Refurbishment strategy

Brussels Capital Region

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BRUXELLES ENVIRONNEMENT

IBGE - INSTITUT BRUXELLOIS POUR LA GESTION DE L'ENVIRONNEMENT

Energy Efficiency Directive (2012/27)

Article 4 :

Member States shall establish a long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private. This strategy shall encompass:

a) an overview of the national building stock based, as appropriate, on statistical

(b) identification of cost-effective approaches to renovations relevant to the building type and climatic zone;

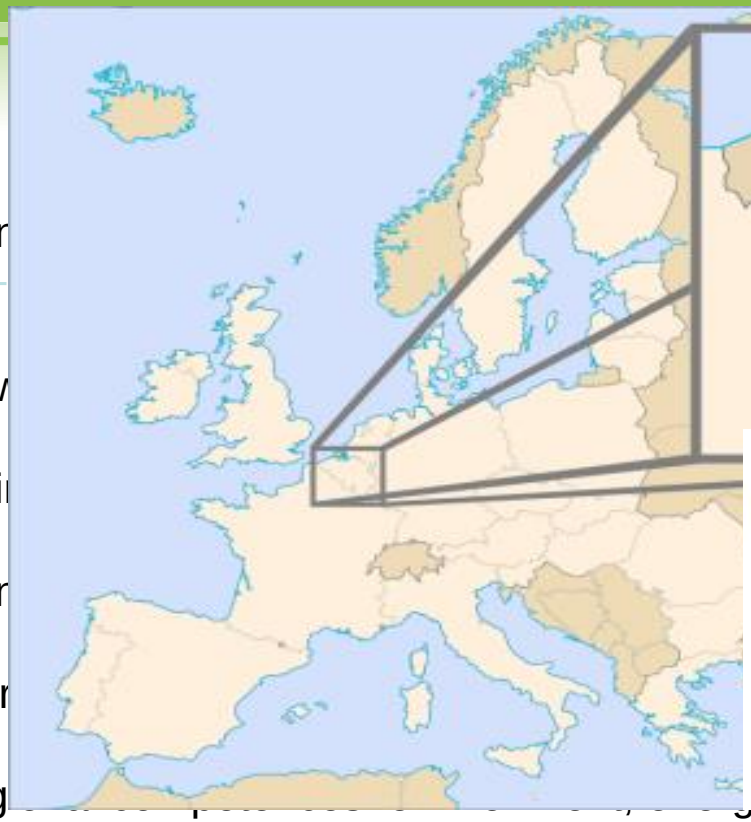
(c) policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations;

(d) a forward-looking perspective to guide investment decisions of individuals, the construction industry and financial institutions;

(e) an evidence-based estimate of expected energy savings and wider benefits.

BRUSSELS SITUATION

- 162 km²
- 1,1 millior
  expected +
- 630.000 v
- Old buildi
- 75% of er
- Very low r
- Large reg
  mobility, urbanism, housing, …



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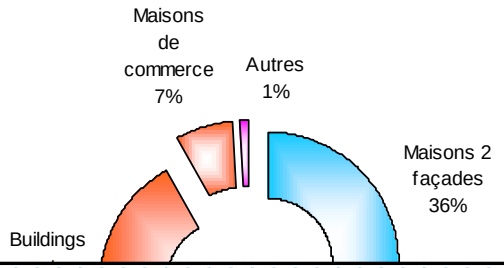
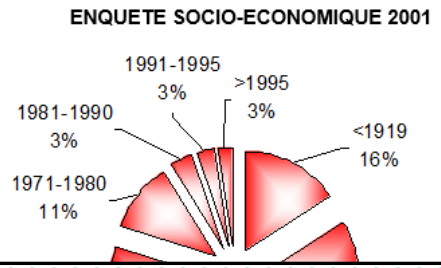
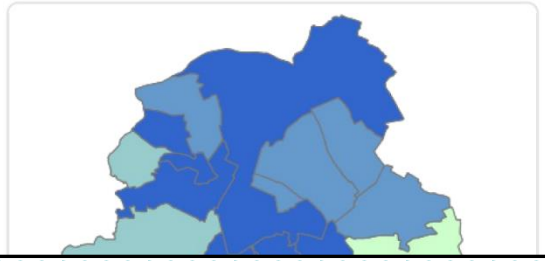
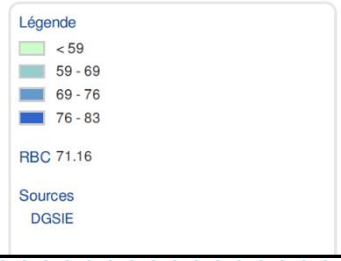
BRUSSELS CONTEXT : DATA SOURCES









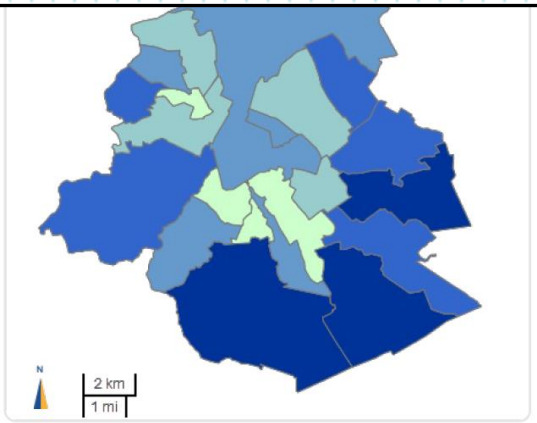
Data sources :

