial situation of UHE.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry
Soundness of the Background Design

27. The project’s fundamentals were based on the extensive experience of the World Bank in the Ukrainian energy sector and on the previous commitments by the Ukrainian Government to energy reform. Cooperation with the Government of Ukraine (GoU) and UHE and a natural continuation of the Hydropower Rehabilitation and System Control Project (P038820), closed on June 30, 2012.

28. The project was the first of the series of projects approved by the World Bank in support of the Energy Sector Reform and Development Program (the Energy Program). Through (the Energy Program) the World Bank helped the GoU set a path to provide sectorwide support for sustainable energy development which, in Ukraine, required coordinating and adapting financial support, policy advice, and technical assistance to a rapidly changing and growing economy. The Energy Program was designed to mitigate the risk of policy reversal by agreeing up front with the Government on a long-term comprehensive strategy for the Energy Sector Reform and Development Program and through aligning this strategy with the recently signed EU-Ukraine Action Plan. Therefore, the Hydropower Rehabilitation Project (HRP) provided further support in the form of technical assistance for these reforms.

29. The project was the result of a balance between the World Bank’s orientation on policy reforms and clients’ desire to prioritize investment-lending activities. Initially, the World Bank was set to continue focusing on implementation of the Energy Program, carrying out investment lending in parallel, whereas the GoU was more keen on continuing the investment lending and was less interested in receiving technical assistance. The GoU’s focus on investment lending could be partly explained by the World Bank’s previous somewhat unsuccessful efforts to support the energy reform in Ukraine. During the preparation stage, it became apparent to the World Bank’s team that without a sound investment-lending program, there would be no interest from the GoU in supporting the World Bank’s involvement in the country’s energy sector. As a result, it was agreed to pursue an investment opportunity which could be sustainable and could have a noticeable impact on the achievement of sector goals. The combination of the implementation of the Energy Program with the rehabilitation of Ukrainian HPPs became this investment opportunity.

Assessment of Project Design

30. The PDO and indicators were, generally, aligned with the planned activities, though further adjustment was required. Two overarching objectives – improving operational stability and reliability of power supply were supported by a set of components which involved upgrades of equipment, rehabilitation and upgrading dam safety monitoring systems and supported institutional development of UHE. The components were linked to specific results indicators, which were set to measure increase of installed capacity, verify operational acceptance of several power plants and establishment of monitoring systems. The objective of facilitating of opening up of the electricity market was supported by two project components dealing with the energy reform and implementation of the concept of wholesale electricity market, with each of them linked to a

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3 The Hydropower Rehabilitation and System Control Project was completed in 2002. The beneficiary of the loan, DniproHydroEnergo, completed rehabilitation of 16 hydroelectric units between 1996 and 2002. After the loan closing, DniproHydroEnergo continued the rehabilitation and its successor company, UHE formed in 2004, completed refurbishment of another 10 units by the end of 2005.
set of specific policy indicators. Institutional development of UHE was supported by a combination of indicators requiring establishment of the Management Information System and by a set of covenants in the Loan Agreement aimed at improving the quality of UHE’s financial management.

31. Project design was guided by an in-depth analysis of options. In particular, special attention was devoted to dam safety issues. The Cascade System of Dams/Reservoirs on the Dniepro River in Ukraine is one of the most impressive and largest systems in dam engineering in the world and the safety of dams located along the river is vital both for 30 million people who use Dnieper river water and for the country as a whole. The respective component was well designed and a thorough understanding of the needs was achieved well in advance before the effectiveness date.

32. There were, however, some shortcomings in the project design—during the first months after loan effectiveness, several indicators needed further tailoring (as will be explained further in more detail). In particular, during the Implementation Review carried out in 2006, a modification of the Results Framework was recommended, to ensure that all development objectives had associated outcome indicators and that intermediate outcome indicators had clear measurements. The necessary adjustments were made during 2006–2009.

Assessment of Risks and Mitigation

33. The overall risk rating at the appraisal stage was considered substantial. Several risks and associated mitigation measures were identified at the preparation stage, including the following:

(a) Vanishing political commitment to reform during the first years of the program when the benefits are not yet fully visible

(b) Slow or no improvement in financial viability of energy enterprises because of (a combination of) low tariffs, inadequate collections, commercial losses, and delays in debt restructuring

(c) Monopoly abuses and distortions arising from market concentration and political interference in NEURC staffing and decision making

(d) Changes in the MFE, NEURC, and UHE and—as a consequence—slowdown in program implementation, raising possible controversies about sector priorities

(e) Project implementation delays due to lack of local financing and poor project management

34. Most of the identified risks were common across the projects being implemented in Ukraine at that time and they did materialize, except for the risk of monopoly abuses. Political commitment to energy sector reform was in place, but coupled with frequent changes in the Government (including seven Ministers of Energy appointed during the project implementation period and frequent changes in the Regulator), it lacked continuity and sustainability. The risks were mitigated to the best of the World Bank team’s ability—the World Bank was in close contact with the Energy Program Coordination Unit (EPCU)/Project Implementation Unit (PIU) and the Government, identified concerns at early stages, and adjusted the indicators and legal covenants
accordingly. Unfortunately, some of the risks materialized because of circumstances which were beyond the direct control of both the Ukrainian Government and the World Bank. The Project was significantly affected by the financial crisis of 2008 and by the political crisis of 2014.

35. **Adequacy of the Government’s commitment.** At entry, the Government’s commitment to the energy sector program, as well as to the project, was considered strong. Based on the experience under previous World Bank operations in Ukraine, a special coordinating body, the Commission for Energy Sector Reform and Development, was established at the Cabinet of Ministers level to supervise and implement the energy reform related components of the project. The work of the Commission was supported by Energy Sector Reform and Development Program Coordination Unit established at the MFE/MoECI. However, as will be discussed below, despite assuring starting conditions, the Government’s commitment did not prove to be stable during the project’s lifetime. As in the case with other projects implemented in Ukraine around the same time, the Government was overtaken by political events and had to periodically refocus its attention, to respond to the mounting urgent economic and political challenges.

2.2 Implementation

*Summary*

36. The Project achieved most of its targets. It took more than 11 years (2005–2016) from project approval to the Project Closing, making it one of the longest infrastructure and energy sector reform projects ever implemented in the Europe and Central Asia Region by the World Bank. The duration of the Project’s implementation was in many regards due to the project’s complex structure – it consisted of two loans (original and additional), each of them being able to stand out as a separate project with its own implementation period (2006–2012 and 2010–2016). Merging two loans under the umbrella of one project helped increase efficiency and pace of the rehabilitation when the need of additional financing materialized, albeit leading to an overall increase of the project’s implementation period.

37. During those years the project was affected by successes and challenges specific to Ukraine, including the consequences of two revolutions, two economic and several political crises, loss of the territory and civil unrest in the Eastern part of the country, and major devaluation of the Ukrainian currency (the hryvnia). In particular, two major financial crises took place during the project’s implementation period: in 2008 and in 2014. As a result, in 2009, the hryvnia lost 60 percent of its value compared to the U.S. dollar which required UHE to reevaluate the project costs to cover the mounting cash deficits. The deficit has also led to delays with installation of the equipment that was purchased with the World Bank’s funding. The governmental approval of the revised Project Title (project costs estimate) took longer than expected—almost two years. To finance rehabilitation works and catch up with the implementation delays, the GoU applied to the World Bank for additional financing in the amount of USD$60 million to cover the additional cost of replacement of turbine equipment which initially was considered to be financed by the borrower. The additional financing was approved by the World Bank in 2009, two years before the original Closing Date and at that time a significant amount of works was yet to be completed. However, due to the borrower’s need for funds to be available in a short time, the decision was made to request an additional financing without engaging in the process of the closing date extension.
Considering the circumstances, the team decided to continue close monitoring of the implementation process and apply for extension of the closing date, should such a need materialize.

38. The main factors which contributed to successful implementation included
   - the UHE team’s initial good knowledge of the World Bank’s rules and procedures—the team used the experience gained during the implementation of the first HRP; and
   - the World Bank’s active role in addressing the challenges and needs facing the project, timely provision of needed technical assistance, and overall help with adjusting the project requirements to the fast changing political and economic environment.

39. The main challenges faced with regard to project implementation included
   - initial slow implementation progress due to (a) lengthy bidding procedures for procurement of complex equipment, carried out in parallel, resulted in first contracts being signed one and a half years after the loan effectiveness date and (b) significant number of bidding packages of different complexity;
   - lack of continuous political commitment and support for development of the energy sector program, largely due to political instability in Ukraine, where constant changes in the Government also entailed several changes at the ministerial level;
   - periodic delays by the Government in processing approvals necessary for enabling uninterrupted financing of the project, including delays with approving the officials’ signature cards and the project’s budget projections, as a result of which the NEURC was sometimes unable to approve the tariff adjustments for UHE on time;
   - interdependency between the delivery of the equipment and corresponding works (for example, replacement of the equipment [units] could only be done, when the hydro unit is shut down and all equipment is delivered); dependency of the hydro unit shutdown schedules on the energy system requirements, imposed by the system operator; and
   - external factors beyond UHE’s control such as, several devaluations of the Ukrainian currency, which required periodic readjustments of the project’s budget and civil unrest in Eastern Ukraine which made execution of several manufacturing contracts more difficult.

40. In view of the above challenges, it is indeed noteworthy that the World Bank and the implementing agencies were able to step up the level of their efforts to successfully complete most of the key activities. This is particularly commendable given the scale of the proposed reforms in one of the key sectors of the national economy and the scope of works in the hydropower system of Ukraine, which have been unique and ambitious for projects in the Europe and Central Asia Region.

Component A: Rehabilitation of Hydroelectric Plants
41. The project closed with successful rehabilitation of 67 units and associated plant equipment, therefore fully achieving planned targets. Some significant issues arose during implementation which had an adverse impact on the pace of implementation.

- **Financing issues.** Initially, a large part of the equipment was to be financed from UHE’s own funds with procurement of most of the heavy electromechanical equipment (that is, turbines, generators, and power transformers) according to the Ukrainian legislation, without referring to the ICB. During the first years of the implementation, UHE faced severe scarcity of funds, which affected the pace of the rehabilitation works, as well as the replacement of the equipment and system installations. The financing issues were resolved when new loans were opened with the IBRD (additional financing for purchase of six turbines) and EBRD-European Investment Bank (EIB) (for production of three generators) in 2011. This and the fact that a major part of the procurement packages was to be financed from local funds, and only auxiliary equipment was to be financed using World Bank funds under the ICB method, led to significant delays in the bid preparation processes. This resulted in some equipment being ordered with major delays and some being supplied only during the third year of implementation and then stored awaiting completion.

- **UHE’s project management capacity.** UHE initially struggled to handle contract management of a project of such scale and complexity. In the beginning of the project, it was due to a big number of bidding procedures which were taking place in parallel. A number of contracts for delivery of auxiliary equipment were added to the original set of contracts, and together with contracts for delivery of turbines and generators, the total number increased to 54 (including contracts for consultant services and audit) out of which 26 contracts were for delivery of complex equipment. This made executing contract management activities extremely difficult for UHE’s PIU. The experience gained during the course of the implementation, as well as technical assistance and continuing project support provided by the World Bank in the form of hiring a project management consultant (PMC) (who advised on 25 packages) helped gradually increase the efficiency of the contract management activities. UHE has also taken measures to increase the contract management efficiency—several managers within the PIU, responsible for certain particular procurement packages, were appointed by UHE, which led to improvements in the pace and the quality of certain procurement procedures and contract management overall.

- **Some of the delays were because of reasons out of UHE’s control.** For example,

  (i) the Kremenchug contract experienced several delays starting at the end of 2013 due to unexpected defects in the shafts necessitated their replacement. This, in its turn, delayed decommissioning of the equipment, which was a step needed for installation and testing of the third (the last) purchased unit. Now the unit
installation is expected to be completed in 2017, that is, after the closing date with the works to be paid out of UHE’s own funds (US$1.36 million);

(ii) delay of several months in implementation of the Supervisory Control and Data Acquisition (SCADA) package was partly caused by its lengthy review by the World Bank’s procurement team; and finally,

(iii) rehabilitation of the units at the Kaniv plant’s Block 3 (which was not financed by the World Bank) did not succeed in the first round due to lengthy procedure of selection of the contractor which was held twice, as required by the national legislation. This contributed to putting installation of some key equipment, including SCADA, beyond the closing date.

Component B: Dam Safety

42. Most of the activities under the dam safety component were completed on time and, as a result, the comprehensive dam safety monitoring system was installed at the Kaniv, Dnister, Dnipro, and Dniprodzershynsk dams. The successfully installed comprehensive and state-of-the-art dam safety monitoring system has significantly improved the efficiency and accuracy of the data collection and analyses and is expected to provide UHE with a unique set of tools to control the safety level and any anomalies at the dams. The system will also help discover potential need for remedial works on time. Given the existing very long crest lengths and aging structures, the new system’s expected contribution to dam safety was considered significant by the World Bank’s, UHE’s, and external experts.

43. The supplier of the dam safety systems completed all necessary tests by the closing date except for warranty tests of the spatial displacement monitoring system at the Dnipro, Dniprodzershynsk, Kaniv, and Dnister dams, which are expected to be completed six months after the closing date.

44. In addition, UHE has completed a study of sedimentation of the Kiev water storage reservoir, carefully inspected and maintained the cascade dams, has undertaken required remedial works in coordination with the design institute, and has prepared emergency preparedness plans.

Component C: UHE Institutional Development (including Management Information System)

45. All the activities envisaged in the project documents were implemented, though some only partially. The installation of the MIS, despite delays, can be considered as one of the significant achievements of the project with far-reaching implications. Overall, the scope of the coverage of the MIS is unique for Ukraine and no other power company in the country has carried out such an ambitious and broad reform of its internal corporate procedures to accommodate a shift to a new MIS. By the time of the project’s closing, two out of six modules (‘documentation workflow’ and ‘equipment and maintenance accounting’) of the system were already in use and have been helping in effective optimization of the UHE business processes, internal operating, and budget procedures. The remaining four modules were in the process being installed by UHE at the time of loan closing, and further work on them will be financed out of UHE’s own funds.
46. Technical assistance for improvement of the procurement and FM capacity, provided throughout the Project’s implementation period, had an overall positive visible impact, especially during the last years of the Project, when the FM and disbursement rating was raised from Moderately Satisfactory to Satisfactory. The procurement capacity has also increased – for example, when the additional funds were accumulated due to devaluation of the local currency two years before the Closing Date, UHE was able to quickly process the procurement packages and absorb part of the funds, by purchasing additional equipment.

Component D: Implementation of Energy Sector Reform and Development Program

47. All activities within Component D have been successfully completed. The component included 31 packages and the funding, though quite modest, was a significant source of support for energy sector reforms. The Action Plan for the Energy Sector Reform and Development Program (Energy Program) was prepared in 2007 and has been in active use by the Government ever since, which has resulted in development of new energy infrastructure legislation. The EPCU has successfully assisted the MoECI in establishing long-term development priorities in the energy sector and has helped prepare the technical and economic justification for priority investments, which were included in the subsequent stages of the Energy Program. In addition, the EPCU contributed substantially to project preparation of the Power Transmission Project (PTP), Second Power Transmission Project (PTP 2), and the Kaniv pumped storage plant (PSP), including contribution to preparation of the Project Concepts. The Bankable Feasibility Study was prepared for the PTP 2 and by the time of the Closing Date the Final Report was approved by the MoECI and Ukrenergo.

