

VEDLEGG VI

0 UTGANGSPUNKT

1 ROTASJON

2 ISOLASJON TAK & GULV

3 ISOLASJON VEGG

4 VINDUSMENGDE & PLASSERING

5 ENERGIFORSYNING

VARMEPUMPE

SOLFANGER

KOMBINASJONER

6 ENERGIPRODUKSJON

SCENARIO 0 – UTGANGSPUNKT

0.1 Utgangspunkt Oslo

0.2 Utgangspunkt Trondheim

0.3 Tiltak Oslo

0.4 Tiltak Trondheim

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction: 2022		Interior temperature winter [°C]: 20,0	
No. of dwelling units: 1		Internal heat gains (IHG) heating case [W/m²]: 2,5	
No. of occupants: 2,8		Specific capacity [Wh/K per m² TFA]: 60	
		Interior temp. summer [°C]: 25,0	
		IHG cooling case [W/m²]: 2,5	
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	24	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	1,0	0,6		no
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	218	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	108	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing

Architecture:

Street:

Postcode/City:

Province/Country:

Energy consultancy:

Street:

Postcode/City:

Province/Country:

Year of construction:

No. of dwelling units:

No. of occupants:

Building: Dråpen moderne

Street:

Postcode/City: 7052

Province/Country: NO0003a-Trondheim NO-Norway

Building type:

Climate data set: NO0003a-Trondheim

Climate zone: 2: Cold

Altitude of location: 0 m

Home owner / Client:

Street:

Postcode/City:

Province/Country:

Mechanical engineer:

Street:

Postcode/City:

Province/Country:

Certification:

Street:

Postcode/City:

Province/Country:

Interior temperature winter [°C]: 20,0

Interior temp. summer [°C]: 25,0

Internal heat gains (IHG) heating case [W/m²]: 2,5

IHG cooling case [W/m²]: 2,5

Specific capacity [Wh/K per m² TFA]: 60

Mechanical cooling:

Specific building characteristics with reference to the treated floor area									
		Treated floor area m²			Criteria		Alternative criteria	Fulfilled?²	
Space heating		139,9			15	-		no	
	Heating demand kWh/(m²a)	42,539	≤		-	10			
	Heating load W/m²		≤						
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤		-	-		-	
	Cooling load W/m²	-	≤		-	-			
	Frequency of overheating (> 25 °C) %	0	≤		10				
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤		20			yes	
Airtightness	Pressurization test result n50 1/h	1,0	≤		0,6			no	
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	226	≤		120			no	
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	107	≤		-	-		-	
	Generation of renewable energy (in relation to projected kWh/(m²a) building footprint area)	0	≥		-	-			

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Task:

First name:

Surname:

Issued on:

City:

Passive House Classic?

Signature:

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Architecture:		Home owner / Client:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Energy consultancy:		Mechanical engineer:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Certification:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Year of construction: 2022	Interior temperature winter [°C]: 20,0	Interior temp. summer [°C]: 25,0	
No. of dwelling units: 1	Internal heat gains (IHG) heating case [W/m²]: 2,5	IHG cooling case [W/m²]: 2,5	
No. of occupants: 2,8	Specific capacity [Wh/K per m² TFA]: 60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	21	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	221	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	109	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

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Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
Postcode/City:		7052	
Province/Country:		NO0003a-Trondheim NO-Norway	
Building type:			
Climate data set:		NO0003a-Trondheim	
Climate zone:		2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	38,520	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	206	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	97	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

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Task:	First name:	Surname:	Signature:	
Issued on:		City:		

SCENARIO 1 – ROTASJON

1.1 135° Oslo

1.2 135° Trondheim

1.3 180° Oslo

1.4 180° Trondheim

1.5 225° Oslo

1.6 225° Trondheim

1.7 270° Oslo

1.8 270° Trondheim

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	22	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	230	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	114	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

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Task:	First name:	Surname:	Signature:	
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Passive House Verification

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		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0003a-Trondheim	
		Climate zone: 2: Cold	Altitude of location: 0 m
Architecture:		Home owner / Client:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Energy consultancy:		Mechanical engineer:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Certification:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Year of construction: 2022	Interior temperature winter [°C]: 20,0	Interior temp. summer [°C]: 25,0	
No. of dwelling units: 1	Internal heat gains (IHG) heating case [W/m²]: 2,5	IHG cooling case [W/m²]: 2,5	
No. of occupants: 2,8	Specific capacity [Wh/K per m² TFA]: 60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	45,836	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	230	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	109	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	-	-	

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Task:	First name:	Surname:	Signature:	
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Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	44,220	-	10	
		22			
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
		-			
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	225	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	112	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

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Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
Postcode/City:		7052	
Province/Country:		NO0003a-Trondheim NO-Norway	
Building type:			
Climate data set:		NO0003a-Trondheim	
Climate zone:		2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture: Street: Postcode/City: Province/Country:		Interior temperature winter [°C]: 20,0 Internal heat gains (IHG) heating case [W/m²]: 2,5 Specific capacity [Wh/K per m² TFA]: 60	
Energy consultancy: Street: Postcode/City: Province/Country:		Interior temp. summer [°C]: 25,0 IHG cooling case [W/m²]: 2,5 Mechanical cooling:	
Year of construction: 2022 No. of dwelling units: 1 No. of occupants: 2,8			

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	43,641	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	225	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	106	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	-	-	

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Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	22	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	223	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	110	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

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I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
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		Climate zone: 2: Cold	Altitude of location: 0 m
Architecture:		Home owner / Client:	
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Postcode/City:		Postcode/City:	
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Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Certification:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Year of construction: 2022	Interior temperature winter [°C]: 20,0	Interior temp. summer [°C]: 25,0	
No. of dwelling units: 1	Internal heat gains (IHG) heating case [W/m²]: 2,5	IHG cooling case [W/m²]: 2,5	
No. of occupants: 2,8	Specific capacity [Wh/K per m² TFA]: 60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	42,274	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	222	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	104	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

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Issued on:		City:		

Passive House Verification

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		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	41,842	≤ 15	-	no
	Heating load W/m²	22	≤ -	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤ -	-	-
	Cooling load W/m²	-	≤ -	-	
	Frequency of overheating (> 25 °C) %	3	≤ 10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤ 20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤ 0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	221	≤ 120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	109	≤ -	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	≥ -	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Photo or Drawing

Architecture:

Street:

Postcode/City:

Province/Country:

Energy consultancy:

Street:

Postcode/City:

Province/Country:

Year of construction:

No. of dwelling units:

No. of occupants:

Building: Dråpen moderne

Street:

Postcode/City: 7052

Province/Country: NO0003a-Trondheim NO-Norway

Building type:

Climate data set: NO0003a-Trondheim

Climate zone: 2: Cold

Altitude of location: 0 m

Home owner / Client:

Street:

Postcode/City:

Province/Country:

Mechanical engineer:

Street:

Postcode/City:

Province/Country:

Certification:

Street:

Postcode/City:

Province/Country:

Interior temperature winter [°C]: 20,0

Interior temp. summer [°C]: 25,0

Internal heat gains (IHG) heating case [W/m²]: 2,5

IHG cooling case [W/m²]: 2,5

Specific capacity [Wh/K per m² TFA]: 60

Mechanical cooling:

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fulfilled? ²
Space heating	Treated floor area m²	139,9				
	Heating demand kWh/(m²a)	40,977	≤	15	-	no
	Heating load W/m²		≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	0	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	219	≤	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	103	≤	-	-	
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	≥	-	-	-

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Task:

First name:

Surname:

Signature:

Issued on:

City:

Passive House Classic? no

PHPP, Verification

PHPP Simuleringer 02.05.22 tilbake til nytt utgangspunkt

SCENARIO 2 – ISOLASJON

TAK OG GULV

2.1 Oslo

2.2 Trondheim

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	20	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	208	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	102	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0003a-Trondheim	
		Climate zone: 2: Cold	Altitude of location: 0 m
Architecture:		Home owner / Client:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Energy consultancy:		Mechanical engineer:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Certification:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Year of construction: 2022	Interior temperature winter [°C]: 20,0	Interior temp. summer [°C]: 25,0	
No. of dwelling units: 1	Internal heat gains (IHG) heating case [W/m²]: 2,5	IHG cooling case [W/m²]: 2,5	
No. of occupants: 2,8	Specific capacity [Wh/K per m² TFA]: 60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	35,448	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	206	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	96	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

SCENARIO 3 – ISOLASJON

YTTERVEGG

3.1 Oslo

3.2 Trondheim

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	19	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	195	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	95	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0003a-Trondheim	
		Climate zone: 2: Cold	Altitude of location: 0 m
Architecture:		Home owner / Client:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Energy consultancy:		Mechanical engineer:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Certification:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Province/Country:		Province/Country:	
Year of construction: 2022	Interior temperature winter [°C]: 20,0	Interior temp. summer [°C]: 25,0	
No. of dwelling units: 1	Internal heat gains (IHG) heating case [W/m²]: 2,5	IHG cooling case [W/m²]: 2,5	
No. of occupants: 2,8	Specific capacity [Wh/K per m² TFA]: 60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	29,806	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	193	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	89	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

SCENARIO 4 – VINDU

4.1 Innsetting

- 4.1.1** 0 mm Oslo
- 4.1.2** 0 mm Trondheim
- 4.1.3** 20 mm Oslo
- 4.1.4** 20 mm Trondheim
- 4.1.5** 40 mm Oslo
- 4.1.6** 40 mm Trondheim

4.2 Foret karm

- 4.2.1** 0 mm Oslo
- 4.2.2** 0 mm Trondheim
- 4.2.3** 20 mm Oslo
- 4.2.4** 20 mm Trondheim
- 4.2.5** 40 mm Oslo
- 4.2.6** 40 mm Trondheim

4.3 Vindusmengde og plassering

- 4.3.1** Oslo
- 4.3.2** Trondheim

Photo or Drawing

Architecture:

Street:

Postcode/City:

Province/Country:

Energy consultancy:

Street:

Postcode/City:

Province/Country:

Year of construction:

No. of dwelling units:

No. of occupants:

Building: Dråpen moderne

Street:

Postcode/City: 7052

Province/Country: NO0003a-Trondheim NO-Norway

Building type:

Climate data set: NO0001a-Oslo

Climate zone: 2: Cold

Altitude of location: 0 m

Home owner / Client:

Street:

Postcode/City:

Province/Country:

Mechanical engineer:

Street:

Postcode/City:

Province/Country:

Certification:

Street:

Postcode/City:

Province/Country:

Interior temperature winter [°C]: 20,0

Interior temp. summer [°C]: 25,0

Internal heat gains (IHG) heating case [W/m²]: 2,5

IHG cooling case [W/m²]: 2,5

Specific capacity [Wh/K per m² TFA]: 60

Mechanical cooling:

Specific building characteristics with reference to the treated floor area

	Treated floor area m²		Criteria	Alternative criteria	Fulfilled?²	
Space heating	Heating demand kWh/(m²a)	25,212	≤	15	-	no
	Heating load W/m²	18	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	2	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	181	≤	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	87	≤	-	-	
	Generation of renewable energy (in relation to projected building footprint area)	0	≥	-	-	-

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Task: First name: Surname: Signature: Passive House Classic? no

Issued on: City:

PHPP, Verification

PHPP Simuleringer 02.05.22 tilbake til nytt utgangspunkt

4.1.2

Passive House Verification									
<div style="border: 1px dashed black; height: 100px; margin-bottom: 5px;"></div> <p style="text-align: center; font-size: small;">Photo or Drawing</p>				<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Building: Dråpen moderne</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text" value="7052"/></p> <p>Province/Country: <input type="text" value="NO0003a-Trondheim"/> <input type="text" value="NO-Norway"/></p> <p>Building type: <input type="text"/></p> <p>Climate data set: <input type="text" value="NO0003a-Trondheim"/></p> <p>Climate zone: <input type="text" value="2: Cold"/> Altitude of location: <input type="text" value="0 m"/></p> </div> <div style="width: 45%;"> <p>Home owner / Client:</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <p>Mechanical engineer:</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p> </div> <div style="width: 45%;"> <p>Certification:</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p> </div> </div>					
<p>Architecture: <input type="text"/></p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p>				<p>Energy consultancy: <input type="text"/></p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p>					
<p>Year of construction: <input type="text" value="2022"/></p> <p>No. of dwelling units: <input type="text" value="1"/></p> <p>No. of occupants: <input type="text" value="2,8"/></p>				<p>Interior temperature winter [°C]: <input type="text" value="20,0"/></p> <p>Internal heat gains (IHG) heating case [W/m²]: <input type="text" value="2,5"/></p> <p>Specific capacity [Wh/K per m² TFA]: <input type="text" value="60"/></p> <p>Interior temp. summer [°C]: <input type="text" value="25,0"/></p> <p>IHG cooling case [W/m²]: <input type="text" value="2,5"/></p> <p>Mechanical cooling: <input type="text"/></p>					

Specific building characteristics with reference to the treated floor area										
		Treated floor area m²	<input type="text" value="139,9"/>			Criteria		Alternative criteria		Fulfilled?²
		Heating demand kWh/(m²a)	<input type="text" value="23,590"/>	≤	<input type="text" value="15"/>	<input type="text" value="-"/>	<input type="text" value="10"/>	<input type="text" value="no"/>		
		Heating load W/m²	<input type="text"/>	≤	<input type="text" value="-"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="no"/>		
Space cooling		Cooling & dehum. demand kWh/(m²a)	<input type="text" value="-"/>	≤	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>		
		Cooling load W/m²	<input type="text" value="-"/>	≤	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="yes"/>		
		Frequency of overheating (> 25 °C) %	<input type="text" value="0"/>	≤	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="yes"/>		
		Frequency of excessively high humidity (> 12 g/kg) %	<input type="text" value="0"/>	≤	<input type="text" value="20"/>	<input type="text" value="20"/>	<input type="text" value="20"/>	<input type="text" value="yes"/>		
Airtightness		Pressurization test result n ₅₀ 1/h	<input type="text" value="0,6"/>	≤	<input type="text" value="0,6"/>	<input type="text" value="0,6"/>	<input type="text" value="0,6"/>	<input type="text" value="yes"/>		
Non-renewable Primary Energy (PE)		PE demand kWh/(m²a)	<input type="text" value="178"/>	≤	<input type="text" value="120"/>	<input type="text" value="120"/>	<input type="text" value="120"/>	<input type="text" value="no"/>		
		PER demand kWh/(m²a)	<input type="text" value="82"/>	≤	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>		
Primary Energy Renewable (PER)		Generation of renewable energy (in relation to projected building footprint area)	<input type="text" value="0"/>	≥	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>		

² Empty field: Data missing; '-': No requirement

<p>I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.</p>				<p>Passive House Classic? <input type="text" value="no"/></p>	
<p>Task: <input type="text"/></p>		<p>First name: <input type="text"/></p>		<p>Surname: <input type="text"/></p>	
<p>Issued on: <input type="text"/></p>		<p>City: <input type="text"/></p>		<p>Signature: <input type="text"/></p>	

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	25,018	-	10	
		18			
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
		-			
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	181	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	87	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Photo or Drawing

Architecture:

Street:

Postcode/City:

Province/Country:

Energy consultancy:

Street:

Postcode/City:

Province/Country:

Year of construction:

No. of dwelling units:

No. of occupants:

Building: Dråpen moderne

Street:

Postcode/City: 7052

Province/Country: NO0003a-Trondheim NO-Norway

Building type:

Climate data set: NO0003a-Trondheim

Climate zone: 2: Cold

Altitude of location: 0 m

Home owner / Client:

Street:

Postcode/City:

Province/Country:

Mechanical engineer:

Street:

Postcode/City:

Province/Country:

Certification:

Street:

Postcode/City:

Province/Country:

Interior temperature winter [°C]: 20,0

Interior temp. summer [°C]: 25,0

Internal heat gains (IHG) heating case [W/m²]: 2,5

IHG cooling case [W/m²]: 2,5

Specific capacity [Wh/K per m² TFA]: 60

Mechanical cooling:

Specific building characteristics with reference to the treated floor area

	Treated floor area m²		Criteria	Alternative criteria	Fulfilled?²	
Space heating	Heating demand kWh/(m²a)	23,398	≤	15	-	no
	Heating load W/m²		≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	0	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	178	≤	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	81	≤	-	-	
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	≥	-	-	-

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Task:

First name:

Surname:

Signature:

Issued on:

City:

Passive House Classic? no

PHPP, Verification

PHPP Simuleringer 02.05.22 tilbake til nytt utgangspunkt

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	25,077	-	10	
		18			
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
		-			
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	181	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	87	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

4.1.6

Passive House Verification

Photo or Drawing

Architecture:

Street:

Postcode/City:

Province/Country:

Energy consultancy:

Street:

Postcode/City:

Province/Country:

Year of construction:

No. of dwelling units:

No. of occupants:

Building:

Street:

Postcode/City:

Province/Country:

Building type:

Climate data set:

Climate zone:

Altitude of location:

Home owner / Client:

Street:

Postcode/City:

Province/Country:

Mechanical engineer:

Street:

Postcode/City:

Province/Country:

Certification:

Street:

Postcode/City:

Province/Country:

Interior temperature winter [°C]:

Interior temp. summer [°C]:

Internal heat gains (IHG) heating case [W/m²]:

IHG cooling case [W/m²]:

Specific capacity [Wh/K per m² TFA]:

Mechanical cooling:

Specific building characteristics with reference to the treated floor area

			Criteria	Alternative criteria	Fulfilled? ²	
Space heating	Treated floor area m²	139,9				
	Heating demand kWh/(m²a)	23,456	≤	15	-	no
	Heating load W/m²		≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	0	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	178	≤	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	81	≤	-	-	
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	≥	-	-	-

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Task:

First name:

Surname:

Issued on:

City:

Passive House Classic?

Signature:

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0001a-Oslo	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction:	2022	Interior temperature winter [°C]:	20,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2,5
No. of occupants:	2,8	Specific capacity [Wh/K per m² TFA]:	60
		Interior temp. summer [°C]:	25,0
		IHG cooling case [W/m²]:	2,5
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	24,643	-	10	
		17			
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
		-			
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	180	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	86	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
		Postcode/City: 7052	
		Province/Country: NO0003a-Trondheim NO-Norway	
		Building type:	
		Climate data set: NO0003a-Trondheim	
		Climate zone: 2: Cold	Altitude of location: 0 m
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Year of construction: 2022		Interior temperature winter [°C]: 20,0	
No. of dwelling units: 1		Internal heat gains (IHG) heating case [W/m²]: 2,5	
No. of occupants: 2,8		Specific capacity [Wh/K per m² TFA]: 60	
		Interior temp. summer [°C]: 25,0	
		IHG cooling case [W/m²]: 2,5	
		Mechanical cooling:	

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	23,025	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
	Frequency of overheating (> 25 °C) %	0	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	177	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	81	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

4.2.3

Passive House Verification

Photo or Drawing		Building: Dråpen moderne	
		Street:	
Postcode/City:		7052	
Province/Country:		NO0003a-Trondheim NO-Norway	
Building type:			
Climate data set:		NO0001a-Oslo	
Climate zone:		2: Cold	
Altitude of location:		0 m	
Home owner / Client:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical engineer:			
Street:			
Postcode/City:			
Province/Country:			
Certification:			
Street:			
Postcode/City:			
Province/Country:			
Architecture: Street: Postcode/City: Province/Country:		Interior temperature winter [°C]: 20,0 Internal heat gains (IHG) heating case [W/m²]: 2,5 Specific capacity [Wh/K per m² TFA]: 60	
Energy consultancy: Street: Postcode/City: Province/Country:		Interior temp. summer [°C]: 25,0 IHG cooling case [W/m²]: 2,5 Mechanical cooling:	
Year of construction: 2022 No. of dwelling units: 1 No. of occupants: 2,8			

Specific building characteristics with reference to the treated floor area					
	Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	139,9	15	-	no
	Heating load W/m²	24,575	-	10	
		17			
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	-	-	-
	Cooling load W/m²	-	-	-	
		-			
	Frequency of overheating (> 25 °C) %	2	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	20		yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	180	120		no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	86	-	-	-
	Generation of renewable energy (in relation to projected building footprint area)	0	-	-	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.			Passive House Classic?	no
Task:	First name:	Surname:	Signature:	
Issued on:		City:		

4.2.4

Passive House Verification									
<div style="border: 1px dashed black; height: 100px; margin-bottom: 5px;"></div> <div style="font-size: 0.8em;">Photo or Drawing</div>				<div style="font-size: 0.8em;"> Building: Dråpen moderne Street: Postcode/City: 7052 Province/Country: NO0003a-Trondheim NO-Norway Building type: Climate data set: NO0003a-Trondheim Climate zone: 2: Cold Altitude of location: 0 m </div>					
<div style="font-size: 0.8em;"> Architecture: Street: Postcode/City: Province/Country: </div>				<div style="font-size: 0.8em;"> Home owner / Client: Street: Postcode/City: Province/Country: </div>					
<div style="font-size: 0.8em;"> Energy consultancy: Street: Postcode/City: Province/Country: </div>				<div style="font-size: 0.8em;"> Mechanical engineer: Street: Postcode/City: Province/Country: </div>					
<div style="font-size: 0.8em;"> Year of construction: 2022 No. of dwelling units: 1 No. of occupants: 2,8 </div>				<div style="font-size: 0.8em;"> Certification: Street: Postcode/City: Province/Country: </div>					
<div style="font-size: 0.8em;"> Interior temperature winter [°C]: 20,0 Internal heat gains (IHG) heating case [W/m²]: 2,5 Specific capacity [Wh/K per m² TFA]: 60 </div>				<div style="font-size: 0.8em;"> Interior temp. summer [°C]: 25,0 IHG cooling case [W/m²]: 2,5 Mechanical cooling: </div>					

Specific building characteristics with reference to the treated floor area										
		Treated floor area m²	139,9			Criteria		Alternative criteria		Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	22,958	≤	15	-					no
	Heating load W/m²		≤	-	10					-
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-					-
	Cooling load W/m²	-	≤	-	-					-
	Frequency of overheating (> 25 °C) %	0	≤	10						yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20						yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6						yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	177	≤	120						no
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	81	≤	-						-
	Generation of renewable energy (in relation to projected building footprint area)	0	≥	-						

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.				Passive House Classic?		no
Task:	First name:	Surname:	Signature:			
Issued on:		City:				

4.2.5

Passive House Verification									
<div style="border: 1px dashed black; height: 100px; margin-bottom: 5px;"></div> <p style="text-align: center; font-size: small;">Photo or Drawing</p>				<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Building: Dråpen moderne</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text" value="7052"/></p> <p>Province/Country: <input type="text" value="NO0003a-Trondheim"/> <input type="text" value="NO-Norway"/></p> <p>Building type: <input type="text"/></p> <p>Climate data set: <input type="text" value="NO0001a-Oslo"/></p> <p>Climate zone: <input type="text" value="2: Cold"/> Altitude of location: <input type="text" value="0 m"/></p> </div> <div style="width: 45%;"> <p>Home owner / Client:</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <p>Mechanical engineer:</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p> </div> <div style="width: 45%;"> <p>Certification:</p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p> </div> </div>					
<p>Architecture: <input type="text"/></p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p>				<p>Energy consultancy: <input type="text"/></p> <p>Street: <input type="text"/></p> <p>Postcode/City: <input type="text"/></p> <p>Province/Country: <input type="text"/></p>					
<p>Year of construction: <input type="text" value="2022"/></p> <p>No. of dwelling units: <input type="text" value="1"/></p> <p>No. of occupants: <input type="text" value="2,8"/></p>				<p>Interior temperature winter [°C]: <input type="text" value="20,0"/></p> <p>Internal heat gains (IHG) heating case [W/m²]: <input type="text" value="2,5"/></p> <p>Specific capacity [Wh/K per m² TFA]: <input type="text" value="60"/></p> <p>Interior temp. summer [°C]: <input type="text" value="25,0"/></p> <p>IHG cooling case [W/m²]: <input type="text" value="2,5"/></p> <p>Mechanical cooling: <input type="text"/></p>					

Specific building characteristics with reference to the treated floor area										
		Treated floor area m²	<input type="text" value="139,9"/>			Criteria		Alternative criteria		Fulfilled?²
		Heating demand kWh/(m²a)	<input type="text" value="24,633"/>	≤	<input type="text" value="15"/>	<input type="text" value="-"/>	<input type="text" value="10"/>	<input type="text" value="no"/>		
		Heating load W/m²	<input type="text" value="17"/>	≤	<input type="text" value="-"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="no"/>		
Space cooling		Cooling & dehum. demand kWh/(m²a)	<input type="text" value="-"/>	≤	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>		
		Cooling load W/m²	<input type="text" value="-"/>	≤	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="yes"/>		
		Frequency of overheating (> 25 °C) %	<input type="text" value="2"/>	≤	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="yes"/>		
		Frequency of excessively high humidity (> 12 g/kg) %	<input type="text" value="0"/>	≤	<input type="text" value="20"/>	<input type="text" value="20"/>	<input type="text" value="20"/>	<input type="text" value="yes"/>		
Airtightness		Pressurization test result n ₅₀ 1/h	<input type="text" value="0,6"/>	≤	<input type="text" value="0,6"/>	<input type="text" value="0,6"/>	<input type="text" value="0,6"/>	<input type="text" value="yes"/>		
Non-renewable Primary Energy (PE)		PE demand kWh/(m²a)	<input type="text" value="180"/>	≤	<input type="text" value="120"/>	<input type="text" value="120"/>	<input type="text" value="120"/>	<input type="text" value="no"/>		
		PER demand kWh/(m²a)	<input type="text" value="86"/>	≤	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>		
Primary Energy Renewable (PER)		Generation of renewable energy (in relation to projected building footprint area)	<input type="text" value="0"/>	≥	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>	<input type="text" value="-"/>		

