

Elamu, Kuldar Leis, Põlva

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Tartu Ülikooli tehnoloogiainstituut



22. november 2012 Tallinn

Elamu, Kuldar Leis, Põlva



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Projekteerimise algus 2010



Suletud netopind: 338 m²
Köetav pind: 307 m²



Arhitektid:
G. W. Reinberg
M. Reinberg

Projekti juhtimine:
Sense OÜ

Ehituse algus: sept 2011
Eeldatav lõpp: dets 2012

A

Hoone energiavajadus on väike

kui väike?

- ruumide küte kWh/a
- soe vesi kWh/a
- elektriseadmed kWh/a

B

**See on suures osas kaetud
taastuveni energiaga, mille maja on
ise tootnud**

kui suures osas?

- ruumide küte kWh/a
- soe vesi kWh/a
- elektriseadmed kWh/a

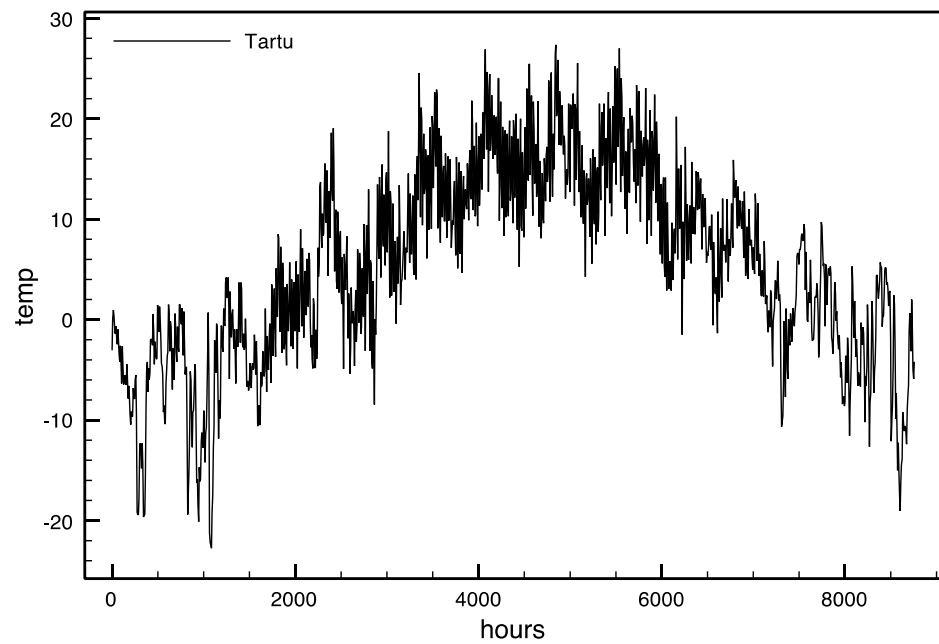
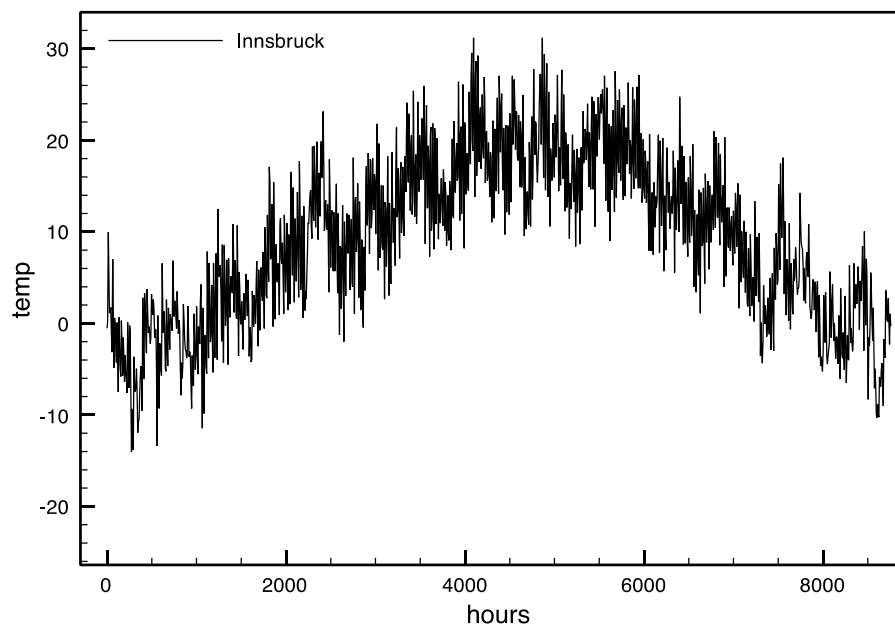
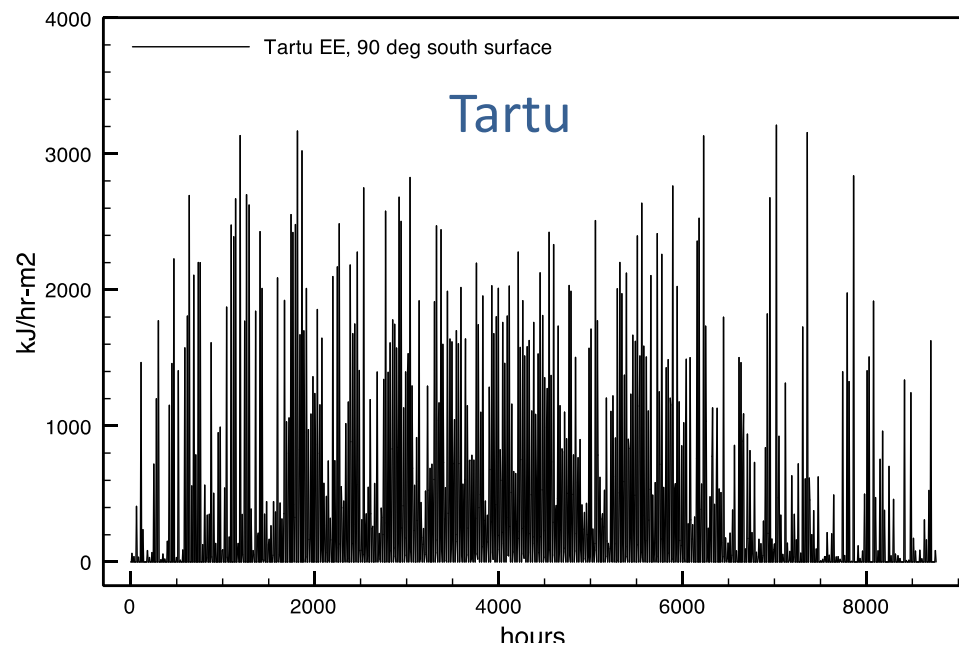
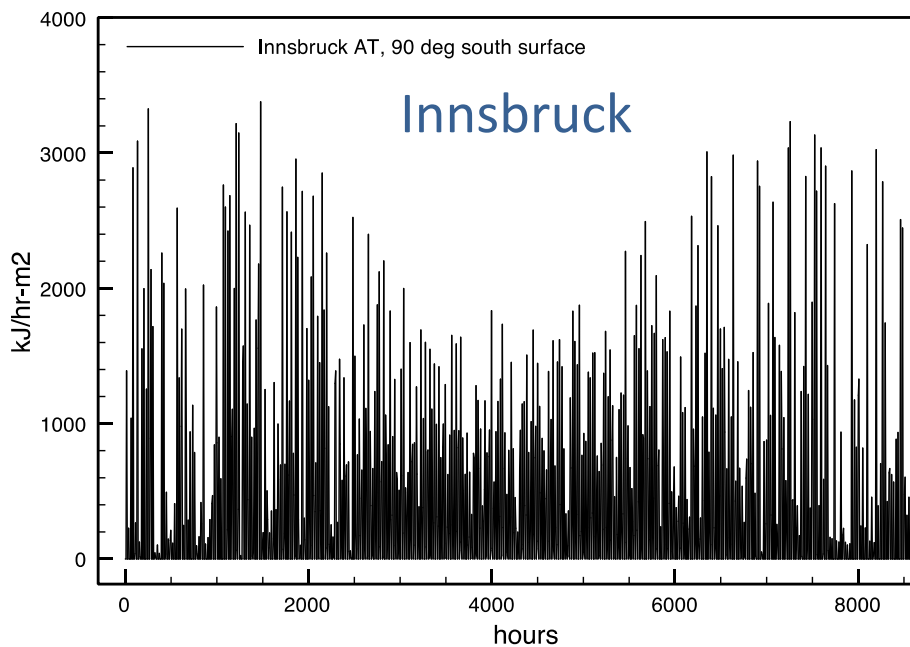
null?

