The Role of the Council for Mutual Economic Assistance in the Construction of the Transnational Electricity Grid Mir

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ABSTRACTS

Der Beitrag betrachtet die Rolle des Rates für Gegenseitige Wirtschaftshilfe (RGW, 1949–1991) bei der Entstehung und Entwicklung des transnationalen Stromverbundes „Mir" (russisch: Frieden). Dieses Stromnetz wurde 1959 offiziell gegründet und verband die nationalen Elektrizitätsnetze der sozialistischen Staaten Osteuropas auf der Basis grenzüberschreitender Hochspannungsleitungen. Diese transnationale Infrastruktur wurde über fast vier Jahrzehnte ausgebaut und umfasste auch Atom-, Wasser- und Wärmekraftwerke. Planung und Bau grenzüberschreitender Energieinfrastrukturen gehörten zu den Hauptaufgaben des 1949 gegründeten RGW. Entsprechende Institutionen wie die Ständige Kommission für Elektroenergie, die Zentrale Dispatcherverwaltung oder „Interatomenergo" sollten die Kooperation der beteiligten RGW-Länder effektivieren. Seit der politischen Annäherung zwischen Ost- und Westeuropa in den siebziger Jahren rückten außerdem den „Eisernen Vorhang" überwindende Stromlieferungen in den Fokus. Im Vergleich zu anderen transnationalen Energieübertragungssystemen für Rohöl und Erdgas zeichnete sich das „Mir"-Netz durch einen relativ hohen Institutionalisierungsgrad aus. Diese Koordination war für den reibungslosen Betrieb des Gesamtsystems wichtig. Das Ende des RGW im Jahr 1991 erschwerte die notwendige Koordination und führte zu einer im Vergleich zu anderen transnationalen Infrastrukturen raschen Auflösung des Stromverbundes „Mir". Der Beitrag analysiert, wie dieser transnationale Stromverbund funktionierte und welche Akteure beteiligt waren. Damit schließt er eine Forschungslücke bezüglich der Entwicklung grenzüberschreitender Elektrizitätsnetze im sozialistischen Ostblock.

The article addresses the role of the Council for Mutual Economic Assistance (CMEA, 1949–1991) in the creation and development of the transnational electric power grid "Mir" (Russian: Peace). This power grid was officially established in 1959 and connected the national electric

Comparativ | Zeitschrift für Globalgeschichte und vergleichende Gesellschaftsforschung 27 (2017) Heft 5 / 6, S. 48–64.

networks of the socialist states of Eastern Europe by means of cross-border power lines. This transnational infrastructure was developed over the next decades and included nuclear, hydro, and thermal power plants. The planning and construction of cross-border energy infrastructures was one of the primary tasks of the CMEA. CMEA institutions, such as the Permanent Commission for Electric Energy, the Central Dispatch Organization, and the "Interatomenergo" were supposed to facilitate cooperation between participating CMEA countries. Following the political rapprochement between East and West Europe in the 1970s, the idea of surmounting the iron curtain to create a European-wide system of electrical supply became the focus. Compared with other transnational systems of energy transmission for crude oil and natural gas, the Mir network had a relatively high degree of institutionalization. This coordination was essential for the smooth operation of the overall system. The disintegration of the Comecon in 1991 impeded this cooperation and led to the rapid dissolution of the Mir power grid (compared to other transnational networks). This article analyses how this network worked and the actors involved. In doing so, it addresses a gap in research on the development of transnational electrical networks in the socialist Eastern Bloc.

1. Introduction

In October 1995, four electricity network operators in Central and Eastern Europe (CEE) joined the Union for the Coordination of Production and Transmission of Electricity (UCPTE). At that time, the UCPTE comprised only countries from western and southern Europe. The new members were electricity system operators from the Czech Republic, Hungary, Poland, and the Slovak Republic, which had formed the CENTREL[1] network in October 1992. After the fundamental political and economic changes in Eastern Europe, there was a need to stabilize national power grids by establishing close ties with the UCPTE. However, cross-border links in CEE had already existed since the 1950s, when national power grids became part of a transnational electricity network with the name United Energy Systems "Mir". The Mir electricity grid was officially established in 1959. After almost four decades of continuous extension, the electricity grid, which had included nuclear, hydroelectric, as well as thermal power plants, was finally dissolved in 1991.

How did the Mir grid work? In which way was it extended? What were the underlying key drivers of this endeavour? Why was the grid disconnected so swiftly after four decades of construction? The key to these answers can be found in the Council for Mutual Economic Aid (CMEA).[2] This transnational economic organization was founded in 1949 and comprised all socialist countries of the Eastern Bloc. One of the CMEA's main goals was to secure energy supplies for member states, which were urgently needed

1 CENTREL was the name of a union of electricity system operators from the Czech Republic, Hungary, Poland, and the Slovak Republic. It was officially established in October 1992 and synchronized with the synchronous grid of Continental Europe UCTE in 1995.

2 Sometimes also Council of Mutual Economic Assistance. Especially in Western literature also Comecon.

in industrializing socialist economies. Therefore, the planning and construction of cross-border energy infrastructures, such as electricity transmission lines as well as oil and gas pipelines, was a primary task of the CMEA and its bodies, such as its executive committee, the secretariat, or the standing commissions. The Standing Commission for Electric Energy had been established in May 1956 and was one of the first CMEA commissions. This fact indicates that the construction and extension of the United Energy Systems Mir was of great economic and political relevance. It linked the national power grids of Bulgaria, Czechoslovakia, the German Democratic Republic (GDR), Hungary, Poland, Romania, and western parts of the Soviet Union enabling a stable and efficient electricity supply to member states. In order to plan and construct cross-border electricity transmission lines, institutions like the aforementioned Standing Commission for Electric Energy, the Central Dispatching Office (CDO), or international economic organizations such as "Interatomenergo" were set up. Due to the political rapprochement between East and West in the 1970s, an aspect of concern was if electricity transfers to Western Europe would be possible.

