RENOMIA

Risk report
ENERGO-PRO Grid AD
Varna Towers, tower G,
258 Vladislav Varnenchik Blvd, Varna

Prepared by:

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April 2015

Content

1. Introduction

Since June 2012 ENERGO-PRO has taken over the distribution and supply of electricity in Northeastern Bulgaria. The company operates through ENERGO-PRO Grid AD and ENERGO-PRO Sales AD, being a major shareholder in both companies.

ENERGO-PRO Grid AD main business activities are exploitation of electricity distribution grid, electricity transmission, distribution and power supply on a service territory of nearly 30 000 sq.km in Northeastern Bulgaria.

Current status shows:

- 42,185 km distribution network
- 4.8 TWh supplied electricity
- 1634 employees

ENERGO-PRO Sales AD is supplier of electricity to more than 1,1 million customers and provides related services.

During the visit we inspected the following sites:

- Substation Varna East, Dubrovnik street, Varna
- Substation Varna South, Devnja 2, Varna
- Nodestation Chrabrovo
- High voltage laboratory and administrative building, Devnja street, Varna

2. Summary and risk assessment

ENERGO-PRO Bulgaria operates more than 42,000 km distribution network in Northeastern Bulgaria and in 2013 have supplied 4.8 TWh of electricity to 1.1 million customers. The distribution network is organizationally divided into two parts, western and eastern part.

Western part is operated from dispatching in Gorna Oriachovitsa, Eastern part is operated from dispatching in Varna. Both dispatching are substitutable. EP delivers the electricity to the following bigger cities in the area:

- Gabrovo
- Gorna Oriachovitsa
- Ruse
- Razgrad
- Targoviště
- Šumen
- Silistra
- Dobrič
- Varna

Chart 1: Western part description numbers

	Gabrovo	Gorna Oriachovitsa	Razgrad	Ruse	Targoviště	Šumen
Clients number	99 620	187 742	83 116	150 220	86 747	114 641
Middle voltage net km.	176	259	140	80	95	150
Low voltage	1 156	2 518	1 405	1 157	1 229	1 760

overhead km						
Low voltage underground km	310	580	229	163	130	244
Substations 110/20, 10 kV	1	4	3	5	0	0
Transformers 110/20, 10 kV	2	9	5	11	0	0
Substations (10 or 20/04 kV) nm.	1 152	2 157	662	644	832	1 543
Transformers (10 or 20/04 kV) nm.	1 363	2 410	819	739	959	1 654

Chart 2: Eastern part description numbers

	Varna	Dobrič	Silistra
Clients number	301 365	138 455	75 096
Middle voltage net km.	458	233	80
Low voltage overhead km	2 174	2 390	1 157
Low voltage underground km	907	568	163
Substations 110/20, 10 kV	8	2	0
Transformers 110/20, 10 kV	14	3	0
Substations (10 or 20/04 kV) nm.	2 298	1 839	644
Transformers (10 or 20/04 kV) nm.	2 960	2 191	739

Distribution is designed from 10 kV and 20 kV network. EP owns also high voltage network 100 kV with length of 54 km.

The electricity comes from state owned high voltage network owned by NEC (the state distribution company).

In our assessment the physical condition of substations and distribution network we assess as average. EP has an investment plan to enlarge the connections of new customers and to rehabilitate the network and substations which are mostly 20 - 30 years old, but well maintained. The statistics of grid and transformers age are in the appendix.

No significant investments have been done since last visit in 2012.

In our assessment, maintenance of the substations is average to upper average. The maintenance is mostly outsourced.

We assess the operation as upper average. There is sophisticated control system for the distribution network operated from two dispatching centers. EP has complete overview about the distribution net and its condition.

Fire risk:
The risk of fire in this type of operation is most likely from high voltage appliances, as electricity is the generally the most frequent cause.

From a fire perspective, the risk lies mostly in the substations, especially in respect of the switchgears and transformers. On the distribution network, transformers are mostly located outside the buildings. 110 kV, 20 kV and 10 kV parts are located within the buildings. In urban areas also transformers are located within the building like in Čajka substation. Only in three locations are the 100 kV part enclosed and insulated by SF6. Those are Čajka, Trakata and Bjala. The switches in the visited substation were mostly SF6 or vacuum insulated.

Smoke detection is installed on visited locations but do not cover all the spaces. Alarm is local. Only one automatic fixed extinguishing system is installed in Čajka substation. This system extinguishes the transformers by nitrogen.

