ETHICS AND ECO-DESIGN FOR COMPLEX USES OF ENERGY

Giuseppe Parise (L.F. IEEE)
parise@ieee.org

Mara Lombardi
mara.lombardi@uniroma1.it

Abstract. A new scope of the electrical engineering shall be the ethical design and management, the environmental sensitivity. The technical implication of electrical engineers is increasingly to promote a methodology of development, growth and progress towards the innovations of electrical technologies. Eco-design of power systems has to balance active intelligence of system components with passive intelligence of system structures. It has to combine energy saving and rational use of energy with the exigencies of service continuity, energy quality and electrical safety with a unitary and coordinated vision of the other non-electrical needs. The technological innovations of Internet of Things and digitization determine a complex spatial-temporal reality consisting of structured microsystems and virtual-dynamic systems. Their complex interactions operate in a simple way with a local management based on the principle of adjacency of the flock logic. It is urgent the human society becomes aware of the electrical ethical rights and claims them before their complete compromise. Essential electrical rights of the users are, in synthesis, system and equipment ownership, sustainable innovations, use of equipment life cycle, good operability, micro approach design, defense of electrical structuration, energy communities, society of things, socialized process, reparability and unification, auto protection of special exigencies of appliances.

Key words: Ecological transition, Microgrid, IoT, Design Criteria, System Distributions.

I. INTRODUCTION

The sustainability is an ethical principle founded on generational equity, global justice and protection of the environment. A sustainable future cannot be separated from a lifestyle change, new technical rules and a revised acceptability of residual risks. Certainly, the solution to the problem of general sustainability against the risks of climate degradation and in favor of the rational use of energy is necessarily based on the popular will and on the action of individuals to implement a change of lifestyle in compromise with the acceptance of the residual risks of the measures to be adopted [1].

The present codes for electrical design, installation, and inspection contain provisions that are considered necessary for the safety. Electrical equipment and systems which are in conformity with standards shall be presumed to be in conformity with the objectives of not to endanger the health and safety of persons and domestic animals, or property [2, 3]. An investment is considered sustainable if it “does not significantly harm” (DNSH) any environmental or social objective [4]. In the digital age, it is necessary to recognize a technological ethics in the user-system relationship to guarantee of “free will" (decision-making) and for the electrical energy use and for an eco-design of power systems (benefits-risk exposure) [5]. In the age of smart things, it becomes essential to compensate in an equilibrated way the active intelligence of the components of systems designed with an intrinsic/passive intelligence (healthy mind in healthy body).

Ethics can be defined by what it is for, it is constituted by the means to implement it (deontology) and it is measured by the results (consequentialism). It is, therefore, a "normative" and "social" set of rights-duties of technical coordination. In order to safeguard the technological rights of users, ethics has to set limits between users and the market, between the different technologies such as between electrical structures and electronic innovations. Essential electrical rights for the users are, in synthesis, system and equipment ownership, sustainable innovations, use of equipment life cycle, defense of electrical structuration, society of things and socialized process, reparability and unification, auto protection of special exigencies of appliances, energy communities, good operability, micro approach design [6].

The eco-design of a system is the design that already in its very preliminary phase considers the efficiency of the system in defining the "genetic code" for a planned development of the subsequent phases aimed at executive installation, at operation and maintenance management.

In the system design, the engineers’ responsibility is to achieve the objectives of safety, power quality, load optimization, energy management and emergency systems, through the integration of all environmental aspects in the design of the system and its components with the aim of improving environmental performance as a whole life cycle [7]. The backbone of a system is ordinary in its structure, while the design of the single system requires the definition of the genetic code of its life cycle development. In our case of electrical systems, the identification of the load areas, the different requirements and environmental conditions shall affect the design of the electrical systems, in its topology and partitioned configuration in coordination with the guarantee of service continuity and safety. Intelligent management of energy and the balance between cost and quality require creativity that can reveal opportunities, mitigate risks and support strategic decision-making in management.

