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Newsletter

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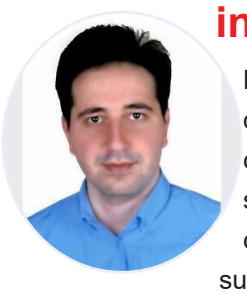
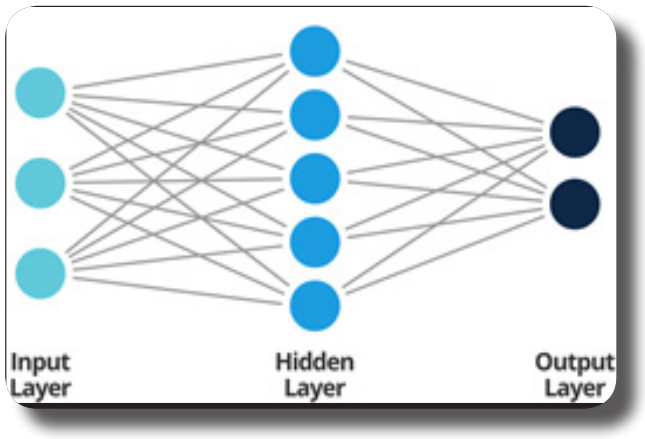
Message From Market

The Application of Artificial Intelligence in Power Systems



Nowadays, the power system complexity is dramatically increased. Therefore, applying the conventional techniques for analyzing the power system is more complicated and needs more computational burden. Therefore, the novel techniques such as Artificial Intelligence (AI) have been used to handle the mentioned challenges. In other words, the major concern in the operation of power system is to choose a computational tool which could give the requested results in the least possible time. Since AI can speed up solving difficult problems, It is particularly used in the operation of the power system. Artificial intelligence is a scientific discipline aiming to research, develop and simulate human behavior and its rules. AI techniques are including Brain Science, Neurology, information technology, and various discipline. Artificial intelligence is generally used to the project of developing systems equipped with the intellectual processes features and characteristics of humans, like the ability to think, reason, find the meaning, generalize, distinguish, learn from experience or rectify their mistakes.



AI technologies include the following techniques:

- Artificial Neural Networks (ANNs)
- Expert System Techniques (XPS)
- Fuzzy Logic systems (FL)
- Genetic algorithm (GA)

Artificial Neural Networks (ANN) are biologically inspired systems. ANN mathematical models simulate the human biological neural network for processing information,where each neuron produces one output as a function of inputs.

Each type of neural network is capable of some specific work after being trained and is able to conclude a function from observations faced in real life such as function approximation, classification, data processing, etc. Power system problems concerning the encoding of an unspecified non-linear function are appropriate for ANNs. ANNs can be particularly useful for problems that require quick results, like those in real-time operation. The reason of mentioned fact is related to ANN ability to quickly generate results after obtaining a set of inputs.

Fuzzy systems were developed in 1965 and had become popular in technical problem-solving. They are considered as mathematical means of describing ambiguity in linguistic terms instead of exact mathematical descriptions. Since it performs and can take a decision like a human brain, it can be standardized and systematized approximate reasoning. Therefore, with certain or even approximate information and data, it produces fairly accurate solutions. Hence, this technology is used in machines so that they can perform like a human. Fuzzy logic can be used for designing the physical components of power systems. They can be used to increase the efficiency of the components used in power systems. As most of the data used in power system analysis are approximate values and assumptions, fuzzy logic can be used to derive a stable, and relatively accurate output.

Expert systems were developed during the 1960s and 1970s and commercially applied throughout the 1980s. It is also called knowledge-based systems or rule-based systems. It is a computer program that incorporates knowledge derived from experts in a specific subject to provide problem analysis to users. This knowledge is generally stored in one of the many forms, like rules, decision trees, models, and frames. It uses this knowledge and interface mechanism to solve problems that cannot be or difficult to be solved by human skill and intellect. The common form of an expert system is a computer program containing the rules for analysis and recommendations for users. Expert systems are especially useful for problems when a large amount of data and information have to be processed in a short time. Many applications in power systems related to Power system designing and analysis match the abilities of expert systems.