48. There were, however, a few difficulties—the group of consultants responsible for preparation of recommendations regarding the adaptation of Ukrainian legislation to the requirements of the EU’s Acquis Communautaire mentioned periodic difficulties in timely responsiveness by the MoECI to their requests for meetings and for provision of feedback to the consultants’ reports during 2010–2011. The MoECI struggled to maintain the continuity of work of the EPCU during the second half of 2014 and the first half of 2015 by not extending the contracts with the head of the EPCU and the power sector specialist, which resulted in delays in the unit’s work. The extensions of the Closing Date required reallocation of the initial funds to Component D and such reallocation was also delayed several times. Overall, the EPCU’s outputs were highly instrumental and were used throughout the Project’s implementation period. Owing to the high importance of its work, the EPCU was fully reestablished in January 2016 and upon completion of the current Project, will continue its operation under the PTP 2.

Component E: Implementation of the Wholesale Electricity Market of Ukraine

49. The component was fully implemented – the consortium of consultants supported the NEURC in development of legislation to ensure the transition of the Ukrainian electricity market to a new model and as a result, significant volume of legislation was elaborated under this component, including the Law of Ukraine ‘On Operating Principles of Electricity Market of Ukraine’ (effective as of January 1, 2014). Market rules for a market of bilateral contracts and balancing, technical codes (Transmission Code, Distribution Code, Commercial Metering Code); amendments to the Terms and Rules of the licensing activities; Ancillary Services rules; and templates of bilateral contracts were prepared as well. Services, provided under Component E, as
well as the reports produced, were used as a basis for Ukrainian electricity market reform by all key stakeholders: NEURC, MoECI, UHE, and Energorynok. After the new government came into power in 2014, the new Electricity Market Law was prepared to reflect the latest developments in the EU-Ukraine energy dialogue and to comply with the 3rd EU Energy Package. The new Electricity Market Law was approved in the first reading in the Ukrainian Parliament in September 2016.

**Carbon Financing**

50. Emissions reduction was one of the objectives of the project. Against the contracted level of 1,000,000 tons of CO₂ reduction, the actual achievement is 818,397 tons.

51. This was the first JI project that was registered by the Ukrainian Ministry of Environment and the first Emission Reduction Purchase Agreement (ERPA) signed in Ukraine. In this project, the World Bank acted as a trustee of the Netherlands European Carbon Facility. This signing kick-started a pipeline of JI projects in Ukraine and helped build a foundation for further CF interventions. Emission reduction units, generated by UHE during 2007–2012 through the HRP, generated additional cash flow, which the company used to procure additional equipment and finance the Hydropower Project Loan.

**Loan Savings and Cancellation of Funds**

52. Due to substantial devaluation of the hryvnia during 2014–2015, the Project accumulated loan savings in the amount of US$25 million. The World Bank and the GoU agreed to utilize these sums for the benefit of UHE. However, UHE experienced delays with the signing of the additional set of contracts, and as a result, some of these contracts could not be completed by the closing date. In addition, due to the continuing devaluation of the hryvnia, there were further savings which resulted in the cancellation of US$4 million from the original loan and US$24 million from the additional financing.

**2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization**

**M&E Design**

53. A certain disconnect was present between the M&E indicators selected at project appraisal and the PDOs, which ultimately caused difficulties in proper monitoring of implementation progress and achievement of the project outcomes. Initially, the PDO indicators were not fully aligned with the project’s objectives and components. Even though most of the PDO key indicators included in the project documents, were focused on the implementation of the energy reform, a significant number of activities carried out under the Project were pursuing objectives mostly of a technical nature (increase of capacity, safety, reliability, and so on). After the Implementation Status and Results Report review, carried out several months after project effectiveness, a revision of the key and intermediate indicators was suggested, because the project’s initial monitoring framework did not include development outcome indicators measuring increase of regulatory capacity, efficiency, and safety of HPPs. During the next several years, efforts were made to introduce new indicators to address the recommendation.

**M&E Implementation**

13
54. The MoECI and UHE were responsible for the collection of the project’s performance indicator data and analysis of the results. Progress toward the achievement of the final targets was monitored through regular reports, provided by UHE and the EPCU team at the MoECI separately and the World Bank’s implementation reviews and Implementation Status and Results Reports. Some difficulties with data collection and M&E were attributed, to a large degree, to very frequent changes at the MoECI level, where key coordinators were replaced almost on a yearly basis. The quality and timeliness of the data collection and reporting improved throughout the project’s lifetime. Despite the initial inadequacies with quality and timeliness of reporting, the World Bank team’s support and timely reaction created conditions for improvements in M&E reporting. The environmental responsibility and financial sustainability issues which were addressed through covenants in the Loan Agreement were also monitored on a regular basis. As the Project progressed, some minor design shortcomings were recognized, and it was agreed, as part of the 2012 and subsequent restructurings, to adjust the key and intermediate indicators in line with the progress of the project.

55. UHE internal monitoring needed improvement as well. At the midterm review, it was agreed that the internal monitoring and information systems at UHE required improvement because the control and monitoring functions were carried out manually and at times unsystematically. In addition, implementation of the MIS contract was delayed several times because of reorganization of the contractor and disagreements between UHE and the reorganized contractor regarding the exact software configuration. The issues were sorted out during the two years preceding the Closing Date and by the end of 2015, parts of the MIS were in use by UHE, which helped the project receive Satisfactory ratings for M&E. UHE was responsive to the World Bank’s comments throughout the project’s lifetime. For example, in response to the World Bank’s team concerns regarding tracking the progress of implementation of number of contracts, it was agreed, that UHE would prepare quarterly reports to inform the World Bank on the progress of key contracts (including SCADA, the Dnieper HPP 2 turbine contract, and the Kremenchug HPP turbine contract). This way, the World Bank’s timely involvement helped ensure the delivery of reports and continuous tracking of the project’s progress.

**M&E Utilization**

56. The set of intermediate indicators were useful in timely reaction to the delays. Performance indicators were designed to ensure adequate monitoring and reporting of project implementation progress and were utilized efficiently after some adjustment. Information regarding the procurement and execution of contracts was used to follow the progress of the Project and address the implementation issues as they arose.

**2.4 Safeguard and Fiduciary Compliance**

**Safeguard Compliance**

57. The Project was structured not to have negative social impacts. No land acquisition or resettlement was required and no social assets were to be affected. Because hydropower accounted for only about 7 percent of the total electricity generation in Ukraine, planned increase in hydropower cost, as a result of the Project, was supposed to have only negligible impact on the wholesale electricity tariff.
58. The project triggered three safeguard policies: OP/BP 4.01 (Environmental Assessment), OP/BP 4.37 (Safety of Dams), and OP/BP 7.50 (Projects on International Waterways). During the preparation stage, the team obtained an exception from the notification requirement under OP/BP 7.50, because the project was not to affect the quantity or quality of water flows to the riparians nor was it to be adversely affected by their use.

59. Initially, the team acknowledged the potential for environmental hazard due to the use of lubricating oil in aging equipment; however, rehabilitation and modernization activities, carried out in parallel with installation of better control systems, have reduced the risk of pollution to a minimum. Modernization had an overall positive environmental impact due to higher efficiency of turbines and generators. Labor safety systems were in place at the Dnieper and Dniester HPPs and PSPs. No new hazardous objects were created and working conditions for the staff have not deteriorated. No emergency situations have taken place during the project implementation period.

60. The recipient and the implementing agency were in compliance with the agreed safeguard policies under both the original credit and the additional financing. The project received Satisfactory ratings for safeguard compliance throughout the implementation period, being rated Satisfactory both overall and with regard to compliance with particular safeguard policies. The project was given an environmental category B (Limited Assessment) as it was assessed to have only limited impact on the environment. As far as the Dam Safety Safeguards were concerned, by the time of the midterm review, UHE had established an adequately staffed Dam Safety Center under terms of reference acceptable to the World Bank and completed and implemented design proposals for dam safety measures.

**Financial Management**

61. The FM design relied on existing institutional FM systems, within UHE, Ministry of Finance, and the MoECI, which were in charge of the FM and disbursement, and other existing institutional mechanisms in both UHE and MFE were used to some degree.

62. FM monitoring visits were carried out periodically by the World Bank staff during the project implementation. The project had a wide range of FM and disbursement issues throughout implementation, most of them due to the relatively low capacity of both UHE and the MFE and despite continuous training effort and ongoing assistance by the World Bank staff. Following is the summary of the key issues noted in the course of project implementation

- During 2006–2010, FM arrangements were rated in the range of Moderately Unsatisfactory to Moderately Satisfactory, due to a wide range of factors including the following: (a) absence of automated accounting and reporting system; (b) significant delays in submission of annual audit reports, including both project and entity reports; (c) issues raised by auditors in their management letter and lack of management actions to address those; (d) low quality of submitted withdrawal applications and errors in Statement of Expenditure reports; and (e) delays in submission of quarterly Interim Financial Reports and periodic issues with the quality of those reports.
- In March 2011, FM rating was upgraded to Moderately Satisfactory and it remained at this level until August 2016. The upgrade to Moderately Satisfactory was due to installation of the accounting and reporting system at UHE and full transition to automated project accounting and reporting, as well as because of slightly improved compliance. Still, between 2011 and 2014, a number of issues were periodically reported, including the following: (a) insufficient frequency of Statement of Expenditure reports to document project expenditures; (b) shorter delays in submission of audit reports; (c) minor issues with the quality of quarterly Interim Financial Reports; and (d) changes or temporary absence of FM staff, as well as officials who were designated as project signatories.

- Finally, in August 2016, a Satisfactory rating was assigned. This was due to the project’s full compliance with the auditing and reporting requirements at that time and satisfactory performance the preceding year.

- As of October 31, 2016, all pending FM-related tasks were completed.

**Procurement**

63. Procurement under the project was carried out by UHE for Components A, B, and C, by the MoECI for Component D, and by the NEURC for Component E. The risk level of the environment in which the procurement was to be conducted under the project (before mitigation measures) was initially assessed as ‘Substantial’. The mitigation plan was agreed with UHE and the MoECI and intensive trainings were conducted to help UHE’s PIU and EPCU of the MoECI to improve capacity in procurement. All contracts were subject to prior review by the World Bank (only a small fraction of contracts was post review). Frequent implementation reviews were carried out by the World Bank project team, which included technical staff, FM specialists, and procurement accredited staff.

64. Initially, the Project’s procurement was rated Moderately Satisfactory due to difficulties in bids preparation and delays with signing of contracts. Once the project picked up pace, the procurement rating was upgraded to Satisfactory in June 2013 and remained the same until the last review when the rating was downgraded to Moderately Satisfactory. This was due to difficulties UHE was experiencing in awarding a number of contracts to use the loan savings.

65. The World Bank also contributed to procurement delays in the project. In particular, review of the SCADA contract took significantly more time than it was initially expected. In addition to a poor quality of preparation of the package submitted for World Bank’s review being the reason of the delay, the situation was worsened by capacity constraints on the World Bank’s side. The World Bank’s team at the time did not have the necessary technical experts continuously available for a revision of such a complex contract. Fortunately, delays related to the SCADA contract did not cause cross-delays in the progress of other contracts; however, the SCADA case demonstrated the need to strengthen the World Bank’s procurement teams with technical experts and served as a lesson for design of future operations in the region.

**2.5 Post-completion Operation/Next Phase**
66. Overall, most of the Project’s activities were successfully completed. Some of the remaining activities, due to their strategic sector importance, have been or will be picked by other projects currently being implemented or prepared by the World Bank as a part of the wider Energy Program in Ukraine. The paragraphs below provide a more detailed explanation of the remaining and/or transferred activities.

67. The remaining activities include the contracts for procurement of goods, where the equipment was purchased and delivered but had not yet been installed or commissioned, including (a) turbine rehabilitation works at the Kremenchug HPP; (b) frequency starters for the Kiev HPP; (c) spatial displacements monitoring systems; (d) SCADA; (e) generator circuit-breakers; (f) high-voltage bushes; (g) factory-assembled switchgears; and (h) MIS. UHE has agreed to pay from its own funds for the contracted goods and works which could not be completed by the closing date. The largest expense of about US$1.36 million of the remaining works is related to installation works of the Kremenchug turbine with the last unit to be installed after the closing date.

68. By the end of the Project, the World Bank, GoU, and UHE agreed to use loan savings of about US$25 million by the Closing Date, which accumulated due to depreciation of the hryvnia. Because of the tight time line, UHE was able to tender only a handful of contracts and most of the loan savings were not utilized. In addition, some of those contracts could not be completed by June 30, 2016 because of delays with tenders. Contracts for additional procurement, which stretch beyond the Closing Date will be paid out of UHE’s own funds. The total cost of the remaining works to be completed after the Closing Date is estimated at about US$4.6 million with the amount of US$28 of unused funds to be canceled.

69. Currently, there are two projects, which are picking up some of the activities previously undertaken under the HRP, PTP 2 (active), and the Kaniv Pumped Storage Hydropower Plant Project (in preparation). Further rehabilitation of turbines and auxiliary equipment of UHE was picked up by the loans provided by the EBRD and the EIB to UHE with the estimated completion date around 2018. At the same time, between 2018 and 2024, UHE needs to rehabilitate the remaining 10 turbines and is exploring the possibility of the third HRP with the World Bank.

70. To further use the institutional capacity and maintain the momentum gained by the EPCU during the last several months of the Project’s, the GoU has agreed with the World Bank to continue support of the EPCU. The EPCU will continue to receive financing under Component 3 of PTP 2: ‘Improving of Institutional Capacity of MoECI for Reform Implementation’. It is also envisaged that several technical assistance and capacity-building activities, which were a part of Component C of the HRP (‘Institutional Development of UHE’), will be continued under the Kaniv Project and supported by its Component 2.

71. Based on the Electricity Market Law, which is currently in force, the MoECI in cooperation with the Energy Community Secretariat prepared a new Electricity Market Law, which was approved in the first reading by the Ukrainian Parliament in September 2016.

3. Assessment of Outcomes

3.1 Relevance of Objectives
Rating: High
The objectives of the Project according to the Loan Agreement were (a) to improve operational stability and reliability of power supply through increased regulating capacity, efficiency and safety of hydroelectric plants; (b) to enhance institutional development of UHE; and (c) to support the Ministry of Fuel Energy and NERC in developing and implementing an Energy Sector Reform and Development Program, including the Wholesale Electricity Market (WEM) concept.

The relevance of the PDO is High. The PDO was relevant to conditions in Ukraine at the time of appraisal and remains relevant and consistent with the current development priorities. The high relevance of the PDO is demonstrated by its full alignment with the Country Partnership Strategies for Ukraine for FY08–FY11 and FY12–FY16, where energy and energy efficiency were and continue to be high on the Government's agenda. The Government has developed and is actively implementing the Energy Sector Reform Agenda and Energy Sector Strategies, which are set to introduce a new electricity market model and open up the electricity market. With regard to the Country Partnership Strategy for FY12–FY16, the PDO is specifically aligned with Pillar 4 ‘Improving public services and public finances’, Area 1 ‘Improved governance of public finances’, and Outcome 4 ‘Improved governance in the energy sector’ and Pillar 2 ‘Improving policy effectiveness and economic competitiveness: support to building relations with businesses’, Result Area 5 ‘Improving infrastructure for business activities’, and specifically Outcome 15 ‘Improved performance of power sector’. The high relevance is also demonstrated by the PDO of PTP 2 partly following up the activities of the current project, ‘Improve the reliability of power transmission system and support implementation of the Wholesale Electricity Market in Ukraine’.

