SAP 10 Consultancy

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1.0 INTRODUCTION

1.1 UK Building Compliance have been appointed to undertake research into the effects of the updated SAP 10 methodology on a variety of potential solutions.

1.2 Firstly, SAP 10 will introduce updated Carbon Emission Factors, as described below.

Change in CO_2 emissions factors

	Emissions kg CO_2e per kWh		
	SAP 2012	**Draft SAP 2016**	**Draft SAP 10**
Mains gas	0.216	0.2077	0.210
Electricity	0.519	0.398	0.233

(Source: ICIBSE Journal, *How lower carbon factors in SAP will change heating design* [ONLINE] Available at: https://www.cibsejournal.com/general/sap-in-building-regulations/ [Accessed November 2021).

1.3 Whilst gas emissions remain largely unchanged, there has been a dramatic decline in the carbon factor associated with National Grid supplied electricity. This ensures that the Dwelling Emission Rate (DER) will now be more reflective of real-life performance for these systems.

1.4 A new compliance matrix 'Primary Energy' (DPER) will also be introduced - aimed at reducing energy usage overall and to limit running costs.

1.5 The Dwelling Fabric Energy Efficiency (DFEE) criteria will also be made stricter. For example, the notional external wall standard will be reduced to 0.18, with windows down to 1.2.

1.6 This means that 150mm wall cavities will likely be required to achieve DFEE compliance.

1.7 Whilst SAP 10 Beta is a draft tool and is subject to further updates before its full release, it gives a much more comprehensive insight into SAP 10 performance compared with converting the emission factors alone.

1.8 This is because SAP 10 Beta incorporates the planned wider methodological changes, as well as the uplift in Part L standards.

2.0 METHODOLOGY

2.1 Initial SAP Calculations were carried out using the SAP 10 Beta software version 1.0.0.37.

These calculations were carried out based on typical two-story dwellings of the following nature;

- 2 Bedroom semi-detached property approx. 80m^2
- 3 Bedroom detached property approx. 90m^2
- 4 Bedroom detached property approx. 120m^2

2.2 Each dwelling type was then modelled under the following scenarios;

- Scenario 1: Gas Central Heating/Hot Water & Solar PV
- Scenario 2: Curv 360 ASHP Hot Water Cylinder & Infrared Room Heaters
- Scenario 3: Curv 360 Infrared Room Heaters, Electric Immersion Hot Water & Solar PV
- Scenario 4: Gas Central Heating & Curv 360 ASHP Hot Water Cylinder
- Scenario 5: Curv 360 ASHP Hot Water Cylinder / Infrared Room Heaters PV & Solar PV

2.3 The following U-Values were used in order to reflect the expected residential construction standards after the June 2022 Part L uplift;

- Ground Floor - 0.12 W/m^2K.
- Exposed Floor - 0.17 W/m^2K
- External Walls - 0.18 W/m^2K
- Cold Roof - 0.10 W/m^2K
- Ext Doors - 1.00 W/m^2K
- Windows - 1.20 W/m^2K
- Air Permeability - 5.00 m^3/hm^2

2.4 Accredited Construction Details (ACDs) were assumed to reflect current typical residential construction standards.

2.5 For comparative purposes, the above specification was applied to all house types/ scenarios (where relevant).

2.6 SAP Calculations were then carried out in order to assess each scenario on the three main compliance criteria for SAP 10;

- Target Emission Rate (TER) versus Dwelling Emission Rate (DER)
- Target Fabric Energy Efficiency (TFEE) versus Dwelling Fabric Energy Efficiency (DFEE)
- Target Primary Energy Rating (TPER) versus Dwelling Primary Energy Rating (DPER)

3.0 LIMITATIONS

3.1 Whilst the outlined methodology allows for a very good prediction of SAP 10 performance, it should be noted that there are possible limitations to this strategy.

3.2 Whilst the SAP 10 Beta tool is significantly more comprehensive than previous indications and is very close to being finalised, it is not yet the completed version.

3.3 There is a possibility that changes to the SAP methodology could be made between the transition from SAP 10 Beta and the release of the final SAP 10 software

3.6 Therefore, the figures provided in this report should be used for indicative purposes only and are still subject to some change.

