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ENERGY SECURITY, RESILIENCE AND CRITICAL INFRASTRUCTURE PROTECTION: SPANISH PUERTOLLANO REFINERY CRISIS CASE

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Abstract. Critical Energy Infrastructures can suffer different impacts from accidents and natural disasters which concern the whole energy system and specific functional aspects of Energy Security as well. A negative energy event -i.e. a strategic refinery blockade due to an accident- can provide useful experiences which demonstrate the connection among logistic efficiency, resilience and Energy Security. Spanish refinery Puertollano suffered an accident in year 2003 which stopped oil logistics in a significant part of the country. Military oil refined products logistics in Spain are managed by *CLH* oil products logistic company -operating in the framework of a Public-Private Partnership and civil-military cooperation model- and then this enterprise facilitated the implementation of a resilience measures aimed to guarantee the operation of oil products logistic chain in the affected area. Management of Puertollano refinery crisis in 2003 showed positive results for ensuring National Energy Security, market and business normal function, system stability and infrastructure re-adjustment. This crisis advanced criteria and lesson learned for Critical Energy Infrastructure Protection and business continuity planning.

Keywords: Critical Energy Infrastructure, Energy Security, oil products logistic system resilience.

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1. Introduction

Critical Energy Infrastructure Protection is a key component of Energy Security system (European Commission 2015). Operation of such a kind of facilities is indispensable and its stop generates a deep impact against essential public services. On the one hand, these facilities are a potential target for deliberated attacks coming from several possible agents: criminal organisations, terrorist groups and armed forces (using conventional tools or ways of Hybrid Warfare (Ruehle & Grubliauskas 2015). On the other hand, these infrastructures can suffer different impacts from accidents and natural disasters which concern the whole energy system and specific functional aspects of Energy Security as well. In order to give an efficient response from institutions involved in Energy Security, it is needed to get entities able to engage all the National Security problems associated and capable to interact with other agencies involved. Lesson learned from practical events provide advanced knowledge to implement planning, counter-measures and accurate tools (Domech Moré 2010; Vílchez 2008). Energy logistics are deeply related to Critical Infrastructure Protection issues and this must be planned in advance to have an efficient operational management and resilience under crisis management situation. Military oil refined products logistics in the Spanish case are linked to *CLH* hydrocarbon logistic company -*Compañía Logística de Hidrocarburos S.A.*(CLH 2015) and this is a specific PPP case of civil-military cooperation model as well

(NATO 2015). Considering NATO Strategic Concept approved in year 2010 -which introduced Energy Security topic as a priority for the Atlantic Alliance, boosting previous efforts (NATO EAPC 2007; NATO 2008)- and subsequent Chicago Summit in 2012 which highlighted the important role of Energy Security in common defence framework, this paper focuses in Critical Energy Infrastructure Protection issue to show how a negative energy event -strategic refinery blockade due to an accident- can provide useful experiences which demonstrate the connection among logistic efficiency, resilience and Energy Security.

2. Description of Puertollano refinery crisis

According to the report released by International Energy Agency - Standing Group on Emergency Questions (IEA 2006), we can know important information about the accident in *REPSOL YPF* Puertollano refinery and reaction from *CLH* company. An Emergency Response Programme Review of Spain took place in Madrid -on the 21 and 22 November 2005- conducted by a team comprising representatives of the USA, Sweden and the IEA Secretariat. It was based on Spain´s reply to the Emergency Response Questionnaire IEA/SEQ (94) 26/REV2. Puertollano oil refinery is an inland facility owned by Spanish petroleum company *REPSOL* -in 2003, *REPSOL YPF*- (REPSOL 2015), located 225 km to the South of Madrid. It supplies the area of Central Spain (among cities of Madrid, Mérida and Alcázar). This area is the first consumer of oil products in Spain (near 9 million m3 in the year previous to the accident described in this article). More than half of the product consumed in this area (55%) was supplied from Puertollano, through the pipeline connecting Puertollano and Loeches; the remaining 45% of the product consumed reached the area through other pipelines in the oil logistic track between Rota and Zaragoza: North (11%) and South (34%) ROTAZA (Espejo Marín 2008).

