SOLAR ENERGY IN ALBANIA FROM 5% TO 50%

Petraq **PAPAJORGJI**/ Ardita **TODRI**/ Orkida **ILOLLARI**/ Valdet **GASHI**/ Arben **DUSHI**/ Silvana **SUKAJ**/ Pierluigi **ABIUSO**/ Paola **PATERNA**/ Donato **ABRUZZESE**/ Enkeleida **PRIFTI**/ Petraq **KOKA**/ Besime **SH. KAJTAZI**/ Tania **FLOQI**/ H. **PRIFTI**/ Klodiola **DHAMO**/ Rezarta **SHKRELI**/ Amilda **BALLATA**/ Shpresime **GJETA**/ Ilirjan **MALOLLARI**/ Sami **MAKOLLI**/ Armela **MAZREKU** / Stela **SEFA**/ Julian **SEFA**

INGENIOUS
No. 1, issue 1/2021

JOURNAL OF THE FACULTY OF ENGINEERING, INFORMATICS AND ARCHITECTURE

content

Editorial

Prof. As. Dr. Eng. Arben DUSHI

Ingenious, is the newest scientific magazine of the European University of Tirana, an academic journal of the Faculty of Engineering, Informatics and Architecture (FEIA).

At the end of the third year of its life, FEIA, after successfully completing the full 5-year cycle of engineering studies (Ba + Ma) offers to its readers this first academic journal. We have not tried to amaze the world, but to modestly acquaint the reader with the efforts, work, and achievements of a number of colleagues, dedicated to engineering activities and their approach and vision for the development of the coming years, in the respective fields, closely related to the activity and the scientific research conducted at UET.

One of the main topics of today's technical debate is the country's energy problem. In this debate, which revolves around a very sensitive area being the future of energy and the country's resources, UET offers its expertise that focuses mostly on the problems of enrichment of renewable energy sources. The production of energy from photovoltaic plants, today has taken on a first-hand importance, precisely because the so-called Solar Energy, in the full sense of the word "does not send a bill"! What does this mean?

With the latest technological developments in the production of photovoltaic panels, the return on investment in such an enterprise, has been significantly reduced to 5-6 years and given that the period of operation of these plants goes up to 25 years, in Albania where we have more than 270 sunny days on average, investing in such an industry takes tremendous priority. Adding on to this, the phenomenon of climate change has led to the prolongation of periods of drought (where we are forced to buy energy at high prices to compensate for domestic consumption needs), calculations are simplified and "worryingly" emphasize even more the fact that sources of renewable energy (photovoltaic) must increase rapidly. How?

In Albania, especially the industrial silos that are in bulk, must urgently convert to using photovoltaic plants (process that has already started) to cover their energy needs. But on the other hand, given that about 14% of this production is not self-consumed, this increases the annual losses of the producer by "unjustly" increasing the payback period (ROI) by another 3.5 years and in this context, it becomes imperative to find a rational solution for the recovery of this lost energy.

The western lowlands of Albania from Shkoder to Saranda in particular, with an invasion to cover every industrial silo with such photovoltaic plants, can turn Albania into a powerful producer of photovoltaic energy by increasing its production capacities. And if we add here the possibility of installing high-efficiency photovoltaic plants in the fields and barren hills, whose maximum capacities of photovoltaic energy production, only in the span of a few years, can reach up to 50%, means that Albania, in the near future, could be a country with 100% renewable energy: 50-50, Water - Sun and seen from above, it may even look like a MIRROR country!

This is a debate that should be encouraged and developed precisely because it is related to a very sensitive topic for the future of the country and we welcome in our magazine and beyond, the contribution of any expert in the field. To conclude, as Ingenious Editor–in chief, I feel obliged to greet and guarantee all the specialists who have and will present articles in our magazine that in Ingenious, they will always have a place to exhibit their work, contributions, and achievements in various fields, with a special engineering interest.

Challenges for the National Education System in the COVID19 Era

Petraq Papajorgji

UET

Ardita Todri

"Aleksander Xhuvani" University, Elbasan

Orkida Ilollari

Mediterranean University of Albania

Abstract

The Covid19 pandemic interrupted the normal teaching process all over the world. Some countries, including the G7-member countries, were better prepared for facing the new challenges of the Distance Learning paradigm.

In our country, the effect of Covid19 in the education system was close to a disaster as our system was unprepared for facing such a sudden paradigm shift. The Ministry of Education informed that the teaching will take place using a new, never used paradigm referred to as Distance Learning.

In these circumstances, it was necessary to organize a study to understand what were the feelings of students and professors using distance learning. To undertake the study, the technology of Mind Genomics was used. Mind Genomics uses statistical models, data mining, and clustering techniques to evaluate important patterns of thinking of students and professors as well.

Four pillars (or silos) were defined to be the focus of the study; Effectiveness, Interaction, Feasibility, and the Future of the new teaching paradigm. Among the data collected from students are age, gender, and the reasons 1) Looking for: Fast learning through tutorial services 2) Looking for: Every time and everywhere learning, and 3) Looking for: Learning while working.

Results show that 37% of respondents (the value of intercept) are inclined to use distance learning in absence of any other information about elements. This is a rather encouraging result. In general, most of the students and professors, 49.41% of them, use distance learning for the reason any time and everywhere learning. This result reinforces the idea that 37% of respondents are in favor of this learning paradigm in absence of any other information. Next, 27.06% of respondents use distance learning for Learning through tutorial services. Learning while working is the least appreciated reason, 23.53%.

The study shows that the effectiveness and the interactivity of this new paradigm are very important and any further developments of distance learning should provide strong support for these components. The position of the professor is indispensable as the guide to the entire process, suggesting that at least at the time of this writing (2020) distance learning

approach is perceived only to be an intermittent complementary path to in-person interactions.

Keywords: COVID19, distance learning, statistical models, mind genomics.

Introduction

The Distance Learning (DL), also referred to as distance education, e-learning, and online learning, is a new teaching paradigm mostly forced by the COVID19 pandemic. It represents an education approach which occurs when the professors and students are separated by space and time. DL is based upon the new sophisticated technology of today that allows the participants to communicate with each other as if they were in the same room. Today's sophisticated technologies allow for these 'room's, and have become well-known during the current (Spring 2020) COVID-19 crisis.

DL is not a new technological phenomenon. Its first appearances are around year 2000 and it is growing since with a fast pace. It has grown 900% and it is expected to triple its size by year 2025. The most relevant technologies have been seen in Europe and the United States that have 70% of the global market share (Online Learning Statistics, 2019).

This study aims at understanding the feelings of professors and students about this new teaching paradigm, never seen so dominant before. The existing literature explored addresses various aspects of DL such as users' barriers in the use of technology in higher education platforms (Jariang

Pcasert, 2003; Nedelman, 2013); the evolution of technological institutional communication (Gutierrez et al., 2016); the student's skills and the intellectually-stimulating learning environment elements; distance learning platforms` typologies as well as the technological pedagogical approaches used (Alhih et al., 2017; Coymak, 2019). This study is different from previous ones as it deals directly with people, trying to collect their opinions about this new teaching paradigm.

This study presents results obtained from a Mind Genomics experiment (Moskowitz et. al., 2006; Milutinovic & Salom, 2017) with students and professors of different group-ages, genders and stated reasons why distance learning is relevant to the respondents, or the participants in the Mind Genomics experiment. The underlying theoretical framework is the narrative persuasion theory, which divides the message into logically different components; for whom; under what circumstances; how; and when does each message achieve optimum effect.

Distance Learning at Universities

Learning is an important skill, and the approach to learning is very personal. The most effective strategies vary from student to student (Brown et al., 2014). As of the last year, the evolving paradigm of "Distance Learning" today being literally an important issue (Sun et al., 2007). In this context, the concept of the class room is totally changed, represented in a larger framework. The 'new classroom' has been as is being designed both to deliver education, and to evaluate students who are

the recipients of that education. The modality is the internet, an electronic, multi-media infrastructure, allowing a continual perspective on learning, comprehending, and mastering the material.

The sophistication and usability of the distance learning platforms varies among higher education institutions and different countries. As of this writing (Spring, 2021) there does not appear to be any well-structured framework and model for the use of DL, or educational technology. The lack of a commonly agreed-to set of principles to guide the development of DL platform arises from management attitude, technical readiness, funding, and resources made available, etc. The list of that which is needed can be expanded to pages when the need becomes specific for a given group of professors and students, and the application specified in light of a specific university culture (Nedelman, 2013; Pcasert, 2003).

Beyond the general aspect of 'culture' of the specific institution of higher learning lies the very real aspect of structure and finances. Gutierrez et al., (2016) highlight other obstacles hindering the evolution of technological adoption in the institution. The strategy, or more appropriately the lack of strategy, the change in the nature of administrative costs, as well as the concomitant increase in the new cost to the institution of DL, all become problems as the need for DL becomes increasingly real and immediate.

More funds must be allocated to assure the continuing evolution and improvement of the used tools, and for the integration of new technologies such as the use of virtual and augmented reality-based learning tools (Birch & Barnett, 2009; Moro et al., 2017). The technology changes require that professors and students make the effort to attend training courses to master this new paradigm.

Besides the training courses, another issue is the active use of DL platforms. During the conventional teaching philosophy, the student need only listen to the lecturer, take notes, and ask questions face to face with the instructor. DL requires more effort, and specifically, more focused effort. Thus, Ossiannilsson (2012) and Ossiannilsson et al. (2015) reported that the effectiveness of distance learning platforms is measured through the level of their interactivity, and not just by the ability of the lecturer to present a coherent lecture. New behaviors, skills and attitudes, are required from students to successfully complete the distance courses (Hart, 2014). These skills encourage them to adapt this new education paradigm with greater ease. At the same time, the burden for student interaction comes back to the nature of the course, how it is structured, and how well it is delivered, all this being on the shoulder of the lecturer (Robinson, 2009). Thus, it is both the higher education presenter, the lecturer, and the student, who, together, drive the effectiveness of the DL platform, a new platform in which successful business and social life require engaging intensive knowledge and constant learning (Coymak, 2019).

Considering the way of cooperating with students the distance learning platforms` of higher education institutions are separated into two approaches: asynchronous and synchronous distance learning tools (Alhih et al., 2017). In the asynchronous group the content is constructed before and stocked onto databases and only later on students can access it (Simonson & Schlosser, 2009). The most popular variants used in these cases are the one of courses registered in CD-ROM, audio-visual presentations, audio power point slides, video-recorded courses, etc. By

nowadays standards, these technologies look obsolete today. Students using this distance learning version can explore even the forum, quizzes, messages and announcements practices. In such cases is recommended also the help of an online tutor for a successful comprehension of the presented topics. These types of distance learning platforms seem to be more flexible and fit better the lifestyle of students that work.

In the synchronous distance learning platforms instead, the professors and students are face-to-face (Simonson & Schlosser, 2009). This approach replicates the face-to-face communication style by using, audio and video conferences, and phone connections over the internet and live satellite broadcasts to communicate with the classroom. Thus, both professors and students provide a simultaneous feedback and discuss together as in a traditional classroom (Schwarz & Asterhan, 2011). Later on, students can individually proceed to complete exercises or labs over the discussed topics. These kinds of distance learning platforms seem to be more useful for full time students.

Methodology

In order to collect the thinking of professors and students, a Mind Genomics experiment is designed. 6672 participants; professors and students were invited to participate. The participants were from the Mediterranean Basin (Albanians, Italians, Moroccans, Algerians) and from some African universities. Only 4080 students and professors accepted the invitation.

Among participants, 68.2% of the responders (students and professors) are female and around 31.8% are males. Over 63.5% of the responders were students in the age of 18-24 years old and around 36.5% are professors. The professors in the age of 25-34 years old form 17.74%, 35-44 years old were around 35.48%, 45-54 years old were around 22.58% and over 55 years old were around 24.19%. Around 80 % of the responders were involved in Bachelor study program and the remaining part is involved in Master's study programs. The professors that participated in the study were involved in both study programs.

The approach uses Mind Genomics, a research procedure which combines messages about a topic, presents these combinations to respondents, obtains responses, and then deconstructs the data to estimate the contribution of each message. In short, Mind Genomics allows the researcher to understand the response of individuals to the granular aspects, the specifics of everyday life (Milutinovic & Salom, 2016; Moskowitz et al., 2006). Mind Genomics has a long history, with applications ranging from merchandising (e.g., finding customer requirements for nature food stores (Gere et. al., 2018)), the concerns of people about the prospects of cancer (Gabay et. al., 2018), and even corruption in education (Gere et al., 2019).

Sending to customers with the right message has always been a major objective of companies offering products and services. Successfully achieving this target demands understanding the mind of customers and what they think about specific ideas and messages. It is also important to determine whether there are different Mind-Sets for the same topic, and if there are, assigning people to the right Mind-Set. (Ilollari et al., 2019)

used Mind Genomics as a simple tool, to understand the specifics of what features of a service or product appeals to an individual through the notion of Mind-Sets, and then a method for assigning any new person that has not participated in the survey, to the most appropriate Mind-Set. (Ilollari et al., 2020) used Mind Genomics to understand the client perception of the quality of this paradigm shift that had been forced upon them.

The Mind Genomics approach is hypothesis-agnostic. Finally, the Mind Genomics approach is statistically oriented. The responses to the vignettes are deconstructed by ordinary least-squares regression (OLS) (Zdaniuk, 2014), to reveal the part-worth contribution of each element (answer) to the rating question. It uses a set of new technologies such as statistical models (Zdaniuk, 2014), datamining and clustering techniques (Mucherino et al., 2009) to find out what is of importance to participants. A very unusual field of application for the Mind Genomics approach is the field of law. Many would think that this field is out of the reach of statistical and technological advances. A new book titled *Mind Genomics and the Law* has appeared recently that combines science, the law, and people (Moskowitz et al., 2020).

This study established as main pillars of DL the following aspects: Effectiveness, Interactivity, Feasibility and Perspective of distance learning.

Table 1. The array of "questions" and their associated answers presented in the survey

Question 1 - How effective is distance learning?

A1 Distance learning is not as effective as the face-to-face communication

A2 Distance learning is more an individual learning approach

A3 Distance learning platforms are less friendly to use than social media (Facebook, Instagram)

A4 Distance learning is more appropriate for people that have a job

Question 2 - How interactive is distance learning?

B1 Distance learning platforms do not favor an immediate feedback from students

B2 Distance learning platforms are not helpful for students during web-seminars

B3 Distance learning platforms allow for interaction between professors and students

B4 Distance learning platforms push students towards rational thinking

Question 3 - How feasible is distance learning?

C1 Distance learning platforms require high speed Internet

C2 Distance learning platforms operate with limited supportive infrastructure

C3 Distance learning platforms do provide enough support for labs, seminars and exam sessions

C4   Distance learning platforms provide full support to forums, quizzes, messages, announcements, audio & video recordings

Question 4 - What is the perspective of distance learning as a learning approach?

D1   Distance learning platforms require the ability to upload and download files on and off line

D2   Distance learning platforms should provide interaction as in the classroom

D3   An online tutor is necessary (besides the lecturer)

D4   A better distance learning approach requires more infrastructures and human resources

RESULTS AND DISCUSSION

Results show that 37% of respondents (the value of intercept) are inclined to use the distance learning in absence of any other information about elements. This is a rather encouraging result. In general, most of students and professors, 49.41% of them, use distance learning for the reason any time and everywhere learning. This result shows the idea that 37% of respondents are in favor of this learning paradigm in absence of any other information. Next, 27.06% of respondents use distance learning for Learning through tutorial services. Learning while working is the least appreciated reason, 23.53%. Results show as well that based on their statistical relevance the four pillars/groups considered for this study are ordered as follows: The perspective of distance learning as a learning

approach is evaluated with the value of 3. The effectiveness pillar is evaluated with the value of 2.75. The interactivity pillar is evaluated with the value of 2.5. And last, the feasibility pillar is evaluated with the value of 0.25.

The study shows that as the distance learning approach is taking momentum, the perspective of this paradigm is quite relevant to respondents. The survey results show the more relevant aspects of distance learning from the students and professors' point of view. The aspect of perspective of distance learning as a learning approach shows these facts: The element which respondents' value the most (with value of 4) is that the future learning platforms should provide interaction as in the classroom. Students value this item with 2 and all professors older than 35 years old, agree on the matter, they value this item with 6 to 19. Young professors in the group age 25-34 years old do not consider this to be a problem; they value this item with -6. Males value this item with 6 and are more exigent than females that value this with 4.

Another issue important to respondents is that a better distance learning approach requires more infrastructures and human resources; this element is evaluated with 3. In particular students evaluate this with 2 and professors older than 35 years old, agree on the matter and their evaluation goes from 7 to 19. For professors of younger age, 25-34 years old this is not an issue at all, their evaluation is -13. Males need more infrastructure and human resources to operate with distance learning platforms; they evaluate this element with 9 while for females there is no need for assistance, they evaluate this element with 1.

The element that had the highest evaluation from respondents in the study was distance learning platforms push students towards rational thinking evaluated with the value of 5. Students evaluate this element with a value of 6 and all professors excepting the ones of group age 35 - 44, agree. Professors of age 45-54 evaluate this element with 14. Instead, professors of age 35-44 years old don`t think that distance learning platforms push students towards rational thinking. Males evaluate this item very high, with value of 10 and are more favorable than females that evaluate this item with 3. Regardless of the value, both male and female think that distance learning will push students to be more rationale during their studies.

The issue of students becoming more responsible and more rationale as a result of the use of distance learning tools is a topic widely discussed in the literature (Jossberge et al., 2010). Several authors emphasize the relevance of using workplace simulations (WPS) appeal to students' self-directed learning (SDL) and self-regulated learning (SRL) skills, as students are required to work and learn independently in these settings (Tekkol & Demirel, 2018). As the new learning paradigm is taking a first-hand role in the education process, there is a need to better define the used terminology of self-directed learning (SDL) and self-regulated learning (SRL) skills (Saks & Leijen, 2014). As the distance learning as the main method for teaching is a new paradigm there is a need to foster innovation, particularly in technology-enhanced learning, at institutional scale (Bennett et al., 2018).

An important issue pointed out from this study, is what approach will be used to implement this new teaching paradigm in Albania. Many

European countries have already implemented complex DL systems. Will Albania import those systems or will we design and implement our systems? Both solutions have advantages and disadvantages.

Importing a foreign system implies implementing a teaching philosophy that may not be appropriate for us. Designing and implementing our teaching philosophy might be technologically difficult, but at the same time will push forward our engineers to work harder and advance this technology.

At the same time, the implementation of this new teaching paradigm will put in front of the Ministry of Education several issues to be addressed. The accreditation process implies a number of parameters to be respected such as m3 for student, recreational spaces, etc that must be respected by the institutions of Higher education. Thus, such parameters, translated into numbers must be included in the requirements institutions must respect even when using telematic approaches to teaching.

An important point is that the Law for Higher Education No,80/2015, in item 24 point C, does not include distance learning as one of the teaching paradigms. Thus, the Ministry of Education must revise its regulation and procedures to make room for this new teaching paradigm. In this process, the ministry must include local specialists and perhaps foreign experts to correctly address all these issues.

References

Alhih, M., Ossiannilsson, E., & Berigel, M. (2017). Levels of interaction provided by online distance education Models. Eurasia Journal of Mathematics, Science & Technology Education, 13(6), 2733-2748. https://doi.org/10.12973/eurasia.2017.01250a

Bennett, S., Lockyer, L., & Agostinho, Sh. (2018). Towards sustainable technology-enhanced innovation in higher education: Advancing learning design by understanding and supporting teacher design practice. British Journal of Educational Technology, 49(6), 1014-1026. https://doi.org/10.1111/bjet.12683

Birch, D., & Burnett, B. (2009). Bringing academics on board: encouraging institution-wide diffusion of elearning environments. Australasian Journal of Educational Technology, 25(1), 117-134. https://doi.org/10.14742/ajet.1184

Brown, P. C., Roediger, H. L., & McDaniel. M. A. (2014). Make it stick: The science of successful learning. Cambridge, MA: Harvard University Press. https://doi.org/10.1080/00220671.2015.1053373

Gabay, G., Zemel, R., Gere, A., Zemel, R., Papajorgji, P., & Moskowitz, H. (2018). On the Threshold: What Concerns Healthy People about the Prospect of Cancer? Cancer Studies and Therapeutics, Research Open, 3(4). Retrieved on 28 March 2020 from https://www.researchgate.net/publication/330534911_On_the_Threshold_What_Concerns_Healthy_People_about_the_Prospect_of_Cancer

Gere, A., Papajorgji, P., Moskowitz, H. R., & Milutinovic, V. (2019). Using a Rule Developing Experimentation Approach to Study Social Problems: The Case of Corruption in Education. International Journal of Political Activism and Engagement (IJPAE), 6(3), 23-48. https://doi.org/10.4018/IJPAE.2019070103

Gere, A., Zemel, R., Papajorgji, P., Sciacca, A., Kaminskaia, J., Onufrey, S., & Moskowitz, H. (2018). Customer Requirements for Natural Food Stores - The Mind of the Shopper. Nutrition Research and Food Science Journal, 1(1). Retrieved from https://researchopenworld.com/customer-requirements-for-naturalfood-stores-the-mind-of-the-shopper/

Gofman, A. (2011). Rule Developing Experimentation in Consumer-Driven Package Design. https://doi.org/10.1002/9780470400531.eorms1036

Gofman, A., & Moskowitz, H. (2010). Isomorphic permuted experimental designs and their application in conjoint analysis. Journal of sensory studies, 25(1), 127-145. https://doi.org/10.1111/j.1745459X.2009.00258.x

Gutierrez - Santuste, E. Gallego - Arrufat, M.G. & Simone, A. 2016. Barriers in computer-mediated communication: typology and evolution over time. Journal of E-learning and Knowledge Management, 12(1),107-119. https://doi.org/10.20368/1971-8829/953

Hart, J. (2014). Social learning handbook 2014. Centre for Learning & Performance Technologies.

Ilollari, O., Papajorgji, P., Gere, A., Zemel, R., & Moscowitz, H. R. (2019). *Using Mind Genomics to Understand the Specifics of a Customers Mind*.

Ilollari, O., Papajorgji, P., & Civici, A. (2020). Understanding client's feelings about mobile banking in Albania. *Interdisciplinary International Conference On Management, Tourism And Development Of Territory*, 147–154.

Jariang Pcasert, N. (2003). The opinion of faculty of business administration lectures and students, Chiang Mai University about the use of E- Learning. Songklanakarin J of Social Sciences & Humanities, 9(2), 136-145.

Jossberger, H., Brand-Gruwel, S., Boshuizen, H., & Van De Wiel, M. (2010). The challenge of self-directed and self-regulated learning in vocational education: A theoretical analysis and synthesis of requirements. Journal of Vocational Education and Training, 62(4), 415-440. http://doi.org/10.1080/13636820.2010.523479

Milutinovic, V., & Salom, J. (2016). Mind Genomics: A Guide to Data-Driven Marketing Strategy. Springer.

Moro, C., Štromberga, Z., Raikos, A., & Stirling, A. (2017). The effectiveness of virtual and augmented reality in health sciences and medical anatomy. Anatomical sciences education, 10(6), 549-559. https://doi.org/10.1002/ase.1696

Moskowitz, H. R., Gofman, A., Beckley, J., & Ashman, H. (2006). Founding a new science: Mind genomics. Journal of sensory studies, 21(3), 266-307. https://doi.org/10.1111/j.1745-459X.2004.00066.x

Moskowitz, H., Wren, J., & Papajorgji, P. (2020). *Mind Genomics and the Law* (1st Editio). LAP LAMBERT Academic Publishing.

Mucherino, A., Papajorgji, P., & Pardalos, P. M. (2009). Data mining in agriculture (Vol. 34). Springer Science & Business Media. https://doi.org/10.1007/978-0-387-88615-2

Nedelman, C.A. (2013). Exploring organizational and cultural barriers to developing distance learning programs in higher education (PhD Thesis). North Central University. Retrieved from https://search.proquest.com/openview/a004ead5846591dd5dd3f25594cb090c/1?pqorigsite=gscholar&cbl=18750&diss=y

Online Learning Statistics. (2019). Retrieved on 3 April 2020 from https://skillscouter.com/online-learningstatistics/

Ossiannilsson, E. (2012). Benchmarking e-learning in higher education: lessons learned from international projects. Juvenes Print.

Ossiannilsson, E., Williams, K., Camilleri, A. F., & Brown, M. (2015). Quality models in online and open education around the globe. State of the art and recommendations. Oslo: International Council for Open and Distance Education. Retrieved from https://www.pedocs.de/volltexte/2015/10879/pdf/Ossiannilsson_et_al_2015_Qualitymodels.pdf

Robinson, K. (2009). The element: How finding your passion changes everything. Penguin.

Saks, K., & Ä. Leijen, Ä. (2014). Distinguishing Self-Directed and Self-Regulated Learning and Measuring them in the E-learning Context. Procedia - Social and Behavioral Sciences, 112, 190-198. http://doi.org/10.1016/j.sbspro.2014.01.1155

Schwarz, B. B., & Asterhan, C. S. (2011). E-moderation of synchronous discussions in educational settings: A nascent practice. Journal of the Learning Sciences, 20(3), 395-442. https://doi.org/10.1080/10508406.2011.553257

Simonson, M., & Schlosser, L. A. (2009). Distance Education 3rd Edition: Definition and Glossary of Terms. IAP.

Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y., & Yeh, D. (2007). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. Computers & education, 50(4), 1183-1202. https://doi.org/10.1016/j.compedu.2006.11.007

Tekkol, İ. A., & Demirel, M. (2018). An investigation of self-directed learning skills of undergraduate students. Frontiers in psychology, 9, 2324. https://doi.org/10.3389/fpsyg.2018.02324.

Tulving, E. (1983). Ecphoric processes in episodic memory. Philosophical Transactions of the Royal Society of London. B, Biological Sciences, 302(1110), 361-371. https://doi.org/10.1098/rstb.1983.0060

Tulving, E. (2002). Episodic memory: From mind to brain. Annual review of psychology, 53(1), 1-25. https://doi//10.1146/annurev.psych.53.100901.135114

Zemel, R., Choudhuri, S. G., Gere, A., Upreti, H., Deite, Y., Papajorgji, P., & Moskowitz, H. (2019). Mind, Consumers, and Dairy: Applying Artificial Intelligence, Mind Genomics, and Predictive Viewpoint Typing. In Current Issues and Challenges in the Dairy Industry. IntechOpen. https://doi.org/10.5772/intecopen.85532

Zdaniuk, B. (2014). Ordinary Least-Squares (OLS) Model. In *Encyclopedia of Quality of Life and Well-Being Research* (2014. Edit). https://doi.org/https://doi.org/10.1007/978-94- 007-0753-5_2008

Strategies in the energy's field in Kosovo

Valdet Gashi

Ministry of Economic Development, Kosovo

Arben Dushi

Faculty of Engineering, Informatics and Architecture, European University of Tirana

ABSTRACT:

This paper treats some problems connected to the strategies used in the energy's field in the Republic of Kosovo. It shows how attempts have been made to conduct research, analytical and theoretical analysis in the field of management of various operations in the field of energy, based on innovations to provide a clear picture of the application of new technologies and innovations such as contemporary trends in the country, the region and beyond as a necessity of the future. *After a detailed assessment of the current energy situation in Kosovo, taking into account energy and its resources with energy consumption in general, the application of innovations to increase energy management efficiency, is read respectively their impact on improving the quality of energy services.* In this paper an assessment of the current energy situation has been made, taking into account energy and its sources as well as energy consumption in general.

