

REVAMPING AND DEVELOPING OF THE DISTRIBUTION NETWORK IN POINTE NOIRE, REPUBLIC OF CONGO – AN ENI CONGO AND ENEL PROJECT

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ABSTRACT

Eni Congo is setting out, in collaboration with Enel Distribuzione, a revamping and implementation scheme of the electrical distribution system in Pointe Noire, Republic of Congo (Brazzaville). Pointe Noire is a coastal city washed by the Atlantic Ocean, populated by approximately 1.000.000 inhabitants which represents a strategic centre for the whole commercial activity of the country.

The project consists of 10 new MV feeders (130km cable) extending from the two existing primary substations located and named N’Goyo and Mongokamba, 6 new MV/MV remote controlled Substations, 6 MV/LV Substations and outgoing LV lines and street lighting; it has been carried out applying an EPS form of contract (Engineering, Procurement and Supervision) between Enel and Eni Congo and developed by Enel Engineering Dept using Enel’s standardised network layouts and materials .

This paper is divided in three parts: it firstly illustrates the initial engineering assessment activities aimed to maximize MV grid’s performance, then it describes devices and materials technical requirements and compliance activities, finally it gives a brief description of the construction activities.

ENGINEERING ACTIVITIES

Pointe Noire distribution network is feed by two Primary Substations 220/30/20 kV (N’Goyo and Mongokamba shown in Figure 1) from which depart the primary circuits (seven 20kV and one 30kV cable lines) forming the existing MV network. Initial grid configuration denotes not only inadequacy to sustain the distribution load but also that lines works at rather critical conditions.

Besides Eni Congo has recently started up a new two 150 MW units gas turbine power plant (namely the CEC – Centrale Electrique du Congo), and is therefore producing additional electrical power that need to dispatched throughout a network already close to the saturation point.

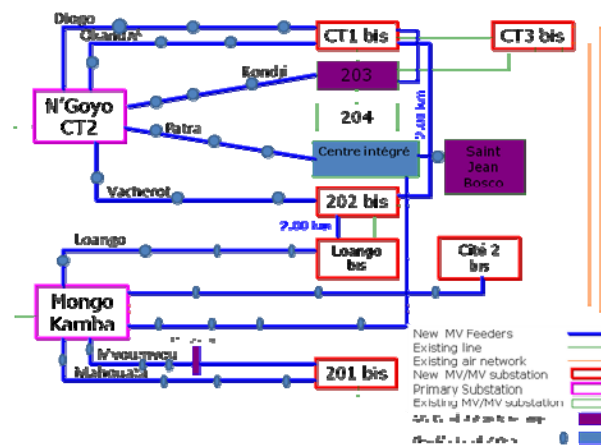


Figure 1: Distribution Network Scheme – City of Pointe Noire, Congo Brazzaville

The first step (Phase 1) of the project focuses on the construction of 10 new MV Al 185mm² cable feeders supplying 6 new MV/MV remote controlled substations named as follows (see Figure 2):

1. **CT1 Bis-** (new primary substation)
2. **202-**(positioned in an existing brick enclosure)
3. **CT3-**(positioned in an existing brick enclosure)
4. **Cité2 Bis-**(new MV/MV substation)
5. **201 Bis-** (new brick enclosure to be built adjacent to the existing refurbished one)
6. **Loango Bis**(New brick enclosure)

Both MV feeders and MV/MV remote controlled substations are designed according Enel’s technical standard design specification.

To connect the primary and the MV/MV substations and allow protection signals transfer and power supply interruptions monitoring, a provision for an optical fiber conductor buried in the same trench of Diogo and Mahouata- Loango MV feeders has been made.

ENI Congo is also considering to extend the project perimeter (Phase 2) erecting 60 new MV/LV substations including LV distribution lines and street lighting (3km

of LV lines each new MV/LV substation).

TECHNICAL REQUIREMENTS

All the specified components and materials are homologated by Enel and fully compliant to Enel technical design standards.

MV feeders

The cable selected for the supply feeders is mainly a 3x1x185mm² aluminium helical type, shielded aluminium tube with reduced thickness extruded insulation, while a 3x1x240mm² is used only for connections to the existing grid.

Considering that Pointe Noire has a neutral earthing system (solidly earthed), a bare copper conductor is laid along the cables whose shield at all junctions is connected with the latter and earthed using 4 pickets.

