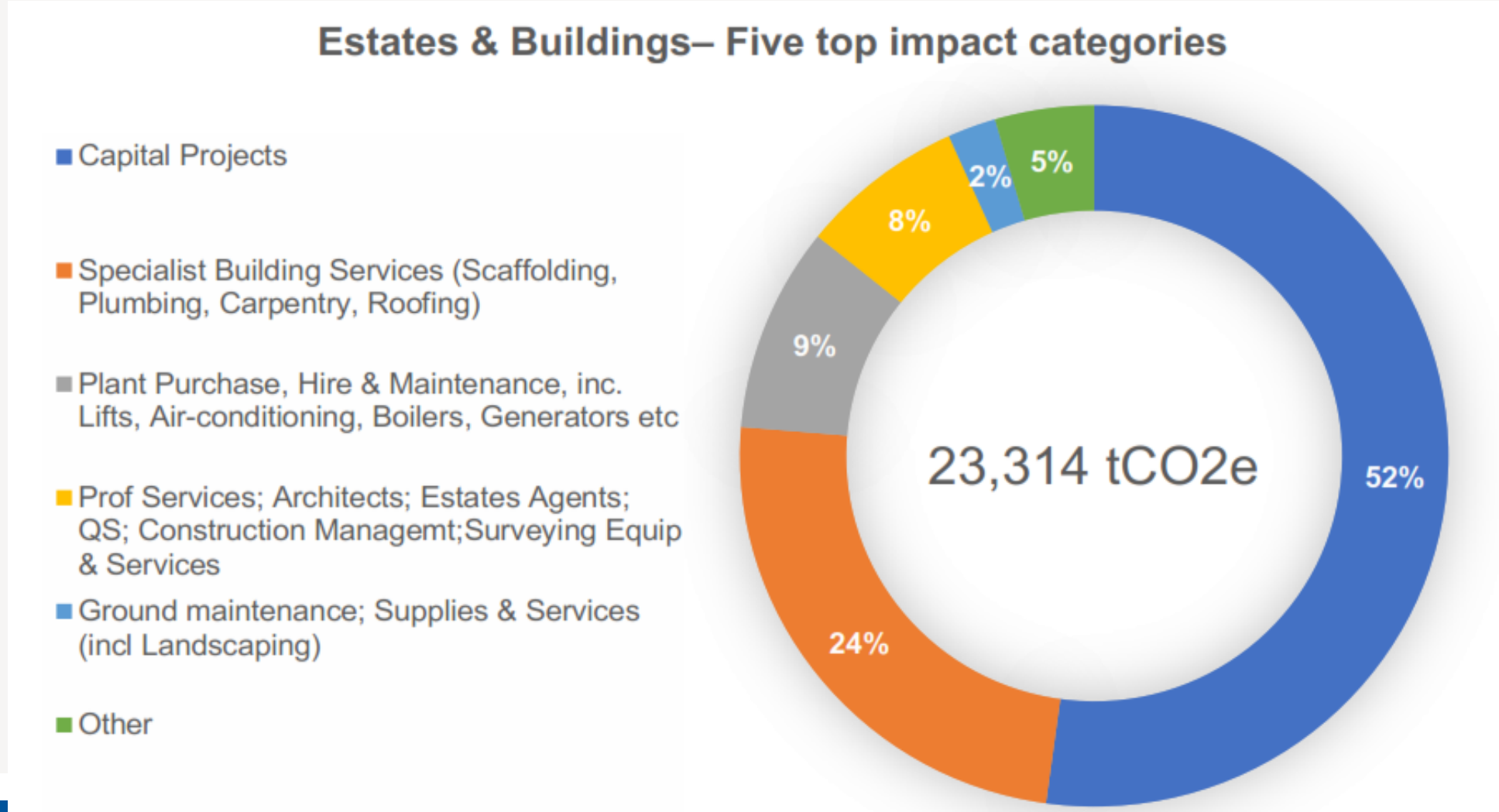
University of St Andrews | FOUNDED 1413

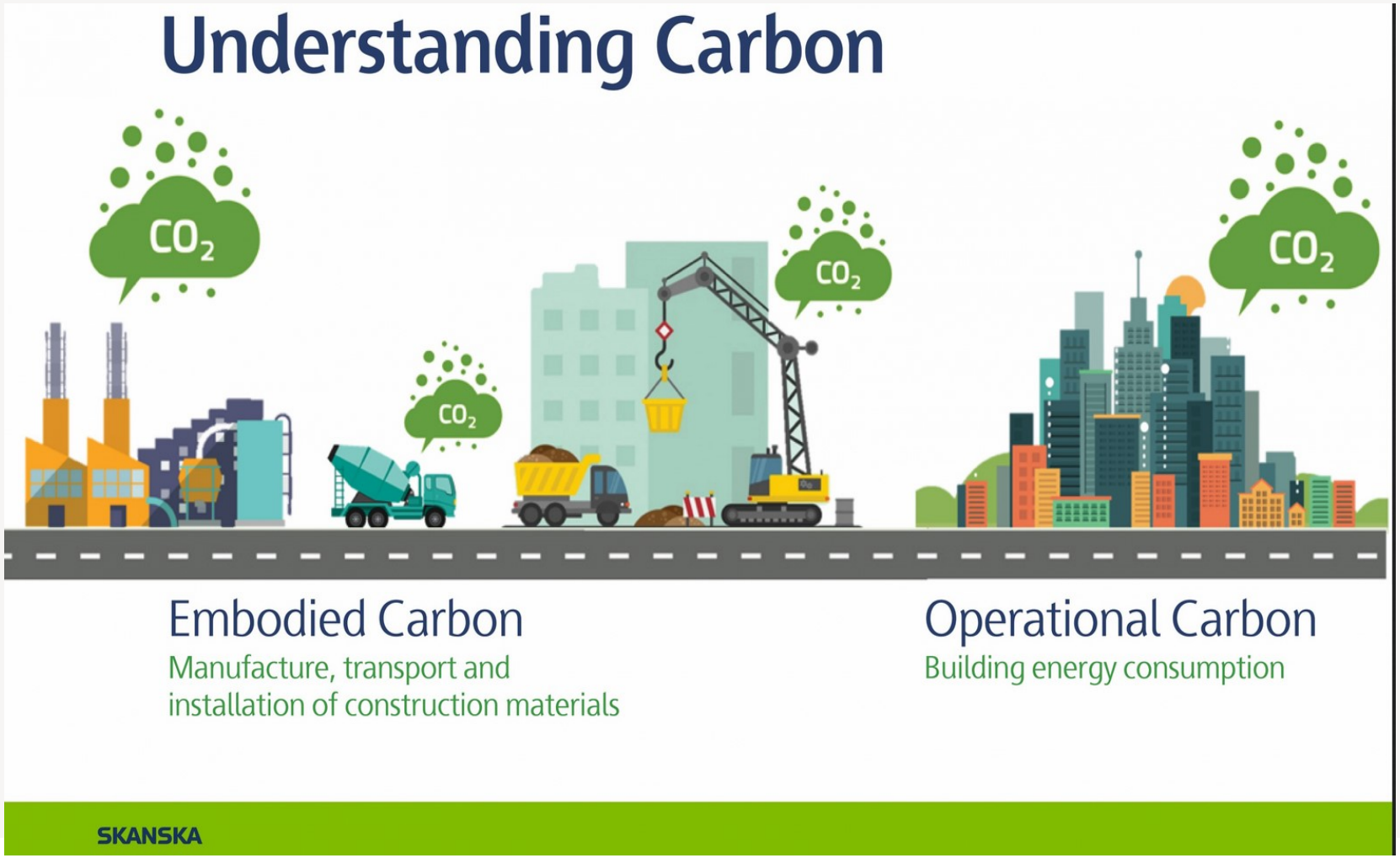
Scope 3 Procurement Emissions Project

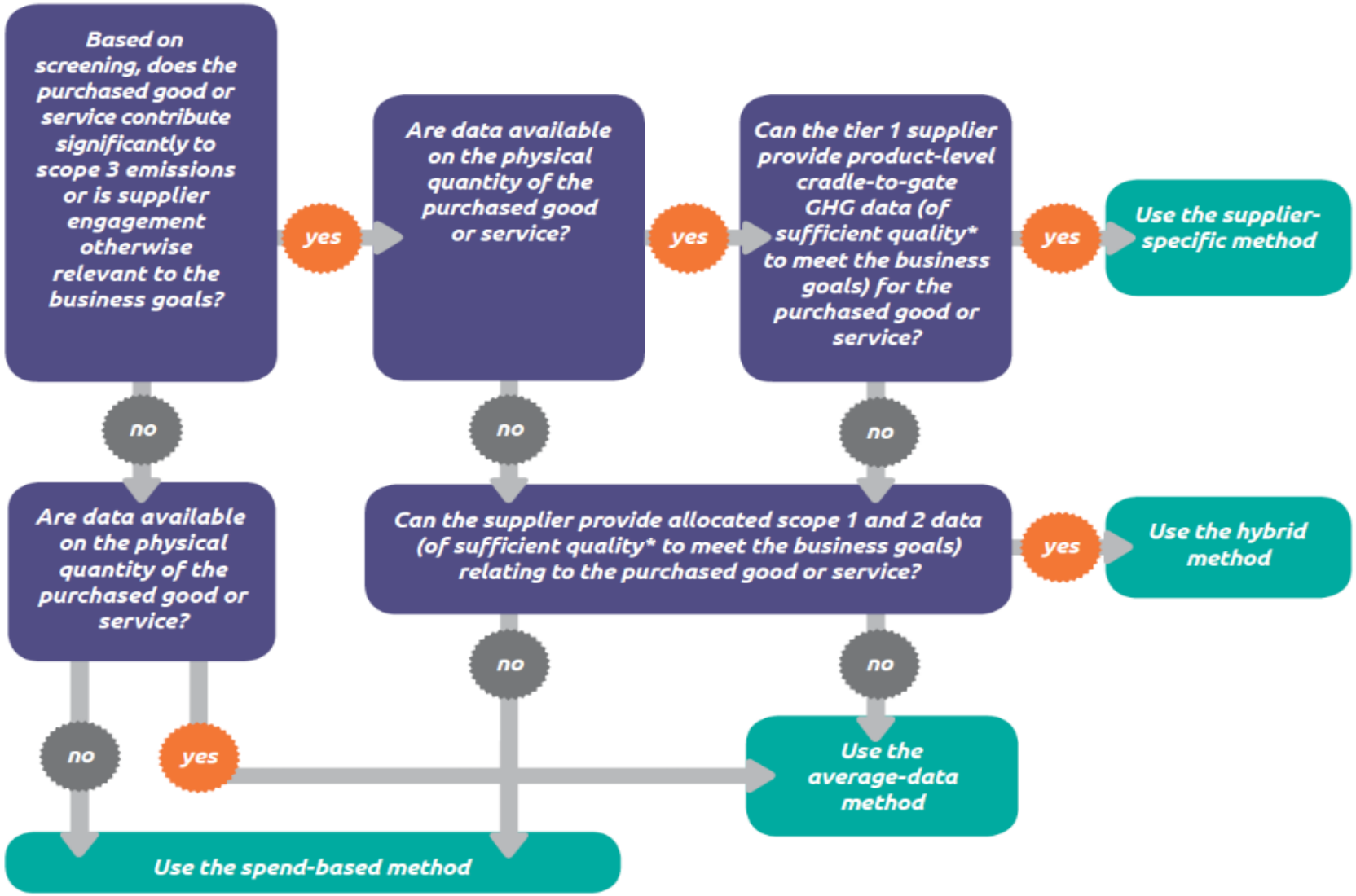
David Stutchfield, Sustainability Manager

Estates Carbon 2018-2019 – HESCET output



Procurement Carbon





GHG Protocol's Decision Tree for Choosing Appropriate Calculation Method for the Scope 3 Category of "Purchased Goods and Services" (WRI & WBCSD, 2013)

Single project – spend based method

CO2e Emissions from the *Project using the Spend-based Method*

Sum of value of purchased goods for the contractor's Bill of Quantities.	project (£) from	10,344,511
DEFRA emission factor for construction corresponding to the Capital Projects subcategory of Estates & Buildings (kgCO2e/£)		0.5561
CO2e emissions from the	**project (tonnes)**	**5,752.14**

