Our Energy Future

UPDATE ENERGIESCENARIO 2016-2050

DEVELOPMENT REGIONAL MODELS

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Context and objective of the study

2014-2015

3E carried out a study with respect to future energy scenario's in Belgium for Greenpeace, BBL and WWF

- 2014: Development of a model that takes into account a large amount of technical, financial and economic parameters
- 2015: The model was extended (including detailed sensitivity analysis) for large biomass

May-November 2016

The impact of changed forecasts of installed capacities and cost and benefit parameters of different technologies compared to the forecasts made in 2014 was analyzed:

- Impact in terms of required investments
- Impact in terms of required subsidies

August-November 2016

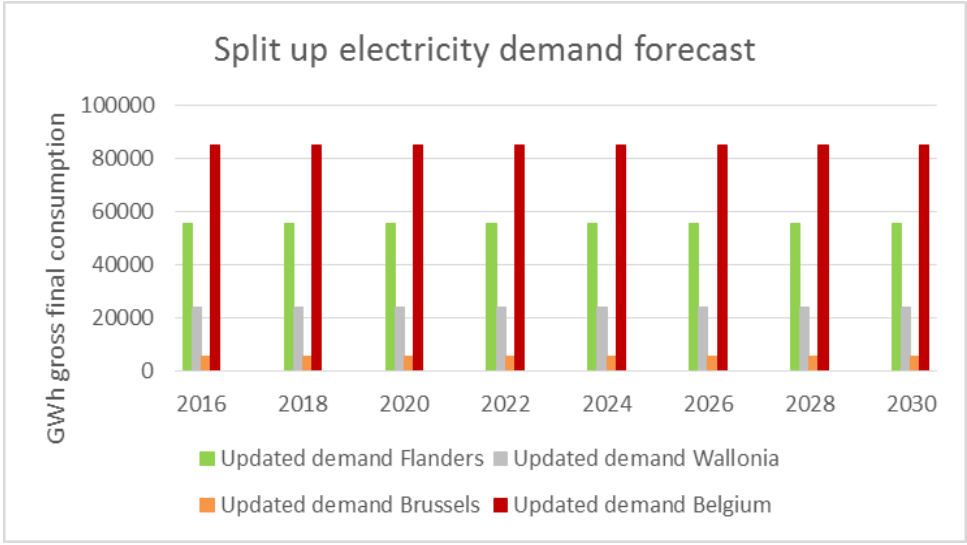
It can also be interesting to look into the required investments and subsidies in the future in both Flanders and Wallonia to better understand energy scenario's in those regions

The objective of this study is to develop separate models for Flanders and Wallonia, using the "Our Energy Future" Scenario as a starting point

Index

1. Split up **electricity demand** and **peak demand** in the “Our Energy Future” Scenario for Flanders and Wallonia
2. Split up **installed capacities** in the “Our Energy Future” Scenario for Flanders and Wallonia as a theoretical exercise
3. Determine the resulting required **subsidies** and **investments** in Flanders and Wallonia
4. Determine the resulting **energy mixes** in Flanders and Wallonia

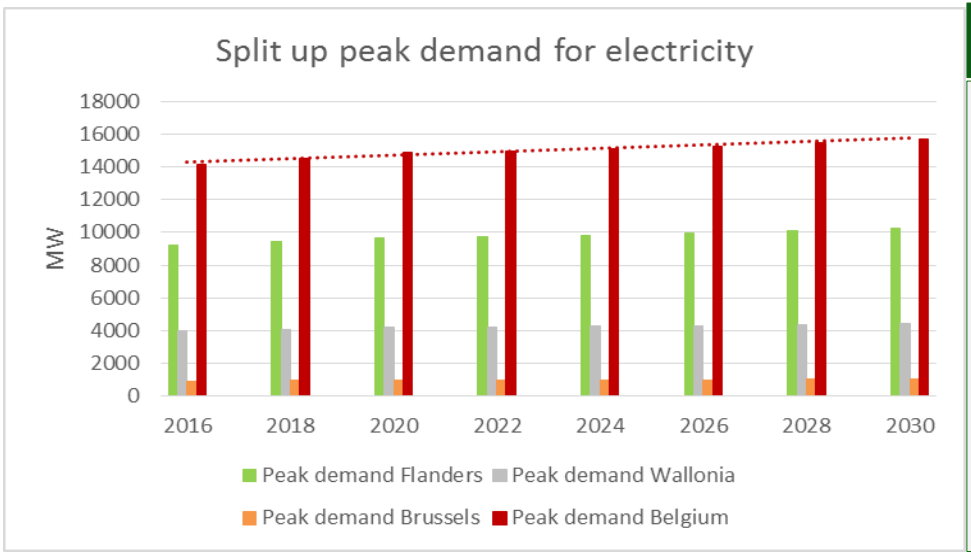
1.Split up demand in the “Our Energy Future” Scenario



