East – West Elektricity Cooperation with Utilization of HV DC Back-To-Back Link

The possibilities of electric power business IPS/UPS and UCTE systems

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1. The purpose of the study and introductory remarks

The purpose of this study is to provide parties interested in doing business with electric power in Europe with necessary information, describe present status and point out the most important development trends, both in Western and Eastern parts of Europe.

In the following text some abbreviations are used, which may require detailed explanation. These are:

CENTREL - union of electric power utilities in Central Europe. This Union comprises power utilities from the Czech Republic (ČEZ, a.s.), Slovakia (SE, a.s.), Poland (PSE, SA) and Hungary (MVM Rt.). CENTREL has also observers, which are Ukraine, Romania (RENEL), ex-DDR (VEAG), Austria (VERBUND) and Bulgaria (NEK). CENTREL was founded in October 1992 with a major goal to get synchronously interconnected with UCPTE.

UCTE - union of electric power utilities of Western and Southern Europe. The members are utilities from Portugal, Spain, France, Benelux, Switzerland, Italy, Germany, Austria, ex-Yugoslavia and Greece. The continental part of Denmark operates in paralel with UCPTE, however, without a membership.

IPS - Interconnected Power Systems. These are the power systems of ex-CMEA countries - from ex-DDR to Russia in the East and Bulgaria in the south. These systems used to be coordinated by CDO-IPS.

HVDC - High Voltage Direct Current link. A semiconductor installation which enables a cooperation of two separate systems which are not in paralel and a power exchange between them. Both systems may have a different frequency. These installations are used on borders between non-synchronous systems.

2 History of IPS interconnection with UCTE

This type of cooperation was launched by an agreement between Czechoslovakia and Austria in 1956. The power exchange itself started in 1959 on a double-circuit 220 kV line Sokolnice - Bisamberg. The exchange growed rapidly and soon the 220 kV line capacity was not satisfactory. In March 1979 the international agreement on construction of 400 kV line Slavětice - Dürnrohr and HVDC link in Duernrohr was signed. This link was commissioned in 1983 and enabled the exchange between Czechoslovakia, Poland, GDR, USSR on one side and Austria, Yugoslavia, FRG and Switzer-land on the other.

Not forgotten must be the Vyborg HVDC link between power systems of USSR and Finland.

Another East-West link is the 400 kV line from Hradec (CS) to Etzenricht (D) with HVDC link in Etzenricht. The link was com-missioned in late 1992 and means a substantial aid to East- West power transports. At almost the same time another HVDC link was commissioned in Wien Süd-Ost substation linking together power systems of Hungary and Austria.

In 1995, October 18, all procedures prescribed in Massnahmenkatalog UCPTE - CENTREL were finished and CENTREL systems were synchronously interconnected with those of UCPTE. The intercon-nection was carried out by 400 kV lines from CZ to VEAG (ex-DDR), from PL to VEAG and, last, the HVDC in Etzenricht (BAG) was by-passed.

On the other side, this brought a necessity to open all connections from CENTREL to its eastern neighbours. This means, that at present time there is no direct connection between Slovakia and Hungary on one side and Ukraine and Russia on the other. With one exception - in order to enable power exports from Ukraine to CENTREL, two or three units in Burštynskaja power station may be switched over to CENTREL through a 400 kV lines from Mukachevo substation in UA to Kapušany in SK and Szajoszeged in HU. But this does not mean a full-valued interconnection, since no load in UA is connected to these lines and the load transits are only one-way and limited in volume to max. 600 MW.

3. Development plans

3.1 CENTREL - IPS development plans

Further extension of synchronised system is not expected in near future, although the study has officially been launched by UCTE. In the meantime, the business with systems located to the East (like Russia) is anticipated to be carried out by HVDC links located on the border of both synchronous areas. The feasibility study has been carried out by the work group of CENTREL together with experts from UCTE.

The large existing transmission systems of the UCTE, the Interconnected Power System (IPS) of the Baltic States, the UPS of the Russian Federation (RF) and the Commonwealth of Independent States (CIS) have prerequisites for interconnection:

- No geographical obstacles obstruct transmission interconnection.
- Each system is under the process of restructuring and deregulation.
- The systems are connected by several 220-, 400- and 750-kV transmission lines constructed between 1964 and 1985 (and are not presently operational).

These European interconnected transmission systems have characteristics shown in the table above.

