Summary report on net zero pathway for cities

19 November 2020

The CSIR has the following comments regarding the net zero carbon pathway for the SA C40 cities. This analysis was performed as part of the work done by the CSIR in support of the City of Tshwane updating of the Green Building Development Policy and By-law and is not a final report but a reflection of work in progress.

Energy Use Intensity

The Sustainable Energy Africa (SEA) proposed EUI values are based on the version of SANS 10400 Part XA that is due to be published in 2020 or early 2021. The pathway to net zero carbon energy in buildings reduces the EUI in steps over a number of years, as shown in Table 1. It is noted that:

- This table does not include all building types that are included in SANS 10400 XA (2020)
- There is no improvement in energy efficiency (EE) for subsidised housing
- There was an assumption/decision that the values are to represent the operational load of buildings (whereas the values in SANS 10400 Part XA represent the baseload only).

Table 1: Energy Use Intensity values proposed by SEA for the SA New Building Programme

Occupancy	Class of Occupancy or building	Occupancy Description	Enery Intensity (EI) kWh/m2/annum						
			2011	2020	2022	2025	2030	2040	2050
			SANS 10400 XA	SANS 10400 XA V2	SANS 10400 XA V2 with compulsory EUI reporting	SANS 10400 XA + 30% EE	SANS 10400 XA + 55% EE	SANS 10400 XA + 65% EE	SANS 10400 XA + 75% EE
Offices	G1.1	Large multistorey office buildings	190	95	95	67	43	33	24
	G1.2	Standalone buildings in Office parks	190	80	80	56	36	28	20
	G1.3	Call Centres	190	145	145	102	65	51	36
Retail	F1	Large shop >250m2	245	145	145	102	65	51	36
	F2	Small shop <250m2	-	80	80	56	36	28	20
Schools	A3.3	Urban, suburban and rural locations	400	55	55	39	25	19	14
Hospitals	E2.1 & E2.2	Large hospital & medium short stay	-	175	175	123	79	61	44
	E2.3 & E2.4	Day hospitals and clinics	-	90	90	63	41	32	23
Hotel	H1.1	Hotel	600	145	145	102	65	51	36
Domestic houses	H4.1	Subsidised housing < R450k value	-	70	70	70	70	70	70
	H4.2, H4.3, H4.4	Middle income and luxury houses >R450k value	-	70	70	49	32	25	18

The CSIR evaluated the values and recommends that the values shown in Table 2

Table 2: : Energy Use Intensity values proposed by CSIR for City of Tshwane

Occupancy	Class of Occupancy or building	Occupancy Description	Energy Use Intensity (EUI) kWh/m²/annum*				
			2020	2025	2030	2040	2050
			SANS 10400 XA V2	SANS 10400 XA + 30% EE	SANS 10400 XA + 55% EE	SANS 10400 XA + 65% EE	SANS 10400 XA + 75% EE
						To be reviewed before 2040	
Public gathering/ entertainment	A1	Venues where people gather for sedentary behaviour	80	56	36	28	20
	A1	Venues where people gather for non-sedentary behaviour	120	84	54	42	30
Theatrical	A2	Theatres and cinemas	95	67	43	33	24
	A2	Sport performance	120	84	54	42	30
Places of instruction	A3	conference halls, auditoria, lecture halls, instruction venues, research laboratories, intermediate scale places of learning	95	67	43	33	24
Schools	A3	Urban, suburban and rural locations	55	39	25	19	14
Worship	A4	Large venues	50	35	23	18	13
	A4	Small venues	45	32	20	16	11
Detention	E1	Place of detention	55	39	25	19	14
Hospitals	E2	Large hospital & medium short stay	175	123	79	61	44
	E2	Day hospitals and clinics	90	63	41	32	23
	E3	Institutional (residential)	120	84	54	42	30
	E4	Health care	85	60	38	30	21
Retail	F1	Large shop >250m2	145	102	65	51	36
	F2	Small shop <250m2	80	56	36	28	20
Offices	G1	Large multi-storey office buildings	95	67	43	33	24
	G1	Standalone buildings in Office parks	80	56	36	28	20
	G1	Call Centres	145	102	65	51	36
Hotel	H1	Hotel	145	102	65	51	36
	H2	Dormitory	70	49	32	25	18
	H3	Domestic residence	70	49	32	25	18
Dwelling houses	H4	~~Subsidised housing < R450k value per unit~~ Category 1 buildings	70	49	49	49	49
	H4	Middle income and luxury houses >R450k value	70	49	32	25	18
	H5	Hospitality	70	49	32	25	18

Legend:	
xx	Occupancy not included in SEA but included in SANS
x	Value differs from SEA recommendation

The following is noted regarding the CSIR recommendations:

- Includes requirements for subsidised housing (while it can be argued that this is costly, at the same time, this sector possibly has the most to gain).
- Changes subsidised housing to Category 1 buildings (as defined by SANS 10400)
- Includes all the same building categories as in SANS 10400 XA.
- Only stipulate improvement in EE up to 2030 in the By-law; ambitions for 2040 onwards will be in the Policy.

Renewable Energy

The SEA recommendations for renewable energy (RE) is shown in Table 3. The following is noted:

- Assumes operational load = EUI above relative to year.
- No RE required for subsidised housing.