The CMEA and its substructures were of decisive relevance for the smooth running of the United Energy Systems. In comparison to other transnational infrastructures such as oil and gas pipelines, a high degree of coordination of load management was necessary to operate the Mir grid. The dissolution of the CMEA in 1991 seriously complicated load management and consequently led to the swift disintegration of the United Energy Systems.

This article addresses a research gap concerning the development of cross-border electricity networks in the socialist Eastern Bloc. Similar research has been conducted with regard to Western Europe,[3] the United States,[4] Scandinavia,[5] and the Baltic region.[6] Eastern Europe, however, remains largely unexplored.

2. Laying the Foundations

One of the main economic aims of the young socialist countries at the end of the 1940s was the accelerated extension of heavy industry. The socialist industrialization, however, was realized without taking into account the allocation of natural resources. The challenge was to provide rapidly increasing amounts of energy supplies for new steelworks, industrial plants, and mines. The resulting discrepancy between energy demand and supply had the potential to cause a slowdown in economic growth. This fact limited autarky

3 See V. Lagendijk, Electrifying Europe. The Power of Europe in the Construction of Electricity Networks, Amsterdam 2008.

4 See D. Nye, Electrifying America: Social Meanings of a New Technology. 1880–1940, Cambridge 1990.

5 See A. Kaijser and M. Hedin (eds.), Nordic Energy Systems. Historical Perspectives and Current Issues, Canton 1995.

6 See P. Högselius, Connecting East and West? Electricity Systems in the Baltic Region, in: E. van der Vleuten and A. Kaijser (eds.), Networking Europe. Transnational Infrastructures and the Shaping of Europe. 1850–2000, Sagamore Beach 2006, pp. 245–275.

efforts, which was a major policy goal in the early 1950s. The Hungarian aluminium industry represents an instructive example. Due to significant bauxite deposits, energy intensive aluminium industries were built up in Hungary, a country with very limited energy resources. On the other side, neighbouring states like Czechoslovakia, the GDR, and Poland had considerable brown and hard coal reserves at their disposal. Since the transport of brown coal is uneconomical, the conversion into electricity at the place of mining and the delivery via cross-border transmission lines appeared to be a practicable solution to bridge the Hungarian energy gap. In the first half of 1956, a series of conferences was held in Prague and Budapest to bring electricity to Hungary from the thermal power station of Hirschfelde in the GDR via Poland. The decisive question was how to establish prices for the planned electricity deliveries. The Czechoslovak, East German, and Polish delegations proposed to calculate electricity prices on the basis of coal prices, since electricity in all three countries was produced especially in coal-fired thermal power plants.[7] The Hungarian side, however, did not agree with the proposed price of 7.6 kopecks for one kilowatt hour (kWh) and a final solution could not be found. Consequently, representatives from the Czechoslovak, East German, and Polish government as well as the Hungarian utility company Erőmű Tröszt only reached a temporary agreement in May 1956, which enabled the transmission of 60 megawatts (MW) annually from the GDR to Hungary.[8] The discussion about how to establish prices for cross-border electricity deliveries was closely related to the broader question of foreign trade prices between socialist countries. Although CMEA countries agreed on the so-called Bucharest principles[9] at the ninth CMEA session in June 1958, this solution only had a temporary character and the pricing question stayed at the top of the agenda during the forthcoming decades.

Another reason for the young socialist countries to construct cross-border transmission lines was to supply energy-poor border regions. Due to frontiers shifting after the Second World War, existing electricity networks did not always match with new borderlines. Already in April 1947 Poland had reached an agreement with the Soviet administration in the Soviet occupation zone, which foresaw electricity deliveries of German power plants to regions in western Poland.[10] In addition to a price of USD 1.8 for 100 kWh, the Hirschfelde thermal power plant, which delivered the largest amounts of electricity, received 12,000 tons of brown coal from the nearby Turów coal mine. Before the war, the power plant and the coal mine had formed one complex. This cooperation was beneficial for Poland since it allowed the country to postpone the costly construction of a transmis-

7 Archiwum Akt Nowych (AAN), 351/84/3, p. 9 (Protokół z posiedzenia w sprawie energii elektrycznej; Prague, 6-14 April 1956).

8 AAN, 351/17/2 (Schlussprotokoll der vierseitigen Konferenz der Aussenhandelsorgane; Prague, 5-8 May 1956).

9 According to the Bucharest Principle, intra-bloc prices were established on the basis of world market prices for a set of basic goods, which were cleared from short-term price fluctuations and averaged over a period of five years. See Bucharest Agreement, in: J. Wilczynski, An Encyclopedic Dictionary of Marxism, Socialism and Communism, London 1981, p. 52.

10 Archiwum Ministerstwa Spraw Zagranicznych, 4/17a/51/56, p. 5 (Protokół o dodatkowych dostawach prądu elektrycznego; Berlin, 18 June 1947).

sion line from Upper Silesia and only came to a halt when Poland commissioned its own lignite power plant in Turów in 1963.[11] The existing link between the GDR and Poland also enabled the aforementioned electricity deliveries of 60 MW to Hungary.

