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Appeared as: "High voltages, lower tensions. The interconnections of Eastern and Western European electricity networks in the 1970s and 1980s", in: Éric Bussière, Michel Dumoulin & Sylvian Schirmann (eds.) [*Milieux économiques et intégration européenne au XXe siècle. La crise des années 1970 de la conférence de La Haye à la veille de la relance des années 1980.*](#) Euroclio: Etudes et Documents series, vol. 35, (Brussels: Peter Lang, 2006), pp.135-167.

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HIGH VOLTAGES, LOW TENSIONS. THE INTERCONNECTIONS OF EASTERN AND WESTERN EUROPEAN ELECTRICITY NETWORKS IN THE 1970S AND EARLY 1980S¹

Introduction

"We are convinced that electrically Europe does not need to be created for it has existed as such for a long time [...]. We note that the existing organisation responds readily to the present needs, that is to say, to the desired present exchanges. It is true that these transfers across frontiers are of little importance and that they have nearly always a simple *marginal* character [...]. Let me add that the continuous increase in the production of thermal energy and the probable introduction of nuclear energy will [...] reduce the importance of these same transmission lines. [...]

We hope above all that we shall not be tied down and that we shall be allowed to continue to work as silently, as effectively for Europe and therefore for the greater good of humanity and of peace."²

Thus spoke Heinrich Freiberger of the *Vereinigung Deutscher Elektrizitätswerke* referring to the *Union pour la coordination de la production et du transport de l'électricité* (UCPTE). In 1955, when Freiberger's quote was recorded, this regional electricity organisation coordinated – amongst other things – the electricity exchanges between eight national grids in Western Europe. At the same time interconnections between this Western network and both Scandinavian as well as Eastern European countries were virtually non-existent. So if Europe did exist 'electrically' at that time, it was composed of various regional networks that were isolated from each other.

Today an integrated network of European electricity grids ranging from Poland to Portugal is 'hidden' behind the plug-socket. This interconnected European network, or *Trans-European Synchronously Interconnected System* (TESIS), has been in place since October 1995, linking the power systems of Eastern and Central, and Western Europe with a frequency of 50Hz. Up until then, Europe was electrically divided in a Western and Eastern network, as well as a separate Nordic network which is still in

¹ I am grateful to Alec Badenoch, Johan Schot, Erik van der Vleuten, and Geert Verbong. I would like to thank Frantisek Cahyna for his comments on the UCPTE's history and technical details. This article is based on research done for my doctoral thesis *Electrifying Europe*, which is part of a larger project, *Transnational Infrastructures and the rise of contemporary Europe* (TIE), awarded to prof. dr. Johan Schot and funded by the Netherlands Organization for Scientific Research (NWO), in September 2002, Dossier number 277-53-001. My PhD project is also financially supported by *Fondation Électricité de France*.

² UNIPEDE, *Compte-rendu du X^e Congrès International, London 1955*, Paris: Imprimerie Chaix, 1955, pp. 126-127.

existence. Current European Union policies, such as the *Trans-European Networks* (TEN), seek to improve infrastructural linkages to ensure optimal conditions for implementing a Single European Market for electricity.

Thus, the opposite of Freiburger's remarks could be argued; Europe had to be created electrically, or at least his view of 'Europe' was a rather narrow one. I will therefore claim in this article that the 'electrically creation' of Europe including both East and West, was preceded by at least a decade of electricity trade and happened before the political upheaval in Eastern Europe. In describing this process, particular attention shall be paid to the socio-economical and political context, that provided historically-imposed constraints and opportunities, and which pressured the structure of the electrical supply industry to change.

Up until now, histories of electrification have been confined to the national level, most of these being written by historians of technology. These national histories of the construction and expansion of electricity grids are relatively abundant.³ What still lacks is an overview of developments on the European level, aside from several regional studies that go beyond the national boundaries.⁴ In my thesis, and therefore in this article, I will focus on *European* developments, a perspective that is currently underrepresented.⁵ I use a framework that is quite common in history of technology, namely the *Large Technical Systems* framework (see below), but I attempt to embed the history of Europe's electrification within a more general political and economic context. Such an endeavour is legitimate as, first, thinking on an international or European level already proliferated in the 1920s, while most national networks would be completed within the following two decades, and second, as the thoughts about and constructing of trans-European networks was greatly affected by alterations in the sphere of politics, economy, and society.

More specific, here I will look at the organisation of the European electricity supply from a long-term perspective, to be able to focus on the changes in the structure of the supply and the interconnections between regional networks that took place during the 1970s and 1980s. These developments will be described against the

³ Some examples of national histories are: Erik van der Vleuten, *Electrifying Denmark. A symmetrical history of central and decentral electricity supply until 1970*, Ph.D. dissertation, Faculty of Science: University of Aarhus, 1998; Jonathan Coopersmith, *The electrification of Russia, 1880-1926*, Ithaca/London: Cornell University Press, 1992; J. W. Schot, H. W. Lintsen & A. Rip, *Techniek in Nederland in de twintigste eeuw. Deel 2. Delfstoffen, energie, chemie*, Eindhoven: Stichting Historie der Techniek, 2000, Section: II Energy, pp.113-268.

⁴ A good example on France is : Christophe Bouneau, "l'Interconnexion internationale de la France et la genese du reseau electrique Europeen de 1945 a nos jours", in: Albert Carreras, Andrea Giuntini & Michèle Merger, *European networks, 19th-20th centuries. New approaches to the formation of a transnational transport and communications system*, Milan: 1994. On Scandinavia, see: Arne Kaijser, "Trans-border integration of electricity and gas in the Nordic countries, 1915-1992", in: *Polhem. Tidskrift för teknikhistoria*, 15, 1997, pp.4-43; Arne Kaijser, "Controlling the grids. The Development of High-Tension Power Lines in the Nordic Countries", in: Arne Kaijser & Marika Hedin (eds.), *Nordic energy systems. Historical perspectives and current issues*, Chicago: Science History Publications, 1995, pp.31-54.

⁵ Some progress has been made, though. Since 2000, an ESF-network *Tensions of Europe. Technology and the making of 20th century Europe* has been in existence, studying the effects of technology on the construction of Europe (see www.histech.nl/tensions). One output of this Network is a special issue of *History and Technology* (volume 21, nr. 1, March 2005). Another effort to bridge this gap is the research project *Transnational Infrastructures of Europe* (TIE), initiated at the Eindhoven University of Technology in 2003. The author takes part in this project.

background of pivotal changes in the electricity industry as a whole, because the 1970s and 1980s were not only a period of a stagnant world economy but also a period of crisis for the electricity supply industry. Extremely high oil prices, growing environmental concerns, and strengthened popular resistance to the expansion of the electricity generating capacity, all put the prevailing ideas of network building increasingly under pressure. Special attention will be reserved for the relations between Eastern and Western Europe in this period, taking as a central question how a rapprochement between East and West could happen in this period. Did the political, social, and economic context play an important role in the initial political and consequently electrical parting of the two sides, and what was its importance in the first attempts to connect both sides of the Iron Curtain?

First I will explain my conceptual framework. The second part of this article will discuss the building of networks in the early 20th century and the Interwar period. Next, it will look at the formation of regional blocs and their respective contexts. The fourth section examines the adjustments in the energy structure after WWII that were necessary after several 'exogenous shocks'. Following this, the developments between Eastern and Western Europe will be described within their economic and political contexts. Lastly, the conclusion will reflect on the relation between network-building and the political, social and economic environment, in particular in the 1970s and 1980s.

A. ELECTRICITY GRIDS AS LARGE TECHNICAL SYSTEMS

The process of integration of electricity systems in Europe took almost a century and was not particularly straightforward. Despite the availability of technology for long-range transmission, and notwithstanding multiple plans for erecting a Europe-wide grid in the late 1920s and 1930s, both the construction and operation of networks remained largely a national matter. These national grids were characterised by high voltage (HV) transmission networks that transported electricity from large centralised production units to centres of consumption. The first decade after World War II saw increased international organisation at the regional level, in Northern, Eastern and Central, and Western Europe. The initiatives to interconnect Eastern and Western Europe, which formed the basis for the later creation of TESIS, were initiated during the late 1970s and 1980s. This trans-European network was thus not the result of a trans-national effort, but the outgrowth of the intercoupling of national grids.

But the construction of cross-border links is more than 'just' building HV-lines between two countries. According to Swedish historian Arne Kaijser the construction of these trans-national connections is influenced by the social, economic and political context, and should be placed within the according institutional setting.⁶ People in the electrical supply industry seems to be aware of the political context they manoeuvre in. As the two Germanies were being reunited in 1990, a representative of the Western European network observed: « Pour la première fois les politiciens sont en avance sur les electriciens ».⁷ Hardly 14 years later, just before the 1st of May, the

⁶ Kaijser, "Trans-border", pp.4-43; Kaijser, "Controlling", pp.31-54; Arne Kaijser, "The helping hand. In search of a Swedish institutional regime for infrastructural systems", in: Lena Andersson-Skog & Olle Kranz (eds.), *Institutions in the transport and communications industries. State and private actors in the making of institutional patterns, 1850-1990*, Canton: 1999, pp.223-244.

