THE EUROPEAN AND NORWEGIAN MARKET FOR WINDOW TECHNOLOGY

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European window market for new-built year 2006

Country	Window U-Value	Current Standard Practice	Future Developments
Austria	1.9	Low E double glazing and argon.	Working towards the development of a national building code by 2005 (currently the provinces have autonomy). Likely to be a total energy consumption requirement.
Baltic States	-	Triple Glazing or Low E double glazing.	Currently writing Regulations. Likely to match Scandinavian standards.
Belgium	3.5 (2.5 in Brussels Region)	Ordinary double glazing (Low E double glazing in Brussels Region).	Flanders Region intend to move to U2.0.
Denmark	1.8	Low E double glazing	From Jan 2006 the requirement for new build will be based on Total Energy Performance. U1.5 will be required for extensions and major refurbishments.
Finland	1.4	Triple (2 + 1), many with Low E and argon.	
France	Total energy consumption, with U-value limits (2.9 in the case of windows), or 2.2-2.4 if following the elemental option. There are also requirements to minimise solar gain in summer.	New Regs came into effect June 2001, leading to Low E double glazing becoming common practice.	Government is working on making improvements from Dec 2005, and every five years thereafter. Will include requirements for solar protection.
Germany	Volumetric, but lower limit elemental values	Low E double glazing and argon.	
Greece	2.5 in the north, 3.0 in the south	Double glazing, increasingly moving to low E.	
Ireland	2.2	Low E (hard coat) double glazing.	
Italy	Volumetric	Ordinary double glazing in the north, single in the south.	U2.4 to 5.5 (depending on climatic zone) currently being proposed for new build and replacement windows.
Luxembourg	2.0	Low E double glazing	
Netherlands	Total energy consumption (EPC), with U-value limits	Low E double glazing	U1.2 being proposed by government. EPC to be improved every year.
Norway	1.6	Low E double glazing and argon.	U1.5 being proposed for 2006.
Poland	2.6	Low E double glazing	Preliminary talk of moving to U2.0 or lower.
Portugal	Volumetric	Double glazing	Heat loss requirement to be tightened by about 40%. Should lead to some double glazing in colder climatic zones.
Russia	1.8*	Low E double glazing or triple clear glazing	
Slovakia	2.0 (for large bldgs)	Low E double glazing	
Slovenia	1.6		
Spain	Volumetric	Double glazing	Regulations under review. New standards in 2005
Sweden	Volumetric	Triple glazing, often with Low E and argon.	Parliamentary review of energy performance of buildings initiated in 2002, to report in 2005. Likely to result in improved regulations in 2006, including provisions for existing buildings.
Switzerland	Volumetric	Low E double glazing	
UK	Window U = 2.2 (metal windows) and 2.0 (non-metal).	Low E (hard coat) double glazing	Government have announced that new Regulations will be published July 2005.

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Source: "Building Regulations for Windows in European Countries", http://www.glassforeurope.com/images/cont/91_96281_file.pdf

European window market for residential year 2017

Member State	Legal requirements		
	U_w – value	g - value	Last update
	W/m²K	-	-
Austria	1.2	-	2015
Belgium - Brussels	1.8 (U_g: 1.1)		2014
Belgium - Flanders	1.5* (U_g: 1.1)		2016
Belgium - Wallonia	1.5 (U_g: 1.1)		2017
Bulgaria	1.4*	-	2015
Croatia	1.6 / 1.8*	-	2015
Cyprus	2.9*	-	2017
Czech Republic	1.5	-	2011
Denmark	-*	-	2015
Estonia	-*	-	2013
Finland	1.0*	-	2012
France	2.3 / 2.6*	-	2008
Germany	1.3	-	2014
Greece	2.6...3.2*	-	2010
Hungary	1.6*	-	2006
Ireland	1.6*	-	2011
Italy	1.7...3.2*	0.35*	2015
Latvia	1.3·k / 1.8·k*	-	2015
Lithuania	1.6·k*	-	2014
Luxembourg	1.5*	-	2016
Malta	4.0*	0.89	2015
Netherlands	2.2	-	2015
Poland	1.1*	-	2017
Portugal	2.2...2.8*	0.10...0.56*	2016
Romania	1.5*	-	2016
Slovak Republic	1.0	0.60	2016
Slovenia	1.3*	0.50	2010
Spain	2.5...5.7*	-	2013
Sweden	1.2*	-	2012
UK – England	1.6*	-	2016
UK – Wales	1.6*	-	2014
UK – Northern Ireland	1.6*	-	2013
UK – Scotland	1.6*	-	2016

From ECOFys report, " Minimum performance requirements for window replacement in the residential sector", 2017

