

Consulting Services Report for Introducing High Energy  
Efficiency Facilities  
On  
Port Romano Power Plant Development Project  
In  
Republic of Albania

March 2010

Japan Consulting Institute

Hitachi, Ltd.

**KEIRIN**



This work was subsidized by Japan Keirin Association  
through its Promotion funds from KEIRIN RACE

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## Summary

### 1. Background and the project necessity

Republic of Albania (hereinafter Albania) is a small eastern-European country, suffering from serious electric power shortage. It covered by electricity import from the neighboring countries, which deteriorates Albania's fiscal conditions. Additionally, blackouts are still chronically planned in the provinces.

One of the major factors of this planned black outs is that hydro electric power generation facilities are disproportionately dominant (90% of total installed capacity in 2007) and that rainfall has been decreasing since 2006. Also, large hydro electric power plants are unevenly distributed in northern mountainous parts of the country, while demands are in central and southern coastal areas.

To solve the above-mentioned problems, best-mix of power sources is one of the solutions. In January – March 2009, Tokyo Electric Power Services Co., Ltd., Marubeni Corporation and Hitachi, Ltd. had implemented a preliminary study, subsidized by METI, on Port Romano Power Plant Development Project, building a new, 100MW – 200MW combined cycle power plant. This is a follow-up and additional study for the previous.

### 2. Outline of the project

<Project Site> (See Map)

- 30km West of Tirana
- Near by Port of Durres
- Within Port Romano Industrial and Energy Park

<Power Plant Features> (See Figure)

- 2 combined-cycle power blocks
  - TOTAL CAPACITY: 177MW (with Distillate Oil)
- Combined-Cycle Power Plant:
  - 2 on 1 configuration: 2 gas turbine generators, 2 HRSGs  
& 1 steam turbine generator  
( HRSG: Heat Recovery Steam Generator)
  - High Efficiency (44.0%, with Distillate Oil, LHV Base)

Map: Location of Port Romano



(Source: Study team)

Figure: Plant Performance (Design conditions, Gross basis)

Item	Unit	Distillate Oil	Natural Gas
Plant Output	kW	88,430 x2Blocks	91,710 x2Blocks
Gas Turbine Output	kW	30,680 x4	32,040 x4
Steam Turbine Output	kW	27,070 x2	27,630 x2
Efficiency (LHV)	%	44.0	45.5

(Source: Study team)

<Scope>

The scope of supply is to construct a new power plant of two (2) combined-cycle power blocks each comprising two (2) gas turbine generators, two (2) HRSGs and one (1) steam turbine generator. Fuel oil pipeline from the Porto Romano Industrial and Energy Park and 110kV single-line transmission to the

existing 110kV Porto Romano substation and related modification work are also included.

#### <Cost>

The project budget for power plant construction, price & physical contingencies, consulting services, and 6-year LTSA contract is totally estimated to be 403.03 million US dollar.

This project cost will be minimized to be 211.13 million US dollar for one-block CCPP (excl. LTSA contract) in case that there is some bilateral political issue to reduce the project cost.

#### <Schedule>

The construction period for two-block CCPP is expected to be 35 months from the EPC contract to the commercial operation.

### 3. Funding for the project

ODA (Yen) loans would be possible source of funding for the project. However, since (1) Japanese government provided Yen loan (totaling up to 11,121 million yen) to finance Greater Tirana Sewerage System Improvement Project in 2008 and Yen loans to Albania are not annually provided, and since (2) Albania's GNI per capita is increasing year by year and there is a possibility that Albania will be elevated to "Upper-Middle-Income Country" as early as FY2011, other sources (export credit, etc.) should be studied for early project materialization.

### 4. Benefits of introducing highly energy-efficient facilities

The main objective of the project is, first of all, solution of electricity shortage and, secondly, improvement of disproportion in electricity sources to northern hydro power plants.

The solution of electricity shortage will reduce electricity import from neighboring countries, which will alleviate fiscal burden of Albanian government.

The improvement of disproportion in electricity sources to northern hydro power plants will reduce scheduled and unscheduled blackouts.

The existing thermal power plants were all conventional (with steam generator). Most of them were built in 1960s and 1970s. The overall plant efficiency of the proposed combined cycle plant, which is inferior to that of larger one, goes far beyond that of the existing plants in Albania. The plant with high energy efficiency needs less fossil fuel, which means less emission of CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>, etc.

## 5. Conclusions and Recommendations

In Porto Romano there is another plan of constructing new power plant under 35 year BOT scheme by RWE of Germany and ENEL of Italy. The capacity is 800MW and the fuel is imported coal, according to the hearings during the site survey.

Some people within Albanian government insist that a 100MW – 200MW combined cycle power plant should be built as an extension of Vlore combined cycle, where the environmental impact assessment (EIA) has been finished but hearings to residents should still be held. There was another opinion that small hydro power plants were first priority for Albania. Finally these opinions were denied, but it seemed that consensus within the government regarding what was the first priority for them was necessary.

Another point is that the project cost should be limited to around 20 billion yen, which is the ceiling of Yen loans to Albania. It can be solved, for example, by dividing the contract into some phases, by unit etc. This idea can be put into execution as far as Albanian government is sure that the project is of top-priority and that it should be materialized by any means.

In conclusion, the key for the project realization is Albanian government's policy on the project. We, the study team, should be continuously appealing the merits of the project as specified in this report in order to gain their support.

## Chapter 1 Introduction

### 1.1 Background and the project necessity

Republic of Albania (hereinafter Albania) is a small eastern-European country, suffering from serious electric power shortage. In 2008, the electricity generation in Albania was 3,788GWh, while the consumption was 4,124GWh and the distribution losses were 2,139GWh. The gaps between the generation and the sum of consumption and losses were covered by electricity import, which was 2,475GWh. (See Graph 1)

The electricity purchase from the neighboring countries deteriorates Albania's fiscal conditions. Additionally, blackouts are still chronically planned in the provinces.

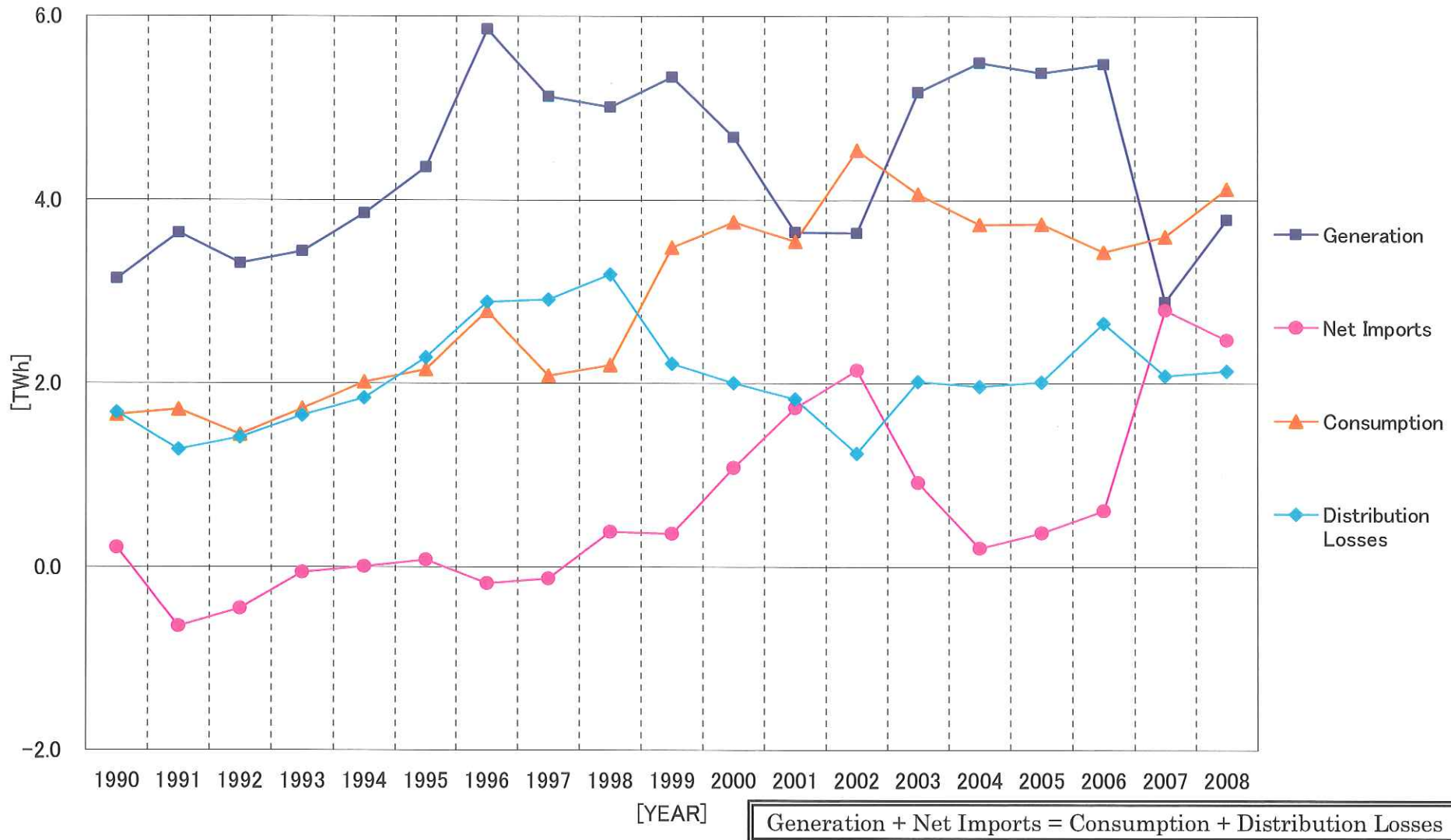
One of the major factors of this planned black outs is that hydro electric power generation facilities are disproportionately dominant (90% of total installed capacity in 2007, see Graph 2) and that rainfall has been decreasing since 2006. Also, only 12 MW thermal generation is in operation out of total installed capacity of 160MW, most of them are aged and obsolete and without environmental control system. In 2008 the electricity generated by thermal power plants was only 2% due to its low availability. (See Graph 3)

Moreover, large hydro electric power plants are unevenly distributed in northern mountainous parts of the country, while demand are in central and southern coastal areas, which may cause concurrently the overload to transmission system and this heavy load flow to central and southern areas could cause voltage drops.

