



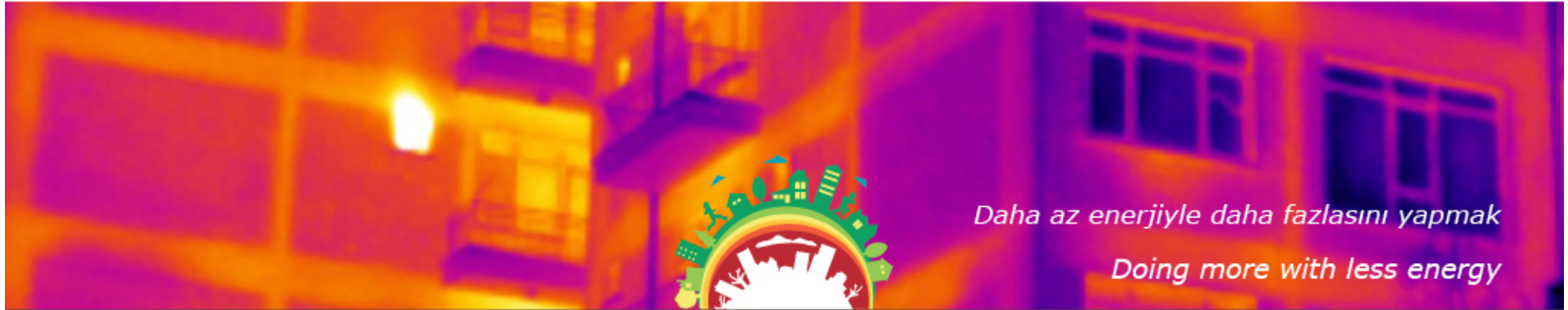
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This project is co-financed by the European Union and the Republic of Turkey

## Binalarda Enerji Verimliliđinin Artırılması iin Teknik Yardım Projesi Technical Assistance for Improving Energy Efficiency in Buildings Project

# Technical Issues

## ENSI and DTI

Nataliya Grytsenko (ENSI), Lars Olsen (DTI), Lars Thomsen Nielsen (DTI)



