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Opportunities for Power Engineers and Expectations from Power Engineers A Global Perspective

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Progression of Electrical Engineering

Electric Power Engineering was one of two branches of electrical engineering of the then new field of electrical engineering back in 1884. The other one was wired communication.

Traditional Electric Power Engineering

For the 19th and the 20th centuries electric power engineering has meant power stations, transmission and distribution networks, high voltage engineering, electric machines, switchgear, transformers and automatic generation control on the hardware side and stability, transient, load flow and production costing studies on the software side.

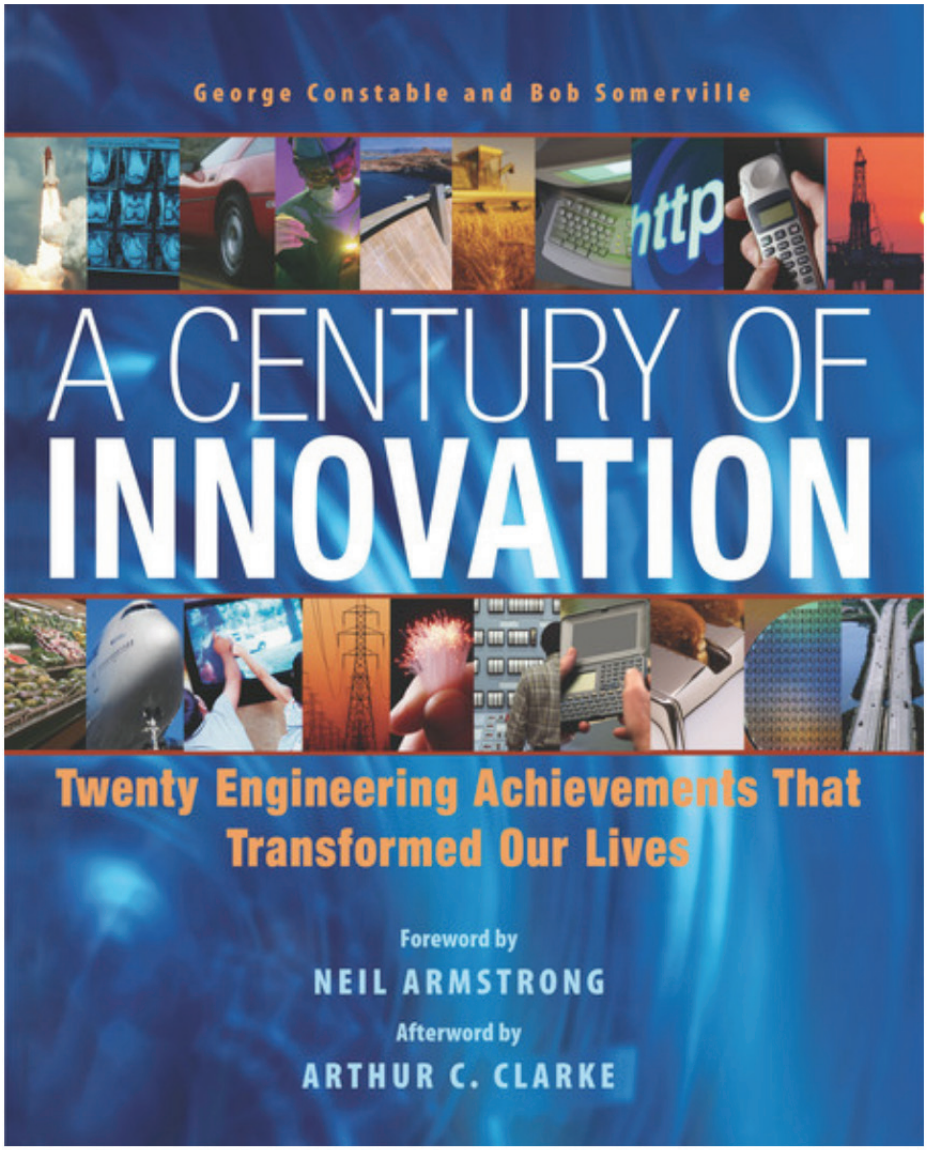
New Paradigms in Electric Power Engineering