3.2. Relevance of Design and Implementation
Rating: Modest

The Project’s components were aligned with the PDO. Components A and B contributed directly to the goal of improving operational stability and reliability of power supply through increased regulating capacity, efficiency, and safety of hydroelectric plants. Component C supported the goal of enhancing the institutional development of UHE, and Components D and E were included to support the MFE and NEURC in developing and implementing an Energy Sector Reform and Development Program, including the WEM concept.

The PDO indicators were not fully aligned with the project’s objectives. The PDO indicators established at approval were instrumental for evaluation of the progress of the energy reform. However, with regard to the progress of hydropower rehabilitation and improvement of efficiency and safety of dams, the PDO indicators were less reflective, measuring only a quantity of rehabilitated units and the volume of installed capacity. Indicators measuring efficiency and safety of hydroelectric plants were included only at the intermediary level and even then the only indicator related to the safety of dams enabled observing of monitoring systems installation with no tools to measure the number of outages or safety-related incidents at the dams. The only indicator measuring the progress of UHE’s institutional development was related to the installation of the MIS and was measuring the mere fact of its installation in UHE. Overall, a certain imbalance among the indicators could be noted, with particular focus on the progress of the energy sector reform and less focus on tools measuring the increase of operational stability or reliability of power supply or safety of dams.
After the restructurings, the relevance of design and implementation is Modest. The restructurings adjusted the indicators to the changing country and project context; however, they did not improve their alignment with the Project’s objectives substantially - most of the dropped indicators were in response to the changes in the Government’s policy approach to the energy reform. No changes were made to the Project’s components.

3.3. Achievement of Project Development Objectives

The achievement of the PDO is rated Substantial. The Results Framework did not include indicators directly measuring improvements in operational stability and reliability of power supply. Instead, the Results Framework focused on the means by which such operational stability and reliability could be improved—by increase in regulating capacity, efficiency, and safety of hydroelectric plants. Though it might look like a design flaw, it is worth noting that even if such indicators were included, measuring the Project’s impact would have been extremely difficult, if not impossible, because the objectives of improving stability and reliability of power supply were also addressed in other energy projects, implemented in Ukraine under the umbrella of the Energy Program, with each of them contributing to those particular objectives with their own outputs. For example, the PDO of the Power Transmission Project (US$200 million), implemented in parallel in Ukraine, included improving security, reliability, efficiency, and quality of power supply. Measuring the contribution of each Project to the improvement in operational stability and reliability of power supply would require a detailed historical analysis of the developments in the Ukrainian power sector, as well as of the results of several World Bank’s projects in the context of the Ukrainian energy mix. In addition, the Project financed only part of a bigger UHE HPP rehabilitation program, which started before the Project’s approval and will continue long after the project closing. Separating the Project’s impact from the impact of the UHE HPP’s own rehabilitation program with regard to contribution to the mentioned objectives would require carrying out an excessive organizational exercise by UHE.

The Project’s Results Framework addressing the first objective was therefore primarily focused on the physical outputs by which such operational stability and reliability could be improved. Those were mostly achieved. The objective of improving operational stability and reliability of power supply was expected to be achieved through increase in regulating capacity, efficiency, and safety of hydroelectric plants. The increase of installed capacity of HPPs reached 192.2 MW through successful rehabilitation of 46 hydropower units. The safety of hydroelectric plants was improved through installation of several modules of the Automated Dam Safety Monitoring Systems at the Kaniv, Dnieper, Dniester, and Dniprodzerhynsk dams and several technical assistance assignments to increase dam safety. Overall, the Project financed purchase and/or installation of 2,500 pieces of 16 types of equipment, as well as 3 types of control, communication, and metering systems across 9 HPPs. The achievement of this objective was supported by two project components (A and B) which were fully implemented. For this reason, the achievement of the objective is rated Substantial.

The achievement of the objective of enhancing the institutional development of UHE is rated Modest. The Project improved the institutional capacity of UHE and the MoECI through partial installation of the MIS in UHE (two out of six modules were installed) and technical assistance to UHE and the MoECI, including various capacity-building interventions. These...
activities helped UHE improve its FM activities and procurement capacity, which was reflected in the increase of the related ratings. The achievement of the objective of supporting the MFE (MoECI) and NEURC in developing and implementing an Energy Sector Reform and Development Program, including the WEM concept, is rated Substantial.

81. The Project significantly contributed to the development of a solid normative base, which was needed for the preparation and implementation of the energy reform and energy investment program. Market Rules were prepared and review of the primary legislation was completed. The project contributed to the introduction of the EU energy directives into the Ukrainian domestic legislation. On a less positive note, the activities related to the restructuring of the energy market and the progress of the opening of the electricity market had to be adjusted in response to slowing down of the pace of the reform, as well as to reflect the new reform priorities, set by the GoU. A certain number of the outputs in the form of secondary legislation, prepared with the World Bank’s assistance, could only be employed when the new primary legislation becomes effective. However, despite the challenges, it is necessary to note that all planned activities were successfully completed long before the Closing Date and both the MoECI and NEURC have benefited from the World Bank’s support.

82. Based on the relative weight of inputs and the impact that the outputs were expected to have to the achievement of the PDO, the achievement of the first goal is considered crucial for the overall success of the project. For this reason, the achievement of the PDO is rated Substantial.

83. Table 1 summarizes the achievement of the PDO indicators in more detail.

<table>
<thead>
<tr>
<th>PDO Indicator</th>
<th>Expected Outcome at Project Completion – Original</th>
<th>Expected Outcome (for the restructured Project)</th>
<th>Actual Achievement at Project Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A conceptual plan for technical and legal harmonization with EU Energy Market</td>
<td>A conceptual plan for technical and legal harmonization with EU energy market.</td>
<td>Implementation of the Conceptual Plan for Technical and Legal Harmonization with the EU</td>
<td>The Conceptual Plan for Technical and Legal Harmonization with the EU is in the implementation phase. A number of pieces of legislation were prepared, which are in conformity with the EU rules and standards.</td>
</tr>
<tr>
<td>2 New market rules and review of primary legislation</td>
<td>Wholesale Electricity Market Law approved, market rules, regulatory and legal framework of new energy market model established.</td>
<td>Approval of Market Rules and development of normative base for new model of power market</td>
<td>New Market Rules and the normative base for new model of power market are developed.</td>
</tr>
<tr>
<td>3 More than 70 units in UHE are refurbished</td>
<td>72</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>4 UHE provides ancillary services required for the power balancing mechanism</td>
<td>Regular operation of balancing market</td>
<td>UHE provides ancillary services under trial operation of the balancing mechanism</td>
<td>Ancillary services are provided; however, the trial operation of the balancing mechanism was not launched because the WEM</td>
</tr>
<tr>
<td>PDO Indicator</td>
<td>Expected Outcome at Project Completion – Original</td>
<td>Expected Outcome (for the restructured Project)</td>
<td>Actual Achievement at Project Completion</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Generation capacity of hydropower constructed or rehabilitated under the project</td>
<td>225</td>
<td>192.20</td>
</tr>
</tbody>
</table>

**3.4 Efficiency**

Rating: Modest

84. The overall efficiency of the project is rated Modest. Actual project costs in U.S. dollar terms were significantly higher as compared to estimates at appraisal (including additional financing). The implementation period was significantly longer (eleven years) as compared to the appraisal projection of six years. The incremental hydropower production from the rehabilitated units over the implementation period was significantly lower than projected at appraisal. The indicators of economic and financial viability were lower than the estimates at appraisal.

85. **Project cost and implementation schedule.** The project was to be implemented over a six-year implementation period (2005 to 2011) with a completion date of December 31, 2011. The actual implementation period was significantly longer (11 years) with project completion in June 2016. At the appraisal of the original project, the total project cost was estimated at about US$374.5 million, to be financed from a World Bank loan of US$106 million and local counterpart financing of US$268.5 million. Under the additional financing approved in 2010, the amount of World Bank financing was increased by US$60 million, which resulted in the share of the World Bank financing increasing to US$166 million, while that of the local counterpart financing was reduced to US$208.5 million. UHE has estimated that the actual project cost, at project completion, was about US$540.7 million, significantly higher (about 44 percent in nominal terms, or about 30 percent in real terms) as compared to the appraisal estimates. The principal reason for this increase in cost was that, during implementation, the actual costs (equipment, materials, and labor) were found to be significantly higher than the levels estimated at appraisal.

86. **Economic and financial viability.** Details of the post-completion economic and financial analysis are given in annex 3 and the main findings are summarized in table 2. With regard to cost efficiency in delivering incremental output from the rehabilitated units during the implementation period (2006 to 2015), the actual delivered incremental output per unit of cost is estimated at about 1.9 GWh per US$1 million, much lower than the 6.4 GWh per US$1 million projected at appraisal. Indicators for economic and financial viability as estimated at project appraisal and re-estimated at project completion are given in table 2.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Appraisal Estimates</th>
<th>Post-completion Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IRR (%)</td>
<td>NPV (%)</td>
</tr>
<tr>
<td>Economic viability</td>
<td>23.2</td>
<td>US$126 million (at 10% discount rate)</td>
</tr>
</tbody>
</table>
87. The post-completion Economic Internal Rate of Return (EIRR) is estimated at 14.4 percent compared to the appraisal estimate of 23.2 percent. The principal reasons for the lower EIRR are (a) substantial increase in the project’s capital costs and (b) significantly longer implementation period with a slower realization of the expected benefits. While the post-completion EIRR (14.4 percent) is lower than what was estimated at appraisal (23.2 percent), it is higher than the discount rates of 10 percent used at appraisal and 6 percent that is applicable under the current guidelines in the World Bank for economic analysis of investment projects. In addition to the slower realization of project benefits due to the slower and longer implementation period, the post-completion estimated EIRR has also been constrained by the adverse hydrological conditions that UHE has faced in recent years. Depending upon an improvement in hydrological conditions and UHE’s ability to achieve further improvements in operations in the rehabilitated units, it is estimated that the EIRR could be higher.

88. The post-completion Financial Internal Rate of Return (FIRR) is estimated to be negative (as compared to the FIRR of 7 percent estimated at appraisal). Principal reasons for this include:

- substantial increase (about 30 percent in real terms) in the project’s capital costs as compared to the estimates at appraisal;
- significantly slower implementation period (eleven years as compared to the projected six years) which resulted in a slower realization of the incremental benefits;
- UHE’s tariffs (which are approved annually by the NEURC) during the implementation period were set based on the overall (project and non-project) financial requirements of UHE; while adequate for meeting UHE’s overall financial requirements, the tariff levels were lower than those that would have enabled a project-level FIRR at least equal to the estimated WACC of 3.5 percent for UHE; and
- the annual cost savings due to reduction in variable costs (operation and maintenance [O&M] expenses) were lower than those projected at appraisal.

3.5 Justification of Overall Outcome Rating
Rating: Moderately Satisfactory

89. The Overall Outcome Rating of the Project is Moderately Satisfactory based on the achievement, efficiency, and relevance of the PDO.

3.6. Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development
90. The Project did not pursue any direct impact on poverty or gender issues and had only an indirect impact on social development by contributing to the increase of the efficiency and reliability of the power supply. However, it is difficult to measure the exact impact.

(b) Institutional Change/Strengthening

91. Institutional strengthening was one of the key goals of the project design. Respective PIUs created within two implementing agencies—the EPCU within the MoECI and the PIU within UHE—consisted of experienced officials from UHE, the MoECI, and other agencies (including the UkrHydroProject institute), which were assigned to work on the various aspects of project preparation, project management, and implementation. The World Bank supported the MoECI/UHE by assisting with the training of specialists on the use of the World Bank’s guidelines and procedures for procurement, FM, and environmental/social safeguards management. Additionally, training and technical support were provided to UHE staff for the supervision of hydropower rehabilitation works under the World Bank’s procurement guidelines. The knowledge gained by the MoECI and UHE will be maintained as long as the key staff are retained. Unfortunately, the MoECI suffered from frequent staff changes and rotations, which drastically affected project implementation, particularly in Component D.

92. In addition to training of the staff of implementing agencies, the decision was made to involve an external PMC to assist UHE with project implementation and provide training to the concerned UHE staff. The decision proved to be effective and resulted in increased procurement efficiency of UHE.

93. Overall, the project was instrumental in encouraging the GoU to play an active role in the implementation of the ambitious Energy Program. Technical assistance and advisory support provided under the project to the GoU were crucial in maintaining the daily work of its implementation related institutions—the EPCU and Commission on Energy Reform and preparation of the WEM Law and supporting legislation. The project has also assisted UHE in entering a new market area—provision of auxiliary services.

(c) Other Unintended Outcomes and Impacts (positive or negative)

94. There are no other noticeable positive or negative impacts of the project.

3.7 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

95. No beneficiary surveys and/or stakeholder workshops were held.

4. Assessment of Risk to Development Outcome

Rating: Moderate

96. Based on the above, the overall risk to the sustainability of the project benefits is assessed as Moderate. Given the experience with the Project, the main risk to the achievement of the development objectives derives from the Government’s commitment to support its energy reform program with limited resources. The ability to continue supporting rehabilitation and development of hydropower facilities, along with other important power sector facilities, is closely interrelated with the political risks and uncertainty as to continuity of the energy reform program. During the
year 2015, a new version of the Electricity Market Law (the Law) was prepared by the Government, which, if signed by the President, will bring the Ukrainian Electricity Market in compliance with the requirements of the 3rd EU Energy Package. The Law was submitted to the parliament in February 2016 and was approved together with the new Law on the NEURC in the first and second readings accordingly, in September 2016 (approval in three readings is required for the Law to be considered passed in the parliament). The next few months are going to be indicative of the future of the energy reform program in Ukraine, and the Government might consider demonstrating more support and vision with regards to the direction in which the energy sector is moving.

97. The financial risk to the Project’s sustainability is closely related to the success of the energy reform program and its impact on the existing arrangements for meeting the financial needs of the energy sector. This includes the uncertainty with the continuity of progressive transitioning from administrative pricing to market-based pricing.

98. Technical, social, stakeholder, and environmental risks are considered negligible. The project will allow UHE to continue generating reliable, environmentally friendly electricity in a more efficient manner.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance
(a) Bank Performance in Ensuring Quality at Entry
Rating: Moderately Satisfactory

99. The World Bank’s performance in ensuring quality at entry is rated Moderately Satisfactory.

100. The project was consistent with the Government’s development priorities and the World Bank’s Country Assistance Strategy. Project preparation included sound background analysis which drew on information collected and sector knowledge gained from the World Bank’s earlier and ongoing operations and sector work in Ukraine, including assisting the GoU in developing an ambitious sector reform and in implementing a number of investment-lending projects. The strategic sector context and the project rationale were sound. Technical, financial, and economic analyses for the project appraisal were detailed and well developed. The analysis in the PAD was strengthened by supporting documentation. Fiduciary and safeguards issues were adequately addressed and M&E arrangements were in place. The project also included strengthening of the institutional capacity of the MoECI, UHE, and NEURC by providing technical assistance and training, in particular, to enhance the capacity of local institutions to manage World Bank procurement and contracts.

101. However, there were shortcomings. The PDO was too ambitious to account the Project for all of the assigned outcomes. In addition, specific PDO targets, monitoring the increase of regulating capacity, efficiency, and safety of hydroelectric plants needed more detailing, which was partly addressed during the first years of the project’s implementation. The World Bank could also have been more alert as to the realism of the borrower’s projections regarding the project readiness and the expected pace of the project’s implementation. While the project had indeed
been a continuation of the first HRP and the team was reasonable in its expectations that the PIU would start project preparatory activities at the earliest, a combination of factors, some of them present at entry (including the tight time line within which the project was prepared), should have moved the team to establish mechanisms that allowed the World Bank to quickly address potential problems that arose at the initial stages of the project.

