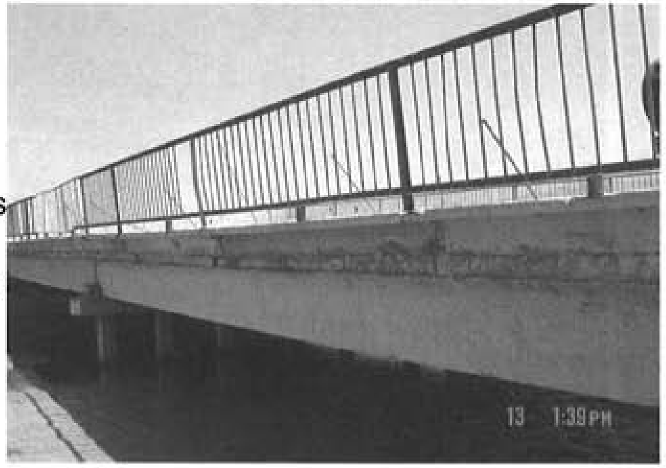
Km 274 Bridge 2 x 14m section
Km 278 Police/immigration check point and Bridge 2 x 9m.
Km 279 Bridge 4 x 14m section.

Km 281 Bridge 5x 9m section.

Km 288 Bridge 3 x 12m section.

Km 294 Bridge 2 x 18m section. This bridge has separate sections of support piers and transports should keep right or left of centre



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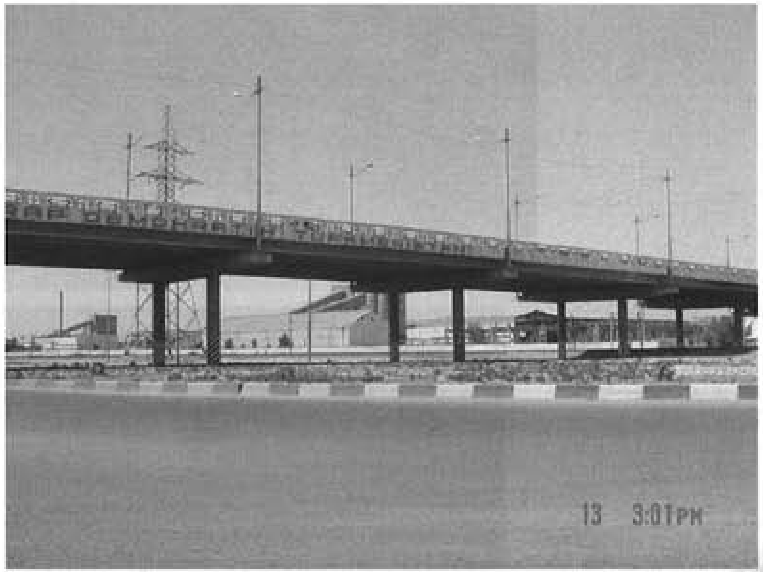
Km 299 Bridge 1 x 18m section.
Km 300 Bridge 1 x 11m section.
Km 306 Bridge 3 x 6 m section.
Km 310 manned railway crossing. "Hump" may be problem for longer trailer combinations

Km 341 Entering Ashgabat under Triumphal Arch.

Km 342 to avoid crossing the bridge at exit of Ashgabat by pass at
Km 343 a temporary rail crossing was made at this point.
It will be at the discretion of Ashgabat authorities to allow passage over bridge for heavy cargo.Bridge height 8m.



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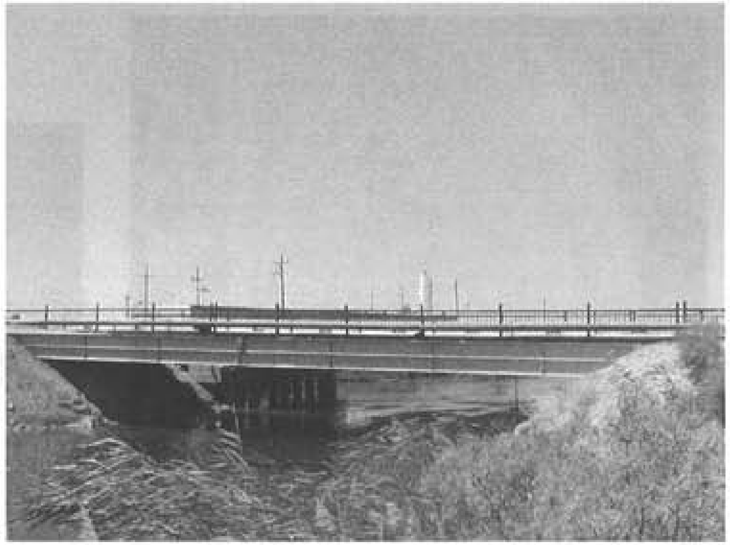
Km 0
Turmenbashi Port under reconstruction. To be completed end 2002.

Km 7 pass under HT lines of krw power station at 8-9 m ht.

Km 8 heavy lift by pass bridge previously used for 460 ton transport.
Km 9 area behind refinery requiring constant consolidation. To be permanently repaired before 2002 ending.

Km 11 pass under pipe rack.
6.2m clearance under outer obstructions with 7m x 3.5m wide through middle section



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Km 13 gradient of 12% for 1km following which road downgrades to category 2 in good condition.
Km 31 one 35kv power line at 7-8m
Km 38 police post where there is a gradient of 12% for 150m.
Km 52 turn right.

Km 83 Bridge 4 x 6m section

Km 102 HT lines 110kv 8m+
Km 103 bridge 3 x 6m section
Km 104 bridge 2 x 6m section
Km 107 bridge 2 x 6m section
Km 122 bridge 3 x 6m section
Km 125 bridge 3 x 6m section
Km 137 bridge 2 x 6m section.
136 Ht lines 9m.
Km146 bridge 2 x 6m
All above bridges in good condition.

Km 147 Bridge 4 x6m. This bridge was formerly 6 x 6m. Reduced following collapse of two sections.
Bridge deck panels are suspect and require engineering report.
Former by pass suggested/required for heavy cargo over 100mton.

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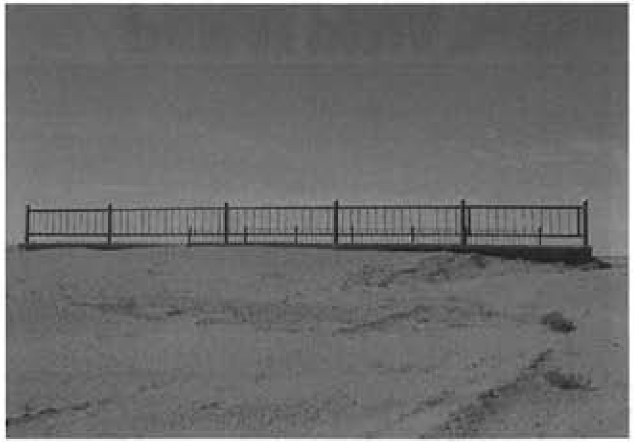
Km 167 Bridge 4 x 6m section.

KM 168 Enter town of Nebidag with number of Ht, domestic power lines and communication lines throughout

Km 215 Bridge 1 x 14m section completely filled under with sand and impossible to check condition.

Km 219
Bridge 3 x 14m section in poor condition and should require by pass due to severe deterioration of support piers as shown.
Alternatively excavate for further investigation for possible repair.



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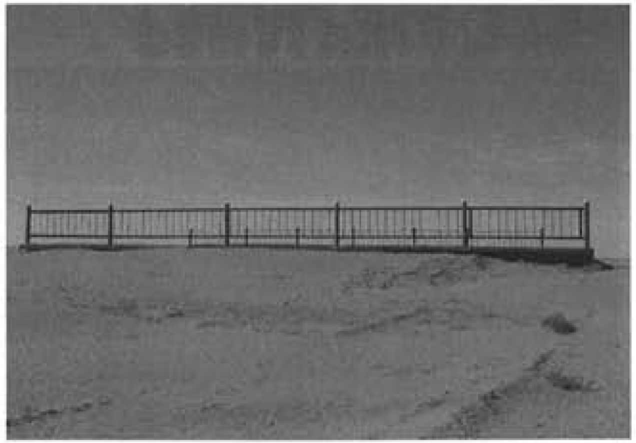
Km 167 Bridge 4 x 6m section.

KM 168 Enter town of Nebidag with number of Ht, domestic power lines and communication lines throughout

Km 215 Bridge 1 x 14m section completely filled under with sand and impossible to check condition.

Km 219
Bridge 3 x 14m section in poor condition and should require by pass due to severe deterioration of support piers as shown.
Alternatively excavate for further investigation for possible repair.



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Km 244 Bridge 3 x 14m section .

Km 258 Bridge 3 x 14m section previously repaired with steel plates which is a typical repair throughout the bridges on port to Ashgabat route.

Km 262 Bridge 2 x 14m section. Centre pier is subsided but is considered useable due to butting of bridge sections.

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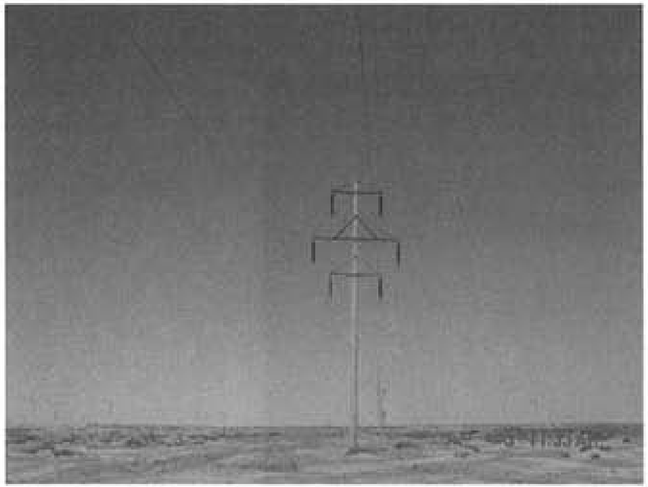
Km 264 bridge 3 x 14m section.

Km 272 bridge 2 x 14m section
Km 275 bridge 2 x 14m section
Km 277 bridge 2 x 6m section
Km 278 bridge 2 x 6m section
Km 278 bridge 1 x 14m section
Km 282 bridge 3 x 14m section
Km 274 bridge 2 x 14m section
Km 278 bridge 2 x 6m section
All in good condition.

Km 292 Railway bridge with available 10km by pass through village of Kazandzhik.
(There is one electrified railway crossing with low mass communication lines to be negotiated and one 110kv HT line of only 7.3m clearance.)

Km 295 HT lines 110kv 7.5m clearance



(Rail crossing on by pass)

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Km 300 Bridge 8 x 14m section with surface cracks on some bridge piers.
Routing to take right of centre when crossing.
Bridge has been repaired with additional steel plates at bridge beam end supports.

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Km302 Bridge 5 x 9m section.

Km 305 Bridge 3 x 14 section
Which has a defect between bridge beams which may affect strength.
Passage should be made left of centre.

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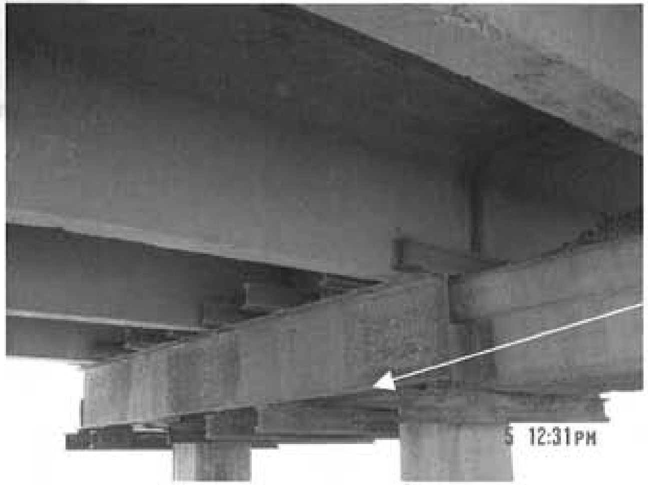
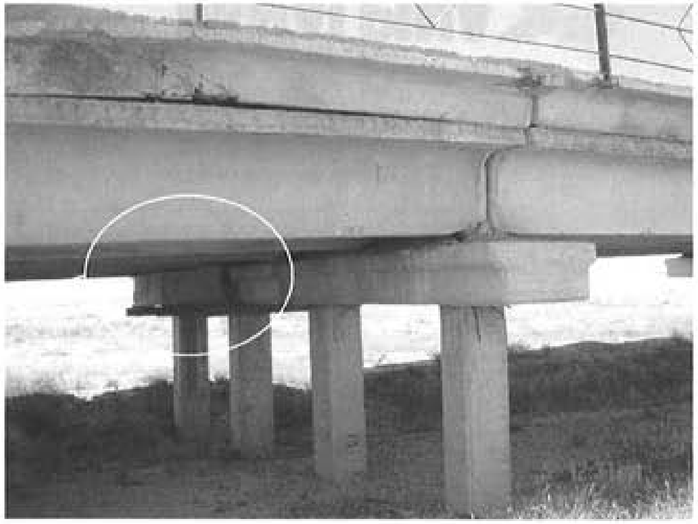
Km 306 Bridge 2 x14m section.

Km 308 bridge 8 x 14m section with repair as shown with additional steel plates in beam end supports.





Km 310: 4 x 14m section
In good condition.

Km 313: 8 x 14m section
Requires one end beam reinforced by steel plates

Km 314: 2 x 14m section
Km 317: 2 x 14m section
Km 318: 3 x 14m section
Km 319: 2 x 14m section
Km 320: 3 x 14m section
Km 321: 3 x 14m section
Km 323: 3 x 14m section
Km 324: 8 x 14m section
Km 326: 3 x 14m section
Km 326: 2 x 14m section
Km 330: 6 x 14m section
Km 330: 2 x 14m section
Km 333: 2 x 14m section
Km 340: 3 x 14m section
All above bridges are in suitable condition.

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Km 345:	8 x 14m section
Km 348:	4 x 14m section
Km 356:	14 x 14m section
Km 359:	2 x 14m section
Km 363:	6 x 14m section
Km 369:	6 x 14m section
Km 376:	2 x 14m section
Km 380:	2 x 14m section
Km 385:	4 x 9m section
Km 405:	2 x 6m section
Km 406:	2 x 6m section
Km 409:	2 x 6m section
Km 415:	4 x 9m section
Km 420:	3 x 6m section
Km 423:	4 x 9m section
Km 426:	5 x 9m section
Km 433:	5 x 9m section
Km 434:	3 x 6m section
Km 438:	2 x 6m section
Km 442:	2 x 6m section
Km 445:	3 x 6m section
Km 451:	2 x 6m section
Km 452:	3 x 6m section
Km 455:	2 x 6m section
Km 457 railway bridge by pass 2km	
Km 463:	4 x 9m section
Km 466:	4 x 9m section
Km 469:	4 x 9m section
Km 471 mass comm. lines	

Bridges inspected and found OK but pictures have data error and will have to be retaken at earliest opportunity

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Km 489 Bridge 1 x 14m section.
Road width 10m

Km 492 Bridge 1 x 14m section
as above

Km 395 Bridge 1 x 9m section

Km 498 Turn left due to road construction/bridge replacement.
Road width 7m with enough area to turn 14 axle lines.
Km 9.5 turn right at cross roads.