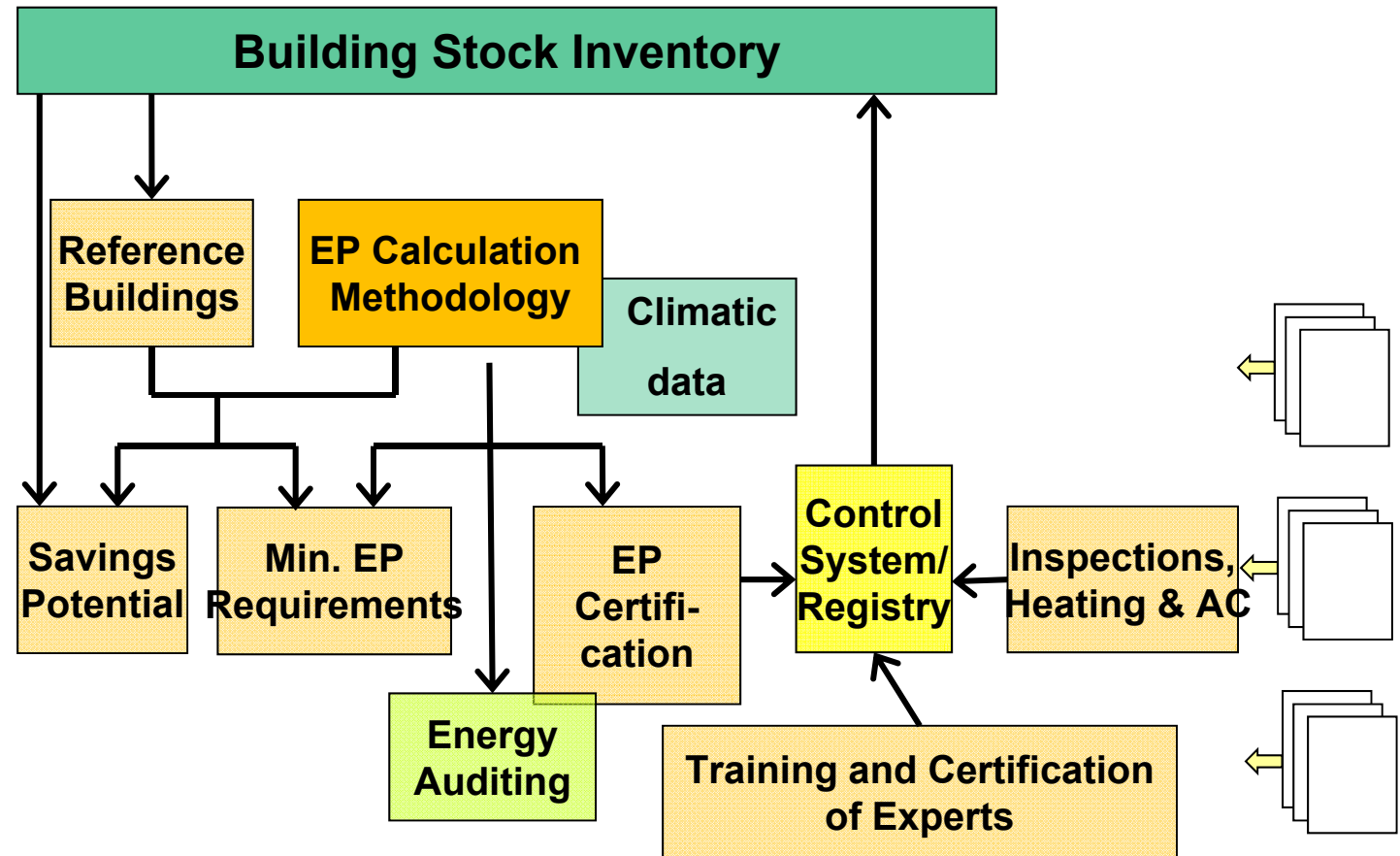
**NIRAS**





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## Overview



Binalarda Enerji Verimliliğinin Artırılması için Teknik Yardım Projesi  
Technical Assistance for Improving Energy Efficiency in Buildings Project





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## Technical issues

- ❖ Selection of calculation methodology for Energy Performance of Buildings
- ❖ Methodology for certification of apartments and single family houses buildings
- ❖ Rules for energy rating
- ❖ Technical requirements - minimum energy performance requirements (building envelope, systems, etc.) **and how to check their compliance**
- ❖ Reference climatic data for determining the building energy performance....