² Empty field: Data missing; '-': No requirement

<p>I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.</p>				<p>Passive House Classic? <input type="text" value="no"/></p>	
<p>Task: <input type="text"/></p>		<p>First name: <input type="text"/></p>		<p>Surname: <input type="text"/></p>	
<p>Issued on: <input type="text"/></p>		<p>City: <input type="text"/></p>		<p>Signature: <input type="text"/></p>	

4.2.6

Passive House Verification																																																																																							
<div style="border: 1px dashed black; height: 100px; margin-bottom: 5px;">Photo or Drawing</div> <div> Architecture: <input style="width: 100%;" type="text"/> Street: <input style="width: 100%;" type="text"/> Postcode/City: <input style="width: 50%;" type="text"/> <input style="width: 50%;" type="text"/> Province/Country: <input style="width: 100%;" type="text"/> </div> <div> Energy consultancy: <input style="width: 100%;" type="text"/> Street: <input style="width: 100%;" type="text"/> Postcode/City: <input style="width: 50%;" type="text"/> <input style="width: 50%;" type="text"/> Province/Country: <input style="width: 100%;" type="text"/> </div> <div> Year of construction: <input style="width: 50px;" type="text" value="2022"/> No. of dwelling units: <input style="width: 50px;" type="text" value="1"/> No. of occupants: <input style="width: 50px;" type="text" value="2,8"/> </div>				<div> Building: <input style="width: 100%;" type="text" value="Dråpen moderne"/> Street: <input style="width: 100%;" type="text"/> Postcode/City: <input style="width: 50%;" type="text" value="7052"/> <input style="width: 50%;" type="text"/> Province/Country: <input style="width: 50%;" type="text" value="NO0003a-Trondheim"/> <input style="width: 50%;" type="text" value="NO-Norway"/> Building type: <input style="width: 100%;" type="text"/> Climate data set: <input style="width: 100%;" type="text" value="NO0003a-Trondheim"/> Climate zone: <input style="width: 50px;" type="text" value="2: Cold"/> Altitude of location: <input style="width: 50px;" type="text" value="0 m"/> </div> <div> Home owner / Client: <input style="width: 100%;" type="text"/> Street: <input style="width: 100%;" type="text"/> Postcode/City: <input style="width: 50%;" type="text"/> <input style="width: 50%;" type="text"/> Province/Country: <input style="width: 100%;" type="text"/> </div> <div> Mechanical engineer: <input style="width: 100%;" type="text"/> Street: <input style="width: 100%;" type="text"/> Postcode/City: <input style="width: 50%;" type="text"/> <input style="width: 50%;" type="text"/> Province/Country: <input style="width: 100%;" type="text"/> </div> <div> Certification: <input style="width: 100%;" type="text"/> Street: <input style="width: 100%;" type="text"/> Postcode/City: <input style="width: 50%;" type="text"/> <input style="width: 50%;" type="text"/> Province/Country: <input style="width: 100%;" type="text"/> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> Interior temperature winter [°C]: <input style="width: 50px;" type="text" value="20,0"/> Internal heat gains (IHG) heating case [W/m²]: <input style="width: 50px;" type="text" value="2,5"/> Specific capacity [Wh/K per m² TFA]: <input style="width: 50px;" type="text" value="60"/> </div> <div> Interior temp. summer [°C]: <input style="width: 50px;" type="text" value="25,0"/> IHG cooling case [W/m²]: <input style="width: 50px;" type="text" value="2,5"/> Mechanical cooling: <input style="width: 100px;" type="text"/> </div> </div>																																																																																			
Specific building characteristics with reference to the treated floor area																																																																																							
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Interior temperature winter [°C]:	20,0	Interior temp. summer [°C]:	25,0																																																																												
Internal heat gains (IHG) heating case [W/m²]:	2,5	IHG cooling case [W/m²]:	2,5																																																																												
Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:																																																																													
Specific building characteristics with reference to the treated floor area																																																																															
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2"></th> <th style="text-align: center;">Treated floor area m²</th> <th></th> <th style="text-align: center;">Criteria</th> <th style="text-align: center;">Alternative criteria</th> <th style="text-align: center;">Fulfilled?²</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Space heating</td> <td>Heating demand kWh/(m²a)</td> <td style="text-align: center;">139,9</td> <td>≤</td> <td style="text-align: center;">15</td> <td style="text-align: center;">-</td> <td rowspan="2" style="text-align: center;">no</td> </tr> <tr> <td>Heating load W/m²</td> <td style="text-align: center;">21,160</td> <td>≤</td> <td style="text-align: center;">-</td> <td style="text-align: center;">10</td> </tr> <tr> <td rowspan="4">Space cooling</td> <td>Cooling & dehum. demand kWh/(m²a)</td> <td style="text-align: center;">-</td> <td>≤</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Cooling load W/m²</td> <td style="text-align: center;">-</td> <td>≤</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Frequency of overheating (> 25 °C) %</td> <td style="text-align: center;">0</td> <td>≤</td> <td style="text-align: center;">10</td> <td></td> <td style="text-align: center;">yes</td> </tr> <tr> <td>Frequency of excessively high humidity (> 12 g/kg) %</td> <td style="text-align: center;">0</td> <td>≤</td> <td style="text-align: center;">20</td> <td></td> <td style="text-align: center;">yes</td> </tr> <tr> <td>Airtightness</td> <td>Pressurization test result n₅₀ 1/h</td> <td style="text-align: center;">0,6</td> <td>≤</td> <td style="text-align: center;">0,6</td> <td></td> <td style="text-align: center;">yes</td> </tr> <tr> <td>Non-renewable Primary Energy (PE)</td> <td>PE demand kWh/(m²a)</td> <td style="text-align: center;">171</td> <td>≤</td> <td style="text-align: center;">120</td> <td></td> <td style="text-align: center;">no</td> </tr> <tr> <td rowspan="2">Primary Energy Renewable (PER)</td> <td>PER demand kWh/(m²a)</td> <td style="text-align: center;">78</td> <td>≤</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td rowspan="2" style="text-align: center;">-</td> </tr> <tr> <td>Generation of renewable energy (in relation to projected building footprint area)</td> <td style="text-align: center;">0</td> <td>≥</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> </tbody> </table>												Treated floor area m²		Criteria	Alternative criteria	Fulfilled? ²	Space heating	Heating demand kWh/(m²a)	139,9	≤	15	-	no	Heating load W/m²	21,160	≤	-	10	Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-	Cooling load W/m²	-	≤	-	-	-	Frequency of overheating (> 25 °C) %	0	≤	10		yes	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes	Airtightness	Pressurization test result n ₅₀ 1/h	0,6	≤	0,6		yes	Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	171	≤	120		no	Primary Energy Renewable (PER)	PER demand kWh/(m²a)	78	≤	-	-	-	Generation of renewable energy (in relation to projected building footprint area)	0	≥	-	-
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SCENARIO 5 – ENERGIFORSYNING

5.1 Varmepumpe

- 5.1.1** 50/100 PER Oslo
- 5.1.2** 50/100 HP Oslo
- 5.1.3** 80/80 PER Oslo
- 5.1.4** 80/80 HP Oslo
- 5.1.5** 100/60 PER Oslo
- 5.1.6** 100/60 HP Oslo
- 5.1.7** 50/100 PER Trondheim
- 5.1.8** 50/100 HP Trondheim
- 5.1.9** 80/80 PER Trondheim
- 5.1.10** 80/80 HP Trondheim
- 5.1.11** 100/60 PER Trondheim
- 5.1.12** 100/60 HP Trondheim

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 68,9 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

2-Heat pump(s)

Secondary heat generation type (optional & different)

5-Direct electricity

Contribution margin (useful energy)

Heating	DHW
100 %	50 %
0 %	50 %

Addl. input in following worksheets

HP, possibly HP ground

Building type:

Treated floor area A_{TFA}:

Projected building footprint A_{Projected}:

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

140

97

22,69

25,12

m²

m²

kWh/(m²a)

kWh/(m²a)

kWh/(m²a)

Energy demand	Efficiency	Final energy		PER			PE		CO ₂	
		Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/(m²a)
Reference: Treated floor area	Calculation	User defined value								
	-	-	kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
68,95							145,59		29,8	
Heating							48,4		9,9	
Electricity (HP compact unit)				1,31		24,47	2,60		0,532	
Electricity (heat pump)	1,40	100 %	16,227	1,45	1,29	20,98	2,60	42,2	0,532	8,6
District heating: 1-None				2,8 4,5 3,3					0,000	
Wood and other biomass				1,10			-		-	
Natural gas / RE gas				1,75			1,10		0,250	
Heating oil / RE methanol				2,30			1,10		0,320	
Solar thermal system							0,00		0,045	
Electricity (direct)				1,45			2,60		0,532	
Vedovn med vannkappe	1,00			1,10						
Aux. electricity (heating, wintertime ventilation)			2,403	1,45	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification							4,7		1,0	
Electricity cooling (heat pump)				1,00		1,80	2,60		0,532	
Auxiliary electricity cooling, ventilation summer			1,804	1,00			2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)				1,00			2,60		0,532	
Auxiliary electricity (dehumidification)				1,00			2,60		0,532	
DHW generation							51,1		10,4	
Electricity (HP compact unit)				1,20		23,56	2,60		0,532	
Electricity (heat pump)	1,77	50 %	7,077	1,20	1,20	8,49	2,60	18,4	0,532	3,8
District heating: 1-None				2,8 4,5 3,3					0,000	
Wood and other biomass				1,10			-			
Natural gas / RE gas				1,75			1,10		0,250	
Heating oil / Methanol				2,30			1,10		0,320	
Solar thermal system							0,00		0,045	
Electricity (direct)	1,00	50 %	12,559	1,20	1,20	15,07	2,60	32,7	0,532	6,7
Vedovn med vannkappe	1,00			1,10						
Aux. electricity (DHW + solar DHW)				1,20			2,60		0,532	
Household electricity							41,4		8,5	
Electricity (household or non-residential lighting, etc.)			15,9	1,20	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)				1,20			2,60		0,532	
Gas / RE gas dry/cook							0,0		0,0	
			0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy		PER		PE		CO ₂	
	Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ -eq emissions
Reference: Projected building footprint area	kWh/a	kWh/(m²A _{Projected})	kWh/kWh	kWh/(m²A _{Projected})	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
				0,0		0,0		0,0
PV electricity	0	0,0	1,00	0,0	-		-	
Solar thermal system	0	0,0	-	0,0	1,22	0,0	0,045	0,0
		0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	146	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)

	Useful energy, performance				Airtightness n ₅₀
	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	
Requirement Passive House Premium					
Requirement Passive House Plus	15	10	-	-	0,60
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30		-		1,00
Current building reaches following class for aspect	23	16	-	-	0,6
	PHI Low Energy Building		Premium		Premium

Summary

	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	7,8	9,6	20,37	4168	4168
Demand	7,8	9,6	20,37	4168	4168
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	7,83	9,65	20,37	4168	4168
Demand w/o household electricity	5,6	7,0	14,58	2982	2982
Demand w/o household electricity, cum. generation	5,61	6,97	14,58	2982	2982

Primary Energy Renewable PER

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 68,9 kWh/(m²a)

		Building type:	
Treated floor area A_{TFA} :		140	m²
Covered fraction of space heating demand	(<i>PER' worksheet</i>)	100 %	
Space heating demand + distribution losses	$Q_H + Q_{HL}$ (<i>DHW+Distribution</i>)	3175	kWh/a
Solar fraction for space heat	$\eta_{Solar, H}$ (<i>"SolarDHW" worksheet</i>)	0 %	
Effective annual heating demand	$Q_{H,WI} = Q_H \cdot (1 - \eta_{Solar, H})$	3175	kWh/a
Covered fraction of DHW demand	(<i>PER' worksheet</i>)	50 %	
Total heating demand of DHW system	Q_{gDHW} (<i>DHW+Distribution</i>)	3514	kWh/a
Solar fraction for DHW	$\eta_{Solar, DHW}$ (<i>"SolarDHW" worksheet</i>)	0 %	
Effective DHW demand	$Q_{DHW, WI} = Q_{DHW} \cdot (1 - \eta_{Solar, DHW})$	1757	kWh/a
Number of heat pumps in the system		1	
Functionality		Heating & DHW	
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature		θ_{design} (<i>DHW+Distribution</i>)	35,00 °C
Nominal power of distribution system		P_{nom}	2,30 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system		P_{nom}	
Radiator exponent		n	
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	$U \cdot A_{Storage}$		
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		
Sink temperature of heat pump for heating	θ_{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(<i>DHW+Distribution</i>)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	$U \cdot A_{Storage}$		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
$\Delta\theta$ of electric continuous flow water heater			
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(<i>Manufacturer, tech. data</i>)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		m
Power of pump for ground heat exchanger	P_{pump}		kW

5.1.2

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

Electr. energy consumption pump (grnd. water / ground)	$Q_{EI,Pump}$	0	kWh/a
Energy by direct electricity	$Q_{EI,dir}$	445	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	2692	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	553	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	1204	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	2729	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	516	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	1122	kWh/a
Electrical consumption of HP	$Q_{EI,HP}$	2815	kWh/a

Seasonal performance factor of heat pump	SPF_{H-1}	1.58	1. HP: Heating or heating & DHW		2. HP: Domestic hot
Final electrical energy demand heat generation	Q_{final}	3260	kWh/a		kWh/(m²a)
Annual primary energy demand		8477			23,3
Annual CO ₂ -equivalent emissions		1734	kg/a		60,6
					kg/(m²a)
					12,4

5.1.3

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.7 kWh/(m²a) / Freq. overheating: 2 % / PER: 66.3 kWh/(m²a)

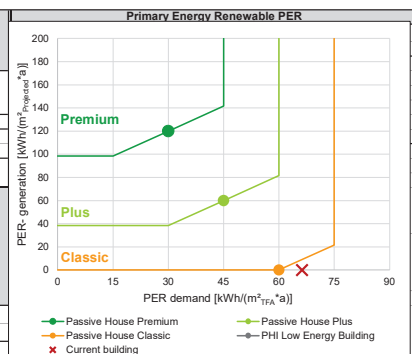
			Building type:			
			Treated floor area A_{TFA} :		140	m²
			Projected building footprint $A_{P_{project}}$:		97	m²
Selection of heat generation system(s)			Addl. input in following worksheets		Heating demand incl. distribution & hydr. frost protection	
Primary heat generation type			HP, possibly HP ground		Cooling energy dem. incl. dehumidification	
2-Heat pump(s)					DHW demand including distribution:	
					25,12	kWh/(m²a)
Secondary heat generation type (optional & different)						
5-Direct electricity						

Energy demand		Efficiency		Final energy		PER			PE		CO ₂					
Reference: Treated floor area		Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/(m ² a)				
		-	-		kWh/(m ² a)	kWh/kWh	kWh/kWh	kWh/(m ² a)	kWh/kWh	kWh/(m ² a)		kg/(m ² a)				
									1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)					
									66,26		139,31		28,5			
Heating				100 %		1,32		25,73		2,60		50,7		10,4		
Electricity (HP compact unit)						1,45			2,60				0,532			
Electricity (heat pump)		1,45		80 %	12,560	1,45		1,25	15,67		32,7		0,532		6,7	
District heating: 1-None						2,8[4,5]3,3							0,000			
Wood and other biomass						1,10			-				-			
Natural gas / RE gas						1,75			1,10				0,250			
Heating oil / RE methanol						2,30			1,10				0,320			
Solar thermal system									0,00				0,045			
Electricity (direct)		1,00		20 %	4,538	1,45		1,45	6,58		11,8		0,532		2,4	
Vedovn med vannkappe			1,00			1,10										
Aux. electricity (heating, wintertime ventilation)					2,403	1,45		1,45	3,48		6,2		0,532		1,3	
Cooling and dehumidification						1,00		1,80		4,7				1,0		
Electricity cooling (heat pump)						1,00			2,60				0,532			
Auxiliary electricity cooling, ventilation summer					1,804	1,00		1,80	2,60		4,7		0,532		1,0	
Electricity dehumidification (heat pump)						1,00			2,60				0,532			
Auxiliary electricity (dehumidification)						1,00			2,60				0,532			
DHW generation				100 %		1,20		19,62		2,60		42,5		8,7		
Electricity (HP compact unit)						1,20			2,60				0,532			
Electricity (heat pump)		1,77		80 %	11,323	1,20		1,20	13,59		29,4		0,532		6,0	
District heating: 1-None						2,8[4,5]3,3							0,000			
Wood and other biomass						1,10			-				-			
Natural gas / RE gas						1,75			1,10				0,250			
Heating oil / Methanol						2,30			1,10				0,320			
Solar thermal system									0,00				0,045			
Electricity (direct)		1,00		20 %	5,024	1,20		1,20	6,03		13,1		0,532		2,7	
Vedovn med vannkappe			1,00			1,10										
Aux. electricity (DHW + solar DHW)						1,20			2,60				0,532			
Household electricity					15,9		1,20		19,11		41,4				8,5	
Electricity (household or non-residential lighting, etc.)					15,9	1,20		1,20	19,11		41,4		0,532		8,5	
Auxiliary electricity (other)						1,20			2,60				0,532			
Gas / RE gas drv/cook					0,0	1,75			2,60		0,0		0,270		0,0	

Energy generation Reference: Projected building footprint area		Final energy		PER		PE		CO ₂	
		Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
		kWh/a	kWh/(m ² ·a) _{Projected} ^a	kWh/kWh	kWh/(m ² ·a) _{Projected} ^a	kWh/kWh	kWh/(m ² ·a)	kg/kWh	kg/a
					0,0		0,0		0,0
PV electricity		0	0,0	1,00	0,0	-		-	
Solar thermal system		0	0,0	-	0,0	1,22	0,0	0,045	0,0
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	139	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness n_{50} 1/h	Primary Energy Renewable PER $\text{kWh/m}^2 \cdot \text{year} \cdot \text{ta}$
	Annual heat. dem Treated floor area $\text{kWh/m}^2 \cdot \text{a}$	Heating load Treated floor area W/m^2	Useful cool. energy Treated floor area $\text{kWh/m}^2 \cdot \text{a}$	Cooling load Treated floor area W/m^2		
Requirement Passive House Premium	15	10	-	-	0,60	
Requirement Passive House Plus	30	-	-	-	1,00	
Requirement Passive House Classic	23	16	-	-	0,6	
Requirement PHI Low Energy Building	30	-	-	-	1,00	
Current building reaches following class for aspr	23	16	-	-	0,6	Premium
	PHI Low Energy Building		Premium		Premium	



Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO ₂ factors GEMIS (Germany)	1-CO ₂ factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,5	9,3	19,49	3988	3988
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	7,50	9,27	19,49	3988	3988
Demand w/o household electricity	5,3	6,6	13,70	2802	2802
Demand w/o household electricity, cum. generation	5,27	6,60	13,70	2802	2802

5.1.4

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 66,3 kWh/(m²a)

		Building type:	
		Treated floor area A _{TFA} :	140 m²
Covered fraction of space heating demand	(<i>PER' worksheet</i>)		80 %
Space heating demand + distribution losses	Q _H +Q _{H,L} : (<i>DHW+Distribution</i>)		3175 kWh/a
Solar fraction for space heat	η _{Solar, H} (<i>"SolarDHW" worksheet</i>)		0 %
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})		2540 kWh/a
Covered fraction of DHW demand	(<i>PER' worksheet</i>)		80 %
Total heating demand of DHW system	Q _{gDHW} (<i>DHW+Distribution</i>)		3514 kWh/a
Solar fraction for DHW	η _{Solar, DHW} (<i>"SolarDHW" worksheet</i>)		0 %
Effective DHW demand	Q _{DHW,WI} =Q _{DHW} *(1-η _{Solar, DHW})		2811 kWh/a
Number of heat pumps in the system			1
Functionality			Heating & DHW
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature	θ _{design} (<i>DHW+Distribution</i>)		35,00 °C
Nominal power of distribution system	P _{nom}		1,84 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system	P _{nom}		
Radiator exponent	n		
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	U * A _{Storage}		
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		
Sink temperature of heat pump for heating	θ _{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(<i>DHW+Distribution</i>)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	U * A _{Storage}		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
Δθ of electric continuous flow water heater			
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(<i>Manufacturer, tech. data</i>)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		
Power of pump for ground heat exchanger	P _{pump}		

5.1.4

Heating

Heat pump:Standard air/water heat pump

Source:1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5,0K

DHW

Heat pump:Standard air/water heat pump

Source:1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5,0K

Electr. energy consumption pump (grnd. water / ground)	$Q_{EI,Pump}$	0	kWh/a
Energy by direct electricity	$Q_{EI,dir}$	224	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	2256	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	885	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	1926	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	2316	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	825	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	1795	kWh/a
Electrical consumption of HP	$Q_{EI,HP}$	3118	kWh/a

Seasonal performance factor of heat pump	SPF_{H-1}	1.63	1. HP: Heating or heating & DHW		2. HP: Domestic hot
Final electrical energy demand heat generation	Q_{final}	3341	kWh/a		kWh/(m²a)
Annual primary energy demand		8687	kg/a		23,9
Annual CO ₂ -equivalent emissions		1777			62,1
					kg/(m²a)
					12,7

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 65,1 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

2-Heat pump(s)

Secondary heat generation type (optional & different)

5-Direct electricity

Contribution margin (useful energy)

Heating	DHW
60 %	100 %
40 %	0 %

Add. input in following worksheets

HP, possibly HP ground

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA}:

m²

Projected building footprint A_{Projected}:

m²

kWh/(m²a)

kWh/(m²a)

kWh/(m²a)

Energy demand	Efficiency	Final energy	PER factor	PER	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
Reference: Treated floor area	Calculation	Contribution (final energy)	Final energy demand						
	-	-	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/(m²a)	
					65,10		136,23		27,9
Heating		100 %		1,33	27,20	2,60	53,3		10,9
Electricity (HP compact unit)				1,45		2,60		0,532	
Electricity (heat pump)	1,51	60 %	9,033	1,45	10,55	2,60	23,5	0,532	4,8
District heating: 1-None				2,8 4,5 3,3				0,000	
Wood and other biomass				1,10		-		-	
Natural gas / RE gas				1,75		1,10		0,250	
Heating oil / RE methanol				2,30		1,10		0,320	
Solar thermal system						0,00		0,045	
Electricity (direct)	1,00	40 %	9,077	1,45	13,16	2,60	23,6	0,532	4,8
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (heating, wintertime ventilation)			2,403	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification				1,00	1,80		4,7		1,0
Electricity cooling (heat pump)				1,00		2,60		0,532	
Auxiliary electricity cooling, ventilation summer			1,804	1,00	1,80	2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)				1,00		2,60		0,532	
Auxiliary electricity (dehumidification)				1,00		2,60		0,532	
DHW generation		100 %		1,20	16,98	2,60	36,8		7,5
Electricity (HP compact unit)				1,20		2,60		0,532	
Electricity (heat pump)	1,77	100 %	14,153	1,20	16,98	2,60	36,8	0,532	7,5
District heating: 1-None				2,8 4,5 3,3				0,000	
Wood and other biomass				1,10		-		-	
Natural gas / RE gas				1,75		1,10		0,250	
Heating oil / Methanol				2,30		1,10		0,320	
Solar thermal system						0,00		0,045	
Electricity (direct)				1,20		2,60		0,532	
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (DHW + solar DHW)				1,20		2,60		0,532	
Household electricity			15,9		1,20		41,4		8,5
Electricity (household or non-residential lighting, etc.)			15,9	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)				1,20		2,60		0,532	
Gas / RE gas dry/cook			0,0	1,75	0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PE factor kWh/kWh	Emission factor (CO ₂ -eq) kg/kWh
	kWh/(m²A _{Projected})		PE Value kWh/(m²a)	CO ₂ eq emissions kg/a
PV electricity	0	1,00	-	-
Solar thermal system	0	-	1,22	0,045
	0,0		0,0	0,0

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]

120

Current building reaches following class

136

Requirement met?

no

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)

Requirement Passive House Premium

Requirement Passive House Plus

Requirement Passive House Classic

Requirement PHI Low Energy Building

Current building reaches following class for aspi

PHI Low Energy Building

Premium

Premium

Premium

Premium

Premium

Premium

Premium

Premium

Premium

Premium

Premium

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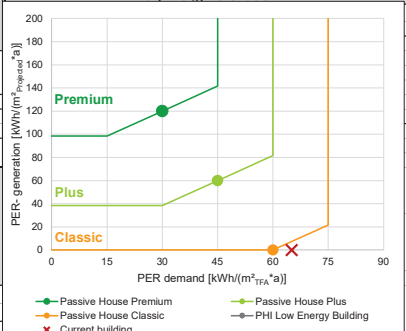
Premium

Premium

Premium

Premium

Primary Energy Renewable PER



Summary

Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.

