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CURRENT PROJECTS UNDER THE SOUTHEAST EUROPEAN COOPERATIVE INITIATIVE (SECI) RELATED TO THE INTERCONNECTION OF SUB-REGIONAL ELECTRIC POWER NETWORKS

(Submitted by the Government of The former Yugoslav Republic of Macedonia) [1]

Introduction

1. According to the decision of the Southeast European Cooperative Initiative (SECI) Agenda Committee, the Project Group on "Development of Interconnection of Electric Power Systems of SECI Countries for Better Integration to the European System" was established. The former Yugoslav Republic of Macedonia was nominated as Host Country and coordinator of the Project Group.

2. The Government of The former Yugoslav Republic of Macedonia in cooperation with The Power Utility, ESM, prepared the first meeting on 30 January 1998. Up to January 1999, five meetings were held, four in The former Yugoslav Republic of Macedonia and one in Ankara, Turkey. In this preparation phase, on a voluntary basis, governmental representatives and experts from the power utility mainly participated, from the following SECI countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Yugoslavia, The former Yugoslav Republic of Macedonia, Romania, Slovenia and Turkey. Representatives from UNECE, SECI Office, European Commission, United States of America, Union for Coordination and Transmission of Electricity (UCTE), International Financial Institutions, companies and others follow the activities of the Project Group.

[1] Prepared by Mr. Trajce Cerepnalkovski, SECI Project Coordinator, State Electricity Company (ESM), Skopje.

3. At these meetings, the main aspects of common interest for the cooperation of the power systems in the region were discussed and five issues were agreed as priority for further development, briefly described below:

1. Rehabilitation of existing electricity lines and substations in Bosnia and Herzegovina and Croatia in order to reconnect the south wing of UCPTE.

   Extensive technical and feasibility studies for reconstruction of the 400 kV network in Bosnia and Herzegovina (repair of Mostar 3 and Mostar 4 - 400/220 kV transformer substations) and in Croatia (Ernestinovo and Adriatic line) have been already carried out by two ad hoc groups of SUDEL (second Draft Report, Annex III). The main problem was funding of these projects. In Bosnia and Herzegovina activities were started among three EPs for the establishment of a Joint Power Coordination Centre (JPCC), which is a prerequisite for funding.

   The Project Group invited the SECI Coordinator to take urgent specific action, as an additional effort, for funding possibilities for the realisation of the reconnection of the UCPTE island to the main European system.

   (*Comment: In the meantime JPCC in Bosnia and Herzegovina was successfully established and activities for the reconstruction of Mostar Substation started in the framework of Power 3 programme. The activities for reconstruction of Ernestinovo are prioritised in Croatia and are expected to start soon*.)

2. Feasibility and Technical Study for east-west corridor in the high voltage transmission systems of the south-east European countries, including issues related to the interconnection of the region to the power grid of Turkey.

3. Investigation of economic and technical advantages of the integrated operation of the interconnected Balkan Electric Power Systems.

4. Tele-information system for the connection of the dispatching centres of the power systems in the region in order to improve the cooperation, electricity exchange and opening up of electricity market.

5. Study to define a revitalization methodology for high-voltage lines and transformer substations by identifying a priority criteria.

4. For projects 2, 3, 4 and 5, the Project Group adopted the final text of the Terms of Reference for the specific Studies to be developed. The Project Group proposed to SECI Agenda Committee and possible donors to provide the funds for execution of the Studies.

II. Background

A. Power Systems status and interconnection

5. The Power Systems of the SECI countries have a different status concerning UCTE membership: some of them are members of the UCTE (Slovenia, Croatia, Bosnia and Herzegovina, Yugoslavia, The former Yugoslav Republic of Macedonia and Greece); Bulgaria and Romania are in an advanced process for full UCTE membership and Turkey has made an

application and started the procedure. Hungary, through CENTREL has also become a member of UCTE.

6. On the other hand, as a result of the war activities in ex-Yugoslavia, very important points in the high voltage network in the region were damaged and have been out of operation for many years. These are: Mostar Substation 400 kV with connected lines that caused the interruption of the Adriatic line; Ernestinovo Substation 400 kV with connected lines that caused interruption of the North ex-Yugoslavian power corridor. As a result the southeast UCTE wing was separated from the main European interconnected grid. In the meantime, UCTE members from the southeast island (Greece, The former Yugoslav Republic of Macedonia, Serbia, Montenegro and part of Bosnia and Herzegovina) were interconnected and work in parallel synchronous operation mode with Bulgaria, Romania and Albania. Turkey recently applied for UCTE membership. At the moment there is only one interconnection line of Turkey with the region and it is used for exchange of power only in an island mode operation. The second Interconnection line 400 kV between Bulgaria and Turkey is under construction and a new 400 kV interconnection line between Greece and Turkey is under study.

B. Related initiatives in the region

7. The European Commission project "Balkan Energy Interconnection Task Force" was carried out in 1997, and is one of the background documents for the SECI Project Group activities. In the framework of this Task Force, the Inventory of the potential interconnections in the Balkan region was described. The aim of the project was to help ensure the efficiency and coordination of electricity, oil and gas interconnection investment initiatives in the Balkan region. Mr. Cendrowicz from DG XVII presented the results to the first Project Group meeting.

8. In parallel with the SECI Project Group activities, the Study for a Regional Electricity Market (REM) was initiated and carried out in 1999, under EC sponsorship. Based on this Study, the two Memorandams were signed by the Energy Ministers in the region, aimed at development of the REM.

9. The Stability Pact was established, and many power infrastructure studies and potential investments were identified and funds pledged.

10. The Project Group has in mind all these activities and the necessity for cooperation and complementarity was recommended.

III. Projects Identification and Preparation

11. Looking for the possibilities for realization of the projects from the common interest list and in correlation with the other initiatives, the following two projects were organized and activated with main sponsorship by the United States Agency for International Development (USAID), Energy and Infrastructure Bureau for Europe and Eurasia, headed by Mr. Robert Ichord:

1. Tele-information System among the National Dispatch Centres in SECI Countries;
2. Regional Transmission System Planning.

12. In the process of identification USAID, according to the previous investigation and assessment of the regional needs and possibilities and following the SECI Project Group activities, decided that the project "Tele-information System among the National Dispatch Centres in SECI Countries" could be of great interest in the region and could be an effective incentive for straightening the cooperation and better operation of the Power Systems in the region. This project was also considered in the light of the new initiative for developing the regional electricity market environment. All Power utilities in the region have their own strategy for internal Tele-information development and upgrading their Energy Management Systems (EMS), at various levels of implementation. Mainly International Financial Institutions are involved providing the financing of these projects in the countries. These projects also have significant attention in the Stability Pact support programme. Having all these in mind, the regional Tele-information project was considered to upgrade the existing internal efforts on a regional level and to develop the TI system according to UCTE criteria and to become a part of the UCTE-URTICA network.

13. The second Project, Regional Transmission Planning was identified and initiated based on a SECI List, item 2 and 3, and the interest of the Power Utilities in the region. The other aspect was a necessity for better evaluation of the possible investments through the Stability Pact. In this direction, one of the aims of this project is to evaluate the regional benefits of the proposed new investments in the power interconnections in the region.

14. For both projects, the main sponsor, USAID, contracted the lead consultant as a project manager. A consultant with ESM as coordinator and with the participation and supervision of USAID, reviewed the existing TORs and drafted the Memorandum of Understanding and Work Plan. They also assessed the interest of the potential participating utilities, prior to starting the project.

IV. Organization and Starting the Projects

15. The SECI Project Group established a common approach in organizing and starting the Projects. The organizational structure for realization of the projects are shown in Figure 1. For general direction and management of the project The SECI Project Group established a Steering Committee in which representatives from each participating country/utility, UNECE, sponsor (USAID or any in the future), lead consultant (USAID contractor), EC and IFIs participate. The Technical Coordinating Group is responsible for coordination and leading the project at a technical, expert level and consists of representatives from: each participating country/utility at expert level, project coordinator (ESM), lead consultant, UCTE. The Working Groups (3 –4 working groups were used in these projects) which carried out the detailed expert work in the framework of the projects, consisted of the representative of the member countries in the project and leading consultant.