On August 14, 2003, the Puertollano refinery was forced to interrupt its activity as a consequence of an explosion which severely affected the two production units. Safety conditions were good: facilities had completed regular checks; control and alarm systems had right function parameters. None of them were activated in the hours before the accident; staff were qualified and well-skilled.Cause of the accident was an explosion and fire in tanks (FCC section), after gas (butane and other LPG) burse reached critical level of heat; gas escaped from light gasoline tank 2178-C where it was unexpectedly transfered from tower C-43. This irregular situation was not rectified on time (IEA 2006). This explosion also affected the pipes in the storage area of finished product, thus stopping the tender to the pipeline. It also had one of the worst possible consequences for the tender of oil products to Central Spain: no supply of 55% of the total oil product consumed in the area during almost half a year (5 months). The accident forced the immediate interruption of the Puertollano-Loeches pipeline activity, since this pipeline starts from the Puertollano refinery. The ROTAZA North and South pipeline working at its maximum capacity barely covered 50% of supply required daily in the area.

3. Reaction and emergency measures to keep oil products supplies

Crisis reaction and management coordination to solve Puertollano refinery accident included complex public-private coordination, involving 4 players mainly: ministry department (*Direction General for Energy Policy and Mines*), national agency *CORES* (CORES 2015) and two corporate entities (*REPSOL YPF* and *CLH* companies).

The governmental body *Direction General for Energy Policy and Mines* activated the response system for emergencies -in that time, current Spanish *CNPIC - National Centre for Critical Infrastructure Protection* (CNPIC 2015) did not exist- and the Administration summoned the *Sectorial Committee of Energy Resources* (*CSREM*), as well as national agency for oil reserves *CORES* -state-owned corporation of strategic reserves of oil-based products, which is responsible for managing strategic reserves and controlling the compulsory minimum security stocks in Spain- , petroleum company *REPSOL YPF* and oil logistic company *CLH*, and it called for an evaluation of the crisis situation plus the necessary measures to be adopted. The Administration established the priorities to guarantee supply in the area affected and to avoid market distorsions; the actions criteria: equal treatment for all operators; a procedure for information and for a follow up of evolution until the end of the crisis (firstly on a weekly basis during months 1st and 2nd, furtherly on a monthly basis).

National agency *CORES* authorized company *REPSOL YPF* to transfer 115,000 m3 of strategic reserves from the Puertollano refinery to other refineries located in the Spanish coast (in towns of La Coruña, Cartagena and Tarragona). *CORES* also allowed a transfer of other geographical areas, of up to 300,000 m3 of the strategic reserves stored by enterprise *CLH* in Central Spain. *CLH* asked for this transfer in order to keep normal supplies to final consumers of oil products. Both authorizations were based on the firm compromise to restore the original paper stocks situation before the end of that year. Later on, the Ministry of Industry gave an exceptional authorisation to *REPSOL YPF* for pumping 450,000 m3 of diesel and heating oil through the crude oil Cartagena-Puertollano pipeline. *CLH* would then pump this product from Puertollano to Madrid.

CLH took the following measures in order to ensure the continuity of oil products supply to the affected area:
- In a initial stage, it transferred temporarily 150.000 m3 of gasoline and gas oil from Central Spain to the coast. These products were distributed amongst all the market operators involved, in proportion to the average consumption in the area during the last year, and with the commitment to re-establish the initial paper stock position before year end. An additional transfer of 150,000 m3, requested by CLH for reserve stocks, was not necessary thanks to the Administration authorisation to use REPSOL YPF crude oil pipeline.
- It allowed operators with security reserves located in Central Spain to consume these reserves within the area, allowing replacement of amounts consumed in other peripheral depots.
- Operators adapted the production schedules of their refineries located in the coast in order to supply larger amounts of products and maximize pipeline transport.

Furthermore, *CLH* implemented the following complementary measures:
- Adjustment of tanker rail-wagons to transport oil products from the coast (Cartagena and Grao de Valencia) to Central Spain, and conditioning facilities in Torrejón (where there is a major Spanish air force base) and Villaverde for reception of rail-wagons and tanker trucks.
- Modification of pumping conditions in the pipeline network in order to facilitate the transport of oil products to Central Spain.
- Providing extraordinary logistic services apart of normal contractual conditions.

It is important to have in mind that Spain has no crude oil significant resources and the country has a high external dependence of hydrocarbons (Segoviano Monterrubio 2011), therefore all downstream activities developed in the Spanish refineries are related to petroleum imports.