Average data method

Based on the details Bill of Quantities supplied by the Construction Contractor

	Qty	Unit	Rate	£ p
BILL 01 - PRELIMINARIES			£	1,799,214.79
BILL 02 - PROVISIONAL SUMS			£	1,526,200.00
BILL 03 - ENABLING WORKS/ ALTERATIONS/ DEMOLITION			£	311,561.34
BILL 04 - EARTHWORKS & EXCAVATIONS			£	53,786.33
BILL 05 - IN-SITU CONCRETE			£	308,198.95
BILL 06 - MASONRY			£	25,123.83

Bill of Quantities - detail

BILL NO. 05					CONCRETE WORK	
		Qty	Unit	Rate	£	p
	E20 FORMWORK FOR IN SITU CONCRETE					
	FORMWORK; BASIC FINISH					
	Perimeter edges of slabs					
a	not exceeding 250 high	182	m	13.13	2,389	.66
	Sides of upstands					
b	250 to 500 high	65	m	29.24	1,900	.60
c	500 to 1 m high	65	m	58.49	3,801	.85
	Steps in top surface					
d	250 to 500 high	64	m	24.62	1,575	.68
	E30 REINFORCEMENT FOR IN SITU CONCRETE					
	HIGH YIELD STEEL BAR REINFORCEMENT					
	Straight bars					
e	H10	0.32	t	1330.26	425	.68
	Bent bars					
f	H10	0.48	t	1330.26	638	.52
	STEEL FABRIC REINFORCEMENT					
	Square mesh fabric; slabs					
g	A393; 6.16Kg/m2; 400 side and 400 end laps	2473	m2	7.10	17,558	.30

