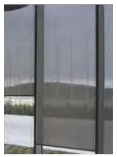


Extra energy savings with solar shading

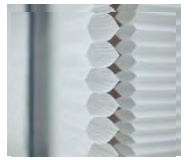
17 April 2015

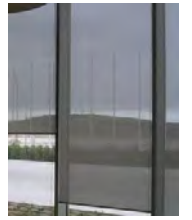
Martin Straver - Romazo

(based on TNO presentation Leo Bakker)

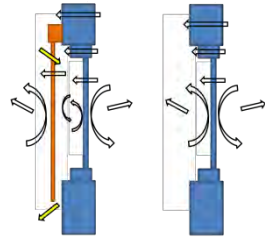
Energy savings with solar shading

1. Savings on the **“cooling energy”**
2. Savings on the **“heating energy”** by extra heat resistance

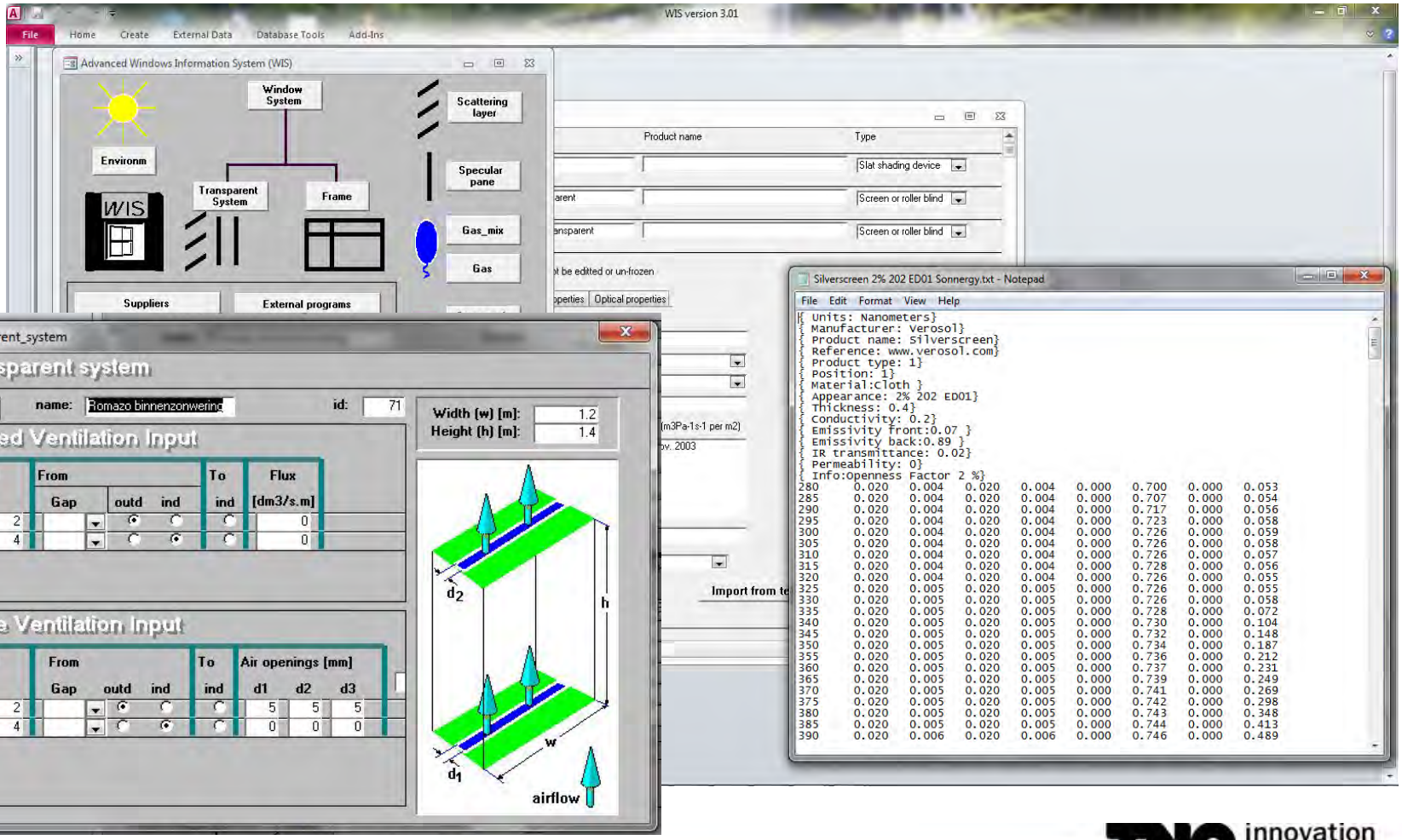




Calculation heat resistance solar shading



- Window Information System (**WIS**)
- European program TNO projectleader



EPG calculations

Energy savings heating + EPC- gain

by additional heat resistance from solar shading

- → All windows have solar shading
- → Heat resistance solar shading systems variety
- → Calculations afterwards adjustments (effect summer)

EPG software

Voorbeeld woning.epg - ENORM V1.4 - Woning- en Utiliteitsbouw

Bestand Bewerken Database Help

- Projectgegevens
- Schematisering
- Bouwkundig
- Installaties
- Zonne-energie
- Verlichting
- Resultaten

