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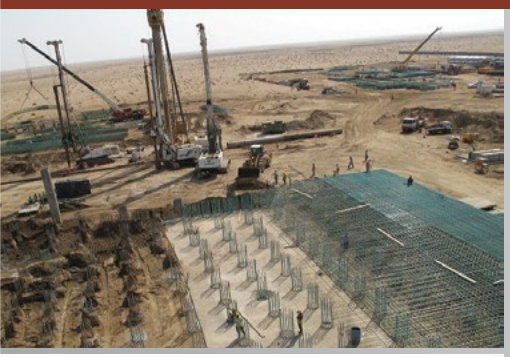





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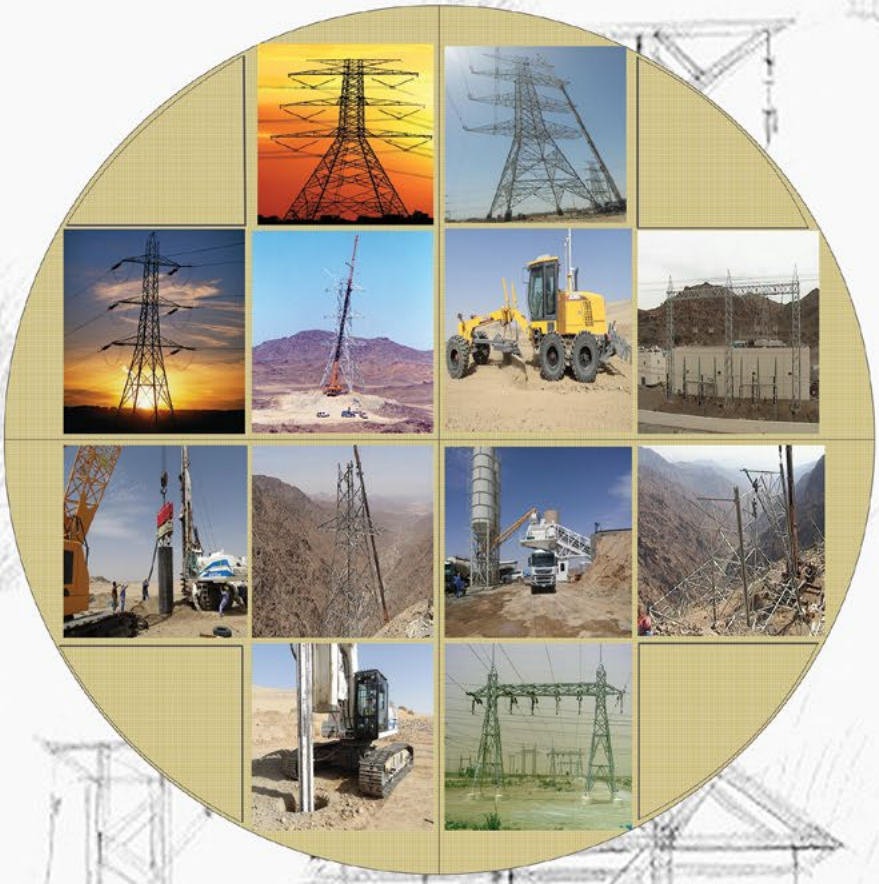

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In This **Issue**

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Engr Mohammad Asim Siddiqui
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From the Chairman's Desk

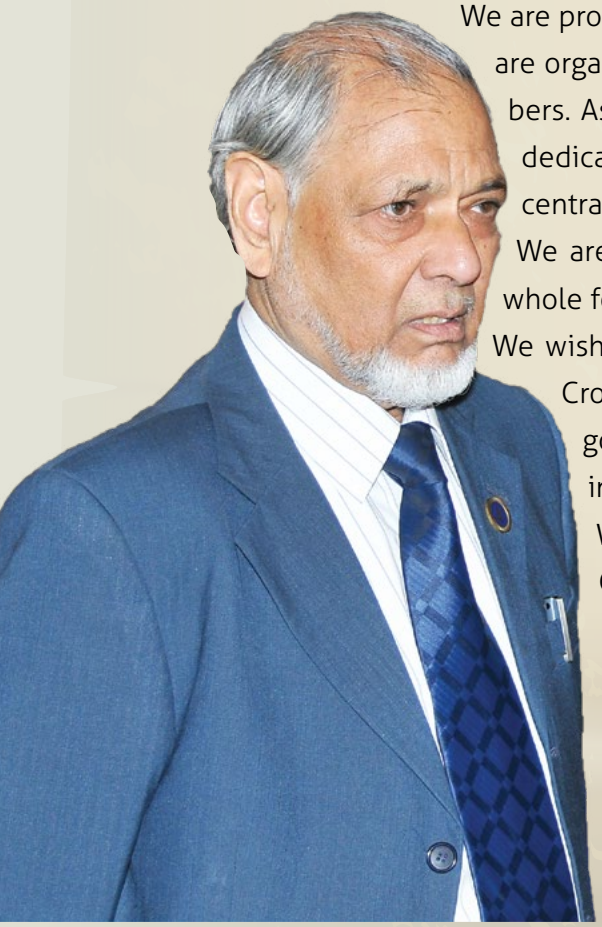
IEP-SAC is a professional body that aims to promote the Engineering profession and endeavors to develop and upgrade the standards of Practicing Engineers.

From this forum, we always insist on the quality and standard of education, especially in Science and Engineering. It is worth mentioning that, " The collapse of education is the collapse of the Nation".

Our engineers ,architects, town planners , skilled and un skilled workers are devoting their vision and caliber and time to their commitment for the development of our brotherly country KSA.

In return, we have earned professional stature and foreign exchange which is injected into the economic arteries of Pakistan for its survival but unfortunately we did not get any recognition for our sacrifices from Government of Pakistan. Even our children remain struggling for getting admission in Engineering or Medical college in Pakistan. We suggest a quota should be reserved in every Engineering and Medical college or university for the children of Pakistani expatriates who do not possess dual nationality.

We are always endeavored to identify the most challenging issues like scarcity of water and environmental pollution. The effect of global warming is altering the earth's climate system, including it's land, atmosphere, ocean and glaciers, in far reaching ways. According to the National climate assessment, human influences are the number one cause of global warming, especially the carbon pollution we cause by burning fossil fuels and pollution capturing we prevent by destroying forests. It is subject of vital importance and should be discussed at every forum of Science and Engineering to make vital recommendations to control it.



We are proud to mention that all of our events, seminars, Engineering Journals are organized through absolute volunteer service of IEP-SAC council members. As a chairman of IEP-SAC, I shall be failing if I do not pay tribute to dedicated and most valuable voluntary services of our council members in central as well as in Eastern and Western provinces.

We are grateful to H. E. Ambassador of Pakistan and Embassy staff as a whole for their continued patronage and support to IEP-SAC.

We wish to extend our gratitude to H. M King Salman Bin Abdul Aziz and Crown Prince H. R. H. Muhammad Bin Salman Bin Abdul Aziz and his government for their hospitality and appreciation of our contribution in the development of our brotherly country.

We wish all success and implementation of Vision 2030 as floated by Crown Prince HRH Muhammad Bin Salman.

Syed Mubashir H. Kirmani

(Chairman, IEP-SAC)

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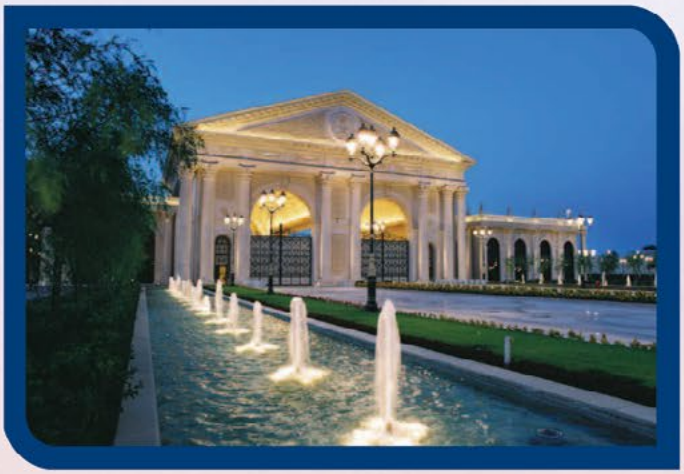

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From The

Ambassador Of Pakistan

AMBASSADOR

It gives me great pleasure to felicitate Institution of Engineers Pakistan-Saudi Arabia Chapter (IEP-SAC) on publication of its annual journal for the year 2018-19 at the eve of its annual seminar. I take immense pride in the contribution of Pakistani engineers, architects and town planners in the development of the Kingdom as well as Pakistan. You have earned the appreciation of all due to your professionalism, hard work which has contributed to project a positive image of country and the Pakistani community in Kingdom of Saudi Arabia.

The Institution of Engineers Pakistan - Saudi Arabian Centre deserves appreciation for its publication of the annual magazine and holding highly useful seminars on topics of immense importance to engineers. I am confident that such publications and seminars help in promoting excellence in professional standards. The Institution provides Pakistani engineers with a platform where they can share their experiences and knowledge with each other for the benefit of both Pakistan and Saudi Arabia

I also applaud its philanthropic activities and noble endeavours such as awards of scholarships to deserving and needy students studying in Pakistani Engineering Colleges and Universities. I take this opportunity to extend my best wishes to IEP-SAC and Pakistan Engineers' community for the success in their future endeavours and assure them of full support of the Embassy of Pakistan in their activities towards promoting goodwill for Pakistan and contributing in the development of Saudi Arabia.

Khan Hasham Bin Saddique
Ambassador
of the Islamic Republic of Pakistan
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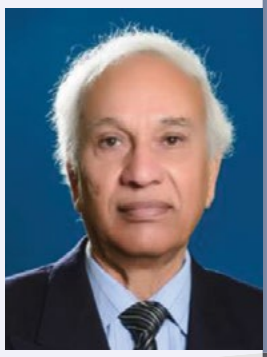
From The
President of IEP



I am pleased to learn that the Institution of Engineers Pakistan, Saudi Arabia Centre (IEP-SAC) is bringing out its annual publication, "The IEP-SAC Journal" 2018-19, on the occasion of its 49th annual Technical Seminar on 10th May 2018.

On behalf of the Institution of Engineers Pakistan (IEP), I avail this opportunity to congratulate IEP–SAC for its continued and consistent efforts in making positive head way in pursuit of its enormous goals by providing unlimited opportunities, incentives, professional recognition and leadership potential. Your scholarship program for the needy students in Public Sector Engineering Universities in Pakistan and Azad Kashmir deserves all praise.

Publication of IEP-SAC Journal containing important articles on current engineering issues and holding Technical Seminars always help to exchange knowledge and information for the best use of engineering profession and building professional ties among the professional engineers of different nationalities, thus building positive image of our country. We are proud of this achievement of IEP-SAC and wish for its great success in coming events and assure on behalf of IEP, full support and acknowledgement.

Engr. Dr. Izhar Ul Haq
President,
The Institution of Engineers, Pakistan

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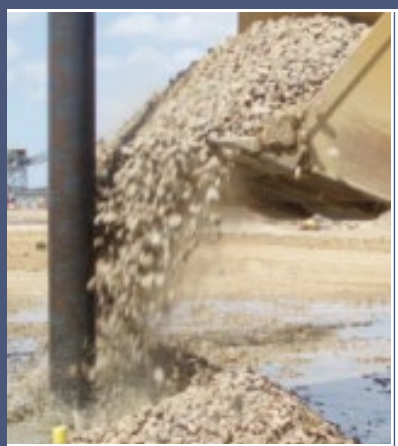

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From The
Secretary of IEP

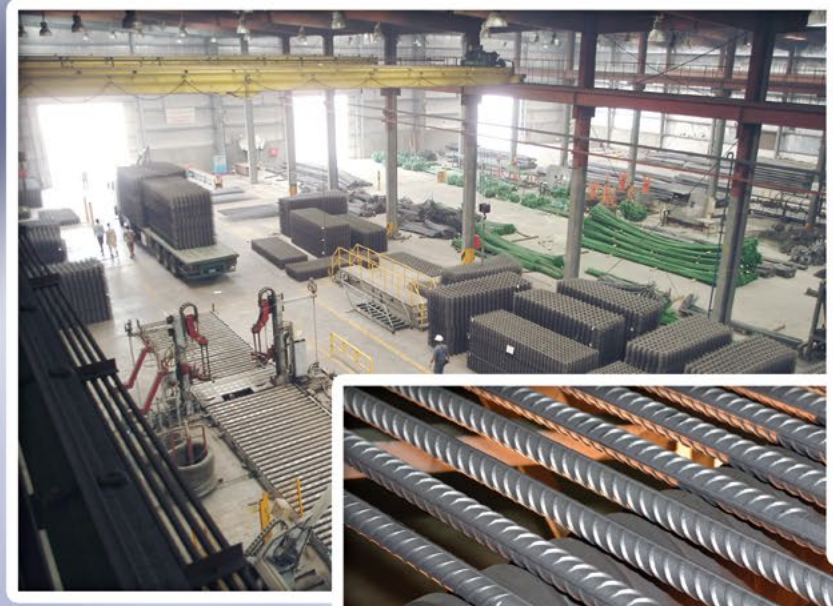
It is a matter of great pleasure to know that the Institution of Engineers, Pakistan (IEP) Saudi Arabia Centre (IEP-SAC) is organizing it 49th Annual Seminar on 10th May 2018 and also publishing the annual magazine on this occasion.

Such Seminars play an important role in sharing the technical knowledge and expertise among the fellow Engineers and are a great Contribution in disseminating the technical knowledge.

The efforts of Institution of Engineers Pakistan Saudi Arabia Center (IEP-SAC) in this regard are commendable and deserve highest appreciation. The seminar will definitely help in advancement of Engineering Knowledge and welfare of Engineering Community working in Saudi Arabia.

I pray for the success and useful outcome of the event.

Engr. Mian Sultan Mahmood
Secretary General,
The Institution of Engineers, Pakistan



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From The
Saudi Council of Engineers

The role of an engineer is to solve societal matters technologically, to increase productivity and the development of any country. The trend for future demand of engineers that will continue even during economic slowdowns will be on research engineers, high-tech engineers, electronics and aerospace engineers. Therefore, the engineering-discipline development through organizations such as SCE or IEP is an important subject. The role of such professional societies is important and vital to meet the needs of 21st century.

Saudi Council of Engineers is a professional body that aims to promote the engineering profession and do whatever may be necessary to develop and upgrade its standards and practices in the Kingdom.

The strategies of SCE include to raise the standard of engineering education in academic, training, and professional fields aiming at materialization of compatibility between educational outcomes and employment market requirements, enhance the capabilities of engineers and technicians by approving curricula for qualifying and training at Kingdom level that enable them to practice their profession effectively and work on authorizing the basics and rules that control the licenses, engineering practices, and ethics of the profession. These also include strive to promote small and medium size engineering establishments and individual engineering offices, encourage research, development, innovation, and creativity in all engineering fields and edify the society about goals and assignments of the Council, and the role of engineering sector in the execution of various developing projects.

The contributions by Pakistan engineers to the development of Saudi Arabia through the past decades are well recognized by SCE. Therefore, Pakistan – Saudi Arabian relationship is a special one, indeed at all levels.

I wish the Institute of Engineers Pakistan, Saudi Arabian Centre (IEP-SAC) complete success in their efforts to share knowledge and promote technical activities. SCE will extend all support to further the cause of IEP-SAC.

General Secretary
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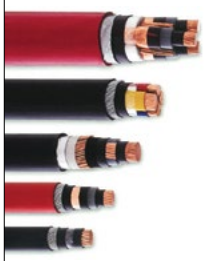

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From The
The General Secretary

It is a moment of immense delightfulness and gratitude to Allah Subhanahu-wa-Taa'la with honour, pleasure and satisfaction to present you the IEP-SAC annual report for the past year 2017-18 along with the new annual journal, which reveals our activities and achievements in providing services to the engineering community in the Kingdom of Saudi Arabia as well as engineering students in Pakistan. Al-hamdolillah it is now my fourth year of fulfilling the responsibility of IEP-SAC General Secretary with satisfaction since October 2014.

I hope every one of us is asking a question to himself, "What role did I play today to **BUILD A BETTER WORLD**?" This is the slogan of IEP on its logo and I advise every Pakistani engineering professional serving in the Kingdom of Saudi Arabia to keep up his positive professional and social activities with full devotion and commitment and share technical knowledge with engineering fraternity.

Under the patronization of Pakistani Embassy, the Institution of Engineers Pakistan – Saudi Arabian Centre (IEP-SAC) is providing a platform of opportunities to all Pakistani engineers to excel their skills, share practical knowledge with the fellow engineers in the field and help engineering students in Pakistan. Being a non-profitable and non-political organization, we are always striving to make advancements in pursuing the main objectives of IEP-SAC, which are mainly:

1. To provide a forum for Pakistani engineers working in the Kingdom of Saudi Arabia to update their professional knowledge through conducting technical seminars and publishing technical papers of Pakistani engineers in the annual journal.
2. To interact with other local organizations related to engineering profession and find opportunities to support Pakistani engineers and safeguard their professional interests in all respects.
3. To facilitate communication and enhancement of friendship among Pakistani engineers and their families by organizing family picnics, publishing updated directory of Pakistani engineers working in KSA every year and participating in organization of other social activities.
4. Helping the needy and meritorious young Pakistani engineering students of various public universities in Pakistan through an ambitious scholarship program.

A brief report of IEP-SAC activities during the current session of 2017-18 is given below.

Annual Convention And Seminars:

Generally our technical seminars are organized to enhance the professional knowledge and awareness of Pakistani engineers about new advancements in the technology. Last year, IEP-SAC organized its annual convention with seminar on 20th May 2017 at King Salman Social Center, Riyadh. The topic of technical seminar # 47 was, "Water Stress and Scarcity – The Grand Challenges for Engineers" presented by chairman of IEP-SAC Engr. Syed Mubashir Hussain Kirmani. The speaker expressed his concerns that the water supplies on our planet are running dry and most of the aquifers in the world are over stressed. In order to alleviate the water crisis throughout the world and particularly in Pakistan, Engr. Kirmani outlined a number of practical recommendations supported by science, engineering and good stewardship.

The exhibition of various engineering products and services of suppliers and manufacturers was also made before the start of the seminar. Shields were presented to the co-sponsors in recognition of their contribution towards IEP-SAC scholarship program through advertisements and stalls in the exhibition. Certificates of appreciation were presented to the authors of various technical papers published in the last year annual journal. Attendance certificates were also issued to all attendees of the seminar at the end of the program. The event reporting was covered by local and Pakistani press and media channels in Pakistan.

Our midterm technical seminar # 48 was held on 22nd December, 2017 at Pak House Restaurant, Murabba, Riyadh. The topic was, "Smart Grid – The Next Generation Power Grid" presented by Engr. Muhammad Abrar Shami, Engineering Specialist & Project Manager – National Grid Saudi Electricity Company, Dammam, KSA. The speaker explained that the evolution of the Smart Grid is the most important and potentially the most beneficial development that has occurred in the electric utility industry recently. He mentioned that a smart grid works as an enabling engine for our economy, environment and future with increased communication of information in the field of generation, transmission, distribution and consumption of electrical energy. The presentation was well taken and appreciated by the attendees. The event was reported in local and Pakistani press and media channels in Pakistan.

The upcoming annual convention and seminar has been planned to be held on 10th May, 2018 in King Salman Social Center, Riyadh on topic "Hazards of Electricity for Humans and Safety Measures" to be presented by Prof. Dr. Nazar Hussain Malik.

IEP-SAC Annual Journal:

At the occasion of its annual convention with technical seminar # 47, exhibition and annual dinner held on 20th May, 2017, IEP-SAC also published its annual journal, which comprised various technical papers, articles, reports, messages and the updated directory of Pakistani engineers working in KSA. This journal used to enhance the professional writing skills of the Pakistani engineers, promote the advancements in technical knowledge and share valuable information among engineers and engineering organizations. The hard work of publication committee made it possible to bring the annual journal 2017-18 into your hands at last annual convention with best quality and standards. The contents of last year annual journal were highly appreciated by the Pakistani engineers and other engineering organizations in KSA. I am sure that

you will equally appreciate the new IEP-SAC annual journal for 2018-19 as well, which will be in your hands in sha Allah at the end of the upcoming annual convention planned on 10th May, 2018. I praise the sincere and notable efforts of the Publication committee and its convener with dedication for the valuable contribution in this regard.

Scholarships Program:

Alhamd-o-lillah IEP-SAC has continued the scholarships program since 1996, which provides financial support to the needy, meritorious and deserving engineering students in Pakistan. From last year, i.e. 2017, we have added eight (8) more scholarships to the previous program, which are being given to the students of Khawaja Fareed University of Engineering and Information Technology, Rahim Yar Khan. This addition makes a total of 96 scholarships being sponsored by IEP-SAC in twelve (12) public sector engineering universities / colleges throughout Pakistan and Azad Kashmir. This could have been possible only by the help of Allah and the financial contributions from various organizations, individual philanthropists and local council members. The appreciation goes to all local council members in general and our Sponsorship and Scholarships committees who had been striving hard throughout the year with full devotion and dedication to procure the resources and manage the timely dispersion of the scholarships to the students in Pakistan. I urge the readers of these lines to come forward a step ahead and contribute towards this noble and just cause. A detailed report of the Scholarship committee from its convener has also been included in this journal on the subsequent pages.

Family Picnic:

To fulfill one of the main objectives of IEP-SAC, we facilitate communication and enhancement of friendship among Pakistani engineers and their families through our famous social event, the family picnic. This year it was organized on 16th Feb, 2018 in an isteraha near Muzahimiyah. The picnic was attended by more than 350 guests including men, women and children belonging to the families of Pakistani engineers in Riyadh. Various indoor and outdoor games for children and adults including cricket, table tennis, carom, races, quiz, poetry and raffle draw were the points of attraction for the guests at gents' side.

The ladies ad hoc committee of IEP-SAC also managed various games and events in ladies section for the girls and women, which were also enjoyed and praised by the families. Excellent food was provided by Marhaba for breakfast and lunch with tea in the evening. The planning and hard work of the IEP-SAC events management committee to organize this event restlessly and the brotherly support from all council members at the occasion made this picnic a successful event. Guests appreciated the event overall and emphasized that it must be organized at least once a year because such social events provide time for interaction among engineering community in a relaxing and entertaining environment. The event reporting was beautifully covered by local and Pakistani press as well as media channels in Pakistan.

Sponsors' Dinner:

In the honour of the sponsors, advertisers and supporters of IEP-SAC scholarship program, this year a dinner was organized by us on 26th March, 2018 at Riyadh Palace Hotel, Riyadh, similar to the dinner arranged last year as well. Main purpose of the dinner was to submit our gratitude in response to their contribution and support towards IEP-SAC activities specially the scholarship program. More than fifty (50) guests including chief executives and their representatives of the companies offering sponsorships and advertisements, philanthropists from Pakistani business community, officers from Pakistani embassy, journalists and individual dignitaries from Riyadh and Eastern province attended this dinner.

