

# REPORTS ON DATA RECORDED DURING IMPLEMENTATION OF THE ENERGY SAVING ACTION PLAN AND STRATEGY

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N. DELIVERABLE D. T. 4.4.3.

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ACTION PLAN AND STRATEGY

Version 01

05.2019

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Edited by PP6 - UNIBO





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## 1) THE GAME NUMBER

Every day, the University of Bologna and the group of Finmatica programmers, managed a large amount of data, elaborating profiles and studying possible solutions to improve the application performance and the monitoring system itself.

Every day, we attended all the participating schools and tried to always provide promptly, at their every request, trying to solve any kind of misunderstanding and difficulty.

Let's see in detail how much data was stored every day:

**School Number: 56**

- 1) Tapioszolos-Ujszilvas Reformed Primary School
- 2) Primary School in Liget street
- 3) Kodaly Zoltan Elementary-music primary school
- 4) Technical School of Petofi Sandor School
- 5) Szent-Gyorgyi Albert Primary School
- 6) Primary School Ujszilvas
- 7) 3 Osnovnašola Celje
- 8) IV Osnovnašola Celje
- 9) Osnovnašola Frana Kranjca
- 10) Osnovnašola Frana Roša
- 11) Osnovnašola Ljubečna
- 12) Osnovnašola Hudinja
- 13) Osnovnašola Lava
- 14) Zespół Szkół nr 12 im. Jana III Sobieskiego
- 15) Giacomo Leopardi
- 16) Zespół Szkół Budowlanych im. Jurija Gagarina
- 17) Zespół Szkół Ogólnokształcących Nr 4
- 18) Zespół Szkół Mechanicznych Nr 2 im. Hubera
- 19) Szkoła Podstawowa Nr 65 im. Czesława Tańskiego
- 20) Zespół Szkół Medycznych im. Warmińskiego
- 21) Zespół Szkół Samochodowych
- 22) Media Emaldi Fusignano
- 23) Primaria succursale Fusignano
- 24) Primaria Battagliasse
- 25) Ujszilvas Elementary School
- 26) Tapiosuolos Elementary School
- 27) NMS 2 Waidmannsdorf
- 28) VS 1 Benediktiner Schule
- 29) VS 8\_VS 24 Renners Schule
- 30) VS 21 Hörtendorf
- 31) NMS 3 Hasnerschule
- 32) VS 23 Wölfnitz
- 33) NMS 5 Wölfnitz
- 34) NMS 11 Annabichl
- 35) VS 9\_VS 10 Körnerschule



- 36)NMS6\_NMS10St.Peter
- 37)RealschuleFeuerbach
- 38)RealschuleStuttgartFeuerbach
- 39)SzkołaSzkoleniowa
- 40)SzechenyiSportsSchoolPrimarySchool
- 41)II.RakocziFerencTwoLanguagePrimarySchool
- 42)Birken-Realschule
- 43)BirkenrealschuleTest
- 44)SchoolRegistration
- 45)Birkenrealschule
- 46)AppleTestSchool
- 47)Gyakorlo\_Iskola
- 48)Próbalskola
- 49)Volksschule22Ponfeld
- 50)VS22Ponfeld
- 51)OsnovnaškolaMahično
- 52)OsnovnaskolaDubovac
- 53)OŠŠvarča
- 54)BraćaSeljan
- 55)OŠRečica
- 56)OsnovnaškolaRečica

**Jeg's Number: 303**

**Classrooms Number: 121**

**Sensors/smart Meters monitored Number: 106**

**Days Number of the game (The days dedicated to the test phase, are not included in the calculation):**

**59 days** for temperature monitoring (41 deleting all weekend)

**49 days** for sensors monitoring (35 deleting all weekend)

**Number of data collected:**

**6481** progressive data from sensors

**8015** temperature data



## 2) THE APPLICATION AND GAME, PURPOSE

1. Teaching and training to teach students what sensors and smart meters are for;
2. Training to give students a method of monitoring and the importance of doing so;
3. The aim of the game was to build the historical consumption profile and implement a criterion to determine performance indicators: average data by time bands, temperature comfort zone, ETC;
4. The practical aim was to experiment with a new application for monitoring consumption and evaluate its merits / defects to implement a new version of the game to be promoted in the future, gradually building new historical profiles useful for evaluating how the consumption based on the action plans for sustainable energy that the JEGs will have developed;

It is important to remember the main objective of this project, which aims to contribute to the awareness and training of the young citizens of tomorrow, for a conscious and more efficient management of energy in schools, in their homes and in any "living" place of the city.

The scoring system and the competition, introduced for the final phase of the E @ S Project, had to serve only to make the training and learning phase more stimulating and participatory, to help children and teachers to fit into a more European context `wide, of the world mobilization for the energetic transition in progress, without feeding divisions and speculative reactions.

In future editions the gamification phase will probably be omitted, instead the initial stages of training of SEGs and JEGs will be intensified, through frontal and multimedia lessons, with didactic contents on specific and carefully selected energy and environmental issues.



### 3) DIFFICULTY DISCOVER DURING THE GAME

The SEGs and the JEGs have contributed with their reports to highlight the problems encountered during the course of the game which have allowed us to improve and stabilize the E @ S application at the moment with respect to the beginning of the game period; however, some problems remain, some of which can be resolved and others which are less easy to manage.

The first thing to note is the substantial advantage given by the number of monitored classes and sensors (a school with 7 objects to be monitored has an advantage over one that has 2) for this reason it is considered indispensable to normalize the scores of the registered ranking at the end of the game, in order to standardize the playing conditions of the different schools; this obviously generated the discontent of some participants following the loss of points but it was essential to make the balance of forces between schools more balanced.

[For the final classification and details on applied normalization, see ATTACHED 2.](#)

**Following are the main difficulties encountered in the last three months:**

- The insertion of progressive data has caused a great deal of problems, both due to the insertion of the initial data (in case it was very large caused unexpected crashes), and for the lack of clarity on the methodologies to be followed for the correct insertion of data (despite instructions mails and video tutorials on the portal).
- Development on iOS has been slowed by Apple policies and their verification system (a mandatory bureaucratic system that requires approval that can take days).
- Some participants had difficulty in reading the data from the meters and / or did not understand the difference between a progressive data and a delta, probably due to an inadequate and timely preparation for the conditions of the game.
- Most bug reports lacked useful information in order to replicate the bugs found and then correct them.
- The beta testing phase between November 2018 and January 2019 was considered not useful by schools or, in many cases, even ignored; consequently the first feedback on bugs and malfunctions were sent to the game started causing an inevitable discontent among users in the early stages of the game.

It is important to highlight the last two points, given that testing and feedback are two fundamental steps, not to be ignored when an application is being developed, in this case they have in fact caused inconvenience and delays during the course of the game.



**The bugs solved can be summarized in the following categories:**

- Unusual frontend behavior that prevented the game from working properly.
- Bugs regarding the calculation of the deltas, the averages and in particular the delta created by the first insertion in the case in which one does not start from 0.
- Ghosts that cannot be resolved due to inconsistent data.
- Problems with deleted data remaining in the monitoring system cache.
- Inability to enter data for students who are usually half a day due to the time constraints initially set.
- Ghost invisible due to the presence of invalid characters in the message sent by the students.

**Other complications found:**

- Some users have complained that the ghosts created subtract two points and those resolved increase the score by two (lack of incentive to solve them).
- Some SEGs complained that their school holidays coincided with the time the game was running.
- Various problems have been reported regarding the malfunctioning of the instruments needed to play (sensors and related software).





#### 4) First Part

Technical check on the training for the use of the APP (October-December) by Seniors and Juniors through a simple questionnaire to which the EGs must answer in order to evaluate the strengths and weaknesses of this monitoring system.

