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EXPERIMENTAL STUDY AND FEASIBILITY ANALYSIS ON BUILDINGS DUAL HEATING SYSTEM

BY

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Abstract. This study examines the functioning of dual heating system in residential blocks in a centralized system and also with individual flat stations which imply difficulties involving management, verification and metering. This is due to the fact that common columns that circulate heat cross apartments disconnected from the centralized system. In Romania the tenants that are disconnected from the centralized system still pay the owners' associations, heat resulting from the joint surface from the columns crossing their apartments. Also all these tenants pay a share of the same radiant area of the common columns traversing common areas of the condominium. This leads to errors of calculation of the radiant area and also errors of monthly maintenance value and finally to conflicts between the inhabitants who have central heating and those who use the centralized system .This aspect is aggravated by the lack of legislation that does not allow the use of dual system as well as the widespread use of cost allocators.

Keywords: heating system; heat cost allocators; cost estimation.

1. Introduction

This study appeared as a necessity after various conflictual situations occurring in the owners association from Romania which have in administration blocks with two heating systems, centralized system spread widely before 1989

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and individidual system based on central apartment. The study was conducted in Iasi, No.12Aleea Roselor Street, Block B8, a block of 40 apartments, with two staircases each with 20 apartments.

Due to the requirements of the study it was necessary the inventory of each apartment by settling the type of radiator, number of elements, the radiating surface in square meters on each item and finally there was settled the total SET on each apartment and common areas in accordance with STAS 11984 / 1983. For scale A and scale B there was identified a number of 20 apartments for each individual scale. Also, for each scale there was calculated the SET for the stairwell and for the basement and finally having the total SET for each scale separately for apartments and common spaces. These measurements are real, being an operation that accurately reflects the situation on the ground at the time of the survey. This study has been materialized in plans showing the distribution and columns diameter in the basement, floor1 - floor 4 and the general isometric plan to scale both these columns for scale A and for scale B.

The results thus obtained embodied in the sheet of the block for scale A and B were placed in our own program computing by using the programming language FOX. This algorithm presented and performed for the two scales A and B bl. B8, is agreed by the Owners Associations Depatment within the Iasi City Hall. From the heat bills issued by SC DALKIA TERMO IASI for the Association of Owners PT 9 Cantemir Iaşi there were extracted the values for thermal energy consumed by the scales A and B, which were distributed through the energy calculation program.

2. The Presentantion Of The Study Methodology

Relationships used in this program are described and explained below:

I. Area of the apartment – (SL) is the one from the act of sale-purchase of the apartment.

II. With these data one should calculate the coefficient:

$$k = \text{total set common areas} / \text{total scale set} \quad (1)$$

III. Undivided share of each apartment: z = area of the apartment / total area od the scale apartment.

IV. Radiant set = total set – column set for each apartment (2)

V. set_rad_ap = set_tot_ap – set_col_ap (3)

VI. tot_set = total scale set (4)

VII. tot_set_col = total set for columns scale (columns including common areas) (5)

VIII. set_sp_common = basement columns set + columns staircase set (6)

IX. Vi_fact = Heating invoiced value of the heat supplier

X. The value of heating for common areas columns from the apartment is calculated as

$$Vi\_sp\_common\_ap = k * z * Vi\_fact \quad (7)$$

XI. The value of heating columns in each apartment is calculated as

$$Vi\_col\_ap = set\_col\_ap / (tot\_set - set\_sp\_common) * (Vi\_fact - Total\ Vi\_sp\_common) \quad (8)$$

XII. The value of heating for radiant surface in each apartment is calculated as

$$Vi\_rad\_ap = set\_rad\_ap / (tot\_set - tot\_set\_col) * (Vi\_fact - TotalVi\_sp\_common\_ap - Total\ Vi\_col\_ap) \quad (9)$$

XIII. The value of total heating for apartment

$$Tot\_val\_ap = Vi\_sp\_common\_ap + Vi\_col\_ap + Vi\_rad\_ap \quad (10)$$

For verification, the amount of heating values for all the apartments in that scale must be equal to the amount of heat supplier invoice.

The requirements of the study were as follows:

1. The calculation of thermally heated surfaces in a centralized system (CET) at Block B8, scale A and scale B for the period November 2011 to April 2012 for each apartment separately: calculating the actual surface of the heated apartments and real surface heated from common areas (basement) is due to each apartment through shares. The calculations were compared with values calculated by the apportions company SC Techem Srl in September 2011, the table that formed the basis for establishing a centralized heating system configuration.