- Electric Vehicles
- Renewable Energy
- Storage Applications
- Smart Grids
- Smart Cities

- Demand Response
- Renewables Integration

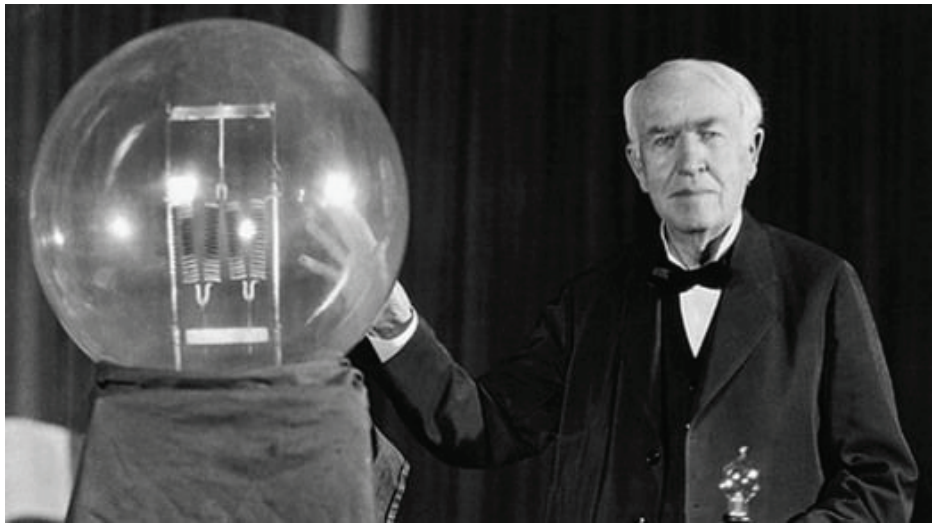
Heavy usage of communication technologies

Electrification was the Most Important Innovation of T\the 20th Century



Source: www.nae.edu, April 2017.

The Electric Bulb



Invention of the electric bulb [1879]

First step in the journey of electrification.

Source: Edison Tech Center, http://www.edisontechcenter.org/, April, 2017.

Electric Street Lights

Street Lights: First electric lighting, New York, USA 1882

Source: Edison Tech Center, http://www.edisontechcenter.org/, April, 2017.

Electric Power Plants, New York and Calcutta

First central power plant in the US, fired by coal. 4th September 1882

Source: The New York Times, 14th November, 2007, https://cityroom.blogs.nytimes.com/2007/11/14/off-goes-the-power-current-started-by-thomas-edison/comment-page-3/?_r=0, April, 2017.

Calcutta Electric Supply Corporation Limited was registered in London in 1897

17 April 1899, the first thermal power plant of the Calcutta Electric Supply Corporation Limited was commissioned

Source: WiKipedia 23 June 2020

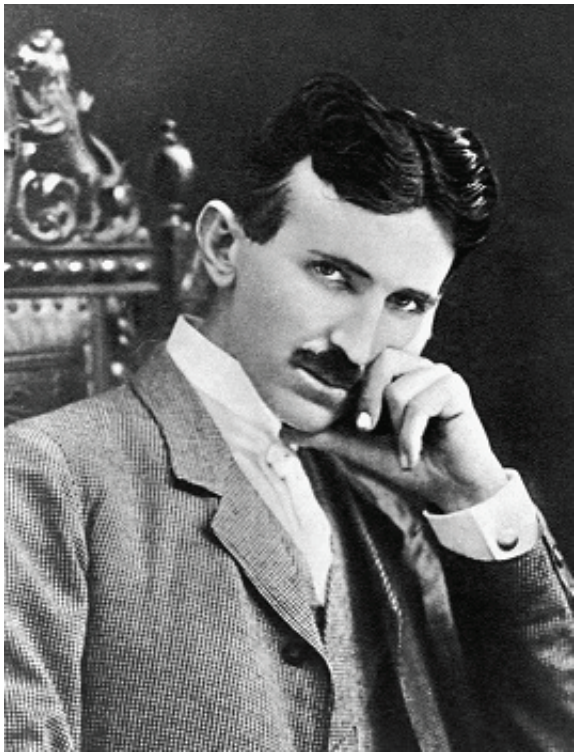
Lighting up the Brooklyn Bridge, NY

Edward Weston, President of AIEE [1888-89]

