



## Exploration of Building Energy and Environmental Assessment Certification (BEEAC) Tools

On 14th November 2018, Emeka Efe Osaji delivered a CIBSE ASHRAE Group webinar, entitled “Enhancing Building Energy and Environmental Assessment Certification (BEEAC)”. It is available at: <https://www.cibseashrae.org/presentations/Osaji141118.pdf>

BEEAC tools share an underlying principle to facilitate: **(1) Transparency; (2) Certification; (3) Rating; and (4) Efficiency** in the energy performance of buildings. Table 1 illustrates “Building Energy and Environmental Assessment Certification (BEEAC) Tools” while Table 2 illustrates “Global Coverage of BEEAC Tools”.

**Table 1: Building Energy and Environmental Assessment Certification (BEEAC) Tools**

(Source: Emeka Efe Osaji)

Number of Countries		Building Energy & Environmental Assessment Certification Tools	Data Source & Reliability
1	Antarctica	(1.1) The Passivhaus Standard	BRE Ltd (2018d)
2	Australia	(2.1) National Australian Built Environment Rating System (NABERS) (2.2) Green Star (2.3) The Passivhaus Standard	NABERS (2010) GBCA (2011) BRE Ltd (2018d); Passive House Institute (2015b)
3	Austria	(3.1) DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen) (3.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
4	Belgium	(4.1) The Passivhaus Standard	Passive House Institute (2015b)
5	Bangladesh	(5.1) LEED	USGBC (2017)
6	Brazil	(6.1) AQUA (6.2) LEED	Gomes <i>et al.</i> (2008) Holmes (2014)
7	Bulgaria	(7.1) DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen)	DGNB GmbH (2018)

		(7.2) The Passivhaus Standard	Passive House Institute (2015b)
8	Canada	(8.1) BREEAM (8.2) DGNB (8.3) ENERGY STAR (8.4) Green Globes (8.5) LEED (8.6) The Passivhaus Standard	BRE Ltd (2017a); BRE Ltd (2017b); Dixon <i>et al.</i> (2007) DGNB GmbH (2018) EPA (2018) Green Building Initiative (2018); Green Globes (2011) CaGBC (2011); Holmes (2014); USGBC (2017) BRE Ltd (2018d); Passive House Institute (2015b)
9	Chile	(9.1) The Passivhaus Standard	Passive House Institute (2015b)
10	China	(10.1) DGNB (10.2) GBAS (Green Building Assessment System) (10.3) LEED (10.4) The Passivhaus Standard	DGNB GmbH (2018) Borong <i>et al.</i> (2007) Holmes (2014); USGBC (2017) BRE Ltd (2018d); Passive House Institute (2015b)
11	Colombia	(11.1) LEED	USGBC (2017)
12	Costa Rica	(12.1) LEED	USGBC (2017)
13	Croatia	(13.1) The Passivhaus Standard	Passive House Institute (2015b)
14	Cyprus	(14.1) The Passivhaus Standard	Passive House Institute (2015b)
15	Czech Republic	(15.1) DGNB (15.2) SBToolCZ (Czech Sustainable Building Tool) (15.3) The Passivhaus Standard	DGNB GmbH (2018) Hajek & Tywoniak (2008); Larsson (2015) Passive House Institute (2015b)
16	Denmark	(16.1) DGNB (16.2) SPeAR ® (Sustainable Project Appraisal Routine) (16.3) The Passivhaus Standard	DGNB GmbH (2018) Arup (2018); Earley (2013) Passive House Institute (2015b)
17	Dominican Republic	(17.1) LEED	USGBC (2017)
18	Estonia	(18.1) The Passivhaus Standard	Passive House Institute (2015b)
19	Finland	(19.1) PromisE (19.2) LEED (19.3) The Passivhaus Standard	DESA (2010) Holmes (2014) Passive House Institute (2015b)