Source: Elia 2016, VITO 2015, ICEDD 2014 and IBGE 2013

Main drivers

- Electricity demand is expected to be stable up to 2027 (Elia adequacy report 2016)
- The split up of electricity demand in 2013-2014 is used to split up demand forecasts:
  - 65.1% in Flanders
  - 28.3% in Wallonia
  - 6.6% in Brussels

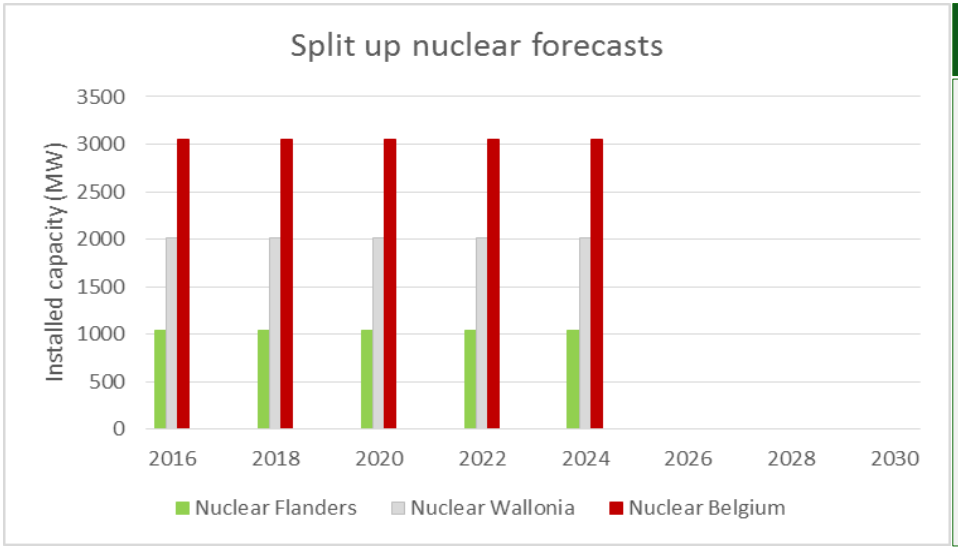


Source: VITO 2015, ICEDD 2014 and IBGE 2013

Main drivers

- The split up of electricity demand in 2013-2014 is used to split up peak demand forecasts:
  - 65.1% in Flanders
  - 28.3% in Wallonia
  - 6.6% in Brussels

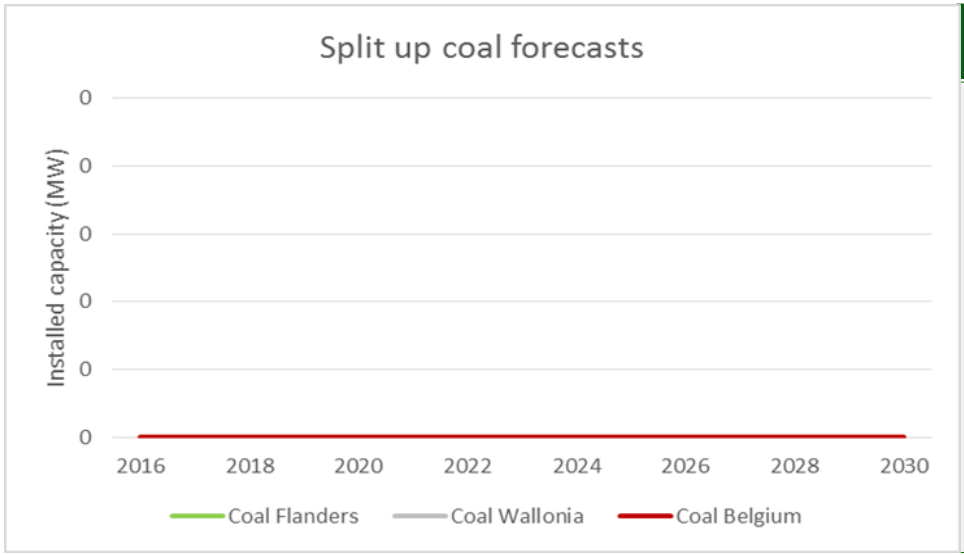
2.Split up installed capacities in the “Our Energy Future” Scenario



Source: PRIS database IAEA

Main drivers

- Starting point is an installed capacity of around 3046MW in Belgium in 2016
- Doel 4 (1037 MW) in Flanders and Tihange 1 and 3 (2009 MW) in Wallonia will be the only plants running in 2020