Table 3: Renewable Energy (RE) requirements proposed SEA for the SA New Building Programme

Occupancy	Class of Occupancy or building	Occupancy Description	Renewable energy kWh/m2/annum						
			2011	2020	2022	2025	2030	2040	2050
				voluntary installation			compulsory to meet net zero requirement, but additional voluntary if City able to accept "prosumption"		
Offices	G1.1	Large multi-storey office buildings					43	33	24
	G1.2	Standalone buildings in Office parks					36	28	20
Retail	F1	Large shop >250m2					65	51	36
	F2	Small shop <250m2					36	28	20
Schools	A3.3	Urban, suburban and rural locations					25	19	14
Hospitals	E2.1 & E2.2	Large hospital & medium short stay					79	61	44
	E2.3 & E2.4	Day hospitals and clinics					41	32	23
Domestic houses	H4.1	Subsidised housing < R450k value					0	0	0
	H4.2, H4.3, H4.4	Middle income and luxury houses >R450k value					32	25	18

The CSIR recommends the RE requirements as shown in Table 4.

Table 4: Renewable Energy (RE) requirements proposed by CSIR for City of Tshwane

Occupancy	Occupancy Class	Occupancy Description	Percentage annual demand met through renewable energy				
			2020	2025	2030	2040	2050
			voluntary installation		compulsory to meet net zero requirement		
Public gathering	A1	Venues where people gather for sedentary behaviour		25%	100%	100%	100%
	A1	Venues where people gather for non-sedentary behaviour		25%	100%	100%	100%
	A2	Theatres and cinemas		25%	100%	100%	100%
	A2	Sport performance		25%	100%	100%	100%
Places of instruction	A3	conference halls, auditoria, lecture halls, instruction venues, research laboratories, intermediate scale places of learning		25%	100%	100%	100%
Schools	A3	Urban, suburban and rural locations		25%	100%	100%	100%
Worship	A4	Large venues		25%	100%	100%	100%
	A4	Small venues		25%	100%	100%	100%
Detention	E1	Place of detention		25%	100%	100%	100%
Hospitals	E2	Large hospital & medium short stay		25%	50%	50%	100%
	E2	Day hospitals and clinics		25%	50%	100%	100%
	E3	Institutional (residential)		25%	50%	100%	100%
	E4	Health care		25%	50%	100%	100%
Retail	F1	Large shop >250m2		25%	100%	100%	100%
	F2	Small shop <250m2		25%	100%	100%	100%
Offices	G1	Large multi-storey office buildings		25%	100%	100%	100%
	G1	Standalone buildings in Office parks		25%	100%	100%	100%
		Call Centres		25%	100%	100%	100%
	H1	Hotel		25%	100%	100%	100%
	H2	Dormitory		25%	100%	100%	100%
	H3	Domestic residence		25%	100%	100%	100%
Residential	H4	~~Subsidised housing < R450k value~~ Category 1 buildings		10%	10%	10%	10%
	H4 H4 H4	Middle income and luxury houses >R450k value		10%	50%	100%	100%

Note that:

- Includes all building types included in EUI table in SANS 10400 XA
- Rather than being prescriptive about operational load, the by-law will stipulate a percentage of the energy being provided from renewable energy sources (whether on-site or off-site).

    - This allows flexibility for different users to determine their own (unique) reasonable operational load. The building design engineer will need to establish the predicted operational load in order to design a suitable RE system, taking into account the percentage of the municipal grid that is decarbonised as the time of design and supplementing the remainder with on-site RE.
    - At plan approval stage, the extent of the demonstration of compliance can only include the predicted operational load (x); the percentage that will be provided by RE (y% of x); the percentage of the grid that is decarbonised at the time (z% of grid); then z% of (y% of x) needs to be provided by on-site RE.
    - The Policy can contain guidelines for predicted load (e.g. 20% of baseload ± 10%) so that the BCO can see if the operational load predicted is reasonable. The BCO will not have mandate to fail a plan based on predicted load but it may be an indicator of 'careless' planning. The predicted load can be used in future as a baseline against which to measure actual operational load.
      There is a risk that the planner/engineer/owner will inflate the predicted load to avoid penalties for not operating within predicted load in future. To mitigate this, it may be recommended that the monitoring and evaluation component be completely separated from the by-law/policy. (?)
- Shorter term transition than SEA but only for 25% of the load (2025), as opposed to a jump 100% in 2030.
- More gradual transition for residential (to ease the market in, acknowledging the cost for home owners with longer pay-back; expecting the initial cost to decrease as the market picks up).
- Include subsidised housing (category 1 buildings) – only 10%, which should be enough for basic electrical requirements in the event of municipal service failure.

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This report was drafted before the workshop on 19 November. The following points raised in the meeting after the workshop are noted:

- General support for inclusion of EUI for subsidised housing/category 1 buildings that is flat from 2025.
- RE: 10% for residential is very little and not cost effective. Omit RE for subsidised housing/category 1 buildings.
- Consider omitting the 25% RE in 2025.

Further comments are welcome.

Report compiled by **Coralie van Reenen**, CSIR Infrastructure Innovation Research Group (cvreenen@csir.co.za).