To solve the above-mentioned problems, best-mix of power sources is one of the solutions. In other words, building thermal power plants in the central to southern coastal areas is to be recommended. As referred in detail later, many large power plants are planned mainly by large foreign electrical and industrial companies, but none of them (except for Vlore 100MW combined cycle) is materialized. Therefore, small to medium sized (100-200MW) plants are desirable, not only in terms of lead time for the electricity generation, but in terms of adequate load to the current transmission system.

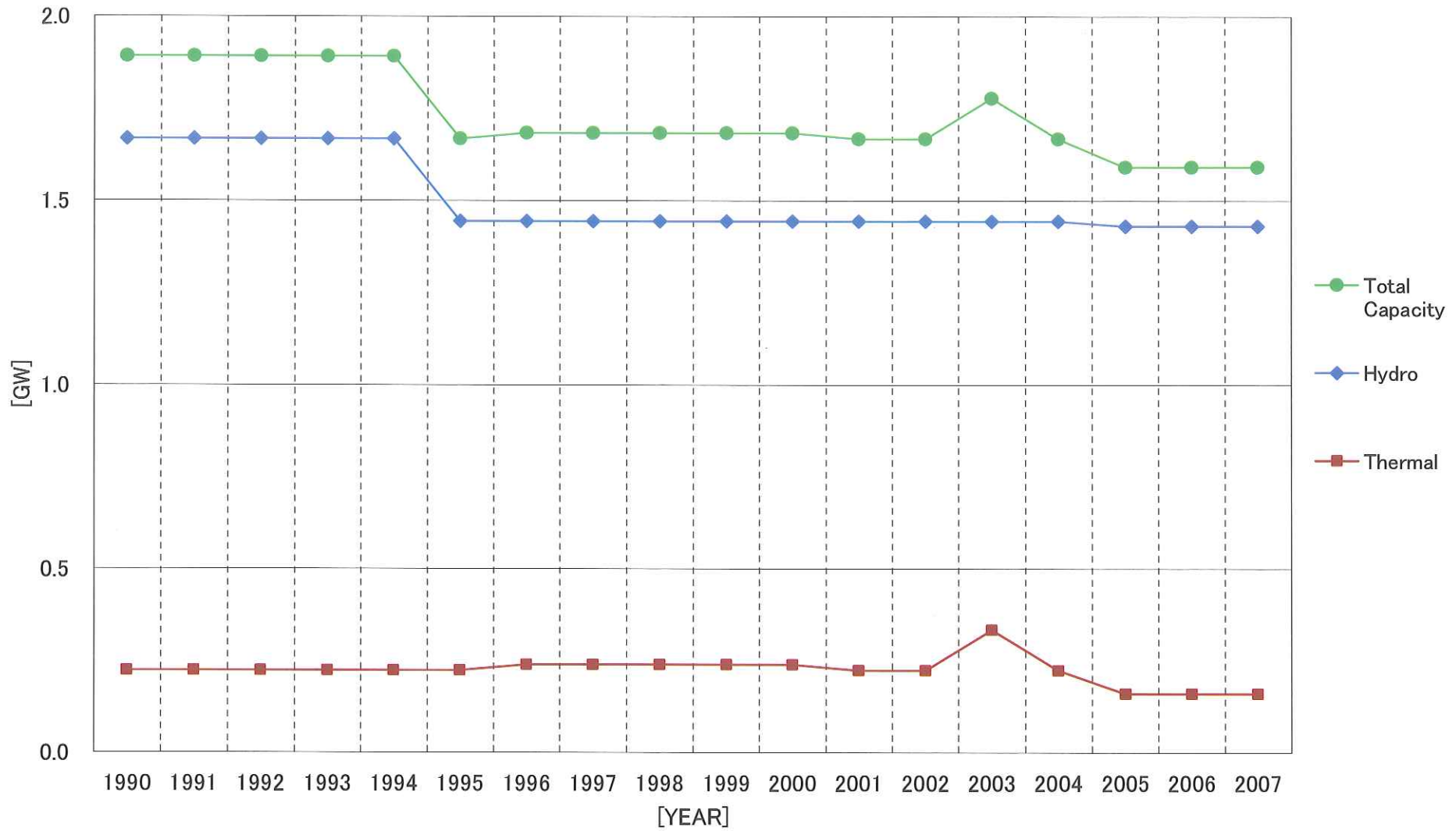
Therefore, in January – March 2009, Tokyo Electric Power Services Co.,

Ltd., Marubeni Corporation and Hitachi, Ltd. had implemented a preliminary study, subsidized by METI, on Port Romano Power Plant Development Project, building a new, 100MW – 200MW combined cycle power plant in Port Romano Industrial and Energy Park, near the port of Durres. This is a follow-up and additional study for the previous.



Graph 1: Electricity Supply and Demand in Albania

(Source: DOE/EIA International Energy Statistics <<http://www.eia.doe.gov/international/>>)



Graph 2: Electricity Generation Capacity by Source in Albania

(Source: DOE/EIA International Energy Statistics <<http://www.eia.doe.gov/international/>>)



Graph 3: Electricity Generation by Source in Albania

(Source: DOE/EIA International Energy Statistics <<http://www.eia.doe.gov/international/>>)

## 1.2 Purpose of the study

This study is to investigate the situation of Albanian power sector, to make optimal proposal to the situation and to verify the effectiveness of the proposal.

## 1.3 Scope of the study

To fulfill the purpose mentioned in the previous section, the study team conducted one-week Site survey to collect information from the related agencies in Albania. Preparation associated with the survey is also included in the scope of the study. Preparation of Study report (this report) is included in the scope, too.

## 1.4 Method and schedule of the study

### 1.4.1 Method of the study

The information of this study consists mainly of hearings from the related agencies in Albania during the site survey. Other information publicly distributed by the research institutes (EIA of DOE, etc.) on the web is also utilized in this report, if specified.

<Study team (Member)>

Name	In charge of	Belongs to
Seki, Jun	Leader	Senior Engineer, Overseas Thermal Power Business Development Department, Thermal System Development & Management Division, Thermal Systems Division, Power Systems, Hitachi, Ltd.
Sano, Toshiya	Funding	General Manager, Finance & Business Assistance Team Power Project & Infrastructure Administration Department Marubeni Corporation
Okano, Hideyuki	Circumstances	Group Manager / Mechanical Engineer, Mechanical No.2 Group, Overseas Thermal Power Engineering Department, Overseas Business Center Tokyo Electric Power Services Co., Ltd.

(Source: Study team)

1.4.2 Schedule of the study

<Overall schedule>

Oct-09	Nov-09	Dec-09	Jan-10	Feb-10
Preparation for site survey				
Site survey				
Analysis of information collected during survey	Preparation of report			
				Review of report

(Source: Study team)

<Site survey schedule>

No.	Day			AM/ PM	Itinerary, Meeting Schedule	Stay in
1	Oct	19	Mon	—	12:20 Narita - 17:35 Munich (LH 715), 21:30 Munich - 23:10 Tirana (LH3398)	Tirana, Albania
2	Oct	20	Tue	AM	<ul style="list-style-type: none"> <li>Ministry of Economy, Trade &amp; Energy (METE)</li> <li>JICA Tirana Office</li> </ul>	
				PM	<ul style="list-style-type: none"> <li>Albanian Power Corporation (KESH)</li> <li>UNDP Tirana Office</li> </ul>	
3	Oct	21	Wed	AM	<ul style="list-style-type: none"> <li>Power Policy Directorate, METE</li> </ul>	
				PM	<ul style="list-style-type: none"> <li>EUDB</li> <li>MOFA</li> <li>Prime Minister's Office</li> </ul>	
4	Oct	22	Thu	AM	11:35 Tirana - 13:00 Rome (AZ 585)	Rome, Italy
				PM	<ul style="list-style-type: none"> <li>Japanese Embassy in Rome</li> </ul>	
5	Oct	23	Fri	—	10:10 Rome - 12:10 Frankfurt (LH3841)* * Delayed by strike in airport	Frankfurt, Germany
6	Oct	24	Sat	—	13:55 Leave Frankfurt (LH 710, Seki & Sano) 20:45 Leave Frankfurt (NH210, Okano)	(Overnight flight)
7	Oct	25	Sun	—	7:50 Arrive in Narita (Seki & Sano) 15:00 Arrive in Narita (Okano)	

(Source: Study team)

## Chapter 2 Overview of Albania

### 1.1 Overview of Republic of Albania

- National flag:



- Dimensions: 28,700km<sup>2</sup> (1.5 times of Shikoku Island)
- Population: 3.2 million
- Capital city: Tirana
- Ethnogenesis: Albanian
- Official language: Albanian
- Religion: Muslim (70%), Albanian Orthodox (20%), Catholic (10%)
- Government: Parliamentary republic
  - President: Topi, Bamir (Democratic, 2007-2012)
  - Prime Minister: Berisha, Sali (Democratic, 2005-)
- GDP: USD 9.1 billion (2006, World Bank)
- GDP per capita: USD 2,960 (2006, World Bank)
- Growth rate: 5.5% (2006, EBRD)
- Currency: Lek (0.97Yen / Lek, Jan 2010)
- Geography:

Albania is positioned on the western edge of the Balkan Peninsula, having land borders with Greece in the south, Macedonia in the east, Montenegro to the northwest and Kosovo in the northeast, whose population is 90% Albanian. It also faces Italy across the Adriatic Sea (See Map 1).

