



WEST AFRICAN POWER POOL
SYSTEME D'ECHANGES D'ENERGIE ELECTRIQUE OUEST AFRICAIN

General Secretariat / Secrétariat Général

**SECOND SESSION OF THE GENERAL ASSEMBLY OF
THE WEST AFRICAN POWER POOL ORGANISATION**

**DECISION WAPP/18/DEC.26/10/07 RELATING TO THE
WAPP EMERGENCY POWER SUPPLY SECURITY PLAN (EPSSP)**

The General Assembly

CONSIDERING the Decision A/DEC.5/12/99 of the twenty-second summit of the Authority of the Heads of States and Governments of ECOWAS held in Lomé on December 10, 1999 relating to the establishment of the West African Power Pool (WAPP);

CONSIDERING the Decision A/DEC. 18/01/06 of the twenty-ninth summit of the Authority of Heads of State and Government of ECOWAS held in Niamey on January 12, 2006, relating to the Articles of Agreement for the establishment and functioning of the WAPP;

CONSIDERING the Decision A/DEC. 20/01/06 of the twenty-ninth summit of the Authority of Heads of State and Government held in Niamey on January 12, 2006, relating to the establishment of the WAPP Secretariat as a specialized institution of ECOWAS;

CONSIDERING the Articles of Agreement relating to the organisation and functions of the West African Power Pool dated July 6th, 2006 in particular Articles 4, 5, and 7;

CONSIDERING the Resolution WAPPP/13/RES.27/04/07 of the 3rd Meeting of the WAPP Executive Board of WAPP in Cotonou on April 27th, 2007, and the correspondence from the ECOWAS Commission dated May 3rd, 2007 and referenced ECW/INST/EEEOA/CommInf/4/2007 requesting the Secretary General to develop an urgent plan for emergency power supply to Members;

NOTING that the WAPP commissioned a fast track study to develop an emergency power supply security plan to curtail the outages being experienced by WAPP Members and ECOWAS Member States;

CONSIDERING the Final Report of the 1st Meeting of the Strategic Planning Committee held in Cotonou from October 1st to 2nd, 2007 examining the study report and recommending for adoption the outcome of the study;

CONSIDERING the Resolution WAPP/25/RES.24/10/07 of the 5th Meeting of the Executive Board of WAPP held in Abuja on October 24th, 2007 adopting the WAPP Emergency Power Supply Security Plan (EPSSP);

DECIDE:

- Article 1:** The attached Outcome Statement and Action Plan relating to the WAPP Emergency Power Supply Security Plan (EPSSP) are adopted. The implementation of the WAPP EPSSP shall be done in conjunction with the national initiatives already in progress in ECOWAS Member States;
- Article 2:** The Secretary General is empowered to further explore the initiative proposed by the Strategic Urban Development Alliance LLC (SUDA) to develop a public private partnership for the establishment of a nominal 100 - 400 MW thermal generating plant at a mutually agreed location in a host country within reasonable proximity to the West African Gas Pipeline;
- Article 3:** The Secretary General is empowered to further explore the initiative proposed by CenPower to develop a 330 – 440 MW power plant at Kpone near Tema in Ghana;
- Article 4:** The Secretary General is empowered to further explore the preliminary proposal submitted by Korea Electric Power Corporation (KEPCO) to develop 100 – 400 MW dual-fueled gas turbine plant at a WAPP designated “Export Processing Zone” (“Freezone”) to be located adjacent to the Maria Gleta Terminal of the West African Gas Pipeline in Benin;
- Article 5:** A recommendation be submitted to the Committee of ECOWAS Ministers of Energy to:
- Adopt the WAPP Emergency Power Supply Security Plan and Action Plan;
 - Submit the WAPP Emergency Power Supply Security Plan and Action Plan to the ECOWAS Council of Ministers for endorsement and subsequent submission to the Conference of ECOWAS Heads of State and Government for adoption;
- Article 6:** The present Decision comes into effect upon its signature.
- Article 7:** The Secretary General shall take all necessary measures to ensure the implementation of this Resolution.