ICE Database Tool – based on Environmental Product Declarations

	A	B	C	D	E	F	G	H
1	Material Classification			Quantity and Units		Embodied Carbon		
2	Material	Sub-material	ICE DB Name	Quantity of declared unit	Units of declared unit	Embodied Carbon (kg CO2e per declared unit)	CO2e Emissions of Material (kg CO2e)	CO2e Emissions of Material (tCO2e)
3	Concrete	ncrete, GEN 1	Concrete GEN1 with average UK additions cement	183	m3	212.54	38,895.32	38.90
4	Concrete	Concrete, 40/50	Concrete RC40/50 with average UK additions cement	197	m3	379.51	74,764.02	74.76
5	Steel	Steel, Bar and Rod	Steel, Rebar	10200	kg	1.99	20,298.00	20.30
6	Concrete	Concrete, GEN 1	Concrete GEN1 with average UK additions cement	8	m3	212.54	1,700.34	1.70
7	Concrete	Concrete, 35/45	Concrete RC35/45 with average UK additions cement	286	m3	354.65	101,429.57	101.43
8	Steel	Steel, Bar and Rod	Steel, Rebar	800	kg	1.99	1,592.00	1.59
9	Concrete	Concrete, GEN 1	Concrete GEN1 with average UK additions cement	4	m3	212.54	850.17	0.85
10	Concrete	Concrete, 40/50	Concrete RC40/50 with average UK additions cement	51	m3	379.51	19,355.15	19.36
11	Steel	Steel, Bar and Rod	Steel, Rebar	4260	kg	1.99	8,477.40	8.48
12	Concrete	Concrete, 28/35	Concrete RC28/35 with average UK additions cement	136	m3	300.56	40,876.28	40.88
13	Steel	Steel, Bar and Rod	Steel, Rebar	5690	kg	1.99	11,323.10	11.32
14	Concrete	Concrete, 28/35	Concrete RC28/35 with average UK additions cement	39	m3	300.56	11,721.87	11.72
15	Steel	Steel, Bar and Rod	Steel, Rebar	1570	kg	1.99	3,124.30	3.12
16	Concrete	Concrete, block wall	100 mm thickness wall, single skin concrete block, solid, high de	6	m2	19.52	117.10	0.12
17	Concrete	Concrete, block wall	215 mm thickness wall, single skin concrete block, solid, high de	108	m2	42.03	4,539.73	4.54
18	Concrete	Concrete, GEN 1	Concrete GEN1 with average UK additions cement	7	m3	212.54	1,487.80	1.49
19	Concrete	Concrete, block wall	100 mm thickness wall, single skin concrete block, solid, high de	14	m2	19.52	273.24	0.27
20	Steel	Steel, Section	Steel, Section	120020	kg	1.55	186,031.00	186.03
21	Steel	Steel, Section	Steel, Section	164920	kg	1.55	255,626.00	255.63
22	Steel	Steel, Sheet galvanised	Steel, hot-dip galvanized steel	1430	kg	2.76	3,946.80	3.95
23	Steel	Steel, Sheet galvanised	Steel, hot-dip galvanized steel	22822.80	kg	2.76	62,990.93	62.99
24	Timber	Timber, General	Timber - Average of all data - No Carbon Storage	24319.82	kg	0.49	11,985.44	11.99
25	Steel	Steel, Sheet galvanised	Steel, hot-dip galvanized steel	2457	kg	2.76	6,781.32	6.78
26	Glass	Glass, Toughened	Toughened, 12 mm of glass, ex frame	56.70	m2	50.02	2,835.96	2.84
27	Glass	Glass, Glazing triple	Triple glazed unit, 18 mm of glass, ex cavity and ex frame	56.70	m2	78.61	4,457.45	4.46
28	Timber	Timber, Plywood	Timber, Plywood - No Carbon Storage	14089.26	kg	0.68	9,601.33	9.60
29	Timber	Timber, Softwood	Timber, Softwood - No Carbon Storage	124505.65	kg	0.26	32,694.49	32.69
30	Timber	Timber, Fibreboard	Timber, Fibreboard - No Carbon Storage	232.20	kg	0.72	166.10	0.17
31	Steel	Steel, plate	Steel, Plate	19453.42	kg	2.46	47,855.42	47.86
32	Cement	Cement, Mortar	Mortar or screed (1:4 cement:sand mix) (Using average UK Ceme	57204	kg	0.15	8,547.81	8.55
33	Steel	Steel, Sheet galvanised	Steel, hot-dip galvanized steel	316747.5	kg	2.76	874,223.10	874.22
34	AggregateSand	AggregateSand, General sand	Aggregates and sand, general UK, mixture of land won, marine, s	1008000	kg	0.01	7,529.40	7.53
35	Asphalt	Asphalt, for roads	Road surface, asphalt, 3% (bitumen) binder content (by mass)	309	m2	14.20	4,386.95	4.39
36	Concrete	Concrete, Pre-Cast	precast concrete paving (Blocks, Slabs, Channels and Kerbs)	86104	kg	0.13	11,288.59	11.29

Please select a material

Results from the Tool Developed from the ICE Database

Breakdown of CO2 emissions by material

Material	Sub-material	Percentage of Category Total CO2e Emissions of Material (tCO2e)
Steel	Steel, Sheet galvanised	63.24%
	Steel, Section	27.32%
	Steel, fabric reinforcement	3.46%
	Steel, plate	2.96%
	Steel, Bar and Rod	2.80%
	Steel, Sheet stainless	0.21%
Steel Total		**70.22%**
Concrete	Concrete, 35/45	31.54%
	Concrete, 40/50	26.87%
	Concrete, 28/35	14.90%
	Concrete, Pre-Cast	12.84%
	Concrete, GEN 1	12.46%
	Concrete, block wall	1.40%
Concrete Total		**15.34%**
Glass	Glass, Insulated	90.89%
	Glass, Glazing triple	5.57%
	Glass, Toughened	3.54%
Glass Total		**3.48%**

Supplier-specific Environmental Product Declaration - Kingspan

Environmental Product Declaration - Kingspan

Table 6: Environmental information for wall panel: KS1000RW, 40mm thick, R2.35.