PARTNER'S ANSWERS	QUESTION OF THE SATISFACTION SURVEY											Do you agree with the scoring system?	16) Do you have any recommendations and / or suggestions to improve the APP?
	2) How many schools did you register?	6) How much difficulty did you have to register your school?	7) How much you like the game?	8) How useful did you find the video tutorials?	9) How much did you find it difficult to navigate in the "MENU"?	10) How difficult was it to enter consumption data for the classes?	11) How difficult was it to enter consumption data for the sensors?	12) Were you able to view charts?	13) How much did you find the graphs understandable?	15) Have you ever been able to solve ghosts?			
PP1	3	2	8	7	3	6	5	YES	6	5	YES; The scoring system is fair, however for the purposes of the game it would have been very important to reset the ranking at the beginning of the game. (1st February).	To improve the app it is essentially necessary that no more errors occur during data entry, because this leads to accumulating lots of ghosts.	
PP3	7	1	2	5	4	6	5	YES	4	4	NO; Despite correct behaviour ghosts appeared all the time.	We recommend to check if everything works and react to the feedback from the school/institutions involved in the game, the contacts in the country were on a high level, but the international contact left much to be desired. It is known that with such a large number of participants it is difficult to control everything, but a malfunctioning system only worsens the situation. The idea was and is still more good, such monitoring teaches a lot to young people as well as to school employees when it comes to observing certain rules. Unfortunately, the motivation to act usually ended with, because the students were not sure every day of the application's operation.	
PP5	4	5	5	8	1	2	8	YES	8	5	YES; BUT At the beginning we were entering the data every day. Then the app broke and we lost points. When ever I wasn't able to enter the data somebody else (probably you) had to do it and we lost points. Also, a friend from other school said she filled in the data after a long time (wasn't filling it every day) and had more points than we did. How?? It was explained that entering the data every day gives you more points. In the scoring data it said we had Ghosts and points were taken away from us, but no ghosts appeared. .		
PP7	5	1	5	8	1	1	8	YES	10	3	YES, but we think that is not correct change point at the end of the game.	The app doesn't work well. It can't do what to do with school brakes (National Day, or ski break). On these days there is no power consumption in the classrooms. The program does not accept this and does not allow the enter of real data. It may happen that we are mistakenly entering incorrect data, but this cannot be corrected afterwards. It would be necessary to be able to improve on the input data.	
PP8	3	5	7	8	2	5	5	yes	9	8	NO;	APP is a very useful and creative idea, helping children and adults to shape their minds, but in international environment more time is needed to understand, develop and improve; but The scoring system and the rules of the game must be clarified before the tournament begins, not after the race is over. For game players, it was a little bit disappointing and incorrect solution. For some player feel it was not fair.	
PP9	1	9	9	8	1	1	1	YES	9	8	NO	It would be nice to know, what you have done well when you solve a ghost. There is no transparency regarding the score of the schools – how many ghosts were solved by other schools, how many classes are involved	
PP10	2	2	4	6	2	8	8	YES	4	5	NO; The indication of the scores was incomprehensible. The scores shown at the school info (in the upper display) was not identical to the display in the charts.	Unfortunately we have to say that the app is not suitable for students from primary schools.	
PP12	7	1	5	10	1	1	5	YES	8	9	YES	First suggestion is most definitely that the consumption data should be collected in the app automatically. And since the app is for the children it could include some pictures, colors and some fun interesting tips for energy efficiency and savings.	

In the table we can see how each school has had a different approach to the use of the application and also a rather specific and personal approval rating, in fact some schools have remained very enthusiastic about the app and its functioning, while others have been completely annoyed , mainly due to some difficulties encountered during data entry and for the subsequent redefinition of the system of normalization of the points in the standings.



Below are the pdf files ([ATTACHED 1](#)) of all the satisfaction questionnaires, filled in by each partner, in order to provide a more accurate and detailed testimony of the considerations on the game conditions.

## ATTACHED 1

### PP1 ITALY

#### CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

3 schools:

- Primary school L. Battaglia (Fusignano) main building
- Primary school L. Battaglia (Fusignano) branch building
- Secondary school R. Emaldi (Fusignano)

4 Which are the schools registered through the APP that participated in the game?

Primary school L. Battaglia (Fusignano)

Secondary school R. Emaldi (Fusignano)- mainly the secondary school classes participated in the competition.

5 Write the start and end date for each registered school.

We registered all classes in the application in November 2018.

6 How much difficulty did you have to register your school?

1 2x 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

7 How much did you like the game?

1 2 3 4 5 6 7 8x 9 10

8 How useful did you find the video tutorials?

1 2 3 4 5 6 7x 8 9 10



9 How much did you find it difficult to navigate in the "MENU"?

1 2 3x 4 5 6 7 8 9 10

10 How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6x 7 8 9 10

If you have had difficulties, explain in detail how and why.

Often we were unable to insert the data on the correct day.

11 How difficult was it to enter consumption data for the sensors?

1 2 3 4 5x 6x 7 8 9 10

if you have had difficulties, explain in detail how and why.

Often we were unable to enter the values of electrical consumption (after entering the value instead of approving it, the system referred to the initial login page).

12 Were you able to view the charts?

Yesx No

But sometimes we have had visualization problems, especially from mobile phone.

13 How much did you find the graphs understandable?

1 2 3 4 5 6x 7 8 9 10

14 Have you ever been able to solve ghosts?

1 2 3 4 5x 6x 7 8 9 10

Please, try to expose in full what you had difficulty and why.



We often had difficulty eliminating them (especially in the testing phase and in the first few weeks of the game) because the system did not allow it (it always gave errors or went back to the login). On other occasions it was no longer possible to visualize ghosts, both those resolved and those still to be resolved.

15 Do you agree with the scoring system?

Yesx No

If not, why?

The scoring system is fair, however for the purposes of the game it would have been very important to reset the ranking at the beginning of the game. (1<sup>st</sup> February).

16 Do you have any recommendations and / or suggestions to improve the APP?

To improve the app it is essentially necessary that no more errors occur during data entry, because this leads to accumulating lots of ghosts.



## PP3 POLAND

### ANSWERS FROM BYDGOSZCZ

First 5 questions are answered by external expert, rest are collected answers from SEGs (the one who responded).

1) Have you registered your school?

Yes

2) How many schools did you register?

7

3) Which are the schools registered through the APP that participated in the game?

Zespół Szkół nr 12 im. Jana III Sobieskiego

Zespół Szkół Budowlanych im. Jurija Gagarina

Zespół Szkół Ogólnokształcących Nr 4 im. Kazimierza Wielkiego

Zespół Szkół Mechanicznych Nr 2 im. Tytusa Maksymiliana Hubera

Szkoła Podstawowa Nr 65 z Oddziałami Integracyjnymi i Sportowymi im. Czesława Tańskiego

Zespół Szkół Medycznych im. E. Warmińskiego

Zespół Szkół Samochodowych

4) Write the start and end date for each registered school.

I don't understand the question. If you mean the starting and ending date of the game it is the same - 01.02.2019 till 31.03.2019

5) How much difficulty did you have to register your school?

**1** 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

The rest are replies of three teachers from three different schools who agreed to answer the survey.