Explosion:
High voltage components can explode especially in the case of a short circuit or voltage overload. Where many appliances such as circuit breakers and transformers also contain insulation oil, such an explosion could be accompanied by a spread of fire.

In the case of transformers, an explosion could also be caused by the gases in the oil, especially if the oil is not tested regularly.

Flood:
Visited substations were located on elevated positions with remote risk of flood. The substations with possible flood risk are.

- Substation Devnya (close to the Varna's lake)
- Substation Asparuchovo (it is on an island underв Asparuchov bridge), Varna
- Substation Sinkevitsa next to the river.

Natural peril risks:
The risk from natural perils including earthquake was assessed using the NATHAN Munich Re tool. See appendix.

Environmental accidents:
Environmental accidents, or accidental pollution, could particularly be caused by oil leaks from transformers. During our visit we observed transformers only with emergency pits designed with enough capacity to catch more than the volume of oil in one transformer. We assess the risk of environmental pollution as low.

Business interruption:
In most of the open air substation could the fire of one transformer initiate the fire of another one. The distance is about 10 m. In Varna east substation is the distance about 20 mAlso the fire in switchgear 110 kV, 20 or 10 kV could shut down the whole substation. We are not sure about stability of distribution grid missing one substation 100 kV/20 or 10 kV, but we assess, that it could be partly substituted by another EP substation in the area, because those are mostly interconnected on middle voltage level and supplied from different parts of NEC grid.

EP Bulgaria has storage of significant spare parts in the middle of supplied area. We do not expect the longer business interruption except the case when NEC interrupts the electricity delivery.

3. Basic company information

ENERGO-PRO was established in the Czech Republic in 1994. The company's main scope of activities is in the field of management, construction, operation, maintenance and rehabilitation of hydroelectric power plants and electricity networks, as well as electricity trading.
ENERGO-PRO has been on the Bulgarian energy market since the year 2,000 and currently owns fourteen hydroelectric power plants, ten of which are united in four cascades - Sandanska Bistritsa, Pirinska Bistritsa, Koprinka and Petrohan - which turns the company into the largest private producer of hydroelectric power in the country.

ENERGO-PRO is officially the new electricity distribution and electricity supply Company for Northeastern Bulgaria. The Czech energy company fortifies its position on the Bulgarian market with the acquisition of the E.ON Bulgaria group companies. The companies, based in Varna, operate more than 42,000 km distribution network in Northeastern Bulgaria and in 2013 have supplied 4.8 TWh of electricity to 1.1 million customers.

4. Area description

During this visit we inspected the sites within the Varna and one small substation in Chrabrovo. Sites within Varna are situated in the urban area surrounded mostly by living houses. Site in Chrabrovo is located in the wind mill area, close to the Chrabrovo village.