Shields of honour were given to all participants in response to their continuous suppot. Chief guest was the new ambassador of Pakistan Vice Admiral (Retd) Khan Hasham bin Saddique, who is patron in chief of IEP-SAC as well by virtue of the position. He applauded this noble cause of IEP-SAC for supporting the needy engineering students of Pakistan from here and urged to extend its base as much as possible. The event was very successful mainly due to continuous follow up and hard work of the convener and other members of the Sponsorship committee. The event was widely reported by local and Pakistani press and TV news channels in Pakistan.

IEP-SAC Sub-Centres:

IEP-SAC has three (3) centers in KSA, comprising a main center in Riyadh (Central region) and two sub-centers in Eastern and Western regions. All centers are very active in organizing various technical seminars and other social events mainly for the Pakistani engineering community in KSA. Detailed reports about the activities of the sub-centers from their chairmen with photographs are also included on the subsequent pages of this annual journal.

Appreciation And Gratitudes:

On behalf of IEP-SAC, I would like to express the gratitude to the Custodian of the Two Holy Mosques, King Salman Bin Abdul Aziz Al-Saud and the Government of the Kingdom of Saudi Arabia for providing opportunities to Pakistanis in general and Pakistani engineering community in particular to contribute towards the development of our brotherly country Saudi Arabia. We are also thankful to the patronage and support of the Pakistani embassy and its senior staff to all of our centers in KSA throughout the year. We hope this cooperation will be continued by our patron-in-chief the new Pakistani Ambassador His Excellency Vice Admiral (Retd) Khan Hasham bin Saddique in the same way as it was done by the past ambassadors.

The contribution of IEP-SAC sub-center of Eastern region (Engr. Rizwan Ahmed and his local council members) in raising the funds for our scholarship program is also highly appreciated and I urge our Western region sub-center also to participate in this noble and just cause. I wish to extend my thanks to all brother engineers, sponsors, advertisers, press/media personnel and well-wishers for their cooperation and continuous support to IEP-SAC.

Finally I wish to convey my deep appreciation to our chairman Engr. Syed Mubashir Hussain Kirmani and all local council members of the central region for their guidance, support and untiring efforts without which IEP-SAC could not achieve the present height of success.

Thank you very much.

Engr. S. M. Iqbal Ahmed
General Secretary IEP-SAC

AWARDS AND SCHOLARSHIPS COMMITTEE

لَيْسَ الْبِرَّ اَنْ تُوَلُّوْا وُجُوْهَكُمْ قِبَلَ الْمَشْرِقِ وَالْمَغْرِبِ وَلٰكِنَّ الْبِرَّ مَنْ اٰمَنَ بِاللّٰهِ وَالْيَوْمِ الْاٰخِرِ وَالْمَلٰٓئِكَةِ وَالْكِتٰبِ وَ
النَّبِيّٖنَ ۚ وَاٰتَى الْمَالَ عَلٰى حُبِّهٖ ذَوِي الْقُرْبٰى وَالْيَتٰمٰى وَالْمَسٰكِيْنَ وَابْنَ السَّبِيْلِ ۙ وَالسَّآئِلِيْنَ وَفِي الرِّقَابِ ۚ .... ﴿۱۷۷﴾

اِنْ تُبْدُوا الصَّدَقٰتِ فَنِعِمَّا هِيَ ۚ وَاِنْ تُخْفُوْهَا وَتُؤْتُوْهَا الْفُقَرَآءَ فَهُوَ خَيْرٌ لَّكُمْ ۭ وَيُكَفِّرُ عَنْكُمْ مِّنْ سَيِّاٰتِكُمْ ۭ وَاللّٰهُ
بِمَا تَعْمَلُوْنَ خَبِيْرٌ ﴿۲۷۱﴾

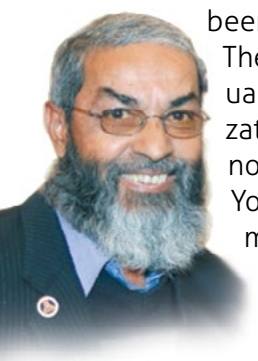
"But Al-Birr (righteousness, piety) is the quality of one who believes in Allah, and the Last Day, and the Angels, and the Book, and the Prophets and distributes his wealth, in spite of love for it, to the kinsfolk, and to the orphans, and to the needy, and to the wayfarer, and to those who ask, and to the ransom of prisoners." (Al-Baqarah-177)

" If you disclose your (acts of) charity, it is well, but if you conceal it, and give it those (really) in need, that is better for you; it will remove from you some of your (stains of) sins and Allah is well acquainted with what you do." (Al-Baqarah-271)

Education plays a very important role in the development of any society. Due to this reasons, IEP-SAC decided at the very start to facilitate the education of deserving engineering students in Pakistan. By the grace of Allah the Almighty, the IEP-SAC scholarship program for needy and academically sound students in the Engineering Universities and Colleges of Pakistan which was launched 22 years ago continued during this year also. With the joint efforts of IEP-SAC Local Council members, local and other donors, at present 8 students selected from each of the following 11 public-sector universities and colleges were offered scholarships through this program during September 2017-August 2018 period.

1. University of Engineering and Technology, Lahore
2. University of Engineering and Technology, Taxila
3. University College of Engineering and Technology, Baha'uddin Zakariya University, Multan
4. Institute of Chemical Engineering and Technology, University of the Punjab, Lahore
5. Dawood College of Engineering and Technology, Karachi
6. NED University of Engineering and Technology, Karachi
7. Mehran University of Engineering and Technology, Jamshoro
8. Quaid-e-Awam University of Engineering Sciences and Technology, Nawabshah
9. KPK University of Engineering and Technology, Peshawar
10. Balochistan University of Engineering and Technology, Khuzdar
11. Mirpur University of Science and Technology, Mirpur (AJ&K)
12. Khawja Fareed University of Engineering and Information Technology, Rahim Yar Khan

As can be noted from the list, this scholarship program serves all the four provinces of the Islamic Republic of Pakistan and the State of Azad Jammu and Kashmir. The rules and regulations, selection criteria and application forms can be accessed and printed from IEPSAC website. Up to now, 20 batches of the scholarships have been completed so far and 21st batch will be launched in September 2018.



The continuity of IEP-SAC scholarship program has been maintained and also been expanded gradually with the help of financial contributions from various philanthropists, individuals, and organizations in Saudi Arabia. I request Pakistani community and engineers to join hands with us in this noble and just cause. It is a great service to the humanity Engineering community in Pakistan.

Your suggestions to improve the program further are most welcomed. You can contact any of the members of IEP-SAC Awards and Scholarships Committee or Local Council for any suggestion or information.

Engr. Shaikh Akhtar Hussain, Convener
IEP-SAC Awards and Scholarships Committee

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SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

47th IEP–SAC Annual Technical Seminar, held on 20th May 2017
at King Salman Social Centre Riyadh

SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

47th IEP–SAC Annual Technical Seminar, held on 20th May 2017
at King Salman Social Centre Riyadh












SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

48th IEP–SAC Annual Technical Seminar, held on 22nd December 2017
at King Salman Social Centre Riyadh







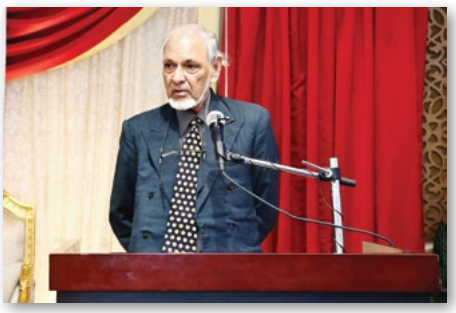




SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

48th IEP–SAC Annual Technical Seminar, held on 22nd December 2017
at King Salman Social Centre Riyadh



SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

Family Picnic, 10th February 2018, Istraha AMASI












SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

Family Picnic, 10th February 2018, Istraha AMASI












SCENES FROM IEP–SAC **Activities**

CENTRAL REGION

An event "Thanks to Sponsors" hosted by IEP–SAC at Riyadh Palace Hotel on 26th March 2018 in the appreciation of sponsors for their valuable contribution to the cause of IEP.









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Institution of Engineers – Pakistan focuses on Engineering education, Science and Technology, R&D, talent hunt and building on intellectual capital to make a "Better World" as its logo projects its vision. This is our mission too.

We have conducted following technical seminars in 2017-2018 to enhance & share knowledge with our fellow engineer's.

1. **"Metal Casting Technologies, Past, Present and Future";** By Engr. Muhammad Azhar Ali Khan A PHD candidate at King Fahd University of Petroleum and Minerals.

   A look into the metal casting technologies of past, present and future. Including new design strategies and the use of virtual reality in this field like engine blocks, valves, impellers, pump housings and brackets starting from its evolution to casting design strategies which are being used today.

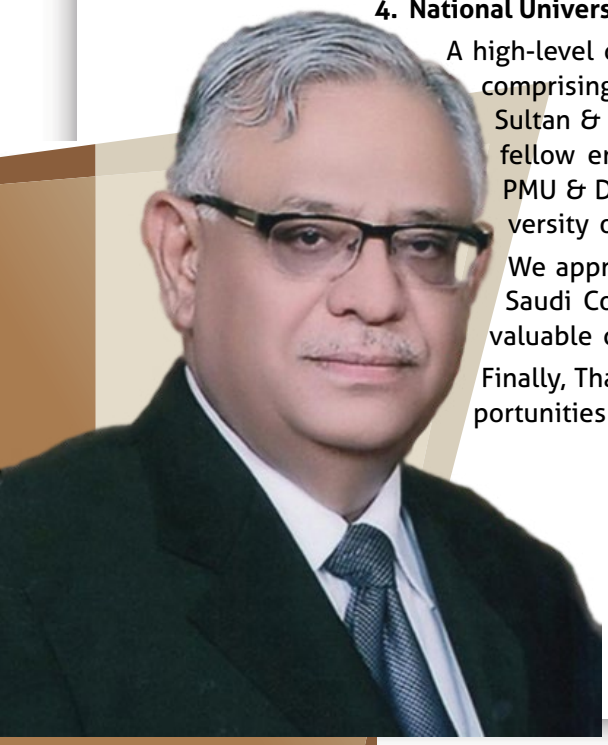
2. **"Smart Grid: A myth or reality";** by Engr. Muhammad Abrar Shami.

   The Evolution of the "Smart Grid" in Electricity distribution, its world-wide effect and how it will affect our future were discussed. It was elaborated that how Smart Grid has become the need of the day due to increased use of communication and Information Technology in the generation, delivery and consumption of electrical energy.

3. **"Motivational Leadership For Effective Project Management";** by Engr. Sayed Bader Alawi.

   Strategic approaches to projects delivery and leadership requirement for the construction industry were discussed. The talk included the difference between management and leadership; with a focus on "Soft skills" of leadership – from communication to negotiation, employee engagement and dispute resolution.

4. **National University of Science & Technology (NUST) Visit**



A high-level delegation of National University of Science & Technology (NUST) comprising Rector, Pro-Rector, visited KFUPM & met rector of UPM Dr. Khalid Sultan & its key faculty members. IEP-SAC-EP hosted their presentation for fellow engineer's key business executives, professors, doctors of KFUPM, PMU & Dammam University to share information of No. 1 Engineering University of Pakistan.

We appreciate support of our sponsors, fellow engineers, local industries, Saudi Council of engineers and Jordanian Engineers Association for their valuable contribution in our success.

Finally, Thanking Al-Mighty ALLAH for providing us resources, energy and opportunities to serve our engineering community.

Engr. Rizwan Ahmed
Chairman
IEP-SAC Eastern Region

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قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ لِيَسْأَلْ أَحَدُكُمْ رَبَّهُ حَاجَتَهُ كُلَّهَا حَتَّى يَسْأَلَ شِسْعَ نَعْلِهِ إِذَا انْقَطَعَ

Allah's Messenger (SAW) said, "Let everyone of you ask his Lord for all his needs-asking also for the thong of his sandal when it is damaged."

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Annual event on "Motivational Leadership For Effective Project Management" held on January 15, 2018 at Dhahran International Hotel, Al-Khobar.

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Seminar by collaboration of IEP–SAC–EP and NUST under the patronage of Pakistan Embassy to share NUST initiatives to the Pakistani community held on March 6, 2018 at Karawan Compound Community Hall, Al Bustan District, Al Khobar.












SCENES FROM IEP–SAC **Activities**

EASTERN REGION

Technical Seminar on "Metal Casting Technologies – Past, Present & Future"
held on May 10, 2017 at Marhaba Restaurant, Al Khobar.












SCENES FROM IEP–SAC **Activities**

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Technical Seminar on "Smart Grid; A Myth or Reality" held on October 24, 2017 at Marhaba Restaurant, Al Khobar.











SCENES FROM IEP–SAC **Activities**

EASTERN REGION

Dinner Reception hosted to commemorate IEP–SAC–EP 150th Executive Council meeting to honor Sponsors, Advertisers and Speakers valuable contributions and support on April 10, 2018 at Karawan Compound Community Hall, Al Bustan District, Al Khobar












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From The FEIIC Advisor

I am pleased to learn that the IEP-SAC, is bringing out its annual magazine, The JOURNAL. The previous issues were hailed by the fellow engineers for its format as well as the contents. I am confident that this issue will be yet another milestone in the Editorial Board's pursuit of excellence.

While, however, technical and artistic excellences are very desirable and necessary, there are other elements required in a publication of The JOURNAL in order to fulfill its object completely. Of these other elements one, and perhaps the most important, is that our Magazine should convey a direct—a human—interest to as many individual members of the community as possible. There is a social as well as a business side to our relations with each other, and the cultivation of the human touch adds to the happiness and contentment of members who are engaged in the performance of their multifarious duties. The section on the light of Islam in The JOURNAL furnishes an outlet for items of this nature. I congratulate the Editorial Board for presenting and promoting this idea and hope that our other regions will follow suit.

All regions of IEP-SAC have gone extra length to extend their helping hand not only to the victims of such calamities as the 2005 earthquake and 2010 floods but also enlarging on a continuing basis an impressive scholarship program for needy engineering student of Pakistani engineering universities in the public sector. Our steps may be small but they are giant leaps under the light of Islam.

The volunteer services of the council members at the three regions—Central, Eastern, and Western—is the vehicle for making this success a possibility. Without their sheer hard work and dedication, our programs on the technical and social fronts could not have been held so successfully, and as always. I salute them all.

I call upon the community to come forward and contribute to the objects and purposes of the IEP-SAC and join hands with the Saudi Council of Engineers who has now more than 5300 Pakistani engineers registered with them. The cooperation of IEP-SAC and SCE will ensure ever growing strong relationship between PAKISTAN and SAUDI ARABIA.

Engr S M Jaleel Hasan

Advisor

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Water Losses In Transmission And Distribution Network-Methods Of Its Effective Management

by
S.M.H. Kirmani

Abstract

It is easy to understand that controlling water loss saves money, but it is not always easy to determining what your water loss is? Why is there or how to reduce it?

If losses are due to under registering customer meters, you lose revenue on water you paid to deliver. If losses are caused by leaks, you have lost the money it cost to produce or purchase that water.

Further water loss awareness is a never ending job, each water supply system could differ from the other.

This article summarizes the main concept in water loss determination, suggests ways to keep loss under control, and describes some of the reasons why water loss determination is essential to good.

I. Introduction:

Water is the basis of the great biodiversity on our planet, without water in sufficient quantity and quality the future of human life, wild life and eco-system is threatened, rather without water planet earth would be a gigantic dead desert.

Based on the importance and pivotal role of water in sustaining livelihood, it is obligatory to use water sensibly, economically and to save it from wastage.

In this regards the teaching of QURAN is evident. In Sura-e-al al'araf (7:31) all mighty allah has directed: "eat and drink, but be not excessive. Indeed, he likes not those who commit excess".

However it is estimated in UNESCO's report that 60-63 % UFW (unaccounted for water) of drinking water is lost through water transmission and distribution network (real losses) or due to unauthorized consumption and metering inaccuracies (apparent losses).

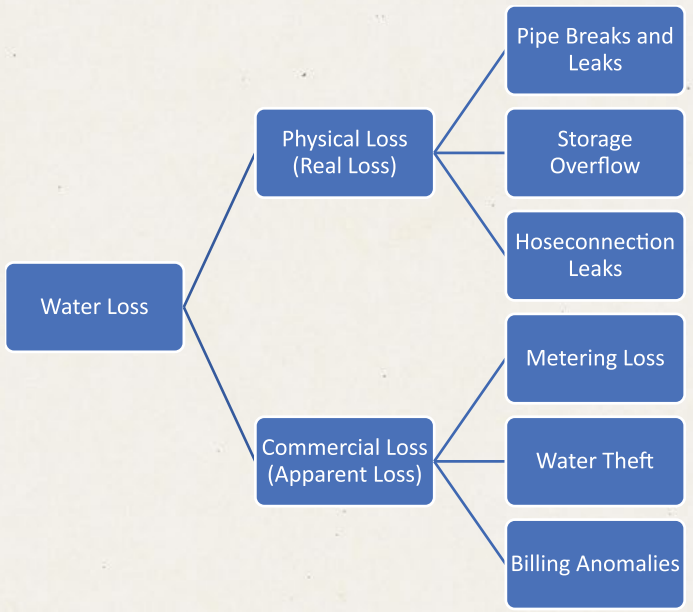
It is easy to understand that controlling water loss saves money but is not always easy to determine what your water loss is? why it is there, or how to reduce it?

The annual volume of water loss is an important indicator in assessing water utility efficiency both in individual years and as a trend over a period of years. High and increasing water losses are an indicator of ineffective planning and construction and also of low operational maintenance activities.

II. What is water loss:

The UFW (unaccounted-for-water) loss is the difference between water entering the supply system (through wells, surface intakes and / or whole sales purchases) and water used (sold to customers or used for free).

UFW="Net Production"- Legitimate consumption components of water loss:



III. Components of water loss:

As the magnitude of two components of water losses, "real and apparent" loosses is known, it is possible to

- Predict the potential savings (from real losses) and potential revenue increases (from apparent losses)
- Develop real and apparent looses reduction strategy
- Set realistic targets

Standard terminologies: Table No. 1 indicates the standard terminologies used in this article

System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption (including water exported)	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	Non-Revenue Water (NRW)
			Unbilled Unmetered Consumption	
	Water Losses	Apparent* Losses	Unauthorised Consumption	
			Metering Inaccuracies	
		Real* Losses	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
			Leakage on Service Connections up to the measurement point	

All quantities in m^3 / year

IV. Non Revenue Water:v

Non Revenue Water (NRW) represents the difference between the volume of water delivered into a network and bill authorized consumption.

NRW= "Net Production" – "Revenue Water"

= UFW + Water which is accounted for but no revenue is collected (unbilled authorized consumption)

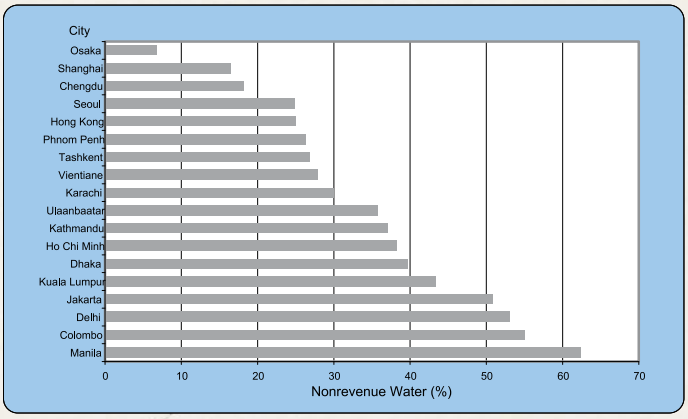
Unbilled authorized consumption is normally only a small component of the water balance. It includes items such as fire fighting, flushing of mains and sewers, public hydrants, public fountains, watering municipal gardens, etc.

V. Non-Revenue water in some Asian countries:

Fig No 1 (UNESCO -IHE) indicates about 30% non-revenue water loss in Karachi

Calculation of NRW %= [1-Billed water/ input volume] x 100 [1]

Non- Revenue Water in some Asian Cities:



Source: Water in Asian Cities, ADB (2004) Fig: 1

Non Revenue Water in major Pakistani Cities:

Table No 2 [2]

Karachi	Lahore	Faisalabad	Rawalpindi	Multan	Peshawar
45%	40%	40%	45%	40%	50%

VI. What is an acceptable water loss:

It is a compromise between the cost of reducing water loss and maintenance of distribution system and the cost (of water) saved.

American Water Works Association (AWWA) leak detection and accountability committee recommends 10% as a bench mark for UFW.

- Less than 10%: acceptable, monitoring and control needed
- 10-25%: Intermediate, could be reduced
- More than 25%: Matter of concern; reduction needed.

Unavoidable Annual Real Looses (UARL):

It is impossible to eliminate all real losses from a distribution system as:

- Some looses are unavoidable
- Some leakages are believed to be un detectable (too small to detect) or uneconomical to repair

However, an estimate of unavoidable annual real looses (UARL) can help to evaluate the feasibility of real loss minimization (provides better understanding of real loss components)

The UARL is computed based on background looses and burst estimates (BABE).concept.[2]

The UARL values shown in table number 3 provide a rationale yet flexible basis for predicting UARL values for a wide range of distribution system, taking into account of supply, length of mains, number of service connections, location of customer meters and average operating pressure.

Table 3 : Calculated components of Unavaoidable Annual Real Losses (UARL)

Infrastructure Components	Background Looses	Reported Bursts	Unreported Burst	UARL Total	Units
Mains	9.6	5.8	2.6	18	Liters/ Km mains/Day/ meter of pressure.
Service connections, meters at edge of street	0.60	0.04	0.16	0.80	Liters / connection / day / meter of pressure.
Underground pipes between edge of street and customer meter	16.0	1.9	7.1	25	Liters / Km u.g Pipe / Day / Meter of pressure.

The above components are indicated in following Fig No. 2 [3]

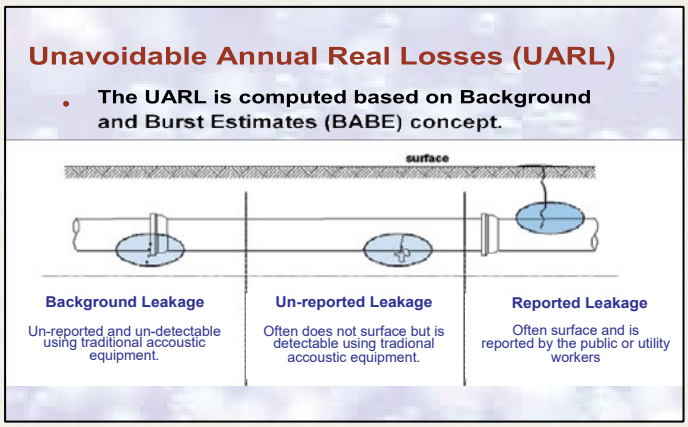


Fig-2

The values shown in table 3, can also be presented by the equation as:

UARL (L/day) = (18xLm + 0.80x Nc+25Lp) x P [3]

Where, L= Length of mains in Km

Nc= Number of service connections

Lp= Total length in Km of underground connection pipe (between the edge of the street and customer meter)

P = Average operating pressure in meter

According to UNESCO recommendation, table number 04 indicates UARL in liters / service connection / day for customer meters located at edge of street.