⁷ Archive of the UCPTE, Brussels; UCPTE, *Comité restreint*, October 16-17 1990, Interlaken, p.8.

UCPTE considered the expansion of the European Union with 10 new members 'an integration process anticipated' within the electricity industry.⁸

These social, economic and political conditions help determine how the network is being built and expanded – or why it is not. One way to study electricity networks as a socio-technical system is by using the conceptual framework of *Large Technical Systems*.⁹ Using this definition, electric power systems are made of more than technology. They are socially constructed artefacts, indeed including technological artefacts, but also existing out of institutions and organisations, scientific components, natural resources, and legislative artefacts.¹⁰ These socio-technical systems are constructed by so-called system builders, which can be either persons or institutions.¹¹ In times of political, social and economic upheaval, these system builders are often replaced by new ones, or pursue new interests.¹² The system builders and system components interact with each other to accomplish the 'common goal' of the system, which is in this case the continuous supply of electricity.

But not everything falls within the system's control. A socio-technical system is inevitably also influenced by intractable social, political and economic factors that make up the 'environment' in which it is located. A shift in one of these factors – like increased oil prices – can necessitate an adjustment in the system components. To eliminate such extern impacts, system builders often attempt to integrate the 'environment' into the system.¹³ In the 1970s the combination of high oil prices, economic crisis, and socio-political opposition against the construction of new plants endangered a secure generating capacity. These adverse factors all came from outside the reach of control. As I will subsequently show, the electricity supply industry sought a solution that was under their control. They expanded their system, or network, towards the East where several Eastern European countries, like Poland, Romania and the Soviet Union, harboured large amounts of fossil fuel resources that could be utilised for electricity production. In addition, political developments and the state of Eastern economies made more power lines across the Iron Curtain possible.

⁸ UCTE Press release, "UCTE welcomes tomorrow's enlargement of EU - 5 of 10 new member countries are already firmly interconnected and their TSOs are full members of UCTE", Brussels, 30 April 2004.

⁹ For more on the theory of LTS, see for example Thomas P. Hughes, *Networks of power. Electrification in Western society, 1880-1930*, Baltimore: Johns Hopkins University Press, 1983; Bernward Joerges, "Large technological systems: concepts and issues", in: Renate Mayntz & Thomas P. Hughes (eds.), *The development of large technological systems*, Frankfurt am Mainz: Campus Verlag, 1988, pp.51-82. A good overview is presented in E. van der Vleuten, "Infrastructures and societal change. A view from the Large Technical Systems field", in: *Technology Analysis & Strategic Management*, 16, 3, 2004, pp.395-414.

¹⁰ Thomas P. Hughes, "The evolution of large technical systems", in: Wiebe E. Bijker, Thomas P. Hughes & T. J. Pinch (eds.), *The social construction of technological systems*, Cambridge: MIT, 1987, p.51.

¹¹ *Ibidem*, pp.51-52. System-builders, implementers of technological innovations within an institutional and cultural framework, are not necessarily people. Due to up scaling and increasing complexity of systems since the First World War, the system-building process gradually shifted from inventor-entrepreneurs to organisations and governments. After the Second World War, European institutions played a significant role as well. Also see Thomas P. Hughes, *Rescuing Prometheus*, New York: Vintage Books, 1998.

¹² Per Högselius, "Electricity systems in the Baltic region: connecting East and West", early draft version in: Arne Kaijser & Erik van der Vleuten, *Networking Europe*, forthcoming, p.2.

¹³ Hughes, "The evolution", p.53.

B. EXPORT AND EXCHANGE

But before we come to account of the developments in the 1970s and 1980s, more should be said on trans-national electricity flows and their impacts. A part of the answer why national networks were preferred to a European-wide network can be found in the political and economic implications of international collaboration. In describing the Scandinavian cooperation in the electricity sector before World War II, Arne Kaijser makes a useful distinction between electricity *exchange* and electricity *export*. While the first is symmetrical, suiting the needs of all parties involved without any form of dependency, the latter is asymmetrical and does create a dependency.¹⁴ Since electricity cannot be stored properly, the supply has to be adjusted to the demand while keeping a certain ratio of backup capacity. Interconnections enable the exchange of electricity, thus making emergency supplies possible in case of a power outage and acting as back-up capacity, but in some cases also to obtain a better economic mix.¹⁵

Power export is asymmetrical according to Kaijser, as it creates a mutual dependence; one country becomes dependent on a steady supply of electricity, the other on the export revenue. A solid relationship between the trading countries is thus an absolute necessity. It proved difficult to achieve cooperation based on power exports in Scandinavia before WWII, due to reasons of a political and economic nature.¹⁶ This observation probably holds for Europe as a whole before the 1950s, placed in the framework of fierce political and economic nationalism, a deep economic crisis, and two catastrophic wars. In their comparative study of Swedish and German network-building in 1930s, Mats Fridlund and Helmut Maier introduce the term *engineering nationalism*, showing that the trajectories chosen were infused by 'cultural influences concerning national prestige and national superiority'.¹⁷

I. THE HISTORY OF EUROPE'S ELECTRICITY SUPPLY

The conceptual framework laid out above is crucial to understand the history of electricity network-building in Europe. As I stated above, this history has until now been written from the regional and national perspective. What is lacking is an overview of trans-national developments within Europe. The next section will attempt to sketch the outlines of these processes that exceeded the national boundaries.

A. NATIONAL NETWORKS

The availability of alternating current (AC) made the transmission of electrical energy over longer distances possible, as was demonstrated at the International Electrical

¹⁴ Kaijser, "Trans-border", pp.18-19.

¹⁵ *Economic mix*, a term of Thomas Hughes, encompasses the increase of reliability, security and profitability through the combination of various types of generation. Hughes, *Networks of power*, p.346, 366-367. I will try to clarify this abstract term with an example. Where as Sweden and Norway countries possess aplenty opportunities for hydro plants, Denmark has a thermal-based electricity supply, relying on fuel minerals. Thus through interconnection, hydropower can be exported to Denmark, while the Danish produce extra power in periods of water shortage with their northern neighbours. Also, since electricity producers have to retain a buffer for peak periods, connecting multiple networks results in a common reserve capacity, thus bettering reliability.

¹⁶ Kaijser, "Trans-border", pp.18-19.

¹⁷ Fridlund & Maier, *The second battle*, p.3.

Exhibition in Frankfurt in 1891.¹⁸ There, electrical current, generated by falling water, was transported over a distance of 175 kilometres to Frankfurt from its origin in the Alps. Its power source was 'visualised' at the exhibition in Frankfurt by an electronically powered and illuminated artificial waterfall.¹⁹ This demonstration 'electrified' its spectators, and in Switzerland it touched off an entrepreneurial fever, infused by the country's rich hydroelectric potential. A corporation named *Freiland* addressed the Bundesrat in April 1891, demanding the exploitation of yet unused waterpower in Switzerland by the State. Their main purpose was to thwart the export of generated electricity. But on in April 1895 their request was turned down. Instead, the Bundesrat preferred a more uniform legislation for all cantons, and gave priority to electrification of the railways and to other use within Switzerland. Therefore, every individual request for the export of electrical power had to pass the Bundesrat, making Switzerland one of the first countries to introduce legislation concerning the export of electrical power.²⁰ The development of electricity networks in other European countries resembled the path chosen by the Swiss, where on the whole national interests prevailed. The growth of consumption combined with the utilisation of hydroelectric resources sparked the proliferation of electrical networks, expanding from the local, to the regional, to the national scale.

This mostly national focus did not prevent people looking beyond their national borders. There was some international cooperation between 1910 and WWII, most notably in Scandinavia²¹, Switzerland, and between France and some of its neighbours²². The aftermath of WWI saw engineers envisioning a common European high voltage transmission network that could help to establish peace in Europe by physically connecting European nations and making them dependent on each other. Herman Sörgel for example, proposed a dam spanning the Gibraltar Straits, capable of generating enough power for the whole Europe.²³ Other plans for erecting a European transmission grid came from the Swiss engineer Ernst Schönholzer, the French engineer George Viel, and the German Oskar Oliven.²⁴ The plan by Oliven was

¹⁸ *Direct current* (DC) is another form of electrical transmission. The basic difference between the two is that with DC the electricity flows one-way only, while AC current back and forth through the network components. A synchronised AC network thus requires a similar frequency.

¹⁹ Hughes, *Networks of power*, pp.131-134.

²⁰ A. Vital, *Die Ausfuhr elektrischer Energie*, Lausanne: Imprimeries Réunies S.A., 1928, in: Bundesarchiv Bern, Switzerland, 8190 (A) 1981/1: 37: 82 (E1) Vereinigung exportierender Elektrizitätsunternehmen 1928.

²¹ Kaijser, "Trans-border integration", p.6.

²² This early transnational connections (60kV) were concentrated around Lac Léman and the Ardennes, connecting to Germany, Switzerland, and Belgium. See: Christophe Bouneau, "l'Interconnexion internationale de la France et la genese du reseau electrique Europeen de 1945 a nos jours", in: Albert Carreras, Andrea Giuntini & Michèle Merger (eds.), *European networks, 19th-20th centuries. New approaches to the formation of a transnational transport and communications system*, Milan: 1994, p.61. Also see G. Verbong, E. van der Vleuten & M. J. J. Scheepers, *Long-term electricity supply systems dynamics. A historical analysis*, ECN, 2002, p.18.