16. The projects started with the formal organizational (kick off) meeting which reviewed, adopted and signed the Memorandum of Understanding, reviewed and adopted the Work Plan and established the organization.

SECI PROJECT MANAGEMENT AND ORGANIZATION

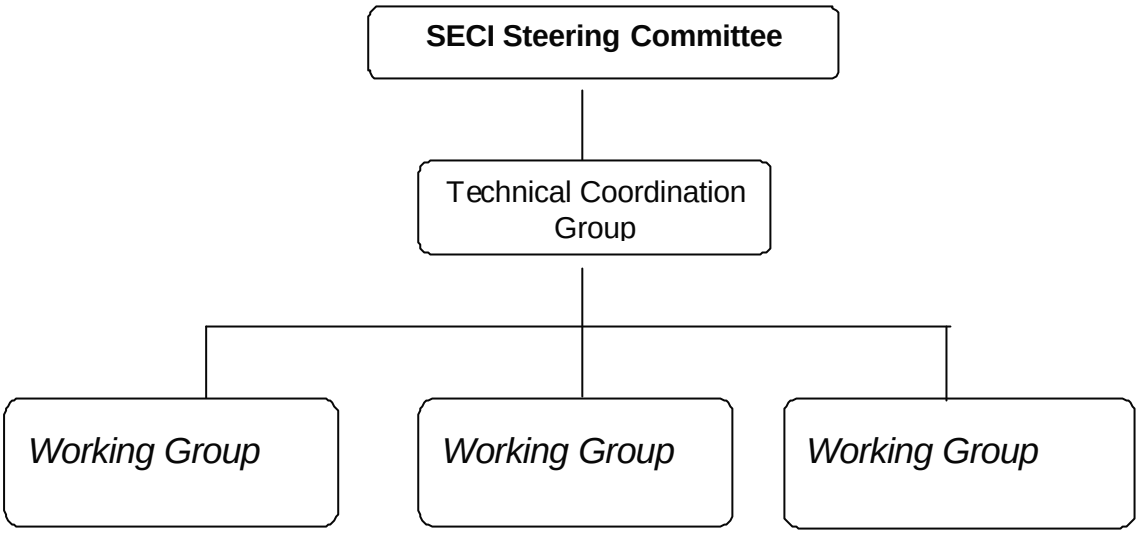

Figure 1 Organizational structures of the SECI Projects

5. Teleinformation System Among National Dispatch Centres of SECI Countries [2]

5.1 Introduction

17. Recent economic and political changes in east European countries have resulted in a closer cooperation within the continent. One important sector of this cooperation is in the domain of electric power exchanges. This cooperation offers benefits to the interconnected power systems. On the other hand, the processes of liberalization of the electricity sector are expected to increase the volume of bulk power exchanges among the power systems. As a result, the power transactions in the area will increase in terms of financial volume and energy transferred. In this framework new interconnections are currently investigated and the reconnection of the Southeast European grid to the UCTE grid is expected to occur soon.

18. Due to this anticipated more integrated operation of the power systems in the SEE area and the closer cooperation with UCTE, the need rises for an increased volume of data exchanges between the Dispatching Centres (Control Centres) of the involved utilities and/or Transmission System Operators. The information exchange should cover, but not be limited to, data related to power system operation and transaction accounting. It will be extended to cover the needs of market operation, i.e. transaction scheduling, energy offers and prices, ATCs and settlement.

[2] The text is based on the Draft Final Report, prepared by the Leading Consultant Electrotek Concepts, Inc., USA with Mr. Sudhir Virmani as Project Manager, Electric Power Company of The former Yugoslav Republic of Macedonia (ESM) as Project Coordinator and participants from the Companies involved in the Project. Information used in this text could be changed in the final version of the Report.

19. Taking part in the UCTE Interconnection and the future European electricity market, operation of the power systems involved will be improved by the availability of the appropriate data exchange facilities between dispatching centres using UCTE recommended technical solutions and communication protocols (URTICA network, ICCP TASE-2 protocol, Intranets and e-mail).

20. Recognizing the importance of this project for the Region, USAID agreed to financially support the project with Electrotek Concepts Inc. as the prime contractor and with the electric utility ESM of The former Yugoslav Republic of Macedonia, as the SECI project coordinator. A Steering Committee was responsible for the overall direction of the project and was headed by the Chairman of the SECI Electricity Interconnections Group.

21. This project was started in February 2000, with the formal kickoff meeting held on 15 nd 16 February 2000 at Skopje, The former Yugoslav Republic of Macedonia. The Draft Final Report was completed in May 2001, and we expect the Final Document to be completed in September 2001. The Final report will consist of Volume 1 - Review of existing TI infrastructure, Volume 2 - TI requirements, Volume 3 - TI Projects Definition and Project Introduction and Summary.

22. The electric utilities in the region participating in the Project are: Albania – KESH; Bosnia and Herzegovina – ZEKC, EP BiH, ERS, EP HZHB; Bulgaria – NEK; Croatia – HEP; The former Yugoslav Republic of Macedonia – ESM; Greece – PPC; Hungary – MVM; Romania – Transelectrica (formerly CONEL); Turkey – TEAS; Yugoslavia[3], Serbia – EPS, Montenegro, EPCG.

23. Besides USAID as main sponsor of the Project, significant financial participation was provided by the ESM – Skopje and all participating utilities.

5.2 Project Methodology

24. The project consisted of six tasks:

Task 1: Review existing dispatching and communications infrastructure and define requirements
Task 2: Evaluate alternative solutions and select optimal alternative
Task 3: Technology transfer
Task 4: Telecommunication system management requirements definition
Task 5: Implementation strategy development
Task 6: Project development and financing

25. Because of scheduling and budget limitations, the first four tasks were completed fully, while tasks 5 and 6 were partially completed. This is further explained below.

[3] Yugoslavia became a SECI member and joined the Project at an advanced stage of the work.

26. Task 3 – Technology Transfer – consisted of a workshop in Ohrid, The former Yugoslav Republic of Macedonia in May 2000 and visits to the UCTE centre in Laufenburg, Switzerland and the CENTREL accounting centre in Warsaw, Poland in July 2000. Presentation material from all three meetings was sent to all participants and Steering Committee members.

5.3 Current Situation and Requirements

27. There was a considerable volume of data collected from all the project participants and for the details it is necessary to refer to the three volumes referenced above. Herein we summarize and provide an overview with an emphasis on the conclusions.

5.3.1 Dispatch Centres

28. The locations of the National Dispatch Centres of the project participants are as follows: KESH – Tirana, Albania; ZEKC – Sarajevo, Bosnia and Herzegovina with Elektroprivreda Centres in Banja Luka -ERS, Mostar (EPHZHB) and Sarajevo (EPBiH); NEK – Sofia, Bulgaria; HEP – Zagreb, Croatia; ESM – Skopje, The former Yugoslav Republic of Macedonia; PPC – Athens, Greece; MVM – Budapest, Hungary; Transelectrica – Bucharest, Romania; TEAS – Ankara, Turkey; EPS – Belgrade, Serbia, Yugoslavia; EPCG – Podgorica, Montenegro, Yugoslavia and ELES – Ljubljana, Slovenia.

29. Several of the electric utilities have regional dispatch centres. All regional centres communicate with the National Centres using internal telecommunication systems (Fibre Optic, Power Line Carrier, Microwave, Satellite). Thus, for the purposes of this project, it is sufficient to provide communication capability among the NDCs only since all data is then accessible. In Yugoslavia there are two centres, one for each Republic, and both are treated as NDCs.

30. Many of the utilities have recently upgraded, or are in the process of upgrading, their dispatch centres. This is an important issue since the Teleinformation System being proposed requires the use of the latest software standards and technologies. Therefore, for those utilities that do not have NDCs of recent vintage, at least some portions of the NDC may need to be upgraded to meet the requirements for this project.

5.3.2 UCTE Second Synchronous Zone Accounting Centre

31. Currently, many of the project countries are operating in the Second UCTE Synchronous zone. Others, for example Hungary, Croatia, Slovenia and part of Bosnia and Herzegovina, are connected to the UCTE main grid. There is an Accounting Centre for the Second Synchronous Zone in Belgrade, Yugoslavia referred to as the EKC, which collects and transmits certain energy accounting data to the UCTE Southern Region Accounting Centre in Laufenburg, Switzerland. Although some details about this centre are included in Volumes 1 and 2 for general interest, EKC is not considered an integral part of this NDC project.

