Manual for the Excel-Tool: "Energy Demand Assessment of Lifts"

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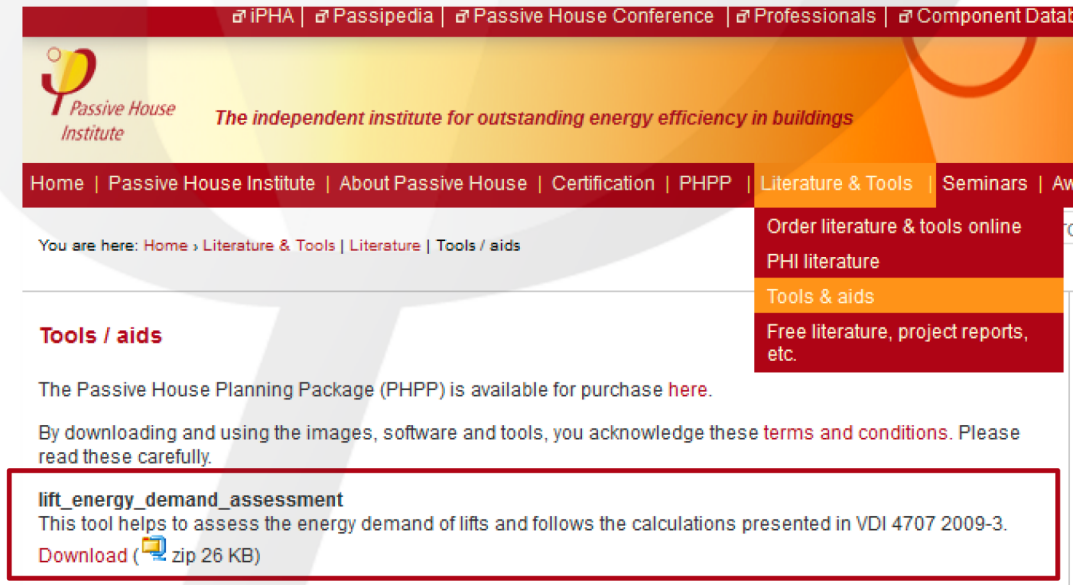
Excel-Tool: Lift Energy Demand Assessment

Important Results

- total energy demand of lifts $E_{year,total}$ kWh/a
- specific total energy demand per lift $E_{lift,spec}$ mWh/(kg m)

assessment follows the calculations presented in VDI 4707 2009-3

Download the Tool from www.passivehouse.com

Excel-Tool: Overview Worksheet 1/2

1. Lift Type: A   B   C   ... expandable

Energy demand assessment of lifts

description of lift			Lift A		
number of lifts			1		
nominal load	Q	[kg]	630		
nominal speed	v_{nom}	[m/s]	1,0		
lifting height	F_H	[m]	12,0		
average distance/trip		[m/trip]	6,0		

standby demand
energy efficiency class according to VDI 4707 2009-3		[W]			
user-determined / manufacturer specification		[W]	40,0		
value for project planning	$P_{standby}$	[W]	40		

specific travel demand
energy efficiency class according to VDI 4707 2009-3		[mWh/(kg m)]			
user-determined / manufacturer specification		[mWh/(kg m)]	0,50		
value for project planning	$E_{travel,spec}$	[mWh/(kg m)]	0,5		

working load
usage intensity according to VDI 4707 2009-3			2-seldom		
time of usage	t_{travel}	[h/d]	0,5		
time of standby	$t_{standby}$	[h/d]	23,5		

user-determined: working load per day
| time of usage per lift | | [h/d] | | | |

distance per lift	s_{nom}	[m/d]	1800,00		
daily standby demand per lift		[kWh/d]	0,940		
daily travel demand per lift		[kWh/d]	0,567		
daily total energy demand per lift	$E_{day,lift}$	[kWh/d]	1,507		

total standby demand lifts in total		kWh/a	343		
total travel demand lifts in total		kWh/a	207		
total energy demand lifts in total	$E_{year,total}$	kWh/a	**550**		

| **specific total energy demand per lift** | $E_{lift,spec}$ | [mWh/(kg m)] | **1,33** | | |
| **specific total energy demand lifts in total** | $E_{total,spec}$ | [mWh/(kg m)] | 1,33 | | |

auxiliary calculation user-determined $E_{travel,spec}$

detailed calculation energy demand reference trip E_R with load spectrum

$E_{R,measured}$	Load spectrum according to VDI 4707 2009-3		$E_{R,load\ spectrum}$
[Wh]	load in % of the nominal load	trip ratio in %	[Wh]
	0%	50%	
	25%	30%	
	50%	10%	
	75%	10%	
	100%	0%	

$E_{R,load\ spectrum}$ ☐ [Wh]

simplified calculation of energy demand reference trip E_R with load factor

measured energy demand reference trip (empty trip) $E_{R,empty\ trip}$ ☐ [Wh]

☐ lift with counterbalance weight (car weight plus 40 % to 50 % of the nominal weight)   load factor k