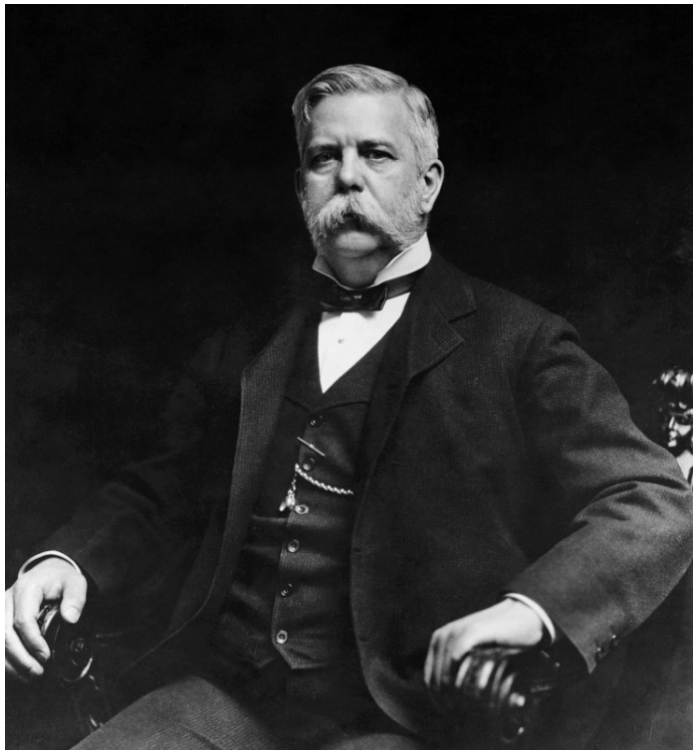
Illumination of Brooklyn Bridge [1899]

Source: Wikipedia, Brooklyn Bridge Gallery, https://www.123rf.com/stock-photo/brooklyn_bridge.html, April, 2017.

Beginning of Polyphase AC Power



Nikola Tesla – pioneered AC supply system



George Westinghouse

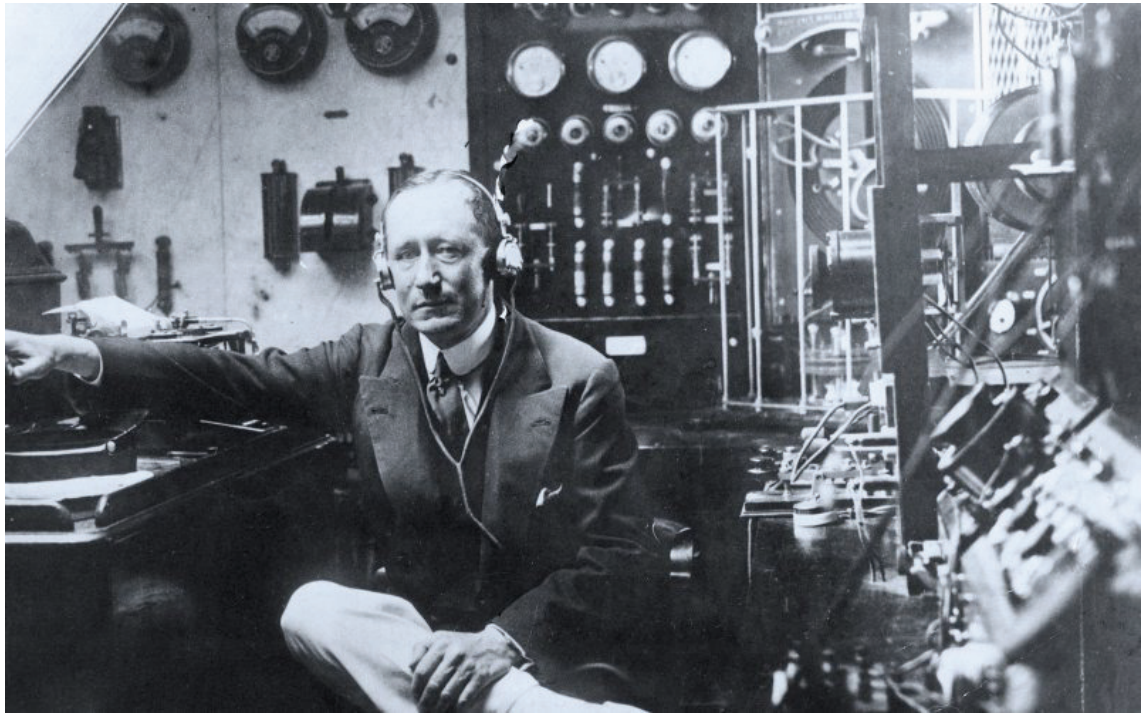
Source: PA History, http://study.com/academy/lesson/nikola-tesla-george-westinghouse.html/, http://explorepahistory.com/hmarker.php?markerId=1-A-3A0, April, 2017.

