7 ENERGY – "BE GREEN"

A renewable energy feasibility exercise has been carried out in order to determine the feasible renewable energy option(s).

The study is summarised in Table 14 below. The viable technology option (solar thermal) is presented below.

SOLAR THERMAL

Technical Overview

Solar thermal water heating is a well-established renewable energy system. Solar hot water can be successfully applied to a range of domestic and non-domestic building types which have high demands for hot water.

There are some maintenance requirements although in general the quality of the installations has been strengthened in recent years by advancements in manufacturing and installer training and accreditation as supported by the Microgeneration Certification Scheme (MCS).

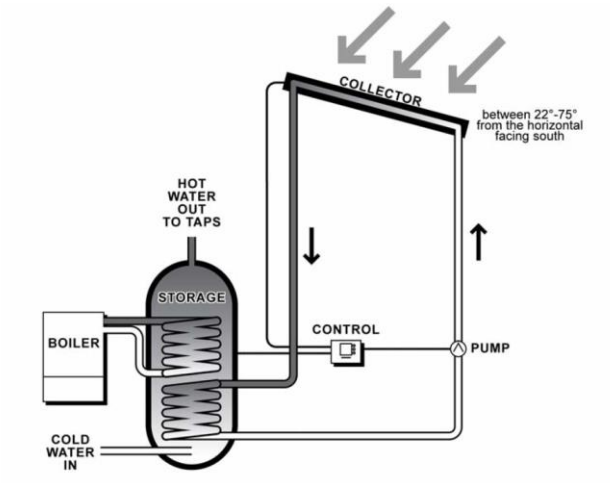

Figure 10: Solar thermal schematic

Applicability to the Proposed Scheme

Solar thermal is applicable to the proposed scheme. As a large house it has a significant hot water demand. Furthermore, the small flat roof area provides a possible location for the installation.

Figure 11: Example solar thermal "flat plate" collector

TECHNOLOGY FEASIBILITY STUDY SUMMARY

The overall summary of the feasibility exercise is presented below.

Technology		Assessment / Viability
Wind Power	Wind turbine installed on the roof of the development.	Due to the neighbouring residential areas, the high cost per kW for smaller building-mounted turbines and the impacts in terms of visual noise and shadow flicker, wind turbines are not considered a viable technology for the development. **CONCLUSION: NOT CONSIDERED FEASIBLE**
Ground Source Heat Pumps	Open or closed loop GSHP system requiring extraction of ground water and / or deep boreholes.	Minimal maintenance and no external visual and low noise impact. However, there are space restrictions and significant investment is required especially for schemes employing bore holes. **CONCLUSION: NOT CONSIDERED FEASIBLE**
Air Source Heat Pumps	Electric powered external plant serving each unit providing heating and cooling	The carbon offsetting potential for an ASHP is very low therefore is not recommended. **CONCLUSION: NOT CONSIDERED FEASIBLE**
Solar Thermal Collectors	Roof-mounted solar thermal panels providing hot water heating	The small flat roof area has good potential for a domestic solar thermal energy collection ($4m^2$). Solar hot water collectors would provide a significant proportion of domestic hot water demand of the development (~50%). **CONCLUSION: CONSIDERED FEASIBLE**
Solar Photovoltaic Panels	Roof mounted Photovoltaic panels (PV) provide electricity directly to the development, exporting any surplus production to the grid.	The flat roof areas is too small for PV. It is only capable of housing 2 panels which is not enough for a viable system. The SE facing pitch roof is heavily overshadowed. The NW pitch roof will not receive a high amount of solar irradiation and is also not recommended. Therefore solar PV is not considered feasible for this project. **CONCLUSION: NOT CONSIDERED FEASIBLE**
Biomass Heating	Biomass-fired community heating system.	Biomass heating is an established technology but has high maintenance requirements, fuel storage and delivery issues and is a source of increase in pollution, notably particulates (PM10), SO_2 and NO_X emissions. **CONCLUSION: NOT CONSIDERED FEASIBLE**

Table 13: Summary of Low and Zero Carbon Study Analysis Results

"Be Green" Total Carbon Emissions

The CO_2 emission associated with regulated energy consumption are given below.

Ref	Bedrooms	DER ($kg.CO_2/m^2/yr.$)
House	6 bed	10.14
Total "Be Green"		**10.14**

Table 14: Be Green Regulated Carbon Emissions

The CO_2 emission associated with unregulated energy consumption are the same as calculated for the baseline scenario. Therefore, the total “Be Green” CO_2 emissions associated with regulated and unregulated energy consumption is summarised below.

Ref	Bedrooms	Regulated Carbon Emissions (kg.CO_2/yr.)	Unregulated Carbon Emissions (kg.CO_2/yr.)	Total Carbon Emissions (kg.CO_2/yr.)
House	6 bed	5,048	6,656	11,704
Total "Be Green" Emissions		**5,048**	**6,656**	**11,704**

Table 15: Be Green Total Carbon Emissions

8 SUMMARY

The predicted total annual regulated CO_2 emissions of the proposed development, following the introduction of energy efficiency measures, passive and active design (Be Lean) and renewable energy systems (Be Green), is summarised below.