The Genetic algorithm gives a global technique based on biological metaphors. It is an optimization technique based on the study of “Natural selection and natural Genetics.” Several methods for increasing the efficiency and analysis of power system to increase power output can be proposed, but out of these methods, Genetic Algorithms withstands all selected constraints. It is the best method for solving complex and nonlinear problems. Areas of applications in power systems include:

- Planning – Wind turbine positioning, reactive power optimization, network feeder routing, and capacitor placement.
- Operation – Hydro-thermal plant coordination, maintenance scheduling, loss minimization, load management, control of FACTS.
- Analysis – Harmonic distortion reduction, filter design, load frequency control, load flow.

The comparison of AI techniques is shown in the following table:

Feature	Approach		
	XPS	ANN	FL
Knowledge used	Expert knowledge in the form of rules, objects etc	Information extracted from the training set of cases	Expert knowledge in the form of criteria
Troubleshooting	Change of rules required	Difficult – the internal signals are almost impossible to interpret	Convenient– the internal signals are understandable and analyzable
Self-learning	Possible	Natural	Possible
Handling unclear cases	Possible	Natural	Natural
Robustness	Not critical and easy to ensure	Difficult to ensure	Not critical and easy to ensure
Computational burden	Extensive	Dedicated hardware	Moderate

There are some real world applications of AI techniques in power system. For instance, Startup Upside Energy provides a service that distributes energy in the power grid using machine learning algorithms and artificial intelligence. Under the control of artificial intelligence, power stations, energystorage, and solar batteries are already working. That is why, experts believe that artificial intelligence will soon become an integral part of energy. Upside Energy creates a virtual energy storage. It reduces the load on the power plant. If somewhere there is not enough energy, then under the usual scenario, power plants are forced to increase speed by burning additional fuel. Upside Energy uses predictive algorithms and knows in advance where and at what point the network will overload. With such information, the system automatically redirects the power of neighboring stations and small energy sources to compensate for voltage surges. As a result, the surplus is consumed efficiently, and additional fuel is not needed to generate additional capacity. The service coordinates the work of batteries and generators at 40 sites. Meanwhile, computing power allows you to support thousands of objects, including electric vehicles, solar panels and uninterruptible power supplies. Upside Energy has signed an agreement with the UK›s national energy network to provide precise frequency control services. This means that in case of system overload, the company takes on the job of reducing the load.

Artificial intelligence provides unlimited possibilities for the development of power systems. In the future, the structure and operation mode of power grids will undergo major changes. New material technologies will be widely used in power grids, and physical grids will be highly integrated with information systems. In the promotion of artificial intelligence development and application, it has advantages in data, capital, application scenarios, etc., but currently there are shortcomings in hardware, basic algorithms, and talents. Therefore, development of artificial intelligence algorithms and implementation of the related technology and tools has to be done to overcome the mentioned challenges.

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PhD in Electrical Power Engineering, System & Energy Studies Center

New Field

Developing Strategy of Smart Gas-Metering Infrastructure for National Iranian Gas Company

The value of clear knowledge regarding production, consumption, equipment at pressure gauges and gas stations, and alsouncounted gag is known for everyone. These useful data will lead to online monitoring and efficient management and planning.

Therefore, in line with the agreement between the National Iranian Gas Company and Monenco Iran Company, Smart Solutions Department of Monenco has started its studies for defining the necessary requirements for various gas stations to increase the visibility of the gas network and transfer field data to the gas monitoring center. The purpose of this project is to develop the necessary strategies for stablishing the smart metering infrastructure of Iran's National Gas Company and transfer metering data to the center in order to optimal management of the energy network. Implementation of smart monitoring and measurement system in the National Gas Company will play an effective role to increase the visibility of the gas network, standardize measurement indicators (such as gas analysis) in accordance with international standards, increase measurement accuracy, reduce the likelihood of human error, enabling integrated monitoring and management. By finalizing the project and achieving all the pre-determined goals, the National Gas Company will be able to identify important parts of the national gas network that lack intelligence and implement the smart metering infrastructure efficienly. The following is a description of the services of Monenco Company, which has been determined in 4 phases during 12 months.