Km 499 Bridge 2 x 5m section.

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Km 500 re-join main highway currently under reconstruction. 20m width solid compacted base course/gravel.

Km 502 Ht lines 110kv at 10m+ Immediately followed by new constructed bridge 1 x 14m section

Immediately followed by Ht lines 2 x 110kv at 10m+

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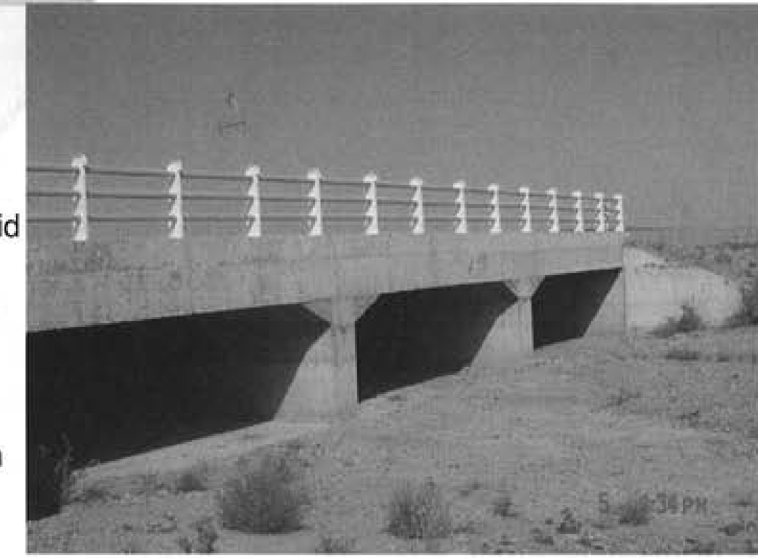
Km 505 road construction ends road dual carriageway 12m each lane.

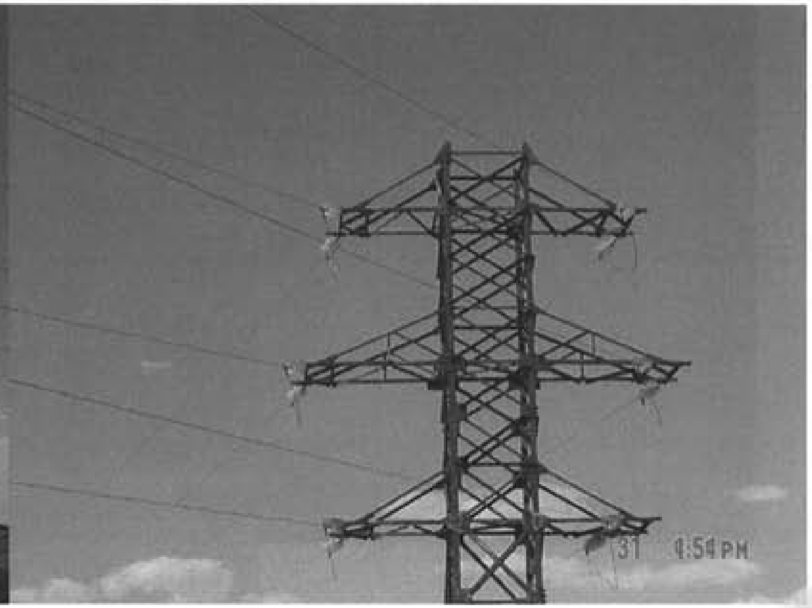
Km 508 Bridge 3 x 6m section solid concrete construction.
This is typical of the bridges on new section of expressway into Ashgabat.
Km 515 Bridge as above
Km 516 Bridge as above 2 section



Km 518 Ht line power rating to be checked. Possible 35kv.
This line is only 5.75 clear space.

Km 522 Bridge 3 section as above.
Km 526 Bridge 3 section as above.
Km 527 Bridge 3 section as above.

Km 528 Ht lines as above at 6.5m



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Km 531 controlled non electric rail crossing.

Km 532
Bridges 2 x 6m and 3 x 6m solid concrete bridges.

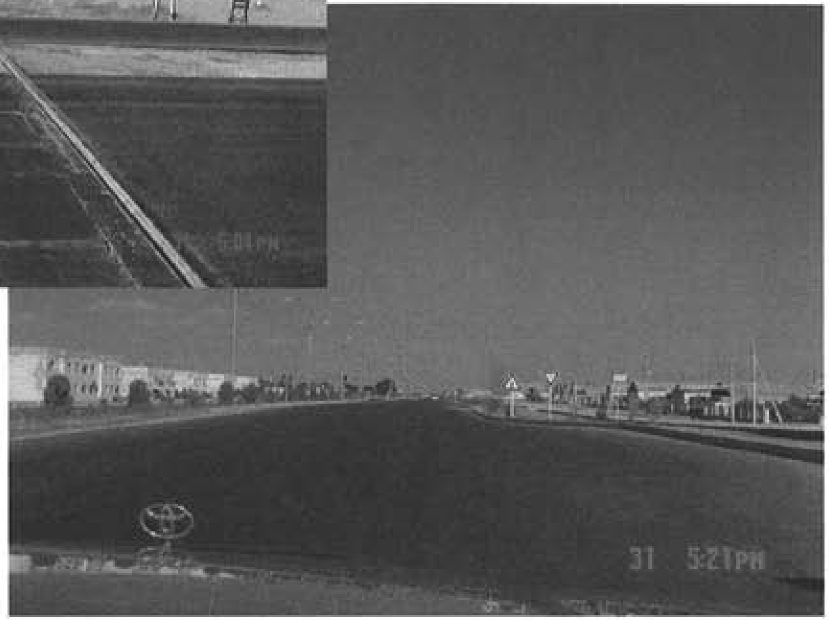
Km 541 Bridge 2 x 14m section
And Ht line 35 kv(?) at 6.5m.

Km 545 and 547 Ht lines as shown before at 5.8m (power rating to be checked.)

Km 549 roundabout, right to Ashgabat, straight on to Buzmeyin. **Take Buzmeyin road** to avoid low bridge at 5.3m on direct Ashgabat road.
Immediately cross single uncontrolled rail crossing.

Km 559 Ht line at 8m+
Km 574 Ht lines 110kv at 9m

Km 579 Buzmeyin power station with associated Ht lines.
This crossing has to be confirmed.
4 sets of ht lines at 10m+ keep to right side for more clearance.



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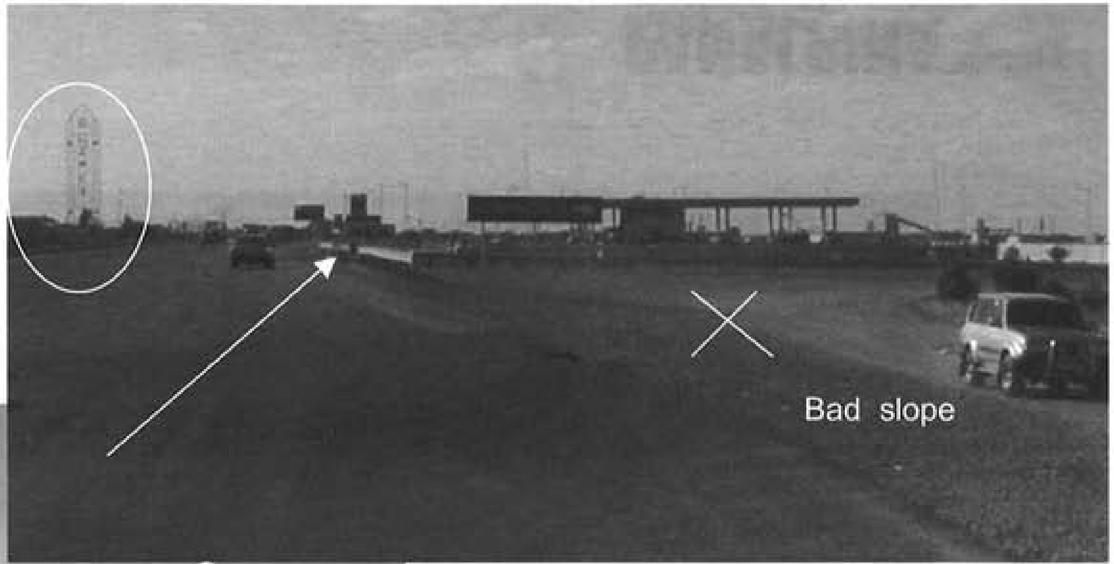
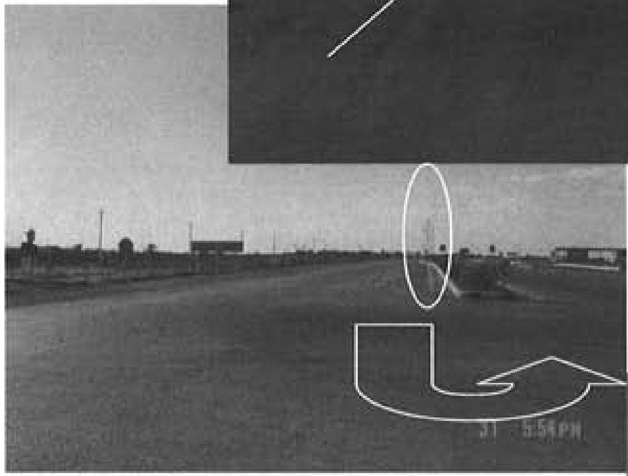
Km 580 Uncontrolled rail crossing.
Km 583 roundabout continue straight

Km 585 immediately after the Buzmeyin
Sign make a U turn, with enough space to make turn with 14 axles.
Road width available 32 m.
Take road to Herikgala to cross to North side of Ashgabat.





Km 589 end of by pass road turn right onto main highway 18m road width.
Km 595 Ht line 35 Kv at 6.8m.
Km 596 Ht line 110kv at 10m.

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Ashgabat by pass from left turn over rail crossing from Km 600

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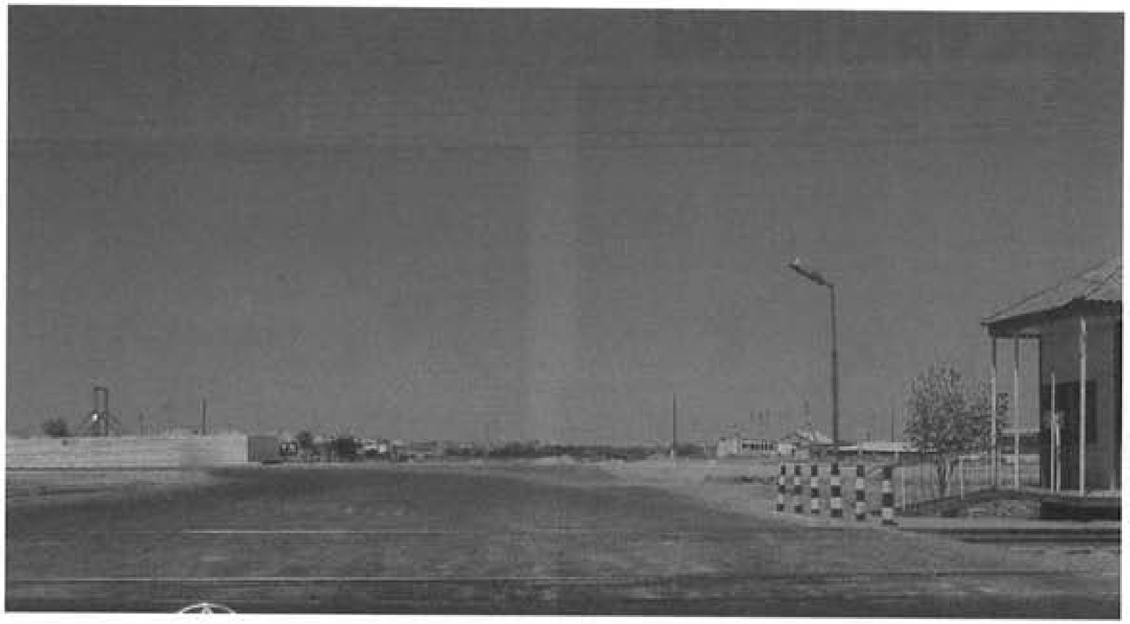
Km 600 turn left over two line non electric rail crossing for road to continue cross over to North side of airport for Ashgabat by-pass.
Immediately turn left.
Km 602 turn right continue down West road of airport
Km 604 turn right onto main highway North side of Ashgabat.
Km 606 cross roads continue straight
Km 609 Ht lines 1 x 110kv, 1 x 220kv At 7.7m and 8.4m

Km 610 Ht line 220kv(110kv?) stretching across right hand bend
At only 6.7m

Km611 one set of trolley bus lines at 5.5m
Immediately followed by
Ht line 110kv at 10.2m



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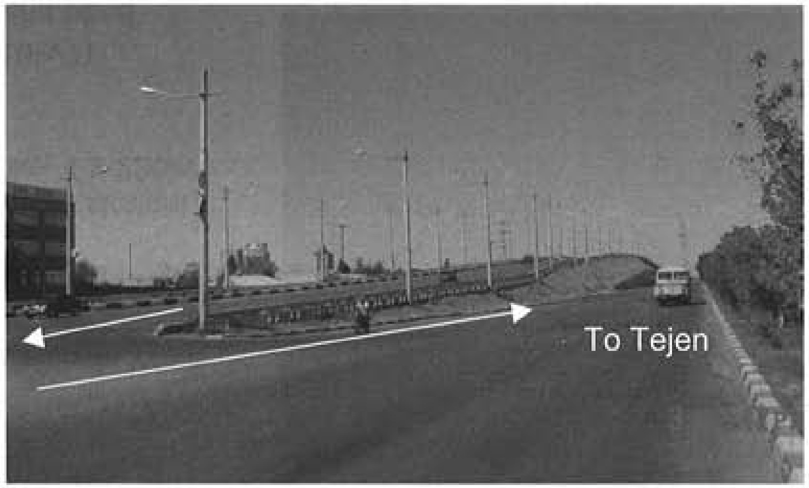
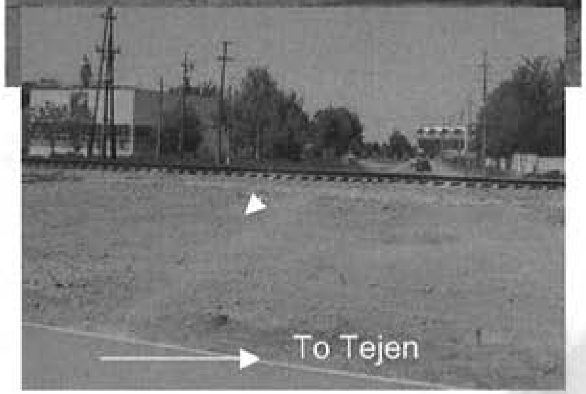
Km 618 Junction for very heavy cargo by pass.(Green route)
Or straight on over bridge for lighter ODC.
Exact weight restrictions are yet to be determined for routings.
Over bridge there is enough area to turn 14 axles for exit on service lane to join main highway to Tejen at Km 620.

