**围护结构节能率计算书**

居住建筑

|  |  |
| --- | --- |
| 工程名称 | 测试项目5#楼 |
| 工程地点 | 四川-成都 |
| 设计编号 | ZTA-CD-2018-Q032 |
| 建设单位 |  |
| 设计单位 | 四川中泰联合设计股份有限公司 |
| 设 计 人 |  |
| 审 核 人 |  |
| 审 定 人 |  |
| 设计日期 | 2021年12月22日 |



|  |  |
| --- | --- |
| 采用软件 | 能耗计算BESI2020 |
| 软件版本 | 20190808 |
| 研发单位 | 北京绿建软件有限公司 |
| 正版授权码 | P181169EE |

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# 建筑概况

|  |  |  |
| --- | --- | --- |
| 工程名称 | 测试项目5#楼 | |
| 工程地点 | 四川-成都 | |
| 地理位置 | 北纬：31.00° | 东经：104.01° |
| 建筑面积(m2) | 地上10495 地下0 | |
| 建筑层数 | 地上28 地下0 | |
| 建筑高度（m） | 地上84.1 地下0.0 | |
| 建筑体积(m3) | 30793.43 | |
| 建筑外表面积(m2) | 10791.18 | |
| 北向角度 | 90 | |
| 结构类型 |  | |
| 外墙太阳辐射吸收系数 | 0.50 | |
| 屋顶太阳辐射吸收系数 | 0.50 | |

# 计算依据

1. 《绿色建筑评价标准》(GB/T50378-2019)

2. 《民用建筑绿色性能计算标准》(JGJ/T 449-2018)

3. 《夏热冬冷地区居住建筑节能设计标准》（JGJ 134-2010）

4. 《民用建筑热工设计规范》(GB50176)

# 计算要求

## 计算目标

依据《绿色建筑评价标准》(GB/T50378-2019)第7.2.4条相关内容，对于建筑围护结构节能率进行计算。

## 计算方法

建立参照建筑和设计建筑，两者建筑外形、内部功能分区、气象参数、室内供暖空调设计温度湿度均保持一致。参照建筑取国家或行业建筑节能设计标准规定的建筑围护结构的热工性能参数，设计建筑取实际设计的建筑围护结构的热工性能参数，各自进行全年的逐时动态能耗模拟。

即：围护结构节能率 ＝ （参照建筑全年围护结构耗冷耗热量 － 设计建筑全年围护结构耗冷耗热量）/参照建筑全年围护结构耗冷耗热量× 100%

# 围护结构

## 工程材料

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 材料名称 | 导热系数λ | 蓄热系数S | 密度ρ | 比热容Cp | 蒸汽渗透系数u | 备注 |
| W/(m.K) | W/(㎡.K) | kg/m3 | J/(kg.K) | g/(m.h.kPa) |
| 水泥砂浆 | 0.930 | 11.370 | 1800.0 | 1050.0 | 0.0210 | 来源：《民用建筑热工设计规范》GB50176-2016 |
| 非固化橡胶沥青防水涂料 | － | － | － | － | － |  |
| 石灰砂浆 | 0.810 | 10.070 | 1600.0 | 1050.0 | 0.0443 | 来源：《民用建筑热工设计规范》GB50176-2016 |
| sbs改性沥青防水卷材 | 0.230 | 9.370 | 900.0 | 1620.0 | 0.0000 |  |
| 钢筋混凝土 | 1.740 | 17.200 | 2500.0 | 920.0 | 0.0158 | 来源：《民用建筑热工设计规范》GB50176-2016 |
| 碎石、卵石混凝土 | 1.510 | 15.360 | 2300.0 | 920.0 | 0.0173 | 来源：《民用建筑热工设计规范》GB50176-2016 |
| 加气混凝土、泡沫混凝土(ρ=700) | 0.180 | 3.100 | 700.0 | 1050.0 | 0.0998 | 来源：《民用建筑热工设计规范》GB50176-2016 |
| 挤塑聚苯板(燃烧性能为B1级) | 0.030 | 0.340 | 35.0 | 1380.0 | 0.0000 |  |
| 不燃型复合膨胀聚苯乙烯保温板（颗粒型）(燃烧性能为A2级) | 0.065 | 0.900 | 200.0 | 1000.0 | 0.0000 | 燃烧性能为A1级 |
| 抗裂砂浆（网格布） | 0.930 | 11.306 | 1800.0 | 1050.0 | 0.0000 |  |
| 聚乙烯隔声保温复合卷材 | 0.034 | 0.500 | 36.0 | 1000.0 | 0.0000 |  |
| 细石混凝土（双向配筋） | 1.740 | 17.060 | 2500.0 | 920.0 | 0.0000 |  |