Carbon Emissions Summary (Be Green)

Target	Regulated Carbon Emissions (kg.CO_2/yr.)	Percentage Improvement	Total Carbon Emissions (kg.CO_2/yr.)	Percentage Improvement (regulated & unregulated)
Baseline Emissions: Part L 2013	6,241	N/A	12,897	N/A
Be Lean	5,310	14.9%	11,965	7.2%
Be Clean	5,310	14.9%	11,965	7.2%
Be Green	5,048	**19.1%**	11,704	9.3%

Table 16: Summary of "Be Green" Carbon Emissions and Baseline Comparison

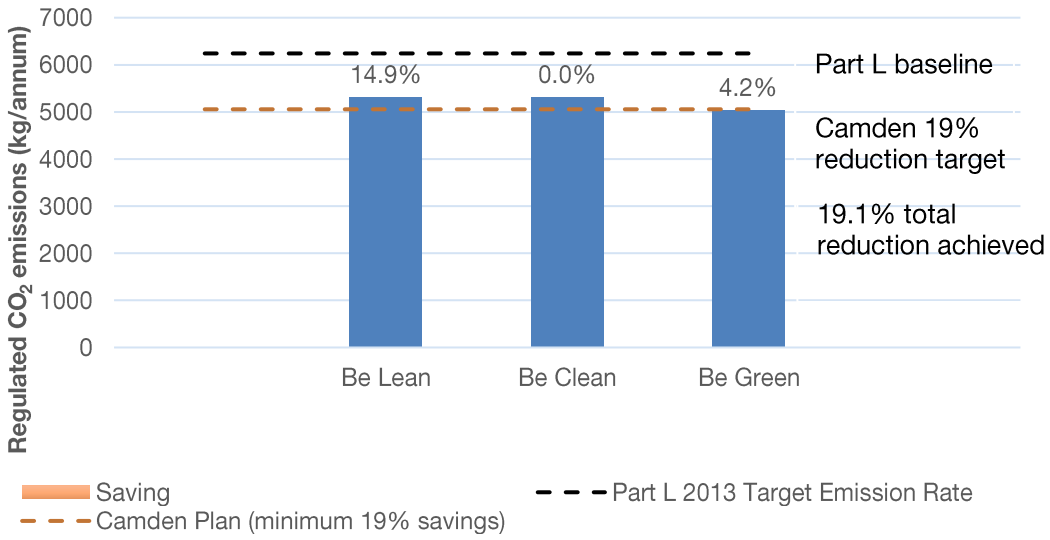

Figure 12: Summary of CO2 savings.

Sustainability Credentials

The scheme will create a large modern home based on a highly efficient, air tight thermal envelope, making use of a central glazed atrium to provide excellent natural ventilation and night cooling as well as daylight access into the core of the building.

The scheme will feature solar thermal collectors and water saving devices. The site has excellent links to low energy public transportation.

APPENDIX A: OVERHEATING CHECKLISTS

Section 1 - Site features affecting vulnerability to overheating		Yes or No
Site location	Urban – within central London or in a high-density conurbation	Yes
	Peri-urban – on the suburban fringes of London	No
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?	Busy roads / A roads	No
	Railways / Overground / DLR	No
	Airport / Flight path	No
	Industrial uses / waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Yes
	Are residents likely to be at home during the day (e.g. students)?	Yes
Dwelling aspect	Are there any single aspect units?	No
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	No
	If yes, is this to allow acceptable levels of daylighting?	NA
	Single storey ground floor units	No
Security - Are there any security issues that could limit opening of windows for ventilation?	Vulnerable areas identified by the Police Architectural Liaison Officer	No
	Other	No

Table A1: Domestic Overheating Checklist Section 1 (GLA Guidance on preparing Overheating Checklist)

Section 2 - Design features implemented to mitigate overheating risks		Response
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided?	Yes (see Figure 5)
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Landscaping
Materials	Have high albedo (light colour) materials been specified?	TBC
Dwelling aspect	% of total units that are single aspect	0%
	% single aspect with N / NE / NW orientation	0%
	% single aspect with S / SE / SW orientation	0%
	% single aspect with W orientation	0%
Glazing ratio - (glazing; internal floor area)	N . NE . NW	TBC
	E	TBC
	S / SE / SW	TBC
	W	TBC
Daylighting	What is the average daylight factor range?	TBC
Window opening	Window opening	All windows are openable
	What is the average percentage of openable area for the windows?	TBC
Window opening - What is the extent of the opening?	Fully openable	Yes
	Limited (e.g. for security, safety, wind loading reasons)	Yes low level “night cooling” openings are secure.
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	NA
Shading	Is there any external shading?	No
	Is there any internal shading?	Yes internal blinds
Glazing specification	Is there any solar control glazing	see G-value specification in main body of report
Ventilation - What is the ventilation strategy?	Natural – background	Yes
	Natural – purge	Yes
	Mechanical – background (e.g. MVHR)	Yes MHVR
	Mechanical – purge	Yes the option for mechanical ventilation boost is possible and a heat recovery bypass is specified.
	What is the average design air change rate	4, Air changes per hour during hot weather
Heating system	Is communal heating present?	No
	What is the flow/return temperature?	N/A
	Have horizontal pipe runs been minimised?	N/A
	Do the specifications include insulation levels in line with the London Heat Network Manual	N/A

Table A2: Domestic Overheating Checklist Section 2 (GLA Guidance on preparing Overheating Checklist)