The application of innovations, good energy management and the changes that follow after the application of the above measures, respectively, their impact on improving the quality of energy services, combined with the use of renewable resources significantly leads to reduced electricity costs and dust emissions.

Keywords: IT innovations in the field of energy, Energy Management, Energy Audit, Tracking total energy consumption, Energy Managment Software, Real Time Energy Management

1. Introduction

We must see innovation as an ongoing process to improve skills, knowledge and results in terms of the process of improving products and their development in general as well as energy in particular. Key issues remain the identification of problems in practice, the generation of creative ideas for problem solving, the development of an effective approach to the implementation of ideas, the reasoning of the innovative potential to generate solutions. The grouping of innovations is divided into the form of innovation and the degree of innovation. Forms of innovation are addressed in contemporary groupings that include innovations in services and innovations in work organization. More specifically, our target has been the assessment of the current energy situation in the Republic of Kosovo, taking into account energy as a product, its sources as well as energy consumption in general, analyzing the current cost of electricity without applying strategies that improve efficiency and energy management and the changes that follow after the

application of these strategies that lead to taking measures that will affect the improvement of the quality of energy services as a whole.

In this study, attempts have been made to conduct research, analytical and theoretical analysis in the field of management of various operations in the field of energy, based on innovations to provide a clear picture of the application of new technologies and innovations such as contemporary trends in the country, the region and beyond as a necessity of the future.

New technologies are considered almost mandatory in developing countries, especially those in the EU, and especially for all those countries that consider that consumption reductions are achieved through innovations and innovations in all indicative areas for the development of the nation and the preservation of the environment in general such as ecology, the performance of buildings in compliance with the mandatory directives from the frameworks of European legislation.

The theoretical overview focuses on the elements chosen for energy analysis, in the design and development of innovations, technologies, service products and energy management. All of these as a whole are analyzed from a theoretical point of view first and then from a practical one through primary and secondary case studies, causing recommendations for improvement or change of any of these aspects.

However, in-depth analyzes of strategies built by years are reflected, starting from 2003, 2009, 2018, 2026 (MEZH, 2018; TSO, 2017)*, related to the management of operations according to their specifics. Based on the use of advanced field literature, examples have been taken from our experience and*

that of others to build recommendations and clarify current positions in the field of energy efficiency.

After a detailed assessment of the current energy situation in Kosovo, taking into account energy and its resources with energy consumption in general, the application of innovations to increase energy management efficiency, is "read" respectively their impact on improving the quality of energy services (GIZ, 2019).

In addition to addressing new technologies in increasing electricity efficiency, it is clear that the use of renewable energy sources will significantly reduce electricity costs and dust emissions will be reduced by more than 90%, those of SOx and NOx by about 70% and there will be no increase in carbon dioxide emissions per unit of electricity produced (GIZ, 2019).

How do IT innovations affect the reduction of energy consumption - by applying electricity efficiency measures? The main argument is the challenges of Kosovo in the energy sector and IT innovations in this area because for the production of electricity Kosovo relies on power plants with lignite combustion mainly. The development of a database on energy consumption in public institutions, the household sector, the industry sector, the services sector and the transport sector, would enable us to identify energy consumption's figures and establish a monitoring process in order to cost-effective energy efficiency measures are planned and implemented (MEZH, 2012; Vokrri, et al., 2017).

2. Literature review

People and businesses have always strived to provide as many resources as possible that enhance their well-being. Even today this interest is not less due to the high demand for resources. So companies are constantly subject to competition and can afford it if they can use these resources carefully. Therefore, for these companies there is always the concern "how to have more technological know-how than others" and that the real competitive advantage of the company is the ability of its people to learn quickly. From this concept, today it is more than logical the appearance on stage of "knowledge enterprises". So we have a pressure of competition between companies, then technological developments, globalization of the economy have made companies more committed to providing a resource - knowledge which is now in the strategy of increasing efficiency for all economic entities (Johnson, et al., 2008; Martinich, 2001).

Knowledge - knowing or controlling processes, is known as the generator of change, our future is in our heads and in our hands. Innovative companies manage innovative managers who have knowledge and know how to motivate their employees.

Many authors attribute knowledge to the attribute of the enterprise asset, it is considered an asset and this asset is sacred, it is an asset that enables companies to have a good competitive position and provides them with development.

Steven Goldman since 1995, describes the strategic dimensions of the organization's behavior, focused on two points:

• Change management and elimination of uncertainty;

• Creating a connection between people (entrepreneurial culture) and knowledge (intellectual capital).

According to Drucker (1993) and Weggeman (1997) there are three stages that society has gone through to reach the knowledge economy:

- The first - the industrial revolution (1750-1880), during which companies used knowledge to produce tools and equipment for production;
- The second - the revolution in production (1880-1945), during which knowledge was used to improve work processes;
- The Third one - represents the last stage of major developments in the process of corporate governance (1945- to date), during which companies have used the knowledge to increase as much as possible the level of knowledge of the employed at work.

"If the competition can be from any corner of the world then businesses are increasingly trying to be special, to be different from others. The uniqueness does not come from tangible tools and equipment, but from knowledge, creativity, specialization, and the uniqueness of the way of doing business and presenting to consumers and competitors products that should be cheaper and more usable, which are characterized by " brand –ing ”(Andriessen, 2004).

Innovations generally support the hope of a dynamic future of new trends, which flow and result in many rapid changes, in general.

Economic benefits from the application of new technologies and IT innovations in energy in the Republic of Kosovo, are also the result of work related to detailed study and preparation according to the trends of the time and coordination between them within the so-called Energy strategy (MEZH, 2018) and where it consists of:

- Legal framework in the energy sector, in accordance with EU directives;
- Strategic framework;
- Strategic documents which reflect the increase of Energy Efficiency in the Energy Sector in the Republic of Kosovo;
- Projects in the implementation of EE measures in Public buildings;
- e-Cooperation under the Energy Community Treaty (ECT);

2.1. The path to success

With the energy independence achieved by Kosovo, it is possible that with the approval of EU member states, energy benefits to be considered reciprocal with Albania, reciprocity which means export / import at the time of summer and winter season (Kosovo will be able to import energy during the summer in Albania due to drought and lack of rainfall and winter season, Albania will be able to import energy in Kosovo because from HPP there will be sufficient production for import);

But still for the full implementation of this reciprocity, the following must be done:

• Completion of the legal basis (establishment of the Fund for Energy Efficiency),

• Institutional capacity building of the public & private sector (at municipal level) for the implementation of the National Plan for EE,

• Expansion of schemes and opportunities for financing and implementation of EE measures,

• Further improve the system of energy statistics and establish an adequate system for monitoring and evaluating the improvement of energy efficiency,

• Continuation of the public information campaign on energy efficiency,

• Establishment of municipal energy offices,

• Compilation of Municipal Energy Efficiency Plans approved by the Municipal Assembly and sent to KEEA,

• Assisting Municipalities in preparing municipal EE plans and reporting on their implementation,

• Creation of Energy Efficiency database (software),

New technologies are considered almost mandatory in all EU countries and especially for all those countries that consider that consumption reductions are achieved through innovations in all indicative areas for the development of the nation and the preservation of the environment in general - ecology , building performance, mandatory directives, etc.

In this paper an assessment of the current energy situation has been made, taking into account energy and its sources as well as energy consumption

in general. The application of innovations, good energy management and the changes that follow after the application of the above measures, respectively, their impact on improving the quality of energy services, combined with the use of renewable resources significantly leads to reduced electricity costs and dust emissions will be reduced by more than 90%, those of SOx and NOx by about 70% and there will be no increase in carbon dioxide emissions per unit of electricity produced (GIZ, 2019).

3. Methodology

The collection of data for the evaluation of this project was done through two methods:

- research of primary and secondary data
- interviews.

Regarding secondary data, sufficient and very productive material has been collected from Government Institutions, non-governmental organizations, KEK, the World Bank, etc.

The results of the presented study are based on the research with survey of consumption of the service sector (public institutions) and households according to these categories: A) -for space heating, B) -for heating of sanitary water, C) -for cooking , D) -for non-thermal use (Kosovo Agency of Statistics, 2017).

The Ministry of Economic Development, as the main responsible for energy, has the basic goal of ensuring a sustainable and secure energy supply for all consumers, taking into account the preservation of the environment and the efficient use of energy (Gashi, 2013).

Interconnection with Albania is a key problem for raising the level of security of electricity supply to a higher level, while electricity generation capacities are outdated and with low reliability of production security. The penetration of renewable energy technologies is very difficult in Kosovo, although the MED, respectively the Energy Efficiency Agency, make maximum efforts to stabilize the situation. The system for monitoring the implementation of legislation, as well as that of the implementation of government policies and programs is not yet effective. Without an efficient monitoring system we can not claim for effective monitoring of power supply security (Grainger & Stevenson, 1994).

Liberalization of the electricity market is also a serious challenge that requires preconditions related to the necessary modernization in the entire infrastructure of the power system, while the requirements of the ECT to the states that are contracting parties are already time-bound for the complete liberalization of the electricity market. All that was said above presents a not so enthusiastic picture in terms of the preconditions for guaranteeing a secure energy supply. However, to take advantage of these opportunities in the energy sector, Kosovo needs a further improvement of the existing institutional and legal framework, while improvement has been made with the establishment of the Ministry of Energy and Mining, the Energy Regulatory Office and the Independent Commission for Mines/Minerals.

Figure 1: TPP Kosova B (digital monitoring of equipmentS)

Regarding to the Energy consumption problem in Kosovo, a following SWOT analisys is done:

- Strengths

Investments for the revival of the energy sector - attracting domestic and foreign investors. By applying innovations and efficient measures, energy consumption costs will be reduced in all sectors (Weedy, et al., 2012).

- Weaknesses

Lack of knowledge on the application of innovation measures and efficiency - awareness of the human factor in Kosovo and insufficient funds from Government Institutions for investments in renewable sources of alternative energies.

- Opportunities

Employment of alternative sources of renewable energy. The stock of buildings in public and private services, in the household includes the largest contribution of energy saving (40% + 30% = 70%) therefore the action plan 2019-2021 foresees the focus on the building sector of Kosovo.

- Threats

Currently 97% of energy is obtained from TPPs of Kosovo A and B, ie 3% are from HPPs, therefore environmental pollution is considered as one of the negative factors for Kosovo, not forgetting the impact on global warming and the construction of a new TPP with lignite fuel.

Through SWOT, four factors will be analyzed in general. Large investments are needed to revive the energy and mining sector and in this regard direct foreign investment is crucial.

4. Results

Approximately 98% of the energy produced in Kosovo is provided by two carbon-fired power plants with lignite (TC), "Kosovo A & B" (GIZ, 2019). These power plants are owned and operated by the Kosovo Energy Corporation (KEK): Kosovo's vertically integrated energy enterprise is responsible for coal mining, generation, distribution and supply.

TPP Kosova A consists of five units (A1-A5), with a total installed capacity of 800 MW, although units A1 and A2 are no longer operational and are considered unsuitable for further commissioning.

TPP Kosova B consists of two larger units (B1 and B2) with an installed capacity of 678 MW.

During 2018 in TPP Kosova A are produced about 2.3 million MWh of electricity. During 2018 in TPP Kosova B are produced about 3.4 million MWh. Total from Kosovo A and B during 2018 were produced 5.7 million MWh of electricity. Thermal energy is produced 450 thousand MWh for population heating purpose (MEZH, 2018).

Hydropower plants (HPPs) account for the remaining 2.2% of Kosovo's net electricity generation. HPP Ujmanit is managed by the public enterprise Ibër-Lipenci.

The remaining small hydropower plants (all owned by private investors) are connected to different locations in Kosovo's distribution network. In total, these small HPPs have approximately a net output of 42 GWh (capacity factor ~ 48%).

KOSTT sh. manages and operates the electricity transmission system of Kosovo and is responsible for the transmission of most of the electricity in high voltage electricity networks (TSO, 2017).

5. Conclusions

Energy saving in the process of energy production and transformation is also a function of innovations and strategies' interweaving that must be applied in accordance with the relevant objectives and targets, including the energy distribution network, reduction of transmission and distribution losses, improving the efficiency of power plants, increasing the energy component produced by high-efficiency cogeneration.

Prior to making strategic economic development decisions, the national potentials in security of supply for a sustainable development should be assessed. Innovation and Electricity Efficiency are an important tool for achieving a reduction in greenhouse gas emissions, so that consumers would reduce their energy bills and demand in general would be reduced.

It is clear that increasing the share of energy from renewable sources and the application of innovations are important for Kosovo in terms of diversification of energy sources and almost complete dependence on generating capacities with lignite combustion.

The construction of the Kosova e Re power plant and the construction of hydropower plants (in line with the opportunities offered by Kosovo) will be a good solution for Kosovo in terms of energy supply.

Energy saving in the process of energy production and transformation, energy prospects and independence and application of Innovations in accordance with the strategies to be applied and objectives, relevant targets including energy distribution network, reduction of transmission and distribution losses, improving efficiency power plant power.

References

1. Gashi, V., 2013. *Monitorimi dhe Mjedisi i Zhvillimit Energjetik ne Kosovë,* s.l.: eptisa.

2. GIZ, 2019. *Plani Komunal i Veprimit për Efiçiencë të Energjisë (PKVEE) 2019 – 2021,* s.l.: GIZ.

3. Grainger, J. & Stevenson, W., 1994. *Power System Analysis.* 1 st a cura di s.l.:McGraw Hill.

4. Johnson, G., Scholes, K. & Whittington, R., 2008. *Exploring Corporate Strategy.* 8th a cura di s.l.:Pearson College Div.

5. Kosovo Agency of Statistics, 2017. *Programi I Statistikave Zyrtare 2018-2022,* Pristina: Kosovo Agency of Statistics.

6. Martinich, J., 2001. *Production and Operations Management: An Applied Modern Approach.* s.l.:Wiley.

7. MEZH, 2012. *Studimi mbi shpërndarjen e konsumit energjetik në sektorin e shërbimeve dhe mundësite e përmirësimit të efiçiencës së energjisë,* Pristina: Ministria e Zhvillimit Ekonomik.

8. MEZH, 2018. *Programi I Zbatimit Të Strategjisë Së Energjisë 2018-2020,* Pristina: Ministria e Zhvillimit Ekonomik.

9. TSO, 2017. *Transmission Development Plan 2018-2027,* Pristina: TSO.

10. Vokrri, V. et al., 2017. *Klima e Biznesit në Kosovë Nga Perspektiva e NVM-VE,* Pristina: INSTITUTI RIINVEST.

11. Weedy, B. M. et al., 2012. *Electric Power Systems.* 5 th a cura di s.l.:Wiley.

Reliability-based evaluation of seismic design and numerical studies of Self-centering moment resisting steel frames

Silvana Sukaj

UET University, Tirana, Albania

Pierluigi Abiuso

University of Rome "Tor Vergata", Rome, Italy

Paola Paterna

University of Rome "Tor Vergata", Rome, Italy

Donato Abruzzese

University of Rome "Tor Vergata", Rome, Italy

ABSTRACT

Recently developed self – centering moment resisting steel frames have been analytically and experimentally validated as having the potential to eliminate structural damage under a design basis earthquake and return to their original vertical position following a major earthquake. The objective of this research is to develop

the understanding of behavior and performance of steel Self Centering – Moment Resisting Frame (SC – MRF) systems. This study examines the response numerically simulated of a 3, 8, and 19 story SC-MRF subject to dynamic time – domain analysis, using a database of different terms, as for instance the recorded earthquake of El Centro 1940, one of the most powerful recorded in history. Peak structural demand responses such as story drift and beam-column relative rotation has been evaluated. This data is used to examine the sensitivity of the SC – MRF behavior to structural properties and geometry. The results could be used to develop a reliability-based seismic design procedure for these SC-MRF connection details.

Keywords: Steel frame, Self-centering moment resisting frame, frame ductility, seismic design

Introduction

In both U.S. and European codes, kept that some necessity on strength and ductility are convinced, yielding is admitted to appear either in beam, panel zone or connections. The development of plastic hinges in columns is forbidden, made exclusion for base plates, column ends at the top of multistory frames, and in case of single storey MRFs. In the logic of the global ductility approach, both AISC 2005 and Eurocode 8 contribute some necessities concerning

inelastic capacities of the dissipative parts. It should happen, in case of steel frame in high class of ductility (DCH/SMF), that the structural system is drew to ductile behaviour if under strong earthquake. The difference between "rigid" node and ductile node is shown in the following fig.1 and fig.2.
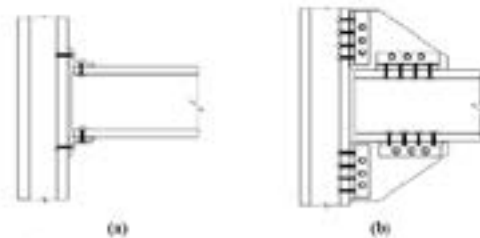

Fig.1   Typical Early Beam-Column Connections: (a) pinned connection and

(b) rigid connection (FEMA 351, 2000).

Among the several connection suggested by experiencing strong earthquakes, one that has been accepted as considered trustworthy and practical (economical) is the Reduce Beams Section (RBS) – or "dogbone" detail (Englehardt et al. 1998). In the RBS connection the section of the beam decreases at a span from the beam-column connection so that yielding is fixed in that diminished area at moments kind of lower than those that activate the full inelastic requirement on the connection.
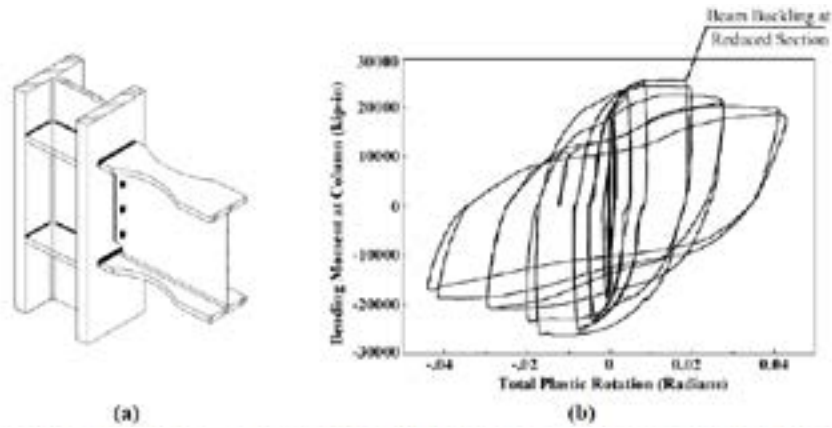
Fig. 2. Reduced beam section connection (RBS): (a) connection arrangement and

(b) moment-rotation relationship (FEMA 355D, 2000).

After that experience the research moved toward and other promising concept. This is the approach of the Self-centering Moment Resisting Frames (SCMRF). Post Tensioned Devices (PTD) and Self-Centering Moment-Resisting Frames (MRFs) have recently been developed as a viable alternative to welded moment frames in high seismicity areas. This connections are designed to prevent brittle fractures in the area of the nodes of the frames, which can cause severe reduction in their ductility. High-strength post- tensioned (PT) steel bars, which clamp beams to the columns, are adopted, and then main energy dissipation is due to the yielding or friction-based energy-dissipation devices (EDs). The pre-stressing elements are designed to remain elastic even when the system experience large lateral deformations. Also, such a devices have the property to assures a fully re-centered structure after strong earthquake (Christpoulous et. al. 2002).
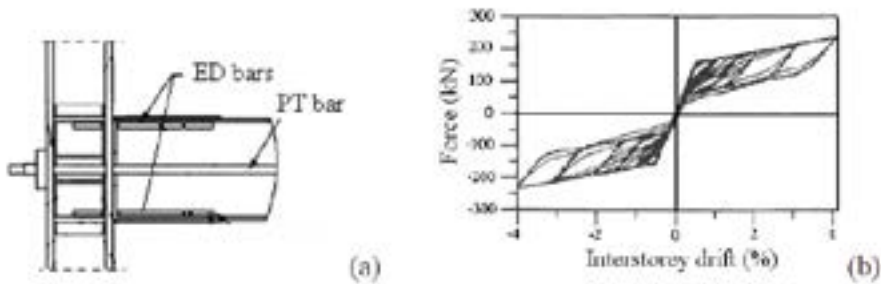
Fig. 3 - PTED connection with PT and ED bars: (a) typical node; (b) experimental force-displacement curve (Christopoulos et al., 2002a, b).
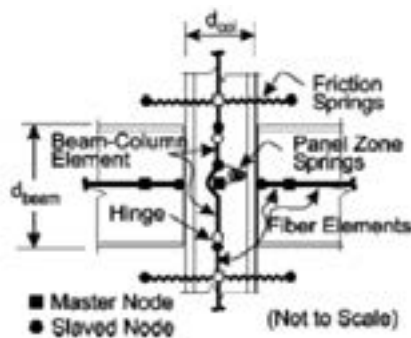

Fig.4 - Numerical modeling of the typical PTED connection with PT and ED element (Rojas et al., 2005)

The object being taken into consideration in the paper for the study of the global effects of self-centering methods to moment resisting frames is conceived as a multi-bay portal frames for three case studies, for buildings whose fundamental period of vibration fall into constant accelerations, constant speeds and constant displacements respectively: 3 stories above ground, 8 stories above ground and 19 floors ground the ground. The frames and their elements are distributed in a regular

manner, both in height and in plan. The mass and stiffness distributions do not vary in height, therefore the structural elements are the same on all floors, both vertical and horizontal elements. For simplicity, it is assumed that the distance between the axis of the columns is 600 cm. Mathematical models are built for the Moment Resisting Frames (MRF) with Rigid Joints and Self-Centering Moment Resisting Frames (SCMRF). Pinned-based structures with hinged joints, which are not taken into account in this study, may cause large displacements, residual deformations and hinge displays on the floor that could lead to the loss of durability of the entire structure by turning the structure into a mechanism. Pinned-based structures with rigid joints on the other hand (MRF) during the earthquakes may lead to moderate displacements, develop residual deformations but provide structural sustainability. But the deformations that this system exerts can have very high cost of reinforcement or retrofit. On the other hand, the other structural type studied is SCMRF, which is characterized by very large displacement, no residual deformation, structural stability and above all, no major repair costs. The models were subjected to dynamic time-domain analysis, using a database of different terms, where the term references for the design of the results in this study is the El Centro 1940's earthquake (http://www.vibrationdata.com/) elcentro.htm), one of the most powerful registered earthquakes in history.
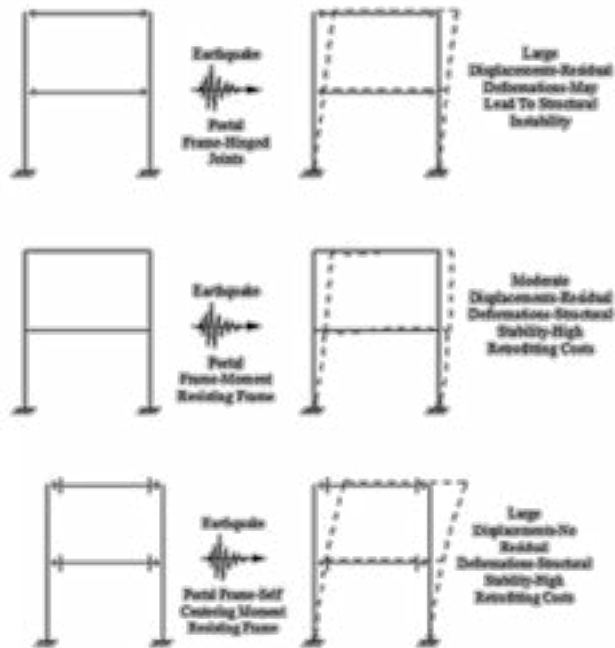
Fig. 5 - Basic behavior of the three models taken into consideration.

The preliminary dimensioning of the structural elements, and their final solution is made with regard to the types of structural steel constructions and the codes that govern them. The object for simplicity is represented as an equivalent two-dimensional frame portal. The conceptualization of the elements of the structure is made based upon the capacitive design of the structural elements. The foundation of the object is assumed as infinitely rigidly while the link of the column element with the foundation is accepted as fully fixed with all of the six rotational degrees restrained.
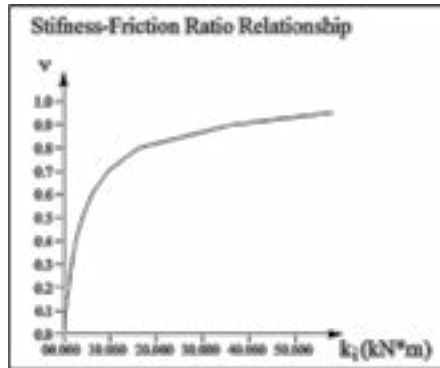
Fig. 6 - The chart of rigidity change of the beam-column node.

Model description

Frame elements and slabs

The object columns are selected with HEA 300 section. The column section does not change in height. Column sizes have been chosen in accordance with design requirements for seismic zones according to European recommendations for their normal ductility, according to Eurocode 3 and Eurocode 8.

The beams of the structure have been preselected as IPE 300 section. Decks are conceived as rigid diaphragms in the horizontal plane with a thickness of 20 cm. In the mathematical model, the weight of the slabs is centered on the joints of the structure.

Material used is the Fe360 steel grade for the entire structure.

SAP2000 Nonlinear calculator was used for calculating the object. The preliminary calculation was done based on Eurocode EC1, EC2, EC5, EC8. The calculation of the objects in seismicity was done according to EC8 per D-type of soil category, PGA =0.27g, for buildings of normal class of significance.

Calculation by multi-modal analysis of seismic forces at the floor levels, according to EC8 is:

$$E_{ki} = m_k * S_{a,i} * \eta_{ki}$$

where $S_{a,i}$ is the response design spectral value.

The calculation of elements according to the method of the limit states includes the ultimate limit state and the serviceability limit state. According to the method of the limit states for the loads, the meaning representative value is introduced, whereas for the resistance the meaning of the characteristic value is introduced. The above values are added to the partial security coefficients for the purpose of obtaining the calculation values. Partial security coefficients cover inadequate load shifts and material resistance. The values of partial security coefficients are also obtained through probabilistic methods.

For the calculation of reinforced concrete structures according to the limit state method we distinguish two types of loads: nominal loads derived by different tables in design codes and design loads obtained by multiplying the loads with safety coefficients. Loads are divided into permanent, temporary and special loads. In the absence of statistical data, the representative values for permanent action can be replaced by nominal values from the norms. Representative values for temporary loads are obtained from the characteristic values of the load multiplied by the coefficient of combinations ψ. Characteristic values in the absence of statistical data are replaced by nominal values, which are derived from experience, evaluation and forecast for future development.