Done in Abuja, Nigeria on this day of October 26th, 2007,


Chairperson

Engr. (Dr.) J.O. Makoju

WAPP STRATEGIC PLANNING COMMITTEE

Statement On Power Supply Security Plan

Considering that all ECOWAS member states, with the exception of Cote d'Ivoire have been enduring power shortages and that these shortages which became prominent in August 2006 have grown particularly acute over the past year into a major crisis.

Considering that the crisis has since its inception engaged the attention of the power utilities and Governments of each member state.

Considering that in the midst of the power shortages, the authorities had been looking for solutions for their individual territories while failing to seek solutions within a regional context which may have promised better effectiveness and efficiency.

Considering that in response to this undesirable situation, the WAPP Executive Board at its ordinary session requested the WAPP Secretariat to conduct a study for the formulation of a Power Supply Plan from the sub-regional perspective for member utilities.

Accordingly and in view of the urgency of the situation, a consultant was engaged at the end of June 2007 to conduct field visits to all the member states and formulate a coherent Power Supply Plan for the sub-region in consultation with all member states.

Thereafter, the consultant submitted a report to the WAPP Strategic Planning Committee at its meeting of October 1 & 2, 2007 for discussion.

The committee noted that having performed the following required tasks:

- Analyze electricity demand and supply in each member state.
- Review the emergency plans (existing or under consideration) of the Member States for the present power shortage situation
- Comment on the condition of relevant generation and transmission infrastructure in the member states.
- Suggest transmission network enhancements needed
- Identify the required additional generation capacity and appropriate sites
- Recommend a Power Supply Plan including suggested solutions and strategies
- Cost the proposed Power Supply Plan
- Propose an implementation strategy and schedule
- Propose a financing plan
- Propose an institutional framework for the implementation
- Propose the roles of various participants.

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The consultant determined that:

1. About 46% of the electricity demand in the ECOWAS sub-region was not being supplied.
2. The generation capacity needs of the sub-region are for power plants that will:
 - Produce Least Cost Power when operated at base load to address power shortage situation of member states
 - Serve as Reserve under normal conditions to ensure network reliability & security of supply.
 - Allow adequate Frequency Control/Regulation for the successful synchronization of the networks in WAPP
3. Sub-regional generation projects offer the best (least cost) option for member states with significant interconnections.
4. The order of merit for least-cost generation is:
 - Coal-fired Steam Turbine Plants; where coal is available, or
 - Natural gas-fired Combined Cycle plants; if gas is available or else
 - Steam or Diesel plant fired with Heavy Fuel Oil.
5. Possible locations for sub-regional plants are:
 - Maria Gleta in Benin.
 - Lome
 - Tema
 - Aboadze
 - Abidjan (Vridi)
 - OMVS (Mauritania)
6. Until power links are built to connect the five (5) isolated member states, which include Liberia, Sierra-Leone, Guinea, Guinea-Bissau and Gambia, a regional approach cannot be adopted for any of them. Only national initiatives (such as for steam turbine or diesel generating plants fueled with heavy fuel oil) can mitigate their power shortages in the interim.

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And the following strategy was proposed to mitigate the situation:

1. Build three (3) plants at locations with access to natural gas to mitigate the situation within interconnected member states.
 - 400MW combined cycle plant at Maria Gleta in Benin
 - 400 MW combined cycle plant at Aboadze in Ghana
 - 150 MW combined cycle plant within OMVS network.
2. Expedite the following proposed networks & lines to provide more member states with access to regional solutions:
 - Volta-MomeHagou-Sakete, Han-Bobo-Sikasso-Bamako, Bolgatanga-Ouaga.
 - Birnin-Kebbi – Niamey - Bembereke (Benin)- Ouaga
 - CLSG System linking Cote d'Ivoire to Guinea(Nzerekoure), Liberia, Sierra-Leone to Guinea(Kindia)
3. In the interim, deploy steam or diesel capacity running on heavy fuel oil for non-interconnected states: Liberia, Sierra-Leone, Guinea-Bissau, Gambia and also Guinea.