- 1) How much did you like the game? *Na ile podoba się Państwu gra? (1- wcale; 10 - bardzo)*

1 2 3 4 5 6 7 8 9 10

- 2) How useful did you find the video tutorials? *Na ile przydatne były video tutorial? (1- wcale; 10 - bardzo)*

1 2 3 4 5 6 7 8 9 10

- 3) How much did you find it difficult to navigate in the "MENU"? *Na ile trudne było nawigowanie po MENU? (1 - proste, 10 bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

- 4) How difficult was it to enter consumption data for the classes? *Na ile trudne było wprowadzenie danych odnośnie zużycia energii (1 - proste; 10 - bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why. *W wypadku wybrania odpowiedzi wskazującej, że było to trudne proszę o uzasadnienie*

- problem with units

- input of electricity data doesn't work - all the time

- 5) How difficult was it to enter consumption data for the sensors? *Na ile trudne było wprowadzenie danych o zużyciu dla poszczególnych czujników? (1 - proste; 10 - bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why. *W wypadku wybrania odpowiedzi wskazującej, że było to trudne proszę o uzasadnienie*

- 6) Were you able to view the charts? *Czy dało się zobaczyć wykresy?*

Yes No

- 7) How much did you find the graphs understandable? *Na ile zrozumiałe były dane na wykresach? (1 - wcale; 10 - bardzo zrozumiałe)*

1 2 3 4 5 6 7 8 9 10



- 8) Have you ever been able to solve ghosts? *Czy byli Państwo w stanie rozwiązać duchy?*

**1** 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why. *Proszę szczegółowo wyjaśnić na czym polegał problem i dlaczego.*

- 9) Do you agree with the scoring system? *Czy zgadzają się Państwo z systemem punktowania?*

Yes **No**

If not, why?

Despite correct behaciour ghosts appeared all the time.

- 10) Do you have any recommendations and / or suggestions to improve the APP?  
*Czy macie Państwo jakieś zalecenia i/lub sugestie odnośnie usprawnienia aplikacji?*

.....

.....

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- 1) How much did you like the game? *Na ile podoba się Państwu gra? (1- wcale; 10 - bardzo)*

1 2 3 4 5 6 7 8 9 10

- 2) How useful did you find the video tutorials? *Na ile przydatne były video tutorial? (1- wcale; 10 - bardzo)*

1 2 3 4 5 6 7 8 9 10

- 3) How much did you find it difficult to navigate in the "MENU"? *Na ile trudne było nawigowanie po MENU? (1 - proste, 10 bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

- 4) How difficult was it to enter consumption data for the classes? *Na ile trudne było wprowadzenie danych odnośnie zużycia energii (1 - proste; 10 - bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why. *W wypadku wybrania odpowiedzi wskazującej, że było to trudne proszę o uzasadnienie*

**When there is no data and no access to the app it is pretty difficult**

- 5) How difficult was it to enter consumption data for the sensors? *Na ile trudne było wprowadzenie danych o zużyciu dla poszczególnych czujników? (1 - proste; 10 - bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why. *W wypadku wybrania odpowiedzi wskazującej, że było to trudne proszę o uzasadnienie*

**When there is no data and no access to the app it is pretty difficult**

- 6) Were you able to view the charts? *Czy dało się zobaczyć wykresy?*

Yes No

- 7) How much did you find the graphs understandable? *Na ile zrozumiałe były dane na wykresach? (1 - wcale; 10 - bardzo zrozumiałe)*

1 2 3 4 5 6 7 8 9 10





- 8) Have you ever been able to solve ghosts? *Czy byli Państwo w stanie rozwiązać duchy?*

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why. *Proszę szczegółowo wyjaśnić na czym polegał problem i dlaczego.*

No data

- 9) Do you agree with the scoring system? *Czy zgadzają się Państwo z systemem punktowania?*

Yes No

If not, why?

- 10) Do you have any recommendations and / or suggestions to improve the APP? *Czy macie Państwo jakieś zalecenia i/lub sugestie odnośnie usprawnienia aplikacji?*

... No comments .....

- 1) How much did you like the game? *Na ile podoba się Państwu gra? (1- wcale; 10 - bardzo)*

1 2 3 4 5 6 7 8 9 10

- 2) How useful did you find the video tutorials? *Na ile przydatne były video tutorial? (1- wcale; 10 - bardzo)*

1 2 3 4 5 6 7 8 9 10

- 3) How much did you find it difficult to navigate in the "MENU"? *Na ile trudne było nawigowanie po MENU? (1 - proste, 10 bardzo trudne)*

1 2 3 4 5 6 7 8 9 10

- 4) How difficult was it to enter consumption data for the classes? *Na ile trudne*



było wprowadzenie danych odnośnie zużycia energii (1 - proste; 10 - bardzo trudne)

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why. W wypadku wybrania odpowiedzi wskazującej, że było to trudne proszę o uzasadnienie

Energy consumption data could not be entered as the date was locked on 5.03

- 5) How difficult was it to enter consumption data for the sensors? Na ile trudne było wprowadzenie danych o zużyciu dla poszczególnych czujników? (1 - proste; 10 - bardzo trudne)

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why. W wypadku wybrania odpowiedzi wskazującej, że było to trudne proszę o uzasadnienie

- 6) Were you able to view the charts? Czy dało się zobaczyć wykresy?

Yes No

- 7) How much did you find the graphs understandable? Na ile zrozumiałe były dane na wykresach? (1 - wcale; 10 - bardzo zrozumiałe)

1 2 3 4 5 6 7 8 9 10

- 8) Have you ever been able to solve ghosts? Czy byli Państwo w stanie rozwiązać duchy?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why. Proszę szczegółowo wyjaśnić na czym polegał problem i dlaczego.

- 9) Do you agree with the scoring system? Czy zgadzają się Państwo z



*systemem punktowania?*

Yes

No

If not, why?

The school on the 1st place in an unnatural way suddenly gained hundreds of points more, but when trying to enter the data of our school jumped errors that sometimes made it impossible to obtain points or system errors adding additional points.

- 10) Do you have any recommendations and / or suggestions to improve the APP? *Czy macie Państwo jakieś zalecenia i/lub sugestie odnośnie usprawnienia aplikacji?*

We recommend to check if everything works and react to the feedback from the school/institutions involved in the game, the contacts in the country were on a high level, but the international contact left much to be desired. It is known that with such a large number of participants it is difficult to control everything, but a malfunctioning system only worsens the situation. The idea was and is still more good, such monitoring teaches a lot to young people as well as to school employees when it comes to observing certain rules. Unfortunately, the motivation to act usually ended with, because the students were not sure every day of the application's operation.



## PP5 CROATIA

### ▲ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

One school.

3) Which are the schools registered through the APP that participated in the game?

Braća Seljan

4) Write the start and end date for each registered school.

1.2.2019. - 31.3.2019.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

**You had to register us, we were not able to do it.**

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

No difficulty

10) How difficult was it to enter consumption data for the sensors?





1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why.

The application broke several times (not several but too many times). There fore I could not write the data for a few days. There fore I lost the daily score points. When you (somebody that I asked for help) entered the data we did not get points.

11) Were you able to view the charts?

Yes No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

**There were no ghosts.**

14) Do you agree with the scoring system?

Yes No

If not, why?

At the beginning we were entering the data every day. Then the app broke and we lost points. When ever I wasn't able to enter the data somebody else (probably you) had to do it and we lost points. Also, a friend from other school said she filled in the data after a long time (wasn't filling it every day) and had more points than we did. How?? It was explained that entering the data every day gives you more points. In the scoring data it said we had Ghosts and points were taken away from us, but no ghosts appeared.

15) Do you have any recommendations and / or suggestions to improve the APP?

**Just try to fix the bugs for next players.**

.....  
.....



## CROSS YOUR ANSWER

1) Have you registered your school? yes

2) How many schools did you register? 1

3) Which are the schools registered through the APP that participated in the game?

Osnovna škola Dubovac

4) Write the start and end date for each registered school.

1.2.2019.-31.3.2019.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.



10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why.