In this presented analysis "nominal loads" include:

a. Permanent loads (self-weight of the object, including frame skeleton, finishing layers and permanent partition walls.)

  b. Live loads (long-acting live loads, short-acting live loads: mobile lifting-carrying equipment, weight of people in different furniture in residential or social buildings, wind, snow)

Mathematical modeling with Finite Elements

Mathematical modeling with finite elements was carried out using the structural code SAP2000 Nonlinear version. The three-dimensional model was accepted to be fully restrained at the base without taking into account the soil reaction. The decks were conceived as horizontal rigid diaphragms. Columns and beams were modeled as elements of the frame type, while the decks as lumped masses in storey level nodes. The seismic measures were applied in the form of horizontal pseudo static loads at the levels of floors. The elasticity modulus of steel was assumed E = 200000 MPa while the unit volume weight γ = 78kN/m3. The seismic analysis was carried out with the multimodal response spectrum method for each of the directions with its own specifics. The damping for all modes was accepted equal to 5%. Since individual periods of vibration resulted very close to each other, modal superposition was made according to the Complete Quadratic Combination method. In the analysis according to EC8 it was accepted that the type of soil is D and the reference acceleration of ag,R=0.27g. This analysis for the conditions of EC8 was performed for high class of ductility.

Three storey model numerical analysis results

The three storey model consists of a portal frame. In the nodes of the portal are concentrated the lumped seismic masses. In each level is applied a tendon which represent the strands effect and the linear behavior during earthquake. Also, in the beam-column interface the damping properties of the plates and the nonlinear rotational spring properties are localized. All of the three components are developed in the frame of the gap opening of the semi-rigid connection which has been assumed to represent the ideal joint of SCMRFs beam-column connection. For initial fixity factor $v=0.99$ (full semi-rigid connection) the correspondent ki value is ki=405197 kN/m.
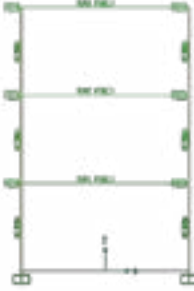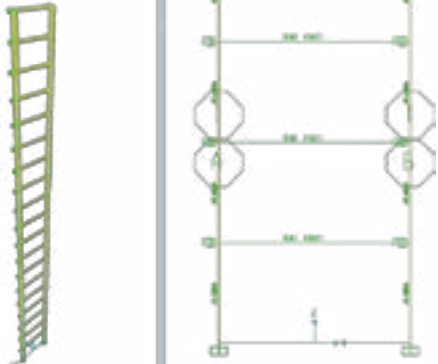

| a) Three storey plan model | b) Eight storey plan model | c) Nineteen storey plan model |

Fig. 7 – Three different storey frame, with damper, non linear springs and tendons

Input parameters for the time domain dynamic analysis are taken those of El Centro (1940) earthquake (Fig.6), with proportional damping , time integration as for Hiber-Hughes-Taylor method and direct integration of motion equations.
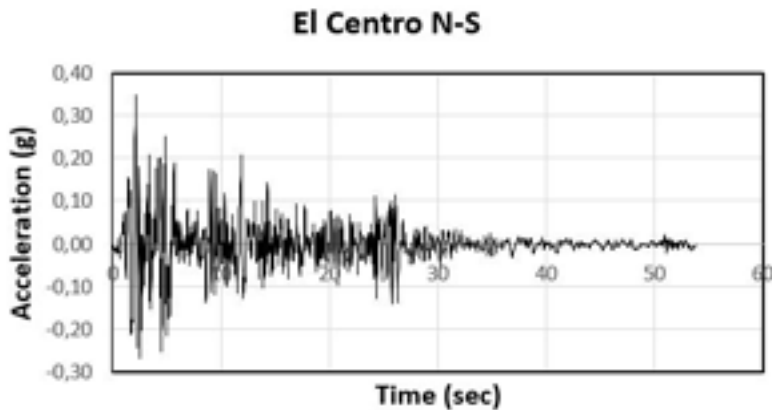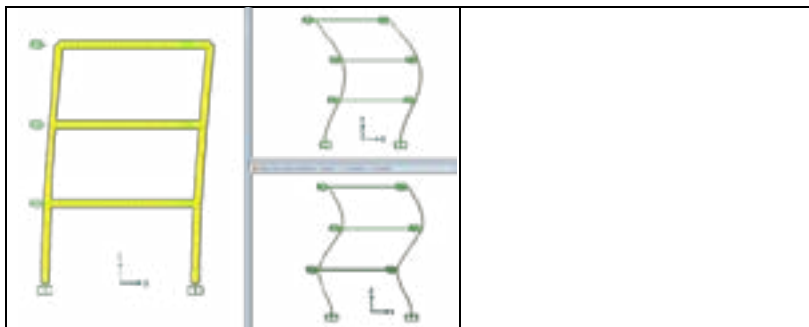

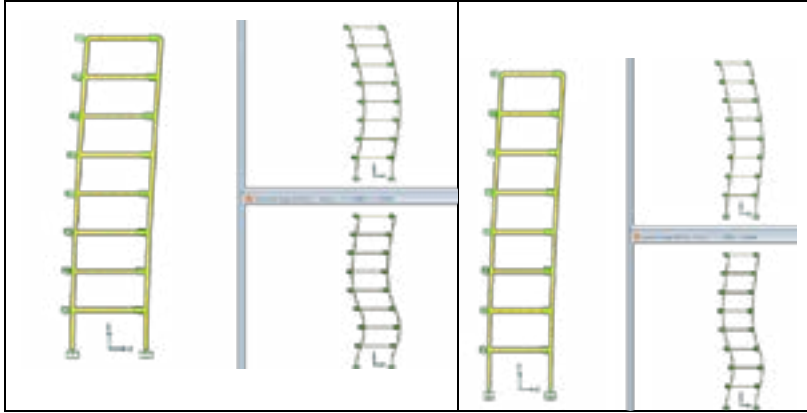Fig. 8 - El Centro (1940) earthquake accelerogram, North-South component.

Fig. 9a, 9b, 9c: Three fundamental periods of vibration of the three, eight and nineteen storey models.

Modal analysis conducted for the three storey SCMRF model shows that the fundamental period of T1=0.6s (Fig.9a) is approximately twice the empirical approach of conventional MRFs. Also the second and third period of vibration are 0.55 s and 0.42 s respectively, almost twice the respective periods of conventional MRFs. Compute of the frequency of vibrations vs. pseudo-accelerations shows that the pseudo-accelerations obviously increase much more then proportionally, by increasing the damping of the connection. The difference comes by the changing of the stiffness of SCMRFs semi-rigid interface between columns and beams.

The comparison between the displacements of SCRF and conventional MRF, clearly shows that the SCMRF system provides larger displacements. The comparative graphic (Fig. 10) shows that SCMRF exhibits less cycles than conventional MRF, while the amplitude of displacement at the top of the building, which at the beginning of time history tend to have a great difference, at the

second half of the time history tend to be equal in both cases. This result of course reflects the fact that for weak motions no gap opening will occur due to tensile force of the strands and the stiffness of the systems is almost equal in both cases.
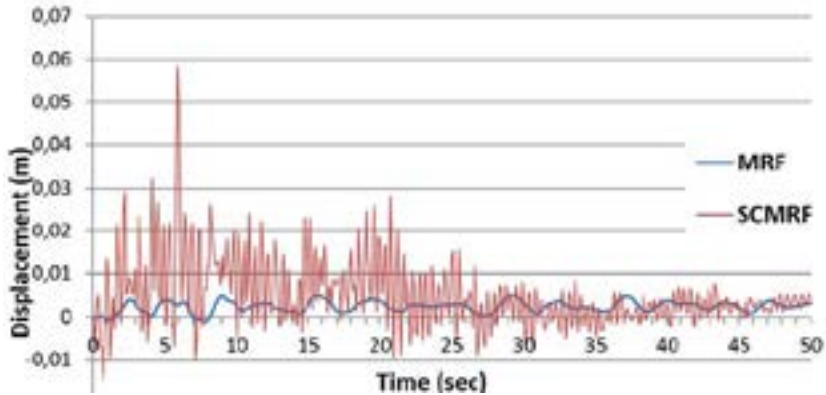

Fig. 10 Comparison of spectral displacements of MRF and SCMRF for the three storey model.
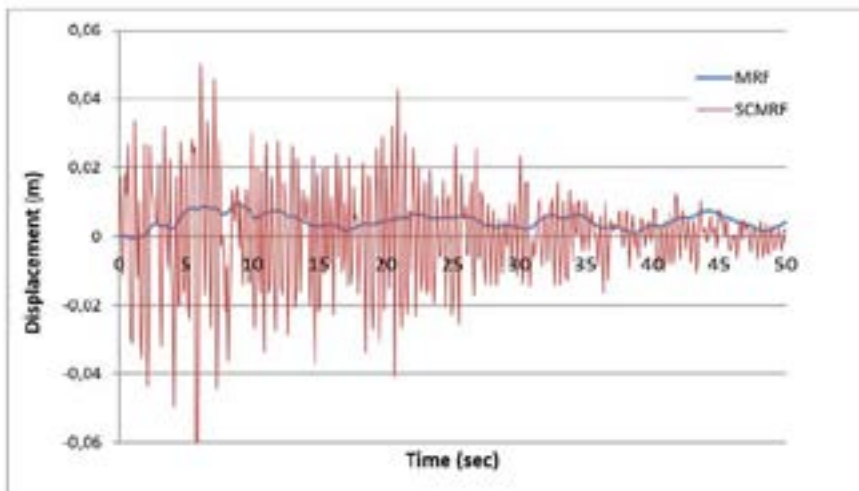
Fig. 11 - Comparison of spectral displacements of MRF and SCMRF for the eight storey model.
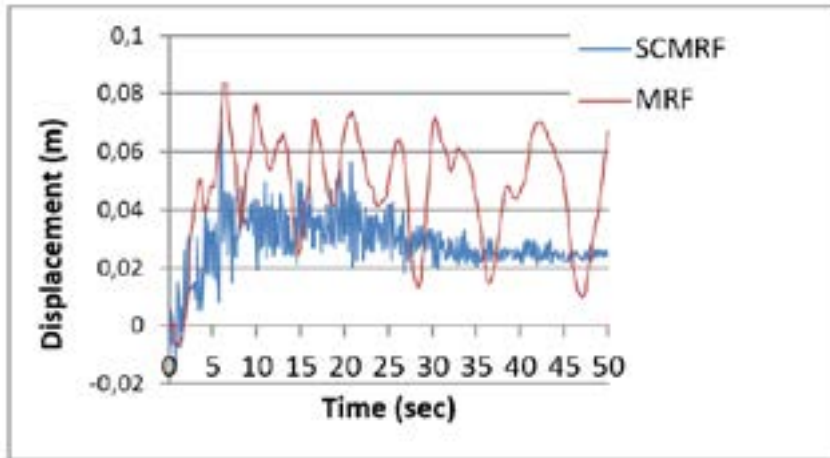
Fig. 12 - Comparison of spectral displacements of MRF and SCMRF for the nineteen storey model.

Nonlinear "pushover" analysis for the conventional MRFs and SCMRFs show a significant increase in the overall capacity of post-tensioned system. The initial stiffnesses in the linear phase of the pushover curves are comparable, especially for systems with high values of post-tensioning. In the nonlinear phase the results show that in SCMRF this phase begins for greater lateral forces, while the continuing curve shape will depend on the nonlinear capacity of plates, as the post tensioned strands must remain in the elastic phase. even the collapse point of the systems are clearly visible in all the models it must be noted that for well designed SCMRF (adequate post tensioned force)systems theoretically it cannot be reached, as the capacity of the system guarantees that the flag shape behavior has no residual displacements.
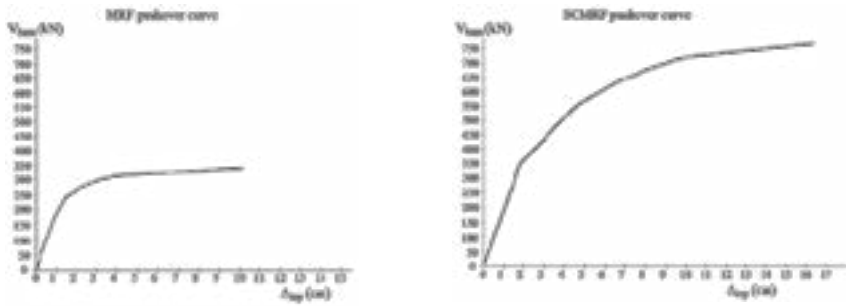
Fig. 13 - Pushover curves for MRF and SCMRF, three storey model.
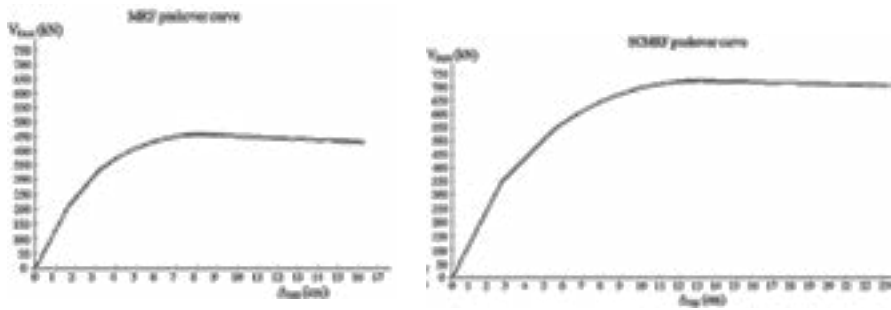
Fig. 14 -   Pushover curves for MRF and SCMRF, eight storey
model.
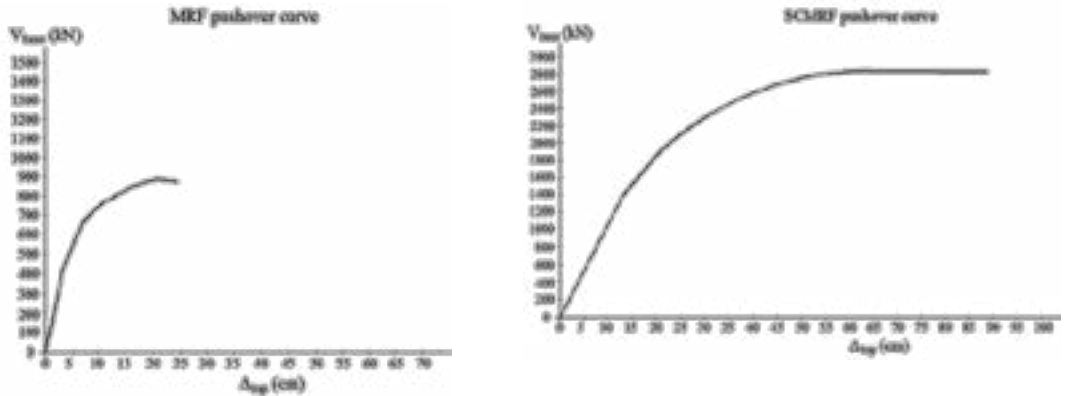
Fig. 15 - Pushover curves for MRF and SCMRF, nineteen storey model.

Summary and Conclusions

Self-Centering Moment Resistant Frames SCMRF's is a big improvement in structural steel frame design. Earthquake action is resisted by the ductility of the frame which is represented by the ability to perform without excessive deformations. This ductility is due to the actual movement of frame and not by the permanent or elastic deformation of the steel material. On the other hand, the sway of the SCMRF frame is definitely much higher than that of a conventional frame MRF. Of course the great advantage of SCMRF is its capacity to preserve its structural integrity after big earthquakes. After conducting the nonlinear dynamic

analysis for three models of 3, 8 and 19 stories, the conclusions are as described below:

1.   Deformations during earthquakes are greatly increased in all models. The difference is greater as the number of stories rise, as the structural systems due to their dynamic properties tend toward the constant displacements zone in the response spectra. These deformations, even the structural system guarantees they provide safe behavior, are beyond the limits set for conventional MRF's in actual codes throughout Europe.

2.   The natural periods of vibrations are significantly higher in SCMRF's, rather than in conventional MRF's. This is caused by the lowering of the rigidity of the nodes and as a result the increase of the flexibility of the system. As a result, SCMRF may maybe affected by disturbances during building occupation due to impulsive vibrant forces which can trigger first mode vibrations. The study over the possible effects that the increase of natural periods may cause to SCMRF's in short and long time loading has not been part of this work and further studies on this topic may be made in the future.

3.   The pushover curves generated for all of the models, show an increase in structural capacity. The presence of the tensile forces applied by the tendons during the opening of the gap earthquakes, brings into the equilibrium the structural system with very low deformations which occur in the thin plates. Because of this behavior larger forces are needed to bring the system to the unstable equilibrium condition (failure). Performance points in SCMRF where considerably higher than in conventional MRF's.

From the energetic point of view, the total amount of energy dissipation was higher in SCMRF's tan in MRF's.

4. Residual deformations of SCMRF's are insignificant compared to MRF's. In MRF's the behavior under cyclic loading in earthquake simulations has the classical form of hysteresis type, which is summed in the degradation "backbone" curve. On the other hand, in SCMRF's the pattern of the cyclic behavior is flag shape with no residual deformations. Actually, the models provide a moderate accuracy in the calculation of pushover increments and plot data, while the hysteretic and flag shape curves of respectively the material and joint behavior are not plot exactly as theoretical and experimental results.

5. The amount of energy damped in SCMRF's nodes is composed by the energy spent in the elastic deformation of the post-tensioned strands (tendons) and by the energy spent for the inelastic deformation of the thin plates. The actual work with the mathematical models with SAP 2000 Nonlinear has not evaluated the contribution of each of the components by numerical values but it was used for capturing the general behavior of the structure. Further investigations could also be performed with other powerful software.

The frame of this work has been the computer modeling, simulation of mathematical finite elements models and interpretations of results for the basic SCMRF model with nodes composed by post tensioned strands, nonlinear helicoidally springs and hook damping properties. Future developments in this area with the aid of specific tools, laboratories and new technologies are the basis for further mini scale and full scale experiments. Experimental data and theoretical results achieved in this

work must be compared and must be calibrated in order to provide a more accurate model for the study of the behavior of Self Centering Moment Resisting Frame's, and may be after that for the implementation of the design of this structural system to civil engineering codes.

References

Garlock, M., Ricles, J.M., Sause, R., Peng, S.-W., Zhao, C., and Lu, L.-W. (1998), "Post Tensioned Seismic Resistant Connections for Steel Frames," Workshop Proc., Frames with Partially Restrained Connections, Atlanta.

Chou, C., Chen, J. H., Chen, Y. C. & Tsai, K. C., 2006. Evaluating performance of post-tensioned steel connections with high-strength strands, Earthquake Engineering and Structural Dynamics 35 (9), 1167–1185.

Christopoulos, C., Filiatrault, A., Uang, C.-M., Folz, B., 2002. Posttensioned Energy Dissipating Connections for Moment-Resisting Steel Frames, Journal of Structural Engineering, ASCE, 128(9), 1111-1120.

Garlock, M. (2002), "Full-Scale Testing, Seismic Analysis, and Design of Post-Tensioned Seismic Resistant Connections for Steel Frames,"Ph.D Dissertation, Dept.of Civil & Env.Eng., Lehigh University, Bethlehem,PA

Field, E. H., Jordan, T. H., and Cornel, C. A., 2003. OpenSHA: A developing community-modeling environment for seismic hazard analysis, Seismological Research Letters, 74(4), 406-419.

Garlock, M. M., Ricles, J. M., Sause, R., Peng, S.W., Zhao, C., and Lu, L.-W., 1998. Post-Tensioned Seismic Resistant Connections for Steel Frames, Structural Stability Research Council Conference Workshop, Atlanta, Georgia.

Garlock, M, Ricles, J., and Sause, R., 2005. Experimental Studies on Full-Scale Post-Tensioned Steel Connections, Journal of Structural Engineering, ASCE, 131(3).

Garlock, M, Sause, R., and Ricles, J., 2007. Behavior and Design of Post-Tensioned Steel Frames, Journal of Structural Engineering, ASCE, 133(3), 389-399.

Garlock, M, Li, J. and Vanmarcke, E., 2009. Floor diaphragm design of steel self-centering moment frames, Proc. of the Sixth Intern. Conf. on Behavior of Steel Structures in Seismic Areas, STESSA, Philadelphia, PA, August.

Herning, G, Garlock, M., and Vanmarcke, E. 2009. Evaluation of design procedure for steel self- centering moment frames, Proceedings, Steel Strucutres in Seismic Areas (STESSA), Philadelphia, PA, August.

International Code Council, 2000. International Building Code, Falls Church, Virginia.

Pant, R. and Vanmarcke, E., 2009. New attenuation models for earthquake intensity and frequency-content indicators, Earthquake Spectra

Ricles, J., Sause, R., Garlock, M., and Zhao, C., 2001. Post-Tensioned Seismic Resistant Connections for Steel Frames, Journal of Structural Eng, ASCE, 127(2).

Rojas, P., Ricles, J.M., and R. Sause, 2005. Seismic Performance of Post-Tensioned Steel MRFs With Friction Devices, Journal of Structural Engineering, ASCE, 131(4), 529-540.

Christopoulos C, Filiatrualt A, Uang C, and Folz B. (2002a), "Post-tensioned Energy Dissipating Connections for Moment-Resisting Steel Frames". Journal of Structural Engineering, 128(9), 1111-1120.

How architectural design can impact energy efficiency of a residential building.
Case Study: 'An addition for one-story house, adapting 'Florida-room' space.

Enkeleida Prifti

European University of Tirana, Engineering and Architecture Department

Abstract: The purpose of this project and study is to determine and evaluate the sustainability of architectural solutions that will provide energetically efficient buildings. The add to an existing one-story house, by adapting an existing 'Florida-room' will expand surface of the conditioned area, and increase the value of the house by modern designed interiors. But the purpose was to reward this investment with an addition that will be sustainable and energy saving. The methods and materials used to complete this project include three stages of work: collection of data's to compare then the final results for a conclusion, projecting and receiving a permit according to the building code, and construction.

City Hall of Largo, department of 'Permits and Planning' gives information on construction permits and community planning codes for residents of Largo. Department of P&P provided with applications, forms, information about community standards and guidelines from the code council of Florida. With these information started design according to the codes and policies of the state, for an efficient project. This provided as a beginning a successful receiving of the permit and notice of commencement, which allowed us to start construction works. Assessment of major components of project and relations between them showed that: architectural solutions chosen for this project and constructing with new modern materials that meet the standards, affected consummation of energy in lowering consummation per square feet.

Finally two approaches in architectural design were discussed for providing a sustainable design and energy efficiency building.

Key words: Energy Efficiency – architectural design – sustainability - Florida room – residential building quality.

INTRODUCTION

This paper aims to identify and evaluate importance of architectural choices made in project, to contribute positively to the energy balance used in the building through a sustainability design. Shape of a building is one of the important components when architects design it. Concepts have always been discussed by different philosophers, historians, architects, constructors and many others. It has always been issue of aesthetics and construction technology, which are both objective and

subjective at the same time. But, after changes that have occurred in society of the 21-st century and electricity required for developing and emerging economies, we still lack access to modern energy services for billions of people. Also the dramatic increase of energy prices and awareness of limited known energy sources shall generate a new way of thinking in architectural design. [1]

"Bring all existing and future elements of the built environment – in their design, production, use and eventual reuse – up to sustainable design standards." - Declaration of Interdependence for a Sustainable Future at the UIA/AIA World Congress of Architects in Chicago, 18 – 21 June 1993. Architects design not only for a concept, for a climate or environment, but also to reduce energy consumption in our bills regardless of market trading prices for energy. [6] Indoor Climate – creates a healthier and more comfortable life for the occupants and has a positive impact on the environment. [4, 5] By the twentieth century the gradual but whole-scale absorption of the responsibility for the environmental performance of buildings by the HVAC engineer appeared complete to the extent that some architecture schools today do not even teach basic building science, concentrating on history, theory, philosophy, graphic design and computer modelling. [4] The power grab of the role of the environmental designer by service engineers from the grip of the architect has been well described by many authors and was outlined in our *ASR* paper on twentieth-century standards for thermal comfort in 2010. [4] The regulatory imperative to replace opening windows with fixed 'glazing' and provide year round ventilation with an HVAC plant was to a large extent driven by the thermal comfort standards that were developed by the

air-conditioning industry to enable engineers to determine the best temperatures at which to set building thermostats. That research resulted in regulations based on the idea that 'people' could only be considered comfortable if room temperatures were kept within a narrow thermal band, ranging typically around 20–24°C. [4] The more extreme the climate the greater the HVAC plant needed to achieve these temperatures in buildings that are increasingly 'modern', light weight, over-glazed and energy hungry. [6]

Therefore; having in mind all of these facts, we shall design in order to sustain benefits of the known so far designed methods, providing not only high aesthetic quality but also sustainable and energetically efficient buildings.

MATERIALS AND METHODS

Study area: The one-story house is located in Largo city, state of Florida, USA. Area of construction is the Florida – room of this house. Basic information for the house's plan comes from 'Survey of Existing Key Plan' which is a plan about 'Erosion controls'. Design criteria for all work is in accordance with the Florida Code 2010: Occupancy type R – 3; Construction type V – B; Fire sprinkler No. 3; Flood zone: C; Basic wind speed 150 mph; Risk category: II; Wind exposure: C; Building: Enclosed; Pressure design factor: +/- 0.18 [2]

The existing plan (pic. 3) includes: three bedrooms, two water-closets, living room, family room, laundry, garage; kitchen and Florida-room. Kitchen –is designed according to American philosophy that it should be located at the center of the house, with an open view from the living

room for the guests. Florida – room is located on the northern side of the house. The term "Florida room" refers to an extra living area that features extra glass to bring in light and to enjoy an outside view. A Florida room has some features in common with a Sun Room, a room that permits abundant daylight and views of the landscape while sheltering from adverse weather. Florida room is a roofed structure with mesh screen for walls and is not air-conditioned. (pic.2)

METHOD: Many are the methods and theories designers approach to ensure optimal temperatures for comfort, through year round in all types of climate. [4] [11] [12]. But in the twenty first century architects and engineers have come to conclusions on whether people were comfortable or not, based mainly in two methods. [4] So there are two categories in which project is focused; and buildings can be designed using either method, or both.

- The Heat Balance method: This method discourages natural ventilation and the problem with building models is that they tend to lump the many design factors into one model. [4] In natural ventilation systems, enhanced cooling can be garnered from gusts in airflows and the need for research into optimal gusting frequencies from airflow devices for comfort. It suggests that responsibility for the design of resilient buildings that can keep people thermally safe in a warming world must be taken by the first-stage designers who shape the immutable form of the building and the air pathways through them. [4]
- On the other hand the **Adaptive method** enables natural ventilation and there are International Comfort Standards for

both. Standard ISO 7730 (BSI 2005) for the Heat Balance model and ASHRAE/ANSI standard 55 (ASHRAE 2010) and CEN Standard 15251 (BSI 2007) both include versions of the *Adaptive approach.* [4]

So far we have seen that a well-designed home can, with a low cost and low impact, provide comfort even at high temperatures, using natural ventilation, energy storage and adaptive opportunities, without compromising indoor air quality. Also highlighted has been that many modern buildings are overheating and will increasingly do so in a warming climate. [4] So the challenge is to reduce overheating in buildings at the design stage. They may include a range of choices from manually to mechanically operated elements such shades, shutters, glazing type and ceiling fans to heating or air-conditioning systems. These secondary systems may all be changed over time but not the fundamental building form itself. [4] Finally, interviews about the development and refinement of house design over time, with the engineers of city-hall Largo; who work with 'HVAC equipment efficiency verification', showed that the occupants of the buildings involved adaptive changes that brought better results in efficiency. So went for the second one, *Adaptive Method*. The following case study demonstrate the importance of climate in design and of architectural shape of the building.
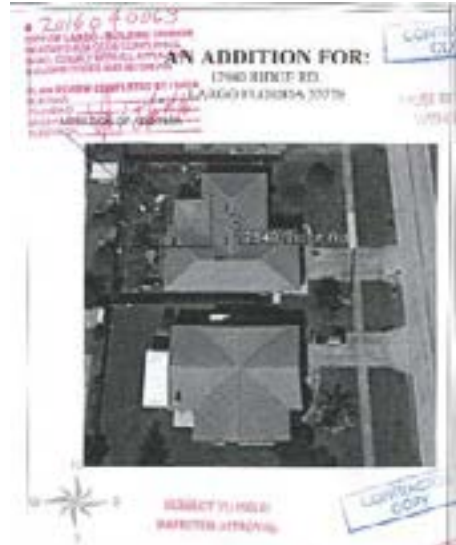
Case Study:

Building Constructed: 1975 (Pic. 1)

Owners: Family with two children

Location: Ridge Rd, Largo, FL; 10 m above sea level

Climate: on average there are 246 sunny days per year; Gets 51 inches of rain on average, per year.

