Project Title: Design of power quality laboratory for cryptocurrency mining systems

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Project Necessity:

The power quality is one of the most important issues in the power grids. The increasing trend of the sensitivity of electrical equipment to voltage quality and, at the same time, the growing trend of using devices that produce power quality disturbances has made the efforts to reduce power quality related disturbances is of particular importance.

In recent years, the causes of power quality phenomena were limited to some industrial devices such as arc furnaces and welding machines. But today, the use of new industrial loads such as power rectifiers and drives, the small loads in residential homes and commercial and office places such as energy-saving lamps, dishwashers, personal computers, etc. have become very popular as the main factors in creating power quality phenomena.

Power system operators try to eliminate or reduce the effect of these factors in order to meet the expectations of customers and gain their trust in addition to providing electricity with the desired quality. The cryptocurrencies have become very popular over the past several years in Iran along with all over the world. One of the concerns in this field is the amount of energy consumption in the process of mining and their impact on the power grid. Therefore, some criteria in determining the tariff for electricity consumption and providing the relevant connection have been announced by the Ministry of Energy and Tavanir Company. In addition to these limitations, it is necessary to consider the technical requirements for cryptocurrency miners so that all of these devices comply with specific instructions and requirements and do not adversely affect the power grid.

Considering the letter No. 58144/T55637 on 13/05/1398 regarding the announcement of electrical power quality standards for the production and import of cryptocurrency processing equipment by the National Standard Organization of Iran in cooperation with the Ministry of Energy, a symposium was held on the preparation of a roadmap for standardization of this equipment with the presence of related organizations. In this regard, the task of determining the power quality requirements of miners was assigned to Niroo Research Institute. Therefore, a project was defined in the Power Electronic Equipment Technology Development Center by the department of power systems

planning and operation. This project is being implemented in Niroo Research Institute, by the power systems planning and operation research group, and its national standard has been issued as the National Standard for Mining Equipment of Encrypted Cryptocurrencies – the Limits of Power Quality Disturbances for Cryptocurrency Mining Process - Part 1: Equipment Requirements. In this standard, the requirements of power quality phenomena include current harmonics and voltage variations.

According to the above-mentioned standard and the rules of the National Standard Organization, the tests of harmonic current and voltage variations of miners must be performed by laboratories that are approved by the "Evaluation and Compliance Council of Tavanir Company" as a valid laboratory in this field. Test methods should also be based on the latest version of the standards used in the national standard.

Project Goals:

The main purposes of this project is to design and prepare the necessary documents to set up a reference laboratory for the power quality of cryptocurrency mining equipment. The general stages of this project are as follows:

• Studies on the standard tests of power quality of miners

• Review of reference power quality laboratories in the world from both technical and economic point of view

• Designing a reference laboratory for power quality of miners and specifying equipment according to legal and technical requirements, including ISO/IEC 17025: 2017

• Feasibility study of using equipment made in Iran and determining the imported equipment with cost estimation

• Development of required test instructions and test sheets

• Determination of power quality tests of the cryptocurrency miner

• Checking the conditions for performing the tests

• Determining the technical specifications of the equipment required for the tests

• Investigating the available facilities in the Niroo Research Institute

• Investigating the available facilities in partner laboratories

• Preparation of documents for the power quality reference laboratory of miners

Abstract:

The project is divided into five stages. First, the necessity of design the reference power quality laboratory of miners is examined based on the relevant standards. In addition, a list of tests and the way to perform them is extracted and a list of the main required equipment is provided. In the second stage, the reference power quality laboratories inside and outside the country are reviewed from a technical and economic point of view, and the existing capabilities of

the Niroo Research Institute are also evaluated. Then, the technical specifications and approximate price of the required equipment are determined and the internal and foreign manufacturers are identified. In the fourth stage, all the requirements and conditions for the laboratory to comply with the IEC/ISO 17025 standard are specified. Finally, initial draft of laboratory instructions is developed and the required checklists and forms are prepared.

Steps and Methodologies:

Stage No.	Title		Method
1	Initial Studies		Studying the documents
	1-1	Examining the necessity of equipping and setting up the laboratory (reports, documents, and relevant standards)	
	1-2	Studying the tests and related standards and determining the list of tests and their scope	
	1-3	List of basic required equipment	
	1-4	Determining the necessary approvals for the laboratory	
2	Investigation of reference power quality laboratories in the world from a technical and economic point of view		Internet and field research
	2-1	Investigating the facilities of similar laboratories inside and outside the country, as well as the capabilities available in the laboratories of Niroo Research Institute	
	2-2	The economic study of setting up a power quality laboratory for miners	
3	Determining the technical specifications and approximate price of the required equipment		Negotiation with equipment manufacturers and importers
	3-1	Preparing the final list of test equipment and determining their physical and technical specifications	
	3-2	Identification of the manufacturers of required test equipment and comparison of their technical specifications, warranty, after-sales service, training, calibration certificate and approximate price	
	3-3	Providing a list of test equipment with approximate price, technical specifications, scope of work and purchase priority	
4	Determining other requirements such as the location specifications and the necessary infrastructure in order to set up the laboratory		Investigating the documents
	4-1	Specifying the required conditions for the installation and commissioning of each equipment	
	4-2	Determining the location and arrangement of equipment in the laboratory (in accordance with the requirements of ISO/IEC 17025)	
	4-3	Determining the environmental conditions of the laboratory so as not to invalidate the test results and how to monitor, control and record (according to the requirements of ISO/IEC 17025)	
	4-4	Predicting the necessary actions to meet the requirements of ISO/IEC 17025 regarding the traceability of measurements	
5	Providing the draft of laboratory instructions and standard checklists		Conclusion
	5-1	Providing the initial draft of test instructions and preparing the forms and checklists	

Main Results (technical outputs, patents, papers, books, reports, etc.):

Five volumes of reports for different stages