

Quelles solutions énergétiques faut-il favoriser pour participer à la transition vers un territoire zéro-énergie? Stratégie appliquée au cas de la région Wallonne.

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TRANSITION METHODOLOGY TOWARDS AN AUTONOMOUS QUASI-ZERO-ENERGY-TERRITORY APPLIED TO THE CASE OF THE WALLOON REGION. DEVELOPMENT OF A DESIGN ASSISTANCE TOOL

Travail de fin d'études réalisé en vue de l'obtention du grade de Master en Ingénieur Civil
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ABSTRACT

The notion of energy transition refers to a revision of the production and consumption modes of energy, by the transit from an energy system using almost all non-renewable energy sources towards an energy mix based on 100% of renewable resources.

In the current context, the purpose of this work is to meet the challenges of energy demand and production that arise today in a perspective of social justice and sustainable development, so as to trigger an energy transition of territorial scale and to emancipate from non-renewable energies.

Therefore, the goal is to design a methodology that will define the most effective energy and sustainable solutions in a perspective of transition toward a quasi-zero-energy territory (TqZE). And to create an interactive support tool, based on the Microsoft Excel software, that will help implement the variables and optimize the energy performance of the territory.

The studied methodology is based on the annual demands for heat (heating, hot water), air conditioning, and electricity (lighting, ventilation, electrical appliances, etc.) in the residential and tertiary sectors. At the end of this work, the interactive calculation tool will highlight one or more energy transition scenarios of the TqZE. The parameters taken into account affecting 4 criteria called the 4A (availability, affordability, accessibility, acceptability) to integrate technical, urban and social concepts in the transition strategy.

This work consists of two main parts. A theoretical part including a state of the art and the development of a transition methodology towards a quasi-zero-energy-autonomous territory (TqZEA). And a practical part allowing to apply this transition approach on the Walloon territory via the elaborate calculation tool. The results, related to the implementation of a transition methodology to a TqZE, the creation of the calculation tool and its application on a real case, make it possible to draw different conclusions.

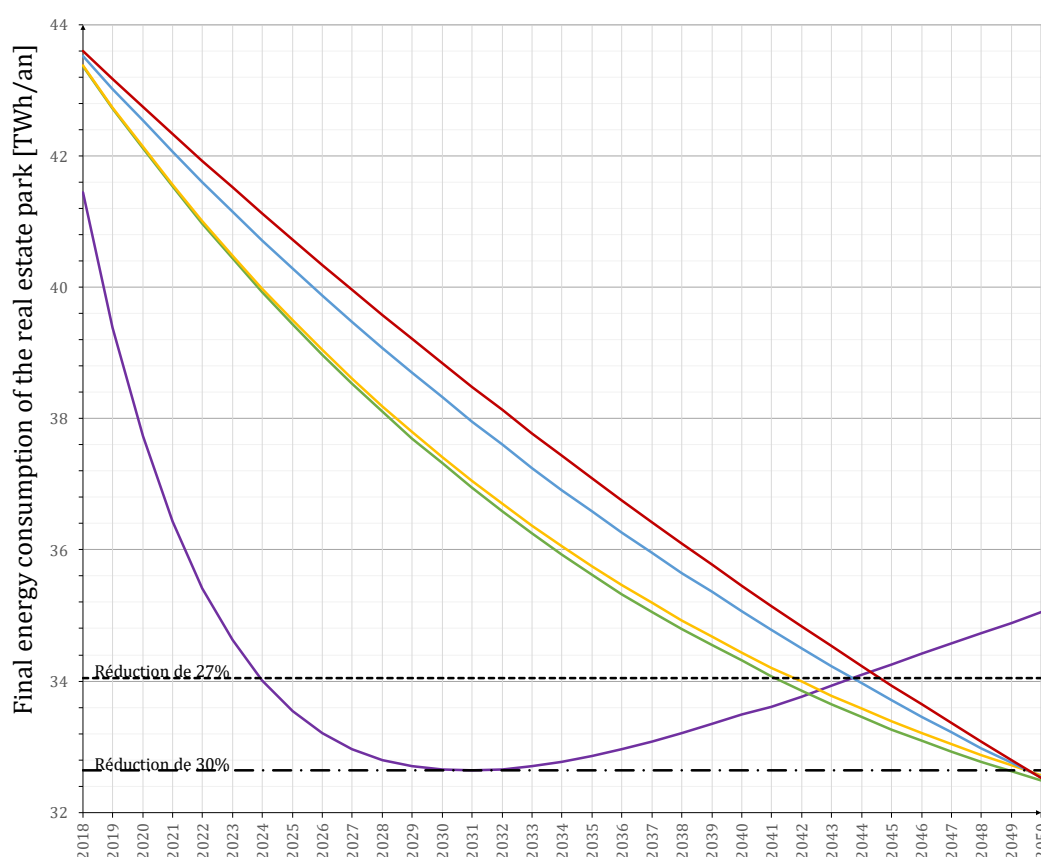
First of all, one of the main lessons of this study is that a new Walloon energy model must be created in order to participate in the transition to a zero-energy territory by 2050. It is brought out from this work that the energy performance requirement for the renovated buildings is the most important factor of impact. It has effect on the efficiency, the profitability and the acceptability of the energy transition strategy. The challenges of sustainable transition must therefore be articulated around the decrease of the final energy demand in the buildings to be renovated. It also appears that the evolution towards an energy system based exclusively on renewable energies implies improvements in the energy efficiency of production systems in terms of availability but also of power. Variations in the production rates of the energy park having a less perceptible influence.