	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,3	9,1	19,06	3900	3900
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	7,33	9,11	19,06	3900	3900
Demand w/o household electricity	5,1	6,4	13,27	2714	2714
Demand w/o household electricity, cum. generation	5,10	6,43	13,27	2714	2714

5.1.6

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 65,1 kWh/(m²a)

		Building type:	
		Treated floor area A _{TFA} :	140 m²
Covered fraction of space heating demand	(<i>PER' worksheet</i>)		60 %
Space heating demand + distribution losses	Q _H +Q _{HL} : (<i>DHW+Distribution</i>)		3175 kWh/a
Solar fraction for space heat	η _{Solar, H} (<i>"SolarDHW" worksheet</i>)		0 %
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})		1905 kWh/a
Covered fraction of DHW demand	(<i>PER' worksheet</i>)		100 %
Total heating demand of DHW system	Q _{gDHW} (<i>DHW+Distribution</i>)		3514 kWh/a
Solar fraction for DHW	η _{Solar, DHW} (<i>"SolarDHW" worksheet</i>)		0 %
Effective DHW demand	Q _{DHW, WI} =Q _{DHW} *(1-η _{Solar, DHW})		3514 kWh/a
Number of heat pumps in the system			1
Functionality			Heating & DHW
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature	θ _{design} (<i>DHW+Distribution</i>)		35,00 °C
Nominal power of distribution system	P _{nom}		1,38 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system	P _{nom}		kW
Radiator exponent	n		
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	U * A _{Storage}		W/K
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		°C
Sink temperature of heat pump for heating	θ _{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(<i>DHW+Distribution</i>)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	U * A _{Storage}		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
Δθ of electric continuous flow water heater			K
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(<i>Manufacturer, tech. data</i>)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		m
Power of pump for ground heat exchanger	P _{pump}		kW

5.1.6

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

Electr. energy consumption pump (grnd. water / ground)	$Q_{EI,Pump}$	0	kWh/a
Energy by direct electricity	$Q_{EI,dir}$	47	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	1783	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	1107	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	2407	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	1857	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	1032	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	2244	kWh/a
Electrical consumption of HP	$Q_{EI,HP}$	3197	kWh/a

Seasonal performance factor of heat pump	SPF_{H-1}	1,66	1. HP: Heating or heating & DHW		2. HP: Domestic hot
Final electrical energy demand heat generation	Q_{final}	3244	kWh/a		kWh/(m²a)
Annual primary energy demand		8434	kg/a		23,2
Annual CO ₂ -equivalent emissions		1726			60,3
					kg/(m²a)
					12,3

Primary Energy Renewable PER

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 64,1 kWh/(m²a)

Biomass ►

Passive House with PHPP Version 9.6a

Selection of heat generation system(s)

Primary heat generation type

2-Heat pump(s)

Secondary heat generation type (optional & different)

5-Direct electricity

Contribution margin (useful energy)	
Heating	DHW
100 %	50 %
0 %	50 %

Addl. input in following worksheets

HP, possibly HP ground

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA} :

Projected building footprint $A_{\text{projected}}$:

Projected building footprint $A_{Projected}$ -
demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DUM = dehumidification distribution

DHW demand including distribution:

140	m ²
97	m ²
21,16	kWh/(m ² a)
	kWh/(m ² a)
25,12	kWh/(m ² a)

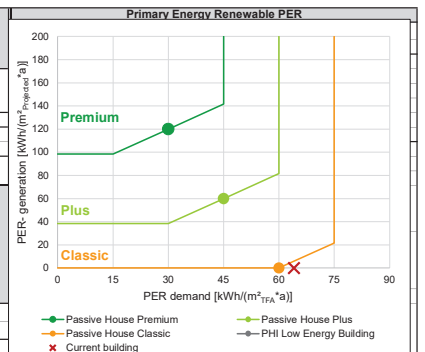
Energy demand	Efficiency		Final energy		PER			PE		CO ₂		
Reference: Treated floor area	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)	
-	-	-	-	kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	-	-	
							64,09	1-PE factors (non-renewable) PHI Certification		141,49	29,0	
								1-CO ₂ factors GEMIS (Germany)				
Heating			100 %		1,25		21,78	2,60	45,4		9,3	
Electricity (HP compact unit)					1,35			2,60		0,532		
Electricity (heat pump)	1,40		100 %	15,065	1,35	1,23	18,52	2,60	39,2	0,532	8,0	
District heating: 1-None					2,814,513,3					0,000		
Wood and other biomass					1,10			-		-		
Natural gas / RE gas					1,75			1,10		0,250		
Heating oil / RE methanol					2,30			1,10		0,320		
Solar thermal system								0,00		0,045		
Electricity (direct)					1,35			2,60		0,532		
Vedovn med vannkappe		1,00			1,10							
Aux. electricity (heating, wintertime ventilation)					2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification						1,00		1,11		2,9		0,6
Electricity cooling (heat pump)					1,00			2,60		0,532		
Auxiliary electricity cooling, ventilation summer				1,113	1,00		1,11	2,60	2,9	0,532	0,6	
Electricity dehumidification (heat pump)					1,00			2,60		0,532		
Auxiliary electricity (dehumidification)					1,00			2,60		0,532		
DHW generation			100 %			1,15	22,89	2,60	51,7		10,6	
Electricity (HP compact unit)					1,15			2,60		0,532		
Electricity (heat pump)	1,71		50 %	7,342	1,15	1,15	8,44	2,60	19,1	0,532	3,9	
District heating: 1-None					2,814,513,3					0,000		
Wood and other biomass					1,10			-		-		
Natural gas / RE gas					1,75			1,10		0,250		
Heating oil / Methanol					2,30			1,10		0,320		
Solar thermal system								0,00		0,045		
Electricity (direct)	1,00		50 %	12,558	1,15	1,15	14,44	2,60	32,7	0,532	6,7	
Vedovn med vannkappe		1,00			1,10							
Aux. electricity (DHW + solar DHW)						1,15		2,60		0,532		
Household electricity				15,9		1,15	18,32		41,4		8,5	
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5	
Auxiliary electricity (other)					1,15			2,60		0,532		
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0	

Energy generation		Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area		Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
		kWh/a	kWh/(m ² A _{Projected})	kWh/kWh	kWh/(m ² A _{Projected})	kWh/kWh	kWh/(m ² a)	kg/kWh	kg/a
					0,0		0,0		0,0
PV electricity		0	0,0	1,00	0,0	-		-	
Solar thermal system		0	0,0	-	0,0	1,22	0,0	0,045	0,0
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m².a)]	120	Current building reaches following class	141	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness
	Annual heat dem	Heating load	Useful cool. energy	Cooling load	n ₅₀
	Treated floor area kWh/(m²a)	Treated floor area W/m²	Treated floor area kWh/(m²a)	Treated floor area W/m²	1/h
Requirement Passive House Premium					
Requirement Passive House Plus	15	10	-	-	0.60
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30		-		1.00
Current building reaches following class for asp	21	#VERDII	-	-	0.6
		#VERDII	Premium		Premium

Summary	Final energy	PER specific value	PE value	CO2eq emissions	CO2eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,6	9,0	19,79	4050	4050
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	7,61	8,97	19,79	4050	4050
Demand w/o household electricity	5,4	6,4	14,00	2865	2865
Demand w/o household electricity, cum. generation	5,38	6,40	14,00	2865	2865



5.1.8

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 64,1 kWh/(m²a)

		Building type:	
		Treated floor area A _{TFA} :	140 m²
Covered fraction of space heating demand	(PER worksheet)		100 %
Space heating demand + distribution losses	Q _H +Q _{HL} : (DHW+Distribution)		2960 kWh/a
Solar fraction for space heat	η _{Solar, H} ("SolarDHW" worksheet)		0 %
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})		2960 kWh/a
Covered fraction of DHW demand	(PER worksheet)		50 %
Total heating demand of DHW system	Q _{gDHW} (DHW+Distribution)		3514 kWh/a
Solar fraction for DHW	η _{Solar, DHW} ("SolarDHW" worksheet)		0 %
Effective DHW demand	Q _{DHW,WI} =Q _{DHW} *(1-η _{Solar, DHW})		1757 kWh/a
Number of heat pumps in the system			1
Functionality			Heating & DHW
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature		θ _{design} (DHW+Distribution)	35,00 °C
Nominal power of distribution system		P _{nom}	2,24 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system		P _{nom}	
Radiator exponent		n	
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage		U * A _{Storage}	
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)		(DHW+Distribution)	
Sink temperature of heat pump for heating		θ _{sink}	61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(DHW+Distribution)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage		U * A _{Storage}	0,7 W/K
Room temperature (storage location: outside of thermal envelope)		(DHW+Distribution)	20,00 °C
Type of backup heater			1-Elec. Immersion heater
Δθ of electric continuous flow water heater			
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority		(Manufacturer, tech. data)	1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe		z	
Power of pump for ground heat exchanger		P _{pump}	

5.1.8

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink

$\Delta\theta_{\text{Sink}}$

5,0

K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink

$\Delta\theta_{\text{Sink}}$

5,0

K

Electr. energy consumption pump (grnd. water / ground)

$Q_{\text{El,Pump}}$

0

kWh/a

Energy by direct electricity

$Q_{\text{El,dir}}$

419

kWh/a

Space heat supplied by HP

$Q_{\text{HP,Heating}}$

2506

kWh/a

Winter DHW supplied by HP

$Q_{\text{HP,DHW,Winter}}$

529

kWh/a

Summer DHW supplied by HP

$Q_{\text{HP,DHW,Summer}}$

1228

kWh/a

Space heating supplied by HP without storage losses

$Q_{\text{HP,Heating}}$

2542

kWh/a

Winter DHW supplied by HP without storage losses

$Q_{\text{HP,DHW,Winter}}$

493

kWh/a

Summer DHW supplied by HP without storage losses

$Q_{\text{HP,DHW,Summer}}$

1144

kWh/a

Electrical consumption of HP

$Q_{\text{El,HP}}$

2716

kWh/a

Seasonal performance factor of heat pump

$\text{SPF}_{\text{H-1}}$

1,57

kWh/a

Final electrical energy demand heat generation

Q_{final}

3135

8150

kg/a

Annual CO₂-equivalent emissions

1668

2. HP: Domestic hot

kWh/(m²a)

22,4

58,3

kg/(m²a)

11,9

5.1.9

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21.2 kWh/(m²a) / Freq. overheating: 0 % / PER: 61.6 kWh/(m²a)

			Building type:				
			Treated floor area A _{TFA} :		140	m²	
			Projected building footprint A _{Projected} :		97	m²	
Selection of heat generation system(s)			Addl. input in following worksheets		Heating demand incl. distribution & hydr. frost protection	21,16	kWh/(m²a)
Primary heat generation type			HP, possibly HP ground		Cooling energy dem. incl. dehumidification		kWh/(m²a)
2-Heat pump(s)					DHW demand including distribution:	25,12	kWh/(m²a)
Secondary heat generation type (optional & different)							
5-Direct electricity							

Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emission kg/(m²·a)
	-	-		kWh/(m²·a)	kWh/kWh	kWh/kWh	kWh/(m²·a)	kWh/kWh	kWh/(m²·a)		
							61,61	135,50		27,7	
								1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
Heating			100 %		1,25		22,89	2,60	47,6	9,7	
Electricity (HP compact unit)					1,35			2,60		0,532	
Electricity (heat pump)	1,45		80 %	11,660	1,35	1,19	13,92	2,60	30,3	0,532	6,2
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / RE methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		20 %	4,232	1,35	1,35	5,71	2,60	11,0	0,532	2,3
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification					1,00		1,11	2,9		0,6	
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,113	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %		1,15		19,29	2,60	43,6	8,9	
Electricity (HP compact unit)					1,15			2,60		0,532	
Electricity (heat pump)	1,71		80 %	11,747	1,15	1,15	13,51	2,60	30,5	0,532	6,2
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		20 %	5,023	1,15	1,15	5,78	2,60	13,1	0,532	2,7
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)					1,15			2,60		0,532	
Household electricity			15,9		1,15		18,32	41,4		8,5	
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas dry/cook			0,0		1,75		0,00	2,60	0,0	0,270	0,0

Energy generation Reference: Projected building footprint area		Final energy		PER		PE		CO ₂	
		Final energy generation kWh/a	Final energy generation kWh/(m²A _{Projected})	PER factor kWh/kWh	PER specific value kWh/(m²A _{Projected})	PE factor kWh/kWh	PE Value kWh/(m²a)	Emission factor (CO ₂ -eq) kg/kWh	CO ₂ eq emission kg/a
		0	0,0	1,00	0,0	-	0,0	-	0,0
PV electricity		0	0,0	-	0,0	1,22	0,0	0,045	0,0
Solar thermal system			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	136	Requirement met?	no
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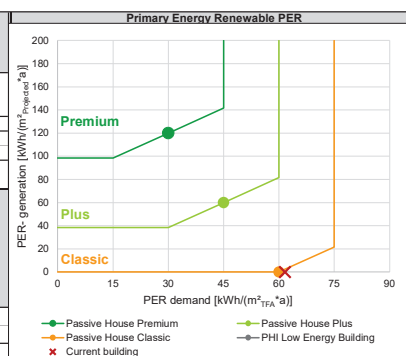
Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness	Primary Energy Renewable PER
	Annual heat. dem Treated floor area kWh/(m²·a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²·a)	Cooling load Treated floor area W/m²	n ₅₀ 1/h	
Requirement Passive House Premium	15	10	-	-	0,60	
Requirement Passive House Plus	30	-	-	-	1,00	
Requirement Passive House Classic	21	-	-	-	0,6	
Requirement PHI Low Energy Building	21	-	-	-	0,6	
Current building reaches following class for aspi	#VERDI	#VERDI	Premium	Premium	Premium	

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a
Demand	7,3	8,6	18,96	3879	3879
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	7,29	8,62	18,96	3879	3879
Demand w/o household electricity	5,1	6,1	13,16	2693	2693
Demand w/o household electricity, cum. generation	5,06	6,06	13,16	2693	2693

PER-generation (kg CO₂eq/kWh) vs PER demand (kWh/(m²·a))

Legend:

- Passive House Premium
- Passive House Plus
- PHI Low Energy Building
- Current building



5.1.10

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 61,6 kWh/(m²a)

		Building type:	
		Treated floor area A _{TFA} :	140 m²
Covered fraction of space heating demand	(<i>PER</i> worksheet)		80 %
Space heating demand + distribution losses	Q _H +Q _{HL} : (<i>DHW+Distribution</i>)		2960 kWh/a
Solar fraction for space heat	η _{Solar, H} (<i>"SolarDHW" worksheet</i>)		0 %
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})		2368 kWh/a
Covered fraction of DHW demand	(<i>PER</i> worksheet)		80 %
Total heating demand of DHW system	Q _{gDHW} (<i>DHW+Distribution</i>)		3514 kWh/a
Solar fraction for DHW	η _{Solar, DHW} (<i>"SolarDHW" worksheet</i>)		0 %
Effective DHW demand	Q _{DHW, WI} =Q _{DHW} *(1-η _{Solar, DHW})		2811 kWh/a
Number of heat pumps in the system			1
Functionality			Heating & DHW
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature	θ _{design} (<i>DHW+Distribution</i>)		35,00 °C
Nominal power of distribution system	P _{nom}		1,80 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system	P _{nom}		
Radiator exponent	n		
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	U * A _{Storage}		
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		
Sink temperature of heat pump for heating	θ _{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(<i>DHW+Distribution</i>)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	U * A _{Storage}		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
Δθ of electric continuous flow water heater			
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(<i>Manufacturer, tech. data</i>)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		
Power of pump for ground heat exchanger	P _{pump}		

5.1.10

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

Electr. energy consumption pump (grnd. water / ground)
Energy by direct electricity
Space heat supplied by HP
Winter DHW supplied by HP
Summer DHW supplied by HP
Space heating supplied by HP without storage losses
Winter DHW supplied by HP without storage losses
Summer DHW supplied by HP without storage losses
Electrical consumption of HP

$Q_{\text{EI,Pump}}$
 $Q_{\text{EI,dir}}$
 $Q_{\text{HP,Heating}}$
 $Q_{\text{HP,DHW,Winter}}$
 $Q_{\text{HP,DHW,Summer}}$
 $Q_{\text{HP,Heating}}$
 $Q_{\text{HP,DHW,Winter}}$
 $Q_{\text{HP,DHW,Summer}}$
 $Q_{\text{el,HP}}$

0	kWh/a
215	kWh/a
2096	kWh/a
847	kWh/a
1964	kWh/a
2153	kWh/a
789	kWh/a
1831	kWh/a
3060	kWh/a

Seasonal performance factor of heat pump

$\text{SPF}_{\text{H-1}}$

Final electrical energy demand heat generation
Annual primary energy demand

Q_{final}

Annual CO₂-equivalent emissions

1. HP: Heating or heating & DHW

1,60
kWh/a
3275
8514
kg/a
1742

2. HP: Domestic hot

kWh/(m ² a)
23,4
60,9
kg/(m ² a)
12,5

		Building type:			
		Treated floor area A _{TPA} :		140	m²
		Projected building footprint A _{Projected} :		97	m²
Selection of heat generation system(s)		Contribution margin (useful energy)	Add. input in following worksheets	Heating demand incl. distribution & hydr. frost protection	21,16 kWh/(m²a)
Primary heat generation type		Heating 60 % DHW 100 %	HP, possibly HP ground	Cooling energy dem. incl. humidification	
2-Heat pump(s)				DHW demand including distribution:	25,12 kWh/(m²a)
Secondary heat generation type (optional & different)					
5-Direct electricity		40 % 0 %	-		

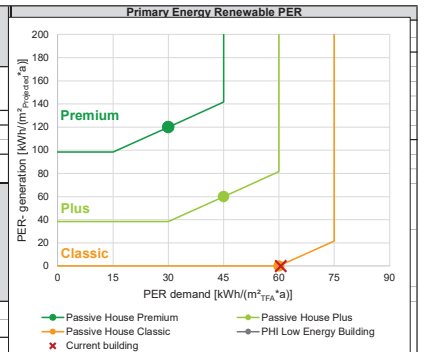
Energy demand	Efficiency		Final energy		PER		PE		CO ₂			
Reference: Treated floor area	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m ² a)	
	-	-		kWh/(m ² a)	kWh/kWh		kWh/kWh	kWh/kWh	kWh/(m ² a)		kg/(m ² a)	
							60,50	1-PE factors (non-renewable) PHI Certification		132,55	1-CO ₂ factors GEMIS (Germany)	27,1
Heating			100 %			1,26	24,18	2,60	50,1		10,2	
Electricity (HP compact unit)					1,35			2,60		0,532		
Electricity (heat pump)	1,52		60 %	8,380	1,35	1,13	9,49	2,60	21,8	0,532	4,5	
District heating: 1-None					2,814,5	3,3				0,000		
Wood and other biomass					1,10			-		-		
Natural gas / RE gas					1,75			1,10		0,250		
Heating oil / RE methanol					2,30			1,10		0,320		
Solar thermal system								0,00		0,045		
Electricity (direct)	1,00		40 %	8,464	1,35	1,35	11,43	2,60	22,0	0,532	4,5	
Vedovn med vannkappe		1,00			1,10							
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3	
Cooling and dehumidification					1,00		1,11		2,9		0,6	
Electricity cooling (heat pump)					1,00			2,60		0,532		
Auxiliary electricity cooling, ventilation summer				1,113	1,00		1,11	2,60	2,9	0,532	0,6	
Electricity dehumidification (heat pump)					1,00			2,60		0,532		
Auxiliary electricity (dehumidification)					1,00			2,60		0,532		
DHW generation			100 %			1,15	16,89	2,60	38,2		7,8	
Electricity (HP compact unit)					1,15			2,60		0,532		
Electricity (heat pump)	1,71		100 %	14,684	1,15	1,15	16,89	2,60	38,2	0,532	7,8	
District heating: 1-None					2,814,5	3,3				0,000		
Wood and other biomass					1,10			-		-		
Natural gas / RE gas					1,75			1,10		0,250		
Heating oil / Methanol					2,30			1,10		0,320		
Solar thermal system								0,00		0,045		
Electricity (direct)					1,15			2,60		0,532		
Vedovn med vannkappe		1,00			1,10							
Aux. electricity (DHW + solar DHW)					1,15			2,60		0,532		
Household electricity				15,9		1,15	18,32		41,4		8,5	
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5	
Auxiliary electricity (other)					1,15			2,60		0,532		
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0	

Energy generation		Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area		Final energy generation	Final energy generation ^a	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
		kWh/a	kWh/(m ² A) _{Projected@}	kWh/kWh	kWh/(m ² A) _{Projected@}	kWh/kWh	kWh/(m ² a)	kg/kWh	kg/a
					0,0		0,0		0,0
PV electricity		0	0,0	1,00		-		-	
Solar thermal system		0	0,0	-		1,22	0,0	0,045	0,0
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	133	Requirement met?	no
--	-----	--	-----	------------------	----

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness	Primary Energy Renewable PER [kWh/(m²·year@a)]
	Annual heat dem. Treated floor area kWh/(m²·a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²·a)	Cooling load Treated floor area W/m²	n ₅₀ 1/h	
Requirement Passive House Premium						
Requirement Passive House Plus	15	10	-	-	0.60	
Requirement Passive House Classic						
Requirement PHI Low Energy Building	30		-	-	1.00	
Current building reaches following class for aspi	21	#VERDII			0.6	
		#VERDII	Premium		Premium	

Summary	Final energy	PER specific value	PE value	CO2eq emissions	CO2eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,1	8,5	18,54	3794	3794
Generation	0,0	0,0	0,00	0	0
Demand, cumulative generation (annual balance)	7,13	8,46	18,54	3794	3794
Demand w/o household electricity	4,9	5,9	12,75	2609	2609
Demand w/o household electricity, cum. generation	4,90	5,90	12,75	2609	2609



Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 60,5 kWh/(m²a)

		Building type:	
Treated floor area A_{TFA} :		140	m²
Covered fraction of space heating demand	(<i>PER' worksheet</i>)	60 %	
Space heating demand + distribution losses	$Q_H + Q_{HL}$: (<i>DHW+Distribution</i>)	2960	kWh/a
Solar fraction for space heat	$\eta_{Solar, H}$: (<i>'SolarDHW' worksheet</i>)	0 %	
Effective annual heating demand	$Q_{H,WI} = Q_H \cdot (1 - \eta_{Solar, H})$	1776	kWh/a
Covered fraction of DHW demand	(<i>PER' worksheet</i>)	100 %	
Total heating demand of DHW system	Q_{gDHW} : (<i>DHW+Distribution</i>)	3514	kWh/a
Solar fraction for DHW	$\eta_{Solar, DHW}$: (<i>'SolarDHW' worksheet</i>)	0 %	
Effective DHW demand	$Q_{DHW, WI} = Q_{DHW} \cdot (1 - \eta_{Solar, DHW})$	3514	kWh/a
Number of heat pumps in the system		1	
Functionality		Heating & DHW	
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature		θ_{design} : (<i>DHW+Distribution</i>)	35,00 °C
Nominal power of distribution system		P_{nom}	1,35 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system		P_{nom}	
Radiator exponent		n	
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	$U \cdot A_{Storage}$		
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		
Sink temperature of heat pump for heating	θ_{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(<i>DHW+Distribution</i>)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	$U \cdot A_{Storage}$		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(<i>DHW+Distribution</i>)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
$\Delta\theta$ of electric continuous flow water heater			
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(<i>Manufacturer, tech. data</i>)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		m
Power of pump for ground heat exchanger	P_{pump}		kW

5.1.12

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink

$\Delta\theta_{\text{Sink}}$

5,0

K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink

$\Delta\theta_{\text{Sink}}$

5,0

K

Electr. energy consumption pump (grnd. water / ground)

$Q_{EI,Pump}$

0

kWh/a

Energy by direct electricity

$Q_{EI,direct}$

50

kWh/a

Space heat supplied by HP

$Q_{HP,Heating}$

1655

kWh/a

Winter DHW supplied by HP

$Q_{HP,DHW,Winter}$

1058

kWh/a

Summer DHW supplied by HP

$Q_{HP,DHW,Summer}$

2455

kWh/a

Space heating supplied by HP without storage losses

$Q_{HP,Heating}$

1726

kWh/a

Winter DHW supplied by HP without storage losses

$Q_{HP,DHW,Winter}$

987

kWh/a

Summer DHW supplied by HP without storage losses

$Q_{HP,DHW,Summer}$

2289

kWh/a

Electrical consumption of HP

$Q_{EI,HP}$

3177

kWh/a

Seasonal performance factor of heat pump

SPF_{H-1}

1,63

kWh/a

Final electrical energy demand heat generation

Q_{final}

3227

Annual primary energy demand

8389

kg/a

Annual CO₂-equivalent emissions

1717

1. HP: Heating or heating & DHW

2. HP: Domestic hot

kWh/(m²a)

23,1

60,0

kg/(m²a)

12,3

SCENARIO 5 – ENERGIFORSYNING

5.2 Solfanger

- 5.2.1 10 m² Solar Oslo
- 5.2.2 10 m² PER Oslo
- 5.2.3 13 m² Solar Oslo
- 5.2.4 13 m² PER Oslo
- 5.2.5 10 m² Solar Trondheim
- 5.2.6 10 m² PER Trondheim
- 5.2.7 14 m² Solar Trondheim
- 5.2.8 14 m² PER Trondheim

Building type:

Treated floor area A_{TFA} :

139.9 m²

Projected building footprint $A_{Projected}$:

97.1 m²

Latitude (Climate worksheet)

59.9 °

DHW demand (DHW+Distribution)

3514 kWh/a

Heating demand ('Heating' and 'DHW+Distribution' worksheets)

3175 kWh/a

Occupancy

2.8 Persons

Location: Selection in 'Areas' worksheet

5-Fasade 4

Size of selected area

20 m²

Free area (less solar thermal and electrical systems)

10.2 m²

Deviation from North

180 °

Angle of inclination from the horizontal

90 °

Alternative input: Deviation from North

180 °

Alternative input: Angle of inclination from the horizontal

°

Solar collector area

10.00 m²

Specific collector area

3.5 m²/Pers

Height of the collector field

1.00 m

Height of horizon

0.00 m

Horizontal distance

1000.00 m

Additional reduction factor shading

100 %

Collector

2-Softlanger lapevann

Heating support (check if appropriate)

DHW priority (check if appropriate)

h_{hor}

a_{hor}

f_{other}

Results

	Footprint area	Absolute
	kWh/(m² Projected a)	kWh/a
Solar contribution total	62 %	2169
Solar contribution to DHW	62 %	2169
Solar contribution to space heating	0 %	0

