3 ENERGY [E]

3.1 GENERAL

3.1.1 Scope

1 The Energy category consists of factors associated with energy demand of buildings, the efficiency of energy delivery, and the use of fossil energy sources that result in harmful emissions and pollution.

(a) Impacts: Negative impacts resulting from energy use and unsustainable practices include:

(i) Climate Change

(ii) Fossil Fuel Depletion

(iii) Air Pollution

(iv) Human Comfort & Health

(b) Mitigate Impact: Factors that could mitigate environmental impacts due to energy use include:

(i) Designing the building to lower its energy demand

(ii) Selecting efficient building systems

(iii) Lowering the demand on non-renewable sources of energy thereby reducing harmful emissions and depletion of fossil fuels

(iv) Minimizing the amount of harmful substances produced by the energy delivery systems and the energy supply network

(c) Energy is sub-categorised as follows:

(i) Energy Demand Performance

(ii) Energy Delivery Performance

3.1.2 Reference

1 The following documents are referred to in this section:

Global Sustainability Assessment System (GSAS) – V2.1 2013, ASHRAE 90.1-2013, KAHRAMMAA Energy & Water Conservation Code.

3.1.3 Abbreviations

1 The following abbreviations are defined for use in this section.

- EPC — Energy Performance Coefficient
- EPC_{nd} — Energy Demand Performance
- EPC_{del} — Energy Delivery Performancet
- EPC_{p} — Primary Energy Performance
- f_{op} — Operation factor for a particular Building category
- $E_{delivery}$ — The delivered energy is defined as the supplied energy To the technical building systems through the system boundary, to satisfy the uses of the building in KWh/m^2/yr.
- E_{ref_del} — The reference value used in the GSAS scoring method for the Delivered energy for the building type in KWh/m^2/yr.
- EP — The total primary energy consumed for the building in KWh/m^2/yr.
- E_{ref_p} — the reference value used in the GSASscoring method for primary Energy for the building type in KWh/m^2/yr.

- CO_2 The emitted mass of CO_2 in g/m²/yr. calculated from the net delivered Energy and emission coefficient. The emission coefficient includes the CO_2 emissions associated with the primary energy consumed for the building.
- CO_{2ref} the reference value used in the GSASscoring method for CO_2 emissions for the building type in g/m2/yr.
- Q_{design} the building thermal energy demand in kwh/m²/yr. which takes into account the energy losses (transmission and ventilation), heat gains (solar, internal and system heat losses), and the dynamic parameter (loss utilization factor).
- Q_{ref_nd} the reference value used in the GSAS Scoring method for energy demand for the building type in kwh/m²/yr.
- NOX,SOX The emitted masses of NOX & SOX in gm./m²/yr. calculated from the net delivered energy and emission coefficients.
- NOX_{ref},SOX_{ref} the reference values used in the GSAS scoring method for NOX & SOX emissions for the building type in gm./m²/yr.

3.2 ENERGY [E.1] ENERGY DEMAND PERFORMANCE

3.2.1 Scope

1 The energy demand performance shall be measured for the following categories of buildings:

Table 1: Building Typologies

Commercial
Governmental
Education
Mosques & other religious buildings
Light Industry
Health Centres
Railways Buildings
Sports

3.2.2 Description

1 Establish energy demand performance levels for the building in order to reduce environmental and economic impacts associated with excessive energy use.

3.2.3 Measurement Principle

1 The Engineer shall Calculate Building performance in relation to the baseline as specified below. All calculations will adhere to the GSAS Energy Application document.

3.2.4 Measurement (EPC_{nd})

1 The Engineer shall calculate the EPC_{nd} value based on building data and cooling energy needs of the project as per the energy performance standard calculation tool (EPSCT).

2 Calculated EPC_{nd} = Q_{design} / Q_{ref_nd} The Q_{design} is calculated according to the GSAS Energy Application document.