APPENDIX B: SAP CALCULATION (BE GREEN) WORKSHEET

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.9

Property Address: Glenilla Road

Address : 30, Glenilla Road, LONDON, NW3 4AN

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	161.8	(1a) x	2.7	(2a) =	436.86	(3a)
Ground floor	135.55	(1b) x	2.7	(2b) =	365.99	(3b)
First floor	96.89	(1c) x	2.7	(2c) =	261.6	(3c)
Second floor	58.8	(1d) x	2.7	(2d) =	158.76	(3d)
Third floor	44.57	(1e) x	2.7	(2e) =	120.34	(3e)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	497.61	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1343.55	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.2 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.17 (21)

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DER WorkSheet: New dwelling design stage

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m												
	0.22	0.21	0.21	0.19	0.18	0.16	0.16	0.16	0.17	0.18	0.19	0.2

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 74.8 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.34	0.34	0.33	0.31	0.31	0.29	0.29	0.28	0.3	0.31	0.32	0.33	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.34	0.34	0.33	0.31	0.31	0.29	0.29	0.28	0.3	0.31	0.32	0.33	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1	=	2.1			(26)
Doors Type 2			2.1	x	1	=	2.1			(26)
Windows Type 1			5.13	x1/[1/(1.4)+ 0.04]		=	6.8			(27)
Windows Type 2			9.45	x1/[1/(1.4)+ 0.04]		=	12.53			(27)
Windows Type 3			2.7	x1/[1/(1.4)+ 0.04]		=	3.58			(27)
Windows Type 4			3.51	x1/[1/(1.4)+ 0.04]		=	4.65			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			2.88	x1/[1/(1.4)+ 0.04]		=	3.82			(27)
Windows Type 7			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 8			3.51	x1/[1/(1.4)+ 0.04]		=	4.65			(27)
Windows Type 9			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 10			2.88	x1/[1/(1.4)+ 0.04]		=	3.82			(27)
Windows Type 11			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)

DER WorkSheet: New dwelling design stage

Windows Type 12			2.88	x1/[1/(1.4)+ 0.04]	=	3.82			(27)
Windows Type 13			2.08	x1/[1/(1.4)+ 0.04]	=	2.76			(27)
Windows Type 14			3.51	x1/[1/(1.4)+ 0.04]	=	4.65			(27)
Windows Type 15			2.72	x1/[1/(1.4)+ 0.04]	=	3.61			(27)
Windows Type 16			2.4	x1/[1/(1.4)+ 0.04]	=	3.18			(27)
Windows Type 17			3.51	x1/[1/(1.4)+ 0.04]	=	4.65			(27)
Windows Type 18			2.7	x1/[1/(1.4)+ 0.04]	=	3.58			(27)
Rooflights Type 1			2	x1/[1/(1.4) + 0.04]	=	2.8			(27b)
Rooflights Type 2			3	x1/[1/(1.4) + 0.04]	=	4.2			(27b)
Rooflights Type 3			7.5	x1/[1/(1.4) + 0.04]	=	10.5			(27b)
Floor			161.8	x	0.12	=	19.416			(28)
Walls Type1	24.3	0	24.3	x	0.16	=	3.89			(29)
Walls Type2	55.35	0	55.35	x	0.16	=	8.86			(29)
Walls Type3	24.3	0	24.3	x	0.16	=	3.89			(29)
Walls Type4	55.35	0	55.35	x	0.16	=	8.86			(29)
Walls Type5	20.25	14.58	5.67	x	0.16	=	0.91			(29)
Walls Type6	55.35	8.31	47.04	x	0.16	=	7.53			(29)
Walls Type7	20.25	6.3	13.95	x	0.16	=	2.23			(29)
Walls Type8	55.35	2.7	52.65	x	0.16	=	8.42			(29)
Walls Type9	20.52	4.96	15.56	x	0.16	=	2.49			(29)
Walls Type10	37.26	3.51	33.75	x	0.16	=	5.4			(29)
Walls Type11	20.52	4.96	15.56	x	0.16	=	2.49			(29)
Walls Type12	37.26	1.3	35.96	x	0.16	=	5.75			(29)
Walls Type13	18.9	4.96	13.94	x	0.16	=	2.23			(29)
Walls Type14	22.68	3.51	19.17	x	0.16	=	3.07			(29)
Walls Type15	22.68	0	22.68	x	0.16	=	3.63			(29)
Walls Type16	18.09	0	18.09	x	0.16	=	2.89			(29)
Walls Type17	22.41	3.51	18.9	x	0.16	=	3.02			(29)
Walls Type18	18.09	0	18.09	x	0.16	=	2.89			(29)
Walls Type19	22.41	0	22.41	x	0.16	=	3.59			(29)
Walls Type20	18.9	5.12	13.78	x	0.16	=	2.2			(29)
Roof Type1	108.73	11.5	97.23	x	0.12	=	11.67			(30)
Roof Type2	83.83	3	80.83	x	0.12	=	9.7			(30)
Total area of elements, m²			944.58							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	227.36	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	56255.54	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 51.28 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = — 278.64 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	151.97	150.08	148.2	138.77	136.89	127.47	127.47	125.58	131.24	136.89	140.66	144.43	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	430.6	428.72	426.83	417.41	415.53	406.11	406.11	404.22	409.87	415.53	419.3	423.06	