(b) Quality of Supervision
Rating: Satisfactory

102. The World Bank’s fiduciary role is rated Satisfactory in (a) ensuring regularity of supervision missions and adequate skills mix of World Bank staff; (b) providing timely responses to project issues and involving management when called for by the complexity of the project matters; (c) actively involving the field office in maintaining close working contacts with the local project counterparts; and (d) applying realistic project performance ratings.

103. During the first years of the Project, most of the team members were based in Kiev, which helped create a basis for close cooperation with the GoU and UHE during the implementation phase and respond to the Project needs operatively. During the second half of a project’s lifetime supervision of the Project was carried out hand-in-hand with the supervision over the PTP, which helped coordinate the pace of the energy reform and create a synergy between two projects, because the implementing entities in both projects were facing similar challenges.

104. The World Bank’s supervision teams had the appropriate skills mix. Supervision missions were conducted on a regular basis. However, because the Project covered several locations, missions could only devote a limited time to each of the locations. Due to delays with the start of the implementation described above, the World Bank team postponed the Mid-Term Review to 2009 instead of 2008 and successfully assisted the GoU in approval of the necessary restructurings. The skills mix and frequency of missions were aligned with the project’s needs as they emerged. Close supervision and interaction with the Ukrainian counterparts facilitated constructive agreements on amending contracts, loan covenants, and project scope in response to evolving needs, changes in sector structure, and adverse external impacts. This approach allowed for the extension of the loan closing date by four years to ultimately achieve project objectives.

105. In addition, close and regular supervision enabled the World Bank to take a proactive stance and follow up on cases of non-compliance with the World Bank requirements, using a flexible approach, and being adjustable to the client and PIU needs. To assist UHE with the procurement issues and accelerate the procurement process, the World Bank’s team held regular meetings with the PIU to discuss any pending issues and answer related questions. The World Bank’s team proactivity, continued throughout the project, through regular follow-up on key agreements on project financing, audits, and completing project works under a realistic schedule.

106. The World Bank developed a very good working relationship with the management and staff of the implementing entities during supervision missions, site visits, and regular follow-up communications. A productive interaction also continued with the National Electricity Regulatory Commission, the MoECI, and the Ministry of Finance to ensure proper project financing.

(c) Justification of Rating for Overall Bank Performance
Rating: Moderately Satisfactory

107. Based on the Moderately Satisfactory rating for quality at entry and for Satisfactory supervision, the overall World Bank performance is rated Moderately Satisfactory. The World Bank’s performance in overcoming many challenges posed by the economic and political complexity of the country context and in being reasonably flexible and responsive to the client’s needs without compromising the objectives of the Project can be regarded as commendable.

5.2 Borrower Performance
(a) Government Performance
Rating: Moderately Unsatisfactory

108. The Government’s performance was not stable over the life of the Project. Nine ministers of energy were appointed over the Project’s implementation period, and nine management teams were replaced in the MoECI, the Ministry of Finance, and NEURC. The project team experienced various degrees of the Government’s engagement and though some of the project coordinators and governmental officials were efficient and developed constructive relationships with the World Bank, it was difficult to maintain such relationships due to an overall atmosphere of unpredictability, which ultimately had a negative impact on the consistency of the implementation process. The project started with ensuring the level of the Government’s engagement—the elements of Components D and E were successfully implemented during the first years of the project’s lifetime. Generally, the approvals necessary for moving the project forward were provided on time.

109. Subsequent turbulence in the political and economic environment, caused by the world financial crises and events, created significant challenges to the pace of the Project’s implementation. The World Bank’s team, as well as UHE, faced several organizational challenges while working with the Government on the Project, which ultimately led to numerous closing date extensions. In particular, the Government was slow while processing approvals of the documentation necessary for annual budget allocations for the Project, which caused payment delays in UHE’s contracts and slowed down disbursements. This delayed the overall pace of the project’s implementation and constrained the ability of the NEURC to make the necessary tariff adjustments needed to generate adequate revenues to cover the local part of the financing. Furthermore, the Government was not operative in issuing signature cards that were required for disbursement approvals—the problem was especially evident considering frequent changes in the management of the line ministries. The EPCU experienced problems with financing and (re)appointments of key personnel, which made coordination between different governmental entities, regarding the energy reform, more difficult.

110. In addition, the Government did not demonstrate consistency when dealing with the energy reform. After the Electricity Market Law, prepared in cooperation with the World Bank, became effective in 2014, its implementation stalled—secondary legislation needed for the energy reform to take off did not get approved according to the schedule. As a result of a number of circumstances, including a change of Government and obligations of Ukraine as a member of the Energy Community, in 2015 the new Government initiated development of a new Electricity Market Law with the goal of bringing the domestic legislation in conformity with the 3rd EU Energy Package. With no dates as to when the Law might be approved by the parliament (nine
months after introduction to the parliament, it had only been approved in the first out of three required readings) and become effective, the energy reform is again on hold.

111. During the final years of the Project, the Government has become much more instrumental in cooperating with UHE and the World Bank, and as a result, many of the issues, which were considered problematic earlier, were fully or partially resolved. In particular, the MoECI demonstrated commitment to the energy reform by backing the new Electricity Market Law and by actively cooperating with multiple donors. The targets related to Component D were achieved. The PIU was adequately staffed, which resulted in successful preparation of a number of pieces of sector documentation necessary for the implementation of the WEM reform. In particular, the MoECI, in cooperation with international donors, Energy Community Secretariat, and consultants, prepared two versions of the Law ‘On Operating Principles of the Electricity Market in Ukraine’ (2013 and 2015), the Grid Code, the Market Rules, and other documents including sector reports. As a result, the new Electricity Market Law was approved in the first reading in the parliament, and the Law on Independent Regulator passed the second reading. The World Bank’s team remains optimistic and hopeful on the outcome of the approval process.

(b) Implementing Agency or Agencies Performance
Rating: Moderately Satisfactory

112. Several implementing agencies were involved in the project’s implementation. The performance of the Government was described in the previous section. The assessment of UHE is detailed in the following paragraphs.

113. UHE was responsible for the implementation of three Project components. Its performance is rated Moderately Satisfactory. During its first years the Project experienced significant procurement and installation delays because of difficulties caused by a significant number of bids held simultaneously, lengthy bid procedures, and low procurement capacity. As a result, even by the revised Midterm Review date, which was postponed for a year, the disbursement rate was minimal and signing of contracts was only starting to happen. Because the matrix of activities was closely interdependent, delays in one set of activities caused subsequent delays across the project’s contractual framework, which was further complicated by the seasonal nature of works at certain sites. UHE’s PIU initially lacked capacity in managing projects of such scale and scope. This was not expected by the World Bank team because the same PIU had worked on the first HRP, which closed in 2002.

114. However, after the launch of the bids and overcoming several difficulties of external nature, UHE demonstrated strong commitment and ownership with respect to the project throughout the second half of the implementation period. The company demonstrated a high level of commitment to the project by ensuring that all possible actions within the scope of its capacity and authority were undertaken to enable project completion, including provision of adequate management and staffing. Interaction with the World Bank and Government counterparts on project issues was efficient and became a solid foundation for achieving the project’s objectives. Project reporting and audit compliance were adequate except for a few minor delays, which were fixed as a result of supervision.
115. With regard to financial covenants, over the implementation period, UHE was in compliance with most covenants with the exception of the current ratio covenant. Reasons for this are explained in annex 3.

(c) Justification of Rating for Overall Borrower Performance
Rating: Moderately Satisfactory

116. Based on the Moderately Unsatisfactory rating for the Borrower and the Moderately Satisfactory rating for the implementing agencies, the overall Borrower performance is rated Moderately Satisfactory.

6. Lessons Learned

Project Design

117. Assessment of the Government’s long-term commitment and ability to carry out reforms is a key aspect of analyzing overall project sustainability. It is important to have a reform-oriented government not only during the project preparation but also throughout the entire project cycle. It would also be useful to elaborate and include, in future projects, the mechanisms of mitigation of adverse effects that an unstable political and economic environment has on the project’s implementation.

118. Development of the EU legislation is an ongoing process. Experience of harmonization of the Ukrainian legislation with the requirements of the EU law demonstrated difficulties in keeping up with the pace of changes in EU legislation. It is, therefore, advisable to avoid indicators, whose sole objective is similar to “bringing the Borrower’s legislation in accordance with the relevant sectoral EU legal legislation.”

119. The project objectives should be focused and specific enough to avoid pursuing overly ambitious goals, especially in countries with a track record of political instability. In countries undergoing significant structural reforms and facing substantial financial challenges, it may be advisable to separate investment lending from development lending activities. Tying structural sector reforms to investment lending may adversely affect the achievement of the project’s objectives for reasons beyond the direct control of the World Bank.

120. Importance of early preparation of the bidding documents at the project preparation phase is critical for the avoidance of delays during the implementation. It was underlined in a few recently completed projects in Ukraine, and is applicable to the HRP, that activities which can be identified during the preparation stage should have their feasibility studies completed and, where possible, design preparation should be under way by the time the project goes to the Board. In particular, preparation of the bidding documentation should be carried out at the earliest. Having a bidding package ready by the time of loan effectiveness with the prospect of determining tender results within a first few months after the effectiveness date significantly increases the project’s sustainability and its potential for timely completion. Given the experience of slow implementation of the portfolio in Ukraine due to overall cumbersome administrative procedures and political and economic uncertainties, projects need to aim at the highest level of readiness by the end of the appraisal.
121. The teams must actively engage the mechanisms enabling early project preparation. Referring to the project preparation facility or retroactive financing to get the project up and running by the loan effectiveness date is highly advisable, especially in countries with a track record of slow implementation.

**Project Implementation**

122. Combining capacity building and technical assistance with investment-lending activities strengthens project implementation and sustainability. As demonstrated by the current project, technical assistance that provided capacity-building support to the implementing company (UHE) improved its technical competence and institutional capacity, thus supporting the sustainability of investments.

123. Timely selection of the PMC is crucial for the project’s success. Unless the project implementing entity has a proven track record of managing projects of comparable scale and complexity, it is critical to have a PMC in place from the very beginning of the project’s implementation (or even during the project preparation phase). In addition to the extensive PMC sector experience, special attention should be paid to the PMC’s ability to build a trustworthy and working relationship with the management and staff of the project implementing entity, because, as the project indicated, the lack of such working relationship may seriously hamper the project’s progress.

124. For the sake of project management optimization, it may be advisable for the borrower or the implementing agency to consider merging bidding packages, where it is possible, so that the implementing agency or the PMC ends up minimizing transacational costs and time, required for the preparation of the package, before or during the implementation phase.

125. The World Bank should put more effort into creating adequate internal capacity within the institution, sufficient to absorb a significant volume of bidding packages originating from the high-cost infrastructure projects.

126. Prioritizing local manufacturers over internationally recognized ones should be made with care. Though the main manufacturer for the project was selected as a result of a competitive bidding procedure, the selection was made bearing in mind the significance of supporting local producers and the historical interdependence between UHE and the local manufacturer. However, this did not prove to be an ideal solution. Over the course of implementation, the local manufacturer did not always prioritize the time line agreed with UHE, instead choosing to work for export, and as a result, significant delays were incurred by UHE. This, combined with several other factors, led to an overall delay of the project. For the future operations, it may be appropriate to consider bid applications from a wider scope of manufacturers and employ additional legal arrangements protecting against delays in execution of contracts.

127. Although, most of the delivery options are quite similar in the agreements signed as a result of tenders, particular attention must be paid to the content of the legal provisions describing the delivery process. It might be practical for the implementing entity to consider including supply and installation obligations in contracts for supply of manufacturing equipment instead of relying only on delivery obligations. This becomes key for the timely completion of the contract,
especially when the purchaser does not have the capacity or is unfamiliar with the particular equipment.

128. One of the problems that the project faced during the last years of implementation was a low manufacturers’ participation rate in the bids. UHE has not always been paying its contractors on time (mostly due to reasons out of the company’s control) and has not always been able to motivate its contractors to maintain working relationships, which has made them either lose interest in participating in further bidding rounds or raise their bid prices to unacceptable levels. Because UHE will continue to seek the World Bank’s financing under other projects, it is advisable to elaborate a procurement strategy during the preparation stage, which will aim to increase the attractiveness of the company in the eyes of the potential contractors, including suggesting strategies in case problems with Government financing arise.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/Implementing agencies

129. During preparation of the ICR, the team communicated with the borrower and implementing agencies and all comments were taken into account. The overall assessment and rating on the performance of the project was found acceptable. A summary of the borrower's ICR is presented in annex 7.

(b) Cofinanciers

Not applicable.

(c) Other partners and stakeholders

Not applicable.
Annex 1. Project Costs and Financing

(a) Project Cost by Component (in US$, millions equivalent)

<table>
<thead>
<tr>
<th>Components</th>
<th>Appraisal Estimate including Additional Financing (USD millions)</th>
<th>Actual/Latest Estimate (USD million)</th>
<th>Percentage of Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Baseline Cost</td>
<td>226.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Contingencies</td>
<td>17.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price Contingencies</td>
<td>52.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Project Costs</strong></td>
<td>297.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest during construction</td>
<td>12.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front-end fee IBRD</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes and duties</td>
<td>64.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Financing Required</strong></td>
<td>374.5</td>
<td>540.7</td>
<td>144%</td>
</tr>
</tbody>
</table>

(b) Financing

<table>
<thead>
<tr>
<th>Source of Funds</th>
<th>Appraisal Estimate including Additional Financing (USD million)</th>
<th>Actual/Latest Estimate (USD million)</th>
<th>Percentage of Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrower</td>
<td>208.5</td>
<td>408.7</td>
<td>196%</td>
</tr>
<tr>
<td>International Bank for Reconstruction and Development</td>
<td>166.0</td>
<td>132.0</td>
<td>80%</td>
</tr>
</tbody>
</table>
Annex 2. Outputs by Component

### Component A: Rehabilitation of Hydroelectric Plants

**Description.** Refurbishment of 46 hydroelectric units and associated plant equipment at 9 hydroelectric plants. It also includes refurbishment of high-voltage equipment in nine switchyards connected to these hydroelectric plants.

**Outputs at Closing:**
1. All of the 46 units are rehabilitated and commissioned.
2. Increase in power by 192.2 MW.
3. Management, communication, and accounting systems implementation:
   - Nine automatic power metering systems on the HPPs consolidated at six at the central level in UHE
   - Six private automatic branch exchanges (PABXs) for HPPs integrated into the company’s system
   - 144 SCADA/Energy Management System, protection, alarm systems (unit, block, and plant levels)

### Component B: Dam Safety

**Target.** Rehabilitation and upgrade of the existing dams as well as installation of new dam safety monitoring systems and rehabilitation of drainage facilities and spillway gates on six dams on the Dnipro River and one dam on the Dnister River.

**Outputs at Closing:**
1. Automated Dam Safety Monitoring System (ASMS) implementation
   - 4 ASMSs are put into commercial operation at the Kaniv, Dniprodzerzhynsk, Dnipro, and Dnister dams, as well as at the Cascade Safety Center.
   - Permanent deformation monitoring systems installed and put into trial operation at four dams: Kaniv, Dniprodzerzhynsk, Dnipro, and Dnister.
   - Dam monitoring software installed at eight plants (Kyiv, Kaniv, Kremenchuk, Dniprodzerzhynsk, Dnipro, Kakhovka, Dnister HPPs, and Kyiv PSP), including the data online consolidation and monitoring system at the company’s Dam Safety Center.
2. Technical assistance for dam safety
   - Sedimentation study of Kyiv Reservoir completed.
   - Hydrometeorological forecasting system upgrading. The analysis of all existing hydrometeorological stations was performed. The proposals for the best scope of the stations’ rehabilitation in Dnieper and Dnister basins were developed to upgrade the hydrometeorological forecasting equipment, issued in the form of a bidding document, and submitted to the hydrometeorological service.