Table 4 [3].

UAR in liter / service connection / day for customer meter located at edge of street					
Density of connections Nc / Lm (per (Km mains	Average operating pressure (P) in meters				
	20	40	60	80	100
20	34	68	112	146	170
40	25	50	75	100	125
60	22	44	66	88	110
80	21	41	62	82	103
100	20	39	59	78	98

Brief description of the infrastructure leakage index (ILI)

As an alternative indicator for the measurement of real losses in infrastructure leakage index (ILI) has been developed. ILI is effectively an indicator of how well the distribution network is being managed and maintained at the current operating pressure.

It is the ratio of current Annual Real Losses (CARL) to unavoidable annual real losses (UARL) [4]

ILI= CARL/ UARL

However the use of ILI as the sole performance indicator (PI) for real losses in not globally used, but the following PI's are acceptable:

I. Liters / service connection/ day or L/ Km / day (if service connection density is greater than 20)

II. % of losses

III. ILI

Example Calculation:

A distribution system has 1500 Km mains and 60000 service connections with customer meters located (on average) 6 meters from the edge of the street. The system is pressurized for 90% of the time, and the average pressure when pressurized is 30 meters.

The current annual real losses in the above system for the annual water balance are 4000 x 10^3 m^3 / year. Calculate Tech. Indicator for real losses (CARL); unavoidable annual real losses (UARL) using table 3 and infrastructure leakage index (ILI).

Calculation:

I. Performance indicator of Real Losses (CARL)

= 4000 x 10^3 x 10^3 (liters) / 60000 (s.c) x 0.9 (% timing) x 365

= 202 Liters / service connection / day

II. Unavoidable real looses (UARL) components:

a. Mains (Refer to Table 3) = 18 (L) x 1500 (Km) x (0.9 x 365) (days) x 30 (m.pressure) / 10^6 = 266 x 10^3 m^3 / year

b. 0.8 L / connection / day / meter of Pressure (Refer to Table 3)

= 0.8 x 60000 x (0.9 x 365) x 30 = 473 x 10^3 m^3 / year

c. Edge of street to customer meter:

= 25 / Km u.g Pipes / day / meter of Pressure (Table 3)

= 25 x (60000x 6/1000) x (0.9 x 365) x 30

= 87 x 10^3 m^3 / day

Total unavoidable Annual real looses (UARL)

(a)+(b)+(c) = 826 x 10^3 x 10^3 / (60000 x 0.9 x 365)

= 42 L / service connection / day

I.L.I = CARL / UARL = 202 / 42 = 4.8

VII. Water Loss Control Program [5]

A water loss control program consists of 3 major steps :

1. Water Audit
2. Intervention
3. Evaluation

Step 1: Water Audit:

A water Audit identifies and quantifies the water uses and losses from a water system. Water Audit data needs:

i. Gathering information.
ii. Determining flows into and out of the distribution system based on estimates or metering.
iii. Calculating the performance indicators.
iv. Assessing where water losses appear to be occurring based on available metering and estimates.
v. Analyzing data gaps.
vi. Considering options and making economic and benefit comparison of potential actions.
vii. Selecting the appropriate intervention.

Step 2: Intervention Action themes:

i. Gathering further information, if necessary.
ii. Metering assessment, testing or a metering replacement program.
iii. Detecting and locating leaks.
iv. Repairing or replacing pipes
v. Operation and maintenance program and changes
vi. Administrative processes or policy changes.
vii. No further action is necessary.

Step 3: Evaluation Performance Indicators:

i. Were the goals of intervention met? If not, why not.
ii. Where the system need more information?
iii. How often should the system repeat the audit, intervention and evaluation process?
iv. Is there another performance indicator the system should consider?
v. How does the system compare to the last audit, intervention and evaluation process?
vi. How can system improve performance?

VIII. Understanding a Multidimensional problem:

Four important components of an active real loss as well as of an active apparent loss management program are indicated in Fig 3 and Fig 4 respectively [6]

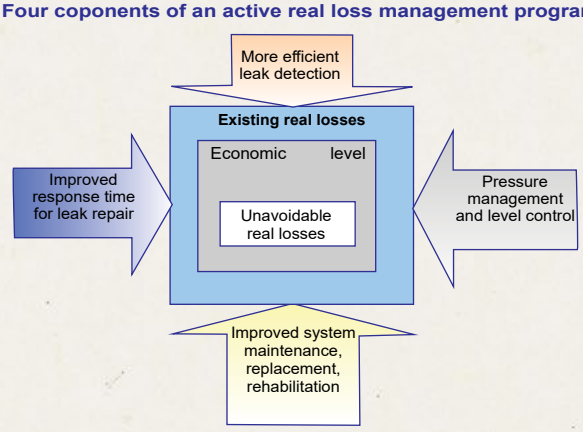


Fig-3 [6]

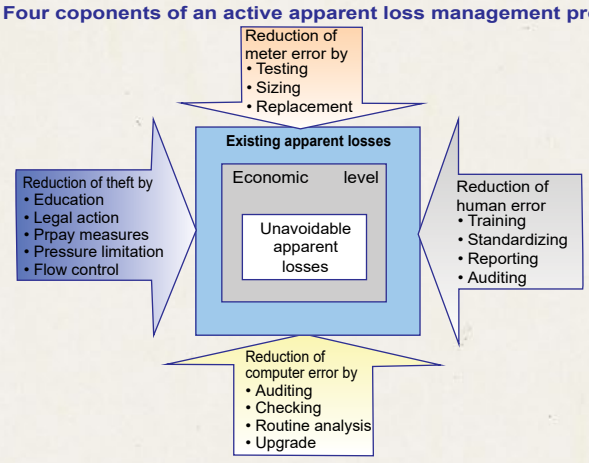


Fig-4 [6]

The four components are briefly described as follows:

i. Meter under-registration consists of the inability of a revenue water meter to accurately measure flows, the lower flows. This tends to increase with time as the meter degenerates.
ii. Water theft is easy to conceptualize and consists of usually of bypasses to the water meters, illegal connections, or willful damage to the water meter.
iii. Meter reading errors consist of mistaken or intentionally incorrect meter reading mistakes.
iv. Water accounting errors consist of billing anomalies, such as computer-based estimation that do not reflect actual consumption values.

For apparent losses a base value of 5% of water sales is recommended as a reference, and the actual Apparent loss value calculated against this benchmark. The performance indicator would appear, for a specific area, as follows:

Apparent Loss index=Apparent loss value/5% of water sale

A recommendation is made to utilize similar concept to that of Real losses and the Infrastructure leakage index (ILI).

IX. Conclusion:

Non-revenue water (NRW) is water that has been produced and is "LOST" before it reaches the customer. Looses can be real looses (through leaks, sometimes also referred to as physical looses) or apparent looses (for example: through theft or metering inaccuracies). High value of NRW are detrimental through the financial viability of water utilities, as well as to the quality of itself.

Controlling leakage effectively relies upon a "proactive" leakage management program that includes a means to identify hidden leaks; optimize repair functions, manage excessive water pressure levels, and upgrade piping infrastructure before its useful life ends.

Effective technologies have been developed in recent years including flow and component analysis to quantify leakage amounts, break noise

Correlations and loggers to pinpoint leaks, and pressure management to systematically reduce leakage under the right conditions. Many effective strategies now exists to allow water utilities to identify, measure, reduce or eliminate leaks in a manner that is consistent with their cost of business.

It is agreed that the basic principle of effective governance includes:

- Participation by all stakeholders; transparency; equity; accountability; coherence; responsiveness; integration and ethical issues.

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For the past 40 years he has been Chief Engineer at Rashid Engineering Consultant, Riyadh. He has vast experience in technical coordination, Engineering management, Pre-qualification of equipment/material and participation in high level Tech. meetings in various countries of Europe, South Asia and USA. He is author of several Tech. Papers and made presentation in Seminars. He is currently chairman of IEP-SAC.

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مجموعة عبدالله الخريف
ABDULLAH KHURAIF GROUP

Healthcare, Agriculture, Industry, Trading & Engineering Contracting

Abdullah Khuraif Group Introduction:

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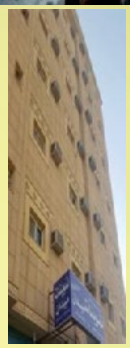
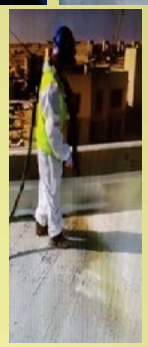
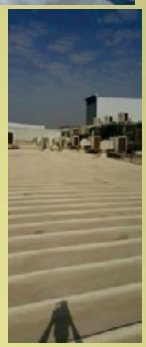



فرع المقاولات العامة وإعادة تأهيل وأعمال التشطيبات والعزل المائي والحراري

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Recent Trends in Membrane Desalination

By

Eng. Fayyaz Muddassir Mubeen

Abstract

Membrane technologies have seen a significant growth in the last two decades. This paper gives a quick overview of membrane technologies with their general use and application. Reverse Osmosis (RO) membrane technology has been successfully used since 1970's for brackish and seawater desalination. A lower pressure RO technology called nanofiltration (NF), also known as "membrane softening," has also been widely used for treatment of hard, high color, and high organic content feed water. RO systems are also utilized for removal of inorganic contaminants. During the last 8-10 years, utilities worldwide have turned to low pressure membrane filtration to meet more stringent water quality requirements. The membrane technologies has the answer for any situation, with multiple full scale global applications in drinking water, municipal wastewater, industrial wastewater, ultra-pure water, recovery/ reuse, agriculture, pharmaceutical, power generation, pulp and paper, semiconductor, specialty chemicals, submarines and oceangoing ships.

I. Introduction

Membrane technologies have seen a significant growth and increase in application in the last two decades. Membrane systems are now available in several different forms and sizes, each uniquely fitting a particular need and application. This article gives a quick overview of membrane technologies with their general use and application.

Reverse Osmosis (RO) membrane technology has been successfully used since 1970's for brackish and seawater desalination. A lower pressure RO technology called nanofiltration (NF), also known as "membrane softening," has also been widely used for treatment of hard, high color, and high organic content feed water. RO systems are also utilized for removal of inorganic contaminants such as radio-nuclides, nitrates, arsenic, and other contaminants such as pesticides.

A non- pressure, electric potential driven membrane called Electro Dialysis Reversal (EDR) has also been widely used for removal of dissolved substances and contaminants.

RO is a physical separation process in which properly pretreated source water is delivered at moderate pressures against a semi-permeable membrane. The membrane rejects most solute ions and molecules, while allowing water of very low mineral content to pass through. This process also works as an absolute barrier for cysts and most viruses. The process produces a concentrated reject stream in addition to the clean permeate product. Byproduct water or the "concentrate" may range from 10% to 60% of the raw water pumped to the reverse osmosis unit. For most brackish waters and ionic contaminant removal applications, the concentrate is in the 10-25% range while for seawater it could be as high as 60%. Typical RO/NF elements are in spiral wound element configuration, while EDR is in stacks containing membrane sheets.

During the last 8-10 years, utilities worldwide have turned to low pressure membrane filtration to meet more stringent water quality requirements. Low pressure microfiltration (MF) and ultrafiltration (UF) membrane filtration technologies have emerged as viable options for addressing the current and future drinking water regulations related to the treatment of surface water, groundwater under the influence, and water reuse applications for microbial and turbidity removal. MF membranes can remove particles with sizes down to 0.1- 0.2 microns. Some UF processes have a lower cutoff rating of 0.005-0.01 microns. Pressure or vacuum may be used as the driving force to transport water across the membrane surface. Most MF / UF systems operate with high recoveries of 90 – 98%. Full-scale facilities have demonstrated the efficient performance of both MF and UF as feasible treatment alternatives to conventional granular media processes. Both systems have been shown to exceed the removal efficiencies identified in the Surface Water Treatment Rule such as Cryptosporidium oocyst, Giardia cyst, and turbidity. MF and UF membrane systems generally use hollow fibers that can be operated in the outside-in or inside-out direction of flow. Pressure (5 to 35 psi) or vacuum (-3 to -12 psi for outside-in membranes only) can be used as the driving force across the membrane.

MF and UF membranes are most commonly made from various organic polymers such as cellulose derivatives, poly-sulfones, polypropylene, and polyvinylidene fluoride (PVDF). Physical configurations include hollow fiber, spiral wound, cartridge, and tubular.

Membrane Bioreactor (MBR) and tertiary treatment systems are the best available technologies for communities that are concerned about protecting the environment and preserving potable water supplies. Whether a community needs to improve the effluent quality from its existing conventional wastewater treatment plant, or construct a new compact and highly efficient wastewater treatment system, MBRs provide cost-effective solutions that will meet or exceed discharge standards for years to come. Effluent from these systems is of such high quality that it can be safely discharged into the most sensitive aquatic environments or reused in irrigation, industrial processes, or groundwater recharge.

With so many utilities facing the threat of contamination from an increasing number of sources, the need for new and better ways of treating and protecting our water supplies is paramount. Although there is no guarantee of 100% protection against an attack, spill, or infiltration of natural or intentional contaminants, the multi barrier approach, along with the other benefits of membrane technology, can reduce the potential for disasters substantially. Together with all other safety and security measures recommended by World Health Organization (WHO) guidelines, the installation of membrane systems in a facility provides water agencies with an effective multi-barrier system.

In summary, one of these membrane technologies has the answer for any particular situation, with multiple full scale global applications in:

- Drinking Water
- Municipal Wastewater
- Industrial Wastewater
- Ultra-pure Water
- Recovery/Reuse
- Agriculture
- Landfill Leachate
- Pharmaceutical
- Power Generation
- Pulp and Paper
- Semiconductor
- Specialty Chemicals
- And even Floating Plants

II. Membrane Filtration (MF/UF)

Water utilities worldwide are turning to advanced filtration to meet more stringent WHO drinking water regulations in order to remove turbidity, precursors, and disinfectant tolerant micro-organisms from both groundwater and surface water supplies.

Low pressure microfiltration (MF) and ultrafiltration (UF) membrane filtration technology have emerged as viable options for addressing the current and future drinking water regulations related to the treatment of surface water, groundwater under the influence, and water reuse applications for microbial and turbidity removal. Full-scale facilities have demonstrated the efficient performance of both MF and UF as feasible treatment alternatives to conventional granular media processes. Both MF and UF have been shown to exceed the removal efficiencies identified in the Surface Water Treatment Rule and related rules, such as Cryptosporidium oocyst, Giardia cyst, and turbidity.

MF and UF membrane systems generally use hollow fibers that can be operated in the outside-in or inside-out direction of flow. Pressure (5 to 35 psi) or vacuum (-3 to -12 psi for outside-in membranes only) can be used as the driving force across the membrane. Typical flux (rate of finished water-permeate per unit membrane surface area) at 20 degrees C for MF and UF ranges between 50 and 100 gallons per square foot per day (gfd).

Since both processes have relatively small membrane pore sizes, membrane fouling, caused by the deposition of organic and inorganic compounds on the membrane, may occur at unacceptable levels if the system is not properly selected, designed, and operated. Automated periodic backwashing and chemical washing processes are used to maintain the rate of membrane fouling within acceptable limits. Chemical cleaning is employed once a maximum transmembrane pressure differential has been reached. Some systems utilize air/ liquid backwash. Typical cleaning agents utilized include acids, caustic, surfactants, enzymes, and certain oxidants, depending upon membrane material and foulants encountered. Chemicals used for cleaning, and the method used in the cleaning process, must be acceptable to the membrane manufacturer.

Overall treatment requirements and disinfection credits must be discussed with and approved by the reviewing authority. Disinfection is recommended after membrane filtration as a secondary pathogen control barrier and distribution system protection.

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Overall treatment requirements and disinfection credits must be discussed with and approved by the reviewing authority. Disinfection is recommended after membrane filtration as a secondary pathogen control barrier and distribution system protection.

MF and UF membranes are most commonly made from various organic polymers such as different cellulose derivatives, poly-sulfones, polypropylene, and polyvinylidene fluoride (PVDF). Physical configurations include hollow fiber, spiral wound, cartridge, and tubular. MF membranes can remove particles with sizes down to 0.1- 0.2 microns. Some UF processes have a lower cutoff rating of 0.005-0.01 microns. Pressure or vacuum may be used as the driving force to transport water across the membrane surface.

Membrane filtration is also becoming popular for conventional plant retrofits, replacing sand media, for enhanced water quality and capacity increase.

When Selecting MF/UF Systems, the Following Should be Considered:

1. A review of historical source raw water quality and variability data, including turbidity, algae, particle counts, seasonal changes, organic contents, microbial activity, and temperature as well as other inorganic and physical parameters is critical to determine the overall cost of the system. The degree of pretreatment, if any, should also be ascertained. Design considerations and membrane selection at this phase must also address the issue of target removal efficiencies and system recovery versus acceptable membrane fouling rate. At a minimum on surface water supplies, pre-screening is required.
2. The life expectancy of a membrane under consideration should be evaluated (typically 7-10 years). Membrane replacement frequency is a significant factor in operation and maintenance cost comparisons in the selection of the process. Warranties offered by manufacturers vary significantly and should be considered closely.
3. Some membrane materials are incompatible with certain oxidants such as chlorine. If the system must rely on pretreatment oxidants for other purposes, for example, zebra mussel control, taste and odor control, or iron and manganese oxidation, the selection of the membrane material becomes a significant design consideration.
4. The source water temperature can significantly impact the flux of the membrane under consideration. At low water temperatures, the flux can be reduced appreciably (due to higher water viscosity and resistance of membrane to permeate), possibly impacting process economics by the number of membrane units required for a full-scale facility. System capacity must be selected for the expected demand under seasonal (cold and warm water temperature) conditions.
5. Backwashing waste volumes can range from 4 to 15 percent of the permeate flow, depending upon the source water quality, membrane flux, frequency of backwashing, and the type of potential fouling.
6. Membrane systems used for drinking water production should be provided with an appropriate level of finished water monitoring and a direct integrity test feature. Monitoring options may include laser turbidimeters, particle counters, and manual and/or automated integrity testing using pressure decay or air diffusion tests.
7. Cross-connection control considerations must be incorporated into the system design, particularly regarding the introduction and discharge of chemicals and waste piping. Membrane systems that use chemical washing processes with harsh chemicals require additional consideration.
8. Redundancy of critical components and control features should be considered in the final design.
9. Other post-membrane treatment requirements such as corrosion control and secondary disinfection must be evaluated in the final design.
10. Other contaminants of concern such as color and disinfection by-product precursors should also be addressed.
11. Prior to initiating the design of an MF or UF treatment facility, the nation's reviewing authority should be contacted to determine the disinfection credits available for the membrane process, and whether a pilot plant study will be required. In most cases a pilot plant study will be necessary to determine the best membrane to use, particulate/organism removal efficiencies, cold and warm water flux, the need for pretreatment, fouling potential, operating and transmembrane pressure, and other design considerations. The reviewing authority should be contacted prior to conducting the pilot study to establish the protocol to be followed.

III. Nanofiltration and Reverse Osmosis (NF/RO)

Reverse osmosis (RO) is a physical separation process in which properly pretreated source water is delivered at moderate pressures against a semipermeable membrane. The membrane rejects most solute ions and molecules, while allowing water of very low mineral content to pass through. This process also works as an absolute barrier for cysts and viruses. The process produces a concentrated reject stream in addition to the clean permeate product. Reverse osmosis systems have been successfully applied to saline groundwaters, brackish waters, and seawater, as well as for removal of inorganic contaminants such as radionuclides, nitrates, arsenic, and other contaminants such as pesticides.

In an RO system, a higher concentration solution on one side of a semipermeable plastic membrane is subjected to pressure, causing freshwater to diffuse through the membrane leaving behind a more concentrated solution containing a majority of the dissolved minerals and other contaminants. The major energy requirement for reverse osmosis is to pressurize the source, or "feed" water. Depending on the characteristics of the feedwater, different types of membranes may be used. Because the feedwater has to pass through very narrow passages in the membrane module, larger suspended solids must be removed during the initial treatment phase (pretreatment).

A lower pressure RO technology called nanofiltration (NF), also known as "membrane softening," has been successfully used for treatment of hard, high color, and high organic content feedwater. The NF membrane has lower mono-valent ion rejection properties, making it more suitable to treat waters with low salinity, thereby reducing post-treatment and conditioning as compared with RO. The NF membrane also works as an absolute barrier for cysts and most viruses. Nanofiltration plants typically operate at 85 to 95 percent recovery. Brackish water RO plants typically transfer 70 to 85 percent of the source water into permeate, and seawater RO recovery rates range from 40 to 60 percent.

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When Selecting RO/NF Systems, the Following Should Be Considered:

1. Membrane Selection: Two types of membranes are most commonly used. These are cellulose acetate based and polyamide composites. Membrane configurations typically include spiral wound and hollow fiber. Operational conditions and useful life vary depending on the type of membrane selected, quality of feedwater, and process operating parameters. Most current manufacturers only have the spiral wound option.
2. Useful Life of the Membrane: Membrane replacement and power consumption represent major components in the overall water production costs. The relative contributions depend primarily on feedwater salinity. In well designed and operated RO systems, membranes have lasted 5 to over 10 years in suitable applications.
3. Pretreatment Requirements: Acceptable feedwater characteristics are dependent on the type of membrane chosen and operational parameters of the system. Without suitable pretreatment or acceptable feedwater quality, the membrane may become fouled or scaled, and consequently its useful life is shortened. Pretreatment is usually needed for turbidity reduction, iron or manganese removal, stabilization of the water to prevent scale formation, microbial control,

chlorine removal (for certain membrane types), and pH adjustment. As a minimum pretreatment, cartridge filters are used for protection of the membranes against particulate matter.

4. Treatment Efficiency: Reverse osmosis is highly efficient in removing metallic salts and ions from raw water. Efficiencies, however, do vary depending on the ion being removed and the membrane utilized. For most commonly found ions, removal efficiencies will range from 85% to over 99%. Organics removal is dependent on the molecular weight, shape and charge of the organic molecule, and the characteristics of the membrane utilized. Organic removal efficiencies may range from as high as 99% to less than 50%, depending on the membrane type and treatment objective.
5. Bypass Water: Reverse osmosis permeate will be virtually demineralized. If the raw water does not contain unacceptable contaminants, the design may provide for a portion of the raw water to bypass the unit and blend with RO permeate to maintain a stable water within the distribution system and improve process economics. Bypass/Blend will reduce equipment size and power requirements.
6. Post-Treatment: Post-treatment typically includes degasification for carbon dioxide (if excessive) and hydrogen sulfide removal (if present), pH and hardness adjustment for corrosion control, and disinfection as a secondary pathogen control and for distribution system protection.
7. Desalting By-Product: By-product water or the "concentrate" may range from 10% to 60% of the raw water pumped to the reverse osmosis unit. For most brackish waters and ionic contaminant removal applications, the by-product is in the 10-25% range while for seawater it could be as high as 60%. The by-product volume should be evaluated in terms of availability of source water and cost of disposal. Acceptable methods of byproduct disposal typically include discharge to municipal sewer system or to waste treatment facilities, discharge to sea, or by deep well injection, depending on the by-product concentration and availability of the discharge option being considered.
8. Pilot Plant Study: Prior to initiating the design of a reverse osmosis treatment facility, the country's reviewing agency should be contacted to determine if a pilot plant study will be required. In many cases, a pilot plant study will be necessary to determine the best membrane to use, type of pretreatment as well as post- treatment, bypass ratio, amount of reject water, system recovery, process efficiency, and other design and operational parameters.

