Energy Transition in Belgium – Choices and Costs

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Agenda

- Introduction
- Times Belgium Exercises
- Results
  - Power capacity & generation
  - Power system costs
- Conclusions
  - Energy Transition
  - Modeling
Introduction - Current Context in Belgium

- **Nuclear Phase-out:**
  - 6 GW planned to be phased-out by 2025
- **‘Energy Union’ – EU GHG and RES targets for 2020 & 2030**
- **Belgium ‘Energie Pact’:**
  - Clear long-term integrated vision
- **Energy Dependency:**
  - Strategical position of Belgium as a hub for transmission in EU;
  - Reliance on electricity and natural gas.
- **Electrification of Belgium’s Energy System:**

Source: [www.modernpowersystems.com](http://www.modernpowersystems.com)
Introduction - Timeline

Jan/2017 - ‘Energy Transition in Belgium: Choices and Cost Study’ by FEBELIEC

“Experts’ views on possible energy scenarios for Belgium till 2030 including their implications on energy security and energy system costs.”

Aug/2017 - ‘The Role of Natural Gas in the Belgian Energy Transition till 2030’ by EDF-Luminus

“Assessing the impact of different levels of natural gas capacity in for electricity generation. Showing the relevance of natural gas to keep the electric system safe and affordable.”

Dec/2017 - Signature of Belgium Energy Pact by 4 energy ministries

“Assessing impacts on costs, power capacity and generation towards new scenarios for the power sector. Better depiction of the role of nuclear, offshore wind and natural gas power technologies.”

Feb/2018 - ‘Sensitivity scenarios for the underpinning choices for the Belgian Energy Pact’ by Greenpeace, BBL, IEW
Impact

Kerncentrales of niet: energie wordt sowieso duurder

Bataille de Eleia

En attendant que le gouvernement se mette d'accord, ça s'active également du côté des lobbys. Et cette fois, c'est au tour de l'ONG Greenpeace, associée à Inter-Environnement Wallonie (IEW), d'y aller de sa petite contribution. Ils publient ce jeudi une étude, réalisée par EnergyVille (des chercheurs de la KU Leuven et de l'UHasselt). Détail piquant : cette étude n'est pas tout à fait neuve. Il s'agit en réalité d'une étude préparée pour EnergyVille en avril 2017. A

Increasing interconnections: to build or not to build, that is (one of) the question(s)

Addendum to the cost-benefit analysis of adequate future power policy scenarios

ur le lundi 30 janvier 2017 à 20h14

September 2017
Energy system model – TIMES
Building and using a TIMES model

The EnergyVille TIMES model for Belgium

- Belgium as geographic region with interconnections to neighbouring countries
- Energy Statistics from 2014 (corrected for 2016 data where available) as the base for the model
- Reporting years from 2016 to 2040 (varied among studies)
- Key sectors:
  - Power + Heat
  - Industry
  - Commercial
  - Residential
  - Agriculture
  - Transport
- To capture variations in balancing demand and supply a 2-hourly time resolution is used for 10 representative days (‘timeslice tool’).
- Technology assumptions aligned with EU and BE literature (JRC, 2013; Meuris et al, 2017, ...
Times Belgium Scenarios & Updates

EnergyVille (2017a)

2016, 2020, 2030
- Base + 4 scenarios:
  - Central/Base
  - 10% Import Restriction
  - Nuclear Extension 2GW
  - Low Fossil Fuel Price
  - High Fossil Fuel Price
- Step-wise approach for EE import price.

EnergyVille (2017b)

2016, 2020, 2026, 2030
- Base + 2 scenarios:
  - Central/Base
  - High NG Power Cap.
  - Low NG Power Cap.
- + EE import price with annual volatility;
- Detailing NG power plants (stock + life);
- NG CHP constraint;

EnergyVille (2018)

2016, 2020, 2030, 2040
- Base + 1 scenarios:
  - Central/Base
  - Nuclear Extension 2GW
- Updated NG prices;
- Improved nuclear AF;
- 2.2 GW offshore in 2020.
Electricity Trade

Import Price Approach

- Import price increases the more capacity is utilized for import flows within Belgium;
- Price variation within one period is based on the base year (for calibration) profile (2014);
- Price increase in the long term follows fossil fuel prices trend.
Nuclear generation with 2 reactors
EnergyVille (2018)

EnergyVille (2017a) – 80% average:

EnergyVille (2018) – 80% average:
Results

Results Central scenario – EV (2017a)

Power Sector - 2016 to 2030:

- Fossil-fuel generation capacity close to stable (mostly natural gas)
- Nuclear phases out
- Renewable capacity grows triples (x3)

Fossil-fuel generation growth by 2030
- 50% of Belgian generation originates from renewable sources in 2030
Results, Scenario Comparison – EV (2017a)

Power Generation, 2020 & 2030

- Nuclear extension reduces NG generation and imports;
- NG generation covers import restrictions;
- Fossil fuel prices impact import levels;

![Total Generation - TWh](chart)

Legend:
- Nuclear
- Natural Gas
- Other Fossil
- Biomass & Other Ren.
- Hydro
- Solar PV
- Wind Onshore
- Wind Offshore
- Net Imports
High and low fuel price scenarios result in the lowest and highest total energy generation systems costs.

Nuclear extension scenario (= partial delay in system transition) results in 11-12% lower system cost compared to central scenario in 2030.
Results, Scenario Comparison – EV (2018)

Power System Costs

- Lower gas prices:
  - lead to cost reductions;

- Nuclear extension lead to a 4% cost reduction in 2030:
  - Main driver of costs is fuel price
  - Same cost level in 2040;
Conclusions

For the energy transition in Belgium:

- RES expansion is key to the energy transition and must happen due to increased electricity demand;
- Natural gas PPs have an important role on flexibility and energy dependency:
- Annual power system costs are more sensitive to fuel prices than import prices and investment costs;
- Extension of 2 GW of nuclear capacity does not provide a long-term cost advantage to the power system;
- Nuclear extension would delay investments in natural gas power plants;
Conclusions

For modeling exercise:

- National energy systems models are a good basis to provide facts and figures regarding technology options and associated costs for the energy transition;
- Stakeholder engagement lead to legitimacy of the work;
- Transparency on assumptions and limitations of the exercise to stakeholders and broader audience;

Further work:

- Better depiction of interconnections and electricity import availability;
- Enhance grid requirements detailing for large amounts of RES in the system;
- Improve of representation of power costs and total costs;
Thank you!

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