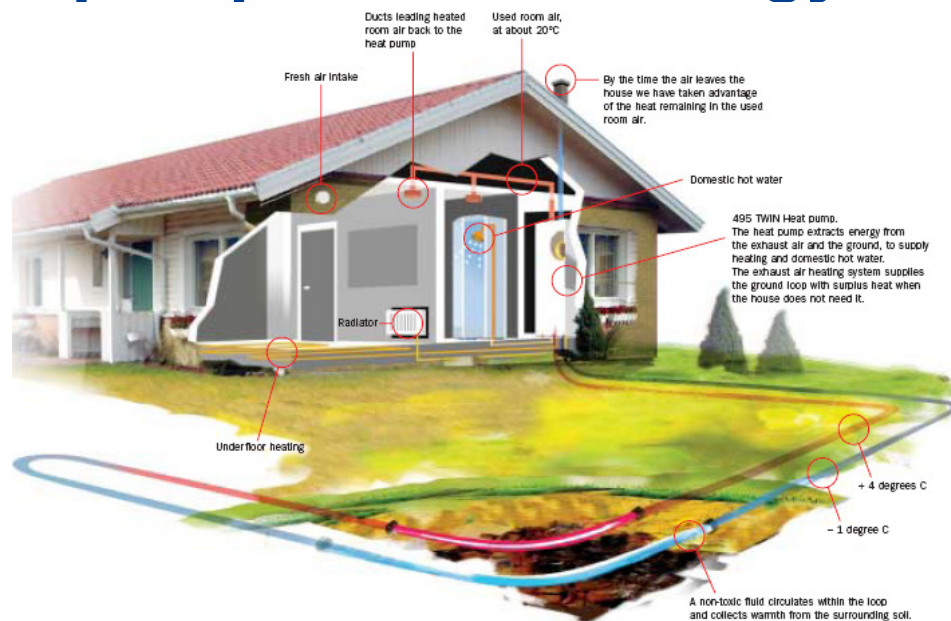


# New building regulations boosts the redesign/development of heat pumps for low energy buildings



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## Existing regulations (from 1th of July 2006)

- **Divides Sweden in two temperature zones**  
(North and South)
- **Requires maximum specific energy use,**  
excl. household electricity

### **For not direct electric heating:**

110 kWh/m<sup>2</sup> in the south

130 kWh/m<sup>2</sup> in the north

### **For direct electric heating:**

(single & two family houses)

75 kWh/m<sup>2</sup> in the south

95 kWh/m<sup>2</sup> in the north



## Calculations of how different houses meet requirements

Building env.:	Normal standard	( $U_m = 0,27 \text{ W}/(\text{K m}^2)$ , $V_{n50} = 0,8 \text{ l}/(\text{s m}^2)$ )
	Improved standard	( $U_m = 0,21 \text{ W}/(\text{K m}^2)$ , $V_{n50} = 0,6 \text{ l}/(\text{s m}^2)$ )
	Passive house std	( $U_m = 0,15 \text{ W}/(\text{K m}^2)$ , $V_{n50} = 0,4 \text{ l}/(\text{s m}^2)$ )

Heating system:	ExHP	Exhaust air heat pump
	ExGrHP	Exhaust- and ground source heat pump
	GrHP	Ground source heat pump
	GrHP+HR	Ground source heat pump + heat recovery
	LVVP	Air-to-water heat pump
	LVVP+HR	Air-to-water heat pump + heat recovery
	DH	District heating
	DH+HR	District heating + heat recovery
	DH+ExHP	District heating + exhaust air heat pump
	BIO+SUN	Biofuel burner + solar collector
	BIO+SUN+HR	Biofuel burner + solar collector
	BIO+ExHP	Biofuel burner + exhaust air heat pump



## Common data for all calculations

Floor area:	140 m <sup>2</sup>
Envelope area:	350 m <sup>2</sup>
No of inhabitants:	4
Household electricity:	5700 kWh/year
Room temperature:	21 C°
Wind speeds at location:	Medium
Heat distribution:	Floor heating + radiators
Night set back:	Yes
Demand controlled ventilation:	Yes (not for exhaust air HP:s)
Resurseffektiva blandare:	Ja
Electric towel dryer:	1
Electric floor heating:	6 m <sup>2</sup>



”Default values” for different heating systems

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# Results from calculations (kWh/m<sup>2</sup>, existing regulations)

North of Sweden (demand < 130 kWh/m<sup>2</sup>), Kiruna, Mean outdoor air temperature -11 °C

Building env.	ExHP	ExGrHP	GrHP	GrHP +HR	AirHP	AirHP +HR	DH	DH +HR	DH+ ExHP	BIO+ SUN	BIO+ SUN +HR	BIO+ ExHP
Normal	169	128	85	73	142	122	202	180	169	171	151	175
Impr.	137	101	66	57	114	92	166	141	137	139	117	142
Passive	107	78	54	46	88	66	132	103	106	109	85	110