Area: 198 m2

Pic. 1. Permit for an addition for the building

KEY DESIGN OBJECTIVES: 1) Adapting Florida-room into a large kitchen; and giving the existing space of the kitchen to the living-room and to family-room ; 2) Creating a room after the kitchen to isolate direct contact of the kitchen with outside-door in the garden behind; (pic. 3&4); 3) Good new walls and good insulation on walls and roof (pic.11); 4) Use good windows and doors, air tight, no thermal bringing, heat recovery; 5) Renovation of chimney isolation for thermal storage and natural ventilation, 6) building a climate refuge, with mixed mods technology for extreme weather options; 7) improve natural ventilation and adaptive

envelope. And of course a well-treaded building is going to be a safe building.

Designing started with verification of all plantings and irrigation / sprinkles systems and risers for spray heads which shall be at least 1 foot from building sidewalls. Soil treatment shall meet the requirements of 2014 FBC R318 Method. Basic information comes from Key Plan and Department of city-planning at City-Hall, which gave the limits of construction field. Existing plan includes a Florida –room which is a space that is not covered by HVAC system. It is roofed with sandwich – aluminum construction and has light walls of aluminum frames. Assessment of major components, and relations between each one of them showed that: we got components that form visual quality of the exterior and interiors where the coverings like tiles, windows, doors, colors of the shingles play an aesthetic positive role to the style of the house [3]; And we deal with components that improve commodity of living such as: better light, ventilation, air-conditioned space, more space for mobility, electric energy saving, hurricane protection, better aromatic inner-climate. So together with all of these above in mind is good that the project achieves some key construction objectives in renovation and construction.

After listing objectives, started with the new planning of the house that includes: 1) replacing existing aluminum frame walls in Florida-room with concrete walls covered with good insulation that will improve energy efficiency of the building. (pic.4 & 13.b); 2) and, replacing old existing sliding glass doors which create vertical thermal bridges. (pic. 3&2)
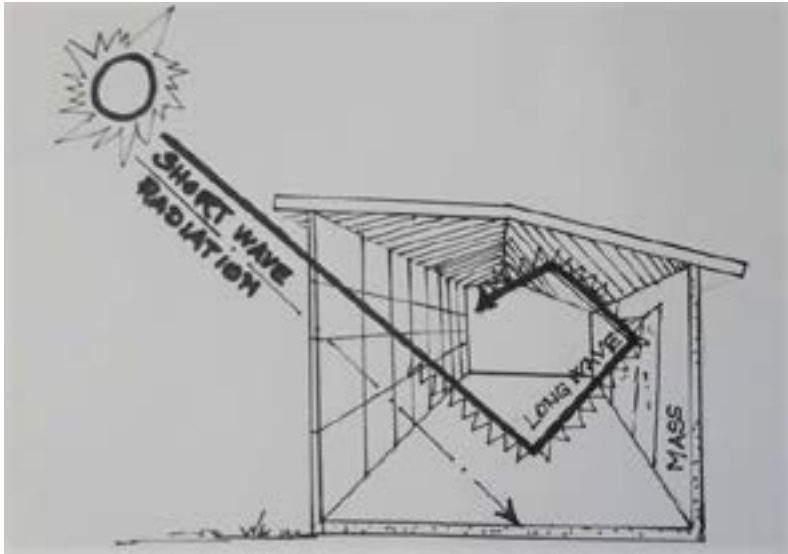
Pic. 2. Entry of solar radiation in space, transform it into thermal and storage at building blocks.
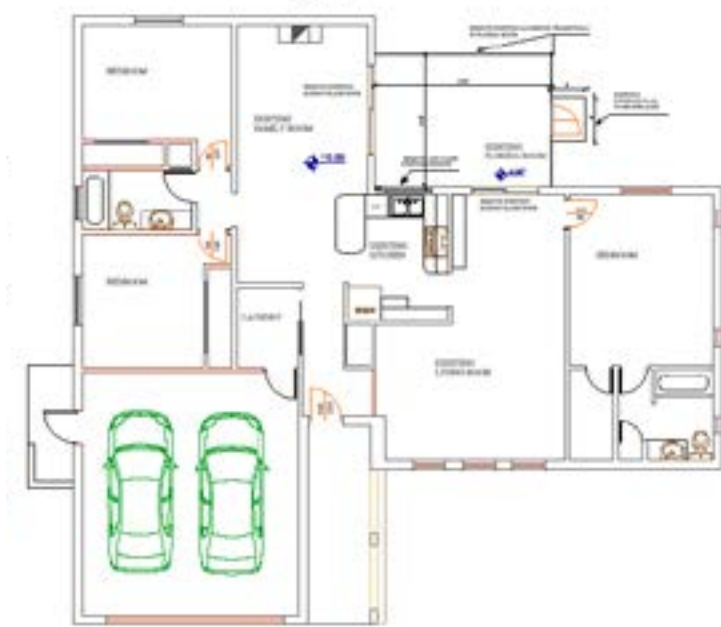
Pic. 3. Existing floor plan.
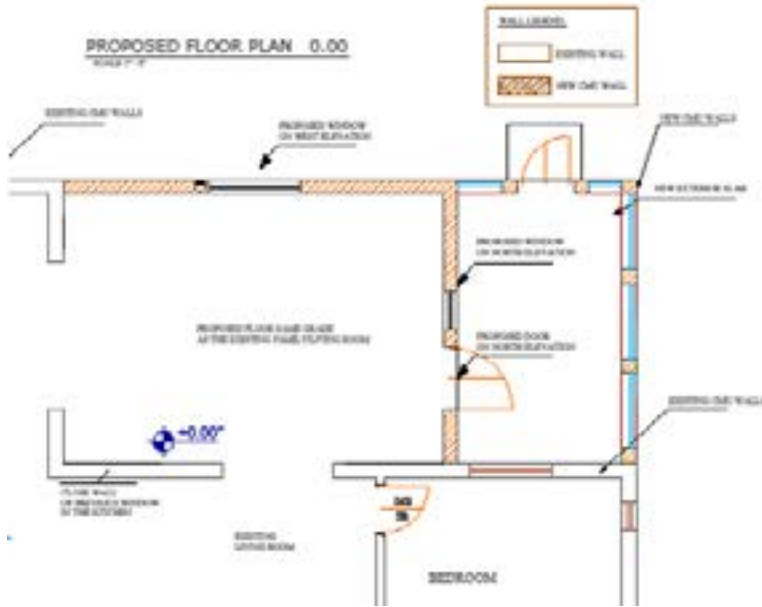
Pic. 4. Final Proposed floor plan.

The second step was to adapt the area of Florida- room into new kitchen. Remove kitchen from the existing place will give more space to living-room and family room for a new design of open-concept, but will also create a wide open kitchen with a space of three times bigger than the old one. (It was 9 m² and it became 27 m²) Putting kitchen further from the living room and bedrooms, improves climate of the house and prevents lingering cooking smells before you even start cooking and even though you use ventilation system from the HVAC. Also positioning kitchen closer to the wall openings and chimney, kitchen gets closer to possibilities of natural ventilation. (pic. 13)

CONSTRUCTION DESIGN OBJECTIVES: Wood grade stakes shall not be used. Protection against decay and termites shall be provided in accordance with 2014 FBC R317, R318. Roof flashing shall be

provided in accordance with the requirements of 2014 FBC R703.7.5, R703.8, R903.2 and R905. [2] About soil was noted that: was needed compact back fill 5'-0" from structure. Minimum allowable bearing capacity shall be 2000 PSF. All soil shall be free of debris and organic materials and compacted to 95% of modified proctor (ASTM D1557). Foundations shall be built on undisturbed soil or properly compacted fill material complying with the FBC – R 2014. [2] Stem wall fill shall not exceed 12" lifts, Soil below footings shall be tested and all subsequent fill soil in lift not to exceed 12" intervals. All fill material shall be SP or SM material as defined by the uniform soil classification system. Any questionable soil shall be removed or brought to the attention of the engineer of record for evaluation. Soil bearing capacity in based upon 2,000 PSF. Wood grade stakes are prohibited. [2] During construction works, contractors were to verify manufactured truss plan prior to placement to placement of stem wall or monolithic footing. Plumber is to inform superintendent of any venting which utilizes a masonry wall to resolve any possible structural integrity issues. There were drawings for demolition plan and proposed layout. Modified structural members are in compliance with Florida Building Code 2014. Were designed with dimensions and elevations all architectural drawings.

CAST – IN – PLACE CONCRETE NOTES (Pic. 5)**:** Concrete mixes shall be designed per ACI 30, using Portland cement conforming to AST C – 150, aggregate conforming to ASTM C – 33, and admixtures conforming to ASTM C-494, C-1017, C-618, C-989 and C-260. Concrete shall be ready – mixed in accordance with ASTM C-94. Concrete shall be conform to be following compressive strength, slump

and water/ cement ratio requirement: In all salt environments a min. of 5000 PSI concrete shall be used. (Slab shall be exempt.) For other environment use 3000 PSI concrete. All concrete work shall be conform to ASTM A-615, Grade 60. All welded wire fabric (WWF) shall conform to ASTM A- 185 (flat sheets only). All reinforced steel including hooks and bends, shall be detailed in accordance with ACI 315. All reinforcing steel indicated as being continuous (cont.) shall be lapped 40 x bar diameter. Lap continuous bottom bars over supports, lap continuous top bars at mid-span unless otherwise noted. Unless otherwise noted, the following minimum concrete cover shall be provided for reinforcement in accordance W/ ACI 318-08.
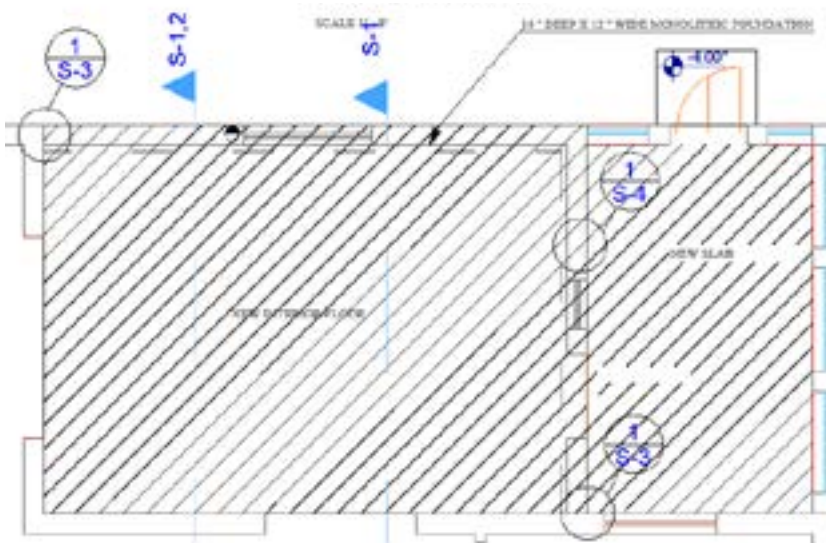
Pic. 5. Foundation plan.

EXTERIOR OPENINGS:

Pic. 6. Existing west elevation (left) & Proposed west elevation (right).

Exterior windows and glass doors (fig. 6) shall be tested by an approved independent testing laboratory and bear an AAMA, WDMA, or other approved label identifying and manufacturer, performance characteristics and approved product ANSI / AAMA / NWWDA. Window and door assemblies shall be attached in strict accordance with the published manufacturer recommendation to achieve resistance to appropriate wind speed with 3 second wind gusts and shall include the specification of buck strip materials and anchoring. Wood cribs above arched windows shall comply with drawing detail contained herein. All shim materials shall be made from materials capable of sustaining applicable loads, and located and applied in a thickness capable of withstanding those loads. Opening perimeters have been designed to transmit the imposed loads to main wind force resisting system. Impact glass or shutters shall be used per FBC 1609.1.2

DESIGN LOADS AND NOTES: LIVE LOADS: Roof -20PSF; DEAD LOADS: Shingle roof - 10PSF; Ceiling -10PSF; DL = 10 PSF in combination with wind loads. Lateral loads in trusses are resisted by roof diaphragm at point of wind load input unless noted otherwise. (Pic. 7)
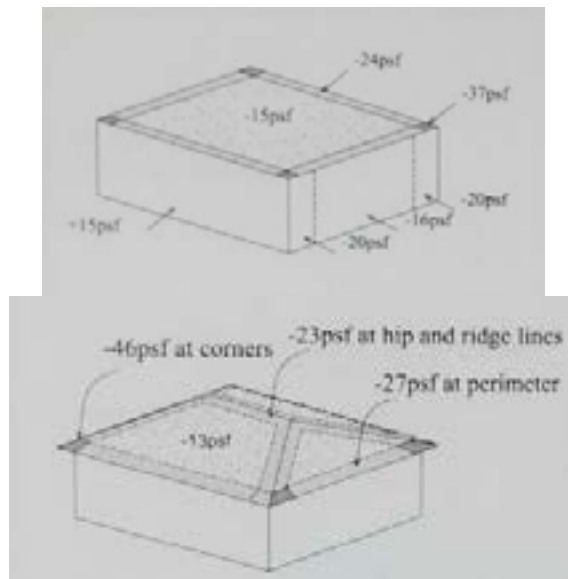
Pic. 7. Scheme of flat gable roof; Hip or gable roof.

FRAMING NOTES: Wood construction, connections and nailing shall conform to the FBC 2014 EDITION. All wood framing materials shall be surface dry and used at 19% maximum moisture content. All load bearing wall framing shall be #2 southern pine. All joist and rafter framing shall be #2 southern pine or hem-fir. All framing exposed to the weather or in contact with masonry or concrete shall be pressure treated. All door headers at bearing walls to be (2) 2x10SYP or better, unless

noted otherwise. Prefabricated metal joist hangers, hurricane clips, hold-down anchors and other accessories shall be manufactures by "SIMPSOM STRONG TIE COMPANY OR EQUIVALENT". Install all accessories as per manufacturers' requirements. All steel shall have a minimum thickness of 0.04 inches (ASTM A446 GRADE A) and be galvanized Coating G60). Trusses and beams shall bear directly on GLB or SYP posts U.N.O. where required, shims to be A36 steel U.N.O. GLB or SYP posts U.N.O. shall bear directly on concrete slab or on SYP or PT plate unless noted otherwise. Members designed 'LVL' (E.G., 1¾" x 14" LVL) shall be laminated veneer lumber as manufactured by boise (Versa – Lam) or Engineer approved substitutions. Bolt heads shall be centered & drilled no more than 1/16" larger than bolt diameter. Bolted connections shall be tight but not to the extent of crushing wood under washers. All nail shank sizes to be minimum of 0.131 inches (fig. 8, 9 & 10).

Pic. 8. Proposed cross section 1-1 & 2-2.

ROOF FRAMING NOTES: The design of roof framing shall be based on the requirements of the Florida building CODE, 2014 EDITION. Design wind loads (pic. 7) shall be applied in accordance with ASCE 7 – 10. See wind notes for wind design requirements. Roof truss manufacturer shall submit and provide complete layout and furnish the following information: Roof pitch, lumber size, spacing, species and

grading, location and magnitude of uplift loads. Roof sheathing shall be 15/32" CD PLYWOOD or EQ. Trusses must be designed to support walls against out – of – plane loads. This applies to all trusses with a raised heel condition that bear on an exterior wall. Truss manufacturer's truss layout shall show all connections between trusses and other trusses, and between trusses and wood beams. Use Simpson H10 or H10 – 2 at each truss for wood walls and HETA 20 for concrete walls where possible. Where the H-10 cannot be used on wood walls (EG. On 3-ply girders, at corners, etc.) Use Simpson H 2.5 and additional tiedowns to meet uplift requirements. (pic. 9)
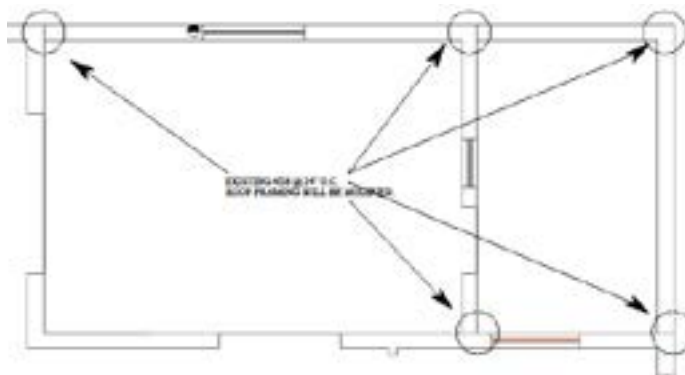
Pic. 9. Roof framing plan – pointing construction and thermal bridges.

NOTES: Extension of beam as is described in the scheme secures us that fasteners will transfer half of the load from the lumber (Pic. 10). This procedure will take place after the wall is built up, so that the beams will be based loosely on the new wall.
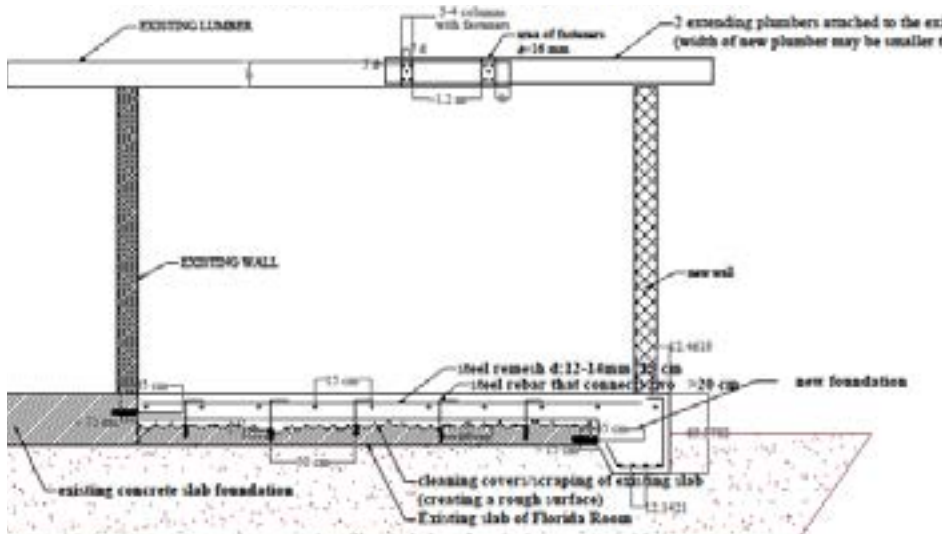
Pic. 10. Longitudinal section align the lumber
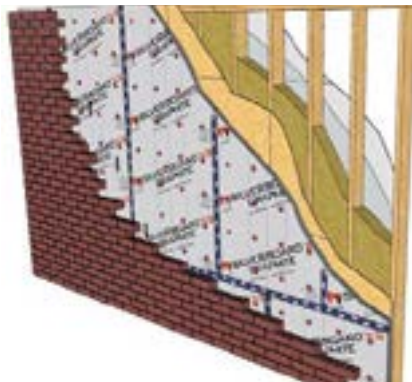
Pic. 11. Insulating sheets used in typical wall (was assembly with SilverRboard Graphite XS as continuous insulation and brick veneer cladding). [18]

PEST / DECAY PROTECTION NOTES:

DESIGN WIND PRESSURES (ASD) FOR COMPONENTS and CLADDING (psf) 150 MPH (ult) CAT B @ 15' HEIGHT					
TRIBUTARY AREA [SF]	ZONE				
	ROOF			WINDOWS & DOORS	
	1	2	3	4	5
10	+16.0 / –22.2	+16.0 /– 38.7	+16.0 / –57.2	+24.3 / –26.3	+24.3/– 32.25
20	+16.0 / –21.6	+16.0 /– 35.6	+16.0 / –53.5	+23.2 /– 25.3	+23.2/– 30.3
50	+16.0 / –20.8	+16.0 /– 31.5	+16.0 /– 48.6	+21.7 /– 23.8	+21.7 /– 27.4
100	+16.0 / –20.2	+16.0 / –28.4	+16.0 /– 44.9	+20.7 /– 22.7	+20.7 /– 25.3

ELECTRICAL NOTES: Electrical work shall include but not be limited to the following: Power for connections to equipment provided and installed by other trades, i.e., HVAC equipment. Notify and install locally certified smoke detectors as required by national electric code (nec) and meeting the requirements of all governing codes. Provide and install ground fault circuit - interrupters (gfi) as required by national electric code (nec) and meeting the requirements of all governing codes. (Pic. 12)
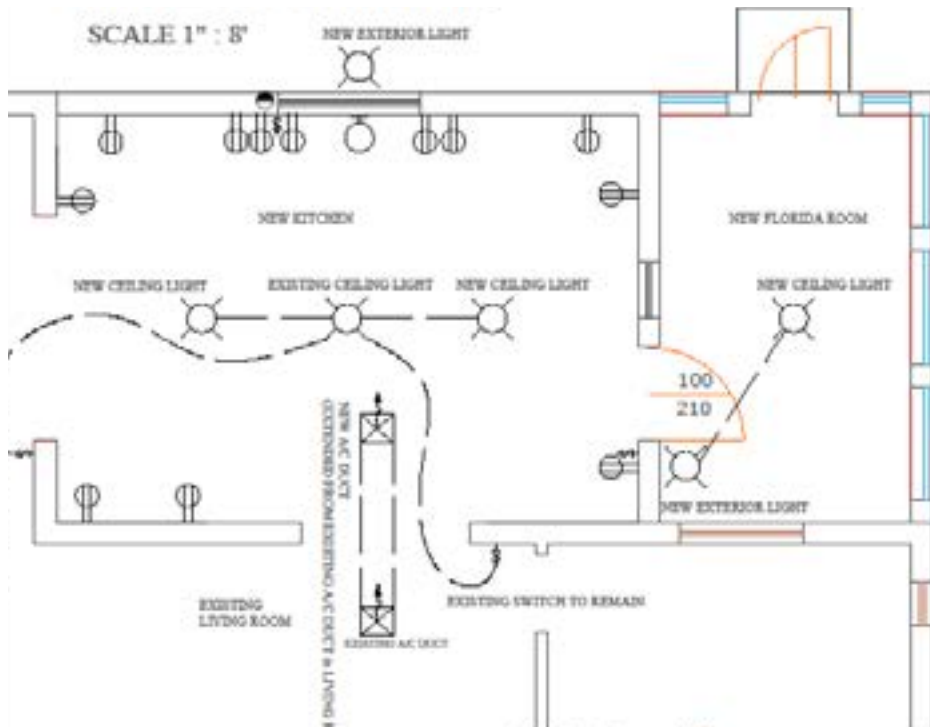
Pic. 12. M.E.P. floor plan.

RESULTS AND DISCUSSION

Once one of the two models designed (pic. 13 a), b) was chosen based on the targets that contractor has set in the beginning, one indicator has been defined and measured. This indicator must be interpreted against a benchmark or a standard to determine whether the observed performance is satisfactory or not. [11]
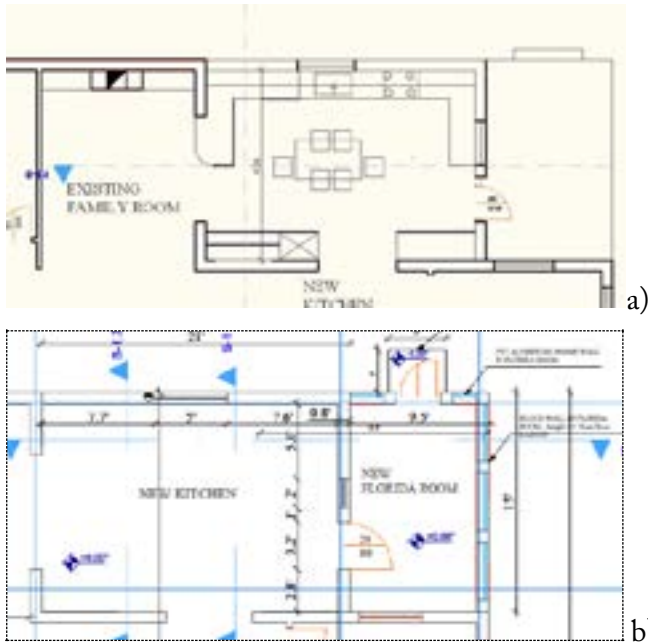
Pic. 13. First proposal plan (a); Second proposal plan (b)

Targets must be set from the position of knowledge on the representative operational circumstances, which may be affected by one or more of the following factors:

1) Current and baseline production volume; 2) Nominal Production capacity (Plant capacity) – production capability over the course of a day, month or a year defined as number of standard shifts per day, hours per shift, multiplied by items or volume produced (pieces, ton, kg..); 3) Capacity utilization – actual production divided by nominal production capacity. ; 4) Product mix.

If any of these factors change significantly over the time, targets may need to be redefined in order to reflect new circumstances. [11] Factors that

influence energy and environmental performance are summarized as in pic. 14 [11]
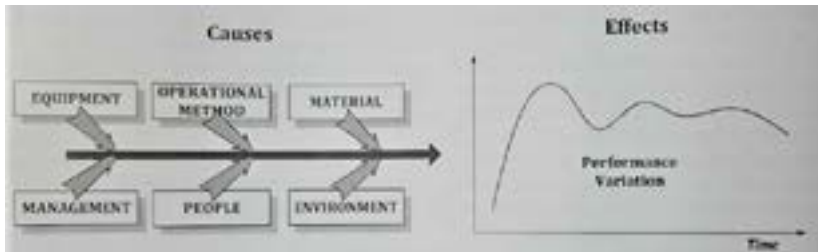
Pic. 14. Symbolic Cause-Effect Relationship of Influencing Factors and Performance Variations.

Although the large part of the project is somewhat technical, there are some sections that help in monitoring and verification of results of the choices made in design and construction. These components are [11]:

- Savings measurement with simple formula: Energy Savings = Base Year Use – Post Retrofit Energy Use ±Adjustments.
- Measurement options: Method of whole building Approach (analyzing utility bills before and after implementation)
- Monitoring and verification plan: calculation and interpreting the intended result at the design stage) (pic. 15)
- Valuation of units of utility resource savings. Energy cost savings may be calculated by applying the price of each energy or demand unit to the determined savings [11]

As a results, after adding air-conditioned surface of 42 m^2 to the existing surface covered by old HVAC equipment (for 1 ton) showed that needs to be replaced to a bigger one (for 2 tons). In the beginning the contractor decided to keep the old one, which failed working after

few months the construction works were finished. But this approach in architectural design proved to have positive change for providing an energy efficiency building. Comparing the results with the whole building approach method, this add to the house provided sustainability and energy efficiency for the house. Finally project was rewarded with inspector approval after HVAC Equipment Efficiency Verification.