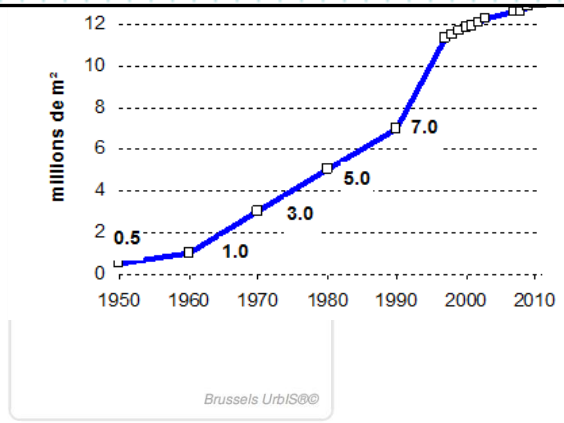
Brussels-Capital energy balance (2012)

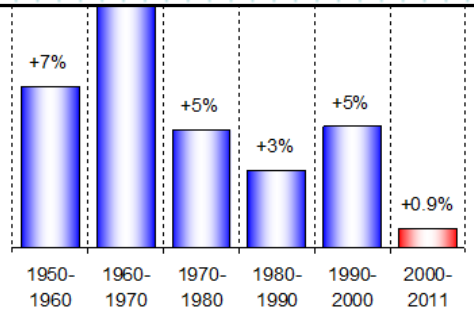
Neighbourhoods monitoring : www.monitoringdesquartiers.irisnet.be

National statistics : http://statbel.fgov.be

« Energy Consumption Survey for Belgian households » (2011)

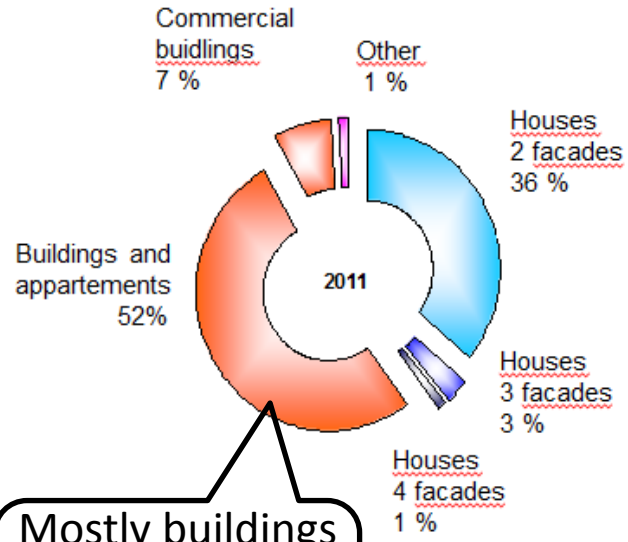






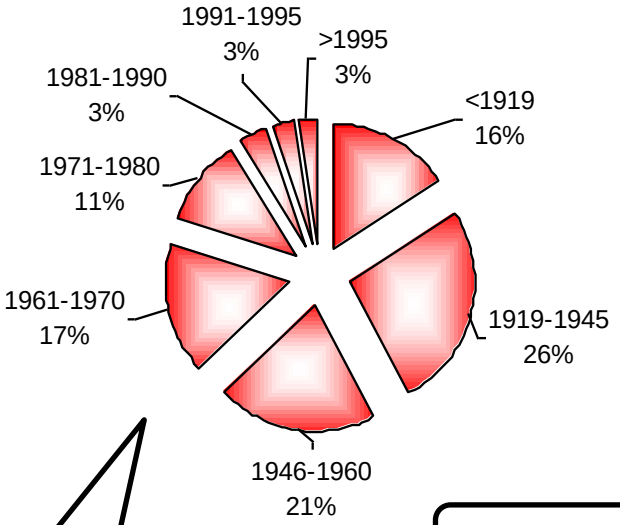
BRUSSELS CONTEXT : BUILDING STOCK PARTICULARITIES