Most of the time app was not working completely ok. Most of the time when we were clicking submit app was logging out by itself. Than after a while datas were entered more times and showing 2 or 3 times values for one day.

11) Were you able to view the charts?

Yes No

12)How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13)Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

Most of the time we couldn't solved ghosts and message we were getting was "today's data can not solve ghost". In one day we managed to solve almost all Ghost and our guess was that we were able to do that because average values Of sensors were finally good.

14) Do you agree with the scoring system?

Yes No

If not, why?

**15)** Do you have any recommendations and / or suggestions to improve the APP?

We don't have any suggestion how to improve app but obviously there were problems and app needs to be improved if it will be used in future.



## ▲ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

1 school

3) Which are the schools registered through the APP that participated in the game?

Osnovna škola Mahično

4) Write the start and end date for each registered school.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.





10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why.

11) Were you able to view the charts?

Yes No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

14) Do you agree with the scoring system?

Yes No

If not, why?

15) Do you have any recommendations and / or suggestions to improve the APP?

.....

.....



## ▲ **CROSS YOUR ANSWER**

1) Have you registered your school?

Yes

2) How many schools did you register?

One

3) Which are the schools registered through the APP that participated in the game?

Osnovna škola Rečica

( OŠ Rečica is registrated too but we did not use it in the game at all)

4) Write the start and end date for each registered school.

At first we started from 1.2. but later it was canceled and we started from 11.2.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

It was not difficult but we made a mistake in the first registration

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

Sometimes we have had problems out of the app



10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why.

We often knew it was us that we were ejected from the app and we could not enter the data. Sometimes it happened that because we did not do that during the day because of other obligations we did this at later in the night so sometimes we were out of data. Due to the ejection of the application, we happened to have the same data twice in a day, so the difference in consumption was 0. In the coming days, this would become a big difference in consumption (spending) and we got a lot of ghosts.

11) Were you able to view the charts?

Yes No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

We noticed errors in the readout for one weekend. The graphs showed negative consumption but on the monitor we read lower consumption, which is normal for the weekend when no one is in school. We also got lots of ghosts because of that

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

In the last two weeks we had a lot of problems with that. Last week we could not solve a single ghost and did not understand why. The application has always been published and we have not solved it.

14) Do you agree with the scoring system?

Yes No

If not, why?

Because of the inability to solve the ghost first of all. The second reason is that we have already mentioned when entering the data



15) Do you have any recommendations and / or suggestions to improve the APP?

We hope you read our problems you can fix and improve the app.  
Regardless of the problems we are happy to be involved in the game and the  
project. We consider it useful and the children were happy during the  
game.....



## PP7 HUNGARY Szolnok

### ▲ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

One

3) Which are the schools registered through the APP that participated in the game?

Kodaly Zoltan Elementary-music primary school, Hungary, Szolnok

4) Write the start and end date for each registered school.

It was 15 minutes.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10



if you have had difficulties, explain in detail how and why.

In last two weeks it was impossible to enter data.

11) Were you able to view the charts?

Yes      No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

Most often it was possible to solve it with the help of “special day” button.

14) Do you agree with the scoring system?

Yes      No

If not, why?

15) Do you have any recommendations and / or suggestions to improve the APP?

We had problems with the app. It can't do what to do with school brakes (National Day). On these days there was no power consumption in the classrooms because nobody was in the school. The program did not accept this and did not allow the entry of real data.

It may happen that we are mistakenly entering incorrect data, but this cannot be corrected afterwards. It would be necessary to be able to improve on the input data.





## ▲ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

One

3) Which are the schools registered through the APP that participated in the game?

Primary School in Liget street, Hungary, Szolnok

4) Write the start and end date for each registered school.

It was 12 minutes.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10



if you have had difficulties, explain in detail how and why.

In last two weeks it was impossible to enter data, and during the game it was impossible to enter data of Sensor 2. This has been reported several times in the weekly reports, but nothing happened.

11) Were you able to view the charts?

Yes      No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

Most often it was possible to solve it with the help of “special day” button.

14) Do you agree with the scoring system?

Yes      No

If not, why?

Because it was changed at the end of the game.

15) Do you have any recommendations and / or suggestions to improve the APP?

The app doesn't work well. It can't do what to do with school brakes (National Day, or ski break). On these days there is no power consumption in the classrooms. The program does not accept this and does not allow the enter of real data.

It may happen that we are mistakenly entering incorrect data, but this cannot be corrected afterwards. It would be necessary to be able to improve on the input data.





## CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

One

3) Which are the schools registered through the APP that participated in the game?

Technical School of Petofi Sandor School, Hungary, Szolnok

4) Write the start and end date for each registered school.

It was 10 minutes.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10



if you have had difficulties, explain in detail how and why.

In last two weeks it was impossible to enter data.

11) Were you able to view the charts?

Yes      No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

Most often it was possible to solve it with the help of “special day” button.

14) Do you agree with the scoring system?

Yes      No

If not, why?

15) Do you have any recommendations and / or suggestions to improve the APP?

We had problems with the app. It can't do what to do with school brakes (National Day). On these days there was no power consumption in the classrooms because nobody was in the school. The program did not accept this and did not allow the entry of real data.

It may happen that we are mistakenly entering incorrect data, but this cannot be corrected afterwards. It would be necessary to be able to improve on the input data.



## CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

One

3) Which are the schools registered through the APP that participated in the game?

Technical School of Petofi Sandor School, Hungary, Szolnok

4) Write the start and end date for each registered school.

It was 10 minutes.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10



if you have had difficulties, explain in detail how and why.

In last two weeks it was impossible to enter data.

11) Were you able to view the charts?

Yes      No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

Most often it was possible to solve it with the help of “special day” button.

14) Do you agree with the scoring system?

Yes      No

If not, why?

15) Do you have any recommendations and / or suggestions to improve the APP?

We had problems with the app. It can't do what to do with school brakes (National Day). On these days there was no power consumption in the classrooms because nobody was in the school. The program did not accept this and did not allow the entry of real data.

It may happen that we are mistakenly entering incorrect data, but this cannot be corrected afterwards. It would be necessary to be able to improve on the input data.



## ■ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

One

3) Which are the schools registered through the APP that participated in the game?

Szechenyi Sports School Primary School, Hungary, Szolnok

4) Write the start and end date for each registered school.

It was 5 minutes.

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10





if you have had difficulties, explain in detail how and why.

In last two weeks it was impossible to enter data.

11) Were you able to view the charts?

Yes      No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

14) Do you agree with the scoring system?

Yes      No

If not, why?

Because it was changed after the game.

15) Do you have any recommendations and / or suggestions to improve the APP?

We had problems with the app. It can't do what to do with school brakes (National Day). On these days there was no power consumption in the classrooms because nobody was in the school. The program did not accept this and did not allow the entry of real data.

It may happen that we are mistakenly entering incorrect data, but this cannot be corrected afterwards. It would be necessary to be able to improve on the input data.



## PP8 HUNGARY Újszilvás

### ▲ CROSS THE ANSWER

1) Have you registered your school?

YES

2) How many schools did you register?

2

3) Which are the schools registered through the APP that participated in the game?

- Újszilvás - Újszilvás Calvinistic Primary School and Kindergarten (It is a member institution of Újszilvás)
- Tápiószőlős - Újszilvás Calvinistic Primary School and Kindergarten (It is a member institution of Újszilvás)

4) Write the start and end date for each registered school.

Újszilvás: 06/02/2019 01/04/2019

Tápiószőlős: 06/02/2018 01/04/2019

5) How much difficulty did you have to register your school?

❌ 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

-

6) How much did you like the game?