4.0 SCENARIO 1

Gas Central Heating / Hot Water & Solar PV

4.1 The following data have been used in order to model this scenario

Gas Heating:

- 2 Bedroom: Worcester Greenstar 30i Combi Boiler
- 3 Bedroom: Worcester System 12i Boiler
- 4 Bedroom: Worcester System 12i Boiler

Hot Water:

- 2 Bedroom: N/A
- 3 Bedroom: 150l Cylinder & Declared Loss Factor 1.27 kWh/day
- 4 Bedroom: 210l Cylinder & Declared Loss Factor 1.7 kWh/day

Solar PV:

All based on a 45 degree, south facing roof

- 2 Bedroom: 1.5 kWp
- 3 Bedroom: 1.8 kWp
- 4 Bedroom: 2.4 kWp

4.2 Table 4.2 outlines the initial results of SAP 2012 performance.

	TER	DER	Pass / Fail Margin
2 Bedroom	17.99	11.55	+ 35.8%
3 Bedroom	18.24	10.03	+ 45%
4 Bedroom	17.27	8.93	+ 48.3%

4.3 Table 4.3 outlines the updated SAP 10 performance, including Primary Energy.

	TER	DER	Pass / Fail Margin
2 Bedroom	11.64	12.23	5.06%
3 Bedroom	12.86	12.8	+ 0.5%
4 Bedroom	12.42	11.99	+ 3.5%
	TPER	DPER	
2 Bedroom	45.65	55.54	17.81%
3 Bedroom	52.06	57.87	10.04%
4 Bedroom	46.80	52.84	11.43%

5.0 SCENARIO 2

Curv 360 ASHP Hot Water Cylinder & Infrared Room Heaters

5.1 The following data have been used in order to model this scenario

Heating:

- Input: Electric Room Heater
- Controls: Programmer & Room thermostats
- Efficiency: 100%

Hot Water:

- Input: Curv 360 Limited HP200M3
- Efficiency: 268.3% (NPCDB approved)
- Loss Factor: 1.170 (kWh/day)

5.2 Table 5.2 outlines the initial results of SAP 2012 performance.

	TER	DER	Pass / Fail Margin
2 Bedroom	25.94	26.33	**1.5%**
3 Bedroom	26.91	27.22	**1.15%**
4 Bedroom	25.58	27.42	**7.19%**

5.3 Table 5.3 outlines the updated SAP 10 performance, including Primary Energy.

	TER	DER	Pass / Fail Margin
2 Bedroom	12.27	6.50	**+ 47%**
3 Bedroom	12.91	6.94	**+ 46.2%**
4 Bedroom	12.46	7.02	**+ 43.7%**
	TPER	DPER	
2 Bedroom	49.03	71.75	**31.67%**
3 Bedroom	52.35	76.56	**31.62%**
4 Bedroom	52.24	77.49	**32.58%**

6.0 SCENARIO 3

Curv 360 Infrared Room Heaters, Electric Immersion Hot Water & Solar PV

6.1 The following data have been used in order to model this scenario

Heating:

- Input: Electric Room Heater
- Controls: Programmer & Room thermostats
- Efficiency: 100%

Hot Water:

Input: Electric Immersion, Cylinder in Heated Space & Cylinderstat

- 2 Bedroom: 120l Cylinder & Declared Loss Factor 1.06 kWh/day
- 3 Bedroom: 150l Cylinder & Declared Loss Factor 1.27 kWh/day
- 4 Bedroom: 210l Cylinder & Declared Loss Factor 1.7 kWh/day

Solar PV:

All based on a 45 degree, south facing roof

- 2 Bedroom: 1.5 kWp
- 3 Bedroom: 1.8 kWp
- 4 Bedroom: 2.4 kWp

6.2 Table 6.2 outlines the initial results of SAP 2012 performance.

	TER	DER	Pass / Fail Margin
2 Bedroom	25.66	23.04	+ 10.2%
3 Bedroom	26.76	24.29	+ 9.2%
4 Bedroom	25.60	23.32	+ 8.9%

6.3 Table 6.3 outlines the updated SAP 10 performance, including Primary Energy.

	TER	DER	Pass / Fail Margin
2 Bedroom	12.09	6.19	+ 48.8%
3 Bedroom	12.82	6.48	+ 49.5%
4 Bedroom	12.48	6.19	+ 50.4%
	TPER	DPER	
2 Bedroom	48.05	68.35	29.7%
3 Bedroom	51.86	71.50	27.47%
4 Bedroom	52.31	68.27	23.38%

7.0 SCENARIO 4

Gas Central Heating, Curv 360 ASHP Hot Water Cylinder & Solar PV

7.1 The following data have been used in order to model this scenario

Gas Heating:

- 2 Bedroom: Worcester System 12i Boiler
- 3 Bedroom: Worcester System 12i Boiler
- 4 Bedroom: Worcester System 12i Boiler