²³ Alexander Gall, *Das Atlantropa-Projekt. Die Geschichte einer gescheiterten Vision. Herman Sörgel und die Absenkung des Mittelmeers*, Frankfurt: Campus 1998, pp.198; Dirk van Laak, *Weisse Elefanten. Anspruch und Scheitern technischer Grossprojekte im 20. Jahrhundert*, Stuttgart: Deutsche Verlags-Anstalt, 1999.

²⁴ Ernst Schönholzer, "Ein elektrowirtschaftliches Programm für Europa", in: *Schweizerische Technische Zeitschrift*, No. 23, 5 Juni, 1930; Georges Viel, "Etude d'un reseau 400.000 volts", in: *Revue generale de l'electricité*, 28, 1930; Oskar Oliven, "Europas Großkraftlinien.

particularly interesting as the *Commission for Enquiry for European Union*, part of the League of Nations, took up his initiative.²⁵ The League, and in particular its *Conference on Communications and Transit*, advocated for the removal of ‘artificial obstructions to transit raised by political boundaries’.²⁶ The League believed in the contribution of electricity networks to peace in Europe:

«L'un des résultats de la création d'un réseau électrique européen serait d'établir entre les différents pays une communauté d'intérêts bien propres à consolider la paix. »²⁷

An additional motive for these plans was to make more rational use of resources. A better balance between hydro electricity and thermal electricity would enable the utilisation of scarce coal elsewhere in the recovering economies.

In spite of these plans, the dominant paradigm in network building remained based on national grids with large centralised production centres that utilised economies of scale, and transmission by a high voltage transmission network to supply consumption centres. In most cases this resulted in an integrated national grid. Germany, France, and the United Kingdom already had such schemes in place before the Second World War, others like the Netherlands, Sweden, and Denmark followed directly after. Rationalisation would be pursued on a national scale, leading to larger and more efficient plants, with lower investment costs per kWh.²⁸ International connections were mainly devised for emergency supply and seasonal exchanges, but could also be used for export and import of power. After WWII this would change gradually, as trans-national connections were expanded and cooperation increased. Rationalisation and economic mix were sought on an international level.

In the post-war period, several processes of integrating national networks were initiated. This linking of national grids led to the formation of three main blocks that exchanged electrical energy: the UCPTE in Western Europe, IPS/CDO in Eastern and Central Europe, and Nordel in the Scandinavian countries. All of these were in some way influenced by the wish for more political and economical integration in Europe. These three will be introduced below in their respective contexts. All were also – at least indirectly - consequences of the Marshall Plan, and as a matter of fact resembled the political situation in Europe.

Vorschlag eines europäischen Höchstspannungsnetzes", in: *Zeitschrift des Vereines Deutscher Ingenieure*, 74, 25, June 1930. All three are also mentioned in Fridlund & Maier, *The second battle*.

²⁵ Archive of the League of Nations, Geneva; Transit: Electric questions, Box R2572, 9e/30846/1668. This archive folder contains a letter from Dr. Alfred Ekstrom, M.I.E.E. of Crompton & Ekstrom to secretary-general of the League, Eric Drummond, and also another sheet, *A European super power system*, by R.E.B. Crompton, C.B., R.E., M.Inst.C.E., M.I.E.E. and Alfred Ekstrom, D.Sc., M.I.E.E. The actual reason why this project stalled is yet to be analysed.

²⁶ H.R. Greaves, *The League Committees and World Order: A Study of the Permanent Expert Committees of the League of Nations as an Instrument of International Government*, London: Oxford University Press, 1931, p.152. Also see Jo-Anne Pemberton, "New worlds for old: the League of Nations in the age of electricity", in: *Review of international studies*, 28, 2002, p.318.

²⁷ Archive of the League of Nations, Transit: Electric question, Box R2572, section 9e, dossier 26461, document 29306: Note. Divers aspects de la question du transport et du transit de l'énergie électrique et notamment du problème de la création d'un réseau européen.

²⁸ Kaijser, "Controlling the grids", pp.32-33.

B. ELECTRICAL INTEGRATION IN WESTERN EUROPE

In April 1948 the *Organisation for European Economic Cooperation* (OEEC) was founded to supervise the allocation of Marshall Aid, harmonise fiscal and monetary policy, and to encourage intra-European trade. In addition to these tasks, the OEEC also dealt with energy policy, divided in committees on the oil, coal, and electricity sector.²⁹ The overarching idea was to "integrate Europe and create the new era of *lasting peace and prosperity*".³⁰

One of the core tasks of the Electricity Committee was to get an overview of bottlenecks in the European electricity supply, and to find suitable solutions. According to one of their reports, these problems were mainly national but the potential solutions were essentially international. First, expanding the cross-border capacity of electrical lines would enable a more economic utilisation of the hydro electric potential of countries like for example Norway and Austria. Second, more in the realm of energy supply as a whole, the transmission of thermal generated power could compete with the shipment and transport of the raw materials for generating electricity:

« [D]ans le cas d'électricité thermique, le prix du transport du courant est très rapidement supérieur à celui du transport du charbon correspondant par voie d'eau ou par voie ferrée. »³¹

Therefore, the OEEC stressed the abolition of restrictions on intra-European trade, including electricity trade, and promoted the compulsory coordination of investments. It also advocated for the extension of international HV-networks that could increase economies of scale. Already at this point, the prospect of nuclear was expected energy would enable even further centralisation (a thought that lasted until the 1970s³²) and that more international coordination would be necessary:

« C'est dire que les organismes internationaux nécessaires au bon fonctionnement de ces échanges ont été créés et il ne reste qu'à souhaiter que les gouvernements continuent à favoriser leurs initiatives. Il ne faut néanmoins pas se faire d'illusion sur leur importance; celle-ci n'est pas à l'échelle du problème européen de l'énergie. »³³

All these propositions and potential solutions came together in the Committee's explicit wish for a Western European power pool that would coordinate

²⁹ Wendy Asbeek Brusse & Richard T. Griffiths, "Exploring the OEEC's past: the potentials and the sources", in: Richard T. Griffiths, *Explorations in OEEC history*, Paris: OECD, 1997, pp.27-28.

³⁰ Michael J. Hogan, "American Marshall planners and the search for a European neocapitalism", in: *The American historical review*, 90, 1, 1985, p.47.

³¹ Archives Générales (Historiques et courantes) C.C.E., Brussels, CEAB 2, No 1245, CECA: Haute Autorité, Secrétariat général, 1953-1955, Organisation for European Economic Co-operation, Council. Intra-European economic co-operation in the production and distribution of power, note by the Secretary-General, Paris 14th December, 1953, c(53)325.

³² Verbong, Vleuten & Scheepers, *Long-term electricity supply*, p.18. The first discussions about joint operated nuclear power plants within the Electrical Committee of the OEEC are found in 1956. Archives of the European Union, Florence, OEEC archive, EL (1956) 6, Comité de l'électricité, Probleme relatifs a la creation en commun de centrales electriques nucleaires. Commentaires du Comité de l'Électricité sur le rapport du groupe de Travail ad hoc, Paris, 30th May, 1956.

³³ Archives Générales (Historiques et courantes) C.C.E., CEAB 2, No 1245, CECA: Haute Autorité, Secrétariat général, 1953-1955, Organisation for European Economic Co-operation, Council. Intra-European economic co-operation in the production and distribution of power, note by the Secretary-General, Paris 14th December, 1953, C(53)325.

electricity exchange and trade between the countries.³⁴ This pool would become reality in 1951 when the *Union pour la coordination de la production et du transport de l'électricité* (UCPTE) was founded. It was established by representatives of utilities from eight countries - Belgium, Germany, France, Italy, Luxemburg, the Netherlands, Austria and Switzerland on a basis of voluntary cooperation. Since April 1958, the electricity networks within the UCPTE were in synchronous operation.³⁵ Although all its members were geographically limited to the western part of Europe, the UCPTE presented itself as a European organisation. Looking back at the first 25 years of existence they celebrated that "the close co-operation, that came into existence between the UCPTE-members, and the common understanding that resulted from this, the electrical utilities have accomplished a coupled operation on a European level."³⁶

C. DEVELOPMENTS IN EASTERN EUROPE

But the UCPTE was not alone in claiming to be 'European'. Their activities were limited to the geographical realm of Western Europe. Nevertheless, a similar kind of organisation was established in 1962 to improve coordination between Central and Eastern European countries, the *Central Dispatch Organisation of the Interconnected Power Systems* (CDO/IPS). Just like the UCPTE, this organisation described itself as European, being 'one of the centres of European integration in the electric power industry'.³⁷ Like the UCPTE, the CDO was a consequence of the Marshall Plan, but in a different way as its members did not participate in the OEEC, but in the *Council for Mutual Economic Aid* (COMECON) instead. As the Soviets took over power in the region, they 'advised' the individual countries to reject Marshall Aid. The COMECON was founded in 1949 as an alternative.³⁸

Although the main incentive was initially a political one, the COMECON also aimed at the integration of the eastern Socialist economies. One problem with this was that their economies had historically been more aimed at trading with Western Europe than at trading amongst themselves. The structures of the Eastern European economies were therefore more competitive than complementary.³⁹ The first decade of its existence would be one of relative inactivity. This would change on the brink of the 1960s. Between 1959 and 1962 the first steps to common investment purposes were taken, cumulating in the decision to build an underground pipeline, transporting crude oil from Kuybyshev in the Urals, to Poland, East Germany, Czechoslovakia,

³⁴ Historical archives of the European Union, Florence: OEEC archive, EL 1950, file OECD. EL (50)11, Electricity Committee, Memorandum by the special study group on the 1,035 MW Thermal Programme, Paris 28th February, 1950.