Phase 1- Comprehensive study of the current situation and extracting requirements of different units

Phase 2- Reviewing the required reports of the National Gas Company based on the agreements of various contracts with companies and affiliated organizations, including refineries, transmission companies and gas supply companies

Phsae 3- Gap Analysis and Determining the requirements of an integrated management system

Phase 4- Prepare Tender Documents

Sample Projects

Site Supervision Services for Construction at Industrial Cities Projects in Fars Province

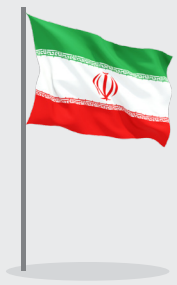
Start Date: 2021
Client: Fars Industrial Cites Company
Location: Iran

Description: Fars Industrial Cities Company has been created with the approach of establishing a dynamic and knowledge-based organization in line with global development in order to increase the share of industry in the country`s gross domestic product (GPD) by emphasizing on development and completion of all required infrastructures, establishment of industries in cities and industrial areas and improving the business of small industries.

Phase 2 of Khorramabad Power Plant (Gas Portion)

Start Date: 2021
Client: MAPNA MD2
Location: Iran

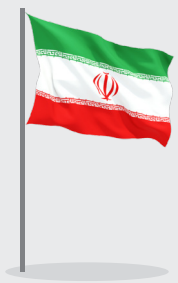
Description: Monenco Iran has recently signed a contract of “Civil and BOP Basic and Detail Design of Phase 2 of Khorramabad Power Plant (GAS PORTION)”. The importance of the project is completing the whole project of the Khorramabad Power plant and increasing the grid capacity.



Engineering and Supervision Services on Contractors Operations in Koh-e-Lar hydrated lime

Start date: 2021
Client: Iranian mineral production and supplying Co. (IMPASCO)
Location: Iran

Description: The increase of industrial needs for lime in recent years due to the construction of new production units and development projects in various industrial sectors, it is foreseeable that it will not be possible to meet the country’s need for lime with existing lime production units. Therefore, the IMPASCO will construct a hydrated lime factory in Charam - Kuh-e Lar.



Consulting Services for Design and Supervision of Mechanic, Electric, Architecture, Structure, Equipment, Execution, Installation and Maintenance of the 1300 square meter Industrial Refrigerator of Tehran General Warehousing and Customs Services Company

Start date: 2021
Client: Tehran General Warehouses and Customs Services Company
Location: Iran

Description: Today, due to the increasing population growth and foodstuffs consumption on the one hand and the importance of reducing the rate of waste of food and pharmaceutical products on the other hand, the use of industrial refrigerator (cold storage) has become a major need of processing and food industries. Rising prices and declining natural resources are other factors that have made the use of standard cold storage an inescapable necessity. One type of refrigerator that is used for the purpose of storing in the short term and temporarily is the customs cold storage.

The industrial refrigerator with an area of 1300 square meters is one of the largest industrial refrigerator in the company of public warehouses and customs services and the maintenance of goods with the highest standards is particularly important.
So, based on the valuable experiences of Monenco Iran, this project awarded to Monenco Iran.

Sample Projects

Contributing Conceptual & Basic Design for Tang-e Bijar & Kamankooh Gas Compressor Station