In fact, the eco-design aims to configure a system topology suitable to integrate all environmental aspects, including also criteria against the catastrophic events, when necessary, and to improve the environmental performance throughout its whole life cycle. The designer has to evaluate initial costs for installation aspects and to consider energy performance and the maintenance costs for operational aspects.

II. ELECTRICAL ETHICAL RIGHTS

In this present digital age, smart innovations, as Internet of Things (IoT), present exciting occasions, but impact ethical and social aspects to human society and impact technical solutions towards the power systems [8]. It is necessary a general campaign for an ethical design, installation and management, with sensitivity for the environment and the social implications. Innovation requires a wise balance that must limit the whirling processes in the name of the new which is not always better than the old. It is urgent the human society becomes aware of the electrical ethical rights and claims them before their complete compromise, with an opportune action on the political class and on the lawmakers.

The electrical ethical rights must safeguard the sustainability of the system and the technological components; the issue is that each user participates in the benefits and relative risk-exposure and maintain the decision in their choice and management (benefits /risk-exposure/ decision-making). The three roles are basic in concurring to characterize the ethical rights [5]. The exposures to avoid are the risks of health, personal data losses and higher costs

Role of receiving benefits

1 Right to have guaranteed the life cycle of equipment

The discontinuity of innovations that leads to greater continuity of competitive primacy of companies must be contrasted in the interest of the human society. It is necessary a balanced conciliation between market interests and user rights and in the guarantee of a life cycle of the products.

Inopportune changes in the software and hardware of electronic components of electrical assistance cause relevant problems because in shorter time these changes disable equipment and make digital works inaccessible. A solution is the establishment of a software archive for long-term accessibility.

2 Right to repair and to have a possible unification of all the devices for a circularity of elements

It certainly appears required to allow the maintenance accessibility and the right to repair devices especially electronics, independently from manufacturers. It must be guaranteed to upgrade the devices by substituting parts and not by their complete substitution. It is desired all possible unifications for the elements that can be standardized against irrelevant innovations. These two aspects allow also favoring the circular reuse of equipment.

3 Right to have a sustainable "genetic code" in the eco-design of electrical systems

The efficacy in the use of electrical loads is the issue of power system efficiency. The engineers' responsibility is to aim on both the "installation approach" and the "operating approach" as criterion of the electrical power systems eco-design. This In-Op design [9] considers the gap on load in selecting the rating P_B of components but also their gap on lifetime with an actual life loss lower than the time from installation. It is well known that the load diagram of the absorbed power P(t) varies in the operating time t_{op} (cycle as minutes, day as 24 hours, year as 8760 hours) and the integration of P(t) in the same t_{op} calculates the consumed energy E. Therefore, it is possible to evaluate the average power $P_M = E/t_{op}$ and the duration of utilization $h_u = E/P_B$ of the maximum value of the design power P_B. A parameter characteristic of the In-Op design, is the ratio $h_u/t_{op} = P_M/P_B$ between the mean value P_M of operating power and the P_B value of the design power [9]. The design power P_B governs the prospective rating of components, but the mean power P_M is the reference to evaluate the actual energetic operation of the system. It is necessary to avoid using components that with a short use do not even manage to amortize the pollution caused during their production. For example, it appears not correct to impose Light Emitting Diode (LED) lamps and to prohibit incandescent lamps, because they are not very efficient, even in cases where their use is only a few hours a year and the power absorption is however relatively low.

Role of avoiding risk-exposure

4 Right to convenient and sustainable innovations

The human society must defend itself against the product discontinuity to satisfy ineffective exigencies, must favor the innovations that guarantee the essential functionalities. A huge publicity campaign of innovative technologies as an infodemic campaign drives the unconditional attention by users to the search for the most innovative products in the name of an ecology unbalanced to the actual results and of benefits of some performances that are rarely used. Generally, all the innovations, positive and negative /trivial (logic ±1), present a high impact with the appeal of novelty (logic $\pm1^2$), much amplified with a huge publicity via web and social media (logic N^n). An infodemic is an excess of information and disinformation that flows across digital and physical environments (logic product $\pm1^2 N^n$). This powerful impact cannot be eliminated, but it can be managed by prompt counter information (logic $\Sigma\pm1=0$).