### Component C: UHE Institutional Development

**Target.** Establishment of a corporate-wide MIS in UHE. It also included provision of technical assistance to UHE in improving FM, enhancing dam safety, optimal scheduling of the multipurpose cascade of HPPs, capacity building in procurement and project management, and training for the UHE staff in dam safety.

**Outputs at Closing:**
1. Implementation of the MIS in UHE
   - Two out of six MIS modules were commissioned. The remaining four will be installed out of UHE’s funds.
2. Technical assistance for UHE
A PMC was hired to assist UHE with preparation, execution, and oversight for 25 packages under ICB procedure.

10 audits of UHE’s and project financial statements were performed with the help of international auditors.

UHE experts took part in a program held at the International Training Center of the International Labour Organization (Torino, Italy) concerning the investment projects’ implementation for IBRD funds and ICB arrangement.

UHE’s assets revaluation study was completed.

3. Technical facilities for the project

- Vehicles and office equipment were procured to improve working conditions at HPP sites.

**Component D: Implementation of the Energy Sector Reform and Development Program**

**Description.** Providing the MFE advisory services and consultant assistance in developing and implementing (a) an action plan for legal and technical harmonization of Ukraine’s energy market with the EU Internal Energy Market and (b) a program of priority investments and technical assistance in the energy sector.

**Outputs at Closing:**

- The Action Plan for Energy Sector Reform and Development was developed, agreed with key stakeholders, and approved by the Order of Cabinet of Ministers of Ukraine dated June 13, 2007, No. 408-p.
- Consultancy services provided, including services for harmonization of the Ukrainian energy legislation with the acquis communautaires, for development of legal acts to stimulate the renewable energy development, and for development of legislative acts in the field of regulation of power sector infrastructure facilities construction.
- Technical support is provided to the MFE/MoECI on Power Sector Property Reform, Electricity Market Reform; new Energy Strategy is prepared.
- Other outputs include an Internal Electricity Market Study to identify the sector investment needs by 2016, project advisory for the NEC ‘Ukrenergo’; preparation of terms of reference for a feasibility study for the thermal power plant rehabilitation project; and preparation of the Bankable Feasibility Study of the PTP 2, Kaniv PSP Project, and other projects.

**Component E: Implementation of the WEM Concept**

**Description.** Providing technical assistance to the NEURC in implementing the WEM concept, as required for (a) clarifying market design and main principles of market operation; (b) drafting of main codes and rules; and (c) specifying the supporting tools such as software, telecommunication systems, and metering.

**Outputs at Closing:**

- Analysis of the current electricity market legislation was carried out, which resulted in the approval of the Government’s Regulation on WEM Concept Implementation Plan.
- Pieces of legislation (both primary and secondary) for introduction of the new model of the electricity market were elaborated, which resulted in approval of the Law No.663-VII ‘On foundations of operation of the Electricity Market in Ukraine’ in 2013.
Annex 3. Economic and Financial Analysis
Annex 3. Economic and Financial Analysis

Project Economic and Financial Analysis at Appraisal

**Economic Analysis:** The economic evaluation of the project was carried out by a comparison of the ‘with project’ and ‘without project’ scenarios. The economic investment cost did not include the cost of dam safety, institutional development (MIS) and technical assistance for which it was assessed that no direct economic benefit could be assigned. The economic investment cost included physical contingencies but did not include price contingencies, taxes and duties. The project economic benefits were assessed under five categories:

(i) Increase in hydroelectric production due to (a) improved efficiency of the rehabilitated equipment and (b) improved plant management and control.
(ii) Increase in (winter firm) peaking capacity due to (a) increased capacity of the rehabilitated units and (b) improved reliability and availability of units and plant.
(iii) Power system dynamic benefits.
(iv) Reduced operation and maintenance (O&M) costs due to the improvements brought about by rehabilitation.
(v) Environmental benefits from reductions in polluting emissions attributable to the reduction in electricity generation from thermal power plants due to the increased hydroelectric production under the project.

Based on the above, at appraisal, three indicators of economic efficiency were estimated: the economic internal rate of return (EIRR), the economic net present value (ENPV) and the economic benefits/costs (B/C) ratio. The indicators were estimated for each of the plants to be rehabilitated under the project and were aggregated into corresponding indicators at the level of the project.

The project level indicators are given in the following table:

**Table A3-1:- Economic Indicators at Appraisal**

<table>
<thead>
<tr>
<th>Discounted investment cost (US$ million)</th>
<th>Discounted project benefits (US$ million)</th>
<th>EIRR (%)</th>
<th>ENPV (US$ million)</th>
<th>B/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>149</td>
<td>275</td>
<td>23.2</td>
<td>126</td>
<td>1.85</td>
</tr>
</tbody>
</table>

Note: The discount rate used at appraisal was 10 percent.

**Financial Analysis:** The analysis was carried out at (i) the project level and (ii) entity level.

Project-level analysis: The analysis was carried out on the basis of a comparison of the ‘with project’ and ‘without project’ scenarios. The analysis examined the incremental financial cash flows defined as the difference between the ‘with project’ and ‘without project’ scenarios. The investment costs included contingencies, taxes and duties. The indicator used was the Financial Internal Rate of Return (FIRR) in real terms which was estimated at about 7 percent in real terms.
compared to the estimated Weighted Average Cost of Capital (WACC) of about 5 percent for UHE.

**Entity-Level Financial Analysis:** This included an assessment of the historical financial situation and projections for a 20-year period. Based on the assessment, it was determined that the key financial performance indicators that should be adopted in project implementation should be (i) annual current ratio (current assets/current liabilities) of not less than 1.2 and (ii) annual debt service coverage (net cash from operations divided by the sum of interest and loan repayments) of not less than 1.5. These were formulated as financial covenants under the Project Agreement with UHE.

**Post-Completion Economic and Financial Analysis**

To enable comparability with the estimated results at appraisal, the post-completion economic and financial analyses have been carried out utilizing, to the extent possible, a similar approach to that used at appraisal, based on a comparison of ‘with project’ and ‘without project’ scenarios.

**Economic Analysis:** The actual investment costs have been adjusted by excluding taxes and duties. Key factors affecting the economic efficiency and the assumptions made in the analysis are the following:

**Incremental energy from the rehabilitated units:** Due to the slower than projected implementation of the project, the annual incremental energy from the rehabilitated units was lower than originally projected. At project completion in 2015, UHE estimates that the annual incremental energy was about 155 GWh as compared to the estimate of 360 GWh at appraisal. However, the results in 2015 (and in 2014) were affected by the adverse hydrological conditions prevailing at the time as a result of which UHE’s hydropower production was only about 60 percent of the average levels during more normal hydrological conditions. Since, on average, UHE’s power generation in the 2006 to 2015 period has been about 10 TWh (compared to 6.43 TWh in 2015), for the post-completion projections, for the base case, the incremental energy is conservatively assumed to increase to about 200 MWh by 2016, to 250 MW by 2018 and be maintained thereafter at this level thereafter. Sensitivity of the EIRR to higher levels of incremental energy is also presented in Table A.3-2 below.

**Avoided capital costs:** At appraisal, this was valued at US$ 460 per kW (in 2006 prices). Recent US estimates suggest that a more current figure would be about US$ 670 per kW (in 2015 prices) or about US$ 550 per kW in 2006 prices (deflating by the US inflation assumed at about 2 percent per year). Impacts on the estimated EIRR and ENPV from using the two different values are presented later below in Table A.3-2.

**Increment in (winter firm) peaking capacity:** UHE estimates that, at project completion in 2016, this was about 192.2 MW (as compared to the 225 MW estimated at appraisal). Since the 2015 figure is based on results in a year with abnormally adverse hydrology, for the analysis it is assumed that this would gradually increase to the level of 225 MW by 2018 and be maintained at this level thereafter.
Reductions in variable costs (O&M expenses): UHE estimates that, at project completion in 2015, the cost savings on this account were about US $4.2 million. For the projections, the savings are assumed to be maintained annually at this level in future.

Dynamic benefits: At appraisal, these were estimated at US$ 5 per kW. For the post-completion analysis, the same figure has been used.

Discount rate for the ENPV: At appraisal, the discount rate used was 10 percent. For the post-completion re-estimation, the discount rate is assumed at 6 percent (the upper end of the range suggested in the Bank’s recent Guidelines on Use of Discount Rates in Investment Projects).

Based on the foregoing, the re-estimated EIRR and ENPV are presented in the following table.

### Table A.3-2: Post-Completion Economic Efficiency Indicators

<table>
<thead>
<tr>
<th>Base Case</th>
<th>Incremental Energy Cost</th>
<th>Peaking Capacity</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRR</td>
<td>ENPV</td>
<td>300 MWh</td>
<td>350 MWh</td>
</tr>
<tr>
<td>14.4%</td>
<td>US$ 75 million (at 10% discount rate)</td>
<td>14.8%</td>
<td>15.1%</td>
</tr>
<tr>
<td></td>
<td>US$ 231 million (at 6% discount rate)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion: The post-completion EIRR is estimated at about 14.4 percent (compared to 23.2 percent at appraisal). The ENPV (at a discount rate of 10 percent) is estimated at US$ 75 million compared to US$ 126 million at appraisal. If the discount rate is set at 6 percent as recommended under the current guidelines in the Bank for economic analysis of investment projects, the ENPV would be higher at US$ 231 million. Depending upon UHE’s ability to achieve the higher incremental energy levels indicated, the EIRR could be higher, ranging from 14.8 percent to 18.0 percent.

The principal reasons for the lower economic viability indicators as compared to the estimates at appraisal are (i) substantially higher capital costs (about 44 percent higher in nominal terms), (ii) significantly longer implementation period (eleven years as compared to six years), and (iii) significantly lower annual incremental energy outputs, as compared to the appraisal estimates.

**Project Financial Viability:** For the financial analysis, only the relevant monetary costs and benefits impacting UHE have been taken into account. Costs and benefits which impact the economy (e.g. externalities) but do not directly impact UHE’s financial situation, have not been included. The investment costs are those actually incurred including taxes and duties. Benefits consist of (i) the incremental energy from the rehabilitated units valued at UHE’s average sales tariff per kWh (as approved by NEURC) and (ii) the cost savings from the reduction in O&M expenses as a result of the rehabilitation. All values are converted to real terms to enable
comparability with the estimates at appraisal. The FIRR is compared with the currently estimated WACC of about 3.5 percent for UHE.

Table A.3-3: Post-Completion Financial Viability Indicators

<table>
<thead>
<tr>
<th>FIRR</th>
<th>WACC</th>
</tr>
</thead>
<tbody>
<tr>
<td>-9.7%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

As compared to the appraisal estimate of 7 percent (in real terms) for the FIRR, the post-completion estimate is that the FIRR is negative (about – 9.7 percent). Factors contributing to this result are the following:

- Substantial increase in project costs as compared to those estimated at appraisal. At completion, UHE estimated the project costs at US$ 540.7 million as compared to the appraisal estimate, including Additional Financing, of US$ 374.5 million. This implied an increase of about 44 percent in nominal terms or about 30 percent in real terms as compared to the appraisal estimates.
- Significantly slower implementation period (eleven years as compared to the projected six years) which resulted in a slower realization of the incremental benefits.
- UHE’s tariffs (which are approved annually by NEURC) during the implementation period were based on the overall (project and non-project) financial requirements of UHE; while adequate for meeting UHE’s annual financial requirements, they were lower than those necessary to enable a project-level FIRR at least equal to the WACC.
- The annual cost savings due to reduction in variable costs (O&M expenses) were lower than those projected at appraisal.

**UHE’s financial performance:** UHE’s annual hydropower production is subject to periodic fluctuations in hydrological conditions. Its tariffs are regulated and approved annually by NERC and are essentially set on a cost-plus basis to enable UHE to cover its (i) operating expenses, (ii) debt service, and (iii) own internal funding contributions to annual investments. Key indicators of UHE’s financial performance are given in Table A3-4 below.

Table A.3-4: Key Indicators of UHE’s Financial Performance (2007 to 2015)

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower generation</td>
<td>TWh</td>
<td>9.62</td>
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<td>kopek/kWh</td>
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<td>11.6</td>
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Financial ratios

| Net profit after tax/revenues % | 41% | 38% | 44% | 35% | 23% | 38% | 48% | 21% | 24% |
| Current ratio ratio | 4.0 | 0.8 | 0.9 | 1.1 | 2.1 | 1.4 | 1.9 | 1.1 | 0.9 |
| Debt service coverage ratio | 14.6 | 3.6 | 5.3 | 6.1 | 5.8 | 4.9 | 10.8 | 2.8 | 4.1 |
| Self-financing ratio⁴ | % | | | | | | | | 76% |

Definitions:

- Current ratio = current assets divided by current liabilities.
- Debt service coverage = net cash from operations divided by debt service (interest plus loan repayments).
- Self-financing ratio = net cash from operations after debt service divided by three year (past, current and following) average of annual capital expenditures.

Compliance with financial covenants: Under the Project Agreement, UHE had undertaken to:

- Carry out a revaluation study of its fixed assets by 12.31.2007.
- Maintain annually a current ratio of not less than 1.2; and
- Maintain annually a debt service coverage ratio of not less than 1.5.

Revaluation of fixed assets: UHE, with the assistance of consultants, carried out the study for the revaluation of assets. The study was completed in 2008 (as compared to the original target date of 12.31.2007). However, the results and recommendations of the study were not implemented until 2013 pending a decision by the Government as to adopting a sector-wide policy within the electricity sector in regard to utilizing revalued assets as a basis for tariff-setting and taxation. The results and recommendations of the study started to be reflected in 2013 after the results were actualized and confirmed by local experts.

Debt service coverage ratio: UHE was in compliance with this covenant during the implementation period (2007 to 2015).