Red route
over bridge
passing under
Ht line at 10m

Green route
1 km to rail line crossing
passing under Ht line at
8m clearance





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4. CLEAN DEVELOPMENT MECHANISM- PROJECT DESIGN DOCUMENT (CDM- PDD)

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT (CDM-PDD)

Tashkent Thermal Power Plant Modernisation Project

July 31, 2003

Introductory Note

This Clean Development Mechanism - Project Design Document (CDM-PDD) of the Tashkent Thermal Power Plant Modernisation Project is prepared, assuming it to be a CDM project. And baseline methodology and monitoring methodology have been developed and applied for this PDD with due to no existing methodologies approved by the Executive Board of CDM.

CONTENTS

Annexes

A. General description of project activity

A.1. Title of the project activity:

Tashkent Thermal Power Plant Modernisation Project

A.2. Description of the project activity:

Project objectives

Objectives of the project are as follows: increase of power generation capacity of Tashkent Thermal Power Station (hereinafter referred to the Power Station) for growing demand, its operation cost reduction together with increasing power generation stability, increase of thermal efficiency in power generation to contribute to the conservation of natural resources (such as natural gas and oil) and the mitigation of adverse impact on environment (by reducing CO_2 emission). For this purpose, it is planned to replace twelve (12) existing power plants with nine (9) modern high performance Combined Cycle Power Plants (CCPPs) with capacity of 370MW each, and as the first stage of this improvement, it is planned to implement installation of one (1) CCPP, which shall be in operation in late 2007, at the Power Station. (Thus, following descriptions and calculations are provided in the context of one CCPP installation.)

In addition to the objectives above, up-to-date-technical transfer is also sought with the project implementation. And it will be materialised through the training and involvement of many engineers, technicians and management peoples of Uzbekistan in the province of designing, construction, installation, operation and maintenance of the new power plant.

Project background

The capital of the Republic of Uzbekistan, Tashkent has about 2.2 million population (about 9% of the country total), and it is of the zone of the highest energy consumption. For this important area, the Power Station produces electric energy. This station has now the capacity of 1,860MW, energy is being generated by twelve conventional power plants using natural gas and heavy oil as fuel. However, all units were constructed during the period from 1963 to 1971 and the 1st unit has been operated for about 40 years. As the result, average annual utilisation rate of these plants amounts to 70% and capacity amounts to 60%. On the other hand, the thermal efficiency of 34.55% (year 2001) is significantly lower than the latest plants (average efficiency of those plants is over 50%). In addition, being superannuated leads not only to degradation of the output but also to increase of costs of providing power and decrease of operation availability. Hence, it is requested that the Power Station shall have modern high performance thermal power plants.

Project implementation schedule

Schedule of the project implementation after contracting with EPC contractor is planned as follows. Contract with EPC contractor is to be made within the year 2003, and the CCPP is expected to commence operation in late 2007.

Project implementation schedule

Tasks	Lapse of months
Civil and architectural designs	3
Foundation works for buildings and equipment	6
HRSG manufacturing, assembly and testing	16
Gas turbine, steam turbine and generator manufacturing, assembly and testing	19
Installation and test operation	26

Hand over and start operation	28

About the Power Station

Facilities

The Power Station has 12 conventional power plants using natural gas as main fuel and heavy diesel fuel as secondary one. Total output of the power plants is 1,860 MW (unit capacity is 150-160 MW). First plant had been implemented in 1963 and the last - in 1971. Eleventh (11^{th}) and 12th plants are designed for generation of 78 Gcal/hour of heat energy along with electric energy. Cooling water is taken from water intake canal being a diversion from the Bozsu canal streaming along the western boundary of the Power Station.

Fuel supply

Natural gas that is used as main fuel for power plants is supplied by the gas-pipeline to the Power Station from Bukhara and Shurtan. The supply capacity of Shurtan is enough to provide the operation of twelve existing plants at rated power. Even after completion of installation of the CCPP, its capacity to supply will be enough. Heavy oil being used as secondary fuel is stored in seven tanks (10,000 m^3) installed in the Southern part of the Power Station and is then supplied via six feed-tanks (5,000 m^3) located next to the power plants. Heavy oil is supplied from oil refineries via railway directly to the Power Station and is unloaded.

Power distribution

Distributing station is constructed in the Eastern part of the Power Station and overhead transmission lines are installed to the North: two lines 500 kV each, 7 lines - 220 kV each and 12 lines 110 kV each.

Plants operation

Tashkent Thermal Power Plants operate under relatively high availability factor as a power station with basic load. Though service factor of all units since commissioning amounted to 72.0%, the factor slightly varies from unit to unit among 12 units, namely: it is lower for unit No.5 (65.8%) and No.7 (66.9%) and higher for unit No.1 (78.8%) and No.2 (79.0%). The Power Station is operated and managed by personnel of 1,400 people headed by the Director. Four operation groups 50 people each conduct operational control of plants and these groups on four shifts basis operate power units. More than 700 people conduct technical maintenance and repair of the units.

A.3. Project participants:

The following participants are to be involved in the project. Among these participants, the Power Station, State Joint Stock Company Uzbekenergo (hereinafter referred to Uzbekenergo) and Tokyo Electric Power Service Co., Ltd. (hereinafter referred to TEPSCO) play important roles in the project implementation.

Project participants

Participants	Position, Roles
The Uzbekenergo / the Power Station	Project planning / Plant operation
TEPSCO	Feasibility study, plant design and consultation on the project implementation
Teploelektroproekt	EIA, Site measurement and geological survey
Japan Bank for International Cooperation (JBIC)	Fund provision (Loan agreement : March, 2002)
State Committee for Nature Protection of the Republic of Uzbekistan	EIA approval
Contractor --- not yet named	Engineering, Procurement, Construction (EPC)

Neighbouring residents	Opinions on this project

Contact

TEPSCO is named to contact for the project activity. Contact information is in ANNEX 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host country Party(ies):

Republic of Uzbekistan

A.4.1.2. Region/State/Province etc.:

Tashkent Region

A.4.1.3. City/Town/Community etc:

Kibray Raion (Kibray District)

A.4.1.4. Detail on physical location, including information allowing the unique identification of this project activity:

Location

Tashkent Thermal Power Plant is located at about 10 km to the Northeast of the city of Tashkent and is one of the most important stations that supply heat and power to the city. It occupies an area of 2 km long from South to North and about 1 km wide from East to West with total area about 146 hectares.

Climate and land condition

The location of the territory is close to deserts (Karakum and Kyzlkum -- on the west of Tashkent) and foothills (Kuramin, Chatkal, Pskem, Ugam mountain ridges of western Tien-Shan Mountains -- on South, East and Northeast of Tashkent), and its climate condition is of sharp continental with significant variations of temperature in winter and summer. Average annual atmospheric temperature is equal to +14.85°C. Maximum is registered in July (+44.6 °C), and minimum in January (-14.2 °C).

In Tashkent, the amount of precipitation is rather low (annual average is 449.8mm). There is only one rain season, from October to May. Some snow can be observed from October to March. And, humidity is lower in summer (average humidity of July is 40%) and higher in winter (average humidity of December is 75%).

The Power Station is situated on the land elevation 501.5m from the sea level. The ground under the Power Station is composed of three geologic layers. First layer constitutes of clay (9 to 12m thickness) and silt stratum (some 2 to 3 layers of 2 to 3m sandy loam). Second layer is formed with 2 to 3m pebble stratum. And third layer has rather hard lime soil stratum starting from 15m below the surface. The altitude of the ground water level is between 497 and 499m.

A.4.2. Category of project activity

This project belongs to the category of "Energy industries".

A.4.3. Technology to be employed by the project activity:

The project employs the CCPP for modernisation of the Power Station. The CCPP adopting modern and ecologically clean technologies provides mitigation of adverse impacts to the environment and greater thermal efficiency that contributes to making GHG emissions lower per electricity compared to existing conventional type power plants. The CCPP is intended to produce heat for regional heat supply system during winter period in addition to electric energy generation. The CCPP is composed of the followings:

- Gas turbine;
- Heat recovery steam generator (HRSG);
- Steam turbine;
- Generators and own electric equipment;
- Gas compressor;
- Distributing equipment room;
- Additional equipment (feed pump, etc.);
- Fuel and water feeding equipment;
- Water intake and discharging equipment; and
- Gas turbine, steam turbine and control system building.

- Gas Turbine ---- It is composed of axial-flow air compressor, combustor and axial-flow turbine.
- HRSG ---- It is a device that converts heat energy of exhaust gas from gas-turbine into steam and produces steam of triple levels of pressure and feeds it into steam-turbine.
- Steam Turbine ---- It comprises HP, IP and LP stages that correspond three pressure levels. River water once-through type will be adopted to condenser cooling water system using existing water intake and discharge equipment at the best advantage.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHG) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

(Note that carbon dioxide (CO_2) is regarded as a main greenhouse gas (GHG), according to well-known international and recommended by International Panel on Climate Change (IPCC) guideline, and GHG given in the following description represents CO_2 gas otherwise specified.)

The CCPP has the much higher power generation efficiency (56.7%) than existing conventional thermal power plants (34.55%, year 2001) in the Power Station, and it provides more electric power production at the same amount of fuel. Consequently, introduction of the CCPP makes GHG emissions per unit of electricity lower than "without".

In case that the Power Station generates 11,770GWh a year (planned by the Uzbekenergo for 2003 and further), the annual total GHG emissions of the Power Station is estimated at 6,720 thousand tCO_2 "with the CCPP in operation", and 7,460 thousand tCO_2 "without the CCPP". The difference between "with CCPP" and "without CCPP" is 740 thousand tCO_2 which is GHG emission reduction by the project implementation.

GHG emission reduction forecast of the energy sector of Uzbekistan

Emission of GHG (CO_2, CH_4 and N_20) in the four categories such as the power engineering, industry, agriculture and wastes show that in 2010, depending on economic development options and emission reduction interventions, GHG emission may constitute from 185.6 million to 209.0 million tons in term of the CO_2 equivalent, and GHG emission structure as well as its sources structure will not change.

The main greenhouse gas will be carbon dioxide (depending on the option, its share may constitute from 65 to 70%), methane will account for 29 to 25% of emission, and the remaining amount of 5 to 6% will fall on the nitrous oxide.

The main GHG sources will be those falling under the category of power engineering, the share of which will constitute 83 to 86% of the aggregate emission. The share of agriculture will be no more than 10%, and the combined share of industry and wastes will approximately constitute 5%.

Technical possibilities of reducing GHG emission (not including renewable energy sources) for the period up to 2010 as assessed in "the First National Communication of the Republic of Uzbekistan on Climate Change" constitute 27.2 million tons (CO_2 equivalent). And the energy sector harbours the biggest possibilities of GHG emission reduction in the order of 25 million tons, while industrial process, agriculture and wastes may permit a reduction of up to 2.2 million tons (CO_2-equivalent).

GHG mitigation measures in the energy sector, which have focused on energy saving, were prepared by ministries and governmental agencies for the development of "The Energy Program of Uzbekistan for the period until 2010". A specific feature of the measures is that they have been designed as part of an overall development program, and CO_2 emission resulting from these measures are seen as an auxiliary benefit. Documents on power supply demonstrate that the energy saving potential under this sector likely to be realised for the period until the year 2010 is around 10.0 million tons energy equivalent (7.0 million tons oil equivalent energy), resulting in CO_2 emissions reductions of about 17.1 million tons.

A.4.5. Public funding of the project activity:

Construction of a new building for the CCPP, procurement and installation of the CCPP system and other implementation tasks will require the fund of 220 million US$. Of this fund eighty-five percentage (85%) of the fund for the project implementation will be supplied by JBIC through its loan scheme (Loan agreement was made in March 2002 with interest rate of 0.75% and 40 year repayment period with 10 year grace period). And rest of it (15%) is to be provided by the Uzbekenergo.

B. Baseline methodology

B.1. Title and reference of the methodology applied to the project activity:

(Note that the baseline methodology described hereinafter is the new methodology, and this "B. Baseline methodology" is basically the same with the methodology in Annex 3. This methodology has been newly developed due to no authorised methodology being available at this moment. For the baseline determination, refer to Appendix "Baseline Study Report.)

The baseline methodology is named as "Baseline Methodology for the Thermal Power Plant". It has condition that:

- Existing plants supposedly generate the power equal to the power generated by the CCPP.
- CO_2 emission of existing plants if these existing plants generate the said power.

This method is applied when the CCPP in actual operation, through the monitoring, to figure out how much the reduction of CO_2 emissions be by introduction of the CCPP.

Concept of "Baseline Methodology for the Thermal Power Plant"

	By the CCPP		By Existing plants	
Actual amount of power generation, by the CCPP		**CO_2 reduction**	Natural gas and oil consumption	**Baseline CO_2 emission**
	Natural gas consumption	**CO_2 emission**		
	↓ related		↓ related	
		Leakage reduction	Natural gas and heavy oil supply	Leakage
	Natural gas supply	Leakage		

Though GHG emissions of outside of the boundary are included in this illustration, it is bypassed and not included in the method with the reason for difficulty to measure it, a small amount and positive effect on the emission reduction (Inclusion the leakage increases the emission reduction amount).

CO_2 emission calculation, when the CCPP is actually in operation

CO_2 emission of the baseline is defined as the amount of CO_2 emission of existing plants in generating the power equal to the power generated by the CCPP. And power generation of the baseline is the amount of power generated by the CCPP. While power generation amounts of existing plants and the CCPP are to be obtained through the monitoring, the baseline of CO_2 emission is to be calculated as follows.

Note that LHV of fuels is of the reference fuel, but if the difference between the reference fuel LHV and actually procured fuels LHV exceeds permissible range, proper adjustment should be made on LHV value. This measure shall be applied on all calculations in this PDD.

- Baseline CO_2 emission = COb * Pccy / Py

Py Annual power generation of existing plants

Pccy Baseline power generation (= annual power generation of the CCPP)

COb = (Fcn * LHV * *15.3 * 0.995 * 44 / 12*) + (Fch * LHV * *21.1 * 0.99 * 44 / 12*)

COb	CO_2 emission of existing plants
Fcn	Natural gas consumption of existing plants ($10^6Nm^3/yr$)
Fch	Heavy oil consumption of existing plants ($10^3ton/yr$)
LHV	Lower Heating Value of the reference fuel

- CO_2 emission of the CCPP

  COcc (tCO_2) = Fcc * LHVr * *15.3* * *0.995* * *44 / 12*

COcc	Annual CO_2 emission of the CCPP
Fcc	Natural gas consumption of the CCPP ($10^6Nm^3/yr$)
LHV	Lower Heating Value of the reference fuel

- CO_2 emission reduction

  Annual CO_2 reduction amount = COb - COcc

Coefficient from IPCC guidelines

Following coefficients applied to CO_2 emission calculations are from IPCC guidelines

- *15.3* ----- Carbon emission factor of natural gas (tC/TJ)
- *0.995* ----- Share of oxidised carbon of natural gas
- *21.1* ----- Carbon emission factor of heavy oil (tC/TJ)
- *0.99* ----- Share of oxidised carbon of heavy oil
- *44 / 12* ----- Conversion factor to carbon dioxide equivalent

"ESTIMATION" of the baseline emission, before the CCPP in operation

In addition to the methodology above, another approach is provided, which is basically the same with the baseline methodology, for estimating CO_2 emission before the CCPP in actual operation. Its concept is illustrated below.