Type



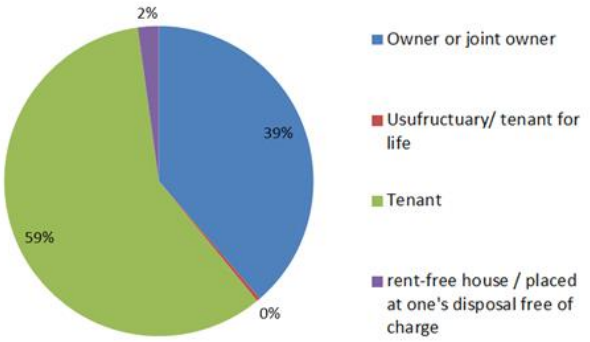
Mostly buildings and 2 facades houses

Age



Mostly build between 1919 and 1970

% Owner – tenant



Majority of tenant

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

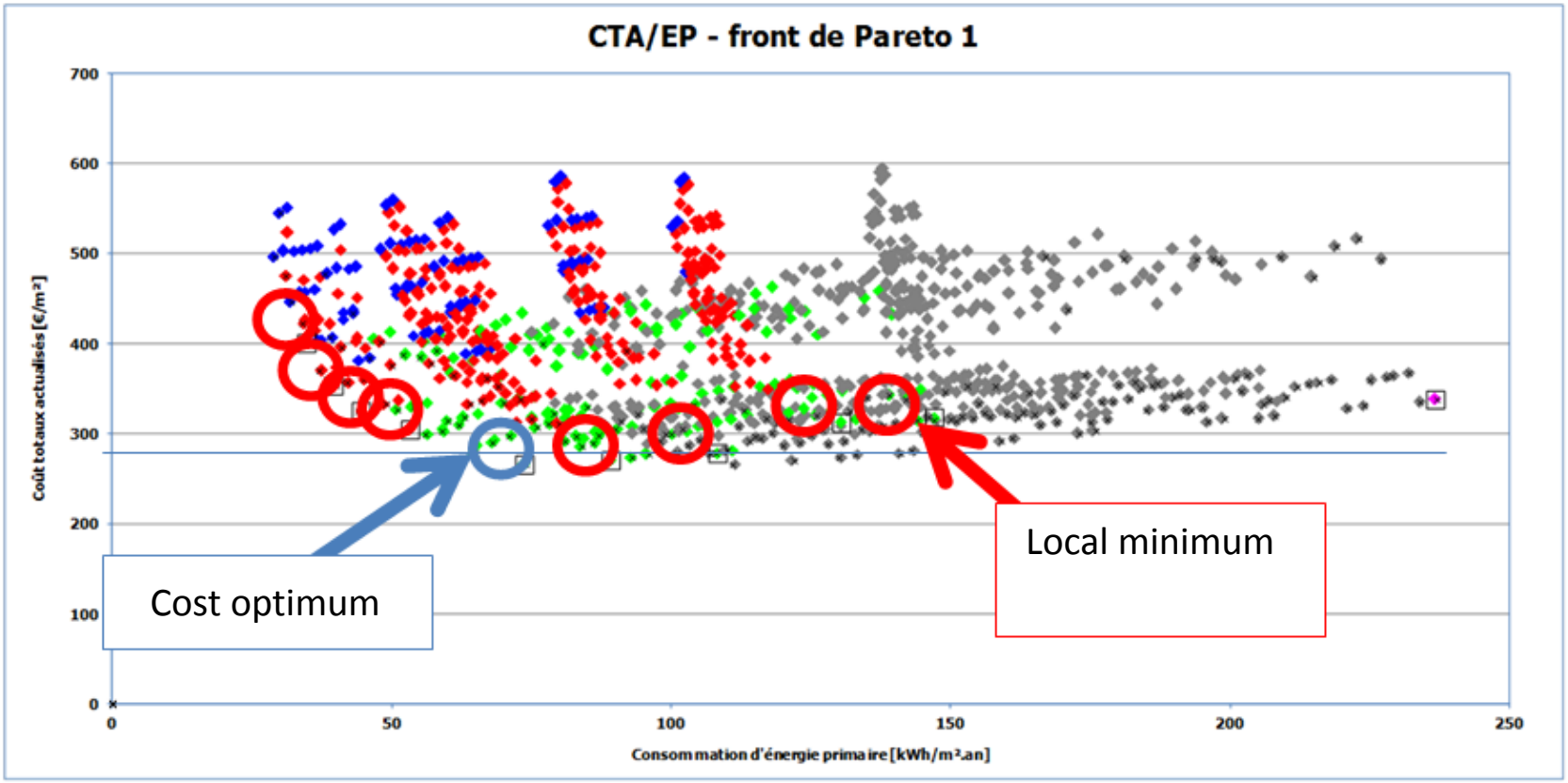
- Based on the « **Cost-optimum** » study required in the framework of the EPBD directive

- **Cost effective approaches for refurbishment** = architectural and technical solution which provide the most important primary energy savings for a minor global cost

- **Global cost** = global cost of an installation in terms of net value for a determined time
  - 30 years for residential and public building (dwellings)
  - 20 years for non-residential (offices) and commercial buildings

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Types of buildings studied : houses, apartments and offices
Analyse of architectural and technical alternatives



(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Evaluation of primary energy consumption (and potential savings)	Dwellings (2 facades houses + apartments)	Offices
Heating	X	X
Sanitary hot water	X	
Cooling	X	X
Auxiliary	X	X
Lighting		X