In June 1955, the GDR and Czechoslovakia agreed to link their national power grids, too. Bilateral agreements between other socialist countries followed.[12] The trend to link national electricity networks was supported by the CMEA, which was becoming increasingly active due to Nikita Khrushchev's endeavour to transform it into a central planning authority for the entire Eastern Bloc.[13] At its Moscow meeting in September 1957, the CMEA's Standing Commission for Electric Energy[14] approved the construction of additional cross-border transmission lines to enable electricity transfers between Czechoslovakia, the GDR, and Poland, as well as to strengthen the electricity exchange with Hungary. In the beginning of 1960, the following transnational links were in place:[15]

Figure 1: Cross-border transmission lines between CMEA Countries (1960)[16]

11 AAN, 274/1526, p. 58 (Protokół końcowy z obrad Komisji Współpracy Gospodarczej Energetyk NRD i PRL; Warsaw, 8-23 November 1954).

12 R.C. Ribi, Das Comecon. Eine Untersuchung über die Problematik der wirtschaftlichen Integration sozialistischer Länder, Zurich 1970, p. 407.

13 A. Uschakow, Probleme der Wirtschaftsintegration im RGW, in: Aussenpolitik 23 (1972) 3, pp. 150-151.

14 In the first two years of its existence (1956–1958), this body had been called Standing Commission for the Exchange of Electricity and the Use of the Danubian Energy Resources.

15 Y.N. Savenko, Ob˝edinennye Élektroénergeticheskie Sistemy Stran-Chlenov SÉV, Moscow 1983, p. 11.

16 Source: Own drawing based on an open-access map of the Leibniz Institute of European History, www.ieg.maps.de (accessed 19 December 2016).

1: Zwönitz (GDR) – Vyškov (ČSSR); 2 x 220 kV
2: Hirschfelde (GDR) – Bolesławiec (Poland); 1 x 110 kV
3: Berzdorf (GDR) – Mikułowa (Poland); 2 x 220 kV
4: Poříčí (ČSSR) – Wałbrzych (Poland); 2 x 110 kV
5: Lískovec (ČSSR) – Skawina (Poland); 1 x 220 kV
6: Bystričany (ČSSR) – Vác (Hungary); 1 x 220 kV
7: Nové Zámky (ČSSR) – Kisigmánd (Hungary); 2 x 110 kV

3. The Establishment of "Mir"

Cross-border transmission lines between Czechoslovakia, the GDR, Poland, and Hungary served as a starting point for a bloc-wide electricity grid in Eastern Europe. The eleventh CMEA session in May 1959 officially approved the establishment of the United Energy Systems and called the project "Mir", which means peace in Russian. CMEA Vice Chairman Henryk Różański stated in his memoirs that the head of the energy department, G. Novikov, had made the initial proposal for the construction of a bloc-wide network.[17] An important argument in favour of a transnational electricity grid was that peak loads in individual countries differed considerably. Therefore, a transnational power grid could help reduce national standby capacities by using additional power plants.[18]
In July 1962, an exceptional CMEA session in Moscow stressed the importance of these efforts and approved the Basic Principles of the International Socialist Division of Labour, which was one of the most important CMEA documents. Concerning the energy sector, the Basic Principles declared the establishment of the Mir network as "one of the most progressive directions of labour division […] in the socialist camp".[19] Three weeks later, following the recommendation of the Standing Commission for Electric Energy representatives of all European CMEA countries[20] established the CDO in Prague. Primarily, the CDO was responsible for the smooth running of the Mir network as well as coordinating with member state utilities. Expenses were covered in equal shares and the Czechoslovak government provided the headquarters on Prague's Jungmannova Street. Although the CDO was not a direct CMEA body, it had to take into account recommendations of the Standing Commission for Electric Energy as well as to regularly inform the CMEA about its work. Implicitly, the CMEA had the authority to issue instructions to the CDO.[21] In the following years, the CDO established contacts with other international organizations such as the United Nations Economic Commission for

17 H. Różański, Spojrzenie na RWPG. Wspomnienia, Dokumenty, Refleksje, Warsaw 1990, pp. 82–83.
18 Differing peak loads were related to the intersystem effect based on divergent production and consumption patterns in individual countries due to industrial, cultural, and climatic differences. See for example R. Cižek, Die Zusammenarbeit der RGW-Länder auf dem Elektroenergiesektor, Aussenhandel (1974) 4, p. 21.
19 Reprint of the Fundamental Principles in: German in A. Uschakow, Integration im RGW (COMECON). Dokumente, Baden-Baden 1983, pp. 1018–1035 (Quotation p. 1026).
20 In June 1962, Mongolia had joined the CMEA.
21 L. Kieres, Die rechtliche Regelung der Energiewirtschaft im RGW, in: Osteuropa 37 (1991) 1, p. 51.