1-CO2 factors GEMIS (Germany)

kgCO2eq/kWhFinal

1.0

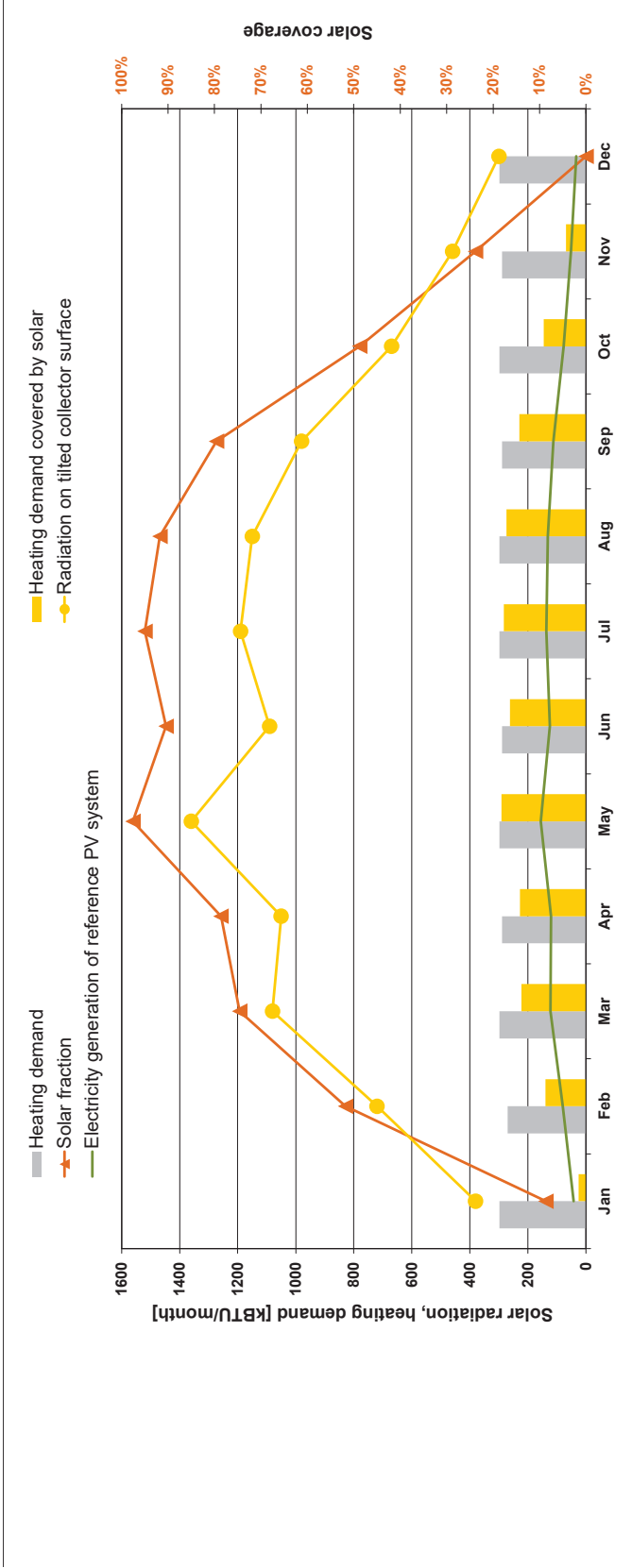
kgCO2eq/a

98

Determination of PER factors

Yield reference PV syst	PER _{ref}	PER _{calc therm}
kWh _{ref} /a	kWh _{TP,m-a} /kWh _{ref}	kWh _{Th} /kWh _{TP,m-a} /kWh _{ref}
1189	1.20	0.46
1189.4	1.20	0.46
0.0	1.45	

5.2.1



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heating demand DHW-preparation	298	270	298	298	298	298	298	298	298	298	298	298	3514
Space heating demand	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating demand	298	270	298	298	298	298	298	298	298	298	298	298	3514
Radiation on tilted collector surface	380	720	1080	1050	1360	1090	1190	1150	980	670	460	300	10430
Please enter: Solar production for DHW													0
Please enter: Solar production for heating													0
DHW heating demand covered by solar	26	140	223	227	291	261	283	274	230	145	69	0	2169
Space heating demand covered by solar	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating demand covered by solar	26	140	223	227	291	261	283	274	230	145	69	0	2169
Solar fraction	9 %	52 %	75 %	79 %	98 %	90 %	95 %	92 %	80 %	49 %	24 %	0 %	62 %
Electricity generation of reference PV system	42	81	122	120	156	125	136	132	113	77	52	34	1189
													kWh/month

5.2.2

Biomass ▶

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 74 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

5-Direct electricity

Secondary heat generation type (optional & different)

-

Contribution margin (useful energy)

Heating	DHW
100 %	100 %
0 %	0 %

Addl. input in following worksheets

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA}:

Projected building footprint A_{Projected}:

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

140	m²
97	m²
22,69	kWh/(m²a)
	kWh/(m²a)
25,12	kWh/(m²a)

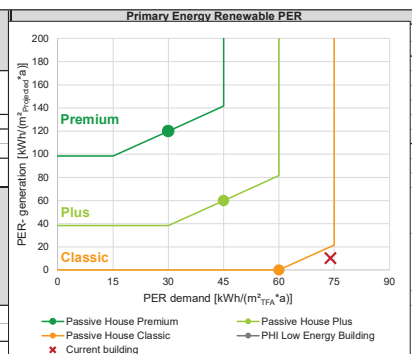
Energy demand	Efficiency	Final energy	PER factor	PER	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/(m²a)
Reference: Treated floor area	Calculation	Contribution (final energy)	PER factor	Effective PER factor (including biomass kWh/kWh)	PER specific value kWh/(m²a)	PE factor kWh/kWh	PE value kWh/(m²a)	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/(m²a)
	-	-	-	-	-	-	-	-	-
					73,97		137,63		28,9
Heating		100 %		1,35	33,84	2,60	65,2		13,4
Electricity (HP compact unit)			1,45			2,60		0,532	
Electricity (heat pump)			1,45			2,60		0,532	
District heating: 1-None			2,8 4,5 3,3					0,000	
Wood and other biomass			1,10			-		-	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / RE methanol			2,30			1,10		0,320	
Solar thermal system						0,00		0,045	
Electricity (direct)	1,00	100 %	22,692	1,45	1,34	30,36	2,60	59,0	12,1
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (heating, wintertime ventilation)			2,403	1,45	1,45	3,48	2,60	6,2	1,3
Cooling and dehumidification				1,00	1,80		4,7		1,0
Electricity cooling (heat pump)				1,00		2,60		0,532	
Auxiliary electricity cooling, ventilation summer			1,804	1,00		1,80	2,60	4,7	1,0
Electricity dehumidification (heat pump)				1,00		2,60		0,532	
Auxiliary electricity (dehumidification)				1,00		2,60		0,532	
DHW generation		100 %		0,75	19,21	1,03	26,3		6,1
Electricity (HP compact unit)			1,20			2,60		0,532	
Electricity (heat pump)			1,20			2,60		0,532	
District heating: 1-None			2,8 4,5 3,3					0,000	
Wood and other biomass			1,10			-		-	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / Methanol			2,30			1,10		0,320	
Solar thermal system		62 %	15,501	0,46	0,46	7,08	0,00	0,0	0,045
Electricity (direct)	1,00	38 %	9,618	1,20	1,20	11,54	2,60	25,0	5,1
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (DHW + solar DHW)			0,489	1,20	1,20	0,59	2,60	1,3	0,3
Household electricity			15,9		1,20	19,11		41,4	8,5
Electricity (household or non-residential lighting, etc.)			15,9	1,20	1,20	19,11	2,60	41,4	8,5
Auxiliary electricity (other)				1,20			2,60		0,532
Gas / RE gas dry/cook			0,0	1,75		0,00	2,60	0,0	0,270

Energy generation	Final energy	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/a
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PER specific value kWh/(m²A _{Projected})	PE factor kWh/kWh	PE Value kWh/(m²a)	Emission factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/a
			10,2		27,3		97,6
PV electricity	0	0,0	1,00	0,0	-	-	-
Solar thermal system	2169	22,3	0,46	10,2	1,22	27,3	0,045
		0,0					97,6

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	138	Requirement met?	no
--	-----	--	-----	------------------	----

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀ 1/h
Requirement Passive House Premium	15	10	-	-	0,60
Requirement Passive House Plus					
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30		-		1,00
Current building reaches following class for asp	23	16	-	-	0,6
	PHI Low Energy Building		Premium		Premium

Summary	Final energy MWh/a	PER specific value MWh/a	PE value MWh/a	CO ₂ eq emissions kg/a	CO ₂ eq substitution balance kg/a
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO ₂ factors GEMIS (Germany)	1-CO ₂ factors GEMIS (Germany)
Demand	9,6	10,3	19,25	4037	4037
Generation	-2,2	-1,0	-2,65	98	-451
Demand, cumulative generation (annual balance)	7,41	9,36	16,60	4135	3586
Demand w/o household electricity	7,3	7,7	13,46	2852	2852
Demand w/o household electricity, cum. generation	5,18	6,68	10,81	2949	2401



Solar thermal system

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.7 kWh/(m²a) / Freq. overheating: 2 % / PER: 67 kWh/(m²a)

Building type:

Treated floor area A_{TFA} :

135.9

m²

Projected building footprint $A_{Projected}$:

97.1

m²

Latitude (Climate worksheet)

59.9

°

DHW demand (DHW-Distribution)

3514

kWh/a

Heating demand ('Heating' and 'DHW-Distribution' worksheets)

3175

kWh/a

Occupancy

2.8

Persons

Location: Selection in 'Areas' worksheet

5-Faslane 4

Size of selected area

20

m²

Free area (less solar thermal and electrical systems)

7.2

m²

Deviation from North

180

°

Angle of inclination from the horizontal

90

°

Alternative input: Deviation from North

180

°

Alternative input: Angle of inclination from the horizontal

°

Collector

3-Solfanger kombi Oslo

Heating support (check if appropriate)

x

DHW priority (check if appropriate)

Solar collector area

13.00

m²

Specific collector area

4.6

m²/Pers

Height of the collector field

1.00

m

Height of horizon

0.00

m

Horizontal distance

1000.00

m

Additional reduction factor shading

100 %

Results

	footprint area	Absolute
	kWh/(m² Projected * a)	kWh/a
Solar contribution total	45 %	31,1
Solar contribution to DHW	64 %	23,0
Solar contribution to space heating	25 %	8,1

Determination of PER factors		
Yield reference PV syst	PER _{ref}	PER _{calc therm}
kWh _{ref} /a	kWh _{TP,m-a} /kWh _{ref}	kWh _{th} kWh _{TP,m-a} /kWh _{ref}
1546	1,27	0,40
1142,3	1,20	0,43
403,9	1,45	0,35

kgCO₂eq/ a

1,4

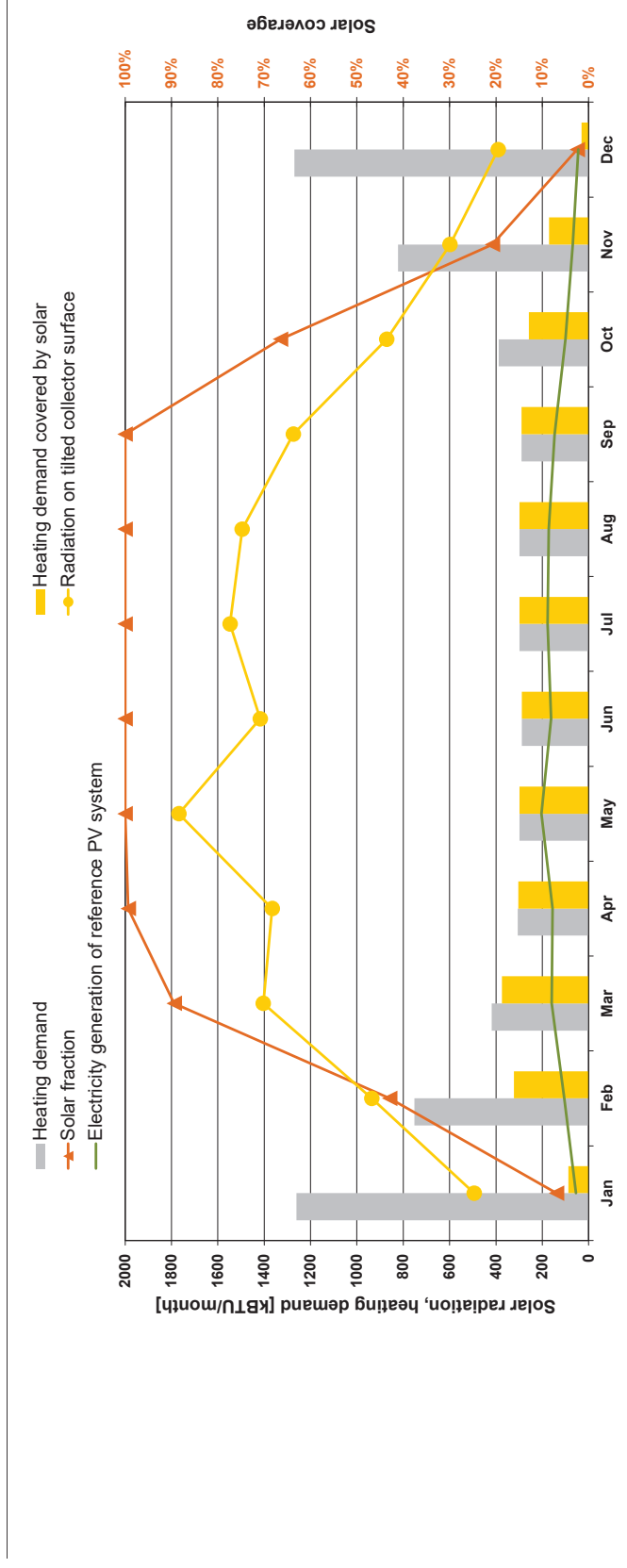
kgCO₂eq/a

kgCO₂eq/ kWhFinal

0,045

kgCO₂eq/a

5.2.3



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heating demand DHW-preparation	298	270	298	289	298	289	298	298	289	298	289	298	3514
Space heating demand	962	482	120	17	0	0	0	0	1	89	533	970	3175
Heating demand	1260	751	418	305	299	289	298	298	290	388	822	1269	6689
Radiation on tilted collector surface	494	936	1404	1365	1768	1417	1547	1495	1274	871	598	390	13559
Please enter: Solar production for DHW													
Please enter: Solar production for heating													
DHW heating demand covered by solar	0	40	254	287	298	289	298	298	289	169	10	0	2232
Space heating demand covered by solar	88	283	120	17	0	0	0	0	1	89	161	31	789
Heating demand covered by solar	88	323	374	303	299	289	298	298	290	258	171	31	3021
Solar fraction	7 %	43 %	89 %	99 %	100 %	100 %	100 %	100 %	100 %	67 %	21 %	2 %	45 %
Electricity generation of reference PV system	55	105	159	156	203	162	177	171	146	100	68	44	1546
													kWh/month

Biomass ►

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.7 kWh/(m²a) / Freq. overheating: 2 % / PER: 67 kWh/(m²a)

		Building type:			
		Treated floor area A _{TFA} :		140	m²
Selection of heat generation system(s)		Projected building footprint A _{Projected} :		97	m²
Primary heat generation type		Heating demand incl. distribution & hydr. frost protection		22,69	kWh/(m²a)
5-Direct electricity		Cooling energy dem. incl. dehumidification			kWh/(m²a)
Secondary heat generation type (optional & different)		DHW demand including distribution:		25,12	kWh/(m²a)

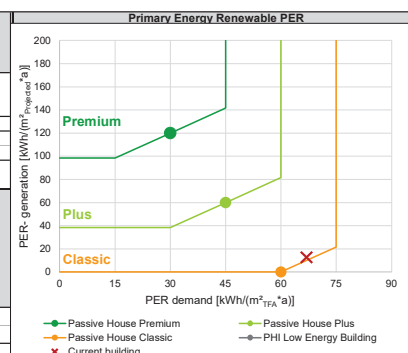
Energy demand		Efficiency		Final energy		PER		PE		CO ₂		
Reference: Treated floor area		Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emission
		-	-		kWh/(m²·a)	kWh/kWh	kWh/kWh	kWh/(m²·a)	kWh/kWh	kWh/(m²·a)		kg/(m²·a)
								66,96	121,78		25,9	
Heating				100 %			1,10	27,65	2,02	50,6		10,6
Electricity (HP compact unit)						1,45			2,60		0,532	
Electricity (heat pump)						1,45			2,60		0,532	
District heating: 1-None						2,8 4,5 3,3					0,000	
Wood and other biomass						1,10			-		-	
Natural gas / RE gas						1,75			1,10		0,250	
Heating oil / RE methanol						2,30			1,10		0,320	
Solar thermal system				25 %	5,642	0,35	0,35	1,99	0,00	0,0	0,045	0,2539
Electricity (direct)		1,00		75 %	17,050	1,45	1,30	22,18	2,60	44,3	0,532	9,1
Vedovn med vannkappe			1,00			1,10						
Aux. electricity (heating, wintertime ventilation)					2,403	1,45	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification							1,00	1,80		4,7		1,0
Electricity cooling (heat pump)						1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer					1,804	1,00		1,80	2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)						1,00			2,60		0,532	
Auxiliary electricity (dehumidification)						1,00			2,60		0,532	
DHW generation				100 %			0,72	18,39	0,98	25,1		5,9
Electricity (HP compact unit)						1,20			2,60		0,532	
Electricity (heat pump)						1,20			2,60		0,532	
District heating: 1-None						2,8 4,5 3,3					0,000	
Wood and other biomass						1,10			-		-	
Natural gas / RE gas						1,75			1,10		0,250	
Heating oil / Methanol						2,30			1,10		0,320	
Solar thermal system				64 %	15,956	0,43	0,43	6,80	0,00	0,0	0,045	0,718
Electricity (direct)		1,00		36 %	9,163	1,20	1,20	11,00	2,60	23,8	0,532	4,9
Vedovn med vannkappe			1,00			1,10						
Aux. electricity (DHW + solar DHW)					0,489	1,20	1,20	0,59	2,60	1,3	0,532	0,3
Household electricity				15,9			1,20	19,11		41,4		8,5
Electricity (household or non-residential lighting, etc.)					15,9	1,20	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)						1,20			2,60		0,532	
Gas / RE gas drv/cook				0,0		1,75		0,00	2,60	0,0	0,270	0,0

Energy generation Reference: Projected building footprint area		Final energy		PER		PE		CO ₂	
		Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emission
		kWh/a	kWh/(m²·a) <small>(Projected)</small>	kWh/kWh	kWh/(m²·a) <small>(Projected)</small>	kWh/kWh	kWh/(m²·a)	kg/kWh	kg/a
					12,6		38,0		136,0
PV electricity		0	0,0	1,00	0,0	-		-	
Solar thermal system		3021	31,1	0,40	12,6	1,22	38,0	0,045	136,0
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	122	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness	Primary Energy Renewable PER
	Annual heat. dem Treated floor area kWh/(m²·a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²·a)	Cooling load Treated floor area W/m²	n ₅₀ 1/h	
Requirement Passive House Premium					0.60	
Requirement Passive House Plus	15	10	-	-		
Requirement Passive House Classic	30		-		1.00	
Requirement PHI Low Energy Building	23	16		-	0.6	
Current building reaches following class for aspi	PHI Low Energy Building		Premium		Premium	

Summary	Final energy	PER specific value	PE value	CO2eq emissions	CO2eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	kg/a	kg/a	kg/a
Demand	9,6	9,4	17,04	3622	3622
Generation	-3,0	-1,2	-3,69	136	-628
Demand, cumulative generation (annual balance)	6,55	8,15	13,34	3758	2993
Demand w/o household electricity	7,3	6,7	11,24	2436	2436
Demand w/o household electricity cum. generation	4,32	5,47	7,55	2572	1808



Solar thermal system

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 67,7 kWh/(m²a)

Building type:				
	Treated floor area A_{TFA} :	139,9	m²	
	Projected building footprint $A_{Projected}$:	97,1	m²	
	Latitude (Climate worksheet)	63,4	°	
	DHW demand (DHW+Distribution)	3514	kWh/a	
Heating demand ('Heating' and 'DHW+Distribution' worksheets)		2960	kWh/a	
	Occupancy	2,8	Persons	
Location: Selection in 'Areas' worksheet				
	Size of selected area	20	m²	
	Free area (less solar thermal and electrical systems)	10,2	m²	
	Deviation from North	180	°	
	Angle of inclination from the horizontal	90	°	
Alternative input: Deviation from North		180	°	
Alternative input: Angle of inclination from the horizontal			°	
Solar collector area				
	Solar collector area	10,00	m²	
	Specific collector area	3,5	m²/Pers	
	Height of the collector field	1,00	m	
	Height of horizon	0,00	m	
Horizontal distance		1000,00	m	
Additional reduction factor shading		100 %		
		Collector		
		Heating support (check if appropriate)		
		DHW priority (check if appropriate)		
		2-Soilfanger lapevann		

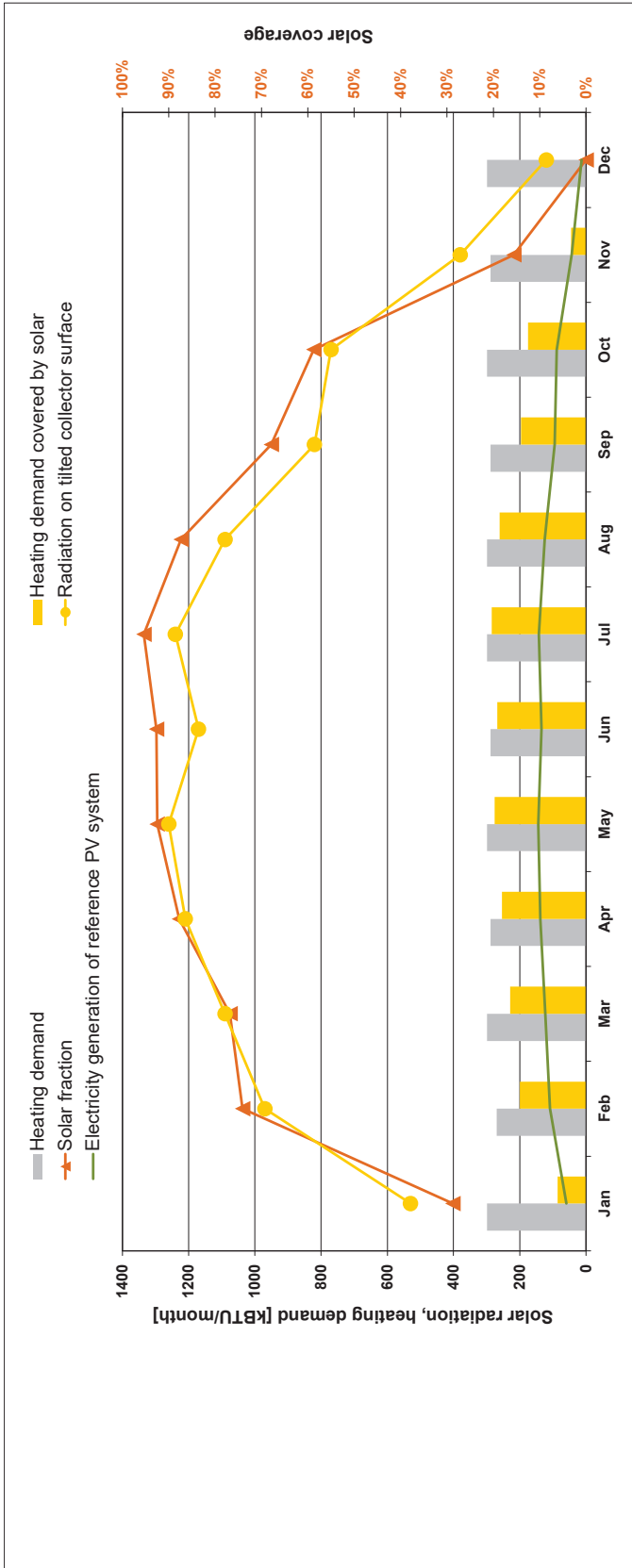
Results

Solar contribution total	Footprint area		Absolute	
	kWh/(m²·Projected·a)		kWh/a	
	65 %	23,4	2273	
	65 %	23,4	2273	
Solar contribution to DHW	0 %	0,0	0	
Solar contribution to space heating				

Determination of PER factors			
Yield reference PV syst	PER _{ref}	PER _{calc therm}	
kWh _{ref} /a	kWh _{Therm-ref} /kWh _{Therm}	kWh _{Therm} /kWh _{Therm-ref}	
1214	1,15	0,46	
1213,8	1,15	0,46	
0,0	1,35		

1-CO2 factors GEMIS (Germany)	kgCO ₂ eq/ a	kgCO ₂ eq/a
	1,1	102

5.2.5



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heating demand DHW-preparation	298	270	298	289	298	289	298	298	289	289	289	298	3514
Space heating demand	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating demand	298	270	298	289	298	289	298	298	289	289	289	298	3514
Radiation on tilted collector surface	530	970	1090	1210	1260	1170	1240	1090	820	770	380	120	10650
Please enter: Solar production for DHW													0
Please enter: Solar production for heating													0
DHW heating demand covered by solar	86	200	229	253	276	268	285	261	196	175	45	0	2273
Space heating demand covered by solar	0	0	0	0	0	0	0	0	0	0	0	0	0
Heating demand covered by solar	86	200	229	253	276	268	285	261	196	175	45	0	2273
Solar fraction	29 %	74 %	77 %	88 %	92 %	93 %	95 %	87 %	68 %	59 %	16 %	0 %	65 %
Electricity generation of reference PV system	59	109	123	138	144	134	142	125	94	88	43	14	1214

5.2.6

Biomass ▶

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 67,7 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

5-Direct electricity

Secondary heat generation type (optional & different)

-

Contribution margin (useful energy)

Heating	DHW
100 %	100 %
0 %	0 %

Addl. input in following worksheets

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA}:

Projected building footprint A_{Projected}:

