ICHQP 2010 Conference Program

Sessions at a glance

Sunday 26th September 2010

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 – 17:00</td>
<td>Tutorial &quot;Harmonics in the Changing Power System&quot; (restricted entrance through registration)</td>
</tr>
</tbody>
</table>
| 10:00 – 13:00 | • Professor Math Bollen – Introduction to harmonic distortion  
                  • Professor Sarah Rönberg and Professor Anders Larsson – Emission by modern energy–efficient equipment and possible impact on communication  
                  • Professor Math Bollen – Harmonics and windpower: emission and resonances  
                  • Professor Alfredo Testa – Interharmonics due to modern switching techniques |
| 13:00 – 14:00 | Lunch                                                                         |
| 14:00 – 17:00 | • Professor Guido Carpinelli – Advanced signal processing techniques for monitoring waveform distortion  
                  • Professor Paola Verde – Economics of waveform distortion  
                  • Professor Math Bollen – Summary and conclusions |
| 17:30 – 17:50 | Conference Opening                                                           |
| 17:50 – 18:20 | Keynote Address  
                  "An Introduction to the Concept of Randomness Power"  
                  Alexander Eigeles Emanuel, Worcester Polytechnic Institute |
| starting from 18:30 | Welcome Cocktail Reception - Congress Center "Centro Congressi Giovanni XXIII" |
806 –"Charging and Regulating the DC Link Voltage of Hybrid Active Series Power Filters"

908 –"Electric Substation Ancillary Services Power Consumption Analysis. Case study: Timisoara 400/220/110 kV Substation"
C. Barbulescu, S. Kilyeni, D. Jigoria-Oprea, “Politehnica” University of Timisoara, Romania;
N. Chiosa, Romanian Power Grid Company "Transelectrica", Romania

919 –"Genetic Algorithms applied for the Optimal Allocation of Power Quality Monitors in Distribution Networks"
J.C. Cebrian, C. F. M. Almeida, N. Kagan, University of São Paulo, Brazil

922 –"On the Validity of Harmonic Source Detection Methods and Indices"
M.E. Balci, Balikesir University, Turkey;
M.H. Hocaoglu, Gebze Institute of Technology, Turkey

923 –"Power System Harmonic State Estimation using WLS and SVD; A practical Approach"
M. Moghadasian, H. Mokhtari, A. Baladi, Amirkabir University of Technology, Iran;

925 –"Network Power Quality Monitoring System"
M. Wciślik, R. Kazała, M. Laskawski, Kielce University of Technology, Poland

935 –"Numerical Observability Analysis of Distribution Systems"
R. Gelagaev, P. Vermeyen, J. Driesen, ESAT/Research Group, Belgium
J. Vandewalley, Katholieke Universiteit Leuven, Belgium

941 –"Recognition and Classification of Power Quality Disturbances Using Mutual Information and Probabilistic Neural Network"
Z. Moravej, M. H. Velayati, M. R. Ansari, Semnan University, Iran

1008 –"A Current resolution for Fast Measurement of Power Resolutions in Non Sinusoidal Single Phase Systems"
M.E. Balci, Balikesir University, Turkey;
M.H. Hocaoglu, Gebze Institute of Technology, Turkey

1307 –"Control of Three Phase Grid Connected Photovoltaic Power System"
A.S. Khalifa, E.F. El-Saadany, University of Waterloo, Canada

1312 –"Optimization of Distributed Generation Location and Capacity for Improving Voltage Profile and Reducing Loss Using Genetic Algorithm (SPEA) Proposing a New Index"
H. Jafri, A.R. Karamizadeh, M.J. Foroughi, M. Jadidoleslam, University of Mashhad, Iran;

1609 –"Optimal Number and Location of Area Operation Centers (AOC's) in IRAN Power Network according to Index of Generation and Consumption Balance"
F. Razavi, S.S.K. Madahi, S.A. Araghi, Islamic Azad University, Iran

1610 –"Transmission Cost Allocation Based on Power Flow Tracing Using Z Bus Matrix"
S. Kilyeni, O. Pop, G. Prostean, C. Craciun, “Politehnica” University of Timisoara, Romania
Optimal Number and Location of Area Operation Centers (AOC's) in IRAN Power Network according to Index of Generation and Consumption Balance

Farzad Razavi, Seyed Siavash Karimi Madahi, Saeid Amir Araghi

Abstract--Dispatching centers are regarded as the heart of the integrated network both in generation and transmission network and play an important role in safe and stable operation and also have a great importance observing economical usages. Basically stepwise dispatching system is corresponding to electrical network structures and the ministry of power management methods, and also has to be more flexible with future operation methods and able to coordinate with future ministry of power structures. In this paper, important hints and tips to improve dispatching situation, is presented besides clarifying indexes to find the optimum number and location of area operation dispatching centers (AOC). One of the most important indexes, the balance between generation and consumption, was examined in Iran current power network structure. Finally the presented method in the paper determines the number and location of area operation centers in Iran power network.