Primair energiegebruik [MJ]	Waarde
Verwarming	36 322
Warm tapwater	8 884
Koeling	1 489
Bevochtiging	0
Ventilatoren	4 121
Verlichting	5 728
Totaal	**56 543**
Electriciteitsproductie gebouwgebonden	-1 338
Afgenomen energie	**55 205**
Geëxporteerde energie	0
Electriciteitsproductie niet gebouwgebonden	-3 104
EPtot	**52 102**
EP;adm;tot	36 748
Specifieke energieprestatie per m²	420

E_{Ptot} / $E_{P;adm;tot;nb}$	1.418	EPC [-]	0.86
E_{Ptot} [MJ]	52 102	EPC voldoet niet	

Primair energiegebruik | CO2 en schil | Energiegebruik

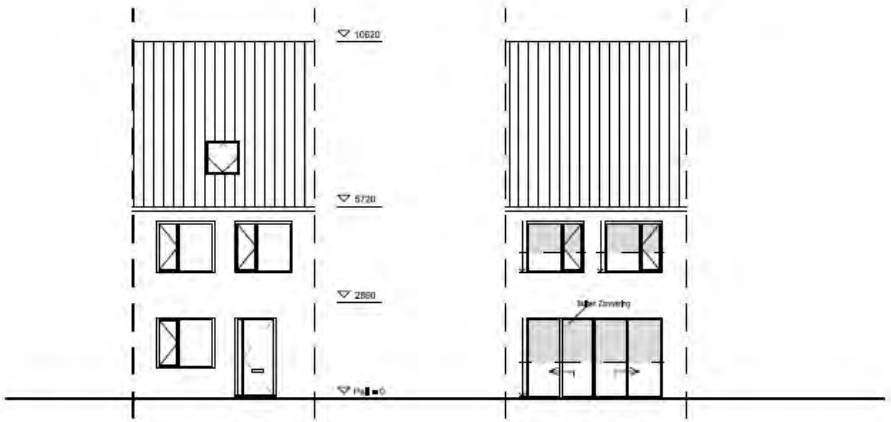
Deelpost	Energiegebruik geconverteerd naar primaire energie [MJ]						
	elektriciteit	aardgas	stookolie	hout, biomassa	externe warmte	externe koude	Totaal
Verwarming	0	33 815	0	0	0	0	36 322
(hulpenergie)	2 507						
Warm tapwater	0	8 884	0	0	0	0	8 884
(hulpenergie)	0						
Koeling	0	0	0	0	0	0	0
(hulpenergie)	0						
Zomercomfort	1 489						1 489
Bevochtiging	0	0	0	0	0	0	0
Ventilatoren	4 121						4 121
Verlichting	5 728						5 728
Totaal	**13 844**	**42 699**	**0**	**0**	**0**	**0**	**56 543**
Geproduceerd (EPus)	-1 338						-1 338
Afgenomen energie	**12 506**	**42 699**	**0**	**0**	**0**	**0**	**55 205**
Geproduceerd (nEPus)	-3 104						-3 104
EPtot							**52 102**

3.1 Tussenwoning

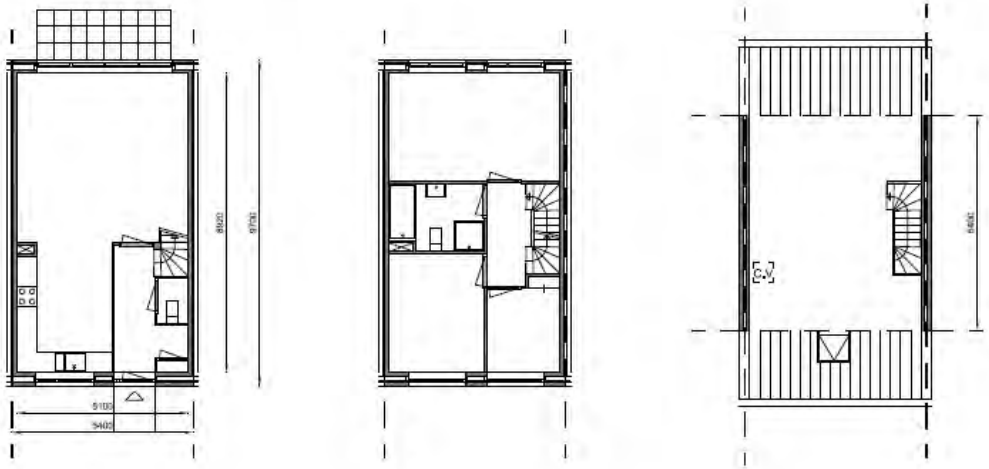
Algemene beschrijving

De oppervlakte van een tussenwoning is gemiddeld 125 m² (bron: MNW). In een tussenwoning zijn doorgaans drie slaapkamers aanwezig. Een tussenwoning komt in verschillende uitvoeringen voor, zowel met een zadel- of een lessenaarsdak als met een plat dak. Een zadeldak komt relatief vaak voor.

