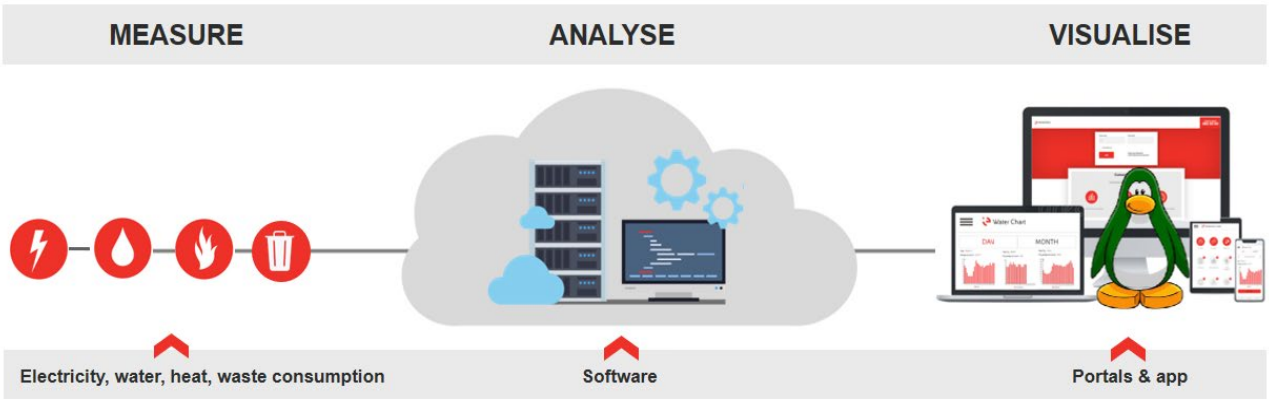
ARGUMENTATION, CALCULATIONS, SOURCES.
Kranj, Slovenia – 6 December 2020

1. WHO:

Iskraemeco - Bringing intelligence to Energy; Slovenian global company designing smart energy solutions helping utility companies, cities, communities all over the globe to improve their efficiency

Klappir Green Solutions, Icelandic company designing digital solutions that empower businesses, municipalities, investors and governments to work systematically toward improved sustainability.

2. WHAT & HOW:



GREEN PENGUIN

Technology & digitalization & visualization + gamification + environmental & digital literacy
=
social & economical & environmental benefits

I'ts about time, we use all the potentials of technology to benefit the environment, nature and planet.

Our idea is based on the use of smart, digital technologies (measurement, cloud computing, edge computing, big data analysis, visualization tools, list of possible best practices, ideas for reduction …. engagement of school kids through gamification and user applications), to achieve:

- **significant CO2 reductions** based on created energy efficiencies and resource consumption reductions;
  - if all schools and kindergartens of Ljubljana municipality reduce CO2 footprint for 15%, they can save 1086 t of CO2, meaning 3259 m³ ice not melted = 3259 penguins saved.
  - If kids bring this practice back home, to their households (proved by many studies & similar projects) only for 5% - this means households save 7522t CO2, meaning 22.565 m³ ice not melted = 22.565 penguins saved; 1,5 football stadium of penguins ☺
- **we teach kids environmental literacy**; as this is missing in the adult generation, that's why things are not moving anywhere. We need to know…… same as we all know what is in real life 1 kg or 1m, we need to know what is 1 kg, 1t of CO2 footprint, what it causes…we want to make things tangible. So we calculated in trees and in m3 of icebergs = penguins.
- **we teach kids digital literacy**; they learn about the tools, effects of real time data, potentials of synergies of technologies,… They will need this in future very much
- **we create sense of belonging**; kids see effects of their actions, they compete school to school, are awarded, they can teach the adults,
- **we reduce costs and above all mitigate future financial risks**, as we all know, prices of energy will be taxed somehow for CO2 and will increase in future…
- based on the technology we can create **full environmental compliancy and reporting for Municipality, offer them great, accurate, real time resource management tool** (important: use of all resources for schools and kindergartens is municipality cost, as well as maintenance of buildings)
- **Learning & engagement through gamification;** to increase engagement, we added gamification to the idea – schools are collecting penguins and compete against each other, based on their activities, kids all have access, parents have access, school, municipality,…

Some facts, to underline the idea:

Fact 1: we only took into consideration CO2 decrease that is done based on changes of our behavior, not reduction based on building renovations, etc. This would add a whole lot more of CO2 reduction.

Fact 2: technological solutions exist, the problem is, that companies and households are not motivated enough, as mainly they seek financial motivation & incentive; for average household this would be 5€/month - and obviously this is not enough (data: Slovenian project Nedo, other international projects). This is because the price of energy in Slo is relatively low – in countries where prices are higher, community's motivation is also higher (Germany, UK, Nordic countries, Middle East countries, North Africa)

Fact 3: We know that with changes of the existing legislation on energy, with coming energy taxation and with the overall strategy of EU to meet climate goals, this will change and the financial risk is also, what we wish to mitigate with the project.