III.0 Disposal of Desalting By-Product

Desalination water treatment plants (DWTPs) produce by-product as they separate salts, minerals, and other dissolved constituents from the water. The separation of these constituents results in two flow streams: 1) a purified potable stream (permeate), and 2) a stream containing the separated dissolved constituents. The latter byproduct stream is typically referred to by regulators as "concentrate" and sometimes inappropriately referred to as "brine". Brine is water with twice the concentration of dissolved solids as seawater. Most desalting by-products do not fit this definition. The word "brine" carries a negative connotation since it is also used to refer to some wastes from the petroleum industry. In some areas it is also known as "Reject or Reject Water."

By-Product Disposal Alternatives

Desalting by-product is commonly disposed of through one of six practices: 1) sewer discharge, 2) surface water discharge, 3) irrigation, 4) deep well injection 5) evaporation ponds, 6) zero liquid discharge thermal processes. Each of these methods varies in complexity of permitting and costs, with sewer discharge commonly being the least complex and least costly and zero liquid discharge being the most complex and most costly.

1. Sewer Discharge is dependent on the ability of the wastewater treatment plant to accept high salinity discharge both in terms of capacity as well as water quality. The treatment plant outfall location may be affected by total dissolved solids restrictions or other limiting water quality concerns.
2. Surface Water Discharge involves discharge to a point of outfall such as a bay, tidal lake, brackish canal, or ocean. The location and potential required byproduct treatment prior to discharge are determined by the relevant province, city or town and regulatory agency water quality standards and bioassay toxicity testing.
3. Irrigation is sometimes used for by-product streams relatively lower in salinity. Saline tolerant vegetation and habitat are required. This is usually determined by site-specific soil and drainage characteristics.
4. Deep Well Injection is also common, especially in North America and Europe. This method injects the by-product stream deep below ground under at least one overlaying, confining geologic layer. The by-product is permanently stored in the injection zone.
5. Evaporation Ponds may be used to reduce or eliminate by-product flows. This method of disposal is land-intensive and requires relatively

dry climates. Dry salt is the waste product, and it must be characterized and disposed of accordingly as solid waste.

Zero Liquid Discharge Thermal Processes greatly reduce or eliminate the by-product liquid stream through thermal treatment processes. These processes are energy intensive and are very costly. Wastes must be characterized and disposed of accordingly.

IV. Membrane Desalination Costs

Worldwide membrane and thermal desalination capacity is over 11 billion gallons per day from over 12 thousand plants, worth $9.2 billion per year, growing at rate of 12% per year. Desalinated water has found many uses throughout the world. The desalinated drinking water quality standards has been established by the global Agencies, such as the World Health Organization (WHO) and many others.

Figure 1 shows the general cost reduction trend in the last few decades, in producing water using brackish and sea water sources [5].

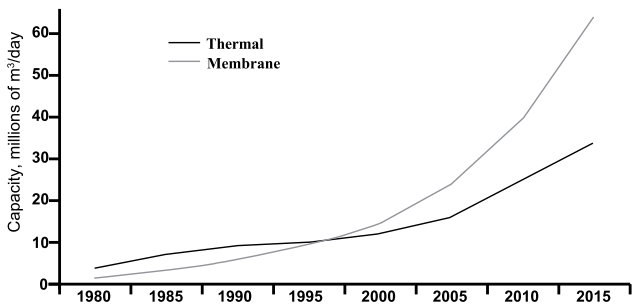

Figure 1- Growth and forecast desalination capacity by thermal and membrane processes.

Over the last 3 decades, pricing for desalting elements has been reduced substantially. As shown in Figure 2 and 3, due to technological improvements by suppliers, automation in the manufacturing process and competition, there have been significant reductions in seawater membrane costs. Similar trends have been present in brackish water modules.

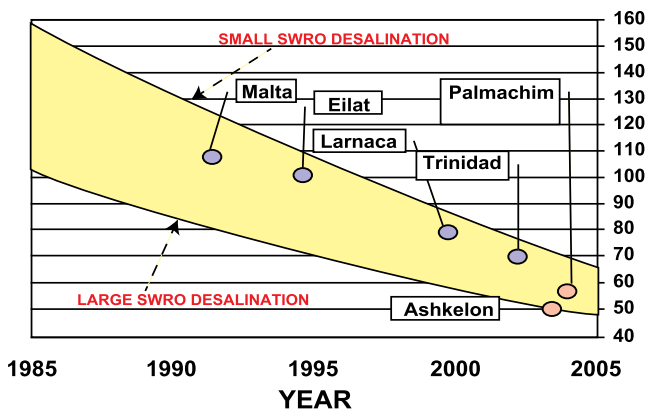

Figure 2 Trends in desalinated water cost

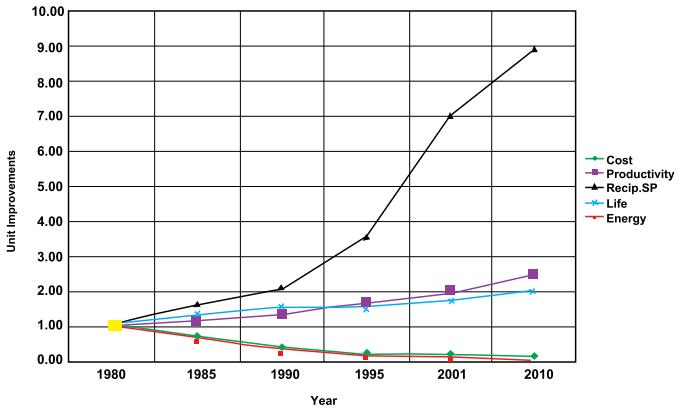

Figure 3: Improvements in RO technology [6]

Desalting Versus Traditional Water Development

In almost all countries, most inexpensive traditional water resources have already been developed. New sources of supply will be more expensive than the existing ones. Of the potential new treatment options, in many cases, desalting a local resource is financially and environmentally competitive with the traditional methods such as building dams, aqueducts, canals and waste treatment plants. Cost comparisons are often made to existing water supplies. Since desalted water represents a new source of supply, comparisons should be made to the cost of developing other new sources, such as surface water impoundments, remote deep well fields, dams and long-distance pipelines.

In the last decade, desalting technology has improved significantly and costs have decreased by over 50 percent. At the same time, the cost of developing traditional water sources has escalated, as drinking water quality and environmental standards have become more stringent. Inflation affected prices and the distances from source to consumer have also increased. In many water-short areas, the costs for desalted water are already competitive with the tapping of new traditional supplies. As alternative energy sources and improved processes and equipment are developed, additional desalting cost reductions can be expected.

Cost Factors and Graphs

The cost factors of desalting include capital costs and operating and maintenance costs. Costs can vary considerably from one locality to another based on many issues. In general, the amount of salt to be removed greatly affects the cost of desalting plant operation. The more salts to be removed, the more expensive the desalting process. The capacity of the facility also impacts costs, with larger plants generally being more economical. The larger the facility, the more cost efficient will be the utilization of equipment, labor and funds.

Energy and recovery of capital are the main ingredients of the total cost of water, amounting to about

75% of the total, as shown in Figure 4. To these values, 10-15% can be added for profit, if the desalting project is contracted as a sale of water. The energy cost portion of the total cost greatly depends on the power/fuel pricing.

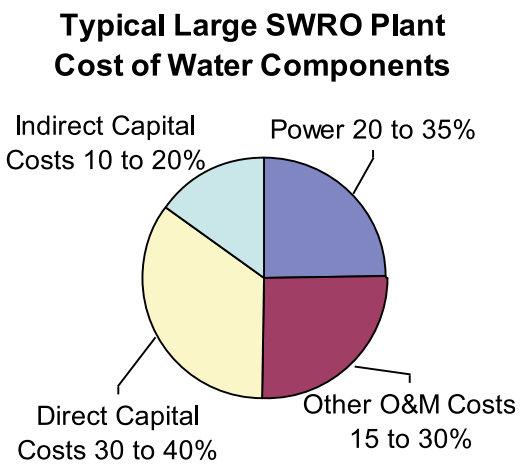

Figure 4: Typical Large SWRO Plant Cost of Water Components.

Other factors include the amount and type of pre- and post-treatment required, ancillary equipment selected, reliability, disposal of salts (concentrate), regulatory issues, land costs and conveyance of the water to and from the plant. Installing and operating a desalting plant involves many individual cost items, all of which are affected by local conditions. Figure 4 depict typical breakdowns of these costs.

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Mr. Fayyaz Mubeen is RO Desalination Expert at Desalination Engineering Services (DES). He is B.E (NEDUET), MS (KFUPM), PGD (ICTP-TRIESTE). He director, International Desalination Association (IDA) USA; President, Pakistan Desalination Association (PakDA); Member, Editorial Board, Int. Journal for Nuclear Desalination, Paris. He has vast experience in WRO, BWRO, DAF, UF & MF membranes, sand filtration, ZLD, clarification, GAC, IX, EDR, oil / water separation, oxidation of BOD & COD.

ISO QMS 9001-2015

DEEP OCEAN
TRADING & CONTRACTING
المحيط العميق للتجارة والمقاولات

ABOUT DEEP OCEAN COMPANY:

Deep Ocean Trading & Contracting is one of Saudi Arabia's fastest growing companies in the field of Construction, Trading and Facility Management services. Established in 2012 focusing primarily on general Construction and Maintenance Services, Deep Ocean Trading & contracting has maintained steady growth and expanded into various other fields. Today Deep Ocean Trading & Contracting is licensed to and engaged in all critical disciplines including, general Construction, Buildings, Road, Bridges, Sidewalks, Lighting Work, Water Desalination and Sanitation, Irrigation, Drainage System, Sanitary Work, Demolition, Electrical Work, Mechanical Work, HVAC, Power Generation and Distribution Work, Refrigeration and Air Conditioning, Firefighting supplies & installation, Streel Works, house / Office furniture and Landscaping.

For Deep Ocean Trading & Contracting all the projects are of equal importance irrespective of the size and value. Strict adherence to best available standards, time schedule, and integrity with which the projects delivered has earned us a great reputation and resulted in multiple opportunities. This has enabled Deep Ocean Trading & Contracting to be the front-runner for the specialized project in the kingdom and a prominent competitor in various sectors.

The success and consistent growth of Deep Ocean Trading & Contracting on all levels are mainly due to its job commitments, adoption of sophisticated methods and up to date information systems. The structured integration in the key business areas, besides having a high quality of technical and administrative capacity, where the principles of Total Quality Management is ranked first in date to day operations and the decision-making process has earned a high reputation in the market.

Our goal is to give our customer the best possible results at the least possible cost. Our clients receive personal attention, job site management, construction scheduling and continuous communication for smooth and successful project completion.

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Trading division supports contractors with high-quality products in a timely and cost-effective manner. Apart from being a shot in the arm for the in-house contracting division, our trading division has been serving many customers across the kingdom with high quality reputed products, especially to the electrical, steel works, seamless steel, Black Steel Fittings, Expansion Joint/Flanged & Threaded, Forged Steel Fittings, Grooved Fittings, PVC-UPVC & Pipes.

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A Foundation to Develop Cloud Computing Strategy and Risk Management Plan

By

Mian Abdul Hamid

Abstract

Even though cloud computing has entered into second decade still a significant amount of industries and businesses are confused about terminologies and have nontechnical concerns like Cost, Governance and Security. Many CIOs, Architects , IT Leaders and business leaders are muddleheaded about usage and control of cloud computing.

Developing a cloud strategy and a migration blueprint is one of the top issues of business leaders and IT leaders. Since many strategists get confused by assuming that adaptation of cloud computing will follow the technology adaptation trends of traditional IT. Thus they are unable to develop right strategic plan. In fact a blended and diversified strategy is needed to fulfill the requirement of future and for a successful cloud computing implementation multiple paths to success and cloud computing must be identified. Lack of common definition of cloud computing among Business and IT people is also a hurdle in making adequate strategy and moving towards standardization.

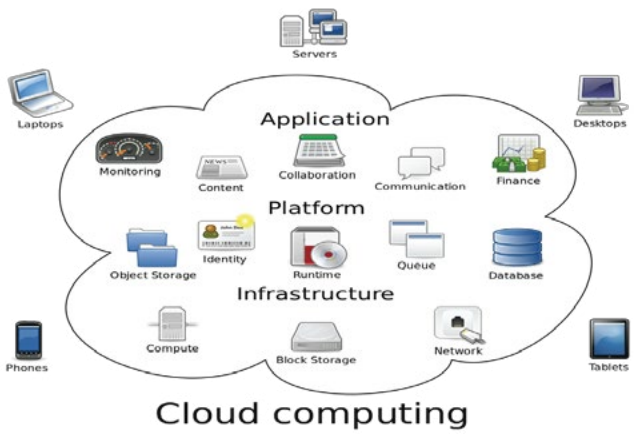
In this paper we have tried to provide some basic building blocks to lay down the foundation of Cloud Strategy Development. Various organization can get benefit to develop their customized strategic plan and policies.

1. Introduction

Cloud computing is a buzz word in today's business world. Implementation of next-generation technologies inclusive of Virtual Reality, Machine Learning, Autonomous Driving, Internet of Things, Modular Smartphones are becoming the solution vector for the 21st century's global challenges. Those Next-Generation Technologies are perceived as capable of transforming the status quo. Next Generation Technologies can be termed as " a radically innovative and relatively fast growing technologies characterized by the certain degree of coherence existing over the time and with the potential to exercise a substantial effect on the socio-economic domain(s).

world is transforming from traditional IT to next-generation IT , cloud computing is a critical component of business and IT. Even though cloud computing has entered into second decade still a significant part of industry and businesses are confused about its terminologies and have nontechnical concerns like Cost, Governance and Security (there are technical concern also but here we are describing only the non-technical part). Many CIOs, Architects , IT Leaders and business leaders are muddleheaded about usage and control of cloud computing.

Developing a cloud strategy and a migration blueprint is one of the top issues of business leaders and IT leaders. Since many strategists get confused by assuming that adaptation of cloud computing will follow the technology adaptation trends of traditional IT. Thus they are unable to develop right strategic plan. A single path will not adequately take to the success , thus multiple paths for a successful cloud computing implementation must be identified. In fact a blended and diversified strategy is needed to fulfill the requirement of future.



Business and IT people are having various definitions of cloud computing, a common definition has not been adapted yet. US National Institute of Science and Technology (NIST) has described the terminologies for their agencies to bring all of them on same page. Following are the important terminologies as per NIST publication 800-145 which can take the strategists and planner onto same page.

2. The NIST Definition of Cloud Computing

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.

2.1 Essential Characteristics:

2.1.1 On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

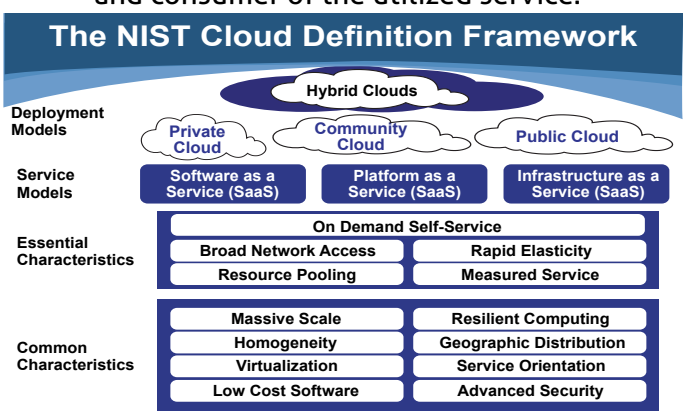
2.1.2 Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by

heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

2.1.3 Resource pooling: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

2.1.4 Rapid elasticity. Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

2.1.5 Measured service. Cloud systems automatically control and optimize resource use by leveraging a metering capability1 at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.



2.2 Service Models:

2.2.1 Software as a Service (SaaS): The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure2. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings

2.2.2 Platform as a Service (Paas): The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider.3 The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment

2.2.3 Infrastructure as a Service (Iaas): The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

2.3 Deployment Models:

2.3.1 Private cloud: The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

2.3.2 Community cloud: The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

2.3.3 Public cloud: The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It ex-

ists on the premises of the cloud provider.

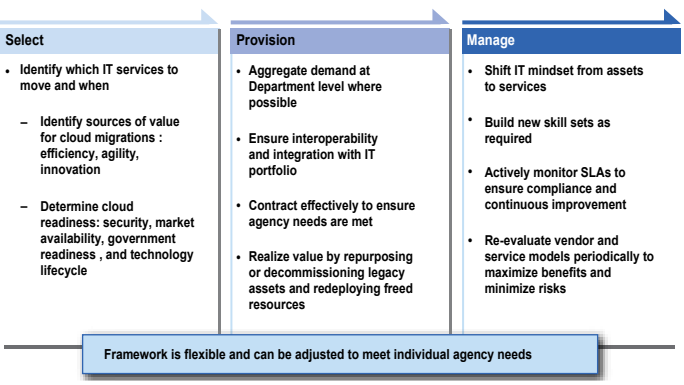
2.3.4 Hybrid cloud. The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

3. Decision Framework for Cloud Computing:

This framework has been taken from the US Federal Cloud Computing Strategy published in 2011. Understanding of this framework will be beneficial for both Government and Corporate Strategists and planners in developing their own cloud adaptation strategies. (Please read the following text keeping in mind that this is written for a specific country but could be utilized for other entities).

The broad scope and size of the cloud transformation will require a meaningful shift in how government organizations think of IT. Organizations that previously thought of IT as an investment in locally owned and operated applications, servers, and networks will now need to think of IT in terms of services, commoditized computing resources, agile capacity provisioning tools, and their enabling effect for American citizens. This new way of thinking will have a broad impact across the entire IT service lifecycle – from capability inception through delivery and operations.

The following structured framework presents a strategic perspective for agencies in terms of thinking about and planning for cloud migration.



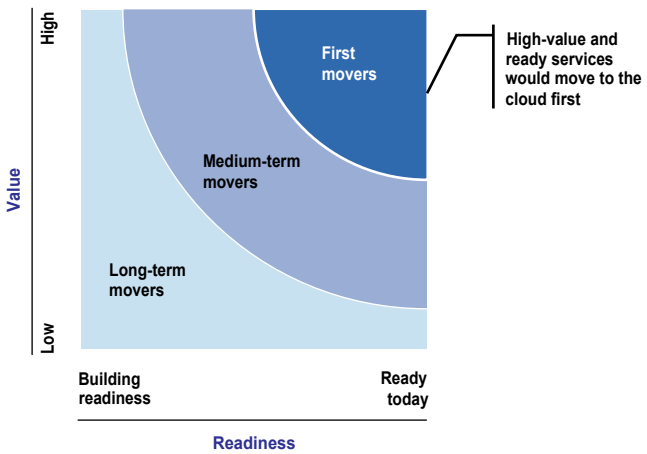
A broad set of principles and considerations for each of these three major migration steps is presented below.

3.1 Selecting services to move to the cloud

Successful organizations carefully consider their broad IT portfolios and create roadmaps for cloud deployment and migration. These roadmaps prioritize services that have high expected value and high readiness to maximize benefits received and minimize delivery risk. Defining exactly which cloud services an organization intends to provide or consume is a fundamental initiation phase activity in developing an agency roadmap.

The chart shown below uses two dimensions to help plan cloud migrations: Value and Readiness. The Value dimension captures cloud benefits in the three areas discussed in Section 1 (i.e., efficiency, agility, and innovation).The Readiness dimension broadly captures the ability for the IT service to move to the cloud in the near-term. Security, service and market characteristics, government readiness, and lifecycle stage are key considerations. As shown below, services with relatively high value and readiness are strong candidates to move to the cloud first.

Figure 4: Selecting Services for Cloud Migration



The relative weight of the value and readiness dimensions can be adjusted to meet the individual needs of agencies. Some agencies may stress innovation and security while others may stress efficiency and government readiness. However, the logic and structure of the framework should be applicable for all agencies.

Described below are a number of considerations for value and readiness that agencies may find helpful when completing this evaluation.

3.1.1 *Identify sources of value*

Cloud computing provides three primary sources of business value: efficiency, agility, and innovation. Listed below are a number of considerations for each value category.

Agencies should feel free to stress one or more of these sources of value according to their individual needs and mission goals .For instance, some agencies may place a higher value on agility, while others may stress cost savings brought about by greater computing efficiency.

3.1.1.1 Efficiency: Efficiency gains can come in many forms, including higher computer resource utilization due to the employment of contemporary virtualization technologies, and tools that extend the

reach of the system administrator, lowering labor costs. Efficiency improvements can often have a direct impact on ongoing bottom line costs. Further, the nature of some costs will change from being capital investment in hardware and infrastructure (CapEx) to a pay-as-you go (OpEx) model with the cloud, depending on the cloud deployment model being used. Services that have relatively high per-user costs, have low utilization rates, are expensive to maintain and upgrade, or are fragmented should receive a relatively high priority for consideration.

3.1.1.2 Agility: Many cloud computing efforts support rapid automated provisioning of computing and storage resources. In this way, cloud computing approaches put IT agility in the hands of users, and this can be a qualitative benefit. Existing services that require long lead times to upgrade or increase / decrease capacity should receive a relatively high priority for consideration, and so should new or urgently needed services to compress delivery timelines as much as possible. Services that are easy to upgrade, are not sensitive to demand fluctuations, or are unlikely to need upgrades in the long-term can receive a relatively low priority.

3.1.1.3 Innovation: Agencies can compare their current services to contemporary marketplace offerings, or look at their customer satisfaction scores, overall usage trends, and functionality to identify the need for potential improvements through innovation. Services that would most benefit from innovation should receive a relatively high priority.

3.1.2 *Determine cloud readiness*

It is not sufficient to consider only the potential value of moving to cloud services. Agencies should make risk-based decisions which carefully consider the readiness of commercial or government providers to fulfill their Federal needs. These can be wide-ranging, but likely will include: security requirements, service and marketplace characteristics, application readiness, government readiness, and program's stage in the technology lifecycle. Similar to the value estimation, agencies should be free to stress one or more of these readiness considerations according to their individual needs.

