INFRABEL
Right On Track

Transition from 3 kV to 2x25 kV:

lessons from the past years

Jennifer Widart
Ir. Substations
Koen De Gussemé
Manager Substations & Power Distribution
11.02.19

INFRABEL
Right On Track

Contents

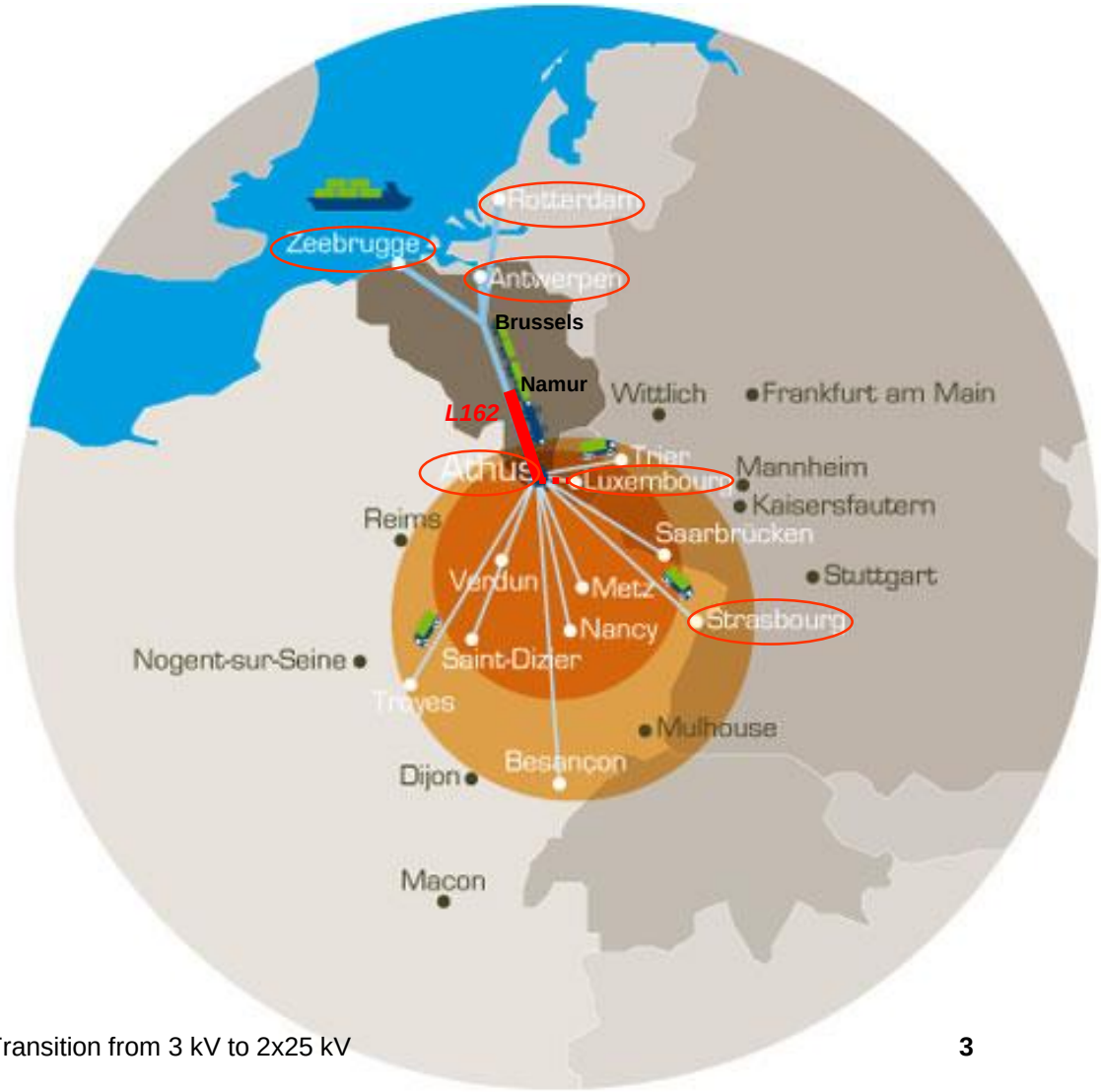
- Context and interests
- Re-electrification in 3kVDC
- Switching from 3kVDC to 25kVAC
- 2x25kVAC supply
- Specific technical problems/solutions