Tekeningen



voorgevel achtergevel



beganegrond 1e verdieping 2e verdieping

3.6 Appartementencomplex

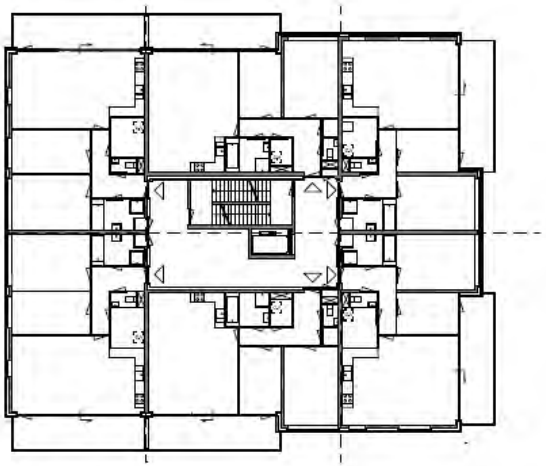
Algemene beschrijving

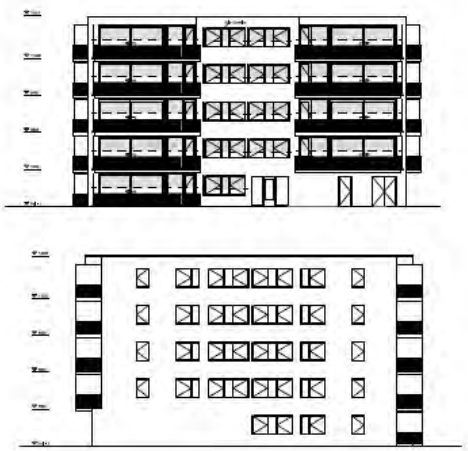
De oppervlakte van een meergezinswoning in de koopsector is gemiddeld 105 m² (bron: MNW). In dit gemiddelde zijn zowel luxe penthouses als eenvoudige galerijwoningen opgenomen. Een meergezinswoning heeft meestal twee slaapkamers.

Gebiedsgebonden maatregelen en bijna energieneutrale woningen

	EMG variant 1	EMG variant 2	BENG
EPC volgens NEN 7120	**0,54**	**0,40**	**0,16**
Jaarlijks energieverbruik per m^2 volgens NEN 7120	256 MJ/m^2	191 MJ/m^2	74 MJ/m^2
Jaarlijkse CO_2-emissie	51.394 kg	35.596 kg	10.275 kg

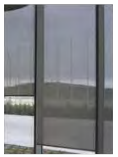
Tekeningen



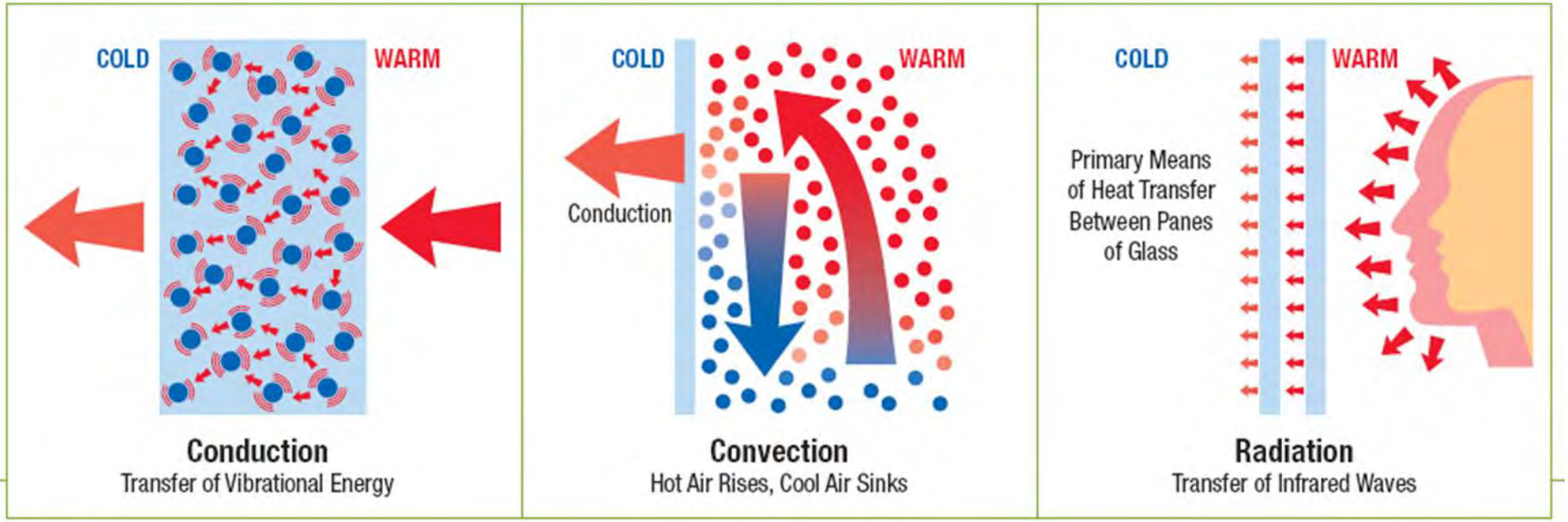


Starting point

- Standard reference townhouse and apartment with EPC of 0,6
- Window size 140 cm X 120 cm
- U value 1,65 W/m2K = HR++ glazing in a wooden window frame
- The solar shading covers the entire window
- WIS program used for calculations