3. ARGUMENTATION AND EXPLANATION OF CALCULATIONS

Our idea was based on a study that explored the impact of curriculum-based learning on environmental literacy and energy consumption. The study revealed that through education on electricity and electricity consumption a 30% decrease in electricity consumption of the monitored school facility was recorded. Additionally, over 15 % decrease in electricity consumption in student households was also recorded (Craig and Allen, 2015).

Through the research of environmentally orientated curriculums or school activities we learned that such activities provide a unique opportunity that empowers school children to lead change within their school and have a positive impact on their wider community. These activities and study programs encourage pupils of all ages and abilities to work together to develop their knowledge and environmental awareness (Eco-Schools).

We concluded that students and pupils are the best focus group for introducing changes regarding sustainability. The results are not only evident instantly but the shift in their mentality enables the change for the better in the long run, we create several environmental conscious generations – through them also education their families. We need to be educating the population of tomorrow.

We based our calculations on the data from a concrete elementary school in Slovenia. According to the school's internal environmental management system (E2 Manager) the total emissions amounted to 175 tCO_{2e} (CO_2 equivalent) in 2019. This means the average footprint per-student amounted to 33,75 $kgCO_{2e}$ per month.

We took into consideration the fact that this school is an unusually large school. In order to define the average emissions for the 53 schools in Ljubljana, we adjusted calculation to the average Ljubljana school, which we know has 238 students (official data). In Ljubljana, there are 53 schools and 47 kindergartens (official data). The average annual tCO_{2e} emissions for Ljubljana schools was 107,02 tCO_{2e}.

According to the research from Notz and Stroeve, 3 m^3 of arctic sea ice is lost for every ton of CO_2 emitted. The annual sum for all Ljubljana's 53 schools was 5.565,425 tCO_{2e} amounting to the loss of 16.696 m^3 of arctic sea ice (Notz and Stroeve, 2016).

By increasing their energy consumption efficiency by 15%, every school in Ljubljana could prevent the loss of 48 m^3 of Arctic sea ice. The annual sum of prevented Arctic sea ice loss could amount to = 2.504 m^3.

Additionally, we calculated the data for 47 kindergartens in Ljubljana. We assumed that an average kindergarten produces 30 % of CO_{2e} of an average school. Therefore, the average annual tCO_{2e} emissions for Ljubljana kindergartens was 35,673 tCO_{2e}. By increasing their energy consumption efficiency by 15%, every kindergarten in Ljubljana could prevent the loss of 11,55 m^3 of Arctic sea ice. The annual sum of prevented Arctic sea ice loss could amount to = 542,85 m^3 (Notz and Stroeve, 2016).

By introducing changes regarding energy consumption in schools and kindergartens in Ljubljana, the children could help save more than 3.000 m^3 of Arctic sea ice per year!

We calculated the equivalents of CO_{2e} for trees to graphically illustrate what impact our actions have. We defined that by reducing the CO_{2e} by 0,03 t, we save a tree (Akbari, 2002). As explained above we calculated what reduction of CO_2 means for protection of Arctic ice and we also defined the equivalent that 1m3 of Arctic sea ice saved, is 1 penguin's life is saved.

Furthermore, we applied our cognitions to the households where the pupils live. On average, three people live in a household (stat. data). Therefore, the total CO_{2e} emitted in 2019 by the students households was 176.979 tCO_{2e}. Should they manage to reduce it even by 5 %, they would reduce the CO_{2e} footprint by 7.522 tCO_{2e}, that equals: 229.200 trees, 22.565 m^3 of ice not melted and 22.565 penguins saved.

Sources:

- Akbari, 2002. Accessible via: https://www.sciencedirect.com/science/article/abs/pii/S0269749101002640
- Craig and Allen, 2015. Accessible via: https://www.sciencedirect.com/science/article/abs/pii/S0957178715300084
- Notz and Stroeve, 2016. Accessible via: https://science.sciencemag.org/content/354/6313/747/tab-figures-data
- Eco-School. Accessible via: https://www.eco-schools.org.uk

4. WHAT CAN BE NEXT STEPS:

The best part of the story is that the system can be applied to other Municipality clusters of buildings & societies.

- Retail stores, supermarkets; imagine having green screen in the stores and application, where you can check, how they act, transparently; where would you choose to go shopping, which store would you award with your money?
- Hotels – same as above with stores, you engage tourists
- Healthcare facilities
- Logistic centers…
- City districts

<u>This is how we can engage residents, business into concept of smart city to create the environmental benefits and decarbonization needed:</u>

- From schools to smart city,
- From schools to other public buildings
- From school to households, city districts

We are aware that Municipality requirements and demands play significant role here, and are a bit limited when we talk about private stakeholders, however we think the legislation & trends will also help us. And above all, the clock is ticking, and there is no time to be “too polite” but to do some action.

Mope opportunities:

- This can be applied city to city in national and international level
- We know that one of aims of EU presidency of the 3: Germany, Portugal, Slovenia is also sustainability and climate goals – we can contribute there. There is project in the city Kranj and Maribor with schools.
- We already agreed to pitch the same idea to the city of Reykjavik – their mayor is interested to hear the idea, as they are working hard on building carbon neutral city.

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