A series of measures are compared during the years, but comparing one year before add (2016) with two years after the add was constructed, electric energy consumption (with the new HVAC equ.) decreased from 0.5$/m² to 0.4 $/m². Knowing that: the average residential electricity rate in Largo is 15.32% greater than the Florida average and average (residential) electricity rate in Largo is 10.86% greater than the national average rate, therefor designing an add to the existing building with these results is a practice that will have serious impact for the life of occupants and for sustainability of building and environment as well, making an existing building energetically efficient.

Design Temperature			
	Inside	Outside	Difference
Winter	75	60	15
Summer	79	86	7

HEATING		COMMON DATA SECTION		COOLING	
BTUH LOSS	HEATING FACTOR	SUBJECT	AREA Sq Ft	COOLING FACTOR	BTUH GAIN
		GROSS WALL	1369		
660.05		DOORS & WINDOWS	139		4762
2070.6	1.74	NET WALL	1190	0	0
636.9	0.33	CEILING	1930	1.3	2509
					0.28
7913	4.10	FLOORS	1930	0	0
2288	0.8	INFILTRATION FACTOR BTU Hr		0.4	600.8
13568.55		SUB-TOTAL BTUH LOSS (per 10 deg F)			
X 2		ADJUSTMENT FACTOR			
27137		TOTAL BTUH LOSS			
		PEOPLE(Assume 2 persons per bedroom)		300	1800
		APPLIANCES			1200
		SUB TOTAL BTUH GAIN(Room sensible only)			11072.08
X	1.1	DUCT LOSS / GAIN FACTOR		1.15	X
		SUB TOTAL BTUH (Sensible Gain)			12732.892
		MOISTURE REMOVAL		1.3	X
29850.7		TOTAL BTUH LOSS			16552.76

Pic. 15. Final analyses calculations.

CONCLUSSION AND RECOMMENDATIONS

Twentieth century markets of today can often prove an impediment to the development of truly innovative and ultimately more resilient building solutions. For instance new thinking on natural ventilation proliferates but investment priorities and procurement thinking must change too in response, and be modified to reward more common sense approaches that address the need for better basic climatic design for all new buildings. Where does 'modern architecture' fit into all of this? It should be right at the heart of it, as evidenced by the research papers in

this issue and importance of climate in design. No longer should any client accept a building from an architect that does not deal well with the relationship between the indoor and outdoor climate. [6] Nevertheless, there are situations where improper installations, may reflect design faults, so these must be corrected to achieve expected output or efficiency. We shall not assume that the design is correct just because the facility has been operating for a period of time. [11] [10]

As it's said in the Declaration of Interdependence for a Sustainable Future At the UIA/AIA World Congress of Architects in Chicago, 18 – 21 June 1993 : " As members of the world's architectural and building-design professions, individually and through our professional organizations: to place environmental and social sustainability at the core of our practices and professional responsibilities; develop and continually improve practices, procedures, products, curricula, services and standards that will enable the implementation of sustainable design; and educate out fellow professionals. .."
Consequently, design and results of this study provide valuable information for architects, engineer designers and curricula of architecture.

REFERENCE

1. Dilip Ahuja & Marika Tatsutani, Daniel Schaffer, 2009. Sustainable energy for developing countries.

2. 2010 Florida Building Code – Residential

3. St. Petersburg's Design Guidelines for Historic Properties

4. Sue Roaf & Fergus Nicol, 2017. Running buildings on natural energy: design thinking for a different future. Architectural Science Review, DOI: 10.1080/00038628.2017.1303924

5. ASHRAE. 2010. ANSI/ASHRAE Standard 55-2010: Thermal Environmental Conditions for Human Occupancy. Atlanta: American Socieity of Heating, Refregerating and Air-Conditioning Engineers.

6. Roaf, Sue . Ecohouse – a design guide 1. Architecture – Environmental aspects I. Title 720.4'7

7. AMVIC – Building system – rigid board installation Builder's guide

8. Gerasimos Paizis, Michael Tornaris, Eleftherios Andritsakis – 2012. Training book Energy Efficiency Auditors for Buildings – TUV Rheinland Hellas – Volume I HVAC systems.

9. Technical directive of Greek Technical Chamber No TOTEE 20701 – 1/2010

10. Training booklet of Greek Technical Chamber for DK1 Legislation & regulation

11. Dusan Gvozdenac & Miroslav Kljajic. 2013. Training Manual – Monitoring and Verification of Energy Systems.

12. Example Measurement & Verification Plan for a Super ESPC Project, 2007,

www.eere.energy.gov/femp/financing/superespcs.mvresources.cfm.

13. ISO 13790 E2 (2009), Energy performance of buildings – Calculation of energy use for space heating and cooling (ISO 13790:2008)

14. https://www.electricitylocal.com/states/florida/largo/

15. ISO 13789 E2 (2009), Thermal performance of buildings – Transmissions and ventilation heat transfer coefficients – Calculation method (ISO 13789:2007)

16. ISO 14683:2009. Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values (ISO 14683:2007)

17. ISO 10211 (2009) Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations.

18. Rigid Board Installation Builder's Guide – amvic building system

The analysis of a five-storey brick Masonry building "type" 77/5

Petraq Koka

"Speed Engineers" l.t.d

ABSTRACT

This paper presents the main results of numerical analyses carried out to evaluate the seismic response of an existing brick masonry building, *type 77/5,* built in 1977.(*fig. 1*)

This type is a representative of many other brick masonry buildings built in 1975-1990, in Albania.

The main reason why this building was chosen for analysis is: Its *floor plan derives from regular geometry, based on recommendations of the Eurocode 8* [6]. [**4.2.3.2 Criteria for regularity in the plan,** pg. 48, Part 1]

This study firstly intends to analyze and after to propose a way how to rehabilitate this type of building, if this result necessary after the analysis. The study comprehended analysis based on 2 steps:

- a linear analysis, with help of finite elements model

- a nonlinear analysis, carried out with a simplified modeling procedure.

These numerical analyses refer to the strengthened building. The results showed that both procedures were useful to investigate the structural problems. The finite elements model furnished a good prediction of the masonry stresses under vertical loads and the modal response of the structure. [13]

The non-linear analyzes, with simplified method is performed based on the AM quake program. For this analysis a value of ag = 0.27 m / s2 was accepted.

The results of the nonlinear analysis are not the subject of this publication.

Key words: brick (9), building (19), masonry (11) wall (10), slab (4) concrete (4) seismic (7)

INTRODUCTION

Fig. 1 - The **3D** view of the building **77/5**

During the January 1988 earthquake, I used to live in a building type 77/5(Fig. 1). Although the damages that the building experienced were small, their locations were rather interesting. Based on the studies done thus far in seismic behavior of masonry buildings, the damaged areas were the same as those predicted for such buildings. That is the main reason why i choose to investigate this topic even further, utilizing the modern-day software advancements.

While this 5 storey building makes a considerable percentage of the residential buildings, all over Albania, the basic question is: "Are safe these buildings under seismic actions, to be housed from so many families?"

The structural stability of existing masonry buildings is a topic of great interest, notably in the light of evolution of technical regulations, i.e. the continuous improvements that have been made in the theory of masonry buildings.

This raises on the one hand, the choice of conservative techniques for the reinforcement of these inhabited buildings, and on the other hand the development of adequate numerical procedures for their seismic verification.

Different models for the assessment of masonry structures exist in the literature: they are one-dimensional (frame or macro-element) and two-dimensional (finite elements).

Among these, those based on finite element modeling and those that use simplified macro-element models are of particular importance.

- The finite element method offers numerous possibilities for modeling all structural cases, however, nonlinear analyzes are

particularly cumbersome from the point of view of computation and the results reading.

The poor tensile strength of the masonry does not allow the direct use of elastic models linear for the prediction of the response and the damage of a building, subject to seismic actions. [12].

From this perspective, the use of a finite element model in the linear field, ETABS model, developed *by Computer and Structure Inc.*, in our case, appears interesting, for study of the stress state, under the action of static loads and the modal behavior of the building.

- The one-dimensional ones are based upon a simple approach which includes models that schematize the structure as an equivalent frame. The first frame model was proposed by Tomazevic (1978) and it is the well known POR method [9], where the masonry walls are schematized by a set of piers connected by a rigid spandrel.

Many of the macro-element methods developed as evolutions of the POR method, are based on an incremental iterative procedure (non-linear static analysis) in which, the seismic load, is evaluated for the **collapse of the building**. Among them are 2 programs that we used in our analyzes, such **AM-Quake** and **Atena**. They perform non-linear dynamic analysis, with step by step technique, for masonry buildings with rigid floors in their own plane and congruent with the walls.

MATERIALS AND METHODS

The main purpose of this study is to analyze the effect of seismic action on the sustainability of buildings, type 77/5 [11]

The main building material is **brick masonry**.

The bricks are clay bricks, **Class = 7.5 N/mm²**

Cement mortar is **Class = 2.5 N/mm²**

The ground and the first floor walls of the building are 38 cm thick. The second till fourth floor walls are 25 cm thick.
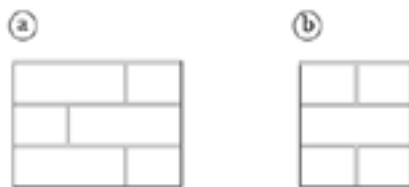
Fig. 2 - Masonry sections: **a**- wall 38 cm ; **b** – wall 25 cm
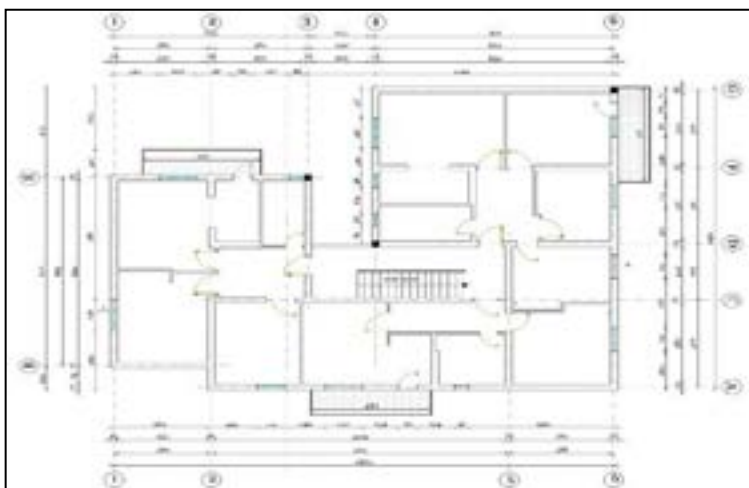
Fig. 3 Ground floor plan [11]

Based on above materials, bricks and mortar, Table 1 give this *Resistance of masonry:*

$$f_k = 1.1\ N/mm^2$$

Tab.1 Resistance in pressure, f_k of masonry [5]

Nr	Brick class	Mortar class (N/mm2)						
	N/mm2	10	7.5	5.0	2.5	1.5	0.4	0.0
1	15	2.2	2.0	1.8	1.5	1.35	1.2	0.8
2	10	1.8	1.7	1.5	1.3	1.1	0.9	0.6
3	7.5	1.5	1.4	1.3	1.1	0.9	0.7	0.5

The intermediate floor slabs are type Zoellner, cross section shows in Fig.7. They are composed of bricks height 15cm, filled every 20 cm with concrete, width 8cm.

The concrete grade is accepted relatively low, C15/20, due to the bad quality of raw materials at that time.
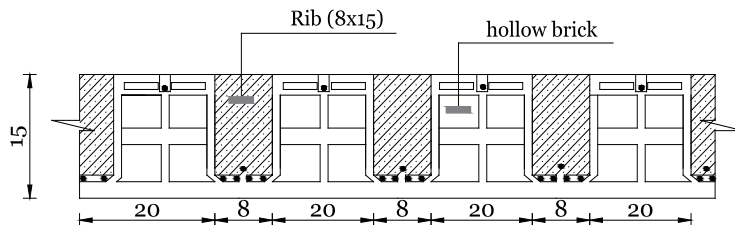
Fig. 4 Slabs cross section

In Etabs these slabs are converted in secondary beams, they transmit the load in one direction, in X or Y respectively.

The foundations of these buildings are stone walls, with cement mortar, a significant weakness, especially if we consider the preparation conditions and the quality of participant materials, especially the cleanliness of sand and gravel, at that time. I base this on my several years of experience in construction site. The foundations effect on building safety belongs to another analysis.
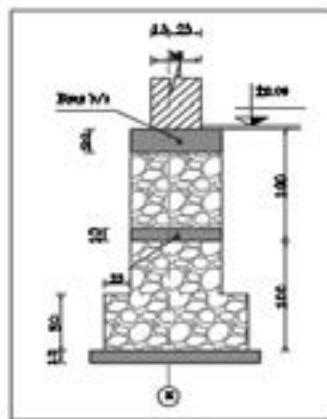
Fig. 5 Typical foundation section

The masonry elasticity modulus **E,** for serviceability conditions, in **EC6** is recommended **E= 1000 f_k** N/mm2, while for the calculation on the last limit state (mainly in **nonlinear analysis**) is recommended to use the value **600 f_k N/mm2**. [6]

From various comparisons with experimental values, (Tomazevic 1999) results that:

- "**Recommendations in Eurocode lead to overestimation of the modulus of elasticity**".

Author Thomas Zimmermann* (Zimmermann, et al., 2012) recommends the following equation as closer to experimental values [5]

$$E = 300\ f_k\ [N/mm2] = 300 *1.1 = 330\ N/mm2\ (in$$

nonlinear analysis)

RESULTS AND DISCCUSSION

It should be noted that **KTP.N.2-89** (Technical Design Conditions, publication of the Seismological Center, Tirana) recommends some essential limitations for the floor plans of the buildings. Thus, in fig 1, the dimension "**c**" must respect the condition: c < 0.25 B. [7]
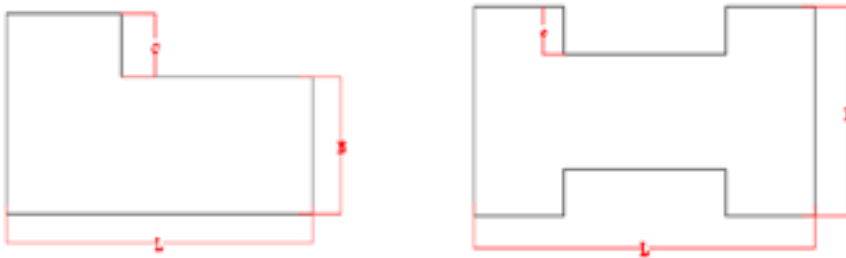
Fig 6- Illustration of KTP-N2 recommendations
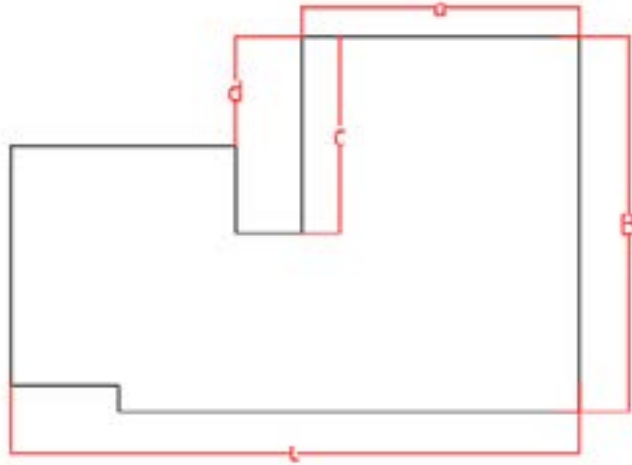
Fig. 7   Planimetric form of building 77/5

The main dimensions of the building are: L = 18.60; B= 14.24; c = 7.45 ; d= 4.15
Limitations of KTP: d/B = 4.15/ 14.25 = 0.29 > 0.25, but: 7.45/14.25 = 0.52 >>0.25 !!!

- The recommendation 4, page 11 of KTP-89 states that, if the condition **e/L < 15%** is met, the eccentricity is considered insignificant, where **e** is the eccentricity in one direction, i.e.:

   e = (10.21- 8.38) = 1.83 m and in our case, we have: 1.83/18.65 = **9.81%.** The condition is met.

   - Let verify **[EC 8, pg.48**]: **4.2.3.2 Criteria for regularity in the plan:**

"for each fracture, the surface that is included between the contour of the intersection and a convex polygonal line, does not exceed **5%** of the intersection area.
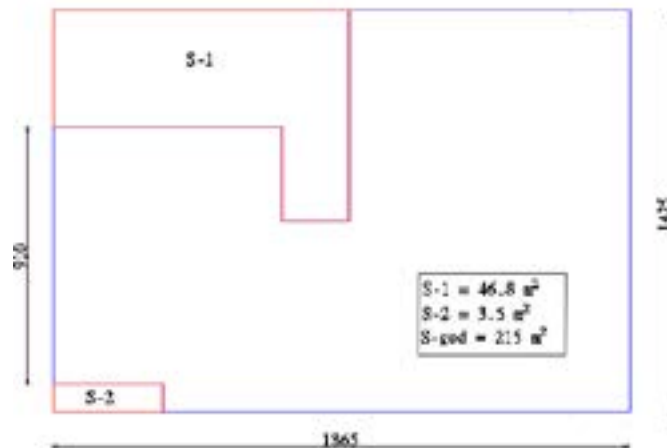
Fig. 9 The missing areas (1,2,3)

The missing areas to the total (full rectangular shape), is **51.4m2**, while the total area is 265.3 m2.

In percentage, the missing area, to the total is: 50.3 / 265.3 = **19 %!!**
Criterion is not respected, the value exceeds **5%**
The mass and the gravity center are defined, and they are as below:
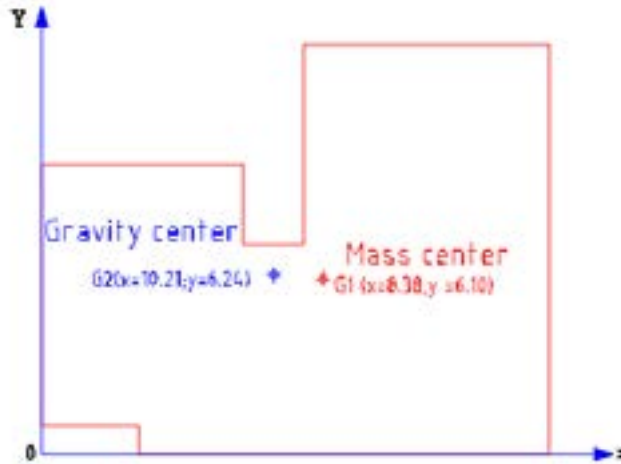
Fig.8 Mass and gravity center

Gravity center	**Mass center**
X_C = 10.21 m	X_C = 8.38 m
Y_C = 6.24 m	Y_C = 6.10 m

THE ETABS DATA INPUT

Loads

After calculation, the slab dead load is **200 kN/m²**.

Based on the EC, we accepted these loads:

Live = 200 kN/m2; Additional dead load = 200 kN/m2

Also, based on the Department of Seismology, Institute of Geosciences data, for the case of Tirana land, is accepted :

- land type - category C,
- acceleration ag = 0.25g.

Seismic data

Since we want to analyze the most unfavorable case, we choose from the type of elastic response spectra, the type "1" of the earthquake, based on the EC recommendation [6], with magnitude MS > 5.5. So, we used spectrum type 1, the masonry ductility factor **q = q$_0$ k$_w$ ≥ 1.5**, and **3%** extinction. [6]

Below we present the tables with the data that have been entered in the Etabs program, on the basis of which have been obtained the respective results.
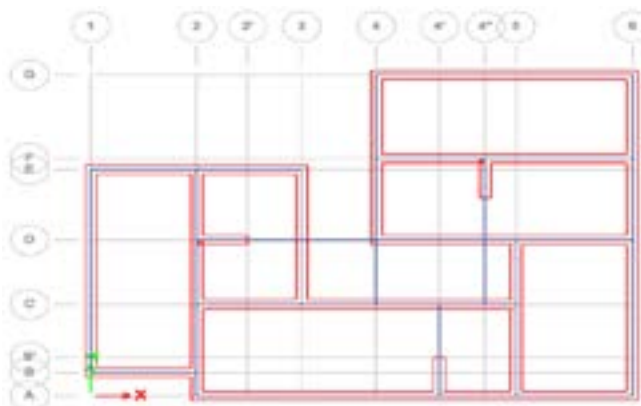
Fig. 10 - Plan type, input in Etabs
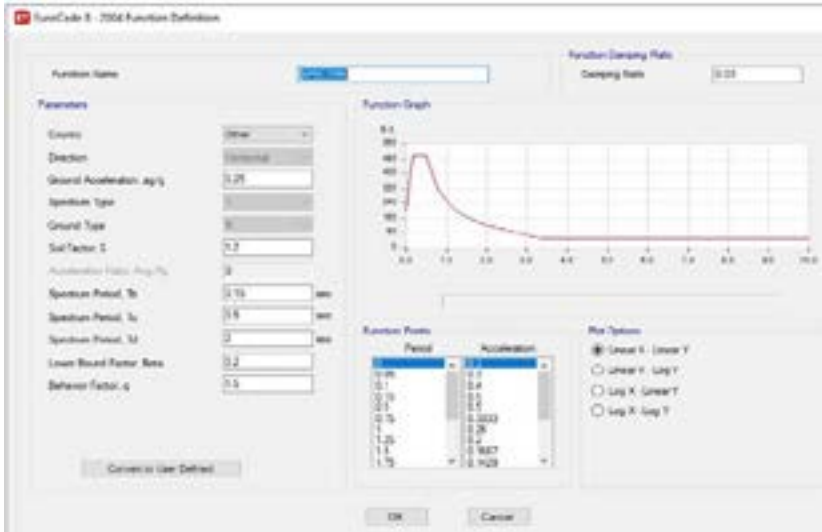
Fig.11- Seismic spectra, periods and accelerations
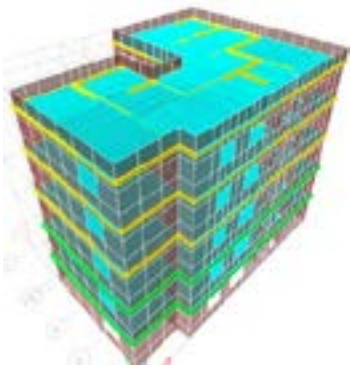
Fig. 12- Etabs 3D

(Yellow- concrete parts)

Fig. 13 - Etabs brick data
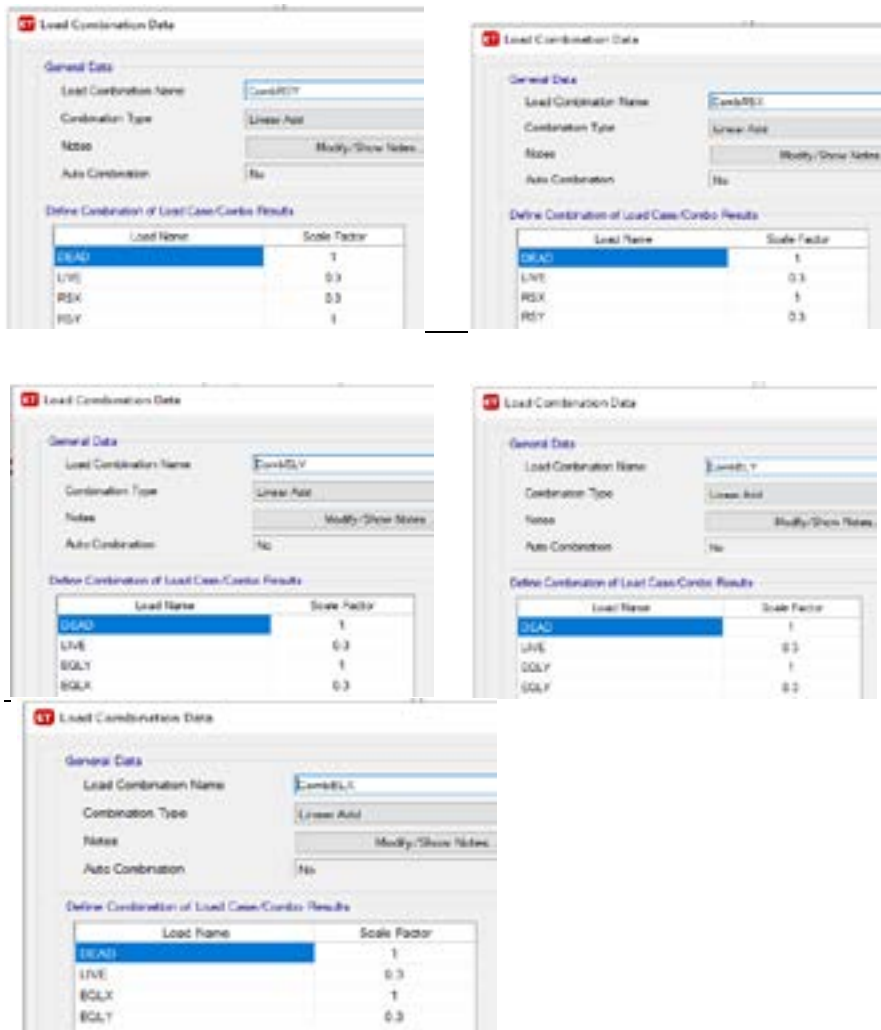
Fig. 14 Etabs main load combinations

The period of personal oscillations, according to the recommendations of EC 8 should be:

$$[T] = 0.05 \times Hg^{0.75} = 0.05 \times 14.2^{0.75} = 0.366 < T = 0.728 \text{ s !!!}$$

where **0.728 s** is the period in the first form of oscillation.

LOCAL CONTROLS:

Based on the Etabs analysis we have selected the walls with the greatest stresses and deformations. Some from the stresses and deformations results, which exceeds the allowed values are presented below, through respective screenshots.

Looking at the stress diagrams, we see that, the **upper area**, [upper floors], suffer mainly under the effect of tensile stresses, while the lower part (1-3) mainly, is under the effect of compressive surface stresses.

(The blue arrow indicates the analyzed elements)

AXIS 2-2
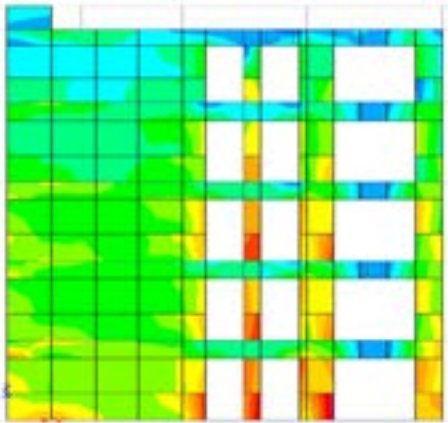
Fig. 15- Axis 2-2 elevation. The blue arrow indicates the most stressed element W828

Fig. 16- W828 element detached from axis2-2   **Fig. 17**- The analyzed stress **s**2-2 in W88 element

The max value on this axis is the compression **s**2-2, with value = -**1.46 MPa > - 1.1MPa**
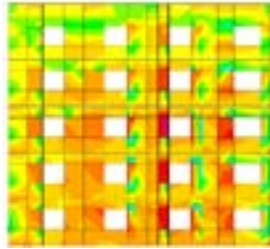
Fig. 18 - Axis 6-6 elevation. The blue arrow indicates the most stressed element W559
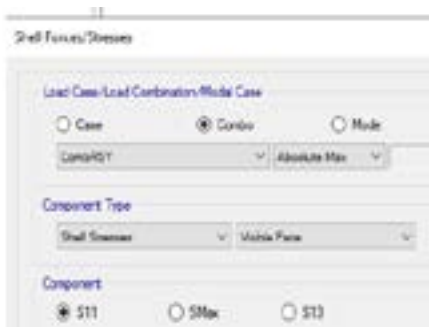
Fig. 19- Analyzed stress **s**1-1 of element W559   **Fig 20** - W88 element detached from axis2-2.