The First Telephone Call

Made on 10th March, 1876– Alexander Graham Bell in his Boston Laboratory calling Watson

Source: America's Library, http://www.americaslibrary.gov/jb/recon/jb_recon_telephone_1.html, April, 2017.

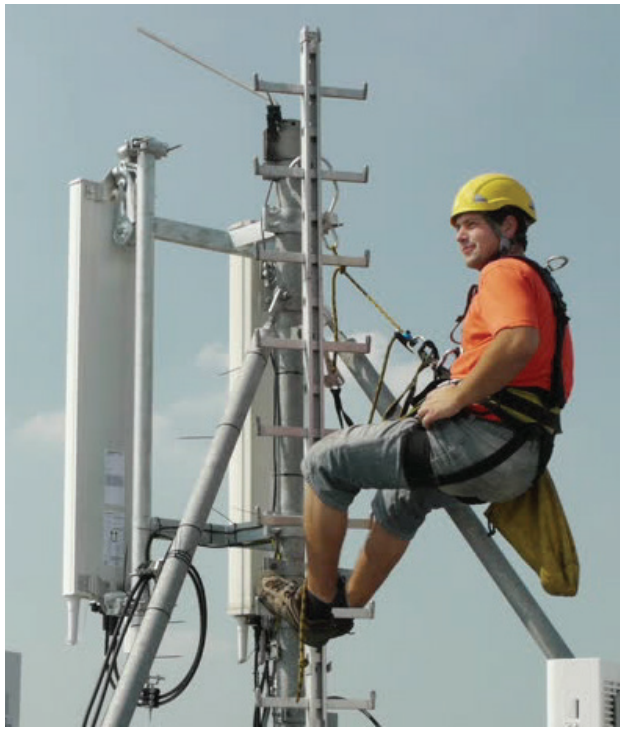
Wireless Telegraphy



Guglielmo Marconi, inventor of wireless telegraphy in 1896

Source: Wireless Telegraphy, Wikipedia, April, 2017.

Today's Wireless Phones



Telecom Tower

Source: Mangalam Internet Services, StockClip, http://www.mangalaminternet.com/, April, 2017.