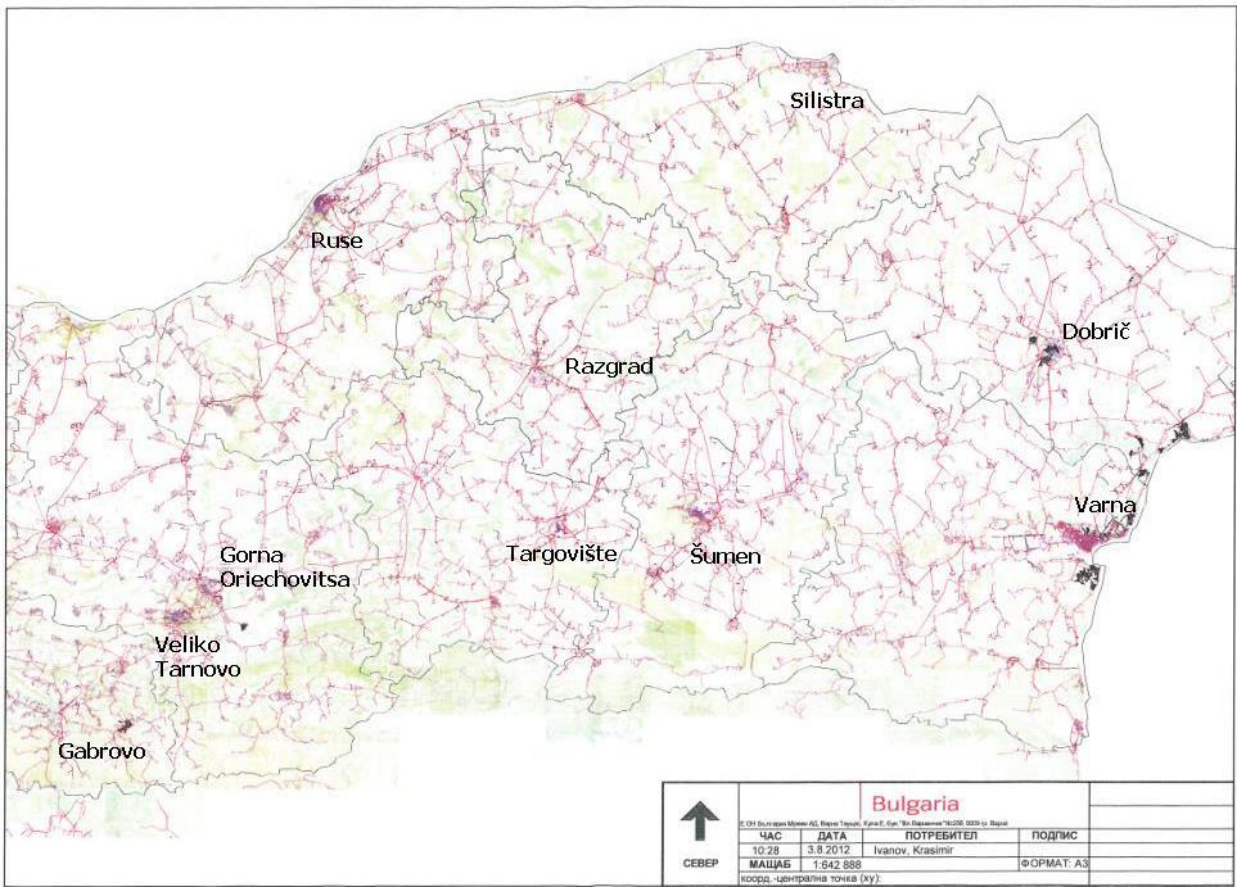
5. Description of Activities

General information:
EP distribution activities in Bulgaria consist of mostly medium and low voltage distribution grid in north east Bulgaria. Also high voltage (110 kV) lines are present within the EP grid as transmission lines. About 54 km of high voltage grid is present. The total distribution grid length is about 42 124 km from which about 31 912 km is overhead. The distribution grid consists of medium and low voltage grids, the transmission high lines are 110 kV:

- High voltage (110 kV) – about 54 km total length from which about 43 km (Zvezditsa) are overhead. Perla, Briliant, Potsdam, Ruschuk, Panteon (11,45 km) are underground lines.
- Medium voltage (20 or 10 kV) – about 18 421 km total length from which 15 017 km are overhead
- Low voltage (0,4 kV) – about 23 650 km from which 16 853 km is overhead.

The total number of medium to low voltage transformers is 12 595 pcs. The distribution is divided into 9 distribution districts mentioned in table 1 and table 2 and two zones East and West. West is operated from dispatching in Gorna Oriachovitsa and East - from Varna.

Picture 1: EP distribution area



Visited substations:

Varna East is dedicated for the Levski quarter, Izgrev quarter, Čajka quarter and Varna center. Three 110 kV lines are connected into this substation. Two transformers 110/10 kV are installed with the output of 40 and 50 MVA. 40 MVA transformer is produced by ElProm in 1982. 50 MVA transformer is SGB, produced in 2014. Distance between transformers is cca 20 m. Both transformers are equipped with the tank pit filled with crushed stone.

During the summer one transformer is enough to provide the service. 110 kV part is outdoor installation, 10 kV part is indoor installation. Substation is remotely controlled from the central dispatching in Varna.

Picture 2: 110 kV part

The electrical backup for basic manipulation and control system is assured by batteries. Battery room has permanent ventilation.

Varna south substation is located in near the harbor. This substation is practically in one area with high voltage laboratory in Devnja street. Complete reconstruction of 10 kV part was done in 2013. Thus substation supplies southern industrial zone, city center and the harbor. Two transformers 110/20/10 kV, SGB with output of 50 MVA each are installed since 2012. Manipulation is remotely controlled from central dispatching. 110 kV and also 10 kV part are indoor.

Picture 3: Varna south building

Manipulation with switches is electrical with backup by batteries. New type of gel batteries is installed. The substation is with remote control from the central dispatching as the most of the substations in the system. Local control system is also installed connected to central system.

Chrabrovo is node station for the surrounding wind mills. No transformers are installed. Backup batteries are installed. New switchboards are installed since 2012. This substation is remotely controlled from Varna.