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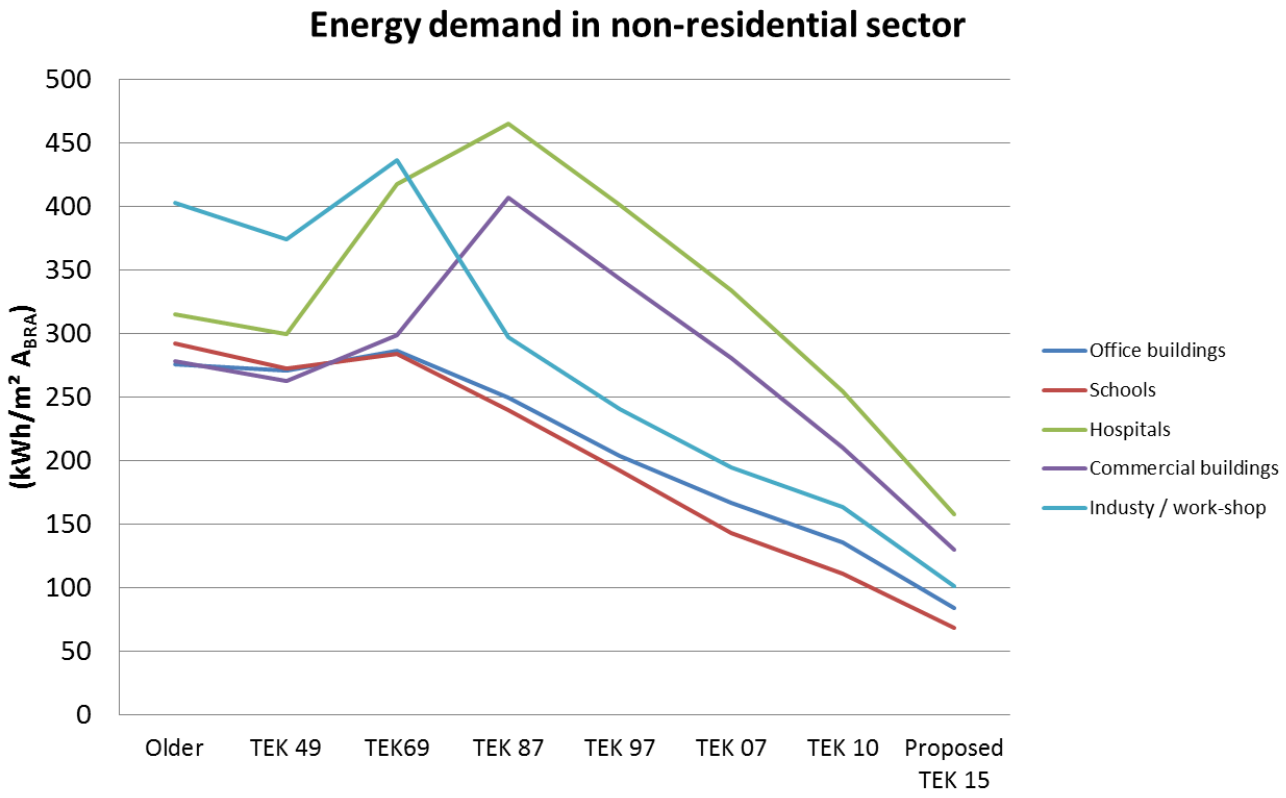
The Norwegian window market



Source: Potensial- og barrierestudie Energieffektivisering i norske yrkesbygg, enova report 2012:01.2

- 2017 regulations became a game-changer for window manufacturers
  - Moving from 2-pane to 3-pane IGU's
  - Difficult to achieve U= 0.8 for "traditional" windows

Building component	TEK 10	TEK 15
U-value roofs (W/m²K)	0,.18	0.18
U-value walls (W/m²K)	0.22	0.22
U-value floors (W/m²K)	0.18	0.18
U-value windows & doors (W/m²K)	1.2* (Min. 1.6)	0.8* (Min 1.2)
Air leakages n_{50} (1/h)	3,0	1,5