1 2 3 4 5 ❌ 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 ❌ 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 ❌ 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 ❌ 9 10



If you have had difficulties, explain in detail how and why.

For each of the two participating schools, we have repeatedly indicated that we cannot record data. (On February 6, 2019 We sent an email to Martina about the problem) After we entered date was inactive (In the case of Újszilvás) Therefore, we had a short period, when we could not record data.

10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7  9 10

if you have had difficulties, explain in detail how and why.

We could not record data on the telephone interface (On March 26, 2019 We sent an email to Martina about this problem)

11) Were you able to view the charts?

 No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6  8 9 10

Please, try to expose in full what you had difficulty and why.

After the recording of kW data, no matter how much data was recorded, we had got a ghost for it. (On March 26, 2019 We sent an email to Martina about this problem)

14) Do you agree with the scoring system?

Yes 

If not, why?

The scoring system and the rules of the game must be clarified before the tournament begins, not after the race is over. For game players, it was a little bit disappointing and incorrect solution. For some player feel it was not fair.

15) Do you have any recommendations and / or suggestions to improve the APP?

APP is a very useful and creative idea, helping children and adults to shape their minds, but in international environment more time is needed to understand, develop and improve.





**PP9 GERMANY**

**CROSS YOUR ANSWER**

1) Have you registered your school?

Yes

2) How many schools did you register?

1

3) Which are the schools registered through the APP that participated in the game?

Birken-Realschule

4) Write the start and end date for each registered school.

1. February - 31. March

5) How much difficulty did you have to register your school?

9

If you have had difficulties, explain in detail how and why.

No special characters (+,-) usable, which is nowhere mentioned.

6) How much did you like the game?

9

7) How useful did you find the video tutorials?

8

8) How much did you find it difficult to navigate in the "MENU"?

1

9) How difficult was it to enter consumption data for the classes?

1

If you have had difficulties, explain in detail how and why.



10) How difficult was it to enter consumption data for the sensors?

1

if you have had difficulties, explain in detail how and why.

11) Were you able to view the charts?

Yes

12) How much did you find the graphs understandable?

9

13) Have you ever been able to solve ghosts?

8

Please, try to expose in full what you had difficulty and why.

14) Do you agree with the scoring system?

No

If not, why?

The normalization should be included in the app

15) Do you have any recommendations and / or suggestions to improve the APP?

It would be nice to know, what you have done well when you solve a ghost.

There is no transparency regarding the score of the schools - how many ghosts were solved by other schools, how many classes are involved



## PP10 AUSTRIA

### ▲ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

We registered 14 schools of which 2 participated in the game;

3) Which are the schools registered through the APP that participated in the game?

We registered 8 primary schools and 6 secondary schools -

2 primary schools participated in the game;

4) Write the start and end date for each registered school.

VS 22 Ponfeld: 01.02.2019 - 28.03.2019

VS 23 Wölfnitz: 01.02.2019 - 26.03.2019

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

No special occurrences

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

Very often there were problems with entering the data. The program switched off and the log in often took a long time.



10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 5 6 7 8 9 10

if you have had difficulties, explain in detail how and why.

See our answer question no. 9)

11) Were you able to view the charts?

Yes No

12)How much did you find the graphs understandable?

1 2 3 4 5 6 7 8 9 10

13)Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 8 9 10

Please, try to expose in full what you had difficulty and why.

14) Do you agree with the scoring system?

Yes No

If not, why?

The indication of the scores was incomprehensible. The scores shown at the school info (in the upper display) was not identical to the display in the charts.

15)Do you have any recommendations and / or suggestions to improve the APP?

Unfortunately we have to say that the app is not suitable for students from primary schools.

.....  
.....



## PP12 SLOVENIA

### ▲ CROSS YOUR ANSWER

1) Have you registered your school?

Yes

2) How many schools did you register?

7

3) Which are the schools registered through the APP that participated in the game?

All 7 involved

4) Write the start and end date for each registered school.

We have a testing period last year, so we are not sure when we registered school in the application. This year all school started with monitoring on 1.2.2019

5) How much difficulty did you have to register your school?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.

6) How much did you like the game?

1 2 3 4 5 6 7 8 9 10

7) How useful did you find the video tutorials?

1 2 3 4 5 6 7 8 9 10

They were useful, but we didn't use them.

8) How much did you find it difficult to navigate in the "MENU"?

1 2 3 4 5 6 7 8 9 10

9) How difficult was it to enter consumption data for the classes?

1 2 3 4 5 6 7 8 9 10

If you have had difficulties, explain in detail how and why.





10) How difficult was it to enter consumption data for the sensors?

1 2 3 4 **5** 6 7 8 9 10

if you have had difficulties, explain in detail how and why.

On Mondays after the weekend when we want to insert the consumption data the application shut down couple of times before it saved inserted data.

11) Were you able to view the charts?

**Yes** No

12) How much did you find the graphs understandable?

1 2 3 4 5 6 7 **8** 9 10

13) Have you ever been able to solve ghosts?

1 2 3 4 5 6 7 **8** 9 10

Please, try to expose in full what you had difficulty and why.

Sometimes even though we have insert today's data the sign has appears that it is not possible to solve the ghost because the today's data are not inserted.

14) Do you agree with the scoring system?

**Yes** No

If not, why?

15) Do you have any recommendations and / or suggestions to improve the APP?

First suggestion is most definitely that the consumption data should be collected in the app automatically. And since the app is for the children it could include some pictures, colors and some fun interesting tips for energy efficiency and savings.



## ATTACHED 2

### FINAL RANKING

Appropriate technical investigations and analysis of the scoring algorithm enabled us to define the following classification and normalized scores:

School	Score	Nr Classes/Sensors
Media Emaldi Fusignano	368	7
Osnovna škola Rečica	309	5
Osnovna škola Mahično	281	3
Braća Seljan	257	5
Osnovna škola Dubovac	256	3
VS22 Ponfeld	222	5
Primary School in Ligetstreet	217	4
VS23 Wölfnitz	216	3
Szechenyi Sports School Primary School	214	4
Technical School of Petofi Sandor School	198	4
Primaria succursale Fusignano	174	3
Osnovnaškola Frana Kranjca	158	9
IV Osnovna škola Celje	155	8
Osnovna škola Frana Roša	151	9
Primaria Battaglia sede	143	3
Zespół Szkół Mechanicznych Nr 2 im Hubera	136	3
Kodaly Zoltan Elementary-music primary school	127	4
Szkoła Podstawowa Nr 65 im Czesława Tańskiego	124	3
OŠ Švarča	121	3
Osnovna škola Hudinja	120	4
Gyakorló Iskola	111	3
Zespół Szkół Medycznych im Warmińskiego	106	3
Zespół Szkół Ogólnokształcących Nr 4	105	3
Szkoła Szkoleniowa	102	3
Osnovna škola Ljubečna	84	7
Zespół Szkół nr 12 im Jana III Sobieskiego	83	3
Osnovna škola Lava	81	8
II Rakoczi Ferenc Two Language Primary School	71	4
3 Osnovna škola Celje	60	11
Realschule Stuttgart Feuerbach	55	3

THE GAME WANTS TO REWARD THE RATIONAL USE OF ENERGY BUT ABOVE ALL THE GOOD WILL OF THE JECS FOR HAVING ENGAGED IN A SYSTEMATIC AND PUNCTUAL MONITORING.

### SUMMIT FOR SCORING

- An initial score of 100 was defined for each school in the ranking, to avoid negative scores, especially in the initial stages of the game.
- 2 points were subtracted for each ghost on;
- For each solved ghost the 2 lost points have been returned.
- By entering all the values of a day, NO points were obtained but only by punctual insertions, each set of data entered punctually, made 1 point (Monday-Thursday); while



every triad inserted on a Friday of a week without lighted ghost realized 3 points (4 if punctual).

