

Impact uitdienstname Doel 3 en Tihange 2 (D4) tijdens winter 2012-2013

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### Import Limit for Winter 2012-2013 (1/2)



Following the announcement of **unavailability of two nuclear plants Doel 3 (D3) and Tihange 2 (T2)**, and according to the system adequacy studies, Belgium could need to import massively during periods of cold weather to cover its domestic demand, during several peak hours.

The goal of the study is to determine the maximum sum of NTC that Elia can propose on the import capacities (FR>BE and NL>BE), during the winter 2012-2013, available to the market

•supposing full availability of network elements (no maintenance)

•and without requiring further constraints to internal actors (the study supposes no must runs, and no may not runs).

#### Two scenarios have been tested:

•Situation of Feb. 2012 with increased but realistic constraints

#### •Full network available (no unavailable grid elements)

- Scenario 1 = 4500MW import & high loop-flows resulting from high FR import and DE+NL export
- Scenario 2 = 3500MW import & high loop-flows resulting from high FR import and DE+NL export
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3 levels of steady state validation (overvoltages, undervoltages, overloads, shortcircuit power, ...)

•N State simulation

•N-1 State simulation (each loss of an element of the internal 380kV, 220kV, 150kV grid (including interconnection lines) or a generator

•N-2 State simulation (combined loss of a generator and lines or cables or transformer in the vicinity of the generator of the internal 380kV grid (including interconnection lines)

4 levels of dynamic validation (transient overvoltages, transient undervoltages, transient overloads, stability of generators, generator speed and voltages, ...)

•Generator Critical Clearing Time determination

•Dynamic N-1 line, cable & transformers (Short-circuit on element followed by element opening)

•Dynamic N-1 busbars (Short-circuit on busbar followed by busbar clearing)

•Dynamic N-2 generators (stability in case of important flow of primary reserve)

A load margin on the dynamic stability is tested to identify interval of confidence

### Specific study for absense of D3 (+D4) + T2



Under the above mentioned hypotheses, the conclusions of the study are that :

→ During the winter 2012-2013, in absence of D3, D4 and T2,

- **BE can import 3000 MW** with limited additional conditions on the market; NL export to BE and FR should be limited to 2300MW or FR import should be limited to 2000MW.
- BE can import 3500MW (Sum of NTC) in the winter, under the condition that either this power is supplied by DE or FR is not importing from DE nor NL.
- $\rightarrow$  During the winter 2012-2013, in absence of D3 and T2,
  - **BE can import 3500MW** (Sum of NTC) in the winter under the condition that **no more than 2400MW** of this power is supplied by NL (or north of DE).
  - BE can import **4500 MW**, under the condition that the imported **power is supplied by DE** (center or south).
  - No condition on FR import is required in these scenarios.

# Specific study for absense of D3 + T2, 3500 MW Import case result



	Scenario	BE (NTC) Balance = NTC+TRM North	Total NTC FR & BE (out of 6500MW)	NL (and/or North DE)	FR (from DE & NL)	South and Center DE (towards FR & BE)	Static	Dynamic
*	/	-3500	6500 (100%)	3500	-3000	3000	N – OK N-1 PST – NOK	NOK
<b>√</b>	10	-3500 (PST#1)	6500 (100%)	2850	-3000	3650	N – OK, N-1 – OK, N-2 OK	CCT – OK, N-1 Elements – OK, N-1 BusBars – OK, N-2 Nuclear – OK.
<b>√</b>	10b	-3500 (PST#3)	6500 (100%)	2400	-3000	4100	N – OK, N-1 – OK, N-2 OK	CCT – OK, N-1 Elements – OK, N-1 BusBars – OK, N-2 Nuclear – OK.

# Specific study for absense of D3 + T2, 4500 MW import case result



	Scenario	BE (NTC) Balance = NTC+TRM North	Total NTC FR & BE (out of 6500MW)	NL (and/or North DE)	FR (from DE & NL)	South and Center DE (towards FR & BE)	Static	Dynamic
*	/	-4500	6500 (100%)	3500	-2000	3000	N – OK N-1 PST – NOK	/
$\checkmark$	11	-4500 (PST#1)	6500 (100%)	1400	-2000	5100	N – OK, N-1 – OK, N-2 OK	CCT – OK, N-1 Elements – OK, N-1 BusBars – OK, N-2 Nuclear – OK.
$\checkmark$	11b	-4500 (PST#3)	6500 (100%)	1050	-2000	5450	N – OK, N-1 – OK, N-2 OK	CCT – OK, N-1 Elements – OK, N-1 BusBars – OK, N-2 Nuclear – OK.

# **Specific study for absense of D3 + T2, case result**



### **Steady state N-1 limits:**

PST Zandvliet on minimal accepted tap position and Van Eyck at maximum power flow in N 1.

•Low voltages in Heimolen, Aalst Noord, Ligne, Aalst, Ninove and Eizeringen in case of N-1

•Doel and Tihange produce their maximum quantity of reactive power,

#### **Dynamic limits:**

•Critical Clearing time (CCT) of SOLJEM 1 & 2 @ 200ms due to low Ssc.

•Transient undervoltages Voltage in Heimolen, St Pauwels, St Gillis, Woluwe: Risk of local voltage collapse. Very slow voltage recovery in BayerMi and Flora. Load tolerance < 1000MW to avoid large scale voltage deviation in case of N-1 line or cable.

•Transient undervoltages in the East ("la boucle de l'Est") in case of clearing of Brume1\_1 and in the region of Izegem in case of clearing of Avelgem1. Risk of local voltage collapse.

•Load tolerance < 1000MW to avoid low voltages in the region of Hannut, Saive, in the region of Pondrôme and overloads of Avelin-Avelgem and Doel-Zandvliet in case of N-2 nuclear.

•DEGUSSA is lost due to the dynamic behavior of the system related to the loss of any 2 nuclear power plants. This is mainly due to the limited short-circuit power.

### **Main Conclusions**



During the winter 2012-2013, in absence of D3 and T2 and in full availability of network elements,

- **BE can import 3500MW** (Sum of NTC) in the winter under the condition that **no more than 2400MW** of this power is supplied by NL (or north of DE).
- BE can import **4500 MW**, under the condition that the imported **power is supplied by DE** (center or south).
- No condition on FR import is required in these scenarios.