

Using DMAIC methodology for the Conversion of Ready-Mix Concrete Plant Energy to Solar PV

Dr. Slim Saidi

Associate Professor of Industrial Engineering
Industrial Engineering Department
Rochester Institute of Technology
Dubai, United Arab Emirates
Slim.Saidi@rit.edu

Zulfa A. Rasheed

Master of Engineering Management Student
Industrial Engineering Department
Rochester Institute of Technology
Dubai, United Arab Emirates
zulfa.rasheed@gmail.com, zulfa.rasheed@mail.rit.edu

Abstract

The project studied a case of a ready-mix concrete company to evaluate the feasibility of converting the electrical consumption to solar PV which encourages the adoption of the technology in heavy industry. We used the DMAIC methodology to address the question “what could be changed to reduce electricity consumption, therefore electricity bill?”.

Data are collected to find how much electricity to cover through the project excluding areas critical to production taking data from company, walkthrough observations and interviews. Key observation is the weather dependency of electricity consumption. To measure the targeted amount of electricity, we used the company’s initial electrical design and calculated the electricity required to produce 1 m³ of ready-mix concrete. The target is 29,594.9144 KWH per month.

Options for improvements were: Replacing the inefficient devices; Enhancing building performance; Avoiding the peak hours; Using automated control systems to eliminate waste and the latest option is the use of renewable energy. We designed a grid-connected solar PV system to support full load.

Prices have been estimated based on the current market. To design a system to cover 29,594.9144 KWH equivalent to 13,672.89 AED, the company need to invest 75,480.00 AED which will break-even in half a year. The maintenance (like cleaning of PV) can be done by the company. The cost of replacement will occur every 25-30 years for PV and every 3-4 years for batteries. This solar PV system design reduces 205,980.6 Kg CO₂e in a year equivalent to 1 month of emissions.

Keywords

Solar Energy, Photovoltaics, Concrete, Renewable Energy, DMAIC.

Acknowledgements

We would like to express our gratitude to SijiMix Ready-Mix concrete company, a member of Fujairah National Group for their support and contribution to make this work successful. Special thanks to to Engr. Ahmed Albahy, co-founder and projects manager at Smart Innergy for Energy solutions who contributed in validating technical design.

Biographies

Dr Slim Saidi is Associate Professor of Industrial Engineering and is heavily involved in Innovation, Systems Thinking and Design Thinking. He held a number of Senior Executive positions in the telecommunications sector across the Middle East and Africa and was a Partner with the global management and strategy consultants, KPMG and Arthur D. Little. He was also involved in the development and rollout of value-added services for a Major North American Railroad and contributed to the strategic Transformation of many companies across the world.

Dr Saidi has been associated with Universities in Canada (Bishop's University, Ecole Polytechnique), Tunisia (SUPCOM) and UAE (UOWD, AUS and AGU). He obtained a PhD from the Ecole Polytechnique of Montreal, Canada. He also holds a Graduate Diploma in Business Administration (DSA) from HEC Business School, Montreal, and a degree in Industrial Engineering from ENIT, Tunisia.

Zulfa Rasheed is a Master of Engineering Management Student at Rochester institute of Technology, Dubai, UAE. And a former graduate student researcher with UNESCO between Ethiopia and UAE. She was a winner of Middle East Electricity Future Generation award and a winner of Akoun business idea award. Rasheed is active writer and researcher in the field of solar energy who wrote for PV magazine and she is a contributor to CleanEnergy4Africa blog, an initiative by Dr. Mohamed Alhaj, project engineer (renewable energy) Qatar General Electricity and Water Corporation, Qatar. She earned B.S. in Electrical Engineering from Ajman University, UAE. During her bachelor studies, Zulfa was a member of the IEEE students board. She has worked with the Federal Competitiveness and Statistics Authority, a governmental entity as quality auditor where she served to apply and monitor quality measures in the field work. She is an affiliate engineer with ASHREA.