## **NORMALIZATION PHASE**

The final ranking is the result of appropriate assessments and analysis of the scores in the original classification. The standardization was necessary because the schools did not all have the same sensors as shown in the above table. For the calculation of the normalized score we have decided to consider only the schools that had totaled at least 150 points. Before the normalization a careful check was carried out on the points obtained as some schools had inconsistencies due to bugs or incorrect use of the application, in particular it was checked that the number of ghosts present on the database actually corresponded to the recorded score variations.

The formula used to normalize the data is as follows: (Corrected score x 3) / (Number of classes and sensors)

in order to bring all schools to the same level (2 sensors and 1 class). However, the normalization carried out does not take into account the effort required to manage more than three sensors, so we thought one method to add bonus points to all the schools that monitored 4 or more classes / sensors.

### **Method 1:**

This method involves normalizing the final score always taking into account additional sensors.

Formula applied:  $(\text{Corrected score} \times 3) / [3 + (\text{Number of classes and sensors} - 3) \times 0.5]$

In doing so the first three sensors / classes weigh 1 on the division while the remaining ones weigh half so as to better balance the points of the schools with more sensors.

## **NORMALIZATION DETAILS**

The normalization formula was initially:  $(\text{Score} \times 3) / n$

where is it:

Score = score visible from the application by removing all points "given" by bugs or incorrect data

$n$  = number of classes + number of sensors monitored by the school

3 = we consider 2 sensors and 1 class for the schools

This formula, however, not taking into account the bonus decided for schools with more sensors had to be changed so that the division was less impacting for schools with the right to the bonus. In the initial formula each class / sensor has a weight of 1 on the divider so we decided to have 0.5 classes / sensors weighed over the third, so the formula turned into:  $(\text{Score} \times 3) / [3 \times 1 + (n - 3) \times 0.5]$   $n$  decomposed into  $3 + (n - 3)$ , two parts to which two different multipliers 1 and 0.5 are applied. From here we understand that the 2 sensors and 1 base class weigh 1, while those in more weigh 0.5. The schools that have only 2 sensors and 1 class (ie those that are not entitled to the bonus) in the formula have  $n = 3 \rightarrow 3 - 3 = 0 \rightarrow$  return to the initial formula because it does not receive the bonus.



## 5) SECOND PART

The main purpose of the game / monitoring is to create energy culture in children. The monitoring action, followed by the discussion on the appearance and disappearance of the phantom, on the trend of consumption and its environmental impact, based on the reduction of waste and the virtuous strategic actions put in place, is the added value we give with the E @ S. application

We therefore want to share the educational value of the E @ S experience in order to optimize the experimental phase of the application, aimed at defining a reliable monitoring model; in fact, in this first year of experimentation we have put in place tools and difficulties that are essential for identifying the average historical profiles of each school.

The instability and the difficulties, encountered in this first experimental phase, in the game and in the evaluation of the results, were due to the lack of an average reference value, the data history, which allowed us to calculate ghosts with respect to a value average stable over a fixed period of at least 7 days (period in which it was assumed that there was no significant change in consumption due to climate variability and lifestyles); this has generated the need to realize the consumption profile day by day through a weight average. The inevitable little robust statistical data has led to ignitions and shutdowns of ghosts, often not always linked to actions closely linked to the choices of JEGs. At this stage, however, it was necessary to accept this inevitable compromise to build a first historical consumption profile to be used and further refined in the coming years.

If on the one hand the management of ghosts presented objective difficulties, on the other hand, during the entire period of play, the indispensable consumptions were monitored to realize the first historical profile which will be calculated for each school over an average of 7 days and which will be inserted in the application. In the second year of monitoring and play, each school will enter its consumption data, referring to its historical profile, defined in the first year of experimentation (2019). At this point the ghosts will appear on a more robust statistical basis and at the same time, by doing so, a second new profile will be generated that will be mediated with the first and that will represent the new historical reference profile for the third year of monitoring. In this way, each year of monitoring and play will increasingly refine the historical consumption profile, making the statistics based on the experimental data collected by the JEGs increasingly robust.



In the second part of the report, real examples of consumption graphs of one of the participating schools are shown, taken during the E @ S competition.

It explains how to interpret consumption trends through graphs and how to identify one's own profile, between consumption, ghosts and actions.

## 6) NOTES ON THE GRAPHS:

**Temperatures:** The dotted lines parallel to the x axis represent the limits of the comfort zone

**Presence:** The values that the presence can take are only two 0 (NO) or 1 (YES), this graphic representation is not the most suitable for these data but is the only one available

**External temperature:** the selected interval is the same as Temperature so it is very easy to superimpose these graphs for a more precise analysis

**Progressive data:** this graph represents the progress of progressively entered data, in theory the occurrence of a "step" represents a significant change

... **Delta:** it represents the delta based on the time band, to be compared with the average chart

... **delta average:** the formula used to activate ghosts is the following

(Last delta inserted) >  $1.05 \times$  (Average delta of the last 15 days)

therefore a value at time t represents the average of the deltas inserted over a period of time ranging from t-15 to t

**Ghosts:** it shows how many ghosts are activated day by day, the value goes from 0 (no ghost) to 3 (all values entered caused a ghost).