# 房间类型

## 房间表

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 房间类型 | 空调温度 ℃ | 供暖温度 ℃ | 新风量 | 人员密度 | 照明功率 密度 | 电器设备 功率 |
| 主卧室 | 26 | 18 | 0.5(次/h) | 32(㎡/人) | 6(W/㎡) | 5(W/㎡) |
| 卫生间 | － | － | 0.5(次/h) | 0(㎡/人) | 6(W/㎡) | 0(W/㎡) |
| 厨房 | － | － | 0.5(次/h) | 0(㎡/人) | 6(W/㎡) | 24(W/㎡) |
| 楼梯间 | － | － | 0(m3/h.人) | 0(㎡/人) | 0(W/㎡) | 0(W/㎡) |
| 次卧室 | 26 | 18 | 0.5(次/h) | 32(㎡/人) | 6(W/㎡) | 5(W/㎡) |
| 空房间 | － | － | 0(m3/h.人) | 0(㎡/人) | 0(W/㎡) | 0(W/㎡) |
| 走廊 | － | － | 0(m3/h.人) | 0(㎡/人) | 0(W/㎡) | 0(W/㎡) |
| 起居室 | 26 | 18 | 0.5(次/h) | 32(㎡/人) | 6(W/㎡) | 5(W/㎡) |

## 作息时间表

详见附录

# 计算结果

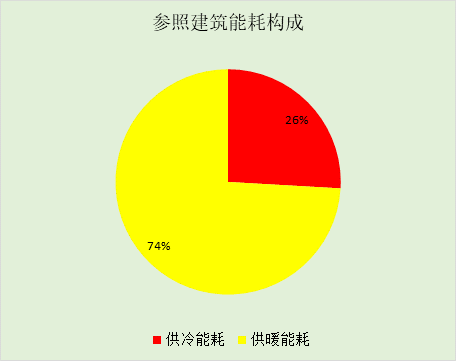
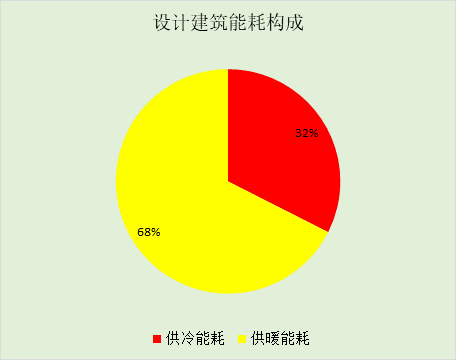
## 围护结构热工性能对比

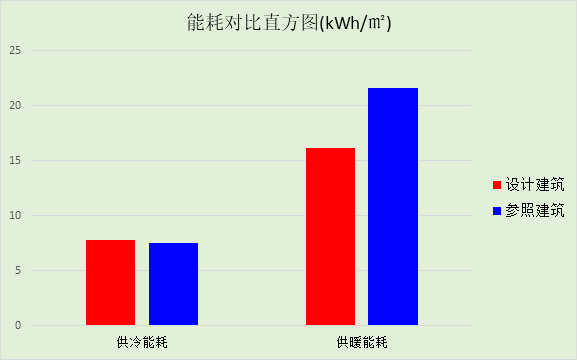
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | 设计建筑 | | | | 参照建筑 | | | |
| 体形系数S | | 0.35 | | | | 0.35 | | | |
| 屋顶传热系数K [W/(m2·K)] | | 0.52 | | | | 0.80 | | | |
| 外墙（包括非透明幕墙）传热系数K [W/(m2·K)] | | 1.15 | | | | 1.50 | | | |
| 屋顶透明部分传热系数  K [W/(m2·K)] | | － | | | | － | | | |
| 屋顶透明部分遮阳系数 | | － | | | | － | | | |
| 底面接触室外的架空或外挑楼板传热系数K [W/(m2·K)] | | 1.16 | | | | 1.50 | | | |
| 楼板K [W/(m2·K)] | | 1.74 | | | | 2.00 | | | |
| 分户墙K [W/(m2·K)] | | 0.87 | | | | 2.00 | | | |
| 外窗（包括透明幕墙） | 朝向 | 窗墙比 | 传热  系数 | 遮阳  系数(夏季) | 遮阳  系数(冬季) | 窗墙比 | 传热  系数 | 遮阳  系数(夏季) | 遮阳  系数(冬季) |
| 南向 | 0.50 | 1.88 | 0.22 | 0.22 | 0.45 | 2.80 | 0.40 | －－ |
| 北向 | 0.29 | 2.29 | 0.36 | 0.36 | 0.29 | 4.00 | －－ | －－ |
| 东向 | 0.03 | 3.40 | 0.68 | 0.68 | 0.03 | 4.70 | －－ | －－ |
| 西向 | 0.05 | 3.40 | 0.68 | 0.68 | 0.05 | 4.70 | －－ | －－ |

