

Fireplace research: How
fireplace is heating house

VTT, Technical Research Centre
of Finland

The logo for Tulikivi, featuring the brand name in white text on a dark green, rounded rectangular background.
® Tulikivi

Fireplace research: What was researched

- Maximum heating capacity of fireplaces in old and modern houses. Fireplaces used:
 - "Kamin öfen" Traditional stove
 - Heat retaining fireplace (slow, $T_{100\%}-T_{50\%} < 15 \text{ h}$)
 - Small fireplaces
 - Heat retaining fireplace (really slow, $T_{100\%}-T_{50\%} > 15 \text{ h}$)
 - Big TLUs and group #2 fireplaces
 - Computer simulation done to over 80 cases where these fireplaces where used
 - 4 houses where simulated
 - Old and old renovated
 - New and passive house

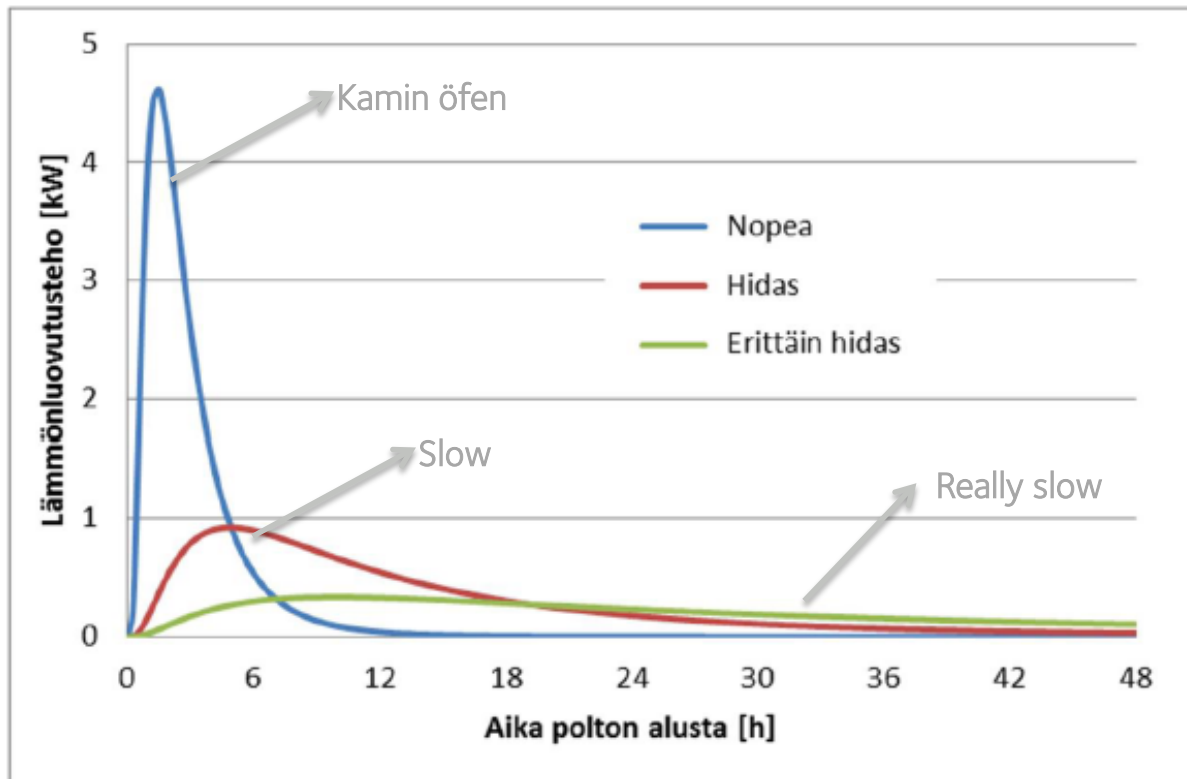
Fireplace research: What was researched

- Boundary condition of calculation
 - Heating the house that temperature do not rise higher than 24 C degrees (do account short peaks) (Finnish regulation of health ministry)
 - Fireplaces simulated from CE mark information
 - Real live fireplaces
 - Heating up every day if house inner temperature low enough
 - Heating started at 18.00. Heating times
 - 2 hours, 2 loads, really slow
 - 3 hours, 3 loads, slow
 - 4 hours, 3 load, fast