³⁵ UCPTE, Rapport annuel 1976-1977, p.103.

³⁶ UCPTE, 1951-1976. *25 Jaar UCPTE*, p.150. My emphasis and translation from Dutch.

³⁷ CDO, *40 years of activity of the Central Dispatching Organisation of the Interconnected Power Systems, 1962-2002*, Prague: 2002, p.2. Unfortunately, not much has been published on this organisation and a lot of research remains to be done. Therefore my main focus in this piece will be on the UCPTE and their interaction with the other regional grids.

³⁸ Herman van der Wee, *Prosperity and upheaval. The world economy 1945-1980*, London: Penguin, 1986, pp.390-391. COMECON was not a 'purely European' affair as Mongolia, Cuba and Vietnam were also accepted as full members, but their share of the total COMECON intra-bloc trade was never more than 5 per cent.

³⁹ Paul G. Lewis, *Central Europe since 1945*, The Postwar World, London: Longman, 1994, pp.213-214.

and Hungary.⁴⁰ Two other major achievements in the field of infrastructure building were reached in these years: the construction of a coordinated transport network and an electricity grid.⁴¹ This grid was developed through bilateral links, and was coordinated by the CDO.

Despite this coordinating function, the network of the CDO was in practise **subject to** the Soviet *United Power System* (UPS), to which it was linked. The Soviet system, that operated with little reserve capacity, could interrupt the flow of electricity to the IPS countries if necessary. The UPS also regulated the network's frequency, which was different from the Western European one.⁴² This for the moment forestalled a synchronised operation between the CDO and UCPTE networks.

D. INTEGRATION IN NORDIC COUNTRIES

While in Eastern and Western Europe the fundamentals for trans-national cooperation in the electricity sector were initiated by the Marshall Plan and its consequences, in the Nordic countries the path of integration was slightly different. This was not the least caused by a history in cooperation in the field of electricity. Exchange of electricity in this region dates back to the installation of a submarine cable between Denmark and Sweden in July 1914. One could easily claim that, from a technical standpoint, a Nordic network had emerged in the 1950s, even though the actual exchanges were still only arranged bilaterally.⁴³

But while all countries were OEEC-members, they all abstained from joining the newly found UCPTE. Instead, they responded to the call of the Nordic Council which – amongst other things - took the initiative to start a coordinating organisation. The Nordic Council was founded to promote political integration in the Scandinavian countries, while the attempts to create a customs union proved fruitless. Subsequently, this role was taken up by *Centrala Driftledning*, the Swedish body for power exchange. In 1963 Nordel was founded, despite some reservations from the Norwegian side.⁴⁴

The choice for a Nordic association reflects the overall Scandinavian attitude towards European cooperation, which embraced post-war European integration – if at all – with ‘mixed feelings’.⁴⁵ During the Cold War, the foundation of the Nordic international political position was built around the so-called *Nordic balance*, which was “a political balance [...] whereby Nordic countries could enjoy a lower level of tension than Central Europe and yet keep both [...] superpowers at a distance.”⁴⁶ Its

⁴⁰ Jan S. Prybyla, "Eastern Europe and Soviet oil", in: *The journal of industrial economics*, 13, 2, 1965, pp.154-155.

⁴¹ Paul Marer, "Prospects for integration in the Council of Mutual Economic Assistance (CMEA)", in: *International organization*, 30, 4, 1976, p.633.

⁴² Paul K. Lyons, *75 years of cooperation in the electricity industry*, Brussels: Union of the Electricity Industry/EURELECTRIC, 2000, p.63.

⁴³ Kaijser, "Trans-border integration", pp.5-6.

Another important step was the construction of a HV transmission line from Norwegian hydro power plants through Sweden to Denmark, which was proposed and built in the 1950s. Archives of the European Union, Florence: OEEC archive, EL/M (1950)1, Comité de l'électricité, Procès-verbal des 35, 36, 37ème séances (10ème session), tenues au Château de la Muette, les 8, 9 et 10 février 1950.

⁴⁴ Kaijser, "Trans-border integration", pp.13-14.

⁴⁵ Thorsten B. Olesen, "Choosing or refuting Europe? The Nordic countries and European integration, 1945-2000", in: *Scandinavian journal of history*, 25, 2000, p.147.

⁴⁶ Ole Waever, "Nordic nostalgia: Northern Europe after the Cold War", in: *International affairs*, 68, 1, 1992, pp.78-79

basic foundations were based on the NATO membership of Norway and Denmark, Sweden's policy of non-alignment, and the *Treaty of Friendship, Cooperation and Assistance* between Finland and the Soviet Union (April 8th, 1948).⁴⁷ Instead of joining the Western European developments, the Scandinavian countries went ahead with their own integration process.

FIGURE 1 - ELECTRICITY PRODUCTION IN THE THREE REGIONS (IN GWH)

| Year | CDO/IPS | Nordel | UCPTE |
|------|---------|---------|-----------|
| 1954 | - | - | 190.352 |
| 1962 | 187.604 | 92.737* | 349.910 |
| 1971 | 369.901 | 143.180 | 649.894 |
| 1981 | 579.160 | 251.992 | 1.187.704 |

*Figure from 1963. Sources: Various UCPTE & Nordel yearbooks; CDO, 40 years of activity of the Central Dispatching Organisation of the Interconnected Power Systems, 1962-2002, Prague: 2002; UNIPEDE, Vienna 1976, 17th congress volume II - Proceedings of the working sessions and other functions, Paris, Imprimerie Chaix, 1976.

E. A DIVIDED CONTINENT

In addition to these the larger networks, three smaller networks also existed. Besides being UCPTE-member, France also formed a union with the Iberian Peninsula in the UFIPTTE, and in April 1964 Sudel was found, composed of Italy, Austria, Yugoslavia, and Greece. Because of the close cooperation with UCPTE - both were in synchronous operation with the UCPTE - they will not receive special attention. At the end of the 1980s, all countries became full members of the UCPTE. The last network is the *Central Electricity Generating Board* (CEGB) in England and Wales. These organisations will fall out of the scope of this study. Nordel will also receive less attention, as it did not interfere in East-West connections.

Nevertheless, since the 1960s there were three regionally organised networks of different sizes in Europe, with virtually no connections between each other and also more or less reflecting the political situation. The only interconnections between the three regional networks were between socialist countries and politically neutral countries like Austria and Finland, which were all non-synchronous as well as of a marginal character. While the border between UCPTE and CDO reflects the 'Iron Curtain', the founding of Nordel could be interpreted as a product of the political stance towards European political and economic integration of the Scandinavian countries. The most important link between the Nordic and Western European network would be the so-called *Konti-Skan*. This submarine DC line would be operational since 1966.

Notwithstanding the fact that Europe was 'electrically' divided into regional organisations, there were also organisations where Eastern and Western Europe (as well as Scandinavia) did come together. One of these was the *World Power Conference* (WPC). Established in 1923, the WPC was a platform where international energy experts could meet, with national committees as its backbone. Another such organisation is *l'Union Internationale des Productions et Distributeurs d'Énergie Électrique* (UNIPEDE). In existence since 1925, it was founded by representatives of the electrical industries of France, Italy, and Belgium, and it served as a forum where

⁴⁷ Mikael af Malmborg, "Swedish neutrality, the Finland argument and the enlargement of "Little Europe"", in: *Journal of European Integration History*, 1: Enlargement of "Little Europe", 1997, p.65.

technical, administrative, commercial and financial issues were debated. Although it had members from outside like the United States and China, European countries were best represented at their congresses.⁴⁸ But the most important - and arguably, most influential in light of East and West relations – organisation was the Electrical Energy Committee of the United Nations Economic Commission for Europe (UNECE), which was considered by many to be ‘virtually the only arena in which Eastern and Western Europe met to discuss European affairs’.⁴⁹ UNECE has a broad view of Europe, and a sense of openness to all nations, regardless of ideology. This was the case for integrating European networks as well. At a UNIPEDÉ congress in 1985 Trigo Trindade, representative of the *Committee of Electrical Energy* of UNECE, said that:

"whenever interconnection concerns countries of Eastern and Western Europe, it falls inevitably within the mandate of the *Economic Commission for Europe*. [...] Our main purpose is basically to find ways and means to develop communication and understanding among peoples."⁵⁰

Although the post-war developments spurred the founding of three separate organizations, corresponding with regional political and economic integration, it did not lead to isolated spheres in the international professional organisations. The Cold War did not lead to a division in Eastern and Western European organization. The long established forums would remain in tact as a meeting place. The newly-founded UNECE would go even further and actively lobby for the rapprochement of both sides.

