INTERNATIONAL CONFERENCE
St Petersburg, RUSSIA
04 March 20120

SUAI State University of Aerospace Instrumentation

Science & Technology City Hall

«Metrological Support of Innovative Technologies» ICMSIT-2020

«Energy consumption of water supply system's utilities in building»

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ICMSIT-2020
Metrological Support of Innovative Technologies

Problem statement

This work is a continuation of the methodology which was proposed by V.M. Chaplin, and later improved by V.I. Prokhorov, "Calculation of the specific thermal and electrical characteristics of the building". If the engineer knows the design consumption of thermal and electric energy by the building engineering systems it will affects to the determination of the requested capacity from external urban energy systems, and also will help's to determine further ways to select new energy-saving technologies. As an example, it could be the electric energy which was generated by the solar module and used by a booster (circulation) pump of the water supply system.

Solution methods

- Thermal part of energy consumption's calculation

$$q_{asc(T)}^{cwss.w} = \frac{n}{24} \times (t_{room}^{w} - t_{c.w}^{w}) \times Z_{h.p.} \times q_{cwss}^{d.w.}, \ W \times h / m^3 \times year$$

$$q_{asc(T)}^{cwss.s} = \frac{n}{24} \times (t_{room}^{s} - t_{c.w}^{s}) \times Z_{w.p.} \times q_{cwss}^{d.s.}, \ W \times h / m^3 \times year$$

- Electric part of energy consumption's calculation

$$N_{asc(E)}^{cwss.w} = 24 \times Z_{h.p} \times \frac{N_{cwss}^{w}}{V_e} \times \frac{n}{24}, W \times h / m^3 \times year$$

$$N_{asc(E)}^{cwss.s} = 24 \times Z_{w.p} \times \frac{N_{cwss}^{s}}{V_e} \times \frac{n}{24}, \ W \times h / m^3 \times year$$

The application of using this method is wastewater pumping station. There is a Contribution of cold (CWSS) and hot (HWSS) water supply system to the total thermal characteristic of the building water supply system in figure 1 and Contribution of cold and hot water supply system to the total electric characteristic of the building water supply system in figure 2.

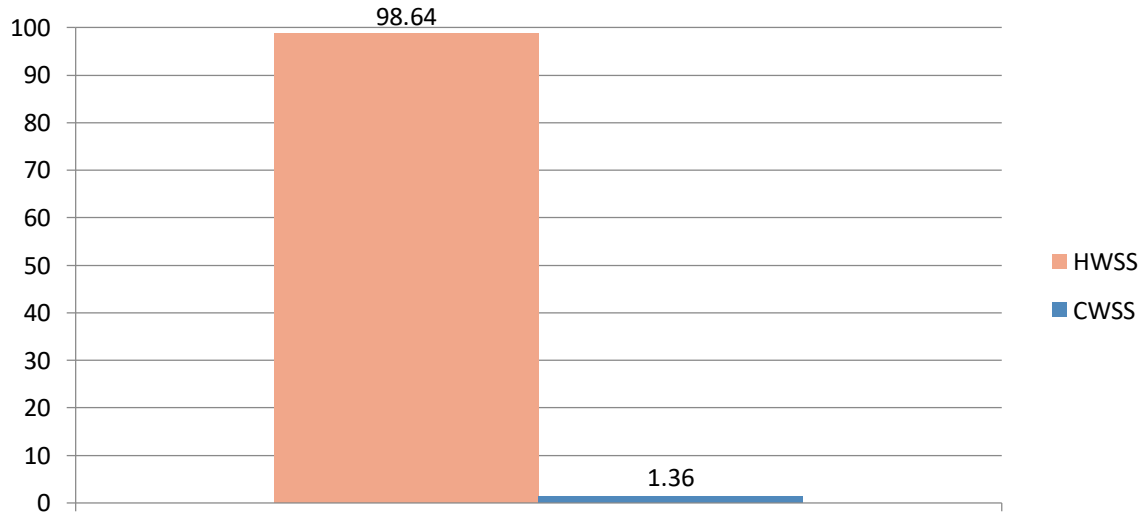

Figure 1.

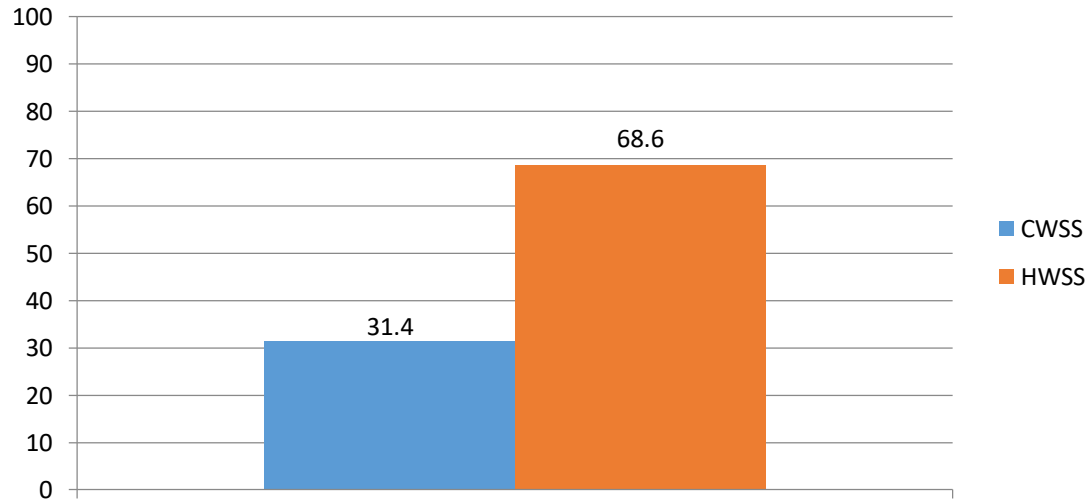

Figure 2.

Conclusion

In this paper, there is a methodology for calculating the 5th component of the specific building's thermal and electrical characteristics of engineering life support systems - cold water supply system. Comparing the specific thermal and electrical characteristics of building's cold and hot water supply systems in a sewage pumping station, it can be concluded that for this building the contribution of the specific thermal characteristic of the cold water supply system is much less (1.36%) than the contribution of the hot water supply to the total specific thermal characteristic of the overall water supply system. The contribution of the specific electrical characteristic of the building's cold water supply system to the overall specific electrical characteristic of the water supply system is significantly higher (31.4%) than the thermal part.

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