Albania has rugged terrain, particularly in the north where the Dinaric Alps extend from Macedonia. In the west, low hills descend to the coastal plain, the most densely populated area and most of the country's arable land. The longest river is the Drin, which has three major hydro power plants extremely important for Albania's electricity production. Albania is subject to frequent earthquakes.

- History:

For hundreds of years, Albania was part of the Ottoman Empire and did not gain its independence until November 1912. It is Europe's only predominantly Muslim country.

Albania was formed as a communist state after World War II. First, it had diplomatic and trading relations with other communist states such as the Soviet Union and China, but in late 1970s remained isolated due to ideological disputes.

In 1990 the government ended the communist's political monopoly and national isolation trading policy. Although the Albanian government had struggled with democratization and transition to market economy, which were rewarded with positive growth for a while, the economy remained in fragile condition. Albanian economy again deteriorated in 1997, accompanied by the collapse of Ponzi-scheme investment organizations, which caused social unrest and political instability.

The economical and, latterly, social stabilization came back to Albania after accepting the structural adjustment facility by IMF and the World Bank, and other assistances by multinational financial agencies. In 2000s growth rate sustains 4 to 7%. Since 2005 Democratic Party has remained in power. In the 2009 parliamentary election Democrats remained a dominant party.

Albania joined NATO in 2009. Albania also signed Stabilization and Association Agreement in 2006 as a process to EU accession, which was ratified in 2009.



Map 1: Map of Albania

(Source: The University of Texas at Austin

<<http://www.lib.utexas.edu/maps/index.html>>

## 2.2 Electric Power Sector in Albania

Although the electric power sector in Albania was a monopoly market of Albanian Power Corporation (Korporata Energjitike Shqiptare, KESH), it was liberalized in 1996 based on EU directive. KESH was split into the generation, the transmission (KESH-Ost) and the distribution sectors and the generation and the distribution companies were privatized.

Since 2004 Fier thermal and several small hydro power plants have been sold to Greek investors.

European large utilities such as ENEL, EVN (Austria) and RWE have plans to build new power plants under BOO or BOT scheme. (See Table 1)

- Total installed capacity (2007): 1.592GW (Hydro 90%, Thermal 10%)
- Major power plants:
  - Hydro: Komani 150MW x 4, Fierza 125MW x 4, Vau I Dejes 50MW x 5
  - Thermal: Fier 160MW
- New power plant (under construction):  
Vlore 100MW combined cycle (Single-shaft, GT: Ansaldo V64.3)
- Tariffs (2008/09):
  - Residential (average) 8.23Lek/kWh
  - Low-voltage: 7.50 – 12Lek/kWh.
  - Medium-voltage: 7 – 10Lek/kWh  
(+ 1.13 - 1.40Lek/kWA for reactive power)
  - High-voltage:
    - \* KESH-connected customers : 7Lek/kWh  
(+ 1.05Lek/kWA for reactive power)
    - \* Customers with their own HV connections:5.2/kWh  
(+ 0.98Lek/kWA for reactive power)
  - Peak charge (for all categories): 9 – 11Lek/kWh
- Frequency: 50Hz

Table 1: New Power Plant Projects in Albania

No	Project name	Capacity	Owner	Status	Remarks
1	Vlore Combined Cycle	100MW	KESH (Loan by WB, EBRD & EIB)	Under commissioning (as of Oct 09) C/O: Nov 09, delayed from Mar 09	EPC: Marie Technimont, GT: Ansaldo V64.3, single-shaft C/C
2	Ashta Hydro	48MW x 2	EVN - Verbund Consortium	Concession Agreement (Jul 08) C/O in 2012	160MEuro, Hydro turbine: Andritz
3	Banja Hydro Lozhan Hydro, Braboves Hydro	60MW 130MW 180MW	EVN	C/O in 2014 - 16	
4	Kalivac Hydro	100MW (92MW)	Enelpower, Becchetti Energy		
5	Bretile Hydro	70MW	Enex Consortium		
6	Skavica Hydro	500MW	Tassara-Geoteca Progetti-Kinglor Consortium		
7	Fushe Kruje coal-fired thermal	500 – 800MW	RWE, Public Power Corp, Titan Cement		To be built within the factory of Titan Cement
8	Fier thermal	1200MW	ASG Power Consortium		To be built within LNG terminal under planning
9	Porto Romano coal-fired thermal	1300MW	ENEL		Fuel: imported coal
10	Porto Romano GT	100 – 200MW	KESH		

(Source: Platts/UDI International Electric Power Sourcebook 2009, Summarized and edited by Study team)

## Chapter 3 Outline of the project

### 3.1 Basic policy of Albanian government on the Project

Albanian government and KESH, the organization which will implement the project, have a plan to develop a power plant within the Port Romano Industrial and Energy Park near the port of Durrës.

The capacity of the plant is 100 – 200MW, both in terms of the lead time for the electricity generation and in terms of the adequate load to the current transmission system. The applied fuel is diesel oil, which is common in Albania.

Since Albania is a net importer of oil products, high energy efficiency is a top priority. Therefore, Study team recommends a combined cycle plant, which can be accomplished the plant efficiency of around 40%.

### 3.2 Outline of the project

<Project Site> (See Map 2 & Figure 1)

- 30km West of Tirana
- Near by Port of Durrës
- Within Port Romano Industrial and Energy Park

<Power Plant Features>

- 2 combined-cycle power blocks (See Figure 2)
  - TOTAL CAPACITY: 177MW (with Distillate Oil)
- Combined-Cycle Power Plant:
  - 2 on 1 configuration: 2 gas turbine generators, 2 HRSGs  
& 1 steam turbine generator  
( HRSG: Heat Recovery Steam Generator)
  - High Efficiency (44.0%, with Distillate Oil, LHV Base)

Map 2: Location of Port Romano



(Source: Study team)

Figure 1: Location of Site (Porto Romano Industrial & Energy Park)



(Source: Study team)