5.3.3 Internal Telecommunication Facilities

32. There are substantial efforts under way in all of the electric utilities to upgrade and modernize their internal telecommunication network. All of them have decided to implement a

fibre optic based network for the "backbone" communication facilities supplemented by a variety of communication media for the tributaries and spurs. The progress to date is not uniform for a variety of reasons mainly budget constraints. However, it is anticipated that at least the key portions of the internal telecommunication facilities will be upgraded by the participating utilities so that access to data from regional dispatch centres and substations will not be a problem.

5.3.4. Traffic Analysis

33. Based on the results of a questionnaire, an initial estimate of the volume of data to be exchanged was prepared. This data to be exchanged was assumed to consist of:

- Real-time data (every four seconds). Examples of this data include status of switches, voltages, line flows, Area Control Error;
- Hourly data. This data includes energy counters, accounting information, schedules and Application data (Load Flow calculations).

34. Based on this it was estimated that a 128 Kbps channel would suffice. Taking into account the geography, the conceptual telecommunication topology that results is shown in Figure 2

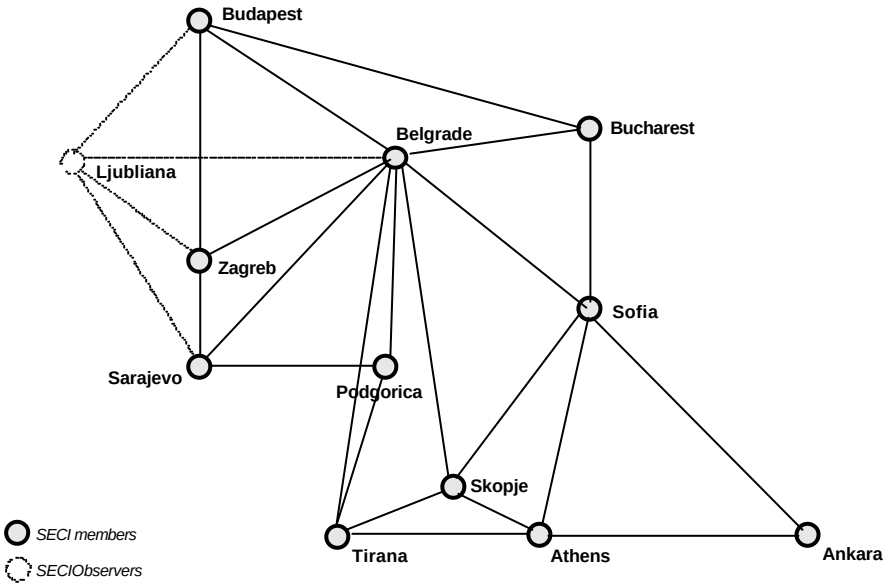

Figure 2. Conceptual Topology for the SECI NDCs Teleinformation System

35. Based on the data exchange requirements of 128 Kbps and the conceptual telecommunication topology in Figure 2, the required data capacity to ensure that each NDC has available a 128 Kbps channel to every other NDC was calculated and particular links were ranked with required data capacity up to 1,408 Kbps.

36. Adding an allowance for voice traffic and recognizing that some links will carry traffic for third parties, and consistent with the minimum SDH channel, a channel capacity of 2 Mbits per second (designated E1) between each NDC pair in each direction was assumed adequate. Even with the maximum data volume of 1,408 kbps, approximately 10 voice channels (10*64kbps) can be accommodated without any voice compression. As a benchmark, the STM – 1 channel on a SDH network is rated at 155 Mbits per second. Most of the SECI NDC project members plan to use SDH.

5.3.5. Development of an Electricity Market in the Project Countries

37. All of the countries participating in this project have stated that they intend to comply with EU Directive 92/96 on the Internal Electricity Market. Thus, if the SECI NDC project participants do conform to the EU Directive, they will be operating in a more competitive market environment. In fact many of the project participants have already started along this path as briefly explained in the Report.

38. Assuming that the current plans are realized, a competitive electricity market in the SECI NDC countries will develop consistent with the EU Directive. It appears that there will be multiple ISOs and that energy trades will take place according to the Third Party Access mechanisms spelled out in the EU Directive, with the tariffs for cross border trades being set in accordance with those developed by the UCTE/ETSO.

39. With regard to the development of a centralized Balkan power exchange, the situation is less clear. By power exchange we mean an organization for trading energy and perhaps ancillary services by multiple parties. The EU Directive does not require that such a system be put in place by any of the utilities. However, the trend in Europe is for these exchanges to be developed by "for profit" organizations with or without direct electric utility involvement. It is our assumption that this will also be the case in the Balkan region. Specifically, in relation to this project, since such exchanges plan to rely on the Internet to support the trading activity, we do not expect that they will substantially affect the capacity of the NDCs Teleinformation system.

5.3.6 Regional Functions

40. There are nevertheless certain functions that need to be performed on a regional basis. The first set of functions is related to the Teleinformation system itself and the second to the operation of the power systems in the region.

5.3.6.1. *Telecommunication System Monitoring*

41. In today's market, service excellence is essential to the survival of the business. New entrants can differentiate their service by managing their network with modern expert systems that can assure optimal performance at the service level. The objective of any system management solution is to expedite the detection, location, identification, and correction of a system fault and minimize and mitigate the occurrence of a system fault.

42. The functions of the Network operations centre and telecommunications system management can be separated into several areas including:

- Fault Management
- Performance Management
- Accounting Management
- Configuration Management
- Security Management

43. Since the approach for the SECI NDCs Teleinformation System is to build on the internal networks, the regional telecommunication management functions will also rely on the in-country communication management facilities. The regional management function thus will be one of monitoring and coordination rather than controlling. Volume 3 contains additional details.

5.3.6.2. *Power System functions*

44. This set of functions at the regional level can be further subdivided into:

- Power System Security Monitoring
- Energy Accounting
- Interfacing to External Entities

5.2.6.2.1 Power System Security Monitoring Functions

45. The transmission security functions will provide for monitoring and coordinating the demand and energy transactions over the region's transmission lines as utilities and power marketers in the region buy and sell power every day. Since the generation of electricity must continuously be matched to customer demand, day-to-day, minute-by-minute monitoring by the security centre and member utilities is necessary to keep the transmission system functioning reliably.

46. The new operating scenario created by the upcoming Regional Electricity Market in Southeastern Europe will have to be considered both on a regional level, and in the broader context of the UCTE interconnection. As a result, the transmission security assessment activities to be performed for the region will encompass both conventional functions and new ones, including:

- Security Monitoring
- Voltage and Reactive Control
- Congestion Management
- Transfer Capability Assessment

5.2.6.2.2 Energy Accounting

47. This function is needed to account for all energy flows between the regional entities. It is envisaged that this regional function will focus on inter-country flows with the internal energy accounting being the responsibility of the local System Operator (SO)/Market Operator (MO). Essentially this function collects hourly values and computes the actual flows and identifies the imbalances between scheduled and actual values for each day (and then month). This data is reported to a central organization for any corrective actions and settlements. This function could be performed for the SECI NDC project members only or could be incorporated into an existing UCTE centre such as the one at Laufenburg, Switzerland

5.2.5.2.3 Interfacing to External Entities

48. There are potentially a number of external entities that the SECI NDCs region could interface with. These include one or more MOs, perhaps Ancillary Services providers, Distribution Companies and other market agents. In addition, interfaces will be required to UCTE centres either existing or new that are responsible for UCTE-wide reliability and transmission network management. At the present time, some of the SECI countries are in full synchronous operation with UCTE while others are operating within the Second UCTE synchronous zone. However, in the long run it is expected that all the countries will be part of the main UCTE synchronous zone (after the destroyed transmission system infrastructure is repaired and augmented). This will require interconnection to the URTICA network being developed in the UCTE Region.