Heat transfer



Compare mounting methods

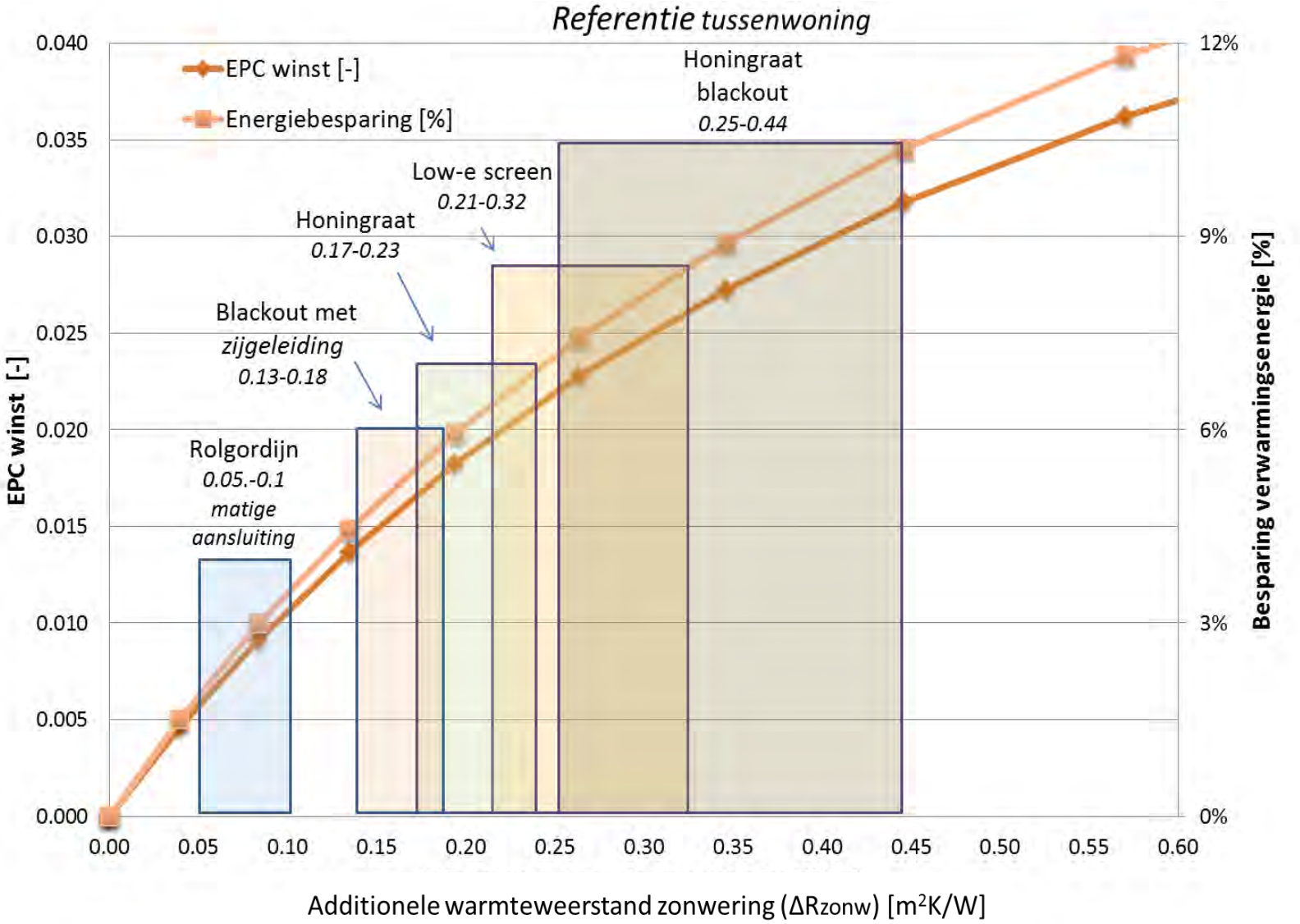


Diagram 10: Energy savings on heating and potential EPC-gain by different types of interior shading for reference dwelling (tussenwoning).
NB - reference is to apply on all façade orientations shading without adapting U-value (variant 1, table 1).