MV/MV substations

The 6 MV/MV Substations are designed using Enel's modular air-insulated compact type switchboard (see Figure 2), assembled with vacuum-type circuit breakers set for the rated operating sequence O-0.3s-CO-30s-CO. The switchboard has tested for short-circuit current and internal arcing resistant at 12,5 kA; the rated thermal current is 1600A [1].

Being extremely compact this type of unit permits to minimize the volume of the outer enclosure. As shown in Figure 2, each single compact switchboard element is designed to be the most possibly simple circuit breaker metal enclosure; bus-bar and cable's disconnectors can be easily removed using a built-in lifting system. Also, a vertical motion transmitting screw allows the circuit breaker to move from the on (high) to the disconnected position (low). The lifting system successfully passed a mechanical endurance test (1000 simulated manual operations).



Figure 2: Enel compact type MV switchboard

The MV/MV Substations layout is Enel's standard using single busbar system divided in two inter-connectable switchboard; each has an incoming line and a modular number (5-8) of outgoing lines. Switchgears are equipped with the appropriate line protection, earth switch, and safety interlocks.

Optical Fibre

To achieve a remotely controlled ring connection between the 6 new MV/MV substations and the existing 2 primary substations (N'Goyo and Mongokamba), a 24 fibres cable has been laid with the MV cables feeders, with a total length of 38 km.

The monitoring of all the MV/LV substations, will be included in Phase 2.

Future Implementations (Phase 2)

Design criteria, technical requirements and materials included in Phase 2 are already being defined.

CONSTRUCTION ACTIVITIES

Construction works are assured by two local companies under Enel supervision. Each contractor has open 2-3 working sites involving one to three hundreds local workers. The digging activity have been carried out with both manual and mechanical tools. The presence of so many workers along the streets and the open dig closed to the houses and local activities had a relevant impact in terms of safety. To manage this impact a team of four – five person belonging to the contractors were dislocated along each dig area to have a constant control of the correct use of individual protection devices and of adopting measures to protect local population. Also the safety team of Enicongo and Enel supervisors monitored the effective implementing of the required safety protection measures. In the period from April to December 2010 nearly 120 km of cable were installed without any relevant incident.

To connect each length of cable about 1500 joints have been installed. Enel has arranged a dedicate course to the selected personnel of contractors and SNE to train them to use tools and instruction for a correct execution of the joints. The voltage tests showed that nearly all the joints were resulted well executed, with very few outages

On December 31st 2010, progress on planned feeders works was at 94% (see Figure 4). Seven out of ten planned feeders are completed of which six are already in service.

Civil works at substations CT1bis (see Fig. 3) and 202 are moving ahead at a very satisfactory level and half 202 substation's MV busbar is already serving the existing feeders.

Enel Distribuzione has developed its own process and material standardisation combining experience and latest

technologies.

Enel's design and construction projects benefits outputs, fundamentals for a valuable, modern, reliable and performing distribution network can be summarised as follows:

- Reduction of tender estimation duration using Enel's standard schedule of rates
- Fully standardised and interchangeable network components, easily controlled and economically competitive
- Construction design guide detailing single components, aimed to simplify installation avoid mistakes and reduce installation and maintenance costs
- Know-how transfer between Enel and the local utility personnel (SNE) during design, construction and operational phases stimulated by specialised training and also supported by manufacturers
- Constant day by day Enel Engineers site supervision to overcome and solve promptly eventual construction difficulties through clear operative instructions

At the end of each final construction phase, Enel has provided punctual test specification and operational procedure.



Figure 3: CT1 bis MV Switchboard

RESULTS

In view of the start-up of the two Power Plants (CEC), together with the increased transformers installed capacity in primary substation Mongo Kamba 1 and the new MV feeders, in the city of Pointe-Noire the value of energy consumption registered a 29% increase: from 358 GWh (2009) to 463 GWh (2010).

This project works were also valuable for the existent grid which is now more reliable and able to warrants continuity of service;



Figure 4: Work progress at 6th January 2011

the plan for the future will be to double, at stages, the distributed LV power by erecting new secondary substations.

In conclusion the cooperation between the local distributor (SNE) and an experienced utility such as Enel, has proved a dramatic shrink of the design & construction duration (1 year) together with an assurance of quality and reliability design.

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