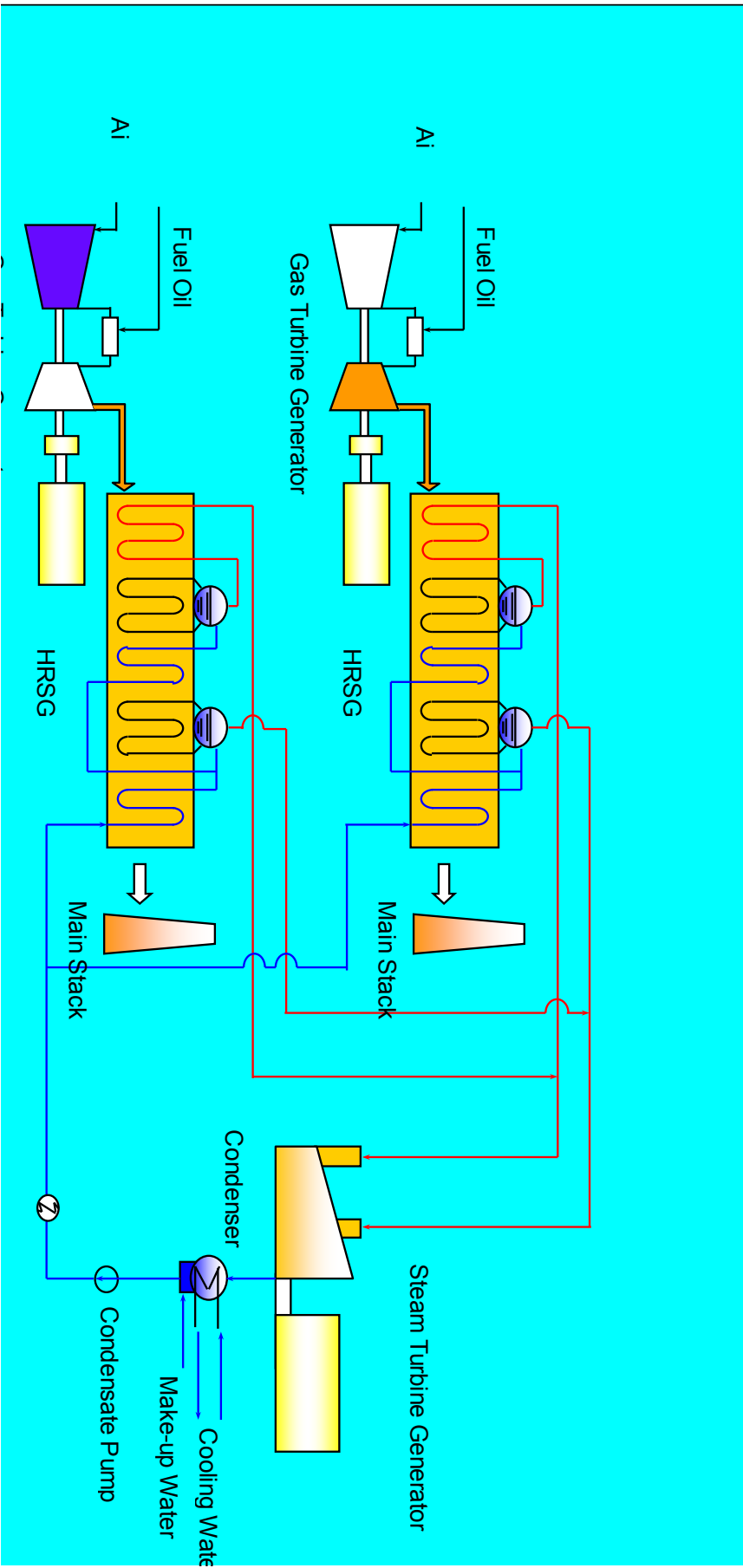


Figure 2: Typical 2 on 1 configuration

(Source: Study team)

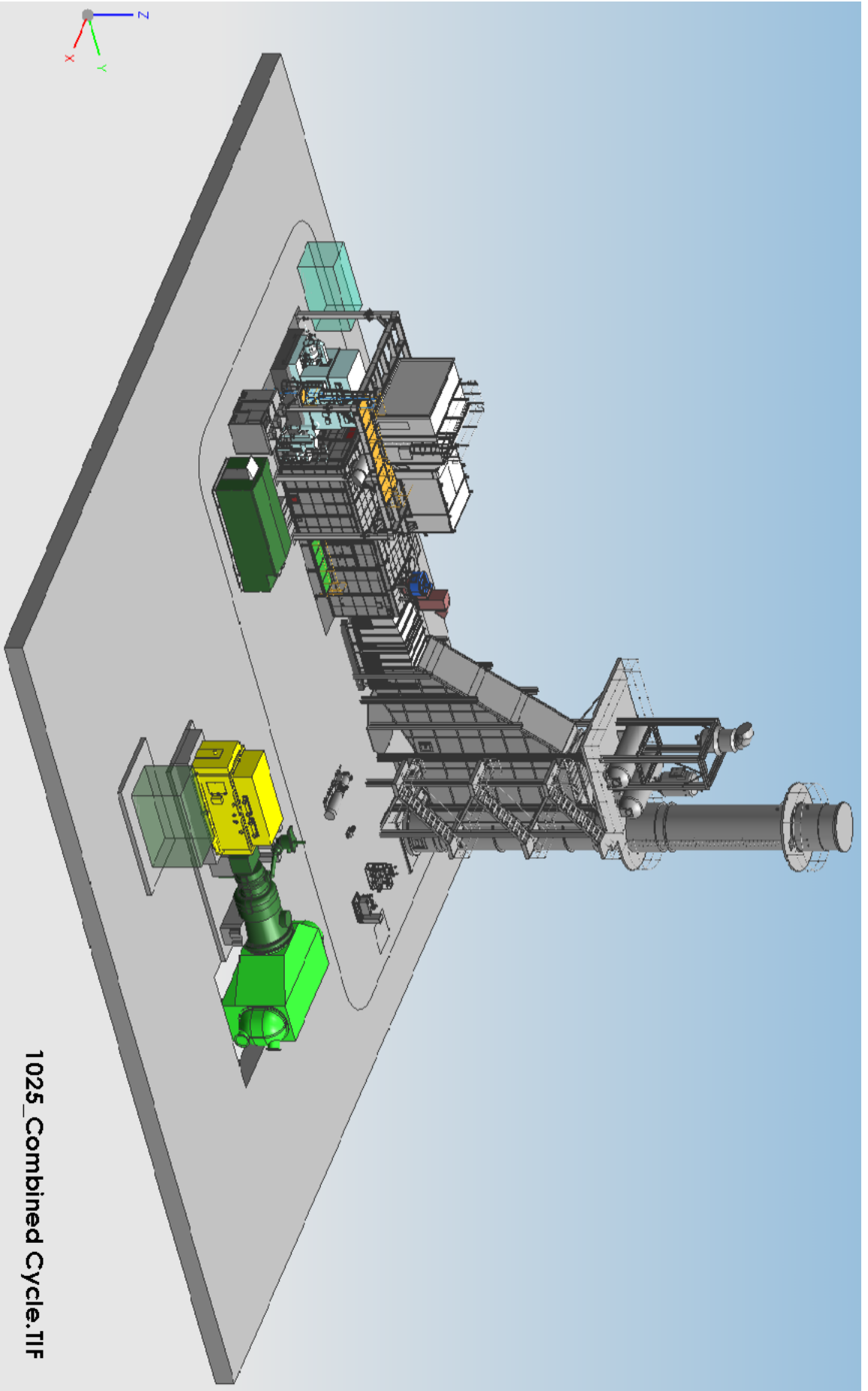


Figure 3: 3-D combined cycle plant (1 on 1 configuration)

(Source: Study team)

<Performance>

The following conditions were considered for the design of the power plant from average weather conditions of Porto Romano.

**Table 1 Design Conditions**

Ambient Temp.	15 °C
Ambient Temp. Min. / Max..	-5 °C / 39 °C
Relative Humidity	60 %
Altitude	0 m
Cooling Water Inlet Temp.	20 °C
Fuel Type	Distillate Oil & Natural Gas

(Source: Study team)

The following plant performance is expected, and all EU regulations with regard to ambient and water emissions will be satisfied.

**Table 2: Plant Performance (Design Conditions, Gross Basis)**

Item	Unit	Distillate Oil	Natural Gas
Plant Output	kW	88,430 x2Blocks	91,710 x2Blocks
Gas Turbine Output	kW	30,680 x4	32,040 x4
Steam Turbine Output	kW	27,070 x2	27,630 x2
Efficiency (LHV)	%	44.0	45.5

(Source: Study team)

<Scope>

- General

The entire scope of supply is to construct a new power plant of two (2) combined-cycle power blocks each comprising two (2) gas turbine generators, two (2) HRSGs and one (1) steam turbine generator.

The scope of work covers design, engineering, procurement, fabrication, shop testing, packing, delivery to the site, erection, site testing, commissioning, performance test and defect liability for the supplied equipment.

In accordance with the scope of work stated below, the plot plan and the power train arrangement are provided in Figure 4 and 5, respectively.

- Key Features

- Two (2) power blocks with the total capacity of 177MW at the site conditions
- Two (2) power blocks each having two (2) gas turbine generators, two (2) HRSGs and one (1) steam turbine generator
- No gas turbine simple-cycle operation
- Dual-firing flexible fuel application
- Once-through cooling water system to condenser
- Plant make-up water & water injection to gas turbine combustors fully supplied from desalination plant
- Full automated digital control

- Scope of Supply

- For One Power Block
  - \* Two (2) gas turbine generator packages (note 1)
  - \* Two (2) heat recovery steam generators
  - \* Two (2) complete sets of exhaust gas ducts and main stacks
  - \* One (1) steam turbine generators
  - \* Boiler feed water system
  - \* Condensate system
  - \* Condenser and once-through cooling water system
  - \* Closed cooling water system
  - \* Chemical injection system
  - \* Sampling system
  - \* Auxiliary steam system
  - \* Compressed air system

- \* Gas turbine building
  - \* Steam turbine building
  - \* Overhead crane and hoist
  - \* Instrumentation and control system
  - \* Electrical system
  - \* Erection and civil work
  - \* Spare parts
- Common Facilities (note 1)
- \* Fuel oil storage and supply system (note 2)
  - \* Water intake and discharge channel
  - \* Auxiliary boiler
  - \* Emergency diesel generator
  - \* Desalination plant
  - \* Water demineralization system
  - \* Waste water system
  - \* 110 kV switchyard
  - \* Fire detection and protection system
  - \* Service water and portable water system
  - \* Sanitary waste water system
  - \* Administration building
  - \* HVAC system
  - \* Work shop and warehouse
  - \* Erection and civil work
  - \* Spare parts
- Extended Works
- \* Fuel oil pipeline from the Porto Romano Industrial and Energy Park (Note 3)
  - \* 110kV single-line transmission to the existing 110kV Porto Romano substation and related modification work. (Note 4)

Notes: 1) All common facilities shall have a capacity for the rated-operation of two power blocks.

2) Gas turbine generator package shall furnish dual-firing combustors for fuel gas & fuel oil application. Fuel supply system, however, shall not cover fuel gas pipe line, fuel gas treatment system and/or fuel gas compressors.