3 Commercial & Governmental (with baseline reference) Q_{ref_nd} = 125 [kWh/m²/yr].

4 Education: With Baseline reference Q_{ref_nd} = 122* $f_{op.education}$ [kWh/m²/yr]. where $f_{op.education}$ is the operation factor for education typologies. The Q_{design} and $f_{op,school}$ are calculated according to the GSAS Energy Application document.

5 Mosques & other religious buildings: With Baseline reference Q_{ref_nd} = 170 [kWh/m²/yr] . The Q_{design} is calculated according to the GSAS Energy Application document.

6 Health Centers: The Q_{ref_nd} are area weighted average calculated according to the reference guidelines document.

7 Railways: The Q_{ref_nd} are area weighted average calculated according to the refference guidelines document.

8 Sports : the Engineer shall determine energy demand performance in two steps. Step 1, the project will use the Energy Performance Calculator to determine the Energy demand ($Q_{nd.fc,l}$) for each functional component (FC) of the project. Step 2, the project will enter the $Q_{nd,fc,l}$ for each FC in the composition sheet in the energy calculator to determine the aggregated criterion score for the entire sports facility.

9 Light Industry : With Baseline reference Q_{ref_nd} = 475 [kWh/m²/yr.]

3.2.5 Score (EPC_{nd})

1 The Recommended minimum requirement * value for EPC_{nd} shall be as per table 2:

Note : (*) minimum QCS's requirements unless other values specified by the relevant authority

Table 2: EPC_{nd} Values

EPC_{nd} Value	$0.8 < EPC_{nd} \leq 1.0$

3.3 ENERGY [E.2]: ENERGY DELIVERY PERFORMANCE

3.3.1 Scope

1 The energy delivery performance shall be measured for the following categories of buildings:

Table 3: Building Typologies

Commercial
Governmental
Education
Mosques & other religious buildings
Light Industry
Health Centres
Railways Buildings
Sports

3.3.2 Description

1 The Engineer shall establish delivered energy performance levels of the project in order to reduce environmental and economic impacts associated with excessive energy use.

3.3.3 Measurement Principle

1 The Engineer shall calculate the building performance in relation to the baseline as specified below. All calculations will adhere to the GSAS Energy Application document.

3.3.4 Measurement (EPC_{del})

1 The Engineer shall complete the Energy Performance Standard Calculation Tool (EPSCT) to determine the EPCdel value based on building data, HVAC specifications, lighting system, and DHW system and energy generation.

2 Calculated EPC_{del} $=E_{del}$ / E_{ref_del} the E_{del} is calculated according to the GSAS Energy Application document.

3 Commercial & Governmental : with Baseline reference E_{ref_del} = 89 [kWh/m²/yr].

4 Education With Baseline reference E_{ref_del} = 88* $f_{op\_education}$ [kWh/m²/yr]. where $f_{op\_education}$ is the operation factor forEducation Typologies. The $E_{delivery}$ and $f_{op,education}$ are calculated according to the GSAS Energy Application document.

5 Mosques & other religious buildings: With Baseline reference E_{ref_del} = 82 [kWh/m²/yr]. The $E_{delivery}$ is calculated according to the GSAS Energy Application document.

6 Light Industry: With Baseline reference E_{ref_del} = 165 [kWh/m²/yr].

7 Sports Facilities: The Engineer shall determine energy delivery performance in two steps. Step 1, the Engineer shall use the Energy performance calculator to determine the delivered energy ($E_{del,fc,i}$) for each functional component (FC) of the project. Step 2, the Engineer shall enter the $E_{del,fc,I}$ for each FC in the energy score calculator to determine the aggregated criterion score for the entire sports facility.

3.3.5 Score (EPC_{del})

1 The Recommended minimum requirments* EPC_{del} value shall be categorised as per table 4.

Note : (*) minimum QCS's requirements unless other values specified by the relevant authority

Table 4: EPC_{del} minimum required value

EPC_{del} Value	$0.8 < EPC_{del} \leq 1.0$

END OF PART