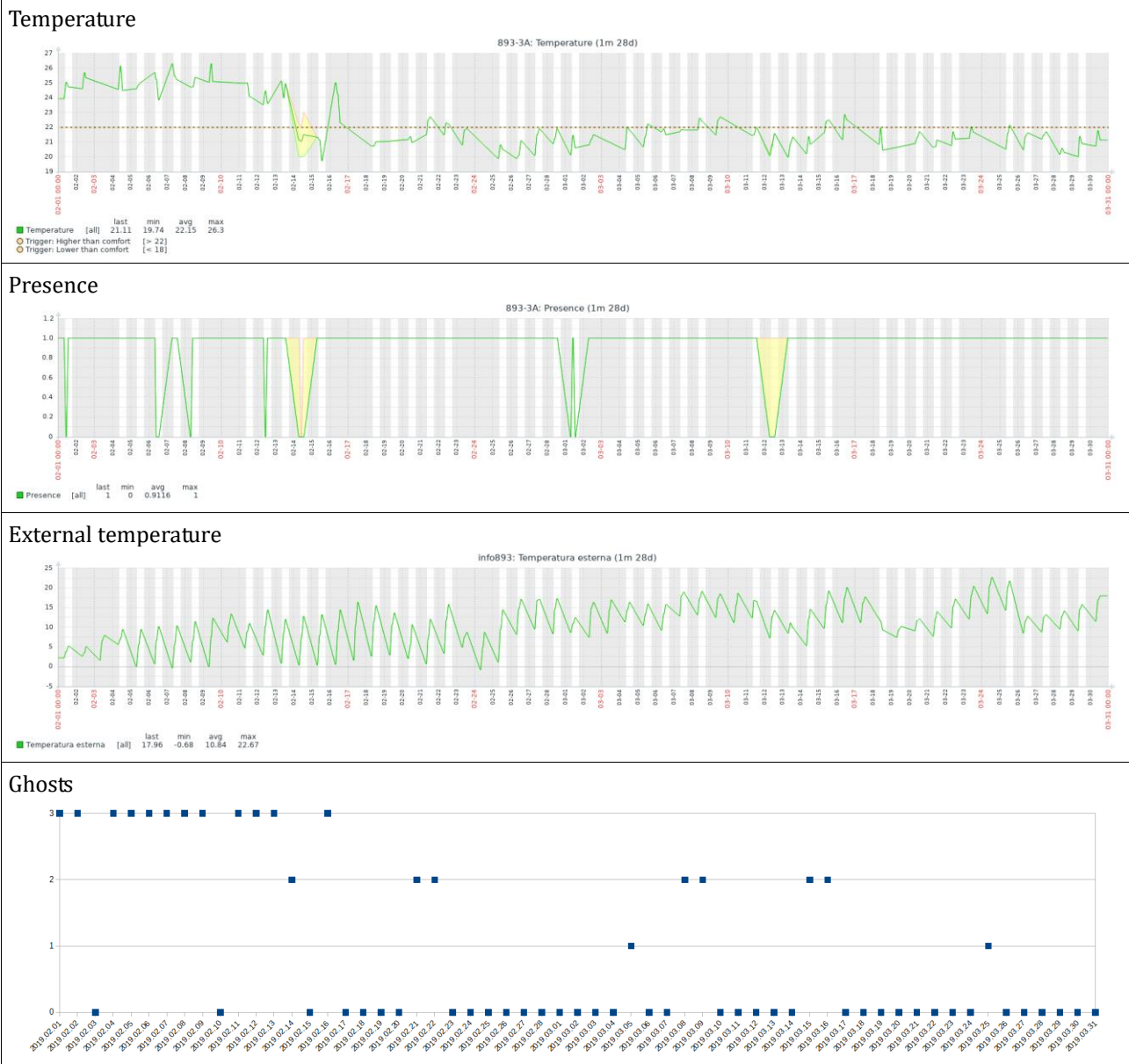




## 7) EXAMPLE OF GRAPHICS INTERPRETATION

### Media Emaldi Fusignano

Classroom: 3A



The "sensors" of internal temperature, external temperature and the presence of students give us a macro data on the climate of the school. The internal temperature in fact gives us an index of the degree of comfort present during the presence or absence of the students from the classes and is a figure strongly dependent on the external temperature.

In the school, for example, it can be seen that the internal temperature at the beginning of the game was definitely outside the comfort zone. This indicator quickly returned to the comfort zone after about 15 days coinciding with a slight increase in outside



temperatures but above all due to the control of the heat input of the heating in the rooms. This example demonstrates how constant monitoring of the structure can improve the efficiency of energy management consumed in the school.

The ghost trend is consistent with these data, in fact, after the initial appearance of ghosts due to the comfort zone indicator, the ghosts started to decrease as the temperatures recorded fell within the European range established as comfort zone (from 18 ° to 22 °). It is interesting to note that during periods of student absence (presence sensor) there was no significant drop in internal temperature which is reflected in constant school consumption even on weekends. This consumption trend is well expressed by the progressive consumption of natural gas which does not show slowdowns on weekends. On the management of heating, further improvements could be made that are already clearly visible on the progressive electricity consumption in which consumption slows significantly during weekends. From the variations in gas consumption, a progressive very rapid reduction is observed after the first 15 days of play and progressive in the subsequent ones due largely to the increase in the external temperature. As for the consumption of electricity, in addition to the attention shown during the absence of students from the classrooms, a progressive reduction in consumption was also observed in the midday time slot which is certainly not affected by the external light effect but which is partly may be due to less use of heating. The reduction in this band could undoubtedly be attributed to a greater attention of the JEGs to the rationalization of electricity consumption. This data is undoubtedly consistent with the appearance of ghosts during the week compared to the weekend and their disappearance in the absence of students during the weekend.

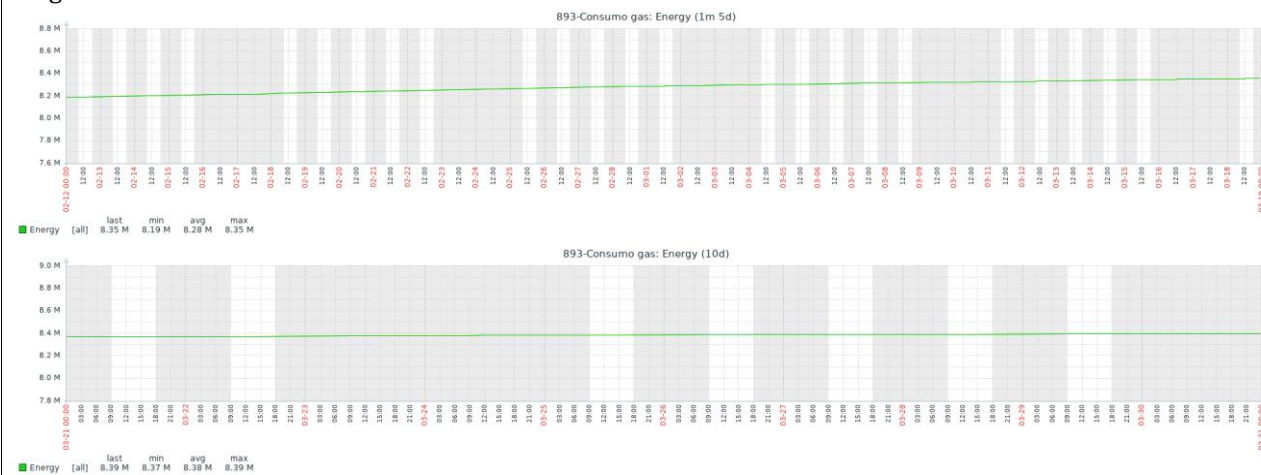
**The appearance and disappearance of the ghosts is therefore affected by the presence and absence of the students, so that in the second year monitoring during the weekend will be eliminated and the profile of consumption will be taken into account only between Monday and Friday.**

**By cleaning up the monitoring data for the weekend period, it can be seen that the trend in consumption changes is more coherent and more manageable from a statistical point of view.**