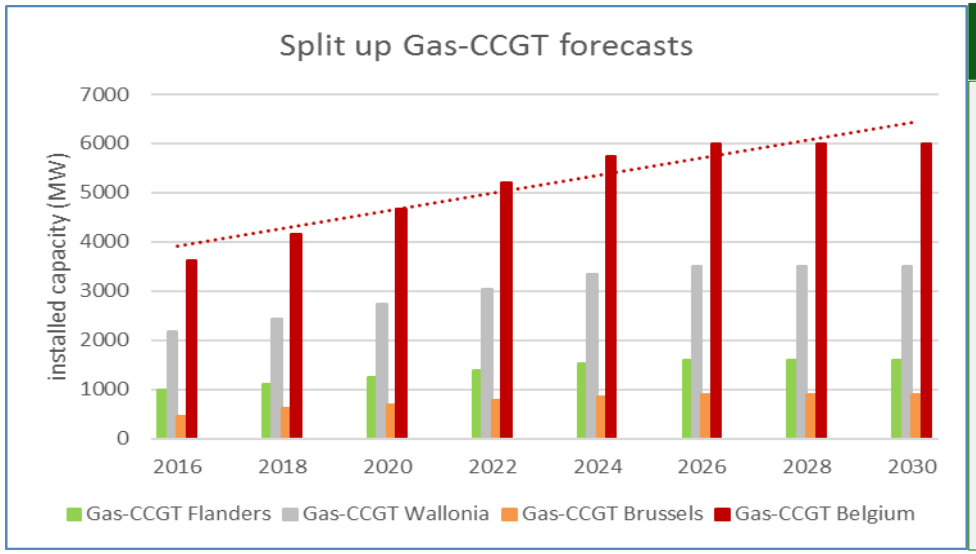


Source: Federal Planning Bureau, 2015

Main drivers

- No coal in Belgium in 2016 and afterwards

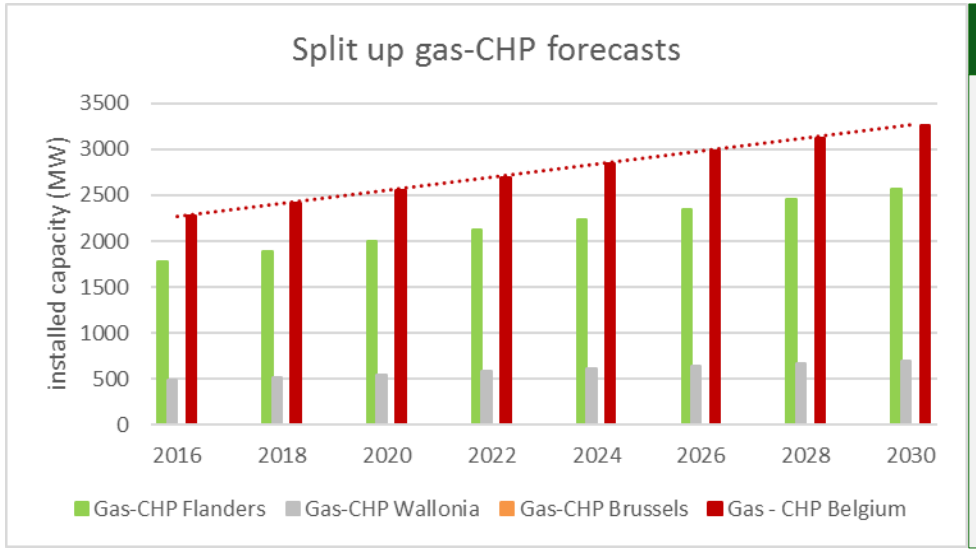
2.Split up installed capacities in the “Our Energy Future” Scenario



Source: VITO 2015, ICEDD 2015 and University of Ghent 2013

Main drivers:

- 460 MW for Drogenbos plant in Brussels in 2016 and 2017
- The split up of installed capacities in 2013-2014 is used to split up forecasts:
  - 26.5% in Flanders
  - 58.5% in Wallonia
  - 15% in Brussels

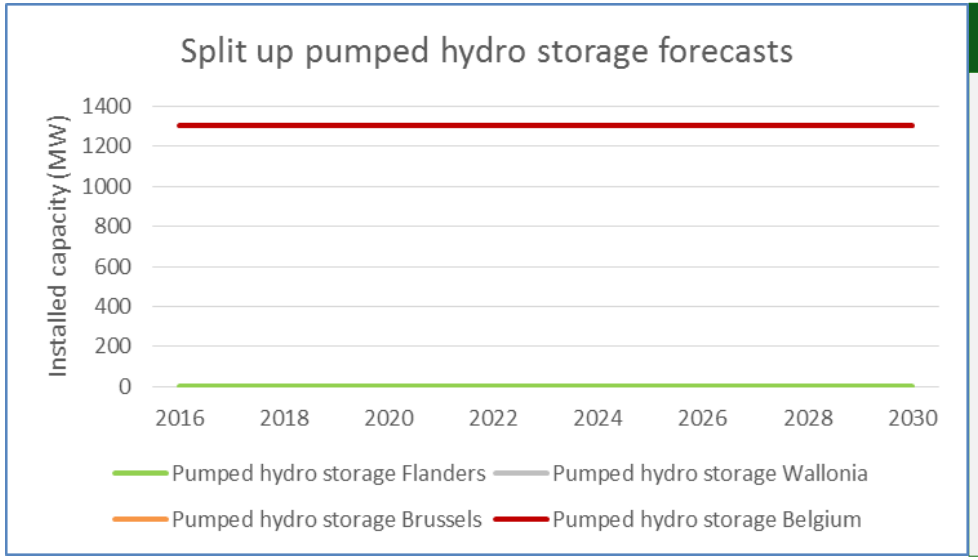


Source: VREG 2016, ICEDD 2015 and Brugel 2015

Main drivers:

- The split up of installed capacities in 2013-2015 is used to split up forecasts:
  - 78.5% in Flanders
  - 21.5% in Wallonia
  - No gas-CHP in Brussels

2.Split up installed capacities in the “Our Energy Future” Scenario

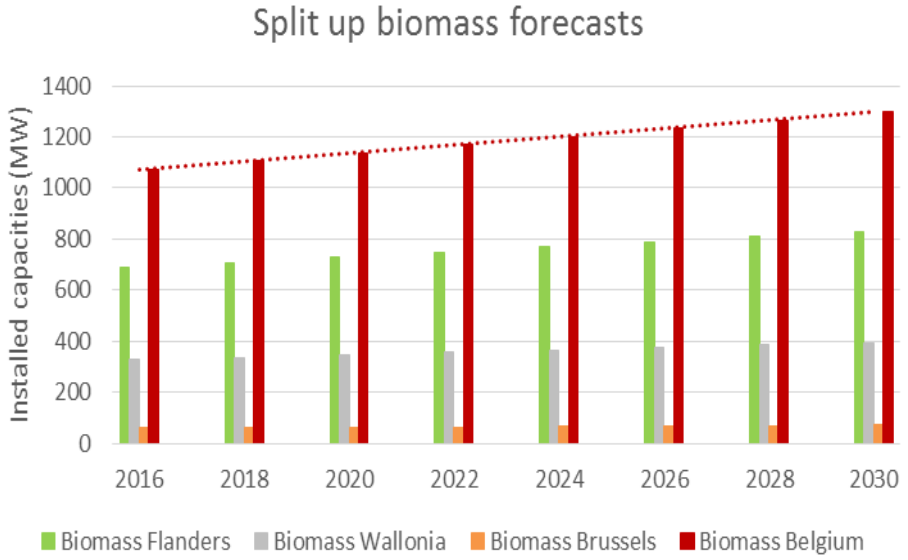


Main drivers:

- We assume that all pumped hydro storage capacities will be in Wallonia in the future – as it is the case in 2016
- We assume that no new pumped hydro storage capacities will be installed up to 2030

Source: Enerdata 2016

2.Split up installed capacities in the “Our Energy Future” Scenario

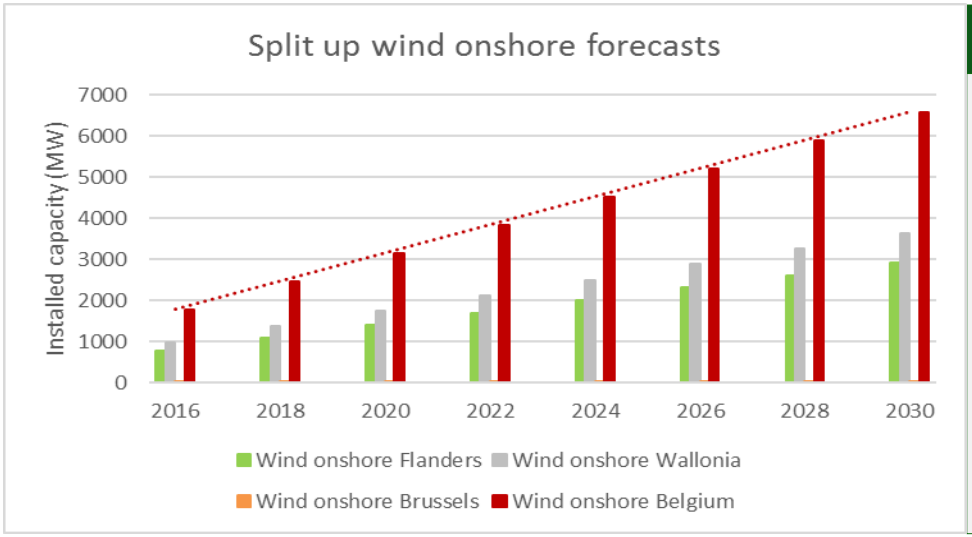


Main drivers:

- The split up of installed capacities in 2013-2015 is used to split up forecasts :
  - 64% in Flanders
  - 30.5% in Wallonia
  - 5.5% in Brussels
- Capacities in 2016 include Max Green and Awir
- It can be expected that larger units will be replaced be a higher amount of smaller units in the long run

