

Towards an integrated approach for zero energy schools in Chile: a comparative study with Belgium.

Authors: Franklin Lester Vivanco Garrido Beatriz Piderit Shady Attia

E-mail: frankvivanco@gmail.com

Address: Building Design Lab (SBD) Quartier Polytech 1 Allee de la Decouverte 9 4000 Liege, Belgium www.sbd.ulg.ac.be Tel: +32 43.66.91.55 Fax: +32 43.66.29.09

### ABSTRACT

In Chile, there is a shortfall in the quality of school buildings, that is seen in the low standard of thermal comfort in the classrooms with temperatures as low as 8° C in a city with a Mediterranean climate in winter [1]. The Chilean Government has promoted some policies and investigation projects to improve this kind of buildings, however, none of them have become in a regulation, leaving the decision of what and how to improve in hands of the owners. The aim of this work was to inform and influence decision makers at government level to adopt Net Zero Energy Schools policy. Highlighting the importance for Chile to have strategic NZES to be useful in a catastrophe case, exploring also, the feasibility to became more attractive to owners and administrators, to improve in a right way their buildings and to build new ones with better indoor conditions and high energy efficiency standards. At the present, no study has been carried out related to the NZES goal in Chile. The follow work presents an assessment of the existing scenario of the school buildings. and technologies to reach the NZEB, to provide a snapshot of the state of ure and or beginations, concepts, and technologies to reach the NZEB, to provide a snapshot of the existing scenario of the school buildings and the perspective to applied the NZEB concept in Chile. Several definitions of NZEB, regulations, studies and standards that are in force in Chile were analyzed and put them in perspective. Then a comparative study was made with Belgium in order to establish a pathway of strategies to the implementation of this target in Chile. A holistic analysis of the Strength, Weakness, Opportunities and Threats (SWOTs) was made to establish the lacks, and the feasibilities of implement NZES and a group of recommendations was delivered to reach this goal in Chile.

# KEYWORDS

Thermal Comfort - Recommendations - Energy Regulation -Fuel Poverty - Social resilience - Zero Energy Buildings.

#### PROBLEM

Chile is having a serious challenge with the educational infrastructure and facilities in the future years and in its expectations of grows.

A low standard of indoor quality in the scholar buildings, which usually are working as free running even in climates with low temperatures in winter and high temperatures in summer. The year 2012 the Ministry of Education made a cadaster of infrastructure which result was a total of 7538,2 m2 built in a 5530 schools [2], none of the study variables was indoor comfort or energy efficiency.

There is a limited regulation on environmental comfort in schools, classrooms only required to achieve a minimum of 12°C when they have a heating system (south latitude 36°) and 2 air changes per hour when mechanical system is required [3], there is no regulation for energy efficiency in schools.

Due to the constant happening of catastrophes in Chile, It is common that the government use the scholar infrastructure like refuge or operation center. For example for the alluvion of 2015 in the north of the country 15 schools buildings of the Atacama region were use like refuge [4].

It is projected that Electricity consumption in Chile will increase from 49.518 Gwh in 2015 a 81.652 Gwh in 2035, the energetic matrix of Chile in 2014 it was a 35,3% coal and 31,3% hydroelectric, renewables only reach to 2,7% [5], which is why Chile need to find strategies to diversify its source energy production.

### **OBJETIVE / HYPOTHESIS**

- Propose a definition of Net Zero Energy Schools for Chile.
- Identify gaps, needs and opportunities to implement Net Zero Energy Schools.

Share and disseminate the results of the study.

#### AUDIENCE

Schools Owners, Government Decision Makers, Design Teams.

### RESEARCH QUESTION

- How to develop an integrated policy for Net Zero Energy Schools in Chile?
- How to influence government entities and regulatory bodies to adopt the NZES Target?

### ORIGINALITY

At present, no study has been carried out related to the Net Zero Energy Schools goal in Chile. The present work seeks to establish recommendations related to the implementation of the NZES target, finding the barriers and potentialities, in this way to influence the decision making regarding this type of buildings.

# **METHODOLOGY**

- Literature Review of several topics to stablish a base line of the state of the art in Chile about the NZES.
- 2. A comparative study and lesson learned between the case of Chile and Belgium in order to extract strategies, to implement an integrated policy view.
- A Holistic analysis of the Strength, Weakness, Opportunities and Threats was 3. made to stablish the lacks, and feasibilities of implement this target in Chile.
- Interviews and brainstorming sessions to establish recommendations for implementing the target NZES in Chile.

# RESULTS

Strengths	Weakness
Proving a Holistic concept that embrace Densey Sciences, comfort and renewables Earney Catalogness, comfort and renewables Can Provide refuge during catastrophes for location communities. Improve comfort conditions and IEO for Reduce operational energy cost. Improve the Architectural, Engineering and Construction. Industry and maintain as laten-Americae. Laten-Americae.	Lew declarated budget for to construct activated budgets, in infrastructure and dependence of imports for technological components.     Lack of knowledge competency and salities that the second second second second second NZES.     Lack of technological infrastructure including best recovering system, and components, this will force the import and increase the cost.     The also phenomena regarding the governmental authorities.
Opportunities	Threats
<ul> <li>Accelerate, to achieve Chilean goals to increase the renewal integration in the building</li> </ul>	<ul> <li>Not embracing facility management to maintain the quality and operation of NZES</li> </ul>
Develop adaptive comfort model for school building in Chile.     Transferring the built environment by	<ul> <li>Failing to build consensus among educator, children families, government and local authorities</li> </ul>
demonstrating NZES as pilot project or show cases for energy neutral buildings.	
<ul> <li>Can be a way to apply the Net Zero concept</li> </ul>	

Table 2. Comparison results

- Performance requirements
- Comfort and Air quality
- **Envelope and Passive design**
- HVAC + REs
- **Controls and occupants**



Figure 1. Roadmap Low-Tech approach to NZEB target Figure 2. Roadmap High-Tech approach to NZEB target

# CONCLUSION

1.- In order to implement the NZEB target in Chile, the national building codes has to update to align them with the NZEB requirements.

2.- More detailed studies and research should be conducted in the area of thermal behavior of schools .

3.- This study present an overview of the state of the art of regulations and standards that are now in force in Chile.

### Resources

Design Builder Software, Data of occupancy measure of the schools studies

### References

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[2] Portal web mineduc, Catastro de infraestructura escolar, http://portales.mineduc.cl/index2.php?id\_portal=42&id\_seccion=4907&id\_contenido=27664, 2012 [3] DS 548, Aprueba normas para la planta física de los locales educacionales que establecen las exigencies mínimas que deben cumplir los establecimientos reconocidos como cooperadores de la función educacional del estado, según el nivel y modalidad de la enseñanza que impartan, Bibliota del Congreso Nacional de Chile, Santiago, 2012.

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