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**Project Title:** Drafting a regulation for the implementation of the critical peak pricing programs

<b>Department:</b>	Document on the development of technologies related to smart grids in the electricity and energy industry	<b>Employer:</b>	Niroo Research Institute
<b>Project/Program Manager:</b>	Hamidreza Arasteh	<b>Executor:</b>	Alireza Sheikhi Fini
<b>Project Financial Code:</b>	179001	<b>Project Quality Code:</b>	PSP1PN04
<b>Type of Project/Program:</b>	Based on an agreement	<b>Assistant:</b>	Technology

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#### Keywords:

Demand Response (DR), dynamic pricing, customers' baseline estimation, critical peak pricing, preparing a regulation, DR uncertainties, elasticity, possibilistic probabilistic model, Z-number.

#### Project Necessity:

Recently, due to the increasing electricity demand, the system planners should use all the available resources in an optimal way. Therefore, besides the generation units, demand side resources should be able to actively participate in the electricity delivery chain system. One of the main challenges of the operators is to provide the electricity demand in the peak load hours with an acceptable reliability level. Hence, Demand Response (DR) programs are introduced to enable the active participation of the demand side resources. DR programs could help the system operators to minimize the unplanned and costly curtailments during the peak hours or when the system reliability level is not well-satisfied.

Price-based programs are considered as one of the main approaches for managing the electric consumption pattern in peak periods. These programs are categorized into different classes that are different with each other based on the policies and their performances. Among the price-based programs, critical peak pricing programs are very important due to their high capability to reduce the peak load levels. In order to reduce the load levels during the critical hours of a year – when the electricity consumption level is very high, or the system reliability is in danger or the wholesale market prices are very high – the utilization of the critical peak pricing programs is an effective and suitable solution. The empirical results show that these programs could reduce the load levels to the desired levels.

#### Project Goals:

- 1- Investigation of the empirical experiences of the CPP programs;
- 2- Evaluation of the effects of the CPP implementation on the selected customers in Iran;
- 3- Drafting a regulation regarding the implementation of the critical peak pricing programs.

## **Abstract:**

The critical peak pricing programs are investigated in this project. Briefly, the following tasks have been considered in this project: recognition of the dynamic pricing requirements, investigation of different experiences for implementing the CPP programs, customers' baseline estimation, studying the effects of the CPP programs on the customers' consumption patterns, comparison of the effects of different tariffs on the consumption patterns of the customers, investigation of the effects of implementing different technologies on the CPP capacities, modelling the uncertainties of the DR, performing the numerical studies by considering different scenarios on the price and time periods of the CPP implementation (by using the load data of several selected customers in Iran), and drafting a regulation regarding the implementation of the CPP programs.

## **Steps and Methodologies:**

- 1- Recognizing the key concepts and dynamic pricing requirements based on the experiences;
- 2- Studying the customers' baseline estimation methods;
- 3- Recognizing the effects of the CPP programs on the customers' load patterns;
- 4- Investigating the effects of different tariffs on the penetration level of the DR programs;
- 5- Recognizing the effects of the implementation of the customers' control and communication technologies on the execution of the the CPP programs;
- 6- Modelling the DR resources by considering their uncertainties;
- 7- Performing the simulations and numerical studies in order to investigate the effects of the CPP programs on the load pattern of the selected customers in Iran;
- 8- Drafting the regulation regarding the implementation of the CPP programs.

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

- 1- Recognition of the key challenges and fundamental concepts of dynamic pricing programs;
- 2- Recognition of the customers' baseline estimation methods;
- 3- Investigation of the potential of the CPP programs;
- 4- Investigation of the acceptance level of the DR programs, as well as the effective factors on the customers' acceptance;
- 5- Modelling the DR resources by considering their uncertainties using the possibilistic probabilistic method (the DR uncertainties are modelled by considering two aspects: a) the uncertainties regarding the participation level of the demand side resources, and b) the participation quality that means the demand elasticity values);
- 6- Investigations to know how to determine the price tariffs and their effects on load curves;
- 7- Drafting a regulation regarding the implementation of the CPP programs.