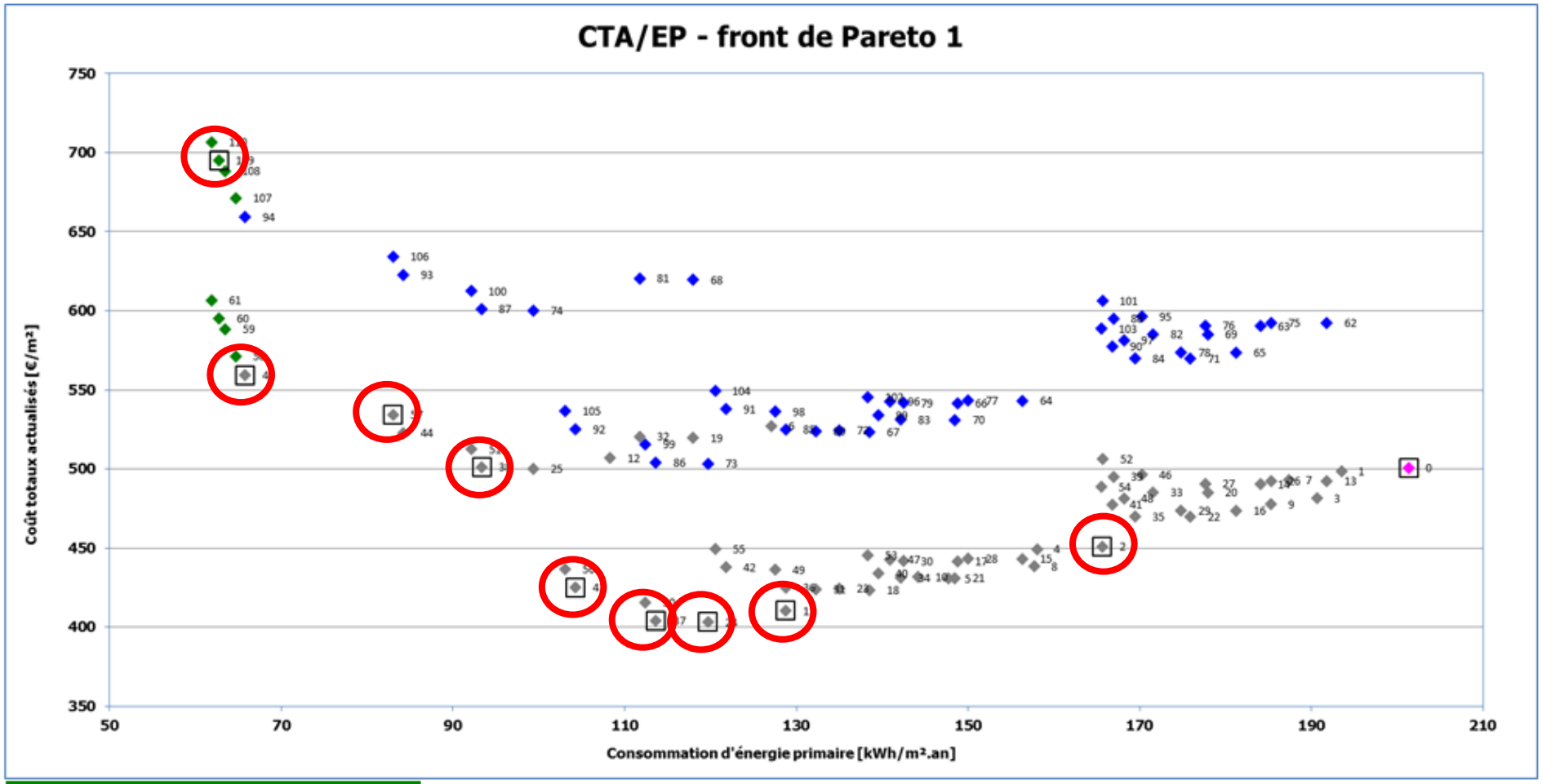
(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – architectural variant

Hab. ind. Existant 1	HI-B	var 1	var 2	var 3	var 4
Utoit	**0.6**	0.40	0.24	0.12	0.08
Umur	**2.2**	0.60	0.24	0.12	0.08
Rsol	**0.31**	1.67	4.17	8.33	12.50
Uw	**3**	1.80	0.85		
Ug	**2.8**	1.10	0.6		
v50	**12**	6.07	2.02	1.21	
n50	**5.93**	3.00	1.00	0.60	
inertie	**mi-lourd**	-			
surface vitrée	**50%**	-			
g	**76%**	60%			
prot sol amov	**non**	protection solaire ext manuelle			

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – selection of 10 architectural variant



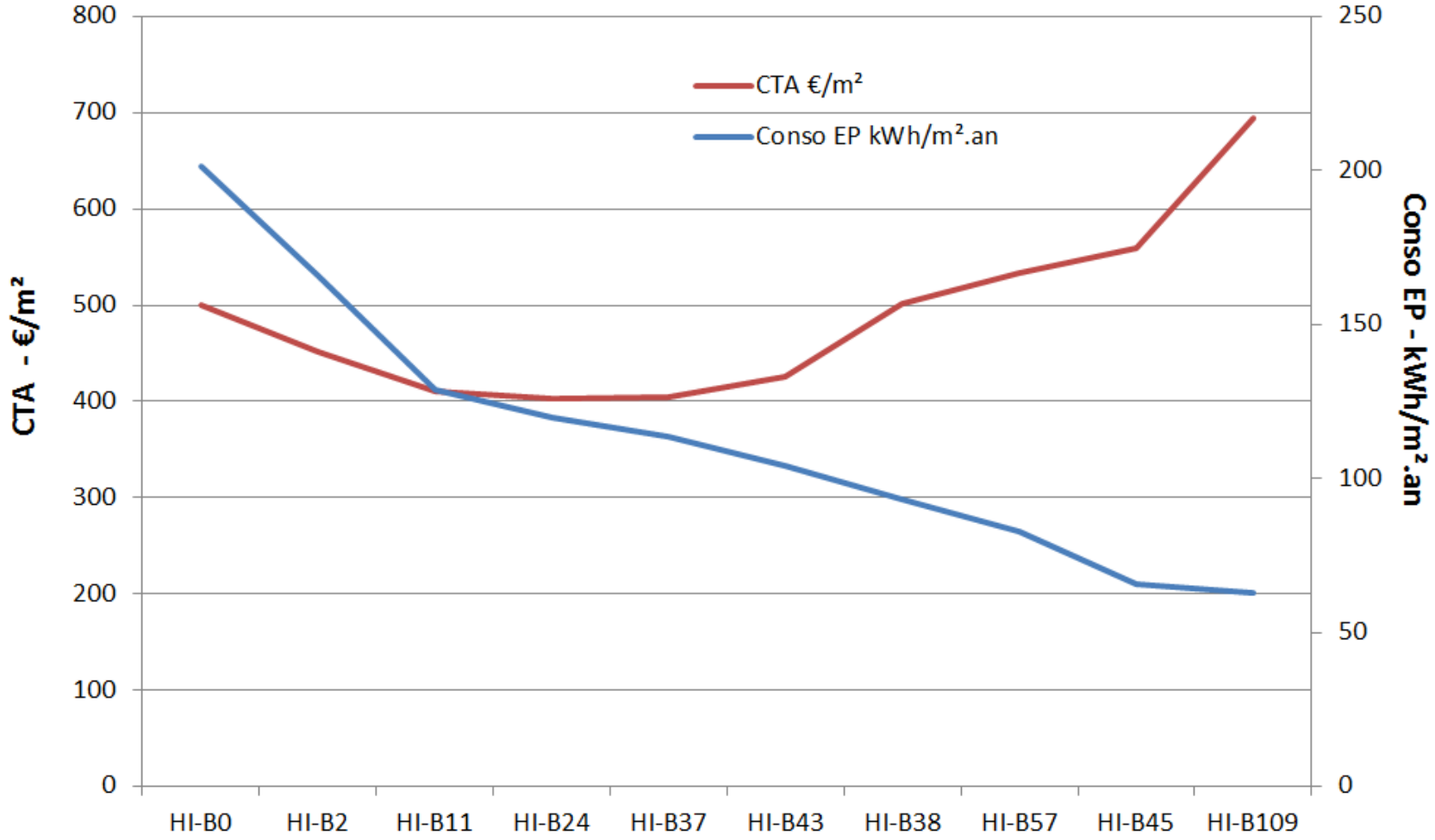
(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – selection of 10 architectural variants