Europe (UNECE), the International Union of Producers and Distributors of Electrical Energy (UNIPEDE), or the International Council on Large Electric Systems (CIGRÉ). As a next step towards an integrated bloc-wide electricity grid, CMEA organs initiated the linking of the Rumanian, Bulgarian, and Soviet southern energy system[22] with the already connected grids of Czechoslovakia, the GDR, Hungary, and Poland. A transmission line between eastern Poland and the Dobrotvor thermal power plant[23] in the west of Ukraine became operational in 1963.[24] One year later, a link between Czechoslovak Veľké Kapušany and Romanian Luduș via Mukachevo located in the Ukrainian Soviet Socialist Republic (SSR) was established.[25] Starting from Mukachevo, another line to Sajószöged, Hungary was introduced . A look at the map shows that the emerging infrastructure of Mukachevo and the West Ukrainian energy system provided by Ľvovénergo represented a key intersection in the Mir network. The case of Mukachevo is interesting from another point of view as well. In June 1963, representatives from Bulgaria, Czechoslovakia, Hungary, Romania, and the Soviet Union signed an agreement to construct the Mukachevo transformer station.

This was one of the first construction projects in the East European energy sector, where CMEA countries made a direct investment in another socialist state. The conditions of the investment were threefold. Soviet state-owned enterprises carried out construction work, whereas the other participating countries delivered construction material. After commissioning, the Soviet Union would become the sole owner of the facility. Operational expenses were to be equally distributed amongst the five countries.[26] This form of investment was a kind of blueprint for later large-scale projects like the Soyuz gas pipeline in the 1970s.

With the construction of a transmission line between Craiova, Romania and Boĭchinovtsi, Bulgaria, the linking of East European socialist countries was completed in 1967.

22 The United Energy System of the South was part of the bigger Unified Energy Systems of the USSR and consisted of the energy grid of the Ukrainian SSR (energy systems of Donbass, Dnjepr, Kharkov, Kiev, Ľvov, Vinnitsa, Odessa, Crimea) as well as the Moldavian SSR.

23 In accordance to source material, toponyms in the Ukrainian and Belarussian SSR are transliterated from their Russian spelling.

24 A transmission line between Ross' in Belarussian SSR and Białystok in the east of Poland was in operation since 1962. However, this line was not connected to the Mir grid. See Z. Mozer, Czy Polskie Sieci łączą Wschód z Zachodem?, in: Gazeta Prawna, 26 January 2005, p. 1.

25 O.A. Chukanov (ed.), Sodruzhestvo Stran-Chlenov SÉV. Politiko-Ékonomicheskiĭ Slovar'-Spravochnik, Moscow 1986, p. 183.

26 D. Mentz and J. Pfeffer, Die rechtliche Regelung der internationalen Energiebeziehungen der RGW-Länder, Munich 1982, pp. 89–91.

Figure 2. Cross-border transmission lines between CMEA Countries (1967)[27]

1: Dobrotvor (Soviet Union) – Zamość (Poland); 1 x 220 kV
2: Veľké Kapušany (ČSSR) – Mukachevo (Soviet Union) – Luduș (Romania); 1 x 400 kV
3: Mukachevo (Soviet Union) – Sajószöged (Hungary); 1 x 220 kV
4: Craiova (Romania) – Boĭchinovtsi (Bulgaria); 1 x 220 kV

27 Source: Own drawing based on an open-access map of the Leibniz Institute of European History, www.ieg.maps.de (accessed 19 December 2016).

4. Impacts of the Socialist Economic Integration

In July 1971, representatives of CMEA countries agreed to enact the Comprehensive Programme.[28] Next to the Basic Principles, it was one of the most important CMEA policy papers. Some of its explicit aims were to cover growing energy demands by the expansion of nuclear energy, the joint construction of energy-related facilities, and the further extension of the Mir grid. This would be achieved by the establishment of a network of high voltage transmission lines of 750 kilovolts (kV) in combination with the joint construction of nuclear power plants.[29] In February 1974, representatives of Bulgaria, Czechoslovakia, the GDR, Hungary, Poland, and the Soviet Union approved the construction of the first high voltage line from Vinnitsa, Ukrainian SSR to Albertirsa, Hungary with a total length of 842 kilometres (km). The Soviet organization Ënergosetproekt elaborated technical plans with the assistance of the Hungarian enterprise Eröterv.[30] Similar to other infrastructure projects, the Soviet Union and Hungary conducted construction work on their own territories. Other countries provided machines, building materials, and consumer goods. From 1980 on, the participants imported electricity and benefited from higher grid stability. The transmission line between Vinnitsa and Albertirsa was the first of three electricity aortas running from the Soviet Union to Eastern Europe in order to supply electricity and to strengthen the interconnection between the Soviet Unified Energy Systems and the Mir network.
Simultaneously, the construction of minor cross-border transmission lines continued. Between 1975 and 1978, three links between Poland and the GDR, the GDR and Czechoslovakia, as well as Czechoslovakia and Hungary went online enabling additional electricity exchanges.[31]

Table 1: Mir in the mid-1970s:

	1962	1977
Total power generation capacity (MW)	28,400	83,600
Electricity production (GWh)	137,500	401,000
Electricity exchange within Mir (GWh)	3,400	21,600
Electricity exchange in comparison to overall electricity production (in %)	2.5	5.4

Source: M. Engert and H. Stephan, Lexikon RGW, Leipzig 1981, p. 244.

28 The full name was Comprehensive Programme for the Further Extension and Improvement of Cooperation and the Further Development of Socialist Economic Integration by Comecon Member Countries. Reprint in German in L. Rüster, Grunddokumente des RGW, Berlin 1978, pp. 47–141.

29 A. Uschakow, Internationale Rohstoffabkommen im RGW, in: G. Gutmann, K.C. Thalheim and W. Wöhlke (eds.), Das Energieproblem in Ostmitteleuropa. Part II: Energiepolitik und Energieverbund in den mitteleuropäischen RGW-Staaten, Marburg 1984, p. 102.