Evolution of the Telephone

Normal Phone

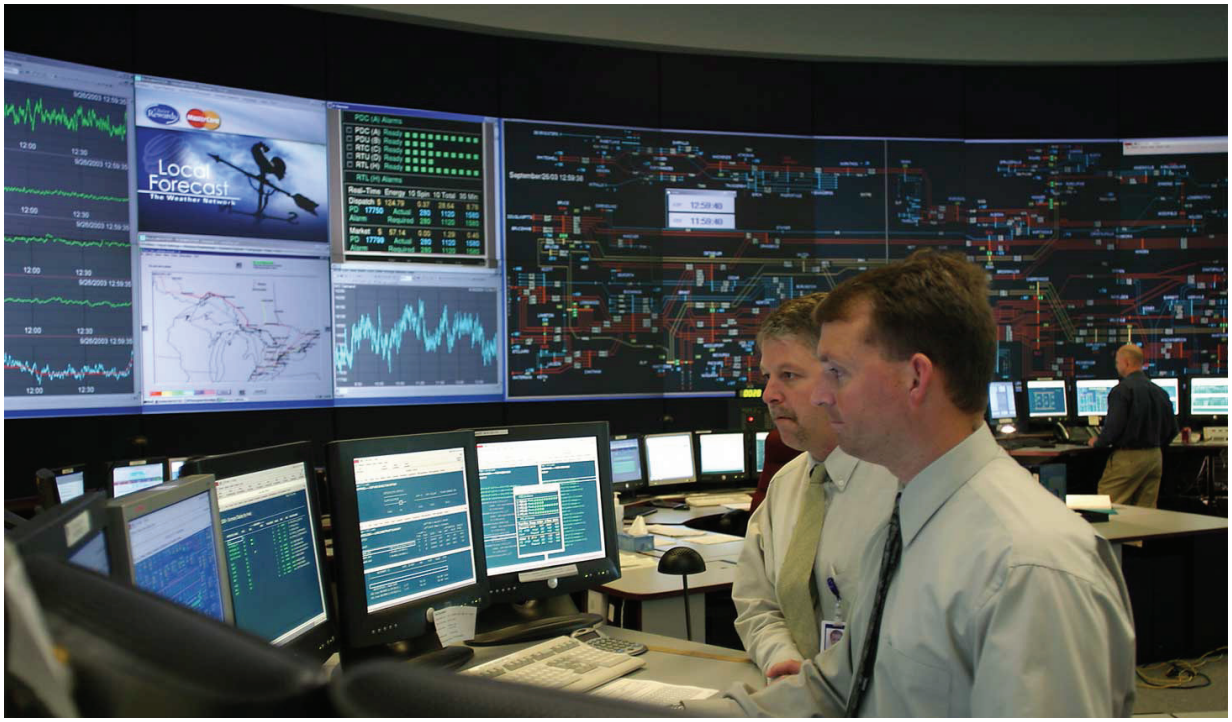
Smart Phone

Electric Power Grid: Past & Present

Source: http://www.jlsteelstructure.com

Source: www.sxc.hu

SCADA System



SCADA system for monitoring

Source: All about circuits, https://www.allaboutcircuits.com/uploads/thumbnails/scada.jpg, April, 2017.

Evolution of the Sources of Electricity

Solar Power Plant

PV Power Plant

Source: U.S. Air-Force, http://www.af.mil/News/ArticleDisplay/tabid/223/Article/486227/nellis-afb-to-add-second-large-solar-plant.aspx, April, 2017.

Wind Farm

Wind Farm 1

Source: GAS2, http://gas2.org/2016/10/17/carbon-emissions-power-generation-25-year-low/, April, 2017.