The question of interconnection of these systems has been the subject of studies and preparatory works for the past 20 years. The most recent study was performed when the TACIS consortium of energy companies — EDF (France), TRACTABEL (Belgium), RWE (Germany), CEZ (Czech Republic) and RAO-UES (Russia) — conducted a survey in 1998/1999 on the synchronization of TESIS (UCTE-CENTREL) and UPS (European of the Russia, the energy systems of the Baltics, Belorussia, Ukraine and Moldavia). This survey concluded that, subject to compliance with the principles and technical standards associated with the synchronization and operation of the interconnected systems, the power exchange could be active by 2005 and offer the following benefits:

- The interstate transmission lines may carry a maximum of 6200 MW during the winter peak load, provided there are no limits to the electric-power exchange between the UPS and TESIS.

- Analysis of the energy systems confirmed that the interstate-connection capacity does not limit the electric-power exchange that is economically advantageous to both systems.
- Synchronization of the West and East European energy systems would optimize the use of installed generating capacity (over 1000 GW). Furthermore, the combined reserved capacity will be reduced and the variations in the timing of daily peak demands and seasons will increase the opportunity for power exchanges.

The future interconnection of these energy systems was discussed at the European Community (EC) & Russia Summit Meeting held in Brussels on Oct. 3, 2001. The joint statement by EC President Verhofstadt and Russian President Putin said the decision on the "interconnection of the parties' electricity networks" was reached.

The synchronous operation of the UPS/IPS with TESIS was adopted as the "most important and strategic goal" in a meeting of the CIS Electric Power Council held on March 19, 2002. The member states of the CIS-EPC resolved to support and provide candidates for the Working Commission who are authorized to cooperate with power agencies and utilities in western, central and southeastern Europe.

3.2 UCTE/CENTREL Interconnection

Transmission and distribution remain the only natural monopolies of the deregulated electricity industry, and their operators bear the responsibility for the reliability of the electricity.

Since its formation, the UCTE has played a key role in coordinating the complex task of ensuring the reliability of the European TSOs that form the interconnected system. Thus, all new applicants must satisfy the UCTE that their systems meet two basic system reliability parameters (system adequacy and system security), and are able to operate and perform in accordance with a set of technical rules established to maintain overall system operational security.

The technical approval process is naturally complex and a relatively long-term exercise, but an insight into the practical input to the "European Union — Russia Energy Dialogue," launched in October 2000, was presented at the Towards a Pan-European Energy Partnership Conference held in Warsaw in March 2002. Anatoli Chubais, CEO of RAO EES Rossii, included in his presentation on "Developments in the Russian Electricity Sector" details on system operational reliability and load-transfer capability, in

addition to outlining a phased program of East-West Synchronous Operation Development. This three-stage development includes:

- Stage 1: The Eastern Interconnection — Burshtynsky Island (UCTE) [via two 750-kV and two 330-kV transmission lines].
- Stage 2: The Eastern Interconnection — Poland (UCTE) [via one 750-kV transmission line].
- Stage 3: The Eastern Interconnection — Second nonsynchronous zone of UCTE (Bulgaria and Romania) [via one 750-kV and two 400-kV transmission lines].

Plus, reinforcement of the interface in the northwest with interconnections between Belorussia, Lithuania, Kaliningrad and Poland is proposed.

Following a protocol aiming to introduce close cooperation with electricity generators in the CIS signed by EURELECTRIC (Association of the Electricity Industry in Europe) in Warsaw, EU-Russia Summit participants on May 29, 2002, decided to force the pace. Work is now focusing on a legal basis that will permit interconnection in the longer term of the Russian and European power grids.

3.3 Massnahmenkatalog

Before the IPS/UPS systems get synchronised to CENTREL/UCTE, they must execute major improvements in its system and provide all partners with an evidence of having done so. The technical requirements are summed up in a document called Mass-nahmenkatalog (List of required Measures). This document (version for Lvovenergo)was prepared by joint forces of UCTE and CENTREL and was agreed with Ukrainian representatives. The measures in this Catalogue are focused primarily at power balance and regulation possibilities of LvovEnergo and precise definition of its network borders. The border must be defined by installation of HVDC link connecting LvovEnergo with the rest of Ukraine.

Fulfilling the Massnahmenkatalog by Ukraine will require huge investment into Ukrainian system and the date of interconnection is expected not sooner than after two years.

It is highly recommended to take part in this modernisation process in Ukraine. The reason is simple - the HVDC links will probably be located at LvovEnergo's border, since the synchronisation with all Ukraine and Russia is technically impossible within decade to come.

The outcome is obvious - the HVDC will be installed, but it can be put into service only after LvovEnergo is in paralel with CENTREL, in other words, only after it fulfills the Massnahmenkatalog. Without financial and technical aid from outside, Ukraine is very unlikely to be able to cope with all these requirements.