In order to pursue the proposed strategy, the consultant developed the following road map for implementation:

1. Obtain Concessions for "Power Parks" in Member States:- WAPP to approach Host Governments to secure Land and Free Zone Status for Power Parks at target locations.
2. Appoint Strategic Partners to lead development consortia under a Public-Private-Partnership arrangement: - WAPP & Member utilities appoint Strategic Partners (one for each proposed facility) to assemble and lead the consortia. Consortia are awarded the concession to design, build and transfer the proposed plants.
3. Interested Member Utilities form jointly-owned Special Purpose Companies (SPC) to own the plants to be constructed: - Identified WAPP Member Utilities confirm interest in SPCs. Members negotiate and agree the terms of joint ownership and form a distinct SPC for each proposed facility.
4. Secure Funds: 20% as SPC equity & 80% from debt arranged by Consortia: - Participating utilities arrange their equity contribution possibly from Multi-lateral sources through their Governments. Consortia mobilize debt from international market with SPC support.

5. Construct Plants:- Consortia appoint Engineering Procurement and Construction (EPC) Contractor with the prior consent of the SPC to Design, Build & Commission the plant. After completion of construction, Ownership Title to plant is transferred to SPC.
6. Operate Plants: - Plants are leased back to consortia under lease & operate contract. Consortia appoint Operators with the prior consent of SPC. Consortia administer power off-take & payment arrangements and meet debt service obligations on behalf of SPC.

The committee in its deliberations of the consultant's recommendations took cognizance of the presentations of two private sector initiatives.

SUDA expressed its readiness to be a Strategic Partner to assist WAPP with:

- Developing a public-private-partnership for the establishment of a nominal 100-400MW thermal plant at a mutually agreed location in a host country within reasonable proximity to the West African Gas Pipeline;
- Studying identified sites for development of the plant. The activity may include: developing viable general terms for site procurement; facilitating initial studies of environmental impacts of proposed sites; assess specific right-of-ways and the site access issues including power transmission and fuel supply facilities; and, any other pre-development site specific activities proposed by WAPP.

SUDA also advised in its presentation that maintaining flexibility in the financing concept at this stage would enable the optimum financial arrangements to be made at the time of financial closing.

CENPOWER in its presentation advised the committee of the advanced stage of preparation of its 330-440MW power plant project for an approximate cost of \$ 335-415 million to be located at Kpone near Tema in Ghana. It also indicated its willingness to integrate its project with the WAPP Power Supply Security Plan.

The WAPP Strategic Planning Committee after intense discussions amongst members and consultations with potential project developers who were invited to share their views and experience, has accepted the findings and adopted the recommendations of the consultant as the most viable way forward.

The Committee has recommended that the WAPP explore further and elaborate the concept for Public-Private-Partnership proposed by the two private sector entities towards the early implementation of the Plan.

The Committee also discussed the possible impact of demand side management in mitigating the shortages prior to the realization of the WAPP Power Supply Security Plan in about three (3) years. It recommended the development of demand side management policy in order to rationalize the use and mitigate the wastage of energy. The proposed measures included the use of new technologies such as energy efficient lighting in domestic and public applications as well as punitive tariffs for excessive electricity usage.

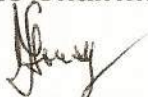
The WAPP Strategic Planning Committee has noted with gratitude, the beneficial support provided by Strategic Urban Development Alliance (SUDA) which funded the study as well as the keen interest and commitment shown by potential developers. The committee has also appreciated the professional and timely execution of the assignment by the consultant Arthur Energy Advisors.

The Committee has commended the WAPP Secretariat for its expeditious attention to this matter of great significance for the entire sub-region.

In conclusion, the WAPP Strategic Planning Committee has decided to submit these recommendations to the Executive Board for adoption and onward transmission to the ECOWAS decision-making bodies for further action.