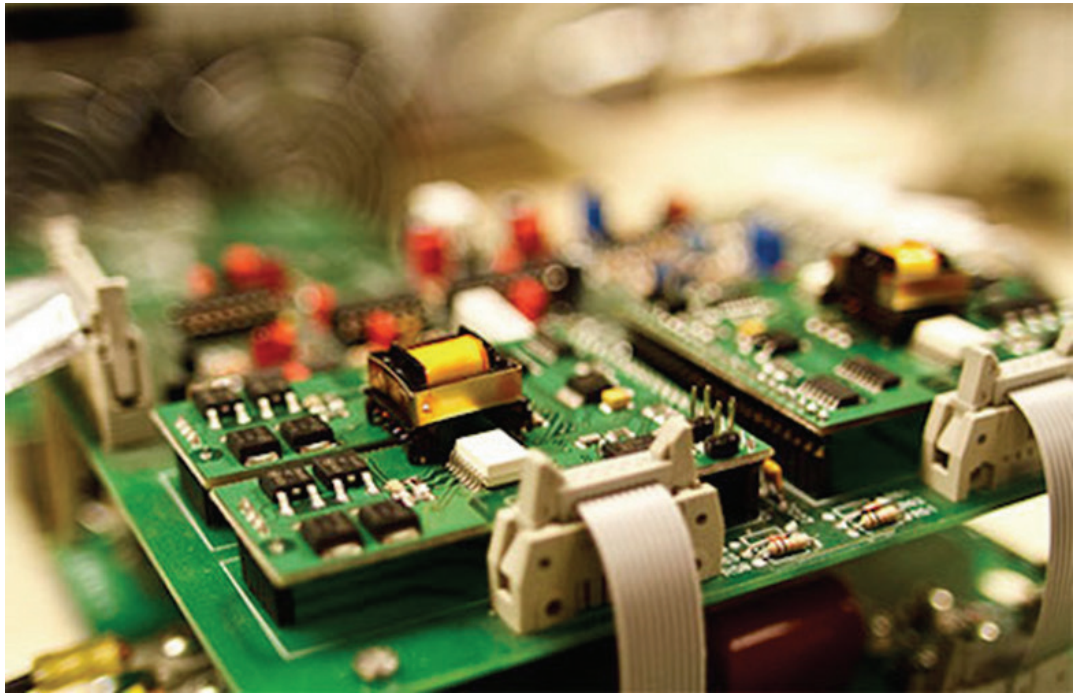
Large Scale Hydroelectricity

Hydro Power plant – Three Gorges Dam, China.

Source: Environmental Portal, http://portal.rebia.org.br/agua/10329-mundo-pode-ter-so-60-da-agua-que-precisa-em-2030-diz-onu, April, 2017.

The Use of Other Technologies In Electric Power Systems

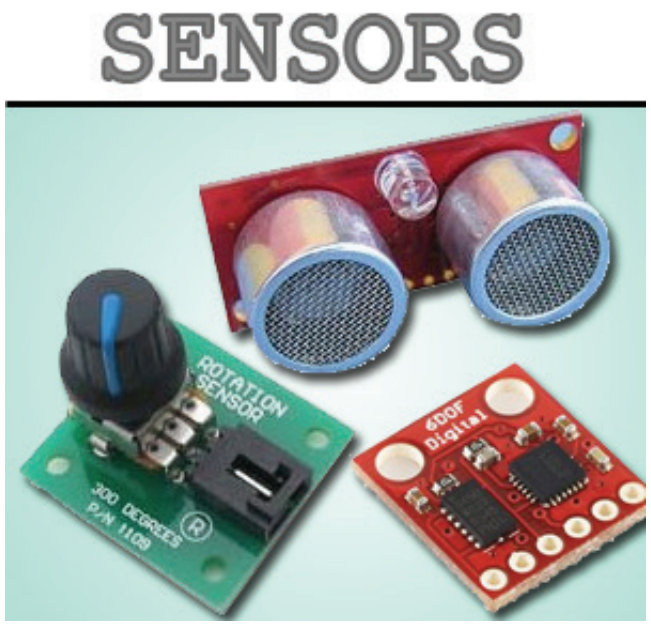
Power Electronics



Power Electronics

Source: Electronics for you, http://www.thesis123.com/power-electronics-and-drives/, April, 2017.

Sensors



Sensors

Security

Source: Robotshop, LOREX, http://www.robotshop.com/en/contact-sensors.html, April, 2017.