Source: VITO 2016, CWAPE 2014 and Brugel 2015

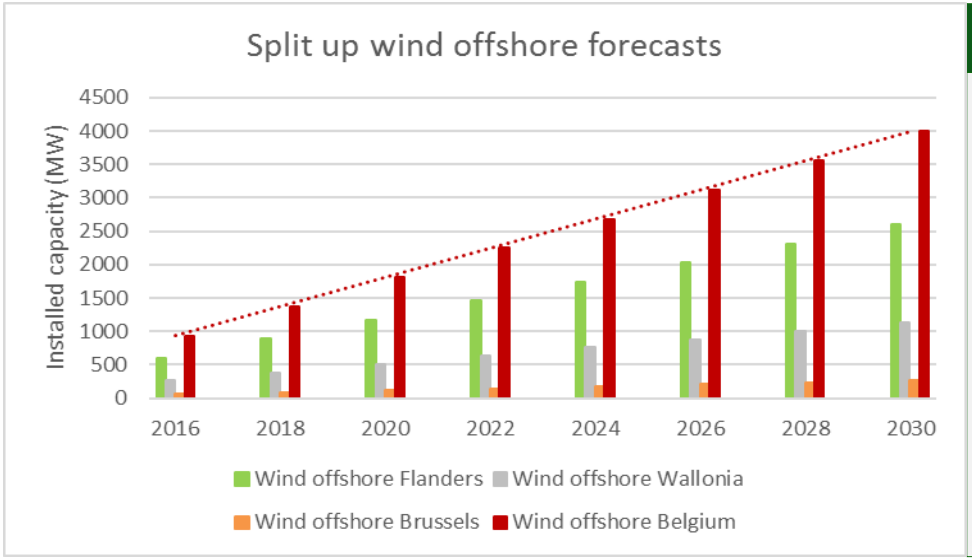
2.Split up installed capacities in the “Our Energy Future” Scenario



Main drivers:

- Split up of forecasts by split up land surface in 2013:
  - 55.2% land surface in Wallonia
  - 44.3% land surface in Flanders
  - 0.5% land surface in Brussels

Source: Belgian Federal Government 2013

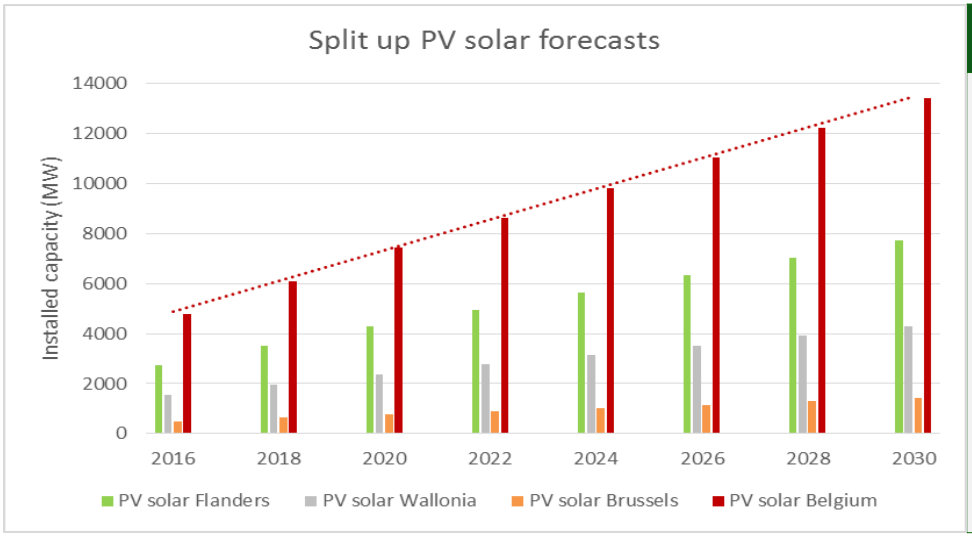


Main drivers:

- Split up forecasts by electricity demand in 2013-2014:
  - 65.1% in Flanders
  - 28.3% in Wallonia
  - 6.6% in Brussels
- Theoretical exercise because offshore wind is managed on the federal level