<b>20</b>	France	(20.1) HQE (High Quality Environmental Standard) (20.2) The Passivhaus Standard	Association HQE (2011) Passive House Institute (2015b)
<b>21</b>	Germany	(21.1) DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen) (21.2) CEPHEUS (Cost Efficient Passive Houses as European Standards) (21.3) LEED (21.4) The Passivhaus Standard	DGNB GmbH (2018); GeSBC (2012) Passive House Institute (2011) Holmes (2014) BRE Ltd (2018d); Passive House Institute (2015a; 2015b)
<b>22</b>	Greece	(22.1) LEED (22.2) The Passivhaus Standard	USGBC (2017) Passive House Institute (2015b)
<b>23</b>	Hong Kong	(23.1) BEAM Plus (23.2) CEPAS (Comprehensive Environmental Performance Assessment Scheme for Buildings) (23.3) HK BEAM (Building Environmental Assessment Method)	Hong Kong GBC Ltd (2018) Buildings Department (2018) BEAM Society (2011)
<b>24</b>	Hungary	(24.1) DGNB (24.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
<b>25</b>	Iceland	(25.1) ENERGY STAR	EPA (2018)
<b>26</b>	India	(26.1) GRIHA (Green Rating for Integrated Habitat Assessment) (26.2) IGBC Green SEZ Rating System (26.3) LEED-INDIA for New Construction	GRIHA (2017) IGBC (2008a) Holmes (2014); IGBC (2008b); USGBC (2017)
<b>27</b>	Indonesia	(27.1) Greenship Existing Building (27.2) Greenship New Building (27.3) The Passivhaus Standard	GBC Indonesia (2010) GBC Indonesia (2010) Passive House Institute (2015b)
<b>28</b>	Ireland	(28.1) The Passivhaus Standard	Passive House Institute (2015b)
<b>29</b>	Italy	(29.1) LEED Italy (29.2) Protocollo Itaca (29.3) SBTool (29.4) The Passivhaus Standard	GBC Italy (2011) ITACA (2011) Larsson (2015) Passive House Institute (2015b)
<b>30</b>	Japan	(30.1) CASBEE (Comprehensive Assessment System for Built Environment Efficiency) (30.2) ENERGY STAR	JSBC (2006) EPA (2018)

		(30.3) The Passivhaus Standard	BRE Ltd (2018d); Passive House Institute (2015b)
31	Jordan	(31.1) EDAMA (an Arabic word meaning 'sustainability')	EDAMA (2009)
32	Kazakhstan	(32.1) The Passivhaus Standard	Passive House Institute (2015b)
33	Latvia	(33.1) The Passivhaus Standard	Passive House Institute (2015b)
34	Liechtenstein	(34.1) ENERGY STAR	EPA (2018)
35	Lithuania	(35.1) The Passivhaus Standard	Passive House Institute (2015b)
36	Luxembourg	(36.1) DGNB (36.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
37	Macedonia	(37.1) The Passivhaus Standard	Passive House Institute (2015b)
38	Malaysia	(38.1) GBI (Green Building Index)	GBI (2011)
39	Mexico	(39.1) LEED Mexico (39.2) The Passivhaus Standard	Bondareva (2005); USGBC (2017) Passive House Institute (2015b)
40	Moldova	(40.1) The Passivhaus Standard	Passive House Institute (2015b)
41	Monaco	(41.1) SBTool	Larsson (2015)
42	Mongolia	(42.1) DGNB	DGNB GmbH (2018)
43	Netherlands	(43.1) BREEAM-NL (43.2) DGNB (43.3) The Passivhaus Standard	DGBC (2011) DGNB GmbH (2018) Passive House Institute (2015b)
44	New Zealand	(44.1) Green Star NZ (44.2) Homestar (44.3) The Passivhaus Standard	NZGBC (2008a) NZGBC (2008b) Passive House Institute (2015b)
45	Norway	(45.1) ENERGY STAR (45.2) The Passivhaus Standard	EPA (2018) Passive House Institute (2015b)
46	Pakistan	(46.1) LEED	USGBC (2017)
47	Peru	(47.1) LEED	USGBC (2017)
48	Philippines	(48.1) BERDE (Building for Ecologically Responsive Design Excellence)	PHILGBC (2010); WGBC (2011)

49	Poland	(49.1) DGNB (49.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
50	Portugal	(50.1) LiderA - Sustainable Assessment System (50.2) SBTool (50.3) The Passivhaus Standard	LiderA (2012) Larsson (2015) Passive House Institute (2015b)
51	Republic of Korea (South Korea)	(51.1) GBCS (Green Building Certificate System) (51.2) LEED (51.3) The Passivhaus Standard	KGBC (2000) Holmes (2014) Passive House Institute (2015b)
52	Romania	(52.1) DGNB (52.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
53	Russia	(53.1) DGNB (53.2) The Passivhaus Standard	DGNB GmbH (2018) BRE Ltd (2018d)
54	Serbia	(54.1) The Passivhaus Standard	Passive House Institute (2015b)
55	Singapore	(55.1) BCA (Building & Construction Authority) Green Mark Scheme (55.2) LEED	Building & Construction Authority (2011) Holmes (2014)
56	Slovakia	(56.1) DGNB (56.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
57	Slovenia	(57.1) The Passivhaus Standard	Passive House Institute (2015b)
58	South Africa	(58.1) Green Star SA Rating Tools, e.g., Green Star SA – Office v1	GBCSA (2012)
59	Spain	(59.1) DGNB (59.2) LEED (59.3) SBTool (59.4) The Passivhaus Standard (59.5) VERDE Certificate	DGNB GmbH (2018) GBCe (2012a); Hui (2010); USGBC (2017) Larsson (2015) Passive House Institute (2015b) GBCe (2012b)
60	Sweden	(60.1) The Passivhaus Standard	Passive House Institute (2015b)
61	Switzerland	(61.1) DGNB (61.2) ENERGY STAR (61.3) LEED	DGNB GmbH (2018); GeSBC (2012) EPA (2018) USGBC (2017)