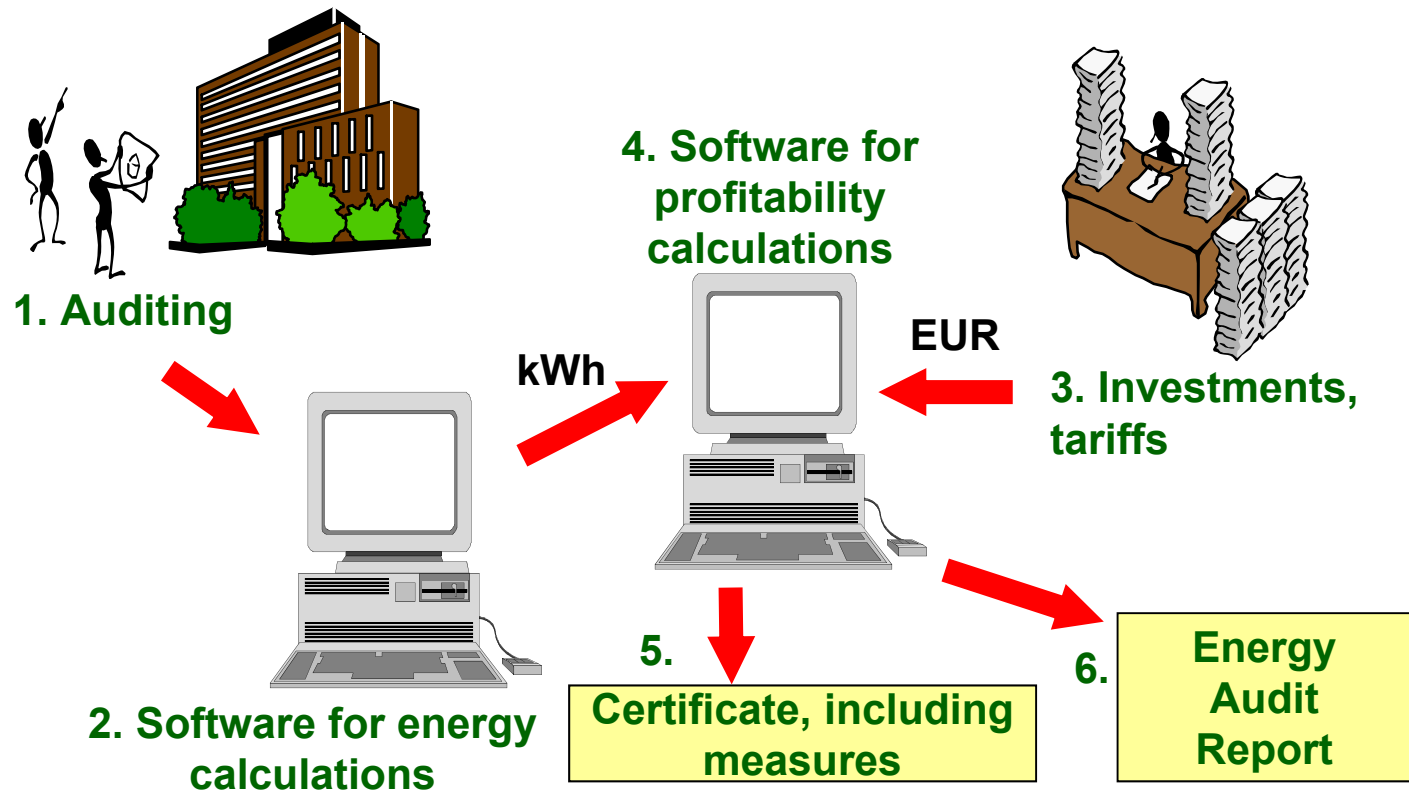




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## Calculation

Norway: simple hourly data, Bulgaria + Denmark: monthly values



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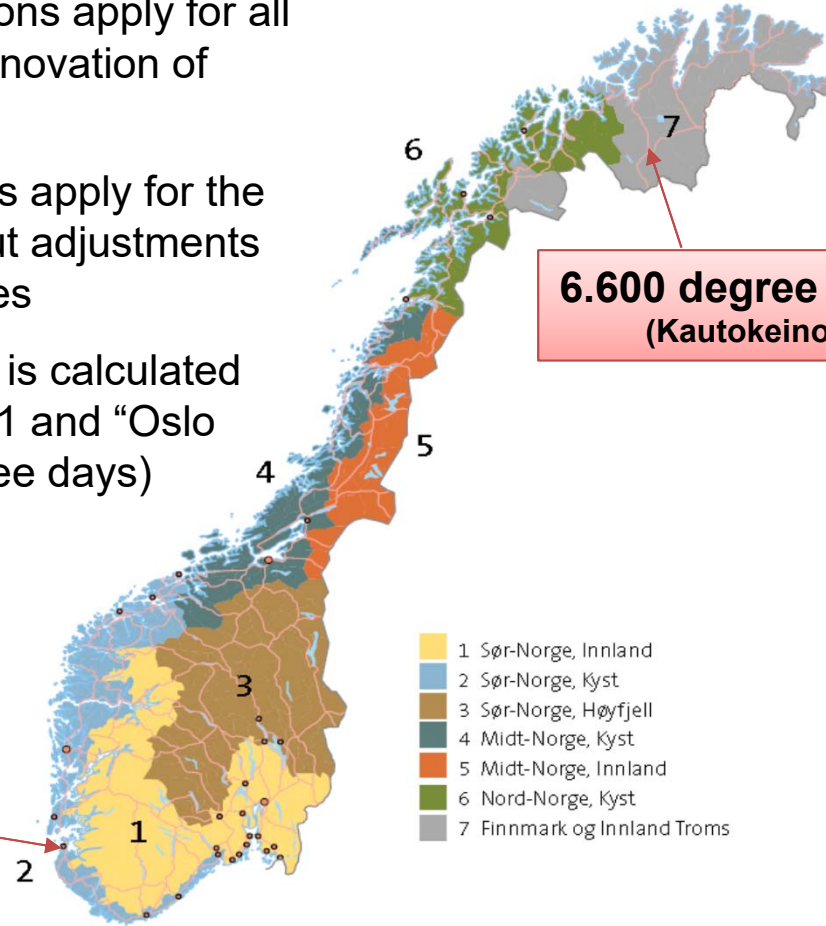
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## National Building Codes

### Key features of Norwegian Building Codes

- The building regulations apply for all new buildings and renovation of existing buildings
- The same regulations apply for the whole country without adjustments for climatic differences
- Energy performance is calculated according to NS 3031 and “Oslo climate” (4.000 degree days)

**3.000 degree days  
(Stavanger)**



- 1 Sør-Norge, Innland
- 2 Sør-Norge, Kyst
- 3 Sør-Norge, Høyfjell
- 4 Midt-Norge, Kyst
- 5 Midt-Norge, Innland
- 6 Nord-Norge, Kyst
- 7 Finnmark og Innland Troms