Source: VITO 2015, ICEDD 2014 and IBGE 2013

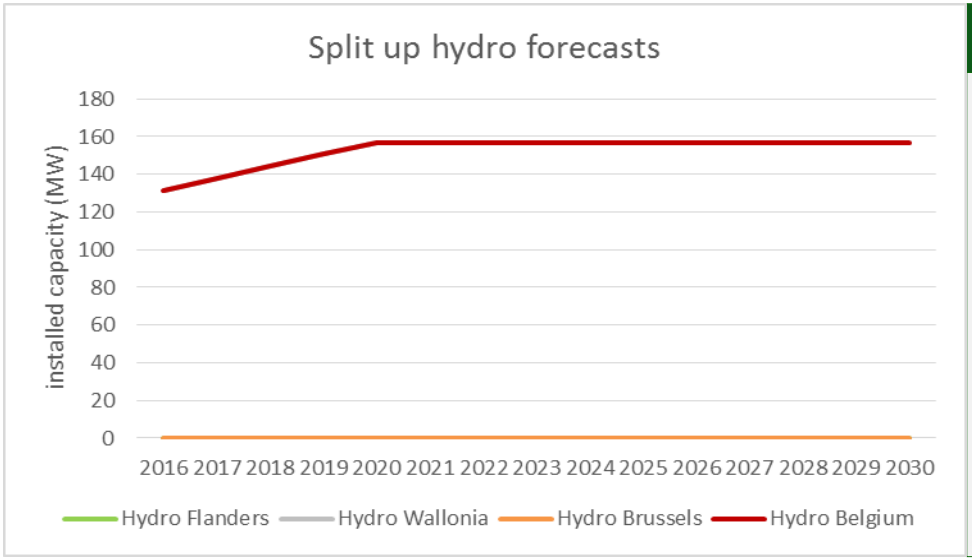
2.Split up installed capacities in the “Our Energy Future” Scenario



Source: Belgian Federal Government 2015

Main drivers:

- Split up of forecasts by split up per capita in 2015:
  - 57.5% in Flanders
  - 32% in Wallonia
  - 10.5% in Brussels



Source: Federation Wallonie Bruxelles

Main drivers:

- We assume that all hydro capacities will be in Wallonia in the future – as it is the case in 2016

3.Resulting subsidies and investments: Flanders

	Subsidies 	Investments 
Flanders	4.7 bn €	19.9 bn €
Wallonia	*3.1 bn €*	*13.5 bn €*
Belgium ("Our Energy Future" Scenario)	*8.6 bn €*	*36.2 bn €*

NB: Calculations done over the period 2016-2050

Flanders	Required subsidies Flanders 2016-2050 (M€)	Required investments Flanders 2016-2050 (M€)
Nuclear	0	0
Coal	0	0
Peak Units	0	0
Gas - CCGT	-455	-635
Gas - CHP	0	-1,000
Biomass small	-1,253	-711
Wind - onshore	-105	-3,544
Wind - offshore	-2,871	-7,500
Solar PV	-12	-6,558
Hydro	0	0
Geothermal	0	0

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NB: Calculations done over the period 2016-2050

Required subsidies Flanders:

- Subsidies in order of importance over period 2016-2050:
  1. Wind offshore
  2. Biomass small
  3. Gas CCGT
  4. Wind onshore

Required investments Flanders:

- Investments in order of importance over period 2016-2050
  1. Wind offshore
  2. Solar PV
  3. Wind onshore
  4. Gas CHP

3.Resulting subsidies and investments: Wallonia

	Subsidies 	Investments 
Flanders	*4.7 bn €*	*19.9 bn €*
Wallonia	3.1 bn €	13.5 bn €
Belgium ("Our Energy Future" Scenario)	*8.6 bn €*	*36.2 bn €*

NB: Calculations done over the period 2016-2050

Wallonia	Required subsidies Wallonia 2016-2050 (M€)	Required investments Wallonia 2016-2050 (M€)
Nuclear	0	0
Coal	0	0
Peak Units	0	0
Gas - CCGT	-1,003	-1,402
Gas - CHP	0	-274
Biomass small	-597	-339
Wind - onshore	-131	-4,417
Wind - offshore	-1,248	-3,261
Solar PV	-7	-3,649
Hydro	-164	-209
Geothermal	0	0

3.Resulting subsidies and investments: Wallonia

	Subsidies 	Investments 
Flanders	*4.7 bn €*	*19.9 bn €*
Wallonia	3.1 bn €	13.5 bn €
Belgium ("Our Energy Future" Scenario)	*8.6 bn €*	*36.2 bn €*

NB: Calculations done over the period 2016-2050

Required subsidies Wallonia:

- Subsidies in order of importance over period 2016-2050:
  1. Wind offshore
  2. Gas CCGT
  3. Biomass small
  4. Hydro and wind onshore

Required investments Wallonia:

- Investments in order of importance over period 2016-2050
  1. Wind onshore
  2. Solar PV
  3. Wind offshore
  4. Gas CCGT

4.Resulting updated energy mixes in 2020 and 2030 in “Our Energy Future” Scenario