3.4 HVDC links locations

According to what was mentioned above, Russia and bigger part of Ukraine will be connected to CENTREL/UCPTE not synchronously but rather through HVDC links. There are several alternatives for locating these links. According to CENTREL/UCTE study following places are possible:

1. Zapadnoukrainskaja (UA)
2. Rzeszow (PL)
3. Mukačevo (UAL)
4. Kisvarda (HU)
5. Albertirsa (HU)

   Alternatives 1-5 allow instalation of 1200 MW in HVDC capacity.

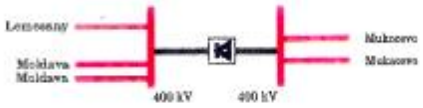
6. Veĺké Kapušany (SK)

   This location allows instalation of 600 MW in HVDC.

Variants for 1x600 MW

Rzeszów 600 MW BTB station

Variant P 1.1

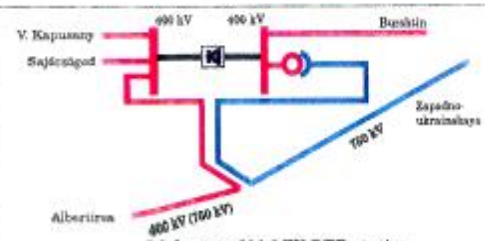


V. Kapusany 600 MW BTB station

Variant S 1A

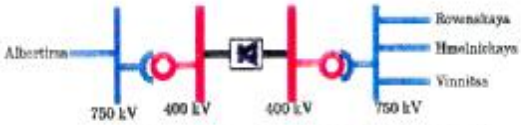
V. Kapusany 600 MW BTB station

Variant S 1B



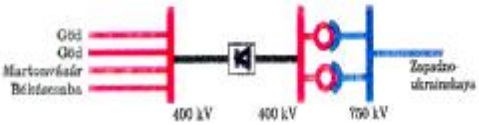
Mukacevo 600 MW BTB station

Variant U 1



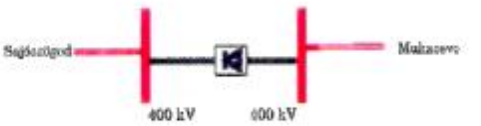
Zapadnoukrainskaya 600 MW BTB station

Variant U 4



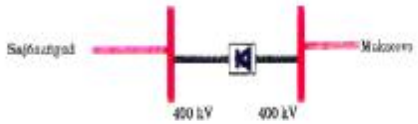
Albertirsa 600 MW BTB station

Variant H 1



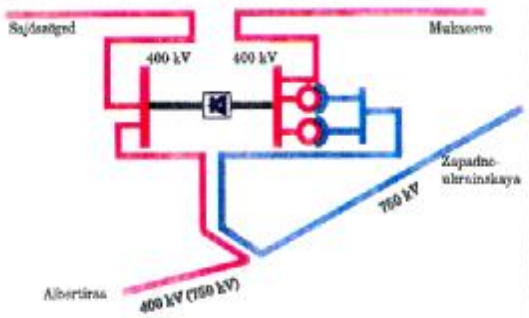
Kisvárda 600 MW BTB station

Variant H 3a

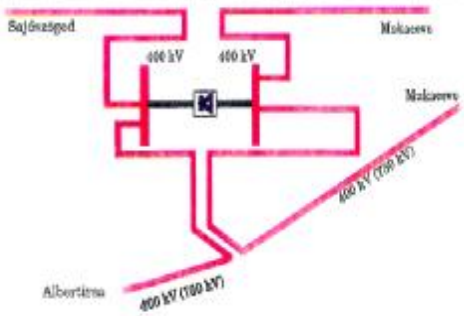


Kisvárda 600 MW BTB station
(750/400 kV tr. at Mukacevo)

Variant H 3b



Kisvárda 600 MW BTB station



Kisvárda 600 MW BTB station
(750/400 kV tr. at Mukacevo)