5.3.7 SECI NDCs Communication Infrastructure

49. It was recognized that future requirements and regional functions are not adequately reflected in the E1 capacity calculation. For example, data exchanges with regional coordination and accounting functions, with the future market operations, and greater energy trading would be needed. Therefore, it was decided to plan for the equivalent of four E1 (4*2 Mbps) links among the dispatch centres.

50. There were two main alternatives for implementation. The first was to superimpose a SECI NDC communication system on the internal systems. The second was to use the capacity of the existing system and augment it as needed. It was decided that the second option offered a more cost effective and faster alternative and so it was selected. It was agreed by all parties that each country would be responsible for the portion of the network up to its boundary with the neighbouring country. If the agreed to connectivity was not already being implemented it would be a candidate for funding under the Stability Pact or other mechanisms available for the SECI initiative.

5.3.8 The Physical Connectivity

51. The conceptual connectivity shown in Figure 2 and the traffic volume briefly explained in 5.3.4 have to be translated onto the physical connectivity showing the actual communication links that will constitute the conceptual link. This physical connectivity is shown in Figure 3. In this only the links relevant to the data exchange among the NDCs are shown – the internal communication networks that are not part of the NDC interconnections are not shown. The complete in-country telecommunication facilities are described in Volume 1.

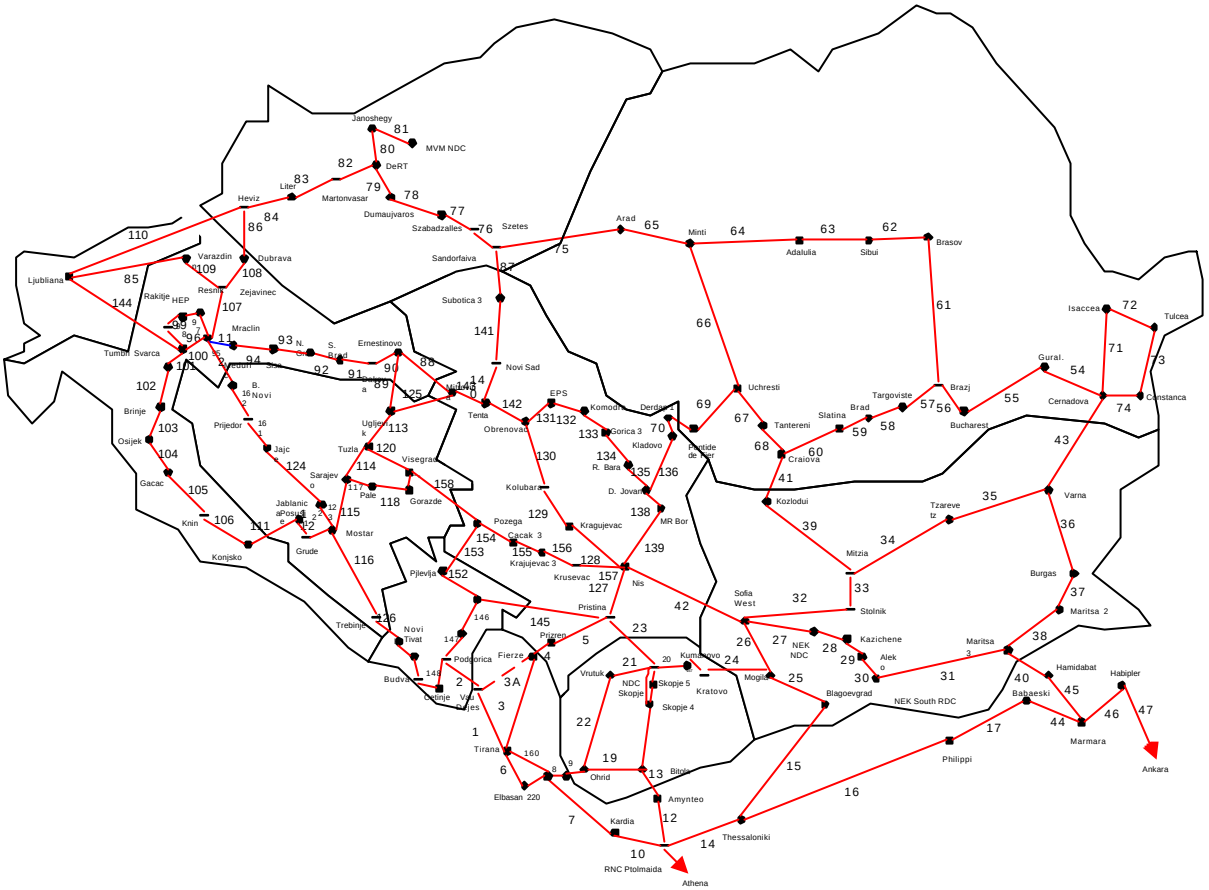

Figure 3.[4] Physical Connectivity among the NDCs

Each link with its number is specified in Volume 3 in the Table – Link Map Locations. A fragment of this table is reproduced below in Table 1 to illustrate its contents.

Table 1 – Link Description Examples (Fragment of Table 3.2 of Volume 3)

Link No	Location 1	Location 2	Traffic Requirements (kbps)
1	Tirana - Albania	Vau Dejes - Albania	1,408
2	Vau Dejes - Albania	Podgorica - Montenegro	1,280
3	Tirana - Albania	Fierze - Albania	256
etc. …			

Using these links, the complete path between the NDCs can be defined (as shown in Figure 2). A geographical description of each path is given in Table 3.4 of Volume 3 and the first few entries in this table are reproduced below in Table 2 as an example.

4 This Figure is based on the Draft report and could be subject to change in the Final Report. The geographical presentation of Greece and Turkey are avoided for better visualization.

Table 2 – Example of NDC connectivity. Part of Table 3.4 of Volume 3.

NDC	NDC	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	etc
Tirana	Athens	6	7	10	11								
Tirana	Sofia	6	8	9	20	21	22	24	26	27	164	167	
Tirana	Sarajevo	1	2	115	116	126	148	149	150	151			
Tirana	Skopje	6	8	9	21	22							
etc.	Etc												

52. Table 2 is to be interpreted as follows. The first two columns show the NDC locations. The column headers L1-L11 are numeric link counts. The entries in each cell are the physical links shown in Figure 2 and Table 1. Thus for example the connection from Tirana to Athens requires four hops (links) consisting of physical links 6, 7, 10, 11. The connection from Tirana to Sofia will require 11 hops.

5.4 Potential Projects

53. Based on the connectivity defined above as being necessary to interconnect the NDCs, projects were identified which complete the telecommunication network. These projects are listed for each participating country. In addition, it was felt that some EMS/SCADA system upgrades will be necessary in utilities that have relatively old systems. These are also identified. Finally, the general requirements for Regional functions (with no location picked) are also listed.

5.4.1 In-Country Projects

54. To ensure the physical connectivity and to build the SECI TI System, a list of various new Projects was identified. These projects are on a different level of complexity. The development of these projects will bring significant improvements in TI infrastructure, which is assumed to become adequate and capable to satisfy the functions and requirements previously defined. In this paper we will present a list of the projects identified as an illustration, but this list will be changed and improved according to the conclusions of the Technical Coordinating Group Meeting held in July 2001 in Sofia. The final version will be available in September 2001. The following projects illustrate the necessary upgrading of the TI infrastructure for realization of the SECI TI System:

- Link KESH – PPC: OPGW (Optical fibre on Power line Ground Wire) with associated equipment on existing 400 kV overhead line from S/S Elbasan (ALB) to S/S Kardia (GRE).
- Link KESH – EPCG: OPGW with associated equipment on a new planned 400 kV overhead line S/S Elbasan – S/S Tirana (ALB) – S/S Podgorica (MN, YUG).
- Link KESH – ESM: Installation of fibre optic link between S/S Struga (MKD) and the nearest point on a 400 kV line from Elbasan (ALB) to Kardia (GRE). The estimated length is 15 km.
- Link NEK – ESM: OPGW with associated equipment, and digital PLC as back up, on planned 400 kV overhead line S/S Chervena Mogila (BUL) – S/S Stip (MKD) – S/S Dubrovo (MKD) cca 190 km., and upgrading of the existing 400 kV line S/S Dubrovo – S/S Skopje 4 with OPGW, estimated length 82km.