Concept of "ESTIMATION of CO_2 emission before the CCPP in operation"

Thermal efficiency, etc. of existing plants performance of the reference year

↑ referred ↑ referred

	By CCPP + Existing plants		By Existing plants	
Planned power and heat generation amount		**CO_2 reduction**	Gas and oil consumption	**Baseline CO_2 emission**
	Gas and oil consumption	**CO_2 emission**		
	↓ related		↓ related	
		Leakage reduction	Natural gas and heavy oil supply	Leakage
	Natural gas and heavy oil supply	Leakage		

Same as "Baseline Methodology" above, leakage is also bypassed and not included in the calculation of CO_2/GHG emission and reduction for the same reason.

B.2. Justification of the choice of the methodology and why it is applicable to the project activity

Employment of this methodology can be justified by the following reasons.

- More than ninety-nine (99%) of GHG emission is covered. ---- All generated power and all fuels used in power generation are included in figuring out CO_2 emission of the Power Station.
- Leakage is disregarded due to its amount being a little. ---- There are some GHG emissions from the leakage of the gas pipeline and fuel consumption in transportation of heavy oil, but these are negligible since it is a small amount. It accounts for less than 1% of total GHG emission of the project activity. And the project activity has a positive effect on GHG emission from these sources.
- Well-grounded assumptions are applied. ---- Some assumptions are applied in CO_2 emission calculation, but these are concrete and well grounded.
- Standards and formula commonly known are applied. ---- Coefficients defined in IPCC guideline, commonly accepted formulas and standard are applied to CO_2 emission calculation and estimation.

B.3. Description of how the methodology is applied in the context of the project activity:

The baseline methodology is used in the following two cases. For "ESTIMATION" the baseline methodology is applied with some modification.

- After the CCPP is actually in operation, the methodology is to be applied every year-end to determine the CO_2 emission of the Power Station and CO_2 emission reduction contributed by the CCPP introduction. The CO_2 emission and reduction are figured out through calculations of the methodology based on the monitored data of actual power generation and fuel consumption of the all plants.

- To estimate CO_2 emission and reduction of the Power Station before the CCPP in actual operation, "ESTIMATION" methodology, which is developed from the baseline methodology with some modification, is applied. In this case, the planned power generation amount and performance data of the existing plants in reference year are used to estimate the CO_2 emission and reduction. (Refer to E.)

B.4. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity

The CCPP has higher thermal efficiency (56.7%) than existing plants (34.55%, year 2001). And the CCPP generates more electric power than existing plants at the same amount of fuel, and the CCPP consumes less amount of fuels than existing plants in generating the same amount of power. Thus, introduction of the CCPP leads to relatively lower GHG emissions of the Power Station.

B.5. Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity:

The project boundary is drawn between the Power Station, which is defined as "within the project boundary", and outside of the Power Station, which is defined as "outside of the project boundary". Since GHG emission outside of the Power Station is bypassed in aggregation of CO_2 emission and the reduction, from three reasons that leakage is difficult to measure, it accounts for less than 1% of the total emission and it increases the reduction of CO_2 emission of the project activity by taking it into account, the methodology focuses on the emission "within the project boundary".

Reference: Natural gas and heavy oil supply to the Power Station

Natural gas is supplied through the private gas-pipeline which is connected to the main gas-pipeline of the Oil & Gas Company at the distribution point about 6km away from the Power Station. Heavy oil is transported to the station by the railway from oil refineries in Bukhara (624km away from the station) and Ferghana (450km away from the station).

B.6. Details of baseline development

B.6.1. Date of completing the final draft of this baseline section:

31 / July / 2003

B.6.2. Name of person/entity determining the baseline:

The baseline is determined by TEPSCO who is a participant of the project. Refer to ANNEX 1 for its address, telephone, etc. for contact.

C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

1 / January / 2008

C.1.2. Expected operational lifetime of the project activity:

Twenty-five (25) years: Economical operational life of the CCPP, this period is an equivalent for a service life of this project.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period *(at most seven (7) years per period)*

C.2.1.1. Starting date of the first crediting period:

1 / January / 2008

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period *(at most ten (10) years)*:

N/A

D. Monitoring methodology and plan

D.1. Name and reference of methodology applied to the project activity:

(Note that the monitoring methodology described hereinafter is the new methodology, and this "B. Baseline methodology" is basically the same with the methodology in Annex 4. This methodology has been newly developed due to no authorised methodology being available at this moment.)

The name of the monitoring methodology is "Monitoring GHG Emission of Thermal Power Plants". All necessary data for the calculation of CO_2 emission of the power plants are to be monitored, recorded and archived by the Power Station. (Refer to D.3 below)

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

Employment of this methodology can be justified with the following reasons.

- All data monitored and recorded ---- All data for figuring out CO_2 emission and its reduction of the Power Station will be collected and recorded through the monitoring. (Refer to D.3)
- Monitoring-schedule established ---- Time schedule of monitoring is clearly defined (Refer to D.3)
- All data archived ---- All data monitored and recorded will be kept in the archive of the Power Station for the verification of CO_2 emission and its reduction. (Refer to D.3)
- Monitoring in-charge assigned ---- The Power Station is in charge of monitoring power generation, fuel consumption and other relevant sources.
- Monitoring procedure established ---- The Power Station have established the monitoring and recording procedure, and they have been practising tasks according to the procedure. Thus, no additional efforts to the current practices of the Power Station is required in terms of monitoring, recording and archiving.

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data type	Data variable	Data unit	Measured (M), calculated (C) or Estimated (E)	Recording Frequency	Proportion of data to be monitored	Data archive	Period to be archived	Comment
D.3.1	Power generation	Actual amount	KWh	M	Daily	100% of each plant	Recording book	10 years	
D.3.2	Natural gas consumption	Actual amount	Nm^3	M	Daily	100% of each plant	do.	10 years	
D.3.3	Heavy oil consumption	Actual amount	Kg	M	Daily	100% of each plant	do.	10 years	
D.3.4	Natural gas LHV	Value	J/m^3	From supplier	On procurement	Of each natural gas	do.	10 years	
D.3.5	Heavy oil LHV	Value	J/kg	From supplier	On procurement	Of each heavy oil	do.	10 years	
D.3.6	CO_2 emission of the baseline	Value	tCO_2	C	Yearly	Total	do.	10 years	
D.3.7	CO_2 emission of the CCPP	Value	tCO_2	C	Yearly	Total	do.	10 years	
D.3.8	CO_2 emission reduction	Value	tCO_2	C	Yearly	Total	do.	10 years	

D.4. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	Data archive	Period to be archived	Comment
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

D.5. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

ID number	Data type	Data variable	Data unit	Will data be collected on this item? (If no, explain).	Data archive	Period to be archived	Comment
	Same as D.3						

D.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored.

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline of QA/QC procedures
D.3.1	Low	Yes	Concrete procedure (with in-charges) of monitoring and recording power generation, fuels consumption and others relevant data has been established as the administrative system of the Power Station.
D.3.2	Low	Yes	
D.3.3	Low	Yes	
D.3.4	Low	Yes	
D.3.5	Low	Yes	
D.3.6	Low	Yes	"How to" is included in the administrative procedure of the Power Station.
D.3.7	Low	Yes	
D.3.8	Low	Yes	

D.7. Name of person/entity determining the monitoring methodology:

Monitoring methodology is developed by TEPSCO who is a participant of the project. Refer to ANNEX 1 for address, telephone, etc. for contact.

E. Calculation of GHG emissions by sources

E.1. Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary:

"ESTIMATION" of CO_2 emission of the Power Station with the CCPP

The following calculation is provided to estimate CO_2 emission of the Power Station, assuming that electric power generated (by existing plants and the CCPP) is 11,770GWh, which is planned by the Uzbekenergo. (Due to no available data of the heat supply for 2003 and further, actual performance data of year 2001 is used as reference to determine the heat supply amount.) And the result of the calculation, CO_2 emission of the Power Station (assuming the CCPP in operation) is 6,720 tCO_2.

a. Power generation of the CCPP = *376*MW * 8,760 (h) * *0.85* = 2,800GWh
b. Natural gas consumption of the CCPP = 2,800 * 3,600 / *0.567* = 17,800TJ

----

c. Power generation of existing plants = (*11,770* – 2,800)GWh * 3,600 = 32,300TJ
d. Heat supply of existing plants = *254,000*Gcal = 1,064TJ (= 254,000 * 4.19 / 1,000)
e. Natural gas consumed by existing plants
   = (32,300 +1,064) / *0.3455* / (*93,000* + *19,100*) * *93,000* = 80,100TJ
f. Heavy oil consumption by existing plants
   = (32,300 +1,064) / *0.3455* / (*93,000* + *19,100*) * *19,100* = 16,400TJ

----

g. CO_2 emission by natural gas consumption = (17,800 + 80,100)TJ * 44/12 * 15.3 * 0.995
h. CO_2 emission by heavy oil consumption = 16,400TJ * 44/12 * 21.1 * 0.99
i. Overall CO_2 emission from the Power Station (g. + h.) = 6,720 thousand tCO_2

376	Power generation capacity of the CCPP (MW)
0.85	Operation rate of the CCPP
0.567	Thermal efficiency of the CCPP
11,770	Planned power generation (GWh) --- planned by Uzbekenergo
254,000	Heat supply of the planned year (Gcal) --- Refer to E.4.
0.3455	Overall thermal efficiency of existing plants in the reference year (2001)
93,000	Annual natural gas consumption of the reference year (TJ)
19,100	Annual heavy oil consumption of the reference year (TJ)

Overall thermal efficiency (LHV base) of the Power Station of the reference year (2001)

a. Power generation = 10,503 (GWh) * 3,600 = 37,810TJ
b. Heat supply = 226,697 (Gcal) * 4.19 = 950TJ
c. Natural gas consumption = 3,174.6 * *29.31* * 10^6 (J/kg) = 93,000TJ
d. Heavy oil consumption = 651.9 * *29.31* * 10^6(J/kg) = 19,100TJ
e. Overall thermal efficiency = (37,810 + 950) / (93,000 + 19,100) = 0.3455

29.31	LHV of reference fuel (7,000kcal/kg = 29.31 * 10^6J/kg)

OTHER CASE of "ESTIMATION" of CO_2 emission

In the said "EATIMATION", the operation rate of the CCPP is assumed at 85% (, which is known as an average operation rate of Combined Cycle Power Plants in other countries), then aggregate CO_2 emission of the Power Station is 6,720 thousand tCO_2 a year. But in case the operation rate of the CCPP goes down by 10% to 76.5% and other conditions stay as "ESTIMATION" above, the total CO_2 emission of the Power Station would go up by about 80 thousand tCO_2 to 6,800 thousand tCO_2 per year.

E.2. Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity:

In addition to CO_2 emission from the Power Station, methane leaked from the gas pipeline is to be taken into account as GHG emission. However, it is difficult to measure and its amount is rather small (about 0.68%) comparing to the total CO_2 emission of the Power Station (Refer to "GHG emission, outside of the project boundary" below), and including GHG emission outside of the project boundary will increase CO_2 emission reduction amount. Thus, it is bypassed in the GHG emission calculation.

GHG emission, outside of the project boundary

The calculation below is for "ESTIMATION" of "GHG of outside of the project boundary". But it is tentative from the following reasons

- Natural gas leakage rate (0.8%) is of gross amount of sales to all natural gas customers of Oil & Gas Company, not of actual leakage from private gas-pipeline between the distribution point and the Power Station.
- Estimated distance (500km) might be different from actual distance between oil refinery and the Power Station due to not knowing which oil refinery where the heavy oil is conveyed from.
- Fuel efficiency of railway locomotive (4.1g/tkm) is of locomotives that are used only in long distance transportation, and fuel consumption in marshalling yard, etc. are not included.

Tentative calculation of GHG emission from leakage

5,460,000 * *0.8%* = 43,700 tCO_2

561 (10^3ton) * *500*(km) * *4.1*(g/tkm) / 10^6 * 29.31 * 44/12 * 21.1 * 0.99 = 1,900tCO_2

(43,700 + 1,900) / 6,720,000 (tCO_2) = 0.68% --- Ratio of the leakage outside of the project boundary against total emission from the Power Station.

5,460,000 (tCO_2)	CO_2 emission from natural gas consumption, when 11,770GWh (power generation, planned) and 254,000Gcal (heat supply) is produced, by existing power plants and the CCPP.
561(10^3ton)	Heavy oil consumed: ditto
0.8%	Average leakage ratio against "Natural gas sold to customers of Oil & Gas Company" amount.
500(km)	Assumed distance between the oil refinery and the Power Station
4.1(g/tkm)	Fuel efficiency of diesel locomotives of the Railway

Other parameters used in the above calculation are from the IPCC guideline.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

6,720 thousand tCO_2 /year ----- Not including leakage, this is equal to the amount calculated in E1.

E.4. Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline:

The CO_2 emission of the baseline is estimated at 7,460 thousand tCO_2. The following calculation is carried out for estimating CO_2 emission of the Power Station before actual operation of the CCPP, assuming that electric power generated is 11,770GWh, which is planned by the Uzbekenergo. But, since no concrete amount of heart supply is available in the planning, it is estimated, in calculation, based on the ratio of power to heat generation of the reference year (2001).

CO_2 emission of the Power Station without the CCPP

a. Power generation of the planned year = *11,770* GWh = 42,400TJ
b. Heat supply of the planned year = *226,697 / 10,503* * *11,770* = 254,000 Gcal
c. Total output = 42,400 + (254,000 / 1,000 * 4.19) = 43,430TJ
d. Total fuel consumption = 43,430TJ / *0.3455* = 125,700TJ
e. Natural gas consumption = 125,700TJ / (*93,000* + *19,100*)TJ * *93,000*TJ = 104,300TJ
f. Heavy oil consumption = 128,300TJ /(*93,000* + *19,100*)TJ * *19,100*TJ = 21,400TJ
g. CO_2 emission by natural gas consumption = 104,300TJ * 44/12 * 15.3 * 0.995
h. CO_2 emission by heavy oil consumption = 21,400TJ * 44/12 * 21.1 * 0.99
i. Overall annual CO_2 emission from the Power Station = 7,460 thousand tCO_2

11,770	Planned power generation (GWh)
226,697	Heat supply of the reference year (Gcal)
10,503	Power generation of the reference year (GWh)
93,000	Natural gas consumption of the reference year (TJ)
19,100	Heavy oil consumption of the reference year (TJ)
0.3455	Overall thermal efficiency of the reference year (Refer to "Overall thermal efficiency of the reference year" in E.1.)

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

"ESTIMATION" of CO_2 emission reduction

Assuming the CCPP in operation, CO_2 emission reduction is estimated at 740 thousand tCO_2 par year.