$$A - B \leq 0$$

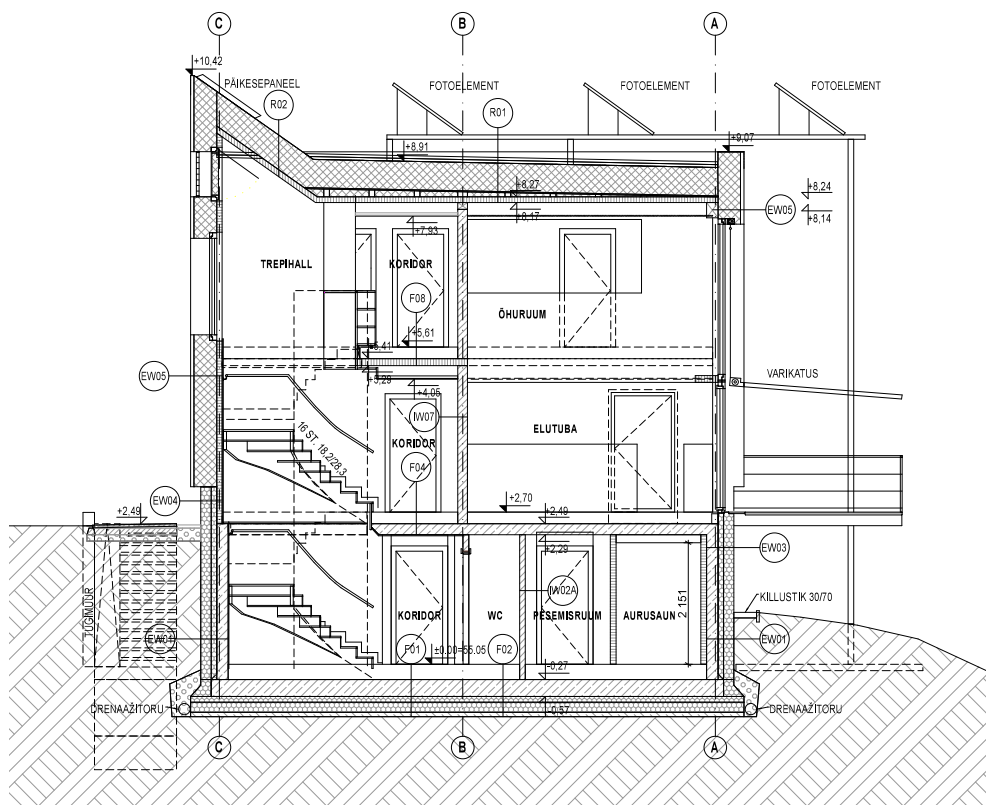
(0 kWh/a)



G. W. Reinberg



Välispiire



Sein

400 mm tselluvill, 94 mm KLH
massiivpuit, sisekrohv
 $U = 0,105 \text{ W}/(\text{m}^2\text{K})$

Katuslagi

500 mm soojustus, 102 mm KLH
 $U = 0,079 \text{ W}/(\text{m}^2\text{K})$

Keldrisein

500 mm EPS, 200 mm betoon
 $U = 0,066 \text{ W}/(\text{m}^2\text{K})$

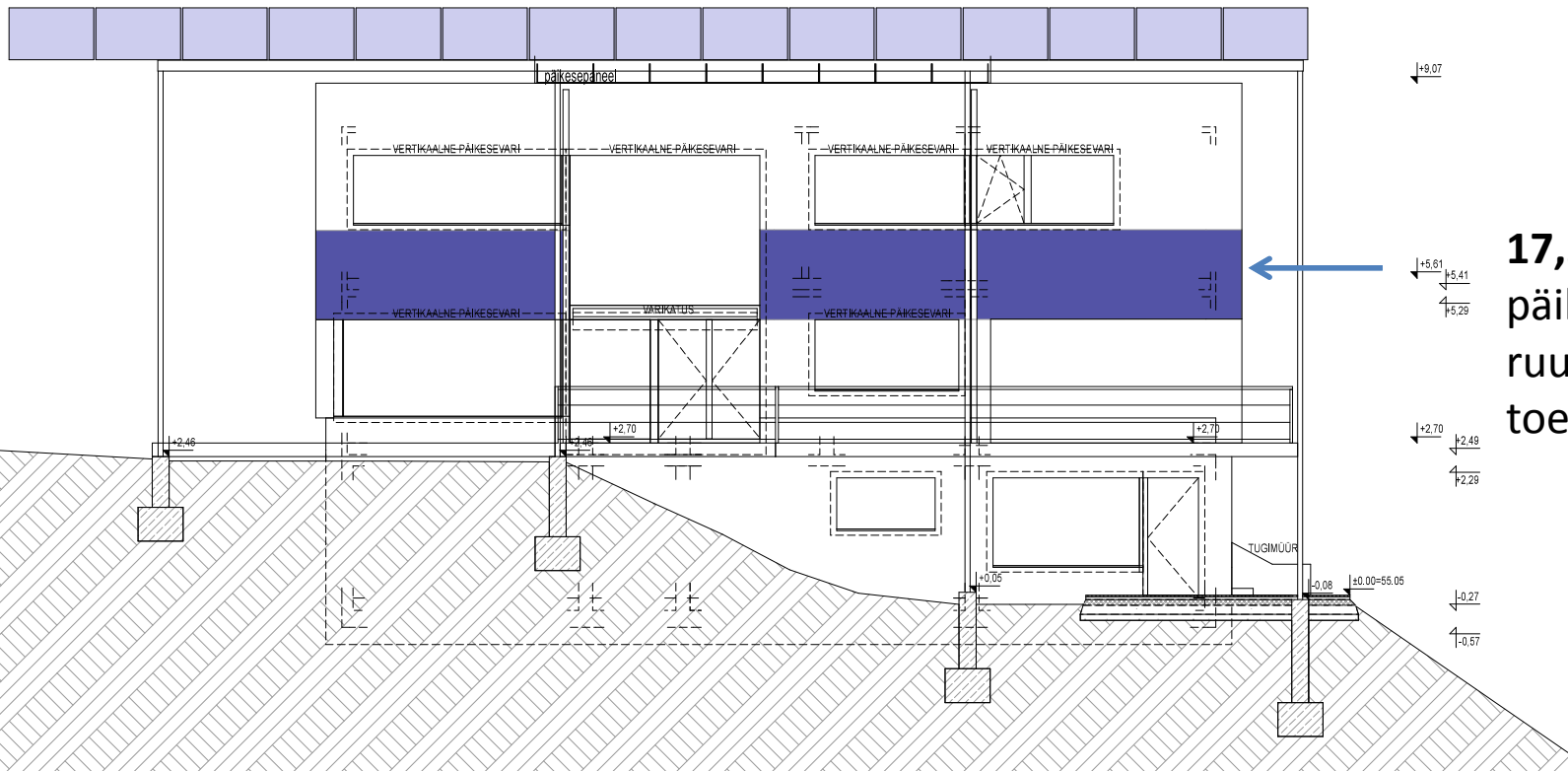
Põrand pinnasel

300 mm XPS, 300 mm betoon,
100 mm EPS
 $U = 0,086 \text{ W}/(\text{m}^2\text{K})$