EXAMINED CASES

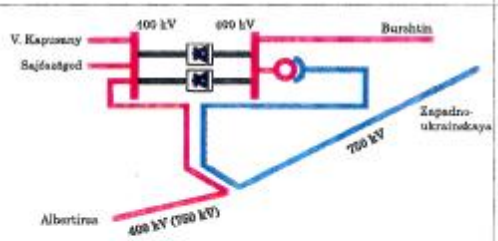
Variants for 2x600 MW

Rzeszów 2x600 MW BTB station

Variant P 1.2

Rzeszów 2x600 MW BTB station

Variant P 2

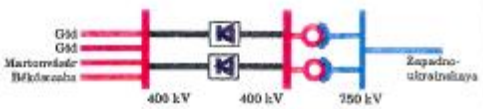


Mukacevo 2x600 MW BTB station

Variant U 2

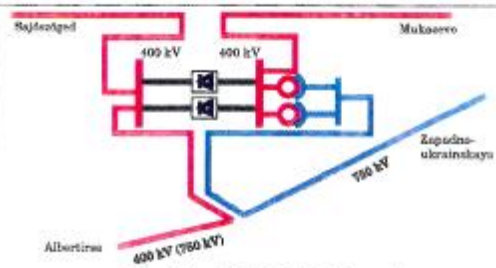
Zapadnoukrainskaya 2x600 MW BTB station

Variant U 3



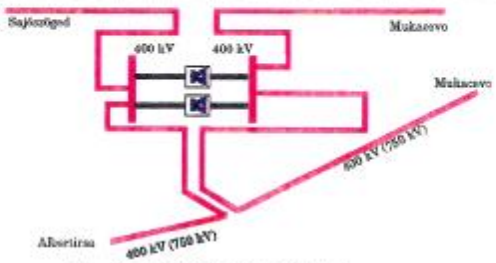
Albertirsa 2x600 MW BTB station

Variant H 2



Kisvárda 2x600 MW BTB station

Variant H 5a



Kisvárda 2x600 MW BTB station

3.5 Evaluation of the site studies

Feasibility studies were prepared by joint forces of CENTREL, UCTE and IPS/UPS experts for each site mentioned above. These studies contain variants for 1x600 MW and 2x600 MW transmission capacity, including:

- load flow calculations,
- short circuit calculations,
- necessary network development,
- variants for síte locations and schemes (Iayout), - cost estimation.

The examined cases are summarized in figurek above informing on the necessary network development as well. The main results of the investigation are shown in following Tables. The prices respekt the level estimated in 1995.

Variants for .1x600 MW Ident;-fication	Locátion	Cost estimation (M USD)
P 1.1	Rzeszów	65.2
S1A	V. Kapušany (V.Kap.-Moldava line)	155.6
S18	V. Kapušanv (V.Kap.-Sajószoged line)	140.4
U 1	Mukachevo	93.4
U4	Zapadnoukrainskaya	98.2
H1	Albertirsa	70.8
H 3a	Kisvárda	83.1
H 3b	Kisvárda (750/400 kV at Mukachevo)	100.5
H4a	Kisvárda (S.szoged&Muk.line, 750/400 Kisv.)	99.5
H4b	Kisvárda (S.szoged&Muk. line, 750/400 Muk.)	105.1

Variants for 2x600 MW		Cost estimation (M USD)
Identi-fication	Location	
P 1.2	Rzeszów	130.1
P2	Rzeszów	134.2
U2	Mukachevo	157.0
U3	Zapadnoukrainskaya	161.0
H2	Albertirsa	146.6
H 5a	Kisvárda (S.szoged&Muk.line, 750/400 Kisv.)	164.5
H 5b	Kisvárda (S.szoged&Muk. line, 750/400 Muk.)	170.9

Estimated cost in million USD includes the cost of the site enlargement, extension of the substation, new equipment, network development, movable BTB parts, transportation, civil works, erection, engineering and commissioning. The costs were estimated by the receiving countries except the costs of the BTB parts that were estimated by BAG and OVG in 1995. According to the information from OVG, the removal of the Dürnrohr BTB station is less expensive than that of the other ones.

4. Electric power business possibilities in Europe

The situation in European countries as seen from the point of view of electric power business opportunities is not the same in all countries. There are countries which have a strong export potential and on the other side there are countries heavily dependent on electric power imports. But generally speaking, the power wheeling on a long distance is not very common in Europe these days and most of the business is carried out on short distance, like between neighbours or through one transit partner. The long-distance electric power wheeling is not competitive compared to gas or coal transport. To be competitive, it would require either much wider differences in electricity prices between partners (unlikely) or severe shortage of electricity in some countries (which may be the case in near future). For technical realisation of massive electricity transports on a long distance there would have to be much more sophisticated infrastructure in place than that available today, namely long distance direct current transmission lines with appropriate converter stations (HVDC). The investment funds and time necessary for establishing such an infrastructure are remar-kable. For illustration - a price of 600 MW HVDC is estimated to more than 100 MEUR and the time from beginning of construction to

beginning of exploatation takes about 4 years. In case of transmission lines this time is even longer due to the difficulties in negotiating with land owners.

4.1 Present and potential exporters

In Europe, there are several countries with huge export potential. In these days they are namely France, Poland and Russia. Some other countries, especially those with generation based on hydro have an export potential during spring time (Austria, Norway, Switzerland). But the studies published by UNIPEDE show that after 10 years, according to the development plans of respective companies, the export potential will be retained only in France and Russia, but definitely in much smaller scale than today.