Misleading advertising must be sanctioned to those who make it and to those who allow it: it is a corporate social responsibility [10].

5 Right to a physical operation by design

An adequate system structure allows by design ensuring maintenance activities with partial and recoverable electrical supplying degradations and overcoming fault situations. The system configuration in case of failure of "smart" components allows inhibiting all them to enable a manual management. When load variation is desired/required, the distribution topology has to guarantee by design a basic manual adjustment of distributed loads as well as any automated system. An adaptive partitioned architecture either of electrical distribution system in proper circuits and of the loads in independent common and local systems [11, 12]. It seems essential to keep a mechanical switch for all mobile devices, avoiding the need to use the electric plug to connect and disconnect them.

6 Right to limit risk-exposure of devices

Electrical appliances that pose particular protection problems must be intrinsically guaranteed and not affect the sophistication and complication of protections that are aimed to the circuits and to the sockets and not to special exigencies of the plugged equipment. A relevant example is the protection of electric vehicle EV charging.

In the charging wallbox, the international standards require to install a type B RCD as exclusive exigency of EV [13] that appears recommendable to transfer to inside the car. In fact, in this manner, the function of the wallbox could be reduced to a charging PWM socket protected also by fuses, the wallbox management is relieved of responsibility from car internal faults and each car is guaranteed of a proper adequate protection self-controlled at each charging wallbox.

Role of decision-making

7 Right to acquire the full ownership of the proper system and devices

It certainly appears required to allow the full acquisition of ownership, management and use of the appliances to each user without intermediations. As relevant example, the cloud computing is useful in many applications, but must remain only an assistance in the rapport between users and devices. It is vital that the cloud does not insert as a mediation between user and own device. Internet, system software and software of worldwide public service cannot be privately owned; in history, even the greatest emperors were forced to yield.

It appears that a state enterprise or a United Nation enterprise is required for which the United Nations or states must have a significant control of internet and its neutrality in competition with private providers [14]. The internet services must be recognized public utility such as the water supply, sewer, gas and electrical energy. The digital technologies can increase the right to access to data and have to be a free property for humanity. Internet appears a new element to add to the four classical elements, earth, water, air, fire.

8 Right to organize communities of “socialized” smart devices

The IoT defines a global system of connected amenities, such as mobility, home automation, energy and many others. Therefore, the IoT users can institute "social" organisms, which can act as virtual dynamic systems that need electrical management and consultancy assistance [8]. Digitization and advanced communication networks will promote the spread of the Internet of things IoT and of the Blockchain.

The presumed impact of the IoT on the use of electricity can allow an epochal evolution in the structure and operation of electricity grids and facilitate the efficient establishment of electrical microgrids. The beneficial impact of the IoT is that it will allow a new role of the use of electricity emancipated from distribution, transmission and generation, the simultaneous use of energy can no longer be random. The IoT promotes the constitution of clusters of things involved in persistent interactions (society of things), such as appliances, cell phones, vehicles and countless other objects. A significant positive impact can occur on the production of household appliances. The possibility of communicating user microsystems through IoT creates the possibility of hinging on a dynamic microsystem that do not require a structure. It will be possible with the ability to delegate in programming their operation; dynamic microsystems will acquire a new role among the traditional macrosystems of distribution, transmission and generation.

The interaction of electrical equipment favors their "socialization", the better integration of which requires, as far as possible, a revision of their load profiles and their way of functioning, and a more "social" behavior of the loads requires new languages - codes for their identification. For example, the passage from a binary code (ON, OFF) to a ternary code (ON, NO-pause, OFF) allows to split the cycles, as far as possible, into smaller entities (atomization) that have less variations in power due to almost constant power and shorter duration, and facilitate integration [15].