3.1.3 *Security Requirements:*

Federal Government IT programs have a wide range of security requirements. Federal Information Security Management Act (FISMA) requirements include but are not limited to: compliance with Federal Information Processing Standards agency specific policies; Authorization to Operate requirements; and vulnerability and security event monitoring, logging, and reporting. It is essential that the decision to apply a specific cloud computing model to support mission capability considers these requirements. Agencies have the responsibility to ensure that a safe, secure cloud solution is available to provide a prospective IT service, and should carefully consider agency security needs across a number of dimensions, including but not limited to following;

- Statutory compliance to laws, regulations, and agency requirements
- Data characteristics to assess which fundamental protections an application's data set requires
- Privacy and confidentiality to protect against accidental and nefarious access to information
- Integrity to ensure data is authorized, complete, and accurate
- Data controls and access policies to determine where data can be stored and who can access physical locations
- Governance to ensure that cloud computing service providers are sufficiently transparent, have adequate security and management controls, and provide the information necessary for the agency to appropriately and independently assess and monitor the efficacy of those controls

3.1.4 *Service characteristics:*

Service characteristics can include service interoperability, availability, performance, performance measurement approaches, reliability, scalability, portability, vendor reliability, and architectural compatibility.

Storing information in the cloud will require a technical mechanism to achieve compliance with records management laws, policies and regulations promulgated by both the National Archives and Records Administration (NARA) and the General Services Administration (GSA).The cloud solution has to support relevant record safeguards and retrieval functions, even in the context of a provider termination.

Depending on the organizational missions supported by the cloud capability, Continuity of Operations (COOP) can be a driving solution requirement. The purpose of a COOP capability is to ensure that mission-essential functions continue to be available in times of crisis or against a spectrum of threats. Threats can include a wide range of potential emergencies, including localized acts of nature, accidents, and technological and/or attack-related emergencies.

The organization should consider scalability

requirements concerning the ability of the cloud solution architecture to either grow or shrink over time, with varying levels of processing, storage, or service handling capability. They should also consider both the impact on their business processes if network connectivity to their cloud provider fails, resulting in a loss of IT capability, and the possibility (likelihood) of this occurrence.

Requirements concerning administrative support should be included as well, covering topics such as the daily hours of prime support, problem escalation times, resolution of recurring problems, and trouble ticket submission methods.

3.1.5 *Market Characteristics:*

Agencies should consider the cloud market competitive landscape and maturity, including both fully commercial and government-provided cloud services. Agencies can consider whether cloud markets are sufficiently competitive and are not dominated by a small number of players. Agencies can consider whether there is a demonstrated capability to move services from one provider to another, and whether there is a demonstrated capability to distribute services between two or more providers in response to service quality and capacity. Agencies should consider the availability of technical standards for cloud interfaces which reduce the risk of vendor lock-in.

3.1.6 Network infrastructure, application and data readiness:

Before migrating to the cloud agencies must ensure that the network infrastructure can support the demand for higher bandwidth and that there is sufficient redundancy for mission critical applications. Agencies should update their continuity of operations plans to reflect the increased importance of a high-bandwidth connection to the Internet or service provider. Another key factor to assess when determining readiness for migration to the cloud is the suitability of the existing legacy application and data to either migrate to the cloud (i.e., rehost an application in a cloud environment) or be replaced by a cloud service (i.e., retire the legacy system and replace with commercial SaaS equivalent).If the candidate application has clearly articulated and understood interfaces and business rules, and has limited and simple coupling with other systems and databases, it is a good candidate along this dimension. If the application has years of accumulated and poorly documented business rules embedded in code, and a proliferation of subtle or poorly understood interdependencies with other systems, the risks of "breakage" when the legacy application is migrated or retired make this a less attractive choice for early cloud adoption.

3.1.7 Government readiness:

In addition, agencies should consider whether or not the applicable organization is pragmatically ready to migrate their service to the cloud. Government services which have capable and reliable managers, the ability to negotiate appropriate SLAs, related technical experience, and supportive change management cultures should receive a relatively high priority. Government services which do not possess these characteristics but are otherwise strong cloud candidates should take steps to alleviate any identified concerns as a matter of priority.

3.1.8 Technology lifecycle:

Agencies should also consider where technology services (and the underlying computing assets) are in their lifecycle. Services that are nearing a technology refresh, approaching the conclusion of their negotiated contract, or are dependent upon inefficient legacy software or hardware should receive a relatively high priority. Technology services that were recently upgraded, locked within contract, and are based on leading-edge technology may want to wait before migrating to the cloud.

3.2 Provisioning cloud services effectively

To effectively provision selected IT services, agencies will need to rethink their processes as provisioning services rather than simply contracting assets. Contracts that previously focused on metrics such as number of servers and network bandwidth now should focus on the quality of service fulfillment.

Organizations that are most successful in cloud service provisioning carefully think through a number of factors, including:

3.2.1 Aggregate demand:

When considering "commodity" and common IT services, agencies should pool their purchasing power by aggregating demand to the greatest extent possible before migrating services to the cloud. Where appropriate, demand should be aggregated at the departmental level and as part of the government-wide shared services initiatives such as government-wide cloud-based email.

3.2.2 Integrate services:

Agencies should ensure that the provided IT services are effectively integrated into their wider application portfolio. In some cases, technical experts may be required to evaluate architectural compatibility of the provided cloud service and other critical applications. Rather than a one-time event, this principle should be followed over time to guarantee that systems remain interoperable as individual IT services evolve within

the portfolio. Business process change may similarly be required to properly integrate the systems (e.g., adjusting call center processes).

3.2.3 Contract effectively:

Agencies should also ensure that their contracts with cloud service providers set the service up for success. Agencies should minimize the risk of vendor lock-in, for instance, to ensure portability and encourage competition among providers. Agencies should include explicit service level agreements (SLAs) for security, continuity of operations, and service quality that meet their individual needs. Agencies should include a contractual clause enabling third parties to assess security controls of cloud providers. The SLA should specify the support steps that the consumer can take when the service is failing to meet the terms specified in the agreement, and should include points-of-contact and escalation procedures. It is important to be precise in the definition of metrics and specify when and where they will be collected. For example, performance is different when measured from the consumer or provider due to the network delays. Metrics should measure characteristics under the control of the vendor. Finally, the SLA should describe a mutual management process for the service levels, including periodic reporting requirements and meetings for management assessments.

3.2.4 Realize value:

Agencies should take steps during migration to ensure that they fully realize the expected value. From an efficiency standpoint, legacy applications and servers should be shut down and decommissioned or repurposed. Data center real estate used to support these systems should be closed down or used to support higher value-add activities. Where possible, staff supporting these systems should be trained and re-deployed to higher-value activities. From an agility and innovation standpoint, processes and capabilities may also need to be refined in order to fully capture the value of the investment.

3.3 Managing services rather than assets

To be successful, agencies must manage cloud services differently than traditional IT assets. As with provisioning, cloud computing will require a new way of thinking to reflect a service-based focus rather than an asset-based focus. Listed below are a few considerations for agencies to effectively manage their cloud services.

3.3.1 Shift mindset:

Organizations need to re-orient the focus of all parties involved – providers, government agencies, and end users – to think of services rather than assets. Organizations that successfully make this transition will effectively manage the system towards output metrics (e.g., SLAs) rather than input metrics (e.g., number of servers).

3.3.2 Actively monitor:

Agencies should actively track SLAs and hold vendors accountable for failures. Agencies should stay ahead of emerging security threats and ensure that their security outlook is constantly evolving faster than potential attacks. Agencies may also consider incorporating business user feedback into evaluation processes. Finally, agencies should track usage rates to ensure charges do not exceed funded amounts. It can be advantageous for a consumer to "instrument" key points on the network to measure performance of cloud service providers. For example, commercial tools can report back to a centralized data store on service performance, and instrumentation agents can be placed with participating consumers and at the entry point of the service provider on the network. By gathering data across providers on the performance of pre-planned instrumented service calls throughout typical work periods, service managers can better judge where performance bottlenecks arise. Agencies should include requirements for service instrumentation where appropriate.

3.3.3 Re-evaluate periodically:

Agencies should periodically re-evaluate the choice of service and vendor to ensure that efficiency, agility, and innovation are maximized. Agencies should ensure portability and hold competitive bids for cloud services at regular intervals. Agencies should also consider increasing the scope of cloud-provided services as markets mature (e.g., moving from IaaS solutions to PaaS and SaaS solutions).Opportunities to consolidate and standardize solutions between agencies should be periodically evaluated as well, particularly for "commodity" services. To effectively conduct re-evaluations, agencies should maintain awareness of changes in the technology landscape, in particular, the readiness of new cloud technologies, commercial innovation, and new cloud vendors

4. Cloud Computing Framework of Saudi Arabia by CITC:

Communication and Information Technology Commission (CITC) has the power according to Councils of Ministers Resolution no.133 dated 21/5/1424H.

- Implement the policies, plans and programs approved for the development of information technology and set out the appropriate procedures.
- Propose regulations and their amendments re-

lated to information technology, and pursue approval of these regulations from the appropriate authorities.

- Issue the necessary licenses in accordance with the terms and acts related to them.

CITC has Issued the cloud computing regulatory framework in the kingdom, based on the best international practice and public consultation analysis, which includes the rights and obligations of the service providers, Individual Customers, Government entities and Enterprises.

CITC stated that the regulatory framework for Cloud Computing will enter into force after 30 days from 20/5/1439H corresponding to 6/2/2018.

The provisions of this Regulatory Framework shall apply with regard to any Cloud Service provided to Cloud Customers having a Residence or Customer Address in the Kingdom.

'Customer Address' shall mean a Cloud Customer's (i) address provided in the Cloud Contract or (ii) invoicing address, and if the two are different and only one of them is in the KSA, Customer Address shall mean that address.

'Residence' shall mean a permanent or temporary residence in the Kingdom under the Kingdom's laws. It shall not include a temporary presence of Persons on a short visit or transiting through the Kingdom.

More generally, it is up to each customer of Cloud services, including any and all Government agencies making use of Cloud services, and not up to the Cloud Service Provider (CSP), to select the information security level among those listed in the CITC framework, which best matches their specific needs and security requirements, and to inform CSPs accordingly. Such requirements may be set out in the relevant government service's internal rules or in more generally applicable legislation, regulations, policy or administrative instructions. Particular attention should be drawn to any existing rules (outside the scope of the Regulatory Framework) requiring that government authorities' data be kept inside the territory of Saudi Arabia.

It is up to the Government Agencies concerned to ensure that their use of any Cloud services remains compliant with any such applicable rules, in addition to those set out in the Regulatory Framework. CSPs do not have an obligation or even the capability to constantly monitor their customers' data and content, let alone assess independently their level of confidentiality.

Cloud customers, including government authorities using the Cloud, should be aware that it may be difficult, and sometimes impossible, to enforce against CSPs that are not registered in the KSA, in line with the relevant provisions of the Regulatory Framework on Cloud computing. An obligation for such a registration exists only for CSPs that:

- Have a datacenter or other essential Cloud infrastructure in the territory of the Kingdom, and/or
- Exercise of direct or effective control over the processing and/or storing of Customer Content classified as 'Level Three' Customer Content .

The Cloud computing regulatory framework also impose on CSPs the obligation to notify their affected customers in case of information leakage or security breach. Furthermore, in case of an information leakage or security breach involving Level 3 data or in case of a massive leakage, CSPs also have an obligation to notify Public Authorities as well.

5. Risks of Cloud Computing:

PEW research center said that " solid majority of technology experts and stakeholders participating in the fourth future of the Internet survey expect that by 2020 most people will access software applications online and share and access information through the use of remote server networks, rather than depending primarily on tools and information housed on their individual, personal computers " and that " most users will perform most computing and communication activities through connections to servers operated by outside firms.

More and more companies will continue to move their data to the cloud, urged by cloud providers.

Cloud providers (Amazon, Microsoft, Google, etc.) are now preparing a strong push to move clients towards cloud.

But on the contrary organizations have to think and prepare to mitigate the risks posed by cloud. Due to many cases, premise behind cloud computing began looking a bit creaky. If you remember that Amazon was hosting the Wiki Leaks and they have dropped the content mentioning that " they were (wiki leaks) not following the terms of service". That is an eye opening event for every Government and Commercial organization that a public cloud service provided is ruling on customer's data by saying that they are Not Following the Terms of Service.

Recent case of unauthorized use of customer data by face book has blown another whistle.

We have listed some major risks for consideration of strategic planner and policy makers to be dealt and mitigate for their entities.

- The major risk persist from day one is "Control of Data". Business using cloud services like Email, applications, storage, databases will have to hand over their data to service providers which could be utilized for any unauthorized purpose
- Moving from one service provider to other is another problem area.
- Business will rely more upon third parties. some people argue that standardization could solve this problem but this is an emerging technology

so standardization will take a long journey which is full of hurdles.

- Manipulation of analytics is a business risk caused by a service provider [i.e. if service provider is provisioning a service to provide best rate for a specific product, they may guide you to the specific supplier]
- Absence of regulatory framework for Cloud Service provider
- Shortage of skilled manpower for emerging technologies.
- Providing Guaranteed performance / Service level
- Service Provider outages, and/or lack of disaster management.
- Availability and reliability of Broadband to access the services.
- Even though it has been mentioned greatly that Cloud will save the cost but as demand increase the cost will also be increased. This has to be analyze with due care.
- Cloud may provide unwanted updates and function which may cause security problems
- Vendor lock-in may cause disastrous situation , in case of restoring to On-Premise in future may incur a huge cost.
- Maintenance of specific regulatory and policy compliance is another pain area.
- Security defect in the technology itself could cause problem for entire tenants of cloud.
- Inability to set or enforce security policy in cloud service provider environment
- Ensuring CSP Business Continuity and Disaster Recovery
- How to track and troubleshot data once it enter into cloud
- Business viability of CSP, if CSP business fails then what will happen
- Portability of data and application from CSP to another CSP
- Immature technology
- In case of any kind of control systems; using cloud computing could make worst impact.

6. Recommendations:

- Each entity should develop strategy and policy for cloud computing, decision framework given in this article will be helpful for this purpose.
- To develop strategy and policy a cross functional team should be formed comprising of all stakeholders inclusive of Corporate Business Strategist, Cyber Security, IT and Finance.
- Depending upon the type, criticality, sensitivity, availability requirements; worst case scenarios shall be created, discussed and incorporate into strategy and policy.
- In case of any kind of control systems; using cloud computing could make worst impact so it is very much important to consider how the control and monitoring (analytics) should be isolated and remained in the hands of organization.
- Failure of connectivity could halt the whole business so redundancy is most important.
- Interoperability should be ensured when using different service providers for different services.
- Carefully study the issues of migration from one service provider to another.
- Carry out a complete risk assessment and analysis inclusive of all the risks mentioned in previous section of this paper.
- Following Service Level Management model will be helpful to manage the cloud service.

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About Author

Mian Abdul Hamid, is working as IS and Governance Consultant at Saudi Electricity Company. His main interests are in Cyber Security System in Power System Network.

How to Solve Your Energy Crisis?

By

M. S. Mushtaque

Abstract

Even though cloud computing has entered into second decade still a significant amount of industries and businesses are confused about terminologies and have nontechnical concerns like Cost, Governance and Security. Many CIOs, Architects , IT Leaders and business leaders are muddleheaded about usage and control of cloud computing.

Developing a cloud strategy and a migration blueprint is one of the top issues of business leaders and IT leaders. Since many strategists get confused by assuming that adaptation of cloud computing will follow the technology adaptation trends of traditional IT. Thus they are unable to develop right strategic plan. In fact a blended and diversified strategy is needed to fulfill the requirement of future and for a successful cloud computing implementation multiple paths to success and cloud computing must be identified. Lack of common definition of cloud computing among Business and IT people is also a hurdle in making adequate strategy and moving towards standardization.

In this paper we have tried to provide some basic building blocks to lay down the foundation of Cloud Strategy Development. Various organization can get benefit to develop their customized strategic plan and policies.

Energy crisis in Pakistan is one of the most significant and crucial factor which is hindering not only the economic growth but also effecting daily life and social activities of the citizens. The electricity tariff is sky rocketing and is more expensive than ever, which has becoming out of reach of the commoner. People are thinking for the alternatives. Here are their findings.

Pakistan has tremendous potential to meet its power demands from Renewable Energy sources, especially solar and wind as it lies in the sunny belt having a high level of insolation and adequate hours of sunshine. This energy source is distributed widely and available abundantly in the country. Pakistan receives global insolation over more than 95% of its area. The mean of global irradiation falling on a horizontal surface is 60-70% more than Germany, this results in about 1500–3000 sunshine hours making 1.9–2.3 MWh per m^2 per year with an annual mean sunshine duration of 8–8.5 hours a day. The sunny days in Pakistan, range from 185 to 290 in a year as evident from historical data. The annual mean value of GHI for the whole of Pakistan, based on preliminary analysis by the World Bank is 2,071 kWh/m^2/ year. The map shows average solar radiation in each area of Pakistan.

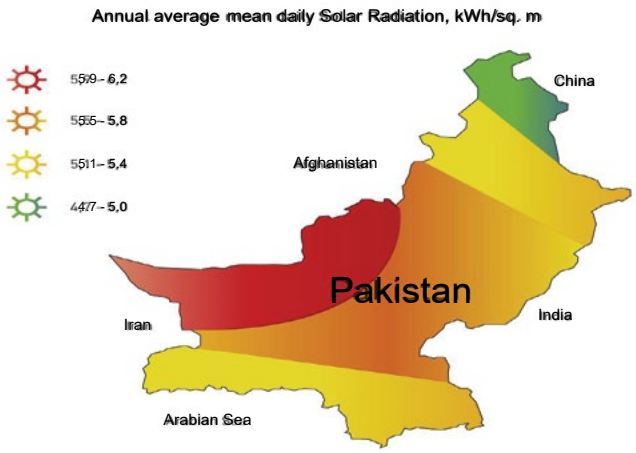

Figure 1: Average Solar Radiations GHI

Pakistan is among those countries in which sun warms the land throughout the year and therefore has a strong potential for solar power generation. The results indicate that the values of solar radiation intensity greater than 200 W/m^2 were observed in the months: February to October in Sindh, March to October in almost all regions of Baluchistan, April to September in KPK, Northern Areas and Kashmir regions while March to October in Punjab.

Pakistan's electric utilities are facing problems to delivering the system peak demands due to accrual of circular debt non-payment by the Government which will cause forced load shedding. It is expected that power cuts shall be faced during this summer season although the installed capacity of power plants seem sufficient to meet the load demand. However, unlike industrial and commercial consumers, the residential consumers shall suffer more. In such a situation, it will be difficult for the electric utilities to fill the gap between supply and demand, so the consumers have to think of alternatives.

Residential consumers can play an important role to fill the gap of demand and supply. The Government of Pakistan realizes that if residential consumers adapt an On-Grid Rooftop Solar PV system, that would not only reduce their electricity bill, but will also help the Government to reduce the gap between supply and demand, lowering the load of the National Grid and improving environmental conditions. According to Bloomberg New Energy Finance (BNEF), Pakistan will see PV installations increase

46% in 2017, up from 700 MW in 2016, to 1.020 GW.

In Pakistan, residents make up the largest proportion of consumers, as shown below:

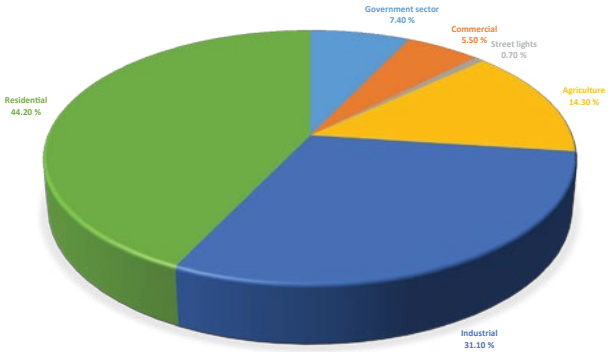

Figure 2: Proportion of Residential Consumers

National Electric Power Regulatory Authority (NEPRA) Pakistan has approved a regulatory framework for solar and wind energy for both commercial and residential installations. The framework includes **Feed-in-Tariffs (FiT) for Commercial Power Producers and Net Metering for Residential Consumers** from 1 kW to 1 MW. Pakistan has updated its net metering guidelines. The Prime Minister of Pakistan has officially launched these changes at a ceremony in Islamabad on January 3, 2018. Overall, the framework is said to have been simplified. Net metering connections can now be gained in less than one month with the following fees:

SN	Size of the Rooftop Solar PV	Fee to be paid by Applicant
1	0 - 20 kW	Free of Cost
2	20 - 50 kW	Rs. 500
3	50 - 100 kW	Rs. 1000
4	100 - 1000 kW	Rs. 5000

Table 1: Onetime fee payment to NEPRA

According to the refinancing facility scheme as announced by the State Bank of Pakistan (SBP), consumers (domestic, commercial or industrial) willing to install RE facility ranging from 4 kW to 1 MW will be provided with financing facilities through all commercial banks and DFIs on 'first-come first-serve' basis. The consumers intending to install the solar PV systems at their premises can apply for loans to the commercial banks and Development Finance Institutes (DFIs). Alternative Energy Development Board (AEDB) has approved the qualified companies for the installation and commissioning of rooftop solar PV system.

Net metering is a billing mechanism that pays solar energy system owners for the electricity they add to the grid. It allows residential customers with rooftop solar panels to generate more electricity than the home uses during daylight hours and sell it to the power supply company. It will require a bi-directional meter (or two separate meters) for implementation. Customers are only billed for their "net" energy use. On average, only 20-40% of a solar energy system's output ever goes into the grid. Exported solar electricity serves nearby customers' loads. Net metering is a concept mostly applied for the promotion of decentralized solar PV in many parts of the world.

Feed-in Tariffs for Commercial Power Producers are a price-based mechanism. In order to qualify for being labelled a Feed-in Tariff consists of at least a purchase obligation, and a stable tariff payment which is guaranteed over a long period of time. First, the purchase obligation obliges the nearest grid operator to buy all renewable electricity – independent of electricity demand. Second, the renewable power producer is guaranteed a certain amount of money per unit of electricity that is produced. Third, this payment is guaranteed over a long period of time (usually 20 to 25 years), which increases investment security and allows for cost amortization.

Global grid connected Rooftop Solar power consumers are playing significant role in many countries that have a large solar market, such as Germany, USA, Japan, and UK.

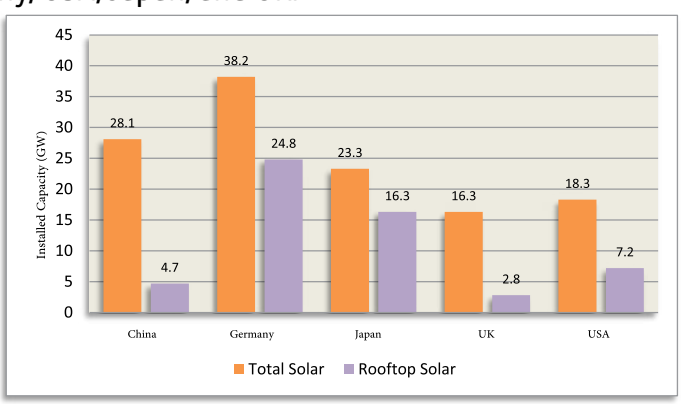

Figure 3: Contribution of Rooftop Solar to overall Solar power capacity in various countries

Rooftop Solar PV System

It has two Options

- Off- Grid
- On- Grid

Off-Grid Solar PV system is usually installed where the consumer does not require to connect their Solar PV with the grid or when it is not economically viable to connect to the electric utility company's grid system. Usually Off-grid Solar PV systems have battery storage to provide the feedback power when solar is not able to generate power.