- Link NEK – EPS: Upgrading of the existing 400 kV line S/S Sofia West (BUL) – S/S Nis (YUG), cca 123 km. and further to Belgrade via S/S Nis – S/S Kragujevac 2 – S/S Obrenovac A, estimated length 324 km. with OPGW and installation of the associated equipment and digital PLC as back up. (From S/S Obrenovac A to Belgrade link is defined in the other project).
- Necessary internal links in Croatia: Installation of OPGW on the 110 kV line S/S Mraclin – S/S Sisak – S/S Medulic – S/S Djakovo. Already exist the link S/S Djakovo - S/S Ernstinovo already exists. This is a 110 kV line and will encompass five intermediate stations with Mraclin and Ernistinovo as the terminal points.
- Link CRO – B&H: Installation of OPGW on existing line S/S Mraclin (CRO) - S/S Jajce (B&H).
- Link CRO – B&H: Installation of OPGW on existing 400 kV line S/S Ernestonovo (CRO) – S/S Ugljevik (B&H).
- Link CRO – SER: Installation of OPGW on existing 400 kV line S/S Ernestinovo (CRO) – S/S S. Mitrovica (SER, YUG).
- Link HUN- ROM: Installation of OPGW on existing interconnected overhead line from S/S Sandorfalva (HUN) to S/S Arad (ROM).
- Internal Connections to NDC in MKD:
- S/S Skopje 4 – NDC (OPGW on existing line 110 kV and underground FO). The estimated length is 12 km.
- S/S Skopje 1 – NDC (OPGW on existing line 110 kV and underground FO). The estimated length is 14 km.
- Upgrading with OPGW existing 400 kV line S/S Skopje 1 – S/S Skopje 4. Estimated length 22 km.
- New EMS for the NDC in Montenegro
- Link MN, YUG – B&H: OPGW on new overhead line 110 kV Podgorica 2 – Cetinje, upgrading with OPGW existing overhead line 110 kV: Cetinje – Budva – Tivat – Herceg Novi (MN) – Trebinje (B&H).
- Link MN – SER: upgrading with OPGW existing overhead line 220 kV S/SPodgorica 1 – S/S Mojkovac – S/S Pljevlja (MN) – S/S Pozega (SER)
- Link TUR – GRE: Installation of OPGW and terminal equipment on planned new 400 kV line S/S Babaeski (TUR) – S/S Philippi (GRE).
- Training, consultancy services and technical support for communication, computer and metering infrastructure and software tools;
- SCADA/EMS Software for operation in new market environment;
- Link SER – HUN: DC EPS – S/S Beograd 3: installation of approximately 9.5 km OPGW on existing line 110 kV, S/S Obrenvac A – S/S Beograd 3: installation of approximately 32.7 km OPGW on 220 kV, S/S Obrenvac A – RP Mladost: installation of approximately 5.3 km OPGW on existing line 400 kV, RP Mladost – S/S Novi Sad 3 installation of approximately 90.5 km OPGW on existing line 400 kV, S/S Novi Sad 3 – S/S Subotica 3: installation of approximately 81.9 km OPGW on existing line 400 kV, S/S Subotica 3 (SER) – S/S Sandorfaiva (HUN): installation of (approximately 27.5 to the border with Hungary) OPGW on existing line 400 kV.
- Link SER – MN: S/S Obrenvac A – S/S Valjevo 3: Installation of approximately 49.2 km of OPGW on existing 220 kV line, S/S Valjevo 3 – S/S Bajina Basta: Installation of approximately 57.3 km of OPGW on existing 220 kV line, S/S Bajina Basta – S/S

Pozega: Installation of approximately 48.9 km of OPGW on existing 220 kV line and connecion to S/S Pljevlja (MN).

- Link SER – ROM: DC EPS – Kumodraz: Microwave, Kumodraz – Gorica: Microwave, Gorica – Rakova Bara: Microwave, Rakova Bara – D. Jovan: Microwave, D. Jovan – Kladovo: Microwave, Kladovo – HE Djerdap 1; Microwave, HE Derdap 1 (SER) – HE Portide de Fier (ROM): installation of OPGW on existing 400 kV line.
- Link SER – ALB: TS Nis 2 – TS Kosovo B: installation of approximately 124.2 km of OPGW on existing 400 kV line, TS Kosovo B – TS Prizren: installation of approximately 71.7 km of OPGW on 220 kV line, S/S Prizren (SER/KOS) – S/S Fierze (ALB): installation of approximately 45 km of OPGW on existing 220 kV line to the border with Albania.
- Link SER – MKD: S/S Kosovo B – S/S Skopje 1: installation of approximately 83 km of OPGW on existing 400 kV line.

5.4.2 Regional Projects

55. In the previous section we identified the projects that are candidates for implementation within each country. In addition, there are three projects that are regional in nature that are necessary and can be implemented at locations determined by the SECI members and UCTE. These projects are:

5.4.2.1 Security Functions

56. The functions for regional security can vary over a wide range. For example, the regional centre could be a Regional Transmission Operator (RTO) or could simply be a monitoring centre that alerts the NDCs and local ISOs regarding existing or potential short-term transmission problems. It is not therefore possible to estimate the scope of this project unless a detailed functional specification for the software and services to be provided is developed. However, at this time we believe that the four E1 channels between the NDCs and to the Security Centre should be adequate to meet needs.

5.4.2.2 Energy Accounting Functions

57. Based on the current UCTE requirements, the Energy Accounting functions can be supported via a low capacity link since the data is not transferred in real time and the amount of data is relatively small. Thus the Energy Accounting function should be located on the backbone network so that it can get data from all the NDCs and if required transfer the data to the UCTE accounting centre.

58. As noted earlier, the Balkan regional utilities could in theory become participants in one of the existing UCTE centres such as the one at Laufenburg.

5.4.2.3 Teleinformation System Management

59. The network management architecture is relatively simple. It consists of one or more management stations connected to a local area network. This LAN is then connected to the communication system. The management stations communicate with the individual

management centres for the member utilities communications systems. In most cases information will flow from the member utilities to the regional centre. This regional function will be capable of monitoring the entire system and thus be able to detect problem areas that may cross utility networks.

60. The data volumes and voice traffic is quite low and it will be well within the capability of the backbone Teleinformation network. Thus by connecting the Network Management Nodes on the backbone network either directly or via a channel of sufficient capacity, the regional NMS can be located at any mutually agreed, convenient point.

5.5 Conclusions

61. In this project, information regarding the existing and planned Dispatching and Telecommunication facilities in each country was obtained and documented in Volume 1.

62. The requirements for the Teleinformation System among the NDCs were determined taking into account:

- An analysis of the data and voice traffic among the NDCs.
- The support for a competitive electricity market in the region
- The intent of all participating countries to comply with the EU 96/92 Directive on the Internal Electricity Market.

These requirements were then converted into a conceptual architecture and link capacities as described in Volume 2.

63. The physical communication network to support the Teleinformation system requirements was developed next. It was determined that four E1 links between NDCs would be sufficient to meet foreseeable needs. From this the projects to be implemented were identified and are listed in Volume 3. Thus the major objective of the project was successfully completed.

64. Technical exchanges were also undertaken with the CENTREL countries and the Southern Region UCTE accounting centre in Laufenburg via both a workshop in Ohrid, The former Yugoslav Republic of Macedonia, and site visits. These visits enabled the project team to gain an improved awareness of the URTICA, PIA and CENTREL telecommunication networks.

65. The final step is to complete the financial analysis of the candidate projects to determine the “bankable” projects that could be supported by the International Financial Institutions. This task will require additional funding and an extension of the schedule.

6. Regional Transmission System Planning Project

6.1 Introduction

66. This Project was developed based on the two SECI proposed Studies from the common list mentioned in chapter one of this report. Below are extracts from the Terms of References agreed in the first phase of the Project Group activities, to better understand the approach used in implementating this project.