Impact Category	A1 - 3	A4	A5	B2	C1	C2	C3	C4	D
Potential Environmental Impacts									
Global warming ($kgCO_2$ eq)	44.6	3.57	0.743	2.90	6.35E-04	0.405	0.00	0.0615	-5.06
Ozone depletion (kgCFC11 eq)	2.44E-06	1.39E-07	2.68E-08	7.68E-08	1.14E-10	1.41E-08	0.00	4.98E-09	-2.51E-07
Acidification of land and water ($kgSO_2$ eq)	5.72E-01	1.22E-02	6.31E-03	1.02E-02	4.77E-06	1.31E-03	0.00	2.48E-04	-1.57E-02
Eutrophication ($kgPO_4^{3-}$ eq)	1.68E-01	3.30E-03	1.82E-03	2.43E-03	1.10E-06	3.56E-04	0.00	6.25E-05	-9.81E-03
Photochemical ozone creation (kgC_2H_2 eq)	1.68E-01	7.43E-04	2.65E-04	3.82E-04	1.26E-07	8.45E-05	0.00	1.53E-05	-4.76E-03
Depletion of abiotic resources (elements) (kgSb eq)	1.49E-03	1.57E-05	1.51E-05	9.25E-07	2.00E-10	2.01E-06	0.00	2.53E-07	-3.92E-06
Depletion of abiotic resources (fossil) (MJ)	667.21	53.5	6.65	41.1	0.00897	6.22	0.00	0.89	-64.8
Use of Resources									
Renewable primary energy (excl. raw materials) (MJ)	35.9	0.691	0.917	0.453	5.16E-05	0.0733	0.00	0.0108	0.204
Renewable primary energy (raw materials) (MJ)	3.46								
Total use of renewable primary energy (MJ)	**39.40**	**0.691**	**0.917**	**0.453**	**5.16E-05**	**0.0733**	**0.00**	**0.0108**	**0.204**
Non-renewable primary energy (excl. raw materials) (MJ)	661.9	54.0	6.607	43.7	0.0097	6.25	0.0	0.93	-41.4
Non-renewable primary energy (raw materials) (MJ)									
Total use of non-renewable primary energy (MJ)	**661.9**	**54.0**	**6.607**	**43.7**	**0.0097**	**6.25**	**0.0**	**0.93**	**-41.4**

Comparison between Supplier-specific and Average-data Methods

Material	Sub-material	ICE DB Name	Quantity	Unit	Embodied Carbon Factor	tCO2e	Difference
a) From EPD							
Insulation	Insulation, wall panel	Kingspan wall panel system	320.00	m2	44.6	**14.27**	
b) From ICE							
Insulation	Insulation, wall panel	Insulation foam (26%)	856.96	kg	4.26	3.65	
Steel	Steel, Sheet	Steel, finished cold-rolled coil (63%)	2,076.48	kg	2.73	5.67	
					Total	**9.32**	**-35%**

Supplier Specific Method

- Requires contractor to collect EPDs from all material suppliers
- Must be specified at beginning of project
- Only large contractors have sufficient experience
- Additional cost

It has to be a mandatory requirement (…) We could do it for them, all they have to do is ask. (Head of Procurement, Organisation 3)