II. THE CHANGING STRUCTURE OF ELECTRICITY SUPPLY

The preceding section focused on the organisational structure of networks in Europe. Broadly speaking, networks were built on a local or regional scale, and later expanded to a national grid. The latter development took place in the 1930s and 1940s. The 1950s and 1960s consequently saw an increase of international collaboration. This period was one of unprecedented economic growth. This section will discuss the consequences of this growth on the electricity supply structure.

Les trente glorieuses succeeding the Second World War caused an enormous increase in energy use; energy consumption even outstripped population growth. Between 1960 and 1973, electricity consumption doubled in most Western European countries, with energy production following close behind.⁵¹ The pattern of increasing centralisation and network building was buttressed by the seemingly continuous growth of energy consumption. This influenced the plans for expanding network and generation capacity, where long-term planning, forecasting, and investment estimation

⁴⁸ Henri Persoz, "40 ans d'interconnexion internationale en Europe. Le rôle de l'UNIPEDÉ", in: Monique Trede (ed.), *Électricité et électrification dans le monde. Actes du deuxième colloque international d'histoire de l'électricité, organisé par l'Association pour l'histoire de l'électricité en France, Paris, 3-6 juillet 1990*, Association pour l'histoire de l'électricité en France, 1992, 293.

⁴⁹ Derek W. Urwin, *The community of Europe. A history of European integration since 1945, The Postwar World*, London/New York: Longman, 1991, p.14.

⁵⁰ UNIPEDÉ, *Twentieth Congress, Athens 1985, Proceedings of the working sessions and other functions*, Paris: Imprimerie Chaix, 1985, p. 305.

⁵¹ Lyons, *75 years*, pp.27-28.

are vital.⁵² After 1973 this growth-infused pattern came under pressure from the supply side, due to higher oil prices and a slackening coal production. A possible alternative fuel, nuclear power, had been expected to provide even cheaper electricity and further centralisation, on an international level. But in fact costs proved much higher and several accidents caused popular unrest strong enough to resist the construction of new plants in some countries.

F. OIL

Post-war energy policy was based on the belief that coal would remain the dominant energy source. The *European Coal and Steel Community* was an obvious exponent of this idea. This would change in the coming decades. By 1957 it had become clear that coal output could not increase significantly, while energy demands kept rising. But at the same time massive oil resources were discovered in the Middle East. As this oil could be extracted with relative ease, it substantially lowered world oil prices. Subsequently, the Western world became its principal buyer. Besides the Middle East, the Soviet Union also began to exploit their oil resources, and started to export to Western Europe. Within twenty years the energy supply structure had changed, and as the use of oil rose at the expense of coal. In 1953 the share of oil in energy production was estimated at 20 %, and by 1970 this had risen above 40 %; the use of coal decreased from 70 % to a mere 45 % in the same period.⁵³

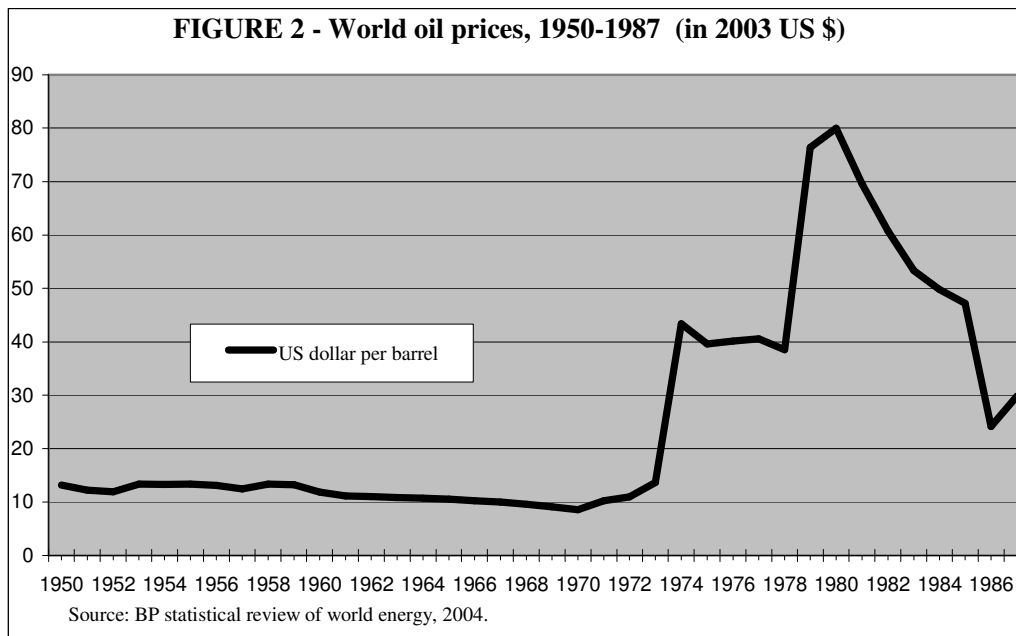
But the expansion in utilisation of oil also gave impetus to several negative side effects. First of all the negative side effects and possible depletion of mineral resources of this economic surge were also, until then, more or less neglected. The publication of the Club of Rome's *Limits to growth* in 1972 symbolised a turning point, as it created more environmental awareness and attention for unintended consequences of economic growth among policymakers and the general public. Second, as Western Europe grew dependent on oil, its main suppliers were all situated in the Middle East - an all but stable region. Over the course of the 1960s the oil market had already tightened somewhat because of environmental constraints in the field of production, but mostly because of the increasing influence of oil producing countries, grouped in the *Organisation of Petroleum Exporting Countries* (OPEC).⁵⁴ At the Conference of the Exporting Countries, held in Baghdad on 10-14 September 1960, the oil producing countries sought ways to strengthen their bargaining position vis-à-vis the main oil companies. Replacing ineffective and individual government action, a coordinated policy between producers "sought to solve these problems by utilizing the public international law institutions of diplomacy and international organization to increase their individual economic and political power."⁵⁵ This development reached its apotheosis in 1973. As turmoil hit this region the security of oil supplies came under threat, especially as several western countries were penalised for their position in the Arab-Israeli conflict. The *Organisation of Arab Petroleum Exporting Countries* (OAPEC) targeted its 'oil weapon' mainly against Denmark, the Netherlands, Portugal, Rhodesia, South Africa, and the United States, as a repercussion for the Western support for Israel during the Yom Kippur War.

⁵² Francis McGowan, *The struggle for power in Europe. Competition and regulation in the EC electricity industry*, Energy and environmental programme, London: The royal institute of international affairs, 1993, pp.3-5.

⁵³ Wee, *Prosperity and upheaval*, pp.127-129.

⁵⁴ *Ibidem*, p.28.

⁵⁵ *Ibidem*, p.30.



The direct consequence of this oil crisis was a steep increase of the oil price on the world market (see figure 2). Forecasting supply and demand therefore became difficult as a seemingly ‘normal’ growth of consumption of about 7 % ended.⁵⁶ On the whole, national administrations responded with measures for energy conservation became concerned with the security of the energy supply, and encouraging people to use less energy. On all the international level, the major attempt to stand up to the increasing oil prices came from across the Atlantic. The US initiative to establish the *International Energy Agency* (IEA) and to develop contingency plans for oil within the framework of the *Organisation for Economic Cooperation and Development* (OECD) was willingly received by most Western countries. The plan acted as an incentive for cooperation on energy policy in industrial countries, as the increasing oil prices shocked governments and electricity systems. This situation would be aggravated by the 1979 revolution in Iran, as the new democratic Islamic regime -- replacing the Shah -- a limited the oil exports to the West. This caused the oil price to leap beyond US\$40 per barrel (see figure 2).

Now let us look at the effects of these oil crises on the electricity supply industry, as liquid fuels had gained importance in thermal electricity production over the last decades. Nevertheless, the effects of the boycott and the price increase varied per country, and per region. Belgium and Italy were the most important ‘victims’, while Luxemburg and Switzerland hardly had any troubles. In Belgium the oil crisis was aggravated because the Antwerp harbour did not receive large shipments of petroleum. Making a shift to coal would take all winter, and therefore the government recommended the economised use of fuel by power plants, while other measures aimed at reducing the electricity consumption of households and industry.⁵⁷ After 1979 the Belgian government proposed measures to strengthen energy policy, while the national government also became involved in planning. In Italy, which was,

⁵⁶ Walt Patterson, *Transforming electricity. The coming generation of change*, London: The royal institute of international affairs, p.65.

⁵⁷ Archive of the UCPTE, Brussels; UCPTE, *Comité restreint - Reunion extraordinaire*, December 18th 1973, Dusseldorf.

according to a UCPTTE report importing 80% of its primary energy, 57% of the electricity supply was for dependent on liquid fuel. Its oil reserves, enough for 45 days, were rapidly depleting. But in Luxemburg, on the other hand, the situation was hardly problematic, as it depended on oil for only 20%, which was easily replaced by coles. In West Germany, agreements were made between the electrical utilities and the industry to reduce fuel consumption. Some 2,8 TWh (12% of the national production), that normally was generated with oil, was to be replaced by lignite.