Lõunafassaad

PV

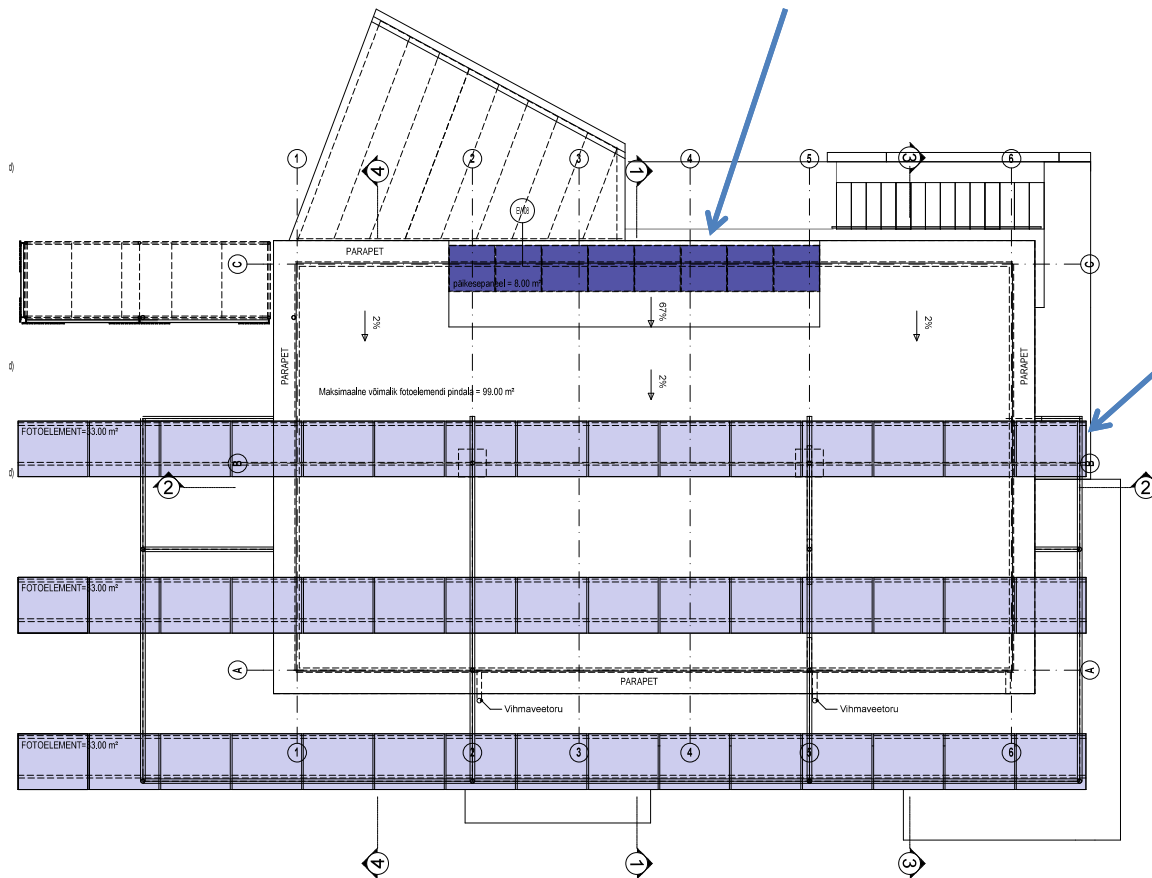
FOTOELEMENT



17,5 m² vert.
päikesekollektor
ruumide kütte
toetamiseks

Katuse plaan

11,5 m² päikese-
kollektorid sooja
tarbevee tootmiseks



92 m² PV paneelid
1x1,8m 235W 51 tk.



elamu Kuldar Leis Põlva

7. veebr 2013 Tartu, T. Muring







elamu Kuldar Leis Põlva









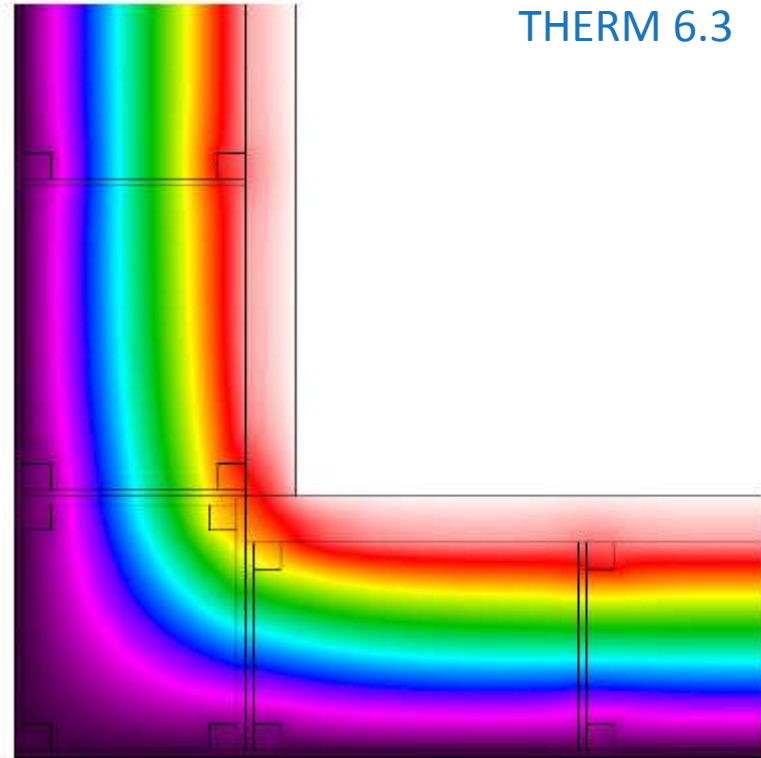
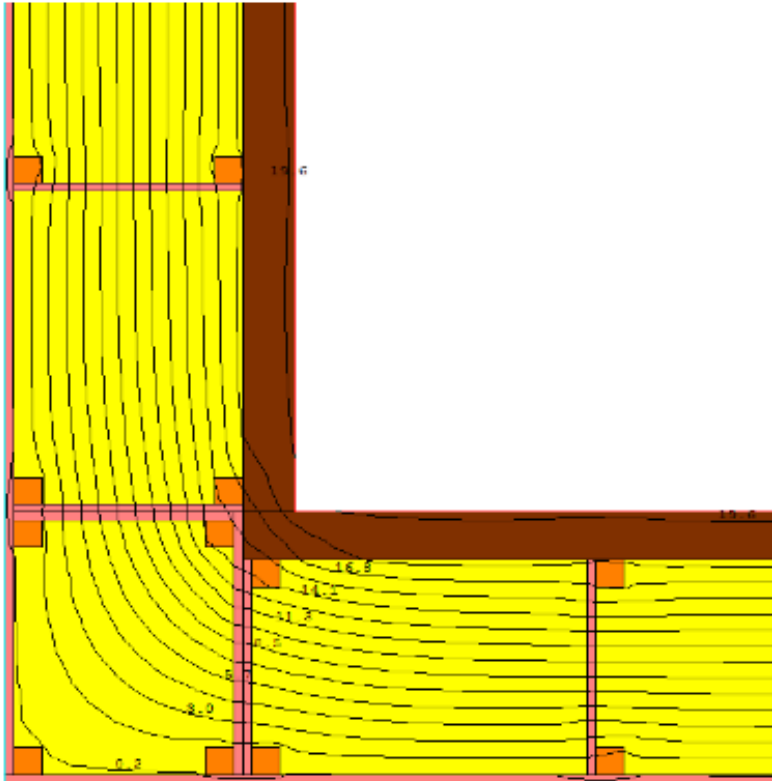
elamu Kuldar Leis Põlva