6.1.1. Feasibility and Technical Study for an East-West Corridor in the High Voltage Transmission System of the South-East European countries, including issues related to the Interconnection of the Region to the Power Grid of Turkey

A. Background

67. Recent economic and political changes in east European countries created the conditions for closer cooperation within Europe. The fact that the electricity sector represents a very important area is due to the possible beneficial effects of power systems interconnection, such as installed capacity, reserve and operational cost savings, mutual assistance etc. As a consequence of the further extension of the UCTE Interconnection, the electric power systems of East Germany and CENTREL (Poland, Hungary, Czech Republic and Slovakia) have already joined the Interconnection, while Romania and Bulgaria are about to be connected to the UCTE Interconnection. For this purpose, several feasibility studies have been carried out.

68. During the recent conflict in Croatia and Bosnis and Herzegovina, and due to the substantial damage incurred by the electrical networks in these countries, UCTE members; Greece, The former Yugoslav Republic of Macedonia and Yugoslavia to the present date are in the island operation with respect to the remaining part of the UCTE system.

69. It is assumed that Romania and Bulgaria will join the synchronous parallel operation of the UCTE system, and that the development of the European power networks and the establishment of the European internal electricity market will contribute to the improvement of the electricity trade to and from the EU.

70. The further strengthening of the connection between south-east European electric power systems and the connection of the Turkish Power System through Bulgaria and Greece and other new power systems in the Interconnection will have the economic effect that could be obtained by exchanging bulks of energy through interconnected networks.

71. The analyses which have been made up to now on the subject of the possibilities for transit in the Balkan area have shown that some bottlenecks for the exchange of large quantities of the electrical energy have occurred. .

B. Objectives

72. The purposes of this Study are :

(a) To carry out the feasibility of the construction of new lines between Albania and The former Yugoslav Republic of Macedonia and The former Yugoslav Republic of Macedonia and Bulgaria, Albania and Yugoslavia and Greece and Turkey.
(b) To examine the possibility of parallel and synchronous operation of the Turkish power system with the interconnected Electric Power system in the Balkans. This with regard to compliance with UCPTE requirements taking into consideration the existing tie-line between Turkey and Bulgaria and the prospective tie-line between Turkey and Greece.

(c) To identify all technical costs involved in the project and construction of the new line, and evaluate the possibilities for the improvement of the operation of this Interconnection after the connection of a new electric power system.

C. Scope

73. The study will cover 400 kV and 220 kV networks in the power systems of Greece, The former Yugoslav Republic of Macedonia, Bulgaria, Albania, Yugoslavia, Romania and Turkey. The northern part of 150 kV power networks of Greece and the western part of 154 kV power network of Turkey will be represented, and the remaining power systems will be simulated by appropriate equivalents. The power systems of other neighbouring interconnected countries will be simulated up to the level, which will ensure the correctness of the analyses.

74. The technical part will cover the energy balance of the analysed systems, load flow analysis in normal, maintenance and contingency operating conditions, short circuit current calculations, transient and dynamic stability analysis, requirements for primary and secondary control, voltage/reactive power control, measurements, telecommunication, protection systems and fast transient analysis.

75. The analysis related to the time horizon 2002 includes both maximum and minimum load operating conditions, so that they may be compatible with similar studies. This year has been chosen as the probable period when the connection of both the Romanian and Bulgarian power systems with the UCTE, the connection of the Italian and Greek power systems and the reconnection of the networks in Croatia and Bosnia and Herzegovina will have taken place. The study also has to take into consideration the fact that the construction of the new 400 kV line between the power systems of Greece and Bulgaria, and the upgrading of 150 kV line between Greece and RM to the level of 400 kV will take place.

76. On the basis of the technical analysis, the maximum bulk amounts of power exchanges that can be reliably transferred will be identified. Various assumptions will be made concerning possible exchange from and to south-east European electric power systems. The economic part will give the approximate estimation of all costs involved in the project, construction, telecommunication links, measurements and protection systems required for the construction of the new lines.

6.1.2 Investigation of the economic and technical advantages of the integrated operation of the interconnected Balkan EPSs

A. Introduction

77. Recent economic and political changes in East European countries have allowed a closer cooperation within the continent. One important sector of this cooperation is in the domain of electric power exchanges. This cooperation offers benefits to the interconnected power systems related to better exploitation of installed capacity, reserve requirements and operational cost savings, mutual emergency assistance etc. On the other hand, new regulations (liberalization) in the electricity sector guided by the EU directive are expected to increase the volume of bulk

power exchanges among the electric utilities of EU and non-EU countries. As a result, the power transactions in the area will increase in terms of financial volume and energy transferred.

78. Since May 1996, the Electric Power Systems (EPSs) of Greece, Bulgaria, Albania, Romania, Yugoslavia, The former Yugoslav Republic of Macedonia and part of Bosnia and Herzegovina, have been interconnected in synchronous and parallel operation. This regime has followed a previous regime where the electric power systems of Greece, Albania and the former Yugoslavia were interconnected to the UCTE network. This interconnected system, hereafter called "Balkan interconnection" is currently operating isolated from the European networks (UCTE) due to the damage to the interconnection lines in the former Yugoslavia. Reconnection to the UCTE network is expected in the near future. The control of the "Balkan interconnection" is performed by the coordination of the Energy Management Systems (EMSs) of the involved utilities in a decentralized mode. In the years to come reconnection to the UCTE grid is expected to happen.

79. Following the relevant EU directive the energy market in Greece, the only country in the area that is a member of the EU, opens by the year 2001. This fact is expected to trigger relevant policy changes in the electricity sector of the neighbouring countries and offer the possibility to create a local energy market in the area. An increased volume of power transactions is anticipated in this regime.

80. To establish the interconnected operation, power utilities in the area have studied in detail the conditions in the Balkan interconnection with respect to transmission system capabilities and limitations as well as issues related to the reconnection to UCTE. More specifically, studies performed have focussed on the following issues:

- Load flow and steady state security
- Short circuit levels
- Dynamic behaviour of the interconnection
- Primary and secondary control
- System and other protection relay settings on the tie lines, etc.
- Secure transfer capability calculations in several possible directions

81. Although the benefits from the interconnected operation have been widely studied from the technical point of view, the corresponding benefits by the integrated management of the generation systems and the assessment of volume of energy to be transferred have received little attention.

82. The purpose of the proposed study is twofold:

- Evaluation of the economic advantages of the integrated operation of the generation systems of the interconnected Balkan power systems taking into consideration the different structure of the load profiles, production capacities, hydro scheduling, etc. and the expected changes in the electric sector.
- Analyses of operational practices using a realistic environment provided by a close to real-time dispatchers training facility. In a regime of enhanced transactions in the area close cooperation and exchange of information between the operating personnel in the control centres in the area is foreseen as necessary.

B. OBJECTIVES

83. The objectives of the study are:

- To estimate the energy volume to be transferred and the benefits resulting from a more integrated operation of the interconnected power systems in terms of operational production cost and reliability of supply.
- To analyse operational practices for the realization of such an operational scheme
- To further train the operators of each system in a decentralized control mode.

84. More specifically, the objectives of the project are:

Phase A

(a) To establish a complete database containing:
(b) Generation system data, ie. all necessary data to fully analyse the generation systems operation of the above-mentioned Electric Power Systems
(c) Network data, i.e. the appropriate network models to be included in the real time tools of the Control Centres of the involved utilities
(d) To analyse the current operation practices and to calculate the respective economic and reliability parameters.
(e) To investigate the possibilities of a more integrated operation in the production scheduling level
(f) To schedule optimized operation strategies and consequently to estimate the resulting economic benefits.

Phase B

(a) To analyse in real-time environment operational practices for the realization of the optimized operational strategies
(b) To provide an integrated training facility for the operators (dispatchers) of these systems in an environment with enhanced transaction activity.

C. SCOPE

C.1. Estimation of the economic transactions

85. Based on the generation system data and the calculations of the transfer capabilities among the systems, the economic power exchanges for a period ahead will be scheduled for several scenarios concerning the level of generation systems coordination. These scenarios concern:

(a) The isolated operation of each system
(b) Agreed in commercial (current practice) and other transaction types
(c) Several degrees of integrated scheduling of the generation systems operation such as:
(d) Exploitation of load diversities
(e) Optimization hydro-scheduling
(f) Maintenance scheduling of big generating units

86. Power exchanges are the results of the optimization of the same power systems operated in a more integrated way with the main constraints being the necessary spinning reserve requirements and the transfer capabilities among the systems. For these scenarios reliability indices will also be calculated in order to quantify the benefits in terms of reliability for each scenario.