Other regions did not feel the direct effects of the oil crisis. Within COMECON, petroleum was priced according to a formula based on five-year averages. Even though prices did increase, they did so but rather gradually and so the Eastern European did not felt the immediate impact of the oil crisis since they were not fully exposed to world market prices.⁵⁸ In the Nordic countries the effects were also far from severe, since the share of oil-based power production was marginal, limited to industrial use and district heating.⁵⁹

G. THE NUCLEAR OPTION

As I mentioned above, since the late 1950s nuclear energy had been regarded a possible substitute for oil, that could satisfy cover ever-growing energy needs. International cooperation for the research and development of nuclear energy was therefore initiated; in Western Europe, Euratom provided a framework for common research accounting for a \$90 million a year, of which 80 % was used for research on nuclear power production, in particular on the fast breeder programme.⁶⁰ The OEEC also established its own organisation on nuclear energy, the *European Nuclear Energy Agency* (ENEA). In Eastern Europe, a programme for nuclear research among COMECON members was set up by the 1950s and in 1954 the *Institute for Nuclear Research* was founded near Prague.⁶¹ In 1957 the *International Atomic Energy Agency* (IAEA) was established as an independent organisation within the UN.

As could have been expected, the oil crises were followed by a vast increase in orders for nuclear power plants. Extrapolating from this trend, the IAEA estimated that by 1990 the total installed nuclear capacity would be 1.0 - 1.3 million MW.⁶² But as it turned out, the fulfillment of this prophecy was hampered by several factors. First, despite the promising prospect of a cheap power source, the actual building costs of nuclear plants were higher than expected. Second, international cooperation did not always result in joint interests, as several countries pursued mainly national interests in nuclear collaboration. France for example, 'used' her strong nuclear industry to revitalise its national identity, and economy.⁶³ Third, several incidents changed the public's image of nuclear energy. Already in 1979, the accident in the Three Mile Island nuclear plant in Harrisburg aroused criticism, and led to a decrease

⁵⁸ Kazimierz Grzybowski, "The Council for Mutual Economic Assistance and the European Community", in: *The American journal of international law*, 84, 1, 1990, p. 491.

⁵⁹ Nordel, *Annual report 1982*, p.58.

⁶⁰ Richard L. Gordon, "Energy policy in the European community", in: *The journal of industrial economics*, 13, 3, 1965, p.219.

⁶¹ Lyons, *75 years*, p.28.

⁶² David Fischer, *History of the International Atomic Energy Agency. The first forty years*, Vienna: IAEA, 1997, p.147.

⁶³ See: Gabrielle Hecht, *The radiance of France. Nuclear power and national identity after World War II*, Inside technology, Cambridge: MIT Press, 1998; Gabrielle Hecht, "Technology, Politics and National Identity in France", in: Gabrielle Hecht & Michael Thad Allen (eds.), *Technologies of power. Essays in honor of Thomas Parke Hughes and Agatha Chipley Hughes*, Cambridge/London: MIT Press, 2001.

in nuclear power plant construction in the United States. Seven years later the nuclear incident in a reactor in Chernobyl caused worldwide concern, revealing the potential danger of nuclear energy and strengthening the already existing resistance to nuclear technology.

The ambiguity toward the future prospects of nuclear energy after Chernobyl was well phrased by UNIPEDE's vice-president Jean Bergougnoux. At the 1988 congress in Sorrento, Italy, he said that 'regarding our energy programmes, the main subject of concern today remains the use of electronuclear energy', but not without adding that 'the catastrophe has had a significant impact on public opinion'.⁶⁴ In the face of this ambiguity, some countries like France, Finland, and Belgium chose nuclear energy as the base load for their electricity supply, while others like Sweden, completely banned it and made plans to phase out the operational plants. An exceptional case was France, which became the second largest nuclear power producer in the world. While importing some 700 million kWh in 1938, in 1989 France exported an estimated 42 billion kWh.⁶⁵ Italy had also planned to make nuclear energy the base load after the severe energy crises, but popular resistance prevented this.⁶⁶ In the event, France became one of the world's largest exporters of electricity, and Italy one of the biggest importers. By 1995 the installed capacity of nuclear-generated electricity was 344.422 MW – still a fairly large figure, but much less than the IAEA had predicted in the 1970s.⁶⁷

The oil crises and Chernobyl, as well as the increased awareness of environmental pollution, had a profound impact on the electricity supply industry, as 'painfully slow approval procedures, sharpened environmental regulations, and drastic prices hikes [made] the construction of new generation units and expansion of the transmission network increasingly more difficult'.⁶⁸ Increasingly, the electricity supply industry had difficulties obtaining approval for expanding generation capacity and the network, not only from governments but also from the general public. These factors not only put pressure on the current practises of network-building and operation, but also the security of supply of electricity.

Therefore, a discussion on the role of trade took place within the UCPTE in April 1974. President Erbacher noted that trading larger flows of electricity between UCPTE-members would become more complicated for two reasons. First, because of the social opposition to the construction of large power plants, and second, because of the difficult situation of the sector, domestic utilisation had priority. The latter already showed during the oil crisis, when exchange was less than normal, and only mutual assistance in emergency situation increased. In the light of this situation, he made several proposals. First, agreements for both exchange and export should be made more flexible, and second, the construction of plants to countries with domestic reserves of primary energy sources, such as Poland, should be financed from the West.⁶⁹

⁶⁴ Lyons, *75 years*, p.56.

⁶⁵ Bouneau, "l'Interconnexion internationale", pp.61 & 64. Also see the EDF website: http://www.edf.com/index.php4?coe_i_id=41268

⁶⁶ Francis McGowan & Steve Thomas, *Electricity in Europe. Inside the utilities*, London: Financial Times Business Information, 1992, pp.93-94.

⁶⁷ Fischer, *History of the IAEA*, p.147.

⁶⁸ UCPTE, *Rapport annuel 1981-1982*, Rhode-St.-Genese, p.305.

⁶⁹ *Ibidem*.

III. BRIDGING THE DIVIDE

This last section will deal with the rapprochement between Eastern and Western Europe in the field of electricity trade. As I showed in the preceding section, the *modus operandi* of the electricity network in Western Europe was seriously affected by circumstances from outside the system. In 1974 the UCPTE already looked at the possibilities of 'expanding' towards Eastern Europe. In the coming decade, the networks of the UCPTE and the IPS/CDO would indeed be connected.

Already in early 1973, a Soviet economist wrote that the "creation of a common power system for Europe by linking the existing power systems of the C.M.E.A. member-countries and the countries of Western Europe [...] is technically possible [...]".⁷⁰ A synchronous connection between the UCPTE and IPS/CDO was indeed possible, although some technical adjustments would be necessary. The combined operation of both networks would enable a more rational and efficient use of resources. Crucially, however, the transmission lines that were built in the 1970s and 1980s would not use AC-technology, but rather DC-technology - and thus prevent a synchronised operation. In other words, electricity would be *traded* rather than *exchanged*, contradicting Kaijser's findings for Nordic cooperation. He concluded that electricity export is hard to establish on as it creates an asymmetrical relation between the exporting and importing countries.

Notwithstanding the conclusions of Kaijser, I will argue that in this instance an asymmetrical relation was preferred to a symmetrical one. Several changes of a technical, political and economic nature made the construction of more DC-interconnections more favourable. First, the political environment was rather favourable, as the tension between East and West eased, especially after the Helsinki Summit. Second, from an economical point of view, electricity trade held advantages for both Eastern and Western Europe. Two questions are to be answered: first, how was this increase of trade facilitated, and second, why this could happen in this period.

A. LOWER TENSIONS

The initial conditions were outlined above; after WWII, Eastern and Western Europe both started to cooperate on a regional level, without linkages between their grids. According to UNECE "the cold war holds back economic progress on both sides of the dividing line. [...] In a united Europe we should be able to think, for example, in terms of the construction of oil and gas pipelines from the Middle East serving the great consuming centres as these fuels move from East to West, from South to North, through the continent. [...] We should look upon the coal resources in all parts of Europe as a whole and draw up a programme which would take account of geological factors irrespective of political frontiers."⁷¹ The barrier was thus not technical, but political. Metaphorically speaking, transmission lines had to be constructed through the Iron Curtain.

The slump in 'economic progress' would be an important reason to facilitate more trade. The previous section discussed the economic problems in Western Europe, plagued by the oil crises. In Eastern Europe, this hurt Eastern Europe much less. As stated above, the oil shocks had different effects at the other end of the Iron Curtain. In effect, lower fuel prices – because of the COMECON price system - also

⁷⁰ Voinov, *Economic cooperation of socialist states with the developed capitalist countries*, Planovoe Khoziaistvo, no.3, March 1973, p.110-120, cited in: Grzybowski, "The Council for Mutual Economic Assistance", pp.286-287.

⁷¹ Gunnar Myrdal, "Twenty years of the United Nations Economic Commission for Europe", in: *International organization*, 22, 3, 1968, p.625.

meant lower electricity prices, which made electricity import profitable from a Western European standpoint.