☐ lift without the compensation weight or a compensation weight of up to 30 % of the car weight   load factor k

$E_{R,loadfactor}$ ☐ [Wh]

nominal load   Q ☐ [kg]
lifting height F_H ☐ [m]

user-determined specific travel demand $E_{travel,spec}$ ☐ [mWh/(kg m)]

2. auxiliary calculation user-determined travel demand ($E_{travel,spec}$)

3. Daily Working load: user-determined calculation for daily usage time per lift [h/d] (hidden cells)

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Excel-Tool: Overview Worksheet 2/2

1. If more lifts are necessary the column can be easily expanded (copy total column and paste).

2. There are three separate auxiliary calculations available (hidden cells). The results of the auxiliary calculation are not connected to the main calculation, and have to be transferred separately.

3. The user-determined calculation for the daily usage time per lift is hidden, and need only be completed when the usage intensity according to VDI 47072009-3 is not selected.

If entries for the specific travel demand/user-determined working load per day have been made in efficiency class/usage intensity as well as in user-determined, the user-determined value will be used for the calculation.

Excel-Tool: Input Data

description of lift			**Lift A**
number of lifts			**1**
nominal load	Q	[kg]	**630**
nominal speed	v_{nom}	[m/s]	**1,0**
lifting height	F_H	[m]	**12,0**
average distance/trip		[m/trip]	6,0

standby demand

energy efficiency class according to VDI 4707 2009-3		[W]	
user-determined / manufacturer specification		[W]	**40,0**
value for project planning	$P_{standby}$	[W]	40

specific travel demand

energy efficiency class according to VDI 4707 2009-3		[mWh/(kg m)]	
user-determined / manufacturer specification		[mWh/(kg m)]	**0,50**
value for project planning	$E_{travel,spec}$	[mWh/(kg m)]	0,5

working load

usage intensity according to VDI 4707 2009-3			**2-seldom**
time of usage	t_{travel}	[h/d]	0,5
time of standby	$t_{standby}$	[h/d]	23,5

user-determined: working load per day

time of usage per lift		[h/d]	

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Excel-Tool: Standby Demand

description of lift			Lift A	
number of lifts			1	
nominal load	Q	[kg]	630	
nominal speed	v_{nom}	[m/s]	1,0	
lifting height	F_H	[m]	12,0	
average distance/trip		[m/trip]	6,0	
standby demand				
energy efficiency class according to VDI 4707 2009-3		[W]		
user-determined / manufacturer specification		[W]	40,0	
value for project planning	$P_{standby}$	[W]	40	

The total energy demand of the lift in standby mode

- **energy efficiency class** according to VDI 4707 2009-3 **or**

- **user-determined**/ manufacturer specification
  - Measurement of the standby demand: five minutes after the last trip has ended

→ priority for calculation: user-determined value

energy efficiency class	output (standby time) [W]
A	50
B	100
C	200
D	400
E	800
F	1600
G	3200

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Excel-Tool: Specific Travel Demand

- **energy efficiency class** according to VDI 4707 2009-3
  or
- **user-determined**/ manufacturer specification
  - Measurement of the specific travel demand: auxiliary calculation

→ priority for calculation: user-determined value

energy efficiency class	Specific energy consumption (travel time) [mWh/(kg m)]
A	0,56
B	0,84
C	1,26
D	1,89
E	2,8
F	4,2
G	8,4

specific travel demand

energy efficiency class according to VDI 4707 2009-3	[mWh/(kg m)]	
user-determined / manufacturer specification	[mWh/(kg m)]	**0,50**
value for project planning $E_{travel,spec}$	[mWh/(kg m)]	0,5

Total energy demand of the lift during travel at specified cycles and with a specific load.

working load

usage intensity according to VDI 4707 2009-3		**2-seldom**
time of usage t_{travel}	[h/d]	0,5
time of standby $t_{standby}$	[h/d]	23,5

user-determined: working load per day

time of usage per lift	[h/d]	

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Excel-Tool: Auxiliary Calculation

auxiliary calculation user-determined $E_{travel,spec}$

detailed calculation energy demand reference trip E_R with load spectrum

$E_{R,measured}$	Load spectrum according to VDI 4707 2009-3		$E_{R,load\ spectrum}$
[Wh]	load in % of the nominal load	trip ratio in %	[Wh]
	0%	50%	
	25%	30%	
	50%	10%	
	75%	10%	
	100%	0%	

$E_{R,load\ spectrum}$ ⬜ [Wh]

- **Measurement of reference trip consists (VDI 4707 2009-3) :**
  - 1) begin of reference trip with open lift door
  - 2) closing lift door
  - 3) trip up or down using the full lifting height
  - 4) opening and immediate closing of the lift door
  - 5) trip up or down using the full lifting height
  - 6) door opening
  - 7) end of reference trip

- $E_{R,\ load\ spectrum}$: Sum of all reference trips with different nominal load and trip ratio

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Excel-Tool: Auxiliary Calculation