Done in Cotonou on the 2nd day of October 2007.

The Chairman



Moussa SENE

Directeur des Etudes générales

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Summary

Emergency Power Supply Plan

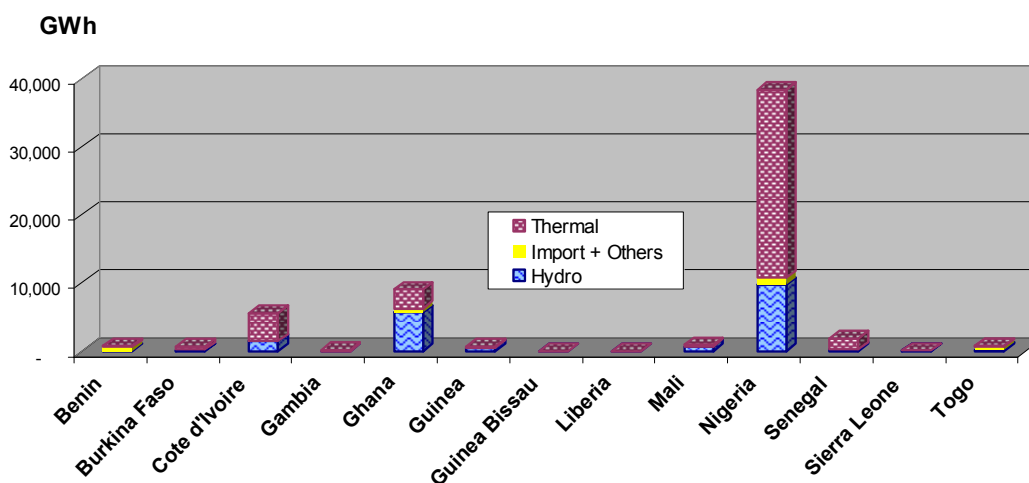
To Curtail Power Shortages Faced By ECOWAS Member States

Background

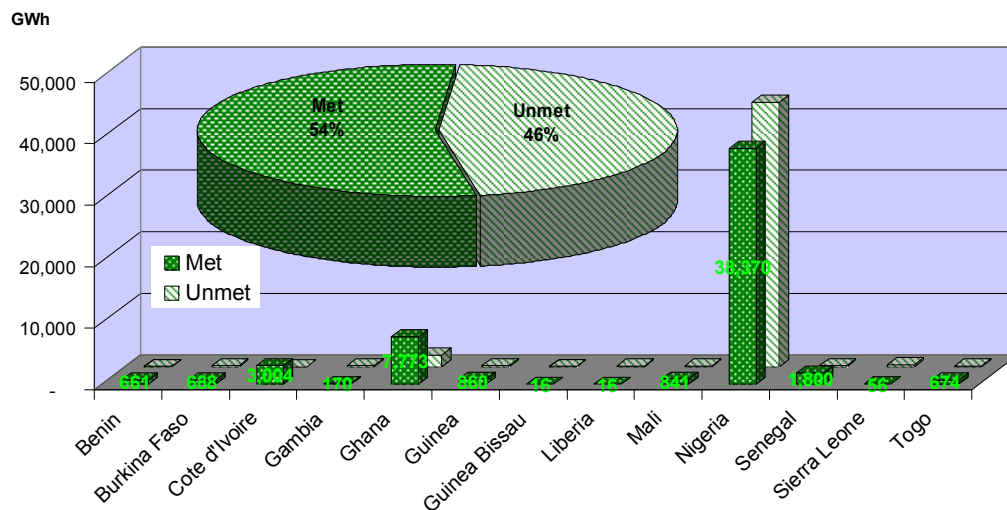
Almost all the ECOWAS Member States are faced with energy crises as the power utilities in the sub-region are unable to meet demand. The Executive Board of the West African Power Pool (WAPP) having considered the widespread power shortage across the ECOWAS sub-region requested its Secretary General to develop an urgent plan for emergency power supply to WAPP Members. Subsequently, the consulting firm Arthur Energy Advisors (AEA), was contracted to perform a study over a ten-week period from June 25th 2007. The objective of the study was to formulate a coherent plan for power supply to WAPP Member Utilities.