Usually On-Grid (or Grid-Tied) Solar PV System is opted for locations or premises with existing connection with the grid system, purposely to reduce electric consumption from the grid or to export ex-

cess generation to the grid depending on utilities rule.

Off-Grid Connected Solar PV System:

Off-grid connected solar PV system typically includes battery backup. Normally, during the day when the sun shines, the PV system charges the backup batteries and supplies power to the connected loads or appliances. This backup battery provides its supply of electricity (depending on its capacity) when the sun sets or when the Solar PV System is momentarily not capable of producing electricity due to weather conditions such as during night, rainy or cloudy days.

Off-grid Solar PV system is installed with the battery storage, so during the day, excess energy charges the battery and when solar panel doesn't produce energy, the battery provides power to the appliances.

Off-grid Solar PV system is installed with two options;

(i) In a remote area where there is no electricity supplied by the Distribution Company. This system can be a lot cheaper than paying for a grid connection using a very long line and its attendant accessories. It also solves the problem of voltage drops and/or electrical losses as it reaches the consumer;

(ii) Consumers of the national grid whose solar system is isolated from it, but is connected with the important appliances with a battery backup.

Typical Off-Grid Solar Systems require the following major equipment:

- Solar Panels
- Solar PV array support structure
- Solar Charge Controller
- Battery Bank
- Off-Grid Inverter

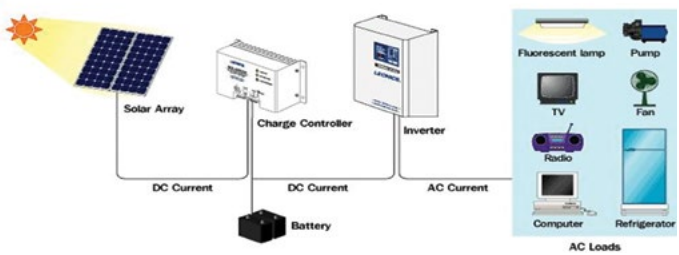

Figure 4: Stand Alone (Off Grid) Solar PV System Diagram

Grid Parity

This is the point where the cost of the alternative energy becomes equal to or less than the electricity from conventional energy forms like fossil fuels. It's one of the most important things that energy analysts look at when determining how economically viable an alternative energy form is for widespread development and adoption. At present Rooftop without battery is cheaper compared to electricity tariff in the country but the system with the battery backup is still expensive than Grid power. However, analysts expect that 2018 be the year when solar power reaches so-called grid parity, due to cost reduction and improved batteries which increase their operating life.

On-Grid (Grid-tie) Solar PV System:

Grid-tie or grid connected solar PV systems have no battery backup. The system is connected to both the electric utility grid and the solar PV system using Grid-tie Inverter, in order to always have a supply available at the flick of switching to either sources of electricity; even at night, or if it is cloudy.

DC generated by the PV panels is converted into AC power by the inverter (the same high quality AC current is delivered to the establishment by the utility-provided power grid). Output from the inverter is supplied to the existing distribution panel which feeds the different loads. While both sources are capable of providing power, it is the solar PV that provides first (up to its capacity) the requirements of the home, thus reducing or eliminating the power it would have drawn from the utility grid at that time. During the time periods when the solar PV system is generating even more energy than what is being required by the connected loads, the excess energy is injected into the grid for others to use. Depending on the agreement with the electric utility or on the Rules and Regulations prescribed by the Regulator, this excess generation most of the time provide credits to the consumers. On the other hand, when the consumer needs to draw more energy than what the PV system can produce especially during cloudy conditions or at night, electricity is provided by the utility.

Typical On-Grid solar systems require the following major equipment:

- Solar PV (photo-voltaic) array
- Solar PV array support structure
- AC/DC Disconnect Switch
- Solar grid inverter
- Protection devices

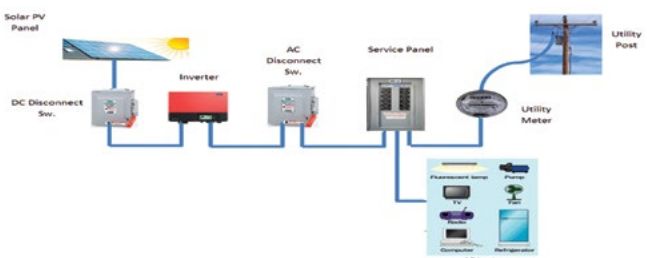

Figure 5: On-Grid (Grid-tie) Solar PV System Diagram

Solar Panels

Solar panels are composed of silicon semiconductors, which capture energy through photovoltaic effect from the sun's rays in the form of a direct current charge, which can be measured in watts. Solar

panels can range in their energy output from roughly 75 watts to 350 watts, with an average output of about 250 watts. When solar panels are grouped together, they form a solar panel system. The energy potential of the system is calculated by the number of panels multiplied by their power output. Most common used Solar PV technologies are discussed as follows:

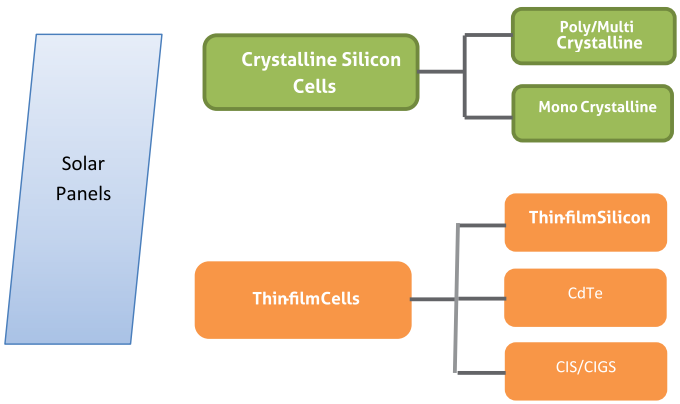

Figure 6: Commonly used Solar PV technologies

Each solar PV technology has its advantage and disadvantage based on their technical parameters and commercial use. The table below indicates some commonly used solar technology.

Solar Cell Type	Efficiency-Rate	Advantages	Disadvantages
Mon crystalline Solar Panels (Mono-SI)	~20%	High efficiency rate; optimized for commercial use; high life-time value	Expensive
Polycrystalline Solar Panels (p-Si)	~15%	Lower price	Sensitive to high temperatures; lower lifespan & slightly less space efficiency
Thin-Film: Amorphous Silicon Solar Panels (A-SI)	~7-10%	Relatively low costs; easy to produce & flexible	shorter warranties & lifespan

Table 2: Commercial properties of some commonly used Solar PV technologies

Solar PV array support structure

Solar Panel Systems for households or businesses are most commonly installed on either the roof of a facility or mounted on the ground with steel structures that secure the solar panels in place. Since these structures are designed to support the weight of the solar panels, their method of attachment varies based on their mounting style and location.

Inverters

Solar panels produce a direct current charge, which needs to be converted to alternating current in order to supply power to appliances. This is done with the help of inverters, which regulate and adapt the energy produced by solar panels to levels necessary for energy usage. The inverters are compatible with single-phase applications (found in most households) and three-phase applications. Solar inverters connect the solar panel system to the existing electrical meter.

Solar charge controllers

The function of Solar charge controllers is to regulate the energy flowing from the PV array and transfer it directly to the batteries as a DC-coupled system, which is the most efficient and effective manner of giving batteries a long a life.

Electricity Consumption of a typical residential consumer

The amount of electricity consumed depends on the size and number of persons living in a home. A typical house consumes anywhere from 900 to 1500 kWh per month. The following table is showing the appliances their average rating, daily and monthly average consumption.

Types	No. of Units	Operating Hours per Day	Conventional Technology			
			Average Capacity per Unit (W)	Total Cap. per Appliance Type (W)	Est. Daily Consumption per Appliance Type (kWh)	Est. Monthly Consumption per Appliance Type (kWh)
Lightings (720 Lumens)	8	8	60.0	480.0	3.8	115.2
Airconditioner (10,550 kJ/h)	3	6	1420.0	4260.0	25.6	766.8
Refrigerator (10 Cubic Ft.)	1	18	200.0	200.0	3.6	108.0
Ceiling + Pedestal Fan	4	16	100.0	400.0	6.4	192.0
Food Processor	1	0.5	750.0	750.0	0.4	11.3
Deep Freezer	1	18	350.0	350.0	6.3	189.0
Microwave	1	0.5	850.0	850.0	0.4	12.8

Types	No. of Units	Operating Hours per Day	Conventional Technology			
			Average Capacity per Unit (W)	Total Cap. per Appliance Type (W)	Est. Daily Consumption per Appliance Type (kWh)	Est. Monthly Consumption per Appliance Type (kWh)
Flat Iron	1	1	1000.0	1000.0	1.0	30.0
Washing Machine	1	0.5	400.0	400.0	0.2	6.0
LCD Television	1	10	100.0	100.0	1.0	30.0
Desktop Computer	1	5	200.0	200.0	1.0	30.0
Water Pump	1	1.5	1200.0	1200.0	1.8	54.0
Total				10,190.0	51.5	1,545.0

Table 3: Electricity consumption of a typical residential consumer

Rooftop Solar PV System

Rooftop Solar PV power systems with net metering are used world widely for the Residential consumers because of advantages like clean energy, substantial reduction in bills and support to grid and Pakistan has no exception. Usually household consumers have relatively less electricity consumption than commercial ventures or organizations whereas businesses and organizations consume more electricity. They also have more space and area to house solar panels which makes it easier to install solar panels to fulfill their electricity requirements. According to the weather in Pakistan, an estimated Rooftop Solar PV average generation in winter and summer is given in the table below:

Table 4: Solar PV output of various capacities in summer and winter

The graph shows solar PV generation, consumption and export to grid.

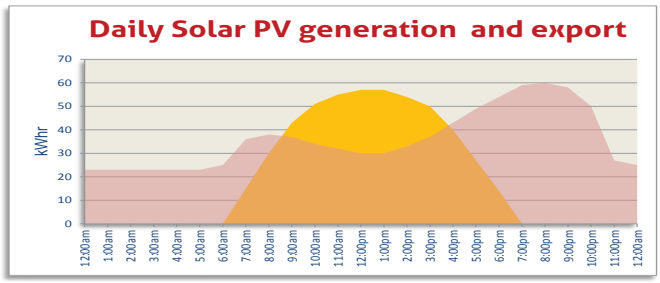

Figure 7: Daily curve of Solar PV System generation, consumption and export to grid

Here we will discuss to what extent the bill of residential consumers having On-Grid Rooftop solar PV can be reduced based on following parameters;

- Size of your Rooftop Solar PV
- Electricity consumption of home
- Ambient temperature
- Solar irradiance or sunshine
- Electricity Tariff
- Monthly bill paid by the consumer

A typical consumer will consume an average of 1,500 kWh monthly and if this consumer installs 5 kW Solar PV on his rooftop, the Solar PV will generate approximately 630 kWh per month. Currently in Pakistan, the residential consumers having a load of more than 5 kW have an electricity tariff of 18.0 Rs/kWh at peak load time and 12.5 Rs/kWh off peak time. The Peak and Off-Peak Timings are shown in the table as follows:

Peak and Off- Peak Timings in Pakistan		
Season	Peak Timings	Off - Peak Timings
Dec to Feb	5 PM to 9 PM	Remaining 20 hours
Mar to May	6 PM to 10 PM	Remaining 20 hours
Jun to Aug	7 PM to 11 PM	Remaining 20 hours
Sep to Nov	6 PM to 10 PM	Remaining 20 hours

Table 5: Peak and Off-Peak timings in summer and winter

Offsetting a part of your electrical bills through an On Grid solar system could be the best way to save money. If the average bill is Rs. 20,000 to 25,000 then solar may save Rs. 3,000 to 5,000 per month. The Rooftop Solar PV will lower the monthly bill by 25%. The payback period of rooftop solar system is

given below:

Rooftop Solar PV Capacity	5.85 kWp	10.78 kWp
Maximum Output (AC)	5.0 kW	10.0 kW
Total Cost (Rs.)	625,000	1,022,000
Payback Period	5.5 Years	4.6 Years

Table 6: Payback period of Standard Rooftop Solar PV System

An electricity cost of Rs. 16, inclusive of all taxes is considered for calculation purposes. This payback is based on Chinese equipment only. The PV modules have a 10 years product warranty but if we use SUNPOWER Module which has a 25 Years Product warranty, the payback is increased by one year.

Recommended Energy Conservation Measures

Another important factor to reduce your electricity bill is energy conservation. The Energy Conservation Measures shall be adapted if the energy efficiency of the home appliances is increased. The following are the standard energy conservation tips will reduce your bill significantly.

(i) Using energy intensive appliances during Off-Peak hours e.g. water pumps, irons and washing machines.

(ii) Using LED lightings which have more life and will save about 60% energy.

(iii) Using inverter A/C that will save about 40% energy.

(iv) Replace old refrigerators and freezers with new energy efficient models. This helps save 25% consumption.

(v) Switch OFF unnecessary appliances during peak hours' time.

(vi) Use heat rejection films on windows to avoid heat during day time.

Conclusion

If you choose to adapt

- On-grid solar rooftop PV: Your electricity bill will be reduced by 20-25%.
- Energy Conservation Measure: Your electricity bill will be reduced by 20-25%.
- BOTH (Solar PV & Energy measures): Your electricity bill will see a reduction of 40-50%!

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About Author

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Consulting Services for Design and Supervision in Construction Project in the Kingdom of Saudi Arabia

By

Prof. Rafiq Muhammad Choudhry

Abstract

The consulting services are very important to the project life of construction projects. When owners select the contract type, they need to analyze the design work and the supervision work to be arranged. Is this service be carried out by a single consulting firm having the required qualification and capacity? This work presents advantages and disadvantages of appointing the design consultant as construction supervision consultant in the construction industry in Saudi Arabia. A questionnaire was designed that comprised of five project phases including the project inception phase, project planning and design phase, project construction phase, project monitoring and control phase, and project closing phase. This work collected 101 valid questionnaires responses from construction projects and SPSS (Statistical Package for Social Sciences) for Windows software package is used for analysis. The results indicate that owners, consultants, contractors, and researchers strongly support appointing the same design consultant as supervision consultant. The results indicate that the number of advantages for appointing the design consultant as construction supervision consultant in the industry more than doubles the number of disadvantages of appointing the same design consultant as supervision consultant in the construction industry. Results further show that it is not appropriate to employ different professionals on a project for these two services when close coordination is generally required for the successful completion of the same. Research concludes that there is no harm to appoint a third party for proof engineering and design vetting. This work is beneficial for owners, consultants and contractors who want good services from designers and consultants on construction projects.

I. Introduction

In planning and developing a construction project, feasibility studies, planning, design, procurement, construction, supervision, project commissioning, all stages are tightly linked (Choudhry 2016). The project consulting services can cover the entire project lifecycle. The consulting services include counseling services, feasibility studies, design, preparation of contract documents, and preparation of shop drawings, supervision, project management, and program management (Bunni, 2005: 66-82). Fédération Internationale Des Ingénieurs-Conseils (FIDIC), in 'FIDIC policy statement on selection of consultants', states that consulting engineering industry (CEI) undertakes activities related to planning, designing, constructing, inspecting and managing the infrastructure required for meeting the ever-increasing demands for energy, transportation, shelter, health and water (FIDIC 2004).

During the selection process, the owner of a project needs to select a responsible consultant or a team of consultants for design and supervision of works (Bunni 2005). Correct selection of a consultant has major bearing on the quality, overall project cost, and on the success of the project as well as on the overall value of the delivered project (FIDIC 2011a). At the time of organizing the project, the owner needs to decide who will design the project and who should supervise the site construction.

FIDIC guidelines for integrity management in consulting states that one of the important factor in success of a project is obtaining the services of the most competent and experienced consultant (FIDIC 2011b). There are enormous investment opportunities in the construction industry including heavy engineering construction: oil and gas, highways, airports, ports, power generation plants, irrigation; industrial construction: petroleum refineries, petrochemical plants, manufacturing plants; building construction: hospitals, schools, universities, commercial towers, warehouses, government buildings, recreation centers; residential construction: single-family homes, multi-unit townhouses, high-rise apartments, and condominiums (Choudhry and Iqbal 2013). Nonetheless, it is not clear how consultants are selected for construction projects. Specifically, the objective is to evaluate advantages and disadvantages of appointing the design consultant as supervision consultant on construction projects to draw scientific conclusions for the benefit of construction industry's stakeholders in Saudi Arabia.

II. Methodology

This work reports the results of the questionnaire survey in the construction industry in Saudi Arabia. A rigorous study is carried out to assimilate the relevant literature (e.g. Oppenheim 1992; Yin 1984) in understanding the research domain. The researcher used secondary sources such as journals, reports, previous studies related to the research topic to gather information about the questionnaire. Based on the literature review a questionnaire is designed to collect data. Many ideas about the

structure and content of the questionnaire are discussed with experts in the industry. The questions introduce the concept to the participants simply and smoothly to achieve the research objectives. Checklist format is used for the development of the questionnaire. Twelve (12) questions of the questionnaire are related to personal characteristics of the respondents. The rest of the questionnaire consisted of 42 questions and comprised of 5 sections outlining project phases including project inception phase, project planning and design phase, project construction phase, project monitoring and control phase, and project closing phase. Each question has five choice i.e. '1-strongly agree', '2-agree', '3-not sure', '4-disagree', and '5-strongly disagree'. Respondents are required to choose only one choice out of the five.

A pilot survey is conducted with experts to check its suitability for the construction industry. For this purpose, 12 questionnaires are presented to experts – clients (3), consultants (3), contractors (3), and universities (3). An interview is also conducted with each expert. The questionnaire is further modified by the feedback from the pilot survey to adopt it for the construction industry. A cover letter is attached to the questionnaire for each respondent in order to relay objectives of the survey. Final questionnaire is distributed to engineers, architects, owners, academics and contractors for their responses. The questionnaire solicited information about the respondents covering their qualification, designations, working experience and the group which they represent (owner, consultant, contractor, and academia). Forty two (42) questions are related to the 5 project phases and the questionnaire followed a five-point Likert-type scale for statistical analysis. Google drive is used to collect responses. The questionnaire is designed in two languages (English and Arabic) for easy understanding of respondents.

The sample for this work is selected from a population of construction companies in Saudi Arabia. For a population of 40,000 companies or over, Dillman (2000) stated that a sample size of 96 is enough with ±10% sampling error and 95% confidence level. The judgmental sampling method is used, and 120 questionnaires are sent to respondents. Out of the 120, 103 questionnaires received and 101 valid responses are analyzed representing a response rate of 85%. Two questionnaires are rejected because they were incomplete.

From the 101 valid responses, owners' response rate is 23.76%, consultants 32.67%, contractors 36.63%, and academia 6.93%. Approximately 45.54% had 6-10 years of experience and 19.80% had over 10 years of experience, 57.65% of the respondents belong to private organization, and 1.98% of the respondents had acquired PhD degree, 11.88% held MS degree whereas 70.30% had acquired bachelor degree and 2.97% held diploma and 12.87% had certificates. Of the organizations, 38.10% respondent's organizations employ more than 500 employees and 73.26% of respondents are used to work at buildings and infrastructure projects. For the cost of the projects, 35.62% organizations executed project worth 10-100 million, 31.51% organizations executed projects worth 100-500 million, 13.70% organizations undertook construction projects having cost more than Saudi Riyal 500 Million (1 US$ = 3.75 SR).

Ten interviews are recorded and analyzed. These persons who had accumulated extensive working experience provided valuable information to the researcher. The study used the analytical descriptive method. The data gathered are analyzed by using the SPSS (Statistical Package for Social Sciences) by analysis as explained by Pallant (2007). A 0.05% level of significance presents a statistically significant relationship in the data. The relative importance index (RII) is calculated for the 42 questions by using the formula used by researchers (Chan and Kumaraswamy 1997, Enshassi et al. 2008) as:

$$RII = \sum w/(A \times N) \qquad \text{Eq. (1)}$$

Where w = weight as assigned by each respondent in a range from 1 to 5; A = highest weight i.e. '5';

N = the total number in the sample.

III. Results and Analysis

The results show that by appointing the same design consultant as supervision consultant advantages are 55.86%, disadvantages 28.28% and not-sure respondents are 15.86% (see Fig. 1). The results indicate that advantages are almost 2 times to that of disadvantages of appointing the same design consultant as supervision consultant. Overall 84.14% respondents are well conversant with the involvement of designer and supervision consultant in the construction industry.

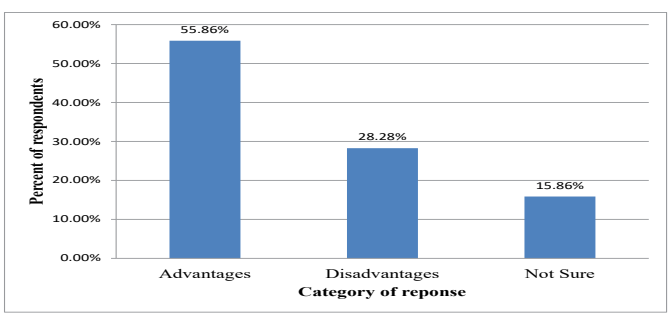

Fig. 1. Overall response by respondents

Responses show that there are 31 advantages and 11 disadvantages out of 42 questions asked from the respondents. Overall response of respondents concerning advantages are ranked. The responses with higher relative importance index (RII) are ranked as "1". The RII "by appointing the design consultant as the supervision consultant, there shall be quick decision can be made during execution by eliminating the lengthy process" is 0.34 and this factor is ranked as number 1. The RII "by appointing the design consultants as the supervision consultant, consultants become fully conversant with the project background right from the inception phase of the project" is 0.35 and this factor is ranked at number 2. The RII "by appointing the design consultants as the supervision consultant, there shall be comfortable coordination and communication between design and supervision teams" is 0.36 and this factor is ranked at number 3. The RII "by appointing the design consultants as the supervision consultant, approval of construction methodology, material approval or shop drawings takes less time" is 0.38 and this factor is ranked at number 4. The RII "by appointing the design consultants as the supervision consultant, the project scope can be arranged well" is 0.39 and this factor is ranked at number 5. All 42 factors are ranked according to the relative importance index. By appointing the design consultant as the supervision consultant, the strongest disadvantages is the domination in the consultant's decisions making and this is ranked at number 42 with RII = 0.71.