Picture 4: Chrabrovo building

High voltage laboratory is in the same area like Varna South substation. This is the only one certified high voltage laboratory for Bulgaria. High voltage generators 2,000 kV and 700 kV are installed. Isolators and other parts for distribution are tested here. Also training classrooms are present here. Administrative building is situated in the same area.

Picture 5: High voltage lab building

Picture 6: High voltage lab.

5.1 Sources for operation

5.1.1 Raw materials

Not applicable.

5.1.2 Electricity

All systems described are designed to distribute electricity at low to high voltage levels. Most of the substation has electrical manipulation system with backup batteries. Dispatching centers in Gorna Oriachovitsa and Varna are equipped with diesel generators with automatic start. Those generators are periodically tested each week. All distribution substations are connected to state owned NEC transmission grid.

5.1.3 Heating

Visited places are heated electrically.

5.1.4 Steam

Not applicable.

5.1.5 Air pressure and air conditioning

Air pressure air is not used for substation control movements. Those movements are mostly performed electrically or manually.

5.1.6 Technical gases

Not used.

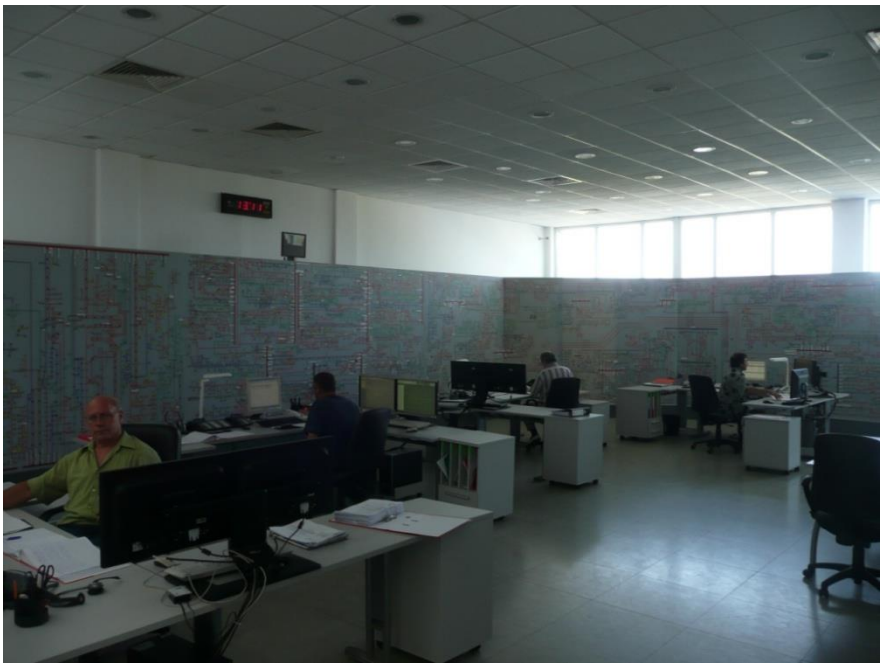
5.1.7 Water

Water systems are installed in the substations just for hygiene reasons.

5.1.8 Control systems

The distribution is controlled from two independent dispatching centers located in Gorna Oriachovitsa and Varna. These dispatching are substitutable. Varna dispatching operates 6 substations, Gorna Oriachovitsa dispatching operates 5 substations. Dispatching is permanently manned. The control system is mostly based on Schneider Monitor Pro 7.2. platform, or Siemens platform or ABB platform (older systems). The operator has complete visualization of individual substation current status. Also CCTV cameras installed in most medium to low voltage substations help the operator to see current status. Operators can remotely manipulate with the substation premises in the case of necessity or can send the field operators to solve the problems.

Picture 7: Gorna Oriachovitsa control room



5.2 Storage

5.2.1 Storage of raw materials and products

EP has a central storage of spare parts. We did not visit this storage. In visited locations, there are no significant storages.

5.2.2 Chemicals

No significant volumes of chemicals are stored in the visited areas. Quite significant volumes of oil are present inside the transformers. The volumes are about 30 - 40 t/transformer. Transformers are installed with emergency pits mostly of concrete construction. Those pits are filled by crushed stone. There is no possibility to control the fullness of the pits.

5.3 Layout and construction

Substations are mostly designed with 110 kV part as open air with steel or concrete constructions of the poles. In three locations are the 110 kV parts enclosed. In one location from three mentioned above is 110 kV part installed within the building. Medium and low voltage parts are located inside the building. Control rooms are located inside the building, which are made from bricks or concrete.