7. veebr 2013 Tartu, T. Mäuring



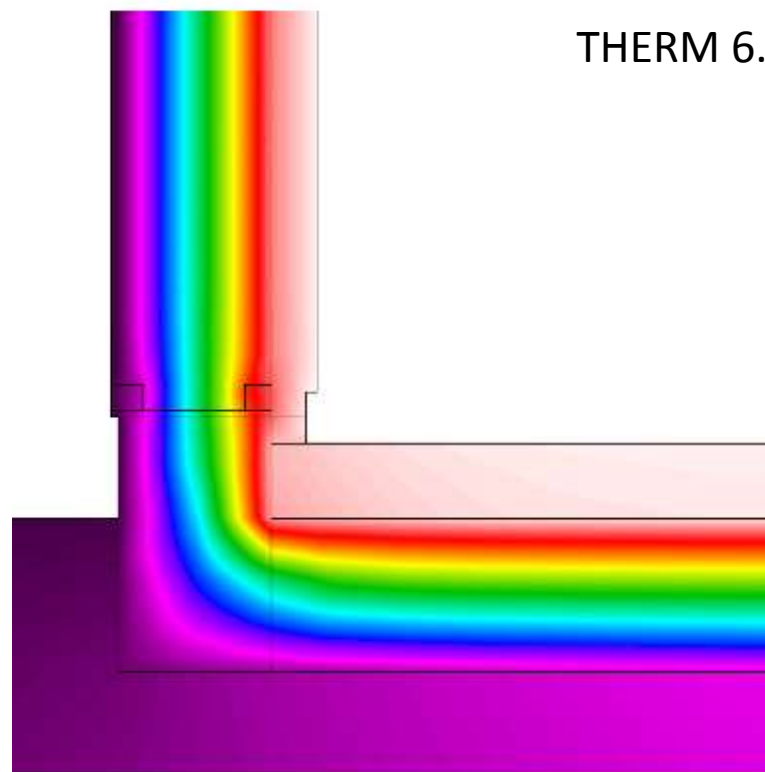
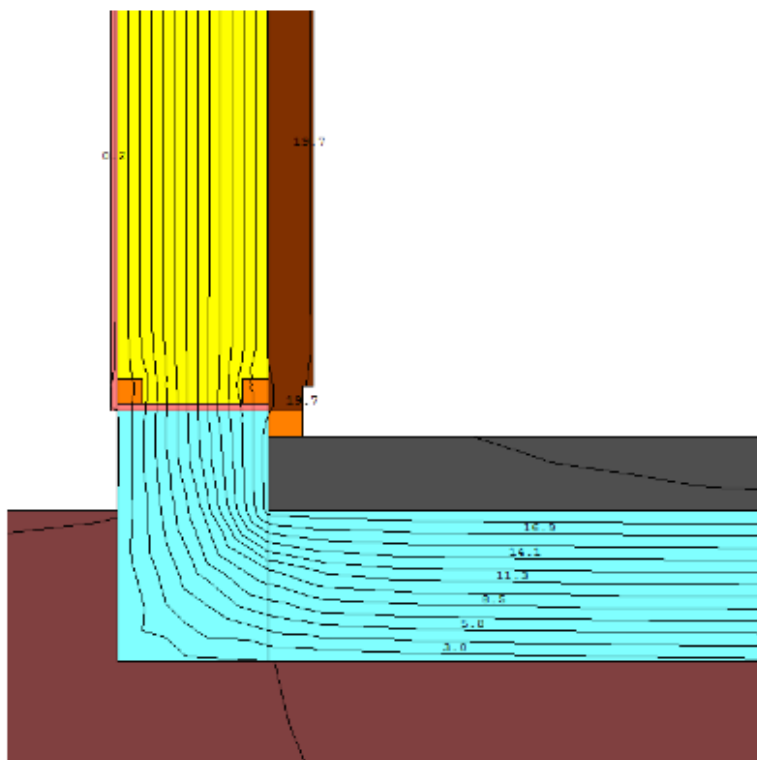
Külmasillavabad sõlmed

Külmasilla lisakonduktanss Ψ -0,046 W/(mK)
välismõõtu järgi

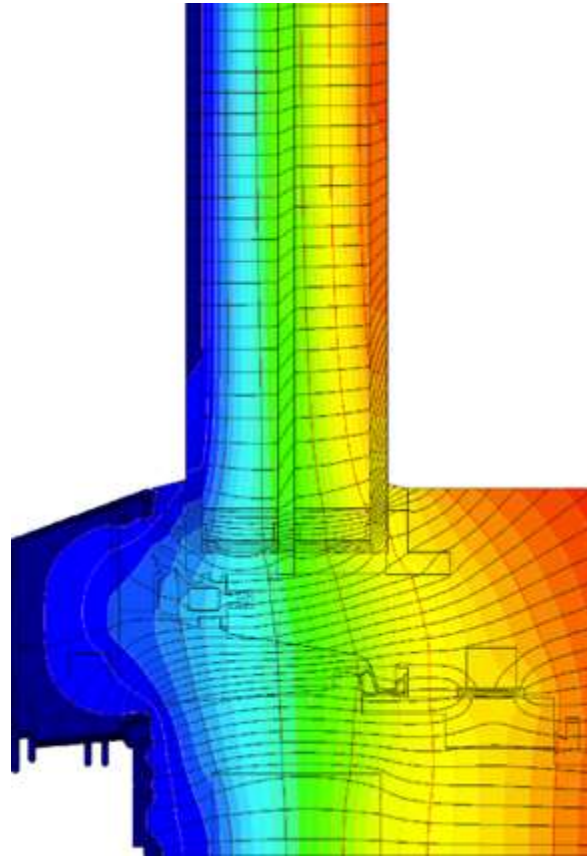
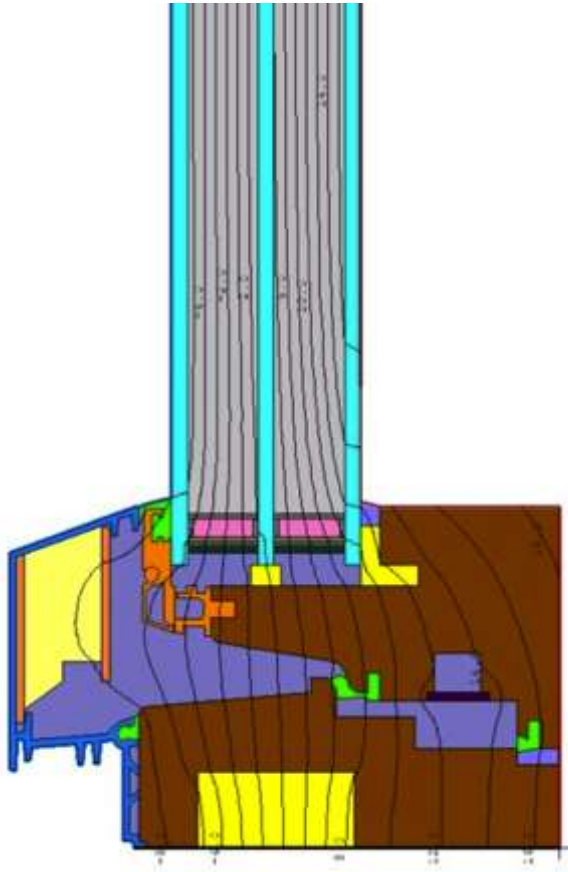


Külmasillavabad sõlmed

Külmasilla lisakonduktanss Ψ -0,014 W/(mK)
välismõõtu järgi



Aken



SmartWin fixed

U raam **0,57** W/(m²K)
 ψ spacer 0,026 W/(mK)
 ψ installation 0,010 W/(mK)

SmartWin avanev

U raam **0,77** W/(m²K)
 ψ spacer 0,026 W/(mK)
 ψ installation 0,010 W/(mK)

U klaas **0,54** W/(m²K)
g-väärtus **0,50**

Aken

väljast soojustatud aknaraam,
viimistletud fassaadi näide



SmartWin fixed

U raam **0,57** W/(m²K)

ψ spacer 0,026 W/(mK)

ψ installation 0,010 W/(mK)

SmartWin avanev

U raam **0,77** W/(m²K)

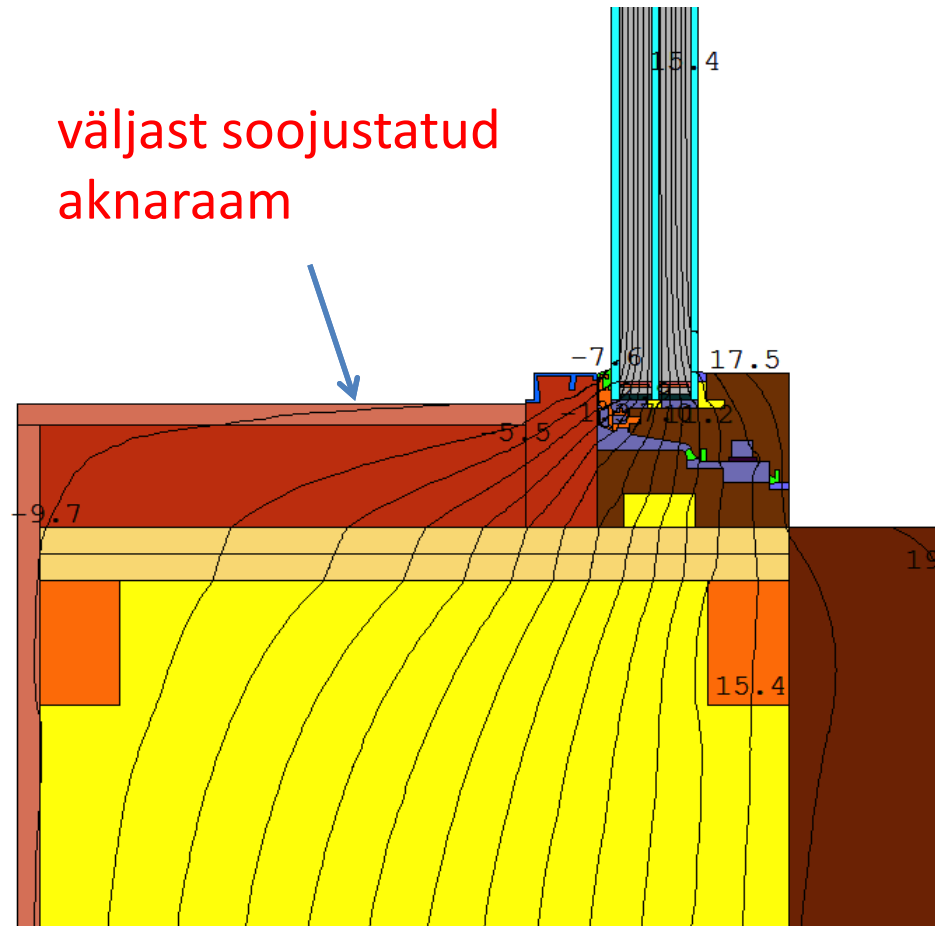
ψ spacer 0,026 W/(mK)