Average = Sum(39)$_{1...12}$ /12= 416.94 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.86	0.86	0.84	0.84	0.82	0.82	0.81	0.82	0.84	0.84	0.85	

Average = Sum(40)$_{1...12}$ /12= 0.84 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 3.39 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 114.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	126.15	121.57	116.98	112.39	107.8	103.22	103.22	107.8	112.39	116.98	121.57	126.15	

Total = Sum(44)$_{1...12}$ = 1376.21 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	187.08	163.62	168.84	147.2	141.24	121.88	112.94	129.6	131.15	152.84	166.84	181.18	

Total = Sum(45)$_{1...12}$ = 1804.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	28.06	24.54	25.33	22.08	21.19	18.28	16.94	19.44	19.67	22.93	25.03	27.18	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 250 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 47 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.37 (52)

Temperature factor from Table 2b — 3 (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	4.62 (54)
Enter (50) or (54) in (55)		4.62 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	143.35	129.48	143.35	138.73	143.35	138.73	143.35	143.35	138.73	143.35	138.73	143.35	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	143.35	129.48	143.35	138.73	143.35	138.73	143.35	143.35	138.73	143.35	138.73	143.35	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	1.29	1.13	1.17	1.02	0.97	0.84	0.78	0.89	0.9	1.05	1.15	1.25	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	331.72	294.23	313.36	286.95	285.57	261.45	257.07	273.85	270.78	297.25	306.72	325.78	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	-31.28	-53.63	-94.5	-130.25	-163.29	-161.33	-158.88	-137.37	-105.18	-69.48	-37.4	-25.97	(63)

Output from water heater

(64)m=	300.44	240.61	218.86	156.7	122.28	100.12	98.2	136.48	165.6	227.78	269.32	299.81	

Output from water heater (annual)$_{1...12}$ 2336.21 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	177.21	158.27	171.11	160.18	161.89	151.72	152.43	158	154.82	165.77	166.75	175.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	169.44	169.44	169.44	169.44	169.44	169.44	169.44	169.44	169.44	169.44	169.44	169.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	56.53	50.21	40.84	30.92	23.11	19.51	21.08	27.4	36.78	46.7	54.51	58.11	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	603.75	610.01	594.22	560.61	518.19	478.31	451.67	445.41	461.2	494.81	537.23	577.11	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	39.94	39.94	39.94	39.94	39.94	39.94	39.94	39.94	39.94	39.94	39.94	39.94	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	-135.55	(71)

Water heating gains (Table 5)

(72)m=	238.18	235.52	229.99	222.47	217.59	210.72	204.88	212.36	215.02	222.8	231.59	235.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	975.3	972.58	941.88	890.84	835.72	785.38	754.47	762.01	789.83	841.14	900.16	947.58	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.2	x	11.28	x	0.63	x	0.7	=	14.48	(75)
Northeast 0.9x	0.77	x	2.08	x	11.28	x	0.63	x	0.7	=	7.17	(75)
Northeast 0.9x	0.77	x	2.88	x	11.28	x	0.63	x	0.7	=	9.93	(75)
Northeast 0.9x	0.77	x	2.72	x	11.28	x	0.63	x	0.7	=	9.38	(75)
Northeast 0.9x	0.77	x	2.4	x	11.28	x	0.63	x	0.7	=	8.28	(75)
Northeast 0.9x	0.77	x	4.2	x	22.97	x	0.63	x	0.7	=	29.48	(75)
Northeast 0.9x	0.77	x	2.08	x	22.97	x	0.63	x	0.7	=	14.6	(75)
Northeast 0.9x	0.77	x	2.88	x	22.97	x	0.63	x	0.7	=	20.21	(75)
Northeast 0.9x	0.77	x	2.72	x	22.97	x	0.63	x	0.7	=	19.09	(75)
Northeast 0.9x	0.77	x	2.4	x	22.97	x	0.63	x	0.7	=	16.85	(75)
Northeast 0.9x	0.77	x	4.2	x	41.38	x	0.63	x	0.7	=	53.11	(75)
Northeast 0.9x	0.77	x	2.08	x	41.38	x	0.63	x	0.7	=	26.3	(75)
Northeast 0.9x	0.77	x	2.88	x	41.38	x	0.63	x	0.7	=	36.42	(75)
Northeast 0.9x	0.77	x	2.72	x	41.38	x	0.63	x	0.7	=	34.4	(75)
Northeast 0.9x	0.77	x	2.4	x	41.38	x	0.63	x	0.7	=	30.35	(75)
Northeast 0.9x	0.77	x	4.2	x	67.96	x	0.63	x	0.7	=	87.23	(75)
Northeast 0.9x	0.77	x	2.08	x	67.96	x	0.63	x	0.7	=	43.2	(75)
Northeast 0.9x	0.77	x	2.88	x	67.96	x	0.63	x	0.7	=	59.81	(75)
Northeast 0.9x	0.77	x	2.72	x	67.96	x	0.63	x	0.7	=	56.49	(75)
Northeast 0.9x	0.77	x	2.4	x	67.96	x	0.63	x	0.7	=	49.84	(75)
Northeast 0.9x	0.77	x	4.2	x	91.35	x	0.63	x	0.7	=	117.25	(75)
Northeast 0.9x	0.77	x	2.08	x	91.35	x	0.63	x	0.7	=	58.07	(75)
Northeast 0.9x	0.77	x	2.88	x	91.35	x	0.63	x	0.7	=	80.4	(75)
Northeast 0.9x	0.77	x	2.72	x	91.35	x	0.63	x	0.7	=	75.93	(75)
Northeast 0.9x	0.77	x	2.4	x	91.35	x	0.63	x	0.7	=	67	(75)
Northeast 0.9x	0.77	x	4.2	x	97.38	x	0.63	x	0.7	=	125	(75)
Northeast 0.9x	0.77	x	2.08	x	97.38	x	0.63	x	0.7	=	61.9	(75)
Northeast 0.9x	0.77	x	2.88	x	97.38	x	0.63	x	0.7	=	85.71	(75)
Northeast 0.9x	0.77	x	2.72	x	97.38	x	0.63	x	0.7	=	80.95	(75)
Northeast 0.9x	0.77	x	2.4	x	97.38	x	0.63	x	0.7	=	71.43	(75)
Northeast 0.9x	0.77	x	4.2	x	91.1	x	0.63	x	0.7	=	116.94	(75)
Northeast 0.9x	0.77	x	2.08	x	91.1	x	0.63	x	0.7	=	57.91	(75)
Northeast 0.9x	0.77	x	2.88	x	91.1	x	0.63	x	0.7	=	80.18	(75)
Northeast 0.9x	0.77	x	2.72	x	91.1	x	0.63	x	0.7	=	75.73	(75)
Northeast 0.9x	0.77	x	2.4	x	91.1	x	0.63	x	0.7	=	66.82	(75)
Northeast 0.9x	0.77	x	4.2	x	72.63	x	0.63	x	0.7	=	93.22	(75)
Northeast 0.9x	0.77	x	2.08	x	72.63	x	0.63	x	0.7	=	46.17	(75)
Northeast 0.9x	0.77	x	2.88	x	72.63	x	0.63	x	0.7	=	63.92	(75)
Northeast 0.9x	0.77	x	2.72	x	72.63	x	0.63	x	0.7	=	60.37	(75)