⁴ The self-financing ratio covenant was applicable from 2015
Current ratio: Up to 2007, UHE was able to comply with the covenant. At the time, UHE’s current assets included a large amount of receivables from the national energy market company Energorynok which enabled it to have a higher current ratio. However, in ---, due to changes in the national accounting system, UHE was required to adjust the level of its current assets by transferring the substantially overdue receivables to non-current receivables. This very significantly affected the current ratio situation, and resulted in UHE’s current ratio being substantially less (ranging between 0.5 to 0.8) than the covenanted level of 1.2. To address the situation, UHE agreed with the Bank project supervision team to prepare and implement an Action Plan aimed at restoring the current ratio to meet the covenanted level. Despite some improvements, UHE was not able to consistently meet the covenanted level until 2012. Again, in 2014 and 2015, UHE’s current ratio dropped below the covenanted level. On review, it was found that UHE was having difficulty in meeting the ratio which is calculated based on the situation at the end of each year. Under the prevailing system, Energorynok makes payments on a monthly basis to UHE. However, UHE’s current payables mount up at year end due to the practice of suppliers to invoice towards the end of the year. This results in a temporary mismatch between the funds available to UHE and the payments to be made at the time. UHE is able to meet the payments with some delay following the end of the year but this is not reflected in the current ratio as estimated at the end of the year. In view of this, the Bank agreed in 2015 and 2016 to replace the current ratio covenant with another covenant (the self-financing ratio). UHE has been successfully meeting the self-financing ratio covenant.
Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

<table>
<thead>
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<th>Names</th>
<th>Title</th>
<th>Unit</th>
<th>Responsibility/ Specialty</th>
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<td>Irina Babich</td>
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<tr>
<td>Bernard Baratz</td>
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<td>Ludmilla Butenko</td>
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<td>Nicholas Chistyakov</td>
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<td>Richard Gargrave</td>
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<tr>
<td>Dmytro Glazkov</td>
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<td>Sergio Augusto Gonzalez Coltrinari</td>
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<td>Sara Gonzalez Flavell</td>
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<td>IEGDG</td>
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<td>Vitaly Kazakov</td>
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<td>Peggy Janice Masterson</td>
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<td>Kishore Laxmikant Nadkarni</td>
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<td>Dejan R. Ostojic</td>
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<tr>
<td>Claudia M. Pardinas Ocana</td>
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<td>Jonathan David Pavluk</td>
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<td>Norval Stanley Peabody</td>
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<td>Rozena Serrano</td>
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<td>Jari Vayrynen</td>
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<td>Anna L Wielogorska</td>
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<td>Knut J. Leipold</td>
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(b) Staff Time and Cost

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Annex 5. Beneficiary Survey Results

Not applicable.
Annex 6. Stakeholder Workshop Report and Results

Not applicable.
Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

Completion of Project of Hydropower Rehabilitation (parts A, B, C)

1. General Information of Project

1. Project Preparation and Implementation. In 1995 the Company launched a full-scale program of Hydropower integrated rehabilitation required in view of the HPPs long-lasting operation. The tasks included into the 1st stage of the rehabilitation program were implemented in 1995-2002 within the frames of the Project of Hydropower Rehabilitation and System Management (Loan №3865-UA), which was common with IBRD. The Company implemented rehabilitation of hydropower plants (General Designer - PJSC «Ukrhydroproject») in 2002-2005 using its own funds. Simultaneously within the frames of the Ukrainian power generation reformation support the Bank was preparing a new project for the further hydropower rehabilitation, the main provisions of which are described in the Project Appraisal Document «Loan proposed to Ukraine to the amount equal to USD 106 mln., for Project of Hydropower Rehabilitation implementation» (April 2005). The relevant Loan Agreement between Ukraine and IBRD №4795-UA was signed on 19.09.2005, ratified by Verkhovna Rada of Ukraine on 21.12.2005, and took effect on 03.02.2006.

2. Additional Financing. In 2010 the share of IBRD loan in the Project was increased by USD 60 mln. The Agreement of Additional Financing for the Hydropower Rehabilitation Project implementation (including six turbines in two HPPs) №7791-UA was signed on 03.02.2010, ratified by Verkhovna Rada of Ukraine on 06.07.2010, and took effect on 03.08.2010.

3. The total amount of the loan funds granted by the World Bank for the Project financing is USD 166,0 mln., including UHE’s share equal to USD 160 mln.

4. Project Implementation Period. The total period of the Project implementation is 10,5 years (2006-2016 pp.). The initial date of 4795 loan validity (03.02.2006 - 30.06.2012) and of loan 7791 (03.08.2010 – 30.06.2012), nevertheless the Project implementation was extended twice - till 30.06.2014 and till 30.06.2016. The loan deadline is 30.06.2016; the exemption period of financing charges till 31.10.2016; the charges shall be accepted and documented up to and on 30.06.2016.

Purpose of the Project

5. The main purpose of the Project is the increased operation stability and electricity supply durability through increase of the regulated power share in the Ukrainian power system, HPPs efficiency and operational safety improvement.

6. Supplementary purposes of the Project – upgrading of UHE institutional development; assistance to Ministry of Energy and Coal Mining and NERC for drafting and implementation of the power generation program reformation and development.

Objects of the Project

7. Nine (9) UHE’s HPPs situated in 7 regions on 2 water mains of Ukraine – the Dnipro and Dnister rivers, including:
Dnipro river (Dnipro cascade):
- Kyiv HPP and PSPP (Kyiv region)
- Kaniv HPP (Cherkasy region)
- Kremenchuk HPP (Kirovograd region)
- Dniprodzerzhynsk HPP (Dnipropetrovsk region)
- Dnipro HPP-1 and 2 (Zaporizhia region)
- Kakhovka HPP (Kherson region)

Dnister river:
- Dnister HPP (Chernivtsi region)

Project parts:

8. All tasks of the Project are structured and divided in 5 parts by the determined purposes – A, B, C, D, E, among performers of which are:

- UHE – Parts A, B, C (USD 160.5 mln.),
- Ministry of Energy and Coal Mining - Part D (USD 2.5 mln.),
- NERC - Part E (USD 3.0 mln.).

9. The main tasks for UHE in view of the parts are as follows:

- **Part A. Hydropower plants rehabilitation** (9 HPP/PSPP): reconstruction of 46 units; replacement of protection relay, measurement and telecommunication systems, monitoring and control systems; substations and auxiliary equipment refurbishment.

- **Part B. Dam safety**: safety improvement of the existing dams on the Dnipro and Dnister rivers by means of: dam safety automated monitoring systems on Dnipro HPPs, Dniprodzerzhynsk, Kaniv and Dnister dams and HPPs; drainage systems, concrete spillways, reinforced concrete structures and hydromechanical equipment repair and restoration; technical assistance for flood measurement, assessment and forecasting; C) sedimentation studies in Kyiv and Kaniv reservoirs.

- **Part C. UHE institutional development by means of**: implementation of management information system at UHE; technical assistance for Project procurements, UHE’s fixed assets revaluation, Project audit and UHE reports.

Project Monitoring Indices

10. The Project tasks performance by the Company is determined in achievement of the following key monitoring indices:

- 46 units rehabilitation,
- increase in HPPs capacity by 192,2 MW,
- implementation of 4 dam safety automated monitoring systems,
- implementation of Management Information System (MIS).
Procurements for Projects

11. All procurements provided by the Project for the task implementation are divided depending on the financing source into the credit part and the local part (UHE’s own funds) and are included into the Procurement Plan subject to periodical coordination between UHE and IBRD. The main object of revision was clarification of scheduled dates and actual dates of procurements, information of the procurement implementation results and signed contract performance. Essential amendments to the Procurement Plan were performed:

- in 2010 upon the Additional financing location - from the initially scheduled part of the units to be procured for the local funds - 2 packages were separated for 6 units reconstruction for the IBRD loan funds (rehabilitation of three turbines at Dnipro-2 and three turbines at Kremenchuk HPP); Both contracts are signed upon results of ICB – to the total cost of UAH 497.5 mln.

- in 2015 by supplementing the main list of procurements (determined at the initial stage of the Project implementation) with additional packages for the loan funds surplus use resulting due to UAH devaluation, mainly in the loan №7791-UA, due to almost double decrease of USD equivalent of the cost of the contracts signed in UAH (USD 62.5 mln. down to USD 35.5 mln.).

2. Results of the Project implementation and achievement of purposes in view of the Project parts

Part A - Hydropower rehabilitation

12. Within the frames of implementation of the tasks connected with 9 HPPs rehabilitation for the loan funds 23 contracts were signed for the supply of equipment (Goods) and the supply and installation of systems, including 5 additional ones due to the surplus loan funds as described above.

13. Another 3 packages of procurements of this part were cancelled, including:

- Substation electrical protections
- Equipment diagnostics system

14. The decision concerning cancelation of procurement of those 2 packages was taken at the moment of the credit funds deficit, when the cost of the contracted scope exceeded the amount of loans.

- Power transformers – the additional package included into the Procurement Plan at the stage of the loan funds surplus in 2015. The procurement was cancelled in view of impossibility to supply the equipment till 30.06.2016.

15. Pursuant with the contracted scope for HPPs and substations almost 2 500 pcs. of 16 types of equipment and accessories thereto were supplied, as well as 3 types of control, monitoring, communication and metering systems – SCADA, PMS and Telecommunication. See the detailed
list by sites (HPPs) in the table below.

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<th>Kyiv HPP</th>
<th>Kyiv PSP</th>
<th>Kaniv HPP</th>
<th>Kremenchuk HPP</th>
<th>Dniprodzerzhynsk HPP</th>
<th>Dniepro-1 HPP</th>
<th>Dniepro-2 HPP</th>
<th>Kakhovka HPP</th>
<th>Druster HPP</th>
<th>UHE – for all HPPs, including spare parts, cascade centers</th>
<th>Total, pcs.</th>
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<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories for air compressors</td>
<td>12</td>
<td>35</td>
<td>18</td>
<td>50</td>
<td>35</td>
<td>111</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td>363</td>
</tr>
<tr>
<td>Medium Voltage Boards</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>High Voltage Circuit Breakers</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

16. Besides that the delivery of 30 pcs. of HV bushings for power transformers of Dnister HPP (12) and Kakhovka HPP (18) was paid in advance from the loan funds according with the contract signed at the end of the Project implementation (31.03.2016), out of the list of additional procurements due to the funds surplus. The rest of the inputs cost will be paid from UHE’s funds, as far as the supply is scheduled in August 2016, upon the loan closure.

17. The tasks of the part A are mainly performed, and all key scheduled indices are obtained, namely:

- Quantity of rehabilitated units - 46 pcs.
All of 46 units are rehabilitated, out of which on the date of the loans closure (30.06.2016):

- commissioned 44 units,
- 2 units will be put into commercial operation after 2 months of trial operation lasting till the end of this year (the rehabilitation is terminated on 28.06.2016 on the unit No.17 of Dnipro-2 HPP and on 29.07.2016 on the unit No.9 of Kremenchuk HPP).

- **Increase in power - by 192.2 MW**
  - The actual increase in the capacity of rehabilitated 46 units is 192.2 MW.

- **Management, communication and accounting systems implementation:**
  - **Actually commissioned:**
    - 9 Automatic power metering systems on the HPPs consolidated at the central level in UHE,
    - 6 PABXs for hydropower plants, integrated into the Company’s system,
    - 144 SCADA/EMS, protection, alarm systems (unit, block and plant levels).

**Part B - Dam Safety**

18. The tasks in this part were implemented by 3 main directions:

- Automated Dam Safety Monitoring System (ASMS) implementation,
- Technical assistance for dam safety,
- Hydromechanical equipment repair and replacement.


20. The Project activity was concentrated first of all on continuation of the works launched by the Company and connected with PMS implementation on another 4 dams - Kaniv, Dniprodzerzhynsk, Dnipro and Dnister, consolidated into the united system of UHE dams safety data collection and analysis under the Hydrological Structure Safety Center management and control.

21. The practical implementation of this task involved 3 contracts, and the following results were obtained by the date of 30.06.2016:
(a) **Supply and installation of Internal Instrumentation** - 4 ASMSs are put into commercial operation - Kaniv, Dniprodzerzhynsk, Dnipro and Dnister dams, as well as the Cascade Safety Center.

(b) **Supply and installation of Permanent Deformation Monitoring System** - installed and put into the trial operation on 4 dams: Kaniv, Dniprodzerzhynsk, Dnipro and Dnister dams. The operational acceptance is scheduled in September current year, upon the tests completion and approval of the full scope of the system functionalities as provided by the technical specifications.

(c) **Supply and installation of Dam Monitoring Software** - installed on 8 plants (Kyiv, Kaniv, Kremenchuk, Dniprodzerzhynsk, Dnipro, Kakhovka, Dnister HPPs and Kyiv PSP) including the data online consolidation and monitoring in the Company’s Dam Safety Center.

22. The area of technical assistance includes the works as follows:

- **Sedimentation Study of Kyiv Reservoir** - by the National University «Lviv Polytechnics», the results of this study were included into the report submitted to the Bank in 2012.

- **Hydrometeorological Forecasting System Upgrading** - the analysis of all existing hydrometeorological stations was performed, the proposals as for the best scope of the stations renewal on the Dnieper and Dnister basins were developed in order to upgrade the hydrometeorological forecasting, issued as the Bidding Document and submitted to the Hydrometeorological Service, being the upper level of the hydrometeorological stations subordination.

23. The hydrological equipment repair and replacement was performed by the Company in the scope of the local part tasks. During the Project implementation 166 pcs. of new gates and trash racks were manufactured and installed on Kaniv, Kremenchuk, Dniprodzerzhynsk, Dnipro and Dnister HPPs.

24. Additionally to the initially determined tasks the significant work was performed connected with the surplus costs use for rehabilitation of 3 PMSs (Kyiv, Kremenchuk and Kakhovka HPPs which had been previously commissioned) The relevant recommendations concerning unification of those 3 PMSs with 4 PMSs previously implemented during the Project were submitted by the Inter-institutional Board for Hydrological Structures Survey in 2014 (the survey periodicity by the board is 5 years). The long-lasting process of coordination and approval with the Bank of the direct contract resulted in failure of that attempt. The contract signing was cancelled in view of lack of the time required for its performance – 2 months before the loan closure. The Project of 3 PMSs rehabilitation shall be implemented, and technical specifications drafted during the Project shall be used for the Company’s own costs.

**Part C - UHE Institutional Development**

25. This part included 3 main components aimed at the UHE institutional development.
• Implementation of Management Information System (MIS) in UHE
• Technical assistance for UHE
• Technical facilities for the Project

26. The results of the performed works are as follows for separate components:

MIS implementation

27. The task drafting for MIS implementation in UHE for the purpose of the IT current trends inclusion into the company management was divided into 3 stages pursuant to the Bank’s recommendations:

28. **Stages 1-2 - technical assistance** for MIS procurement preparation and performance, including:
   - Determination of the tasks for Consultant selection for Bidding Document drafting required for MIS procurement,
   - Bidding Document drafting and ICB for the Contractor selection.

Stage 3 - MIS design, supply, installation and implementation

29. The system designed by the Contractor includes 6 modules:
   (a) Document circulation
   (b) Equipment and maintenance operations accounting
   (c) Budgeting and financial analysis
   (d) Project management
   (e) Stock control
   (f) Analytical module

30. At the moment of the project termination 2 modules were commissioned: Document Circulation and Equipment and Maintenance Operations Accounting. The remaining 4 modules are currently being finalized and shall be implemented for the UHE’s own funds. MIS implementation over the scheduled time was caused through the number of restrictive factors, e.g. reorganization and numerous replacement of the management team at the contract implementation stage and the change of implementation concept for providing the system installation conditions at the plants and UHE office.

31. **Technical assistance** was received as the consulting services:

32. **Project Procurements** (except MIS) - Project Consultant: EDF-Hydroengineering Centre
(EDF, France). EDF experts were involved into works with 25 packages under ICB procedure. The Consultant was involved at all stages of procurement - ICB preparation and execution and contract. All tasks provided by the contract are performed and financed in the full scope.

33. **UHE and Project financial statements audit** - during the Project 10 audits of UHE’s and Project financial statements were performed. Audit statements in 2006-2015 drafted by the leading audit companies, KPMG, Deloitte & Touche USC, BDO, were accepted by IBRD and financed.

34. UHE financial statements audit in 2016 will be performed and financed for the UHE’s own funds. The audit results will be submitted to the Bank before 30.06.2017.

35. The financial statements audit in 2016 connected with the Project was contracted from the credit funds. The Auditor (BDO) initiated the information collection at the end of August of this year. The audit statement is expected 1 month at the latest after the latest transaction under the Project.

36. UHE staff training - UHE experts took part in a program by International Training Centre of the ILO (Torino, Italy) concerning the investment projects implementation for IBRD funds and ICB arrangement.

37. **Technical facilities for the Project** - to assure proper conditions for immediate missions to the objects (UHE’s HPPs), and for the equipment acceptance arrangement:
   - vehicles (minivan and loader), and
   - office equipment (laptops and multifunctional devices), - were procured.