9 Right to organize energy communities

The production of energy from non-programmable renewable sources requires first a revision of the regulatory rules with almost zero time constraints, without discriminatory values of power or unit identification based on the category of user. Vice versa, the regulatory rules have to favor the establishment of new energy utilization as poles of absorption of coordinated microgrids in achieving cost-benefit threshold values, both in terms of power and energy used.

So that the interventions of energy efficiency, generation from renewable sources and rational / intelligent use of energy are able to result in effective savings in the interest of the local community and in the purpose of the national strategic goal. Considering that renewable sources are capable of producing at low power density, but have the specificity of being Distributed Generations (DGs) on the territory, their production must be committed as far as possible at the local level, pursuing the condition of a community of almost zero energy use (from the network).

In this way, microgrids must essentially remain areas of load only passive for the grid, with a role evolved from centralized distribution, transmission and generation; this solution avoids the problems of congestion and inefficiencies for the grid highlighted by utilities. In other words and in perspective with the help of the digitization, the electrical utilization for the achievement of quality, continuity, energy saving and tariff objectives must be organized in microgrids. This process can start from the most important absorption poles, whose boundaries are naturally delimited, such as large shopping centers, hospitals, airports, ports, data processing centers, fire brigade headquarters, railway stations up to residential complexes and civil buildings. In these cases, the area of utilization is delimited by the common node of the main power supply, both in low voltage and in medium voltage, regardless of the ownership of the node itself. In the most significant situations, the legislation must facilitate the place-based approach of the fullest participation of all actors in energy planning with more effective and coordinated implementation.

10 Right to have an energy use independent from the utility network

A design criterion of electrical distributions is to structure the system based on a *micro system approach* that has to facilitate and coordinate the implementation of smaller sizes of components, energy and costs saving, independent distributions for the diverse load categories. The scope is to design the distribution in order to present a reduced or controlled variation of parameters around the "natural" values of load devices, correlated to the power rating, the cross-section of connectors, versus all prospective status changing for all the prospected system configurations. The *correlation* exists among the electrical parameters of the system components as short-circuit current, let-through energy, protective device characteristics, cable rate current [9].

Considering that the change of the supply status in a power system, as the change of the number of transformers in parallel, causes variations of the short circuit parameters sensitive on main levels more than on the branch circuits (*peripheral effect),* two basic criteria can be applied in modeling each distribution node:

- adopting higher sizes of distribution elements on main distribution adequate to the parameters variation during the system operation, assuming as reference the cable cross-sectional satisfying the admissible let-through energy,
- adapting the system arrangement to set the effective component on the branch distribution, assuming as reference the cable cross-sectional S satisfying the current-carrying capacity. It facilitates the microsystem approach that implements the smaller sizes of components highlighted by the natural correlation that exists among the system distribution parameters.

Achieving optimal safety, operating and selectivity conditions without particular sizing devices becomes a quality objective. An effective general criterion is to coordinate the structure of the system, so that the parameters of the electrical nodes can turn in a controlled manner around the natural values of the set-up in normal mains power regime towards alternative or emergency settings.

III. FROM THE SIMPLE TO THE COMPLEX USE OF ENERGY

The design of an electrical power system must analyze its needs with a multitasking vision and size the structure for operation in normal service and in abnormal conditions, coordinate the various components taking into account their evolution in the life cycle and the objectives to be to pursue. The eco-design must aim at defining an architecture based on the energy ethics of rationalizing the distribution structure and power sources.

It must combine energy saving and rational use of energy with the achievement of the primary objectives of energy quality, electrical safety and in particular of service continuity, indispensable in an increasingly connected world both in urban and rural locations. Each objective presupposes an extensive basic background that has various circular interactions such as with the environment and area situations, with other sectors besides the electrical sector.