This shows a possibility of an economical justification of long-distance transit of electric power.

4.2 Present and potential importers

Many countries in Europe are net importers - both in the West and in the East. The most important are Italy, countries of Benelux, to some extent even Austria and Switzerland (in dry period) and the Czech republic, from Eastern part of Europe Hungary, Bulgaria, Ukraine and Baltic states.

The most common business relations are shown in following Table 2.

IMPORTER	IMPORTING FROM
IT	F,CZ,A
BENELUX	F,D
A	PL,CZ,D
CH	F,PL,CZ,D
CZ	PL,D,A,UAL
HU	UAL,PL,CZ,D,SK
BG	UA
UA	RU
Baltic	RU

4.3 Power wheeling - transit partners

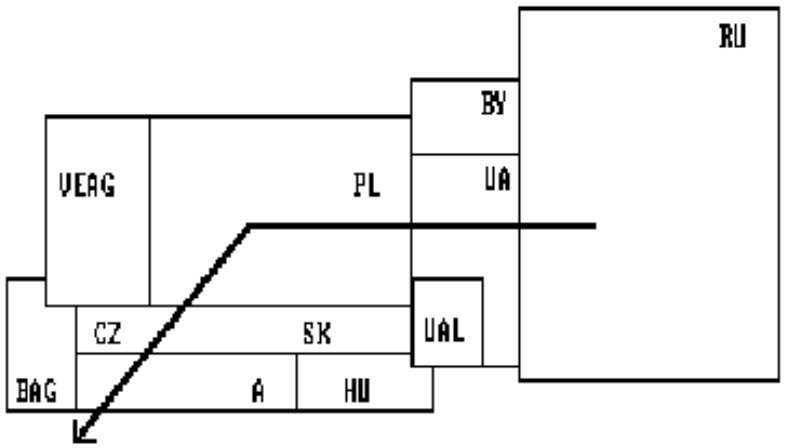
The above presented table shows the most important sources of power (Russia, Poland in the East and France in the West). With the knowledge of importers it is not too complicated to derive the transit partners.

According to their geographical position several transit partners may be defined in case of **transits from Russia.**

Three major roads are possible:

1) NORTHERN

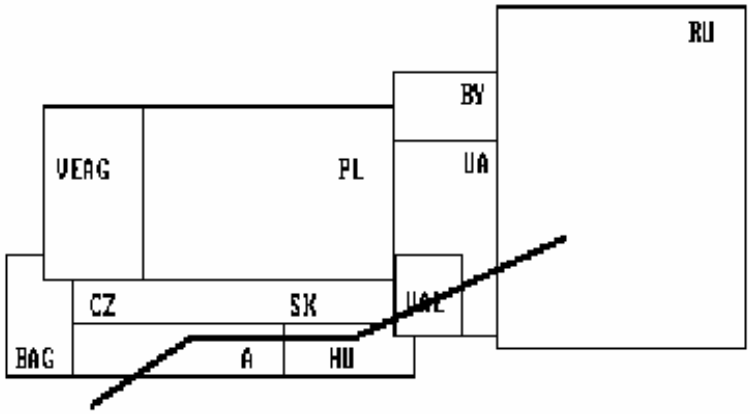
Through 750 kV line Chmelnickaja (UA) - Rzeszow (PL). From PL directly to Germany or through CZ, A to southern Europe (IT,CH). In this case UA,PL,CZ and A are the transit partners.



Transits from Russia - NORTHERN alternative

2) SOUTHERN

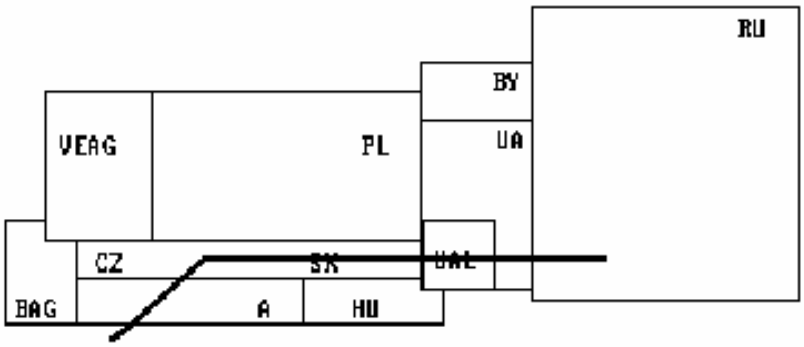
Through 750 kV line Zapadnoukrajinskaja (UA) to Albertirsa (HU) and 400 kV line Mukačevo (UAL) - Sajoszöged (HU). From HU through A directly to CH or It. In this case UA,HU,A are the transit partners.