Référence point	Conso EP	CTA	économie EP	K	E	Surinvest	Utoit	Umur	Rsol	Uw fen	g	n50	protec	reduction
	kWh/m².an	€/m²	kWh/m².an	-	-	€/m²	W/m²K	W/m²K	m²K/W	W/m²K	%	1/h	solaire	Fac*
HI-B0	201	501	0%	**97**	**137**	0,00	0,60	2,20	0,31	3,00	0,76	5,9	non	non
HI-B2	166	451	18%	**76**	**113**	28,12	0,60	0,60	0,31	3,00	0,76	5,9	non	non
HI-B11	129	410	36%	**54**	**88**	68,28	0,24	0,24	4,17	3,00	0,76	5,9	non	non
HI-B24	120	403	41%	**54**	**82**	80,86	0,24	0,24	4,17	3,00	0,76	3,0	non	non
HI-B37	114	404	44%	**54**	**78**	94,99	0,24	0,24	4,17	3,00	0,76	1,0	non	non
HI-B43	104	425	48%	**48**	**71**	136,49	0,12	0,12	8,33	3,00	0,76	1,0	non	non
HI-B38	93	501	54%	**39**	**64**	236,26	0,24	0,24	4,17	1,80	0,60	1,0	non	non
HI-B57	83	534	59%	**33**	**57**	291,89	0,12	0,12	8,33	1,80	0,60	0,6	non	non
HI-B45	66	559	67%	**20**	**45**	354,72	0,12	0,12	8,33	0,85	0,60	1,0	non	non
HI-B109	63	695	69%	**19**	**43**	468,62	0,08	0,08	8,33	0,85	0,60	0,6	oui	non

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – selection of 10 architectural variants



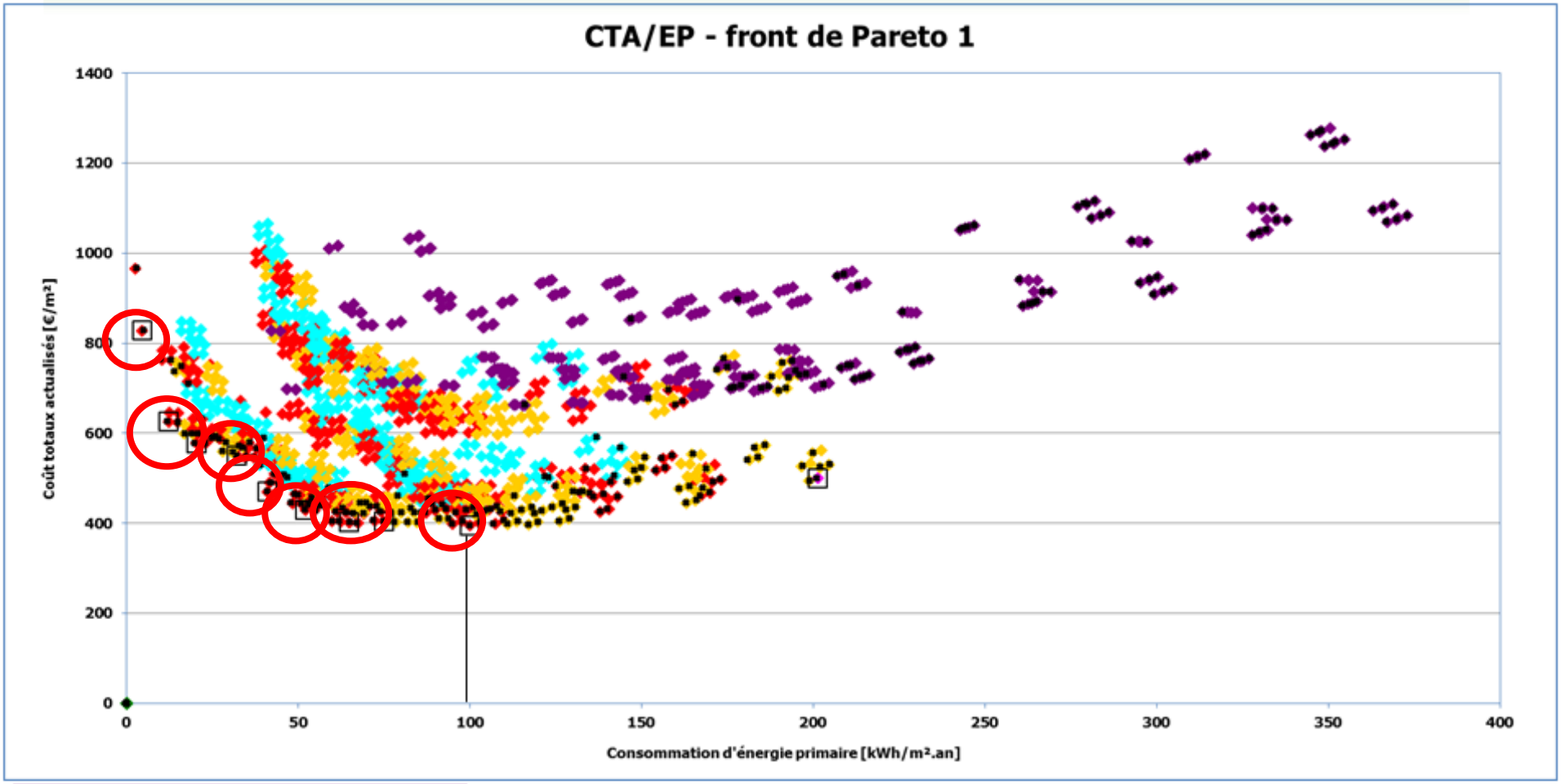
(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – technical variant