The max value on this axis is the traction **s** 1-1 with value = 0.4 MPa
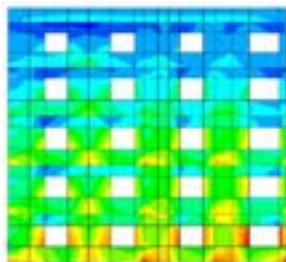
Fig. 21 - Axis 6-6 elevation. The blue arrow indicates the most stressed element **W1039**

Fig 22 – W1039 element detached from axis2-2.   **Fig. 23 -** Analyzed stress **s** 2-2 of element W1039

The max value on this axis is **s** $_{2\text{-}2}$, in compression, with value = -1.42 MPa
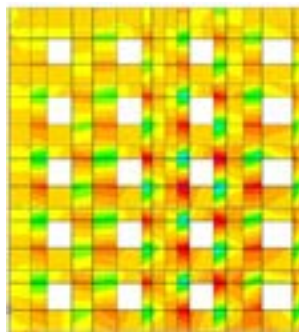
Fig. 24 - Axis 6-6 elevation. The blue arrow indicates the most stressed element W1053
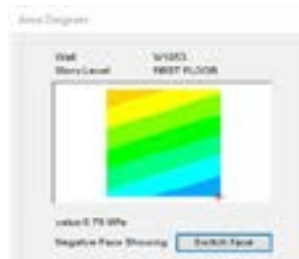
Fig. 25 - Analyzed stress **s** 1-1 of element W1053   **Fig 26 –** W1053 element detached from axis 6-6

The max value on this axis is $s_{1\text{-}1}$, in traction, with value = 0.79 MPa

AXIS 6-6 Deformation

Max - 84.077 at [1.2, 1, 14.6]; Min - -35.193 at [9.7, 13.87, 13.2222]
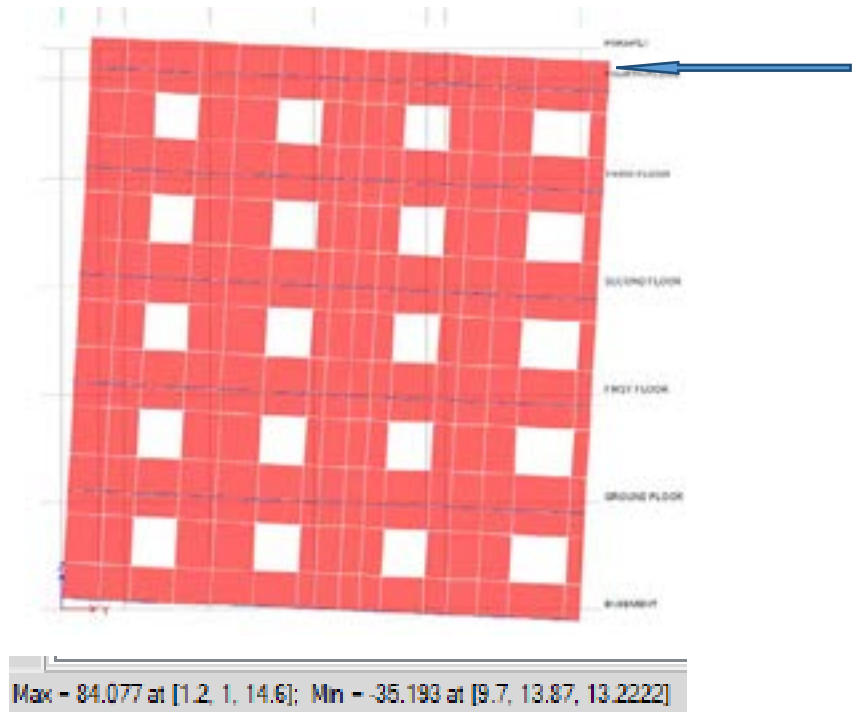
Fig. 27 - Deformed shape of axis 6-6, for EQLY combination

Fig. 28 – The ETAB s ELY combination, and its components

Max displacement = **8.41 cm > > 4.73 cm**

The recommended allowed displacement of the building on the top must be 1/300 H = **4.73** cm

CONCLUSIONS:

The building presents these main problems:

1- Its period 0.728 sec and not 0.336 as recommended by EC8 for masonry buildings

2- The building has mural elements, in which the values exceed [**s**] pressure = - 1.1 MPa

3- The most problematic are the elements that suffer in tractions, since the masonry is very sensitive to it. Thus, the allowable tensile values for masonry are [**s**] pressure = 0.1 MPa, while in the whole masonry of the building, tensile stresses greater than 0.1 MPa occur. This is also the main weakness of the building, which requires reinforcing surface interventions throughout the masonry.

4- Also, the building has significant displacements, which exceed those allowed

However, the next steps of analysis, (the non-linear ones) will highlight the other weaknesses of this building.

REFERENCES:

[1]   Niko Pojani, Seismic Engineering

[2]   *B. Furiozzi, C. Messina, L. Paolini, Handbook for the Calculation of Structural Elements, New edition, 2007*

[3]   Lecturer, Dr. Ing. Isai Clemente Structural Design Course, 2009/10, University of Trieste

[4]   T.Paulay M.J.N. Priestley, *Seismic Design of Reinforced Concrete and Masonry Building*

[5]   Msc Markel Baballeku, Structural Damage Assessment in Buildings of Educational System, Tirana, November 2014

[6]   *Eurocode EC6, EC8*

[7]   *KTP-N.2-89. Technical Design Conditions, Academy of Sciences, Tirana 1989*

[8]   Magenes G., Kingsley G. R., Calvi G. M.: "*Static Testing of a Full-Scale, two-story Masonry Building: Test Procedure and Measured Experimental, Response*". Università degli Studi di Pavia, 1995.

[9]   Calvi G. M., Kingsley G. R., Magenes G.: "*Testing of Masonry Structures, for Seismic   Assessment*". Earthquake Spectra, Vol. 12, No. 1, 1996.

[10] Kerstin Lang, *Seismic Vulnerability of Existing Buildings, Zurich Institute of Structural Engineering, Swiss Federal Institute of Technology, February 2002*

[11] Central Archive of the Ministry of Construction, Tirana

[12] Alberto Antonelli[a], Michele Betti[a], Maria Luisa Del Savio[b], Luciano Galano[a], Maurizio Orlando[a], " Methods for Seismic Analysis of Existing Masonry Buildings", 2010 [a]Department of Civil Engineering, University of Florence, Florence, [b]Civil Engineer, Empoli (FI)

Thermo power plant "Kosovo B"– a pollution source for Sitnica River

Besime Sh. KAJTAZI

Boulevard Bill Clinton Nr 29, 10000 Prishtine, Kosovo

Tania FLOQI

Department of Engineering and Architecture, Faculty of Engineering, Informatics and Architecture, UE Tirana, Albania

ABSTRACT

Kosovo's waters are unevenly distributed in time and space. Kosovo is water scarce, and it also has the low level of water resources development and storage. In particular Iber basin is water stressed, but in the next 20 years it is expected that all Kosovo's basins will be water stressed [1]. This is due to population and general economic growth, and resource variability. The anticipated revitalization of the irrigation and mining sector and additional demands from the energy sector will increase pressure on new water demands. For these reasons, the water quality of existing resources will become an ever-growing problem if not addressed now.

Keywords

Clean rivers; industrial pollution; protection and sustainable use
of water resources

INTRODUCTION

Sitnica is the main river stretching in Kosovo valley that confluence with Ibar, one of main river basins in Kosovo which further flows towards north of country joining Danub later. The watershed covers a total area of 2,873km², or about 25% of the total area of Kosovo. Sitnica is lowland river with very variable flow, being very low during summer 0,5m³/s while during winter reaches up to 328m³/s [2]. It originates in the northeast foothills of the Sharr mountains in the municipality of Ferizaj, where it is called Sazlija. It then heads to the north and the plains of Kosovo where it is joined, by several tributaries. In the suburbs of the capital Pristina, it enters the mining basin of Kosovo and is joined by two much polluted tributaries: Graçanka and Prishtevka. It is in this section that the quality of its water deteriorates sharply with wastewater discharges from Pristina, wastewater from industries located along its course (coal mines and thermoelectric power stations), and landfills and storage of solid wastes along the river banks etc.

Kosovo is at very early stages of building the facilities for treatment of wastewater. Only 0.7% of produced wastewater is treated before its return to the nature [3]. All other wastewater is discharged without any prior treatment to nearby streams and rivers.

The main energy production industry (thermopower plant "Kosovo B") is

located nearby Sitnica and their operation is not compliant with environmental protection standards and regulations.

The wastewater generated from the operation of lignite-fired power plant with minimal treatment such as sedimentation, is discharged into Sitnica river.

The wastewaters discharged from power plant are as follows:

- Bottom ash removal water

- Heavy Fuel Oil polluted water

- Run-off water, potentially polluted by oils and hydrocarbons (including coal yard)

- Water Chemical Treatment plant effluents, including:

  - Sludge produced by softening (decarbonization - DECA) treatment
  - Water from regeneration of ion-exchange resins
  - Overflow of decarbonization (DECA) and demineralization (DEMI) water basins

- Sanitary wastewater

METODS AND MATERIALS

Through wastewater sampling in six discharging points from operations of thermal power plant "Kosovo B" and their laboratory analyses, we have analysed the pollution that this industry being the main source of energy production for the country, is causing to another important natural resource Sitnica river.
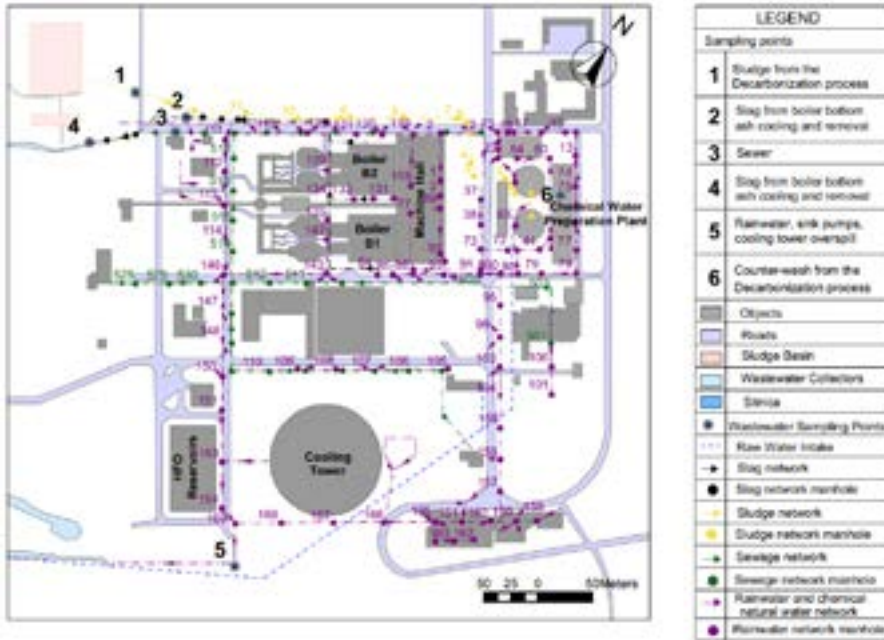
Figure 1: Layout of the thermo powerplant Kosovo B and the locations of the six sampling points

In Figure 1 we have presented the layout of the thermopower plant "Kosovo B" and the locations of the six points where the wastewater samples have been taken for analyses as follows:

1. Sludge from the Decarbonization process. This wastewater is the sludge that is produced from raw water treatment plant that treats water for the energy production;

2. Slag from boiler bottom ash cooling and removal. It is the water that is used to cool the ash created from coal burning before it undergoes sedimentation;

3. Sewer is the sanitary wastewater collected from administrative buildings and kitchen;

4. Slag from boiler bottom ash cooling and removal. The water that is used to cool the ash created from coal burning after sedimentation and before discharge into river;

5. Rainwater, sink pumps, cooling tower overspill. This is mainly drainage water, and spill from cooling tower;

6. Counter-wash from the Decarbonization process. Water that is used to wash the filters in the decarbonization process.

The testing methods and standards applied for analyses are mainly ISO, DIN and EPA standards based on parameters each specifically and they are shown below in Table 1.

In one of the columns of Figure 1, we have presented the Industrial emission limits according to national Administrative Instruction nr. 30/2014 that are applicable for discharges from industry into the river.

Table 1: Wastewater analyses from six samples

Parameter	Unit	Method	Industrial emission limits acc. AI nr. 30/201	Results					
				1	2	3	4	5	6

			4					
Flow	l/m			17.0	5510	18.9	90.0	45.0	6.0
Temperature	°C	DIN 38404 C4		14.6	25.2	20.1	29.3	31.2	16.5
Electrical conductivity	µS/cm	DIN 38404 C8		170	340	620	390	440	120
pH		ISO 10523		10.57	8.72	7.81	9.74	9.92	9.99
Colour	Pt/Co	ISO 7887:1994		None	None	None	Light black	Light black	None
TSS	g/l	ISO 11923:1997	35-60	6.0	40.0	172	128.0	16.0	20.0
TDS	mg/l	US EPA 8163		80.0	200	340	240	220.0	200
TPH	mg/l	EPA 1664				<20	<20		

Total F	mg/l	EPA 365.3			0.55		0.63	0.59	
Total CL	mg/l	ISO 7393:1985			<0.03		0.03	0.06	
Al	mg/l	EPA 3015A, EPA 6010C: 2007	3		0.470		0.320	0.726	
As	mg/l		0.1		<2 ppb		<2 ppb	<2 ppb	
Cr	mg/l		1		0.039		0.038	0.036	
Hg	mg/l		0.01		< 1 ppb		< 1 ppb	< 1 ppb	
Mn	mg/l				0.012		0.016	0.060	
Ni	mg/l		0.5		0.101		0.132	0.130	
Pb	mg/l		0.5		< 1ppb		< 1ppb	< 1ppb	
S	mg/l		400		4.066		9.210	9.240	

Zn	mg/l		1		0.124		0.111	0.132	
Ca	mg/l	ISO 7980:1986, EPA 6010 C:207		8.47					
Mg	mg/l	ISO 7980:1986, EPA 6010 C:207		1.80					
BOD	mg/L	ISO 5815:2003	25			83			
COD	mg/L	ISO 6060:1989	125			236			
N (Total)	mg/L	ISO 5663	20			17.68			
P (Total)	mg/L	EPA 8048				1.16			

Faecal Colifor m	Cfu /ml	ISO 9308-1				>3 00			
Escheri chia Coli	Cfu /ml	ISO 9308-1	1000/1 00ml			>3 00			
Anionic surfacta nts	mg/ L	ISO 7875- 1: 1996				0.3 9			
Non- ionic surfacta nts	g/L	ISO 7875- 2: 1984				0.0 7			

RESULTS

The results from analyses of the six samples of wastewater generated by energy production can be summarised as follows:

- The temperature of these wastewater discharges is between 14-29°C, that can be considered high for some aquatic life species
- Electrical conductivity varies between 120-620 µS/cm
- pH value is going from 7.81 up to 10.5 which makes these wastewaters basic
- TSS are above limit in two samples (3 and 4)

- **BOD and COD analysed in sample 3(sewerage) are above the limits and they show the organic load and total load of the wastewater**
- **It was noted that some of metals(As, Hg, Pb) are exceeding the limits.**

DISCUSSIONS

Pollution coming from thermopower plants represents important pollution pressure in Sitnica river, and its better management represents an important area for improving the ecological status of the river.

In order that the power plant operations are compliant with national legislation requirements and European Directives, based on studies, analyses and the results of the laboratory tests of the taken samples, the appropriate treatment facilities are proposed as follows:

- An appropriate wastewater treatment plant, consisting of a physical-chemical and biological stage should be designed and built in order to treat the wastewater streams: sanitary, bottom ash removal, Deca process sludge and atmospheric water in order to fully comply with environmental standards;
- For runoff and heavy fuel oils (HFO) contaminated water a basin should be dimensioned and built combined with appropriate treatment stages (sedimentation and skimming) in order to remove the pollutants;
- Check the possibility to re-use the treated wastewater in the plant (i.e. for ash transport) in order to reduce the water consumption;

CONCLUSIONS

Sitnica river is important water resource for central part of Kosovo and it must be protected. The achieve this goal there are a series of actions and investments to be undertaken.

On regards to the pollution from thermopower plant we recommend the:

- Construction wastewater treatment plant for industrial wastewater

- Construction and development of monitoring stations of water discharges from thermo power plant in Sitnica river and regular reporting to the competent authorities.

Kosovo as the rest of the Western Balkan region, enjoys an enlargement perspective. The policy development should be aligned with EU "acquis", and infrastructure should be implemented according to European codes and standards.

Country is struggling with the compliance with EU directives, especially with the Urban Wastewater Treatment Directive (UWWTD) and Industrial Emissions Directive (IED). The lack of appropriate facilities for wastewater treatment before their discharge into recipient represents an important gap in water sector that need to be addressed in order to comply with EU standards and regulation.

While water is a central issue in water security, it is increasingly clear that this goes beyond single sector issue topics and it percolates into all parts of society and economy.

REFERENCES

1. *State Water Strategy for Kosovo 2017–2036.*

2. **Report**: *State of waters in Kosovo,* Kosovo Environmental Protection Agency, 2015.

3. **Report:** *Annual report of water service providers 2019, Water Regulatory Authority of Kosovo.*

4. **Report**: TA3-KOS-ENV-01*: Project Preparation Feasibility Study for Prishtina Wastewater Treatment Plant,* December 2012 Kosovo.

5. **Report**: *Kosovo Water Security Report,* The World Bank 2017.

6. **Edited book:** E. Roberts Alley, P.E. 2007 *Water Quality Control.* Mc Graw Hill, WEF PRESS Water Environment Federation Alexandria, Virginia, pp.2.3 -2.7

7. **Administrative Instruction nr. 16/2017** *on classification of surface water bodies*, Ministry of Environment and Economy of Kosovo.

8. **Administrative Instruction nr. 30/2014** *on industrial emission limits*, Ministry of Environment and Economy of Kosovo.

9. *https://ec.europa.eu/environment/water/water-framework/index_en.html*

Solid Waste Management Aiming Biogas Production In Albania

Prifti.H

National Agency of Protected Areas

Floqi.T

Faculty of Engineering, Informatic and Architecture, European University of Tirana

Abstract

One of the main environmental problems in Albania is the continuously increasing generation of municipal solid waste.

In many countries, sustainable waste management as well as waste prevention and reduction, have become major priority. Uncontrolled waste dumping (on the roads, river sides, etc.) in our country is no longer acceptable. Controlled landfill disposal and incineration of wastes are not considered optimal practices, as energy recovery and recycling of nutrients and organic matter is aimed.

Continuously efforts have been done for the improvement of this critical situation such as approval of laws, decisions, regulations etc., according to the National Strategy on Integrated Waste Management (2018-2030) and EU Directives 2008/98/EC on waste and repealing certain Directives.

In this paper are presented the characteristics of a wide range of urban solid waste, industrial solid waste and composition of the waste i.e. waste stream. As organic waste component represents the highest percentage (41% - 66%) at the waste composition should be used for biological treatment and for biogas production.

Keywords: urban solid waste, biogas, environment, waste management, generation.

Introduction

There is still a long way to go to close all resource cycles in the global economy. On the one hand, there are still considerable knowledge gaps concerning possible resource recovery and reuse practices. On the other hand, there are frequently significant political, social and economic obstacles to the implementation of the solution identified. [2].

Environmental sustainability is the core issue that will need to be addressed for development to focus on human well-being and yet stay within the limitations of planet's capacity. Environmentally sound waste management is one of the key elements for sustainable development. [1]. Waste is a global issue. If not properly dealt with, waste poses a threat to public health and the environment. It is a growing issue linked directly to the way society produces and consumes. It concerns everyone. Waste management is one of the essential utility services underpinning society in the 21st century, particularly in urban areas. Waste management is a basic human need and can also be regarded as a 'basic human right'. Ensuring proper sanitation and solid waste management sits alongside the provision of potable water, shelter, food, energy, transport and communications as

essential to society and to the economy as a whole. Despite this, the public and political profile of waste management is often lower than other utility services. [1].

On a larger scale, when significant quantities of municipal or industrial solid waste are dumped or burned in the open, the adverse impacts on air, surface and groundwater, soil and the coastal and marine environment, and thus indirectly on public health, can be severe. [3]. Even worst taking into consideration Albania is a small mountainous country and the total land area covers 28 748 km2. Meanwhile it has a reach hydrographic net (groundwater, streams rivers, springs, lakes, wetlands).

The main problems, expressed in general terms, related mainly to: partial range of service coverage; insufficient collection and removal of waste; limited amount deposited and treated at landfill; a large number of deposit sites (authorized and unauthorized), which are outside the sanitary and engineering standards; limited number and poor quality of waste collection equipment and waste transport; lack of infrastructure for integrated waste management; unexpected change in the policies leading the development of infrastructure for final waste processing; poor implementation of the law and, in general, sub-legal acts; poor interaction and coordination of central government structures with local government and other interested parts.

Methodology

The most important part of this study is the identification and the collection of the data and then selection of them, from the Central Government Institutions, National Agencies, INSTAT, etc, related with the topic.

Processing and calculation of above mentioned data, preparing tables and graphs to obtain indicators, needed for results discussion and conclusions.

Results and Discussion

Monitoring on solid waste generation and waste management is a very important process toward sustainability. Taking into account the monitoring data on different types of solid waste, can prepared the strategy for their management, recycling and reuse according to EU Directives and Albanian Laws. [6][7][8][9][11][12][13][14].

The data on the amount of the **generation of urban solid waste** is only approximately known, because different institutions used different methodologies and practices. Nevertheless the data indicate, within the period of 15 years, a significant increase in urban waste generation. Based on this study during the period 2013 – 2018 (Table 1, 2 and Figure 1, 2), urban solid waste amounted to 0.940 thousand – 1.2 million tones and comparing with the generation of waste in 1998 (520 thousands tones), the amount recently is doubled [4] [5]; in 2018 the generation of urban waste is increased about of 10%. It is expected that the quantities of domestic waste will increase in the future as consumption rises and more household are incorporated in the regular waste collection network.

Table. 1: Generation of managed urban solid waste in years (tonnes)

Solid waste	Urban solid waste (tonn)					
	2013	**2014**	**2015**	**2016**	**2017**	**2018**
Total waste managed	940,160	1,228,884	1,413,233	1,300,373	1,253,913	1,172,907
Household waste	827,828	970,818	1,142,964	1,072,236	1,109,399	1,097,705
Industrial waste	112,332	258,066	270,269	228,137	144,514	227,366
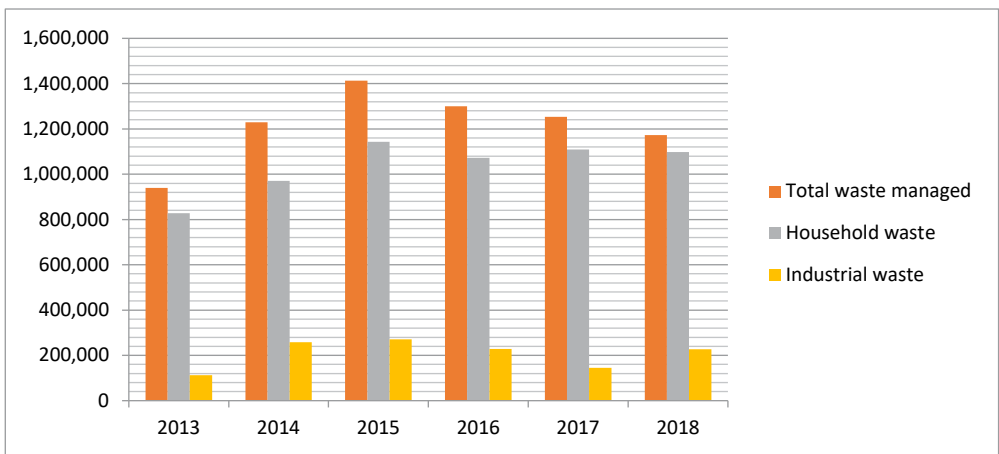
Figure1. Generation of managed urban solid waste

Table.2: Generation of managed urban solid waste in years (%)

Solid waste	Urban solid waste (%)					
	2013	2014	2015	2016	2017	2018
Total waste managed	100	100	100	100	100	100
Household waste	88	79	81	83	89	83
Industrial waste	12	21	19	17	12	17
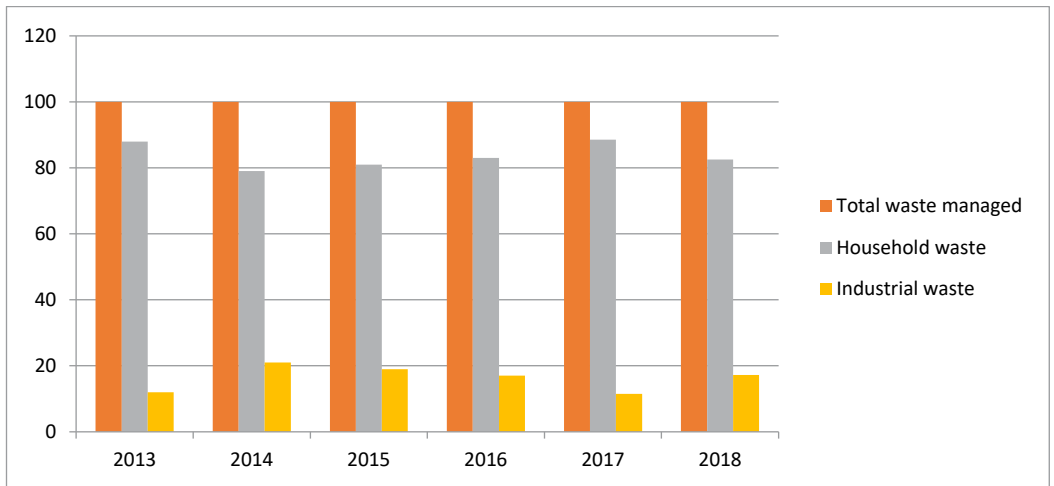
Figure 2. Generation of managed urban solid waste

The sludge from the growing number of Waste Water Treatment Plants, the growing number of discarded car wrecks, the solid waste from rural area and the spoiled up and down on the river sides, lakes are not included in the urban solid waste. These waste impact the underground and surface water quality.

According to the estimated situation during the study, (see Table. 2, Figure. 2) waste from industrial sector represent 12 – 20% of total urban waste (see Table 1, 2 and Figure 1, 2). Comparing with the amount generated in 1998 (415 thousand tones) it's noticed that the quantity is reduced twice in time. Even in 2018 the amount of industrial solid waste (227 thousands tones) is much more less than that of 1998. [4] [5]. This declined trend refers to the closing of many manufacturing, mining industries, leather processing and electricity supply, etc. According to the estimated situation in 2018 industrial waste represent 17% of total waste quantity.