87. Comparison of the above cases will give a clear opinion about the exploitable potential for economic energy interchanges in the area under several operational practices.

C.2. Analysis of operational practices

88. For the scenarios analysed in C1 set up a Dispatchers Training Simulator (DTS) workshop using existing DTS tools:

- The first step is to model the production and transmission networks of the interconnected systems to a realistic extent. This model shall include the dynamic parameters of the generating units involved, main parameters of unit governors, as well as the AGC parameters for each interconnected system and a significant part of the transmission network of each country.
- The second step involves model tuning and setting up training scenarios including enhanced transaction schemes and adverse security conditions.
- The final step involves dispatching personnel and power system experts of related utilities in a workshop session to emulate operating conditions at various exchange levels. Normal and emergency conditions will be considered and will be emulated and further analysed.

6.2. Regional Transmission System Planning Project Starting

89. In the process of preparation and developing the base idea USAID and ESM agreed on the main subject of the project. The USAID contracted CMS Energy, USA as lead consultant and project Manager. After the few months' negotiation and needs assessment in the region, carried out by USAID and CMS with the cooperation of Government of The former Yugoslav Republic of Macedonia and ESM, the Draft text of Memorandum of Understanding and revised Work Plan were prepared. Mr. Nikola Cerepnalkovski, Chief of the Energy Division, Ministry of Economy, The former Yugoslav Republic of Macedonia and Chairman of the SECI Project Group appointed the formal Organizational Meeting, held in Skopje on 6 and 7 March 2001. At this meeting the MoU was adopted and signed by the participants and the Work Plan was reviewed and adopted. In this Project the following countries/companies are involved: Albania – KESH; Bosnia and Herzegovina – ZEKC, EP BiH, ERS, EP HZHB; Bulgaria – NEK; Croatia – HEP; The former Yugoslav Republic of Macedonia – ESM; Greece – PPC/HSTO; Hungary – MVM; Romania – Transelectrica; Turkey – TEAS; Yugoslavia[5], Serbia – EPS, Montenegro, EPCG.

Below, an extract from the Work Plan is shown.

[5] Yugoslavia even in the beginning was not considered as a qualified country for USAID support, was included in the qualified list and receives full support.

6.2.1 Regional Transmission Planning in the SECI Member Countries Work Plan

Background

90. The countries of Southeast Europe have committed to improve their electricity systems and create a regional electricity market integrated with Western Europe by 2006. One important element of a fully functional regional electricity market is the ability to perform electric transmission planning on a regional basis in order that projects not only benefit each national interest, but also the region as a whole.

91. For the utilities from the SECI countries, which are undergoing different degrees of structural and functional change in a political environment, developing a regional transmission planning organization with the necessary tools and procedures suitable for the changing market is an urgent need. In many parts of the region the electric power sector is undergoing restructuring, unbundling and privatization while others remain vertically integrated. The opening of the electric market and the changing regulatory frameworks throughout the SECI region will allow competition, introduce the new role of independent power producers and require open transmission access to all producers. In addition, the growing interest in Southeast Europe for a common electricity market will provide opportunities for utilities from SECI countries to import and export power to meet national objectives while optimizing regional transmission and generation utilization. Finally, the goal for many of the SECI countries to enter the European Union requires that each utility, as well as the region, have fully functional transmission planning capability and the flexibility to meet existing and future EU and UCTE requirements. This SECI Electricity Interconnection Project Group initiative will help to improve and sharpen the capabilities of SECI member utilities in optimal power flow and investment planning methods for determining economically viable investments that improve the transmission systems and take advantage of opportunities for mutually beneficial trade.

92. The overall objective of this project is to promote regional cooperation in transmission planning through the development of common transmission planning tools and methodologies. Common transmission planning capabilities have proven to be the technical catalyst for improved regional electric planning communications, better understanding of least cost solutions and the basis for bankable project proposals in other parts of the world. This involves the installation of the well-known PSS/E transmission planning software in each country (where it does not already exist) and the training of selected transmission planning personnel in both Steady State Analysis and Dynamic Simulation. The project team will work with utilities in the region to convert and improve existing planning data, will assist in developing regional analyses utilizing the planning software to identify key transmission bottlenecks and incorporating the results from on-going and future feasibility studies of specific transmission interconnection, rehabilitation and upgrade projects.

93. The specific project objectives are:

(a) Provide PSS/E software and appropriate training to each qualified utility transmission planning group where the software and/or the training does not already exist.
(b) Create a regional transmission-planning group for the purpose of coordinating the regional planning goals, objectives and activities.

(c) Convert existing national transmission planning data into a common regional format.
(d) Perform certain regional transmission planning studies as defined by the SECI Steering Committee and the Technical Coordination Group.

Approach

Task 1: Transmission Planning Needs and Capability Assessment

94. The scope of the region to be studied includes all SECI countries that sign the proposed project Memorandum of Understanding (MOU). However, USAID country-specific funding would be limited to financial support for the qualified countries of Croatia, Bosnia and Herzegovina, The former Yugoslav Republic of Macedonia, Albania, Romania and Bulgaria. Yugoslavia will probably also be qualified in the near future now that it is formally admitted to SECI and the Stability Pact.

95. Each participating SECI transmission utility will be surveyed to determine the planning software currently used, the capabilities of the planning personnel, the format and completeness of the transmission data and specific transmission planning projects and issues of particular concern to each member. This data will be summarized and used as the basis for the remaining tasks.

Task 2: Purchase and Installation of PSS/E Software

96. The PSS/E software will be funded by USAID and purchased by CMS for the qualified participants. Other SECI participants may purchase the software and participate in the training at their own cost. The training will be conducted by a team consisting of the software vendor and CMS who will conduct one 5-day session, covering the Introduction to PSS/E Power Flow and Steady-State Analysis and then a second 5-day session, covering an Introduction to PSS/E Dynamic Simulation. These courses will be planned for a central location to be determined. Additional follow-up training will be conducted by the CMS team at each transmission utility location as required for successful implementation. The CMS team will assist in the data conversion process at each utility location to assure that transmission planning data is properly formatted for regional planning purposes.

Task 3: Formation of the Regional Transmission Planning Group

97. Initially the coordination of regional transmission planning will be done under the structure of this SECI project utilizing the Steering Committee, the Technical Coordinating Group and the Working Groups as described in the Project Management and Organization section of this work plan. However, the goal of the project is to create institutional mechanisms for the coordination of regional planning and investment that will survive the term of this SECI project and serve the region for years to come. For these reasons, Task 3 is to create the framework for a functioning Transmission Planning Users Group with the organization, expertise, technology and authority to perform regional transmission planning in Southeast Europe.

Task 4: Perform Regional Transmission Investment Studies

98. All information developed during the course of this programme will feed to Task 4 in defining transmission system deficiencies, upgrade requirements, and new projects. The objective will be to define adequately a set of design and performance requirements for an integrated regional transmission system that supports the current and projected electric power distribution needs of the countries within the SECI scope of this programme. As part of this process, the project team will develop a database of supply and demand, generation and transmission network facilities and proposed transmission. Regional transmission system models will be developed and assessed using the PSS/E software and other project tools to ensure cost-effective (least-cost) configurations and a regionally integrated system with high reliability (operation availability) projections.

Deliverables

- PSS/E Transmission Planning Software for each qualified SECI participant after the signing of the License Agreement and payment by non-qualified SECI participants.
- Training of planning professionals in the use of the PSS/E software for 10 days at a central site in Southeast Europe.
- Interim report summarizing the mid term progress and results available to all SECI participants.
- Final report with recommendations for Task 3 (organizational structure) and regional transmission study results from Task 4 provided to all SECI participants.

Project Management and Organization

99. It is proposed that a Steering Committee be established to provide overall guidance for the project (See Exhibit No. 1). Steering committee membership shall be determined as outlined in the project Memorandum of Understanding (MOU).

100. A Technical Coordination Group shall be established to manage the day-to-day activities of three Working Groups. It is recommended that a Technical Coordinator be appointed by each participating utility to serve as the single point of contact for that utility, facilitate communication with CMS and ensure that the work being done by the utility is proceeding on schedule. The individual Technical Coordinators will become members of the Technical Coordination Group. Additional Technical Coordination Group members shall be determined as outlined in the project Memorandum of Understanding (MOU).