5.4 Security

No physical guarding is organized on visited places except substation and high voltage lab on Devnja Street. Two guards are present per shift. On the day shift there are more guards on the administrative building due to cash desks presence. During the night shift periodical patrolling is provided with the period of one hour. Guards on the cash desk have a panic buttons. No cash stay in the administrative building during the night, each day is the cash taken away by security agency. All visited substations are equipped with motion detectors with signal routed to the central dispatching.

Mechanical security is assured with fencing, locked door and closed windows. Mechanical security is only on basic level, but EP has no significant bad experience with burglaries.

6. Organization and management

6.1 Certified management systems

ISO 9001 and OHSAS 18001 are implemented and certified.

6.2 Employees

EP Bulgaria has about 1 630 employees. Employees are trained in EON (previous owner) standard. Substations are mostly not permanently manned and are remotely controlled from dispatching with periodical technicians visits. Field operators are located within the distribution areas able to do the action after dispatching command.

6.3 Fire prevention

EP Bulgaria has written rules of fire prevention. Periodical theoretical and practical training is provided also in cooperation with state professional fire brigades. Two practical trainings per year are provided. Written procedure is also for hot works which could be done only with special permit where safety precautions for each work are set up. After finishing the hot work following guarding is provided.

6.4 Maintenance

In our assessment the maintenance of the substations are better than average. Two times per year periodical inspections are provided including infrared camera thermo vision also on transformers. The transformer oil is tested once a year with chromatography analysis. Based on inspections the plan of maintenance is provided. For each work the special work order is elaborated including the safety precautions (see appendix). The state of visited substations we assess as very good.

7. Safety components

7.1 Fire water

No fire water hydrant or basins were installed in visited locations. According the information obtained from the EP representatives, this is common condition also in other substation. In some substations public fire water hydrants are closed to the station, but without an overview about the their state and water delivery quality.

7.2 Fire smoke detection

Automatic smoke detection was installed on Varna east (all the building), Varna south (low voltage part) and also on high voltage lab. Signal is with local siren. On the Varna south there is planned smoke detection enlargement and routing the signal to the security watch.

7.3 Fixed fire extinguishing systems

Not installed.

7.4 Emergency ventilation

No emergency ventilation is installed.

7.5 Overpressure protection

Not applicable.

7.6 Portable extinguishers

Portable extinguishers are installed on each substation. Periodical revisions are provided once a year.

7.7 Fire brigade

Company does not have its own fire brigade. Practical trainings are provided with municipal fire brigades. Professional fire brigades are located in bigger cities, so we can expect that the fire brigade could take the action. We don’t know exactly the level of the professional fire brigade equipment.

8. Losses in past 5 years

Will be submitted on demand.

9. Loss estimation

9.1 Scenario and loss estimation

There could be many scenarios of major loss in the distribution net. Over ground grid is quite sensitive on natural perils like windstorm, icing or earthquake. It is very difficult to assess the losses caused by this type of perils. Depending on Munich Re NATHAN assessment and terrain relief we could expect slightly elevated risk of earthquake, extra tropical storm and hailstorm. Possible flood risk was identified on

- Substation Devnya (close to the Varna's lake)
- Substation Asparuchovo (it is on an island under Asparuchov bridge), Varna
- Substation Sinkevitsa next to the river.

During our survey we assessed two possible scenario:

1) From the local point of view and focusing on the individual substations, the representative scenario of PML could be the fire and/or the explosion of individual transformer, which could easily spread to other transformers because of the lack of fire separation. This could also cause major business interruption of the substation and also business interruption for local distribution. Assessing the new replacement values we see the PML scenario on Čajka substation, which is situated in Varna, where enclosed 110 kV part from ABB is installed. All facilities of the substation including transformers are installed within the building. As the representative scenario of PML we see the fire or explosion of the transformer and the fire spread on whole substation. For the PML assessment we expect the 100% damage of installed technology, what is 4 560 797 BGN and 90% damage of the building value, what is 574 383 BGN. Because the substation is surrounded with the private houses, there should be also the damage of surrounded property considered. The business interruption is not considered in this scenario, because we expect, that EP is able to substitute the distribution from another substation.
   The PML assessed for Čajka substation is 5 077 741 BGN.

2) From the global point of view it is very hard to assess the maximum loss on distribution net caused by natural perils. So the PML is represented by maximum limit of liability offered by insurer, what is currently 40 000 000 BGN.