A. Participants Ranking

The results indicate that stakeholders (owners, consultants, contractors, academics) strongly support "appointing the design consultant as the supervision consultant". The owners indicate that "by appointing the design consultant as the supervision consultant" advantages are 48.22%, disadvantages 39.32%, and not-sure responses are 12.46%. The consultants indicate that "by appointing the design consultant as the supervision consultant" advantages are 62.28%, disadvantages 22.51%, and not-sure responses are 15.21%. The contractors show that "by appointing the design consultant as the supervision consultant" advantages are 56.54%, disadvantages 24.20%, and not-sure responses are 20.95%. The academia and researchers indicate that "by appointing the design consultant as the supervision consultant" advantages are 58.19%, disadvantages 27.20%, and not-sure responses are 14.61% (see Fig. 2). The results indicate that the advantages are more than 2 times to that of the disadvantages of "appointing the design consultant as the supervision consultant" in the construction in-.dustry in Saudi Arabia

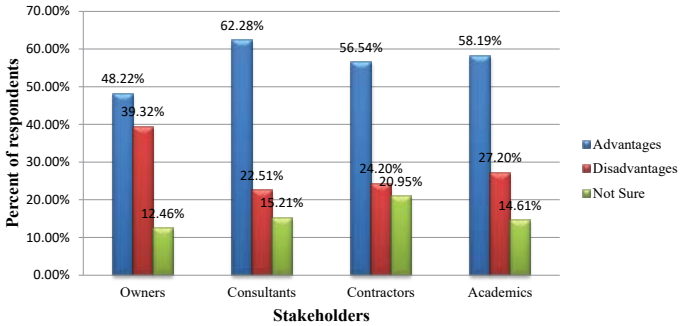

Fig. 2. Response by owners, consultants, contractors and academics

Ratio of advantages and demerit for owners is 1.23, consultants 2.77, contractor 2.34, and academia and researchers 2.14. Although, the owners have little low ratio, nonetheless, all stakeholders had almost similar perceptions. The respondents consider that "by having the design consultant as the supervision consultant" at project inception phase advantages are 82.70%, and they ranked this phase at the top (see Fig. 3). The respondents consider that "by having the design consultant as the supervision consultant" the advantages are 56.94%, and they ranked the construction phase at the 2nd position. Respondents ranked the planning & design phase, closing phase, and the monitoring & control phase at position 3rd, 4th, and 5th respectively.

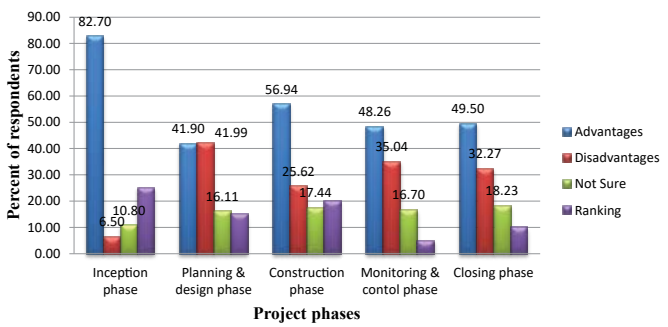

Figure 3.Project phases and ranking

IV. Discussion

Results of this study clearly indicate that it is appropriate to appoint the design consultant as the supervision consultant on construction projects. The results showed that majority of the respondents are well conversant with the involvement of consultants on the construction project. Results indicate that advantages are more than 2 times to that of disadvantages for "appointing the design consultant as the supervision consultant". In this work,

the owners score is 48.22%, consultants 62.28%, contractors 56.54%, and academia 58.19%, which indicate that the stakeholders had the high perceptions for "appointing the design consultant as the .supervision consultant" on construction projects

The response of the respondents for advantages at project inception phase was 82.70%, at project planning & design phase 41.90%, at project construction phase 56.94%, at monitoring & control 48.26%, and at project closing phase 49.50%. These results indicated that respondents had high perceptions for appointing the design consultant as the supervision consultant during all phases of projects. The results showed that the trend is declining and mixed from the project inception phase towards the project-closing phase. The results indicated that it is more beneficial to have the same design consultant as the supervision consultant at the project inception phase, construction phase, planning and design phase, and closing phase, and at the monitoring & control phase of projects. The authors postulate that there is no harm to appoint a third party for the design vetting and proof engineering, irrespective of whether the design company is appointed as the supervision consultant or vice versa.

V. Conclusions

This work is carried out to investigate whether design work and the supervision work is to be performed by a single consulting firm having the required qualification and capacity. The owners, consultants, contractors and researchers strongly support appointing the design consultant as the supervision consultant in the construction industry. Stakeholders perceived that it is quite appropriate to have the design consultant as the supervision consultant at all project phases. Results showed that by appointing the design consultant as the supervision consultant, advantages are more at the project inception phase as compared to the project monitoring & control phase. By appointing the design consultant as the supervision consultant, the strongest advantages are: 1) 'quick decisions can be made during execution by eliminating the lengthy processes' 2) 'Consultants becomes fully conversant with the project background right from inception phase of the project' 3) 'there will be the comfortable coordination and communication between the designer and the supervision teams' 4) 'approval of construction methodology, materials approval and shop drawings takes less time'. By appointing the design consultant as the supervision consultant, the strongest merit is the domination in the consultant's decisions making. Results indicated that it is not appropriate to employ different professionals on a project for these two services when close coordination is generally required for the successful .completion of the project

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لَن تَنَالُوا الْبِرَّ حَتَّىٰ تُنفِقُوا مِمَّا تُحِبُّونَ وَمَا تُنفِقُوا مِن شَيْءٍ فَإِنَّ اللَّهَ بِهِ عَلِيمٌ ﴿٩٢﴾ آل عمران

You shall not attain righteousness until you spend out of what you love (in the way of Allah).75 Allah knows whatever you spend.(Al Imran)

An Intelligent System for Screening of Dysphonic Patients in Smart Cities

By

Zulfiqar Ali, Awais Mahmood

Abstract

Current evolutions in the Internet of things and cloud computing make it believable to build smart cities and homes. Smart cities provide smart technologies to residents for the improved and healthier life, where, smart healthcare systems cannot be ignored due to rapidly growing elderly people around the world. Smart healthcare systems can be cost-effective and helpful in the optimal use of healthcare resources. The voice is a primary source of communication and any complication in production of voice affects the personal as well as professional life of a person. Early screening of voice through an automatic voice disorder detection system may save life of a person. In this paper, an automatic voice disorder detection system to monitor the resident of all age group and professional backgrounds is implemented. The proposed system detects the voice disorder by determining the source signal from the speech through Linear Prediction (LP) analysis. The analysis calculates the features from normal and disordered subjects. Based on these features, the spectrum is computed, which provided distribution of energy in normal and voice disordered subjects to differentiate between them. It is found that lower frequencies from 1 Hz to 1562 Hz contributes significantly in the detection of voice disorders. The system is developed by using sustained vowel and running speech so that it can be deployed in a real world. The obtained accuracy for detection of voice disorder with the sustained vowel is 100% ± 0.1, and that is for running speech is 99.75% ± 0.8.

Introduction

The population of elderly people is increasing rapidly worldwide including Japan, China and Europe [1]. According to an estimate, the number of elderly citizens will rise to 10 million in the coming decade. Health issues among the old age citizen are one of the major concerns in developed as well economically growing countries like Brazil and India. Elderly citizens occupy a large portion of health-related facilities due to different health issues. Smart cities and homes can be developed to meet the needs of citizens/senior citizens in an efficient and cost-effective manner.

The recent development in internet of thing (IoT) makes the smart homes and smart cities a reality [2]. IoT sensors the data from surrounding environment and makes optimized decisions. The purpose of the smart cities is to provide the residents a quality life with basic needs of life as well as health monitoring services [1, 3, 4]. Various pillars of smart cities are depicted in Fig. 1. Smart technologies provide real time correct information to the selected users at right time. To monitor the pet animals, a system based on animal biometrics is implemented successfully in [5]. In addition, a smart healthcare is proposed in [6], the system monitors the status of patients by capturing the voice and video through sensors installed inside the smart homes. The speech is processed by using local

features [7], whereas, the features from video are extracted by using interlaced derivative pattern [8].

Smart cities and homes have many benefits but security of data is still a challenging task. A smart health system with data security is suggested in [9]. This health monitoring smart system including communication technologies, combination of different apps, things (sensors and devices) and people. The components of smart system work together to monitor, track, and store the information of patients to take care of his\her health. The data is collected through mobile devices which is secured by the watermarking. A large amount of data is generated from IoT in a smart city [10, 11]. The quality and the efficiency of data is also one of the major challenge in smart cities. However, an energy efficient cypher-physical system has been described in [12].

Automatic voice disorder detection systems in smart cities can be deployed to continuously monitor the voice of residents and inform him in case of any voice degradation. According to the medical dictionary [13], dysphonia is a difficulty in speaking, usually evidence by hoarseness. Hoarseness represents any deviation of voice quality as perceived by self or others [14].Voice samples can be collected at different public places, i.e. school, colleges, universities, courts, and parks. Residents with the profession of high risk of prevalence of voice disorder can be evaluated regularly, and precautionary campaign could be launched to aware them.

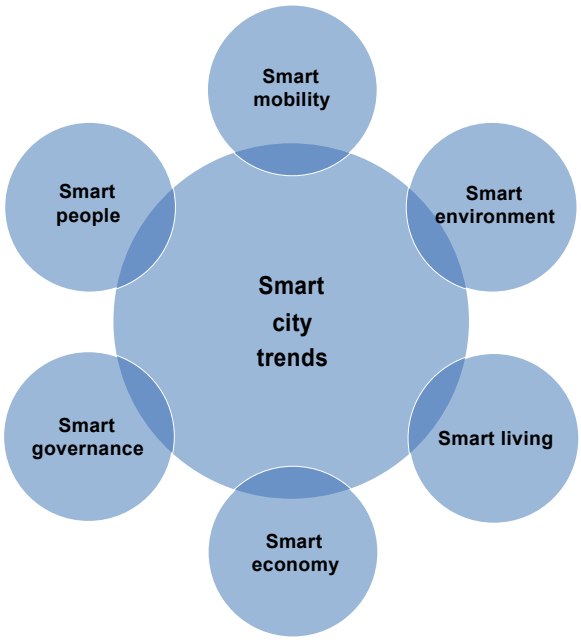

Figure 1. Trends of smart cities [1].

People working in voice demanding professions such as teaching, singing, call centers and judiciary have high risk of suffering from voice complications [15, 16]. In addition, people working in back ground noise like stock markets also have high possibility of suffering from voice problems. Only in USA, around 17.5 million people have voice related problems [17]. Voice complications may rise due to malfunctioning of two muscular layers (called as vocal folds) residing on the top of the trachea. While, damaged nerve system (recurrent laryngeal nerve) due to head and neck injuring which controls vocal folds is also one of the reasons of voice problems [18]. Air pressure generated from lungs vibrates the vocal folds to produce voice. The vibration of vocal folds can be affected by growth of abnormal tissues on the surface of vocal folds [19-21]. Due to problem on the surface of vocal folds, they exhibit irregular vibrations which produced hoarseness, breathiness and harshness in a voice of a person. Voice disorders can affect people of any age, young children to senior citizens. People delay hospital visits due to busy routine of life and long waiting time. Moreover, dependency on other family members is also one of the reasons to delay in consulting a physician. In case of delay or ignorance, treatment by incision of vocal folds becomes necessary, because, some voice disorders are cancerous and life threatening, such as keratosis [14]. To avoid the risk of life, it is important to diagnose voice disorders at early stages and it is possible by the help of automatic voice disorder detection systems. By using the automatic systems, a person can evaluate his\her voice even without visiting the hospitals. Various automatic voice disorder detection system has been reported in the literature. Ali et al. [22] used different frequency bands in an automatic system to determine their contribution in differentiating the normal and disordered subjects. Moreover, Pouchoulin et al. [23] and Fraile et al. [24] also found significant frequency bands to detect the presence of voice disorders.

It is a comparatively easy task to develop a detection system by using sustained vowel as a speech signal remains stationary during phonation of sustained vowels. Any type of acoustic analyses, short- and long-term, can be used to analyse the sustained vowel. A number of studies has been reported those used the short-term acoustic analysis such as Mel-frequency Cepstral Coefficients (MFCC) [25-31] and LP coefficients, and long-term acoustic parameters [28, 32-35] such as shimmer, jitter, fundamental frequency, and formants [36-38]. However, running speech is more realistic than the artificial phonation of sustained vowel as people use running speech in daily life conversation. Running speech contains various characteristics which are crucial for evaluation of voice quality such as voice breaks, voice onset and offset information and voice termination. These vocal characteristics are not fully existed in sustained vowels [39]. In addition to these characteristics, short pauses and silence makes the analysis of running speech difficult. Long-term analysis required only voiced part of a speech, and therefore, not reliable in case of running speech. An accuracy of 86% is achieved in [40] by using long-term analysis which is not good. Short-term acoustic analysis is a preferable choice to extract the features from running speech because running speech varies quickly over time. Only a few number of studies has developed the running speech based voice disorder detection system [40-45]. Most of the work is done for sustained vowel.

In smart cities, the resident will be monitor by using their voices samples which will be a running speech. At the same time, most of the practitioner use sustained vowels during clinical evaluation. Therefore, the proposed system is developed in such a way that it should work for both types of speech signals, sustained vowel and running speech. In this paper, an automatic disorder detection system implemented by using Linear Prediction (LP) analysis based spectrum. The proposed system analyzed the energy variation in the spectrum to differentiate between normal and disordered subjects. LP analysis considers the vocal tract as a liner model, and it divided the vocal tract in number of tubes from glottis to lips. LP analysis estimate the source signal by inverse filtering, and then, spectrum is comput-

ed by using the estimated source signal to analyse energy distribution in both types of subjects for detection of voice disorder. The proposed system provided good accuracy for detection of voice disorder for sustained vowel as well as running speech.

The rest of the paper is organized as follows: Section 2 describes the proposed automatic voice disorder detection system. The description of the voice disorder database and selection of order for LP analysis is also described in this section. Section 3 presents the experimental setup and disorder detection results by using sustained vowel and running speech. Section 4 provides the discussion, and finally, Section 5 draws some conclusions.

I. Material And Method

A. The Proposed System for Disorder Detection

The interaction of the vocal tract with the voice source is a non-linear. In case of a healthy phonation, lower frequencies are strongly depending on source than the higher frequencies. It is due to the low frequency glottal formant. Vocal folds disorder disturbs the vibration of vocal folds which exhibits irregularities in source signal. The glottis produces buzz (a low, vibrating and humming sound) which can be described by its intensity and frequency. The sound generated by voice disorder affected vocal folds contains very low intensity due to abnormal behavior of the vocal folds. To analyze the difference between intensity of normal and disorder subjects, the LP coefficients based spectrum is computed. The proposed system used the computed spectrum to differentiate between normal and disordered subjects. The block diagram of the proposed detection system is shown Fig. 2.

The vocal tract, form glottis to lips, gives rise to the formants. LP analysis [46, 47] determines the formant structure and remove its effect from a speech signal to estimate the source signal. LP analysis considers the vocal tract as a linear tube. The vocal tract can be partitioned into number tubes depending on the order of LP analysis. In case of LP analysis of order R, the number of tubes will be R and the current samples s'(n) will be estimated by R previous samples, as given by Eq. (1)

$$s'(n) = \sum_{r=1}^{R} p_r \times s(n-r) \qquad (1)$$

where, p_r refers to LP coefficients. The inverse filtering removes effects of formants from speech signal, the estimated signal after filtering also referred as residue. In order to calculate an accurate LP model, the error between the current and the estimated sample should by minimum. It can be done by making the first order derivative ξ (mean square error) equal to zero in Eq. (2). The obtained set of equations can be solved by applying Levinson-Durbin recursive algorithm [48]. The solution of the equations by the algorithm provided LP coefficients.

$$\xi = \sum_n e^2(n) \qquad (2)$$

where, e is error between the current sample and the estimated sample and can be defined by Eq. (3) as

$$e = s'(n) - s(n) \qquad (3)$$

To compute the spectrum based on the obtained LP coefficients, the frequency response of the transfer function, given in Eq. (4), is determined.

$$H(e^{jw}) = \frac{B(e^{jw})}{A(e^{jw})} = \frac{\sqrt{\sigma^2}}{p_r(1) + p_r(2)e^{-jw} + p_r(3)e^{-j2w} + \mathrm{K} + p_r(R)e^{-j(R-1)w}} \qquad (4)$$

where σ^2 denotes the gain during LP analysis, and p_r's are the LP coefficients. The coefficient $p_r(1)$ is near to the glottis and $p_r(R)$ is closer to the lips.

To develop the proposed system, two phases are implemented for automatic classification of normal and disordered subjects. The first phase is used to train the system, while, the second phase is used to test the system. In the training phase, the proposed system takes the calculated spectrum as an input and generate acoustic models for normal and disordered subjects. The Gaussian Mixture Models (GMM) are generated by using different number of mixtures. K-means algorithm is used to initial the parameter in GMM $\Theta = (\mu_i, \Sigma_i)$ models, where, μ_i and Σ_i are the mean vector and covariance matrix of the i^{th} Gaussian component, respectively. Moreover, the parameters are tuned by using Expectation-Maximization (EM) algorithm to converge to a model giving a maximum log-likelihood value.

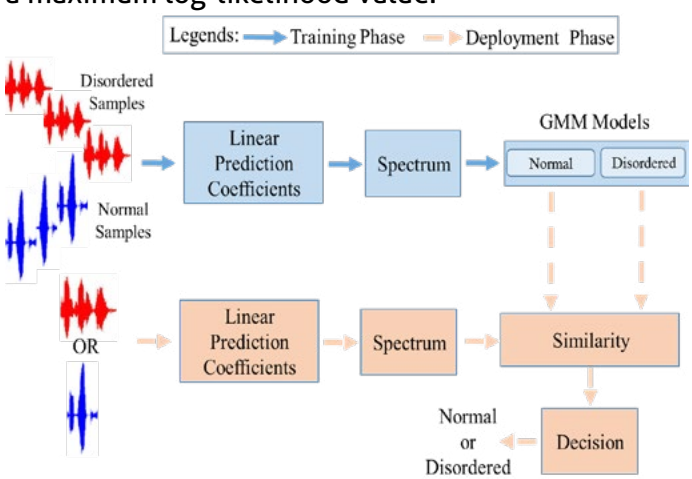

Figure 2. The block diagram of the proposed system.

Table 1. Distribution of normal and pathological samples [49]

Subjects	Gender	Number of Samples	Mean Age (Years)	Age Range (Years)	Standard Deviation (Years)
Pathological	Male	70	41.7	26-58	9.4
	Female	103	37.6	21-51	8.2
Normal	Male	21	38.8	26-59	8.5
	Female	32	34.2	22-52	7.9

The testing phase is used to evaluate the performance of the system. In this phase, the computed spectrum of an unknown speech samples is compared with GMM models of normal and disordered subjects. If the unknown sample has more similarity with disordered subject than normal subject, then, then unknown sample belongs to a disordered patient. Otherwise, the unknown sample belongs to a normal person. The database used to perform the experiments in this study is described in the following subsection.

B. MEEI Database and Parameter Selection

The proposed system is evaluated by using sustained vowel /a/ as well as running speech. The normal and disordered samples of sustained vowels and running speech are taken from Massachusetts Eye & Ear Infirmary (MEEI) database [50]. To compare the results with existing studies, the same subset of the samples is used which has been used in [31, 49, 51-54]. The subset contains 173 disordered subjects and 53 normal subjects, and distribution of these samples is given in Table 1.

In disordered subjects, number of male and female speakers are 70 and 103, respectively. Moreover, in normal subjects, number of males and females are 21 and 32. The age range of both genders for normal and disordered subjects is almost similar. The subset is selected in a way that age and gender of both types of subjects are evenly distributed, and various disordered are considered in it [49]. In MEEI database, samples are recorded at two different sampling frequencies, i.e. 25 kHz or 50 kHz. To have a unique sampling frequency all samples of the subset are down-sampled at 16 kHz.

One of main parameter in the LP analysis is order of the filter (number of LP coefficients) and it can affect the estimation of source signal. In fact, LP analysis perform inverse filtering to get the voice source from a speech signal. The order of the filter need to be adjusted in a way that LP analysis should be able to determine the formant peaks. Because, removing the effect of the formants from the speech signal will provide accurate estimation of the source signal.

In case of sampling frequency of 10 kHz, the analysis bandwidth is 0 to 5 kHz. If the number of coefficients are adjusted to 10 then it means that there are two coefficients for each 1 kHz of the computed frequency domain spectrum. Markel and Gray [55] recommended, an extra pair of coefficients to model the spectral slope and they do not affect the analysis in negative way. The spectral slope is result of both the shape of a single glottal pulse and the effects of lip radiation. Markel and Gray suggested that couple of extra coefficients are also helpful in analyzing the closely space formants and they model the speaker variations in voice quality.

For a vowel recorded at 10 kHz with comfortable pitch, at least 12 coefficients are required. However, these number of coefficients are not sufficient for the higher sampling rates. At least one coefficient is required for each 1 kHz for the higher sampling rates to avoid missing peaks (formants). In this study, all samples of both types of subjects are down-samples to 16 kHz and the number of LP coefficients (order of filter) are determined by using the relation given by Eq. (5)

$$R = \frac{sampling\ frequency\ in\ Hz}{1000} + 2 \qquad (5)$$

II. Experimental Setup And Detection Results

All samples of sustained vowel and running speech in MEEI are down-sampled to 16 kHz. According to Eq. (5), the number of calculated LP coefficient becomes 18. The LP coefficients are computed from each frame of each normal and disordered subjects. By using these LP coefficients, the spectrum is calculated at different frequency resolution to observe the energy distribution.

Various experiments are performed to evaluate the proposed system for detection of voice disorders. Both sustained vowel and running speech are used to conduct the experiments and the results of the experiments are presents by using different performance measures: sensitivity, specificity, and accuracy. Sensitivity (SEN) is a ratio between truly detected disordered samples and total number of disordered samples. Specificity (SPE) is a ratio between truly classified normal samples and total number of normal samples, and accuracy (ACC) is a ratio between all truly identified samples and total number of samples. The measures are calculated by using following relations.

$$SEN = \frac{true\ Abnorm}{true\ Abnorm + false\ Health} \times 100 \qquad (6)$$

$$SPE = \frac{true\ Health}{true\ Health + false\ Abnorm} \times 100 \quad (7)$$

$$ACC = \frac{trure\ Abnorm + true\ Health}{total\ Abnorm + total\ Health} \times 100 \quad (8)$$

where true Abnorm means when a disordered sample is detected as a disordered sample by the system, false Abnorm means that when a normal sample is detected as a disordered sample, true Health means a normal sample is detected as a normal sample by the system, false Health means a disordered samples is detected as a normal sample, total Health represents the total number of normal samples, and total Abnorm stands for the total number of disordered samples.

To avoid the biasness of the training and testing samples during the evaluation of the proposed system, 5-folds cross validation approach is implemented for disorder detection with sustained vowel and running speech. The samples are divided into five disjoint testing subset. Each time one of the subsets is used to train the system, and the reaming four subsets are used to test the system. The results obtained in different scenarios are provided in the following subsections.

A. Disorder Detection with Sustained Vowel at Different Resolutions

An inverse relation exists between the frequency and time resolution. To increase the frequency resolution, the time resolution should be decreased. In other words, the length of analysis window will be increased. The relation for frequency resolution is given by Eq. (9)

$$\Delta f = \frac{1}{T} = \frac{f_s}{N} \quad (9)$$

According to Eq. (9), the frequency resolution will be increase by decreasing Δf. It can be achieved either by decreasing sampling frequency f_s or increasing the number of samples N in the analysis window. In the experiments, we gradually increase the number of samples to increase the frequency resolution. The experiments are performed by using N equal to 128, 256 and 512, one by one. The results for N=128 and N=512 are provided in Table 2 and Table 3, respectively. The results with N=256 are almost same as for N=128, therefore, they are not listed. All results are obtained by using sustained vowel.