This work focuses on the search for innovative solutions towards a more sustainable urban development mode for the planet, concerned with the well-being of the population, respectful of its environment, and adapted to future generations. By answering the 4 criteria presented (availability, accessibility, affordability, acceptability), a territory assimilates all the concerns of a sustainable development. It is thus transversal by integrating the different dimensions of sustainable development that are the environment, the society, and the economy.

SELF EXPLANATORY RESULTS

Summary of the total simulation (consumption / production) of the Walloon territory regarding the 4A criteria

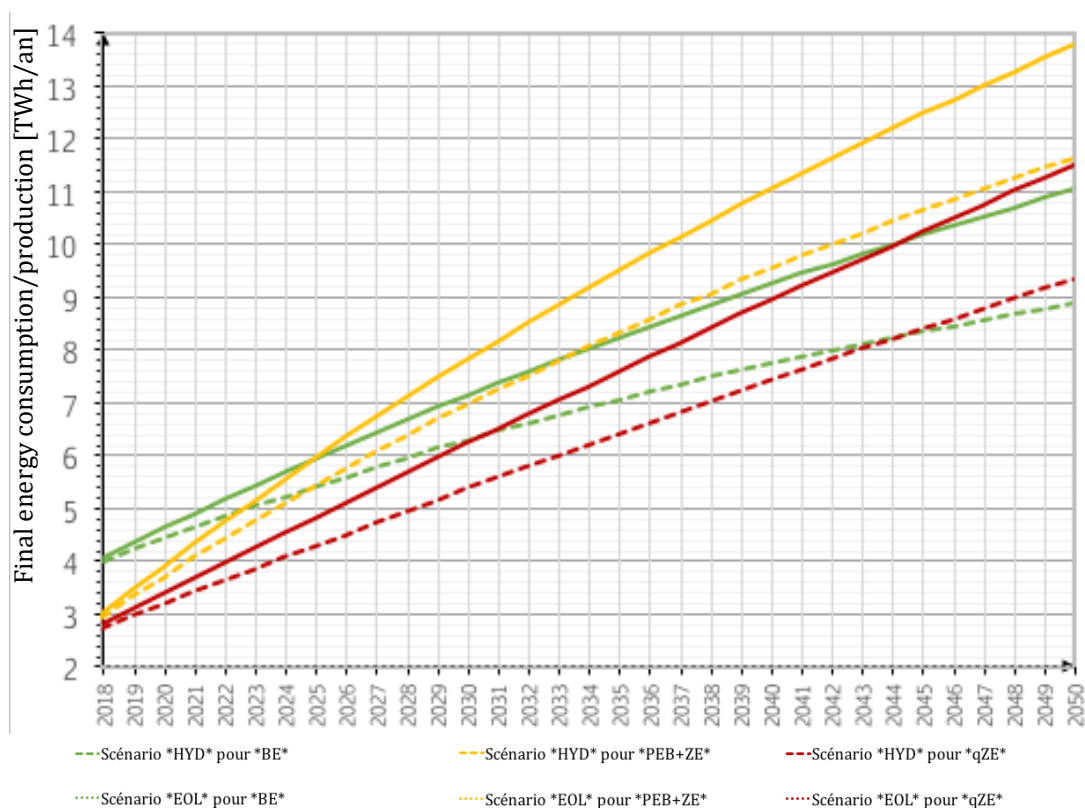
	PEB		*BE*		*PEB+ZE*		*PASSIF*		*qZE*	
	*HYD *	*EOL *	*HYD *	*EOL *	*HYD *	*EOL *	*HYD *	*EOL *	*HYD *	*EOL *
Availability	-2		2		1+0		1		1+0	
	(-2)	(-2)	2	1	2	1	(-2)	(-2)	2	1
Accessibility	(-2)	(-2)	1	1	1	2	(-2)	(-2)	1	1
Affordability	(-2)		1		2		1		1	
	(-2)	(-2)	2	1	1+0	1	(-2)	(-2)	1	1
Acceptability	(-2)		1		1		1		2	
	(-2)	(-2)	1	1	2	1	(-2)	(-2)	1	1
TOTAL (= $\sum 2^x$)	1,75	1,75	20	16	22	19	7	7	19	17

Comparison of the rehabilitation scenarios of the Walloon real estate park

Scenarios	Renov. rate	Specific energy consumption by building					
		RENOVATION		NEUF		REFERENCE	
		RESI.	TERT.	RESI.	TERT.	RESI.	TERT.
	%	kWh/m ² .an	kWh/m ² .an	kWh/m ² .an	kWh/m ² .an	kWh/m ² .an	kWh/m ² .an
PEB	18,9	115	130	85	115	168,99	201,87
BE	3,6	85	115	45	90		
PEB+ZE	4,5	115	130	0	0		
PASSIF	2	45	90	45	90		
qZE	1,4	45	90	0	0		

Comparison of the transformation scenarios of the Walloon energy park

The *PEB* scenario is out of play for the rest of the production simulation since the availability requirement is not respected. The *PASSIF* scenario is also excluded because it ranks last in the list.



Scenarios	Production rate			Percentage of roof cover PV	Final power production			
	hydro.	wind.	PV		hydro.	wind.	PV	pre-existent
	site	unite	%		GWh/an.site	GWh/an.unité	kWh/m ² .an	GWh/an
HYD	2,5	0	70	30	15,179	4,135	107,50	2536,1
EOL	0	25	70	30				