Transits from Russia - SOUTHERN alternative

3) CENTRAL

Through 400 kV line Mukačevo (UAL) - Veĺké Kapušany (SK). From SK through CZ , A to IT. In this case UA, SK, CZ and A are the transit partners.



Transits from Russia - CENTRAL alternative

4.4 Necessary transit agreements

Every transit can be realized only after having an agreement with all "inevitable transit partners". These transit partners are selected usually by an importer or by the broker

offering the import. The selection rule is simple: regardless of where the power actually flows, the transit partners must fulfill only one condition: they have mutual connection, which capacity will not be exceeded by adding a new negotiated transit to existing ones. No other rules apply. In practice - if two paralel ways exist each with sufficient capacity, any of them can be selected (like in case described in 6.3). The consequence is a competition among potential transiters and reduction of transit fees (not very likely with increasing wheeling).

5. Some financial aspects

Any decision on the relocation of a BTB should be made only after the clarification of the energy business and the financial background. The working group has no information on existing or planned long term businesses.

The realization, finance and operation of a new BTB may be in the form of:

- a project company; a newly established undertaking for organizing the energy business, financing, relocation, operation and maintenance of the BTB and refunding the invested money only from the energy business;

- buyer financing; a company interested in energy transit purchases the existing BTB station(s).

6. Conclusions

1. Most parts of the existing BTBs are removable according to the information of BAG and OVG.
2. AU of the examined sites are suitable for placing a BTB station, but with some technical and cost differences between them.
3. Removal of one BTB station takes approximately 4 years.

4. The actual relocation of a BTB must be based on energy businesses and must be decided by the companies interested in these businesses

7. Financial outlook for 1 x 600 MW HV B-T-B DC in Mukachevo

The following Table covers all predictable cost associated with installation of HVDC BTB Link 1 x 600 MW in Mukachevo. The investment 160 MEUR is spread into 2 years, total economical life is estimated to 15 years. After this the synchronous interconnection is libely to take place.

All data in following Table are only rough estimates and must be precised to be used for financial predictions !

	T EUR							
Year	Investment	O&M costs	Losses	Transmission fees	TOTAL Costs	Income	Net result	NPV (T EUR)
1	80000				80000		-80000	94 513,59
2	80000	2400	1170		83570	38415	-45155	
3		2400	1170		3570	38415	34845	
4		2400	1170		3570	38415	34845	
5		2400	1170		3570	38415	34845	
6		2400	1170		3570	38415	34845	
7		2400	1170		3570	38415	34845	
8		2400	1170		3570	38415	34845	
9		2400	1170		3570	38415	34845	
10		2400	1170		3570	38415	34845	
11		2400	1170		3570	38415	34845	
12		2400	1170		3570	38415	34845	
13		2400	1170		3570	38415	34845	
14		2400	1170		3570	38415	34845	
15		2400	1170		3570	38415	34845	

8. Business model

For the succesful realization of the HVDC link project, following partners must be found:

- power generator who will deliver required 600 MW on a long-term basis. This role may be played by RAO-OES Rossii, UkrInterEnergo
- Buyer - Power company who will buy the 600 MW on a long-term basis. This may be Slovenské elektrárne, ČEZ, MVM Rt, Vattenfall (Germany).
- Creditor – either Czech or foreign bank. The negotiations are carried out with Komerční banka, Bank Gutman and some others. Most of the banks require a participation of some bigger partner, who will carry part of the risk – typically 30%. Elegible partners are power companies, technology providers etc.
- Technology provider – either Siemens or ABB .
- Lobbyist – who will take care of all necessary license on Ukrainian side. This may be SAPEX Invest.
- Investor – this role may be played by SAPEX and/or any company from group Technology provider, power generator and Buyer.

8.1 SAPEX Invest - information

SAPEX Invest is a company founded in Ukraine by Ukrainian and Czech subjects, which is meant to serve as a vehicle for realizing selected projects in Ukrainian power sector.

SAPEX is a “limited liability” company, whose founders are:

- Podolskij naučno-issledovatelskij institut (Podolsk science institute), Ukraine
  «Подольский научно-исследовательский институт технологий и материалов», находящийся по адресу: Украина, 29000 г. Хмельницкий, ул. Прибужская 15/1.

- TNK Ukrajina (Ukrainian subject founded by Czech enterpreneur)

Частная фирма «ТНК Украина», находящаяся по адресу: Украина, 29000 г. Хмельницкий, ул. Прибужская 15/1, основатель Ян Щудлик.

- ASTIKO, sro., Ukraine

«АСТИКО, о.о.о.», находящееся по адресу: Украина, 29025 г. Хмельницкий, ул. Проскуровского Подполья 215, кв. 15.