3) The Porto Romano Industrial and Energy Park is located adjacent to

the planned site for new generation.

4) The 110kV Porto Romano substation is located at 6 km away from the planned site for new generation.

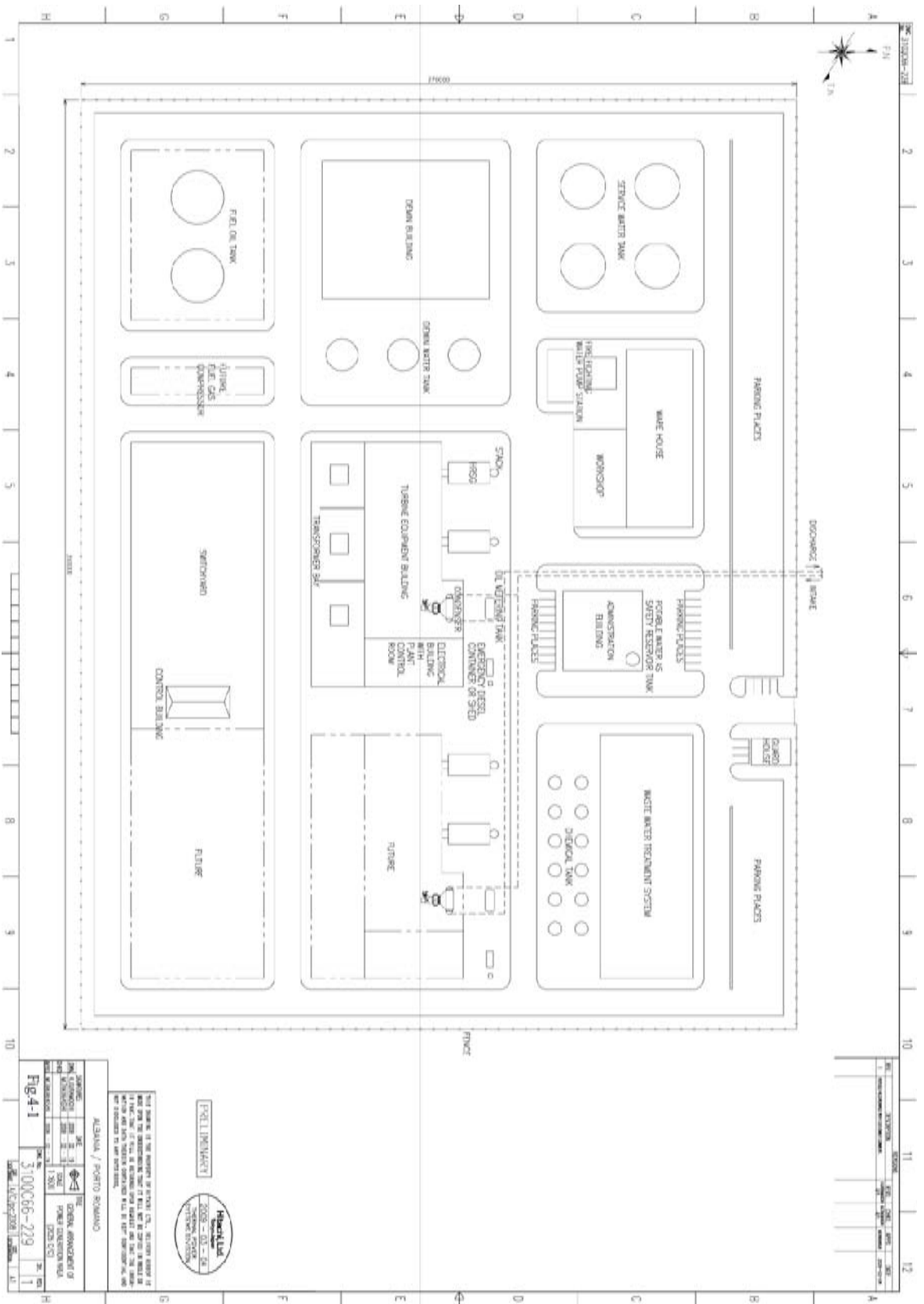


Figure 4: Plot Plan of Power Plant

(Source: Study team)



### 3.3 Cost for the project

The project budget for power plant construction, price & physical contingencies, consulting services, and 6-year LTSA contract is totally estimated to be 403.03 million US dollar as shown on Table 3.

This table is made for the budgetary purpose of Japanese ODA loan framework. Actual project cost will be determined by International Competitive Bidding (ICB) under the procurement based on JICA guidelines.

In addition, this project cost will be minimized to be 211.13 million US dollar for one-block CCPP (incl. power plant construction, price & physical contingencies, and consulting services, excl. LTSA contract) in case that there is some bilateral political issue to reduce the project cost.

**Table 3: Overall Cost Estimate for Porto Romano Power Plant  
Development Project (As of March 2009)**

1USD = 101.86 JPY  
= 100.58 Lek

Category	Foreign Currency			Total	
	Local Portion		Foreign Portion	MUSD	Eqv. MJPY
	MLek	Eqv. MUSD	MUSD		
<b>A1. Power Plant Construction and Associated Works</b>	<b>10,778</b>	<b>107.16</b>	<b>225.65</b>	<b>332.81</b>	<b>33,900</b>
<b>A1.1 Power Plant Construction</b>					
(1) Power Island (2GTGs, 2HRSGs & STG) x 2 Blocks	3,022	30.04	170.23	200.27	20,400
(2) Common BOP incl. 110kV Switchyard	726	7.22	40.89	48.11	4,900
(3) Civil and Erection Works incl. Distillate Oil Pipeline from Port Romano Industrial & Energy Park	5,451	54.19	13.55	67.74	6,900
<b>A1.2 Associated Works</b>					
(4) Cooling Water Intake & Discharge Structure	1,481	14.73	-	14.73	1,500
(5) 110kV Single-Line Transmission to 110kV Porto Romano Substation and other related works	99	0.98	0.98	1.96	200
<b>A2. Physical Contingency (5% of A1)</b>	<b>539</b>	<b>5.36</b>	<b>11.28</b>	<b>16.64</b>	<b>1,695</b>
<b>A3. Price Contingency</b>	<b>1,509</b>	<b>15.00</b>	<b>11.28</b>	<b>16.64</b>	<b>1,695</b>
<b>A4. Consulting Services</b>	<b>86</b>	<b>0.85</b>	<b>4.84</b>	<b>5.69</b>	<b>580</b>
<b>- Out of Scope of Work -</b>					
<b>A5. 6-year LTSA Contract</b>	<b>-</b>	<b>-</b>	<b>21.60</b>	<b>21.60</b>	<b>2,200</b>
<b>Grand total</b>	<b>12,912</b>	<b>128.37</b>	<b>274.66</b>	<b>403.03</b>	<b>41,052</b>

- Notes
- 1) Exchange rates applied herein are based on the average value from actual exchange rates during the period of 6 months from July 2008 to December 2008.
  - 2) The project cost for machines & equipment supplied herein will greatly vary subject to the global demand to power plants, steel products and raw materials.
  - 3) The consulting fee will greatly vary subject to the scope of works of consulting services.
  - 4) The LTSA cost will greatly vary subject to the scope of works of O&M services.

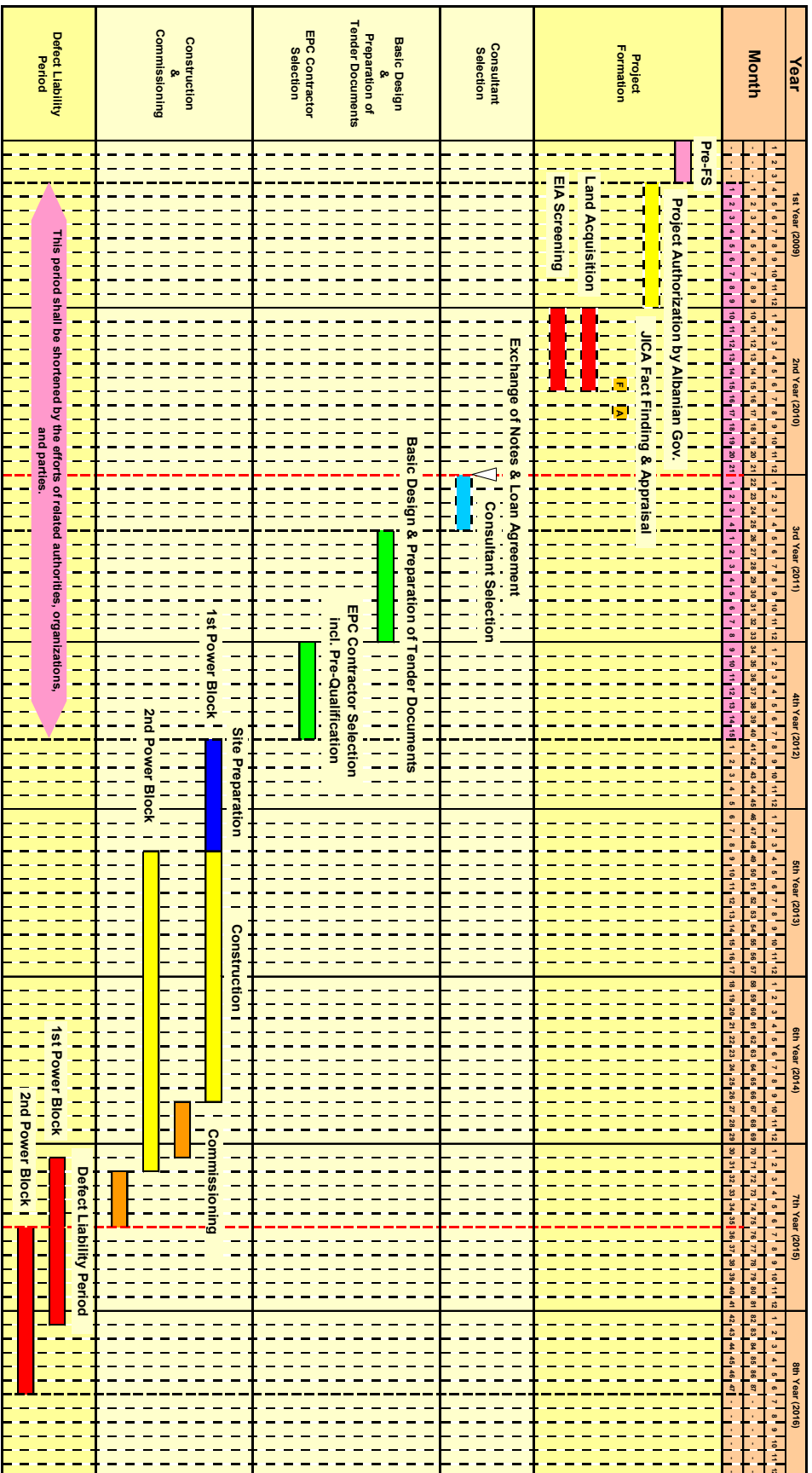
(Source: Study team)