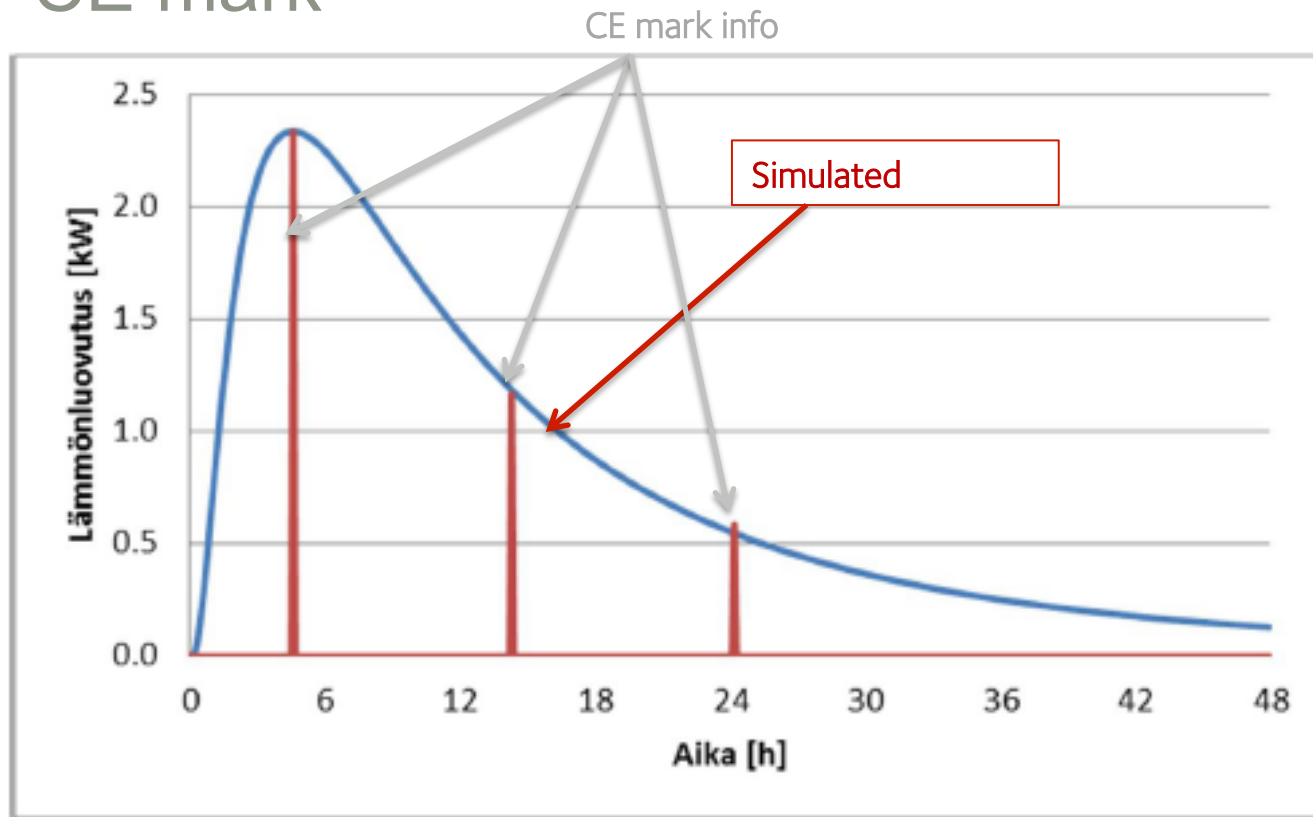
Fireplace research:

- Heating curve is simulated based on CE mark
- Difference of three fireplaces



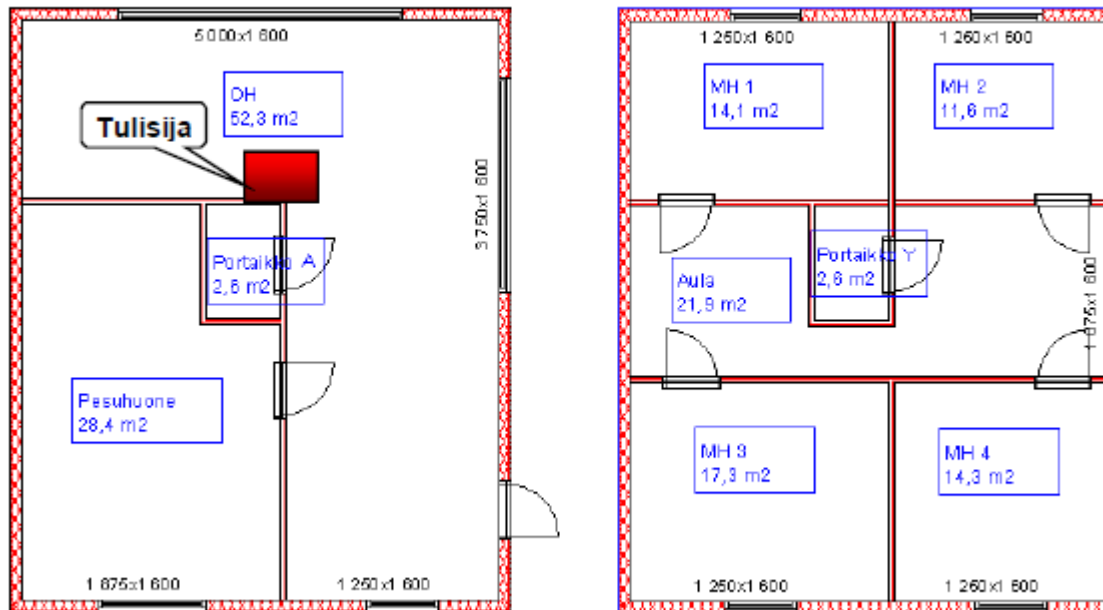
Fireplace research:

- Heating curve is simulated based on CE mark



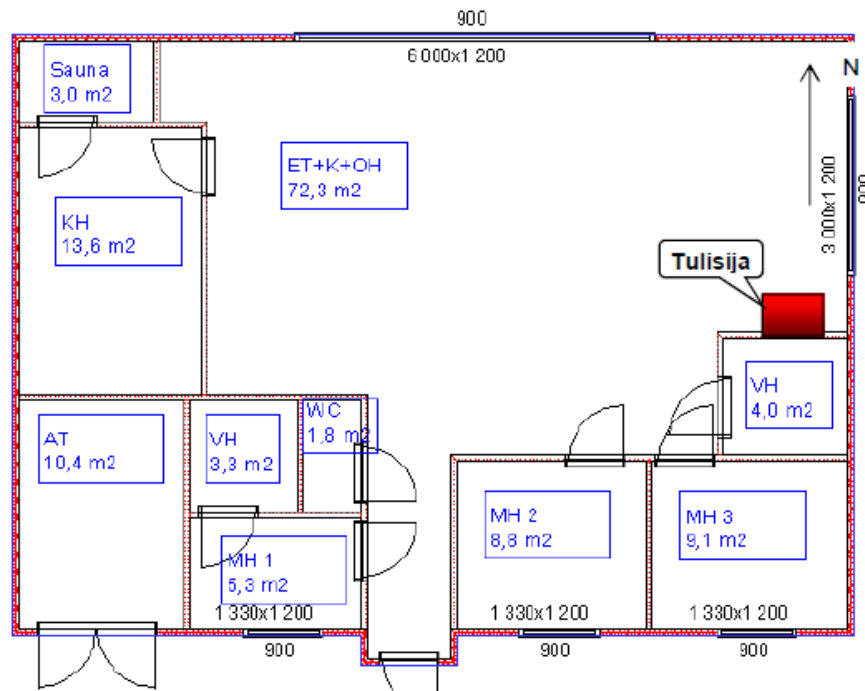
Fireplace research: What was researched

- New house 165 m², in 2-levels:
 - 1) Heat need: 11 638 kWh
 - 2) Heat need: 4 583 kWh (passive house)



Fireplace research: What was researched

- Old house 165 m², in 1-level:
 - 3) Heat need: 25 154kWh
 - 4) Heat need: 17 908 kWh (renovated house)



Fireplace research: Results

Heating capacity	Tulisijoista tilaan saatava lämmitysenergia ja tulisijan tuoton osuus tilojen lämmitystarpeesta							
	Old vanha rakennus		Old, renovated		New uusi rakennus		New, passive	
Kok. Lämmöntarve	25154 kWh		17908 kWh		11638 kWh		4583 kWh	
Tulisijatyyppi	Tuotto kWh	Osuus %	Tuotto kWh	Osuus %	Tuotto kWh	Osuus %	Tuotto kWh	Osuus %
<u>Really slow</u>	14 400	57	10 200	57	4 000	44	2 300	51
<u>Slow</u>	14 100	56	9 900	55	3 900	43	2 200	50
<u>Fast</u>	4 600	18	3 400	19	850 ⁽¹⁾	9	540 ⁽¹⁾	12

Wood log amount	Tarvittava puumäärä, p-m ³ /vuosi ⁽¹⁾			
	1 kerroksinen vanha rakennus	1 kerroksinen peruskorjattu rakennus	2 kerroksinen uusi rakennus	2 kerroksinen passiivirakennus
Tulisijatyyppi				
<u>Really slow</u>	14,1	10,0	4,2	2,3
<u>Slow</u>	14,1	9,9	3,9	2,3
<u>Fast</u>	4,3	3,4	0,8 ⁽²⁾	0,6 ⁽²⁾

⁽¹⁾ Puumäärät on laskettu tiensä hankkeessa määritettyjen tulisijojen lämmönluovutuksen hyötysuhteiden oletusten perusteella.



Fireplace research: Results

Heating times

Tulisijatyyppi	Käyttökerrat, kpl/vuosi ⁽¹⁾			
	Old	Old, renovated	New	New, passive
<u>Really slow</u>	197	144	114	70
<u>Slow</u>	237	201	192	122
<u>Fast</u>	242	212	90	59

Heating efficiency

Tulisijatyyppi	Lämmityksen hyötysuhde, kWh/vuosi			
	Old	Old, renovated	New	New, passive
<u>Really slow</u>	0,91	0,91	0,90	0,90
<u>Slow</u>	0,90	0,90	0,90	0,90
<u>Fast</u>	0,91	0,91	0,91 ⁽¹⁾	0,88 ⁽¹⁾

Fireplace research: Results

- 50 % of the whole house heating can be done with heat retaining fireplace without over heating
- With "kamin öfen" heating capacity only 9-19 %
- Real heat output of fireplaces:
 - Total efficiency = (CE mark efficiency) x (heating efficiency)
 - Eg. Valkia CE 84 %, -> 50 % heat done in house
-> heating efficiency 90 %
 - -> total efficiency = 90% x 84 % = 75,6 %



Projektin tulokset

- EASY RULE, logs 1 m³ = 1000 kWh heating energy (with finnish logs (1330 kWh/ m³))
 - Eg. Beech have little better heating value
- Heat retaining fireplace better heater than "kamin öfen"