The averaged results of 5-folds are presented in the Table 2 and 3 with standard devastation (STD) among the results of 5-folds. The maximum detection accuracy obtained with N=128 to classify the normal and disordered subjects is 92.50% ± 1.1. The results in Table 3 suggest that by increasing the frequency resolution the detection accuracy is increased to 100% ± 0.1. The accuracy of 100% ± 0.1 is achieved with N=512.

Table 2. Disorder detection results with N=128 by using sustained vowel /a/

Number of Gaussians	%SPE±STD	%SEN±STD	%ACC±STD
4	95 ± 6.1	85 ± 3.2	90 ± 4.5
8	95 ± 5.6	85 ± 2.8	90 ± 2.8
16	95 ± 4.8	85 ± 1.9	90 ± 2.2
32	85 ± 3.5	90 ± 0.9	87.50 ± 2.0
50	90 ± 2.1	95 ± 0.7	92.50 ± 1.1

Table 3. Disorder detection results with N=512 by using sustained vowel /a/

Number of Gaussians	%SPE±STD	%SEN±STD	%ACC±STD
4	95 ± 1.8	100 ± 2.5	97.50 ± 1.3
8	95 ± 0.9	95 ± 2.9	95 ± 2.1
16	95 ± 0.6	100 ± 1.8	97.50 ± 1.2
32	95 ± 0.6	100 ± 0.8	97.50 ± 0.7
50	100 ± 0.4	100 ± 0	100 ± 0.1

By increasing the frequency resolution, the computed LP based spectrum differentiates between the normal and disordered subjects significantly. In addition, a comparison between the accuracies for N=128 and N=512 is depicted in Fig. 3. It can be seen in Fig. 3 that accuracy is increased by increasing the number of Gaussian mixtures. It means that high number of Gaussian generates perfect acoustic model for normal and disordered subjects. Moreover, it can be observed from Table 2 that an accuracy of 90% is obtained with 4 mixtures. There is clear difference between SPE (95%) and SEN (85%). By increasing the number of mixtures, not only the accuracy is improved by 2% but also the difference between SPE (90%) and SEN (95%) is reduced.

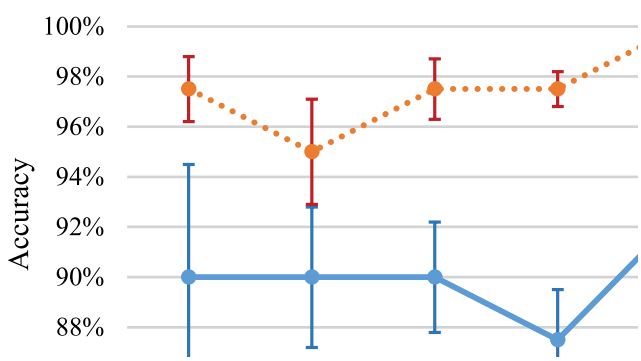

Figure 3. A comparison of accuracy between N=128 and N=512.

B. Disorder Detection with Running Speech

A system based on running speech is more realis-

tic than the artificial utterance of sustained vowel. Hence, the proposed system is also evaluated by using the running speech. As for sustained vowel, the best results are obtained by using high-frequency resolution, i.e. N=512. Therefore, the experiments for running speech are performed only by using N=512, and the results are presented in Table 4. The best obtained accuracy by using running speech is 99.75% ± 0.8 with 50 Gaussian mixtures. The same kind of trend is noticed in case of running speech that accuracy of the system increased by increasing the number of mixtures. In addition, the standard deviation among the results of 5-folds decreased by increasing the mixtures, which makes the results more reliable.

Table 4. Disorder detection results with N=512 by using running speech

Number of Gaussians	%SPE±STD	%SEN±STD	%ACC±STD
4	95.5 ± 2.9	97.5 ± 2.5	96.50 ± 2.2
8	96 ± 1.5	98 ± 1.9	97 ±1.9
16	97 ± 1.1	99.5 ± 0.9	98.25 ± 1.5
32	99 ± 0.9	99.5 ± 0.8	99.25 ± 1.2
50	99.25 ± 0.7	100 ± 0.2	99.75 ± 0.8

III. Discussion

A health monitoring system for smart cities is proposed in this study. The proposed system computed spectrum by using LP coefficients to differentiate between normal and disordered patients. It can be deployed in homes to monitor the elderly citizen, and at different public places to observe the residents of various professional background. Therefore, the system is evaluated by using the running speech so that it could process the daily conversion of people to determine the presence of voice disorders. However, the system is also tested by using the sustained vowels. In this way, it can be implemented in clinics to provide the complementary information to the medical practitioners about the existence of voice disorders.

The irregular vibrations disturb the vocal folds which effect the source signal and causes to produce harsh, strained, weaker and breathier sound. LP analysis apply inverse filtering to determine the source signal. Then, the spectrum is calculated to observe the strength of source signal, and it founds the presence of voice disorder. Due to weaker and breathiness, the voice affected by disorders contains low energy than normal people. It can be observed from Fig. 4 that spectrum of disordered subject does not contain high energies and exhibits irregular pattern. While, Fig. 5 shows that high energies are presented in a regular pattern for a normal sample. In both figures, the spectrum of a sustained vowel of equal length is depicted, and it can be noticed that frequencies from 1 Hz to 1562 Hz are more significant in detection of voice disorders. That range of frequency has different energy pattern for normal and disordered subjects.

The fact is also supported by the study [22]. In the study, normal and disordered subjects are decomposed into different frequency bands to determine the contribution of each frequency band in differentiation of normal and disordered subjects. The study concluded that the lower frequency band of 1 Hz to 1562 Hz contains

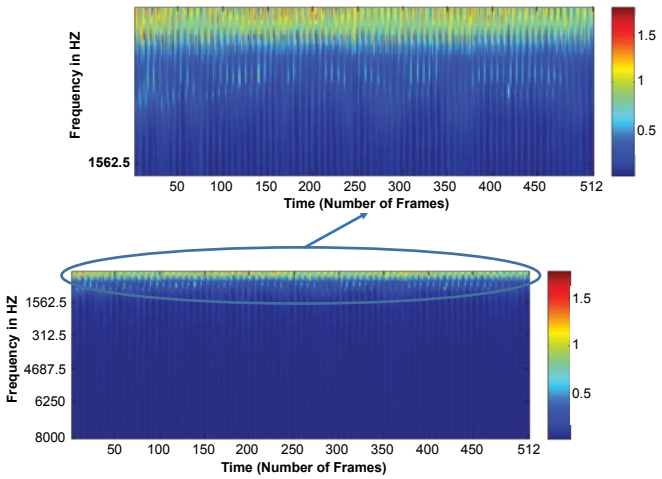

Figure 4. LP analysis based spectrum of a voice disordered subject.

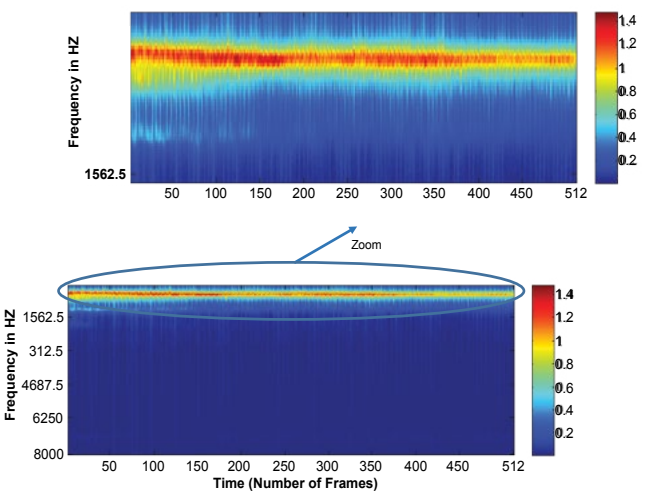

Figure. 5. LP analysis based spectrum of a normal subjects.

lower energy for disorder subjects as compared to normal subjects. For this band, there is significant difference in the energy pattern of normal and disordered subjects. The obtained detection accuracy of the band, 1 Hz to 1562 Hz, was 91.28% ± 0.4.

In our proposed automatic system, we did not implement voice activity detection module. Activity detection is itself a difficult task [44]. Some existing

system based on running speech implemented the voice activity detection module [41-43]. Such systems are not using running speech truly, because they are extracting only voiced part of running speech to develop the systems. Running speech contains silence, voiced and unvoiced parts; therefore, it is challenging task to develop the system with running speech.

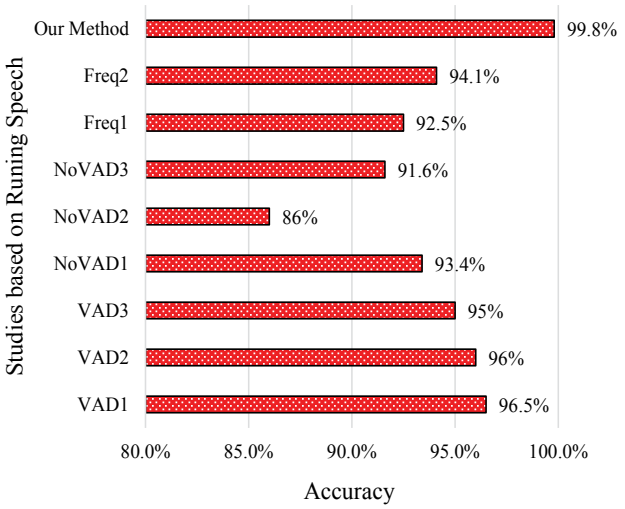

Figure 6. Comparison for accuracy of our proposed system with existing system.

Few disorder detection systems [40, 44, 45] has been implemented without voice activity detection module; however, their accuracy is not good. A comparison of the proposed system with the existing running speech based disorder detection systems is provided in Fig. 6. The comparison of accuracy is done with three types of studies. The studies used voice activity detection are represented by "VAD", the studies which did not implement voice activity detection module are denoted by "NoVAD", and those studies which have used the frequency bands for detection of voice disordered are mentioned as "Freq" in Fig. 6. Our proposed method in this study has outperformed existing systems based on running speech, and an accuracy of 99.8% is achieved. Moreover, our system is also evaluated with the sustained vowel so that medical practitioners can use it in the clinics.

IV. Conclusions

A number of residents in smart cities may belong to the professions which have high risk of prevalence of voice disorders. Voice complications have the negative impacts over the life of individuals. They disturb not only the daily routine of a personal but also affect the professional life. In addition, an increase in the population of senior citizens in developing as well as economically growing countries is alarming. A smart health care system can assist the residents of different professions and of different age groups. Moreover, the early diagnosis of voice disorder is very crucial. Often, people ignore it due to busy and hectic routine of life. Consequently, they risk their lives and undergo the incision process to cure the voice disorders. It is not financially viable, and also wastage of resources at health centers. To avoid these circumstances, a smart healthcare system is proposed and developed. The system monitor the voices of specific residents such as lawyers, teachers, singers, and who are working in background noise like stock markets. Furthermore, the proposed system can monitor the health of all residents specially who have strong family history of voice complications. The proposed system investigates the energy distribution across the spectrum computed by using LP coefficients to differentiate between normal and voice disordered subjects. The subjects suffering from voice disorders exhibit irregular vocal folds vibration which makes the voice weaker, whisper and breathier. Therefore, the voice of a disorder subject contains lower energy as compared to a normal subject. The proposed system is also implemented by using running speech which is a challenging task due to quick variations in it over time. Due to the running speech, the proposed system can be used in the real world as people used running speech in daily life conversion. The performance of the proposed system is promising as the obtained disorder detection accuracy for running speech is 99.75 ± 0.8. The accuracy of the proposed system with the sustained vowel is also good, i.e. 100 ± 0.1.

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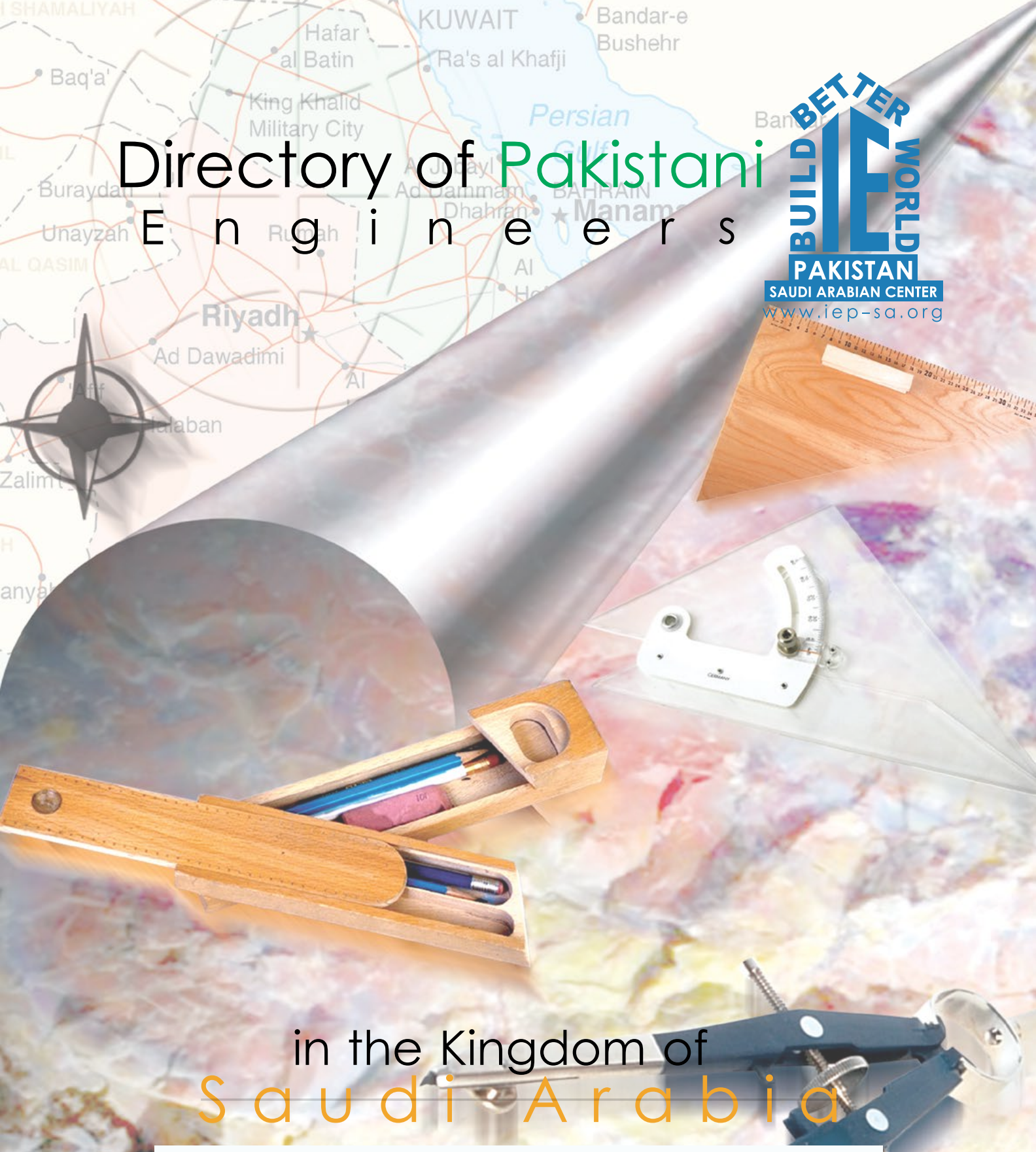

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Artificial intelligence

Intelligence demonstrated by machines, in contrast to the natural intelligence (NI) displayed by humans and other animals. In computer science, AI research is defined as the study of "intelligent agents", any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals.

Artificial intelligence was founded as an academic discipline in 1956, and in the years since has experienced several waves of optimism. The traditional problems (or goals) of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception and the ability to move and manipulate objects. Many tools are used in AI, including versions of search and mathematical optimization, neural networks and methods based on statistics, probability and economics. The AI field draws upon computer science, mathematics, psychology, linguistics, philosophy and many others.

The field was founded on the claim that human intelligence can be so precisely described that a machine can be made to simulate it. Some people also consider AI to be a danger to humanity if it progresses unabatedly. Others believe that AI, unlike previous technological revolutions, will create a risk of mass unemployment. In the twenty-first century, AI techniques have experienced a resurgence following concurrent advances in computer power, large amounts of data, and theoretical understanding; and AI techniques have become an essential part of the technology industry, helping to solve many challenging problems in computer science.

There is no established unifying theory or paradigm that guides AI research.

Symbolic: When access to digital computers became possible in the middle 1950s, AI research began to explore the possibility that human intelligence could be reduced to symbol manipulation. Cognitive Simulation: Problem solving skills and attempted to formalize them, and their work laid the foundations of the field of artificial intelligence, as well as cognitive science, operations research and management science.

Logic-based: Machines did not need to simulate human thought, but should instead try to find the essence of abstract reasoning and problem solving, regardless of whether people used the same algorithms.

Anti-logic or scruffy: Solving difficult problems in vision and natural language processing required ad-hoc solutions –there is no simple and general principle (like logic) that would capture all the aspects of intelligent behavior.

Knowledge-based: Build knowledge into AI applications.

Computational intelligence and soft computing: Interest in neural networks and "connectionism" was revived by David Rumelhart and others in the middle of the 1980s.[141] Neural networks are an example of soft computing.

Statistical: Sophisticated mathematical tools to solve specific sub problems. These tools are truly scientific

Approch of Intelligent agent Paradigm : An intelligent agent is a system that perceives its environment and takes actions which maximize its chances of success. The simplest intelligent agents are programs that solve specific problems. More complicated agents include human beings and organizations of human beings (such as firms). The paradigm gives researchers license to study isolated problems and find solutions that are both verifiable and useful, without agreeing on one single approach. An agent that solves a specific problem can use any approach that works – some agents are symbolic and logical, some are sub-symbolic neural networks and others may use new approaches.

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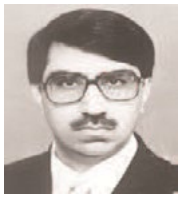

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Harrapa

Harrapa is an archaeological site in Punjab, Pakistan, about 24 km (15 mi) west of Sahiwal. The site takes its name from a modern village located near the former course of the Ravi River which now runs 8 km (5.0 mi) in north. The site of the ancient city contains the ruins of a Bronze Age fortified city, which was part of the Indus Valley Civilization centered in Sindh and the Punjab, and then the Cemetery H culture. The city is believed to have had as many as 23,500 residents and occupied about 150 hectares (370 acres) with clay brick houses at its greatest extent during the Mature Harappan phase (2600–1900 BC), which is considered large for its time. Per archaeological convention of naming a previously unknown civilization by its first excavated site, the Indus Valley Civilization is also called the Harappan Civilization

The Indus Valley Civilization has its earliest roots in cultures such as that of Mehrgarh, approximately 6000 BC. The two greatest cities, Mohenjo-daro and Harappa, emerged circa 2600 BC along the Indus River valley in Punjab and Sindh. The civilization, with a possible writing system, urban centers, and diversified social and economic system, was rediscovered in the 1920s also after excavations at Mohenjo-daro in Sindh near Larkana, and Harappa, in west Punjab south of Lahore. A number of other sites stretching from the Himalayan foothills in east Punjab, India in the north, to Gujarat in the south and east, and to Pakistani Balochistan in the west have also been discovered and studied.

The Indus Valley civilization was mainly an urban culture sustained by surplus agricultural production and commerce, the latter including trade with Sumer in southern Mesopotamia. Both Mohenjo-Daro and Harappa are generally characterized as having “differentiated living quarters, flat-roofed brick houses, and fortified administrative or religious centers. The weights and measures of the Indus Valley Civilization, on the other hand, were highly standardized, and conform to a set scale of gradations. Distinctive seals were used, among other applications, perhaps for identification of property and shipment of goods. Although copper and bronze were in use, iron was not yet employed. “Cotton was woven and dyed for clothing; wheat, rice, and a variety of vegetables and fruits were cultivated; and a number of animals, including the humped bull, were domesticated, as well as “fowl for fighting”. Wheel-made pottery—some of it adorned with animal and geometric motifs—has been found in profusion at all the major Indus sites. A centralized administration for each city, though not the whole civilization, has been inferred from the revealed cultural uniformity; however, it remains uncertain whether authority lay with a commercial oligarchy. Harappans had many trade routes along the Indus River that went as far as the Persian Gulf, Mesopotamia, and Egypt. Some of the most valuable things traded were carnelian and lapis lazuli.

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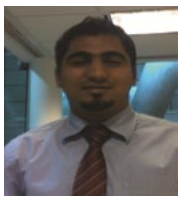

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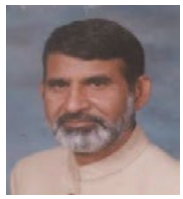

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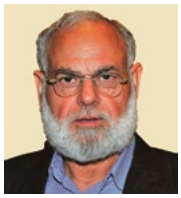

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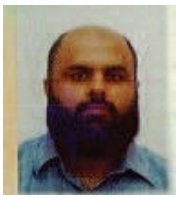

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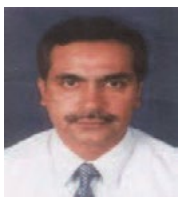

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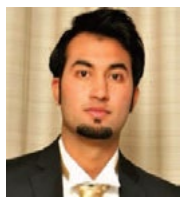

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- ❒ "Let our advance worrying become advance thinking and planning." ~ Winston Churchill
- ❒ "It's a bad plan that admits of no modification." ~ Publilius Syrus
- ❒ "Plans are worthless. Planning is essential." ~ Dwight D. Eisenhower
- ❒ "Expect the best, plan for the worst, and prepare to be surprised." ~ Denis Waitley
- ❒ "Plans are only good intentions unless they immediately degenerate into hard work." ~ Peter Drucker
- ❒ "A good plan today is better than a perfect plan tomorrow." ~ Proverb
- ❒ "First, have a definite, clear practical ideal; a goal, an objective. Second, have the necessary means to achieve your ends; wisdom, money, materials, and methods. Third, adjust all your means to that end." ~ Aristotle
- ❒ "Those who plan do better than those who do not plan even though they rarely stick to their plan." ~ Winston Churchill
- ❒ "If you don't know where you are going. How can you expect to get there?" ~ Basil S. Walsh
- ❒ "A good plan can help with risk analyses but it will never guarantee the smooth running of the project." ~ Bentley and Borman.

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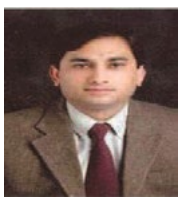

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- "It is change, continuing change, inevitable change, that is the dominant factor in society today. No sensible decision can be made any longer without taking into account not only the world as it is, but the world as it will be." ~ Isaac Asimov
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