E.6. Table providing values obtained when applying formulae above:

CO_2 emission after the CCPP in operation

Items	**Values**
Baseline CO_2 emission	All values when applying formulae above shall be calculated with actual data which are to be obtained through the monitoring.
CO_2 emission of the CCPP	
CO_2 emission reduction	

"ESTIMATION" of CO_2 emission

Items	Values
Baseline CO_2 emission (without the CCPP)	
Power generation of the planned year	11,770 GWh : 42,400TJ
Heat supply of the planned year	254,000 Gcal
Caloric value of power and heat generation	43,400TJ
Natural gas consumption	104,300TJ
Heavy oil consumption	21,400TJ
Overall CO_2 emission from the Power Station	7,460 thousand tCO_2
CO_2 emission of the Power Station (with the CCPP)	
Power generation of the CCPP	2,800 GWh
Power generation of existing plants	8,970 GWh : 32,300 TJ
Heat supply of existing plants	254,000 Gcal
Natural gas consumption	80,100 TJ
Heavy oil consumption	16,400 TJ
Overall CO_2 emission from the Power Station	6,720 thousand tCO_2
CO_2 emission reduction	740 thousand tCO_2

F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts

Environmental Impact Assessment (EIA) focusing on the new power plant (the CCPP) introduction of the Tashkent Thermal Power Plant Modernisation Project was conducted in November 2002 by Teploelektroproekt. This EIA report has been approved by the Chairman of State Committee for Nature Protection of the Republic of Uzbekistan in March 2003. (See attached EIA report for the assessment result.)

F.2. If impacts are considered significant by the project participants or the host Party:

The environmental impacts are considered by the project participants as follows: The environmental impacts of the CCPP during the construction for its installation and operation has been assessed. The proposed CCPP has adopted the latest clean and high energy-efficient technology, including a number of environmental adverse impact mitigation measures. The results of the assessment have shown that none of technological impacts caused by the CCPP installation and operation are significant and the project contributes to the improvement in environmental aspects.

In the environmental impact assessment, followings have been referred.

- Uzbekistan Environmental Standards
- Standards of State Committee for Nature Protection of the Republic of Uzbekistan
- WHO Air Quality Guidelines
- EU Standards (under framework directive on ambient air quality assessment and management, 96/62/EC)
- World Bank standards "Thermal Power: Guidelines for New Plants", 1998

G. Stakeholders comments

G.1. Brief description of the process on how comments by local stakeholders have been invited and compiled:

The public hearing will be carried out in order of following stages.

Stage 1. Informing organisations concerned of the public hearing

EIA designer ("Teploelektroproekt"); EIA customer ("Uzbekenergo"); representatives of the Power Station, local authorities, mahalla committees, TEPSCO, population have been informed about terms of implementation of public hearing - till June 10, 2003.

Stage 2. Providing project information with residents and informing them of public hearing

The deadline of the second stage was June 18, 2003. A summary of results of EIA in regard to modernisation of the Power Station has been prepared, which included the information about a possibility of familiarisation with EIA materials in detail at the Power Station's office and mahalla committee's office from June 20 - 25 (EIA report has been exposed to attention of all interested persons on June 8, 2003, that is, in advance). The summary contained also a request to the inhabitants to express their opinions about given information. Two hundred original copies of the summary in Uzbek and Russian languages have been distributed among the inhabitants.

Stage 3. Questioning and public hearing

A preliminary questioning of population has been conducted, as well as, collection of opinions about results of familiarisation with EIA report; this activity has been carried out by own forces of Teploelektroproekt and the Power Station; a general meeting of participants of public hearing has been held on at the Power Station 's conference hall. The conference-hall had been chosen big enough to accept 60-70 men.

Stage 4. Deciding how to comply with opinions

Refer to G.3. below.

G.2. Summary of the comments received:

At the meeting, there were asked questions about noise impact of CCPP, emergency cases, environmental problems related to operation of CCPP. The EIA report designers gave a full and comprehensive answer on each question. Data on environmental status before the modernisation and after it have been presented to the participants. Executors of EIA report and the Power Station managerial staff explained about the project in order to obtain people's comprehension at the meeting, to give the participants a possibility to weigh all "for and against" modernisation. It's important to note that an analysis of possible emergency cases has been conducted and a degree of the risk of their appearance and measures on prevention of consequences have been discussed. Analysis of the "questioning" and generalisation of public hearing results showed up lack of conflict with population in relation to modernisation of the Power Station and introduction of CCPP. People expressed positive opinions in regard to project realisation. For the detail of public hearing, refer to the EIA report.

G.3. Report on how due account was taken of any comments received:

It has been assumed not necessary to take any particular counter measures for the comments received through the public hearing.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	**State Joint Stock Company (SJSC) Uzbekenergo**
Street/P.O.Box:	6, Khorezmskaya Str., ,
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State/Region:	----
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E-Mail:	N/A
URL:	N/A
Represented by:	
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Organization:	**Tashkent Thermal Power Plant (of SJSC Uzbekenergo)**
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Building:	----
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State/Region:	Tashkent Region
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Represented by:	
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Organization:	**Tokyo Electric Power Services Co., Ltd.**
Street/P.O.Box:	3-3 Higashi-Ueno 3-Chome
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Direct tel:	N/A
Personal E-Mail:	K_mikata@tepsco.co.jp

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Construction of a new building for the CCPP, procurement and installation of the CCPP system and other tasks related to the project implementation will require the fund of 220 million US$. Of this fund eighty-five percentage (85%) of the fund for the project implementation will be supplied by Jana Bank for International Cooperation (JBIC) through its loan scheme (Loan agreement was made in March 2002 with interest rate of 0.75% and 40 year repayment period (with 10 year grace period). And lest of it (15%) is to be provided by the Uzbekenergo.

Annex 3

NEW BASELINE METHODOLOGY

1. Title of the proposed methodology:

"GHG Emission of Thermal Power Plant"

2. Description of the methodology:

2.1. General approach

- ■ Existing actual or historical emissions, as applicable;
- □ Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
- □ The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.

2.2. Overall description (other characteristics of the approach):

The baseline GHG emission is defined as CO_2 emission of existing plants if these plants generate equal amount of power that the CCPP actually generates. In estimating the baseline CO_2 emission before actual CCPP installation, the planned power generation is used. This planned power generation is provided in the future plan developed by the Uzbekenergo.

3. Key parameters/assumptions (including emission factors and activity levels), and data sources considered and used:

Key parameters/assumptions (After the CCPP being in actual operation)

Key parameters	Value
For the CCPP	
Power generation	Actual power generation of the CCPP
Natural gas consumption	Actual natural gas consumption of the CCPP
LHV of fuel consumed	Actual LHV
For the baseline	
Power generation 1	Actual power generation of existing plants
Power generation 2	Actual power generation of the CCPP
Natural gas consumption	Actual natural gas consumption of existing plants
Heavy oil consumption	Actual heavy oil consumption of existing plants
LHV of fuel consumed	LHV of actual fuels
From IPCC guideline	
Carbon emission factor of natural gas (t C/TJ)	15.3
Share of oxidised carbon of natural gas	0.995
Carbon emission factor of heavy oil (t C/TJ)	21.1
Share of oxidised carbon of heavy oil gas	0.99
Conversion factor to carbon dioxide	44/12

Key parameters/assumptions in "ESTIMATION"

Key parameters	Value
For the baseline of CO_2 emission calculation	
Power generation	11,770GWh (planned by the Uzbekenrgo)
Heat supply	Calculated based on reference year's performance
Natural gas consumption	
Heavy oil consumption	
LHV of the reference fuel	29.31
For the CCPP	
Power generation capacity	376MW
Rate of operation	0.85
Thermal efficiency	56.7
Power generation	2,800GWh
LHV of the reference fuel	29.31
For existing plants (operated with the CCPP)	
Power generation	11,770 – 2,800 GWh
Heat supply	Calculated based on reference year's performance
Natural gas consumption	
Heavy oil consumption	
Thermal efficiency	34.55
LHV of the reference fuel	29.31
From IPCC guideline	
Carbon emission factor of natural gas (t C/TJ)	15.3
Share of oxidised carbon of natural gas	0.995
Carbon emission factor of heavy oil (t C/TJ)	21.1
Share of oxidised carbon of heavy oil gas	0.99
Conversion factor to carbon dioxide	44/12

4. Definition of the project boundary related to the baseline methodology:

From the Power Station operation point of view, a chain of process can be divided into two major spheres. One is procurement of fuels from outside, and another is consumption of fuels in power and heat generation. This severance can be justified from a standpoint of the Power Station management as well. And also, a large part of CO_2 emission (more than 99 % of aggregate GHG emission of the project activity) comes out from the power plants and a small part of the emission (less than 1%) comes out from leakage of the pipeline and heavy oil transportation. Thus, the project boundary of the baseline methodology is drawn between inside of the Power Station and outside of the Power Station, as below illustration..

	Inside of the boundary	Project boundary	Outside of the boundary
	Plant operation •CCPP: •Existing plants		Fuels procurement •Gas pipeline •Heavy oil transportation
Total GHG emission	CO_2 emission by: •Power generation •Heat generation		GHG emission from: •Leakage of gas pipeline •Fuel consumption in heavy oil transportation
(=100%)	(> 99%)		(<1%)

5. Assessment of uncertainties:

The followings describe a matter of uncertainty in relation to GHG emission from the Power Station and how it is dealt in the methodology.

- CO_2 emission from the Power Station is difficult to measure practically, therefore it is estimated by the calculation based on the fuel consumption. Thus, there would be some differences between actual and estimation.

- Leakage outside of the project boundary is difficult to measure, and it is excluded from the methodology. However, its amount is very small. It is estimated less than 1% of aggregate CO_2 emission of the Power Station. Thus, it has little impact on the project activity in terms of GHG emission.

6. Description of how the baseline methodology addresses the calculation of baseline emissions and the determination of project additionality:

The methodology has two ways in approach to CO_2 emission calculations as follows.

- Estimation of CO_2 emission of the Power Station before the CCPP in actual operation
- Monitoring of CO_2 emission when the CCPP is in operation.

The difference in terms of approach to CO_2 emission calculation between the two above is the data to start calculation of CO_2 emission. In "ESTIMATION", CO_2 emission is calculated from planned power generation amount, on the other hand, in "Monitoring", it is to be calculated from actual fuels consumption with the following formulas. (refer to "B.1. Baseline Methodology" and "E. Calculation of GHG emissions by sources")

Project additionality

The CCPP has higher thermal efficiency (56.7) than existing plants (34.55; which is determined with the Power Station's actual performance in year 2001). This means that the CCPP generates more electric power than existing plants at the same amount of fuel, and the CCPP consumes less amount of fuels compared with that of existing plants in generating the same amount of power. Thus, introduction of the CCPP is an additional measure in terms of CO_2 emissions reduction.

7. Description of how the baseline methodology addresses any potential leakage of the project activity:

The project boundary is drawn between the Power Station, which is defined as "within the project boundary", and outside of the Power Station, which is defined as "outside of the project boundary". And the methodology focuses on the emission "within the project boundary" for the following reasons.

- GHG emission amount is less than 1% of the total emission of the Power Station.
- It is difficult to measure.
- Including GHG emission of outside of the project boundary has a positive effect on the GHG emission reduction.

8. Criteria used in developing the proposed baseline methodology, including an explanation of how the baseline methodology was developed in a transparent and conservative manner:

The baseline methodology is developed on the following principles.

- Information and data used in the methodology shall consistency with the engineering study results.
- Formulas of calculation shall be of commonly acceptable and well known.
- As much as possible, well and commonly known coefficients, such as coefficients defined in IPCC guideline, shall be applied in the methodology.
- All estimations shall be grounded by actual operation data of the past years and planned operational data.

9. Assessment of strengths and weaknesses of the baseline methodology:

The methodology of "GHG Emission of the Thermal Power Plant" has the following strengths and weaknesses.

Potential strengths

- CO_2 emission is easily calculated because that it is calculated from the fuel consumption, which is monitored every day at the Power Station.
- Sources of all values are clear and well grounded.
- Formula of calculating CO_2 emission and its reduction is simple.

Weaknesses

- In the method, CO_2 emission is determined by the calculation based on the fuels consumption, not by measuring its actual discharge to the air, and result of the calculation would have a gap from the actual emission.
- In terms of GHG emission outside of the project boundary, it is bypassed due to the difficulty to measure it and its small amount (It is estimated less than 1% of the aggregate CO_2 emission by power and heat generation of the Power Station.

10. Other considerations, such as a description of how national and/or sectoral policies and circumstances have been taken into account:

In developing the methodology, the followings are taken into accounts.

- Uzbekistan has established the environment standards and regulations on pollutant emission into the air (such as Nitrogen dioxide, Nitrogen oxide, Sulphur dioxide, Carbon oxide, etc.; emission of CO_2 is not included), and on waste-water, solid-waste, noise and other hazardous substances discharge.

- The Power Station is an entity who shall report the authorities discharging pollutant substances. And to examine pollutant substances discharged into the air and river, the Power Station has a laboratory in the Power Station premises. However, the Power Station has not examined CO_2 yet and it has no procedures about CO_2 emission examination and its amount calculation.

- Uzbekistan also declared to make effort for mitigating climate change, and in line with this policy, and makes various projects as much as gentle to the environment. However, Uzbekistan has not provided laws, regulations and guidelines specifically for CDM projects from no CDM projects in Uzbekistan up to the present.

Annex 4

NEW MONITORING METHODOLOGY

1. Brief description of new methodology

The monitoring methodology, "Monitoring GHG Emission of Tashkent Thermal Power Plants", covers followings for calculation of CO_2 emission of the power plants.

Monitoring methodology includes:

- List of all data necessary to be monitored, recorded and archived
- Monitoring schedule
- Monitoring in-charge
- Monitoring procedure

Monitoring procedure

Following monitoring procedure is presently employed by the Power Station operation. Monitoring of CO_2 emission is to be included in this procedure.

- Daily data collection, recording and reporting ---- During plants operation, power and heat generation and fuels consumption are monitored with monitoring device by plant operators under Central Control Room of the Power Station. Power and heat generation and fuel consumption of each plant is recorded on the Daily Plan Operation Journal. In terms of power generation, amount of output is recorded every two hours, and it is reported to Central Distribution Office in the Uzbekenergo every daily for managing the power supply.
- Monthly reporting ---- Every month, monthly amount of power generation, heat generation and fuel consumption of each plant are recorded on the Monthly Report.
- Quarterly reporting ---- Every quarter of the year, quarterly amount of power generation, heat generation and fuel consumption of each plant are recorded on the Quarterly Report.
- Yearly reporting ---- Every year, yearly amount of power generation, heat generation and fuel consumption of each plant are recorded on the Yearly Report.
- Reporting ---- All documents above are a subject to submit to the Uzbekenergo. In addition, every quarter amount of power and heat generation is reported by the Power Station to regional and district branches of the Statistic Office of the Government.

Report to State Committee for Nature Protection of RU

In addition to monitoring power and heat generation and fuels consumption, CO, SO, P_2O_5, NO_X, dust and wastewater are examined by the laboratory of the Power Station two times a week. The result of these examinations is reported monthly to the Uzbekenergo and State Committee for Nature Protection of the Republic of Uzbekistan.

2. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived

ID number	Data type	Data variable	Data unit	Measured (M), calculated (C) or estimated (E)	Recording frequency	Proportion of data to be monitored	Data archive	Period to be archived	Comment
2.1	Power generation	Value	KWh	M	Daily	Of each plant	Paper	10 years	
2.2	Natural gas consumption	Value	Nm^3	M	Daily	Of each plant	Paper	10 years	
2.3	Heavy oil consumption	Value	Kg	M	Daily	Of each plant	Paper	10 years	
2.4	Natural gas LHV	Value	J/m^3	From supplier	On procurement	Of each natural gas	paper	10 years	
2.5	Heavy oil LHV	Value	J/kg	From supplier	On procurement	Of each heavy oil	paper	10 years	
2.6	Baseline CO_2 emission	Value	tCO_2	C	Yearly	Total	Paper	10 years	
2.7	CO_2 emission of the CCPP	Value	tCO_2	C	Yearly	Total	paper	10 years	
2.8	CO_2 emission reduction	Value	tCO_2	C	Yearly	Total	paper	10 years	

3. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources

In addition to CO_2 emission from the Power Station, methane leaked for the gas pipeline is to be taken into account as GHG emission. However, it is difficult to measure and its mount is rather small comparing to the CO_2 emission. Thus, it is neglected in the GHG emission calculation.

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

4. Assumptions used in elaborating the new methodology:

In the methodology, all data for estimating CO_2 emission are measurable, able to calculate or well grounded.

5. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored.

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline of QA/QC procedures
2.1	Low	Yes	The procedure of monitoring, recording and archiving has been established as a formal administrative system of the Power Station.
2.2	Low	Yes	
2.3	Low	Yes	
2.4	Low	Yes	
2.5	Low	Yes	
2.6	Low	Yes	To be included in the administrative system of the Power Station.
2.7	Low	Yes	
2.8	Low	Yes	

6. What are the potential strengths and weaknesses of this methodology?

Potential strengths

- Monitoring procedure and data to be monitored are simple and clearly defined.
- Monitoring data is easily and accurately collected, because that power generation and fuel consumption of each power plant (These data is essential for the power plant operation.) are being recorded on daily bases by the plant operators.
- Procedure with which monitoring is to be carried out has been developed and employed in the Power Station operation for many years. Thus, CO_2 emission monitoring to be included in it can be easily and clearly understood.

Weakness

- CO_2 emission is to be estimated/calculated based on power generation and fuels consumption, not directly monitored.

7. Has the methodology been applied successfully elsewhere and, if so, in which circumstances?

It is the first case to apply this methodology in determination of CO_2 emission and reduction.

ANNEX 5

TABLE: BASELINE DATA

(When the CCPP is actually in operation.)

Items	Values
Baseline CO_2 emission	
Power generation of existing plants	Actual
Power generation of the CCPP	Actual
Natural gas consumption of existing plants	Actual
Heavy oil consumption of existing plants	Actual
Natural gas consumption of the CCPP	Actual
CO_2 emission of existing plants (from natural gas consumption)	To be calculated
CO_2 emission of existing plants (from heavy oil consumption)	To be calculated
CO_2 emission of existing plants, assuming these plants generate the same amount of power generated by the CCPP	To be calculated
CO_2 emission of the CCPP	To be calculated
CO_2 emission reduction	To be calculated

TABLE: BASELINE DATA in "ESTIMATION"

(Planned for 2003 and further)

Items	Values
Baseline CO_2 emission of the Power Station (without the CCPP)	
Power generation	11,770GWh (= 42,400TJ)
Heat supply	254,000Gcal
Natural gas consumption	104,300TJ
Heavy oil consumption	21,200TJ
Overall CO_2 emission from the Power Station	7,460 thousand tCO_2
CO_2 emission of the Power Station (with the CCPP)	
Power generation of the CCPP	2,800GWh
Power generation of existing plants	8,970GWh (= 32,300 TJ)
Heat supply of existing plants	254,000Gcal
Natural gas consumption by the CCPP	17,800TJ
Natural gas consumed by existing plants	80,100TJ
Heavy oil consumption of existing plants	16,400TJ
Overall CO_2 emission from the Power Station	6,720 thousand tCO_2
CO_2 emission reduction	740 thousand tCO_2

5. Baseline Study Report

Tashkent Thermal Power Plant Modernization Project

Baseline Study Report

November 2003

CONTENTS

1. Energy Sector Outlook

In Uzbekistan, natural gas consumption has a tendency to increase while the consumption of oil and coal decreasing. In 1997, natural gas and oil hold, in terms of consumption ratio, 80% and 15.8% respectively, and ratios of coal and electric power are 2.1% and 1.3%. As for sectorial ratio of energy consumption, 37.8% of total energy is consumed by household, and 24.3% by electric power, 11.4% by municipal economy & others, 10.7% by industry, 9.0% by transportation, 6.0% by agriculture, and 0.8% by construction. It would be highlighted that energy consumption by house households is expanding, on the other hand, that of industry hovers low. In terms of total amount of energy consumed, it increased by 18% between year 1990 and 1997 while GDP declined, and this would tell that efficiency in energy consumption fell down largely due to slow of economy of Uzbekistan and neighboring countries, economic and social infrastructure impoverishment, obsolete facility and technology and unconsciousness of energy saving.

Energy Consumption in Uzbekistan

	1990	1997
Primary Energy Consumption		
Gas	63.6%	80.8%
Coal	7.7%	2.1%
Oil	27.8%	15.8%
Electric power	0.9%	1.3%
Energy Consumption by Economic Sector		
Municipal economy & others	7.7%	11.4%
Household	16.1%	37.8%
Agriculture	7.3%	6.0%
Transport	17.7%	9.0%
Construction	1.6%	0.8%
Industry	18.3%	10.7%
Power sector	31.3%	24.3%

Source: Initial Communication of the Uzbekistan under UNFCCC

Energy resources

Natural-gas

Among CIS countries, Uzbekistan is a sole county, which increased natural-gas production after the independence. By developing natural-gas fields, Uzbekistan has become of a world higher rank in terms of natural-gas production. As a natural-gas rich country, Uzbekistan government is promoting use of it for self-sufficient in terms of energy supply in the country. On the other hand, increase of consumption of natural-gas is making its export decrease.

Oil

Among CIS countries, Uzbekistan is a sole county, which increased oil production after its independence. And it has become a self-sufficient country in terms of oil. However, it imports refined oil due to the oil produced in the country is sulfuric.
Oil production volume accounts for only 15.8% (year 1997) of all energy in the country due to increase of natural gas consumption.

Coal

Coal reserves in Uzbekistan are located in specific areas, such as in Angren region producing about 2.4million ton annually. Recently, coal-mining operation has been improved with modern equipment, however, coal accounts for only 2.1% (year 1997) of all energy consumption in the country due to increase of natural gas consumption.

Electric Power

In Uzbekistan, power industry was developed for a long time with constructions of hydropower plants. Consequently, about 50% of Uzbekistan's aggregate power generation was of hydropower plants in 1960. However, thermal power plants having been constructed, percentage of thermal power generation in Uzbekistan is about 90 % (including power generation by heat supply stations) in 2002.

Though some enterprises have power plants of their own, Energo (former Ministry of Power Industry & Electrification) possesses about 97% of power plants and whole transmission and distribution lines in Uzbekistan.

Construction of large scale thermal power plants were started with natural gas field development in 1960s. For 20 years from 1961 to 1980, capacity of power plants was expanded drastically to 68% of present power generation capacity. Refer to the Table : Power Plants in Uzbekistan for present power plants (and plants' capacity and power generation) in Uzbekistan.

Power Plants in Uzbekistan

Power Plant	Year of Commission	Fuel or River	Name Plate Capacity (MW)	Present Capacity (MW)	Generation 2001 (MWh)	Generation 2002 (MWh)
Thermal Power Stations						
Angren	1953	Coal	272	200	581,853	549,624
Novo-Angren	1961	Gas-Coal	2,340	1,750	7,881,617	7,674,334
Navoi	1962	Gas-Oil	1,500	1,000	6,823,619	5,935,548
Takhiatash	1962-1974	Gas-Oil	1,000	770	2,933,419	2,936,411
Tashkent	1963-1971	Gas-Oil	2,230	1,770	10,502,719	10,315,266
Syrdaya	1972-1981	Gas-Oil	3,000	2,340	12,477,762	13,148,310
Talimardjan	(2003)	Gas-Oil	(800)	(800)		
Thermal Power Station Total			10342	7830	41,200,989	40,559,493
Heat Stations						
Fergan		Gas	330	330	668,177	685,676
Mubarek	1980	Gas	166	60	425,664	426,945
Tashkent	1967	Gas	90	30	150,070	175,494
Heat Station Total			586	420	1,243,911	1,288,115
Hydro Power Stations						
Charvak	1970	Chirchik	620	620	2,612,997	3,641,208
Khodzhikent	1978	Chirchik	165	165		
Gazalkent	1980	Chirchik	120	120		
Tavaksk	1941	Chirchik	72	73	996,987	1,129,033
Komsomolysk	1956	Chirchik	88	88		
Akkavask	1946	Chirchik	52	52		
Kubraisk		Chirchik			313,516	327,275
Kadyrynsk		Chirchik				
Saflarsk	1944	Chirchik	10			
Bozelesk		Chirchik			122,729	141,217
Sheikhantarck	1954	Chirchik	11			
Burdjarsk	1936	Chirchik	6			
Akmelinsk		Chirchik				
N-Bozsuyask No.1-6	1944-1959	Chirchik	54	54	187,596	237,912
Andudjan		Chirchik			59,107	50,412
Samarkand		Chirchik			61,849	47,842
Farkhand	1949	Chirchik	120	120	353,504	469,548
Hydro Power Station Total				1,419	4,708,285	6,044,447
Grand Total				9,669	47,153,185	47,892,055

Data source: UzbekEnergo

Demand for Electricity

Consumption of electricity in Uzbekistan dropped year by year (drop ratio: 14%) due to the slow activity of industries till 1995 after its independence. However, the tendency of consumption changed to increase by about 1.5% annually since 1996.

Electricity use in commercial is still falling and amounted to 50% of past biggest consumption. Regarding power consumption in industry, it also dropped to 36%, but since 1996 there has been an indication of recovery of consumption. Drops of electricity consumption in agriculture was relatively small, and it changed to increase since 1994 and the consumption exceeded the past largest in 1996. Electricity consumption in household is now having a temporary lull after drastic increase after the independence.

In Uzbekistan, power usage has a moderate peak in power usage in summer for irrigation pumps operation and winter season for heating. In a year, the lowest power usage is 60 - 70% against the highest. UzbekEnergo forecasts the increase of power consumption in 2010 by 30% against of 2000. Refer to attached "Table: Electricity Consumption in Uzbekistan".

Table: Electricity Consumption in Uzbekistan

In GWh

Year	Households	Industry	Agriculture	Commercial	Transport & Others	Total
1991	5,669	22,175	11,688	3,488	2,176	45,196
1992	6,356	19,953	10,977	3,269	1,773	42,328
1993	7,013	18,926	10,577	3,013	1,656	41,185
1994	7,134	16,382	11,175	2,845	1,630	39,166
1995	6,387	15,713	11,841	3,340	1,586	38,867
1996	6,651	15,500	12,709	2,982	1,624	39,466
1997	6,718	16,347	12,615	2,732	1,525	39,937
1998	6,313	15,790	14,759	2,040	1,520	40,422
1999	7,622	16,601	14,068	2,000	1,140	41,431
2000	5,493	19,143	14,209	2,000	660	41,505
2001	6,499	15,832	13,163	2,559	2,817	40,870
2002	7,120	17,400	15,000	3,250	2,830	45,600
2003	7,180	17,700	15,600	3,510	2,910	46,900
2004	7,240	18,000	16,000	3,740	3,120	48,100
2005	7,300	18,500	16,200	4,040	3,360	49,400
2006	7,340	18,900	16,300	4,260	3,500	50,300
2007	7,380	19,300	16,500	4,450	3,670	51,300
2008	7,420	19,700	16,600	4,690	3,790	52,200
2009	7,460	20,100	16,800	4,920	3,920	53,200
2010	7,500	20,600	17,000	5,050	3,950	54,100

Data source: UzbekEnergo

3. Project Overview

3.1 Project Name, Objectives and Background

This is Tashkent Thermal Power Plant Modernization Project, and it objectives and background are as follows.

Project objectives

Objectives of the project are as follows: increase of power generation capacity of Tashkent Thermal Power Station (hereinafter referred to the Power Station) for growing demand, its operation cost reduction together with increasing power generation stability, increase of thermal efficiency in power generation to contribute to the conservation of natural resources (such as natural gas and oil) and the mitigation of adverse impact on environment (by reducing CO_2 emission). For this purpose, it is planned to replace twelve (12) power plants of Tashkent Thermal Power Station with nine (9) modern high performance Combined Cycle Power Plants (CCPPs), and as the first stage of this improvement, it is planned to install one (1) CCPP, which shall be in operation late 2007. In addition to the objectives above, up-to-date-technical transfer is also sought with the project implementation.

Project background

The capital of the Republic of Uzbekistan, Tashkent has about 2.2 million population (about 9% of the country total), and it is of the zone of the highest energy consumption. For this important area, the Power Station produces electric energy. This station has now the capacity of 1,860MW, energy is being generated by twelve conventional power plants using natural gas and heavy oil as fuel. However, all units were constructed during the period from 1963 to 1971 and the 1^{st} unit has been operated for about 40 years. As the result, average annual utilization rate of these plants amounts to 70% and capacity amounts to 60%. On the other hand, the thermal efficiency of 34.55% (year 2001) is significantly lower than the latest plants (average efficiency of those plants is over 50%). In addition, superannuated plants come up with not only degradation of the output but also increasing costs of power generation and makes difficult to improve the operation rate.

3.2 Implementation Schedule

Schedule of the project implementation after contracting with EPC contractor is planned as follows. Contract with EPC contractor is to be made within the year 2003, and the CCPP is expected to commence operation late 2007.

PROJECT IMPLEMENTATION SCHEDULE

Tasks	Lapse of months
Civil and architectural designs	3
Foundation works for buildings and equipment	6
HRSG manufacturing, assembly and testing	16
Gas turbine, steam turbine and generator manufacturing, assembly and testing	19
Installation and test operation	26

Hand over and start operation	28

3.3 Project Service Area

The project aims mainly to supply electric power to Tashkent city which population is about 2.2 million accounting for 9% of national total.

3.4 Technology, Facilities and Operation

(1) Power generation facility to be installed

The project employs the CCPP for modernization of the Power Station. The CCPP adopting modern and ecologically clean technologies provides mitigation of adverse impacts to the environment and greater thermal efficiency that contributes to making GHG emissions lower per electricity compared to existing conventional type power plants. The CCPP is intended to produce heat for regional heat supply system during winter period in addition to electric energy generation. The CCPP is composed of the followings:

- Gas turbine;
- Heat recovery steam generator (HRSG);
- Steam turbine;
- Generators and own electric equipment;
- Gas compressor;
- Distributing equipment room;
- Additional equipment (feed pump, etc.);
- Fuel and water feeding equipment;
- Water intake and discharging equipment; and
- Gas turbine, steam turbine and control system building.

(2) Tashkent Thermal Power Station

Facilities

The Power Station has 12 conventional power plants using natural gas as main fuel and heavy diesel fuel as secondary. Total capacity of the power plants is 1,860 MW (each plant capacity is 150-160 MW). First plant was commissioned in 1963 and the last one in 1971. Eleventh (11^{th}) and 12th plants are designed for generation of 78 Gcal/hour of heat energy along with electric energy. Cooling water is taken from water intake canal being a diversion from the Bozsu canal streaming along the western boundary of the Power Station.