- ENERGOKOMPLEX, sro., Ukraine

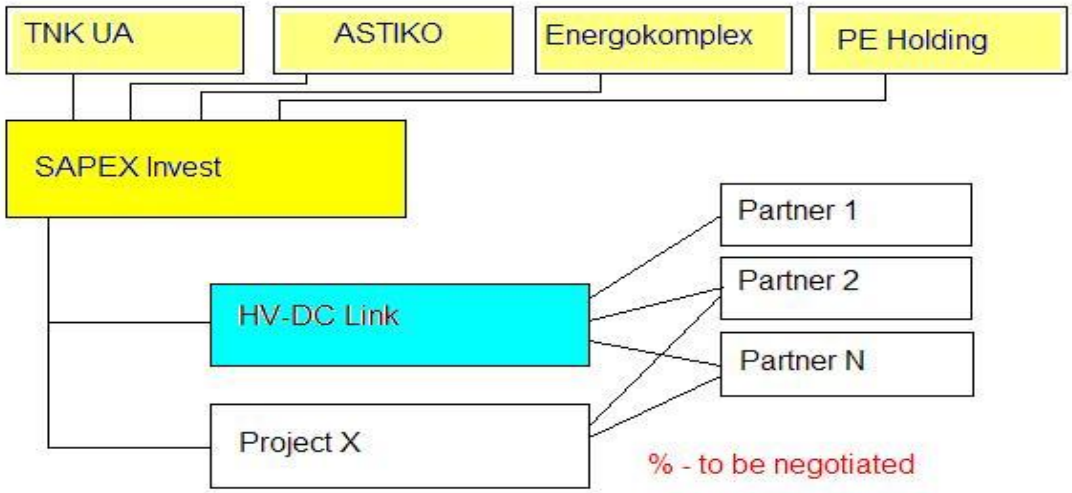
«ПФК ЭНЕРГОКОМПЛЕКС, о.о.о.», находящееся по адресу: Украина, г. Киев, проспект Победы 67, код 30218204.

- PE – Holding, sro., Czech republic

The Company acts according to German way of supervision, which means all important decisions are made exclusively in the Supervisory board and carried out by a local management.

8.2 Organisation of the Project

The possible organisation is shown on the following chart



SAPEX-Invest is involved in several projects in Ukraine. In the chart 2 of them are shown – the DC-link project and another one.

For the realisation of each project a separate company will be established. SAPEX-Invest will be one of partners in such a company, while others are also possible – see text above. The shares in such a company are to be negotiated, even with a possibility of a majority of the other Partner.

8.3 PE-Holding

PE-Holding is a holding company which consists of following members:

- První Elektro, a.s.
- Ekoplast Staněk, sro.
- Severotok, sro.
- BRUGG CZ

8.3.1 První Elektro, a.s.

The biggest of these companies is První Elektro, a.s.

Профиль общества

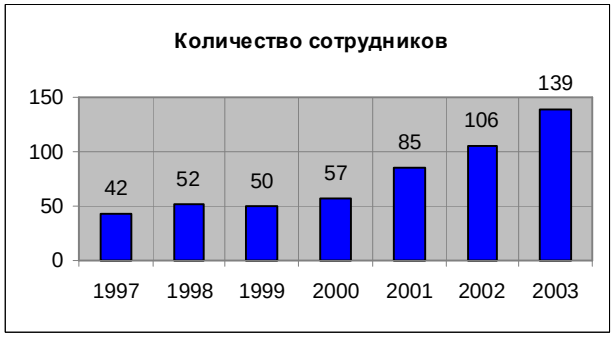
АО «Првни Электро» (První Elektro, a.s.) является производственным, проектным и инженерным обществом, деятельность которого распространяется на всю территорию Чешской республики, с производственной и административной базой в городе Хомутов, заводом Тушимице и отделением Прага. Общество тоже тесно сотрудничает со щвайцарской фирмой Brugg Kabel AG – поставщиком кабельной техники.

Общество осуществляет свою деятельность в области энергетики и электротехники, его продукцию используют разные отрасли промышленности.

Одним из основных компонентов производственной программы является стандартный ряд распределительных устройств, обеспеченных проектным, производственным и сервисным обслуживанием. АО «Првни Электро» полностью интегрирует комплект электроэнергии низкого и высокого напряжения, измерения и регулирования, специальных модулей измерения и защиты, регулированных модулей и профессионального машиностроения.
Мобильные распределительные станции, производимые нашим обществом, используются, например, в горной промышленности, энергетике – в т. ч. ветряные электростанции, химической и строительной промышленности. Общество «Првни Электро» производит указанные распределительные станции разных мощностей. По требованию заказчика можно приспособить их размеры или же предложить отдельные типы с разными модификациями.