4. Lessons learned.

According to the final report about Puertollano refinery incident and considering the results of the actions taken in that time, there are some principal aspects which provide important lessons:
- The transfer of credit entries of 115,000 m3 (from REPSOL YPF) and 150,000 m3 (from CLH) of compulsory reserves owned by CORES from Central Spain to the coast, were crucial during the first days of the crisis, since it provided operators with the necessary product to maintain their normal levels in sales.
- The authorization to change the accreditation of a second amount of product owned by CORES, contributed the calmness to guarantee supply security during the whole period of crisis, and it allowed setting up the planned actions without additional stress.
- The compulsory reserves level was maintained in CLH and in Spanish refineries during the whole crisis.
- The immediate actions of the Public Administration ensured supply to end consumers, without neither price distortion nor market instability. These actions provided the necessary flexibility which CLH and operators needed in order to come up with the required solutions in the short term.
- The strict control system of the rights of each operator to consign products to the affected area of Central Spain by the Administration assured equal treatment for all the operators. The existence of an integrated logistics system of storage and pipeline transport allowed product shifting and truck load movement to depots outside Central Spain.

5. *CLH* logistics system, aimed to energy resilience

During the Puertollano refinery crisis affecting oil products Spanish energy sector, key element for the resilience of the system and ensuring supplies under stable operations were *CLH* oil logistic company and its business model. Therefore, it is necessary to know more about this.

CLH is a private entity, independent, with corporate governance stable under its own bylaw. Company has long business experience of more than 80 years. Its main activities are oil refined products logistics, including storage, pipeline transport and tanker truck loading; management of airport storage facilities and into-plane refuelling services; strategic storage and emergency stocks management for the Spanish central agency *CORES*, other foreign agencies and the operators; injection of quality and fiscal additives; biofuels blending. *CLH* also provides bunkering services.

Main assets include 4,027 km. of pipelines (connecting import harbour facilities, refineries, inland depots and other logistic companies), 7.9 mm3 of storage capacity in 39 facilities, 28 airport storage facilities, 5 hydrant systems in principal airports. Its labour force (2014) has1,461 skilled workers. *CLH* network has a national Spanish coverage, providing service in more than 500,000 km2 and more than 46 million inhabitants; also has international links to Mediterranean and North European markets.

Key aspects of *CLH´*s logistic services are open access for any customer in Spain, competitive prices and flexible conditions, immediate product availability in any of *CLH* facilities upon receipt in *CLH* system, modern business model and efficient operations and information systems (i.e. state-of-the art practices, fully automated, online nominations, inventories and billing), guaranteed product quality with dynamic product rotation. High degree of automation allows to significantly increase its productivity. *CLH* is the main operator of Spanish oil refined products logistic system.

Oil refined products logistic system is performed in open access for any customer, facilitating competitive prices (fee is less than 1% of retail product value) and flexible conditions, immediate product availability in any facility, fully automated operations, periodic quality control and product rotation. This logistic system has a high degree of automated processes and advanced level of integration (of storage and transport facilities, management and control systems), integrity and consistency of the information.

6. The *CLH* oil logistic model, National Security framework and the Armed Forces.

CLH business concept is closely related to Spanish emergency and strategic stocks of refined products, corporate governance and management. *CLH* is permanently linked to Spanish General Staff headquarters, and it includes operational Military Energy Security common framework. At the same time, *CLH* cooperates with national agency *CORES* supporting obligation of 92 days emergency refined products storage (Currently it is obligated by EU Directive 2009/119/CE, September 14, 2009). Although when the accident in Puertollano refinery arose Spanish national energy security rules and institutional framework were different from current conditions, it seems that *CLH* activities 12 years ago during Puertollano crisis provided experiences which have been very useful for performing modern strategies. Nowadays, the modern *Spanish National Security Strategy 2013* considers Energy Security and Critical Infrastructure Protection issues and *Spanish National Energy Security Strategy 2015* recently approved (July) provides more concrete guidelines in this way (nowadays, *CLH* security division implemented Critical Infrastructure Protection measures obligated by *CNPIC* establishing *Operator Security Plan* [PSO], *Specific Security Plans* [PPEs] and some business continuity protocols).

CLH services to military organisations are provided since the 1960´s and company is cooperating with military authorities -customers are *Ministry of Defence* (MINISDEF) and *Defence Energy Support Center* (DESC). Spanish business model related to the ownership and operation of the Spanish military bulk fuel system is a Government concession. Assets are refined products pipeline Rota-Torrejón-Zaragoza (ROTAZA) and strategic storage tanks (La Muela and Loeches). CHoD (Chief of Defence) on behalf of MoD retains the ownership of

the assets integrated in the system, and *CLH* company operates, maintains, updates, upgrades, and permanently improves the system. This military refined products logistic subsystem is fully interoperability with the rest of the Spanish non-military bulk fuel system.