2. There were checked the total monthly consumption of heat resulting from the readings made on the heat meter LUXTERM manufactured AEM, 2.5 metrological class and correspondence with amounts invoiced by the supplier to block B8 Scale A and B.

3. Based on total monthly consumption of heat and real calculated areas (in section No. 1 on each apartment was set and placed the quantity and value of individual heat consumption that had to be enrolled in the payment lists of owners' associations).

4. There were technically analyzed the centralizing of the distribution of thermal energy produced by SC Techem Srl and there were compared with the centralizing of distribution of thermal energy produced by the study, settling the differencesfor the apatments with central heating for each month.

3. Analysis and Results from the Survey

1º The determinationof the real heated surface was made according to the STAS 11984/1983 by determening the thermal equivalent SET surface of radiators and horizontal and vertical pipes of the condominium. The equivalent thermal surface SET is a conventional size that is calculated according to

existing tables in STAS 11984/1983. Each existing heating surface was obtained by laboratory tests conducted by the method SR SR ISO 3148/99 and SR ISO 3150/99. There were determined the heat equivalent surfaces (SET) for each apartment and for all the common areas including the basement and the results were centralized in both tables for scale A and scale B resulting shares from thermal equivalent total area for each scale individually.

The quantity calculation of heat according to invoices and equivalent thermal areas are described in Table 1 for scale A and Table 2 for scale B for each month of calculation. The thermal energy consumption was measured by using heat meter metrological type LUXTERM checked by the Metrological Laboratory of Fluid Goup Hagen permit no. 060-10 as follows:

Scale A:

a) Calculator to measure the heat LUXTERM type series 24081 / 05- under metrological bulletin No. 44 014/25.07.2012 – debit transmitter USECHO II – series 06,521,862, according to metrological bulletin no. 44 025/ 28.07.2012.

b) RTD pair PI 500 with series 0824 and 0831, according to metrological bulletin no. 43 993/24.07.2012.

Table 1

Comparative Situation Scale B

No	Apartament number C T- apartment heaters	Surface m2	Heat Value lei	Techem Heat value lei	Month/Year Nov 2011- Apr. 2012 Diference (4)-(5)
1	2	3	4	5	6
1	Apartment 1	30	1189.08	438.26	-750.82
2	Apartment 2	30	1140.79	1103.25	-37.54
3	Apartment 3	30	880.04	1202.19	322.15
4	Apartment 4	30	126.59	363.04	236.45
5	Apartment 5	30	901.52	1277.57	376.05
6	Apartment 6	40	1174.80	1428.38	253.58
7	Apartment 7	30	880.04	997.61	117.57
8	Apartment 8	30	1035.32	993.79	-41.53
9	Apartment 9	30	799.53	1011.32	211.79
10	Apartment 10 (CT)	40	164.06	457.52	293.46
11	Apartment 11	30	880.02	627.74	-252.28
12	Apartment 12	30	811.01	1508.66	697.65
13	Apartment 13	30	254.75	33.80	-220.95
14	Apartment 14(CT)	40	159.01	220.34	61.33
15	Apartment 15 (CT)	30	138.86	172.99	34.13
16	Apartment 16 (CT)	30	206.73	305.93	99.20
17	Apartment 17 (CT)	30	62.94	33.80	-29.14
18	Apartment 18	30	1056.42	109.45	-946.97
19	Apartment 19	30	905.28	486.27	-419.01
20	Apartment 20	30	879.50	874.33	-5.17
Total			13646.29	13646.24	-0.05

Scale B:

a) Calculator to measure the heat LUXTERM type series 12406/04, under metrological bulletin No. 44011/25.07.2012 – debit transmitter ACTARES – series 0652193, according to metrological bulletin no. 41586/ 10.08.2012.

b) RTD pair PI 500 series 825 and 0934, according to metrological bulletin no. 43993/27.07.2012.

2º The distribution of thermal energy consumption when using the cost-sharing systems to heat this building was done according to the technical norms concerning the allocation of heat consumption among consumers type condominium buildings, rule approved by Order 343 / 13.07.2010, published in MO part I, No. 501 / 20.07.2010. The cost allocators do not measure the amount of heat itself, the cost errors sharing depends on the characteristics of surfaces