30 M. Melkonyan, Stroïka Druzhby, in: Ékonomicheskoe Sotrudnichestvo Stran-Chlenov SÉV (1981) 2, pp. 85-86.

31 J. Bethkenhagen, Die Zusammenarbeit der RGW-Länder auf dem Energiesektor, in: Osteuropa Wirtschaft 22 (1977) 2, p. 74.

Due to increasing energy prices on world markets, the energy question received greater attention since the global oil crisis in 1973. As a counter-measure, socialist countries focused on the acceleration of national nuclear power programmes and the further extension of the joint electricity grid.[32] In November 1977, CMEA countries signed the General Agreement for the Cooperation and Prospective Development of the United Energy Systems of CMEA Member States (hereinafter General Agreement) until 1990. Furthermore, an Agreement for Multilateral International Specialisation and Cooperation in the Construction and Mutual Supply of Equipment for Nuclear Power Plants between 1981 and 1990 was accepted in June 1979. This agreement involved industrial giants all over Eastern Europe like Atommash in Volgodonsk, Škoda in Plzeň, or RAFAKO in Racibórz. Already in the beginning of 1973, the international economic association Interatomenergo had been established in order to coordinate the process of intensified division of labour in the socialist nuclear power sector.[33]

Another major step towards the further extension of the Mir network was the joint construction of the Khmeľnitskiĭ Nuclear Power Plant in the west of the Ukrainian SSR in March 1979. Additionally, Czechoslovakia, the GDR, Hungary, Poland, and the Soviet Union agreed on the joint construction of a 750 kV transmission line between the Khmeľnitskiĭ Nuclear Power Plant and a substation near Rzeszów located in the east of Poland. A similar agreement was signed in 1981 between the Soviet Union, Romania, and Bulgaria in order to construct the South Ukraine Nuclear Power Plant in Yuzhnoukrainsk, Ukrainian SSR and a 750 kV transmission line to Vetrino, Bulgaria via Romania. The financial conditions were modelled after the agreement concerning the Vinnitsa-Albertirsa transmission line. However, further discussions were held due to the considerable financial scope and unclear economic benefits. The question at issue was how long the investors would receive free electricity deliveries from the Khmeľnitskiĭ Nuclear Power Plant. Again, discussions touched on the intra-bloc pricing system, which was the weak point of the intra-bloc trade. Due to specific price setting, which followed the world market price for a commodity with a delay of five years, it was clear by the end of the 1970s that the energy prices would significantly increase in the next years.[34] If prices for future electricity deliveries were accounted for at the time of actual supply, this price setting could have led to unfavourable investments. For importing countries it would have been more beneficial to fix electricity prices to a 1979 level in order to secure deliveries regardless of future price increases.[35] According to the General Agreement regarding the Khmeľnitskiĭ Nuclear Power Plant, however, electricity prices were

32 V.I. Voloshin, Electric power in the Comecon European Countries, in: Energy Policy 18 (1990) 8, p. 742.

33 A.F. Panasenkov, Co-Operation among CMEA Member Countries in the Development of Nuclear Energy. Its Role in the Implementation of the NPT, in: IEAE Bulletin 22 (1980) 34, p. 72.

34 Since 1975, prices were adjusted annually to an average of world market prices of the last five years (Moscow Principle). Before that, the adjustment was made only every five years (Bucharest Principle). See J.M. Kramer, Soviet-CEMA Energy Ties, in: Problems of Communism 34 (1985) 4, pp. 32-47.

35 AAN, 1878/8/260, p. 6 (Instytut Energetyki: Stanowisko IE w sprawie udziału PRL we wspólnej budowie Zachodnioukraińskiej elektrowni jądrowej; Warsaw, July 1977).

not fixed for the entire contract period, but were established in accordance to the CMEA pricing methodology.[36] Nevertheless, both nuclear power plants as well as the corresponding transmission lines were activated in the second half of the 1980s. However, pricing problems were likely the reason that no other 750 kV transmission lines were put into operation.

Figure 3: Cross-border 750-kV transmission lines between Soviet NPPs and neighboring CMEA countries, second half of 1980s)[37]

1: Vinnitsa (Ukrainian SSR) – Zapadnoukrainskaya Substation – Albertirsa (Hungary); 1 x 750 kV
2: Khmeľnitskiĭ (Ukrainian SSR) – Rzeszów (Poland); 1 x 750 kV
3: Yuzhnoukrainsk (Ukrainian SSR) – Isaccea (Romania) – Vetrino (Bulgaria); 1 x 750 kV

36 AAN, 290/2.9/8, p. 111 (Urząd Rady Ministrów; Porozumienie między rządem PRL a rządem ZSRR o współpracy w budowie na terytorium ZSRR Chmielnickiej Elektrowni Atomowej i związanych z tym dostawach energii elektrycznej do PRL; Warsaw, 29 March 1979).

37 Source: own drawing based on an open-access map of the Leibniz Institute of European History, www.ieg.maps.de (accessed 19 December 2016).