Energy ethics in the configuration of the architecture of an electrical system, with more and more smart components, must define adequate solutions to achieve the primary objectives that cannot be renounced for an ecological transition. It can make possible an evolution from the status quo of technological and methodological saturation; it has to upgrade methodologies of development, growth and progress. The methodology of the development of electrical systems with the satisfaction of electrical needs in order to contribute to a real progress requires a unitary and coordinated vision of the other non-electrical needs that scales the weights of the various sectors for the global solution.

The electrical utilization areas must not be penetrated by a utility distribution system that satisfies general needs of the public network (macro approach), but must be conceived as a microsystem with proper and local exigencies. It presents, in relation to its essentiality, the need for continuity of operation and energy quality that cannot be satisfied by resorting only to power supply from alternative sources (multiple connections from the grid) and from autonomous emergency and microgeneration sources, but also by appropriately structuring the architecture of the internal distribution system, the proper micro distribution. The distribution topology has a vital impact on system performance throughout its life cycle. The architecture can be configured with an increasing degree of complexity in relation to the needs to be met, by acting on the distribution levels, on the redundancy of the distribution and power supplies, to guarantee the possibility of safe management and maintenance interventions, safeguarding the continuity of service.

The need for high availability / "integrity" of the loads is met by an electrical system architecture that allows overcoming maintenance operations and failure situations.

The electrical distribution system must guarantee integrity, especially in critical systems:

- powered by at least two independent delivery points (PODs), renewable sources and local emergency and continuity systems,
- configured with a system architecture for flexible electrical distribution with variable configuration [16].

Residential complexes and buildings should be effectively encouraged in the establishment of microsystems, which can integrate ecological environmental aspects electrical, utilization, favoring higher levels of [17]:

- energy efficiency with the adoption of intermediate voltage levels in the main low voltage (LV) distribution up to 1 kV (equal to the low voltage limit value in the new consolidated text on safety at work and in the International Electrotechnical Commission IEC standard) for powering large loads concentrated, such as common building air conditioning, powering electrified garages for electric vehicles and for more efficient distribution to local areas,
- energy quality such as the limitation of harmonic contents with the use of local transformations and the no-

distribution of the neutral in the intermediate distribution and a better balancing of the loads;

- upgraded safety due to the possibility of adopting a local TN system and additional measures (stand-alone TN, lower voltage values to earth as 115 V, etc., with propulsion to the production industry of local transformers for special user areas as three-phase-three-single phase and three-phase-single phase, amorphous iron core transformers),
- local direct current DC distributions.

Port areas need overall planning and efficient management to organize all its users as a common district suitable for the new energy service business (wise port) [18]. The electricity system must evolve to adapt to innovations (energy storage, electric vehicles, shore to ship, etc.) and accommodate local generation (offshore wind, photovoltaic panels, cogeneration and trigeneration) without creating chaotic phenomena. The port must convert to a Smart Grid and Microgrid.

IV. SERVICE CONTINUITY AND STRATEGIC STRUCTURES

The strategic objective of service continuity requires that the electricity grid be developed in a redundant manner throughout the territory, also considering the exposure to catastrophic events. In areas at risk of earthquakes, hurricanes, floods, extreme climatic conditions, strategic structures and structures equivalent to strategic are to be considered structures at greater risk.

Strategic structures need continuity in the service of technological systems (in particular electrical ones) such as hospitals, data processing centers, fire brigade headquarters, railway stations, airports, local coordination centers. These structures host services whose importance is relevant in normal conditions and becomes more relevant in situations of seismic events. Required performances can be the most advanced from an energetic-functional point of view, service recovery times from zero to a few seconds, as well as an adequate dedicated staff to management and maintenance. To ensure the seismic protection of non-structural components and the functionality of the service of the systems of a strategic structure, depending on the level of protection required, mechanical and electrical design criteria can be identified, both for installation, for choice and sizing, and for plant structuring. A necessary research section is certainly the qualification for the earthquake behavior of electrical components and installation methods in buildings of all types [19].The goal of modeling is the achievement of objectives without resorting to special components and complex designs. For mitigating the seismic stresses during an earthquake a specialized methodology is the Darwinian approach [20] that adopts the criteria of minimizing the weight of each component of the system and the seismic force exposure of the component by locating it as close to ground level as possible where the acceleration is lower.