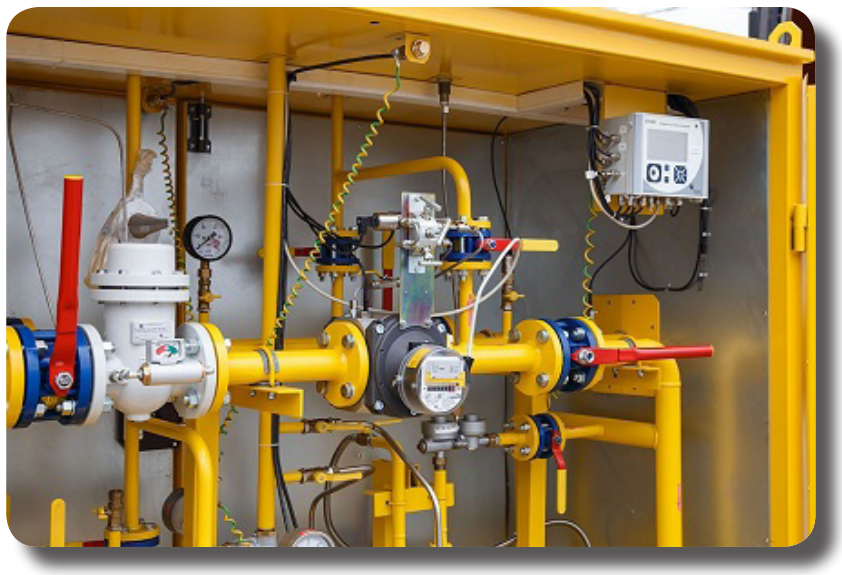
Start date: 2021
Client: Iranian Central Oil Fields Company
Location: Iran

Description: Considering the continuation of gas extraction from Tang-e Bijar gas field and forecasting the reduction of gas reservoir pressure in the coming years, Iranian Central Oil Fields Company decided to install a gas pressure boosting station to supply the required pressure. This Gas field is the only supplier of feed required by Ilam Refinery and if the gas pressure of Ilam Refinery decreases, feed supply to the refinery will be jeopardized.

Strategic Planning for Iran's Gas Smart Metering Infrastructure

Start date: 2021
Client: Flow Measurement Research Center
Location: Iran

Description: Energy network is an interconnected network that is created to transfer and deliver energy from production points to consumption destinations and includes production centers, transmission lines carrying energy from remote production points to consumption centers, and local energy distribution lines connected to energy consumers. Gas stations are established in order to perform measurement and filtration. Therefore, the purpose of the project is to perform comprehensive study on current Gas network and determining the necessary requirements and actions to be considered for increasing the visibility of the network in terms of measurement. The outcome of the project will lead to smart management of generated and distributed gas as well as identifying hidden amount of losses named as UFG.



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Sample Projects

Site Supervision Services for Construction of Projects in Garmsar Special Economic Zone

Start date: 2021
Client: Garmsar Special Economic Zone Management Company
Location: Iran

Description: Upgrading Garmsar region to an economic hub and creating a platform for investment in the region is underway. In this regard and based on the valuable experiences of Monenco Iran, the site supervision services of the project awarded to Monenco Iran.

Supervision Services for Development and Optimization Projects, Planning and Engineering Activities, Operation and Customer Services in Power Distribution Network

Start date: 2021
Client: Kermanshah Electricity Distribution Company
Location: Iran

Description: Monenco Iran has succeeded in obtaining an engineering and supervision services project in the field of development and construction, power distribution network improvement and optimization, operation and customer service at Kermanshah Province Power Distribution Company for the second year.

This project is important for expanding the cooperation of activity in the implementation of future projects of Kermanshah Power Distribution Company and will be a valuable step towards expanding the activities of Monenco west office.

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Supervision services of PPA contract for 330 MW Coal Fired Power Plant

Start date: 2021
Client: Italtech Energy (Private) Limited
Location: Pakistan

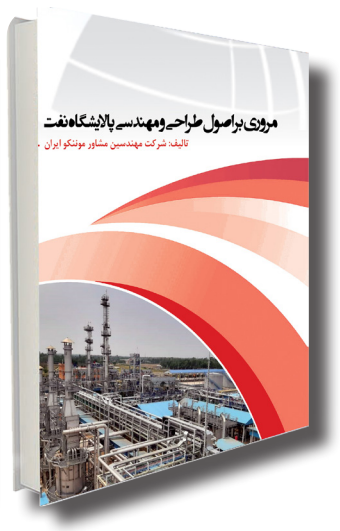
Description: Due to the low capacity of electricity generation in Pakistan and requirement of environmental rules to decommission the fuel oil power plants, the Government of Pakistan has targeted to supply fuel for 5000 MW of coal-fired power plants by investing in the THAR ENGRO coal mine. Therefore, to provide part of the electricity shortage in Pakistan, the second phase of this project with a production capacity of 660 MW (two units of 330 MW) in the form of a POWER PURCHASE AGREEMENT has been assigned to a private company as the financier of this project. Also, due to need a foreign consultant to supervise the contract, Monenco Iran as a leading company in the field of power plant projects has been selected as the supervisor of this project.