5. Failed Exams

In the beginning of the 1980s, the Soviet Union was no longer willing to supply socialist partners with increasing amounts of energy. In late 1981, the Soviet Union announced a 10 per cent reduction of oil deliveries to Eastern Europe from 1982–1985. This measure especially affected industrialized Czechoslovakia and the GDR. In doing so, the Soviet leadership revised an announcement made by the chairman of the Soviet Council of Ministers, Alexei Kosygin, in June 1980. Back then, Kosygin had stated that Soviet energy exports would remain at the 1980 level for the entire five-year planning period.[38] One of the reasons for the cutback was the increasing expenses of grain imports from the United States and the need to scale up Soviet oil and gas exports to West European countries in order to earn hard currencies.[39] However, already at the thirtieth CMEA Session in July 1976 the Soviet Union indicated limiting future oil exports.[40] Nevertheless, the reduction of Soviet oil supplies put CMEA countries under additional pressure to extend nuclear energy and to exploit domestic energy resources.[41]The construction of nuclear power plants however, could not keep pace with the growing demand. The Soviet company Atommash, which was the main producer for components of water-water energetic reactors (VVER),[42] managed to deliver only seven reactors instead of the 43 scheduled to be complete by 1985.[43] These delays were due to several reasons such as the lack of skilled labour and adequate housing in the rapidly growing city of Volgodonsk. The main reason, however, was that Atommash's huge factory hall with a total length of 750 metres had been constructed too close to the Tsimlyansk Reservoir and was slowly sinking into the ground until it eventually collapsed.[44] Consequently, East European countries were forced to rapidly increase electricity imports from the Soviet Union. Whereas Eastern Europe imported 14,700 gigawatt hours (GWh) in 1980, imports grew to 37,000 GWh in 1987.[45] Poland, which was an energy net exporter for decades, became a net importer in 1986. Apart from significant construction delays of its Żarnowiec Nuclear Power

38 S. Closson, A Comparative Analysis on Energy Subsidies in Soviet and Russian Policy, in: Communist and Post-Communist Studies 44 (2011) 4, p. 345.

39 See the article of Christian Gerlach in this volume.

40 R. Ahrens, Gegenseitige Wirtschaftshilfe? Die DDR im RGW. Strukturen und handelspolitische Strategien. 1963–1976, Cologne 2000, p. 300.

41 Therefore, the GDR became the leading brown coal producer with significant repercussions to people's health and environment.

42 The Water-Water Energetic Reactor (VVER, Vodo-Vodyanoï Énergeticheskiï Reaktor) belongs to the group of pressurized water reactors with light water as coolant and moderator and slightly enriched uranium as fuel. The coolant is pumped into the reactor core, where it is heated by the fuel. Due to the high pressure, the coolant remains liquid despite the high temperature in the core. The heated coolant in the hermetically closed first loop flows to a heat exchanger, where it transfers its thermal energy to water in a second loop. This water turns into steam and moves a steam turbine.

43 H. Brezinski, Wirtschaftliche Fragen des Energieverbundes im Ostblock, in: G. Gutmann, K.C. Thalheim and W. Wöhlke (eds.), Das Energieproblem in Ostmitteleuropa. Part II: Energiepolitik und Energieverbund in den mitteleuropäischen RGW-Staaten, Marburg 1984, p. 72.

44 P. R. Josephson, Red Atom. Russia´s Nuclear Power Program from Stalin to Today, New York 2000, p. 104.

45 K. Schappelwein, Atlas Ost- und Südosteuropa. Energiewirtschaft Ost- und Südosteuropas, Vienna 1990, p. 4.

Plant, reasons for this switch were the stagnating domestic coal production after the political and economic crisis as well as unsuccessful energy-saving measures as a reaction to the second oil crisis.[46]

Growing Soviet electricity deliveries could not prevent recurrent energy shortages and severe blackouts. Especially harsh winter weather put grids under pressure. In 1978/79, heavy snowfalls triggered blackouts in the GDR, Poland, and Czechoslovakia. Another bottleneck was that emergency electricity supplies from neighbouring states remained insufficient. One of the main benefits of the Mir network was supposed to be that in cases of emergency, neighbouring countries would supply the troubled country. However, in reality this was not feasible. In January 1987, there was an explosion at Boxberg, one of the biggest thermal power plants in the GDR, causing severe damages. Approximately five per cent of the countrywide electricity production capacity broke down. Other members of the Mir grid could not compensate these losses due to their own strained electricity supplies. Consequently, the GDR was forced to import electricity from Austria, while Austria itself imported electricity by contract from Poland and Czechoslovakia, although in smaller amounts. Moreover, Austria paid an average of 0.33 automatic transfer switch per kWh, as opposed to the GDR, which had to pay 0.77 automatic transfer switch per kWh.[47]

At the end of the 1980s, no change for the better was conceivable. Due to the Chernobyl disaster, national plans for nuclear energy were further delayed. In the case of the Polish nuclear construction site in Żarnowiec, public opposition led to the overall halt of the project at a time when 36 per cent was already finished.[48] At the same time, the Soviet Union could not guarantee its obligations of electricity deliveries anymore. During the meeting of the Standing Commission for Electric Energy in Sofia in 1989, the delegations from Poland, Hungary, and the GDR complained about the Soviet announcement that it would not fulfil contractual obligations.[49]

6. East-West Electricity Exchanges

Similar to the East European Mir grid, a transnational electricity grid existed in the West. The UCPTE network had been established in 1951 and linked the national grids of Austria, Belgium, the Federal Republic of Germany (FRG), France, Italy, Luxembourg, the

46 P. Jansen, Energiepolitik unter dem Eindruck der beiden Ölpreiskrisen. Die Beispiele der ČSSR, DDR, Polens und Ungarns, in: G. Gutmann, K.C. Thalheim and W. Wöhlke (eds.), Das Energieproblem in Ostmitteleuropa. Part II: Energiepolitik und Energieverbund in den mitteleuropäischen RGW-Staaten, Marburg 1984, pp. 24-25.