Still, in Eastern Europe, the economic crisis claimed its tolls as well. The debt problems and need for economic restructuring provided Eastern European countries with an incentive to trade products for hard currency. Despite being relatively isolated from the world economy, the global slump did leave marks on the economic performance of the socialist countries. In the early 1980s this situation changed as growth figures plunged, causing increased income inequality and deteriorating social conditions. Especially heavy industry – long the socialists' showpiece – suffered from this development. Further exacerbating the economic situation was the growing debt resulting from foreign trade imbalances. From the 1960s, the Eastern bloc could no longer finance their Western imports by the export of raw material and industrial products alone. The extension of credit in East-West trade only added to the debt. As a consequence, the COMECON programme of development and integration became sidetracked.⁷²

From the viewpoint of the Socialist countries this was a way to obtain hard foreign currency, especially as Poland and Hungary had serious debt problems. This provided an incentive to raise energy exports to the West - also electric energy. Adding to this was the fact that the construction of new power plants in the West became subject to societal opposition in the 1980s. As it turned out, several Western European countries were willing to finance the expansion of generating capacity in the Eastern bloc in return for electricity.

This fitted in to the trend of increasing trade between the two blocs. Trade was a hot issue in the renewed contacts between East and West. During its 1972 summit, the European Community expressed the wish of a common commercial policy towards the COMECON, and although multilateral trade agreements were not reached, this effort did lead to agreements with several individual states in 1973 for some sectors only.⁷³

These arrangements followed after a period of mainly intra-bloc trade. As an effect of economic integration processes, the bulk of the intra European trade took place within the regional economies of COMECON and the Western European market. Especially within COMECON the trend towards autarky was very strong; in 1953, 83 % of the Soviet Union's trade was within the socialist bloc. This pattern would start to change after the death of Stalin, when Nikita Khrushchev looked further outward for trading partners. Partly, this had to do with the increased oil production, starting in the 1950s.⁷⁴ Exports to Western Europe rose especially after 1983, mainly due to higher sales of Soviet oil and Polish coal. This certainly had to do with the advantages for Western Europe of trading with the Eastern bloc, particularly as the Western market grew unruly. To the West German chancellor Helmut Schmidt "the Communist bloc offers markets which are especially attractive for the West because they are not, or not fully, involved in the synchronization of Western business cycles."⁷⁵

⁷² Lewis, *Central Europe*, p.217.

⁷³ Urwin, *The community*, p.215.

⁷⁴ Bruce W. Jentleson, *Pipeline politics. The complex political economy of East-West energy trade*, Ithaca: Cornell University Press, 1986, pp.70 & 82.

⁷⁵ Helmut Schmidt, "The 1977 Alastair Buchan Memorial Lecture", London, October 28, 1977, reprinted in *Survival* 20, no. 1, 1978, p.9. Cited in: Dana H. Allin, *Cold war illusions. America, Europe and Soviet power, 1969-1989*, London: MacMillan, 1997, p.143.

Politically, the electricity supply industry in the socialist countries was less hampered by administrative interference than other sectors, and was quite similarly organised as in Western Europe where electricity supply was one of the few areas where public ownership and planning prevailed.⁷⁶ Furthermore, international politics were favourable to such connections as Cold War tensions had eased for the moment. The conference on European Security and Co-operation, held in Helsinki in 1975, took the political and economic détente to an even higher level.

Within Eastern Europe, important shifts occurred as well. In several countries, the power of the Communist Party had seriously eroded. In for example Poland, state officials and industrial managers assumed power, at the expense of party members. Nationalistic aspirations proliferated and were nourished, as national historical figures and concepts were revitalised. Between some Eastern European and West German intellectuals, the idea of reviving Central Europe, or *Mittleuropa*, was very much alive in the early 1980s. Thomas G. Masaryk, who coined the term as a political concept in the 1920s, believed that there were strong opportunities for a *New Europe* consisting of small nations between Germany and Russia.⁷⁷ The revitalisation of the term in the 1980s was, on a whole, for the same reasons; to reconstruct the 'centre' of Europe from the destructive effects of Yalta, but also to reassert nationalistic aspirations of both Soviet satellites.⁷⁸ According to the East German dissident Rudolf Bahro the preconditions for an undivided Europe was to create conditions that would enable the Soviet Union to "let Eastern Europe go".⁷⁹ Constructing transnational infrastructures that connected Western to Eastern Europe was such a condition.

B. CONNECTING EAST AND WEST

Such projects were carried out from the mid-1970s. In 1974 for example, a natural gas pipeline connection was built between the Siberian city of Orenburg and the Central European gas network, while links to Western Europe were under serious consideration.⁸⁰ In the field of electricity, the interconnections between East and West were also expanded. Synchronous operation between UCPTTE and CDO networks was not possible at that time. Although frequencies were similar (50 Hz), they were not maintained with similar precision. Thus, exchange was hardly possible. On the other hand, trade became possible, as the technique of HVDC had improved over the last decades. Although synchronising interconnections was still difficult, the progress made with *high voltage direct current* (HVDC) technology would indeed enable links between the two networks. In the mid-1980s a Working Group of UNIPEDE concluded that the main application for HVDC would be submarine cables and back-

⁷⁶ Francis McGowan, *Policy and production integration in the Central European electricity industry*, One Europe or several? The emerging industrial architecture of the wider Europe: the co-evolution of industrial and political structures, Sussex: Economic & social research council, 2002, pp.9-10.

⁷⁷ Josette Baer, "Imagining membership: the conception of Europe in the political thought of T.G. Masaryk and Václav Havel", in: *Studies in East European thought*, 52, 2000, pp.206-210. For the historical and topographical roots of the term see Hans-Dietrich Schultz & Wolfgang Natter, "Imagining *Mittleuropa*: conceptualisations of 'its' space in and outside German geography", in: *European review of history - Revue européenne d'histoire*, 10, 2, 2003, 273-292.

⁷⁸ Hans-Georg Betz, "Mittleuropa and post-modern European identity", in: *New German Critique*, 50, 1990, p.173.

⁷⁹ *Ibidem*, pp.176-177.

⁸⁰ Lewis, *Central*, p.215.

to-back connections between different synchronized AC systems.⁸¹ The new interconnections between UCPTTE and CDO were all of that kind.

In 1968, Austria exported 165 GWh (on a total export of 5548 GWh) to Czechoslovakia. The next year they transmitted 218 GWh to Hungary. Finland even traded with two regional networks; in 1967 they imported 3 GWh from the USSR, while receiving a flow of 403 GWh from the Federal Republic of Germany (FDR).⁸² In the 1970s and 1980s these connections were vastly expanded. And although the financial situation of the socialist states was dire, this did not block the construction of new lines. On the contrary, as it seems that electricity itself became a form of 'hard currency', as in 1974 the Soviet Union agreed to purchase of several nuclear plants from West Germany, to be paid for in energy. For this purpose a 380kV line was built, passing through Poland and Berlin.⁸³ In the same year Austria's *Österreichische Elektrizitätswirtschaft AG* announced the signing of 25-year contract with Poland on electricity supply that foresaw a loan of 3 billion schillings to Poland for obtaining Austrian equipment, to be repaid partly in electricity. This circumvented a basic problem of Poland's rigid economic structure that made it easier to use foreign credits for food and consumer products than to acquire and implement foreign technology.⁸⁴ To ensure an effective supply, a double 380kV line between Austria and Poland was constructed through Czechoslovakia. A high voltage DC line was built in the vicinity of Vienna in 1983, delivering 400 MW in the first phase with a foreseen maximum of 1500 MW.⁸⁵ The connections between Nordel and CDO were reinforced as well. The Finnish municipality of Imatran Voima, in cooperation with Soviet *Atomenergoexport*, was planning the construction of a 1000 MW nuclear power plant, to be completed by 1982.⁸⁶ By 1987 Finland was importing 4738 GWh of a total 6093 GWh from the Soviet Union.⁸⁷

⁸¹ Lyons, *75 years*, p.61. In the mid-1980s a Working Group of UNIPEDDE concluded that the main application for HVDC would cable crossing (for example submarine) and back-to-back connections between different synchronized AC systems.

⁸² United Nations Economic Commission for Europe, *Annual bulletin of electric energy statistics for Europe*, United Nations: Geneva, 1968.

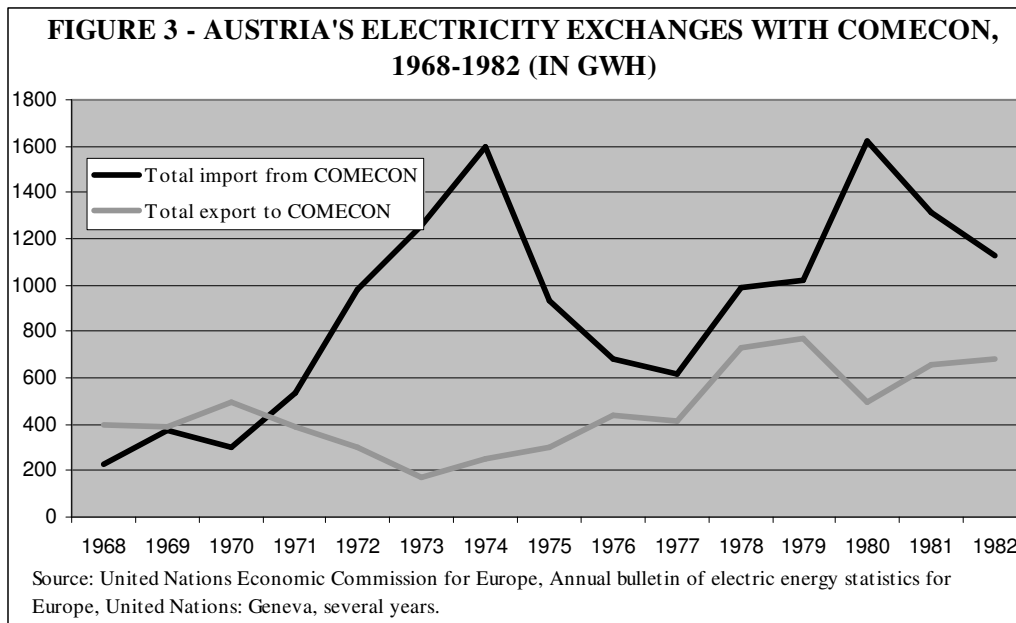
⁸³ Archive of the UCPTTE, Brussels; UCPTTE, *Comité restreint*, 6 June 1973, Kettwig, p.10.