Fuel supply

Natural gas that is used as main fuel for power plants is supplied by the gas-pipeline to the Power Station from Bukhara and Shurtan. The supply capacity of Shurtan is enough to provide the operation of twelve existing plants at rated power. Even after completion of installation of the CCPP, its capacity to supply will be enough. Heavy oil being used as secondary fuel is stored in seven tanks (10,000 m^3) installed in the Southern part of the Power Station and is then supplied via six feed-tanks (5,000 m^3) located next to the power plants. Heavy oil is supplied from oil refineries via railway directly to the Power Station and is unloaded.

Power distribution

Distributing station is constructed in the Eastern part of the Power Station and overhead transmission lines are installed to the North: two lines 500 kV each, 7 lines - 220 kV each and 12 lines 110 kV each.

Plants operation

Tashkent Thermal Power Plants operate under relatively high availability factor as a power station with basic load. Though service factor of all units since commissioning amounted to 72.0%, the factor slightly varies from unit to unit among 12 units, namely: it is lower for unit No.5 (65.8%) and No.7 (66.9%) and higher for unit No.1 (78.8%) and No.2 (79.0%). The Power Station is operated and managed by personnel of 1,400 people headed by the Director. Four operation groups 50 people each conduct operational control of plants and these groups on four shifts basis operate power units. More than 700 people are assigned for maintenance and repair.

3.5 Project Site

The project site where a new CCPP is to be installed locates in Tashkent Thermal Power Station. Present condition of the Station is as follows.

Location

Tashkent Thermal Power Plant is located at about 10 km to the Northeast of the city of Tashkent and is one of the most important stations that supply heat and power to the city. It occupies an area of 2 km long from South to North and about 1 km wide from East to West with total area about 146 hectares.

Climate and land condition

The location of the territory is close to deserts (Karakum and Kyzlkum -- on the west of Tashkent) and foothills (Kuramin, Chatkal, Pskem, Ugam mountain ridges of western Tien-Shan Mountains -- on South, East and Northeast of Tashkent), and its climate condition is of sharp continental with significant variations of temperature in winter and summer. Average annual atmospheric temperature is equal to +14.85°C. Maximum is registered in July (+44.6 °C), and minimum in January (-14.2 °C).

In Tashkent, the amount of precipitation is rather low (annual average is 449.8mm). There is only one rain season, from October to May. Some snow can be observed from October to March. And, humidity is lower in summer (average humidity of July is 40%) and higher in winter (average humidity of December is 75%).

The Power Station is situated on the land elevation 501.5m from the sea level. The ground under the Power Station is composed of three geologic layers. First layer constitutes of clay (9 to 12m thickness) and silt stratum (some 2 to 3 layers of 2 to 3m sandy loam). Second layer is formed with 2 to 3m pebble stratum. And third layer has rather hard lime soil stratum starting from 15m below the surface. The altitude of the ground water level is between 497 and 499m.

4. Calculation of GHG Reduction by Project

Considering the background and condition of the project, GHG emission is calculated and the effect of GHG emission is discussed hereinafter. In discussion and determination of the project boundary and baseline scenario for calculating GHG emission, "Technical Procedures for CDM/JI Projects at the Planning Stage, Interim Report to Ministry of the Environment, Government of Japan, October 2001, Working Group on Baseline for CDM/JI Project" is referred. And it is done by following steps.

(1) Determination of effect of GHG emission

To determine effect of GHG emission by project direct and indirect activities.

↓

(2) Determination of the project boundary

To determine project boundary where the monitoring of project activities to be done.

↓

(3) Determination of the baseline scenario

To determine a scenario of baseline which is without the project.

↓

(4) Calculation of GHG emission by the project

To calculate amount of GHG emission by the project.

↓

(5) Calculation of GHG emission of the baseline

To calculate amount of GHG emission of the baseline.

↓

(6) Calculation of GHG emission reduction by the project

To calculate amount of GHG emission reduction by subtracting (4) above from (5).

4.1 Effect by GHG emission

Firstly, taking account of all activities related to power generation, the flowchart (Flowchart 1) on activities, which have effect of GHG emission, related to the project is developed. Direct effect and indirect effect are defined as follows:

Direct effect :

"Direct Effect" is defined as of GHG emission and/or sink by direct activities in achieving project objectives. "Direct Effect" is further broke up into "Direct Effect by Project Objectives" related to activities in achieving project objectives and "Other Direct Effect" caused by activities of the project implementor on its own initiative.

Indirect effect :

"Indirect Effect" is defined as what GHG emission and/or sink from relevant activities or phenomenon indirectly related to implementation process and/or outputs of the project. "Indirect Effect" is further broke up into "Indirect Effect by Project Objectives" related to activities in achieving project objectives and "Other Indirect Effect" caused by activities of the project implementor on its own initiative.

Secondly, activities to take account for the effect are classified in "Table 1 Selection of Activities related to Effect". In classification of activities, "Decision Tree A" for "Direct effect" and "Decision

Tree B" for "Indirect Effect are applied.

4.2 Project Boundary

Project boundary which includes project activities relating to the effect is determined as indicated in "Relations among Activities related to Project".

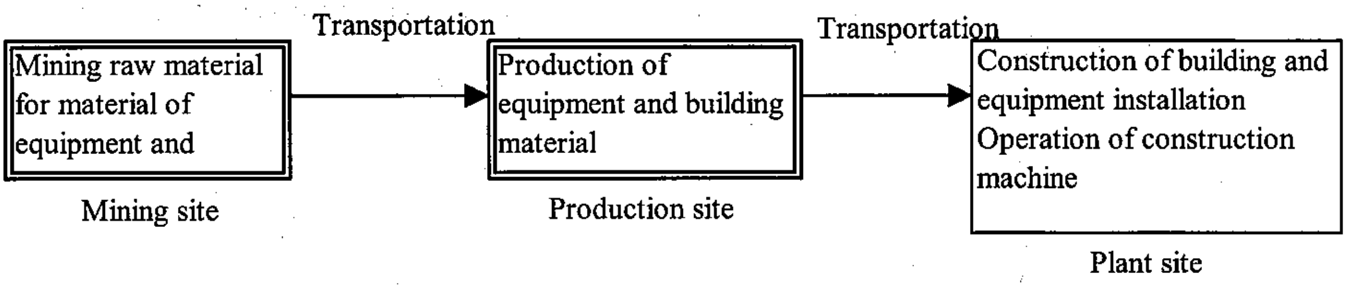
All activities in the power generation composed of fuel supply, power plant operation for power generation and power grid, including power loss in transmission/distribution have been taken into account in determining the project boundary. However, considering incompleteness in defining, data reliability, GHG emission effective rate, etc., the activities of power plant operation are taken up as the inside of the project boundary.

Project Boundary		
Include: ○ Exclude: ×	Activities	Reasons
×	Fuel supply (including leakage)	• GHG emission is negligible comparing whole GHG emission by the project operation(it is calculated about 0.7% of the whole). • Difficulty in accurate-data collection
○	Power plant operation	• GHG emission by the operation
×	Power grid (including loss of transmission and distribution)	• Difficult to identify ratio of the effect. • Effect is the same before and after project implementation.

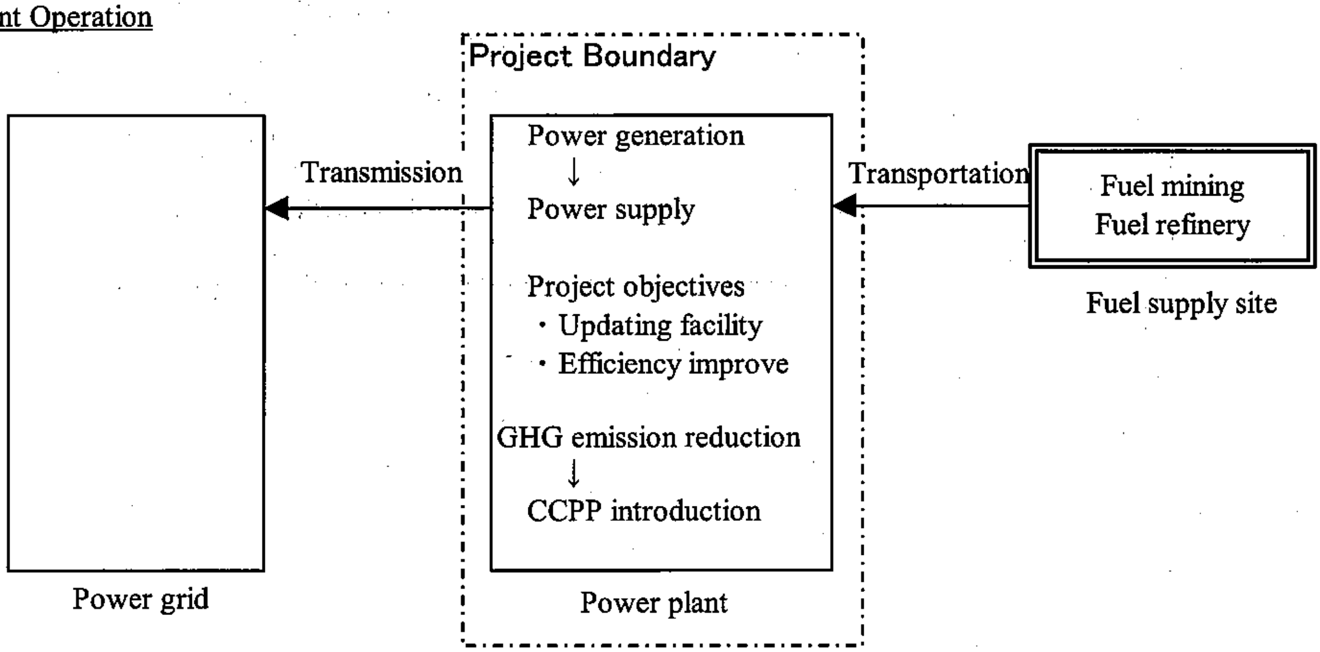
Relations among Activities related to Project