Index Terms--Area Operation Center (AOC), dispatching, index, number of AOC's, optimal location of AOC, power system control

I. INTRODUCTION

The basic and natural structure of integrated power electric network is such that the power generation sources and load centers are normally kilometers apart from each other, and the power system has expanded in a big and vast geographical area, which could be a country or sometimes many adjacent countries. Economical and stable operation of this vast network requires gathering and processing data in a control center and making appropriate commands to the system equipments. This kind of control center is called dispatching center. Since dispatching centers should control a network with hierarchical structure, so it must be compatible with the network [1].

In the Iran power network and the search dispatching center from other countries around the world, there are five levels in power system dispatching which are explaining follow [2-3]:
- First Level: Central Dispatching (National Dispatching)
- Second Level: Area Operation Centers (AOC)
- Third Level: Regional Dispatching Center (RDC)
- Fourth Level: Distribution Dispatching Center (DDC)
- Fifth Level: Low Voltage Distribution Dispatching

Recent shapes and structures of electrical network in Iran, is followed as [4-7]:
- Generation network (vapor, water, gas power plant and combine cycle)
- Transmission network (400,230kV)
- Super distribution network (63, some 132kV)
- Distribution network (33, 20, 11kV)
- Low voltage distribution network (400,230V)

Due to different voltage level, each mentioned network is controlled and performance by different managed centers, although two or more of these centers might be observed by a unit company [8].

Due to lack of information in this field, this paper is based on the earlier experiences in Iran and reviewing the main relevant references. The aim in this paper is to examine the balance between generation and consumption in Iran current power network structure and suggesting a new efficient structure.

Since there is no reference for determining the number and location for AOC, this paper presents the major indexes for site placement of AOC's in a network. The indexes are introduces according to experience of authors in II.

II. INDEXES FOR OPTIMAL PLACEMENT OF AOC's

This paper is concerned with regional dispatching areas as second level of dispatching centers and investigates the needed criteria in a region power network which make these areas as an AOC. On the other hand, the possibility of AOC improvement and building a new one, in order to decrease data traffic in SCC, is investigated.

Main indexes for specifying the number and location of AOC as follow:
A. Generation and Consumption Balance

This index is very important to specify an AOC to a certain region or area. It is important to have an independent AOC, so that the balance between generation and consumption has to be controlled. So, in case of disconnection between SCC and AOC, islanding situation, AOC will be capable to produce its inner consumption and this capability improves the reliability of whole network. Also when it is connected to SCC and other regional dispatching centers, if such balance doesn't exist, causes the transferring AOC networks to be busy, which may even exceeds from their line thermal limitation and CT limitations. Consequently this allow doesn't more current flowing through the lines and causes voltage and frequency interferences.

B. Possession or Heritage

Some parts of a dispatching network had previously been an independent network, and were controlled separately. Therefore they had not been connected to the main network, thus controlling operations were separately done on them. So, when these parts were connecting to the main network, they were automatically turned into a regional dispatching.

C. The Least Transferring Connection (Minimum Connection)

Any previously independent AOC needs a number of lines in order to connect to the network. After determination of these points, it is possible to connect them with minimum number of lines. This connection can be done only by a single line, but in order to increase the reliability, usage of two parallel lines is preferable [3-4],[6-8]. So in case of a fault, AOC won't be disconnected from the main network as much as possible .but of course even in this situation the network has to be capable to estimate the load amount and making the balance between generation and consumption in an islanding situation. Using two parallel lines reduces the impedance and increase the thermal limit which causes more current or in fact more power flowing capability and hence, more stability in an integrated network dispatching. It is predictable that in near future three parallel lines are used to connect AOCs. Regarding to advantages of independent AOC networks, it is more useful to have minimum connection among area operation centers.

D. Major Power Plant

Because of high importance of power plants as generation sources and specially power plants with larger units, it has been tried to place the lines which are connected to the buses of these power plants, on boundary of two AOC's. So, they will have a special control since they are controlled by two AOC's, and furthermore they are controlled through a central dispatching and considered as sensitive points of the network as shown in Fig. 1.