Общество стремится постоянно повышать качество и надежность поставок, неустоянно расширять масштабы поставок и услуг на инвестиционном рынке, также в области технического оснащения, производственно-сборочной базы и усовершенствования услуг со стороны специалистов, решающих конкретные задачи.

АО «První Elektro» (Первая Электро) достигло со времени своего возникновения в 1993 году ряда положительных оценок (в т.ч. в годах 2002, 2003 и 2004 было отнесено к 100 лучшим фирмам в Чешской республике), владеет сертификатом ČSN EN ISO 9001:2001 (TŰV).



Основные данные

Общество:	АО «Првни Электро», (První Elektro, a. s.)	Уставный капитал: 200 000 000 крон чешских (Kč) Идентификационный номер общества (IČO): 26493381 Налоговый идентификационный номер (DIČ): CZ 26493381	
Юридический адрес:	ул. Безручова 4174 430 01 Хомутов Чешская республика	Телефон: Факс: E-mail:	+420 474 699 260 +420 474 699 268 prvnielektro@prvnielektro.cz
Юридическая форма:	Акционерное общество, коммерческий реестр ведущийся в областном суде в Усти над Лабем, папка Б, вкладыш 1412	Интернет: Счет в банке: Номер счета:	www.prvnielektro.cz «Комерчни банка a.c.», филиал Хомутов, ЧР (Komerční banka, a.s., pobočka Chomutov, CZ) 2100490237/0100
Дата основания:	6-ое августа 1993 г		

Акционерное общество «Првни Электро», а.с., обеспечивает своими заводами Хомутов и Тушимице:

Поставки

- Трансформаторные и распределительные станции до уровня сверхвысокого напряжения
- Распределительные щиты высокого напряжения, включая проекты и присоединение низковольтного оборудования
- Производство распределительных низковольтных щитов
- Электротехнологии для ветряных электростанций
- Электротехнологии для «водных парков»
- Системы управления, измерение и регулирование управления технологическими процессами
- Регулированные приводы на основе преобразователей частоты и софтстартеров
- Системы балансового наблюдения расхода электрической энергии
- Устройства для передачи данных
- Наборы кабелей – в сотрудничестве с фирмой Brugg Kabel AG
- Специальные приборы
- Автоматизированные системы
- Мобильные насосные станции

Услуги

- Ремонт и техническое обслуживание электрооборудования, в т. ч. ветряные ЭС
- Ремонт трансформаторов и двигателей, техосмотр
- Диагностические работы и техническое обслуживание специальных компонентов и распределительных щитов
- Ремонт и измерение ручных электроинструментов
- Продажа и сервис электрогидравлических приводов немецкой фирмы EMG Automation GmbH
- Профилактическое запланированное техобслуживание технологического оборудования
- Активный сервис для специальных областей и систем управления
- Целенаправленное техническое развитие
- Контроль электродвигателей путем математического моделирования, предложение мер по оптимализации

Проектная деятельность

- Предварительная подготовка проектов и экспертизы
- Консультационнай деятельность для проекта «Ветряной парк Хомутов»
- Разработка и модификации проектов до уровня свервысокого напряжения
- Преобразование данных в цифровую форму

Отделение Прага обеспечивает:

- Трансформаторные подстанции высокого/низкого напряжения
- Переключательные подстанции в. н., в т. ч. дистанционно управляемые подстанции
- Кабельные комплекты вплоть до уровня напряжения 400 кВ – вместе с фирмой Brugg Kabel AG
- Распределительные станции сверхвысокого напряжения
- Проекты и расчеты новых сетей низкого напряжения
- Проекты новых сетей высокого напряжения
- Проекты и реконструкции сетей низкого и высокого напряжения
- Проекты технологии трансформаторных подстанций низкого/высокого напряжения
- Проекты технологии распределительных станций сверхвысокого напряжения
- Проекты строительных частей трансформаторных и распределительных станций
- Проекты переключательных подстанций высокого напряжения, в том числе дистанционно управляемые подстанции
- Проекты управления и защиты распределительных станций высокого напряжения

В рамках инженерной деятельности обеспечиваем:

При всех выше приведенных работах обеспечиваем также общественноправовое согласование с соответствующими органами государственной администрации и с остальными заинтересо-ванными участниками вплоть до заключения договорных актов, начиная с обеспечения территориального проекта, получения разрешения на строительство и кончая реализацией строительства и приемочным актом. Наша фирма зарегистрирована в реестре проектантов и

поставщиков, имеющих разрешение на проектирование и реализацию строительства сети АО «Пражская энергетика» (Pražská energetika, a.s.).

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