* For a *reference* window w/size 1.23 x 1.48m

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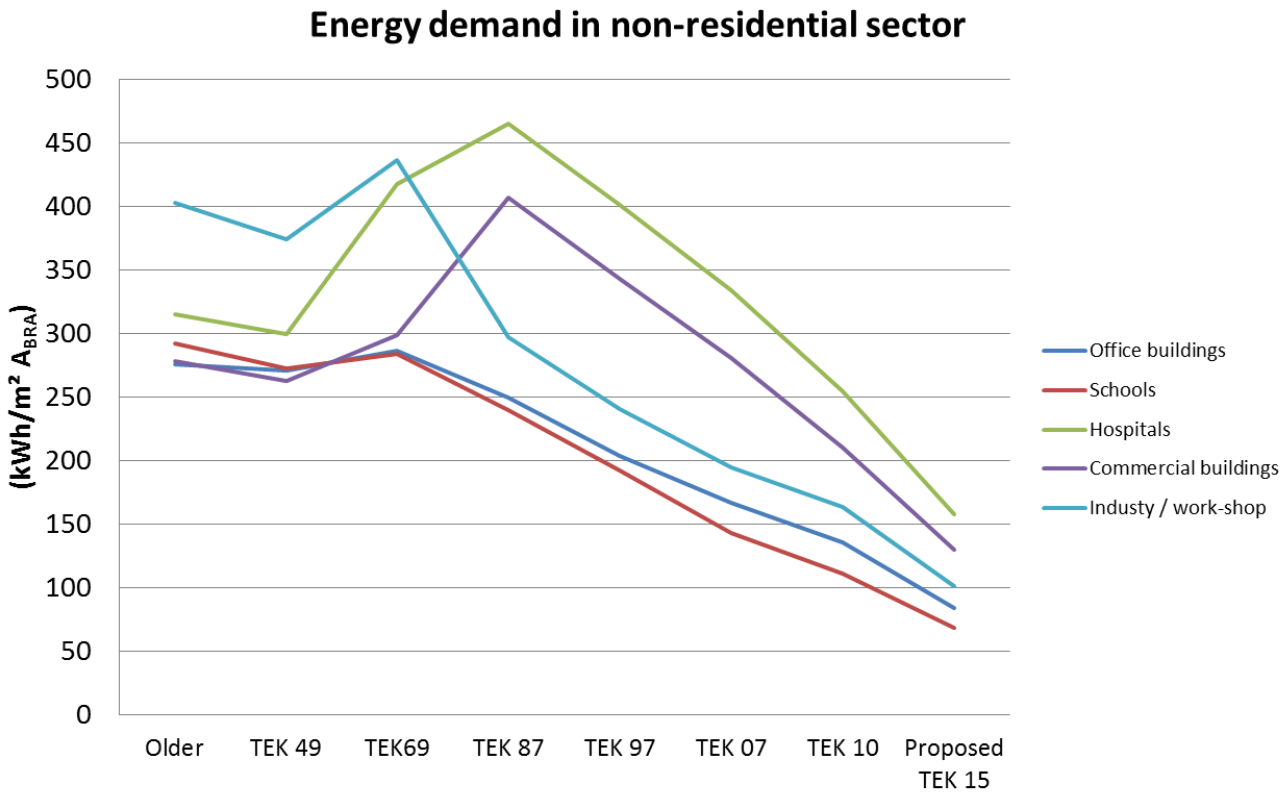
The Norwegian window market



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- 2017 regulations became a game-changer for window manufacturers
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Building component	TEK 10	TEK 15
R-value roofs (h·°F·ft²/BTU)	32	32
R-value walls (h·°F·ft²/BTU)	26	26
R-value floors (h·°F·ft²/BTU)	32	32
R-value windows & doors (h·°F·ft²/BTU)	4.7* (Min. 3.5)	7.1* (Min 4.7)
Air leakages n_{50} (1/h)	3,0	1,5

* For a *reference* window w/size 1.23 x 1.48m

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HVIT

Highly Insulation Windows with Integrated Technology

Goal

- The vision is to enable RVD to provide windows and doors with U-values of as low as 0,43 W/m²K. Todays building code level is 0,8