Electric Power Industry is the Playground

Build (almost) anything you want

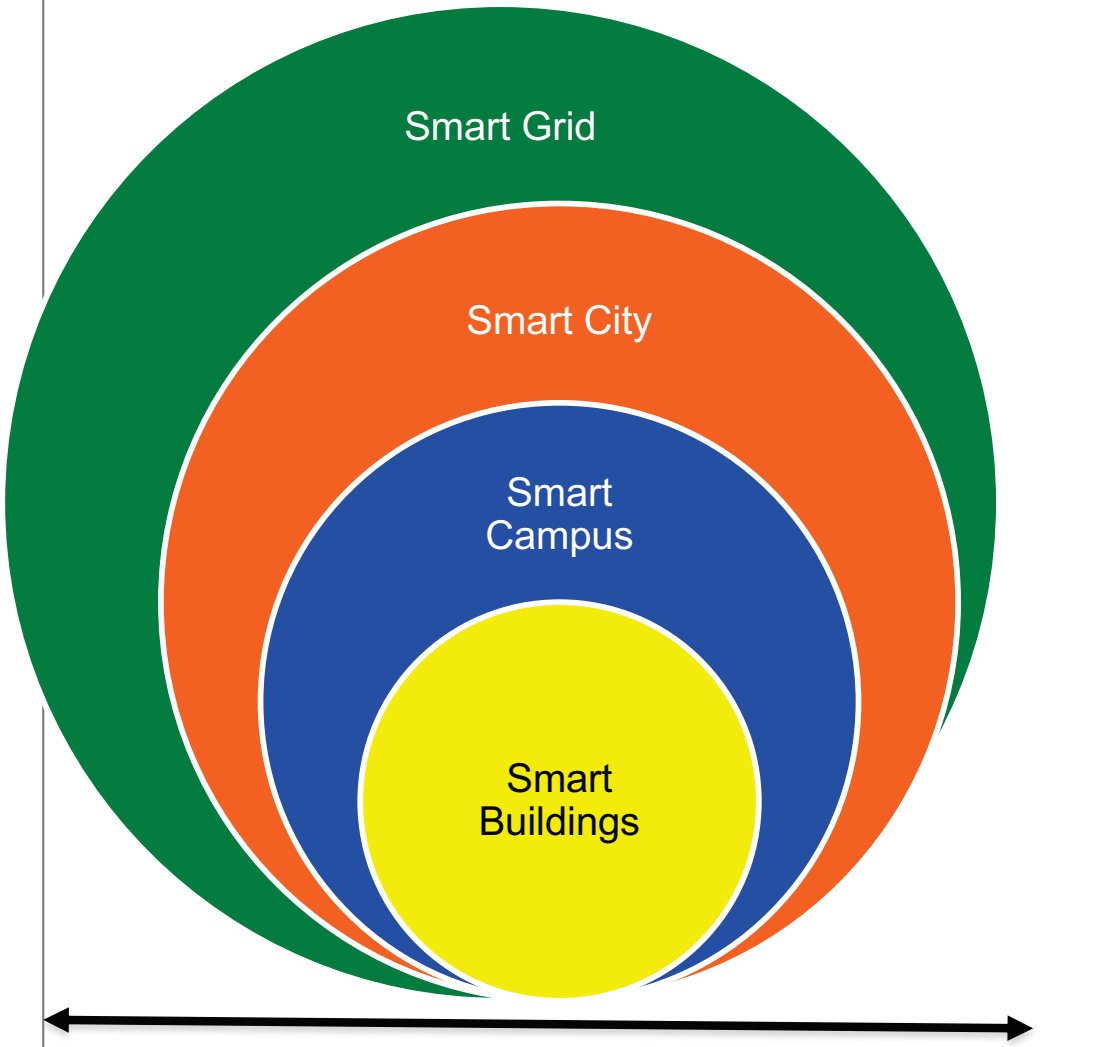
In a safe environment, with clear boundaries and safeguards

We may relax some (but not all) of our rules

Consequences of failure can be contained

Source: Bank Negara Malaysia, https://www.slideshare.net/itrain1/mdec-fintech-conference-facilitating-innovation-through-the-fintech-regulatory-sandbox-bank-negara, April, 2017.

The Smart Grid Ecosystem



Supported by ICT and distributed networks of intelligent sensors, data centers/clouds

Smart grid: Bi-directional flows of energy, remote control/automation of power, integrated distributed energy…

Smart city: Complex system of interconnected infrastructures and services…

Smart Campus: A collection of buildings managed by the same facility manager…

Smart buildings: Intelligent building automation systems, smart devices, productive users, grid integration…

Electric Power Engineering Past, Present and Future

- Electric power is the foundation of electrical engineering
- Electric power industry has encompassed other areas of electrical engineering to provide a robust power supply network
- Renewable energy, smart grid, smart cities, new applications of electrification, etc. will define the future of this industry

Prof. Saifur Rahman

Past-President of IEEE Power & Energy Society
Past-Chair, IEEE Publication Services & Products Board

PES accomplishments:

- PES University
- PES Corporate Engagement Program
- PES Chapters' Councils in China, India, Africa and Latin America

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