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## Minimum Requirements

Besides overall energy performance indicators

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- ❖ Requirements for building envelope
  - U-values,
  - thermal bridges
- ❖ Requirements for air exchange
  - infiltration
  - annual efficiency of heat exchanger in ventilation systems
- ❖ Specific fan performance (SFP)
- ❖ Boilers: It is not allowed to install boiler using oil to cover the base load (60–90% of total energy need). Oil is only allowed to cover peak load.
- ❖ Setback temperatures





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## Minimum Requirements

Besides overall energy performance indicators

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- ❖ Heat supply : In areas having a district heating, all new buildings must be equipped with systems that can utilise district heating .
- ❖ Renewable energy source: minimum 60% of the net energy need for heating is covered with other energy sources than direct electricity or fossil fuel
- ❖ Automatic control systems
- ❖ Energy efficient insulation for piping, equipment and ducts (for heating and cooling distribution systems)







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## Programs

## BEP-TR Çevrimiçi web programı

The screenshot displays the BEP-TR web program interface. The main window is titled "Proje Adı - Kodu: KAHIRAN ÇİLEŞİZ - emlak no: 104 - Tipoloji: Apartman - İl - İlçe: HÜĞLA - Ülk" and features a navigation menu with "Genel Bilgiler", "Veri Giriş Şekli", "Kat Formu ve Ölçüler", "Katlar", and "Isı Köprüleri". The "Genel Bilgiler" tab is active, showing sections for "Sızdırmazlık Bilgileri", "Kiriş Bilgileri", and "Yükseklik Döşeme Bilgileri". The "Sızdırmazlık Bilgileri" section includes a dropdown for "Bina Konstrüksiyon Tipi" (Tajpa veya Blok Bina), checkboxes for "Sızdırmaz Bina" and "Kompleks - (Dikdörtgen Olmayan Kat Planı)", and radio buttons for "Hava Sızdırma Değeri" (Sızdırmaz Barıt Olan - Pencere ve Kapılar, Sızdırmaz Barıt Olmayan - Pencere ve Kapılar). The "Kiriş Bilgileri" section has a text input for "Kiriş Alan Yüksekliği (m)" (0,35) and a "Kiriş Bileşeni" dropdown. The "Yükseklik Döşeme Bilgileri" section has a checkbox for "Yükseklik Döşeme Var mı?". A sidebar on the left shows a tree view of building components like "2. Kat - Çatı", "1. Kat - Kat", "Yatak Odası 1", "Yatak Odası 2", "Mutfak", "Banyo", "Merdiven", "Ekiş", "Banyo", "Banyo". Below the sidebar is a small 3D house icon. A secondary window on the right shows a grid of floor plan icons and a table with columns for "Kat", "Yükseklik (m)", "Alan (m<sup>2</sup>)", and "Yükseklik Döşeme (m)", with rows for "1. Kat", "2. Kat", and "3. Kat".

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# Programs

## CEN

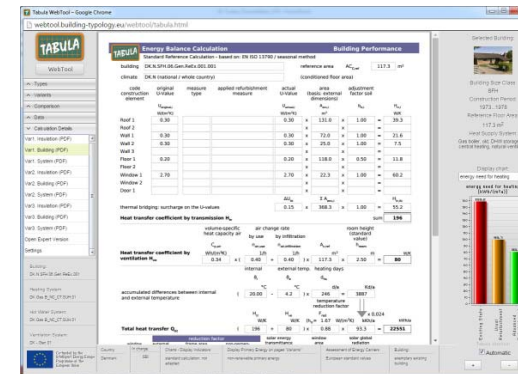
### EN ISO/DIS 52016-1 Energy performance of buildings

Uzunluk	Yükseklik	Alan	Uzunluk	Yükseklik	Alan	Uzunluk	Yükseklik	Alan	Uzunluk	Yükseklik	Alan
1.00	3.00	3.00	1.00	3.00	3.00	1.00	3.00	3.00	1.00	3.00	3.00
1.00	3.00	3.00	1.00	3.00	3.00	1.00	3.00	3.00	1.00	3.00	3.00