Context and interests

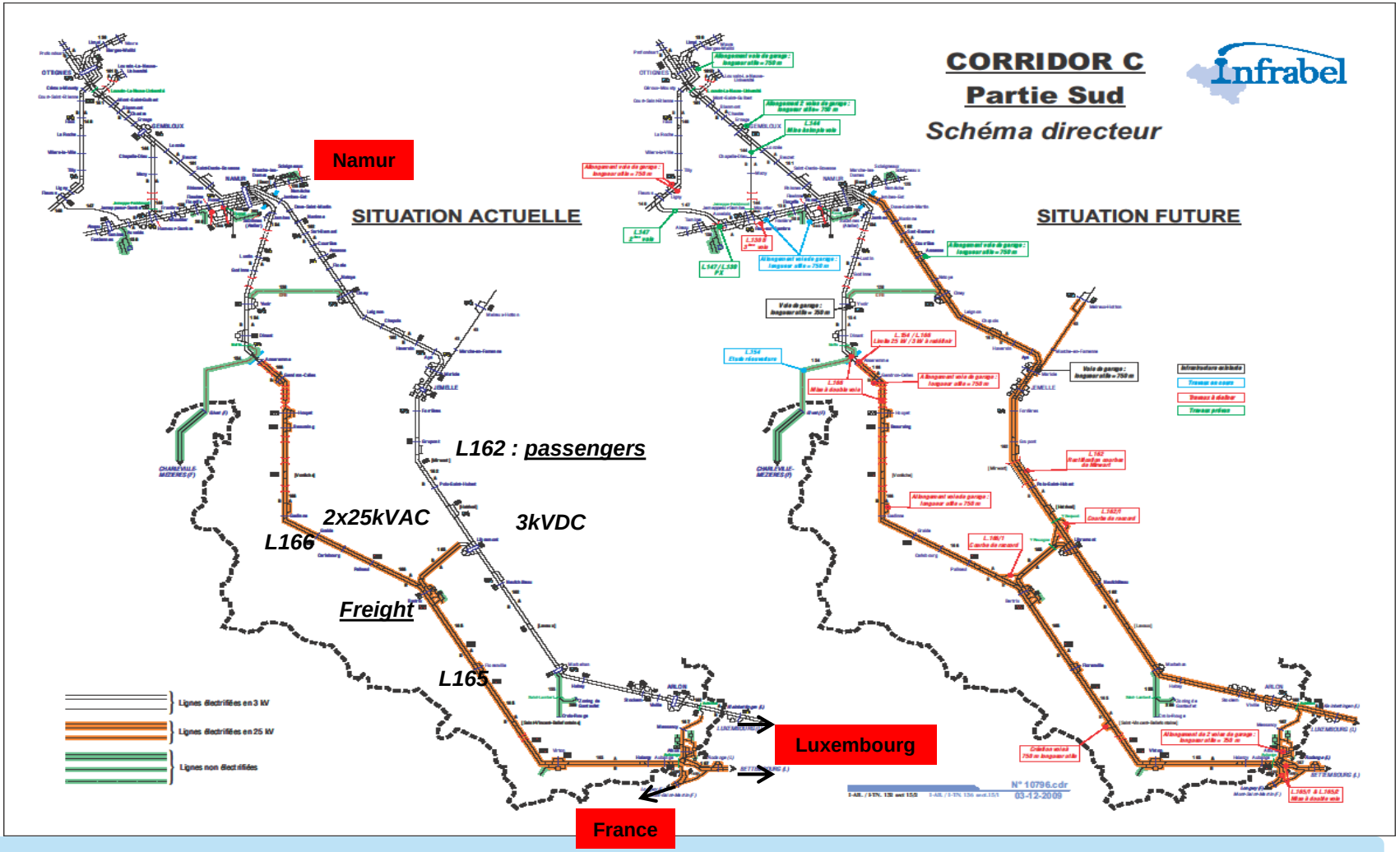
- **Situation – Corridor C**

➔ Freight transport from North Sea to Luxembourg, France and Switzerland

➔ Dry Harbor in Athus, to unload/relieve Antwerp Harbor ~ 300 containers/day



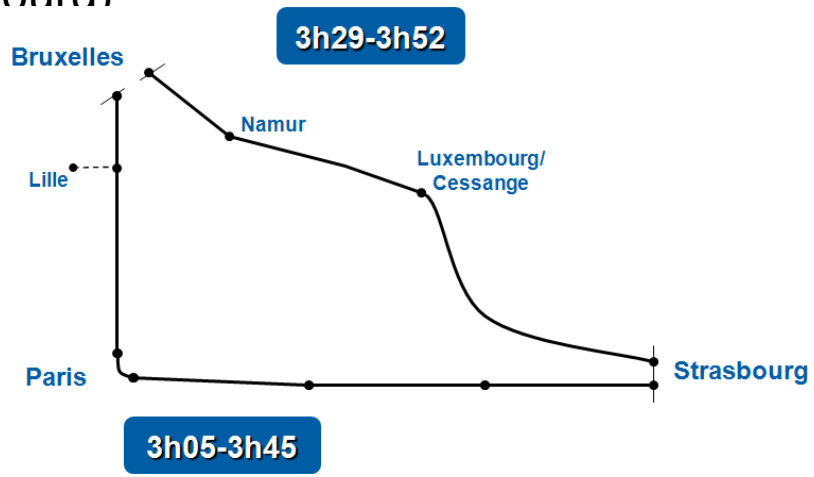
Context and interests

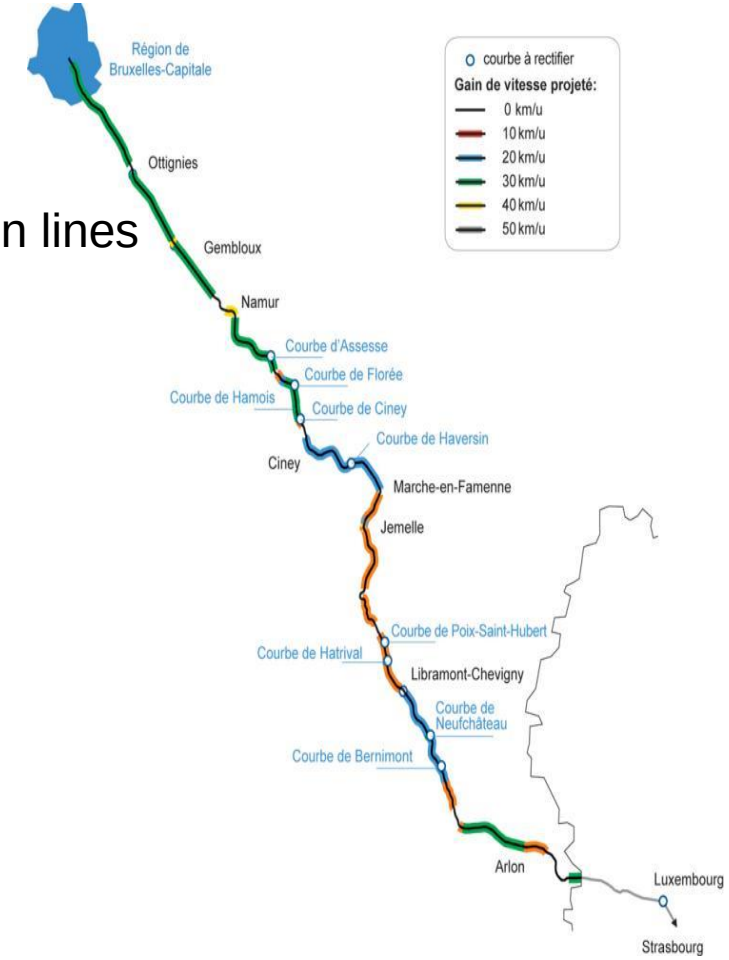


Context and interests

Interest of 2x25kV on L162 :

- Back-up : Freight on L162 in case of problem on lines 165 - 166
- Higher speed : 130km/h to 160km/h
- Saving time (10 – 20 min from Brussels to Luxembourg)





Context and interests

- **Interest of 2x25kV on L162 :**

➢CFL (Luxembourg railways) decided to modernize the axe Luxembourg – border in 25kVAC (2016)

➢Others access lines to Luxembourg (L165,166 and L42) are also in 25kVAC.

➢Power necessary for increasing speed and traffic

➢Loss of existing 70kV feeding points of power grid transmission operator (supply of our current 3kVDC substations)

➢Maintenance costs

➢ Energy & rolling stock aspects are favourable to the 25kVAC system

Context and interests

➔ Large project : modernization Brussels-Luxembourg Axe 3 ~ 1150 mio€$_{2017}$ (from Y LLN)

- curves rectification
- Modernization of grills stations
- Reelectrification
- Modernization on signaling
- Renewal of several engineering structures
- Improvement of track infrastructure (rails, platform, crossings, ect.)

➔L162 Namur – Luxembourg switch from 3kVDC to 25kVAC ~ 155 mio€$_{2017}$

- Substations - autotransformers posts – phase separations posts (~26M€)
- catenary adaptations (separation of systems zones)
- Return circuit (GC)
- Etc.