### 3.4 Schedule for the project

The overall project schedule is presented in Figure 6 including the period of project formation, including bilateral and loan agreements.

The construction period for two-block CCPP is expected to be 35 months from the EPC contract to the commercial operation.

Figure 6: Overall Project Formation & Implementation Schedule



Notes:

- 1) The duration of power plant construction will greatly vary subject to the productivity of local workers and the global demand to power plants due to the availability of manufacturer's factory & the lead time for procurement of steel products & law materials.
- 2) The schedule above is based on 16 months to equipment delivery, 2 months for transportation, 8 months for installation and 4 months of start-up.

(Source: Study team)

### 3.5 How to implement the project

#### <Engineering / Manufacturing / Procurement>

At the project execution stage, design liaison meeting will be held with KESH first, for determining detailed specification of plant and equipment. Specification of equipment means detailed specification of major equipment such as gas turbine, steam turbine, generator and HRSG. Meanwhile specification of plant means detailed specification of plant overall, such as configuration of fuel system, cabling route, piping route, structure of building, plant arrangement, confirmation of terminal points, etc.

After detailed specification mentioned above decided, the supplier will begin detailed design necessary for manufacturing and procurement. With regard to the procurement of the purchased items, main component such as gas turbine, it is desirable to procure from Japanese suppliers with high reliability and performance. On the other hand, for the procurement of other component such as auxiliaries, it is desirable to investigate globally for the purpose of obtaining products with appropriate specification and delivery.

Moreover, soil data necessary for civil design should be provided by KESH since it is assumed that new power station will be constructed in a green field. Civil design may be outsourced to a local consultant familiar with local circumstances.

#### <Transportation>

The Port Romano Industrial and Energy Park, within which project site is located, is on the coast, having a jetty in which oil can be unloaded but the facility for heavy equipment seemed to be insufficient at the time of site survey.

Durres would be an unloading port for the heavy equipment such as turbines and generators, for which further investigations are needed at the time of implementing the project.

#### <Construction (Installation & Commissioning)>

Since installation and commissioning should be implemented at the site, the utilization of local contractor with capacity in terms of technical matters, experience and quality control should be effective. In respect of gathering labor force, the main idea is to employ workers within Albania via contractors.

Technical advisor should be dispatched by the supplier.

#### <Operation & Maintenance>

Sufficient training for operators and maintenance workers is indispensable so that they fully understand the characteristics of equipment and philosophy of manufacturer.

## Chapter 4 Circumstances of the project

### 4.1 Land availability

Building the power plant proposed in this report requires 270m x 350m land. The site for the power plant is prepared within Port Romano Industrial and Energy Park, which is under construction and Albanian government has intention to acquire the land.

### 4.2 Fuel availability

Albania imports most of fuel for power generation such as oil and natural gas. There is only plan but no facility for acceptance and storage for natural gas in Albania. With regard to oil there are facilities within Port Romano Industrial and Energy Park.

Fuel oil pipeline from the fuel tank within the Park is necessary to be built.

### 4.3 Availability of Cooling Water

The combined cycle power plant requires relatively large amount of water for cooling for steam condenser. The site is adjacent to sea and there is no problem with the availability of water.

### 4.4 Connection to transmission system

The 110kV Porto Romano substation is located at 6 km away from the planned site. 110kV single-line transmission to the substation and related modification work is necessary.

## 4.5 Environmental & Social considerations

The EIA (Environmental Impact Assessment) is necessary for power plant development project in Albania. KESH will implement EIA for the project.

Albania is a candidate of EU membership, so new project should be satisfied with EU environmental guidelines. The planned facilities are satisfactory for the mentioned guidelines. Expected NO<sub>x</sub> emission is shown in Table 4

Table 4: Expected NO<sub>x</sub> Emission from the plant

Items	Unit	Nitrogen Oxides (NO <sub>x</sub> )	
		Port Romano (Estimate)	EU Directive
Natural Gas	mg/m <sup>3</sup> N	50 (25ppm)* <sup>1</sup>	< 50
Distillate Oil	mg/m <sup>3</sup> N	86 (42ppm)* <sup>2</sup>	<120

Note: O<sub>2</sub> content by volume in the waste gas of 15% in the case of gas turbines.

\*1: With dual fuel low-NO<sub>x</sub> combustors

\*2: With water injection

(Source: Study team)

## 4.6 Funding for the project

ODA (Yen) loans would be possible source of funding for the project. However, since (1) Japanese government provided Yen loan (totaling up to 11,121 million yen) to finance Greater Tirana Sewerage System Improvement Project in 2008 and Yen loans to Albania are not annually provided, and since (2) Albania's GNI per capita is increasing year by year and there is a possibility that Albania will be elevated to "Upper-Middle-Income Country" as early as FY2011, other sources (export credit, etc.) should be studied for early project materialization. (However, in case of ECA Loan (e.g. JBIC Loan), it may be subject to IMF confirmation to make financing arrangement for the Project.)

If Albania becomes "Upper-Middle-Income Country", applicable fields and sectors will be limited to "environment", "human resource development", "disaster protection and recovery measures" and "measures to reduce disparities in low-income regions", including social infrastructure development in urban areas to improve the living standards of the urban poor, etc.

Albania's GNI per capita, country classification by the World Bank, major economies classified by income category and Terms and conditions of Yen Loans are shown in Table 5 through 8.

**Table 5: Albania's GNI per capita (Historical data)**

Albania	2004	2005	2006	2007	<b>2008</b>
GNI per capita, Atlas method in US\$	2,110	2,610	2,990	3,360	<b>3,840</b>

(Source: The World Bank)

**Table 6: Country Classification by the World Bank**  
(Historical data, classified by GNI per capita Atlas method in US\$)

Bank's Fiscal Year	2006	2007	2008	2009	2010
Data for calendar day	2004	2005	2006	2007	2008
Low Income	<= 825	<= 875	<= 905	<= 935	<= 975
IDA Eligibility	- 1,575	- 1,675	- 1,735	- 1,785	- 1,855
<b>Lower Middle Income(*)</b>	<b>- 3,255</b>	<b>- 3,465</b>	<b>- 3,595</b>	<b>- 3,705</b>	<b>- 3,855</b>
IBRD Graduation	- 5,685	- 6,055	- 6,275	- 6,465	- 6,725
Upper Middle Income	-10,065	-10,725	-11,115	-11,455	- 11,905
High Income	> 10,065	> 10,725	> 11,115	> 11,455	> 11,905

\*equivalent to "Middle-Income Countries" of JICA

(Source: The World Bank)

**Table 7: Major Economies Classified by Income Category**  
(Classified by the DAC and the World Bank, Effective from April 1, 2009)

