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IERE Technology Foresight: In-depth research on Artificial Intelligence (AI)

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Executive summary

Artificial intelligence (AI) is currently a widely-discussed topic; it is perceived as a disruptive family of technologies with potential impacts on several aspects of society including electric power companies. Although AI has undergone several hype cycles, it is very likely that it is undergoing a breakthrough currently. Several drivers are pushing AI technologies into practical and value-adding applications that can replace and improve traditional processes and methods. Such drivers include high volume of available data, exploding computing power, faster data transfer rates, and declining data storage cost. In fact, several well-established AI applications already exist as showcased by the AI use-cases of the IERE members presented in this report.

This report aims to provide an improved understanding of the capabilities of AI including a survey of the current AI tools, its limitations and associated challenges, and recommendations on how to harness this family of technology.

The findings and recommendations are presented under the following four topics:

1) **Utility's Data Management is the core of any AI Strategy**: Electric power companies are required to manage large volumes of data generated by the generation, transmission and distribution of power, and retail businesses. AI requires big data for machine learning; therefore, utilities need to strategically capitalize on the fact that they are equipped with this vast resource for different existing and future utilizations. As a part of normal operations, power companies need to equip and prepare their workforce, update their technology platform(s), and proactively develop innovative applications. This may include capturing expert knowledge of the power sector using AI techniques and retraining/reshaping the workforce to support the changes. For instance, machine learning training should be provided to in-house experts, and different AI tools should be tested to build new application(s) and/or refine existing ones. Moreover, data with sufficient quality is of fundamental importance to develop successful AI applications. In addition, big data resources come with big responsibilities. Power companies must ensure that the source, utilization, and ownership of data not only comply with all regulations but also be aligned with the expectations from society, especially in terms of ethical use of AI.

2) **Impacts of AI on power systems and the society at large might be profound:** With the rapid deployment of Internet of Things (IoT), and ubiquitous and extremely fast connectivity, the adoption of the digital future by a utility will likely be unique to it. Additionally, the pace of adoption will also be specific to each utility. AI may profoundly impact the society: AI is

capable of changing customers' behavior, decision making processes, interactions, and social responses; therefore, how AI would be adopted in a specific community and society is currently uncertain or unknown. Furthermore, with the lack of appropriate and up-to-date regulations, and potential bias, misrepresentation, privacy, and ethical considerations of AI applications, a wide range of research, analyses, and discussions are needed in the near future.

3) **Balanced partnerships or cooperation with tech giants may be a double-edged sword**: AI developments and expertise are most advanced within the tech giants such as Alibaba, Amazon, Apple, Baidu, Google, IBM, Itron, Microsoft, Tencent, Samsung, Siemens, Schneider-Electric, Oracle, and Xiaomi. Their common aims are to accumulate maximum possible data in different sectors, develop new services based on this data, and continue improving the performance and results of their AI tools or platforms. There are few AI experts and trained personnel within the power sector currently; therefore, the experience and guidelines needed to formulate balanced contractual and/or cooperation agreements with these tech giants may be useful for IERE members. Through improved information exchange amongst peers, power companies can better protect their expertise and interests while accelerating the development of AI applications within their jurisdictions/domains in a fair and sustainable manner.

4) **Strengthening the cooperation on AI among IERE members is required**: There are few domain and AI experts within the utilities currently to leverage the international expertise and information exchange platform within the IERE community, more cooperative projects/programs among IERE members are needed for developing the AI technology and applications for dealing with eminent AI solution developers, and for gaining social acceptance of its utilization.