E. Sensitive Points for Extra Controlling

Sensitive points are denoted to the points in which all the network will be controlled if they are controlled. This is due to power network continuity. Control here refers to frequency control and voltage control. In order to fix the frequency in the network one has to minimize number of sensitive points, so that the frequency of sensitive points through national dispatching center (SCC) will be more accurate and faster.

In other words, all the transfer buses of power network could be considered as important points but some of these buses could be controlled trough controlling one of them which is considered as one of the sensitive points.

F. Number of Available Regional Electric Company in Country

Regional electric companies (REC) are defined as geographic areas which consist of one or some provinces. The responsibility of regional electricity company is operation and maintenance and development of power system in related areas. In the present structure of country, Iran grid management company (IGMC) in Iran is in the head of management and industry and regional electricity companies are under its observation. On the other hand each regional electricity company manages the power plant and transmission lines in its regional geographic section.

In the past, regional electric companies were controlled separately and were less connected to the central dispatching and had a complicated connection like the spider's web. So, when specifying an AOC, the center has to be made of several regional power networks, not some part of them. If a part of above mentioned spider web is controlled by an AOC and another part is controlled by other AOC, then there will be several lines between these two AOCs which is not a suitable situation. For example Iran's power network has 16 regional electricity companies, so 16 AOC centers can be specified to Iran's power network. Thus the number of boundary lines between two AOCs which were mentioned in indexes number 2 and 3 shouldn't be increased.

G. "n-1" Contingency

Safety in a power system means the probability of system to pass disturbances without any disconnection of service for users. This depends on the system's stability against interferences and thus is reliant on the type of faults and operation conditions.

Fig. 1. Major power plant connection to AOC
In an integrated network one has to observed (n-1) contingencies, which means that by lose of an equipment of the network, the power system continues its operation without any problem. Here total number of equipments has been considered as \( n \) which they include power plants, substations, transmission lines, transformers, etc.

There are some reserves to avoid from incidents and problems. For example there are reserves as much as the largest power plant unit of country as spare. Also parallel lines are located to gain more reliability, as well as considering taps for transformers to tolerate more overloads. Therefore all the above mentioned precautions have to be observed in each AOC networks, so that the network can continue its operation in islanding situation.

### H. Islanding Operation

As it was mentioned before each of the AOC regions should be capable to operate in islanding condition. Such situation is reached when the connection between AOC and headquarter is disconnected. In this condition AOC should be able to control the inner frequency and balance the generation and consumption. To meet this aim, it must have inner self-restarting power plants, which could be water powered or gas, in order to control the frequency. This issue can also be used in high voltage networks such as AOC's. The possibility of intentional islanding requires a complete review of the safety procedures and a larger adaptation of automation and communication systems [9].

### I. Communication Capacity Limitation

Generally this index is one of the important indexes to prove the necessity of dispatching centers and is one of the main reasons to lay off the system from the main center and change it to a system with more dispatching centers. Because transferring information from substations, power plants and other power network equipments, to a single main center besides having a high volume of data and the problem of processing these data, faces with the lack or shortage of communication capacity. Furthermore, processing all these data needs a high capacity memory. So the unity of receiving point has these problems and can be solved by changing it to a system with many dispatching centers. In fact, the information of substations and power plants and other equipments of an AOC region will be send to its corresponding AOC center and processing will be done in the same place. Finally after decreasing the amount of information it will be sent to the system controlling center or SCC, and the final processing will be done there.

It has to be mentioned that there has been a major breakthroughs in the communication and nowadays optic fibers are used to transfer information to the main center or AOC centers, and having an AOC in each province has made the information transferring easier. Because in the present network there is a limitation of communication capacity and one has to use optimally from this capacity.

### J. Information Processing Speed

Sending a huge amount of information in a dispatching center certainly decreases the data processing speed, which result in delay in the integrated network controlling. By constituting more AOC centers one can increase information receiving points, which can cause a faster transmission and a division of information amount. But of course, the most important point is to have an AOC which has enough ability of data processing.

Regarding its facilities each AOC network should have an acceptable data processing capacity and if the volumes of data processing exceed from a certain amount (especially load amount) that AOC center has to be divided into two separated AOC regions in order to have a better controlling on them.

### K. The Specified Budget

If there are separated AOC networks, the specified budget can be used optimally considering their inner network requirements.