<b>Income Category</b>	<b>2007 GNI per Capita</b>	
	Lower- Income Countries	Afghanistan, Yemen, Uganda, Ethiopia, Eritrea, Cambodia, Gambia, Guinea, Guinea-Bissau, Comoros, Democratic Republic of the Congo, Sao Tome and Principe, Zambia, Sierra Leone, Senegal, Somalia, Solomon Islands, Tanzania, Chad, Central African Republic, Tuvalu, Togo, Niger, Nepal, Haiti, Bangladesh, Burkina Faso, Burundi, Benin, Madagascar, Malawi, Mali, Myanmar, Mozambique, Mauritania, Lao PDR, Liberia, Rwanda
LDC		Angola, Kiribati, Djibouti, Sudan, Vanuatu, Samoa, Equatorial Guinea, Timor-Leste, Bhutan, Maldives, Lesotho
Low- Income Countries	-US\$935	Uzbekistan, Ghana, Kyrgyz Republic, Kenya, Cote d'Ivoire, Zimbabwe, Tajikistan, Nigeria, Pakistan, Papua New Guinea, Vietnam
Lower- Middle- Income Countries	US\$936 - US\$1,785	Iraq, India, Indonesia, Egypt, Guyana, Cameroon, Republic of Congo, Syrian Arab Republic, Sri Lanka, Turkmenistan, Nicaragua, Paraguay, Philippines, Honduras, Bolivia, Moldova, Mongolia
<b>Middle- Income Countries</b>	US\$1,786 - US\$3,705	Azerbaijan, Algeria, <b>Albania</b> , Armenia, Iran, Ukraine, Ecuador, El Salvador, Cape Verde, Guatemala, Georgia, Colombia, Jamaica, Swaziland, Thailand, China, Tunisia, Dominican Republic, Tonga, Namibia, Peru, Bosnia & Herzegovina, Macedonia, Marshall Islands, Micronesia, Morocco, Jordan
Upper- Middle- Income Countries	US\$3,706 - US\$6,465	Argentina, Uruguay, Kazakhstan, Grenada, Costa Rica, Suriname, St. Vincent and the Grenadines, St. Lucia, Serbia, Dominica, Panama, Brazil, Fiji, Belarus, Belize, Botswana, South Africa, Mauritius, Montenegro, Romania, Lebanon

(Source: JICA)

Table 8: Terms and Conditions of Yen Loans  
(Effective from April 1, 2009, truncated)

Category	GNI Per Capita (2007)		Standard / Option	Interest Rate (%)	Repayment Period (Years)	Grace Period (Years)	Conditions for Procurement
Middle-Income Countries	US\$1,786 -US\$3,705	General Terms	Standard	1.40	25	7	Untied
			Option 1	0.95	20	6	
			Option 2	0.80	15	5	
		Preferential Terms	Standard	<b>0.65</b>	<b>40</b>	<b>10</b>	Untied
			Option 1	0.55	30	10	
			Option 2	0.50	20	6	
			Option 3	0.40	15	5	
		STEP	Standard	0.20	40	10	Tied
			Option	0.10	30	10	
Upper-Middle-Income Countries	US\$3,706 -US\$6,465	General Terms	Standard	1.70	25	7	Untied
			Option 1	1.60	20	6	
			Option 2	1.50	15	5	
		Preferential Terms	Standard	1.20	25	7	Untied
			Option 1	1.00	20	6	
			Option 2	0.60	15	5	

(Source: JICA)

## Chapter 5 Effectiveness of the project

### 5.1 Benefits of introducing highly energy-efficient facilities

The main objective of the project is, first of all, solution of electricity shortage and, secondly, improvement of disproportion in electricity sources to northern hydro power plants.

The solution of electricity shortage will reduce electricity import from neighboring countries, which will alleviate fiscal burden of Albanian government.

The improvement of disproportion in electricity sources to northern hydro power plants will reduce scheduled and unscheduled blackouts.

The existing thermal power plants were all conventional (with steam generator). Most of them were built in 1960s and 1970s. The overall plant efficiency of the proposed combined cycle plant, which is inferior to that of larger one, goes far beyond that of the existing plants in Albania. The plant with high energy efficiency needs less fossil fuel, which means less emission of CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>, etc.

## Chapter 6 Conclusions and Recommendations

As specified in Table 1, Chapter 2.2, in Porto Romano there is another plan of constructing new power plant under 35 year BOT scheme by RWE of Germany and ENEL of Italy. The capacity is 800MW and the fuel is imported coal, according to the hearings during the site survey.

Some people within Albanian government insist that a 100MW – 200MW combined cycle power plant should be built as an extension of Vlore combined cycle, where the environmental impact assessment (EIA) has been finished but hearings to residents should still be held. There was another opinion that small hydro power plants were first priority for Albania. Finally these opinions were denied, but it seemed that consensus within the government regarding what was the first priority for them was necessary.

Another point is that the project cost should be limited to around 20 billion yen, which is the ceiling of Yen loans to Albania. It can be solved, for example, by dividing the contract into some phases, by unit etc. This idea can be put into

execution as far as Albanian government is sure that the project is of top-priority and that it should be materialized by any means.

In conclusion, the key for the project realization is Albanian government's policy on the project. We, the study team, should be continuously appealing the merits of the project as specified in this report in order to gain their support.

## Appendix

Project Summary (Presentation material for site survey)

# Port Romano Power Plant Development Project

## Project Summary

REPUBLIC OF ALBANIA  
OCTOBER 2009

- 1. PROJECT OVERVIEW**
- 2. PERFORMANCE**
- 3. SCOPE**
- 4. SCHEDULE**
- 5. COST & FINANCE**

# 1. PROJECT OVERVIEW

## Project Site



- 30km West of Tirana
- Near by Port of Durrës
- Within Port Romano Industrial and Energy Park

# 1. PROJECT OVERVIEW

## Power Plant Location - Porto Romano Industrial & Energy Park -



# 1. PROJECT OVERVIEW

## Power Plant Features

- 2 combined-cycle power blocks

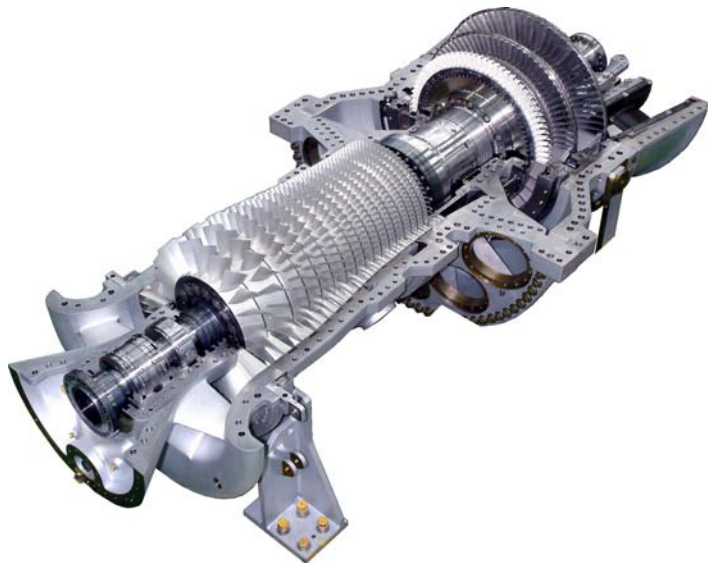
**TOTAL CAPACITY: 177MW** (with Distillate Oil)

- Combined-Cycle Power Plant:

- 2 gas turbine generators, 2 HRSGs & 1 steam turbine generator

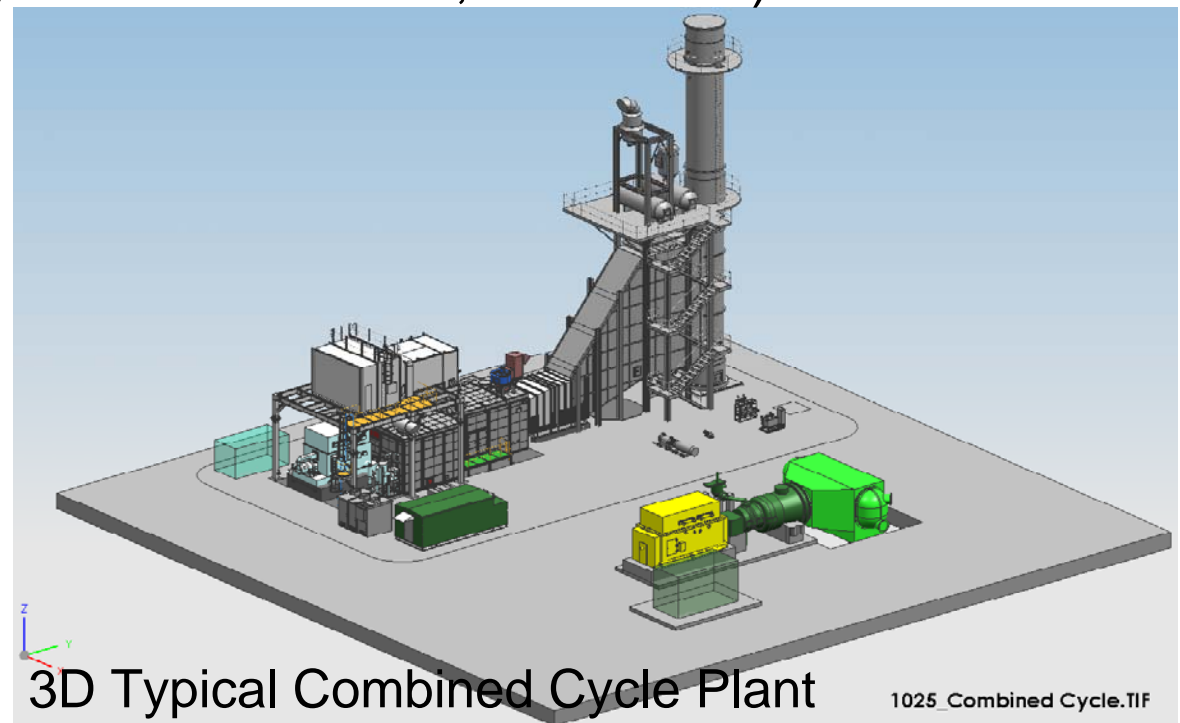
HRSG: Heat Recovery Steam Generator

- High Efficiency (44.0%, with Distillate Oil, LHV Base)