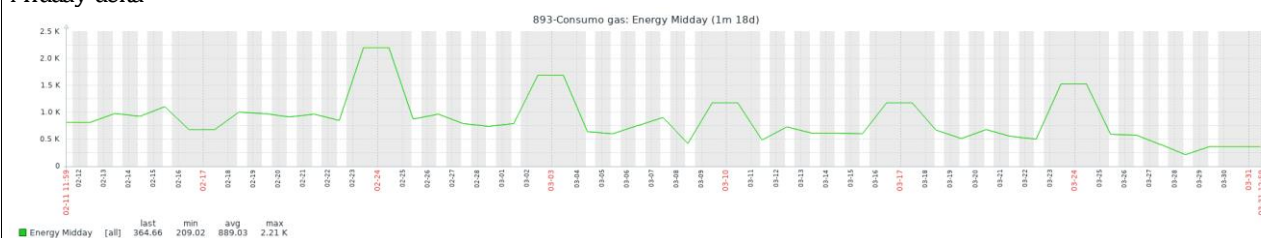


## Sensor: Gas Consumption

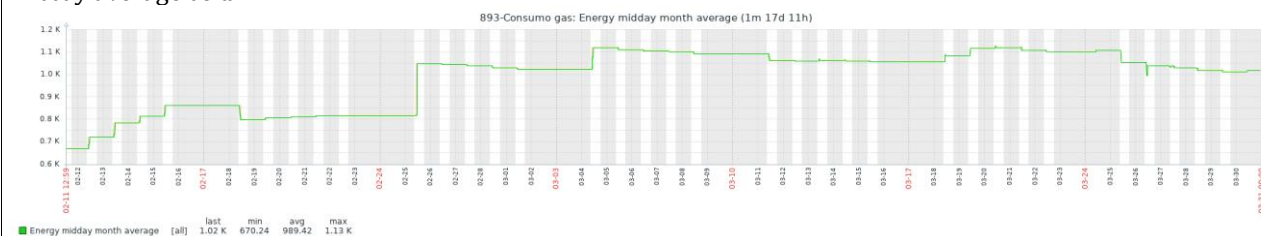
### Progressive data



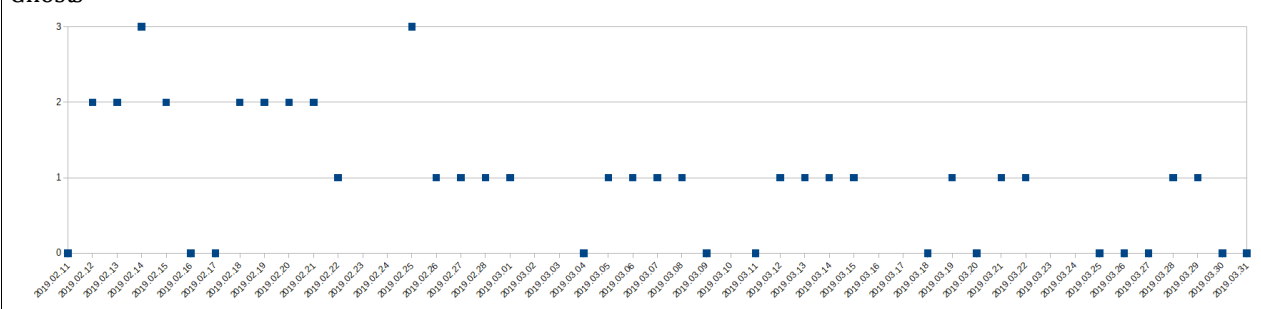
### Midday delta



### Midday average delta



### Ghosts



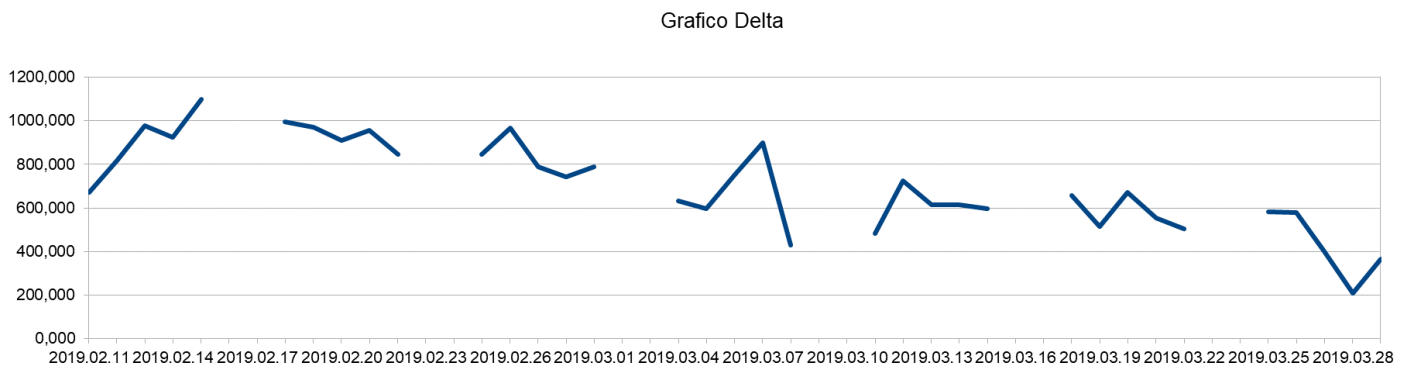
For example, in the "Midday delta" chart, all the deltas are calculated, including the data entries of the same time interval, of a day and its next. In correspondence of Saturdays and Sundays, significant drops may be noted, having had no data monitoring; this detail has caused a distribution of delta and average delta values, not consistent with reality; in fact the value subtended by the whole weekend interval, should be spread over the two days of closure of the school structure, thus reaching a smaller and



more realistic value. We can also notice this imprecision in the graph of the delta average, where the approximate value of the weekend deltas is represented by a single growing segment, bringing the delta back to a single day.

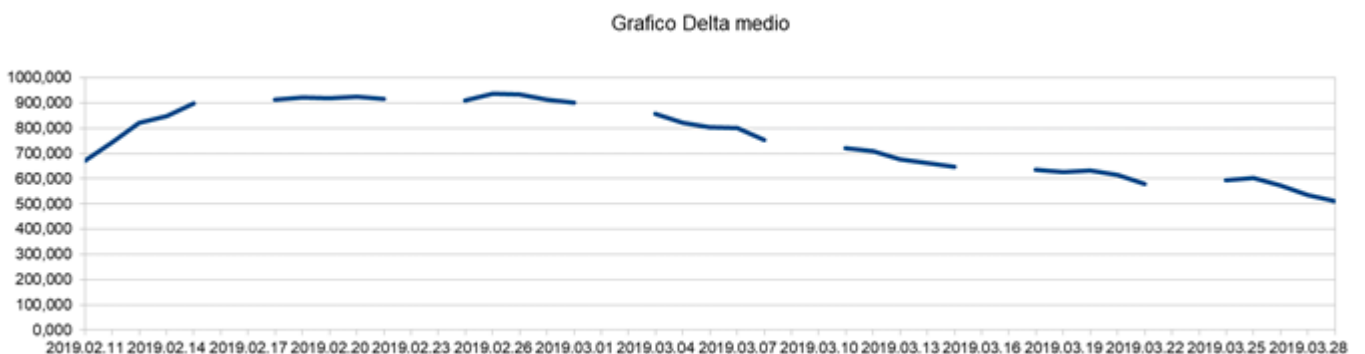
**In this regard, it was considered necessary to eliminate all the weekends from the delta calculations, showing only the school weeks from Monday to Friday in the chart.**

## GAS DELTA



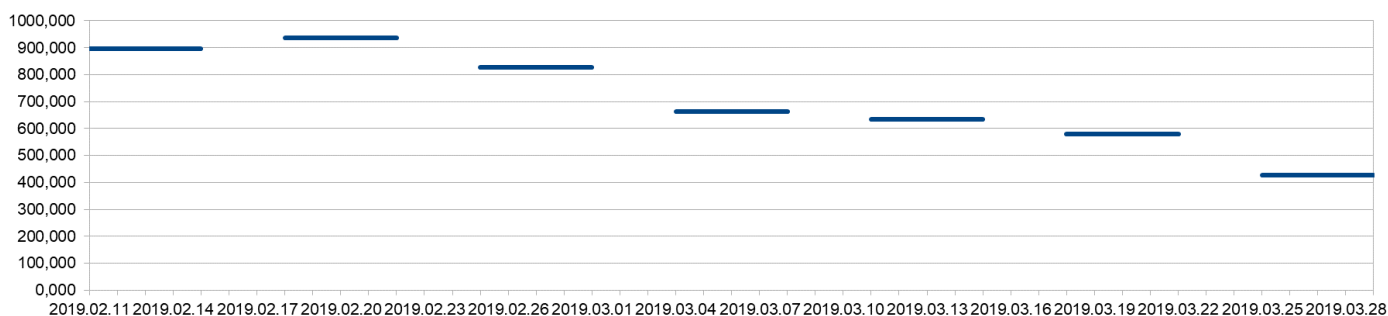
From the graph of the deltas the graph of the average of the deltas is generated, calculated over a period of 7 days, having assumed the hypothesis of not significant variation of the consumption data.

## GAS AVERAGE DELTA



## GAS AVERAGE DELTA ON 7 DAYS

Grafico Media nei 7 giorni



Below is the graph obtained by superimposing the point data on the historical profile on the average of 7 days.

**This is an example of how the game would have been if we had the historical profile available and how it will be next year, going to overlap each time the new experimental delta values on the identified historical profile.**

Grafico Delta + media 7 gg