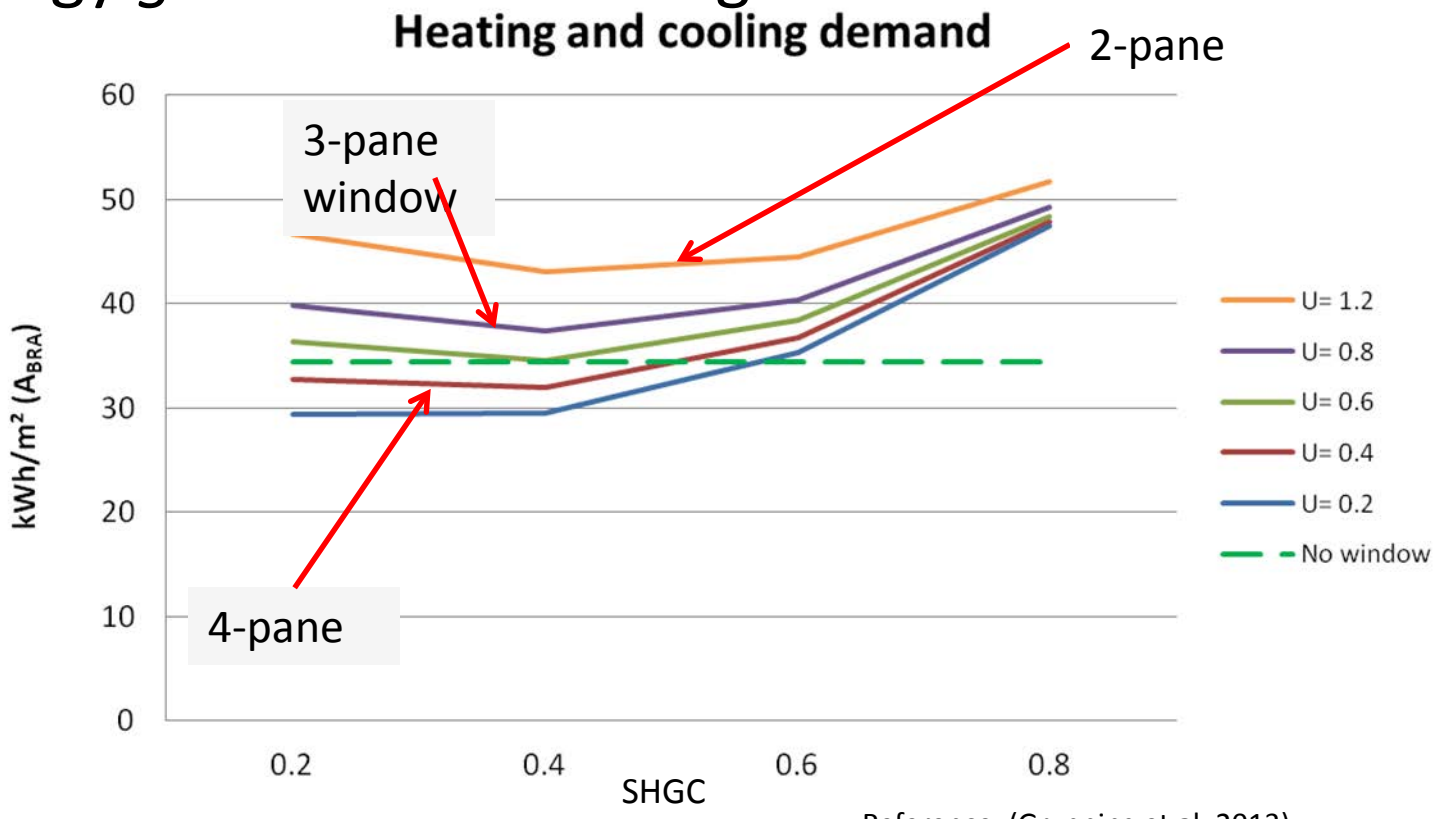
- The aims are to develop windows with
  - Minimal heat losses, high daylight transmission and superior *solar energy* properties
  - Innovative, slim window frames
  - The strenght-interaction of frame and glazing unit are optimized

Main activities

- H1 – Highly insulating windows and doors
- H2 – Energy saving add-ons
- H3 – Installing/mounting solutions
- H4 – Climate adaption and durability
- H5 – Business models and production efficiency
- H6 – Project management and dissemination of results

Heat losses and heat gains…

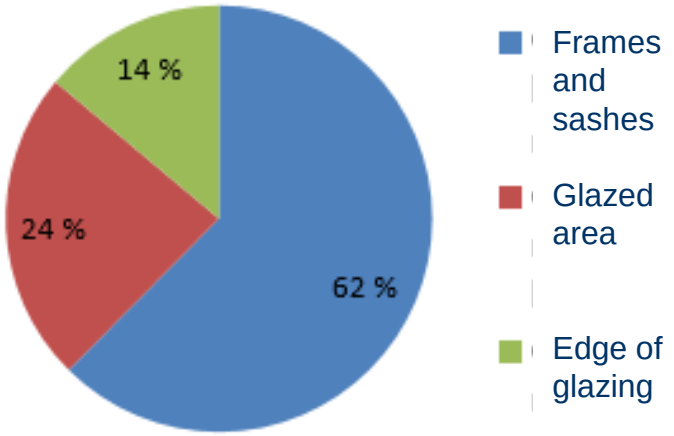
- Can the transparent parts of the façade contribute as energy *gainers* to a building



Reference: (Grynning et al. 2013)

The distribution of heat losses through a window with different sizes

1,23 m x 1,48 m, Uv 0,763 W/m²K



1,2 m x 0,6 m, Uv 0,931 W/m²K