Hot Water:

Input: Curv 360 Limited HP200M3
Efficiency: 268.3% (NPCDB approved)
Loss Factor: 1.170 (kWh/day)

Solar PV:

All based on a 45 degree, south facing roof

- 2 Bedroom: 1.5 kWp
- 3 Bedroom: 1.8 kWp
- 4 Bedroom: 2.4 kWp

7.2 Table 7.2 outlines the initial results of SAP 2012 performance.

	TER	DER	Pass / Fail Margin
2 Bedroom	17.71	7.11	+ 59.9%
3 Bedroom	18.3	7.32	+ 60%
4 Bedroom	17.31	6.47	+ 62.6%

7.3 Table 7.3 outlines the updated SAP 10 performance, including Primary Energy.

	TER	DER	Pass / Fail Margin
2 Bedroom	12.27	7.73	+ 37%
3 Bedroom	12.91	8.59	+ 33.5%
4 Bedroom	12.47	8.79	+ 29.5%
	TPER	DPER	
2 Bedroom	49.03	39.06	+ 20.33%
3 Bedroom	52.35	42.27	+ 19.26%
4 Bedroom	52.24	41.31	+ 20.92%
	Annual Running Cost – Regulated Energy		
2 Bedroom	£123.06		
3 Bedroom	£111.77		
4 Bedroom	£73.21		

8.0 SCENARIO 5

Curv 360 ASHP Hot Water Cylinder / Infrared Room Heaters PV & Solar PV

8.1 The following data have been used in order to model this scenario

Heating:

- Input: Electric Room Heater
- Controls: Programmer & Room thermostats
- Efficiency: 100%

Hot Water:

- Input: Curv 360 Limited HP200M3
- Efficiency: 268.3% (NPCDB approved)
- Loss Factor: 1.170 (kWh/day)

Solar PV: All based on a 45 degree, south facing roof

- 2 Bedroom: 1.5 kWp
- 3 Bedroom: 1.8 kWp
- 4 Bedroom: 2.4 kWp

5.2 Table 5.2 outlines the initial results of SAP 2012 performance.

	TER	DER	Pass / Fail Margin
2 Bedroom	25.94	18.16	+ 30%
3 Bedroom	26.91	18.65	+30.7%
4 Bedroom	25.58	18.59	+ 27.3%

5.3 Table 5.3 outlines the updated SAP 10 performance, including Primary Energy as well as the predicted running costs for regulated energy (taken from Draft EPC Worksheets).

	TER	DER	Pass / Fail Margin
2 Bedroom	12.27	4.36	+ 64.5%
3 Bedroom	12.91	4.69	+ 63.7%
4 Bedroom	12.46	4.71	+ 62.2%
	TPER	DPER	
2 Bedroom	49.03	48.12	+ 1.86%
3 Bedroom	52.35	51.78	+ 1.09%
4 Bedroom	52.24	51.96	+ 0.54%
	Annual Running Cost – Regulated Energy		
2 Bedroom	£320.57		
3 Bedroom	£404.58		
4 Bedroom	£548.90		

9.0 CONCLUSION

9.1 Scenario 1 becomes significantly less favourable under SAP 10 within the TER/DER figures, as well as failing significantly within the TPER/DPER criteria.

9.2 Scenario 2 becomes significantly more favourable under SAP 10 within the TER/DER figures, however also fails on the TPER/DPER criteria.

9.3 Scenario 3 again becomes significantly more favourable under SAP 10 within the TER/DER figures, however fails on the TPER/DPER criteria.

9.4 Scenario 4 becomes less favourable under SAP 10 within the TER/DER figures (although still passes), however manages to achieve compliance on the TPER/DPER criteria too.

9.5 Scenario 5 becomes significantly more favourable under SAP 10 within the TER/DER figures, and also passes marginally on the TPER/DPER criteria.

9.6 As expected – scenarios which involve electric heating/ hot water provision perform considerably more favorable under the TER/DER criteria, when calculated under SAP 10.

9.7 However, the newly introduced TPER/DPER criteria poses the biggest challenge to achieving compliance across all scenarios.

9.8 All scenarios involving gas fail substantially on this criterion, apart from scenario 4. This backs up the widely held speculation that gas will fall largely out of favour for new buildings.

9.9 Electricity will become significantly more favourable, however – will also need to be accompanied by solar PV in order to achieve compliance.

9.10 Furthermore, highly efficient forms of electricity such as heat pumps will need to play a role. Scenarios which utilise only standard electric systems for space heating and hot water will fail, even with the additional of solar PV.