Hab. ind. Existant	HI-X0	var 1	var 2	var 3	var 4	var 5
Ventilation	**VH**	VH1	VH2	VH5		
chauffage - Production	**HP**	HP1	HP3	HP8	HP10	HP12
chauffage - Emission	**HE**	HE1	HE3			
chauffage - Régulation	**HR**	HR2				
chauffage - Distribution	**HD**	HD1	HD2			
ECS - Production	**WP**	IDEM CHAUFFAGE				
ECS - Distribution	**WD**	X				
Energie renouvelable	**SER**	SER1	SER2	SER3	SER5	

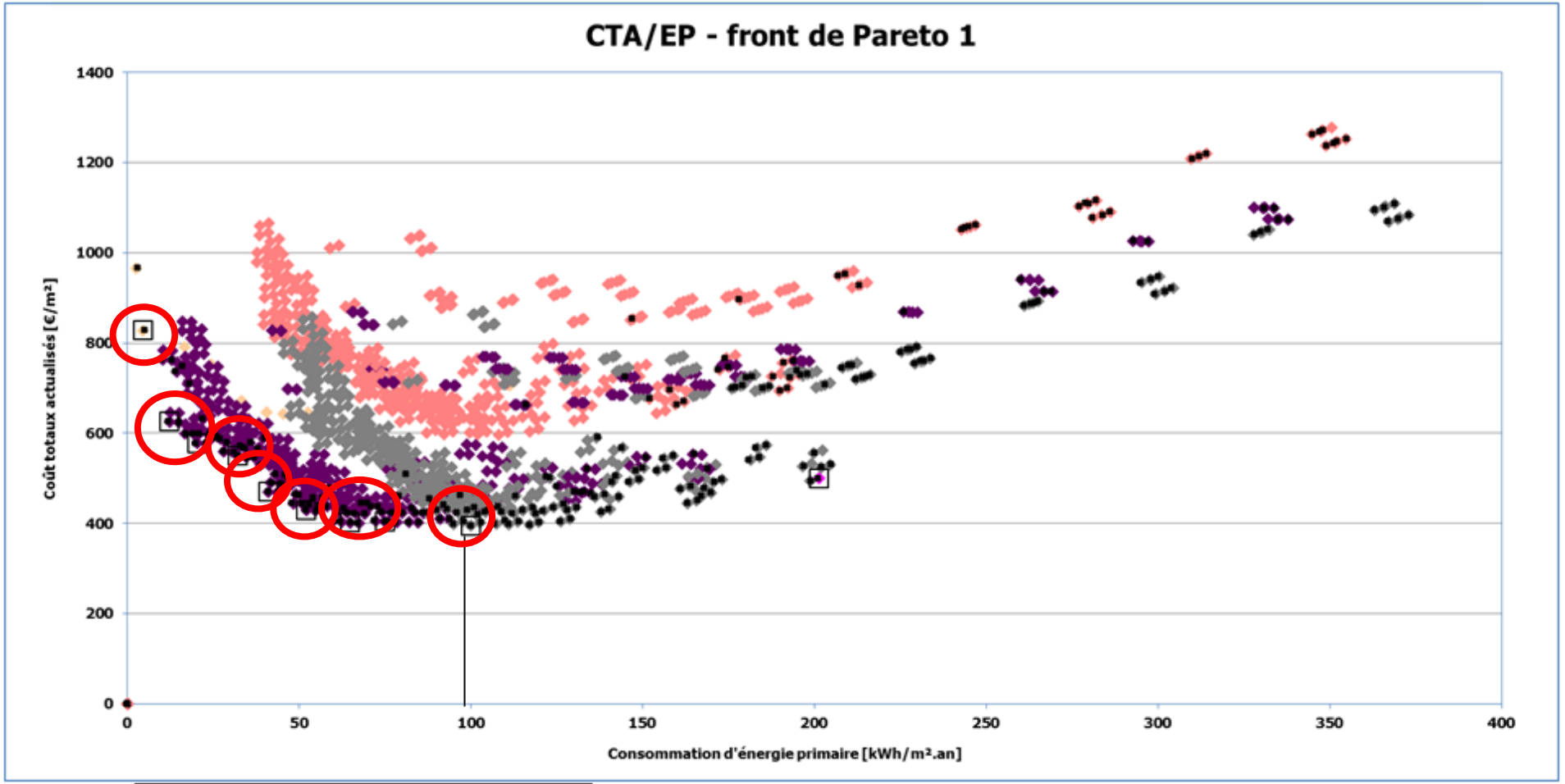
(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – technical variant