In areas exposed to earthquakes or other disasters, where road-rail communication routes are vulnerable as well as electricity, telephone, water and gas networks, structures to be equated with strategic structures, such as schools, churches, hotels and residential sites, must be selected for a special function to be performed as a "safe-functional refuge" for the community (energy castles) [21].

These structures must be set up for the reversible function of active power system in emergency or special ordinary situations for the power supply of some local sites interconnected via the network available upstream or specifically created.

As resilient hubs, they are able to restore the service immediately after the disruption event, to offer an indoor and outdoor equipped areas as collection points for people affected by the disaster and to provide power to some basic other structures.

V. CONCLUSIONS

The energy transition can allow an epochal evolution in the structure and operation of electrical grids and micro grids with a notable propulsion of research and industrialization of new or renewed components. This evolution of power systems has to balance active intelligence of system components with passive intelligence of system structures and so poses the crucial exigency to claim some relevant rights before their compromise. The IEEE, the world's largest technical professional organization, can assist with an opportune action on the political class and on the lawmakers.

This evolution offers also considerable opportunities for the permanent design and the operation of power systems. The energetic transition require innovations, such as new topologies of modular, flexible systems, unconventional electrical distribution and enhancement of electrical safety in particular in residential complexes, the distribution of safety grounding as a new public service. The research for new necessary qualifications of systems and equipment, for new ecological prototypes required by the renewal of electrical equipment such as the IoT for their "socialization", in particular, programmable household appliances.

REFERENCES

[1]. Our Common Future 20.03.1987, Report of the World Commission on Environment and Development C:/Downloads/our_common_futurebrundtlandreport1987.pdf

[2]. NFPA 70, National Electrical Code 2020 Edition

[3]. IEC 60364-1 Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions edition 2009

[4]. Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment

[5]. The Ethics of Technology: Methods and Approaches by Sven Ove Hansson, Rowman & Littlefield Publishers; Annotated edition (March 8, 2017) ISBN-10:9781783486588IEC 60364-8-1 standard: the state-of-the-art for Energy Efficiency in electrical installations 2^ edition 2019

[6]. G. Parise “Eco-design and energy ethics of microgrids” 2021 IEEE Industry Applications Society Annual Meeting, Vancouver pp. 1-6

[7]. IEC 60364-8-1 standard: the state-of-the-art for Energy Efficiency in electrical installations 2^ edition 2019

[8]. G. Parise, D. Mohla, L. Parise and M. Lombardi, "IoT Innovations and Forensic Engineering in the Digital Age," in IEEE Transactions on Industry Applications, doi: 10.1109/TIA.2021.3057344.

[9]. G. Parise, L. Parise, J. R. Harvey and M. A. Anthony, "The In-Op Design of Electrical Distribution Systems Based on Microsystem Criteria," in IEEE Transactions on Industry Applications, vol. 54, no. 1, pp. 32-38, January-February 2018, doi: 10.1109/TIA.2017. 2743073.

[10]. T. M. Lechterman, R. Jenkins and B. J. Strawser, "#StopHateForProfit and the ethics of boycotting by corporations," 2021 IEEE International Symposium on Ethics in Engineering, Science and Technology (ETHICS), 2021, pp. 1-1, doi: 10.1109/ETHICS53270.2021.9632763.

[11]. G.Parise, L. Martirano, “Impact of Building Automation, Controls and Building Management on Energy Performance of Lighting Systems” 2009 IEEE/I&CPS Technical Conf., Calgary, Alberta, Canada, May 3-7, 2009

[12]. G. Parise, L. Parise, M. Allegri, R. Pennacchia, F. Regoli; G. Vasselli “Continuous Availability Lighting Systems: the Led Solution by Design” IEEE Transactions on Industry Applications Volume: 55, Issue: 6 , Nov.-Dec. 2019 Page(s): 5659 – 5665 DOI: 10.1109/TIA.2019.2937863

[13]. IEC 61851-1:2017 Electric vehicle conductive charging system - Part 1: General requirements.