### L. Vulnerability of War Issues

In this case if one of the AOC is damaged, it doesn't result in overall blackout. And it's only cause electrical outage in that special region. If there is only a unit dispatching center it cause critical and major damages to the country which can even cause accruing a complete electricity blackout in whole country.

### III. STUDY OF INDEX IN IRAN

For illustrating the way for considering the defined index, in this section the index of production and consumption balance is examined in Iran network as a case study.

The first step in order to evaluate this index is to obtain load equations, load demand as a function of time (the relevant year), of each AOC. Therefore, maximum load consumption over five sequent years in each 16 Regional Electric Companies (see Table I) is used to define the load equations.

<table>
<thead>
<tr>
<th>MAXIMUM LOAD IN EACH REC OVER THE YEARS, PER MW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REC</strong></td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Tehran</td>
</tr>
<tr>
<td>Semnan</td>
</tr>
<tr>
<td>Zanjan</td>
</tr>
<tr>
<td>Gilan</td>
</tr>
<tr>
<td>Mazandaran</td>
</tr>
<tr>
<td>Khuzestan</td>
</tr>
<tr>
<td>Esfahan</td>
</tr>
<tr>
<td>Azarbaijan</td>
</tr>
<tr>
<td>Sistan &amp; Baluchestan</td>
</tr>
<tr>
<td>Yazd</td>
</tr>
<tr>
<td>Kerman</td>
</tr>
<tr>
<td>Hormozgan</td>
</tr>
<tr>
<td>Khorasan</td>
</tr>
<tr>
<td>Bakhtiar</td>
</tr>
<tr>
<td>Gharb</td>
</tr>
<tr>
<td>Fars</td>
</tr>
</tbody>
</table>
In current structure, Iran’s electricity network is composed of 9 AOC and each of them is made of one or more Regional Electric Company as Fig. 2 shows.

![Fig. 2. Present AOC in Iran](image)

So by adding the maximum load consumption of REC forming the AOC with considering diversity factor for AOC regions including more than one area, maximum load consumption of each AOC is obtained and presented (see Table II). Considering the current structure of Iran’s electricity network diversity factor is considered as 95% [7]. So load equations of each AOC can be obtained (see Table II). The load equation is chosen as a four step equation and their coefficients were obtained with least square error method. In the second step production of power plants in AOCs is gathered. Considering that the aim of this section, review index of balance production and consumption in 2009, the amount of MW production and the largest power plant unit of each AOC has been show (see Table III). For satisfying “n-1” contingency it should exist the reserve equal to largest power plant unit in each AOC. In this way by taking out a power plant unit out of the network no impairment influence the network. So the production should be equation as in (1):

\[ P = G - S \]  \hspace{1cm} (1)

where S consider as Spare.

<table>
<thead>
<tr>
<th>AOC</th>
<th>REC under cover</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAOC</td>
<td>Tehran,Zanjan,Semnan</td>
<td>6528</td>
<td>7297</td>
<td>7505</td>
<td>7664</td>
<td>7743</td>
</tr>
<tr>
<td>NAOC</td>
<td>Gilan, Mazandaran</td>
<td>2033</td>
<td>2570</td>
<td>2695</td>
<td>2911</td>
<td>2836</td>
</tr>
<tr>
<td>SWAOC</td>
<td>Khuzestan</td>
<td>4119</td>
<td>5140</td>
<td>5130</td>
<td>5768</td>
<td>5458</td>
</tr>
<tr>
<td>CAOC</td>
<td>Esfahan</td>
<td>2874</td>
<td>3160</td>
<td>3472</td>
<td>3724</td>
<td>3722</td>
</tr>
<tr>
<td>NWAOC</td>
<td>Azarbaijan</td>
<td>1823</td>
<td>2155</td>
<td>2069</td>
<td>2218</td>
<td>2164</td>
</tr>
<tr>
<td>SEAOC</td>
<td>Yazd,Kerman,Hormozgan,Sistan&amp;Baluchestan</td>
<td>3417</td>
<td>3951</td>
<td>3998</td>
<td>4544</td>
<td>4416</td>
</tr>
<tr>
<td>NEAOC</td>
<td>Khorasan</td>
<td>2074</td>
<td>2595</td>
<td>2745</td>
<td>2648</td>
<td>2596</td>
</tr>
<tr>
<td>WAOC</td>
<td>Bakhtar,Gharb</td>
<td>2931</td>
<td>3236</td>
<td>3194</td>
<td>3651</td>
<td>3385</td>
</tr>
<tr>
<td>SAOC</td>
<td>Fars</td>
<td>2313</td>
<td>2899</td>
<td>2866</td>
<td>3025</td>
<td>3391</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AOC</th>
<th>production 2009</th>
<th>name of major unit power plant</th>
<th>measure production</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAOC</td>
<td>8107</td>
<td>Rajaei(steam)</td>
<td>250</td>
</tr>
<tr>
<td>NAOC</td>
<td>4138.5</td>
<td>Salimi(steam)</td>
<td>420</td>
</tr>
<tr>
<td>SWAOC</td>
<td>9057.5</td>
<td>Ramin(steam)</td>
<td>305</td>
</tr>
<tr>
<td>CAOC</td>
<td>3931</td>
<td>Esfahan(steam)</td>
<td>320</td>
</tr>
<tr>
<td>NWAOC</td>
<td>2560</td>
<td>Tabriz2(steam)</td>
<td>350</td>
</tr>
<tr>
<td>SEAOC</td>
<td>4857</td>
<td>Bandar Abbas (steam)</td>
<td>320</td>
</tr>
<tr>
<td>NEAOC</td>
<td>3369.5</td>
<td>Toos(steam)</td>
<td>150</td>
</tr>
<tr>
<td>WAOC</td>
<td>3499.5</td>
<td>Shazand(steam)</td>
<td>325</td>
</tr>
<tr>
<td>SAOC</td>
<td>2664.5</td>
<td>Kazerun (combine cycle)</td>
<td>120</td>
</tr>
</tbody>
</table>

