Strategic Security of Energy Infrastructure Systems in the Czech Republic

*By Ivan Benes and Monika Mechurova**

Introduction

Tragic events that meaningfully affect human society reach not only into people's privacy, but also lead to new approaches and activities among businesses and politicians, who strive for new measures, regulations and laws in order to protect persons and assets and lower the risk of repetition. The terrorist attacks on September 11, 2001 altered security situations around the world. In order to evaluate the current situation in the Czech Republic, CityPlan, Ltd., with the support of fourteen energy companies that share in these concerns, presented a *study on the strategic security of energy infrastructure systems in the Czech Republic* in April 2002. Investigation was primarily focussed on the reliability of energy supplies in the Czech Republic and the security of the population and property in the event of a terrorist attack on energy infrastructure systems.

This article is an attempt to summarize the basic analyses and concepts for defining suitable measures that should be undertaken by public institutions. An attempt was made to evaluate the essence of threats in relation to the energy infrastructure in the Czech Republic, and, subsequently, to offer rough recommendations resulting from an analysis of the possible consequences of such threats.

Critical Points of Energy Infrastructure

For the bulk of our infrastructure, the level of vulnerability or risk may be acceptable. Most power lines, pipelines and transmission facilities can be repaired within a fairly short period, although sometimes at great expense. Many parts of the energy system can easily be replaced, or kept in operation for a transition period using improvisation, postponing complete renewal to a later date.

However, certain critical components of the energy infrastructure system are at much greater risk to terrorism with serious consequences. Disruption of their operation or complete destruction could cause serious breakdowns locally, regionally, or perhaps even nationally. Such an attack would also have serious domino effects across the entire economy. Depending on how such an attack was carried out, it could also cause widespread human casualties and long-term environmental damage.

An attack against critical components of the Czech energy infrastructure must, therefore, be perceived as one of the greatest threats to the nation, which must be duly considered and resolutely minimized. Efforts to better protect this infrastructure against terrorist attacks should be an essential political priority.

It is essential to pinpoint the weak spots in the energy infrastructure, whose destruction or damage could result in the collapse of the entire energy system. Likewise, we must prepare procedures, which will enable at least temporary emergency operation. Although crisis plans based on the assumption of technological or human error have been elaborated for all energy facilities, substantial changes must be implemented in the private sector. At present, most of these plans (with the exception of nuclear power plants) do not consider the possible consequences of terrorist attacks on such facilities. Pure patriotism aside, private energy companies have considerable business interest in the protection of their facilities and employees. Moreover, prudent companies take steps to limit their liability.

Some of these steps, which companies should try and implement, are relatively simple and low-cost, such as better-trained guards and tighter operational security for sensitive information. Nonetheless, with respect to some relatively vulnerable critical components in the energy infrastructure, the demands for real security go far beyond simply employing more security guards. The Czech Republic has neither the technological nor financial means to solve this situation by interconnecting satellite monitoring of the energy infrastructure with land and air forces; this solution is being considered in the USA. For our nation, it is far more reasonable to resort to short-term measures, while long-term development of the energy infrastructure would ensure limited local effects of terrorist attacks and avoidance of the collapse of the system as a whole on a regional or national scale.

Apparently, no energy company in the world has sufficient means to protect itself against the type of "suicidal" attack that occurred in New York on September 11. The public and private sectors must cooperate during development of new security regulations for the creation of energy concepts and construction of energy facilities. This process is akin to the manner in which environmental issues were introduced in the planning of energy infrastructures. However, because it concerns the co-responsibility of politicians for citizens' security, it must effectively increase the security of energy supplies, without being been just another regulatory burden on the private sector. In order for the energy sector to adequately confront the threat of global terrorism, it will need substantial help from the public sector. In the current liberalized competitive environment, it can hardly be expected that individual private players will be capable of building the necessary infrastructure redundancies into the energy systems without the active support of the Czech government.

The weak point in the world's energy infrastructure is the unequal distribution of international resources and primary energy supplies, in particular crude oil and natural gas. Ensuring access to drilling and transport of these commodities (to ports, terminals, national consumption) is among the most important geopolitical goals of today's superpowers.

Process chains for all types of energy supply are composed of facilities for mining and acquisition of primary energy (coal and uranium mines, wells for drilling oil and gas, hydroelectric, wind and solar power plants, biomass), energy distribution facilities (oil and gas pipelines, heating networks, power lines), storage facilities (coal supplies, liquid fuel tanks, gas tanks), technologies for energy transformation (refineries, power plants, heating plants, transformer stations), technological systems for final energy consumption, and finally power plant waste storage units (ash storage, burned nuclear fuel storage units).