Table 2
Comparative situation scale B

No.	Apartament number C T- apartment heaters	Surface m2	Heat Value lei	Techem Heat value lei	Month/YearNov 2011-Apr. 2012 Diference (4)-(5)
1	2	3	4	5	6
1	Apartment 1	30	1270.30	1378.87	108.57
2	Apartment 2 (CT)	30	101.66	288.78	187.12
3	Apartment 3 (CT)	30	115.58	363.27	247.69
4	Apartment 4	30	1230.15	551.06	-679.09
5	Apartment 5	30	1138.54	1228.56	90.02
6	Apartment 6	40	1256.45	1568.58	312.13
7	Apartment 7	30	1288.00	1062.65	-225.35
8	Apartment 8	30	1305.05	915.68	-389.37
9	Apartment 9	30	1138.54	855.34	-283.20
10	Apartment 10 (CT)	40	114.72	766.92	652.20
11	Apartment 11 (CT)	30	101.66	686.73	585.07
12	Apartment 12	30	1305.05	1608.24	303.19
13	Apartment 13	30	1075.11	1263.96	188.85
14	Apartment 14	40	1349.39	434.33	-915.06
15	Apartment 15	30	1194.48	708.99	-485.49
16	Apartment 16 (CT)	30	178.75	394.38	215.63
17	Apartment 17	30	725.32	933.81	208.49
18	Apartment 18	30	31.65	221.90	190.25
19	Apartment 19	30	61.08	279.00	217.92
20	Apartment 20	30	972.04	809.12	-162.92
Total			15953.52	16320.17	366.65

3º The centralizing of the distribution of thermal energy produced by SC Techem Energy Services SRL, compared with centralizing the distribution of thermal energy drawn from the study are shown in Table 1 for scale A and Table 2 for scale B. The calculated differences are in column 6 per month and total time.

4. Conclusions

In the study, the analysis in the field and recalculating the SET's and thermal energy distribution have reached the following conclusions: the calculation of heating surfaces for columns was made according to the table by sent by ANRSC through the letter no. 4477 / 15.10.2008 to the company splitters. Until installation in apartments of the cost allocators, the distribution of thermal energy for each consumer individually was made under Order 91 / 20.03.2007, methodology applied in this study, As we said from the beginning of this studyt he cost allocators are not measurement devices, as specified by the State Metrologic Bureau.

The distribution of the amounts of heat according to the Order 343/2010, for the two scales G8, Scale A and B could not be done because, the common metering distributor mounted in the metering box both at Scale A and B was WRONG mounted, thus registering a number of units much larger than the amount from the allocators of undisconnected apartments in the building, which led to the allocation of a quantity of heat much larger for the common areas. This was because the ambient sensor recorded exterior temperatures of -20 C^0 while in the apartments the distributors have registered temperatures of -18 C^0. This common distributor or witness distributor, had to be mounted in the basement to the property limit in order to record a number of units close to the total amount of units from the allocators mounted in undisconnected apartments.

The calculation of the amount of heat in each apartment was done according to Order 91/20.03.2007, article 277. The splitters had not been taken into account, and for Scale A and B the common distribution frame mounted to limit property by SC Techem Energy Services SRL is not installed correctly.

From the market analysis on other companies that perform the same activity the allocation of costs for heating using heat cost allocators, it showed that the distribution is different, after calculation programs own that differ from one unit to another and weightings established by firms splitters. The calculation program represents the applying a calculation algorithm by using a programming language. The program used in this study was developed and used by former SC CET Iaşi. There were no problems for 25 years of use.

There is an urgent legislative regulations on limiting the use of dual heating system in residential blocks. It also requires a thorough check of the

annual radiating surfaces for owners who remained connected to the centralized system and not least the use of a single software distribution on price distribution of the radiant surface for all cost allocators firms in Romania.

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STUDIU EXPERIMENTAL ŞI ANALIZA DE FEZABILITATE ASUPRA CLĂDIRILOR CU SISTEM DE ÎNCĂLZIRE DUAL

(Rezumat)

Viitoarele blocuri de locuințe care se vor construi în România vor trebui, prin lege, să asigure încălzirea standardizata a apartamentelor, potrivit Legii Termiei. Astfel,

din stadiul de proiect se va alege o singură formă de încălzire, fie prin centrală de bloc, fie în totalitate prin centrale individuale, încălzirea de tip mixt, valabilă acum la majoritatea blocurilor vechi, şi chiar la unele noi, nemaifiind posibilă. In acest studiu s-a analizat functionarea sistemului dual de incalzire la blocurile de locuit in sistem centralizat si individual cu centrale de apartament. Acest sistem dual implica dificultati de gestionare, verificare si contorizare ,erorile inregistrate astfel reflectindu-se in sume incasate in plus sau minus pentru fiecare apartament in parte. Erorile sunt semnificative iar multiplind cu numarul de apartamente la nivel de tara aflate in acesta situatie, avem un risc crescut de a incasa de la locatari sume care nu reflecta realitatea.