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

140

m²

97

m²

21,16

kWh/(m²a)

25,12

kWh/(m²a)

kWh/(m²a)

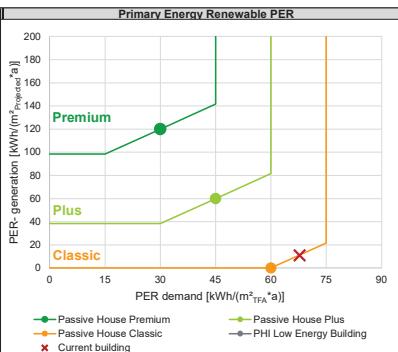
Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		kg/(m²a)
							67,74	129,93		27,3	
Heating			100 %			1,27	30,01	2,60	61,3		12,5
Electricity (HP compact unit)					1,35			2,60		0,532	
Electricity (heat pump)					1,35			2,60		0,532	
District heating: 1-None				2,8 4,5 3,3						0,000	
Wood and other biomass				1,10				-		-	
Natural gas / RE gas				1,75				1,10		0,250	
Heating oil / RE methanol				2,30				1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	21,160	1,35	1,26	26,75	2,60	55,0	0,532	11,3
Vedovn med vannkappe		1,00		1,10							
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification							1,11	2,9		0,6	
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,113	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %			0,71	18,31	0,95	24,3		5,7
Electricity (HP compact unit)					1,15			2,60		0,532	
Electricity (heat pump)					1,15			2,60		0,532	
District heating: 1-None				2,8 4,5 3,3						0,000	
Wood and other biomass				1,10				-		-	
Natural gas / RE gas				1,75				1,10		0,250	
Heating oil / Methanol				2,30				1,10		0,320	
Solar thermal system			65 %	16,248	0,46	0,46	7,54	0,00	0,0	0,045	0,731
Electricity (direct)	1,00		35 %	8,869	1,15	1,15	10,20	2,60	23,1	0,532	4,7
Vedovn med vannkappe		1,00		1,10							
Aux. electricity (DHW + solar DHW)				0,489	1,15	1,15	0,56	2,60	1,3	0,532	0,3
Household electricity				15,9		1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas dry/cook							0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PE factor kWh/kWh	CO ₂ emissions factor (CO ₂ -eq) kg/kWh
	kWh/(m²A _{Projected})	kWh/(m²A _{Projected})	kWh/(m²a)	kg/a
PV electricity	0	1,00	-	-
Solar thermal system	2273	0,46	1,22	0,045
	0,0			

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	130	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀ 1/h
Requirement Passive House Premium	15	10	-	-	0,60
Requirement Passive House Plus					
Requirement Passive House Classic	30		-	-	1,00
Requirement PHI Low Energy Building	21	#VERDI!	-	-	0,6
Current building reaches following class for asp		#VERDI!	Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification	1-CO ₂ factors GEMIS (Germany)	1-CO ₂ factors GEMIS (Germany)
Demand	9,3	9,5	18,18	3822	3822
Generation	-2,3	-1,1	-2,78	102	-473
Demand, cumulative generation (annual balance)	6,99	8,42	15,40	3924	3349
Demand w/o household electricity	7,0	6,9	12,38	2636	2636
Demand w/o household electricity, cum. generation	4,76	5,86	9,61	2738	2163



Solar thermal system

Dräppen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 65,4 kWh/(m²a)

Building type:

Treated floor area A_{TFA} :

139,9

m²

Projected building footprint $A_{Projected}$:

97,1

m²

Latitude (Climate worksheet)

63,4

°

DHW demand (DHW-Distribution)

3514

kWh/a

Heating demand ('Heating' and 'DHW-Distribution' worksheets)

2960

kWh/a

Occupancy

2,8

Persons

Location: Selection in 'Areas' worksheet

5-Fasade 4

Size of selected area

20

m²

Free area (less solar thermal and electrical systems)

6,2

m²

Deviation from North

180

°

Angle of inclination from the horizontal

90

°

Alternative input: Deviation from North

180

°

Alternative input: Angle of inclination from the horizontal

°

Solar collector area

14,00

m²

Specific collector area

4,9

m²/Pers

Height of the collector field

1,00

m

Height of horizon

0,00

m

Horizontal distance

1000,00

m

Additional reduction factor shading

100 %

Collector

4-Solinger Trondheim

Heating support (check if appropriate)

x

DHW priority (check if appropriate)

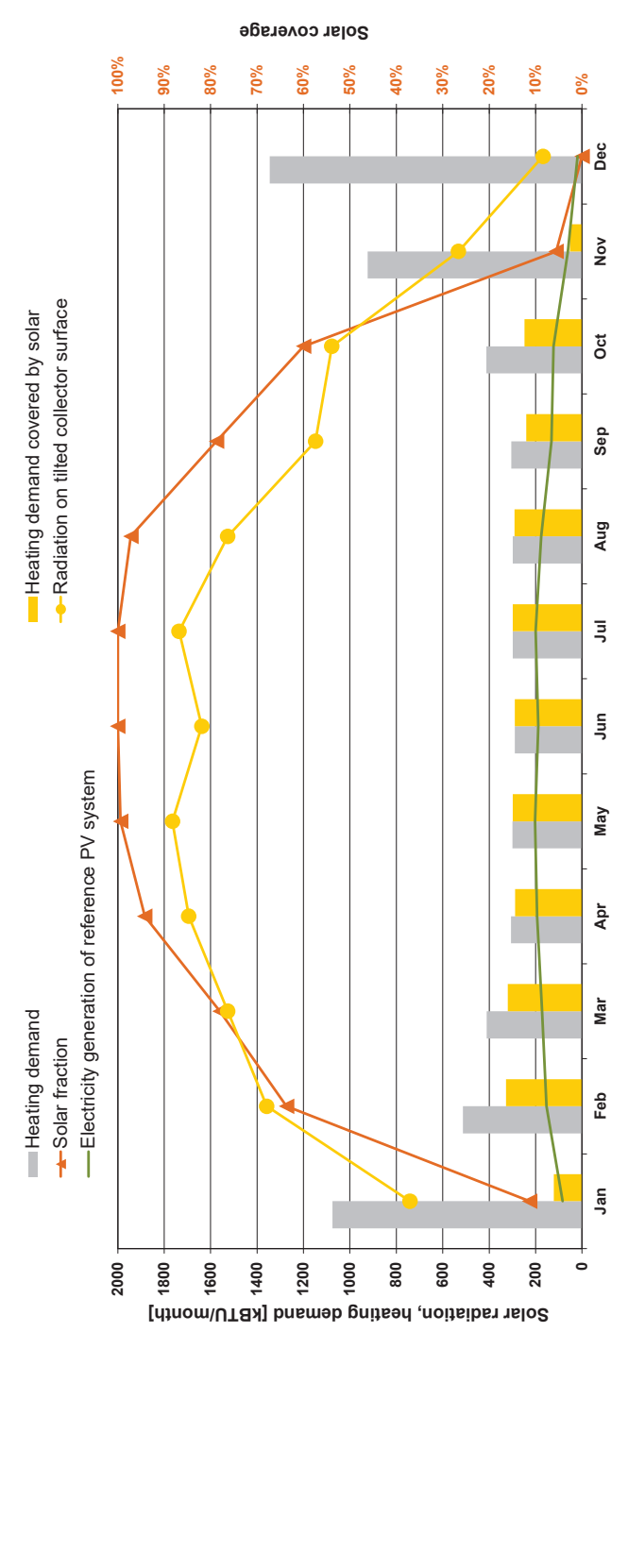
Results

	footprint area	Absolute
	kWh/(m² Projected area)	kWh/a
Solar contribution total	43 %	28,5
Solar contribution to DHW	60 %	21,9
Solar contribution to space heating	22 %	6,7

Determination of PER factors		
Yield reference PV syst	PER _{ref}	PER _{calc therm}
kWh _{ref} /a	kWh _{TP,m=0} /kWh _{ref}	kWh _{th} kWh _{TP,m=0} /kWh _{ref}
1699	1,20	0,51
1302,7	1,15	0,53
396,5	1,35	0,45

kgCO ₂ eq/ kWhFinal	kgCO ₂ eq/ a	kgCO ₂ eq/a
0,045	1,3	125

5.2.7



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heating demand DHW-preparation	298	270	298	289	298	289	298	298	289	289	289	298	3514
Space heating demand	776	244	112	17	1	0	0	0	15	113	635	1046	2960
Heating demand	1074	513	410	305	300	289	298	299	304	412	924	1345	6474
Radiation on tilted collector surface	742	1358	1526	1694	1764	1638	1736	1526	1148	1078	532	168	14910
Please enter: Solar production for DHW													
Please enter: Solar production for heating													
DHW heating demand covered by solar	1	112	208	271	297	289	298	290	224	134	0	0	2123
Space heating demand covered by solar	121	214	112	17	1	0	0	0	15	113	52	0	646
Heating demand covered by solar	122	327	320	288	298	289	299	290	240	247	52	0	2770
Solar fraction	11 %	64 %	78 %	94 %	99 %	100 %	100 %	97 %	79 %	60 %	6 %	0 %	43 %
Electricity generation of reference PV system	83	152	172	193	202	188	199	175	132	123	60	19	1699
													kWh/month

5.2.8

Primary Energy Renewable PER

Biomass ►
Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 65,4 kWh/(m²a)

Selection of heat generation system(s)		Contribution margin (useful energy)		Addl. input in following worksheets	Heating demand incl. distribution & hydr. frost protection	Building type:	
Primary heat generation type		Heating	DHW			Treated floor area A _{TFA} :	
5-Direct electricity		100 %	100 %			140	m²
Secondary heat generation type (optional & different)		0 %	0 %			Projected building footprint A _{Projected} :	
						21,16	m²
						Cooling energy dem. incl. dehumidification	
						DHW demand including distribution:	25,12 kWh/(m²a)

Energy demand	Efficiency	Final energy	PER factor	PER	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/(m²a)
Reference: Treated floor area	Calculation	Contribution (final energy)		Effective PER factor (including biomass kWh/kWh)	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
	-	-							
					65,39		120,70		25,6
Heating		100 %		1,10	25,87	2,09	49,3		10,3
Electricity (HP compact unit)			1,35			2,60		0,532	
Electricity (heat pump)			1,35			2,60		0,532	
District heating: 1-None			2,8/4,5/3,3					0,000	
Wood and other biomass			1,10			-		-	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / RE methanol			2,30			1,10		0,320	
Solar thermal system		22 %	4,620	0,45	2,10	0,00	0,0	0,045	0,2079
Electricity (direct)	1,00	78 %	16,540	1,35	20,51	2,60	43,0	0,532	8,8
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (heating, wintertime ventilation)			2,414	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification				1,00	1,11		2,9		0,6
Electricity cooling (heat pump)				1,00		2,60		0,532	
Auxiliary electricity cooling, ventilation summer			1,113	1,00	1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)				1,00		2,60		0,532	
Auxiliary electricity (dehumidification)				1,00		2,60		0,532	
DHW generation		100 %		0,78	20,09	1,06	27,1		6,2
Electricity (HP compact unit)			1,15			2,60		0,532	
Electricity (heat pump)			1,15			2,60		0,532	
District heating: 1-None			2,8/4,5/3,3					0,000	
Wood and other biomass			1,10			-		-	
Natural gas / RE gas			1,75			1,10		0,250	
Heating oil / Methanol			2,30			1,10		0,320	
Solar thermal system		60 %	15,179	0,53	8,10	0,00	0,0	0,045	0,683
Electricity (direct)	1,00	40 %	9,938	1,15	11,43	2,60	25,8	0,532	5,3
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (DHW + solar DHW)			0,489	1,15	0,56	2,60	1,3	0,532	0,3
Household electricity			15,9	1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)			15,9	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)				1,15		2,60		0,532	
Gas / RE gas dry/cook			0,0	1,75	0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PE factor kWh/kWh	Emission factor (CO ₂ -eq) kg/kWh
	kWh/(m²A _{Projected})		PE Value kWh/(m²a)	CO ₂ -eq emissions kg/a
			34,9	124,6
PV electricity	0	1,00	-	-
Solar thermal system	2770	0,51	1,22	0,045
	0,0			124,6

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	121	Requirement met?	no
--	-----	--	-----	------------------	----

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem. Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀ 1/h
Requirement Passive House Premium	15	10	-	-	0,60
Requirement Passive House Plus					
Requirement Passive House Classic	30		-	-	1,00
Requirement PHI Low Energy Building	21	#VERDI!	-	-	0,6
Current building reaches following class for aspi		#VERDI!	Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification	1-CO ₂ factors GEMIS (Germany)	1-CO ₂ factors GEMIS (Germany)
Demand	9,3	9,1	16,89	3580	3580
Generation	-2,8	-1,4	-3,39	125	-576
Demand, cumulative generation (annual balance)	6,49	7,73	13,50	3704	3004
Demand w/o household electricity	7,0	6,6	11,09	2394	2394
Demand w/o household electricity, cum. generation	4,27	5,17	7,71	2519	1818

SCENARIO 5 – ENERGIFORSYNING

5.3 Kombinasjonsløsning

13 m² solfanger & 100/100 varmepumpe

5.3.1 Solar Oslo

5.3.2 PER Oslo

5.3.3 HP Oslo

14 m² solfanger & 100/100 varmepumpe

5.3.4 Solar Trondheim

5.3.5 PER Trondheim

5.3.6 HP Trondheim

Solar thermal system

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.7 kWh/(m²a) / Freq. overheating: 2. % / PER: 46.7 kWh/(m²a)

Building type:

Treated floor area A_{TFA} :

139.9

m²

Projected building footprint $A_{Projected}$:

97.1

m²

Latitude (Climate worksheet)

59.9

°

DHW demand (DHW-Distribution)

3514

kWh/a

Heating demand ('Heating' and 'DHW-Distribution' worksheets)

3175

kWh/a

Occupancy

2.8

Persons

Location: Selection in 'Areas' worksheet

5-Fasade 4

Size of selected area

20

m²

Free area (less solar thermal and electrical systems)

7.2

m²

Deviation from North

180

°

Angle of inclination from the horizontal

90

°

Alternative input: Deviation from North

180

°

Alternative input: Angle of inclination from the horizontal

°

Solar collector area

13.00

m²

Specific collector area

4.6

m²/Pers

Height of the collector field

1.00

m

Height of horizon

0.00

m

Horizontal distance

1000.00

m

Additional reduction factor shading

100 %

Collector

3-Solfanger kombi Oslo

Heating support (check if appropriate)

x

DHW priority (check if appropriate)

Results

Solar contribution total

45 %

31.1

3021

kWh/(m² Projected *a)

Solar contribution to DHW

64 %

23.0

2232

kWh/a

Solar contribution to space heating

25 %

8.1

789

kWh/a

Determination of PER factors

Yield reference PV syst

kWh_{ref}/a

1546

PER_{ref}

kWh_{system-ref}/kWh_{ref}

1.27

PER_{ref} therm

kWh_{therm}/kWh_{therm-ref}/kWh_{therm}

0.40

Yield reference PV syst

kWh/a

1142.3

PER_{ref}

kWh_{system-ref}/kWh_{ref}

1.20

PER_{ref} therm

kWh_{therm}/kWh_{therm-ref}/kWh_{therm}

0.43

Yield reference PV syst

kWh/a

403.9

PER_{ref}

kWh_{system-ref}/kWh_{ref}

1.45

PER_{ref} therm

kWh_{therm}/kWh_{therm-ref}/kWh_{therm}

0.35

1-CO2 factors GEMIS (Germany)

kgCO2eq/kWhFinal

0.045

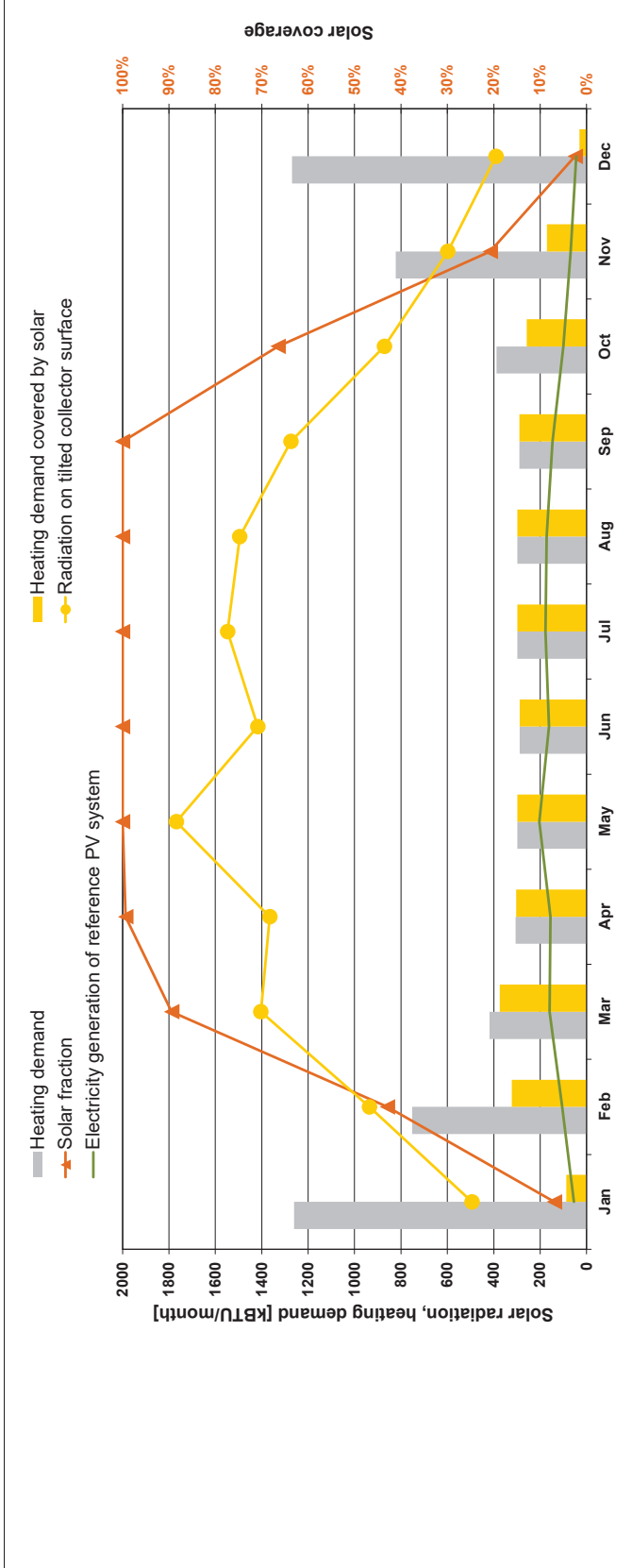
kgCO2eq/a

1.4

kgCO2eq/a

136

5.3.1



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heating demand DHW-preparation	298	270	298	289	298	289	298	298	289	298	289	298	3514
Space heating demand	962	482	120	17	0	0	0	0	1	89	533	970	3175
Heating demand	1260	751	418	305	290	289	298	298	290	388	822	1269	6689
Radiation on tilted collector surface	494	936	1404	1365	1768	1417	1547	1495	1274	871	598	390	13559
Please enter: Solar production for DHW													0
Please enter: Solar production for heating													0
DHW heating demand covered by solar	0	40	254	287	298	289	298	298	289	169	10	0	2232
Space heating demand covered by solar	88	283	120	17	0	0	0	0	1	89	161	31	789
Heating demand covered by solar	88	323	374	303	299	289	298	298	290	258	171	31	3021
Solar fraction	7 %	43 %	89 %	99 %	100 %	100 %	100 %	100 %	100 %	67 %	21 %	2 %	45 %
Electricity generation of reference PV system	55	105	159	156	203	162	177	171	146	100	68	44	1546
													kWh/month

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 46,7 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

2-Heat pump(s)

Secondary heat generation type (optional & different)

Contribution margin (useful energy)	
Heating	DHW
100 %	100 %
Addl. input in following worksheets	
HP, possibly HP ground	
0 %	0 %

Building type:

Treated floor area A_{TFA} :

Projected building footprint $A_{Projected}$:

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

140

m²

97

m²

22,69

kWh/(m²a)

25,12

kWh/(m²a)

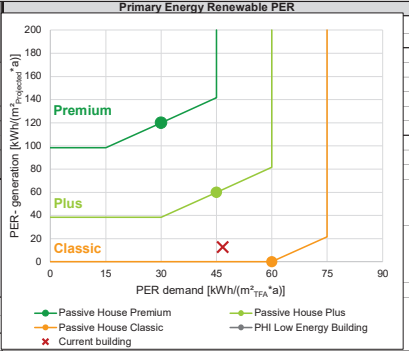
Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq)	CO ₂ -eq emissions
Reference: Treated floor area	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/(m²a)
							46,70	1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
									82,30		17,8
Heating			100 %			0,93	15,80	1,73	29,3		6,3
Electricity (HP compact unit)					1,45			2,60		0,532	
Electricity (heat pump)	1,92		75 %	8,876	1,45	1,16	10,32	2,60	23,1	0,532	4,7
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / RE methanol					2,30			1,10		0,320	
Solar thermal system			25 %	5,642	0,35	0,35	1,99	0,00	0,0	0,045	0,2539
Electricity (direct)					1,45			2,60		0,532	
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,403	1,45	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification					1,00		1,80		4,7		1,0
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,804	1,00			2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %			0,54	9,98	0,37	6,9		2,1
Electricity (HP compact unit)					1,20			2,60		0,532	
Electricity (heat pump)	4,25		36 %	2,156	1,20	1,20	2,59	2,60	5,6	0,532	1,1
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system			64 %	15,956	0,43	0,43	6,80	0,00	0,0	0,045	0,718
Electricity (direct)					1,20			2,60		0,532	
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)				0,489	1,20	1,20	0,59	2,60	1,3	0,532	0,3
Household electricity				15,9		1,20	19,11		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,20	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,20			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy		PER		PE		CO ₂	
	Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ -eq emissions
Reference: Projected building footprint area	kWh/a	kWh/(m²A _{Projected})	kWh/kWh	kWh/(m²A _{Projected})	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
				12,6		38,0		136,0
PV electricity	0	0,0	1,00	0,0	-		-	
Solar thermal system	3021	31,1	0,40	12,6	1,22	38,0	0,045	136,0
		0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	82	Requirement met?	yes
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance				Airtightness n ₅₀ 1/h
	Annual heat dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	
Requirement Passive House Premium					0,60
Requirement Passive House Plus					
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30				1,00
Current building reaches following class for asp	23	16			0,6
	PHI Low Energy Building		Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,45	6,5	11,51	2492	2492
Generation	-3,02	-1,2	-3,69	136	-628
Demand, cumulative generation (annual balance)	4,43	5,31	7,82	2628	1864
Demand w/o household electricity	5,2	3,9	5,72	1307	1307
Demand w/o household electricity, cum. generation	2,20	2,64	2,03	1443	678



5.3.3

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,7 kWh/(m²a) / Freq. overheating: 2 % / PER: 46,7 kWh/(m²a)

		Building type:	
		Treated floor area A _{TFA} :	140 m²
Covered fraction of space heating demand	(PER worksheet)	75 %	
Space heating demand + distribution losses	Q _H +Q _{HL} : (DHW+Distribution)	3175	kWh/a
Solar fraction for space heat	η _{Solar, H} : ("SolarDHW" worksheet)	25 %	
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})	2385	kWh/a
Covered fraction of DHW demand	(PER worksheet)	36 %	
Total heating demand of DHW system	Q _{gDHW} : (DHW+Distribution)	3514	kWh/a
Solar fraction for DHW	η _{Solar, DHW} : ("SolarDHW" worksheet)	64 %	
Effective DHW demand	Q _{DHW, WI} =Q _{DHW} *(1-η _{Solar, DHW})	1282	kWh/a
Number of heat pumps in the system		1	
Functionality		Heating & DHW	
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature		θ _{design} : (DHW+Distribution)	35,00 °C
Nominal power of distribution system		P _{nom}	1,73 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system		P _{nom}	
Radiator exponent		n	
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	U * A _{Storage}		
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(DHW+Distribution)		
Sink temperature of heat pump for heating	θ _{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(DHW+Distribution)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	U * A _{Storage}		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(DHW+Distribution)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
Δθ of electric continuous flow water heater			
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(Manufacturer, tech. data)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		m
Power of pump for ground heat exchanger	P _{pump}		kW

5.3.3

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5,0K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{Sink}$ 5,0K

Electr. energy consumption pump (grnd. water / ground)	$Q_{EI,Pump}$	0	kWh/a
Energy by direct electricity	$Q_{EI,direct}$	60	kWh/a
Space heat supplied by HP	$Q_{HP,Heating}$	1711	kWh/a
Winter DHW supplied by HP	$Q_{HP,DHW,Winter}$	400	kWh/a
Summer DHW supplied by HP	$Q_{HP,DHW,Summer}$	67	kWh/a
Space heating supplied by HP without storage losses	$Q_{HP,Heating}$	1732	kWh/a
Winter DHW supplied by HP without storage losses	$Q_{HP,DHW,Winter}$	373	kWh/a
Summer DHW supplied by HP without storage losses	$Q_{HP,DHW,Summer}$	8	kWh/a
Electrical consumption of HP	$Q_{EI,HP}$	1483	kWh/a

Seasonal performance factor of heat pump

SPF_{H-1}

1. HP: Heating or heating & DHW

2. HP: Domestic hot

Final electrical energy demand heat generation

Annual primary energy demand

Annual CO₂-equivalent emissions

Q_{final}

1. HP: Heating or heating & DHW

2. HP: Domestic hot

1,47

11,0

5,9

kWh/a

kg/(m²a)

kg/(m²a)

1543

28,7

821

kg/a

kg/(m²a)

kg/(m²a)

4013

28,7

821

kg/a

kg/(m²a)

kg/(m²a)

Solar thermal system

Dräppen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 45,6 kWh/(m²a)