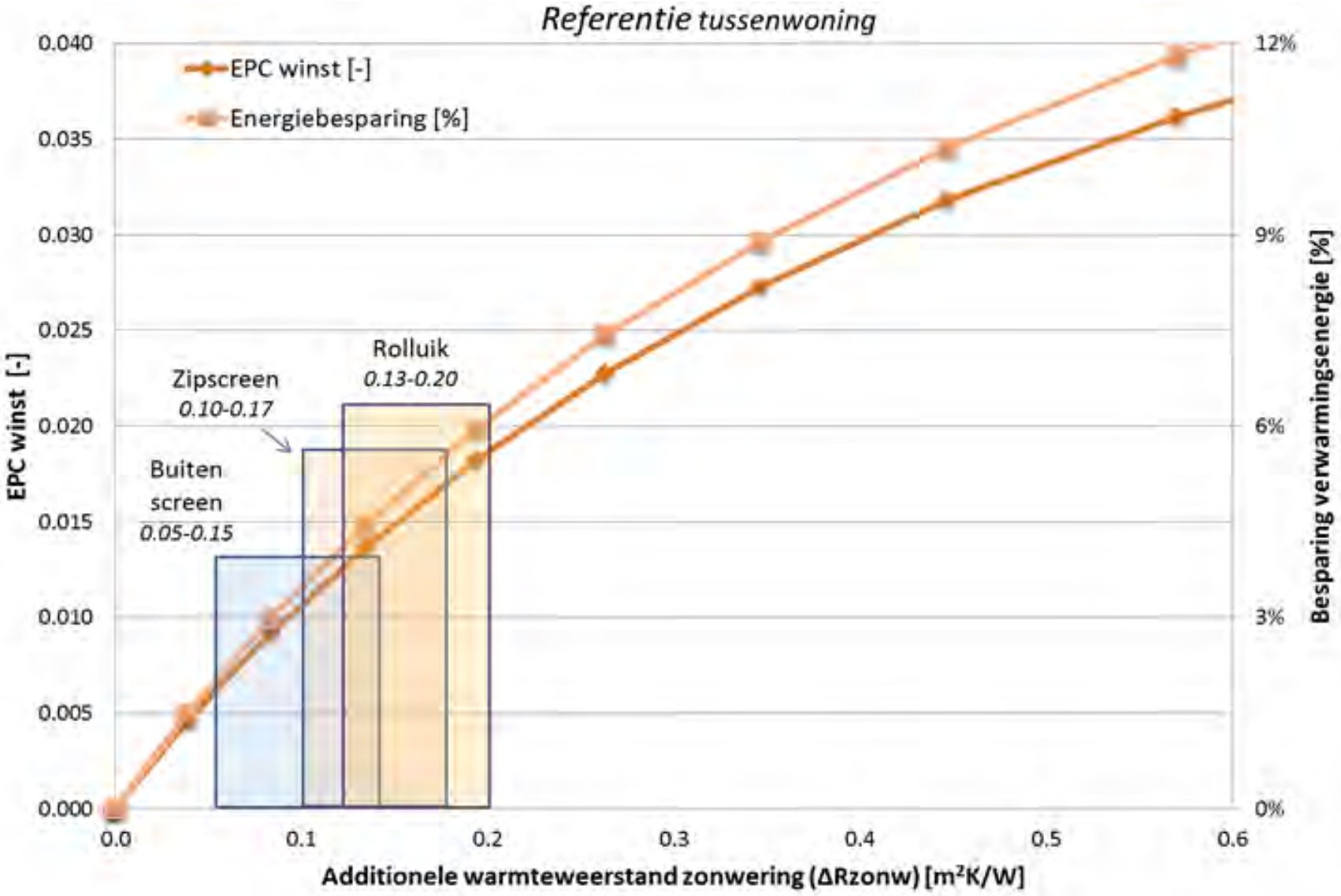


Diagram 11: Energy savings on heating and potential EPC-gain by different types of exterior shading for reference dwelling (tussenwoning).
NB - reference is to apply on all façade orientations shading without adapting U-value (variant 1, table 1).

