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Protection of the Smart City against CME

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Abstract

Today life in many cities strongly depends on electricity. In many articles we can find designs of smart, clean and beautiful modern cities. All aspects of activity in cities are based on the use of control and supply systems. All of them use electricity as control signals and as power. A big but underconsidered problem is reliability of city substructures against Coronal Mass Ejection (CME) from the Sun. These events may damage elements of basic importance for life of people in cities. The article suggests some kinds of protection for the city substructures against CME.

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1. Introduction

Extensive use of electricity is still being developed to power big and small devices in houses and companies. That can be stopped by one accident + massive blackouts of electrical networks. The source of this accident is outside of the Earth. That is our everyday morning star - the Sun. Since the first use of an electrical power network in September 1882, failures of this system have been noticed under the influence of the Sun activity. Flares generated by the Sun are linked with some form of solar activity - the CME (Coronal Mass Ejection). CME has a great kinetic and electric energy. At the time of contact with the magnetic field of the Earth it ionizes the upper atmosphere and generates geomagnetic storms. During normal activity of electrical networks this can generate surge voltages. This can destroy transformers and cables.

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When the first electric power plant was opened in 1881, at first slowly but then faster and faster, electricity became more and more popular (Koester F., 1913). This revolutionized the reloading equipment in harbors and railway stations (Lewandowski K., 2015) and household appliances. In 1911, the following words were used: *Electricity, the silent, mysterious handmaiden of modern scientific and mechanical progress is knocking at the door of every home. She is mute. She has no followers! She wants no "afternoon off." She lets you fix her wages. The children do not bother her. So long as there is a trolley line from which she can obtain necessary encouragement when her spirits are low, she works just as well in the country as in the city. She is never ill, never tired. She does not sleep. She always works at a maximum speed which you fix yourself.* Tarkington H. (1911). Also, electricity was shown as a new possibility for building houses. (Fig.1)

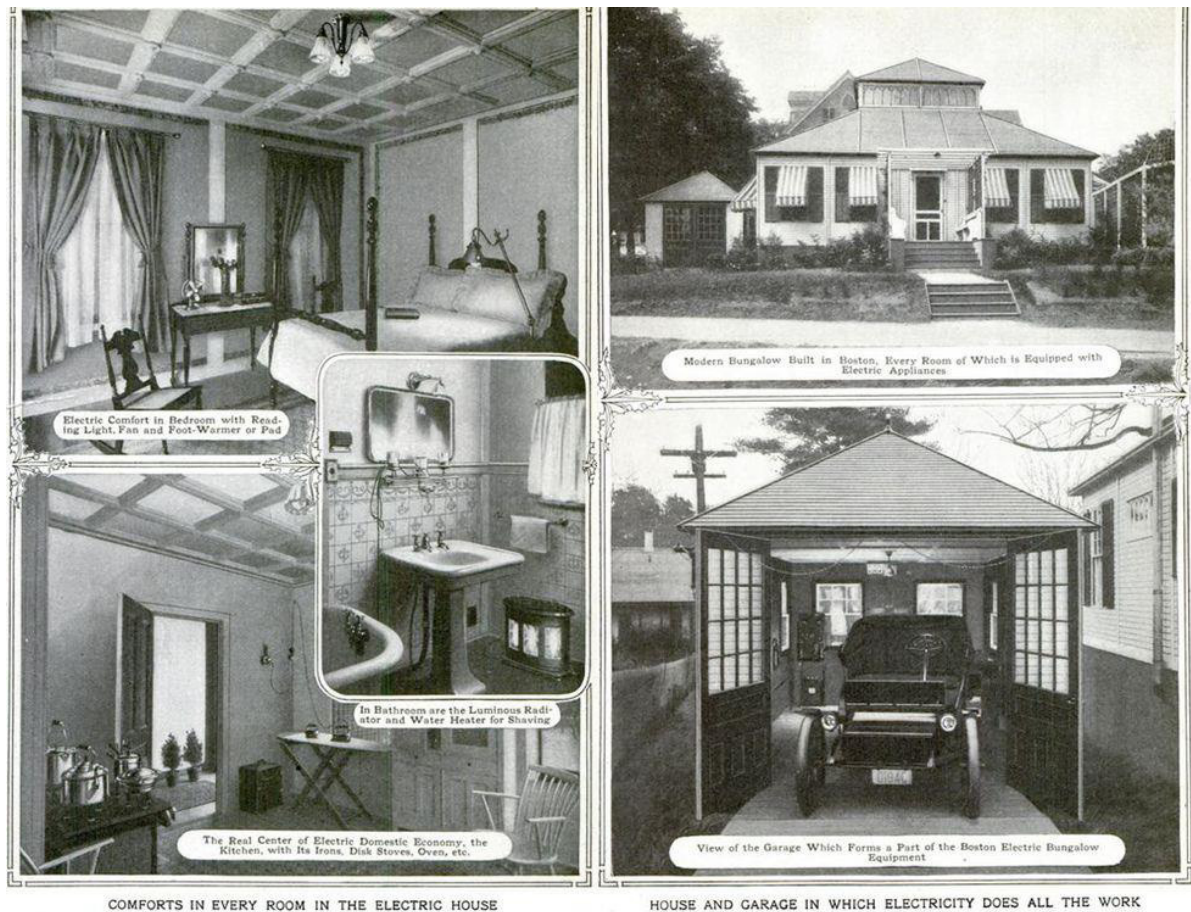


Fig.1. Electricity as the new possibilities for building houses in 1911 Tarkington H. (1911)

In 1912 the applications of electricity were presented as the wonders of the modern world based on the international poll: 1. Wireless 2. Telephone 3. Aeroplane 4. Radium 5. Antiseptics and Antitoxins 6. Spectrum Analysis 7. X-Ray (Windsor H.H., 1912).

Six out of seven of these new wonders used electricity. Similar results were obtained two years later. In 1914, polls from Berlin and Paris were presented. The electric dynamo was chosen as the new wonder in Paris (THE SEVEN, 1914). A much more professional opinion about the influence of electricity for the world can be found in the words of Dr Samuel W. Stratton, President of the Massachusetts Institute of Technology in 1928. Stratton selected **nine** new wonders, (Wheeler E.C., 1928):

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