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	2.4	x	72.63	x	0.63	x	0.7	=	53.27	(75)
Northeast	0.9x	0.77	x	4.2	x	50.42	x	0.63	x	0.7	=	64.72	(75)
Northeast	0.9x	0.77	x	2.08	x	50.42	x	0.63	x	0.7	=	32.05	(75)
Northeast	0.9x	0.77	x	2.88	x	50.42	x	0.63	x	0.7	=	44.38	(75)
Northeast	0.9x	0.77	x	2.72	x	50.42	x	0.63	x	0.7	=	41.91	(75)
Northeast	0.9x	0.77	x	2.4	x	50.42	x	0.63	x	0.7	=	36.98	(75)
Northeast	0.9x	0.77	x	4.2	x	28.07	x	0.63	x	0.7	=	36.03	(75)
Northeast	0.9x	0.77	x	2.08	x	28.07	x	0.63	x	0.7	=	17.84	(75)
Northeast	0.9x	0.77	x	2.88	x	28.07	x	0.63	x	0.7	=	24.7	(75)
Northeast	0.9x	0.77	x	2.72	x	28.07	x	0.63	x	0.7	=	23.33	(75)
Northeast	0.9x	0.77	x	2.4	x	28.07	x	0.63	x	0.7	=	20.59	(75)
Northeast	0.9x	0.77	x	4.2	x	14.2	x	0.63	x	0.7	=	18.22	(75)
Northeast	0.9x	0.77	x	2.08	x	14.2	x	0.63	x	0.7	=	9.02	(75)
Northeast	0.9x	0.77	x	2.88	x	14.2	x	0.63	x	0.7	=	12.5	(75)
Northeast	0.9x	0.77	x	2.72	x	14.2	x	0.63	x	0.7	=	11.8	(75)
Northeast	0.9x	0.77	x	2.4	x	14.2	x	0.63	x	0.7	=	10.41	(75)
Northeast	0.9x	0.77	x	4.2	x	9.21	x	0.63	x	0.7	=	11.83	(75)
Northeast	0.9x	0.77	x	2.08	x	9.21	x	0.63	x	0.7	=	5.86	(75)
Northeast	0.9x	0.77	x	2.88	x	9.21	x	0.63	x	0.7	=	8.11	(75)
Northeast	0.9x	0.77	x	2.72	x	9.21	x	0.63	x	0.7	=	7.66	(75)
Northeast	0.9x	0.77	x	2.4	x	9.21	x	0.63	x	0.7	=	6.76	(75)
Southeast	0.9x	0.77	x	3.51	x	36.79	x	0.63	x	0.7	=	39.47	(77)
Southeast	0.9x	0.77	x	3.51	x	36.79	x	0.63	x	0.7	=	39.47	(77)
Southeast	0.9x	0.77	x	3.51	x	36.79	x	0.63	x	0.7	=	39.47	(77)
Southeast	0.9x	0.77	x	3.51	x	36.79	x	0.63	x	0.7	=	39.47	(77)
Southeast	0.9x	0.77	x	2.7	x	36.79	x	0.63	x	0.7	=	30.36	(77)
Southeast	0.9x	0.77	x	3.51	x	62.67	x	0.63	x	0.7	=	67.23	(77)
Southeast	0.9x	0.77	x	3.51	x	62.67	x	0.63	x	0.7	=	67.23	(77)
Southeast	0.9x	0.77	x	3.51	x	62.67	x	0.63	x	0.7	=	67.23	(77)
Southeast	0.9x	0.77	x	3.51	x	62.67	x	0.63	x	0.7	=	67.23	(77)
Southeast	0.9x	0.77	x	2.7	x	62.67	x	0.63	x	0.7	=	51.72	(77)
Southeast	0.9x	0.77	x	3.51	x	85.75	x	0.63	x	0.7	=	91.99	(77)
Southeast	0.9x	0.77	x	3.51	x	85.75	x	0.63	x	0.7	=	91.99	(77)
Southeast	0.9x	0.77	x	3.51	x	85.75	x	0.63	x	0.7	=	91.99	(77)
Southeast	0.9x	0.77	x	3.51	x	85.75	x	0.63	x	0.7	=	91.99	(77)
Southeast	0.9x	0.77	x	2.7	x	85.75	x	0.63	x	0.7	=	70.76	(77)
Southeast	0.9x	0.77	x	3.51	x	106.25	x	0.63	x	0.7	=	113.98	(77)
Southeast	0.9x	0.77	x	3.51	x	106.25	x	0.63	x	0.7	=	113.98	(77)
Southeast	0.9x	0.77	x	3.51	x	106.25	x	0.63	x	0.7	=	113.98	(77)
Southeast	0.9x	0.77	x	3.51	x	106.25	x	0.63	x	0.7	=	113.98	(77)
Southeast	0.9x	0.77	x	2.7	x	106.25	x	0.63	x	0.7	=	87.67	(77)