Reelectrification in 3kVDC

➔ **Preparing for the switching in 25kV**

1) Electrification in 3 kV with mixed OCL identically, keeping the same sectioning diagram, by sections of ~30km and with one track out of service for a long time period ~3 months

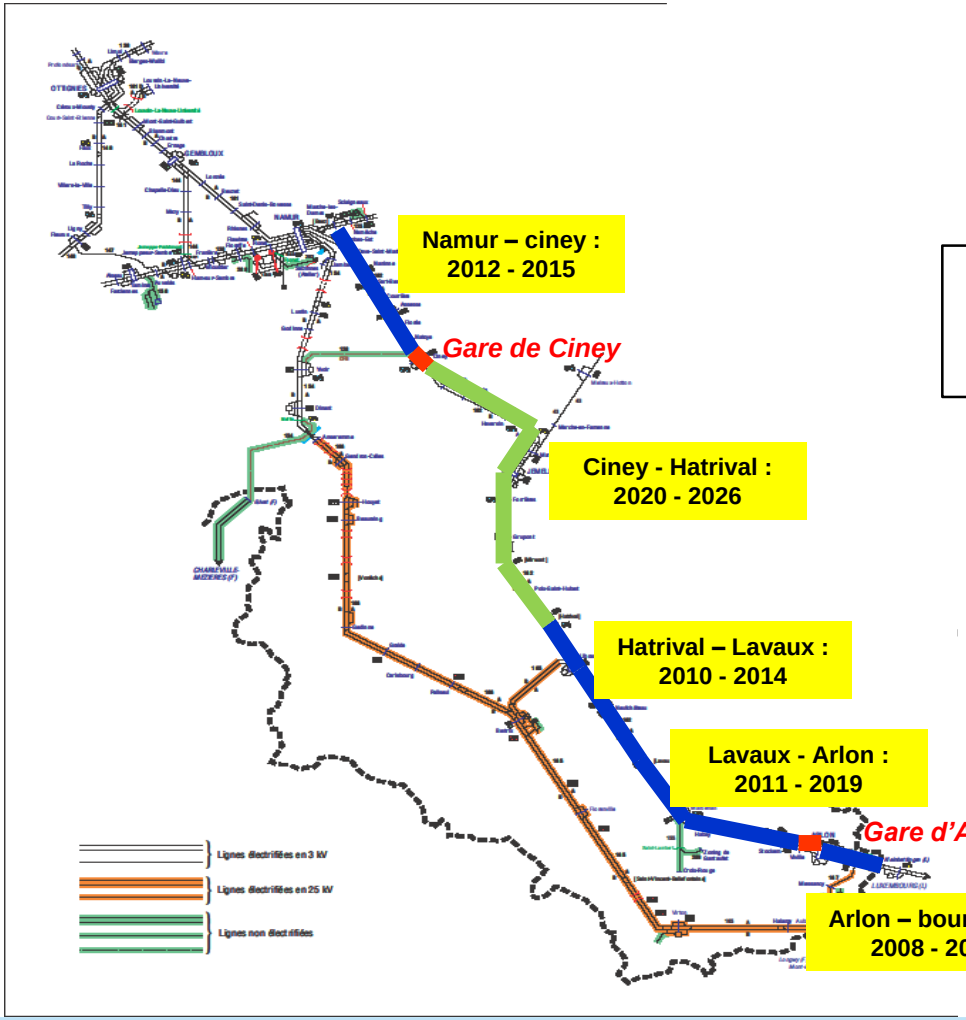
2) Definition of the 25 kV sectioning diagram and implementation (ZSP, ZN, 25kV feeding points, switches, position of HV posts, etc.)

3) Dimensioning of power supplies for normal and degraded situation

4) Preliminary tests before startup for different subsystems

➔ ***Challenge ! During all the works, the line stay in service***

Reelectrification in 3kVDC



INFRABEL
Right On Track

Conception des postes - PAT

Nouvelle approche par l'utilisation de cellules GIS :

- Diminution des coûts d'entretien
- Sécurité du personnel
- Diminution du risque de vol de câbles

Conception des postes – SST Heinsch

INFRABEL
Right On Track

Switch from 3kVDC to 2x25kVAC

1-2 months before :

- Establishment of the return circuit 25kV in its final configuration (except connection to rails)
- Remove parasites connections :
  - * feeder – catenary connections
  - * 3kV surge arrester
  - * 3kV switches
- using 25kV switches in 3kV (as disconnectors)