It explained that the values in this table are the lowest production values of power plants in 2009 (to obtain optimum conditions for manufacturing plant design the lowest values of production is considered). The next step is putting the obtained load equation equal to the production value in 2009. In this way the T value will be obtained. Regarding the fact that T represents the time which the balance between production and consumption is established, it should be obtained 2009 observing mentioned index.

IV. SIMULATION

MATLAB software is used for simulation of each AOC. A case study on Iran power network was done by MATLAB and the results is shown in Fig. 3. In the simulation for each AOC in Iran, the load equation and maximum power plant production is plotted simultaneously. If the time obtained in solving this equation is not consistent with the study means that the index has not been met. Due to the great importance of this index, keeping the AOC requires establishing somehow balance between production and consumption. Fig. 3 shows simulation results.
Simulation results show that none of current AOC in Iran satisfies the consumption and production balance index in 2009. However this is the most important index and the first step in the realization of island operation.

V. NEW STRUCTURE OF AOC

To present a new structure for power network with optimum number and site of AOCs it is necessary to review the recent shape and structure of network. As be mentioned in section III and IV, the observation of generation and consumption balance's index isn't reach in nearly all Iran's power network AOCs and it's inevitable to change in number and site of AOCs. Considering what was mentioned in II-f Maximum number of AOC which can exist in Iran's power network is sixteen. And also regarding this fact that the amount of information sending to dispatching centers has direct relationship with amount of electric load, to equalize information processing speed in different AOCs by way of equalizing amount of consumption, structure of Fig. 4 with optimal operation is suggested. Due to reduction of difference between generation and consumption in proposed structure, optimal operation of power network is to be obtained.

Quantity of generation and consumption and difference between them in this new suggested structure are presented in Table IV and in old structure are presented in Table V.
TABLE IV
LOAD CONSUMPTION AND PRODUCTION IN NEW STRUCTURE IN EACH AOC IN 2009, PER MW