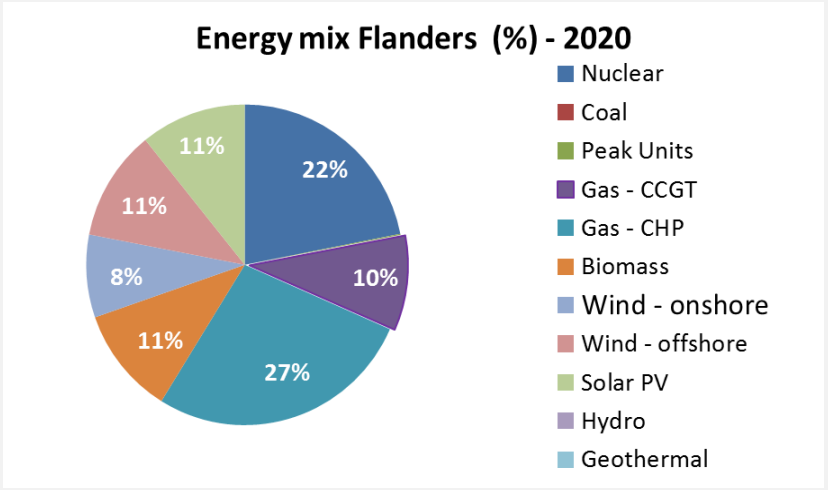
*Energy mix=

$$\frac{\text{(Total renewable energy production)}}{\text{(Total electricity demand)}}$$

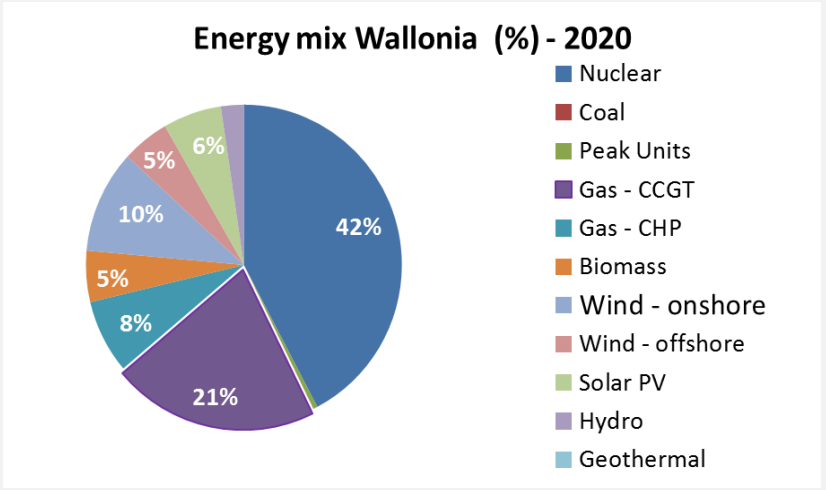
*Gross total electricity demand in Belgium: 85000 GWh/year

4.Resulting updated energy mixes in 2020

	Flanders			Wallonia		
GWh Produced	2016	2020	2030	2016	2020	2030
Biomass	3,782	4,005	4,562	1,802	1,909	2,174
Wind - onshore	1,740	3,078	6,425	2,168	3,836	8,005
Wind - offshore	2,122	4,120	9,114	922	1,791	3,962
Solar PV	2,561	3,974	7,182	1,425	2,211	3,997
Hydro	0	0	0	722	864	864
Geothermal	0	0	0	0	0	0
Total renewable energy production	10,205	15,177	27,283	7,040	10,610	19,002
Total electricity demand	55,335	55,335	55,335	24,055	24,055	24,055
RE %	18%	27%	49%	29%	44%	79%