		(61.4) MINERGIE (61.5) The Passivhaus Standard	MINERGIE (2012) Passive House Institute (2015b)
62	Taiwan	(62.1) EEWH (Ecology, Energy Saving, Waste Reduction & Health) (62.2) ENERGY STAR (62.3) Green Building Label (62.4) LEED (62.5) The Passivhaus Standard	Southern Taiwan Science Park Administration (2012) EPA (2018) Madew (2011) Holmes (2014) Passive House Institute (2015b)
63	Thailand	(63.1) DGNB	DGNB GmbH (2018)
64	Trinidad & Tobago	(64.1) LEED	USGBC (2017)
65	Turkey	(65.1) DGNB (65.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
66	Ukraine	(66.1) DGNB (66.2) The Passivhaus Standard	DGNB GmbH (2018) Passive House Institute (2015b)
67	United Arab Emirates (UAE)	(67.1) Estidama Pearl Rating System (PRS) v.1.0 (67.2) Estidama PRS v.2.0 (67.3) LEED (67.4) The Passivhaus Standard	Abu Dhabi UPC (2010) Abu Dhabi UPC (2010) Holmes (2014) Passive House Institute (2015b)
68	United Kingdom (UK)	(68.1) BREEAM (68.2) CEEQUAL (Civil Engineering Environmental Quality Assessment & Award Scheme) (68.3) Code for Sustainable Homes (68.4) Green Deal (68.5) Green Mark (68.6) SBEM  (SBEM supports the operational phase by providing analysis of a building's energy consumption. It is used for non-domestic buildings in support of the Green Deal, National Calculation Methodology (NCM) & Energy Performance of Buildings Directive (EPBD). The NCM & EPBD underlie the DEC & AR, which are applied at the operational phase)  (68.7) SKA Rating	BRE Ltd (2017a); BRE Ltd (2017b) BRE Ltd (2018b)  Department for Communities and Local Government (2010) BRE Ltd (2018c) Green Mark (2018) BRE Ltd (2018c)  RICS (2018)

		(68.8) SPeAR ® (Sustainable Project Appraisal Routine) (68.9) The Passivhaus Standard	Arup (2018); Earley (2013) Passive House Institute (2015b)
69	United States of America (USA)	(69.1) ENERGY STAR (69.2) Green Globes (69.3) International Green Construction Code (IgCC) (69.4) LEED (Leadership in Energy & Environmental Design) (69.5) Living Building Challenge (69.6) The Passivhaus Standard (69.7) WELL Building Standard / WELL v2	US EPA & US DOE (2017) Green Building Initiative (2018); Green Globes (2011) International Code Council (2018) USGBC (2017) International Living Future Institute (2018) BRE Ltd (2018d); Passive House Institute (2015b) International WELL Building Institute (2017)
< 70	In at least 24 countries	(70.1) HQE (High Quality Environmental Standard)	Alliance HQE-GBC (2017)
< 71	Expected in at least 29 countries (i.e., 28 EU Member States & Norway)	(71.1) Energy Performance Certificates (EPCs) (Based on the EPBD requirements)	Arcipowska <i>et al.</i> (2014)
< 72	In at least 37 countries, i.e., USA, 4 countries plus those of the European Union (EU) & European Free Trade Association (EFTA) that have agreements with the USA EPA on ENERGY STAR  The EU-USA ENERGY STAR Agreement expired on 20/02/2018	(72.1) ENERGY STAR	EPA (2018)