It is clear that terrorist attacks on certain components of the energy infrastructure could have not only economic consequences, but are equally dangerous to life and health.

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Human lives and health can be directly threatened by extensive catastrophes, such as the destruction of a refinery, nuclear power plant or accumulation hydroelectric plant. Such accidents may have long-term effects on the environment (air, water and land pollution), which may in turn threaten the lives and health of people and render entire territories useless.

Although it is important, the protection of human lives and health is not the only aspect of the consequences of such an accident that must be considered. Long-term disruption of energy infrastructure systems may cause both economic and political destabilization and collapse in extensive areas.

Critical Points Evaluation

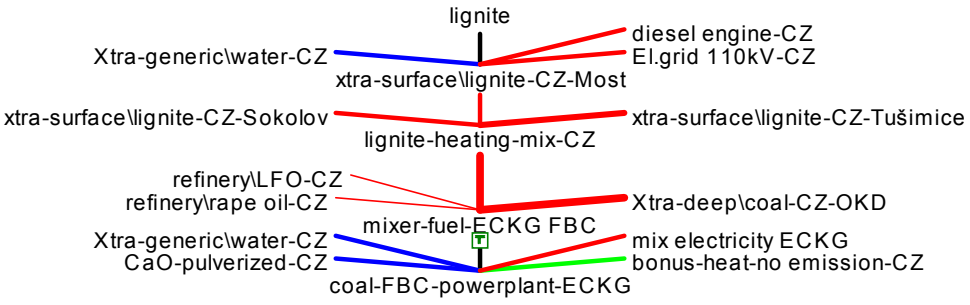
CityPlan provides critical infrastructure evaluation using the GEMIS model. GEMIS (Global Emission Model for Integrated Systems) was originally intended for life-cycle analysis (LCA). In 1987, Öko-Institute (Institute for Applied Ecology) in Germany developed GEMIS as a publicly available, cost-free software and database. In the 90s CityPlan, in cooperation with the Austrian and Czech governments, enlarged the database with Czech data. Utilization of GEMIS in the Czech Republic is now financially supported by the Czech Energy Agency and is used mostly as a Regional Energy Planning tool.

Life-cycle is a concept used in life-cycle analysis and material flow analysis to determine the environmental burdens of products and services from "cradle-to-grave", i.e., from the source (raw material or primary energy extraction) through the use phase to the "sink" (e.g., waste treatment, or recycling.) It includes the materials needed for the construction, all transports and auxiliary inputs as well. The links of all processes, which contribute to a life-cycle, are called the process chain. The most important part of LCA analysis is the Life-Cycle Inventory.

For critical infrastructure assessment it is also important to describe the entire process chain that is necessary for the critical infrastructure function. We can give an example of how the Life-Cycle Inventory is effectively utilized to track energy supply security.

Near to Prague is located the most modern new Czech coal fired power plant, ECK Generating (ECKG). The coal part process chain of the plant is shown in Figure 1.

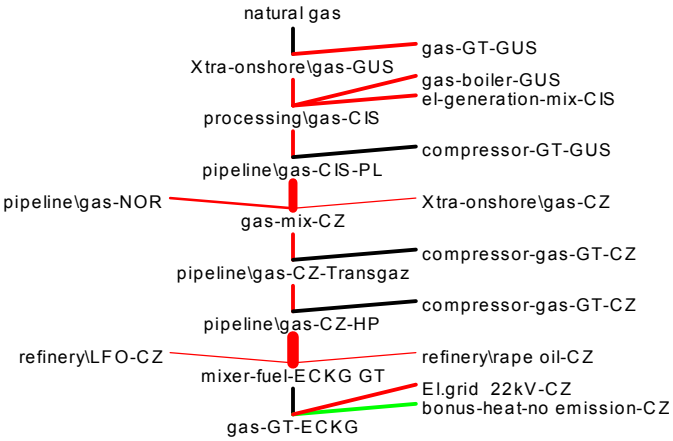
Figure 1
Fluid Bed Circulating Process Chain



As it is shown, operating fuel for the power plant can be supplied either from coal mine (OKD) or from three lignite mines (Tusimice, Sokolov, Most). Light fuel oil (LFO) or rape oil can serve as an ignition fuel. The pulverized limestone (CaO) is needed to capture sulphur from coal; technological water for cooling is also needed. The power plant needs auxiliary electricity for starting and auxiliary consumption (mixed electricity ECKG). Once it is started, the power plant can operate an island grid without external connection. The heat bonus means that the plant also produces heat (as a byproduct) used for the municipal district heating system.