38. **The task of UHE’s assets revaluation** was performed for UHE’s funds in two stages:
   - 2008 - UHE’s assets revaluation in line with the international evaluation standards was performed by the Company selected on the competition basis following the Bank procedure—LLC «Maxima Capital» (Ukraine). The results of the evaluation statement got the positive review from the State Property Fund of Ukraine and approval from the Bank. The assets revaluation was not implemented in UHE’s business accounting, as far as it required the transformation into the current Ukrainian accounting standards.
   - 2013 - the assets revaluation was performed by LLC «Veritex» (Ukraine). The true value of the Company’s assets was determined by LLC «Veritex» as of the date 01.01.13; it got the positive review from the Kyiv Research of Forensics of Ministry of Justice of Ukraine of 01.07.2013 No.5811/13-53/5812/13-54, and was included into the financial statements in the year 2013.

3. **Expenses for financing of the Project credit part tasks**

39. See all data of scheduled and actual expenses of credit funds for the equipment and services supply within the tasks of the parts A, B and C in view of the loans in the tables.
40. Analysis of all provided information testifies the correspondence in the whole between the scheduled and actual values of the credit funds expenditure for the loan No.4795-UA, and the essential discrepancies for the loan No.7791-UA. The main reason is a sharp weakening of the Ukrainian national currency in 2014, resulting in transformation of the credit funds deficit existing before 2013 that had caused cancellation of several procurements (substation electrical protection, diagnostics system) into surplus.

41. This situation affected financing of two contracts for the turbines rehabilitation of Dnipro-2 HPP and Kremenchuk HPP, signed in the national currency funded with the Additional Financing (loan No.7791-UA). USD equivalent of those contracts cost at the moment of the Project completion, considering all settled payments is USD 35.5 mln. against USD 62.5 mln. at the moment of signing.

42. The limited terms required for the additional procedures preparation and performance in line with the Bank standards as well as for the potential contracts implementation prevented UHE from the attempt to use the entire surplus amount for additional procurements for HPPs rehabilitation previously approved by the Bank. At the moment of the Project completion the

### Loan No.4795-UA USD mln.

<table>
<thead>
<tr>
<th>Project part</th>
<th>Scheduled expenses for the Project credit part tasks at the moment of the Project Appraisal in PAD</th>
<th>Actual expenses of WB credit funds (including expected payment during the grace period for the accepted goods and service up to the date of the Project completion, 30.06.2016)</th>
<th>Residual part of the expenses for the contracted goods and services within the WB credit line, to be financed from UHE’s own funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Hydropower rehabilitation</td>
<td>60,0</td>
<td>75,2</td>
<td>1,1</td>
</tr>
<tr>
<td>B. Dam safety</td>
<td>2,6</td>
<td>13,2</td>
<td>0,1</td>
</tr>
<tr>
<td>C. UHE institutional development</td>
<td>6,6</td>
<td>7,6</td>
<td>1,1</td>
</tr>
<tr>
<td>Unbudgeted expenses for material resources and increase in prices, taxes and fees</td>
<td>27,3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-time Bank fee</td>
<td></td>
<td>0,5</td>
<td></td>
</tr>
<tr>
<td><strong>Total for the parts A, B, C</strong></td>
<td><strong>96,5</strong></td>
<td><strong>96,5</strong></td>
<td><strong>2,3</strong></td>
</tr>
</tbody>
</table>

### Loan No.7791-UA

<table>
<thead>
<tr>
<th>Project part</th>
<th>Scheduled expenses for the Project credit part tasks, determined in the Loan Agreement</th>
<th>Actual expenses of WB credit funds</th>
<th>Residual part of the expenses for the contracted goods and services within the WB credit line, to be financed from UHE’s own funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goods and services (other than consultant services) pursuant with Part A of the Project</td>
<td>59,85</td>
<td>35,85</td>
<td>2,5</td>
</tr>
<tr>
<td>Initial one-time fee</td>
<td>0,15</td>
<td>0,15</td>
<td></td>
</tr>
<tr>
<td><strong>Total for the parts A, B, C</strong></td>
<td><strong>60,0</strong></td>
<td><strong>36,00</strong></td>
<td><strong>2,5</strong></td>
</tr>
</tbody>
</table>
amount of USD 1.8 mln. was used from the surplus amount (No.7791-UA) by virtue of additional procurements.

43. UAH weakening also affected the loan No.4795-UA, though it was minimized due to the additional procurements to the amount USD 2.4 mln.

44. Generally the expected disbursement percentage within the loan No.4795-UA after all payments (before 31.10.2016) is 96.5%, while within the loan No.7791-UA - 60%.

45. Considering that fact that in line with the Bank standards has different currencies for payments (USD, EUR, CHF and UAH), any currency fluctuation regarding USD (loan currency), especially UAH sharp weakening, affected the level of the loan funds reimbursement. Considering the performed additional procurements after settlement of all payments, the amount of the unused credit funds is about USD 27.5 mln., including:

<table>
<thead>
<tr>
<th>USD mln.</th>
<th>Loan No.</th>
<th>Loan amount</th>
<th>Used (actually drawdown and expected drawdown before 31.10.2016)</th>
<th>Forecasted amount of unused balance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4795</td>
<td>100.0</td>
<td>96.5</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>7791</td>
<td>60.0</td>
<td>36.0</td>
<td>24.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>160.0</td>
<td>132.5</td>
<td>27.5</td>
</tr>
</tbody>
</table>

4. Project specificity and impact factors during its implementation

46. The Project, considering its technical, financial, social and economic specifications pursuant with the Ukrainian standards, has the highest grade of complexity, to be determined on the ground of class of effects in the event of HPP decommissioning. Any fluctuation from the scheduled steps thereof respectively affects the Project implementation progress and achievement of the scheduled results. The Project included both objective and unexpected/current factors.

47. Among the objective factors should be noted as follows:

- Special conditions of implementation – all works (equipment repair and replacement; management, supervision and accounting systems implementation), were performed on the operating HPPs, 7 of which are placed in series, using cascade principle, requiring the exact schedule of works, approved by the Principal Operator of the Power System and all water users;

- Technical restriction – quantity of the units decommissioned simultaneously on each HPP for the reconstruction purpose is regulated by the engineering specifications considering the hydrological structures operation safety;

- Natural conditions – water regimes, weather conditions and observation of temperature conditions while replacing/installing the equipment on any open territories and erection sites;

- Works complexity – terms of the equipment replacement/installation connected with the object rehabilitation schedules (units, blocks and plants);
Specificity of equipment – practically all equipment and systems (with the exception of gauges and diagnostic instruments) are customized, manufactured with respect to non-standard design, to meet those specific objects.

48. **The current difficulties and problems had a significant effect:**

49. A large scope of procurements - 59 packages, out of which 27 packages are ICB. All bid procedures passed at the same time requiring the simultaneous participation of UHE’s experts and Project Consultant in several procurements, which was especially difficult at the beginning of the Project implementation, while 11 technically complicated ICB were lasting simultaneously.

50. The local financing deficit lasted till 2011 and impeded the tasks both of local and credit parts; while the most part of erection works of the supplied equipment had to be funded with UHE’s own funds. That is why in the situation of the world financial crisis in 2007-2009 and performance by the Company of the large-scale construction of Dnister PSP, the additional financing (USD 60 mln.) was a helpful measure for solving the situation with the local funds deficit, which were required to complete the rehabilitation of 6 turbines, enabling the acceleration of the main task – the units rehabilitation, as well as the energizing the Project activity.

51. Frequent changes in personnel in the ministries—practically yearly replacement of the ministry managers required the reissue of signer cards and payment document packages, which suspended for a long while or delayed the payment settlement with subcontractors and affected terms and scope of the scheduled draw down.

52. Significant exchange rate fluctuations, especially by virtue of the quick weakening of the Ukrainian national currency resulted in the credit funds surplus at the final stage of the Project. Additional procurements performed in a very restricted period enabled the additional use of USD 4,2 mln.

53. Budget procedure of the credit funds use, which includes yearly delays in the adoption of passports of State Budget programs, in which limits credit funds are used, disabled payments during the first months of the every year, affecting the contract settlement and amounts of the scheduled draw down.

54. The aggregate of the listed restricted factors caused the necessity of the Project implementation and IBRD loans validity prolongation in order to achieve the determined goals. It should be noted at that that the loan 7791 took effect in August 2010, its purpose was financing of the large scope of works of the Project – 6 turbines on two HPPs. ICB preceded the works execution, which had been never performed before as a competitive bidding, and in fact it had been performed by local manufacturers under direct contracts. Bidding procedures on both HPPs required the consultant involving, input data study, TOR drafting pursuant with international standards etc. The schedule of works for each turbine lasts over one year, even if using the improved technology (completion of erection of one turbine simultaneously with dismantling of another turbine). Besides that in order to confirm the Manufacturer’s operational warranties the scope of rehabilitation included the efficiency field measurement for the first time, requiring considerable supplementary administrative procedure and time. The last turbine out of this scope will be completed for the UHE’s own funds in the middle of 2017, which is connected with delay
of works on the correspondent generator financed from EBRD-EIB loans. So it’s obviously that the loan No.7791 was used in the acceptable terms in view of technology matters, i.e. 6 years.

5. **Generalized Estimation of the Project Results in Accordance with Defined Goals**

55. In accordance with the basic indicators defined for UHE under A, B and C parts of the Project in the Monitoring table of the Project Agreement, the general estimation of the attained goals is the following:

<table>
<thead>
<tr>
<th>Results indicators acc. to the Project goals</th>
<th>Plan for 2016</th>
<th>Fact as of 30.06.16</th>
<th>Performance level, %</th>
<th>Performance result estimation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrounits rehabilitation, units</td>
<td>46</td>
<td>46</td>
<td>100</td>
<td>satisfactory</td>
<td></td>
</tr>
<tr>
<td>Part A. Increase of HPP output, MW</td>
<td>192,2</td>
<td>192,2</td>
<td>100</td>
<td>satisfactory</td>
<td></td>
</tr>
<tr>
<td>Part B. Implementation of the Automated Safety Monitoring System (ASMS), pcs</td>
<td>5</td>
<td>5</td>
<td>100</td>
<td>satisfactory</td>
<td>4 plant ASMS and 1 integral complex of central level</td>
</tr>
<tr>
<td>Part C. Implementation of the Management Information System (MIS), pcs</td>
<td>1</td>
<td>—</td>
<td>33</td>
<td>relatively satisfactory</td>
<td>2 out of 6 MIS modules were have been implemented</td>
</tr>
</tbody>
</table>

56. 100% performance level of planned indicators of A and B parts, received due to all-inclusive replacement, refurbishment and installation of new equipment on HPP, and also implementation of the systems of control, monitoring, accounting and security give evidence of achieving the Project’s basic goal - *increase of the part of controlled power and increase of effectiveness and functioning safety of HPP*.

57. The intermediate indicators results – supply and installation of equipment are also estimated at the satisfactory level, as incomplete performance of the last works on installation and precommissioning of the supplied equipment, under individual contracts, on the whole has not influenced achievement of key indicators of A and B parts. The works envisaged under these contracts will be completed and financed at the expense of the UHE’s own funds, in particular:

<table>
<thead>
<tr>
<th>Supply name</th>
<th>Plan</th>
<th>Actual</th>
<th>Difference</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Voltage Boards</td>
<td>318</td>
<td>311</td>
<td>7</td>
<td>Installation and commissioning of 7 MV Boards racks were postponed in accordance with the Rehabilitation schedule of Block no.3 of Kaniv HPP</td>
</tr>
<tr>
<td>SCADA/EMS, protection, alarm system</td>
<td>152</td>
<td>144</td>
<td>8</td>
<td>Installation and commissioning depend on the Rehabilitation schedule of corresponding hydrounits of Block no.3 of Kaniv HPP</td>
</tr>
<tr>
<td>Turbines for Dnipro HPP-2</td>
<td>3</td>
<td>3</td>
<td>—</td>
<td>The rehabilitation was completed in time; the last turbine was put into</td>
</tr>
<tr>
<td>Supply name</td>
<td>Plan</td>
<td>Actual</td>
<td>Difference</td>
<td>Reasons</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>------</td>
<td>--------</td>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Turbines for Kremenchuk HPP</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>The installation of the last turbine is in progress in accordance with the Rehabilitation schedule of hydrounit no.8 and will be completed in 2nd quarter of 2017.</td>
</tr>
<tr>
<td>Static Frequency converter for Kyiv PSPP</td>
<td>1</td>
<td></td>
<td>1</td>
<td>The installation of the equipment was performed in time. The commissioning has been postponed due to the necessity of the additional devices installation in order to increase the system reliability, and it was detected during pre-commissioning.</td>
</tr>
<tr>
<td>Permanent Deformation Monitoring System</td>
<td>5</td>
<td></td>
<td>5</td>
<td>Installation and commissioning were performed in time. Delay with the putting into commercial operation is stipulated by the increase of the commissioning period.</td>
</tr>
</tbody>
</table>

58. The Project’s goal is **implementation of the Management Information System**, which is specified by C part indicator, for a time of completion of the Project has been performed by one third, which does not comply with the planned indicator. At the same time, taking into account the changes, which occurred in the company’s structure, and also the significant scope of performed preparatory works for installation of MIS (development of the system configuration, supply of server and network hardware, training of UHE’s personnel), the goal achievement level may be qualified as relatively satisfactory.

6. **Results of the Project Tasks Performed by PJSC Ukrhydroenergo**

59. **The UHE’s activity rating:** Satisfactory

60. At the preparation and implementation stage of the Project UHE used a number of organizational arrangements aimed at ensuring effective Project implementation, namely:

- Project Implementation unit (PIU) was set up, consisting of Company subject-matter specialists and UHE management;
- Project Technical Consultant (EDF, France) was chosen, and cooperation on all procurement procedure steps was optimized;
- Specialists responsible for rehabilitation activities were appointed at UHE Branches;
- Project Coordinator was chosen for cooperation with the Project Consultant, the World Bank, the Bidder, Branches, UHE structural subdivisions, central executive bodies;
- Procurement managers, responsible for tender procedures organization and contract implementation, were appointed.
61. PIU activities, with regards to loan funds use, were based on:

- Performance of goods and services procurement methods envisaged in loan conditions;
- Compliance with IBRD rules and standards during tender procedures;
- Well-organized cooperation with the Bank team,
- Strong cooperation with the Ministry of Energy, the Ministry of Finance, the Ministry of Economy, National Electricity Regulatory Commission to ensure the fulfillment of the rehabilitation program conditions;
- Performance of all procurements envisaged in the Project;
- Ensuring the performance of key indicators of Hydropower rehabilitation, increase of dam safety level, Environment Action Plan;
- Constant monitoring and analysis of Project Tasks performance;
- Implementation of automated financial accounting and financial statements under the Project;
- Ensuring annual auditing of UHE and Project financial statements;
- Introduction and performance of Joint Implementation project etc.

62. According to the Procurement Plan under the tasks financed by local funds, planned replacement and refurbishment of 255 sets of the equipment were carried out at 9 HPPs, among them:

- 23 Power Transformers,
- 149 Surge Arresters,
- 42 Turbines,
- 41 Generators.

Constraining factors during the performance of tasks of the local part of the Project.

63. The deficit of own funds, which UHE solved by:

- Attraction of additional US 60 million from IBRD for 6 turbines,
- Attraction of EBRD-EIB loan (EURO 400 million), which was used for financing of 3 generators for turbines among rehabilitated ones using IBRD funds under the Project, and further Project implementation at the next stage goes on.
• Implementation of Joint Implementation Project and the mechanism of selling of emission reduction units CO2 (818 397 tons) for the amount of EURO 4.5 million by means of the rehabilitation performed in 2007-2012 under JI Project according to Kyoto Protocol,

• Attraction of domestic credits.