A very important indicator related with sustainable development is **generation of waste stream.** It means the composition of total urban waste. This indicator in Albania is started to monitor from 2013 and indicate the improvement of the waste management and a better implementation of the Laws, Decisions and Regulations. [6][7][8][9][11][12][13][14].

According to data acquisition from the study, the highest share in the entire structure of urban waste is that of organic waste (61.2%); see Table 3 and Figure 3, followed by plastic waste (9.7%) and cupboard/paper waste (7.7%).

Table 3. Generation of waste stream in percentage

Waste stream	Generation of waste stream in %					
	2013	2014	2015	2016	2017	2018
Organic waste	41	50.2	51.4	49.52	45.9	61.2
Wood waste	4	6.1	4.6	5.84	3.9	5.1
Biodegradable animal waste						
Cardboard paper waste	12	8.7	9.9	7.87	9.5	7.7
Plastic waste	14	9.1	9.6	10.01	16.8	9.7
Glass waste	7	4	4.5	4.24	4.8	3.8
Textile waste	3	2.6	2.9	2.81	3.2	2.2
Ferrous and non-ferrous metal waste	3	5.8	4.8	3.38	2.7	1.5
Hospital waste	1.9	1.2	0.51	0.26	0.21	2.65
Inert waste	3	3.7	8.2	11.9	7.4	5.5
Electric and electronic waste	9	8.1	1.1	0.84	1.2	1
Other waste	2.1	0.5	2.5	3.34	3.4	0.1
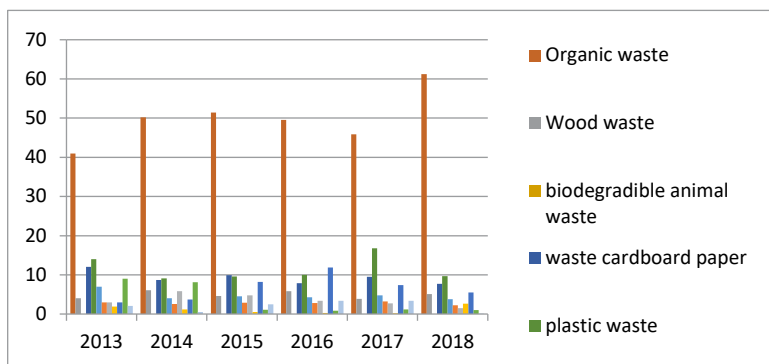
Figure 3: Generation of waste stream in percentage

Organic waste component represent a percentage from 41% to 61% of the material composition of urban solid waste. A large part of these waste are bio digestible and can used for production or utilized as potential substrate in anaerobic digestion to produce biogas, renewable source of energy and environment friendly too.[15]. This share is nearly constant in 2013 – 2017 while there is an increase about 10% in 2018 while the proportion of other materials varies in years. The main decrease is in the share of electric and electronic waste followed by plastic waste and less in glass waste. [5].

According to the data of the study, the high quantity of the organic component, according to the National Strategy of Integrated waste management may be used biologically for many purposes which will find out during the next step of the study. [10]. Also some of the other components of the solid waste are suitable for recycling and reuse.

Conclusions

The generation of total solid waste is increased every year, the major part is household waste is up to 83% and industrial waste is less than 20%.

In the total percentage of solid urban waste, organic waste component represents the highest percentage (41% - 66%) at the waste composition and should be used for biological treatment and for biogas production, which will find out during the next step of the study. [15]

As landfilling and incineration are not considering optimal practices, biogas production from the organic waste will be one of the best solutions as renewable energy sources, reduce greenhouse gas emission, contribute

to EU energy, environmental policies and sustainable waste management strategies.

Reference

[1] David C. Wilson, et al. *Global Waste Management Outlook, UNEP (2015),* International Solid Waste Association ISWA, ISBN: 978-92-807-3479-9, DTI /1957/JA, page 7-10, page 25, 29-35.

[2] UNU- FLORES.2019. *Annual Report 2018*, Dresden, Germany: United Nations University Institutes for Integrated Management of Material Fluxes and of Resources (UNU-FLORES)", 2019, page 10;

[3] Springer International Publishing, Switzerland 2015, C.Stylios, et.al. (eds) *"Sustainable Development of Sea – Corridors and Coastal Waters"*, DOI 10.1007/978-3-319-11385-2…07, Page 151-160, 117-124;

[4] Floqi.T, *"Indikatoret e Mjedisit dhe Zhvillimit"*, Albanian Development Fond, Tirane 2004, p. 68,69,71,72.

[5] INSTAT Albania 2013 -2018;

[6] Directive 2008/98 EC **"On waste"** (19.11.2008) E.U Regulation No. 1179/2012;

[7] Directive 1999/31/EC of 26 April 1999 **"On the Landfill of Waste"**;

[8] Directive 94/62/EC **"On Packaging and Packaging Waste"**;

[9] Directive 2000/76/EC **"On Incineration of Waste"** (04.12.2000);

[10] National Strategy on Integrated Waste Management (2018-2030);

[11] Albanian Laws: Law 10463/2011 "On Integrated Waste Management"

[12] Council of Ministers decision nr.177/2012 "On Packaging and Waste Disposal";

[13] Council of Ministers decision nr.452/2012 "On Landfill of Waste";

[14] Council of Minister Decision nr. 178/2012 "On the Incineration of Waste".

[15] Teodorita Al Seadi, Dominik Ritz, Heinz Prassl, Michael Kottner, Tobias Finsterwalder, Silke Volk, Rainer Janssen. Biogas handbook. Denmark 2008

REVIEWING THE ROLE OF DIETARY LIPIDS IN CORONARY HEART DISEASE

Klodiola DHAMO

Universiteti Aldent

 Rezarta SHKRELI

Universiteti Aldent

 Amilda BALLATA

Fakulteti i Shkencave të Natyrës

ABSTRACT

It has been shown that coronary heart disease (CHD) is related to high serum total cholesterol (TC) levels. In all the urban population compared with the rural population is showed a rise of serum TC. This is reflected in the trend of CHD morbidity and mortality as well. In spite of a declining trend in serum TC level, CHD morbidity and mortality are still high year after year. In general, there is still a rising trend in serum TC level and in CHD mortality in many countries. However it may be controlled and managed. This may be attributed to a better control of other CHD risk factors such as hypertension and smoking. More than a century of laboratory and human findings cholesterol levels with a propensity to develop atherosclerosis. Low-density lipoprotein (LDL) is the major atherogenic lipoprotein, and numerous clinical trials have shown the efficacy of lowering LDL-cholesterol (LDL-C) for reducing CHD

risk. The rising trend in serum TC level remains a cause for concern, as this will emerge as a major problem for CHD morbidity and mortality in the future.

Keywords *Lipids, Coronary heart disease, Total cholesterol, Morbidity*

INTRODUCTION

It is not in doubt that coronary heart disease (CHD) represents a major, often the major, cause of death and ill-health in developed industrialized countries. (WHO 1990) In the U.K, CHD accounts for about one third of male and a quarter of female deaths. While the peak age of death from CHD is 70-74 for men and 75-79 for women, particular concern has been expressed that it is principally a cause of premature death especially in middle aged men, with grave social and economic consequences. (DHSS 1984) Consensus regards environmental factors as more important, although the variety of factors that has been suggested to be involved is bewildering. (Hopkins *et al.* 2001) Of these, diet, smoking habits and physical activity have received most attention as being potentially subject to modification. It is probably true to say that smoking and dietary modification aimed at controlling plasma lipid concentrations, have been the major targets of public education campaigns. This review is concerned only with dietary lipids but the reader is entreated to keep in mind three cautions that set dietary lipids in context. First, diet is but one of many environmental factors that might be targeted and there is controversy about its relative importance; (Stehbens *et al* 1990) second, dietary fat is one of many dietary factors that might be implicated in the development of CHD; (Hopkins *et al.* 2001, Stehbens *et al* 1990) Plasma lipids, although having been given overwhelming emphasis in the formulation of

public policy, are not the only predictors of CHD that might be influenced by dietary lipids. (Senti *et al*. 1998). Moreover, there are very large regional differences even within a country with a small land area, as well as substantial differences between ethnic groups that are independent of geographical location. CHD prevalence is dependent on latitude, altitude and climate. The term "CHD" covers a complex set of contributory conditions. (Beaglehole 1990) Failure to find a satisfactory all-embracing explanation may in part be due to failure to realize that any environmental factors being considered, for example, dietary fatty acids, influence these different aspects of the disease in different ways.

THE LIPID HYPOTHESIS OF CORONARY HEART DISEASE

A combination of factors may influence the likelihood of thrombus formation, including: alterations in the character of the blood and of particular blood proteins; disturbances in blood flow (particularly the development of turbulence) and damage to, or alteration in, function of the endothelial cells. The turbulent blood flow itself, and sometimes alterations to the composition of the blood, may cause actual injury to the epithelium.(Flynn *et al*. 2013) Increased numbers of platelets and increased concentrations of activated aggregation and coagulation factors are found in places where blood flow separates and forms vortices. Fast flowing blood will dislodge platelets from the surface of the thrombus and the aggregator factors will be diluted so that, unless flow is slowed or arrested in these vessels, the likelihood of the formation of a thrombus big enough to block an artery is reduced. Connective tissue is important in the

initiation of thrombi in injured and healthy arteries. (Senti 1998) Rupture of atherosclerotic plaque frequently leads to formation of an occlusive thrombus in a coronary artery. (Falk 1983) Modem concepts of the development of atherosclerosis and thrombosis postulate a degree of interrelationship between the two processes. Blood lipids and tissue lipids are involved in several ways.

DESCRIPTION OF THE LIPID HYPOTHESIS

The lipid hypothesis had its origins in the early part of this century in attempts to reproduce some of the pathology of atherosclerosis in animals given diets rich in cholesterol. (Antisci-iow *et al.* 1913) Among the observations were that the animals developed high concentrations of plasma lipids. It was a wide interest grew in the effects of different dietary fats on plasma cholesterol in experimental animals and man. Much of this early work is reviewed by Mc Gandy and Hegsted (Marmot *et al.* 1987) but the interested reader is encouraged to go back to some of the original classical papers. (Ahrens *et al* 1957, Trenchard 1978). Keys and his colleagues were engaged in the classic epidemiological investigations of the Seven Countries Study that produced cross-cultural evidence for associations between dietary saturated fatty acids (SFA), plasma cholesterol and CHD mortality. (Hopkins *et al.* 2001). The lipid hypothesis is based in four tenets: (1) Diets containing a high fat/saturated fatty acid/cholesterol content lead to high concentrations of cholesterol (particularly LDL-cholesterol) in plasma. (2) A high plasma cholesterol (particularly high LDL-cholesterol) presents a high risk for coronary heart

disease (CHD) and leads to a high CHD morbidity and mortality. (3) Reducing the amount of fat/saturated fatty acids/cholesterol in the diet will result in a reduced concentration of cholesterol (particularly LDL-cholesterol) in plasma. (4) Reducing the concentration of cholesterol (particularly LDL-cholesterol) in plasma will result in a lower risk of CHD and eventually a lower morbidity and mortality. Different authors pose the lipid hypothesis in different ways. Some concentrate on the effects of dietary lipids on blood cholesterol; of these, some will emphasize total fat, others saturated fatty acids and still others cholesterol. Others will emphasize the relationship between high blood lipids and coronary disease, irrespective of the etiology of the high blood lipids. The four tenets set out above give little hint of the complex relationships between blood lipids and total dietary fat, saturated, monounsaturated, trans and polyunsaturated fatty acids and dietary cholesterol. (Trenchard 1978) They do not consider whether it is the absolute intake of these dietary components that is important, the ratio between the different fat components, or between fat and other energy-providing constituents of the diet. Neither do they make sufficient distinction between the types of plasma lipoproteins, of which cholesterol is a constituent. (Hopkins *et al*. 2001) Finally, the concepts embodied in the lipid hypothesis date from an era when attention was concentrated almost entirely on the atherosclerotic component of CHD and the role of lipids in contributing to atherosclerosis. It did not consider whether lipids might play a role in the thrombotic episode.

DIETARY CHOLESTEROL

Addition of cholesterol to the diets of many species of experimental animals elicits a rise in plasma cholesterol concentration. Rabbits are particularly sensitive and so are many types of monkeys while rats are relatively insensitive. (Beznen *et al* 1987) The relevance of these animal experiments to an understanding of human physiology is highly questionable. The influence of dietary cholesterol on plasma concentration in man is in general less pronounced than in other primates. Many carefully supervised experiments with subjects in metabolic wards have demonstrated small but significant rises in plasma cholesterol in response to dietary cholesterol. In contrast, studies with "free-living" subjects seem to have shown little or no effect, (Grundy *et al* 2015). Pure cholesterol added to diets had no influence on human plasma cholesterol concentration in man. (Cortese *et al* 1993) Experimenters have subsequently relied on supplementing the diet with eggs because of their very high content of cholesterol (about 270 mg per egg). (Davms *et al*. 1987) While some experiments conducted under well controlled conditions showed modest (10-20%) rises with one or two eggs when compared with a controlled diet of low cholesterol content, others (Grundy *et al* 1990) found rises of less than 10%. Yet others (Senti *et al*. 1998) found similar plasma cholesterol concentrations in men ingesting as many as 11 or as few as 2 eggs per week. Certain individuals respond strongly and others weakly to dietary cholesterol (hyper and hypo-responders). This phenomenon is seen in a variety of animals and in humans. Mc Namara (Keys *et al*. 2012) has analyzed the results of 68 clinical trials representing 1490 subjects. It should be stressed that such meta-analyses gives mean results for a large number of individuals and that

predictive formulae, such as those of Keys *et al* (2012). Hold only for group or population means, not for individuals. Some epidemiological observations also suggest that there is a linear association between dietary and plasma cholesterol. (Hopkins *et al.* 2001). However, because foods that are rich in cholesterol also tend to have a high proportion of saturated to unsaturated fatty acids, it is difficult to distinguish clearly between the two influences.

SATURATED FATTY ACIDS

Athough early research did indicate that not all saturated fatty acids were equivalent in their cholesterol-raising effects, the use of a single all-embracing term for saturates in the Keys (Keys *et al.* 2012) equation has tended to obscure this fact and it is only recently that serious attention has been given to these differential effects. Early work indicated that fatty acids with chain lengths up to and including 10 carbon atoms (short- and medium-chain fatty acids) do not influence plasma cholesterol (Grundy *et al.* 1990) because they are absorbed directly into the blood supplying the liver and rapidly metabolized in that organ, unlike the longer chain acids which are absorbed as "chylomicrons". (Dreon *et al.* 1990) Lauric (12:0), myristic (14:0) and palmitic (1 6:0) acids have generally been regarded as the three "cholesterol-raising" fatty acids and the major plasma lipoprotein fraction affected is LDL. Palmitic is quantitatively the most significant since it is the principal saturated fatty acid in most diets, occurring widely in animal and plant fats. Cross-cultural epidemiological studies have generally demonstrated correlations between the average consumption of

saturated fatty acids and the mean plasma total cholesterol concentration. Thus, the Seven Countries Study of Keys *et al.* (2012) indicated a high correlation between the percentage of total calories from saturated fatty acids and plasma total cholesterol. The finding that weak or absent correlations between individual dietary intakes, plasma lipoprotein concentrations and CHD risk within populations is explained by Blackburn (*et al* 2018) as being mainly due to the weak and variable measures with which we attempt to characterize an individual's diet, and to the vagaries in blood lipoprotein levels and their measurement.

MONOUNSATURATED FATTY

Keys *et al.* (2012) found that monounsaturates were "neutral" in their effect on plasma cholesterol and did not include a term for them in their equation. Recently, this question has been re-evaluated. Broadly, two types of experiments have been conducted. In the first type, diets of equal (and relatively high) fat content have been compared, differing only in the fatty acid composition, with either saturates, monounsaturates or n-6 polyunsaturates predominating. (Dreon *et al.* 1990) In the second type, carbohydrates have been substituted with fat rich in monounsaturates so that a high fat monounsaturated diet has been compared with a low fat diet. While not all studies were well controlled, (Trenchard 1978) most found that monounsaturates, when substituted for saturates, lowered plasma total cholesterol concentration as effectively as n-6 polyunsaturates, (Grundy *et al.* 1990) although the findings were not entirely consistently The lowering was almost entirely associated with the

LDL fraction. When substituted for carbohydrates, they resulted in a similarly low plasma cholesterol (LDL) but did not elicit the rise in VLDL (and, therefore, triacylglycerol's) often seen with high carbohydrate diets.

POLYUNSATURATED FATTY ACIDS

Just as the term "saturates" embraces a wide range of structures each with different physiological activities, so the term "polyunsaturates" is equally broad and non-specific. An enormous number of studies has left little doubt that a major effect of consuming n-6 polyunsaturated fatty acids, in substitution for saturated fatty acids, is a lowering of plasma cholesterol, principally the LDL fraction. There is little effect on HDL-cholesterol provided that the contribution of linoleic acid is not much more than 12% of dietary energy or the ratio of polyunsaturated to saturated fatty acids (P/S) is not much more than 1.0 (Hopkins *et al* 2001, Beaglehole 1990) These conditions are unlikely to occur in most self-selected diets in developed countries. There is also little effect of exchanging n-6 PUFA for SFA on VLDL. The fact that these effects are similar to those obtained by substituting monounsaturated for saturated fatty acids suggests that the effect may be due more to a reduction in saturates intake than an increase in unsaturates. (Blacburn *et al.* 2018, Beynen *et al.* 1987) In contrast, the effect of dietary n-3 fatty acids is to reduce the concentration of VLDL and since the major lipid component of these lipoproteins is triacylglycerol, the chief response is a lowering of plasma triacylglycerol concentrations. (Muller *et al.* 2014) Only at very high intakes of fish oils is there a lowering of LDL or total cholesterol. The effect seems mainly confined to the very long-chain n-3 PUFA since linseed oil, which has a

high content of 18:3 n-3, is ineffective at similar doses. (Vergroesen *et al* 1995) Just as there are wide differences in individual responses to dietary cholesterol, so there are hyper and hypo responders to dietary fatty acids. It is apparent that one can find subjects with consistently high or low responses but that total insensitivity is rare.

INFLUENCE OF TRIACYLGLYCEROL STRUCTURE

Natural fats are characterized by a stereospecific distribution of fatty acids on the three positions of the glycerol backbone rather than a random distribution. The way in which fatty acids are distributed may influence plasma cholesterol irrespective of the overall composition of the fatty acids. (Grundy *et al*. 1988) Thus linoleic acid is more hypocholesterolaemic and saturates more hypercholesterolaemic (Stehbens *et al*. 1990) when present at position 2 than in positions 1 or 3. The fact that stearic acid is normally esterified at position 1, rarely at position 2, may in part explain the neutral effect of this fatty acid on blood cholesterol. Butter is much less hypercholesterolaemic when the positions of its fatty acids are randomized by interesterification. (Christophe *et al* 1998)

MECHANISMS

Differences between individuals in their responses to dietary cholesterol might be accounted for by differences in: absorption of dietary cholesterol; cholesterol biosynthesis; output of LDL by the liver or in the receptor-mediated clearance of LDL from plasma; sterol and bile acid excretion from the body or the accumulation of cholesterol in body tissues, *(*Grundy

et al. 1990) Differences between individuals in cholesterol absorption and in the capacity to regulate cholesterol biosynthesis to compensate for dietary intake clearly exist. (Flynn *et al* 2013) The apo-B receptor plays a major role in regulating the rate of removal of LDL as well as its rate of synthesis from VLDL. Hepatic receptors for apo-B account for most of the capacity to remove LDL. The binding capacity of the apo-B receptor is genetically determined but the number of receptors expressed is influenced by dietary and hormonal factors. Grundy *et al.* (*1990)* discuss a model in which an increase in absorbed cholesterol reduces the activity of LDL-receptors which, in turn, retards the uptake of LDL and VLDL remnants. An increased conversion of VLDL remnants into LDL as well as a reduced uptake of LDL results in increased plasma concentrations of LDL. The influence of the non-specific endocytosis and scavenger pathways remains uncertain. Likewise, several mechanisms by which specific saturated fatty acids raise LDL cholesterol while specific unsaturated fatty acids either lower it or restrict the rise, have been discussed. *(*Grundy *et al. 1990)* Dietary fatty acid composition may influence: (1) the excretion of bile acids that occurs at each passage of the entero-hepatic circulation; (2) the production of cholesterol and of apo-B-containing lipoproteins; (3) the catabolism of LDL; (4) the .cholesterol ester content of each LDL particle in the plasma. The "hypercholesterolaemic" SFA appear to suppress the receptor-mediated clearance of LDL from plasma. (Grundy *et al.* 1988, Baggio *et al* 1988)) The reduced activity of the LDL receptors reduces the rate of catabolism of LDL as well as enhancing the rate of conversion of VLDL remnants to LDL. Caution has to be exercised in extrapolating results from experimental animals to man. LDL receptor activity may be low in man

compared with other animals. Consequently, LDL cholesterol concentrations could be primarily determined by rates of LDL synthesis rather than by rates of removal. Using radioactively labelled apo lipoproteins to follow the kinetics of LDL synthesis in human subjects, several laboratories have demonstrated a marked reduction in LDL synthetic rates when linoleic acid replaced saturated fatty acids in the diet (Cortese *et al.* 1993, Vergoesen *et al* 1995) and a slight rise in fractional catabolic rate. (Hopkins *et al.* 2001)

CONCLUSION

There can be no doubt that lipids are involved in the progression of CHD both in its atherosclerotic and thrombotic phases. There is also evidence for lipid involvement in other components of heart disease, such as cardiac arrhythmias. (Abeywardena *et al.* 1988) The points of contention are (1) whether plasma LDL has a causal role (Falk 1983) as distinct from an exacerbating role; and (2) whether dietary lipids have a primary role in either causation or exacerbation of the disease. The hemodynamic stress can induce atherosclerosis in vessels of animals with very low LDL concentrations, (Bronsgeest *et al* 1979) suggesting that a high concentration of LDL is not a prerequisite for its development. It is a stronger predictor of CHD risk than LDL and may provide an important link between the atherosclerotic and thrombotic phases of the disease. (Davms 1987, Antisci 1913) Research so far has revealed little influence of diet on its concentration in plasma but this is clearly an area where more investigation is needed. Emphasis has shifted in recent years away from the atherogenic potential of LDL itself toward an understanding of the

role of modified LDL and its uptake by the scavenger receptors of macrophages to form foam cells. (Buzzard *et al*. 1982) LDL may be modified by a number of mechanisms. Thus, Gey *et al*. (2014) studied 16 populations in Europe representing regions of high (Finland, Scotland), medium (Denmark, Northern Ireland, Israel) and low (Switzerland, Southern Italy, Southern France, Catalonia, Spain) CHD incidence. There was an 8-fold difference in CHD mortality between Glasgow, Scotland and Catalonia, Spain but no difference in mean plasma cholesterol (Ahrens *et al*. 1957) Cholesterol could not, therefore, explain the difference. Dietary intervention studies are needed to clarify this point. If subsequent studies confirm the role of antioxidant nutrients in the diet, the emphasis in dietary guidelines may need to shift away from emphasis on the modification of fat towards an emphasis on the consumption of fruit and vegetables rich in antioxidant nutrients. This does not in any way mean that advice to modify fat may not be beneficial for many individuals, especially those with clinical problems of overweight, diabetes mellitus or very severe hyperlipoproteinaemia.

There can be no argument that eating too much of any dietary component--and fat is a good example--is not conducive to good health. The message is that dietary fat reduction or modification may be beneficial for some individuals. The fact is that over 50% of CHD mortality is unexplained by any of the frequently described environmental factors.

REFERENCES

ABEYWARDENA, M. Y., McLENNAN, P. L. and CHARNOCK, J. S. 1988 Nutrition, *Pharmacology and Toxicology*, pp. 98-100 (McLEAN, A. and WAHLQWST, M. L., eds) Libbey, London,

AHRENS, E. H., INSULL, W., BLOMSTRAND, R., HIRSCH, J., TSALTAS, T. T. and PETERSON, M. L. 1957 Atherosclerosis *Lancet* i, 943-953,

ANITSCI-IOW, N. and CHALATOW, S. 1913 *Centralblatt fur allgemeine Pathologic und Pathologic. Anatomi*. 24, 1-9, (Translation by PEBIAS, M. Z., 1983 *Arteriosclerosis)* 3, 178-182

BAGGIO, G., PAGNAM, A., MURACA, M., MARTINI, S., OPPORTUNO, A., BONANOME, A., AMBROSIO, G. B., FERRARI, S., GUARINI, P., PICCOLO, D., MANZATO, E., CORROCHER, R. and CREPALDI, G. 1988 The role of lipoproteins in balanced diet *American. Jornal of Clinic and Nutriation*. 47, 960-964.

BEAGLEHOLE, R. 1990 *Epidemological. Revew*. 12, 1-15

BEYNEN, A. C., KATAN, M. B. and VAN ZUPHEN, L. F. M. 1987 Adverse lipides residues. *Europian. Jornal of pharmacology* 22, 115-171,

BLACBURN, H. 2018 Hypercholesterolemia and Atherosclerosis: Pathogenesis and prevention, pp. 53-98 (STINBERG, D. and OLEFSKY, J. M. eds) *Churchill Livingstone*, New York.

BRONSGEEST-SCHOUTE, D. C., HAUTVAST, J. G. A. J. and HF.RMUS, R. J. J. 1979 Heart disease and lipids *American. Jornal of Clinic and Nutrition*. 32, 2183-2187, 31.

BRONSGEEST-SCHOUTE., HERMUS, R. J. J., DALLINGA-THIE, G. M. and HAUTVAST, J. G. A. J. 1979 Role of dietary supplements in lowering low-density lipoprotein cholesterol *American. Jornal of Clinic and Nutrition*. 32, 2188-2192,

BUZZARD, I. M., Mc ROBERTS, M. R., DRIS~LL, D. L. and BOWERING, 1982. The major risk factors in cardiomyopathy *American. Jornal of. Clinic and. Nutrition*. 36, 94-105,

CHRISTOPHE, A., MATTHYS, F., GEERS R. and VERDO~K, G 1998. Interne. Physiology. *Biochemistry*. 86, 413-415.

CORTESE, C., LEVY, Y., JANUS, E. D., TURNER, P. R., RAO, S. N., MILLER, N. E. AND LEWIS, B. 1993 Hypercholesterolemia and atherosclerosis *Europian. Jornal of pharmacology*. 13, 79-85,

DAVMS, M. J. 1987 Ischaemic heart disease, pp. 38-68 *MTP Press*, Lancaster,

DEPARTMENT OF HEALTH AND SOCIAL SECURITY 1984 Report on Health and Social Subjects, 28. *Her Majesty's Stationery Office*, London,

DREON, D. A., VRANIZAN, K. M., KRAUSS, R. M., AUSTIN, M. A. and WOOD, P. D. J. 1990 Tran's fatty acids. *American. Medical. Association*. 263, 2462-2466,

FALK, E. 1983 Coronary heart disease *Britanian Heart Jornal*. 50, 127-134,

FLYNN, M. A., NOLPH, G. B., FLYNN, T. C., KAHRS, R. 2013 Interactions between Platelets and vessel walls *American Jornal of. Clinic and Nutrition*. 32, 1051-1057.