ψ installation 0,010 W/(mK)

U klaas **0,54** W/(m²K)

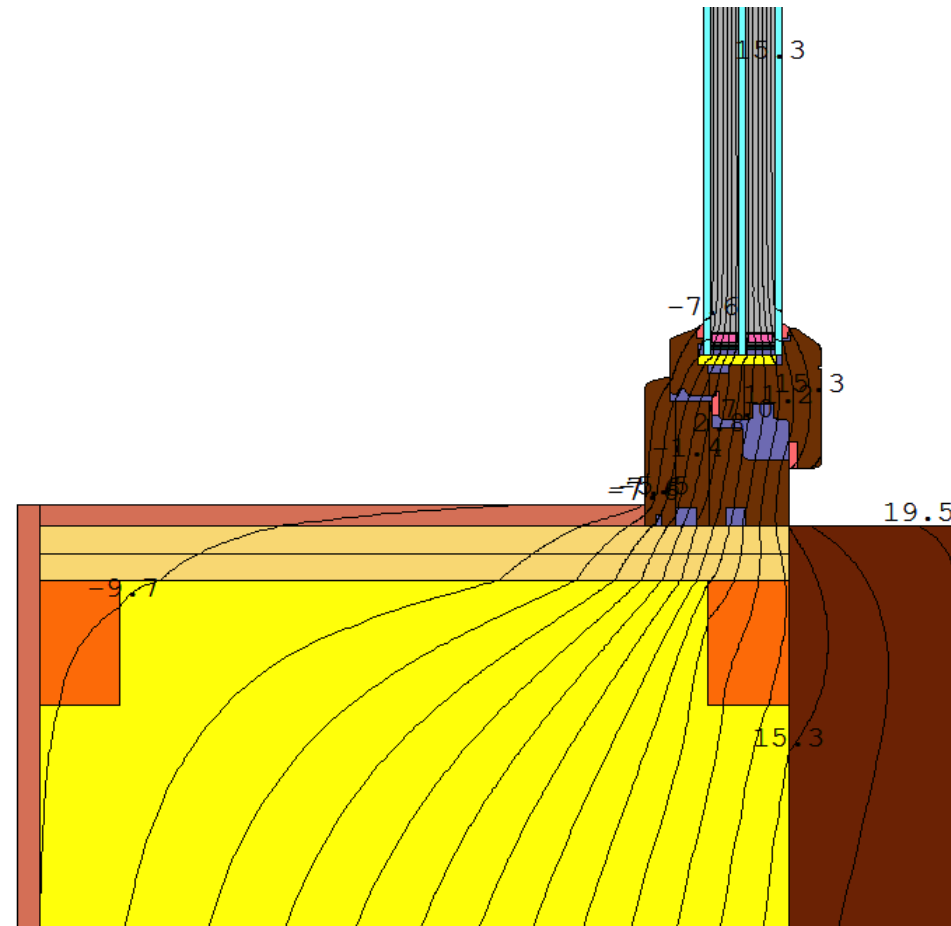
g-väärtus **0,50**

väljast soojustatud
aknaraam



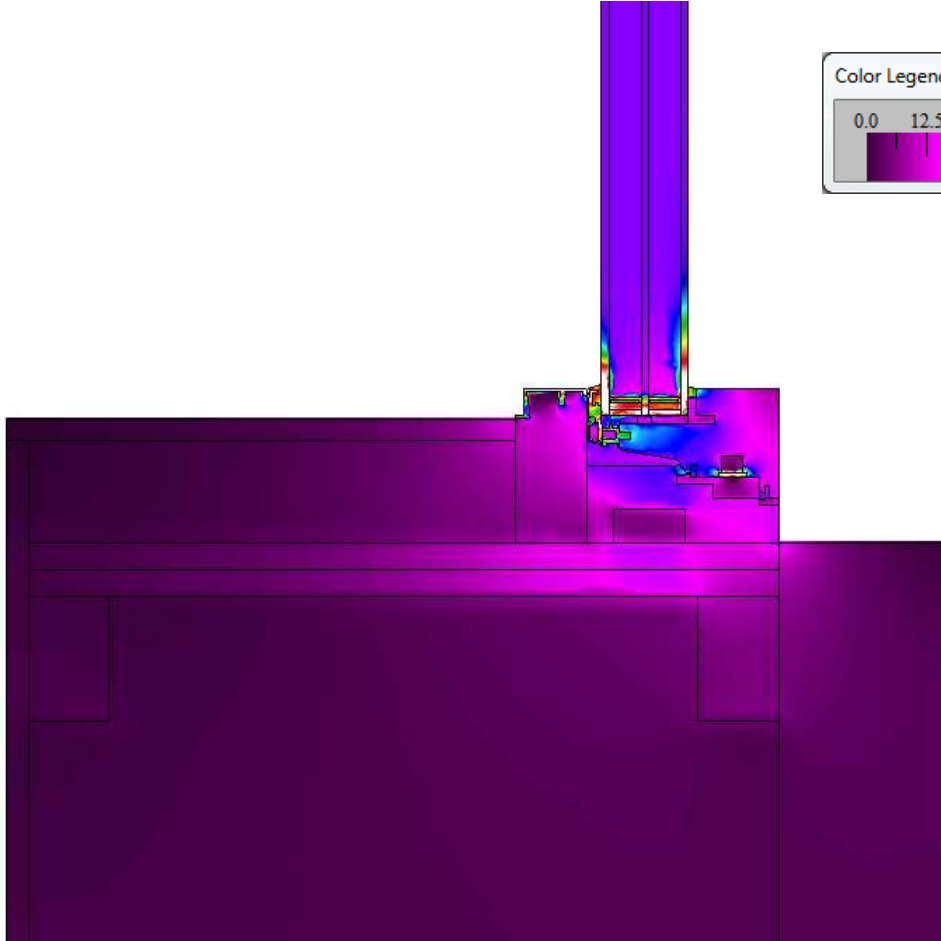
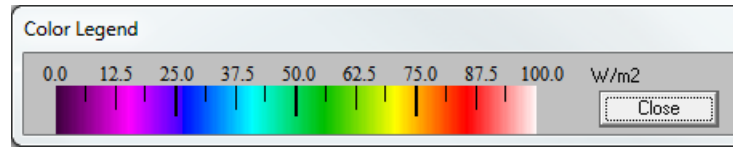
$$\Psi = 0,014 \text{ W/(mK)}$$