(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – technical variant



PV = Panneaux photovoltaïques ; CES = Chauffe-Eau Solaire

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses – technical variant

Référence point	BNC kWh/m²	BNR kWh/m²	Conso EP kWh/m².an	CTA €/m²	économie EP kWh/m².an
HI-B0-1	110.80	-	201.34	500.65	0%
HI-B24-34	55.59	-	99.98	395.56	50%
HI-B11-64	61.70	-	74.92	404.33	63%
HI-B24-94	55.59	-	64.86	401.68	68%
HI-B43-94	45.13	-	52.11	429.47	74%
HI-B43-96	30.18	-	41.03	469.85	80%
HI-B38-96	22.95	-	32.21	550.36	84%
HI-B45-94	19.09	-	20.35	578.36	90%
HI-B45-96	6.64	-	12.32	625.39	94%
HI-B45-181	6.64	-	4.50	827.69	98%

ECS	Ventilation	CES kWh/an	PV kWh/an
s boucle	C	0	0
s boucle	C	0	0
s boucle	C	0	2430
s boucle	C	0	2430
s boucle	C	0	2430
s boucle	D + récupérateur chaleur rendement EN 308: 80% + SFP 3	0	2430
s boucle	D + récupérateur chaleur rendement EN 308: 80% + SFP 3	0	2430
s boucle	C	0	2430
s boucle	D + récupérateur chaleur rendement EN 308: 80% + SFP 3	0	2430
s boucle	D + récupérateur chaleur rendement EN 308: 80% + SFP 3	1265	2430

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

Individual houses (excepted PV) - Optimality range

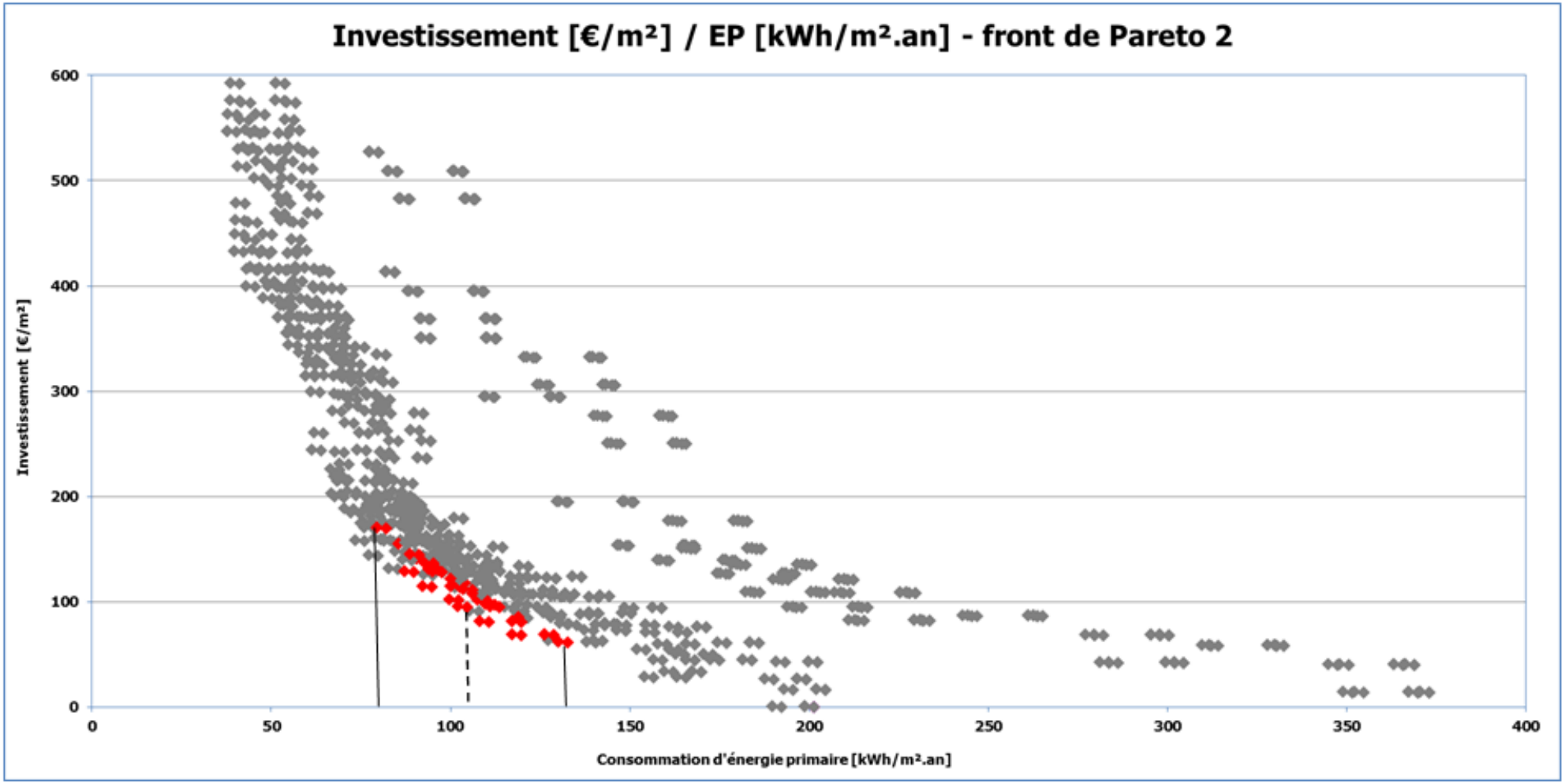


Figure 29 : Front de Pareto Investissement/EP – variantes architecturales et techniques sans énergie solaire - maison individuelle HI-B