Gas Turbine (without upper casings)

Doc No. : DOC091015



3D Typical Combined Cycle Plant

1025\_Combined Cycle.TIF

## 2. PERFORMANCE

Item	Unit	Distillate Oil	Natural Gas
Plant Output	kW	88,430 x2Blocks	91,710 x2Blocks
Gas Turbine Output	kW	30,680 x4	32,040 x4
Steam Turbine Output	kW	27,070 x2	27,630 x2
Efficiency (LHV)	%	44.0	45.5

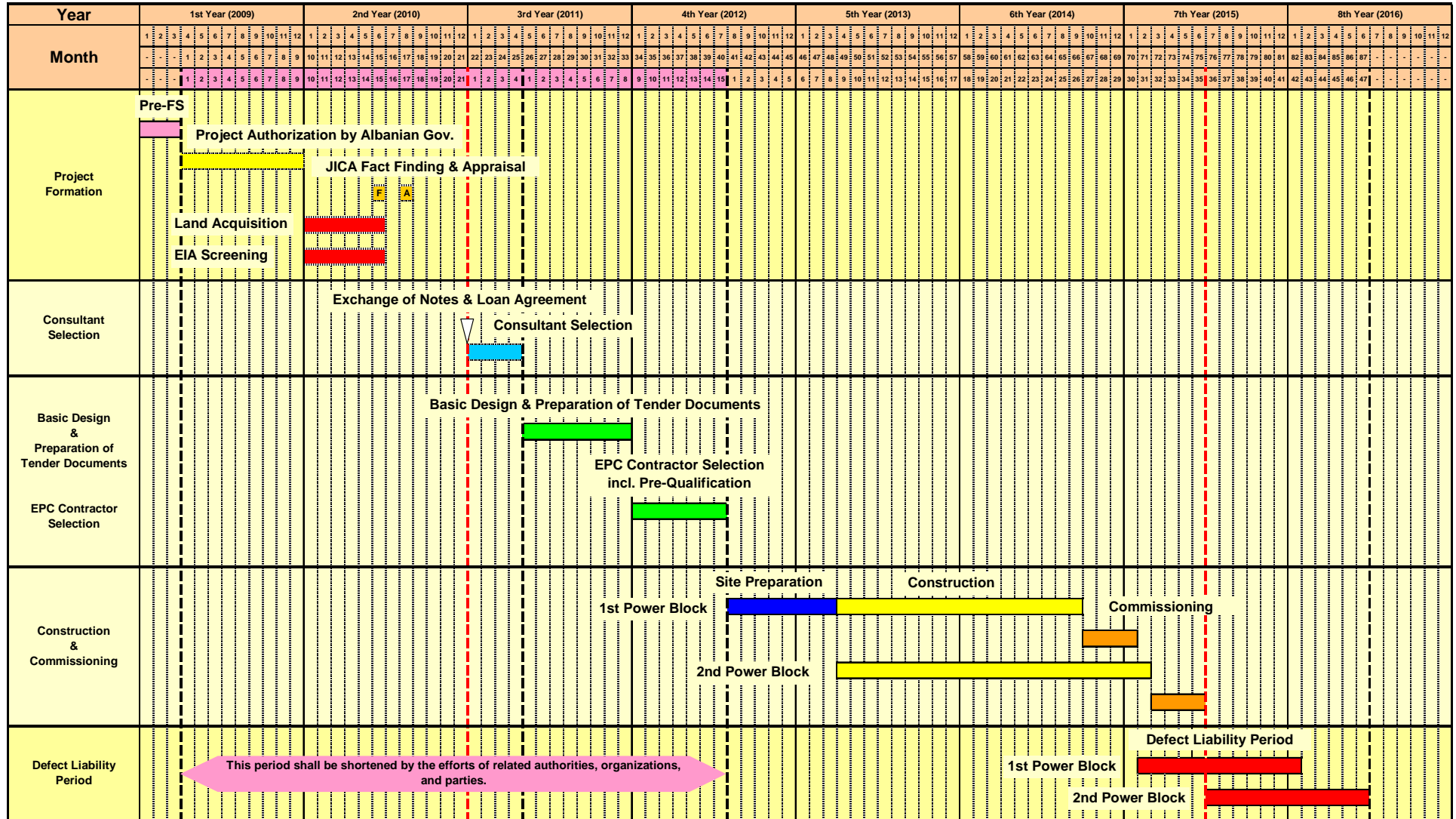
- Design Conditions:
- Ambient Temperature: (Average) 15C / (Min) -5C / (Max) 39C
  - Relative Humidity: 60%
  - Altitude: 0m
  - Cooling Water Inlet Temperature: 20C
  - Complied to EU regulations on ambient & water emission

- Power Island
  - 4 gas turbine generators, 4 HRSGs, 2 steam turbine generators, Condenser & Once-through cooling water system, etc.
- Common Facilities
  - 110kV Switchyard, Fuel Oil Storage & Supply System (\*1), etc.
- Civil & Erection Works
- Cooling Water Intake & Discharge Structure
- Distillate Oil Pipeline from
  - Porto Romano Industrial & Energy Park
- 110kV Single-Line Transmission to
  - Porto Romano Substation (6km)

\*1: Gas turbine generator package shall furnish dual-firing combustors for fuel gas & fuel oil application.  
Fuel supply system, however, shall not cover fuel gas pipe line, fuel gas treatment system and/or fuel gas compressors.

# 4. SCHEDULE

## Overall Project Implementation Schedule



- Notes:
- 1) The duration of power plant construction will greatly vary subject to the productivity of local workers and the global demand to power plants due to the availability of manufacturer's factory & the lead time for procurement of steel products & raw materials.
  - 2) The schedule above is based on 16 months to equipment delivery, 2 months for transportation, 8 months for installation and 4 months of start-up.

# 5. COST & FINANCE

## Overall Cost Estimate (as of March 2009)

1USD = 101.86 JPY  
 = 100.58 Lek

Category	Foreign Currency			Total	
	Local Portion		Foreign Portion	MUSD	Eqv. MJPY
	MLek	Eqv. MUSD	MUSD		
<b>A1. Power Plant Construction and Associated Works</b>	<b>10,778</b>	<b>107.16</b>	<b>225.65</b>	<b>332.81</b>	<b>33,900</b>
<b>A1.1. Power Plant Construction</b>					
(1) Power Island (2GTGs, 2HRSGs & STG) x 2 Blocks	3,022	30.04	170.23	200.27	20,400
(2) Common BOP incl. 110kV Switchyard	726	7.22	40.89	48.11	4,900
(3) Civil and Erection Works incl. Distillate Oil Pipeline from Porto Romano Industrial & Energy Park	5,451	54.19	13.55	67.74	6,900
<b>A1.2. Associated Works</b>					
(4) Cooling Water Intake & Discharge Structure	1,481	14.73	-	14.73	1,500
(5) 110kV Single-Line Transmission to 110kV Porto Romano Substation and other related works	99	0.98	0.98	1.96	200
<b>A2. Physical Contingency</b>					
(5% of Total Cost of A1)	<b>539</b>	<b>5.36</b>	<b>11.28</b>	<b>16.64</b>	<b>1,695</b>
<b>A3. Price Contingency</b>	<b>1,509</b>	<b>15.00</b>	<b>11.28</b>	<b>26.28</b>	<b>2,677</b>
<b>A4. Consulting Services</b>	<b>86</b>	<b>0.85</b>	<b>4.84</b>	<b>5.69</b>	<b>580</b>
- OUT OF SCOPE OF WORK -					
<b>A5. 6-Year LTSA Contract</b>	-	-	<b>21.60</b>	<b>21.60</b>	<b>2,200</b>
<b>Grand-Total</b>	<b>12,912</b>	<b>128.37</b>	<b>274.66</b>	<b>403.03</b>	<b>41,052</b>

- Notes: 1) Exchange rates applied herein are based on the average value from actual exchange rates during the period of 6 months from July 2008 to December 2008. Exchange rates will vary from the above depending on circumstances at the time of bilateral agreement.  
 2) The project cost for machines & equipment supplied herein will greatly vary subject to the global demand to power plants, steel products and law materials.  
 3) The consulting fee will greatly vary subject to the scope of works of consulting services.  
 4) The LTSA cost will greatly vary subject to the scope of works of O&M services.

# 5. COST & FINANCE

## Terms and Conditions of Yen Loans (Effective from July 1, 2008)

Category & GNI Per Capita (2006)	Condition	Standard / Option	Interest Rate (%)	Repayment Period (Years)	Grace Period (Years)	Conditions for Procurement
Middle-Income Countries US\$ 1,736 - US\$ 3,595	General Terms	Standard	1.40	25	7	Untied
		Option 1	0.95	20	6	
		Option 2	0.80	15	5	
	Preferential Terms	Standard	0.65	40	10	Untied
		Option 1	0.55	30	10	
		Option 2	0.50	20	6	
		Option 3	0.40	15	5	
	STEP	Standard	0.20	40	10	Tied
		Option	0.10	30	10	