South of Sweden (demand < 110 kWh/m<sup>2</sup>), Göteborg, Mean outdoor air temperature +8 °C

Building env.	ExHP	ExGrHP	GrHP	GrHP +HR	AirHP	AirHP +HR	DH	DH +HR	DH+ ExHP	BIO+ SUN	BIO+ SUN +HR	BIO+ ExHP
Normal	86	65	50	47	60	52	119	106	86	99	89	88
Impr.	69	56	44	40	50	43	99	85	69	82	70	70
Passive	54	49	38	35	42	35	80	65	54	66	55	54



Specific energy use (heating and domestic hot water, excl. household electricity)  
Including a margin of 10-20 kWh/m<sup>2</sup> (values < 50 kWh/m<sup>2</sup> equivalent to a "passive house")

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## What is the consequences of the existing regulations

- Larger security marginals are needed when designing houses
- Need for separate meters (domestic hot water & household electricity)
- Much better building envelope is needed when district heating is used
- Large window areas as used lately is not always possible anymore
- In general more difficult to meet the demands in the most north part
- Quite easy to meet the demands whwn using heat pumps
- In the south of Sweden a simple exhaust air heat pump is sufficient
- More difficult to meet the demands whith district and biofuel heating
- Almost impossible to use district heating in the north of Sweden
- Ventilation air-to-air heat recovery will be used more (district heating)
- Thermal solar panels is another way to meet the demand (biofuel)
- The investment costs might increase, but the LCC ... ?



## The Board for Housing and Planning proposes new building regulations (from 1th of January 2009)

- **Definition of an electrically heated house is given:**  
More than 10 W/m<sup>2</sup> in installed electric power for heating and domestic hot water.
- No difference between direct electric heating and indirect electric heating using a hydronic distribution system.
- Most houses with heat pumps will be defined as electrically heated
- This applies to all kind of buildings, not only single and two family dwellings (as in the existing regulations)
- For electrically heated buildings the requirements will be:  
95 kWh/m<sup>2</sup> in the far north, 75 kWh/m<sup>2</sup> in the rest of the north and 55 kWh/m<sup>2</sup> in the south, excl. Household electricity.
- Additionally requirements on maximum installed electric power.
- The third climatic zone, introduced in the far north, also makes it a little bit easier to meet the requirements for non electrically heated buildings (150 kWh/m<sup>2</sup> for residential buildings).



# Results from calculations (kWh/m<sup>2</sup>, new regulations)

North of Sweden (demand < 95/150 kWh/m<sup>2</sup>), Kiruna, Mean outdoor air temperature -1°C

Building env.	ExHP	ExGrHP	GrHP	GrHP +HR	AirHP	AirHP +HR	DH	DH +HR	DH+ ExHP	BIO+ SUN	BIO+ SUN +HR	BIO+ ExHP
Normal	169	128	85	73	142	122	202	180	169	171	151	175
Impr..	137	101	66	57	114	(92)*	166	141	137	139	117	142
Passive	107	78	54	46	(88)*	66	132	103	106	109	85	110

South of Sweden (demand < 55/110 kWh/m<sup>2</sup>), Göteborg, Mean outdoor air temperature +8°C

Building env.	ExHP	ExGrHP	GrHP	GrHP +HR	AirHP	AirHP +HR	DH	DH +HR	DH+ ExHP	BIO+ SUN	BIO+ SUN +HR	BIO+ ExHP
Normal	86	65	50	47	60	(52)*	119	106	86	99	89	88
Impr..	69	56	44	40	(50)*	43	99	85	69	82	70	70
Passive	54	49	38	35	42	35	80	65	54	66	55	54

Specific energy use (heating and domestic hot water, excl. Household electricity)  
Including a margin of 10-20 kWh/m<sup>2</sup> (values < 50 kWh/m<sup>2</sup> equivalent to a "passive house")



\*) Will not meet the maximum allowed peak power demand  
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## Consequences of new proposed regulations

- Most house manufacturers will improve their building envelopes, but not as far as to a "passive house standard"
- The simple exhaust air heat pump will no longer be an option
- Air-to-water heat pumps will not be possible to use in the north, in south only combined with air-to-air ventilation heat recovery
- The most probable solution is to use ground source heat pumps that cover most of the peak power demand (and only floor heating)
- Increased focus on low electricity use will increase the use of energy efficient circulation pumps, ventilation fans, etc
- Where heat pumps are not an option, the improved building envelope must be combined with thermal solar panels and/or some kind of ventilation heat recovery
- Investment costs for a new houses will increase considerably, but can be balanced by decreased energy costs
- **New Swedish single family houses with heat pumps will have a specific energy use equivalent to a "passive house"**