9.2 Loss definitions

9.2.1 PML – Possible Maximum Loss

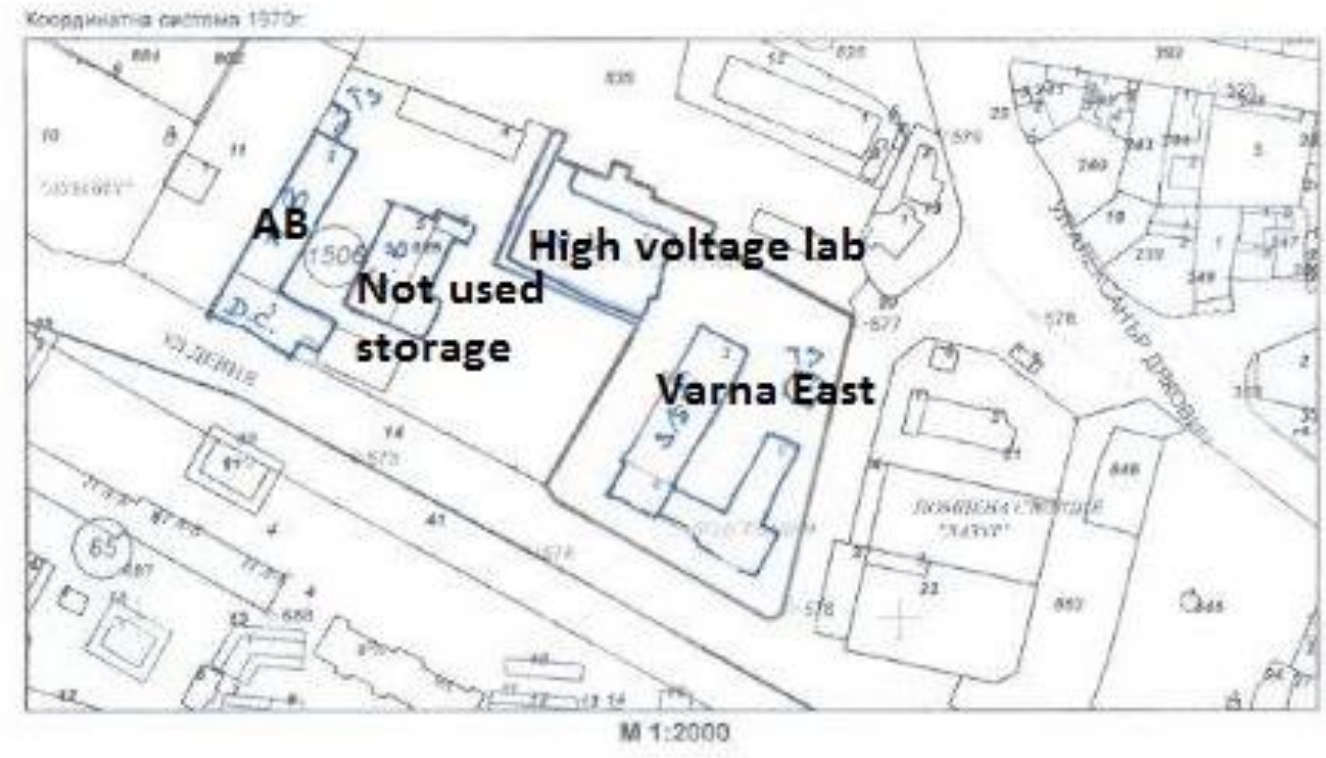
Maximum loss (property and business interruption if is insured), which could be expected as a result of one fire (or other danger if it is limiting factor) in the case of combination of the worst possibilities.
Factors influencing the loss amount are: effective fire complex dividing; lack of combustible material; construction materials of objects; time of business interruption.

9.2.2 EML – Estimated Maximum Loss

The biggest real loss (property and business interruption, if insured), which could be expected as a result of one fire (or other danger if it is a limiting factor) when all internal and external safety systems, able to reduce the loss, are operating.

10. Attachments

Picture 8: Varna south area



Picture 9: Oil testing protocol

SGS

ИЗПИТВАТЕЛНА ЛАБОРАТОРИЯ ЗА НЕФТОПРОДУКТИ
СЖС БЪЛГАРИЯ ЕООД

БУРГАС - 8104 Лукойл Нефтохим, Тел: 056 898412; Тел/факс 056 898037 ; e-mail:ogclab.bourgas@sgs.com

ЕКСПЕРТЕН ПРОТОКОЛ

№3000340-26

Поръка №	3000340
Протокол от изпитване №	5372,5373/14.11.2014 г.