- Measurement of reference trip empty $E_{R,empty\ trip}$

- $E_{R,\ load\ factor}$: $E_{R,\ empty\ trip}$ * load factor k
  - with counterbalance weight
  - without / with up to 30% of car weight

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simplified calculation of energy demand reference trip E_R with load factor

measured energy demand reference trip (empty trip)	$E_{R,empty\ trip}$ _____ [Wh]
☐ lift with counterbalance weight (car weight plus 40 % to 50 % of the nominal weight)	load factor k
☐ lift without the compensation weight or a compensation weight of up to 30 % of the car weight	load factor k
	$E_{R,loadfactor}$ _____ [Wh]

nominal load	Q	_____ [kg]
lifting height	F_H	_____ [m]

user-determined specific travel demand $E_{trav\,el,spec}$ _____ [mWh/(kg m)]

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Excel-Tool: Auxiliary Calculation

auxiliary calculation user-determined $E_{travel,spec}$

detailed calculation energy demand reference trip E_R with load spectrum

$E_{R,measured}$	Load spectrum according to VDI 4707 2009-3		$E_{R,load\ spectrum}$
[Wh]	load in % of the nominal load	trip ratio in %	[Wh]
	0%	50%	
	25%	30%	
	50%	10%	
	75%	10%	
	100%	0%	

$E_{R,load\ spectrum}$ [ ]   [Wh]

simplified calculation of energy demand reference trip E_R with load factor

measured energy demand reference trip (empty trip) $E_{R,empty\ trip}$

lift with counterbalance weight (car weight plus 40 % to 50 % of the nominal weight)   load factor k

lift without the compensation weight or a compensation weight of up to 30 % of the car weight   load factor k

$E_{R,load\ factor}$ [ ]   [Wh]

nominal load   Q   [ ]   [kg]

lifting height F_H [ ]   [m]

user-determined specific travel demand $E_{travel,spec}$ [ ]   [mWh/(kg m)]

Transfer the result $E_{travel,spec}$ to cell "F/G/H20" (main calculation)

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Excel-Tool: Working Load

- **usage intensity** according to VDI 4707 2009-3

usage category	1	2	3	4	5
usage intensity/frequency	1-very seldom	2-seldom	3-occasionally	4-frequently	5-very frequently
average travel time [h/d]	0,2	0,5	1,5	3	6
average standby time [h/d]	23,8	23,5	22,5	21	18

or

- **user-determined** measurement of the usage time per lift:
    - 3 usage profiles available
    - unhide cells to enter user-determined values

→ priority for calculation: user-determined value

working load

usage intensity according to VDI 4707 2009-3			**2-seldom**
time of usage	t_{travel}	[h/d]	0,5
time of standby	$t_{standby}$	[h/d]	23,5

user-determined: working load per day

time of usage per lift		[h/d]	

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Excel-Tool: User–determined Working Load

user-determined: working load per day

user-determined profiles below need only be completed when the *usage intensit*

usage profile I

total number of user	[p]	**20**
number of trips per person	[trip/p d]	**2**
number of person per trip	[p/trip]	**2**
number of trips usage profile I	[trip/d]	20

usage profile II

total number of user	[p]	**8**
number of trips per person	[trip/p d]	**2**
number of person per trip	[p/trip]	**2**
number of trips usage profile II	[trip/d]	8

usage profile III

total number of user	[p]	**12**
number of trips per person	[trip/p d]	**4**
number of person per trip	[p/trip]	**3**
number of trips usage profile III	[trip/d]	16

total number of trips	[trip/d]	44
total time of usage	[h/d]	0,1
total distance	[km/d]	0,3
trips per lift	[trip/d]	44,0
time of usage per lift	[h/d]	0,07

usage profile

- daily usage
- different type of usage

Example: Multi-storey house with doctor's office

- Profile I: patient to doctor's office
- Profile ll: elderly residents
- Profile lll: family

Excel-Tool: Implementation of Results in PHPP

distance per lift	s_{nom}	[m/d]	1800,00	
daily standby demand per lift		[kWh/d]	0,940	
daily travel demand per lift		[kWh/d]	0,567	
daily total energy demand per lift	$E_{day,lift}$	[kWh/d]	1,507	**Only for 1 lift**

total standby demand lifts in total		kWh/a	343
total travel demand lifts in total		kWh/a	207
total energy demand lifts in total	$E_{year,total}$	kWh/a	**550**

PHPP Worksheet "Electricity"

Application	Used ? (1/0)	Within the thermal envelope? (1/0)	Norm demand

Other:

Lift A	1	1	550	kWh/a

$E_{lift,spec}$ [mWh/(kg m)] **1,33**

$E_{total,spec}$ [mWh/(kg m)] 1,33

550 [kWh/a]/365 [d/a]

non-residential buildings PHPP "Electricity non-res"

Kitchen / Aux. electricity	Room category (predominant utilisation pattern of building)	Within the thermal envelope [1/0]	Existing [1/0]	Days of utilisation per year [d/a]	Number of meals per day of use	Norm consumption
Lift A		1	1	200		1,51

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