Status of Power Supply in the Sub-region

The dominant source of electricity supply in the sub-region is thermal power. Half of the Member States depend on thermal sources for the majority of their supply. Three (3) states depend on hydro sources and two (2) states depend on imports for the majority of their supply. The chart below summarizes the supply situation.



The study determined that about forty-six percent (46%) of the electricity demand on the utilities in the sub-region remains unmet; i.e. it is not being supplied. A representation of the demand situation is shown by the chart below.



The current total demand shortfall within the ECOWAS sub region has been assessed to be about 6,350 MW. The power deficit for the Zone A countries has been assessed to be 6,200 MW while that for the Zone B is about 150 MW as indicated as follows:

| | Current (2007) Capacity Deficit (MW) | Projected (2010) Capacity Deficit (MW) |
|---------------------|--|--|
| Zone A | | |
| Benin | 59 | 99 |
| Togo | 62 | 103 |
| Ghana | 254 | 532 |
| Cote d'Ivoire | 0 | 0 |
| Burkina Faso | 25 | 64 |
| Niger | - | - |
| Sub-total | 402 | 756 |
| Nigeria | 5,788 | 11,232 |
| Zone A Total | 6,190 | 11,988 |
| Zone B | | |
| Senegal | 10 | 154 |
| Mali | 15 | 52 |
| Sub-total | 25 | 205 |
| Guinea | 40 | 65 |
| Gambia | 27 | 52 |
| Guinea Bissau | 10 | 17 |
| Sierra Leone | 48 | 56 |
| Liberia | 17 | 50 |
| Sub-total | 125 | 240 |
| Zone B Total | 150 | 445 |

The reasons for the insufficient supply were placed in three categories:

➤ Technical Causes:

The Technical Causes identified which were mostly blamed on the utilities comprised: obsolete & unreliable equipment; inadequate maintenance; operations inefficiencies; insufficient capacity; and, non-availability of primary energy sources.

➤ Financial Factors:

The Financial Factors included low user tariffs, low collection rates, and inadequate financial standing of utilities.

➤ Institutional Issues:

Institutional Issues were to do with planning & implementation responsibility, bureaucracy in decision-making, sensitivity of tariffs to low income/wage levels, and volatile petroleum prices limiting fuel purchases.

The nature of the current power shortage in the sub-region is generally speaking one of energy deficits rather than power deficits especially for those states that are interconnected.

A viable strategy for the power shortages in the sub-region must address the causes that have been identified earlier and if the strategy is to be sustainable, it must also have inherent qualities that overcome the challenges and avoid the obstacles that have been noted to have contributed to the power shortages. Furthermore, the components of the associated Power Supply Plan must be of a kind that is consistent with the deficit being addressed.

Outcome of the Study

The outcome of the study was that:

- The features of the generation needs of the sub-region are:
 - Plants that can produce Least Cost Power when operated at base load to address power shortage situation of Member States;
 - Plants that can serve as Reserve under normal conditions to ensure network reliability & security of supply;
 - Plants that can allow adequate Frequency Control/Regulation for the successful synchronization of the networks in WAPP.
- Sub-regional generation projects are the best (least cost) option for Member States with significant interconnections.
- Until power links are built to connect the five (5) isolated Member States, a regional approach cannot be adopted; only national initiatives can mitigate their power shortages.