## Tabula

### IEE Project TABULA (2009 - 2012)

### Typology Approach for Building Stock Energy Assessment



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# Programs

## ENSI

### Energy Auditing of Buildings Software

Parameter	Standard	Actual	Baseline	Sensitivity	kWh/m <sup>2</sup> a	Measure	Savings
<b>1. Heating</b>							
56,0 kWh/m <sup>2</sup> a							
U-wall	0.30 W/m <sup>2</sup> K	0.45	0.45	+ 0.1 W/m <sup>2</sup> K = 0.37	0.30	>	-7.53
U-window	2.40 W/m <sup>2</sup> K	3.05	3.05	+ 0.1 W/m <sup>2</sup> K = 2.95	1.30	>	-45.67
U-roof	0.20 W/m <sup>2</sup> K	0.20	0.20	+ 0.1 W/m <sup>2</sup> K = 1.35	0.20	>	
U-floor	0.30 W/m <sup>2</sup> K	0.35	0.35	+ 0.1 W/m <sup>2</sup> K = 1.35	0.30	>	
Correspondence ratio	0.33	0.33	0.33		0.33		
Window factor	27.1 %	27.1	27.1		27.1		
Total solar gain	0.55	0.55	0.55		0.55		
Infiltration	0.25 1/h	0.45	0.45	+ 0.1 1/h = 10.13	0.25	>	-14.04
Indoor temperature	21.0 °C	21.0	21.0	+ 1 °C = 6.18	21.0		
Setback temperature	15.0 °C	15.0	15.0	+ 1 °C = 5.65	15.0		
<b>Contribution from</b>							
Ventilation (heating)	kWh/m <sup>2</sup> a	0.00	0.00		0.00		
Lighting	kWh/m <sup>2</sup> a	16.10	16.10		16.04		
Various equipment	kWh/m <sup>2</sup> a	10.92	10.92		9.95		
<b>Energy need</b>							
81.8 kWh/m <sup>2</sup> a							
Emission efficiency	93.0 %	93.0	93.0		93.0		
Distribution efficiency	97.0 %	97.0	97.0		97.0		
Automatic control	96.0 %	96.0	96.0		96.0		
TBEM	95.0 %	95.0	95.0		95.0		-2.81
<b>Sum</b>							
97.4 kWh/m <sup>2</sup> a							
Generation efficiency	100.0 %	100.0	100.0		100.0		
<b>Energy use</b>							
97.4 kWh/m <sup>2</sup> a							

## BE10

### SBI – instructions 213

Documentation according to Danish legislation and Energy labeling

Windows and outer doors	Number	Orientation	Inclination	Area (m <sup>2</sup> )	U-value (W/m <sup>2</sup> K)	g-value (%)	Shading	U <sub>eff</sub> (W/m <sup>2</sup> K)	Loss (kWh)
10-1	1	0	90	0,14	1,05	1,00	1	1,05	21,524
10-2	1	0	90	0,41	1,08	1,00	1	1,08	14,166
10-3	1	0	90	0,16	1,17	1,00	1	1,17	5,994
10-4	1	0	90	0,41	1,08	1,00	1	1,08	14,166
10-5	1	0	90	0,16	1,17	1,00	1	1,17	5,994
10-6	1	0	90	0,16	1,17	1,00	1	1,17	5,994
10-7 overpath	1	90	90	0,41	1,08	1,00	1	1,08	14,166
10-7	1	90	90	2,17	0,84	1,00	1	0,84	16,552
10-8	1	180	90	0,16	1,17	1,00	1	1,17	5,994
10-9	1	180	90	4	0,73	1,00	1	0,73	93,44
10-10	1	180	90	4	0,73	1,00	1	0,73	93,44
10-11 insert	1	180	90	4	0,68	1,00	1	0,68	97,04
10-11 insert	1	180	90	4	0,68	1,00	1	0,68	97,04
10-11 insert	1	180	90	4	0,68	1,00	1	0,68	97,04
10-12	1	270	90	4	0,73	1,00	1	0,73	93,44
10-13	1	270	90	0,16	1,17	1,00	1	1,17	5,994

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## Experience

### Energy labelling of houses

Required energy certificates in EU for:

- New buildings
- Existing buildings when rented or sold



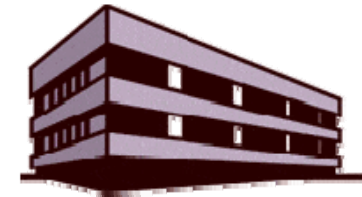
Energy certificates is needed for:



Houses



Apartments



Offices





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## Experience

### Energy labelling of houses


## Inputs to Energy certificates

- External energy auditor (ex. Denmark and Germany)
- Registration by house owner (ex. Norway)


**Energimærkning**

Energimærkning for følgende ejendom:

Adresse: Storskovvej 42  
Postnr./by: 8290 Viby J  
DBF-nr.: 751-487877-001  
Energimærkning nr.: 100244579  
Gyldigt 10 år fra: 10-10-2011  
Energikonulent: Jesper Sørensen  
Programversion: Energy08, Bæ03 version 4  
Firma: Energisust Fyn SWBA



Energimærkning oplyser om ejendommens energiforbrug og om muligheder for at reducere forbruget. Mærkningen er lovpålagt og skal udføres af et certificeret firma eller en beskikket energikonulent.