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Southeast	0.9x	0.77	x	3.51	x	119.01	x	0.63	x	0.7	=	127.66	(77)
Southeast	0.9x	0.77	x	3.51	x	119.01	x	0.63	x	0.7	=	127.66	(77)
Southeast	0.9x	0.77	x	3.51	x	119.01	x	0.63	x	0.7	=	127.66	(77)
Southeast	0.9x	0.77	x	3.51	x	119.01	x	0.63	x	0.7	=	127.66	(77)
Southeast	0.9x	0.77	x	2.7	x	119.01	x	0.63	x	0.7	=	98.2	(77)
Southeast	0.9x	0.77	x	3.51	x	118.15	x	0.63	x	0.7	=	126.74	(77)
Southeast	0.9x	0.77	x	3.51	x	118.15	x	0.63	x	0.7	=	126.74	(77)
Southeast	0.9x	0.77	x	3.51	x	118.15	x	0.63	x	0.7	=	126.74	(77)
Southeast	0.9x	0.77	x	3.51	x	118.15	x	0.63	x	0.7	=	126.74	(77)
Southeast	0.9x	0.77	x	2.7	x	118.15	x	0.63	x	0.7	=	97.49	(77)
Southeast	0.9x	0.77	x	3.51	x	113.91	x	0.63	x	0.7	=	122.19	(77)
Southeast	0.9x	0.77	x	3.51	x	113.91	x	0.63	x	0.7	=	122.19	(77)
Southeast	0.9x	0.77	x	3.51	x	113.91	x	0.63	x	0.7	=	122.19	(77)
Southeast	0.9x	0.77	x	3.51	x	113.91	x	0.63	x	0.7	=	122.19	(77)
Southeast	0.9x	0.77	x	2.7	x	113.91	x	0.63	x	0.7	=	93.99	(77)
Southeast	0.9x	0.77	x	3.51	x	104.39	x	0.63	x	0.7	=	111.98	(77)
Southeast	0.9x	0.77	x	3.51	x	104.39	x	0.63	x	0.7	=	111.98	(77)
Southeast	0.9x	0.77	x	3.51	x	104.39	x	0.63	x	0.7	=	111.98	(77)
Southeast	0.9x	0.77	x	3.51	x	104.39	x	0.63	x	0.7	=	111.98	(77)
Southeast	0.9x	0.77	x	2.7	x	104.39	x	0.63	x	0.7	=	86.14	(77)
Southeast	0.9x	0.77	x	3.51	x	92.85	x	0.63	x	0.7	=	99.6	(77)
Southeast	0.9x	0.77	x	3.51	x	92.85	x	0.63	x	0.7	=	99.6	(77)
Southeast	0.9x	0.77	x	3.51	x	92.85	x	0.63	x	0.7	=	99.6	(77)
Southeast	0.9x	0.77	x	3.51	x	92.85	x	0.63	x	0.7	=	99.6	(77)
Southeast	0.9x	0.77	x	2.7	x	92.85	x	0.63	x	0.7	=	76.62	(77)
Southeast	0.9x	0.77	x	3.51	x	69.27	x	0.63	x	0.7	=	74.3	(77)
Southeast	0.9x	0.77	x	3.51	x	69.27	x	0.63	x	0.7	=	74.3	(77)
Southeast	0.9x	0.77	x	3.51	x	69.27	x	0.63	x	0.7	=	74.3	(77)
Southeast	0.9x	0.77	x	3.51	x	69.27	x	0.63	x	0.7	=	74.3	(77)
Southeast	0.9x	0.77	x	2.7	x	69.27	x	0.63	x	0.7	=	57.16	(77)
Southeast	0.9x	0.77	x	3.51	x	44.07	x	0.63	x	0.7	=	47.27	(77)
Southeast	0.9x	0.77	x	3.51	x	44.07	x	0.63	x	0.7	=	47.27	(77)
Southeast	0.9x	0.77	x	3.51	x	44.07	x	0.63	x	0.7	=	47.27	(77)
Southeast	0.9x	0.77	x	3.51	x	44.07	x	0.63	x	0.7	=	47.27	(77)
Southeast	0.9x	0.77	x	2.7	x	44.07	x	0.63	x	0.7	=	36.37	(77)
Southeast	0.9x	0.77	x	3.51	x	31.49	x	0.63	x	0.7	=	33.78	(77)
Southeast	0.9x	0.77	x	3.51	x	31.49	x	0.63	x	0.7	=	33.78	(77)
Southeast	0.9x	0.77	x	3.51	x	31.49	x	0.63	x	0.7	=	33.78	(77)
Southeast	0.9x	0.77	x	3.51	x	31.49	x	0.63	x	0.7	=	33.78	(77)
Southeast	0.9x	0.77	x	2.7	x	31.49	x	0.63	x	0.7	=	25.98	(77)
Southwest	0.9x	0.77	x	5.13	x	36.79		0.63	x	0.7	=	57.69	(79)