[14]. J. Shakib and D. Layton, "Interaction between ethics and technology," 2014 IEEE International Symposium on Ethics in Science, Technology and Engineering, 2014, pp. 1-5, DOI: 10.1109/ETHICS.2014.6893461.

[15]. G. Parise, L. Parise, F. Di Paolo “Virtual Society of IoT Robosats and Emancipation of Electrical Utilization” 2019 AEIT International Annual Conference (AEIT) Firenze (IT) September 18-20 2019 DOI: 10.23919/AEIT.2019.8893313

[16]. G. Parise, L. Parise, M. Allegri, A. D. Marco and M. A. Anthony, "Operational Resilience of Hospital Power Systems in the Digital Age," in IEEE Transactions on Industry Applications, vol. 57, no. 1, pp. 94-100, Jan.-Feb. 2021, doi: 10.1109/TIA.2020.3032941.

[17]. G. Parise, L. Martirano and L. Parise, "Ecodesign of Ever Net-Load Microgrids," in IEEE Transactions on Industry Applications, vol. 50, no. 1, pp. 10-16, Jan.-Feb. 2014, doi: 10.1109/TIA.2013.2288225.

[18]. G. Parise, L. Parise, L. Martirano, P. B. Chavdarian, C. Su and A. Ferrante, "Wise Port and Business Energy Management: Port Facilities, Electrical Power Distribution," in IEEE Transactions on Industry Applications, vol. 52, no. 1, pp. 18-24, Jan.-Feb. 2016, doi: 10.1109/TIA.2015.2461176.

[19]. G. Parise, M. De Angelis, A. Reggio “Criteria For The Definition Of The Equipment Seismic Levels (ESL): Comparisons Between USA and European Codes”- Industry Applications IEEE Transactions on, 2014 Vol. 50 Issue 3

[20]. G. Parise, M. De Angelis and A. Reggio, "A Darwinian evolution of electrical power systems design for preventing seismic risks in sensitive buildings," *2011 IEEE Industrial and Commercial Power Systems Technical Conference*, 2011, pp. 1-6, doi: 10.1109/ICPS.2011.5890889.

[21]. G. Parise, L. Parise, L. Martirano “Energy Castles” Equalized to Strategic Structures for Disaster Recovery in Emergency - IEEE IAS Annual Meeting, Cincinnati OH USA October 1-5 2017

BIOGRAPHIES

Giuseppe Parise (M’82-SM’03-Fellow 10-Life Fellow 15)) received his M.S. degree in Electrical Engineering from the Sapienza University, Rome Italy in 1972, where formerly Full Professor of Electrical Power Systems He is active in the IEEE Industry Applications Society (past Member at Large of Executive Board), chair of the two subcommittee I&CPS Forensics and Ports, Distinguished Lecturer 2019-2021. He is chair of the R8 Area Chapter and of the Italy Section Chapter IA34, Associate Member of Governors Board of Society Social Impact Technology SSIT. He is President of Association Safety Technology Research for Industry (ASTRI), Since 1975 Registered Professional Engineer .

Mara Lombardi received M.S. degree in Engineering for the Environment and the Territory (old system), at University "Sapienza" Italy in 2003 and Ph.D. degree in Risk analysis of road and rail tunnel from the Sapienza University, Rome Italy in 2008. Since 2003, she has been with the Department of Chemical Engineering Materials and Environment, Faculty of Engineering, Sapienza University of Rome, where she is currently Assistant Professor of Safety and risk analysis. She is the Teaching Commission President of the Degree Course in Safety Engineering of the Engineering Faculty of the Sapienza University of Rome. Since 2008, Registered Professional Engineer.