SmartWin



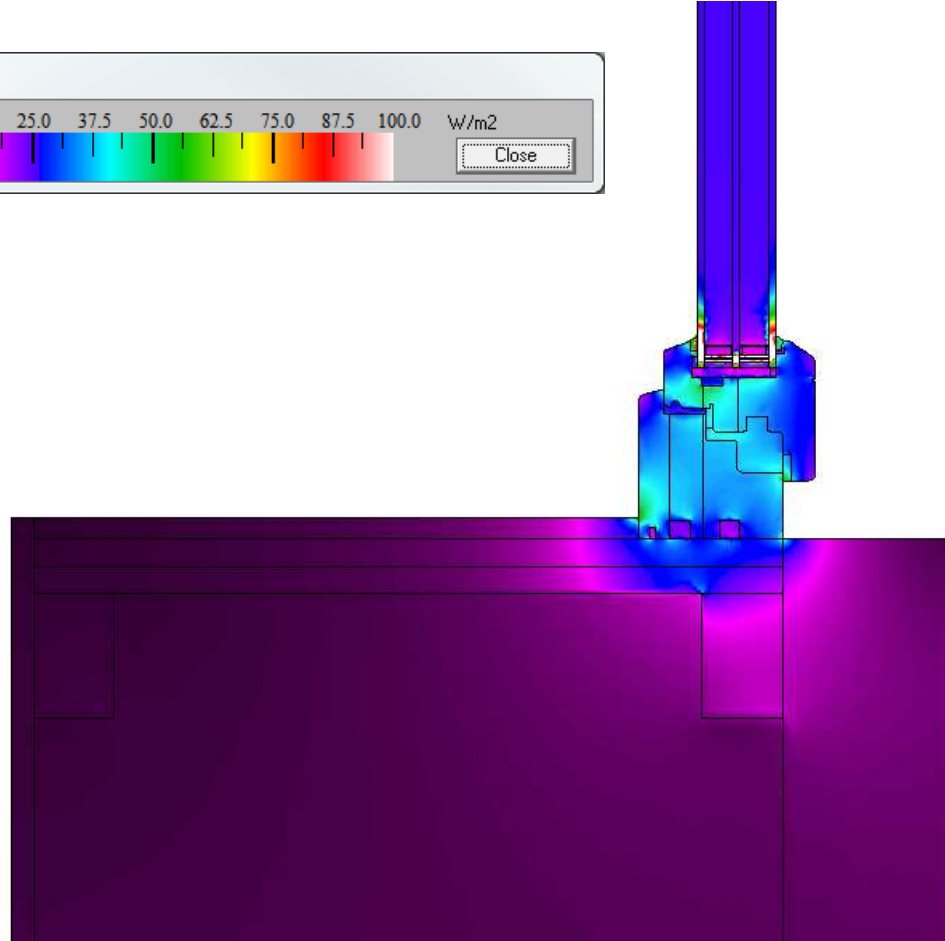
$$\Psi = 0,050 \text{ W/(mK)}$$

võrdluseks soojustuseta paigaldus



$$\Psi = 0,014 \text{ W/(mK)}$$

SmartWin



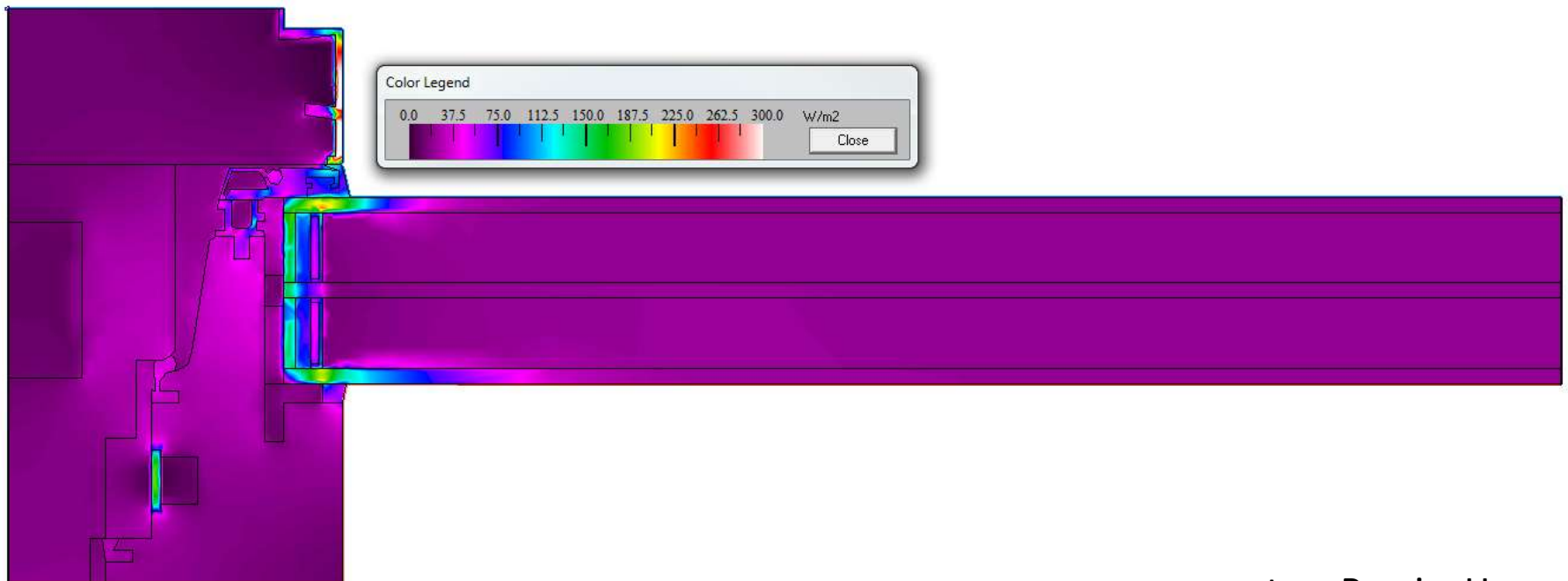
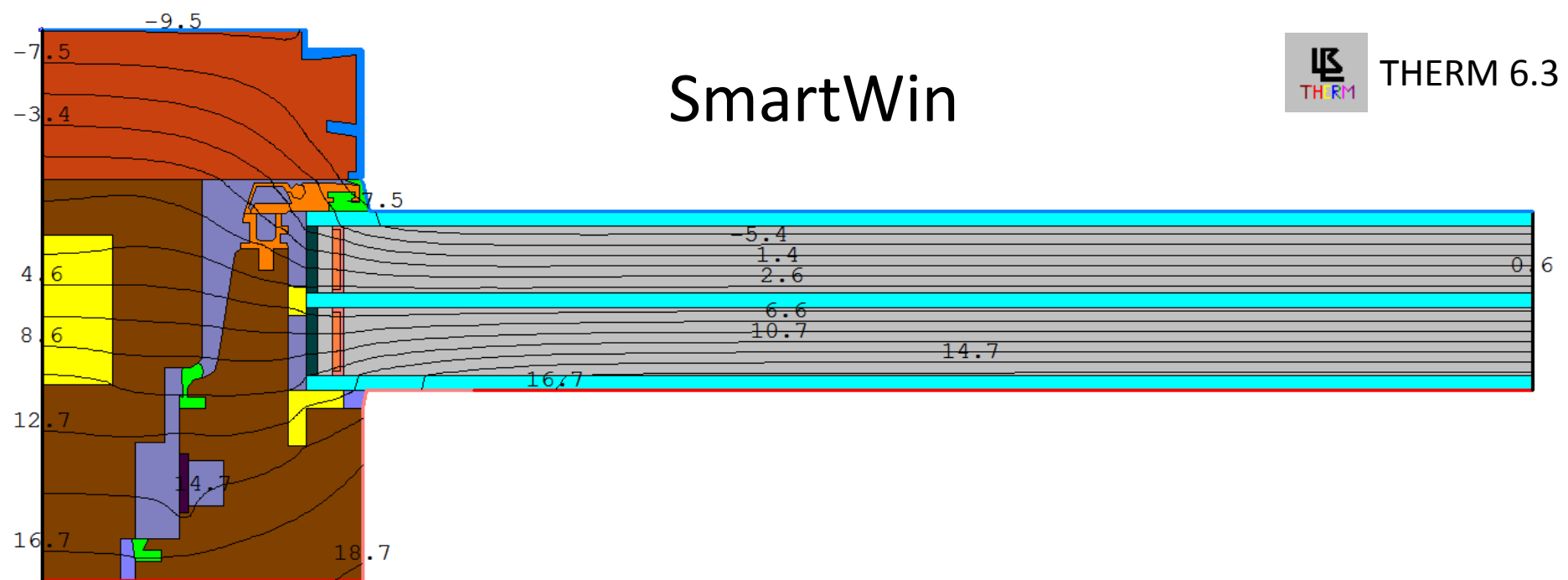
$$\Psi = 0,050 \text{ W/(mK)}$$

võrdluseks soojustuseta paigaldus

SmartWin



THERM 6.3



Certificate

Passive House suitable component
for cool, temperate climate, valid until 31.12.2012

Category: **Window Frame**
Manufacturer: **pro Passivhausfenster GmbH**
83080 Oberaudorf, GERMANY
Product name: **smartwin**

The following comfort criteria were used in awarding this certificate:

Given a U_g value of $0.70 \text{ W/(m}^2\text{K)}$ and a window size of 1.23 m by 1.48 m,

$$U_{W} = 0.78 \text{ W/(m}^2\text{K)} \leq 0.80 \text{ W/(m}^2\text{K)}$$

Taking into account the installation based thermal bridges, and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the window meets the following criterion.