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Southwest	0.9x	0.77	x	9.45	x	36.79		0.63	x	0.7	=	106.26	(79)
Southwest	0.9x	0.77	x	2.88	x	36.79		0.63	x	0.7	=	32.38	(79)
Southwest	0.9x	0.77	x	2.08	x	36.79		0.63	x	0.7	=	23.39	(79)
Southwest	0.9x	0.77	x	2.88	x	36.79		0.63	x	0.7	=	32.38	(79)
Southwest	0.9x	0.77	x	2.08	x	36.79		0.63	x	0.7	=	23.39	(79)
Southwest	0.9x	0.77	x	5.13	x	62.67		0.63	x	0.7	=	98.26	(79)
Southwest	0.9x	0.77	x	9.45	x	62.67		0.63	x	0.7	=	181	(79)
Southwest	0.9x	0.77	x	2.88	x	62.67		0.63	x	0.7	=	55.16	(79)
Southwest	0.9x	0.77	x	2.08	x	62.67		0.63	x	0.7	=	39.84	(79)
Southwest	0.9x	0.77	x	2.88	x	62.67		0.63	x	0.7	=	55.16	(79)
Southwest	0.9x	0.77	x	2.08	x	62.67		0.63	x	0.7	=	39.84	(79)
Southwest	0.9x	0.77	x	5.13	x	85.75		0.63	x	0.7	=	134.44	(79)
Southwest	0.9x	0.77	x	9.45	x	85.75		0.63	x	0.7	=	247.66	(79)
Southwest	0.9x	0.77	x	2.88	x	85.75		0.63	x	0.7	=	75.48	(79)
Southwest	0.9x	0.77	x	2.08	x	85.75		0.63	x	0.7	=	54.51	(79)
Southwest	0.9x	0.77	x	2.88	x	85.75		0.63	x	0.7	=	75.48	(79)
Southwest	0.9x	0.77	x	2.08	x	85.75		0.63	x	0.7	=	54.51	(79)
Southwest	0.9x	0.77	x	5.13	x	106.25		0.63	x	0.7	=	166.58	(79)
Southwest	0.9x	0.77	x	9.45	x	106.25		0.63	x	0.7	=	306.86	(79)
Southwest	0.9x	0.77	x	2.88	x	106.25		0.63	x	0.7	=	93.52	(79)
Southwest	0.9x	0.77	x	2.08	x	106.25		0.63	x	0.7	=	67.54	(79)
Southwest	0.9x	0.77	x	2.88	x	106.25		0.63	x	0.7	=	93.52	(79)
Southwest	0.9x	0.77	x	2.08	x	106.25		0.63	x	0.7	=	67.54	(79)
Southwest	0.9x	0.77	x	5.13	x	119.01		0.63	x	0.7	=	186.58	(79)
Southwest	0.9x	0.77	x	9.45	x	119.01		0.63	x	0.7	=	343.71	(79)
Southwest	0.9x	0.77	x	2.88	x	119.01		0.63	x	0.7	=	104.75	(79)
Southwest	0.9x	0.77	x	2.08	x	119.01		0.63	x	0.7	=	75.65	(79)
Southwest	0.9x	0.77	x	2.88	x	119.01		0.63	x	0.7	=	104.75	(79)
Southwest	0.9x	0.77	x	2.08	x	119.01		0.63	x	0.7	=	75.65	(79)
Southwest	0.9x	0.77	x	5.13	x	118.15		0.63	x	0.7	=	185.23	(79)
Southwest	0.9x	0.77	x	9.45	x	118.15		0.63	x	0.7	=	341.22	(79)
Southwest	0.9x	0.77	x	2.88	x	118.15		0.63	x	0.7	=	103.99	(79)
Southwest	0.9x	0.77	x	2.08	x	118.15		0.63	x	0.7	=	75.11	(79)
Southwest	0.9x	0.77	x	2.88	x	118.15		0.63	x	0.7	=	103.99	(79)
Southwest	0.9x	0.77	x	2.08	x	118.15		0.63	x	0.7	=	75.11	(79)
Southwest	0.9x	0.77	x	5.13	x	113.91		0.63	x	0.7	=	178.59	(79)
Southwest	0.9x	0.77	x	9.45	x	113.91		0.63	x	0.7	=	328.97	(79)
Southwest	0.9x	0.77	x	2.88	x	113.91		0.63	x	0.7	=	100.26	(79)
Southwest	0.9x	0.77	x	2.08	x	113.91		0.63	x	0.7	=	72.41	(79)
Southwest	0.9x	0.77	x	2.88	x	113.91		0.63	x	0.7	=	100.26	(79)