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

General conclusions

- **It is always possible to decrease the primary energy consumption thanks to energy efficiency measures**
- The biggest issues regarding these measures is the **initial investment**
- For a same energy efficiency, **different combination are possible with different cost** → it is important to evaluate not the individual measure but the combination of them

(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

<u>General conclusions</u> : architectural measures

- **Glazing optimisation** is an important measure by reducing the glazing surface
  → Decrease of annual costs
  → Opaque surface is cheaper than glazing surface
  <u>BUT</u> decrease of natural lighting in the building
- **Insulation** is expensive but really interesting for energy savings
- **Airtightness enhancement** allows important savings with a light global cost
- Too high global cost for :
  - Solar protection
  - Triple glazing

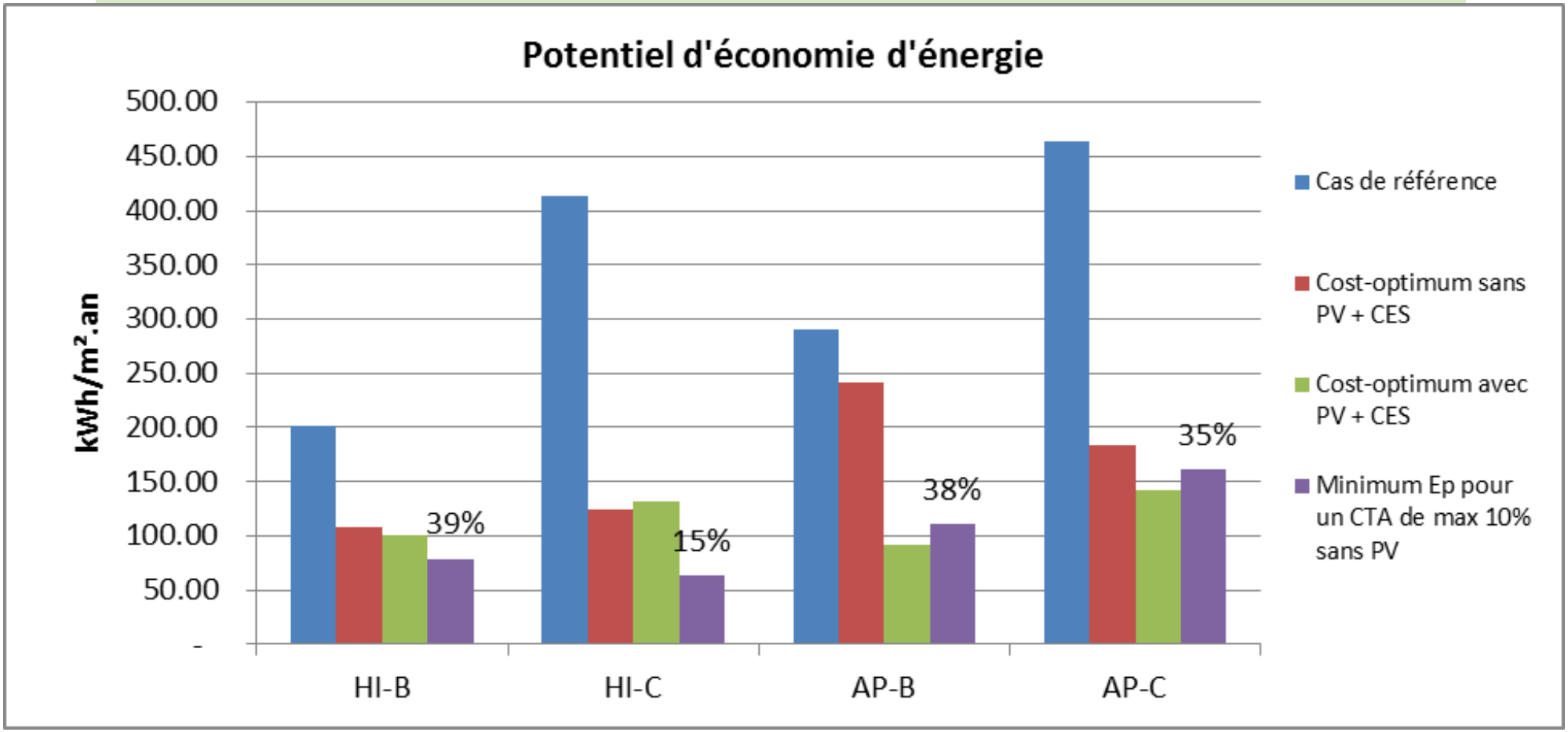
(b) Identification of cost-effective approaches to renovations relevant to the building type and climatic zone

General conclusions : technical measures

- Individual houses :
  - Heating production by **gas condensing boiler, radiators and variable speed circulators** are cost-optimal technical solutions
  - A **constant flow ventilation** (C) is included in cost-optimum cases. The double flow ventilation (D) is not cost-optimal in dwellings but stay an economic and energetic interesting measure

- Conclusions are quite the same for collective dwellings, except :
  - Above 20 apartments in a building, a centralised heating production is preferable;
  - Photovoltaic solution are always in the cost-optimum solution

Potential energy savings



BRUSSELS POLICY FOR HIGH ENERGY PERFORMANCE BUILDINGS

Brussels objective : -30% GHG in 2025

Improve
Knowledge & know-how

Improve SUPPLY

Adapt LEGAL framework

Stimulate DEMAND

CONCLUSIONS

The development of the refurbishment strategy is still running and will be updated for begin 2017 as requested by the EED Directive

THANK YOU FOR YOUR ATTENTION !

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DEPT. OF AIR, ENERGY AND CLIMATE, ENERGY PLANNING