- Based on cost of fuel supply, the economic order of merit for least-cost generation are:
 - Coal-Fired Steam Turbine Plants; where coal is available
 - Natural Gas-Fired Combined Cycle Plants; if gas is available.
 - Steam or Slow Speed Diesel Plant Fired with Heavy Fuel Oil
- The preferred locations for thermal power plants are generally sites along the coast. Possible locations for sub-regional plants are:
 - Alagbado in Lagos
 - Maria Gleta in Benin.
 - Lome
 - Tema
 - Aboadze
 - Abidjan (Vridi)
 - OMVS
- The cost of electricity production from “green-field” hydroelectric sources is so highly site dependent that the ranking of each hydro source in the merit order has to be determined on a case by case basis.
- The rehabilitation of under-performing hydro plants for which large portions of capital costs are already sunk, such as Kainji in Nigeria which is about 40 years old and awaiting major overhaul, Jebba in Nigeria, and Mount Coffee in Liberia which has been vandalized, could bring into service the production capacity that has otherwise been unavailable at relatively low incremental cost. The completion of the ongoing Bumbuna HEP would also bring into use a source of production that had hitherto not been available.

Projected Benefits

The proposed actions bring economy-wide benefits by providing the platform for poverty reduction, economic growth and development. The availability of quick deployment units with competent operational management provides member utilities and states with the best means of quickly and reliably mitigating the impact of acute power shortages. The plants proposed also offer an advantageous opportunity to provide vital ancillary services that are necessary for the successful operation of the sub-regional power network to provide reliable and secure power supply. A standard contract template that would have been negotiated in advance under the auspices of WAPP provides Members with considerable assurance of fairness as well as speedy conclusion of the terms of the leasing contract.

Participation in the proposed supply plan brings direct financial benefits to Member States and utilities by providing power at lower costs than it would otherwise have cost. The quantum of potential annual benefits for the different states have been estimated to be as indicated below:

Benefits from Recommended Best Local Alternatives

| Member States | Energy Shortfall Assumed (GWh/Yr) | Unit Cost of Production (\$ / kWh) | | Savings/Unit (\$ / kWh) | Total Annual Savings (\$m /year) |
|---------------|-----------------------------------|-------------------------------------|------------------------------------|------------------------------|----------------------------------|
| | | Most Efficient Present Ops Possible | Recommended Best Local Alternative | From Best Local Alternatives | |
| Gambia | 384 | 0.158 | 0.117 | 0.041 | 15.8 |
| Guinea | 486 | 0.158 | 0.117 | 0.041 | 20.0 |
| Guinea Bissau | 127 | 0.158 | 0.117 | 0.041 | 5.2 |
| Liberia | 370 | 0.158 | 0.117 | 0.041 | 15.2 |
| Sierra Leone | 417 | 0.158 | 0.117 | 0.041 | 17.2 |

Benefits from Recommended Regional Options

| Member States | Energy Shortfall Assumed (GWh/Yr) | Unit Cost of Production (\$ / kWh) | | Savings/Unit (\$ / kWh) | Total Annual Savings (\$m /year) |
|---------------|-----------------------------------|-------------------------------------|-----------------|-------------------------|----------------------------------|
| | | Most Efficient Present Ops Possible | Regional Option | From Regional Options | |
| Benin | 237 | 0.158 | 0.068 | 0.049 | 21.3 |
| Burkina Faso | 477 | 0.174 | 0.084 | 0.049 | 43.0 |
| Ghana | 2,642 | 0.158 | 0.064 | 0.053 | 249.5 |
| Mali | 412 | 0.189 | 0.084 | 0.065 | 43.5 |
| Senegal | 573 | 0.158 | 0.084 | 0.033 | 42.7 |
| Togo | 153 | 0.158 | 0.064 | 0.053 | 14.4 |

Recommendations

- WAPP to acquire suitable land at locations with access to natural gas for designation as sub-regional Power Parks with “Free Zone Status” and build three (3) power plant as follows:
 - 400MW combined cycle plant at Maria Gleta in Benin
 - 400 MW combined cycle plant at Aboadze in Ghana
 - 150 MW combined cycle plant within OMVS system

- The provisional cost estimate for the proposed power plants are as below:

Provisional Cost Estimate for Power Plants

| Item Description | 150 MW | 400 MW |
|-------------------------|-----------------|-----------------|
| Combustion Turbine | \$ 29 m | \$ 77 m |
| Steam Generator | \$ 15 m | \$ 40 m |
| Steam Turbine | \$ 15 m | \$ 41 m |
| FeedWater | \$ 13 m | \$ 35 m |
| Cooling Water | \$ 5 m | \$ 14 m |
| Electricals | \$ 10 m | \$ 26 m |
| Instr & Control | \$ 4 m | \$ 12 m |
| Buildings etc. | \$ 5 m | \$ 14 m |
| Site Improvements | \$ 5 m | \$ 13 m |
| Other Off-site Costs | \$ 7 m | \$ 18 m |
| Total | \$ 108 m | \$ 290 m |

- Expedite the following proposed networks & lines: Volta - Mome Hagou - Sakete, Han – Bobo Dioulasso – Sikasso – Bamako, Ferke - Sikasso – Segou, OMVG Interconnection Project (linking The Gambia, Senegal, Guinea Bissau, Guinea), Bolgatanga-Ouagadougou, Birnin Kebbi – Niamey – Ouaga, and the CLSG System (linking Cote d’Ivoire to Liberia, Sierra-Leone & Guinea).
- Deploy in the interim, whilst the more optimal actions are being pursued, mobile generating capacity running on suitable fuels for the non-interconnected states including Liberia, Sierra-Leone, Guinea-Bissau, The Gambia and also Guinea as well as other Member States with acute shortages.
- Address the other common “cross-cutting” problems of the power sectors including; Human Resource Capacity; Tariffs and Financial Management; Power System Losses; Taxation on Energy Materials; and, Energy Efficiency & Conservation.

Action Plan

Two groups of actions are foreseen for WAPP. The first group is made up of near-term actions for the most acute of the shortage situations. These near-term actions although sub-optimal are only intended to temporarily mitigate the present difficulties pending the realization of the other group of actions which are the optimal strategic actions for the resolution of the power shortages.

Near-term Mitigation Actions

- Arrange with interested financial institutions to establish private companies to procure (for leasing) in accordance with the needs of member utilities, a fleet of mobile generation plants of about 1-5 MW each. The plants shall be suitable for quick deployment and be complete with associated controls, fuel tanks, transformers and switchgear.
- The units are to be deployed, together with skilled operators and adequate spare parts, to locations at the request of member utilities. The requesting utility will be required to make capacity and energy payments accordingly. Guarantees for capacity payments may be provided to the leasing companies by multi-lateral agencies based on unutilized funds already allocated to the power sector of the respective Member States.

Optimum Strategic Actions

- Obtain Concessions for “Power Parks”: WAPP to approach Host Governments to secure Land and Free Zone Status for Power Parks at target locations.
- Appoint Strategic Partners to lead consortia (PPP): WAPP & Member utilities appoint Strategic Partners (one for each proposed facility) to assemble and lead the consortia to implement each facility as a Public-Private-Partnership.
- Create separate Special Purpose Companies (SPC) to own different plants. The SPCs will also be jointly-owned by interested WAPP member utilities. The proposed steps to accomplish this action are: i) Identified WAPP Member Utilities confirm interest in SPCs; ii) Members agree terms of joint ownership; and, iii) One SPC is formed for each facility.
- Secure Funds: 20% SPC equity & 80% debt by Consortia: The participating utilities arrange their equity contribution possibly from Multi-lateral sources through their Governments. The Consortia mobilize debt from International Market with SPC support
- Construct Plants: – Consortia appoint EPC Contractor (with SPC consent) to design, build & commission: Ownership Title to plant is transferred to SPC after completion.
- Operate Plants: – Plants are leased back to consortia under contract. Consortia appoint operators (with SPC consent) to operate, maintain and manage the facility. Consortia administer power off-take & payment arrangements and meet debt service obligations on behalf of SPC.
- Accelerate completion of the rehabilitation of Kainji, Jebba and Mt. Coffee dams, and completion of the Bumbuna dam.