$$U_{W, \text{installed}} \leq 0.85 \text{ W/(m}^2\text{K)}$$

Thermal data of the window frame

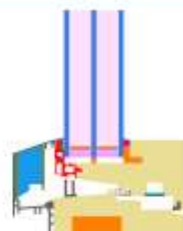
	U_f -value [W/(m ² K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer			SwisspacerV*	
Bottom	0.91	86	0.025	0.70
Side/top	0.70	86	0.026	

* Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

Further information see data sheet

www.passivehouse.com

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY



Passive House
Efficiency Class

phA
advanced
component

phB
basic
component

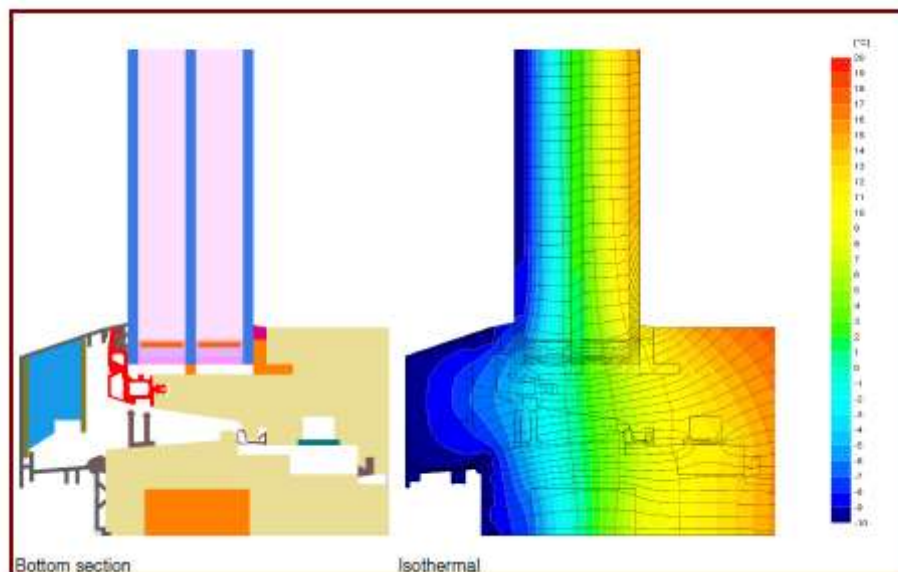
phC
certifiable
component

not suitable
for Passive
Houses

 **Passive House**
suitable
component
Dr. Wolfgang Feist

Data Sheet

Manufacturer: pro Passivhausfenster GmbH
Martin-Greif-Straße 20, 83080 Oberaudorf, GERMANY
Tel.: +49 8033 3040 98
Email: phc@freundorfer.eu, www.propassivhausfenster.net



Description

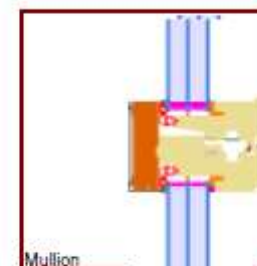
Timber window frame, outside insulated by wood-fibre-board. The outside is rainprotected by aluminium profiles. Used Pane: 48 mm (4/18/4/18/4), intersection of the Glass: 15 mm. Used spacer: SwisspacerV

Thermal data for the window frame

	U_f -value [W/(m ² K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer			SwisspacerV*	
Bottom	0.91	86	0.025	0.70
Side/top	0.70	86	0.026	
Flying Mullion	0.82		0.026	0.72
Spacer			SuperSp. Tri-Seal*	
Bottom	0.91	86	0.026	0.70
Side/top	0.70	86	0.027	
Flying Mullion	0.82		0.027	0.72

* Spacers of lower thermal quality leading to higher thermal losses and lower temperatures.

www.passivehouse.com



Mullion

Soojustagastusega ventilatsioon



Paul Novus 300

Soojustagastuse määr
PHI meetodi järgi 93%

Ruumide küttevajadus

Bilanss EVS-EN ISO 13790:2008, PHPP

	Transmissiooni soojakaod kWh/a
Sein vastu välisõhku	2991
Sein vastu pinnast	364
Katus	1062
Põrand pinnasel	681
Aknad	6412
Külmasillad	-550
Kokku	11613

Ruumide küttevajadus

Bilanss EVS-EN ISO 13790:2008, PHPP

	Ventilatsiooni soojakaod kWh/a
@ n50=0,3 1/h & Paul Novus 300 93% effective heat recovery efficiency	1103
Kokku	1103

Soojakaod kokku	12716
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Ruumide küttevajadus

Bilanss EVS-EN ISO 13790:2008, PHPP

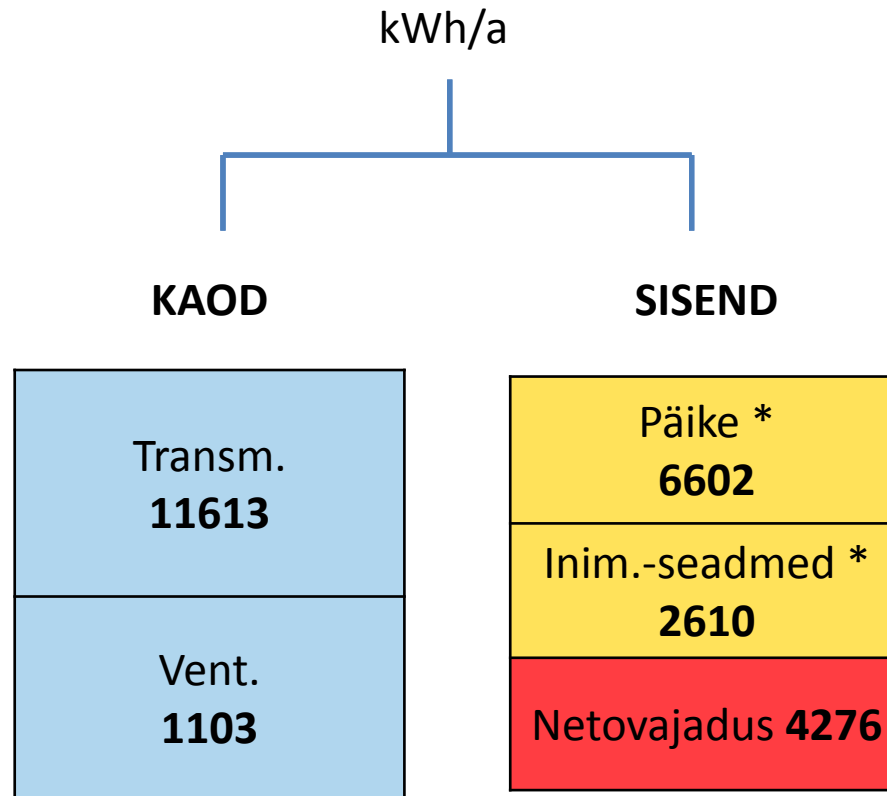
	Vabasoe kWh/a
Vabasoe päikesest	6602
Inimesed-seadmed @2,1 W/m ²	2610

@utilization factor 88%

Vabasoe kokku	8440
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Ruumide küttevajadus