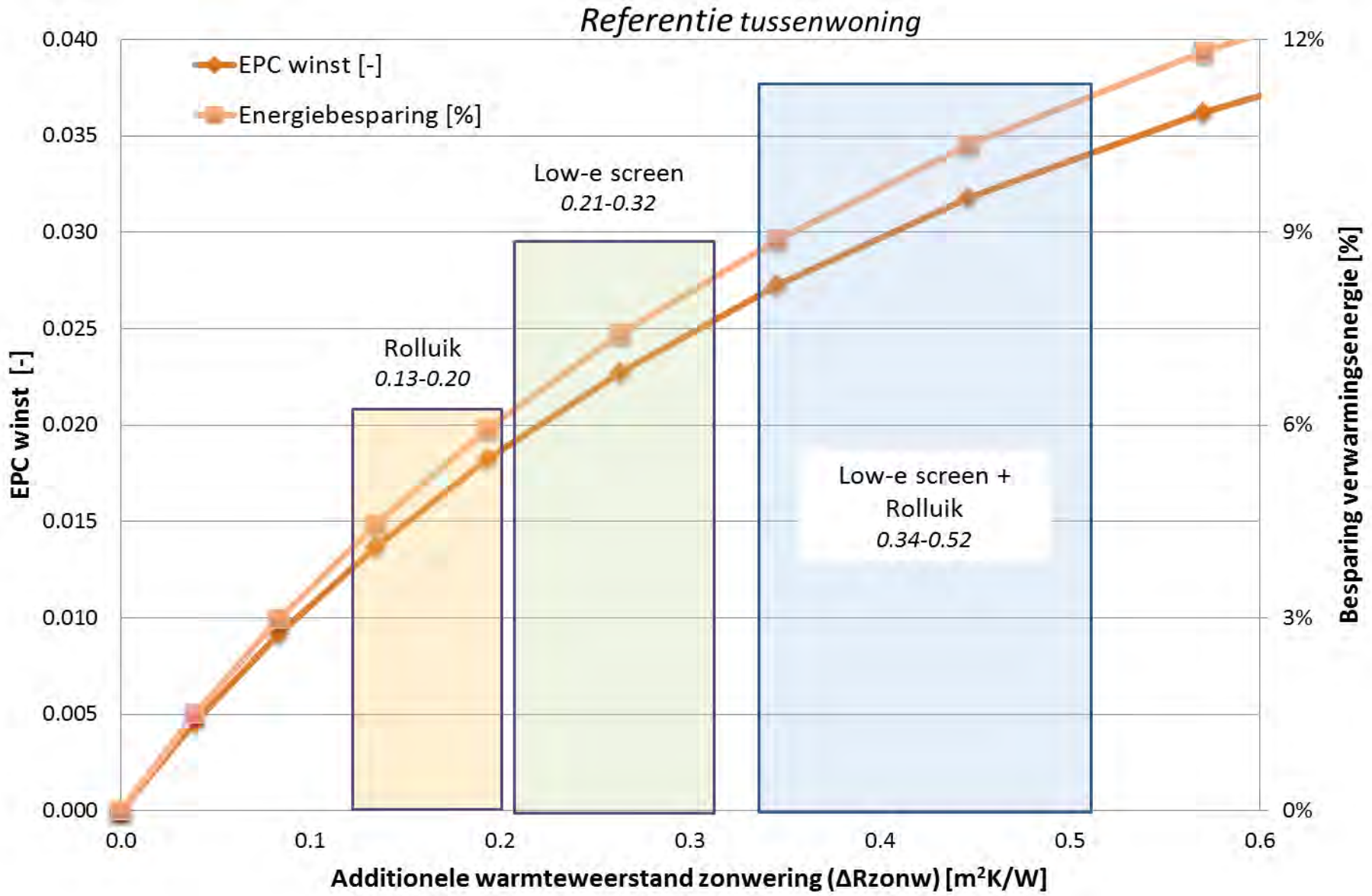


Diagram 12: Energy savings on heating and potential EPC-gain by roller shutter (exterior), a low interior e-screen and a combination of both for the reference dwelling (tussenwoning).