GEY, K. F., PUSKA, P., JORDAN, P. and MOSER, U. K. 2014 Methods in Enzymology, Plasma Lipoproteins, Part A. Preparation

structure and molecular biology *American Jornal of. Clinic and Nutrition*. S3, 326S-334S.

GRUNDY, S. M. 2015 Cardiac pathologies and diet *New England Medical Jornal*. 314, 745-748.

GRUNDY, S. M., BARRETT-CONNOR, E., RUDEL, U L., MIETTINEN, T. and SPECTOR, A. A. 1988 Arteriosclerosis *American. Medical. Association* 8, 95-101

GRUNDY, S. M. and DENKE, M. A. J 1990. Lipid residues in humans. *American. Jornal of Clinic and Nutrition* 31, 1149-1172.

HOPKINS, P. N. and WILLIAMS, R. R. 2001 Atherosclerosis *Europian. Jornal of pharmacology* 40, 1-52.

KEYS, A., ANDERSON, J. T. and GRANDE, F.2012 Metabolism *Acta medica* 14, 776-787, 1.

MARMOT, M. G. and MANN, J. I. 1987 Ischaemic heart disease, pp. 1-31 *MTP Press, Lancaster, UK*,

MULLER, A. D., VAN HOUWELINGEN A. C., VAN DAMMIERAS, M. C. E., BAS, B. M. and HORNSTRA, G. 2014 Thrombotic haemostasis *Europian. Jornal of pharmacology* 61, 468-473.

SENTI, F. R. 1998 Health aspects of dietary trans fatty acids. *Federation of American Societies for Experimental Biology*.

STEHBENS, W. E., DAVIS, P. F. and MARTIN, B. J. 1990 Blood flow in large arteries: Applications to Atherogenesis and Clinical Medicine, pp. I-I 2 *Monographs in Atherosclerosis*, Karger, Basel,

TRENCHARD, LORD. 1978 Diet of man, needs and wants, pp. 225-241 *Applied Science Publishers*, London.

VERGROESEN, A. J. and GOTTENBOS, J. J. 1995 The role of fats in human nutrition, pp. 1-41 *Academic Press, London.*

WORLD HEALTH ORGANIZATION STUDY GROUP. 1990 Technical report series 79Z *WHO, Geneva.*

Bio-ethanol producing possibility from waste glycerine

Shpresime Gjeta,

Chemical Process Engineering Group, Department of Industrial Chemistry, Faculty of Natural Sciences, University of Tirana,

Ilirjan Malollari

Higher Education Institution UBT, Prishtine, Kosove

Sami Makolli

University "A. Xhuvani", Elbasan, Albania

Armela Mazreku

University "A. Xhuvani", Elbasan, Albania

Abstract

There is an effective and recommended way of using waste glycerol, as a byproduct during biodiesel production. It is processing through fermentation which brings into reality bio ethanol obtaining by the development of the valuable and different reactions and processes such as the anaerobic fermentation resulting except bio-ethanol also the succinic

acid as useful chemical compound. We have considered in this study, the processing of these waste glycerol derived by the biodiesel industry includes some steps. The need for these technological waste processing is important, not only for environmental reasons, but also for obtaining profitable chemicals that brings economic improvement, because from the biodiesel industry, a considerable amount of glycerol is produced as a secondary byproduct.

That is why it is meaningful to design or configure a treatment process tendentious for structuring a cycle which begins with the preparation of feed stream for the pretreatment of glycerol, followed by anaerobic fermentation producing ethanol and succinic acid. This process is then followed by the separation of desired products and later, Ethanol produced in that way was denatured with gasoline and reach a purity depending on final destination of the research.

The Aspen Plus computer software was used for process modeling and design. Through the simulation were firstly calculated mass, energy balances and also has been made the process economic evaluations. Main purpose of the simulation performed were establishing two different tentative flow sheets or process diagram, starting by treating the amount raw material of 1000 kg/h and 10000 kg/h, respectively.

Then we have compared the results of both types of technological schemes in order to find the most suitable and economical justified methods. All indicating parameters were strongly depended on the operational conditions defined by the predicted yield of the biodiesel production in Albania.

Introduction

Glycerol is byproduct of biodiesel industry and the amount of waste have become increasing by the timewhileits price is decreasing day by day. [1] The crude glycerol feedstock contains10% by mass glycerol. There are some different ways to treat the glycerol and in this work we have treat the way of the anaerobic fermentation of glycerol. The products of fermentation are bioethanol, succinic acid, hydrogen and carbon dioxide. [2] The manufactured ethanol can be considered a "green" or renewable fuel source. The plant proposed here is divided in three main sections which are: the preparation of crude glycerol feedstock, the fermentation section and the separation section. The section of feed preparation, include the cleaning, diluting and the sterilization of the crude glycerol that comes from biodiesel industries. In the fermentation section *E.coli* is used to ferment the glycerol in anaerobic conditions and then the products are separated in the next section. [3] The process is designed in Aspen Plus.The propose of this design is to examine advantages, disadvantages of this process by using economic analysis and material analysis of the Aspen Plus software. [4]

Materials and Methods

Materials

In this section we will briefly describe what equipment and materials have been used to design such a plant. The units used are storage tanks, heat

exchangers, separators, distillation columns, absorption columns, dryers, pumps, furnaces, blowers. The equipmentare made of stainless steel 304. The materials that have been used are crude glycerol, CSL (Corn Steep Liquor), *E.Coli,* water, while the products are ethanol, succinic acid, carbon dioxide and hydrogen. To design our plant we have used Aspen Plus. Aspen Plus is the software that is used to simulate the material and energy balance of chemical processing plant. [4][5].

Feed preparation section: In this section the crude glycerol that comes from the biodiesel industry is treated diluting and sterilized to be suitable for the fermentation section. The glycerol that will be used as feed is byproduct of biodiesel industries and its composition will be depended by the oil that have been used as feed in the biodiesel industry (soya oil, sunflower oil, ect), it will be depended from the solvents that have been used and it will be depended from the rate of removal of ethanol during the biodiesel production process.

The typical composition of the feed, crude glycerol, is given in the table below where MONG is referred (Matter Organic, Non-Glycerol) where are included free fatty acids, monoglycerides and diglycerides. [6]

Table 1. The table of crude glycerol composition.

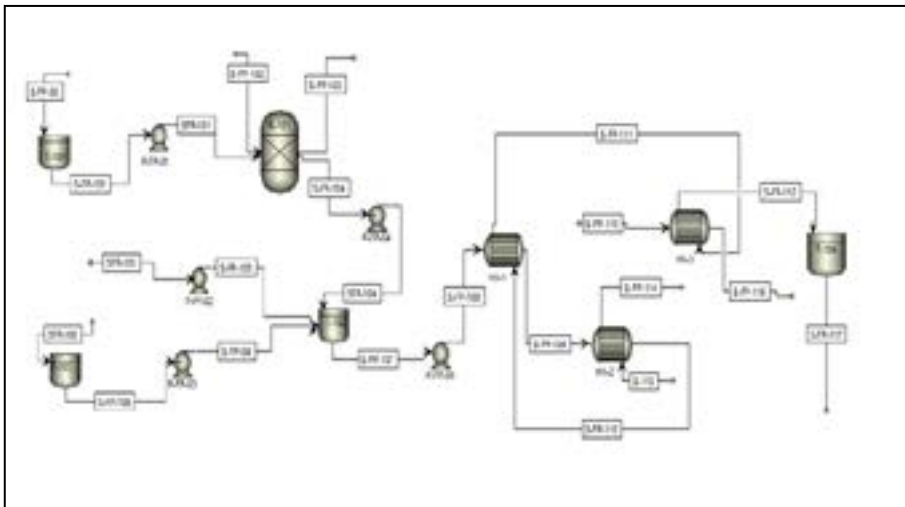| Material	Percentage
Glycerol	85 %
Water	7 %
NaCl	4 %
MONg	4 %

In this section we will add another element to the fermentation feed. In this section we will add CSL (Corn Steep Liquor) an inexpensive nutrient-rich byproduct of the wet milling of the corn. CSL contains variable concentration of salts, minerals, and amino acids to promote microorganism metabolism. The purification will be made by the combination of some processes such as reverse osmosis, electro-pressure membrane and electro-dialysis. [7]
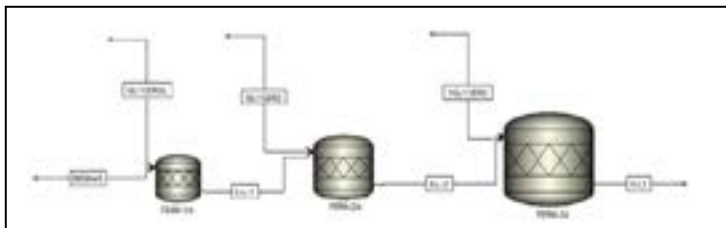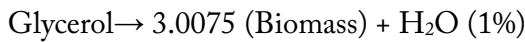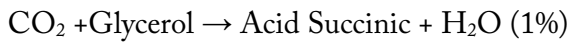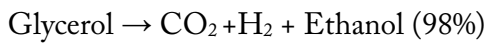
The fermentation section

Fig.1 . The section of the preperation of glycerol

The fermentation section is divided in three stages which are the laboratory fermentation stage, plant fermentation stage and the main fermentation stage. The fermentation occurs first in lab scale and then in a plant because 1mL aliquot of cells cannot be added to the large fermenter
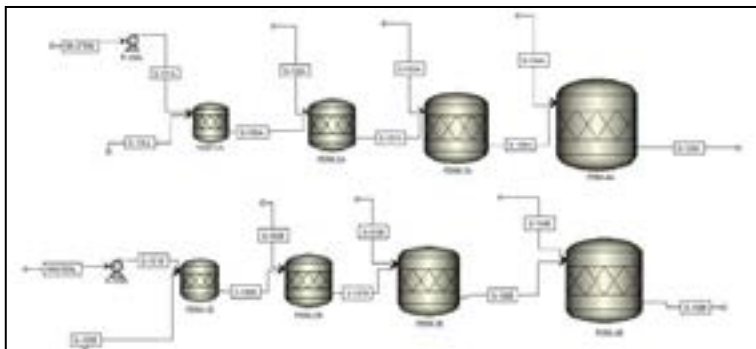

tanks. Optimal ph for the reaction is 7, optimal temperature is 37 °C and anaerobic conditions are required. [8] The required time to occur the reaction is 60 hours. The samples from the fermentation scale are added

to the plant scale fermentation and will serve as source of E.Coli. In the main fermentation scale, tanks have large dimensions and these fermenters are charged with broth from the plant fermentation section which is reach in E.coli and also is charged with sterilized glycerol feed from the purification section. Laboratory section begins with the inoculum of 1mL E.Coli and the reaction and the conversions of glycerol are: [7][3]

Glycerol $\rightarrow CO_2 + H_2$ + Ethanol (98%)

CO_2 + Glycerol $\rightarrow$ Acid Succinic + H_2O (1%)

Glycerol $\rightarrow$ 3.0075 (Biomass) + H_2O (1%)

Fig. 2. The section of laboratory scale fermentation.

Fig. 3. The section of plant scale fermentation.

The separation section

Once the fermentation is complete, the broth is sent to the separation section of the plant. Ethanol from vapour stream from the fermentation section is absorbed in a colon and is sent to the distillation tower to be separated.[4] The dawn stream of distillation colon contain succinic acid and will be send to the crystallisation and then to dryer. The upper stream
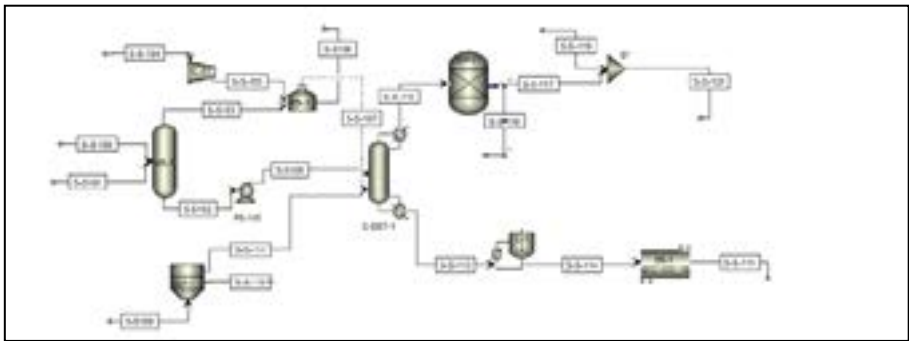
contain ethanol and will be send to the separator to remove other elements to gain the desired purity and then will be denatured with gasoline.

Fig. 5. The section of product seperation.

1. Results AND DISCUSSION

In Aspen we have studied two examples of the operation of this plant by changing the flow. [9] In the first example we have applied a feed rate of 1000 kg/hr glycerol and in the second example we applied a feed rate of 10000 kg/hr. The results for the first example are not positive and do not interest us so we are presenting the results of the second example as can be seen in the tables 2 and 3.

Table 2. Material balances for the process.

PRODUCT	THE FLOW RATE
ETHANOL	2500 KG/HR
ACID SUCCINIC	157 KG/HR
CARBON DIOXIDE	2456 KG/HR
HYDROGEN	4 KG/HR

Table 3. Economic ananlysis.

	The preparation of feed	The plant scale fermentation	The main fermentation	Seperation
Total capital cost	407,000 $	10,000 $	1,043,100$	12,393,350 $
Total installed cost	1,334,300 $	59,700 $	2,445,200$	16,168,400 $
Total operated cost	914,350 $	914,350 $	914,315 $	914,350 $
Energy cost	8,25$/h	8,25$	8,25$/hr	8,25$/hr

2. Discussion

As we can see from the results the amount of produced ethanol is large but also the economic cost is large. The hydrogen produced by the fermentation will be used for the re boiler of column. Succinic acid is another favorable product from this fermentation. About the high cost of plant we can say the plants like that are more favorable where we have

large amount of feedstock. The greater the amount of the feedstock the more effective this kind of plant will be. The dimensions of the tanks are large and this increase installation cost, operated cost and total cost.

Conclusions

Researching and building such facilities is the near future of waste processing, the future of a more ecological environment, and of course the near future of business that brings more revenue from low-cost materials.

Comparing the extremely low glycerol cost of 0.01 $/kg and the large amount of glycerol that is being produced as a secondary product from the biodiesel industry as well as the growing demand for bioethanol at a considerable price of 5.5 $ / kg we will undoubtedly say that the construction of this plant is very effective.

The main problem of this plant is that large quantities of fermentation tanks are needed and this has difficulties not only in their construction but also in the operation of the plant. Based on the simulation results for crude glycerol feed stream 1000 kg/hr the quantities of products obtained and the effectiveness of the plant are smaller compared to the 10000 kg/hr flow. For such plants we can say that the greater the food stream the more effective this plant will be. And finally to give an answer to the question of whether such a plant can be built in Albania we can *declare*: This plant is not suitable for construction in Albania because large glycerol feed is required. Albania does not have a biodiesel production industry so finding glycerol will be difficult and not at the desired cost interval.

REFERENCES

1. Sandra S. Konstantinović Bojana R. Danilović Jovan T. ĆirićSlavica B. Ilić Dragiša S. SavićVlada B. Veljković*"Valorization Of Crude Glycerol From Biodiesel Production"* Faculty of Technology, University of NIS, Nis, Serbia. Chem. Ind. Eng. -2016

2. Ken-Jer Wu, Yeuh-HuiLin , Yung-Chung Lo , Chun-Yen Chen , Wen-Ming Chen Jo-Shu Chang "*Converting glycerol into hydrogen, ethanol, and diols"* with a Klebsiella sp. HE1 strain via anaerobic fermentation" Journal of the Taiwan Institute of Chemical Engineers 42 (2011) 20–25

3. Ramon Gonzalez _, AbhishekMurarka 1, Yandi Dharmadi 1, Syed Shams Yazdani.*"New model for the anaerobic fermentation of glycerol in enteric bacteria.Trunk and auxiliary pathways in Escherichia coli"* Department of Chemical and Biomolecular Engineering, Rice University, P.O. Box 1892, Houston 2008

4. Helen Magnusson *"Process Simulation in Aspen Plus of an Integrated Ethanol and CHP plant"*Department of Applied Physics and Electronics Master Thesis in Energy Engineering EN0601-2010

5. Aspen Plus Bioethanol from Corn Model -2017 (Aspen Examples)

6. Shengjun Hu, Xialon Lu, Caixa Wan "*Characterization of Crude Glycerol from Biodiesel Plants*" Department of Food Agricultual and Biological Engenieering, Thee Ohio State University, Ohio, United States. Journal of Agricultural and Food Chemistry 2012

7. LeGendre, Chloe; Logan, Eric; Mendel, Jordan; and Seedial, Tamara, "*Anaerobic Fermentation of Glycerol to Ethanol"* (2009). SeniorDesign Reports *(CBE).*

8. *Yurany Camacho Ardila*, Jaiver Efren Jaimes Figueroa, Betânia H. Lunelli,Rubens Maciel Filho, Maria Regina W. Maciel Simulation of Ethanol Production Via "*Fermentation of the Synthesis Gas Using Aspen PlusTM*" Laboratory of Optimization, Design and Advanced Control, School of Chemical Engineering, State University of Campinas, Campinas, Brazil. Chemical Engineering Transactions 2014

9. Kamal I.M. Al-Malah. "*Aspen Plus® – Chemical Engineering Applications*" Department of Chemical Engineering Higher Colleges of Technology, Ruwais, United Arab Emirates 2017

Data on Biogas production quality: Evidence from the Wastewater Treatment Plant of Durrës

Stela Sefa

Department of Engineering Science, Faculty of Professional Science,
Aleksandër Moisiu University of Durrës

Tania Floqi

Department of Engineering Science, Faculty of Professional Science,
Aleksandër Moisiu University of Durrës

Julian Sefa

Environmental Engineer, Durres, Albania

ABSTRACT

The wastewater treatment plant (WWTPD) located in Durrës, responsible for a treatment area of 205,000 inhabitants, employs the tertiary advanced wasterwater treatment to generate biogas from activated

sludge for self use. The biogas collected from the anaerobic digestion tank feed the boiler and the co-generation unit which is then transformed to power its own energy grid. In order to evaluate the quality of biogas produced by anaerobic digestion of WWTPD's sludge, is measured the percentage of CH_4 and CO_2 from the biogas production during a three years period (2016 – 2018).

From the performed analyses has resulted a percentage of CH_4 up to 75% and 25% CO_2 in 2016. While the lowest percentage of CH_4 in 2018 with respectively 70% CH_4 and 30% CO_2.

Based on the value measurements, qualitative results of biogas parameters show that physicochemical and biochemical processes are performed under strict conditions and anaerobic digestion is performed according to standards.

Keywords: wastewater treatment plant, biogas, methane, anaerobic digestion, sludge

INTRODUCTION

The wastewater treatment plant (WWTPD) is located 2 km away from the city center of Durrës and treats urban wastewater of 205,000 inhabitants [1]. WWTPD employs the tertiary advanced biological treatment. The deployed technology is with active sludge with advanced

treatment for nitrogen and phosphorus reduction. Biogas obtained from anaerobic digestion of WWTPD's sludge feed the boiler and the co-generation unit and is used to satisfy the needs of the plant with electricity.

The plant has been designed to treat a total flow-rate of 60,000 m³/d. All the flow-rate is preliminary treated (screening, de-sanding) before been divided in the pre-treatment over-flow, where only 30,000 m³/d goes to the further conventional treatment, while the remaining is discharged to the wetland [2]. The sewage arrives to the inlet pumping station where it is screened through coarse screens and pumped to the pre-treatment. In the pre-treatment, Ferric Chloride is also added to remove the phosphorous in the following stages. The final section of the pre-treatment facilities is a diversion unit, which divides the flow-rate to the four lines of the aeration tank. But only two lines of aeration tanks worked because of low flow-rate in this three year of study period. The core of the treatment plant is the activated sludge process. Once the wastewater had received sufficient treatment, excess mixed liquor is discharged into settling tanks and the treated supernatant is run off to undergo further treatment before discharge. Part of the settled material, the sludge, is returned to the head of the aeration system to re-seed the new wastewater entering the tank. Excess sludge is removed from the treatment process to keep the ratio of biomass to food supplied in the wastewater in balance and is pumped to the thickening stage. Into the gravity sludge thickener tanks the sludge is mixed and agitated gently forming a solids blanket on the bottom of the tank. Solids concentration achieved by gravity thickeners were typically 2% solids from waste activated sludge. The sludge from the bottom is pumped to the anaerobic digestion tanks.

WWTP of Durrës has two anaerobic digestion tanks, but in the three years of study only one of the digester tanks has worked. The process used in digester is single-stage mesophilic continuous system. The biogas is collected from the anaerobic digestion and accumulated in the gas-holder tank to feed the boiler and the co-generation unit which is then transformed to power its own energy grid.

Figure 1 Biogas-holder and Anaerobic Digestion tanks in WWTPD

According [3] biogas produced by the wastewater treatment plant contain roughly 55÷70 percent methane and 30÷45 percent carbon dioxide and traces amounts of hydrogen gas, hydrogen sulphide, ammonia (all together about 1÷2 %) and small traces amounts of carbon monoxide, nitrogen and oxygen. The percentage of these gases depends on the sludge composition, temperature, pH and pressure [4].

According to [5]	60	% CH_4	40	% CO_2
According to [6]	55÷70	% CH_4	30÷45	% CO_2
According to [7]	63÷67	% CH_4	33÷37	% CO_2

Qualitative parameters for measuring biogas are the amount of methane CH_4 and carbon dioxide CO_2, but also other gases in the form of traces. The percentage of these gases depends on the composition of the sludge, temperature, pH and others. Since the dissolution of CO_2 depends on the pH, its fluctuations can change the percentage of gas. The amount of biogas produced for biofuel and then electricity is measured by % CH_4 [8].

MATERIALS AND METHODS

The biogas is collected from the anaerobic digestion tank. Samples were taken at the digester tank outlet, according to IS/ISO 14853 [9]. Methods for determining percentages are instrumental and volumetric. In this paper

is used the volumetric method for the determination of CO_2, where CH_4 is then found as the difference with CO_2 (assuming that the amount of other trace gases is very small, negligible). For this purpose, was used the ORSAT apparatus, with the method of absorbing gas in an alkaline solution.

$$\%CO_2 = \frac{(V_1 - V_2) \text{ x } 100}{V_1}$$

$$\% CH_4 = \% 100 - \% CO_2$$

% CO_2 – percentage of CO_2 in the biogas sample

% CH_4 – percentage of CH_4 in the biogas sample

V_1 – initial volume of biogas

V_2 – the volume of biogas after passing into the KOH solution

In order to have the highest quality biogas production, have been controlled its parameters keeping under control the anaerobic digestion process and pH in the anaerobic digestion reactor.

RESULTS AND DISCUSSIONS

Biogas produced by the Wastewater Treatment Plant in Durrës contains methane gas CH_4, carbon dioxide CO_2 and other trace amounts of gases. From the analyzes performed during the three years period (2016 – 2017– 2018), the pH was in normal and stable values. The pH values of the sludge in the digester tank were within normal close to 7.0 with the range $7.47 - 7.58$. This has affected the good quality of biogas with a satisfactory percentage of CH_4. Table 1 presents the average production values calculated by study year as well as the percentage of CH_4 and CO_2 for each year.
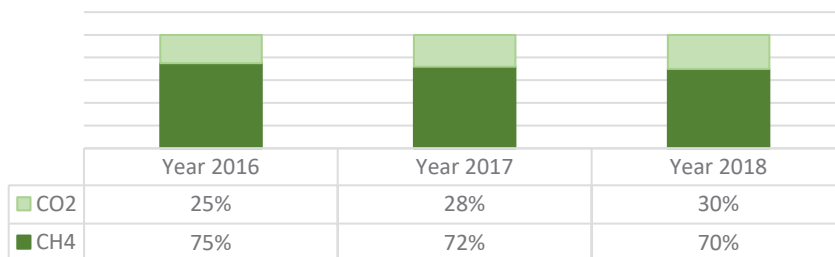
	Year 2016	Year 2017	Year 2018
CO2	25%	28%	30%
CH4	75%	72%	70%

Table 1 Biogas quality of WWTPD

In 2016, where the amount of biogas was higher, its quality is in the ratio 75% CH_4 and 25% CO_2. Referring [10] this year had the best parameters in terms of sludge in the digester tank. A small decrease in the amount of CH_4 is seen in the other two years, but the results are very good. Table 2

presents the average production values of biogas calculated by study year as well as the equivalent amounts in m^3 CH_4 for each year.

Year	Average daily biogas production (m³/day)	Average daily per year of methane (m³CH₄/day)
2016	1392.95	1044.7125
2017	944.88	680.3136
2018	653.34	457.3400

Table 2: Biogas production in 2016, 2017 and 2018 [10]

Qualitative results of biogas parameters show that physicochemical and biochemical processes were achieved under strict conditions and anaerobic digestion was carried out according to standards. The process is made in the absence of oxygen, nitrates or sulphates. During the anaerobic digestion the mixing of the sludge in the tank is carried out. This is a necessary and very important process because the sludge is spreaded evenly throughout the digester tank while maintaining the temperature and the spread of methanogenic bacteria homogeneously. The filling of the reactor is done in small quantities, so that the microorganisms have a constant concentration of organic matter, eliminating the risk of overload and increasing the concentration of volatile acids.

CONCLUSIONS

- During a study period of three years the Wastewater Treatment Plant in Durres has produced a quality biogas with a percentage of CH_4 70÷75 % and 25÷30 % of CO_2.
- The optimal quality of biogas depends on the composition of the sludge, temperature, pH and others.
- Qualitative results of biogas parameters in WWTPD show that physicochemical and biochemical processes were achieved under strict conditions and anaerobic digestion was carried out according to standards.
- Quality parameters of biogas are optimal due to the solids concentration achieved by gravity thickeners with percentage up to 2%.

REFERENCES:

[1] http://www.akm.gov.al/assets/impianti-i-duresit.pdf

[2] Operation and Maintenance Manual of Wastewater Treatment Plant Durres, May 2011

[3] Metcalf dhe Eddy (2013) "Wastewater Engineering: Treatment and Reuse Recovery"

[4] Hickey, Switzenbaum, 1991

[5] A. Steinhauser, "Biogas from waste and renewable resources, dieter doublein" (2008)

[6] Metcalf dhe Eddy (2013) "Wastewater Engineering: Treatment and Reuse Recovery"

[7] Derbal Kerroum, Bencheikh Le-Hocine Mossaab, Meniai Abdesslam Hassen, (2012), "Production of biogas form sludge waste and organic fraction of municipal solid waste", fq. 153-161

[8] Stefano Marzorati, 2016 web: http://marzorati.co/quanti-kwh-per-metro-cubo-di-metano/

[9] IS/ISO 14853: Determination of ultimate aerobic diodegradability of plastic materials in and aqueous medium - Method by Measurement of biogas production

[10] Sefa, S., Floqi, T. and Sefa, J. 2020. Measurement of Energy Production from Biogas: Evidence from the Wastewater Treatment Plant in Durres. *European Journal of Engineering and Technology Research*. 5, 10 (Oct. 2020), 1260-1262. DOI: https://doi.org/10.24018/ejers.2020.5.10.219