The external electricity can be substituted by electricity from a gas turbine that is the gas-part of the ECKG plant. This gas turbine can burn natural gas (from Russia or Norway), or conventional light fuel oil even rape oil. But as is shown in Figure 2, the weak point of the plant from a critical infrastructure point of view is that the gas turbine is not able to start without external electricity. To enable a black-start of the power plant there is the possibility of equipping the gas turbine with a diesel generator.

Figure 2
Gas Turbine Process Chain

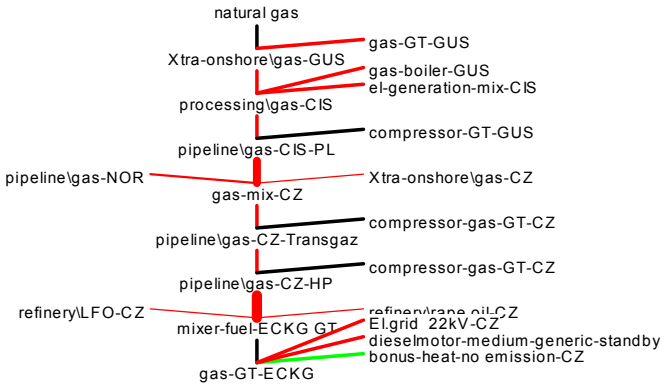


It means that a small investment of about US $100,000 in a diesel generator can provide a relatively large source of power independently on the external grid when necessary (Figure 3). The power plant, ECKG, is than able to cover about 40% of Prague consumption as a critical infrastructure source during a transmission system crisis. The problem is that independent power producer will not invest in a diesel generator if there is no assured market during crises. Public sector involvement is then needed.

Conclusion

Ensuring the general security of the population and property, and defending them against criminal activity, which an organized terrorist attack undeniably is, is a basic responsibility of the state and all components of the public sector. For this reason, the security of the Czech energy infrastructure at all levels against terrorist attack is undoubtedly a leading political priority, because energy is the foundation of political and economic stability in the nation. This responsibility is also one of the most important activities of all parties, which are linked by the obligation to ensure security against criminal terrorist attacks.

Figure 3
Gas Turbine Process Chain Equipped By Standby Diesel Generator for Black Start



The security of citizens and property cannot be part of one party's policy, because it is a compulsory service, which all levels of state government are ordered to perform by the Constitution of the Czech Republic. It should, therefore, be included in the election programs of all democratic political parties, for both parliamentary and particularly community elections.

The analyses indicate that increasing the security of the Czech energy infrastructure against terrorism, and reliably supplying households and other sectors of the national economy under crisis conditions, aside from general planning of considered technological or human errors, exceeds the capabilities of individual energy companies.

Measures, which may contribute to increasing the security of energy supplies in the Czech Republic include:

- In the long-term, it is necessary to take terrorist attacks into account. In order to be able to prevent and confront them, cooperation between the public and private sectors is necessary to strengthen the protection of sensitive parts of the energy infrastructure.
- In the event of worsened security situations in the state, it is necessary to use the assistance of armed forces (police, army) to ensure priority protection of facilities, an attack on which could threaten human lives and have long-term consequences on the environment. Such facilities include nuclear power plants (which was the case for a short time following September 11), chemical factories and oil refining facilities, oil and natural gas drilling equipment, natural gas, oil and petroleum product and dangerous chemical substance storages, overground parts of gas pipelines, including compressor stations, overground parts of oil pipelines and transmission lines, and hydroelectric accumulation plants.
- Increase the security of all systems of the Czech economic infrastructure, including securing of their emergency operation, by amending regulations on territorial planning.
- Ensure an increase in security of sensitive consumer system facilities (hospitals, selected office, banks, large shopping centers, selected industrial facilities, etc.) against long-term electricity blackouts by amending building regulations and project recommendations.
- Special attention must be paid to power systems, because most of its equipment is located on the surface and is easy to find and attack.
- Ensure controlled access to information from GIS (geopolitical information systems) concerning underground components of the energy infrastructure. In combination with the available GPS (global positioning system), such information can enable easy targeting and attacks on important underground elements of the energy infrastructure (pipeline systems, telecommunication systems).
- Increase the capabilities of local public CHP plants and industrial power plants to supply electricity and heat to apartments and other important buildings in cities in cooperation with local distribution companies.
- If necessary, ensure rapid mobilization of mobile substitute resources for emergency electricity supplies to rural populations.
- Ensure the publication of information materials for citizens and companies about procedures in crisis situations and the possibilities of diversification and substitution of individual types of energy.
- In the future, sustain the capability of the coal industry to ensure sufficient independent primary energy supplies in the Czech Republic.
- Support the reduction of specific energy consumption, and support repair of the existing building stock and support the construction of low-energy and passive buildings.
- Support increased use of renewable energy resources.
- Reflect security criteria when solving energy concepts for regions and major cities.
- Reflect security criteria in the performance of energy audits.
- Create security-oriented thinking among government employees and citizens.