⁸⁴ Mark Mazower, *Dark continent. Europe's twentieth century*, London: Penguin press, 1998, p.373.

⁸⁵ Archive of the UCPTTE, Brussels; UCPTTE, *Comité restreint*, 9 October 1974, Rome, p.18.

⁸⁶ Nordel, Annual report 1979, p.50.

⁸⁷ Ibidem, Annual report 1987, p.71.



C. FROM TRADE TO TESIS

A significant moment in bridging Eastern and Western Europe was the proposal for a connection between East and West Germany, presented at the UNIPEDA congress in 1988. At a meeting of the electrical supply industry in 1988, a West German unfolded the plans to connect West and East Germany, and the Western part of Berlin. This would be done by a HV direct current line and was scheduled for 1991.⁸⁸ According to Trigo Trinidad of UNECE, this development was of economic significance. Although the outcome and influence of the acceleration of East-West interconnection were still unclear, Trinidad expressed confidence that "we can say now that it is a step towards developing the potential to increase the level of optimisation of the European electrical supply system, by removing some interconnection constraints".⁸⁹ Besides the fact that this would create a more optimal European power supply, the link also carried a tremendous symbolic meaning for UNECE, as it showed "that electric power lines can carry not only electric power but a refreshing message of peace and this should be very rewarding for us all."⁹⁰ At the same meeting, more connections between East and West were announced. Austria planned several HVDC links with the Soviet Union and Hungary, and the FGR also agreed on connecting with the Soviets and the GDR.⁹¹

But these new HVDC links would not function for long. The disintegration of the Soviet Union in 1991 was quickly followed by several CDO/IPS-members. Four countries - the Czech Republic, Slovakia, Hungary, and Poland - sought to connect with UCPTE, and therefore founded a separate organisation, CENTREL, in October 1992. The Baltic states, also very much in favour of connecting with the West, were technologically incapable of doing so, as their national networks were entangled in the

⁸⁸ UNIPEDA, Sorrento 1988, 21th congress volume II - Proceedings of the working sessions and other functions, Paris, Imprimerie Chaix, 1988, p. 377.

⁸⁹ *Ibidem*, pp. 365-366

⁹⁰ *Ibidem*, pp.377-378.

⁹¹ See the table in *Ibidem*, p.368.

Russian electricity grid.⁹² The remaining obstacle to creating a synchronous connection between Eastern and Central with Western Europe was the – electrical – division of the reunited Germany. Despite the 1988 plans, the German network situation was rather complicated as three different systems existed; West Germany was synchronised with the UCPTE network, the electricity system of West-Berlin functioned as an island, and the eastern part of Germany that working in parallel with the COMECON grid. In the end of 1992 West-Berlin was even in synchronous operation with the CDO network for a while. Only in September 1995 would the grids of East and West Germany be linked. The synchronous operation between CENTREL and UCPTE became effective one month later, on October 18. At the same time the HVDC between the two regional networks were shut down, and TESIS came into being.⁹³ The electrical divide between East and West had been bridged.

Conclusion

I have attempted to place the interconnection of Eastern and Western Europe within its historical context. In doing so, I used concepts related from Thomas Hughes and Arne Kaijser, who looked at electricity grids as shaped by the social, economic and political context within an institutional setting. According to them electric power systems are made up of socially constructed artefacts. In looking at the history of Europe's electricity network, socio-political and economic developments both created and blocked opportunities to come to a synchronous operated grid. That history nearly spans a century.

The idea of a European-wide electricity network first appeared in the aftermath of WWI, and was technologically grounded in recent developments in high voltage transmission. The specific energy circumstances seemed favourable to it as coal was scarce and hydroelectric potential was not fully optimised. But besides an economic rationale, several engineers felt a sense of political emergency, and proposed to 'tie-down' the warring European states by means of infrastructures. Despite all this intentions, a serious building project never took off, likely due to intensified nationalism and the dire economic situation. The period after WWII saw more international collaboration, although not on a European scale. The situation that emerged resembled Europe's political divide between East and West, and corresponded with areas of economic integration as well. Thus, Europe still had to be created 'electrically'.

Only in 1995 this division was overcome as a synchronous network ranging from Poland to Portugal became operational and electricity exchange between Eastern and Western Europe was possible. But this development was preceded by at least a decade of trade between East and West. The sequence of the collaboration - trade before exchange - in the electricity supply between East and West is at least surprising as Kaijser concluded for pre-WWII cooperation in Scandinavia that electricity trade was more difficult to achieve than exchange due to political and economic implications. Kaijser reasoned that electricity exchange was symmetrical while electricity trade was not. In summing up my findings for the circumstances of the rapprochement in the electricity supply industries of East and West in the 1970s and 1980s, I argue that electricity trade was possible due to the socio-political and economic situation, and not the least because of the economic implications for both sides. On the one hand, it was enabled by a stable political climate and an economic

⁹² Per Högselius, "Electricity, forthcoming.

⁹³ Lyons, *75 years*, p.64.

crisis, and at the other hand, stated in LTS terms, by the Western attempt to compensate the lack of control over fuel prices and generating capacity.

In Western Europe the structure of electricity supply was under pressure of various sources outside the system. Hydroelectric potential was exploited near the maximum, and thermal electric generation suffered of the steep price increases caused by the oil crises. The most likely alternative to curtail this threat to energy supply, nuclear power, became even more seriously contested after the Harrisburg and Chernobyl accidents. In addition, the growing concerns about global warming and the environment, also hindered the construction of new plants, especially in large-scale ones, which caused a decline in average plant size.⁹⁴ The construction of new plants in the West was difficult, and fuel prices were higher. As a consequence, the UCPTE already started to look to the East in 1974. Expanding the electricity system to the East would ease the problems in Western Europe, which fell outside the control of the system.

In sum, importing electricity from COMECON helped to get around three crucial Western problems of fossil fuels. First, huge Western oil imports from the OPEC countries were not preferred from the viewpoint of security of supply. This was less an issue in Eastern Europe, where locally or regional abundant fossil fuels were used to generate electricity. Second, the prices of these raw materials were lower, as they were less affected by the effects of the oil crises. Third, while in Western Europe regulations regarding thermal electricity generation were tightened due to environmental concerns, this was less a problem in Eastern European countries. By importing Eastern European electricity, or by utilising Eastern electricity in the Western system, the UCPTE network decreased the influence of external impacts, and possibly even gaining more control.

Other factors aided this development. First, to enable this energy flow, interconnections between two separate synchronised AC systems were needed, which became much easier with the introduction of *back-to-back HVDC connectors*. Second, contact between the two regional blocs was strongly institutionalised in international forums as UNECE, UNPEDE and the WPC. Third, in the early 1970s the international political climate became more tranquil, and the Iron Curtain subsequently became less a barrier. The socialistic countries increasingly took their own path and moved away from Moscow, while the European Community pursued a common trading policy with the COMECON. Fourth, debt problems and economic restructuring in Eastern Europe provided a powerful incentive to export electricity, and offers of some Western European countries to finance new plants in the East in return for electricity were willingly accepted.

Thus, the specific economic situation, technical opportunities, and political circumstances thus provided a window of opportunity. As we have seen, the stakes were different for the actors involved. While the West and UNECE stressed the political advantages of economic cooperation, Eastern Europe placed more emphasis on the economic benefits. At this specific moment, the West (including the USA) regarded trade and investment as an important addition to reshaping the bipolar world.⁹⁵ The response of UNECE to the symbolic reconnection of the two Germanies could be interpreted as an exponent of that. Irrespective to main drivers – economic,

⁹⁴ Rolf W. Künneke, "Electricity networks: how 'natural' is the monopoly?", in: *Utilities Policy*, 8, 2, June 1999, p.102.

⁹⁵ Franklyn D. Holzman & Robert Legvold, "The economics and politics of East-West relations", in: *International organization*, 29, 1, 1975, p.293.

technical or political developments -, Eastern and Central Europe, as well as Western Europe were linked in October 1995.⁹⁶ 'Europe' was thus created 'electrically'.

⁹⁶ Romania and Bulgaria would be in synchronous operation only after 2003.