The Spanish Government concession business model implemented in Spain to operate refined products logistic military assets has several advantages aimed to operational and cost-limited efficiency. Military authorities have the property over the assets and there is a military preferential use, under both peacetime, crisis situation or war conditions. Military assets under normal operation -which is integrated with civil infrastructures- ensures assets maintenance and readiness in crisis situation, therefore it mitigates the risk of technologic or material obsolescence. Civil network can be used for military purposes either under peacetime, crisis situation or war conditions. Emergency stocks always ensure product availability under crisis situation, furthermore for NATO European partners which locate their emergency stocks in Spain as well (i.e. Ireland) (CLH 2015). Military authorities obtain an economic benefit, especially from long term governmental concessions: fee regarding the right of use of the assets for civil purposes; preferential service price based on operation direct costs, and also competitive prices whenever network is efficiently operated. Military standards (i.e. O&M, product quality, specific certifications) are included in the Government concession agreement terms and conditions. This framework was satisfactorily kept during Puertollano crisis.

Regarding military organisation and logistics. *CLH* provides services to Ministry of Defence and Defence Energy Support Center, which a highly coordinated framework. Regulatory committees are established: *Peer Mixed Committee* (*CLH* – MINISEDF) and *Mixed Technical Commission* (DESC – MINISDEF), as regulated in the Defence Agreement between the Kingdom of Spain and the United States of America (April 2002). Services include product transport and storage, quality control and additivation (anti freezing, anti-.corrosion and anti-static additives), proposal and management of improvement projects. That economic relationship is based on a fee paid by *CLH* for using the pipeline (ROTAZA) under a governmental concession scheme. Preferential price is based only on direct costs derived from the operation of the pipeline (i.e. labour, energy, maintenance), depreciation, general costs and industrial margin. This model provides several advantages for military energy conditions taking into consideration that under his PPP framework (Espona 2014), military fuel supply is the priority and always guaranteed over civil services. Operation in crisis situation scheme means that pipeline network and storage facilities are put at military authorities disposal with preferential use, under activation of military operations (i.e. Operations *Desert Storm*, *Irak Freedom* -which was conducted along year 2003, just the same year in which Puertollano accident happened-, *Enduring Freedom* and *Allied Force Joint Guardian*) or crisis management situation (i.e. Puertollano oil refinery activity interruption in 2003). Logistic services -storage and transport- ensure the supply of the Rota (Spanish Armada and U.S.Navy operate units in this naval station) and Morón military bases (South of Spain area). The military assets are used also for civil services integrated in the *CLH* network, maximizing its operational utilization, minimizing risk of obsolescence and ensuring the financial resources for its maintenance.

Conclusions

Management of Puertollano refinery crisis in 2003 showed positive results for ensuring National Energy Security, market and business normal function, system stability and infrastructure re-adjustment. It allowed oil energy system resilience.

Thanks to the coordinated actions by the Public Administration, national agency *CORES*, *CLH* company and operators, one of the most critical scenarios that could happen in production failure in a refinery in Spain was successfully overcome, despite its long duration (5 months).

Considering oil logistic model operated by *CLH*, this crisis advanced criteria and lesson learned for Critical Energy Infrastructure Protection and business continuity planning. These concepts can be found in the Spanish national Energy Security strategic framework established between year 2013 and year 2015, which is the most modern state-level strategic planning public instrument.

Regarding Military Energy Security, this oil logistic model shows several advantages for military energy conditions considering that, under his PPP framework, military fuel supply is the priority and always guaranteed over civil services. Operation in crisis situation scheme means that pipeline network and storage facilities are put at military authorities disposal with preferential use, under activation of military operations or crisis management scenario. Military assets in normal operation -which are integrated with civil infrastructures- ensure assets maintenance and readiness in crisis situation (military refined products logistic subsystem is fully interoperability with the rest of the Spanish non-military bulk fuel system).

Looking at future trends in the security & defence global framework, it seems that such kind of incidents affecting Energy Security should be deeply analysed taking into account the arising strategies and tactics of Hybrid Warfare.

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