64. **Repeated national bids to select the Construction Contractor** due to the absence or poor preparation of bids, which also delayed the replacement of equipment supplied under the contracts “Goods”. In order to avoid this dependence in the project in the future, starting from 2012 under Hydropower Rehabilitation Project using EBRD-EIB financing, UHE uses procurement type “Supply and Installation” with full responsibility for all complex and results of work.

65. **Dependence of work schedule** on the modes set by the power grid dispatcher

66. The abovementioned organizational approach contributed to performance of tasks of loan part as well as local part of the Project and achievement of Project objectives in general, providing the grounds for giving the satisfactory evaluation for UHE activities as responsible performer of Part A, B and C of the Project.

67. Taking into account the general conformity of the received results to the set tasks, excluding the difference between actual duration of works performance under the main loan No.4795, which is 10.5 years and estimated 6 years, the achievement of aims is assessed to be on the satisfactory level.

6. **The World Bank’s Activity and Role in the Project Implementation**

The WB’s activity rating: Satisfactory

68. Involving the World Bank in financing the Ukraine Hydropower Rehabilitation Project allowed to implement this important project for Ukraine’s power industry, having involved well-known world’s manufacturers of equipment, most up-to-date technologies, it encouraged exchange of knowledge and advanced training of the company’s personnel, increased quality of contracts performance by local manufacturers of equipment and performers of works and their prolonged responsibility for obligations under the contracts.

69. Interaction format, the Bank’s team activity, level, promptness and thoroughness of communication on the UHE’s part is estimated positively.

70. Magnitude of the Project, the number of procurement packages and their technical complexity also influenced the response time on the Bank’s experts part. In particular, the Bank’s review and approval procedure of the Bidding Document for procurement of SCADA lasted for almost 1.5 year, which is the most complex procurement package, the cost of which is 30% of the Loan’s principal sum. This delay at the initial stage of the Project influenced implementation of SCADA and was one of the grounds for prolongation of loans.

71. Unfortunately, standard conditions and procedures of draft documents approval influenced, for example, the possibility of implementing some additional procurements.
72. In order to intensify the procurement process and activate the works under the Project of hydro units rehabilitation (the task of the local part), which were practically blocked for lack of own funds, the Bank, taking into account previous experience related to duration of arrangement and conducting of ICB, supported and approved financing of the Consultant’s services for timely development of the Bidding Documents for rehabilitation of turbines, started in 2008, which was conducted in fact simultaneously with preparation of documents for attracting the funds of Additional financing for implementation of the Project. Such flexibility allowed at the moment of coming Loan No.7791-UA into effect practically to conduct the first of two ICB (Turbines of Dnipro-2 HPP), and the second one was conducted in 2 months (Turbines of Kremenchuk HPP). Such approach encouraged optimization of the Project Implementation Schedule and acceleration of starting to use the loan funds of additional financing (USD 60 million).

73. Effective instrument in solving individual problems in implementation of contracts was the format of trilateral meetings (UHE—the Manufacturer/the Contractor—the IBRD), which were held in the course of regular monitoring missions of the Bank under the Project and dedicated meetings.

74. The significant promoting element for manufacturers (Turboatom, Elektrovazhmash) was the Bank’s team visiting directly to the industrial site of Ukrainian plants in the course of monitoring missions for reviewing and monitoring of the manufacturing process of equipment.

75. The Bank played clearly positive role in the implementation process of the Joint implementation Project (2007–2012) (under the Kyoto Protocol), whereby the Bank provided all methodological, administrative and consulting services in order to ensure preparation, performance and successful completion of this Project, which is unique for Ukraine. Its results were highly appreciated at the Annual International Conference Hydro-2009.

7. General Conclusion on the Practical Experience to Be Considered in the Future Projects

76. UHE’s strategic plans, focused on the completion of the rehabilitation of existing capacities and construction of new ones, envisage the introduction of the projects with IFI investment resources attraction. Taking into account gained experience of this Project, it is necessary to pay special attention for the following aspects during the preparation of the projects:

77. Procurement Plan: procedures schedule has to include potential involvement of personnel of all parties (Beneficiary, Consultant, Bank) at simultaneous performance of many procedures that influence on procurement duration.

78. Procurement type: with the aim of optimization of works performance under the Project and focusing the Manufacturer’s responsibility it is reasonable to apply Supply and Installation type of procurement instead of Goods type subject to ensuring maximal competition.

79. PIU activities: forming of the personalized list of PIU personnel with stating of the functions and duties of its members in a directive document, for example, in Operating guidance agreed by the Parties.

80. Application of exclusions/deviations from the standard conditions: consideration of
specific features of the Project and particularities of the procurements in the cases when “end justifies means”. In particular, increasing of the percentage of the advance payment comparing to the standard one (from 10% to 20%) considering unstable economic conditions in the country would allow conducting a number of important procurements to increase the Project outcomes.

81. Personnel training: training programs according to the Bank standards for the personnel of the potential beneficiary, especially at the project development stage.

82. In general, both experience and technology of implementing Rehabilitation Project at the operated big hydropower plants situated as a cascade along the major rivers of the country keeping their environmental and technogenic safety and covering simultaneous complex replacement or refurbishment of the major part of hydraulic and electrical equipment with the resulting increase of its efficiency and operating reliability - are unique and useful for many countries that operate old hydropower plants, which require rehabilitation and power increase. Information about this Project was a matter of significant interest during the annual international conference Hydro-2008 where the practical experience gained in cooperation between UHE and the World Bank in the hydropower field was presented.

**Component D**

83. According to the Hydropower Rehabilitation Project PAD May 24, 2005 the overall Energy Sector Reform and Development Program objective is “to improve the security, reliability and quality of energy supply, and, therefore, facilitate unimpeded operation of the energy market, both domestically and internationally. Also, the proposed Energy Program would support Ukraine’s aspirations with regard to legal, institutional, regulatory and technical harmonization and increasing energy trade with the EU Internal Energy Market”.

84. PAD and LA says that “Component D: Implementation of the Energy Sector Reform and Development Program includes provision to the MFE of advisory services and consultant assistance in developing and implementing: (i) an action plan for legal and technical harmonization of the Ukraine’s energy market with the European Union Internal Energy Market; and (ii) a program of priority investments and technical assistance in the energy sector”.

85. Under the support of Component D the MFE/MECI has complete range of important activities related to (a) the Energy Sector Reform and (b) New Investment Projects Preparation:

(a) On the basis of the **Comprehensive strategy harmonizing Ukraine's energy market with EU internal market** the Energy Sector Reform and Development Program Coordination Unit (EPCU) experts has prepared the detailed "Action Plan for Energy Sector Reform and Development" which has been agreed with key stakeholders and approved by the Order of Cabinet of Ministers of Ukraine dd. 13.06.07 408-p. For identified terms (2007-2012) it was the key governmental Energy Reform programmatic document. EPCU carried out annual monitoring of its implementation, the results of which were sent to the Government.

Other Energy Sector Reform activities under Component D included consultancy for: harmonization of Ukrainian energy legislation to the acquis communautaires with drafting new legal acts (assignments “Recommendations for harmonization of the
Ukrainian legislation of Ukraine with the European Directives 2005/89/EC and 2004/67/EC to ensure the reliability of electricity and gas supply”, “Development of legal acts to stimulate the renewable energy development”, “Development of legislative acts in the field of regulation of power sector infrastructure facilities construction”, “Adoption of the EU legislation within the European Energy Community joining process”), support of the MFE/MECI on Power Sector Property Reform, Electricity Market Reform, preparation of a new Energy Strategy, etc.

(b) Support of Priority Investments in the Energy Sector was the important part of Component D. Such consultancy assignments as “Internal Electricity Market Study to Identify the Sector Investment Needs by 2016”, Project Advisor for NEC "Ukrenergo", “Preparation of TOR for a feasibility study for the TPP rehabilitation project”, “Preparation of Bankable Feasibility Study of the Second Power Transmission Project (PTP-2)” was also added by the permanent EPCU support for the preparation of Power Transmission Project, Second Power Transmission Project, Kaniv PSPP Project and other projects as well as for the preparation of a new Energy Strategy.

86. Considering the above the Component D of the Hydropower Rehabilitation Project fully met the Program and Components objectives. This Component become unique tool of cooperation between the sectoral Ministry and the World Bank combining several-years TA resource, permanent institutional project management support (EPCU), high flexibility and possibility of quick response to the challenges and the donor’s safeguards against corruption.

Disbursement of the Component D funds 2006–2016 (USD thousand):

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<tr>
<td>2006</td>
<td>27.6</td>
<td>133.5</td>
<td>356.7</td>
<td>311.5</td>
<td>228.1</td>
<td>276.2</td>
<td>443.8</td>
<td>240.1</td>
<td>113.8</td>
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5 Front-end fee payment.
Diagram 1. Disbursement the Component D funds for technical assistance by quarters (USD):

87. During the Component D implementation (2007–2016) it had influence of two risk factors identified in the PAD:

- Changes in MFE, NERC and UHE’s management slow down program implementation and raise possible controversies about sector priorities.

- Project implementation delays due to lack of local financing and poor project management.

88. Seven ministers and Ministry teams was changed during 2007–2016. These changes did not lead to any significant changes of sector priorities that would had influence to Program or Component objectives. Nevertheless it caused changes in the structure and staff of the Ministry, which had impact on the Component D realization.

89. EPCU, which administrated Component D as well as two Grants TF 053330 and TF 14447 and supported MFE/MECI with sectoral consultancy, project development and management, procurement and FM, due to both action and inaction of one of the Ministry teams, was not functioning for 2-nd half of 2014 and 1-st half of 2015. As a result of it any procurement, project management and FM were stopped for this period and emerged a risk that the Component D will not be realized until the project is completed. Fortunately, the MECI made necessary efforts and in 2015 EPCU functioning was renewed in full.

90. Deputy Ministers – Project coordinators except the case mentioned above were cooperative

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6 According to p. A2 Schedule 5 of LA Borrower through the MFE shall create and during all the project implementation maintain the EPCU under conditions and in composition acceptable for the Bank.
and effective. Unit for Cooperation with IFIs and Accounting Dept proved their qualification and high reliability. These departments under the EPCU support controlled that all the activities within the Component D strictly followed the World Bank procurement and financial management rules and procedures.

91. The World Bank’s team from the start till the end of the Component D realization proved to be very effective. Assistance from the World Bank at all stages of the Project facilitated the efficient and prompt problem resolution.

92. The main lessons that should be considered in future investment projects include:

- To secure sustainable project/component implementation PIUs and at least its project management, procurement and FM experts should be long-term contracted.

- The failures of disbursement in the 1st quarter of 2008-2011 and 2013 - 2015 indicate the need for additional attention and joint work of the World Bank, Ministry of Finance, Borrowers and Sectoral Ministries for the organization of the procedural mechanisms to ensure continuous payment process within the IFI project, even if the national budget isn’t adopted on time.

Component E

93. Introduction of the Wholesale Electricity Market Concept of the Project (hereinafter referred to as “Project Part E”) envisaged the provision of technical assistance to the National Electricity Regulatory Commission (NERC) in introducing the Concept of Functioning and Development of Ukraine’s Wholesale Electricity Market, approved by Cabinet of Ministers of Ukraine Regulation #1789 dated November 16, 2002 (subsequently referred to as “Concept”).

94. With the assistance of the Ministry of Energy and Coal Industry of Ukraine and at the expense of Government of Japan Grant #TF053330 an international consultant was engaged to prepare terms of reference (TOR) under Project Component E (Contract # MFE/TF053330/ST11).

95. To implement NERC Project Part E (NERC being responsible for Project Part E) in accordance with the World Bank procedures and based on the results of tenders held, in 2007, a contract was concluded with KEMA-ECA consortium to provide consultation services to an amount of 2 160 956.00 Euros. The Contract terms and conditions provided for works to be carried out in two stages (phases). At the first stage that lasted for five months, the consultants analyzed the current state of affairs in the Ukraine’s electricity sector and suggested possible versions of a new model of Ukraine’s electricity market and possible ways of transition from the existing model to a prospective market model. Based on the results of this analysis, Cabinet of Ministers Regulation #1056 “On Approving a Plan of Measures to Implement the Provisions of the Concept of Functioning and Development of Ukraine’s Wholesale Electricity Market” was adopted on November 28, 2007. After the above-mentioned document was adopted, the project second phase was started during which detailed rules of a new market model and drafts of required laws were elaborated (including a draft law on the foundations of electricity market functioning, that was used for preparing Law of Ukraine “On the Principles of Electricity Market Functioning” #663, enacted in 2013), and also drafts of other main legislative acts (rules, codes, agreements, etc) were
96. Implementation of Contract between the NERC and KEMA-ECA consortium within the framework of Project Part E was completed in 2009 and the Contract terms and conditions were fulfilled in full. In view of the fact that in 2008 and 2009, there was a considerable change in the Euro-to-US dollar exchange rate, the actual amount paid under the Contract (which equaled 2 160 956.00 Euros pursuant to the Contract conditions) totaled US$ 3 028 817.54 in the loan currency.

Regarding Achieving Monitoring and Assessment Indicators

97. As regards Project Part E, indicators of results (taking into account their updating in 2015) were generally achieved. In the process of Project implementation, there were developed drafts of primary and secondary legislation necessary to introduce a new market model. Based on the results of work carried out under Project Part E, Law of Ukraine #663-VII “On the Principles of Electricity Market Functioning in Ukraine” (hereinafter referred to as “Law”) was enacted in October 2013, with a period of introducing a full-scale electricity market on the basis of a model of “bilateral agreements and balancing market” starting from July 1, 2017. The Law opened an electricity market for non-domestic consumers (starting from January 1, 2014) and domestic consumers (from January 1, 2015). The provisions of this Law partially ensured introducing the provisions of “The EU Second Energy Package” into the national legislation; however, with respect to some norms, the Energy Community and IFO have expressed a number of remarks. In 2015, a new draft of Law of Ukraine “On Electricity Market of Ukraine” was elaborated in accordance with the “EU Third Energy Package.”

98. Taking into account the time that has elapsed since the Project completion (2009), as well as the latest trends and EU and Energy Community new legislation pertaining to electricity market development, the drafts of primary and secondary legislation that were elaborated within the framework of Project Part E, require updating, adaptation and further improvement.

99. It is important to note that, in addition to main works, Project Part E has an accompanying value as pertains to Ukrainian specialists’ education in matters relating to functioning of liberalized models of electricity markets, and their main segments. In this aspect, Project Part E has become Ukraine’s first project that ensured propagating professional experience of international experts that is essential for Ukrainian specialists, and contributed to the emergence of a certain circle of Ukrainian experts who subsequently took part in elaborating relevant draft laws and secondary legislation drafts.

100. At the NERC level, much attention was devoted to implementing Project Part E and active participation was ensured of the Commission specialists and market participants in respective working groups; project coordination was provided by the Inter-agency Commission on Implementation of the Provisions of the Concept of Functioning and Development of Ukraine’s Wholesale Electricity Market, including representatives of executive power central bodies, as well as representatives of the energy sector and civil organizations, which facilitated its proper functioning and achieving necessary results.
Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders
Annex 9. List of Supporting Documents

- Ukraine World Bank's Country Partnership Strategies FY08–FY11 and FY12–FY16
- Loan Agreement with amendments, dated September 19, 2005
- Project Agreement with amendments, dated November 19, 2005
- Aide Memoires and Management Letters
- Restructuring Papers
- Implementation Status and Results Reports
- Implementation Completion and Results Report Guidelines, OPCS, Aug 2006, last updated July 22, 2014
- Guidelines for Reviewing World Bank Implementation Completion and Results Reports
Project Map (cleared on 12/8/2016)