101. Project Working Groups shall be formed consisting of technical experts from the participants with the following responsibilities:

- Working Group No. 1 – Model Operations

102. This Working Group will consist of Transmission Planning practitioners who will participate in the PSS/E software training programme, work directly on the conversion of existing transmission planning data to the new software formats and perform regional transmission planning studies as identified and prioritized by the Technical Coordination Group.

- Working Group No. 2 – Regional Transmission Planning Studies

103. This Working Group will utilize planning results and data produced by Working Group No. 1 to prepare a regional transmission investment study identifying priority, least cost, alternatives for regional transmission system investment optimization. Working Group No. 2 will also apply regional planning techniques to analyse certain specific transmission projects, as assigned by the Technical Coordination Group, and to provide technical, financial and economic soundness and completeness. The objective is to make these studies/reviews as useful as possible in developing bankable project proposals for consideration by various types of International Financial Institutions.

- Working Group No. 3 – Post CMS/USAID Regional Transmission Planning Group Formation

104. One of the goals of the project is to create institutional mechanisms for the coordination of regional planning and investment that will survive the term of this SECI project and serve the region for years to come. Working Group No. 3 will create the framework for a functioning Transmission Planning Users Group with the organizational structure, expertise, technology and authority to perform regional transmission planning in Southeast Europe after the termination of this USAID/CMS project.

6.3. Realized and planned activities

105. Task 1 was realized during the Organizational Meeting in Skopje on 6-7 March, through the participating companies' presentations. These assumptions were upgraded during the technical meetings of the Working Group consisting of CMS Energy and ESM representatives in all participating countries realized in May 2001. As a result, the Technical Coordinating Group Meeting in June 2001 established the list of new Projects which should be considered in the Study. The list is shown in Table 3.

106. Task 2, CMS Energy purchased the PTI's (Power System Technology) PSS/E Software for Power System Steady State and Dynamics Calculations for all qualified countries, and it was delivered to all participants in May and early June 2001. In the framework of this purchase arrangement, the two years system support from PTI was also ensured.

107. Training: In the Work Plan five days training for maximum 12 participants was originally planned ; in view of the great interest shown, a complete training programme was rescheduled. PSS/E Software training was scheduled in three packages:

- First part, Introduction to PSS/E – Power Flow and Steady-State Analyses, was organized from 2-13 April 2001 in Zagreb, Croatia. The Energy Institute Hrvoje Pozar in Zagreb granted the excellent site and facilities for the training and with HEP (Power Company of Croatia) were well organized hosts. The two groups, 25 students from all interested countries, were split into two 5-day training programmes. This training event, conducted by the high professional teacher from PTI, USA was very useful and successful. It was one of the preconditions for the successful use of the software and to start preparation of data for regional model construction.

- The second part, originally not planned in the Work Plan, will be the training for Optimal Power Flow Calculations and Analyses. It was agreed that it would be very useful to have this specific training to activate this specific option of PSS/E Software. These training activities are scheduled for 10-15 September in Sv. Stefan hotels resorts, Montenegro in two groups of up to 12 students, three days for each group.

- The third part will be the most complicated, training for PSS/E Dynamic Simulation. It will consist of two groups of up to 12 students, 5 days for each group. The dates and location will be determined later.

108. Task 3, formation of the future Regional Transmission Planning Group, will be the subject of the next activities. The original idea is described in the Work Plan.

109. Task 4 is dedicated to performing Regional Transmission Investment Studies. As already mentioned, one of the preconditions for this task was successfully activating the PSS/E Software in all participating countries. At the Technical Coordinating Meeting held in Bucharest, on 25-26 June 2001, the general approach and main directions were agreed. Here we will mention some of them:

- Cooperation with UCTE is necessary to create the model and implement the standards; Coordination with other support programmes and initiatives (EU, SEETEC, USTDA…);
- The regional model will deal with 400 kV and 220 kV network, even the companies could implement the lower voltage level, also;
- The best practices check list was reviewed and some changes will be implemented;
- The study year will be 2005 and the winter and summer peak load will be considered;
- Proposed studies will be divided into three categories which are prioritized as follows:
  - Regional Steady State Load Flow studies using the established list of promising interconnections discussed below;
  - Economic and Financial analyses of the most promising projects identified in the step above;
  - Dynamic Simulation of the selected projects if time and project scope permit.
- A list of interconnections was reviewed and revised as the most probable projects for consideration, shown in Table 3 below. In the table, the projects, which will be in operation in 2005, are indicated. The others will be considered as post 2005 options. However, it was recognized that a limited number of new, at presentlunknown, projects could be discovered once a regional model is used to analyse regional power flows;

Table 3. List of Investment Projects for Studies consideration

Project	Type	Vol.kV	Countries Involved	Status 2005	Current Status
Mostar	S/S	400	B&H, CRO, YUG	In	
Ernestinovo	S/S	400	CRO, YUG, B&H	In	
Ernestinovo -Petz	OHL	400	CRO, HUN	Option	Idea
Sombor - Petz	OHL	400	YUG, HUN	Option	Idea
Nis -Skopje	OHL	400	YUG, MKD	Option	Idea
Sremska Mitrovica - Ugljevik	OHL	400	YUG, B&H	In/Option	Preparation constr.

Project	Type	Vol.kV	Countries Involved	Status 2005	Current Status
B. Luka-Prjedor-Bihac-Zagreb	OHL	400	B&H, CRO	Option	Idea
Hungary - Romania	OHL	400	HUN, ROM	Option	Idea
Arad - Oradea	OHL	400	ROM	In	Business plan
Oradea	S/S	400	ROM	In	Business plan
Rosario	S/S	400	ROM	In	Business plan
Isakchea	B/B	400	ROM	Option	
Burstin Iland		400	ROM, UKR	In/Option	Construction
Elbasan	S/S	400	ALB	In	Construction
Elbasan - Tirana - Podgorica	OHL	400	ALB, MN	In/Option	FS
Kosovo B - Fierza	OHL	220	ALB, YUG	Option	
Bitola - Florina	OHL	400	MKD, GRE	In	Preparation constr.
Dubrovo - Cervena Mogila	OHL	400	MKD, BUL	In/Option	Preparation constr.
The former Yugoslav Republic of Macedonia - Albanija	OHL	400	MKD, ALB	Option	Prelim. Analyses
Maritza 3 - Hamitabat	OHL	400	BUL, GRE	In	Construction
Maritza 3 - Filippi	OHL	400	BUL, GRE	Option	Awaiting Decision
Filippi - Babaeski	OHL	400	GRE, TUR	In	FS
Greece – Italy	DC	400	GRE, Italy	In	Construction

Abbreviations:

S/S	Substation
OHL	Overhead Line
B/B	Back to Back Station
DC	Direct Current Line (Cable under sea)
In	In operation

- Participants from Hungary and Slovenia in consultation with UCTE and SUDEL representatives and coordinating with ESM and CMS will develop region boarder equivalents.
- The two base scenarios will be analysed with assumptions that the region is synchronously interconnected to UCTE with and without Turkey.
- Mr. Cerepnalkovski of ESM and Mr. Hikmet Sezer of TEAS will develop a draft table of exchanges for review by the Work Group.
- It was agreed that the existing project Work Plan does not contain all of the details that are now being finalized and that these details should be presented in a new Terms of Reference Document that will be drafted by ESM and CMS and distributed to the participants for comment.

110. It is obvious that some of the decisions of the Bucharest meeting mean expansion of the Work Plan adopted at the first meeting in March 2001. It was generally agreed upon previously with USAID. The original schedule for project realization was up to September 2001, but it was agreed with USAID that it is necessary to expand the project as a minimum up to the first part of 2002. That made more room for training and for studies. It is important to add that Training for

Economic and Financial evaluation will be done; location and time to be determined later, as a new action. The PTI PSS/E Users Meeting on 10 and 11 October 2001 in Lisbon, Portugal will also be a new action. The new PSS/E users could also use the Lisbon event to exchange experience swith the PTI representatives and the other PSS/E users.