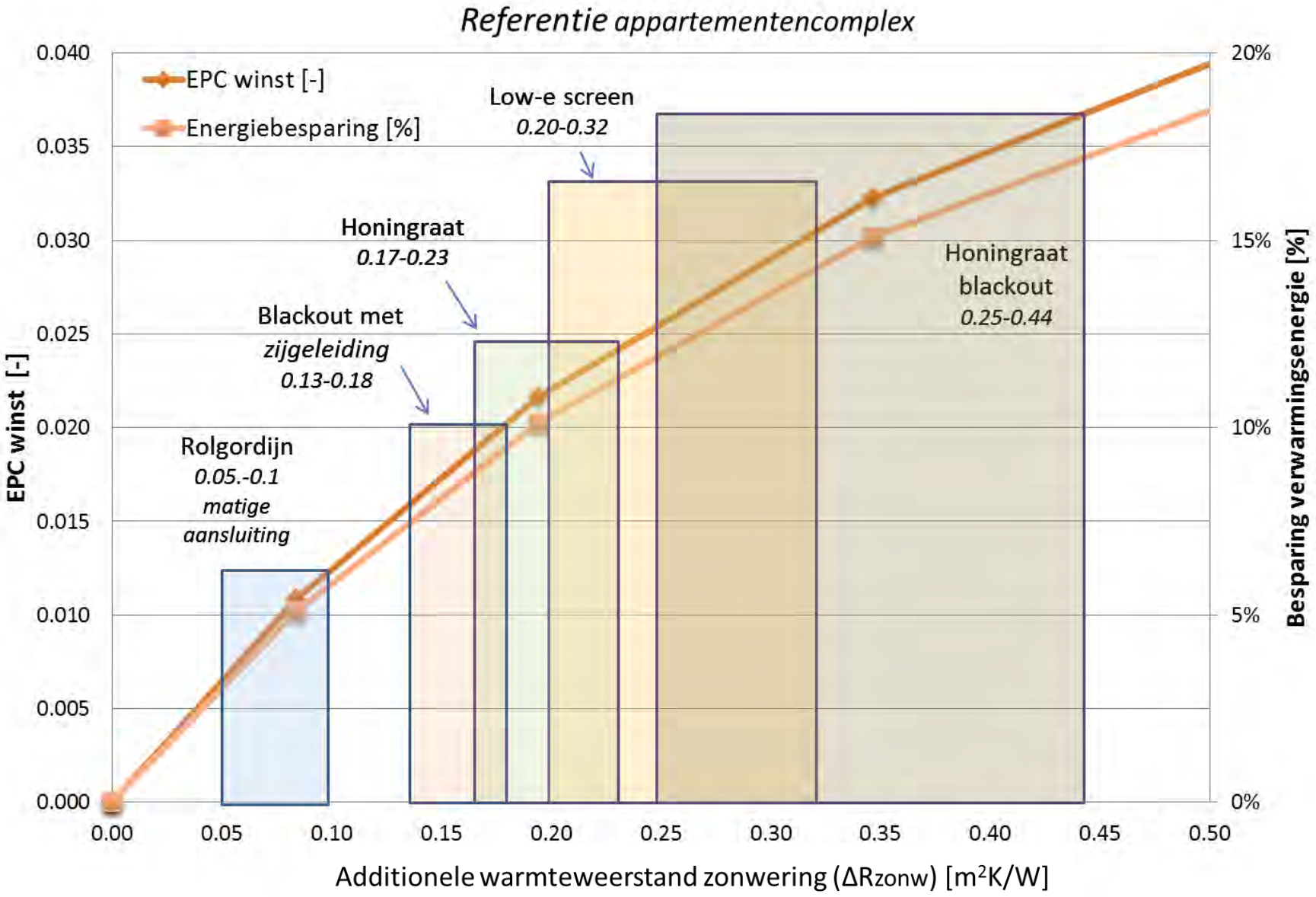


Diagram 13: Energy savings on heating and potential EPC-gain by different types of interior shading for reference dwelling (appartment).
NB - reference is to apply on all façade orientations shading without adapting U-value (variant 1, table 2).

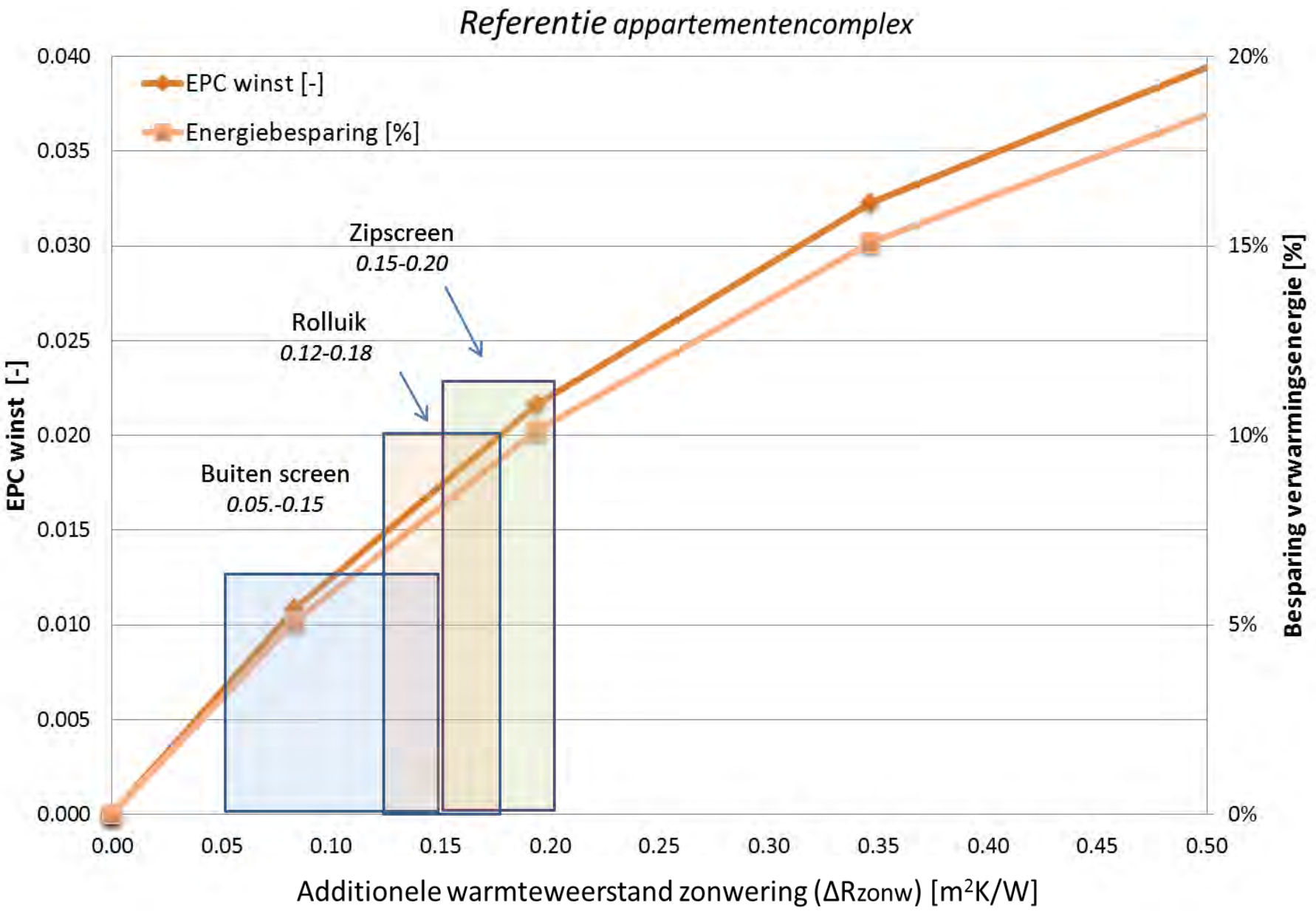


Diagram 14: Energy savings on heating and potential EPC-gain by different types of exterior shading for reference dwelling (appartment).
NB-reference is to apply on all façade orientations shading without adapting U-value (variant 1, table 2).