Bilanss EVS-EN ISO 13790:2008, PHPP



* utilisation factor heat gains 92%

Energiasimulatsiooni tulemus

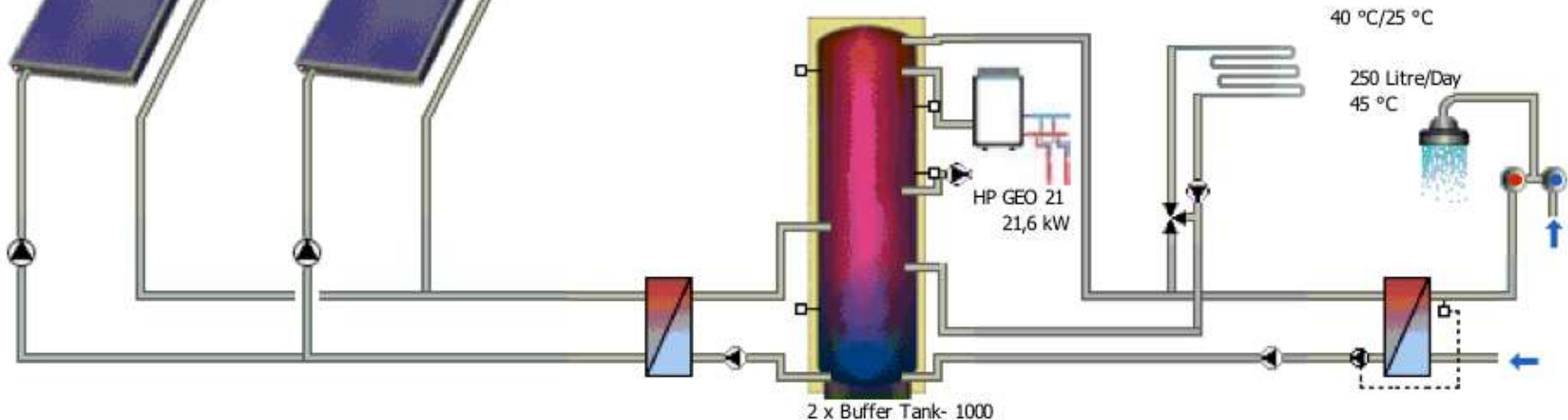
Specific Demands with Reference to the Treated Floor Area					
Treated Floor Area:		284,5 m ²			
	Applied:	Monthly method		PH Certificate:	Fulfilled?
Specific Space Heating Demand:	13,91	kWh/(m ² a)		15 kWh/(m ² a)	Yes
Heating Load:	12	W/m ²		10 W/m ²	Yes
Pressurization Test Result:	0,30	h ⁻¹		0,6 h ⁻¹	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	101	kWh/(m ² a)		120 kWh/(m ² a)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	44	kWh/(m ² a)			
Specific Primary Energy Reduction through Solar Electricity:		kWh/(m ² a)			
Frequency of Overheating:	0	%		over 25 °C	
Specific Useful Cooling Energy Demand:		kWh/(m ² a)		15 kWh/(m ² a)	
Cooling Load:	3	W/m ²			

Päikeseküttesüsteem: ruumide kütte tugi + soe tarbevesi

5 x Sonnenkraft SK IMK
Total Gross Surface Area: 12,50 m²
Azimuth: 0°
Incl.: 30°

1 x IFK
Total Gross Surface Area: 18,00 m²
Azimuth: 0°
Incl.: 0°

4910 kWh/a



Kollektorid:

Sonnenkraft SK IMK

11,5 m² paigaldus 30° horisontaalist

Sonnenkraft IFK

17,5 m² vertikaalpaigaldus

Akupaagid:

2 x 1000 l

Comfort PS1000

Comfort Plus PSC 1000 bacup

Kogu majapidamise elektrienergiatarve

- soojuspump
- majapidamiselekter
- tehnosüsteem)

11 000 – 12 000 kWh/a

PV paneelid

92 m²

1x1,8m 235W 51 tk

Arvutuslik tootlikkus:

11 100 kWh/a

Seire

energiavajadus, energia tootmine, konstruktsioonid



“Hoonete keskkonnamõju vähendamine läbi energiatõhususe parandamise”

Projekti nr: 3.2.0801.11-0035, periood: märts 2012- dets 2014

Tartu Ülikool / Tallinna Tehnikaülikool

Seire:

1. Tarindite temperatuuri, niiskuse ja soojavoo mõõtmine
2. Päikese kiirguse mõõtmine
3. Hoone sisekliima mõõtmine
4. Hoone tehnosüsteemide energiakasutuse, veekulu ja ventilatsiooni õhuvooluhulga mõõtmine



Over the last 20 years, Passive House has become synonymous with quality, comfort and energy requirements low enough to be feasibly and sustainably covered with renewables. From 9 – 11 November 2012, owners and residents of Passive House buildings will be able to show members of the public just that by opening their homes and offices for the 9th annual International Passive House Days.

http://www.passivehouse-international.org/index.php?page_id=262

<http://passivhausprojekte.de/projekte.php?lang=en&detail=2649>

Passive House Buildings

Project Data Sheet

◀ Back to Overview | Print

EE-63305 Põlva (Jõgeva, Põlva, Tartu, Valga, Viljandi, Võru)



Passive House Days Attendance:



Building type:

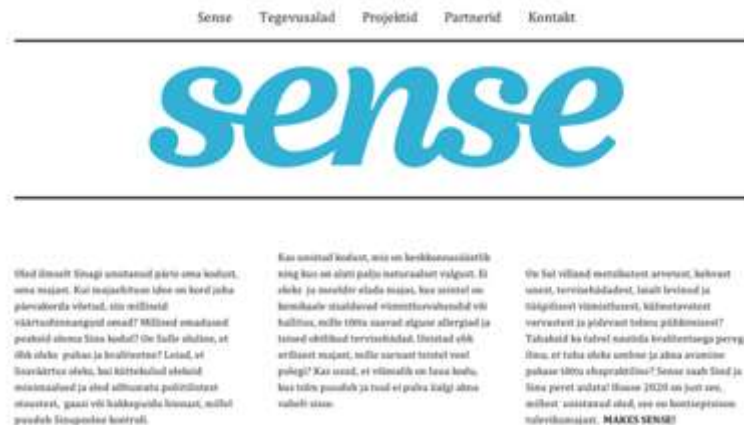
detached single family house (Passive House new build)

<http://kanal2.ee/vaatasaateid/Kodusaade-1?videoid=6710>

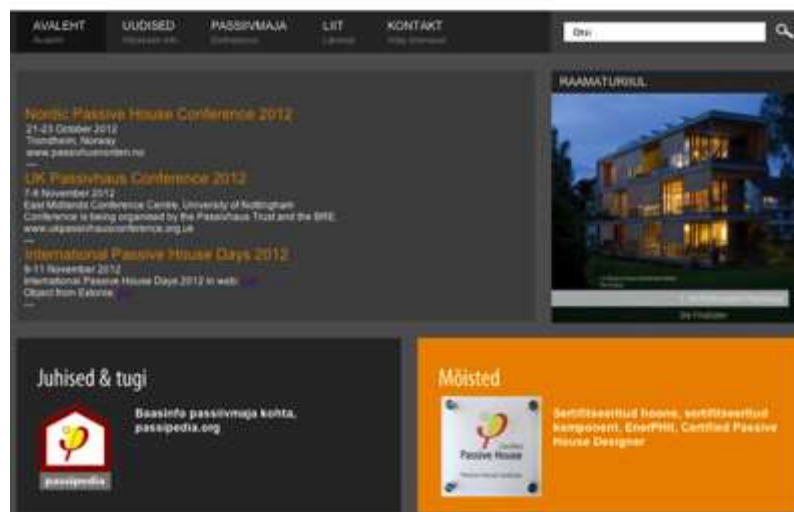


Rohkem infot:

www.sense.ee



www.passiivmajaliit.ee



Rohkem infot:

*** **METSA tn. 5a, PÕLVA LINN**

Projektijuhtimine ja omanikujärelevalve.

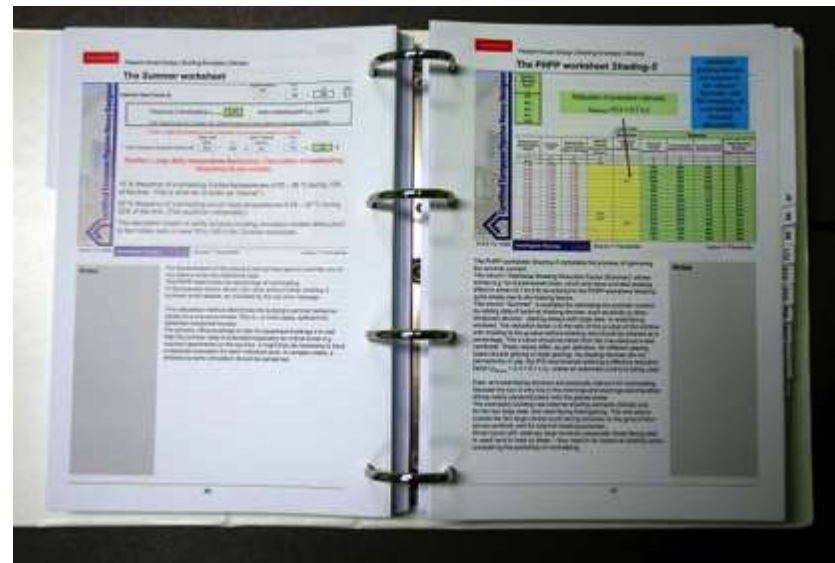


<http://www.flickr.com/photos/61283440@N05/6263456840/in/set-72157627814721214/lightbox/>

Arhitektid: **Martha Enríquez Reinberg ja Georg W. Reinberg** (Austria)

10-päevane täiendõpe

www.passiivmaja.ee



www.passivhausplaner.eu



Täna kuulamast!

Tõnu Mauring tonu.mauring@ut.ee