

Norwegian University of Science and Technology



Development of energy efficiency requirements in buildings in Norway

Natasa Nord

Department of Energy and Process Engineering Norwegian University of Science and Technology

Standards and regulations in Norway

- Norway is following EU and ISO standards, but only as *recommendations*
- Regulation on requirements for buildings and construction products – TEK
- National regulation is *mandatory* to use
- Relevant chapters:
 - Environment and health
 - Energy use
 - Indoor environment

Definition of energy requirements

- **TEK97** Energy demand can be determined in three different ways:
 - By using energy use limits for specific building category
 - By using the requirements for building insulation
 - By using heat losses limits based for the building construction
- TEK07 and TEK10 Energy demand is defined
 - By satisfying defined energy efficiency measures
 - OR by satisfying limits for the **net energy demand**
- TEK17 will be implemented
 - Only by satisfying limits for the **net energy demand**



Requirements for energy efficiency measures

Measures	TEK97	TEK07	TEK10	TEK17
Openings percentage (%)	20	20	≤ 25	
U-value for external walls (W/m²K)	0.22	0.18	≤ 0.18	0.1
U-value for roof (W/m ² K)	0.15	0.13	≤ 0.13	
U-value for floor (W/m ² K)	0.15	0.15	≤ 0.1	
U-value for windows (W/m ² K)	1.6 (2)	1.2	≤ 0.8	0.8
Normalized cold bridges (W/m ² K)		0.03 for small houses else 0.06	≤ 0.05 (0.07)	
Temperature efficiency for ventilation heat recovery (%)		70	≥80	
Specific fan power (kW/m³/s)		Residential 2.5, Office 2/1	≤ 1.5	
Infiltration rate at 50 Pa difference (1/h)		2.5 small houses else 1.5	≤ 0.6	

Requirements for energy efficiency measures

- **TEK07** Energy efficiency measures on maintenance
 - Automatic control of shading devices to avoid need to direct cooling
 - Night set back till 19°C
- TEK10 Similar to low energy building
- TEK 17 Should be similar as passive house standard, but there have been lots of discussions around its development

Net energy demand

Building type	TEK07 (kWh/m²)	TEK10 (kWh/m²)
Detached houses	120 + 1600/A(m ² of heated area)	100 + 1600/A(m ² of heated area)
Apartment buildings	120	95
Kindergartens	150	135
Office buildings	165	115
Schools	135	110
Universities	180	125
Hospitals	325	225 (265)
Nursing homes	235	195 (230)
Hotels	240	170
Sport halls	185	145
Commercial buildings	235	180
Cultural buildings	180	130
Lett industrial buildings	185	140 (160)

Calculated specific net energy demand for office building



Ventilation requirements



TEK10 – low energy building

- Air amount for residential buildings
 - Operation time 1.2 m³/hm²
 - Out of operation time 0.7 m³/hm²
 - Sleeping room 26 m³/h·bed
 - Kitchens and sanitary rooms should have exhaust ventilation with satisfactory efficiency
- Public and work buildings
 - Operation time empty room 2.5 m³/hm²
 - Room in use 2.5 m³/hm² + 26 m³/h·person
 - Out of operation time 0.7 m³/hm²

Ventilation requirements - passive house

Building type	Operation time	Out of operation time
Kindergarten	6 m³/hm²	1 m³/hm²
Office buildings	6 m³/hm²	1 m³/hm²
School buildings	8 m³/hm²	1 m³/hm²
Universities and high schools	7 m³/hm²	1 m³/hm²
Hospital	10 m³/hm²	3 m³/hm²
Nursing home	7 m³/hm²	1 m³/hm²
Hotels	6 m³/hm²	1 m³/hm²
Sport buildings	6 m³/hm²	1 m³/hm²
Commercial buildings	12 m³/hm²	1 m³/hm²
Cultural buildings	7 m³/hm²	
Workshop/Repair shop	7 m³/hm²	

Energy supply requirements



Requirements on heat supply flexibility

- TEK07 A significant part of the heat demand (60 %) should be covered by renewable or other energy sources than electricity or fossil fuels
- TEK10 Buildings bigger than 500 m² of heated gross area should be designed and constructed so that 60 % of the net heat demand can be covered with flexible energy supply and low temperature solutions
- TEK17 Fossil fuels are not allowed. Buildings bigger than 1 000 m² should have flexible energy solutions

District heating

• Where district heating system connection is available, new buildings has to be equipped with the water-based system

Energy use statistics



Occupants' perceptions of energy use and indoor climate in passive house

Standard	Detached houses	Terraced houses	National statistic
80 kWh/m²			160 kWh/m²
Heating	51.76±10.06 kWh/m ²	45.35±8.96 kWh/m ²	
Electricity	63.80±11.54 kWh/m ²	49.60±11.62 kWh/m ²	



Hot Warm A little warm Just right A little cool Cool Cold

Summer



Where are we going?

Housing distribution in 2014



2014 2020 2025 2030 2035 2040 2045 2050 14

Housing projection

CO₂ emissions



Source	CO ₂ emission (g/kWh)
EN 15603, EU mix	617
EN 15603, Hydro power	7
Norsk Energi, Nordic Mix	110
The Norwegian Water Resources and Energy Directorate	3
Electricity origin guaranty	509

What type of electricity are we using actually???



Source: http://www.side3.no/du-trodde-vel-ikke-atdu-bruker-fornybar-strm-i-norge/3423261392.html, 14.09.2016

Questions?

natasa.nord@ntnu.no