Events

Presence of Monenco Iran Company in the 21st International Exhibition of Electricity Industry and unveiling of the book "Introduction to Design and Engineering Principles of Oil Refinary" written by Monenco Iran Consulting Engineers

In this exhibition, the book "A Review of the Oil Refinery Design Specification" by Monenco Iran Consulting Engineers was unveiled. Oil and Gas Deputy of Monaco Iran is proud to provide its various services in mining and chemical industries, in addition to providing other services such as consulting, engineering services to the employers in oil, gas and petrochemical fields. While consolidating its position in the consulting and engineering market of Iran, Monenco has also been capable to employ engineers and experts to expand the geographical area of its services to other countries.

Accordingly, it has published a book entitled «Introduction to Design and Engineering Principles of Oil Refinery», to share the technical and engineering knowledge which are obtained from its experiences and lessons came from the projects with the interested, experts, engineers and students. It is obvious that receiving constructive opinions will lead to the completion, development and presentation new editions of the book.



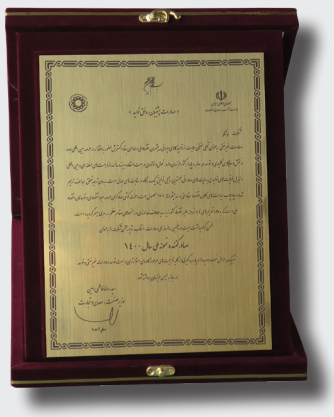
Visit of Deputy Minister of Energy from under construction 400/66 kV DCS Substation of Kharameh

The Deputy of Energy Minister- Mr. Haeri, accompany with the representative of Kharameh, Kavar and Sarvestan in the Islamic Consultative Assembly- Dr. Rahimi Mozaffari and his entourage and also the deputies, managers and experts from Fars Regional Electric Company visited the under construction 400/66 KV DCS substation of Kharameh. Due to the suitable performance of Monenco Iran in the conceptual and basic designing of the project; this Consulting Engineers takes responsibility for the Superior and Site Supervision Services of this substation.

Events

Monenco Iran has achieved Premier National Exporter Award for the second time

Knowledge development beyond borders of Iran has been always one of the main concerns and goals of Monenco Iran Consulting Engineers. In order to attain this goal and export technical and engineering services to other countries, this company has achieved Premier National Exporter Award for the second time.



Certificate of Excellence Awarded to Monenco Oman by OETC

Monenco Oman has proudly received an “Excellence Certificate” from “Oman Electricity Transmission Company” for “Outstanding Professional chievement, Remarkable Leadership and Ingenuity” which have led directly to achieve OETC Milestones of the year 2021.

Introduction the capabilities of Monenco’s Artificial Intelligence (AI) platform for Predictive Maintenance (PdM) and increasing the productivity of refineries

In order to introduce the services of Monenco Consulting Engineers in the field of the Industry IV (Smart Industry) and application of the AI and Machine Learning (ML) algorithms for prognostic detection of anomalies (Predictive Maintenance) and increase productivity in key industries, a meeting entitled “ Introduction of the capabilities of Monenco’s Artificial Intelligence (AI) platform for Predictive Maintenance (PdM) and increasing the productivity of refineries” was held at Persian Gulf Star Oil Company in the presence of Monenco ICT Deputy and Smart Solution Department and representatives of refinery engineering offices.

Certificates

Monenco Oman New Commercial Registration Certificate

Certificate of Excellence Awarded to Monenco Oman by OETC

Monenco Iran FIDIC Affiliate Membership Certificate

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