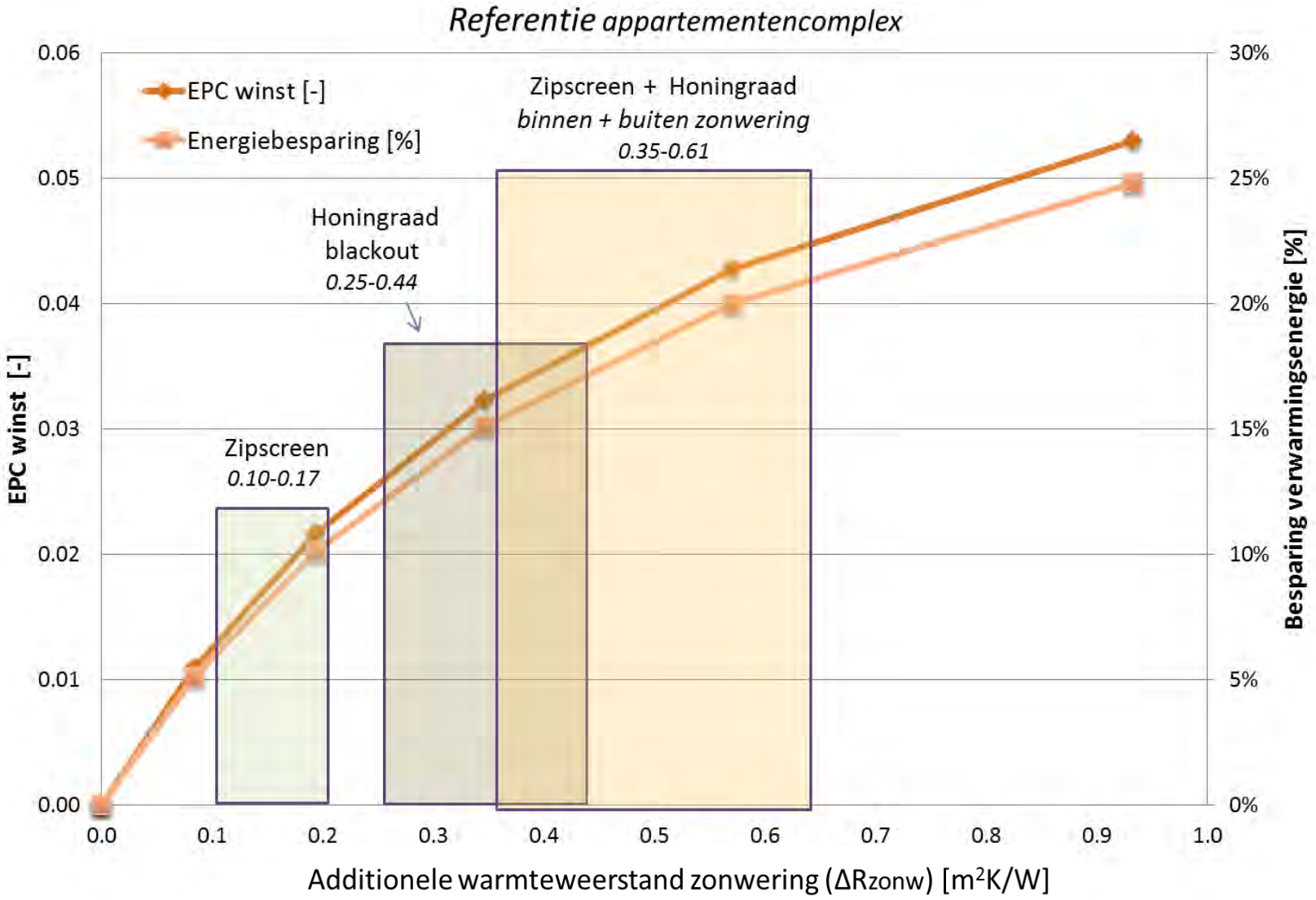


Diagram 15: Energy savings on heating and potential EPC-gain by an exterior zip screen, an interior honeycomb black-out and a combination of both for the reference appartment.

Conclusions

1. **Heath resistance of solar shading** is achieved by:
    1. The mounted position of the solar shading
    2. The airtightness of the material or system
    3. The airtightness of the connection of the junction to the cavity
    4. Coatings (for example Low-e coating)
    5. Captured air in the solar shading itself (for example honeycomb)

2. **The calculated savings on the energy consumption** for heating by solar shading can achieve up to 17% for townhouses and 29% for apartments.

3. **The EPC improvement is comparable for both townhouses and apartments**

4. The method makes **determining and comparing** the energy demand for heating and EPC for (combinations) of solar shading products **easier**

Recommendations

1. Make sure that the cavity between the window and solar shading is as airtight as possible

2. If the solar shading system also covers the whole window frame the heat resistance of the whole window will be significantly higher.

3. Avoid thermal bridges for ex. by leaving space between the solar shading and the windowframe in case the solar shading also covers the window

4. The combination of interior and exterior solar shading improve the thermal insulation significantly

5. Automated systems can ensure solar shading is closed during the night in the heating season