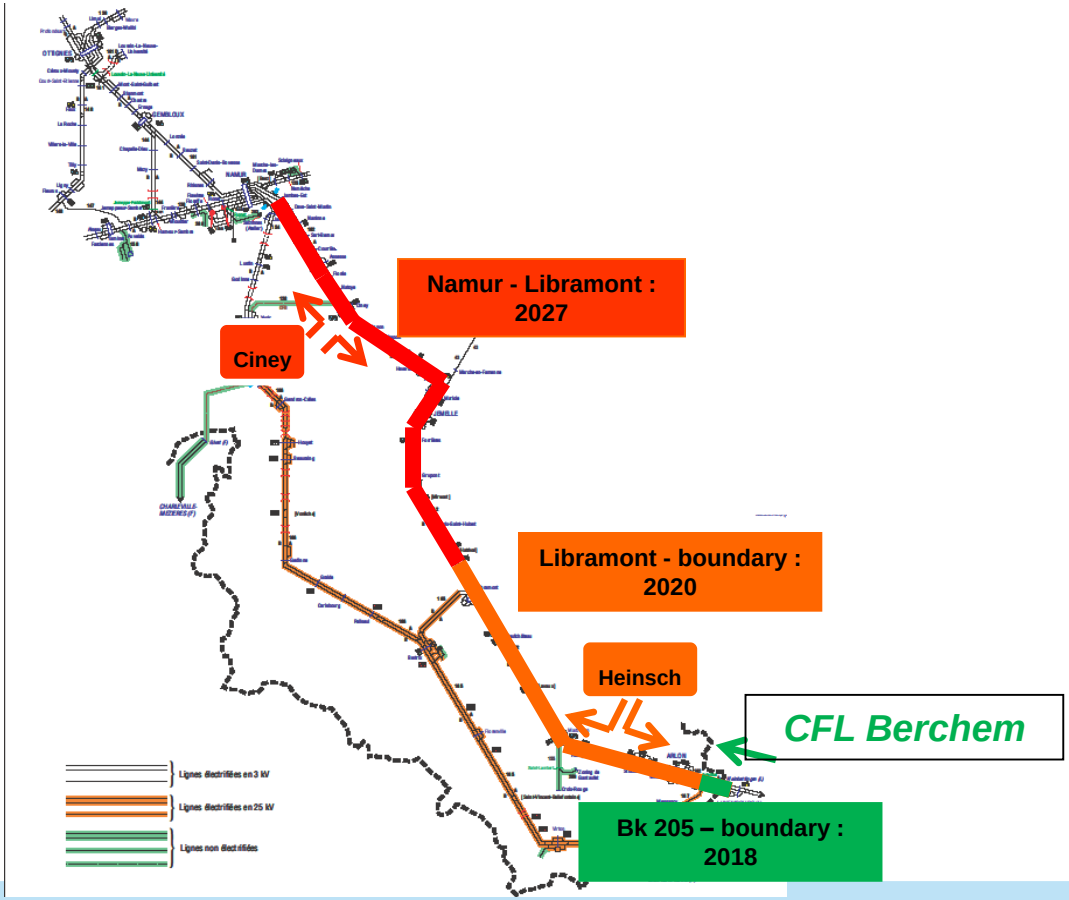
Switch into 1-2 weeks :

- Connection of 25kV switches on the feeding poles (substation and AT-post)
- Connections between posts and rails (return circuit) and rails to earth (LTI)
- Connection of the shield to earth of the second extremity of signaling cables
- Power-up tests unloaded
- Short circuit Tests between OCL and rails, and OCL and earth,
  Voltage measurements rails-earth
  Impedances measurements and protections settings/refinement
- Transform the phase separation zone into a voltage separation zone

➔ ***Challenge ! Switch of the power supply system into a very limited time***

Switch from 3kVDC to 2x25kVAC

Switch by sectors :



INFRABEL
Right On Track

Specific technical problems/solutions

Risks taking necessary for complete renewal of a line with continue train service and switching of supply system :

- ***Stray currents in 3kVDC :***
  - difficulties / complications for the implementation of the return circuit and earthing systems
  - limited risk of stray current corrosion by sectioning earthen cable
  - Long period of coexisting of AC circuits in operating in DC!
  - Earthing of structures (using VLD during DC supply to avoid stray currents)

- ***Weakness of the supply by a single substation during a long time period***
  - substation equipment design focus on reliability and availebility of catenary feeding (EMC, redundancies, protections…)
  - Availability increased by redundancy of the HV 220kV power supply

INFRABEL
Right On Track

Many thanks for your attention!