47 J. Bethkenhagen, Stromwirtschaft im RGW. Trotz Kapazitätserweiterung bleibt Versorgung angespannt, in: Wochenbericht DIW 36 (1988), p. 486.

48 S. Albinowski, Ekonomiczne Przesłanki Rezygnacji z Budowy Elektrowni Jądrowych w Polsce do 2000 r., in: Gospodarka planowa (1989) 10-12, p. 25.

49 AAN, 1878/17/13, p. 27 (Sprawozdanie delegacji polskiej z 3 posiedzenia Stałej Komisji RWPG ds. Współpracy w Dziedzinie Energii Elektrycznej i Energetyki Jądrowej w Sofii od 9. do 13. października 1989 r.; Warsaw, October 1989).

Netherlands, and Switzerland. A linking of Mir and the UCPTE grids would have had the same advantages, which led to the interconnection of national systems on both sides of the Iron Curtain in the 1950s and 1960s. However, the Mir grid worked with a higher frequency deviation, though both networks officially operated on a frequency of 50 hertz.[50] This difference ruled out synchronization. An alternative was the so-called island mode, which means the isolated operation of a power plant is linked by a cross-border transmission line to a neighbouring electricity grid. In 1956, Austria and Czechoslovakia constructed such a transmission line between the Bisamberg and Sokolnice substations. In 1965, a similar link followed between the Austrian substation Wien-Südost and Hungarian substation Győr. Some years earlier, additional cross-border lines between Hungary and Yugoslavia (Szeged-Subotica) as well as between Yugoslavia and Bulgaria (Niš-Sofia Iztok) had already been put into operation.[51] These transmission lines were of minor significance, but the cases of Austria and Yugoslavia are quite instructive. After cutting the last cross-border lines between East and West Berlin in the beginning of the 1950s, neutral Austria and non-aligned Yugoslavia were the only countries in Central Europe with connections to CMEA countries. At that time, both Austria and Yugoslavia were members of the UCPTE.[52]

In the 1970s, the picture changed. Significant price increases in the West European energy sector drew the attention of socialist governments to international electricity trade. After lengthy negotiations, in 1975 Austria and Poland signed a treaty establishing electricity exchanges.[53] A back-to-back station near the Dürnrohr substation as well as a power line running to Slavětice, Czechoslovakia were constructed.[54] The involvement of the Swiss electricity company Laufenburg, which was an important stakeholder on West European electricity markets, indicates the significance of the project.

Due to détente in East-West relations and the Helsinki Accords in 1975, new plans to connect grids were suggested. In his speech at the seventh session of the Polish United Workers' Party in December 1975, Soviet General Secretary Leonid Brezhnev proposed a pan-European energy conference as a response to existing challenges with regard to the global oil crisis. The idea involved the merger of East and West European electricity grids

50 The higher frequency deviation in the Mir grid was related to the lack or belated deployment of reserve power and to the lack of automatic frequency adaptation. Within the UCPTE grid constantly sufficient back-up capacities were available in order to stabilize the grid. The balancing was automated. In the Mir grid, only Soviet power plants were responsible for the regulation of frequency and balancing was conducted by hand, i.e. by the Central Dispatching Office. See W. Kiwit, Großverbundsysteme in Europa. Fakten und Grenzen, in: Energiewirtschaftliche Tagesfragen 40 (1990) 11, p. 765.

51 M. Hegemann, Kurze Geschichte des RGW, Berlin 1980, p. 136.

52 While Austria was one of the founding members of UCPTE in 1951, Yugoslavia was a founding member of the SUDEL-group. Simultaneously, SUDEL-members were associated with UCPTE. In 1987, Yugoslavia became a full member of UCPTE.

53 The motivation was the complementarity of Austrian and Polish energy mixes. While Austria could produce plenty of electricity deriving from its hydroelectric power stations in the Alps (especially in summer time), Poland could offer electricity from conventional thermal power stations fuelled with hard coal.

54 W. Fremuth, Österreich als Stromdrehscheibe zwischen Ost und West, in: R. Dietz and K. Mack (eds.), Energie, Umwelt und Zusammenarbeit in Europa, Vienna 1987, p. 144.

and joint investments in large energy complexes.[55] Other stakeholders tried to benefit from the political thaw in the mid-1970s as well. With considerable assistance from the UNECE, in 1977 Greece and Bulgaria agreed on electricity exchanges and the construction of a power line between Thessaloniki and Blagoevgrad, Furthermore, the UNECE electricity committee examined the construction of an electricity highway of 1,000 kV running from the nuclear power station at Kursk, Soviet Union via Kiev, Lviv, Gottwaldov, and Munich to Laufenburg, Switzerland.[56]

For CMEA countries, the export of electrical energy was an additional source for urgently needed hard currency earnings. The question of electricity re-exports to the West was controversially discussed in connection with the construction of the nuclear power plants in Khmeľnitskiĭ and Yuzhnoukrainsk. While delegations from Poland, Bulgaria, and Romania pressed for the removal of the paragraph prohibiting electricity re-exports, the Soviet side insisted on the ban.[57] The reason for this was that the Soviet Union itself planned to export electricity to the West. One proposal was to deliver electricity to West Berlin and further to the FRG from a planned nuclear power plant near Kaliningrad. Although this proposal must have been attractive to energy-poor Berlin, the project did not materialize due to the still complicated geopolitical situation.[58]