Building type:

Treated floor area A_{TFA} :

139,9

m²

Projected building footprint $A_{Projected}$:

97,1

m²

Latitude (Climate worksheet)

63,4

°

DHW demand (DHW-Distribution)

3514

kWh/a

Heating demand ('Heating' and 'DHW-Distribution' worksheets)

2960

kWh/a

Occupancy

2,8

Persons

Location: Selection in 'Areas' worksheet

5-Fasade 4

Size of selected area

20

m²

Free area (less solar thermal and electrical systems)

6,2

m²

Deviation from North

180

°

Angle of inclination from the horizontal

90

°

Alternative input: Deviation from North

180

°

Alternative input: Angle of inclination from the horizontal

°

Solar collector area

14,00

m²

Specific collector area

4,9

m²/Persons

Height of the collector field

1,00

m

Height of horizon

0,00

m

Horizontal distance

1000,00

m

Additional reduction factor shading

100 %

Collector

4-Solinger Trondheim

Heating support (check if appropriate)

x

DHW priority (check if appropriate)

Results

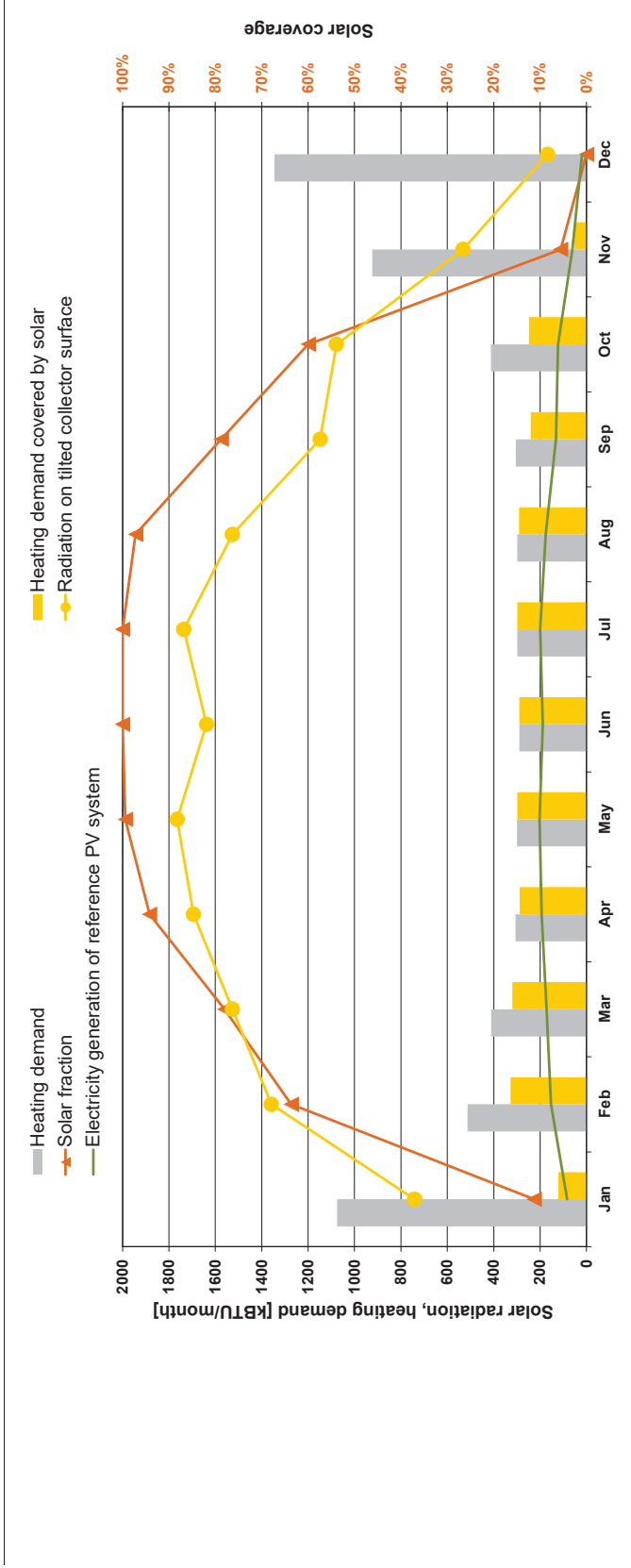
	footprint area	Absolute
	kWh/(m² Projected*a)	kWh/a
Solar contribution total	43 %	2770
Solar contribution to DHW	60 %	2123
Solar contribution to space heating	22 %	646

Determination of PER factors		
Yield reference PV syst	PER _{ref}	PER _{col therm}
kWh _{ref} /a	kWh _{system-ref} /kWh _{ref}	kWh _{th} /kWh _{system} /kWh _{ref}
1699	1,20	0,51
1302,7	1,15	0,53
396,5	1,35	0,45

kgCO ₂ eq/ kWhFinal	kgCO ₂ eq/ a	kgCO ₂ eq/a
0,045	1,3	125

1-CO2 factors GEMIS (Germany)

5.3.4



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heating demand DHW-preparation	298	270	298	289	289	289	298	298	289	298	289	298	3514
Space heating demand	776	244	112	17	1	0	0	0	15	113	635	1046	2960
Heating demand	1074	513	410	305	300	289	299	299	304	412	924	1345	6474
Radiation on tilted collector surface	742	1358	1526	1694	1764	1638	1736	1526	1148	1078	532	168	14910
Please enter: Solar production for DHW													0
Please enter: Solar production for heating													0
DHW heating demand covered by solar	1	112	208	271	297	289	298	290	224	134	0	0	2123
Space heating demand covered by solar	121	214	112	17	1	0	0	0	15	113	52	0	646
Heating demand covered by solar	122	327	320	288	298	289	299	290	240	247	52	0	2770
Solar fraction	11 %	64 %	78 %	94 %	99 %	100 %	100 %	97 %	79 %	60 %	6 %	0 %	43 %
Electricity generation of reference PV system	83	152	172	193	202	188	199	175	132	123	60	19	1699
													kWh/month

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 46,6 kWh/(m²a)

Selection of heat generation system(s)		Contribution margin (useful energy)		Addl. input in following worksheets	Heating demand incl. distribution & hydr. frost protection	Cooling energy dem. incl. dehumidification	DHW demand including distribution:	Building type:	
Primary heat generation type		Heating	DHW					Treated floor area A _{TFA} :	
2-Heat pump(s)		100 %	100 %					140	m²
Secondary heat generation type (optional & different)								Projected building footprint A _{Projected} :	
-		0 %	0 %					21,16	m²
									kWh/(m²a)
									kWh/(m²a)
									kWh/(m²a)

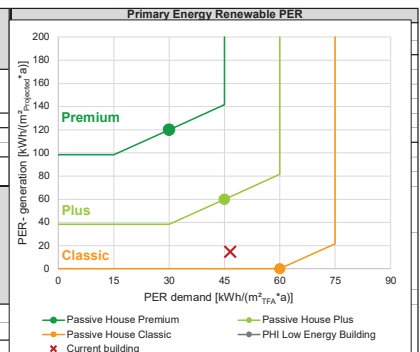
Energy demand	Efficiency	Final energy	PER	PER	PER	PE	PE	CO ₂	CO ₂
Reference: Treated floor area	Calculat on	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh
	-	-	kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/(m²a)
						46,57		81,60	17,6
Heating		100 %			0,98	15,61			
Electricity (HP compact unit)				1,35			1,85	29,5	6,2
Electricity (heat pump)	1,85	78 %	8,939	1,35	1,15	10,25	2,60	23,2	0,532
District heating: 1-None				2,814,513,3					0,000
Wood and other biomass				1,10			-		-
Natural gas / RE gas				1,75			1,10		0,250
Heating oil / RE methanol				2,30			1,10		0,320
Solar thermal system		22 %	4,620	0,45	0,45	2,10	0,00	0,0	0,045
Electricity (direct)				1,35			2,60		0,532
Vedovn med vannkappe	1,00			1,10					
Aux. electricity (heating, wintertime ventilation)			2,414	1,35	1,35	3,26	2,60	6,3	0,532
Cooling and dehumidification				1,00		1,11		2,9	0,6
Electricity cooling (heat pump)				1,00			2,60		0,532
Auxiliary electricity cooling, ventilation summer			1,113	1,00		1,11	2,60	2,9	0,532
Electricity dehumidification (heat pump)				1,00			2,60		0,532
Auxiliary electricity (dehumidification)				1,00			2,60		0,532
DHW generation		100 %			0,63	11,54			
Electricity (HP compact unit)				1,15			0,43	7,8	2,3
Electricity (heat pump)	3,97	40 %	2,501	1,15	1,15	2,88	2,60	6,5	0,532
District heating: 1-None				2,814,513,3					0,000
Wood and other biomass				1,10			-		-
Natural gas / RE gas				1,75			1,10		0,250
Heating oil / Methanol				2,30			1,10		0,320
Solar thermal system		60 %	15,179	0,53	0,53	8,10	0,00	0,0	0,045
Electricity (direct)				1,15			2,60		0,532
Vedovn med vannkappe	1,00			1,10					
Aux. electricity (DHW + solar DHW)			0,489	1,15	1,15	0,56	2,60	1,3	0,532
Household electricity			15,9		1,15	18,32		41,4	8,5
Electricity (household or non-residential lighting, etc.)			15,9	1,15	1,15	18,32	2,60	41,4	0,532
Auxiliary electricity (other)				1,15			2,60		0,532
Gas / RE gas dry/cook			0,0	1,75		0,00	2,60	0,0	0,270

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PE factor kWh/kWh	Emission factor (CO ₂ -eq) kg/kWh
	kWh/(m²a) _{Projected}	kWh/(m²a) _{Projected}	kWh/(m²a)	kg/a
PV electricity	0	0,0	1,00	0,0
Solar thermal system	2770	0,51	1,22	0,045
	0,0			

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	82	Requirement met?	yes
--	-----	--	----	------------------	-----

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀ 1/h
Requirement Passive House Premium	15	10	-	-	0,60
Requirement Passive House Plus					
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30				1,00
Current building reaches following class for asp	21	#VERDII	-	-	0,6
	#VERDII		Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,16	6,5	11,42	2460	2460
Generation	-2,77	-1,4	-3,39	125	-576
Demand, cumulative generation (annual balance)	4,39	5,10	8,03	2585	1884
Demand w/o household electricity	4,9	4,0	5,62	1275	1275
Demand w/o household electricity, cum. generation	2,16	2,53	2,24	1400	699



5.3.6

Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 46,6 kWh/(m²a)

		Building type:	
		Treated floor area A _{TFA} :	140 m²
Covered fraction of space heating demand	(PER worksheet)		78 %
Space heating demand + distribution losses	Q _H +Q _{HL} : (DHW+Distribution)		2960 kWh/a
Solar fraction for space heat	η _{Solar, H} : ("SolarDHW" worksheet)		22 %
Effective annual heating demand	Q _{H,WI} =Q _H *(1-η _{Solar, H})		2314 kWh/a
Covered fraction of DHW demand	(PER worksheet)		40 %
Total heating demand of DHW system	Q _{gDHW} : (DHW+Distribution)		3514 kWh/a
Solar fraction for DHW	η _{Solar, DHW} : ("SolarDHW" worksheet)		60 %
Effective DHW demand	Q _{DHW, WI} =Q _{DHW} *(1-η _{Solar, DHW})		1390 kWh/a
Number of heat pumps in the system			1
Functionality			Heating & DHW
Heating			
Selection of HP:	1-Standard air/water heat pump	Heat source:	1-Outdoor air
Selection of distribution system			1-Underfloor heating
Design distribution temperature		θ _{design} : (DHW+Distribution)	35,00 °C
Nominal power of distribution system		P _{nom}	1,75 kW
Distribution system (to be completed by experienced users only)			
Nominal power of distribution system		P _{nom}	
Radiator exponent		n	
Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)			0-No
Specific heat losses storage	U * A _{Storage}		
Storage location in thermal envelope			1-Inside
Room temperature (storage location: outside of thermal envelope)	(DHW+Distribution)		°C
Sink temperature of heat pump for heating	θ _{sink}		61,50 °C
Entries in relation to the domestic hot water system			
Selection of HP:	0-None	Heat source:	
DHW temperature		(DHW+Distribution)	60,00 °C
Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)			1-Inside
Specific heat losses storage	U * A _{Storage}		0,7 W/K
Room temperature (storage location: outside of thermal envelope)	(DHW+Distribution)		20,00 °C
Type of backup heater			1-Elec. Immersion heater
Δθ of electric continuous flow water heater			K
Additional options in case of one heat pump for both functions: Heating & DHW			
Same heat pump's sink temperature for Heating and for DHW			1-Yes
Heat pump priority	(Manufacturer, tech. data)		1-DHW-priority
Control strategy			
Heat pump control strategy			1-On/Off
Heating			
Depth ground water / Ground collector / Ground probe	z		m
Power of pump for ground heat exchanger	P _{pump}		kW

5.3.6

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0K

Electr. energy consumption pump (grnd. water / ground)

Energy by direct electricity

Space heat supplied by HP

Winter DHW supplied by HP

Summer DHW supplied by HP

Space heating supplied by HP without storage losses

Winter DHW supplied by HP without storage losses

Summer DHW supplied by HP without storage losses

Electrical consumption of HP

$Q_{\text{EI,Pump}}$

$Q_{\text{EI,dir}}$

$Q_{\text{HP,Heating}}$

$Q_{\text{HP,DHW,Winter}}$

$Q_{\text{HP,DHW,Summer}}$

$Q_{\text{HP,Heating}}$

$Q_{\text{HP,DHW,Winter}}$

$Q_{\text{HP,DHW,Summer}}$

$Q_{\text{el,HP}}$

0

87

1700

419

132

1722

390

66

1514

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

Seasonal performance factor of heat pump

Final electrical energy demand heat generation

Annual primary energy demand

Annual CO₂-equivalent emissions

$\text{SPF}_{\text{H-1}}$

Q_{final}

1. HP: Heating or heating & DHW

2. HP: Domestic hot

1,49

kWh/a

kWh/(m²a)

1600

11,4

4161

29,7

kg/a

kg/(m²a)

851

6,1

SCENARIO 6 – ENERGIPRODUKSJON

- 6.1** Solceller 20 panel PV Oslo
- 6.2** Solceller 20 panel PER Oslo
- 6.3** Solceller 20 panel PV Trondheim
- 6.4** Solceller 20 panel PER Trondheim
- 6.5** Solceller 24 panel PV Oslo
- 6.6** Solceller 24 panel PER Oslo
- 6.7** Solceller 24 panel PV Trondheim
- 6.8** Solceller 24 panel PER Trondheim

Kombinasjoner

- 6.9** Solceller & varmepumpe PER Oslo
- 6.10** Solceller & varmepumpe PER Trondheim
- 6.11** Solceller & solfanger PER Oslo
- 6.12** Solceller & solfanger PER Trondheim
- 6.13** Solceller med solfanger & varmepumpe PER Oslo
- 6.14** Solceller med solfanger & varmepumpe HP Oslo
- 6.15** Solceller med solfanger & varmepumpe PER
Trondheim
- 6.16** Solceller med solfanger & varmepumpe HP
Trondheim

Photovoltaic systems

Passive House with PHPP Version 9.6a

Dalgen moderns / Climate: Oslo / TFA: 140 m² / Heating: 22.8 kWh/(m²a) / Freq. overheating: 1 % / PER: 85 kWh/(m²a)

Climate data set: NO2001-1a-Oslo

Building type:

Projected building footprint: 97,1 m²

Name of system	System 1	System 2	System 3	System 4	System 5	Reference PV syst.
Location: Selection in 'Areas' worksheet	9-Trak					6-Fassade 4
Size of selected area	72,0	72,0				20,2 m²
Deviation from North	0	0				180 °
Angle of inclination from horizontal	10	10				90 °
Alternative input: Deviation from North						°
Alternative input: Angle of inclination from the horizontal	10	10				°

Information from the module data sheet

	44Mono-Si	44Mono-Si		44Mono-Si	
Technology					
Nominal current	11,62	11,62			7,71 A
Nominal voltage	33,88	33,88			30,50 V
Nominal power	390	390	0	0	235 Wp
Temperature coefficient short-circuit current	0,040	0,040			0,040 %/K
Temperature coefficient open-circuit voltage	-0,340	-0,340			-0,340 %/K
Module dimensions: Height	1,750	1,750			1,658 m
Module dimensions: Width	1,095	1,095			0,994 m
					Module area [m²]: 1,6

Further specifications

Number of modules	10	10			0,0	m
Height of module array					1	m
Height of horizon					0	m
Horizontal distance					1000,0	m
Additional reduction factor shading	95 %	95 %			100 %	
Efficiency of the inverter	130 %	130 %			95 %	

Results

Area of module field	19,2	19,2	0,0	0,0	0,0	m²
Free area on the selected building element	33,7	33,7			20,2	m²
Allocation to building element	53 %	53 %			0 %	
Annual losses due to shading	180	180				kWh

Annual electricity yield after the inverter, absolute

	System 1	System 2	System 3	System 4	System 5	Total
Related to projected building footprint area	36,3	3529				7059 kWh/a
CO2-equivalent emissions according to 1-CO2 factors GEMIS (Germany)	458,8	458,8				73 kWh/m²A _{wp} kg/a
PE-factor according to 1-PE factors (non-renewable) PHI Certification	0,00	0,00				917,6 kWh _{tp} /kWh

Yield [kWh/month]

Legend: Total, System 1, System 2, System 3, System 4, System 5

Ambient temperature [°C]

PHPP PV

PHPP NULLENERGIEBYGG

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.8 kWh/(m²a) / Freq. overheating: 1 % / PER: 85 kWh/(m²a)

Selection of heat generation system(s)		Contribution margin (useful energy)		Addl. input in following worksheets	Building type:	
Primary heat generation type		Heating	DHW		Treated floor area A_{TFA} :	140 m²
5-Direct electricity		100 %	100 %		Projected building footprint $A_{Projected}$:	97 m²
Secondary heat generation type (optional & different)					Heating demand incl. distribution & hydr. frost protection	22,75 kWh/(m²a)
		0 %	0 %		Cooling energy dem. incl. dehumidification	kWh/(m²a)
					DHW demand including distribution:	25,12 kWh/(m²a)

Energy demand	Efficiency	Final energy	PER	PER	PER	PE	PE	CO ₂	CO ₂
Reference: Treated floor area	Calculati on	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh
	-	-	kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/(m²a)
						84,98		176,78	36,2
Heating		100 %			1,35	33,93			
Electricity (HP compact unit)				1,45			2,60	65,4	0,532
Electricity (heat pump)				1,45			2,60		0,532
District heating: 1-None				2,8 4,5 3,3					0,000
Wood and other biomass				1,10			-		-
Natural gas / RE gas				1,75			1,10		0,250
Heating oil / RE methanol				2,30			1,10		0,320
Solar thermal system							0,00		0,045
Electricity (direct)	1,00	100 %	22,753	1,45	1,34	30,45	2,60	59,2	0,532
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (heating, wintertime ventilation)			2,403	1,45	1,45	3,48	2,60	6,2	0,532
Cooling and dehumidification				1,00		1,79		4,7	1,0
Electricity cooling (heat pump)				1,00			2,60		0,532
Auxiliary electricity cooling, ventilation summer			1,790	1,00		1,79	2,60	4,7	0,532
Electricity dehumidification (heat pump)				1,00			2,60		0,532
Auxiliary electricity (dehumidification)				1,00			2,60		0,532
DHW generation		100 %			1,20	30,14		65,3	13,4
Electricity (HP compact unit)				1,20			2,60		0,532
Electricity (heat pump)				1,20			2,60		0,532
District heating: 1-None				2,8 4,5 3,3					0,000
Wood and other biomass				1,10			-		-
Natural gas / RE gas				1,75			1,10		0,250
Heating oil / Methanol				2,30			1,10		0,320
Solar thermal system							0,00		0,045
Electricity (direct)	1,00	100 %	25,119	1,20	1,20	30,14	2,60	65,3	0,532
Vedovn med vannkappe		1,00		1,10					
Aux. electricity (DHW + solar DHW)				1,20			2,60		0,532
Household electricity			15,9		1,20	19,11		41,4	8,5
Electricity (household or non-residential lighting, etc.)			15,9	1,20	1,20	19,11	2,60	41,4	0,532
Auxiliary electricity (other)				1,20			2,60		0,532
Gas / RE gas dry/cook			0,0	1,75		0,00	2,60	0,0	0,270

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PE factor kWh/kWh	Emission factor (CO ₂ -eq) kg/kWh
	kWh/(m²A _{Projected}) ^a	kWh/(m²A _{Projected}) ^a	kWh/(m²a)	kg/a
PV electricity	7059	72,7	0,00	0,130
Solar thermal system	0	0,0	1,22	0,045
	0,0			0,0

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	177	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀
Requirement Passive House Premium					1/h
Requirement Passive House Plus	15	10	-	-	0,60
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30		-		1,00
Current building reaches following class for aspi	23	16	-	-	0,6
	PHI Low Energy Building		Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a
Demand	9,5120	11,9	24,73	5060	
Generation	-7,0588	-7,1	0,00	918	-2838
Demand, cumulative generation (annual balance)	2,4532	4,83	24,73	5978	2223
Demand w/o household electricity	7,3	9,2	18,94	3875	3875
Demand w/o household electricity, cum. generation	0,22	2,16	18,94	4793	1037

Photovoltaic systems

Dalgen moderns / Climate: Tondheim/TFA: 140 m² / Heating: 21.2 kWh/(m²a) / Free overheating: 0 % / PER: 78.4 kWh/(m²a)

Climate data set: NO0003a-Tondheim	
Building type:	
Projected building footprint:	97,1 m²

Name of system	System 1	System 2	System 3	System 4	System 5	Reference PV syst.
Location: Selection in 'Areas' worksheet	9-Trak					6-Fassade 4
Size of selected area	72,0	72,0				20,2 m²
Deviation from North	0	0				180 °
Angle of inclination from horizontal	10	10				90 °
Alternative input: Deviation from North						°
Alternative input: Angle of inclination from the horizontal	10	10				°

Information from the module data sheet

Technology	44Mono-Si	44Mono-Si	44Mono-Si	44Mono-Si
Nominal current	11,62	11,62		7,71 A
Nominal voltage	33,88	33,88		30,50 V
Nominal power	390	390	0	235 Wp
Temperature coefficient short-circuit current	0,040	0,040		0,040 %/K
Temperature coefficient open-circuit voltage	-0,340	-0,340		-0,340 %/K
Module dimensions: Height	1,750	1,750		1,658 m
Module dimensions: Width	1,095	1,095		0,994 m
Module area [m²]				1,6

Further specifications

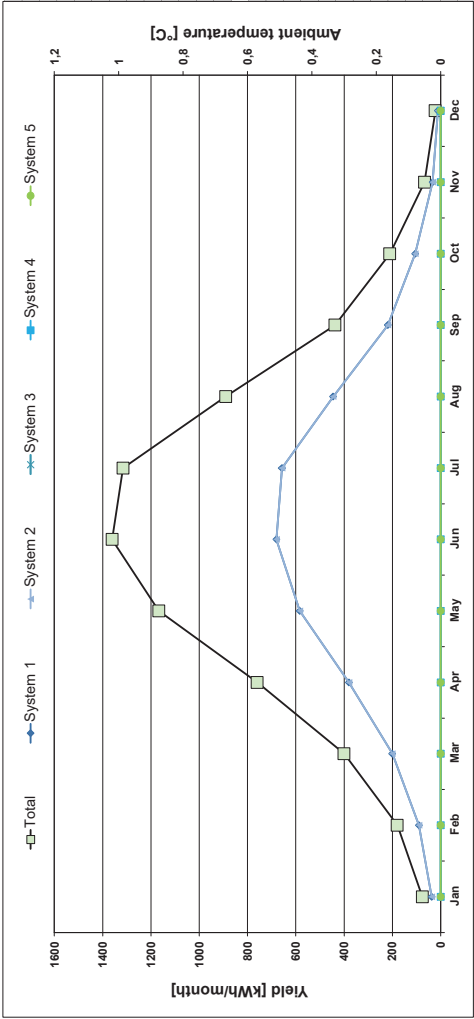
Number of modules	10	10				0,0
Height of module array						1 m
Height of horizon						0 m
Horizontal distance						1000,0 m
Additional reduction factor shading	95 %	95 %				100 %
Efficiency of the inverter	130 %	130 %				95 %

Results

Area of module field	19,2	19,2	0,0	0,0	0,0	0,0 m²
Free area of the selected building element	33,7	33,7				20,2 m²
Allocation to building element						0 %
Annual losses due to shading						0 kWh

Annual electricity yield after the inverter, absolute

Related to projected building footprint area	3444	3444				6888 kWh/a
CO2-equivalent emissions according to 1-CO2 factors GEMIS (Germany)	35,5	35,5				71 kWh/m²A _{imp}
PE-factor according to 1-PE factors (non-renewable) PHI Certification	447,7	447,7				895,5 kg/a
	0,00	0,00				0,00 kWh _{imp} /kWh



Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21.2 kWh/(m²a) / Freq. overheating: 0 % / PEF: 78.4 kWh/(m²a)

							Building type:			
							Treated floor area A _{FRA} :	140	m²	
							Projected building footprint A _{Bprojected} :	97	m²	
Selection of heat generation system(s)	Contribution margin (useful energy)									
Primary heat generation type	Heating	DHW	Addl. input in following worksheets			Heating demand incl. distribution & hydr. frost protection		21,22	kWh/(m²·a)	
5-Direct electricity	100 %	100 %	-			Cooling energy dem. incl. dehumidification				
Secondary heat generation type (optional & different)						DHW demand including distribution:		25,12	kWh/(m²·a)	
-	0 %	0 %	-							