Southwest	0.9x	0.77	x	2.08	x	113.91		0.63	x	0.7	=	72.41	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	5.13	x	104.39		0.63	x	0.7	=	163.66	(79)
Southwest	0.9x	0.77	x	9.45	x	104.39		0.63	x	0.7	=	301.48	(79)
Southwest	0.9x	0.77	x	2.88	x	104.39		0.63	x	0.7	=	91.88	(79)
Southwest	0.9x	0.77	x	2.08	x	104.39		0.63	x	0.7	=	66.36	(79)
Southwest	0.9x	0.77	x	2.88	x	104.39		0.63	x	0.7	=	91.88	(79)
Southwest	0.9x	0.77	x	2.08	x	104.39		0.63	x	0.7	=	66.36	(79)
Southwest	0.9x	0.77	x	5.13	x	92.85		0.63	x	0.7	=	145.57	(79)
Southwest	0.9x	0.77	x	9.45	x	92.85		0.63	x	0.7	=	268.16	(79)
Southwest	0.9x	0.77	x	2.88	x	92.85		0.63	x	0.7	=	81.73	(79)
Southwest	0.9x	0.77	x	2.08	x	92.85		0.63	x	0.7	=	59.02	(79)
Southwest	0.9x	0.77	x	2.88	x	92.85		0.63	x	0.7	=	81.73	(79)
Southwest	0.9x	0.77	x	2.08	x	92.85		0.63	x	0.7	=	59.02	(79)
Southwest	0.9x	0.77	x	5.13	x	69.27		0.63	x	0.7	=	108.6	(79)
Southwest	0.9x	0.77	x	9.45	x	69.27		0.63	x	0.7	=	200.05	(79)
Southwest	0.9x	0.77	x	2.88	x	69.27		0.63	x	0.7	=	60.97	(79)
Southwest	0.9x	0.77	x	2.08	x	69.27		0.63	x	0.7	=	44.03	(79)
Southwest	0.9x	0.77	x	2.88	x	69.27		0.63	x	0.7	=	60.97	(79)
Southwest	0.9x	0.77	x	2.08	x	69.27		0.63	x	0.7	=	44.03	(79)
Southwest	0.9x	0.77	x	5.13	x	44.07		0.63	x	0.7	=	69.09	(79)
Southwest	0.9x	0.77	x	9.45	x	44.07		0.63	x	0.7	=	127.28	(79)
Southwest	0.9x	0.77	x	2.88	x	44.07		0.63	x	0.7	=	38.79	(79)
Southwest	0.9x	0.77	x	2.08	x	44.07		0.63	x	0.7	=	28.01	(79)
Southwest	0.9x	0.77	x	2.88	x	44.07		0.63	x	0.7	=	38.79	(79)
Southwest	0.9x	0.77	x	2.08	x	44.07		0.63	x	0.7	=	28.01	(79)
Southwest	0.9x	0.77	x	5.13	x	31.49		0.63	x	0.7	=	49.37	(79)
Southwest	0.9x	0.77	x	9.45	x	31.49		0.63	x	0.7	=	90.94	(79)
Southwest	0.9x	0.77	x	2.88	x	31.49		0.63	x	0.7	=	27.71	(79)
Southwest	0.9x	0.77	x	2.08	x	31.49		0.63	x	0.7	=	20.02	(79)
Southwest	0.9x	0.77	x	2.88	x	31.49		0.63	x	0.7	=	27.71	(79)
Southwest	0.9x	0.77	x	2.08	x	31.49		0.63	x	0.7	=	20.02	(79)
Northwest	0.9x	0.77	x	2.7	x	11.28	x	0.63	x	0.7	=	9.31	(81)
Northwest	0.9x	0.77	x	1.3	x	11.28	x	0.63	x	0.7	=	4.48	(81)
Northwest	0.9x	0.77	x	2.7	x	22.97	x	0.63	x	0.7	=	18.95	(81)
Northwest	0.9x	0.77	x	1.3	x	22.97	x	0.63	x	0.7	=	9.12	(81)
Northwest	0.9x	0.77	x	2.7	x	41.38	x	0.63	x	0.7	=	34.14	(81)
Northwest	0.9x	0.77	x	1.3	x	41.38	x	0.63	x	0.7	=	16.44	(81)
Northwest	0.9x	0.77	x	2.7	x	67.96	x	0.63	x	0.7	=	56.07	(81)
Northwest	0.9x	0.77	x	1.3	x	67.96	x	0.63	x	0.7	=	27	(81)
Northwest	0.9x	0.77	x	2.7	x	91.35	x	0.63	x	0.7	=	75.37	(81)
Northwest	0.9x	0.77	x	1.3	x	91.35	x	0.63	x	0.7	=	36.29	(81)
Northwest	0.9x	0.77	x	2.7	x	97.38	x	0.63	x	0.7	=	80.36	(81)