ДАННИ ЗА КЛИЕНТА	
Клиент	ЕНЕРГО-ПРО МРЕЖИ АД
Заявител на изпитването	Поръчка за доставка 4500070303/21.10.2014
Адрес	9009 Варна, бул. Владислав Варненчик 258

ДАННИ ЗА ОБОРУДВАНЕТО	
Вид на оборудването:	Трансформатор СТ2, 110 kV / 21 kV /6,3 kV / 40,5 MVA
Идентификация на оборудването:	№ 75961
Местонахождение на оборудването:	подстанция „Девня 2" - гр. Девня
Друго :	Производител – Елпром Енерго – В. Коларов – 1960 г.

ДАННИ ЗА МАСЛОТО	
Тип на маслото	Трансформаторно масло
Вид на маслото	В експлоатация
Срок на експлоатация на маслото	

ДАННИ ЗА ПРОБАТА		
	Пробата е предоставена от клиента	**Пробата е отбрана от SGS**
Ниво на проботбиране		горно
Количество		3 L
Опаковка		3 бутилки x 1 L
Пломба №		
Пробовземач		Емил Иванов
Дата на опробване		11.11.2014
Дата на получаване в лабораторията		12.11.2014
Дати на извършване на изпитването		12.11-14.11.2014
Забележки		

SGS

Експертен протокол № 3000340-26 към Протокол от изпитване № 5372/14.11.2014 и Допълнение № 5373/14.11.2014

РЕЗУЛТАТИ ОТ ИЗПИТВАНЕТО

№ по ред	Наименование на показателя	Единица на величината	Стандартизирани методи	Резултати от изпитването	Забележка
1	2	3	4	5	6
1.	Съдържание на вода. Метод на Карл Фишер	mg/kg	БДС EN 60814	17 ± 2	няма
2.	Киселинно число	mg KOH/g	БДС EN 62021-2	0,087 ± 0,009	няма
3.	Определяне на пробивно напрежение	kV	БДС EN 60156	63,2	няма
4.	Определяне на свободни и разтворени газове*		БДС EN 60567		няма
	- водород	µl/l		10 ± 0,5	няма
	- въглероден оксид	µl/l		133 ± 12	няма
	- въглероден диоксид	µl/l		1093 ± 55	няма
	- кислород	µl/l		28081 ± 1420	няма
	- азот	µl/l		65100 ± 2150	няма
	- метан	µl/l		1 ± 0,1	няма
	- етан	µl/l		2 ± 0,1	няма
	- етилен	µl/l		21 ± 1	няма
	- ацетилен	µl/l		4 ± 0,2	няма
5.	Тангенс от ъгъла на диелектрични загуби при 90 °C,50 Hz	-	БДС EN 60247	0,0515	няма
6.	Коригирано съдържание на разтворена вода при 20 °C	mg/kg	БДС EN 60422	9,0	няма

Получените резултати показват:

Код	Диагностика
	
	
	Няма концентрации влизащи в диапазона или надвишаващи ключовите съгласно IEC 60599-A1.

Код	Състояние на маслото
	
	
	По изпитваните показатели маслото се квалифицира като „Добро” съгласно IEC 60422-13.

10.1 Statistics of the installations and equipment age

Statistics 2012

Transformers:

date of installation	Number
up to 5 years	878
from 5 to 10 years	240
from 10 to 15 years	346
from 15 to 20 years	333
from 20 to 25 years	1183
from 25 to 30 years	2353
over 30 years	7146

Provider	Number
Bulgaria	9 050
Serbia	92
Italy	13
Korea	144
Germany	27
Romania	24
Slovakia	54
Others	17
N/a	3 058

Low voltage lines:

Type of Asset	Up to 5 years	%	Up to 10 years	%	Up to 20 years	%	From 21 to 30 years .	%	From 31 to 40 years	%	Over 40 years	%	TOTAL	Average age (in years)
Overhead lines (km)	1 187	7%	1 219	7%	3 038	18%	4 836	29%	3 663	22%	2 910	17%	16 853	**30**
Underground lines (km)	340	5%	425	6%	1 953	29%	2 561	38%	991	15%	527	8%	6 797	**27**

Medium voltage lines:

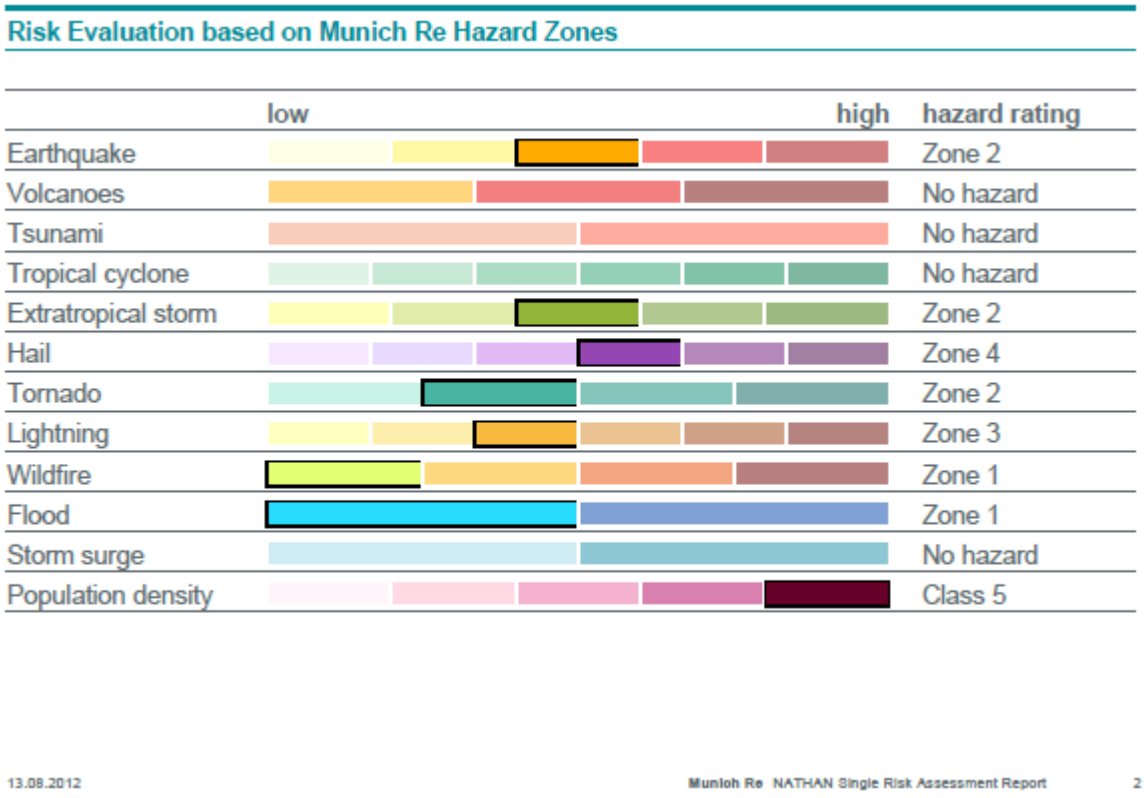
Type of Asset	Up to 5 years		Up to 10 years	%	Up to 20 years	%	Up to 30 years	%	Up to 40 years	%	Over 40 years		TOTAL	Average age (in years)
Overhead (km)	381	3%	420	3%	2 732	18%	4 935	32%	2 398	16%	4 151	28%	15 017	**34**
Underground (km)	501	15%	430	13%	1 105	32%	816	24%	435	13%	117	3%	3 404	**22**

High voltage lines:

Type of Asset	Up to 5 years	%	Up to 10 years	%	Up to 20 years	%	Up to 30 years	%	Up to 40 years	%	Over 40 years	%	TOTAL	Average age (in years)
Overhead (m)	0	0%	6 650	15%	0	0%	16 300	38%	20 000	47%	0	0%	42 950	**32**
Underground high (m)	2 556	22%	0	0%	0	0%	8 897	78%	0	0%	0	0%	11 453	**23**

10.2 Natural perils risk assessment

Picture 10: Natural perils risk assessment for Varna



Risk Evaluation based on Munich Re Hazard Zones

	low — high	hazard rating
Earthquake		Zone 2
Volcanoes		No hazard
Tsunami		No hazard
Tropical cyclone		No hazard
Extratropical storm		Zone 2
Hail		Zone 4
Tornado		Zone 2
Lightning		Zone 3
Wildfire		Zone 1
Flood		Zone 1
Storm surge		No hazard
Population density		Class 5

13.08.2012 Munich Re NATHAN Single Risk Assessment Report 2