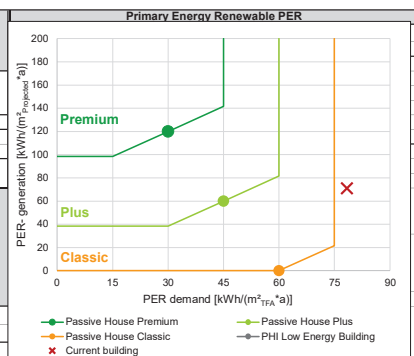
Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
							78,40	171,05		35,0	
			100 %		1,27	30,09	2,60	61,4			
Heating											
Electricity (HP compact unit)					1,35			2,60		0,532	
Electricity (heat pump)					1,35			2,60		0,532	
District heating: 1-None					2,8[4,5]3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / RE methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	21,219	1,35	1,26	26,83	2,60	55,2	0,532	11,3
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification					1,00		1,11		2,9		0,6
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,110	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
			100 %		1,15	28,88	2,60	65,3	13,4		
DHW generation											
Electricity (HP compact unit)					1,15			2,60		0,532	
Electricity (heat pump)					1,15			2,60		0,532	
District heating: 1-None					2,8[4,5]3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	25,117	1,15	1,15	28,88	2,60	65,3	0,532	13,4
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)					1,15			2,60		0,532	
Household electricity				15,9		1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation Reference: Projected building footprint area		Final energy		PER		PE		CO ₂	
		Final energy generation kWh/a	Final energy generation kWh/(m²·a) _{Projected}	PER factor kWh/kWh	PER specific value kWh/(m²·a) _{Projected}	PE factor kWh/kWh	PE Value kWh/(m²·a)	Emission factor (CO ₂ -eq) kg/kWh	CO ₂ -eq emissions kg/a
					70,9		0,0		895,5
PV electricity		6888	70,9	1,00	70,9	0,00	0,0	0,130	895,5
Solar thermal system		0	0,0	-	0,0	1,22	0,0	0,045	0,0
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	171	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness n_{50} 1/h	Primary Energy Renewable PER $\text{kWh/m}^2 \text{EP}_{\text{renew}} [\text{a}]$
	Annual heat. dem Treated floor area $\text{kWh}/(\text{m}^2 \text{a})$	Heating load Treated floor area W/m^2	Useful cool. energy Treated floor area $\text{kWh}/(\text{m}^2 \text{a})$	Cooling load Treated floor area W/m^2		
Requirement Passive House Premium	15	10	-	-	0,60	
Requirement Passive House Plus						
Requirement Passive House Classic						
Requirement PHI Low Energy Building	30				1,00	
Current building reaches following class for aspi	21	#VERDI#	-	-	0,6	
		#VERDI#	Premium		Premium	

Summary	Final energy	PER specific value	PE value	CO2eq emissions	CO2eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	9,2036	11,0	23,93	4896	4896
Generation	-6,8884	-6,9	0,00	895	-2769
Demand, cumulative generation (annual balance)	2,3153	4,08	23,93	5792	2127
Demand w/o household electricity	7,0	8,4	18,14	3711	3711
Demand w/o household electricity cum. generation	0,09	1,52	18,14	4606	942



Photovoltaic systems

Passive House with PHPP Version 9.6a

Dalton moderns / Climate Oslo / TFA: 140 m² / Heating: 22.8 kWh/(m²a) / Freq. overheating: 1 % / PER: 66.3 kWh/(m²a)

Climate data set: NO2001-1s-Oslo

Building type:

Projected building footprint: 97,1 m²

Name of system	System 1	System 2	System 3	System 4	System 5	Reference PV syst.
Location: Selection in 'Areas' worksheet	9-Trak					6-Fassade 4
Size of selected area	72.0	72.0				20.2
Deviation from North	0	0				180
Angle of inclination from horizontal	10	10				90
Alternative input: Deviation from North						
Alternative input: Angle of inclination from the horizontal	10	10				

Information from the module data sheet

Technology	44Mono-Si	44Mono-Si	44Mono-Si	44Mono-Si
Nominal current	11.52	11.52		7.71
Nominal voltage	33.88	33.88		30.50
Nominal power	390	390	0	235
Temperature coefficient short-circuit current	0.040	0.040		0.040
Temperature coefficient open-circuit voltage	-0.340	-0.340		-0.340
Module dimensions: Height	1.750	1.750		1.658
Module dimensions: Width	1.095	1.095		0.994
Module area [m²]				1.6

Further specifications

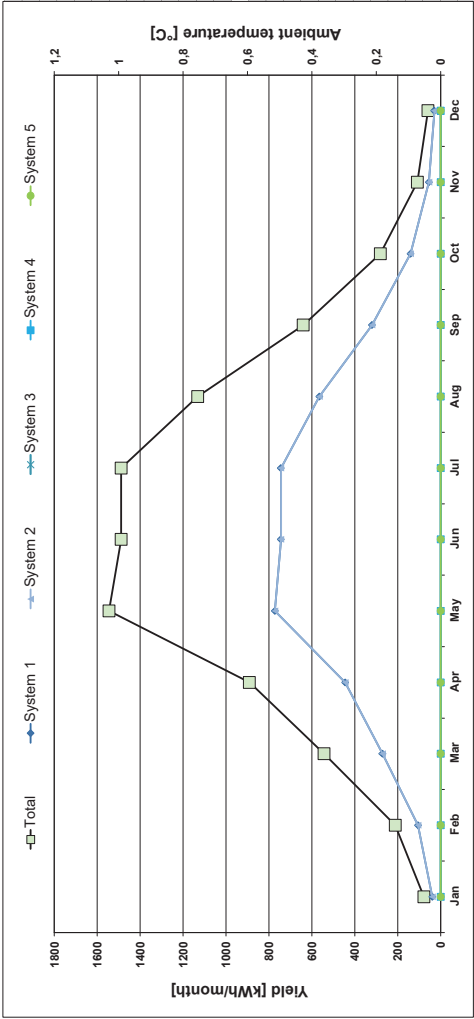
Number of modules	12	12			0.0
Height of module array					1
Height of horizon					0
Horizontal distance					1000.0
Additional reduction factor shading	95 %	95 %			100 %
Efficiency of the inverter	130 %	130 %			95 %

Results

Area of module field	22.0	23.0	0.0	0.0	0.0	m²
Free area on the selected building element	26.0	26.0			20.2	m²
Allocation to building element	64 %	64 %			0 %	%
Annual losses due to shading	216	216				kWh

Annual electricity yield after the inverter, absolute

Related to projected building footprint area	4235	4235			8471	kWh/a
CO2-equivalent emissions according to 1-CO2 factors GEMIS (Germany)	43.6	43.6			87	kWh/m²A _{imp}
PE-factor according to 1-PE factors (non-renewable) PHI Certification	550.6	550.6			1101.2	kg/a
	0.00	0.00			0.0	kWh _{imp} /kWh



Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.8 kWh/(m²a) / Freq. overheating: 1 % / PER: 85 kWh/(m²a)

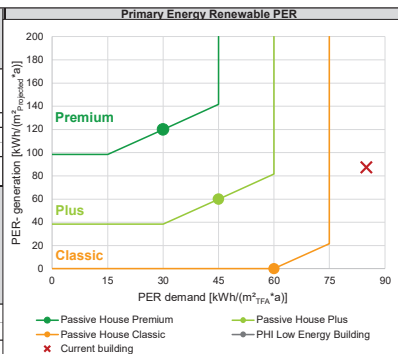
Selection of heat generation system(s)		Contribution margin (useful energy)		Add. input in following worksheets	Heating demand incl. distribution & hydr. frost protection	Cooling energy dem. incl. dehumidification	DHW demand including distribution:	Building type:	
Primary heat generation type		Heating	DHW					Treated floor area A _{TFA} :	
5-Direct electricity		100 %	100 %					140	m²
Secondary heat generation type (optional & different)								Projected building footprint A _{Projected} :	
		0 %	0 %					22,75	m²
									kWh/(m²a)
									kWh/(m²a)
								25,12	kWh/(m²a)

Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
							84,98		176,78		36,2
Heating			100 %			1,35	33,93	2,60	65,4		13,4
Electricity (HP compact unit)					1,45			2,60		0,532	
Electricity (heat pump)					1,45			2,60		0,532	
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / RE methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	22,753	1,45	1,34	30,45	2,60	59,2	0,532	12,1
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,403	1,45	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification					1,00		1,79		4,7		1,0
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,790	1,00		1,79	2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %			1,20	30,14	2,60	65,3		13,4
Electricity (HP compact unit)					1,20			2,60		0,532	
Electricity (heat pump)					1,20			2,60		0,532	
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	25,119	1,20	1,20	30,14	2,60	65,3	0,532	13,4
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)					1,20			2,60		0,532	
Household electricity				15,9		1,20	19,11		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,20	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,20			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area	Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
	kWh/a	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
				87,2		0,0		1101,2
PV electricity	8471	87,2	1,00	87,2	0,00	0,0	0,130	1101,2
Solar thermal system	0	0,0	-	0,0	1,22	0,0	0,045	0,0
		0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	177	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance				Airtightness	Primary Energy Renewable PER
	Annual heat. dem	Heating load	Useful cool. energy	Cooling load		
	Treated floor area kWh/(m²a)	Treated floor area W/m²	Treated floor area kWh/(m²a)	Treated floor area W/m²	n ₅₀	
Requirement Passive House Premium					1/h	
Requirement Passive House Plus	15	10	-	-	0,60	
Requirement Passive House Classic						
Requirement PHI Low Energy Building	30		-		1,00	
Current building reaches following class for aspi	23	16	-	-	0,6	
	PHI Low Energy Building		Premium		Premium	
Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance	
	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a	
Demand	9,5120	11,9	24,73	5060	3875	
Generation	-8,4706	-8,5	0,00	1101	-3405	
Demand, cumulative generation (annual balance)	1,0414	3,42	24,73	6162	1655	
Demand w/o household electricity	7,3	9,2	18,94	3875	3875	
Demand w/o household electricity, cum. generation	-1,19	0,74	18,94	4976	470	



Photovoltaic systems

Passive House with PHPP Version 9.6a

Dalgen moderns / Climate: Tondheim/TFA: 140 m² / Heating: 21.2 kWh/(m²a) / Free overheating: 0 % / PER: 78.4 kWh/(m²a)

Climate data set: NO0003a-Tondheim	
Building type:	
Projected building footprint:	97,1 m²

Name of system	System 1	System 2	System 3	System 4	System 5	Reference PV syst.
Location: Selection in 'Areas' worksheet	9-Trak					6-Fassade 4
Size of selected area	72,0	72,0				20,2 m²
Deviation from North	0	0				180 °
Angle of inclination from horizontal	10	10				90 °
Alternative input: Deviation from North						°
Alternative input: Angle of inclination from the horizontal	10	10				°

Information from the module data sheet

Technology	44Mono-Si	44Mono-Si	44Mono-Si	44Mono-Si
Nominal current	11,62	11,62		7,71 A
Nominal voltage	33,88	33,88		30,50 V
Nominal power	390	390	0	235 Wp
Temperature coefficient short-circuit current	0,040	0,040		0,040 %/K
Temperature coefficient open-circuit voltage	-0,340	-0,340		-0,340 %/K
Module dimensions: Height	1,750	1,750		1,658 m
Module dimensions: Width	1,095	1,095		0,994 m
Module area [m²]				1,6

Further specifications

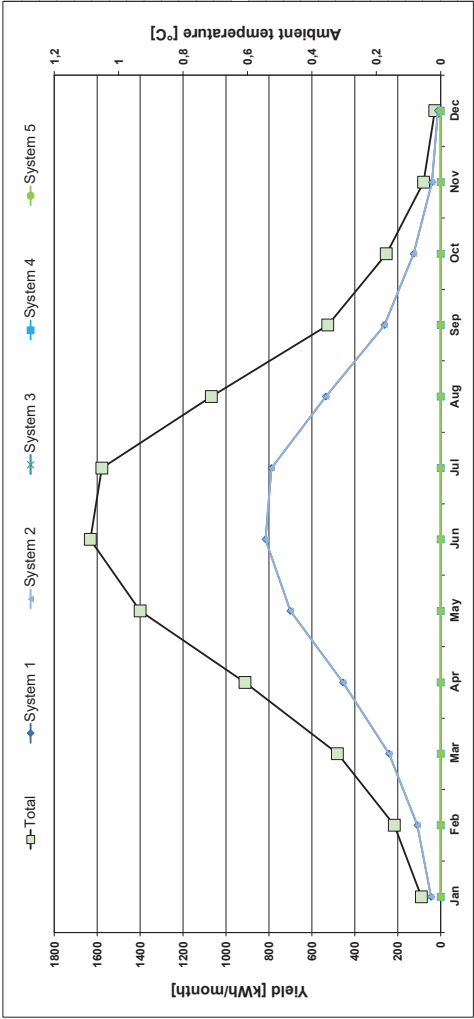
Number of modules	12	12			0,0
Height of module array					1 m
Height of horizon					0 m
Horizontal distance					1000,0 m
Additional reduction factor shading	95 %	95 %			100 %
Efficiency of the inverter	130 %	130 %			95 %

Results

Area of module field	22,0	23,0	0,0	0,0	0,0	m²
Free area of the selected building element	26,0	26,0			20,2	m²
Allocation to building element	64 %	64 %			0 %	%
Annual losses due to shading	211	211				kWh

Annual electricity yield after the inverter, absolute

Related to projected building footprint area	4133	4133			8266	kWh/a
CO2-equivalent emissions according to 1-CO2 factors GEMIS (Germany)	42,6	42,6			85	kWh/m²A _{imp}
PE-factor according to 1-PE factors (non-renewable) PHI Certification	537,3	537,3			1074,6	kg/a
	0,00	0,00			0,00	kWh _{imp} /kWh



Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 78,4 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

5-Direct electricity

Secondary heat generation type (optional & different)

-

Contribution margin (useful energy)

Heating	DHW
100 %	100 %
0 %	0 %

Add. input in following worksheets

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA} :

m²

Projected building footprint $A_{Projected}$:

m²

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

140	m²
97	m²
21,22	kWh/(m²a)
	kWh/(m²a)
25,12	kWh/(m²a)

Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq)	CO ₂ eq emissions
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/(m²a)
							78,40	1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
									171,05	35,0	
Heating			100 %			1,27	30,09	2,60	61,4		12,6
Electricity (HP compact unit)					1,35			2,60		0,532	
Electricity (heat pump)					1,35			2,60		0,532	
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / RE methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	21,219	1,35	1,26	26,83	2,60	55,2	0,532	11,3
Vedovn med vannkappe					1,10						
Aux. electricity (heating, wintertime ventilation)		1,00		2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification					1,00		1,11		2,9		0,6
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,110	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %			1,15	28,88	2,60	65,3		13,4
Electricity (HP compact unit)					1,15			2,60		0,532	
Electricity (heat pump)					1,15			2,60		0,532	
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		100 %	25,117	1,15	1,15	28,88	2,60	65,3	0,532	13,4
Vedovn med vannkappe					1,10						
Aux. electricity (DHW + solar DHW)		1,00			1,15			2,60		0,532	
Household electricity				15,9		1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation		Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area		Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
		kWh/a	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
					85,1		0,0		1074,6
PV electricity		8266	85,1	1,00	85,1	0,00	0,0	0,130	1074,6
Solar thermal system		0	0,0	-	0,0	1,22	0,0	0,045	0,0
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]

120

Current building reaches following class

171

Requirement met?

no

Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)

Requirement Passive House Premium

Requirement Passive House Plus

Requirement Passive House Classic

Requirement PHI Low Energy Building

Current building reaches following class for aspi

Useful energy, performance	Airtightness
Annual heat. dem Treated floor area kWh/(m²a)	n ₅₀
Heating load Treated floor area W/m²	1/h
Useful cool. energy Treated floor area kWh/(m²a)	
Cooling load Treated floor area W/m²	
15	0,60
10	
30	1,00
21	0,6
#VERDI!	Premium

Summary

Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.

Demand

Generation

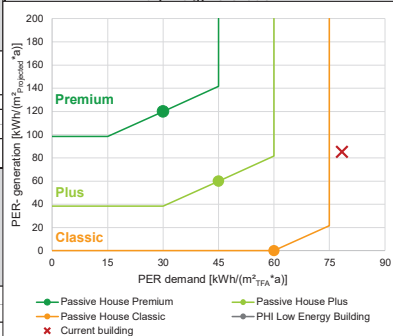
Demand, cumulative generation (annual balance)

Demand w/o household electricity

Demand w/o household electricity, cum. generation

Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a
9,2036	11,0	23,93	4896	4896
-8,2660	-8,3	0,00	1075	-3323
0,9376	2,70	23,93	5971	1573
7,0	8,4	18,14	3711	3711
-1,29	0,14	18,14	4785	388

Primary Energy Renewable PER



Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.8 kWh/(m²a) / Freq. overheating: 1 % / PER: 66.3 kWh/(m²a)

				Building type:			
				Treated floor area A _{TFA} :		140	m²
Selection of heat generation system(s)				Projected building footprint A _{Projected} :		97	m²
Primary heat generation type				Heating demand incl. distribution & hydr. frost protection		22,75	kWh/(m²a)
2-Heat pump(s)				HP, possibly HP ground			kWh/(m²a)
				Cooling energy dem. incl. dehumidification			
Secondary heat generation type (optional & different)				DHW demand including distribution:		25,12	kWh/(m²a)
5-Direct electricity							

Energy demand	Efficiency	Final energy	PER	PER	PER	PE	PE	CO ₂	CO ₂
Reference: Treated floor area	Calculation	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh
	-	-	kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/(m²a)
						66,32		139,39	28,5
Heating		100 %		1,32		25,80	2,60	50,8	10,4
Electricity (HP compact unit)				1,45		15,71	2,60	32,7	6,7
Electricity (heat pump)	1,45	80 %	12,593	1,45			2,60		0,532
District heating: 1-None				2,8 4,5 3,3					0,000
Wood and other biomass				1,10			-		-
Natural gas / RE gas				1,75			1,10		0,250
Heating oil / RE methanol				2,30			1,10		0,320
Solar thermal system							0,00		0,045
Electricity (direct)	1,00	20 %	4,551	1,45	1,45	6,60	2,60	11,8	0,532
Vedovn med vannkappe	1,00			1,10					2,4
Aux. electricity (heating, wintertime ventilation)			2,403	1,45	1,45	3,48	2,60	6,2	0,532
Cooling and dehumidification				1,00		1,79		4,7	1,0
Electricity cooling (heat pump)				1,00			2,60		0,532
Auxiliary electricity cooling, ventilation summer			1,790	1,00		1,79	2,60	4,7	0,532
Electricity dehumidification (heat pump)				1,00			2,60		0,532
Auxiliary electricity (dehumidification)				1,00			2,60		0,532
DHW generation		100 %		1,20		19,62	2,60	42,5	8,7
Electricity (HP compact unit)				1,20			2,60		0,532
Electricity (heat pump)	1,77	80 %	11,325	1,20	1,20	13,59	2,60	29,4	0,532
District heating: 1-None				2,8 4,5 3,3			-		0,000
Wood and other biomass				1,10			-		-
Natural gas / RE gas				1,75			1,10		0,250
Heating oil / Methanol				2,30			1,10		0,320
Solar thermal system							0,00		0,045
Electricity (direct)	1,00	20 %	5,024	1,20	1,20	6,03	2,60	13,1	0,532
Vedovn med vannkappe	1,00			1,10					2,7
Aux. electricity (DHW + solar DHW)				1,20			2,60		0,532
Household electricity			15,9		1,20	19,11		41,4	8,5
Electricity (household or non-residential lighting, etc.)			15,9	1,20	1,20	19,11	2,60	41,4	0,532
Auxiliary electricity (other)				1,20			2,60		0,532
Gas / RE gas dry/cook			0,0	1,75		0,00	2,60	0,0	0,270

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation	PER factor	PE factor	Emission factor (CO ₂ -eq) kg/kWh
	kWh/a	kWh/(m²A _{Projected}) ^a	kWh/kWh	kg/kWh
PV electricity	7059	72,7	1,00	0,00
Solar thermal system	0	0,0	-	0,00

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	139	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem	Heating load	Useful cool. energy	Cooling load	Airtightness
	Treated floor area kWh/(m²a)	Treated floor area W/m²	Treated floor area kWh/(m²a)	Treated floor area W/m²	n ₅₀
Requirement Passive House Premium					1/h
Requirement Passive House Plus	15	10	-	-	0,60
Requirement Passive House Classic					
Requirement PHI Low Energy Building	30		-		1,00
Current building reaches following class for aspi	23	16	-	-	0,6
	PHI Low Energy Building		Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a
Demand	7,5004	9,3	19,50	3990	3990
Generation	-7,0588	-7,1	0,00	918	-2838
Demand, cumulative generation (annual balance)	0,4416	2,22	19,50	4908	1153
Demand w/o household electricity	5,3	6,6	13,71	2805	2805
Demand w/o household electricity, cum. generation	-1,79	-0,45	13,71	3722	-33

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21.2 kWh/(m²a) / Freq. overheating: 0 % / PER: 61.7 kWh/(m²a)

						Building type:			
						Treated floor area A _{TFA} :		140	m²
Selection of heat generation system(s)		Contribution margin (useful energy)				Projected building footprint A _{Projected} :		97	m²
Primary heat generation type		Heating	DHW	Addl. input in following worksheets	Heating demand incl. distribution & hydr. frost protection			21,22	kWh/(m²a)
2-Heat pump(s)		80 %	80 %	HP, possibly HP ground	Cooling energy dem. incl. dehumidification				kWh/(m²a)
Secondary heat generation type (optional & different)					DHW demand including distribution:			25,12	kWh/(m²a)
5-Direct electricity		20 %	20 %	-					

Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
	Calculation	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
Reference: Treated floor area	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
							61,67	135,62		27,7	
Heating			100 %		1,25		22,95	2,60	47,7		9,8
Electricity (HP compact unit)					1,35			2,60		0,532	
Electricity (heat pump)	1,45		80 %	11,693	1,35	1,19	13,97	2,60	30,4	0,532	6,2
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / RE methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		20 %	4,244	1,35	1,35	5,73	2,60	11,0	0,532	2,3
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification					1,00		1,11		2,9		0,6
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,110	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %		1,15		19,29	2,60	43,6		8,9
Electricity (HP compact unit)					1,15			2,60		0,532	
Electricity (heat pump)	1,71		80 %	11,749	1,15	1,15	13,51	2,60	30,5	0,532	6,3
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system								0,00		0,045	
Electricity (direct)	1,00		20 %	5,023	1,15	1,15	5,78	2,60	13,1	0,532	2,7
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)					1,15			2,60		0,532	
Household electricity				15,9		1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy		PER		PE		CO ₂	
	Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/a
Reference: Projected building footprint area	kWh/a	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²A _{Projected}) ^b	kWh/kWh	kWh/(m²a)		
						0,0		895,5
PV electricity	6888	70,9	1,00	70,9	0,00	0,0	0,130	895,5
Solar thermal system	0	0,0	-	0,0	1,22	0,0	0,045	0,0
		0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	136	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance				Airtightness
	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	n ₅₀ 1/h
Requirement Passive House Premium		10	-	-	0,60
Requirement Passive House Plus	15		-		1,00
Requirement Passive House Classic	30		-		0,6
Requirement PHI Low Energy Building	21	#VERDI!	-	-	Premium
Current building reaches following class for aspi		#VERDI!	Premium		Premium
Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a
Demand	7,2972	8,6	18,97	3882	3882
Generation	-5,8884	-5,9	0,00	895	-2769
Demand, cumulative generation (annual balance)	0,4088	1,74	18,97	4778	1113
Demand w/o household electricity	5,1	6,1	13,18	2697	2697
Demand w/o household electricity, cum. generation	-1,82	-0,82	13,18	3592	-72

Primary Energy Renewable PER

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22.8 kWh/(m²a) / Freq. overheating: 1 % / PER: 67 kWh/(m²a)

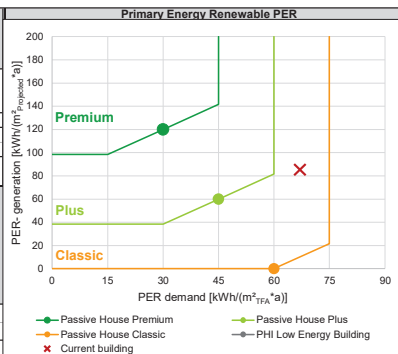
Selection of heat generation system(s)		Contribution margin (useful energy)		Add. input in following worksheets	Heating demand incl. distribution & hydr. frost protection	Building type:	
Primary heat generation type		Heating	DHW			Treated floor area A_{TFA} :	
5-Direct electricity		100 %	100 %			140	m²
Secondary heat generation type (optional & different)						Projected building footprint $A_{Projected}$:	
		0 %	0 %			22,75	m²
						Cooling energy dem. incl. dehumidification	
						DHW demand including distribution:	25,12 kWh/(m²a)

Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
							67,00	121,85		25,9	
			100 %		1,10	27,70	2,01	50,7	10,6		
Heating					1,45			2,60		0,532	
Electricity (HP compact unit)					1,45			2,60		0,532	
Electricity (heat pump)					2,8 4,5 3,3					0,000	
District heating: 1-None					1,10			-		-	
Wood and other biomass					1,75			1,10		0,250	
Natural gas / RE gas					2,30			1,10		0,320	
Heating oil / RE methanol					0,35	0,35	2,00	0,00	0,0	0,045	0,2554
Solar thermal system	1,00		25 %	5,674	1,45	1,30	22,22	2,60	44,4	0,532	9,1
Electricity (direct)		1,00	75 %	17,078	1,45	1,30	22,22	2,60	44,4	0,532	9,1
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,403	1,45	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification					1,00		1,79		4,7		1,0
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,790	1,00		1,79	2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %			0,72	18,39	0,98	25,1		5,9
Electricity (HP compact unit)					1,20			2,60		0,532	
Electricity (heat pump)					1,20			2,60		0,532	
District heating: 1-None					2,8 4,5 3,3					0,000	
Wood and other biomass					1,10			-		-	
Natural gas / RE gas					1,75			1,10		0,250	
Heating oil / Methanol					2,30			1,10		0,320	
Solar thermal system			63 %	15,940	0,43	0,43	6,79	0,00	0,0	0,045	0,717
Electricity (direct)	1,00		37 %	9,178	1,20	1,20	11,01	2,60	23,9	0,532	4,9
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)				0,489	1,20	1,20	0,59	2,60	1,3	0,532	0,3
Household electricity				15,9		1,20	19,11		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,20	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,20			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area	Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
	kWh/a	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²A _{Projected}) ^a	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
				85,3		38,1		1053,7
PV electricity	7059	72,7	1,00	72,7	0,00	0,0	0,130	917,6
Solar thermal system	3024	31,1	0,40	12,6	1,22	38,1	0,045	136,1
		0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	122	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy, performance				Airtightness	Primary Energy Renewable PER
	Annual heat. dem	Heating load	Useful cool. energy	Cooling load		
	Treated floor area kWh/(m²a)	Treated floor area W/m²	Treated floor area kWh/(m²a)	Treated floor area W/m²	n ₅₀	
Requirement Passive House Premium					1/h	
Requirement Passive House Plus	15	10	-	-	0,60	
Requirement Passive House Classic						
Requirement PHI Low Energy Building	30		-		1,00	
Current building reaches following class for aspi	23	16	-	-	0,6	
		PHI Low Energy Building		Premium	Premium	
Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance	
	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a	
Demand	9,5804	9,4	17,05	3624	3624	
Generation	-10,0827	-8,3	-3,70	1054	-3467	
Demand, cumulative generation (annual balance)	-0,5023	1,09	13,35	4678	158	
Demand w/o household electricity	7,4	6,7	11,25	2439	2439	
Demand w/o household electricity, cum. generation	-2,73	-1,58	7,56	3492	-1028	



Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21.2 kWh/(m²a) / Freq. overheating: 0 % / PER: 65.4 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

5-Direct electricity

Secondary heat generation type (optional & different)

-

Contribution margin (useful energy)

Heating DHW

100 % 100 %

0 % 0 %

Add. input in following worksheets

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA} :

140

m²

Projected building footprint $A_{Projected}$:

97

m²

Heating demand incl. distribution & hydr. frost protection

21,22

kWh/(m²a)

Cooling energy dem. incl. dehumidification

-

kWh/(m²a)

DHW demand including distribution:

25,12

kWh/(m²a)

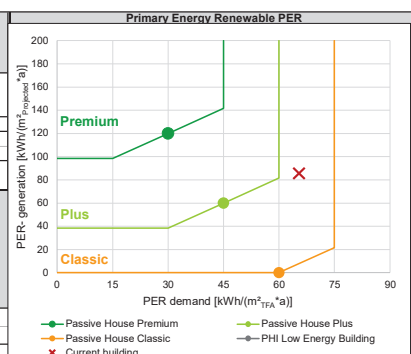
Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
								1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
65,43								120,79		25,6	
Heating			100 %			1,10	25,91	2,09	49,3		10,3
Electricity (HP compact unit)					1,35			2,60		0,532	
Electricity (heat pump)					1,35			2,60		0,532	
District heating: 1-None				2,8 4,5 3,3						0,000	
Wood and other biomass				1,10				-		-	
Natural gas / RE gas				1,75				1,10		0,250	
Heating oil / RE methanol				2,30				1,10		0,320	
Solar thermal system			22 %	4,663	0,45	0,45	2,12	0,00	0,0	0,045	0,2099
Electricity (direct)	1,00		78 %	16,556	1,35	1,24	20,53	2,60	43,0	0,532	8,8
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification					1,00		1,11		2,9		0,6
Electricity cooling (heat pump)					1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,110	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)					1,00			2,60		0,532	
Auxiliary electricity (dehumidification)					1,00			2,60		0,532	
DHW generation			100 %			0,78	20,10	1,06	27,2		6,2
Electricity (HP compact unit)					1,15			2,60		0,532	
Electricity (heat pump)					1,15			2,60		0,532	
District heating: 1-None				2,8 4,5 3,3						0,000	
Wood and other biomass				1,10				-		-	
Natural gas / RE gas				1,75				1,10		0,250	
Heating oil / Methanol				2,30				1,10		0,320	
Solar thermal system			60 %	15,154	0,53	0,53	8,08	0,00	0,0	0,045	0,682
Electricity (direct)	1,00		40 %	9,963	1,15	1,15	11,46	2,60	25,9	0,532	5,3
Vedovn med vannkappe		1,00			1,10						
Aux. electricity (DHW + solar DHW)				0,489	1,15	1,15	0,56	2,60	1,3	0,532	0,3
Household electricity				15,9		1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas delcook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation		Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area		Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ eq emissions
		kWh/a	kWh/(m²·a) _{Projected}	kWh/kWh	kWh/(m²·a) _{Projected}	kWh/kWh	kWh/(m²·a)	kg/kWh	kg/a
					85,6		34,9		1020,2
PV electricity		6888	70,9	1,00	70,9	0,00	0,0	0,130	895,5
Solar thermal system		2772	28,6	0,51	14,6	1,22	34,9	0,045	124,8
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	121	Requirement met?	no
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀
Requirement Passive House Premium	15	10	-	-	0,60
Requirement Passive House Plus	30	-	-	-	1,00
Requirement Passive House Classic	21	-	-	-	0,6
Requirement PHI Low Energy Building	#VERDI!	#VERDI!	-	-	Premium
Current building reaches following class for aspi			Premium		Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO2 factors GEMIS (Germany) kg/a	1-CO2 factors GEMIS (Germany) kg/a
Demand	9,2721	9,2	16,90	3583	3583
Generation	-9,6608	-8,3	-3,39	1020	-3346
Demand, cumulative generation (annual balance)	-0,3888	0,85	13,51	4603	237
Demand w/o household electricity	7,0	6,6	11,11	2397	2397
Demand w/o household electricity, cum. generation	-2,62	-1,72	7,72	3417	-949



Primary Energy Renewable PER

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,8 kWh/(m²a) / Freq. overheating: 1 % / PER: 46,7 kWh/(m²a)

			Building type:		
			Treated floor area A _{TFA} :		140 m²
			Projected building footprint A _{Projected} :		97 m²
Selection of heat generation system(s)			Projected energy dem. incl. dehumidification		22,75 kWh/(m²a)
Primary heat generation type			Cooling energy dem. incl. dehumidification		
2-Heat pump(s)			DHW demand including distribution:		25,12 kWh/(m²a)
Secondary heat generation type (optional & different)					
-					

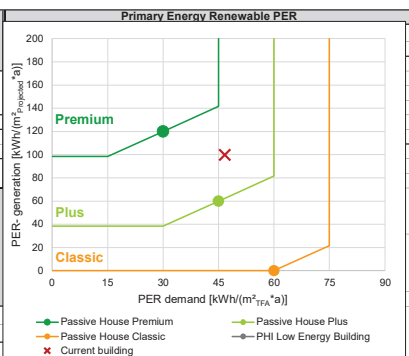
Energy demand		Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area		Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq)	CO ₂ eq emissions
		-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)			kg/kWh	kg/(m²a)
									1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
									46,70	82,30	17,8	
Heating				100 %			0.93	15,82	1,73	29,3		6,3
Electricity (HP compact unit)						1,45			2,60		0,532	
Electricity (heat pump)	1,92			75 %	8,882	1,45	1,16	10,33	2,60	23,1	0,532	4,7
District heating: 1-None						2,8[4,5]3,3					0,000	
Wood and other biomass						1,10			-		-	
Natural gas / RE gas						1,75			1,10		0,250	
Heating oil / RE methanol						2,30			1,10		0,320	
Solar thermal system				25 %	5,674	0,35	0,35	2,00	0,00	0,0	0,045	0,2554
Electricity (direct)						1,45			2,60		0,532	
Vedovn med vannkappe			1,00			1,10						
Aux. electricity (heating, wintertime ventilation)					2,403	1,45	1,45	3,48	2,60	6,2	0,532	1,3
Cooling and dehumidification						1,00		1,79		4,7		1,0
Electricity cooling (heat pump)						1,00			2,60		0,532	
Auxiliary electricity cooling, ventilation summer					1,790	1,00		1,79	2,60	4,7	0,532	1,0
Electricity dehumidification (heat pump)						1,00			2,60		0,532	
Auxiliary electricity (dehumidification)						1,00			2,60		0,532	
DHW generation				100 %			0.54	9,98	0.37	6,9		2,1
Electricity (HP compact unit)						1,20			2,60		0,532	
Electricity (heat pump)	4,24			37 %	2,164	1,20	1,20	2,60	2,60	5,6	0,532	1,2
District heating: 1-None						2,8[4,5]3,3					0,000	
Wood and other biomass						1,10			-		-	
Natural gas / RE gas						1,75			1,10		0,250	
Heating oil / Methanol						2,30			1,10		0,320	
Solar thermal system				63 %	15,940	0,43	0,43	6,79	0,00	0,0	0,045	0,717
Electricity (direct)						1,20			2,60		0,532	
Vedovn med vannkappe			1,00			1,10						
Aux. electricity (DHW + solar DHW)					0,489	1,20	1,20	0.59	2,60	1,3	0,532	0,3
Household electricity					15,9		1,20	19,11		41,4		8,5
Electricity (household or non-residential lighting, etc.)					15,9	1,20	1,20	19,11	2,60	41,4	0,532	8,5
Auxiliary electricity (other)						1,20			2,60		0,532	
Gas / RE gas dry/cook					0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation		Final energy		PER		PE		CO ₂	
Reference: Projected building footprint area		Final energy generation	Final energy generation	PER factor	PER specific value	PE factor	PE Value	Emission factor (CO ₂ -eq)	CO ₂ -eq emissions
		kWh/a	kWh/(m²A _{projected})	kWh/kWh	kWh/(m²A _{projected})	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
					99,8		38,1		1237,3
PV electricity		8471	87,2	1,00	87,2	0,00	0,0	0,130	1101,2
Solar thermal system		3024	31,1	0,40	12,6	1,22	38,1	0,045	136,1
			0,0						

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	82	Requirement met?	yes
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Useful energy performance				Airtightness	Primary Energy Renewable PER [kWh/(m² _{Floorplate} ·a)]
	Annual heat dem. Treated floor area kWh/(m²·a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²·a)	Cooling load Treated floor area W/m²	n ₅₀ 1/h	
Requirement Passive House Premium	15	10	-	-	0,60	
Requirement Passive House Plus			-	-	1,00	
Requirement Passive House Classic			-	-	0,6	
Requirement PHI Low Energy Building	30				Premium	
Current building reaches following class for aspi	23	16			Premium	

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.			1-PE factors (non-renewable) PHI Certification	1-CO ₂ factors GEMIS (Germany)	1-CO ₂ factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	7,4524	6,5	11,51	2492	2492
Generation	-11,4945	-9,7	-3,70	1237	-4034
Demand, cumulative generation (annual balance)	-4,0420	-3,16	7,82	3729	-1542
Demand w/o household electricity	5,2	3,9	5,72	1307	1307
Demand w/o household electricity, cum. generation	-6,27	-5,83	2,02	2544	-2728



Heat pump

Passive House with PHPP Version 9.6a

Dråpen moderne / Climate: Oslo / TFA: 140 m² / Heating: 22,8 kWh/(m²a) / Freq. overheating: 1 % / PER: 46,7 kWh/(m²a)

Building type:

Treated floor area A_{TFA}:

140

m²

Covered fraction of space heating demand

Space heating demand + distribution losses

Solar fraction for space heat

Effective annual heating demand

Covered fraction of DHW demand

Total heating demand of DHW system

Solar fraction for DHW

Effective DHW demand

Number of heat pumps in the system

Functionality

(PER' worksheet)

Q_H+Q_{HL}: (DHW+Distribution)

η_{Solar, H} ("SolarDHW" worksheet)

Q_{H,WI}=Q_H*(1-η_{Solar, H})

(PER' worksheet)

Q_{gDHW} (DHW+Distribution)

η_{Solar, DHW} ("SolarDHW" worksheet)

Q_{DHW,WI}=Q_{DHW}*(1-η_{Solar, DHW})

75 %

3183

25 %

2389

37 %

3514

63 %

1284

1

Heating & DHW

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

Heating

Selection of HP: 1-Standard air/water heat pump

Selection of distribution system

Design distribution temperature

Nominal power of distribution system

Distribution system (to be completed by experienced users only)

Nominal power of distribution system

Radiator exponent

Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)

Specific heat losses storage

Storage location in thermal envelope

Room temperature (storage location: outside of thermal envelope)

Sink temperature of heat pump for heating

Heat source:

θ_{design} (DHW+Distribution)

P_{nom}

P_{nom}

n

U * A_{Storage}

(DHW+Distribution)

θ_{sink}

1-Outdoor air

1-Underfloor heating

35,00

1,73

0-No

1-Inside

61,50

°C

kW

kW

W/K

°C

°C

Entries in relation to the domestic hot water system

Selection of HP: 0-None

DHW temperature

Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)

Specific heat losses storage

Room temperature (storage location: outside of thermal envelope)

Heat source:

(DHW+Distribution)

U * A_{Storage}

(DHW+Distribution)

60,00

1-Inside

0,7

20,00

°C

W/K

°C

Additional options in case of one heat pump for both functions: Heating & DHW

Type of backup heater

Δθ of electric continuous flow water heater

Same heat pump's sink temperature for Heating and for DHW

Heat pump priority

1-Elec. Immersion heater

1-Yes

1-DHW-priority

K

Control strategy

Heat pump control strategy

1-On/Off

Heating

Depth ground water / Ground collector / Ground probe

Power of pump for ground heat exchanger

z

P_{pump}

m

kW

PHPP, HP

PHPP NULLENERGIBYGG

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

Electr. energy consumption pump (grnd. water / ground)

Energy by direct electricity

Space heat supplied by HP

Winter DHW supplied by HP

Summer DHW supplied by HP

Space heating supplied by HP without storage losses

Winter DHW supplied by HP without storage losses

Summer DHW supplied by HP without storage losses

Electrical consumption of HP

$Q_{\text{EI,Pump}}$

$Q_{\text{EI,direct}}$

$Q_{\text{HP,Heating}}$

$Q_{\text{HP,DHW,Winter}}$

$Q_{\text{HP,DHW,Summer}}$

$Q_{\text{HP,Heating}}$

$Q_{\text{HP,DHW,Winter}}$

$Q_{\text{HP,DHW,Summer}}$

$Q_{\text{el,HP}}$

0

60

1713

402

67

1734

375

8

1486

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

Seasonal performance factor of heat pump

Final electrical energy demand heat generation

Annual primary energy demand

Annual CO₂-equivalent emissions

$\text{SPF}_{\text{H-1}}$

Q_{final}

1. HP: Heating or heating & DHW

2. HP: Domestic hot

1,47

1545

4018

kg/a

822

11,0

28,7

kg/(m²a)

5,9

Primary Energy Renewable PER

Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 46,6 kWh/(m²a)

Selection of heat generation system(s)

Primary heat generation type

2-Heat pump(s)

Secondary heat generation type (optional & different)

-

Contribution margin (useful energy)

Heating	DHW
100 %	100 %
0 %	0 %

Addl. input in following worksheets

HP, possibly HP ground

Heating demand incl. distribution & hydr. frost protection

Cooling energy dem. incl. dehumidification

DHW demand including distribution:

Building type:

Treated floor area A_{TFA}:

140

m²

Projected building footprint A_{Projected}:

97

m²

Heating demand incl. distribution & hydr. frost protection

21,22

kWh/(m²a)

Cooling energy dem. incl. dehumidification

-

kWh/(m²a)

DHW demand including distribution:

25,12

kWh/(m²a)

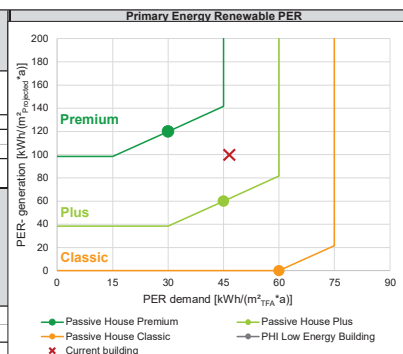
Energy demand	Efficiency		Final energy		PER			PE		CO ₂	
Reference: Treated floor area	Calculati on	User defined value	Contribution (final energy)	Final energy demand	PER factor	Effective PER factor (including biomass)	PER specific value	PE factor	PE value	CO ₂ emissions factor (CO ₂ -eq) kg/kWh	CO ₂ eq emissions kg/(m²a)
	-	-		kWh/(m²a)	kWh/kWh	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)		
							46,57	81,60		17,6	
							1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)		
Heating			100 %		0,98	15,61	1,84	29,5		6,2	
Electricity (HP compact unit)				1,35			2,60		0,532		
Electricity (heat pump)	1,85		78 %	8,930	1,35	1,15	10,24	2,60	23,2	0,532	4,8
District heating: 1-None				2,814,513,3						0,000	
Wood and other biomass				1,10				-		-	
Natural gas / RE gas				1,75				1,10		0,250	
Heating oil / RE methanol				2,30				1,10		0,320	
Solar thermal system			22 %	4,663	0,45	0,45	2,12	0,00	0,0	0,045	0,2099
Electricity (direct)				1,35				2,60		0,532	
Vedovn med vannkappe		1,00		1,10							
Aux. electricity (heating, wintertime ventilation)				2,414	1,35	1,35	3,26	2,60	6,3	0,532	1,3
Cooling and dehumidification					1,00		1,11		2,9		0,6
Electricity cooling (heat pump)				1,00				2,60		0,532	
Auxiliary electricity cooling, ventilation summer				1,110	1,00		1,11	2,60	2,9	0,532	0,6
Electricity dehumidification (heat pump)				1,00				2,60		0,532	
Auxiliary electricity (dehumidification)				1,00				2,60		0,532	
DHW generation			100 %		0,64	11,53	0,43	7,8		2,3	
Electricity (HP compact unit)				1,15			2,60		0,532		
Electricity (heat pump)	3,96		40 %	2,514	1,15	1,15	2,89	2,60	6,5	0,532	1,3
District heating: 1-None				2,814,513,3						0,000	
Wood and other biomass				1,10				-		-	
Natural gas / RE gas				1,75				1,10		0,250	
Heating oil / Methanol				2,30				1,10		0,320	
Solar thermal system			60 %	15,154	0,53	0,53	8,08	0,00	0,0	0,045	0,682
Electricity (direct)				1,15				2,60		0,532	
Vedovn med vannkappe		1,00		1,10							
Aux. electricity (DHW + solar DHW)				0,489	1,15	1,15	0,56	2,60	1,3	0,532	0,3
Household electricity				15,9		1,15	18,32		41,4		8,5
Electricity (household or non-residential lighting, etc.)				15,9	1,15	1,15	18,32	2,60	41,4	0,532	8,5
Auxiliary electricity (other)					1,15			2,60		0,532	
Gas / RE gas dry/cook				0,0	1,75		0,00	2,60	0,0	0,270	0,0

Energy generation	Final energy	PER	PE	CO ₂
Reference: Projected building footprint area	Final energy generation kWh/a	PER factor kWh/kWh	PE factor kWh/kWh	Emission factor (CO ₂ -eq) kg/kWh
PV electricity	8266	85,1	1,00	85,1
Solar thermal system	2772	28,6	0,51	14,6
		0,0		

PE demand requirement in case of verification through PE (non-renewable) [kWh/(m²a)]	120	Current building reaches following class	82	Requirement met?	yes
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Achievable energy standard through the verification of renewable primary energy (assessment of individual aspects)	Annual heat. dem Treated floor area kWh/(m²a)	Heating load Treated floor area W/m²	Useful cool. energy Treated floor area kWh/(m²a)	Cooling load Treated floor area W/m²	Airtightness n ₅₀
Requirement Passive House Premium	15	10	-	-	0,60
Requirement Passive House Plus	30	-	-	-	1,00
Requirement Passive House Classic	21	-	-	-	0,6
Requirement PHI Low Energy Building	#VERDI!	#VERDI!	-	-	Premium
Current building reaches following class for aspi					Premium

Summary	Final energy	PER specific value	PE value	CO ₂ eq emissions	CO ₂ eq substitution balance
Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards.	MWh/a	MWh/a	1-PE factors (non-renewable) PHI Certification MWh/a	1-CO ₂ factors GEMIS (Germany) kg/a	1-CO ₂ factors GEMIS (Germany) kg/a
Demand	7,1631	6,5	11,42	2461	2461
Generation	-11,0385	-9,7	-3,39	1199	-3900
Demand, cumulative generation (annual balance)	-3,8754	-3,17	8,03	3660	-1439
Demand w/o household electricity	4,9	4,0	5,62	1275	1275
Demand w/o household electricity, cum. generation	-6,10	-5,73	2,23	2474	-2624



Heat pump

Passive House with PHPP Version 9.6a

Dräpen moderne / Climate: Trondheim / TFA: 140 m² / Heating: 21,2 kWh/(m²a) / Freq. overheating: 0 % / PER: 46,6 kWh/(m²a)

Building type:

Treated floor area A_{TFA}:

140

m²

Covered fraction of space heating demand

Space heating demand + distribution losses

Solar fraction for space heat

Effective annual heating demand

Covered fraction of DHW demand

Total heating demand of DHW system

Solar fraction for DHW

Effective DHW demand

Number of heat pumps in the system

Functionality

(PER worksheet)

Q_H+Q_{HL}: (DHW+Distribution)

η_{Solar, H} (SolarDHW worksheet)

Q_{H, Wt}=Q_H*(1-η_{Solar, H})

(PER worksheet)

Q_{gDHW} (DHW+Distribution)

η_{Solar, DHW} (SolarDHW worksheet)

Q_{DHW, Wt}=Q_{DHW}*(1-η_{Solar, DHW})

78 %

2969

kWh/a

22 %

2316

kWh/a

40 %

3514

kWh/a

60 %

1394

kWh/a

1

Heating & DHW

Heating

Selection of HP:

1-Standard air/water heat pump

Heat source:

1-Outdoor air

1-Underfloor heating

θ_{design} (DHW+Distribution)

35,00

°C

P_{nom}

1,75

kW

Distribution system (to be completed by experienced users only)

Nominal power of distribution system

P_{nom}

kW

Radiator exponent

n

Heat storage tank (buffer storage tank 'DHW+Distribution' worksheet)

Specific heat losses storage

U * A_{Storage}

0-No

W/K

Storage location in thermal envelope

1-Inside

Room temperature (storage location: outside of thermal envelope)

(DHW+Distribution)

°C

Sink temperature of heat pump for heating

θ_{sink}

61,50

°C

Entries in relation to the domestic hot water system

Selection of HP:

0-None

Heat source:

DHW temperature

(DHW+Distribution)

60,00

°C

Orientation of DHW storage tank ('storage 1' in 'DHW+Distribution' worksheet)

1-Inside

Specific heat losses storage

U * A_{Storage}

0,7

W/K

Room temperature (storage location: outside of thermal envelope)

(DHW+Distribution)

20,00

°C

Type of backup heater

Δθ of electric continuous flow water heater

1-Elec. Immersion heater

K

Additional options in case of one heat pump for both functions: Heating & DHW

Same heat pump's sink temperature for Heating and for DHW

1-Yes

Heat pump priority

(Manufacturer, tech. data)

1-DHW-priority

Control strategy

Heat pump control strategy

1-On/Off

Heating

Depth ground water / Ground collector / Ground probe

z

m

Power of pump for ground heat exchanger

P_{pump}

kW

PHPP, HP

PHPP NULLENERGIBYGG

Heating

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

DHW

Heat pump: Standard air/water heat pump

Source: 1-Outdoor air

	θ_{source} °C	θ_{sink} °C	Heating capacity kW	COP
Test point 1	-7,0	35,0	2,2	2,7
Test point 2	2,0	35,0	2,6	3,1
Test point 3	7,0	35,0	3,1	3,7
Test point 4	15,0	35,0	3,8	4,3
Test point 5	20,0	35,0	4,1	4,9
Test point 6	-7,0	50,0	2,0	2,0
Test point 7	2,0	50,0	2,5	2,3
Test point 8	7,0	50,0	3,0	2,8
Test point 9	15,0	50,0	3,7	3,3
Test point 10	20,0	50,0	3,9	3,5
Test point 11				
Test point 12				
Test point 13				
Test point 14				
Test point 15				

Temperature difference in sink $\Delta\theta_{\text{Sink}}$ 5,0 K

Electr. energy consumption pump (grnd. water / ground)

Energy by direct electricity

Space heat supplied by HP

Winter DHW supplied by HP

Summer DHW supplied by HP

Space heating supplied by HP without storage losses

Winter DHW supplied by HP without storage losses

Summer DHW supplied by HP without storage losses

Electrical consumption of HP

$Q_{\text{EI,Pump}}$

$Q_{\text{EI,direct}}$

$Q_{\text{HP,Heating}}$

$Q_{\text{HP,DHW,Winter}}$

$Q_{\text{HP,DHW,Summer}}$

$Q_{\text{HP,Heating}}$

$Q_{\text{HP,DHW,Winter}}$

$Q_{\text{HP,DHW,Summer}}$

$Q_{\text{el,HP}}$

0

86

1699

421

132

1721

392

66

1515

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

kWh/a

Seasonal performance factor of heat pump

Final electrical energy demand heat generation

Annual primary energy demand

Annual CO₂-equivalent emissions

$\text{SPF}_{\text{H-1}}$

Q_{final}

1. HP: Heating or heating & DHW

2. HP: Domestic hot

1,49

1601

4162

kg/a

852

11,4

29,8

kg/(m²a)

6,1