<table>
<thead>
<tr>
<th>AOC</th>
<th>REC under cover</th>
<th>Load consumption</th>
<th>Load production</th>
<th>Difference percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAOC</td>
<td>Tehran</td>
<td>6722</td>
<td>6249</td>
<td>7.87</td>
</tr>
<tr>
<td>NAOC</td>
<td>Mazandaran, Semnan</td>
<td>2328</td>
<td>2504</td>
<td>7.03</td>
</tr>
<tr>
<td>SWAOC</td>
<td>Khuzestan</td>
<td>5458</td>
<td>9057.5</td>
<td>39.74</td>
</tr>
<tr>
<td>CAOC</td>
<td>Esfahan</td>
<td>3722</td>
<td>3931</td>
<td>5.32</td>
</tr>
<tr>
<td>NWAOC</td>
<td>Azarbaijan, Gilan</td>
<td>2941</td>
<td>4194.5</td>
<td>29.88</td>
</tr>
<tr>
<td>EAOC</td>
<td>Kerman, Yazd</td>
<td>1940</td>
<td>2222</td>
<td>12.69</td>
</tr>
<tr>
<td>SEAOC</td>
<td>Hormozgan, Sistan &amp; Baluchestan</td>
<td>2478</td>
<td>2635</td>
<td>6.03</td>
</tr>
<tr>
<td>NEAOC</td>
<td>Khorasan</td>
<td>2596</td>
<td>3369.5</td>
<td>22.96</td>
</tr>
<tr>
<td>BAOC</td>
<td>Bakhtar</td>
<td>2528</td>
<td>2355.5</td>
<td>6.98</td>
</tr>
<tr>
<td>WAOC</td>
<td>Gharb, Zanjan</td>
<td>1969</td>
<td>3002</td>
<td>34.41</td>
</tr>
<tr>
<td>SAOC</td>
<td>Fars</td>
<td>3391</td>
<td>2664.5</td>
<td>27.27</td>
</tr>
</tbody>
</table>

Results of Table IV demonstrate great improvements in balance between generation and consumption. Due to the results percent of generation and consumption's difference decreased to less than 8% which is so considerable. In case of more than 8% difference usually generation is more than consumption which can be kept as reservation. In case of more than 8% difference which consumption is more than generation like SAOC building new power plants is inevitable.

VI. CONCLUSION

In this paper the index of number and site determination of area operation centers (AOC) in power network dispatching was introduced. This index can be used to determine the location and number of AOCs in any country. One of the major index, generation and consumption balance index was examined in Iran network with 9 AOC and it was shown that current structure cannot meet the index and the AOC position and number should be changed. This paper is involved with optimal allocation of AOC in Iran power network in order to meet generation and consumption balance, in suggested structure exist 11 AOC. Results of new structure of AOC’s show great improvement in this index.

VII. REFERENCES

[3] NIROO research center, investigation of building dispatching center possibility in Iran.
The 14th IEEE International Conference on Harmonics and Quality of Power (ICHQP 2010) is organized by the Politecnico di Milano. It will be held in Bergamo, Italy, from 26th September to 29th September, 2010. This conference is one of the premier international conferences and strives to present research work of academic and technical excellence in the area of power quality. The Conference will feature special sessions and tutorials by international experts.

CALL FOR PAPERS

The Organizing Committee of the 14th International Conference on Harmonics and Quality of Power, (ICHQP 2010) invites researchers, practitioners and students worldwide to submit papers for consideration to be presented at the conference. The conference scope covers topics in power quality including, but not limited to:

- Power Quality Analysis
- Power Quality Mitigation Technologies
- Distribution System Planning for Power Quality
- Power Quality Monitoring / Reporting Methodologies and Indices
- Power Quality State Estimation
- Impacts on Systems and Equipment
- Power Quality Standards
- Equipment Power Quality Immunity
- Transients – Propagation, Measurements and Modeling
- Harmonic Generation and Propagation
- Interharmonics and Other Non-Harmonic Distortion
- Power Quality Case Studies
- Probabilistic Aspects of Power Quality
- Economic Impacts of Power Quality
- Renewable Generation / Distributed Generation and Power Quality
- Smart Grids for Power Quality

All accepted papers will be published in the IEEE Xplore digital library. Selected best papers will be invited for submission to a special issue of European Transactions on Electrical Power (ETEP).

Conference website
http://www.ichqp2010.org/

Important dates
Full paper submission: June 10th 2010
Notification of paper acceptance: July 15th 2010

Sponsorship & Exhibition Opportunities
Opportunities to sponsor or exhibit at the Conference are still available to interested businesses to take part in ICHQP 2010. For details of sponsorship and exhibition packages see the conference website at www.ichqp2010.org, or write an email to ichqp2010@polimi.it

Further Information
For more information please write to ichqp2010@polimi.it or visit the website www.ichqp2010.org

Contact persons:
Prof Dario Zaninelli  
Politecnico di Milano – Department of Energy  
Via La Masa 34  
20156 Milano, Italy  
Ph: +39 0223993721  
Fax: +39 0223998566  
email dario.zaninelli@polimi.it

Prof Enrico Tironi  
Politecnico di Milano – Department of Electrical Engineering  
Piazza Leonardo da Vinci 32  
20133 Milano, Italy  
Ph: +39 0223993713  
Fax: +39 0223993703  
email enrico.tironi@polimi.it