Due to the increasingly strained energy supply situation in most East European countries, the import of electricity from the West was considered in the late 1980s. The GDR with its increasing problems in the field of lignite mining was especially interested. In 1988, the GDR and FRG agreed to construct a cross-border transmission line through the GDR to West Berlin. In September 1989, the first section between Helmstedt, FRG and Wolmirstedt, GDR became operational.[59] After 1989, the fundamentally changing political landscape facilitated cooperation. Political barriers faded away and technical problems became the focus of governments' attention. An interesting example was the cooperation between West Germany and Romania in early 1990. In order to deliver 400 MW, both sides had to make use of all existing cross-border links between the UCPTE and the Mir grid. First, the electricity was transferred to Austria within the synchronized UCPTE grid. The electricity was further transmitted (1) through the back-to-back station near Dürnrohr to Czechoslovakia (2) via a transmission line from substation Wien-Südost to Győr, Hungary, and (3) to the Yugoslav grid, which was part of the UCPTE network. A turbine at the Djerdap hydroelectric power station directed an equivalent amount of electricity of (3) to the neighbouring Porțile de Fier (the Iron Gate I Hydroelectric Power Station) on the Romanian side of the Danube. The electricity equivalents

55 AAN, 1764/7/11, pp. 146–147 (Protokol pervogo zasedaniya soveta po nauchno-tekhnicheskomu sotrudnichestvu v oblasti toplivno-énergeticheskikh problem; Moscow, 20–22 October 1976).

56 Y.N. Savenko, Tendentsii Razvitiya Obmena Élektroénergieĭ mezhdu Énergosistemami Evropeĭskikh Stran, in: Ékonomicheskoe Sotrudnichestvo Stran-Chlenov SÉV (1982) 3, p. 72.

57 AAN, 1878/8/260, p. 26 (Sprawozdanie z drugiego posiedzenia wiceministrów energetyki krajów RWPG w Moskwie w dniach 10–13.X.1977 r.; Warsaw, 8 November 1977).

58 Ibid., p. 178.

59 J. Thiry, Interconnection of European Electric Power Systems: Present Situation and Prospects up to the Year 2000, in: OECD, Seminar on East West Energy Trade, Paris 1992, p. 165.

of (1) and (2) were transferred from a Hungarian power station to Romanian customers in the border region.[60] This kind of electricity delivery was possible because of the commitment of all involved and illustrated the (technical) obstacles and possibilities of East-West electricity deliveries in the beginning of the 1990s.

7. Conclusion

The Mir grid was officially established in 1959. Local and regional cross-border links, which formed the core of the Mir network, had existed since the Second World War or were put into operation in the 1950s. Until 1967, all East European countries as well as the southwestern part of the Soviet Union were connected to the network. The 1970s saw a significant increase in joint construction bringing Eastern Europe even closer to the Union of the Soviet Socialist Republics. The zenith of this integration process was reached in 1979 and 1981 with agreements on the joint construction of two nuclear power plants in Khmeľnitskiĭ and Yuzhnoukrainsk with corresponding long-distance, high-voltage transmission lines. The 1980s, however, revealed the limits of the Mir network. National construction schemes of nuclear power plants fell behind plans. Additionally, the socialist pricing system could not prevent energy importing CMEA countries from paying ever increasing amounts for energy imports even within the bloc. Consequently, the focus shifted towards national energy resources with significant consequences for the environment and the health of the population. Severe winter weather or breakdowns of central components of the national grids had the potential to paralyse domestic electricity supplies. These developments put a heavy economic burden on the energy sectors of East European planned economies. Due to the political détente, since the 1970s East-West cooperation in the field of electricity deliveries has gained momentum. However, large-scale imports of electricity from the West were no feasible alternative to Soviet deliveries. The energy-hungry CMEA countries could only be paid with non-competitive consumer goods on global markets.

As shown above, the CMEA played an important role in the development of the Mir network by continuously planning its further expansion, which lasted several decades. Especially in the 1970s, far-reaching construction plans went hand in hand with the extension of organizational structures within or related to the CMEA. Joint investments in substations, power plants, and institutions like the CDO and Interatomenergo stimulated the integration process. A look into contemporary journals reveals that the successful construction of grid components was highlighted to stress the friendship and mutual assistance of socialist countries. The expansion of Mir reflects a general pattern that can be found in the oil and gas sector, too. However, only in the case of electricity was the role of the CMEA successful in the creation of a transborder network, since the

60 W. Kiwit, Großverbundsysteme in Europa. Fakten und Grenzen, in: Energiewirtschaftliche Tagesfragen 40 (1990) 11, p. 768.

matching of supply and demand necessitated intense cooperation. The disintegration of the socialist bloc and the dissolution of the CMEA in 1991 was a deathblow for the Mir grid. Without the institutional support of the CMEA and related institutions such as the CDO, the functioning of Mir could no longer be guaranteed. Due to the relatively close interconnection of the Czechoslovak, Hungarian, and Polish grids, a substitute had to be put in place and was found in the form of the CENTREL system. Similar to the military and political developments, a quick unification with the West European UCPTE system was the ultimate goal and, therefore, all electricity links to the former Soviet Union had to be shut down. The synchronization of the CENTREL and UCPTE networks was realized in 1995, which means that the electrical unification preceded the military and political integration into NATO and the EU by several years.