RE = 27%



RE = 44%

4.Resulting updated energy mixes in 2030

	Flanders			Wallonia		
GWh Produced	2016	2020	2030	2016	2020	2030
Biomass	3,782	4,005	4,562	1,802	1,909	2,174
Wind - onshore	1,740	3,078	6,425	2,168	3,836	8,005
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Solar PV	2,561	3,974	7,182	1,425	2,211	3,997
Hydro	0	0	0	722	864	864
Geothermal	0	0	0	0	0	0
Total renewable energy production	10,205	15,177	27,283	7,040	10,610	19,002
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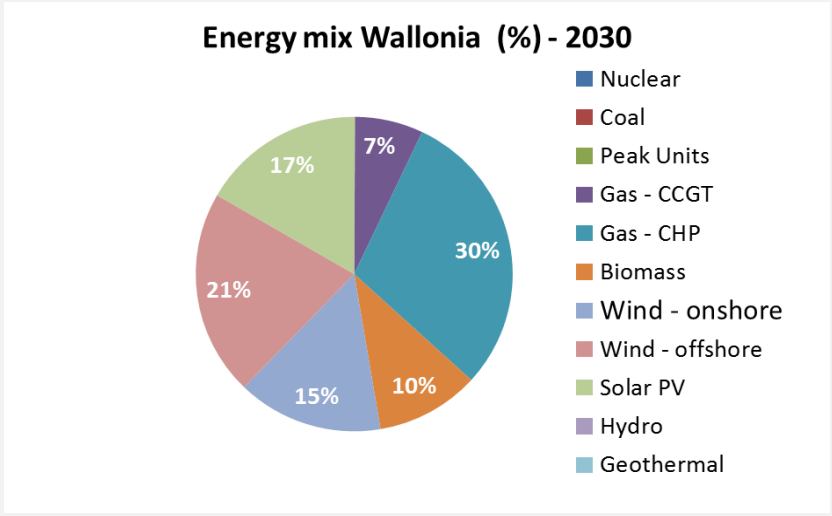
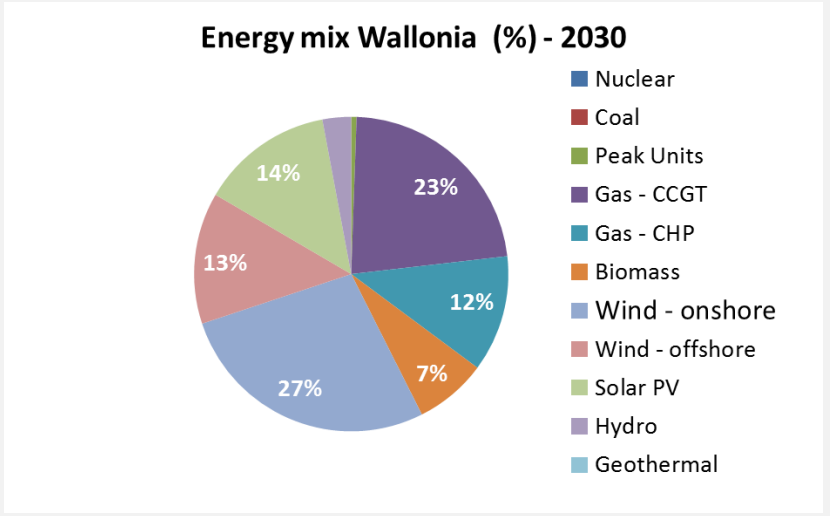
RE %	18%	27%	49%	29%	44%	79%



RE = 49%



RE = 79%

Conclusions

- Required subsidies and investments are higher in Flanders than in Wallonia in “Our Energy Future” Scenario
- The share of RE is higher in Wallonia than in Flanders because production of RE is only moderately lower (30% in 2020) whereas electricity demand is significantly lower (57% in 2020)
- It will be a very challenging task to reach the 202020 objectives under present circumstances

Conclusions

- Wind onshore and PV solar demand high investments in both regions but the required subsidies are rather low
- Required subsidies for PV are low compared to subsidies for other technologies
- Wind offshore requires high resources in terms of subsidies and investments

Thank you

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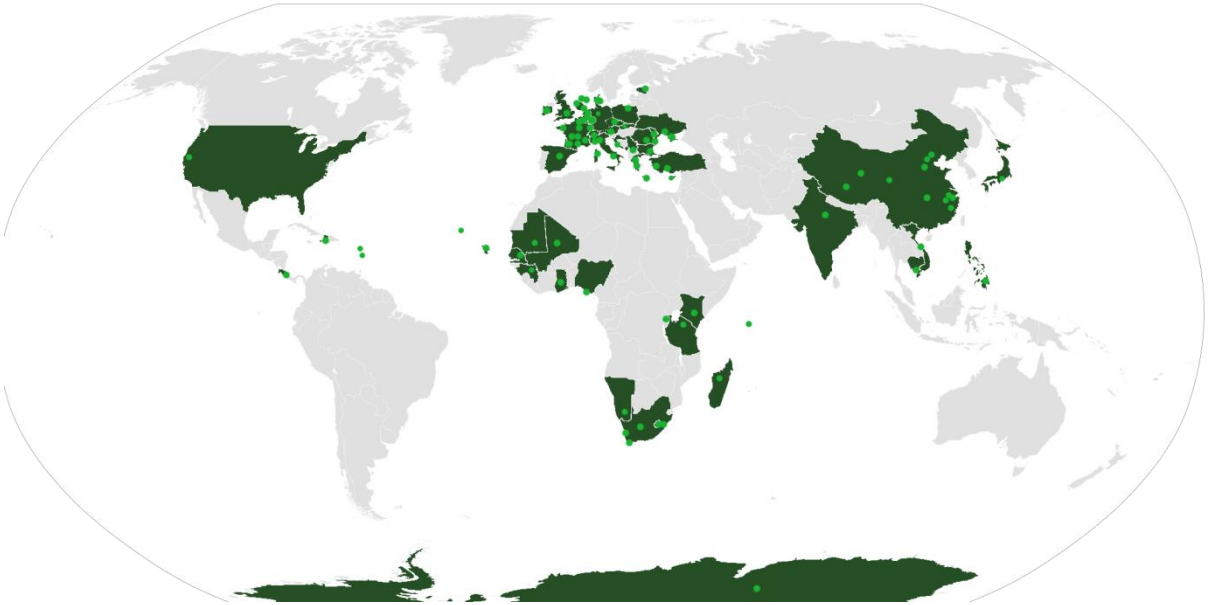

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