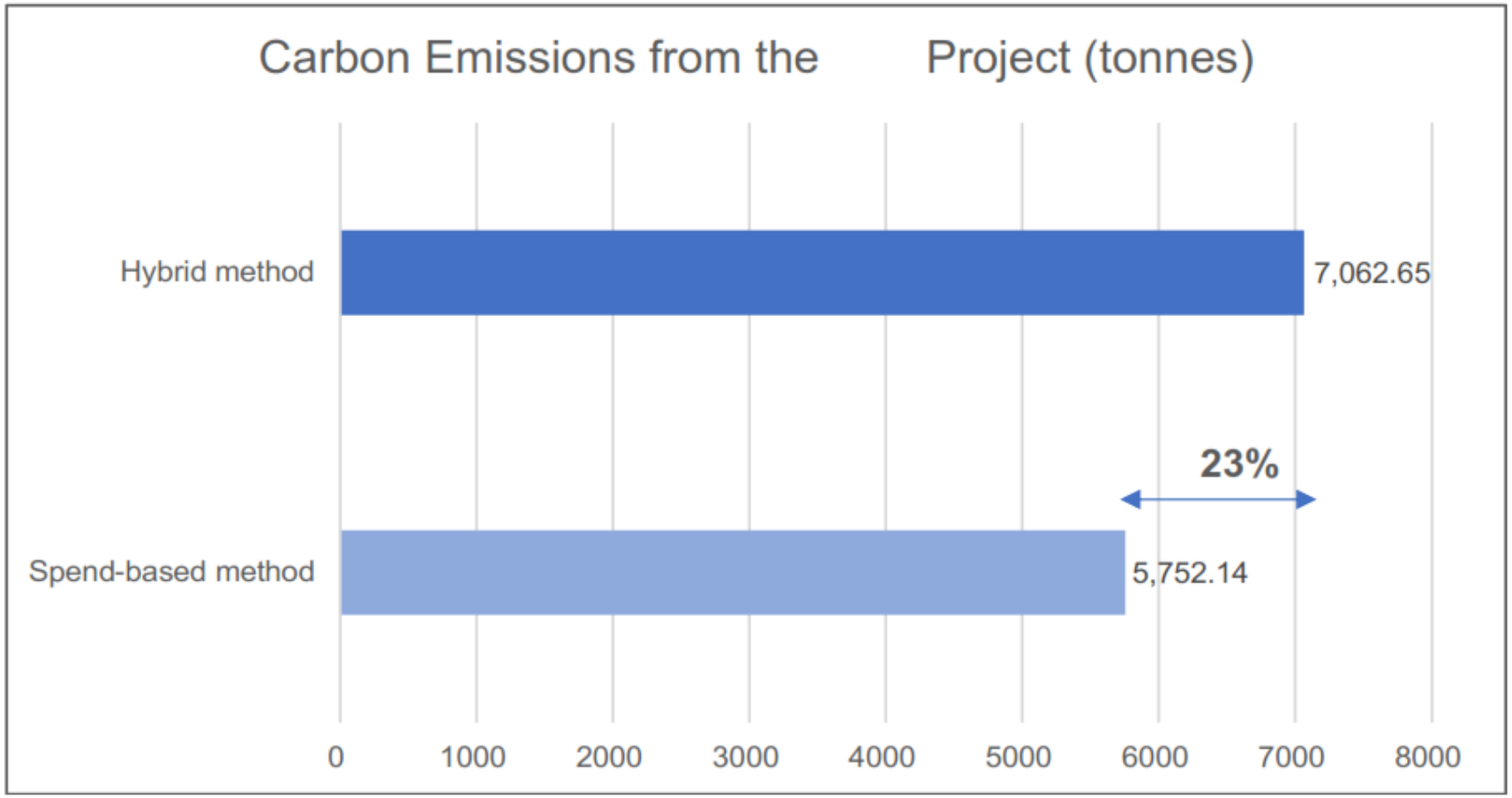
On site direct emissions

Construction Stage Emissions Type	Total Carbon Emissions (tCO2e)
Electricity (from site electricity metering)	71.55
Fuel (from diesel generators, mobile plant & equipment)	47.95
Transportation of construction materials and waste	18.00
Water	0.38
Total	137.88

Result of Hybrid method

Carbon Emissions from the [redacted] Project	tCO2e
Bottom-up emissions data	2,440.01
Top-down emissions data	4,622.64
Total	**7,062.65**

Comparison of calculation methods



Overall Total of CO2e Emissions from Hybrid vs. Spend-based Method

Comparison of calculation methods

- We have looked at all calculation methods for a single project
- A hybrid approach is the most practical
- For a project in St Andrews, more resolution leads to higher emissions
- All calculation methods in same ballpark

Lessons learnt

- Hard to do this retrospectively – needs to be specified at start of project
- For a traditional construction building spend based methods are OK

Summary

- **Key questions going forwards include;**
  - How can we improve carbon data and build these into our baseline reporting across the sector?
  - How do we embed carbon measurement into our procurement process and decision making?
  - How can Scottish Procurement and APUC take the lead by building carbon disclosure through all future contracts as a mandatory criteria?

The climate change reporting duties and sustainable procurement duties, to me, they go hand in hand. At the moment, they may be operating somewhat separately.

(Director, Organisation 4)