The system for increasing the security of the Czech energy infrastructure against terrorism should also be continually tested and improved pursuant to ISO 9001 (quality management) principles.

The following steps will be necessary to create a new security strategy against the threat of terrorist attacks:

- Formulation of the main purpose of increased security of energy supplies in the Czech Republic (security concept from the aspect of global terrorism)
- Formulation of the desirable state (security vision from the aspect of global terrorism)
- Perform analyses of all external factors (including international), which significantly affect energy companies during their fulfillment
- Perform evaluations of the individual parts of the energy infrastructure on the level of specific energy companies
- Analysis of the strong and weak points with external opportunities and threats (SWOT analysis) for fulfillment of the security vision, feasibility study and identification of the main problems
- Definition of strategic areas for increasing resistance of the energy infrastructure against terrorist attacks (definition of areas of key importance for fulfillment of the security vision, specifiction of the importance of individual areas and definition of their mutual relations)
- Formulation of strategic aims (key long-term development

tendencies in individual strategic areas, on which efforts for fulfillment of the security vision will be focussed)

- Formulation of partial goals of increasing security of the energy infrastructure against terrorist attacks (specification of individual strategic aims into the form of interim steps)
- Elaboration of action plans for increasing security of the energy infrastructure against terrorist attacks (specifiction of tasks necessary for the realization of partial goals, including deadlines, responsibilities and conditions necessary for their fulfillment)
- Specification of strategic indicators for assessment of security of the energy infrastructure (selection of criteria for evaluation of the course and results of fulfillment of strategic goals)
- Fulfillment of action plans (performance of practical steps within the framework of fulfillment of individual partial goals and tasks)
- Creation of a surveillance system for monitoring, measuring and evaluating the course and results of fulfillment of strategic goals according to strategic security indicators for the energy infrastructure
- Adaptation (modification of action plans, strategic goals and partial goals of the overall vision in relation to the course and results of realization of the actions plans, development of the security situation and changes in the external environment)
- The result should be achievement of a state that will considerably complicate and limit attacking of the energy system, and make it an unsuitable target for economic and political destabilization of the nation.

The study on the strategic security of energy infrastructure systems in the Czech Republic has been presented to the Ministry for Territorial Development, the Ministry of Interior and the Ministry of Industry and Trade. The study recommended the following:

- analyses of all possible catastrophes (not only terrorist attacks, but also accidents and disasters)
- analysis not only of the energy sector but also of other parts of critical infrastructure

These suggestion have been included in the study and in September 2002 a team of experts under the leadership of Dana Prochazkova, PhD. (Department of Crisis Planning, Ministry of Interior) developed the key principles and approach to evaluation of vulnerability of sensitive parts of critical infrastructure.

Currently CityPlan is preparing a pilot study: *Prevention of the threat of terrorist attack on the energy sector in the Middle-Bohemian and South-Bohemian Regions*. After the floods in August that affected the Czech Repulbic, this study will also extend to prevention of all types of catastrophes. These two regions have specific security concerns because the capital of Czech Republic, Prague, is situated in the center of Middle-Bohemian Region and there is a nuclear power plant, Temelin, in the South-Bohemian Region as well as several dams and hydropower plants on the Vltava river.

Hubbert's Peak *(continued from page 12)*

Footnotes

[1] Fred Guterl (2002). "When wells go dry", *Newsweek* 139(115): 32B.

[2] Deffeyes (2001). Princeton: Princeton University Press.

[3] M. King Hubbert (1965). National Academy of Sciences Report on Energy Resources: Reply. Bulletin of t he American Association of Petroleum Geologists 49(10): 1720-1727.

[4] John M. Ryan (1965). National Academy of Sciences Report on Energy Resources: Discussion of the Limitation of Logistic Projections. Bulletin of the American Association of Petroleum Geologists 49(10): 1714.

[5] Hubbert, op cit., 1723.

[6] Ibid. 1722, Fig. 1.

[7] Ibid. 1724-25

[8] Guterl, op cit.

[9] Op cit., 1723.

[10] Op cit.

[11] National Fuels and Energy Study Group (1962). *Report to the Committee on Interior and Insular Affairs, United States Senate,* 87th Congress, 2d Session, Document No. 159, 354-357, 380. The study group also strongly rejected the argument of impending shortages of crude oil.