Beregnet varmeforbrug	Energimærke
<ul style="list-style-type: none"> <li>• Udgift inkl. moms og afgifter: 13.086 kr./år</li> <li>• Forbrug: 1.887,4 Liter fuelolie</li> </ul>	<p>Lavt forbrug</p>  <p>Højt forbrug</p>

Energimærket angiver varmeforbrug under standard-betingelser for vej-, familiestørrelse, krav til rumtemperatur, forbrugsvarer m.m. Mærket fortæller altså om bygningens kvalitet - ikke om måden den bruges på eller om veldens varikold eller mild. Derfor kan det beregnede årsforbrug afvige fra det faktiske forbrug, som det fremgår af el- og varme-regninger. Læs mere i pjecen "Sådan beregnes varmeforbruget i boligens energimærke" på [www.energiportal.dk](http://www.energiportal.dk).

**Kan det blive bedre?**  
Bygningen kan forbedres, så der bruges mindre energi. Det vil gøre det billigere at bo i huset og kan gøre det mere attraktivt ved salg.

Energikonulenten foreslår forbedringerne nedenfor. Der kan være flere forslag på side 2. Se mere om forslagene i afsluttet "Energikonulentens bygningsevaluering".

Forslag til forbedring	Årlig besparelse i energiforbrug	Årlig besparelse i kr. inkl. moms	Skønnet investering inkl. moms	Tilbagebetalingstid
1 Isolering af varmefordelerne	35,1 Liter fuelolie	300 kr.	1.100 kr.	4,0 år
2 Isolering af tilslutninger til varmtvandsbeholder	5,4 Liter fuelolie	40 kr.	200 kr.	4,4 år
3 Montering af ny cirkulationspumpe på varmesløjf	333 kWh el	700 kr.	4.500 kr.	6,8 år
4 Efterisolering af loft med opvarmet lagrum med 250 mm.	377,5 Liter fuelolie	2.800 kr.	54.800 kr.	19,8 år

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## Experience

### Energy labelling of houses

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## Requirements for a energy certificate

- ❖ A certified independent consultant has to:
  - ❖ Do a building audit
  - ❖ Calculate energy performance
  - ❖ Suggest energy saving measures
  - ❖ Make a certificate.
  
- ❖ Guidance rules available:
  - ❖ Simplification of input
  - ❖ Standard energy efficiencies of installations
  - ❖ Easy collection of data
  - ❖ Consistent certificates independent of consultant.





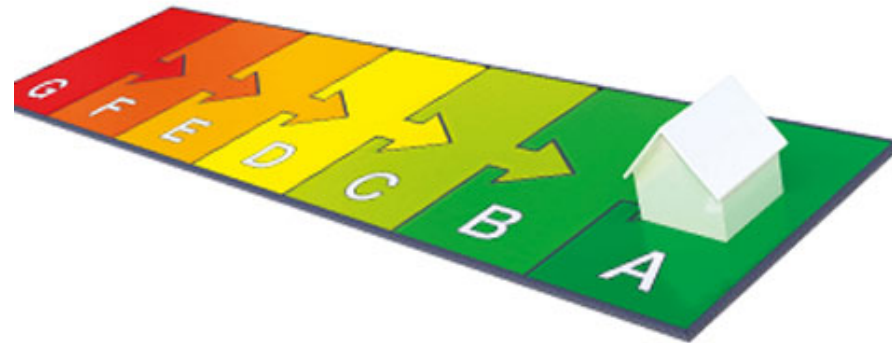
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## Experience

### Energy labelling of houses

## Experiences with energy labeling

- ❖ Encouragement to refurbish house
- ❖ Higher energy label can increase the house price
- ❖ Security for buyer to know about energy performance of a house



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## Contribution from ENSI and DTI



DANISH  
TECHNOLOGICAL  
INSTITUTE



## Thank you for your attention



NIRAS