备注：1. — 代表本工程无对应项; 2. ——代表参照建筑不要求，取值同设计建筑。

## 围护结构节能率

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 能耗分类 | 能耗子类 | 设计建筑  (kWh/㎡) | 参照建筑  (kWh/㎡) | 节能率  （%） |
| 建筑负荷 | 耗冷量 | 21.82 | 21.15 | -3.16% |
| 耗热量 | 29.17 | 38.86 | 24.93% |
| 冷热合计 | 50.98 | 60.00 | 15.03% |
| 供冷能耗 | 综合效率折算权重 | 2.8 | 2.8 | -3.16% |
| 供冷能耗 | 7.79 | 7.55 |
| 供暖能耗 | 综合效率折算权重 | 1.8 | 1.8 | 24.93% |
| 供暖能耗 | 16.20 | 21.59 |
| 供暖供冷综合能耗 | | 24.00 | 29.14 | 17.65% |





# 附录

## 工作日/节假日人员逐时在室率(%)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 房间类型 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 主卧室 | 61 | 61 | 62 | 61 | 61 | 58 | 40 | 21 | 17 | 16 | 15 | 16 | 18 | 18 | 15 | 14 | 14 | 14 | 15 | 18 | 24 | 37 | 52 | 57 |
| 57 | 57 | 58 | 58 | 58 | 59 | 55 | 42 | 30 | 21 | 15 | 14 | 17 | 17 | 14 | 14 | 13 | 13 | 14 | 17 | 23 | 32 | 46 | 52 |
| 卫生间 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 厨房 | 0 | 0 | 0 | 0 | 0 | 7 | 41 | 42 | 9 | 1 | 10 | 41 | 19 | 2 | 0 | 1 | 21 | 71 | 74 | 19 | 2 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 7 | 41 | 42 | 9 | 1 | 10 | 41 | 19 | 2 | 0 | 1 | 21 | 71 | 74 | 19 | 2 | 0 | 1 | 0 |
| 楼梯间 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 次卧室 | 61 | 61 | 62 | 61 | 61 | 58 | 40 | 21 | 17 | 16 | 15 | 16 | 18 | 18 | 15 | 14 | 14 | 14 | 15 | 18 | 24 | 37 | 52 | 57 |
| 57 | 57 | 58 | 58 | 58 | 59 | 55 | 42 | 30 | 21 | 15 | 14 | 17 | 17 | 14 | 14 | 13 | 13 | 14 | 17 | 23 | 32 | 46 | 52 |
| 空房间 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 走廊 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 起居室 | 16 | 16 | 16 | 15 | 16 | 24 | 31 | 19 | 15 | 14 | 14 | 19 | 22 | 19 | 13 | 14 | 18 | 35 | 49 | 54 | 50 | 35 | 21 | 15 |
| 14 | 13 | 13 | 13 | 13 | 18 | 22 | 24 | 29 | 32 | 34 | 37 | 35 | 32 | 26 | 28 | 33 | 39 | 44 | 47 | 45 | 34 | 23 | 16 |

注：上行：工作日；下行：节假日

## 工作日/节假日照明开关时间表(%)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 房间类型 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 主卧室 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 50 | 10 | 10 | 10 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 50 | 10 | 10 | 10 |
| 卫生间 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 厨房 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 楼梯间 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 次卧室 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 50 | 10 | 10 | 10 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 50 | 10 | 10 | 10 |
| 空房间 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 走廊 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 0 |
| 起居室 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 50 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 100 | 100 | 100 | 100 | 50 |

注：上行：工作日；下行：节假日

## 工作日/节假日设备逐时使用率(%)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 房间类型 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 主卧室 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 10 | 10 | 10 | 10 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 10 | 10 | 10 | 10 |
| 卫生间 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 厨房 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 楼梯间 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 次卧室 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 10 | 10 | 10 | 10 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 | 10 | 10 | 10 | 10 |
| 空房间 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 走廊 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 起居室 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 69 | 69 | 23 | 23 | 23 | 23 | 23 | 100 | 100 | 100 | 100 | 69 |
| 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 69 | 69 | 23 | 23 | 23 | 23 | 23 | 100 | 100 | 100 | 100 | 69 |

注：上行：工作日；下行：节假日