Tashkent Thermal Power Plant Modernization Project

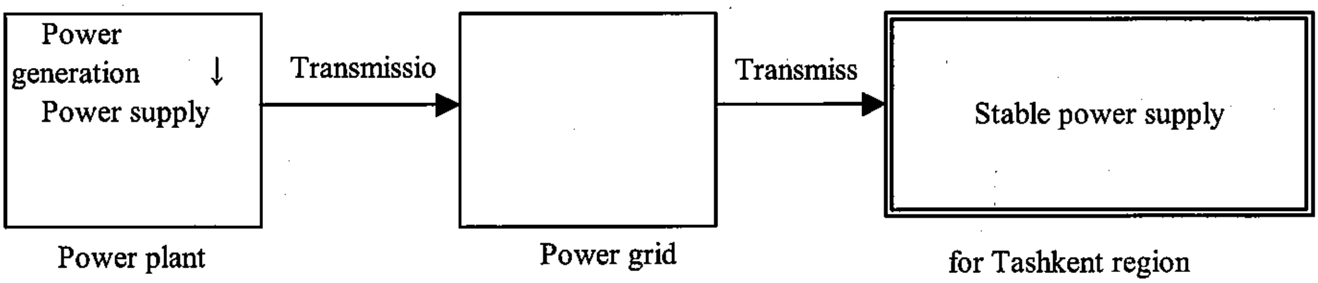
New Plant Construction



Plant Operation



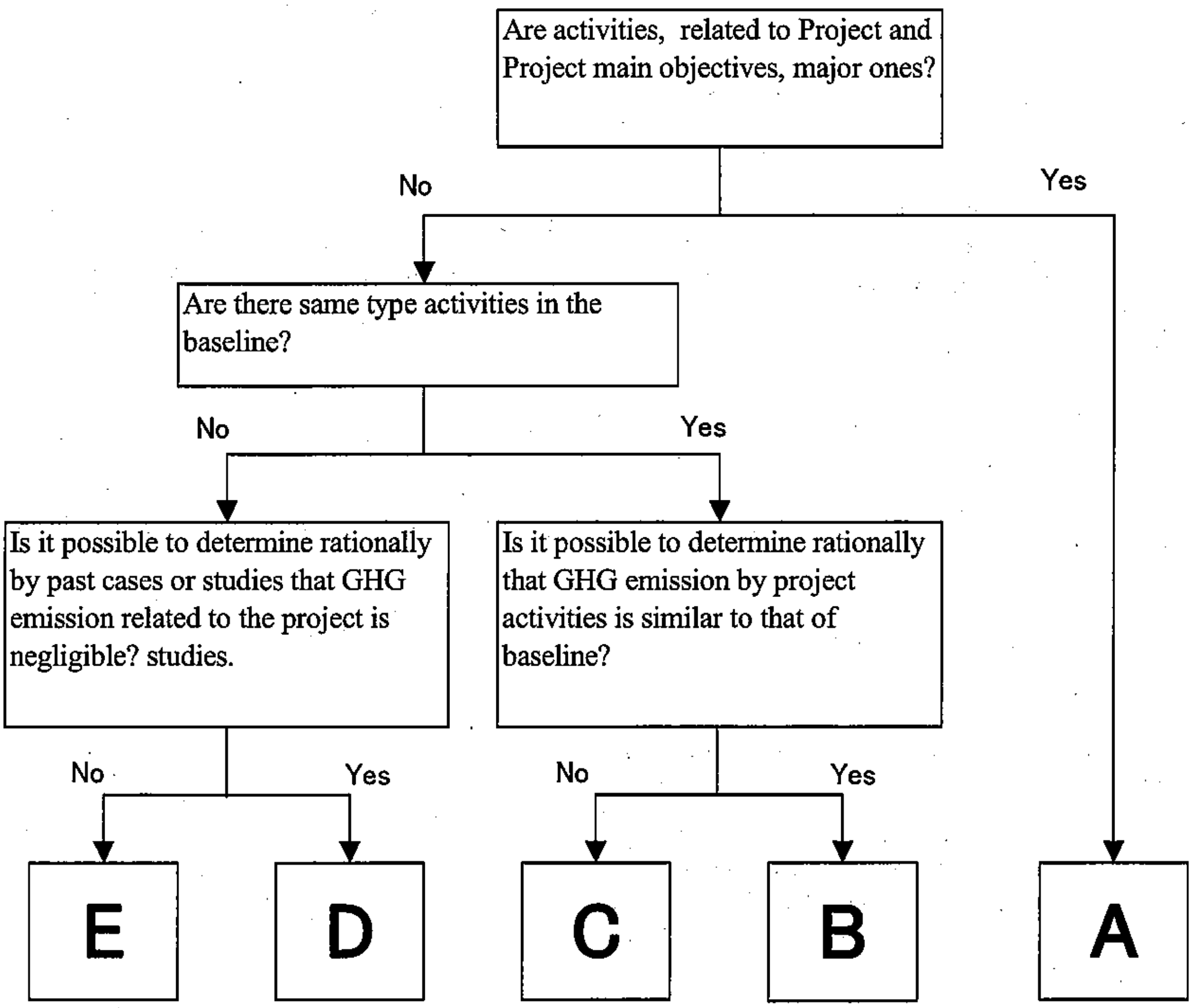
Power Supply



<Note>

▭ : Activities related to indirect effect

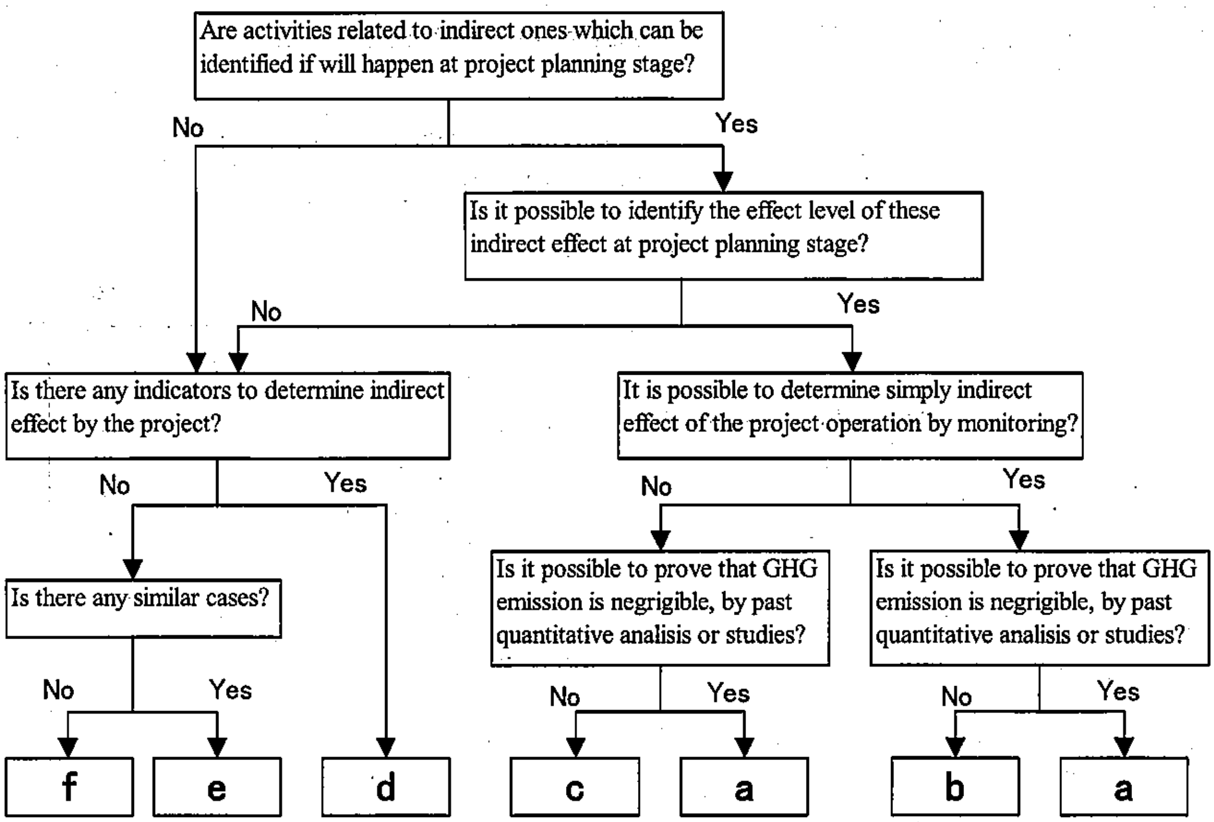
Decision Tree A: To determine Direct Effect of Project



Consideration on Direct Effect

Category	Consideration
A	Including all GHG emission of relevant direct effect of the project activity in calculation.
B	Not including in calculation of GHG emission related to relevant effect of project activity, while including it in the project boundary.
C	Including in calculation of GHG emission related to relevant effect of project activity as performed within the project boundary.
D	Excluding GHG emission from project boundary and calculation after making sure with documents and/or past cases of GHG emission of relevant direct effect that the GHG emission of direct effect is negligible comparing with whole volume.
E	Including in calculation of GHG emission related to relevant effect of project activity as performed within in the project boundary.

Decision Tree B: To determine Indirect Effect of Proiect



Consideration on Indirect Effect

Category	Consideration
a	Excluding GHG emission from project boundary and calculation after making sure with documents and/or past cases of GHG emission of relevant indirect effect that the GHG emission of direct effect is negligible comparing with whole volume.
b	Including relevant indirect effect of project activity in the project boundary, and calculating GHG emission of that effect. In addition, identifying items to monitor and recording actual GHG emission (and/or sink) through monitoring when the operation starts. The GHG emission monitored is applied to credit calculation.
c	Including relevant indirect effect of project activity in the project boundary, and applying ratio of GHG emission of that indirect effect (such as 10% of whole emission) as a subtracting-coefficient and as non-measurable to count to the credit calculation. This transaction shall be made based on past cases and/or documents on quantitative analysis.
d	Including relevant indirect effect of activities in the project boundary, and identifying indicators for determining if there is indirect effect or not. When indirect effect is clearly identified during or after project implementation operation, the same approach of "case c" above shall be made.
e	Not including relevant indirect effect of activities in the project boundary. However, relevant indirect effect together with a important note including the possibility, extent, etc. is to be documented referring to similar cases and shall be examined when credit is applied issuance.
f	Not including relevant indirect effect of activities in the project boundary, but reconsider it adopting this flow chart when recalculation of the baseline GHG emission for credit extension.

Table 1 Selection of Activities related to Effect

Effect	Item	Activities related to GHG emission, sink	Indicator of Activities	Category	Boundary (○／×)
Direct Effect					
By Main Objectives	Fuel consumption	Used in operation	Amount of fuel consumed	A	○
		Used in fuel transportation	Amount of fuel transported and transportation distance	A	○
	Fuel leakage	Leakage during transportation	Amount of fuel transported	A	○
Other Effect	Fuel consumption	Used in construction	Project size	D	×
		Used in conveying equipment and building material	Quantity of equipment and building material and distance from production site	D	×
	Power loss	Loss in transmission and distribution	Power generated and power supply area	B	×

Effect	Item	Activities related to GHG emission, sink	Indicator of Activities	Category	Boundary (○／×)
Indirect Effect					
By Main Objectives	Fuel consumption	Stable fuel price level by fuel surplus	Consumption of fuel Price and amount in fuel market	f	×
Other Effect	Fuel consumption	Mining and processing of equipment and building material	Quantity of raw material used in equipment and building material System of mining and processing	a	×
		Increasing of power usage in society and industry with stable power supply.	Increasing power generation for increasing power demand among society and industries.	f	×
	GHG emission reduction	More same type projects contributing GHG emission reduction.	Improvement of power generation technology of the host country. Applying modern technology.	f	×

4.3 Baseline Scenario

(1) Baseline determination in Marrakeshu Accord

In Marrakeshu Accord, technical conditions for baseline determination is stated as follows.

- Project participant shall chose the appropriate one from following methods when selecting baseline.
  - Existing or past actual emission
  - Emission by most attractive technology considering difficulty of investment.
  - Past five years' average emission of top 20% of the same type projects which is also in the same condition.

- Baseline shall be determined with consideration on expansion plan of power sector, possibility of fuel usage in the region, relevant national policy and circumstances.

- Baseline shall be determined by the conservative and transparent way in choosing approach, method, parameter, data source, key factor.

And credit period is also stated in the Marrakeshu Accord as follows.

- Regarding credit period, project participant is able to choose one of following alternatives.
  - Up to seven (7) years, and this crediting period can be renewed up to two times when assigned Operational Entity verifies and certifies the validity of the beginning baseline or the baseline updated with available data and reported it to CDM Executive Board.
  - Ten (10) years without extension of crediting period.

In Marrakeshu Accord, it is also stated that Executive Board shall develop the guidance for appropriate tool to be applied in baseline determination and monitoring method and advice COP/MOP.

- Guidance including usage of decision tree and other tools to guide selection work is to be developed for the purpose to make sure that most appropriate method is chosen.

(2) Conditions to take account

Taking account of Marrakeshu Accord, UzbekEnergo's power supply forecast up to 2010, arrangement of relevant regulations on power sector and information obtained through interview with parties concerned result, conditions to be considered in the baseline determination are listed as follows.

- New power plant implementation plan.
- Balance between power generation capacity and maximum power consumption, and possible power generation amount and maximum power demand.
- Natural gas production and gas pipeline construction.
- Oil production and modernization of oil refinery.
- Renewal energy (wind, sunlight) development.

(3) List up of baseline scenarios

It is stated in Marrakeshu Accord "In choosing a baseline methodology for a project activity, project participants shall select from among the following approaches the one deemed most appropriate for the project activity: Existing actual or historical emissions, as applicable; or Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment; or The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category."

Taking account of above statement and that the project aims modernization of Tashkent Thermal Power Station with CCPP for stable power supply and economical power generation. "Existing actual or historical emissions" is chosen as a guide for determining the baseline scenario.

In determining the baseline scenario, following three options are obtained by the Decision Tree. In Marrakeshu Accord, it is stated that Decision Tree is the tool to determine the proper baseline and it should be utilized in determining it. And option C is to be chosen as the baseline scenario for the project from the reason stated in the options.

Option A: All power generation plants in Uzbekistan

In Uzbekistan, there are three types of power generation plants consisting of thermal power plant, heat supply station and hydraulic power plant generating 84.7%, 2.7% and 12.6%, in year 2002, of total power production amount in Uzbekistan. So that electric power is generated mainly by the thermal power plant. Regarding the capacity of power plants, almost all plants are much aged (90% of hydraulic power plant aged over servicing period), and all of them seem not have enough to spare for other power plants. Therefore, average power generation of all plants connected to the national power grid not defined as the baseline.

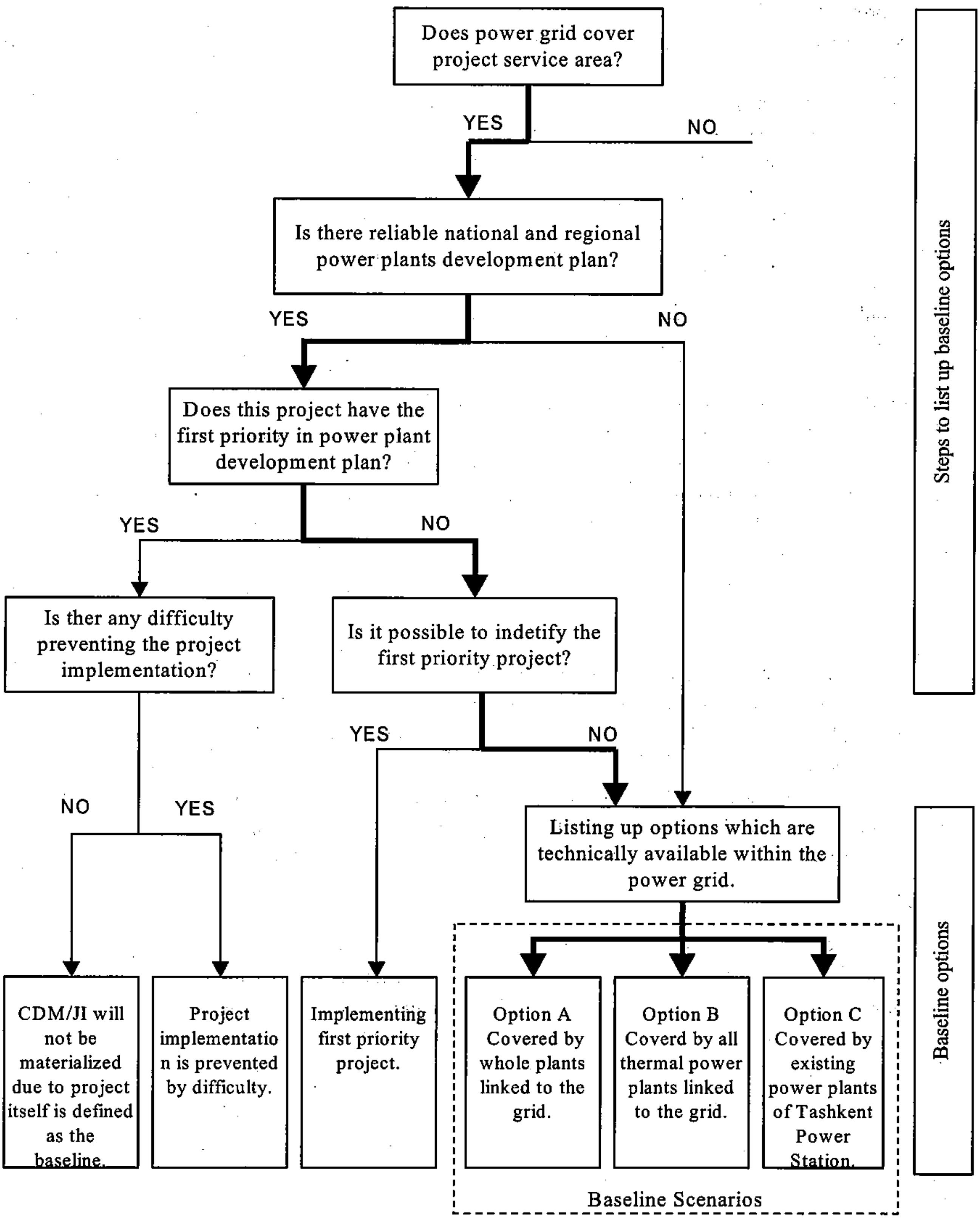
Option B: Power generation of whole thermal power plants in Uzbekistan

Almost all power plants of thermal power stations in Uzbekistan are linked to the national power grid and were in commission in 1960s. These plants equipped with steam turbines and heat supply facilities have low efficiency in terms of power generation against fuel consumption. It is discussed and planned to introduce CCPP at many plants from power generation efficiency and economic point of view. Average power generation efficiency of these power plant is equal or lower comparing with present plants in Tashkent Thermal Power Station, because of old plants. Therefore, this scenario is not adopted as the baseline.

Option C: Power generation of Tashkent Thermal Power Station

In Tashkent Thermal Power Station have twelve (12) power plants with steam-turbines and heat supply facilities. Though these plants can be continuously used for power generation, these are necessary to be replaced with new plant with modern technology for reliance of power generation and economical point of view. It has been discussed about replacement of these existing plants with new modern units, and this project, Tashkent Thermal Power Plant Modernization Project, is taken up as the first step for it. Therefore, it is considered rational to identify the power generation by existing plants as the baseline.

□ **Decision Tree C**



4.4 GHG Emission by Project

Option C of the scenario is selected as the baseline. And followings are calculation results of CO2 emission of the new plant when 2,800GWh is generated by CCPP a year.

	2008	2009	2010	2011	2012	2013	2014
GHG emission (tCO2) by CCPP	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000	6,720,000

4.5 GHG Emission of Baseline

Option C of the scenario is taken up as the baseline. And followings are calculation results of CO2 emission when 2,800GWh, which is to be generated by CCPP, is generated a year by existing plants.

	2008	2009	2010	2011	2012	2013	2014
GHG emission (tCO2) by existing plant	7,460,000	7,460,000	7,460,000	7,460,000	7,460,000	7,460,000	7,460,000

4.6 GHG Emission Reduction by Project

Following is calculation result of GHG emission reduction.

	2008	2009	2010	2011	2012	2013	2014
Reduction of GHG emission (tCO_2)	740,000	740,000	740,000	740,000	740,000	740,000	740,000

It is calculated that CO_2 emission reduction by the project is 740,000 tCO_2 a year and 5,180,000 tCO_2 と for seven (7) years.