< 73	In at least 39 countries	(73.1) WELL Building Standard / WELL v2	International WELL Building Institute (2017)
< 74	In at least 49 countries	(74.1) The Passivhaus Standard	Passive House Institute (2015b)
> 75	In at least over 76 countries	(75.1) CEEQUAL	BRE Ltd (2018a)
> 76	In at least 78 (or over 76) countries, including the UK, USA, Netherlands, Norway, Spain, Sweden, Germany, Austria, Switzerland	(76.1) BREEAM	BRE Ltd (2017a); BRE Ltd (2017b); BRE Ltd (2018a)
> 77	In at least 140 countries	(77.1) EDGE (Excellence in Design for Greater Efficiencies)	IFC (2018)
> 78	In at least over 140 countries	(78.1) LEED (Leadership in Energy & Environmental Design)	Holmes (2014)

**Table 2: Global Coverage of BEEAC Tools**  
(Source: Emeka Efe Osaji; and Based on Table 1)

	<b>Building Energy &amp; Environmental Assessment Certification (BEEAC) Tools</b>	<b>Countries where they are (have been) used</b>	<b>In at least Number of Countries</b>
1	AQUA	Brazil	1
2	BCA (Building & Construction Authority) Green Mark Scheme	Singapore	1
3	BEAM Plus	Hong Kong	1
4	BERDE (Building for Ecologically Responsive Design Excellence)	Philippines	1
5	BREEAM	In at least 78 countries, including the UK	78
6	BREEAM-NL	Netherlands	1
7	CASBEE (Comprehensive Assessment System for Built Environment Efficiency)	Japan	1
8	CEEQUAL (Civil Engineering Environmental Quality Assessment & Award Scheme)	In at least over 76 countries, including UK	76
9	CEPAS (Comprehensive Environmental Performance Assessment Scheme for Buildings)	Hong Kong	1
10	CEPHEUS (Cost Efficient Passive Houses as European Standards)	Germany	1
11	Code for Sustainable Homes	UK	1
12	DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen)	In at least 20 countries	20
13	EDAMA (an Arabic word meaning 'sustainability')	Jordan	1
14	EDGE (Excellence in Design for Greater Efficiencies)	In at least 140 countries	140
15	EEWH (Ecology, Energy Saving, Waste Reduction & Health)	Taiwan	1
16	ENERGY STAR	In at least 37 countries, including the USA	37
17	Energy Performance Certificates (EPCs)	Expected in at least 29 countries based on the EPBD (i.e., 28 EU Member States & Norway)	29
18	Estidama Pearl Rating System (PRS) v.1.0	UAE	1
19	Estidama PRS v.2.0	UAE	1
20	GBAS (Green Building Assessment System)	China	1
21	GBCS (Green Building Certificate System)	Republic of Korea (South Korea)	1
22	GBI (Green Building Index)	Malaysia	1
23	Green Building Label	Taiwan	1
24	Green Deal	UK	1
25	Green Globes	Canada, USA	2
26	Green Mark	UK	1

27	Greenship Existing Building	Indonesia	1
28	Greenship New Building	Indonesia	1
29	Green Star	Australia	1
30	Green Star NZ	New Zealand	1
31	Green Star SA Rating Tools, e.g., Green Star SA – Office v1	South Africa	1
32	GRIHA (Green Rating for Integrated Habitat Assessment)	India	1
33	HK BEAM (Building Environmental Assessment Method)	Hong Kong	1
34	Homestar	New Zealand	1
35	HQE (High Quality Environmental Standard)	In at least 24 countries	24
36	IGBC Green SEZ Rating System	India	1
37	International Green Construction Code (IGCC)	USA	1
38	LEED (Leadership in Energy & Environmental Design)	In at least over 140 countries	140
39	LEED-INDIA for New Construction	India	1
40	LEED Italy	Italy	1
41	LEED Mexico	Mexico	1
42	LiderA - Sustainable Assessment System	Portugal	1
43	Living Building Challenge	USA	1
44	MINERGIE	Switzerland	1
45	National Australian Built Environment Rating System (NABERS)	Australia	1
46	PromisE	Finland	1
47	Protocollo Itaca	Italy	1
48	SBEM	UK	1
49	SBTool	Czech, Italy, Monaco, Portugal, Spain	5
50	SBToolCZ (Czech Sustainable Building Tool)	Czech Republic	1
51	SKA Rating	UK	1
52	SPeAR ® (Sustainable Project Appraisal Routine)	Denmark, UK	2
53	The Passivhaus Standard	In at least 49 countries	49
54	VERDE Certificate	Spain	1
55	WELL Building Standard / WELL v2	In at least 39 countries	39

## Key Issues

- How can Building Energy and Environmental Assessment Certification (BEEAC) likely be enhanced to support an effective response to climate change, CO<sub>2</sub> emissions, and the 'Performance Gap'?

## Links

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